TEQIP–II Sponsored

National Conference on

Communication, Computing & Systems

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NCCCS-2015

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Foreword

It gives me immense pleasure to welcome you to Shaheed Bhagat Singh State Technical Campus (SBSSTC), Ferozepur. In this conference, three departments, viz. Electronics & Communication Engineering, Computer Science & Engineering and Electrical Engineering have collectively taken an initiative to conduct this ***National Conference on Communication, Computing & Systems (NCCCS–2015)*** to encourage young researchers.

The organizers have taken several measures to improve the effectiveness of NCCCS–2015 conference. Due publicity as well as discount in the registration fee was provided to attract young researchers to the conference. However, there is less participation from other states, although there are a number of invited speakers from all the respective areas.

Every received paper has been assigned a unique paper number, authors registered themselves, and final camera ready papers have been sent for the publications. E-mails are also sent from time to time so as to share information among large group of participants. More than hundred research papers were received from various domains of research. Originally, we had a plan of publishing only seventy papers. Therefore, review process was very rigorous involving three blind reviews and an online plagiarism check.

However, all our research papers published in this Conference Proceeding will also be made available online at www.sbsstc.ac.in/ncccs2015. Any researcher can download any paper, free of cost, to study and refer in their present research. This will also increase citations of published papers in conference proceeding. Conference Team has done its job with best possible efforts. Suggestions from the readers and authors are always welcome.

With Best Wishes,

Acknowledgement

SBSSTC, Ferozepur is taking a chronological step on organizing ***National Conference on Communication, Computing & Systems (NCCCS–2015).***

Firstly we wish to thank our worthy Director Dr. T.S. Sidhu for his kind motivation and constant pushing up with unconditional support at every end. Our sincere thanks due to National Project Implementation Unit (NPIU) for inclusion of our institution in the World Bank assisted project of TEQIP-II. Our gratitude to Principal Secretary Technical Education, Sh. M.P., Singh, IAS who gave us necessary instructions from time to time. We also want to acknowledge Dr. Anand Kumar Tyagi, Coordinator TEQIP-II and his TEQIP team who supported us financially from TEQIP funds in organizing this conference successfully.

Our greetings go to all the participants who proposed research papers and have come to SBSSTC, Ferozepur to present the papers. We thank in particular the representatives or coordinators of other projects that agreed to do their work personally. We also thank all the people who agreed to deliver a key-note speech or to play the role of moderator and chair of sessions or round table. As far as the organizing committee is concerned, our first very warm greetings go to all the members of organizing committee who worked intensively since last month to manage with the conference work. They also kept in touch efficiently with all the people who proposed the papers and last but not least, they dared to remind constantly the deadlines to busy and not easy to catch evaluators.

We also wish to thank the members of the National Advisory committee for their thoughtful suggestions without whom contributions we cannot reply to the authors with the best reviewers comments.

Finally, we thank almighty, for giving us this power and courage to organize such an event at this level.

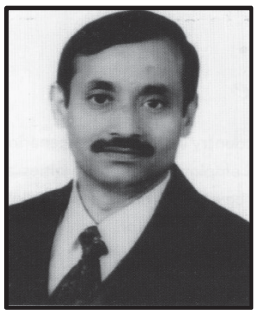
Message

Every year, thousands of professionals from the fields of Engineering and Science gather to refresh their skills, network and collaborate with their colleagues, and learn about the latest developments in their respective field. At these gatherings whether they are conferences, symposia, seminars, colloquia, workshops or conventions participants present their ideas and paths that will shape the future of research in science and Engineering. The technological advances which are fundamental ingredients of a global knowledge economy are challenging the nature of engineering practices, seeking profound skills rather than simply the mastery of scientific and technological disciplines. The growing awareness of the importance of technological innovation in achieving economic competitiveness and national security is demanding a new priority for basic engineering research. The nonlinear nature of the flow of knowledge between fundamental research and engineering application, the highly interdisciplinary nature of new technologies and the impact of cyber infrastructure demand new paradigms in engineering research and development.

I congratulate the Conference team of SBSSTC, Ferozepur on organizing ***National Conference on Communication, Computing & Systems (NCCCS–2015)*.** This Conference will be a great success without researcher's expertise and active participation. I wish the experience of all the participants in this conference would be an enriching, pleasant and memorable one.

Sh. Madan Mohan Mittal
Industries & Commerce and Technical Education
& Industrial Training Minister
Punjab

Message



SBSSTC, Ferozepur is committed to excellence in technical education that is strongly anchored on a system of ethical values and dedication of becoming the premier institution in the field, constantly responsive to the needs of the present times and directed to serve the nation and the world.

Today most of the educational institutions are striving hard to achieve International standards with their world class infrastructural facilities. SBSSTC, Ferozepur is moving fastly ahead of others to satisfy these expectations in this competitive world and in this regard I highly appreciate their next venture of ***National Conference on Communications, Computing & Systems*** on 24th & 25th August 2015 by its three departments.

Success comes to those, who work hard and stays with those, who don't rest on the laurels of the past. I am sure that this conference will facilitate focused and planned research in the fields of Communications, Computing and Systems.

Sh. M.P. Singh, IAS
Principal Secretary to Govt. of Punjab
Department of Technical Education

Message

Linkages between technology and economic development of a country are very much evident following some remarkable technological advancement that took place during the twenty first century. It may not be an exaggeration that technological innovation supported by socio-political institutions is the key driver of long-term economic growth. In the present era of globalization and market-driven economy, the technological changes are transforming from an exogenous feature of economy to endogenous one. Almost all the countries depend upon both the models for raising the living standards and to achieve sustainable long term growth. The experience of third world countries shows that the follower economy that adopts technology without imparting stress on innovation always lags behind the innovators. Technological innovation is also market or demand driven and cannot be boosted through individual entrepreneurship due to high cost involvement in that. Strengthening of the scientific and industrial research in the institutes like SBSSTC and motivating them to take up more and more applied research which can take care of that aspect is need of the hour.

The vibrant discussions and deliberations that will take place in these two days of national conference will enlighten and enrich us and also make us conscious of the increased responsibility of the engineers in promoting engineering innovation and accelerating growth of the nation in all sectors.

Rakesh Kumar Verma
Secretary Technical Education

Message

SBSSTC, Ferozepur is the premier technical institute of Punjab and I am happy to know that Three Departments of this technical campus are Organizing ***National Conference on Communication, Computing & Systems (NCCCS–2015).*** Importance of Technical Education in the life of an individual cannot be overstated. It shapes individuals in their formative years and imbues them with values that would govern all their choices in life. It has been rightly said if you are planning for a year, sow rice; if you are planning for a decade, plant trees; if you are planning for a lifetime, educate people. Indeed, one can even say that the quality of education will determine the destiny of the nation. This conference will provide a conducive atmosphere for researchers to share their knowledge and enable the society to have new innovations. Today's economy's demands are characterized by skilled manpower, modern technology and effective implementation of imparted academic training, Thus our main motto must be to produce high quality, skilled manpower capable of catering the needs of the globalized economy.

My sincere Best wishes to all of the researchers, who will ever remain the prime impetus for this conference, with the note that they are welcome to experience the thrill of the learning in our institute lying right in the lap of natural bounty with a divine ambience.

Wish you all the best.

Sh. B. Purushartha, IAS
Director Technical Education
Govt. of Punjab

Message

I am happy to learn that SBSSTC, Ferozepur is organizing ***National Conference on Communication, Computing & Systems (NCCCS–2015).*** I am confident that the outcomes of the conference will help engineering and technical education to achieve new milestones.

I hope this conference will emerge successful in terms of enthusiastic participation from the researchers across India and would witness new & productive researches in this respective field. I am sure that the conference would set stage for the researchers and academicians across the spectrum of technology and industry to discuss and review the status of technical education in this part of India. The large number of registration and research papers is an indicator of the success of the Conference. It will bring forth new thoughts for new innovations which would benefit the society as well as the nation.

I greet everyone behind this worthwhile venture and wish the organizers very best and success for all they aim to accomplish through this conference.

Er. Mohanbir Singh Sidhu
Additional Director Technical Education &
Industrial Training, Punjab

Message

The ***National Conference on Communication, Computing & Systems (NCCCS–2015)*** represents a growth and maturity of a conference series that started since last year. The purpose of this conference series is to give scientific contribution to the field of computational creativity & progress in the various fields through enriching discussion and publications. Contribution of all the three departments Electrical Engg., Computer Science Engg. and Electronics & Communication Engg. for the success of the conference is exemplary.

We look forward to this conference providing the foundation for future developments in the computational creativity. I hope that this conference would certainly induce innovative ideas among the participants paving way for new inventions and new technologies in their respective fields.

On behalf of the organizing team and on my personal behalf, I would like to extend my good wishes to all the participants. I believe the conference will surely prove enlightening and beneficial to all in equal length.

I wish the conference a fabulous success.

Dr. T.S. Sidhu
Director
SBSSTC, Ferozepur

Message

On behalf of this institute (Especially the Engineering Wing) and myself, I welcome all the participants, invited speakers and guests of the ***National Conference on Communication, Computing & Systems (NCCCS–2015).*** This year's conference theme 'The contemporary status of continuing research in the area of advance computing, communication and systems' encapsulates the diverge topics starting from Power Systems, Human Machine Interaction, Digital Technology, Communication Systems, Optical Networks, Security Aspects to soft Computing and Artificial Intelligence. This event is an attempt to provide a common platform to the academicians, researchers and students to interact among themselves and with the leading experts in the area.

Unique at this year's conference is the jointly organized interdisciplinary technical sessions that aim to showcase the research in an international context and its relevance to the participating individuals, departments and institutions. Maximize your personal involvement, engagement and networking by getting into interactive discussions and deliberations, you will continue your lifelong learning and build on the skills that make you successful as a teacher and researcher both.

Finally, on behalf of SBSSTC, I'd like to thank the conference organizing team and members of various committees, our dedicated volunteers, faculty, staff and students, corporate sponsors and exhibitors for their untiring efforts to make this conference a big success. I also thank you all for making this a truly great event.

Prof. A.K. Tyagi
Associate Director & TEQIP Coordinator

Message

It is a matter of great pleasure that we welcome you to ***National Conference on Communication, Computing & Systems (NCCCS–2015)*** at SBSSTC, Ferozepur. With the advent of the new age technology, today the field of Computing and artificial intelligence is growing exponentially and is playing a vital role in revolutionizing the global industry. The developed countries are at the forefront of research and development in these areas and hence have fostered further technological advancement. Present conference will be dedicated to discuss on newer technologies that can be transfer from lab to land for the benefit and welfare of last person in the society. The conference will accommodate for in-depth discussion in the fields like Electronics, Computing and Systems, needed for the development of the region and will also try to provide a platform to young researchers for their futuristic academic achievements.

It is testament of the importance and significance of this event that it has the presence and active participation of the most important academics, researchers, technocrats and business entities in the respective sector. I hope that the platform that we have created for ourselves for learning from each other and sharing the excitement of the profession will also be a launching pad for the future collaborations and marvelous results.

This interdisciplinary conference will bring together academicians, students and researchers from key government and non-government organizations from all over the country to share and enhance knowledge on latest advancements in their respective fields.

With Best Wishes,

Dr. Sanjeev Dewra
Convener

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Contents

Methods of Electrocardiogram Signal Analysis to Detect Arrhythmia—A Review

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***Abstract*—The Electrocardiogram signal represents the rhythmic contraction and relaxation of human heart muscles. ECG signals are very important in diagnosing heart diseases because every irregular heart beat i.e., arrhythmia can be relevant to a heart disease. Cardiac arrhythmias detection is a challenging task since human eye cannot precisely distinguish the small variations in electrocardiogram (ECG) signal. Several methods including techniques based on fuzzy logic, autoregressive modeling, self organizing map, wavelet transform and neural network based techniques have been used for ECG analysis and recognizing arrhythmia to increase sensitivity and precision. The objective of this paper is to present a review on efforts that have been made in the area of ECG signal analysis and arrhythmia detection in past few years.**

Keywords: Arrhythmia, Electrocardiogram (ECG) Analysis, Heart

I. . INTRODUCTION

In biomedical signals the non-invasive extraction of hidden information is an important and fascinating field of interest [1]. The term 'Arrhythmia' refers to a condition in which heart beats with an abnormal or irregular rhythm [2]. Heart rate can be affected by these irregular rhythms i.e., slow or fast heartbeats [3]. Thus, arrhythmia causes the heart to pump in less effective way. These life threatening arrhythmias cause a number of changes in heart wave with time. Arrhythmias can take place in a healthy heart and may be of minimum repercussion but they may also signify a serious problem that may result in unexpected cardiac death or stroke. ECG is a standard term in the diagnosis of various cardiac diseases. ECG indications have unique morphological features and by analyzing changes in this morphology it is feasible to diagnose a number of cardiac diseases [4]. The analysis of ECG signal for cardiac arrhythmia has gained a significant attention [5]. An ECG is a graphical record of electrical activity produced by heart muscle when heart beats. It provides cardiologists with utilitarian information about a beat and functioning of heart [6]. Trained cardiologists can efficaciously discover distinct groups of heart abnormalities by analyzing ECG signal recordings. Currently, higher efficiency in classification of ECG signal is very important since detection of actual type of cardiac disease is essential for further treatment [2]. Heart disease being hazardous for human; a prudent treatment is must in this case. Different sorts of arrhythmias can be detected in different portions of heart. Heart cannot pump blood in a regular way when it is affected by arrhythmia. However, ECG signal being a non stationary one, irregularities would occur at certain irregular intervals during the day because they may be aperiodic and may not show all the time. It is the signal used in the identification of abnormal condition of heart and is measured on the body surface.

II. ANALYSIS OF ECG WAVEFORM

In identification of the nature and cause of many cardiac arrhythmias, the analysis of ECG signals is an important task [7]. To record ECG signal either on monitor or a graph paper the surface electrodes are placed on specific positions on the body of the patient [8]. An ECG beat refers to one cycle of electrical activity of heart [9]. An ECG signal, the electrical activity of heart is characterized by different peak and valley represented by letters P, Q, R, S, T. Sometimes a conditional U wave is there. The information that an ECG signal makes available for use includes heart position, relative chamber size, impulse origin/ propagation, change in electrolyte concentration, location of myocardial ischemia, effect of drugs on heart condition, heartbeat and conduction disturbances [10]. In ECG signal important information is concentrated in QRS complex, P and T component waves. This information includes magnitudes and /or positions of PR interval, QRS interval, QT interval, ST interval, ST segment and PR segment. The P and T waves represent atrial depolarization and repolarization of ventricle respectively [11]. The Q, R and S wave is generally known as QRS complex and it represents ventricular depolarization. The information to great extent is present around peak R. The shape of QRS complex is the crucial element of ECG signal analysis. Fig.1 represents a wave pattern of normal ECG signal.

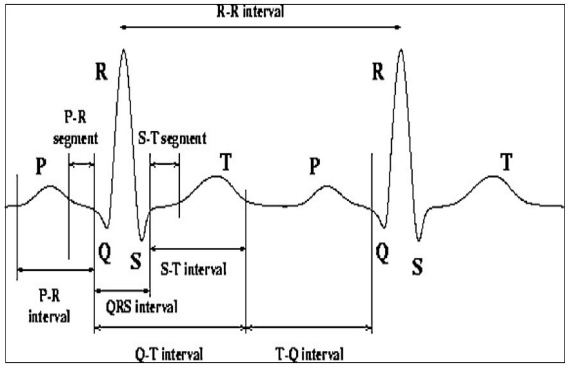

Fig. 1: Wave Pattern of ECG Signal: Normal Rhythm [3]

The durations, intervals and amplitudes of peaks of constituent waves provide cardiologists with important information for diagnosis [12]. Performance characteristic of an automatic ECG analyzing system depends upon the secure and correct detection of QRS complex, P and T waves along with measurement of QT interval. The baseline or isopotential line refers to horizontal section in the ECG wave pattern prior to wave P. The cardiac cycle initiates with wave P that is equivalent to the episode of atrial depolarization in the heart. A normal cycle of the ECG corresponds to subsequent atrial depolarization/ repolarization and ventricular depolarization/ repolarization which takes place with each pulse. The most relevant feature of ECG signals i.e., QRS complex follows P wave. QRS complex is followed by T wave and is equivalent to the period of ventricular repolarization. QRS complex provides the combined effect of the repolarization of the atria and depolarization of the ventricles, which takes place almost at the same time. If U wave is present, it is usually believed to be the consequence of after potentials in the ventricular muscles. The QRS complex, P and T wave features show the rhythmic depolarization and repolarization of the myocardium contractions of atria and ventricles of the heart.

The non stationary ECG signals inhold information about physiologic condition of heart. The bioelectrical activity of heart demonstrates morphology and durations of P interval, QRS interval and T interval. The pacemaker cells on the top of right atrium are used to generate and normalize the heart beat. Usual heart beat is very regular. In healthy condition the value of heart rate is from 60 to100 beats per minute. But in the state of arrhythmia this beat becomes irregular i.e., either fast or slow. A slower rate than normal value of heart beat is known as bradycardia and higher rate than normal value of heart beat is called as tachycardia i.e. slow heart and fast heart respectively. Normal ECG signal characteristic values for different parameters are shown below in Table 1.

TABLE 1: NORMAL ECG SIGNAL CHARACTERISTICS

Parameter	Characteristic Value
Heart rate	60-100 beats per minute
PR interval	0.12-0.20 sec
QPS interval	0.06-0.10 sec
QT interval	Less than half of R-R interval
ST segment	0.08 sec

The source of cardiac arrhythmia may be irregular firing patterns from Sino Atria (SA) node or anomalous activity from other parts of heart. Some serious types of arrhythmias include left bundle branch block (LBBB), premature ventricular contractions (PVC), right bundle branch block (RBBB) and ventricular fibrillation (VF). The wave patterns of abnormalities representing different arrhythmias are shown in Fig. 1 and 2.

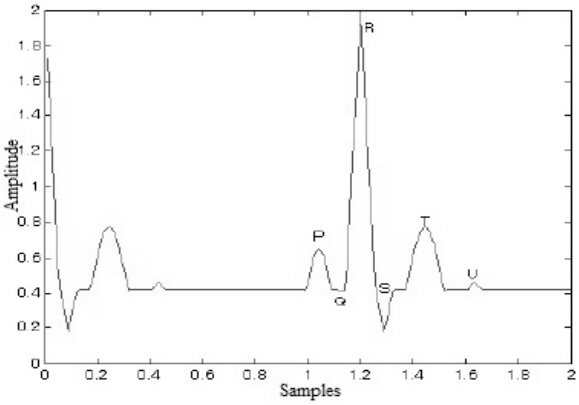

Fig. 1: Bradycardia Waveform [8]

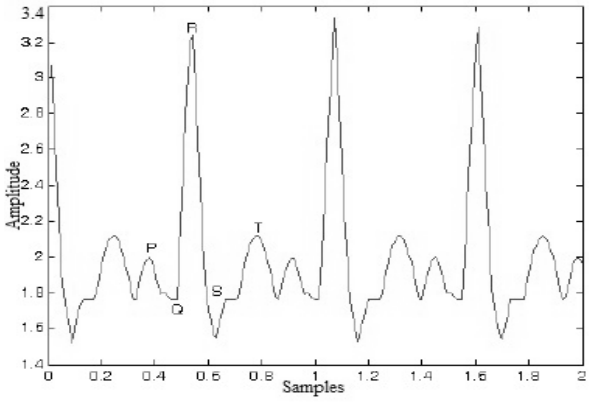

Fig. 2: Tachycardia Waveform [8]

The deviation from standard values of normal ECG wave features and corresponding arrhythmia type is also stated in Table 2.

TABLE 2: TYPES OF ARRHYTHMIA AND THEIR CHARACTERISTIC VALUES

S. No.	Types of Abnormality	Characteristic Values
1	Bradycardia	R-R interval>1s
2	Dextrocardia	Inverted P wave
3	Hypercalcaemia	QRS interval<0.1s
4	Hyperkalemia	Tall T wave and absence of P wave
5	Myocardial ischemia	Inverted T wave
6	Tachycardia	R-R interval<0.6s
7	Sudden cardiac death	Irregular ECG
8	Sinoatrial block	Complete drop out of a cardiac cycle

III. DIFFERENT ARRHYTHMIA DETECTION METHODS

The ECG signal analysis is widely used because of its non-invasiveness and reliability in clinical area for diagnosis of cardiac diseases.

A. Wavelet Transform Method

The concept of wavelet transform has emerged as the most favored mathematical tool by researchers for signal analysis across a wide range of areas over recent years. Wavelet transform has been used to study as well

as used for representation of physiologic signals such as ECG. A soft decision method based on wavelet was proposed to detect patients with cognitive heart failure by making use of power spectral density and soft computing techniques.

Wavelet transform is a mathematical tool and by means of this transform information from a signal can be extracted both in frequency and time domain. It is a time-scale representation that has been effectively used in a range of applications, in specific signal compression. In this transform, different wavelets are generated from fundamental wavelet known as mother wavelet [11]. Wavelet transform is advantageous over other transforms as it is suitable for all frequency ranges because it has a variable size window, being narrow at high frequency ranges and broad at low frequency ranges. It is used to provide a description of signal by decomposing it into various components depending upon the application of interest and components can be assembled again into original wave without any loss of information. It is suitable for analyzing nonstationary signals. The components of ECG wave when subjected to multiresolution analysis become clearly apparent. Wavelet transform has ability to manipulate and compute data in compressed parameters which are oftenly known as features. The behavior of ECG signal is described by the parameters that are obtained from large number of data points which can be compressed into small number of parameters. An important feature of wavelet technique is the availability of number of wavelet functions allowing an appropriate to be selected for signal of interest. Biorthogonal, Coiflet, Daubechies, Haar and Symlet are some wavelet families. These wavelets are localized in time as well as in frequency domain.

Wavelet transforms are classified in two groups: Continuous Wavelet Transforms (CWT) and Discrete Wavelet Transforms (DWT) [14].

1) Continuous Wavelet Transform

The continuous wavelet transform technique differs from Short Time Fourier Transform (STFT) since it allows temporal localization of high frequency signal features [15]. It does this by employing a variable window width, associated to the scale of observed signal, a flexibility that permits for the isolation of high frequency features [8] [15]. CWT differs from STFT in the sense that it is not limited to employ sinusoidal analyzing functions. But localized waveforms can be employed as long as they satisfy a predefined mathematical criterion.

The CWT of a signal is defined as the sum over all time of the signal multiplied by scaled, shifted versions of wavelet function Ψ. The CWT of a signal x (t) is defined as:

$$T(a,b) = 1/\sqrt{a}\int_{-\infty}^{+\infty} x(t)\,\Psi*\left(\frac{t-b}{a}\right)dt \qquad (1)$$

Ψ (t) is called mother wavelet, a is the scaling parameter and b is the shift parameter. The mother wavelet should be chosen carefully depending on the nature of signal because it has a significant effect on the consequence of analysis.

2) Discrete Wavelet Transform

Discrete wavelet transform (DWT) is described as a multiresolution transform having very fast implementation. DWT has an excellent property of space frequency localization [16]. In practice, wavelet transform (DWT) is frequently used for analyzing ECG signal at different scales. DWT is oftenly known as decomposition by filter banks since it makes use of two filters, a low pass filter (LPF) and high pass filter (HPF) to decompose a signal into different scales [17]. The terms 'approximations' and 'details' refer to the output coefficients of low pass filter and output coefficients of high pass filters respectively.

B. Neural Network based Methods

Some systems are available for automatic interpretation of ECG [18]. Moreover, for diagnosing arrhythmia in time, computer based interpreter systems are currently being developed. Various methods are applied to these systems with artificial neural networks being one of them. Neural network or Artificial Neural Network (ANN) is a computational model which is motivated by biological neural network model. An ANN is a processing element and with this tool human cognition can be modeled using mathematical operations [19]. Neural networks are capable of driving meaningful information from complex or imprecise data that can be used to extract pattern as well as for detecting trends that are too hard to be recognized by either humans or other computer techniques [20]. A neural network comprises of interconnected group of artificial neurons having input, hidden, output layers and adjustable weights.

Automatic recognition of abnormalities is important for diagnosis of cardiac arrhythmias. This is realized through analysis of ECG and its extracted features. Features of ECG can be extracted in frequency domain, in time domain or represented as statistical measures. Pattern recognition and classification tasks are some important application areas of artificial neural networks [21]. Because of belief that neural networks have great predictive powers, they have been used in a variety of decision supporting medical diagnostic system applications [22]. ANNs belong to field of artificial intelligence reason being it is a mathematical description of human neural structure reflecting its learning and generalization capabilities [23]. Two different diseases may have approximately similar effects on normal ECG wave [24]. Because of these problems, the diagnosis of heart disease becomes complicated. Therefore, arrhythmia diagnosis of a patient can be improved by making use of pattern classification method.

Automatic ECG pattern recognition methods are used in intensive care unit (ICU) as long time recording and examination of ECG are required. These techniques are also used for improving diagnosis efficiency and reducing physicians' workload. Recognition of an ECG pattern is inherently the process of extracting and classifying ECG parameters. Frequently used features during ECG analysis in time domain include amplitude, areas, duration, R-R intervals and the wave shape. An ECG signal contaminated by background noise adds to the difficulty of automatic ECG pattern recognition.

Currently, the concept of self-organizing map (SOM) is used as one of the generic of neural network tools for visualizing formation of highly dimensional data [25]. The objective of self-organizing map is visualizing highly dimensional data in a low dimensional space. Low dimensional description of highly dimensional data has to keep the topological features of data set. The results formed by SOM approach are more user-oriented in comparison to generally used unsupervised learning techniques, permitting for a thorough interaction with the user in sustaining various tasks of 'what-if' analysis.

C. Fuzzy Logic based Methods

Currently, a great challenge to present technology is prognostication of heart disease [26]. In this perspective utilization of an intelligent method is a real challenge. For building intelligent systems having decision making ability on the basis of expert's acquaintance and observations, fuzzy logic has proved to be an eminent tool [27]. It is observed that using Fuzzy Expert Systems (FES), development of disease specific application is the most important field of interest to researchers. Dissimilarity in decisions of medical practitioners is due to their approaches that deal with ambiguity and uncertainty in the information and knowledge. Also, the diagnosis based decisions are dependent on expertise, perception and experience of the practitioner.

The concept of Fuzzy sets introduced by Zadeh is significant in modeling and processing ambiguous information [28]. Fuzzy logic provides an influential reasoning technique that can handle uncertainty and ambiguity. It is a multivalued logic that deals with intermediary values. This technique is very proficient and it is analogous to human thinking. A membership function plays an important role to represent imprecision and vagueness in term of linguistics. The technique of fuzzy logic proposed by Zadeh can be used in numerous cases. Fuzzy logic can be used to classify arrhythmias. The Fuzzy Expert Systems describes vague information and present linguistic concept with excellent approximation to medical texts. In the world of medicine fuzzy logic is a process to render accurate what is inaccurate. In various image processing applications fuzzy if-then rules are used. In case of pattern classification problems, classification systems based on fuzzy rules can be used. It requires additional learning process and learning process based on error correction [2]. Also, for pattern recognition type-2 fuzzy sets can be used.

D. Fractal Dimension (FD)Based Methods

For recognizing cardiac diseases a method based on the estimation of fractal dimension (FD) of ECG recordings is proposed. With this approach, the variation in fractal dimension values can characterize the variations in texture of an ECG signal. In 1983, Mandelbrot introduced the term 'fractal' [29]. Fractals have uneven or fragmented geometrical profiles. These fragmented geometric shapes can be subdivided into parts. The concept of fractal dimension arises from fractal geometry. Fractal dimension pertains to a non-integer or fractional dimension. Systems essentially irregular at all scales are mathematically characterized by fractal geometry [30] [31]. Fractal geometry, unlike our conventional geometry that deals with circles, triangles, cones, spheres and lines, is concerned with broken shapes. By means of fractal geometry image and shapes within images that cannot be described by Euclidian geometry have been analyzed [32].

Fractal formation has a feature that it would illustrate the intricacy of the whole system, if one magnifies a small part of it. It means fractal structures are made up of transformed copies of themselves. This feature indicates that analytic regularity of the system is absent. The fractal dimension of a waveform corresponds to an influential tool for transitory detection. Being a self similar object, ECG signal must have an FD. This characteristic has been used in the examination of ECG to spot and distinguish particular states of physiological functions.

IV. PERFORMANCE MEASURES

The information is required to express in such ways which are clinically relevant so as to ensure the maximum usability [33]. It is expressed by equations given below:

$$\text{Sensitivity (Se)} = TP/(TP+FN) \quad (2)$$

$$\text{Positive predictivity (p+)} = TP/(TP+FP) \quad (3)$$

$$\text{Specificity(R)} = TN/(TN+FP) \quad (4)$$

Where FN indicates False Negative, FP specifies False Positive, TN denotes True Negative, as in [34] and TP is True Positive.

V. CONCLUSION

This paper provides a thorough review of various methods available for ECG signal analysis to detect arrhythmia. Each technique has its own merits and demerits. Therefore authors intend to do future work which will principally focus on improved analysis of ECG signal to detect abnormalities.

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A Review on OFDM based WiMAX Network

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***Abstract*—WiMAX (Worldwide Interoperability for Microwave Access) is a wireless communications standard designed to provide 30 to 40 Mbps data rate. WiMAX is a viable alternative to the cable modem and Digital Subscriber Line (DSL) technologies due to its high resource utilization, easy implementation and low Cost. This paper presents reviews about the comparison of OFDM-WiMAX network on different values of subcarriers that shows effect on the QoS parameter. This paper also gives review about the upshot alternative of subcarriers on the performance of OFDM-WiMAX network. The selection of an appropriate routing protocol is a key issue when designing a scalable and efficient wireless networks. This paper also reviews the different routing protocols and evaluate their performances on 802.16 WiMAX networks.**

Keywords: OFDM, OFDM Data Transmission, OFDM-WiMAX Network, QoS Estimation, OFDM Parameters

I. INTRODUCTION

The technology commonly named as WiMAX is a BFWA system with the goal of delivering\ last mile" fixed, nomadic, portable and mobile wireless connections on a metropolitan scale. The Physical (PHY) and MAC-layers has been developed by the IEEE 802.16 Working Group for Broadband Wireless Access to enable standardized development and deployment of broadband wireless networks in metropolitan areas. This standard has been evolved beyond the PHY and MAC-layer to encompass an end-to-end network architecture, created by the WiMAX Forum, an organization promoting global interoperability and use of wireless broadband. IEEE 802.16 is a universal standard comprehending various types of network architecture. IEEE 802.16 defines two different network topologies each with a specific MAC protocol: thepoint to multipoint (PMP) mode and mesh mode.

[Eklund *et al*. [2002]][1] The mesh mode is optional in IEEE 802.16e, where data can be routed directly between two SSs. In the PMP mode, a central BS is capable of handling multiple independent SSs simultaneously. It does not need to coordinate with other stations. Now a days, most WiMAX systems are equipped with the PMP mode where traffic only occurs between a BS and its SSs.

II. RELATED WORK

[Andrews and Chen [2005]][2] discussed the IEEE 802.16 family of standards and its related industry monopoly, WiMAX, gives bond for delivering high data rates over large areas so that a large number of users in the near future. This article presented the sober obtainable throughput and of that Expected WiMAX compatible systems based on the 802.16 dstandard approved in June 2004 (now named 802.16–2004). We also suggested future enhancements to the standard that could at minimum tetrad the attainable data rate, while also increasing the coverage, with only moderate elaboration increases.

[Hoymann *et al*. [2007]][3] Discussed a penetrating scheme to extent cellular multihop networks that is based on the technology known as WiMAX. An inferior case consider results in valuable indications for dimensioning cellular WiMAX networks within various multihop scenarios. Relays in these scenarios are operating in ensuing time slots as well as at the same time separated only in space. The following performance evaluation allowed to compare single hopand multihop deployments in terms of capacity. Finally, a general standard procedure proposed to use multihop distribution in some scenarios, whereas it advised single hop distribution in others.

[Bonato Both *et al*. [2011]][4] Described that QoS in metropolitan broadband communications is provided by the WiMAX that is a connection-oriented wireless. In this paper it is defined that alliance between a traffic demand by particular user and physical condition of network used by users.

[Chauhan *et al*. [2012]][5] Multiple users can share radio resources in a large scale wireless network. The efficient utilization of the radio resources have been done with the help of bandwidth allocation algorithms. To support multimedia traffics, the transmission of traffic flows will be co-ordinate by the Medium Access Control (MAC) protocols. To design an efficient MAC layer protocols the channel characteristics of users and traffic flow requirements are largely requires and helps to improve the system performance.

[Lu and Ma [2012]][6] Discussed that Wireless metropolitan area network was known as WiMAX and it is also known as WMAN that is specified by IEEE 802.16. Broadband wireless access for mobile devices is provided by the WMAN. In these systems to set up the mobility. When mobile station (MS) moves from the coverage area of the serving base station to the coverage area of the neighbor base station then the connectivity is maintained by the handover. In the process of handover, scanning was needed to search a suitable target base station and network re-entry was required to maintain the new connection. But in the actual process of handover a long inactivity to data

transmissions is caused resulting in the deliberate severance to services that are ongoing. In this paper,

Handover scheme that was improved was given to clip the dormancy that was introduced in the handover process by reducing the scanning and enhancing the network re-entry. Proposed scanning strategy reduces the dormancy by reducing the number of neighbor base stations to be scanned by calculating the rough location of the mobile station. The enlarged network re-entry reduces the delay by updating transport connection identifiers (CIDs) early to allow the fast revival of current applications.

[Candice King [2013]][9] Basic informational on the types of radiofrequency communications and the avails and burdens of each. Will be verses unlicensed frequencies will provide license so that specific topics to be explored and the distance that lies between remote radios and base stations, and communications architectures.

III. Discussion

A. *OFDM*

OFDM is a multicarrier modulation technique that can support high rate data transmission. It can effectively handle Intersymbol Interference (ISI). OFDM is based on FDM but it improves some of the aspects of FDM. FDM uses guard band to reduce the interference between the different frequencies. This guard band waste lots of bandwidth and hence this technology is not spectrum efficient. OFDM has no guard bands but still can reduce the interference because of its orthogonal modulation techniques. So this is both spectrums efficient and cost effective. OFDM is mitigating the multipath effect by converting the serial data into multiple parallel data by using Fast Fourier Transform (FFT) and inverse FFT. The MCM transmission technique gives the idea of OFDM. The principle of MCM construe the division of input bit stream into several parallel bit streams and then they are used to modulate several sub carriers. Each subcarrier is detached by a guard band to ensure that they do not overlap with each other. In the receiver side, band pass filters are used to separate the spectrum of individual subcarriers. OFDM is a form of spectrally efficient MCM technique. The use of band pass filters are not required in OFDM because of the orthogonally nature of the subcarriers. Hence, the available bandwidth is used very efficiently without causing the ICI. The effect of this is seen as the required bandwidth is greatly reduced by removing guard band and allowing subcarrier to overlap. It is still possible to recover the individual subcarrier despite their overlapping spectrum provided that the orthogonally is maintained. The orthogonally is achieved by performing FFT on the input stream. OFDM provides a composite high data rate with long symbol duration. Depending on the channel coherence time, this reduces or completely eliminates the risk of ISI, which is a common phenomenon in multipath channel environment with short symbol duration. The use of Cyclic Prefix (CP) in OFDM symbol can reduce the effect of ISI even more, but it also introduces a loss in SNR and data rate [Rahman *et al.* [2005]][9].

B. *OFDM Data Transmission*

OFDM follows multicarrier modulation while transmitting the data. The idea of MCM is that the high rate data bit is splitting into several low rate data bit and send each of this sub-streams into several

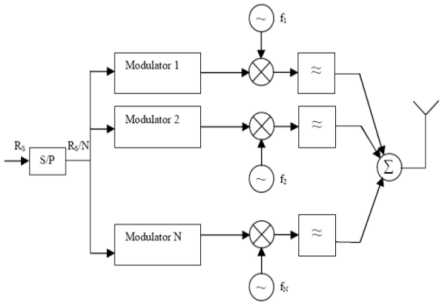
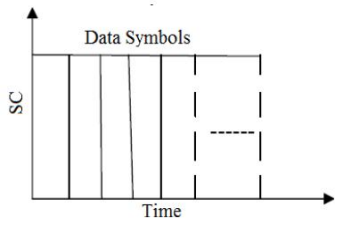
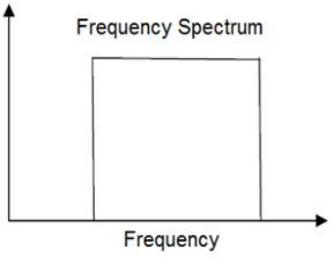


FIG. 1: Block Diagram of a Generic MCM Transmitter

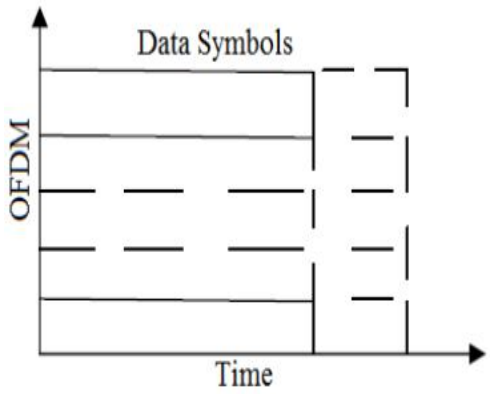
Parallel sub-channel which is also known as OFDM subcarriers or subcarriers. This sub-channel or subcarrier is orthogonal to each other and the bandwidth of each sub carriers much less than the total bandwidth. The advantage of sub channelization is that the symbol time TS of each sub-channel is higher than the channel delay spread which is effectively reduce the Intersymbol Interference. OFDM has smaller frequency bandwidth with longer time period which is effectively resist the multipath propagation and this property and orthogonal carrier is useful for achieving better spectral efficiency.



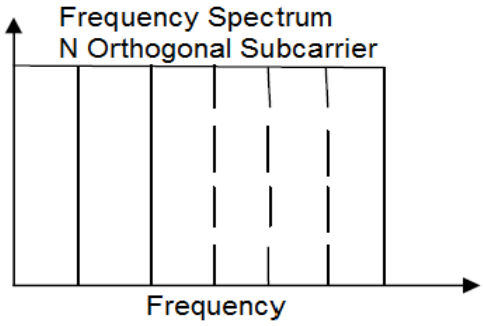
(a)



(b)



(c)



(d)

Fig. 2: Single Carrier and Multicarrier Frequency Representation

C. *OFDM-WiMAX Network*

OFDM-WiMAX access network is followed by a comparison of completion of the narrated OFDM-WiMAX network at each location. The obtained simulative results embolden the clout of the position of mobile station (MS) home agent over achievement of proposed WiMAX network significantly. In more the achievement improvement due to embodiment of OFDM technology by reducing the fading problem in such wireless networks is also reported. The achievement of suggested OFDM-WiMAX network is figure out with respect to QoS parameters such as throughput, average delay (Uplink/ Downlink), end to end delay(Uplink/ Downlink), packet jittering (Uplink/ Downlink), SNR(Uplink/ Downlink), BLER (Uplink/ Downlink), and packet dropped (Uplink/ Downlink).

D. *QoS Estimation*

The performance estimation of OFDM-WiMAX access network is carried out at varied values of subcarriers for UL and DL packet propagation and investigate different routing protocols and evaluate their performances on OFDM-WiMAX networks. OFDMA is a time-frequency hybrid system wherein the frequency band is divided into a large number of small bands called subcarriers that use specific frequencies so as to be completely orthogonal to each other. In every time-slot, each user is assigned a disjoint set of sub-carriers across which the user may spread information for transmission purposes. Because of its capability of exploiting multi-path fading and spatial/ temporal diversity to improve performance, it becomes physical layerwireless networks, e.g. cellular networks, broadband LANs, in

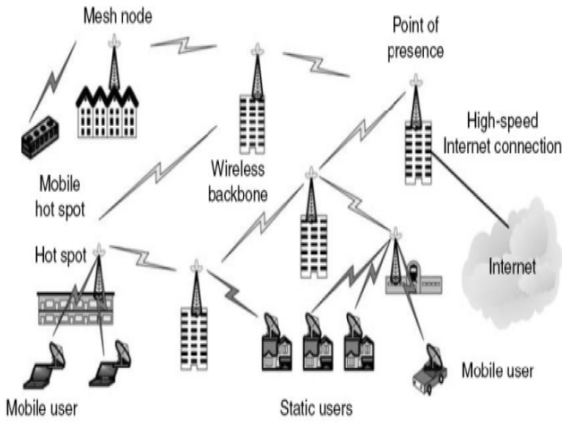


Fig. 3: WiMAX Mesh Networks Architecture
[Djukic and Valaee [2007]] [6]

Transmission scheme of choice adopted by fourth generation order to provide high-speed mobile wireless data services.

E. *OFDM Parameters*

There are two versions of WiMAX, Fixed WiMAX and mobile WiMAX. OFDM physical layer implementation of WiMAX is different for fixed and mobile WiMAX. In fixed WiMAX, FFT size is fixed which is 256 and in mobile WiMAX, which uses resizable OFDMA based physical layer where the FFT size can takes value between 128 bits to 2048 bits. The multiplexing scheme of OFDMA is closely related to OFDM. OFDM divide single high bit rate data stream into several low bit rate parallel substream and modulated the data by using Inverse FFT. OFDMA also do like that with little difference. In OFDMA several users' data is multiplexed onto downlink sub-channel and uplink multiple accesses are provided by uplink sub-channel.

TABLE: 1: ESTIMATED TIMELINE FOR WIMAX
[LAX AND DAMMANDER [2006]] [8]

Feature	Year	Applications
Fixed	2005	Outdoor and Backhaul
Nomadic	2006	Metorozone, Fixed indoor and Enterprise campus piconet
Mobile	2007/8+	Mobile

IV. CONCLUSION

In this paper, implementation of OFDM-WiMAX network is done by changing the location of home agent of MS to different BSs that help to evaluate SNR, Packet jittering, throughput, delay, packet ETE delay,

packet dropping etc. It can be seen that SNR, WiMAX delay, packet ETE delay, packet jittering scenario having larger number of subcarriers gives best performance. Hence, it is concluded that number of OFDM subcarriers increases the QoS get improved Significantly and also OFDM-WiMAX system is implemented by changing different subcarriers and by using routing protocol.

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Reconfigurable Antennas—An Overview

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***Abstract*—The innovation of wireless communication network demands the integration of the numerous radios on exclusive podium to increase the channel capacity and to reduce the antenna dimensions. Reconfigurable antennas are introduced to achieve various wireless services that operate in entire frequency spectrum. These antennas have ability to provide the analogous throughput, in same manner as by multiantennas. Essential configuration of these antennas can be achieved by shifting the electrical length, current via electrical switches such as p-i-n diodes, MEMS and varactors. This paper reviews the different reconfigurable antennas such as frequency, polarization and radiation pattern reconfigurable antenna which have capacity to broaden the horizons more than one contour at different frequencies.**

Keywords: Reconfigurability, Field Programmable Gate Array (FPGA), p-i-n Diodes

I. INTRODUCTION

Recent communiqué structure like cellular phone and other communicating devices are developing upward because of their multifunctionality [1]. Multifunctionality provides figure of services for various responsibilities at odd time. The moving objects like ship, glider plus land vehicle are carrying bulky amount of antennas. These antennas are executing a number of functions at diverse frequencies, bandwidth, variable polarization and radiation characteristics [2]. It is essential for an antenna to convene the communication load. Designing an antenna to achieve appropriate function in entire frequency spectrum is difficult without exceeding hardware composition. The antennas, which have aptitude to transform its characteristics such as frequency, polarization, radiation pattern by morphing its physical structure without extending its region, volume, and are highly adaptive to multipath environmental circumstance, are termed as reconfigurable antennas [3]-[4]. Reconfigurable antennas are of diverse types such as frequency reconfigurable antenna, radiation pattern reconfigurable antenna and polarization reconfigurable antenna. Reconfiguration of an antenna is achieved by altering the current and radiated element [5]. It provides a diversity of functionality and also reduces the number of antennas which are necessary for intended system function [6]. Researchers in antenna field are facing an intricate question that at what times the reconfigurable antennas should be planned. Such development is tedious and requires the observation of many factors, such as achieving a superior gain, steady radiation, and a fine impedance match during the entire antenna's operation [7]. Reconfigurable antennas are cost effective; improve the channel capacity, able to evade the fading by avoiding electromagnetic interferences which occurs in UWB and L-band communication system [8]-[9]. These antennas provide spectrum reallocation for various emerging application relating terrestrial and space such as airborne, radar system, multifunctional communication devices [10]. There are number of reconfiguration techniques that have been anticipated since the growth of reconfigurable antennas. The future reconfiguration techniques are separated into four different categories such as electrical, optical, mechanical, and materials change [7]. Out of four categories, the electrical reconfigurablity can be achieved by various techniques like tunable switches such as p-i-n diodes, MEMS and varactor that distribute the antenna current which is of our interest.

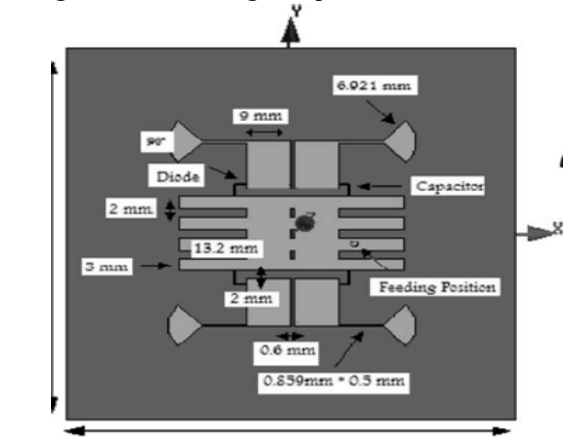
This paper is organized into five sections. Section II illustrates the frequency reconfigurable antenna which can be revised by using electrical switches such as p-i-n diodes. Section III illustrates the polarization reconfigurable antenna whose polarization is changed via MEMS switches. Section IV presents the radiation pattern of reconfigurable antenna. Section V highlights the applications followed by section VI that provides conclusion of this paper.

II. FREQUENCY RECONFIGURABLE ANTENNA

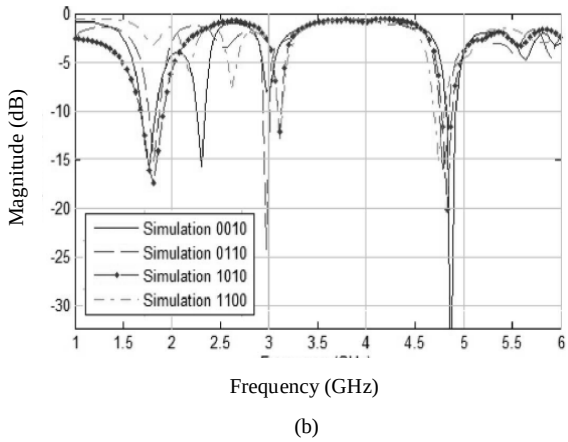
In broadband multimedia appliances the demand of bandwidth has increased significantly. As a consequence, there is need of frequency reconfigurable antenna where outlay and hardware formation are of significant concern [11].

The reconfigurable microstrip antenna proposed by S. Shelley [12], consists of three layers; base layer is a rectangle ground plane that envelops the whole surface. Central layer has a constant dielectric permittivity and top layer consists of superior sheet of metallic strips (patch) that composes a midsection and four neighbouring minor sections as symbolized in Fig. 1(a) and Fig. 1(b). The transreciever current is fed through coaxial wire. The alternative configuration is achieved by shifting the current via convenient switches such as p-i-n, schottky diodes. p-i-n diode functions in an 'ON' and 'OFF' position which is robotically triggered and controlled via an FPGA. p-i-n diodes are connected to the main section of the antenna through lumped capacitors. These capacitors are used to prevent

the dc current in main section, while permitting the RF current [13]. An alternative approach to modify the path of radiating currents of an antenna is its electrical length [14]. The variations in the electrical length help to distribute the current that magnify the radiation of electromagnetic wave [15]. The modification is done by a p-i-n diode which is connected to the main section of antenna to transform the current on path to the patch. The electrical length gets shorted while diode in conduction state switches to '1' whereas the antenna functions in upper frequency band. When diode is off i.e. '0' state then current moves around the patch and antenna operate in lower frequency band. The 'ON' state exhibit when it gets short circuit and 'OFF' state exhibits when it is in open circuit. The radiation pattern in upper and lower frequency band is changed by electrical length of an antenna. Another approach to achieve the reconfigurability of an antenna is varactor diodes which constantly tuned the operating frequencies of microstrip patch antenna at radiating boundaries of the composition [14]. Varactor diodes function in reverse condition from 0 to 30V analogous to capacitance 0.4-2.4pF. The change in voltage means the capacitances at radiating edges is changed, that causes a change in effective length of patch.



(a)

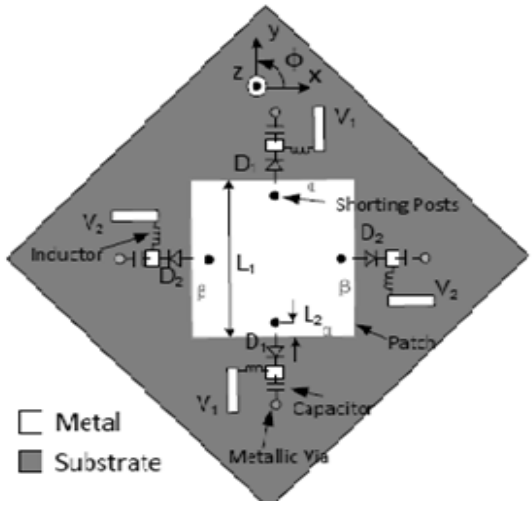


(b)

Fig. 1: (a) Schematic Diagram of Frequency Reconfigurable Antenna (b) Antenna Resonance at 'off' and 'on' State of Diode [12]

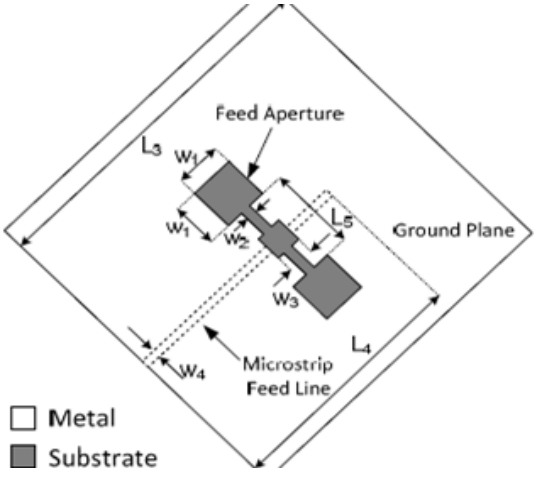
III. Polarization Reconfigurable Antenna

Reconfigurable antennas are used to meet the huge demand for high data rate in wireless communication networks. Polarization reconfigurable antennas are capable of providing polarization diversity and decreases the multipath fading [16] in transmission environments. Reconfigurable antenna allows frequency reuse, which improves the system capacity. A few years back, a polarization reconfigurable antenna has been industrialized for WLAN system, but they reconfigure their polarization on a single frequency band. A dual band reconfigurable antenna [16] has been illustrated which allow switching amid horizontal, vertical, circular in 2.4 and 5.84 GHz frequency band as depicted in Fig. 2(a) and Fig. 2(b). TM10 and TM30 modes of a cube patch antenna are used to execute the dual band operation. To meet the WLAN standards, the frequency of two modes can be modified by inserting four shorting posts into the patch.



(a)

Fig. 2(a): First Layer of Polarization Reconfigurable Antenna



(b)

Fig. 2(b): Second Layer of Polarization Reconfigurable Antenna [16]

The dual band operation can also be realized with horizontal as well as vertical polarization through electrical switches such as p-i-n diodes, RF-MEMS, which switches the polarization of an antenna automatically. The dual band reconfigurable antenna consists of two diodes D1 & D2. The conduction of diodes help out to get the antenna tilting polarization, if first diode is switched off then antenna diversify vertical polarization and if second one is turned 'OFF' then it expand horizontal polarization, out of two diodes one of them is turned 'ON'. When there is no conduction between both diodes then radiate 45˚ linear polarization. When both diodes are turned 'ON', input reflection coefficient of an antenna is too high to be acceptable. Another example of this approach has been proposed by N. Behdad [17] as shown in Fig. 3. The dual frequency operation can be achieved with the insertion of lumped variable capacitors along the slot in reconfigurable slot antenna. The capacitors in the slot antenna change the resonant frequencies of the first and second resonance of the antenna. On the other hand, the shifting of frequencies not only relies on capacitors value but also on their position along the slot. Appropriate placement of capacitors helps out to gain dual-band antenna operations whose first and second resonant frequencies can be controlled separately. In addition to, the frequency of either first or the second band can be fixed, while the other one is automatically tuned. The dual band slot antenna also consists of two inductors that are fixed and capacitors that are robotically triggered via varactor diodes, which operates in 0-30V.

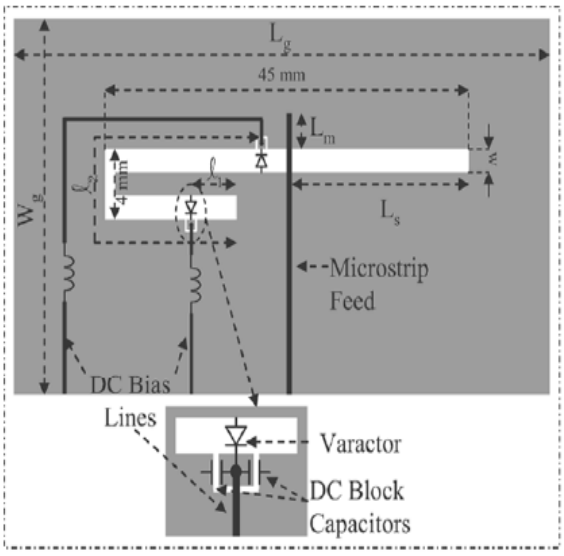


Fig. 3: Schematic Diagram of Dual Band Slot Antenna [17]

IV. Radiation Pattern Reconfigurable Antenna

The radiation pattern reconfigurable antenna has the ability to expand its waves in broader & narrow pattern. This antenna is widely used because of its merits like avoid interferences, reduces the blockage of signal, and also conserve its energy by directing its wave on particular direction [18]. It is an antenna that is capable to reconfigure its radiation pattern, maintains its wide pattern in the absence of interferences. The occurrence of undesired signal at antenna reduces the system performances, restrain these signal as much as feasible. A pattern reconfigurable microstrip parasitic array has been proposed by S. Zhang [19] depicted in Fig. 4. It consists of a probe fed centre stripe with parasitic stripe lying on both sides of antenna, each connected with switches. The antenna is placed on dielectric substrate. The radiation pattern of antenna is altering by shifting the power level diagonally. Power is altered by MEMS switches. Switching method are utilised to reroute the current on different section of an antenna, which modify the radiation pattern. Most of the time MEMS switches are used because they have a few advantages over p-i-n diodes; they have a better utilisation of power, small size, low weight and better isolation. In this antenna, the switches function in four positions-active or deactivate to the dynamic patch and short-open circuit to the ground plane. In the existence of overcrowding signal the microstrip parasitic radiation pattern reconfigurable antennas need to modify the core of beam throughout to maintain the beam shape and diminish these signals as much as feasible. The radiation structure is chosen by altering the major beam, via controlling the switches position and varying the electrical length. An antenna radiation is shifted from certain angle although maintaining VSWR. After controlling the switch position, an omnidirectional radiation pattern is formed by monopole antenna or dipole antenna with reflector forming the directional radiation pattern [20].

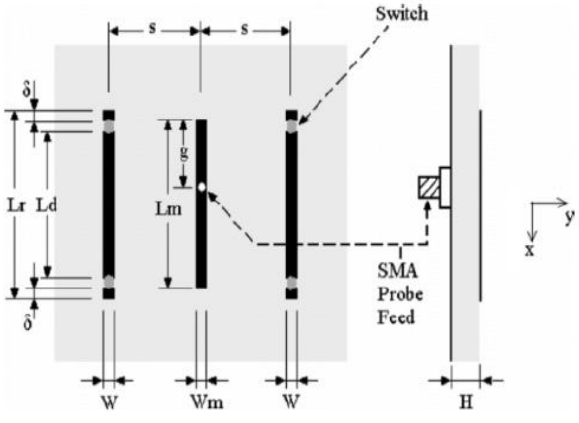


Fig. 4: Pattern Reconfigurable Microstrip Parasitic Array [18]

V. Applications

Reconfigurable antennas are adopted for variety of purposes in communication system as these are cost-effective and are employed to efficiently utilize the bandwidth.

A. *Reconfigurable Antenna for Airborne Application*

For aircraft communication a broadband reconfigurable antenna is used, which covers frequency spectrum from L bands to VHF band. These are also used in mobile objects like as aircraft, ships, and glider hauling bulky amount of antennas. These antennas are executing the numerous functions at diverse frequencies & bandwidth characteristics. It is essential for an antenna to convene the communication load without extending hardware structure. To provide Multifunctionality for such types of application, frequency reconfigurable antennas are suitably choice.

B. *Radiation Pattern Reconfigurable Antenna for Mobile Application*

A communicating device such as mobile phones is using reconfigurable antennas, which can transmit and receive different information simultaneously. The use of such type of antenna increases the system performances and effectively use of bandwidth. These antennas are allowed to communicate with devices to function in radiation pattern configuration. By functioning in pattern configuration it also increases the channel capacity.

C. *Polarization Reconfigurable Antenna for Cognitive Radio System*

Cognitive radio system can be implementing by using new generation of polarization reconfigurable antenna systems. The advantage of this application makes efficient use of frequencies by utilisation of polarization diversity, which transmits signal over busy frequencies. This antenna has ability to provide polarization diversity, such as horizontal, vertical and circular polarization in multipath environment.

VI. CONCLUSION

This paper provides the general idea of electrical reconfigurable antennas, which are split into various categories such as frequency, radiation, and polarization. These antennas can be implemented using different technique to obtain the required reconfigurability. These reconfigurable antennas are useful to increase the channel capacity, reduce the system cost and make use of bandwidth efficiently. This reconfigurable antenna used in various applications such as cognitive radio, cellular phones and wireless sensor networks.

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A Review on FDMAC Protocol in mmWave of 5G Wireless Networks

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***Abstract*—Millimeter wave (mmWave) communication is one of technologies which are used in 5th generation wireless networks. In this paper, we analyze the medium access control issue of the mmWave networks. A frame based scheduling directional MAC (Medium Access Control) protocol, named as FDMAC (Frame-based directional MAC), and is developed in order to accomplish the objective of leveraging collision-free concurrent transmissions to completely exploit spatial reuse in mmWave networks. By settling up the scheduling overhead over multiple concurrent, successive transmissions in a row, the high efficiency of FDMAC is obtained. Graph coloring-based scheduling algorithm is the base of the FDMAC which is named as greedy coloring (GC) algorithm that can estimate near-optimal schedules, with low entanglement, in reference to the total transmission time. With the help of Simulations, FDMAC is investigated and calculated.**

Keywords: 5G Wireless Technologies, Frame-Based Scheduling, Graph Coloring

I. INTRODUCTION TO 5G WIRELESS

5G wireless technology has changed the way of using the cell phones inside very high bandwidth. Camera, video player, dialing speed, large phone memory, MP3 recording and a lot more is including in 5G technology. 5th wireless mobile multimedia internet networks can be established wireless communication without restriction. There are many activities all around the world to taking the applications and requirements for 5G. Some of the requirements are listed below:

- 100-1000 times higher system capacity.
- User data rates in the order of Gbps at everyplace.
- Latency should be of 1 millisecond.
- Number of connected devices per area must be 10-100 or higher.
- 10 times longer battery life.

These requirements will change the wireless experience of a user by offering fast omnipresent connectivity. In order to cover the 5G requirements mentioned above, research on both device side and network side is required. Technologies that covering the requirement for higher system capacity and data rates are i) Denser Multi-radio access technology (RAT) HetNet ii) Massive MIMO iii) Millimeter (mm)-wave Signals iv) Direct Device to Device (D2D) v) Simultaneous Transmission and Reception (STR).

The trouble with medium access control in millimeter wave (mmWave) small cells is considered within this paper. With the huge bandwidth in the mmWave band, a lot of new applications can be supported in mmWave networks with ease. The largest increase in wireless network capacity is achieved by the small cells which are the activator of spectrum's efficient spatial reuse as compared to other technical advances like advanced modulation and coding technique. In the MAC (Medium Access Control) protocol's scheme for mmWave networks, directional transmissions should be explicitly considered. The signal strength is unremarkably low at the third party nodes, resulting from directional listening and transmissions, making it hard to execute carrier sense. This is often known as the *deafness problem*. This diminished interference to contiguous links can be employed for enhanced spatial reuse. It is possible to plan mutual transmissions at numerous links in the absence of interference, to upgrade the network capacity. New scheduling algorithm and directional MAC protocols are required.

Efficient MAC scheduling is essential to fully yield the multi-gigabps physical layer rates for the throughput of the high application layer. Within this paper, the bug of efficient scheduling in mmWave networks is investigated by us. We think of an mmWave small cell comprising of PNC and DEVs. The nodes are familiar with one another's locations and always directed their beams to piconet coordinator (PNC) when idle by assuming some bootstrapping mechanism. The PNC clusters the traffic demands from the multiple devices (DEVs) and estimates schedules to enable concurrent directional transmissions. Frame-based scheduling are considered within this paper and named as Frame-based directional MAC (FDMAC). The aim is to clout collision-free mutual transmissions to completely exploit the mmWave small cells's spatial reuse.

Within FDMAC, frames are used which is due to the partition of the network time into a sequence of non-overlapping intervals. Scheduling phase and Transmission are the two phases which is involved in each and every frame. Scheduling Phase, the time when the traffic demands from DEVs are clustered by PNC and estimates transmission schedule. Transmission phase is eventually occurred when the mutual transmissions following the schedule are started by

DEVs. Packets reaching during the current frame will be saved at the PNC/DEVs and then in the next frame, it is scheduled to be transmitted. In the Scheduling Phase, demands of the traffic, from the DEVs, are gathered by the PNC, a schedule is made to harbored demands of traffic, and then that schedule is transmitted to DEVs. A sequence of topologies, each signifying how the DEVs are paired to make directional links, and time interval sequences, each signifying how long each topology should be conserved, are comprised by the schedule. Throughout the transmission phase, PNC/DEVs are paired with one another takes place and for several time slots, as itemized in the schedule, transmission of packets is started.

Scheduling algorithm estimates a schedule for given traffic demands for the minimization of the total transmission time. The frame based scheduling difficulty is being formulated as a mixed integer nonlinear programming problem which is called as MINLP and GC algorithm based on graph coloring, for the estimation of near-optimum solutions, is developed. The proposed FDMAC is investigated by us and its performance on lower and upper bounds is driven.

II. FDMAC System Model

An mmWave small cell comprising of a PNC and multiple DEVs is assumed. Time is subdivided into non-overlapping, equal-length intervals. The DEVs clocks are synchronized by the PNC and in the small cell, to harbored traffic requests from the DEVs, medium access is coordinated. Assumed that a cell comprising of n DEVs. Only one DEV, in the small cell, is chosen to serve as PNC. A bootstrapping scheme is considered so that DEVs have updated network topology location information. Its directional beam toward can be steered toward either PNC or another DEV for receiving/transmitting data. Beams of all the DEVs are pointed towards PNC during idle state. PNC has the unique ability for serving as a transmitter and receiver in the middle of its transmission phase. Node term is eventually used for PNC or a DEV's referring if distinction between them is not required.

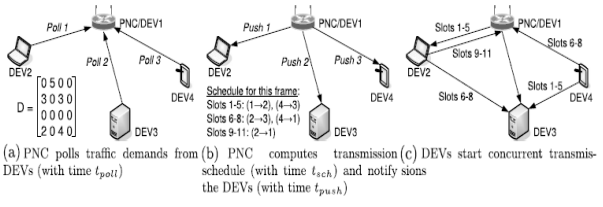

Fig. 1: FDMAC's Operation.

A. Frame based Scheduling and Matching

Figure 1. [18] illustrates the working of FDMAC. In FDMAC, traffic received, from the PNC, is accumulated in the virtual queues in the form of frames, and then gets transmitted in the succeeding frame. A transmission phase with duration t^{tr}_{ph} follows scheduling phase's frame with the duration of t^{sch}_{ph}. At the beginning time of the scheduling phase, from all DEVs point to PNC and for their demand vector d_i, DEVs are polled by PNC. Considering the d_2 = [3 0 3 0], refers to the requests of three time slots for transmitting to both DEV1 and DEV3. t_{poll} is the time for PNC for taking all the d_i's.

To serve the traffic demands D, PNC will estimate a transmission schedule with the time of t_{sch}. Multiple elements are comprised in the schedule. For a certain number of time slots, nodes are paired by these elements. As clearly seen from the fig.1(b), firstly DEV2 is transmitted by DEV1, and DEV3 is transmitted by DEV4 for five time slots. Then DEV3 is transmitted by DEV2 and DEV1 is transmitted by DEV4 for the next three time slots. At last, DEV1 is transmitted by DEV2 for the last three time slots. For clearing the backlogs at all nodes, this schedule is enough. The transmission schedule S is

$$D \prec S = 5\begin{bmatrix}0&1&0&0\\0&0&0&0\\0&0&0&0\\0&0&1&0\end{bmatrix} + 3\begin{bmatrix}0&0&0&0\\0&0&1&0\\0&0&0&0\\1&0&0&0\end{bmatrix} + 3\begin{bmatrix}0&0&0&0\\1&0&0&0\\0&0&0&0\\0&0&0&0\end{bmatrix} \quad (1)$$

At the time interval of t_{push}, transmission of transmission schedules takes place to all nodes. In the succeeding transmission phase, nodes are paired with one another and concurrent, directional transmissions as clearly seen from the fig.1(c). As a whole, for serving the demands of traffic D, 11 slots are acquired. In the virtual queues of nodes, new packet arrivals are backlogged in their current frame. Then they will be scheduled in the next frame's transmission.

B. Problem Statement and Reformulation

G^t or A^t, which are termed as schedule graph and its adjacency matrix, represents the topology made from the corresponding transmission schedule, in the each time slot. The topology is evolved from time slot to time slot within the frame. For avoidance of the frequent steering, we generally consider that each link, in a schedule, energize only once. After the formation of Directional link (i, j), it should be uphold for at least d_{ij} time slots so that all backlogged packets are served in the jth virtual queue at node i. *Proposition 1 is the minimum number of needed time slots for G^t (V, E^t) is*

$$\delta^t = \max \{d_{ij} | a^t_{ij} = 1, I, j \in V\}, \quad (2)$$

a^t_{ij} is the (i, j)th element of adjacent matrix A^t indicates the topology's packet. Many feasible schedules are present for the given demand matrix D. Schedule, which clears the backlog D with minimum number of time slots, called as optimal schedule. This schedule implies maximum transmission parallelism. Frame-based scheduling problem is formulated as

minimize: $\sum^{K}_{k=1} \delta^k$

Subject to:

$\sum^{K}_{k=1} a^k_{ij} = \{ 1, \text{if } d_{ij} > 0; 0, \text{otherwise for all i,j} \quad (3)$

$a^k_{ij} \in \{ [0,1], \text{if } d_{ij} > 0; [0], \text{otherwise for all i,j,k} \quad (4)$

$\sum^{K}_{k=1} (\delta^k . a^k_{ij}) \{\geq d_{ij}, \text{if } d_{ij} > 0; =0, \text{otherwise for all i,j} \quad (5)$

$\sum^{n}_{k=1} (a^k_{ij} + a^k_{ji}) \leq 1 \text{ for all i,j.} \quad (6)$

This problem is NP-hard which is called as MINLP problem. *Reformulation-Linearization Technique* (RLT) is considered to obtain a linear relaxation. A Substitution variable $\mu^k_{ij} = \delta^k . a^k_{ij}$ is defined by us specifically. As δ^k is between 0 and dbar where dbar = max $\{d_{ij} \mid i, j \in V\}$according to the proposition 1. a^k_{ij} is also bounded between 0 and 1. The *RLT bound-Factor product constraints* for μ^k_{ij} as

$$\begin{cases} \mu^k_{ij} \geq 0 \\ \delta^k - \mu^k_{ij} \geq 0 \\ \bar{d} \cdot a^k_{ij} - \mu^k_{ij} \geq 0 \\ -\delta^k - \bar{d} \cdot a^k_{ij} + \mu^k_{ij} \geq -\bar{d} \end{cases} \quad \text{for all } i, j, k. \qquad (7)$$

Substituting μ^k_{ij}, obtained a mixed integer linear programming (MILP) relaxation are

Minimize: $\sum^{K}_{k=1} \delta^k$

Subject to:

$\sum^{K}_{k=1} \mu^k_{ij} \{\geq d_{ij}, \text{if } d_{ij} > 0; =0, \text{otherwise for all i, j}$

III. Greedy Coloring Algorithm

Input: traffic demand D, set of n distinct vertices V, set of edges ordered by non-increasing weights E

Output: $G^1(V, E^1), \delta^1, G^2(V, E^2), \delta^2, \cdots$

1 Obtain a directed and weighted multigraph $G(V, E)$;
2 $t = 0$;
3 **while** $|E| > 0$ **do**
4 $t = t + 1$;
5 Set $G^t(V^t, E^t)$ with $V^t = \emptyset$ and $E^t = \emptyset$;
6 **while** *there is unvisited edge in E and* $|E^t| \leq \lfloor \frac{n}{2} \rfloor$ **do**
7 Get the unvisited edge with the max. weight $e_{ij} \in E$;
8 **if** $i \notin V^t$ *and* $j \notin V^t$ **then**
9 $E^t = E^t \cup \{e_{ij}\}$;
10 $V^t = V^t \cup \{i, j\}$;
11 $E = E - \{e_{ij}\}$;
12 **if** $|E^t| == 1$ **then**
13 $\delta^t = \omega(e_{ij})$;
14 **end**
15 **end**
16 **end**
17 Output $G^t(V, E^t)$ and δ^t;
18 **end**

Fig. 2: GC Algorithm

The base of FDMAC is a scheduling algorithm which is used to solve problem with small t_{sch}. For a given demand D, a near-optimal solution is estimated by GC algorithm as specified in fig. 2[18]. Edge coloring algorithm model can be used for the scheduling problem. *The Proposition 2 is, let* $S = \delta^1 A^1 + \delta^2 A^2 + \ldots + \delta^K A^K$ *is a feasible schedule for a given demand matrix D, then K-edge-colorable graph can be modeled from S.*

GC follows the Proposition 2. In order to minimize $\sum^{K}_{k=1} \delta^k$, obtained K-edge coloring of a directed multigraph G(V, E) is equivalent to the Proposition 2 that solving optimal scheduling-problem. The well known and studied problem is Edge coloring whereas to find the *edge coloring number* ($\chi'(G)$) of a graph G, the problem of conventional edge coloring is eventually used. Edge coloring number represents the minimum no. of colors that are vital in G to color all edges. Our main target is the minimization of the total transmission time $\sum^{K}_{k=1} \delta^k$. No. of colors is not our concern. Additional colors, over the edge chromatic number, are acceptable if the reduction of total number of time slots are possible.

GC algorithm's pseudo-code is considered in Algorithm. Firstly, a guided and padded multigraph G(V, E) is obtained from the GC algorithm. V indicates the set of n nodes and E indicates the set of directed and weighted edges sorted according to edge weights in non-increasing order. Improper coloring of all elements iteratively makes a matching by GC. The termination condition is examined by Line 6 in the Algorithm. Line 8 is a matching condition. This matching condition guarantees the set of pairwise non-adjacent edges.

IV. Studies in Simulation

FDMAC is evaluated and compared with MRDMAC and MDMAC schemes. MATLAB is used for the implementation of all protocols. Relaying traffic between two nodes with no direct connectivity is enabled by MRDMAC. MRDMAC is tuned for TDM systems to a single hop MAC scheme which is based on centralized PNC. In FDMAC, calculation of t_{ph}^{sch} is needed. It comprised of t_{poll}, t_{sch} and t_{push}. For the sequentially exchange of small amount of control data from PNC to DEVs, both t_{poll} and t_{push} must be required. The total number for t_{poll} and t_{push} is estimated from the network size n. n also determines the no. of control messages should be sent in the middle of scheduling phase. The efficiency of the scheduling phase is dependent on the transmission time t_{ph}^{tr}. Three mmWave MAC schemes are compared, under *on-off bursty traffic*, with respect to fairness performance, network throughput and average delay. Initially, each DEV has small amount of packets, which are randomly generated in the virtual queues. Uniform and Non-Uniform patterns of traffic is considered.

C. Delay Performance

Firstly, three MAC protocols's delay performance is evaluated. For the different traffic loads, average delay of the received packets in plotted in the fig.3 and fig. 4[18]. MRDMAC's average delay, in both plots, diverges when the traffic load lies in the range of 0.55

and 0.6. When the traffic load is 3.05 for uniform and 3.0 for non-uniform traffic, the MDMAC's average delay diverges. FDMAC's results are better in both plots as compared to the MRDMAC and MDMAC. It means that reduction in delay and support a heavier traffic load is much better in FDMAC. FDMAC's delay starts diverge when the offered load exceeds 4.5 for uniform and 4.0 for non-uniform bursty traffic.

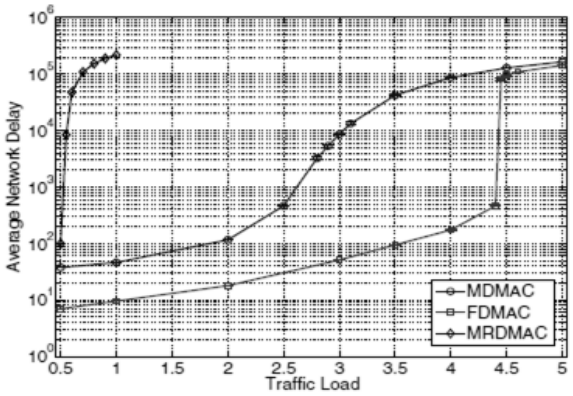

Fig. 3: Three MAC Protocols's Average Delay under Uniform on-off Bursty Traffic

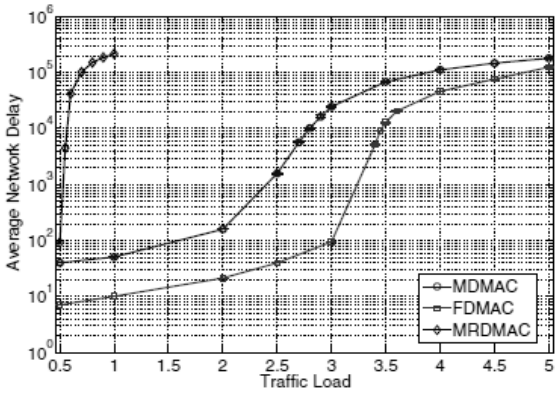

Fig. 4: Three MAC Protocols's Average Delay under Non-uniform on-off Bursty Traffic

D. *Throughput Performance*

Three MAC protocols's achieved total number of transmissions is shown in the fig. 5 and fig. 6[18]. Both delay performance and throughput performance are consistent to each other. Because of the lowest throughput, concurrent transmissions are not supported by MRDMAC. FDMAC and MDMAC's throughputs are close to 450% and 340% respectively when the traffic pattern is uniform. Under the non-uniform traffic pattern, throughput which is achieved by FDMAC is close to 380% while for MDMAC, it is close to 330%. 32.4% and 15.2% are the normalized improvement ratios. The FDMAC curves drop sharply in fig.5 when the offered is exceeded from 4.5. This is because to achieve heavier loads of traffic, we have to increase each element of traffic demand in D. Hence, backlogs will also be increased simultaneously at each DEV. Therefore, beyond 4.5 value, congestion is started in all nodes. In the case of non-uniform traffic plans, abrupt drop is not seen. This is due to fact that some heavily loaded nodes congested earlier than other lightly loaded nodes.

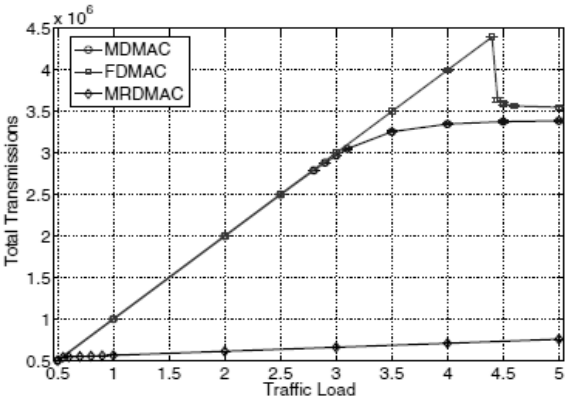

Fig. 5: Three MAC Protocols's Total Number of Successful Transmissions under Uniform Bursty Traffic

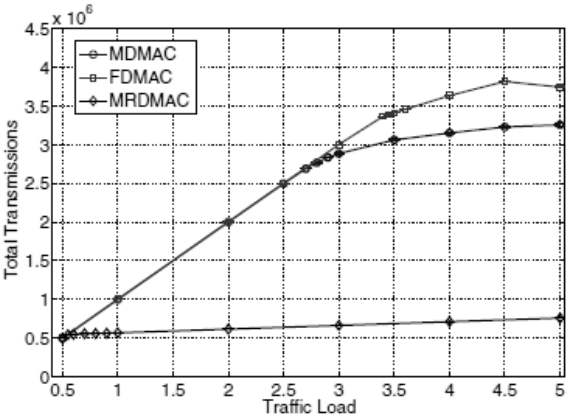

Fig. 6: Three MAC Protocols's Total Number of Successful Transmissions under Non-uniform Bursty Traffic

E. *Fairness Performance*

Jain's fairness index is adopted where fairness index is varied from 0 to 1. For the same average delay of all nodes, maximum value 1 of fairness index is achieved. The fairness index is close to 1/n, when large delay of one node which dominates all other nodes. The simulation results of all three MAC protocols are plotted in fig.7 and fig. 8[18]. Under the uniform traffic pattern, MRDMAC's fairness index is lower than FDMAC and MRDMAC. Because of congestion, FDMAC's fairness curve falls slightly when the load passes the value of 3.0. The MDMAC's performance is affected in the case of non-uniform traffic because of the biased traffic flows. Increase in offered load beyond the congestion point, fairness performances of both FDMAC and MDMAC protocols are comparable. Fairness indices will drop to 0.7 when offered load's value is greater than congestion point under the non-uniform traffic.

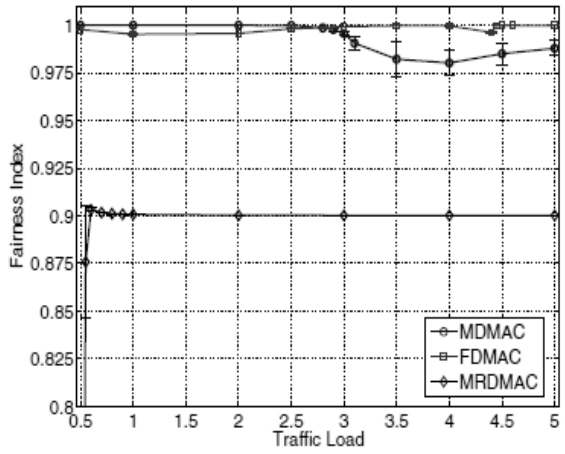

Fig. 7: Three MAC Protocols's Fairness Indices under Uniform on-off Bursty Traffic

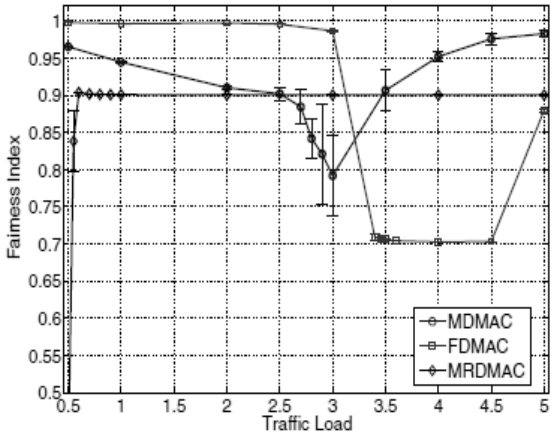

Fig. 8: Three MAC Protocols's Fairness Indices under Non-uniform on-off Bursty Traffic

V. CONCLUSION

The main motive of this paper is to exploit concurrent transmissions for the network capacity's great improvement which is enabled by the highly directional communication. For amortizing, suggested FDMAC included a frame-based scheduling algorithm over the concurrent packet transmission's long sequences. But Blockage problem is still existed in FDMAC that will be important topic for the researchers.

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A Survey on Face Quality Assessment Techniques

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***Abstract*—For Biometric face recognition systems there is the need to capture a good quality facial image from a video sequence. Frames obtained are not always of respectable quality. These are generally degraded in many parameters like sharpness, pose-estimation, resolution and many more. In this paper many techniques have been briefly discussed to firstly select the parameters that are needed to be improved and then quantifying them and then giving them an overall score. Many face quality indices can be obtained that gives the facial quality of an image on a scale of good or bad. Also in some of these indices a suitable measure is made to have a comparison between the scores given by humans and that by the system.**

Keywords: Quality Assessment, Face Quality Index, Surveillance Cameras

I. INTRODUCTION

Today we live in a world in which we are under surveillance all the time. At all places weather they are public, government or even at our homes we are under surveillance. Many people pass through a camera many times and we have to go through a large set of images. Many of the images that are captured are generally not of any use because of the problems like too small size of region of interest, motion blurring, improper pose-estimation, open or close mouth, low or high brightness, glasses or no-glasses, improper focus etc [1, 2]. Out of many images, we get only a couple of them are useful which makes it necessary to extract the best quality image out of the all available ones. For that we have to make some measures for calculating the quality of the input image. This is called "Quality Assessment". A good quality image is used in many fields like surveillance cameras, and in other applications such as compression, printing of high or low quality images [2]. Here we are particularly concerned with the facial parts and the Quality estimation of the facial parts of the images because most of the biometric identification applications are based on the face of a human because of its uniqueness as a tool for personal authentication and identification [3, 14]. Several automatic face recognition techniques have been developed in the past decades and the performance of these face recognition tools depend largely on the quality of the input facial image. There are some terms that are needed to be understood before measuring quality of facial images:

- The various attributes used like sharpness, contrast, illumination, pose estimation, focus, skin color estimation are called as Quality Factors.
- The method used to give a numerical value or quantify the above said quality factors is called Quality measuring and then the computed values are arranged in an array named 'Quality Matrix'.
- Then the overall single value or the resultant that is computed from the Quality measures known as Quality Index [4, 13].

II. LITERATURE SURVEY

The steps for measuring the quality of the facial image can be roughly divided into three parts.

A. Deciding the Quality Factors

To start working with measuring facial image quality, firstly we have to select a group of quality measures out of the various factors like: Pose estimation, Focus and Sharpness, Brightness, Image Resolution, Image size or resolution, Face completeness, Skin-color area, contrast, illumination etc [2, 5, 6, 1]. Fig. 1 shows the generalized Quality Assessment Unit (QUA) in which firstly an image containing faces is given as an input and then face is detected by using a suitable technique and then a face quality assessment is carried out based on the image specific quality measures.

K. Nasrollahi and Thomas B. *et al.* [2], had used four quality factors i.e. pose-estimation, sharpness, brightness, image resolution. Mohammad A. and K. Nasrollahi *et al.* [5], had also chosen four parameters which are sharpness, brightness, Image size or resolution, face completeness. A. Abaza and T. Bourlai *et al.* [1], had used contrast, brightness, focus, sharpness and illumination for their quality metrics. M. Ann, A. Ross, A. Abaza and T. Bourlai *et al.* [4], had worked on illumination, focus and sharpness, contrast and brightness. D. Bhattacharjee, S. Prakash and P. Gupta *et al.* [7], had used Eye Detection, Sharpness, Noise, Luminance and Contrast for working on quality assessment. R. Hsu, J. Shah and B. Martin *et al.* [8], had used parameters based on two categories firstly for image only (High Resolution, Compression Artifacts and others) and then for face only (Shadows, Head Pose Face Geometry, Contrast and Good Exposure, Sharpness and others). N. Binh, N. Huan and H. Kim *et al.* [9], proposed a method in which they had used Background segmentation, Skin detection, Eye detection, Lip feature detection and Chin detection as parameters.

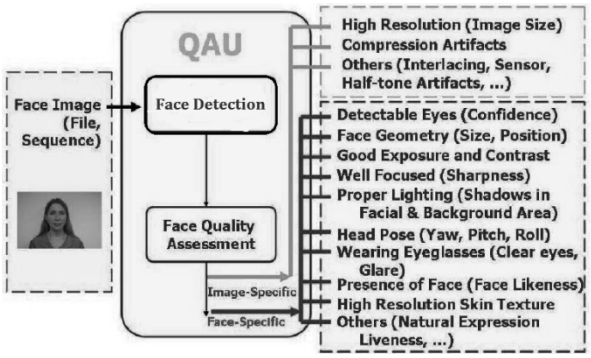

Fig. 1: An Overview of Various Quality Measures [8]

B. *Setting Quality Matrix*

The next step comes is to quantify the various features that we are taking as base for quality assessment. This step is thus named as quality measures and all these measures are grouped in the form of a matrix called Quality Matrix. For various factors there are various techniques that are being used to quantify them.

1) *Sharpness*

The image captured by a surveillance camera may be good enough to easily recognize the facial part from the surveillance video. In most of the cases we get a blurred image. So we need to extract a good sharpened image. This is because sharpness plays an important role in determining image quality [15] and is the quality of details that are captured in an image. Here we have discussed about quality and not about the quantity because there is a definitive difference between these two terms. Different methods have been used by many persons to calculate sharpness. K. Nasrollahi and Thomas B. *et al.* [2], Mohammad A. and K. Nasrollahi *et al.* [5] had used an average method to quantify the sharpness of an image and then to give an overall average score to it using the method given in [20]. D. Bhattacharjee, S. Prakash and P. Gupta *et al.* [7], had used Just Noticeable Blur (JNB) algorithm to compute sharpness.

K. Kryszczuk and A. Drygajlo *et al.* [10], computed the mean of intensity difference between the adjacent pixels, taken in both directions (horizontal and vertical). A. Abaza, M.A. Harrison, T. Bourlai and Arun Ross *et al.*, had used methods named Tenengrad sharpness and adaptive Tenengrad sharpness.

(a) (b)

Fig. 2: Image Sharpening: (a) Original Image;
(b) after Sharpening [21]

Fig. 3: Variation in the Sharpness of an Image [4]

2) *Brightness*

Dark images are generally of not much use. So brightness of an image plays an important role in facial image quality assessment. K. Nasrollahi and Thomas B. *et al.* [2], Mohammad A. and K. Nasrollahi *et al.* [5] computed the illumination of the whole image as an average and then to make a score out of it, the result is divided by the maximum value of the brightness in the sequence or by some preferred threshold [19]. M. Ann, A. Ross, A. Abaza and T. Bourlai *et al.* [4] had used another method to compute the brightness. They have first converted RGB image into HSB domain and then carry out the calculations.

(a) (b)

Fig. 4: Brightness Variation (a) Original Image;
(b) Brighter Version [21]

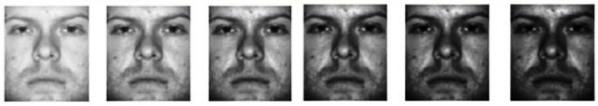

Fig. 5: Variation in the Brightness of an Image [4]

3) *Contrast*

Contrast can be defined as the difference in the intensities of the color components that make up an image. The general methods used to compute contrast of an image is to find root mean square of the image intensity or to use Michelson method [4, 1, 7].

(a) (b)

Fig. 6: Contrast Enhancement: (a) Original Image,
(b) Processed Image [21]

C. Resolution

Generally the surveillance cameras are employed to cover a large area, because of which the view of the person is not so much clear from a distance and what to say if the person is far away and moving as well. Thus resolution becomes a very important factor for assessment of face quality. J. Long and Shutao Li *et al.* [11], had used a method to calculate the image resolution by first setting an lower limit on the detected face and also defining the width and height of the face image [18].

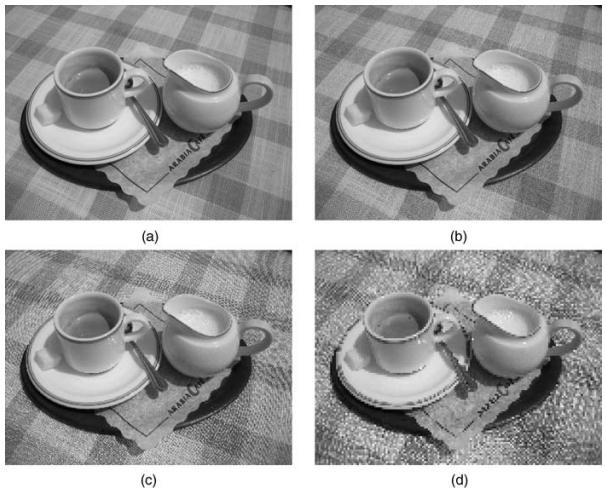

Fig. 7: Effects of Sampling Resolution on Image Quality: (a) A 1944 × 2592 image, 256 Gray Levels, at a 1250 Dpi resolution. The Same Image Resampled at (b) 300 dpi; (c) 150 dpi; (d) 72 dpi. [21]

D. Focus

Image focus represents the degree by which an image is blurred. M. Ann, A. Ross, A. Abaza and T. Bourlai *et al.* [4] had used two methods for measuring the focus of the image i.e. L1-norm of the image gradient and the energy of the Laplacian [17].

E. Proposing Quality Index

The last and the final step is to find out the resultant of all the quality measures that we have chosen to compute the facial quality. For that many types of quality indices have been proposed so for, like: A Abaza, M.A. Harrison, T. Bourlai *et al.* [1], proposed an index in which they have firstly quantify each quality measure on to a scale of 0 to 1 (normalized), which represents good or bad in a simple way. Then these normalized values are mapped onto a Gaussian scale. This proposed index is having the ability to handle deviations of quality factors and also it uses a geometric mean [16]. A. Abaza, M.A. Harrison, T. Bourlai and Arun Ross *et al.* [4] have used a supervised learning methods, basically a Neural Network to demonstrate the quality of the image as either 'good' or 'ugly' by carrying out experiments on the FOCS database [12]. Bhattacharjee, S. Prakash and P. Gupta *et al.* [7], had made an overall quality metric by giving a weighted sum to all the parameters which is used to evaluate them on the scale of [0 1] where 0 is for bad and 1 is for good. A large number of images from IITK database had been used and are distorted at eight levels of distortion and then the overall quality measure is computed for them and is then compared.

III. Conclusion and Future Scope

In this paper we have discussed many face quality assessment methods and every method is different from the other. This is because every method is using a different strategy to work. As the face quality assessment method firstly deals with selecting the different attributes regarding the quality of the image. These methods are selected on the basis of their importance in estimating quality. In almost all the methods a general assessment is made between the system output and human perception. Making the quality assessment more accurate, in many of the methods instead of discarding the low quality faces, best quality faces are selected by applying a windowing method in which all the facial images are judged on a single platform. Some of the techniques based on fewer quality factors are sometime not able to respond correctly to changes in intensities. Likewise various quality factors are selected, similarly many approaches are used to quantify these parameters and each time a different face quality index is used in which the overall resultant is shown in different ways like by using fuzzy based approach, bar graph representation, Neural network system, results in simple tabular form.

Our plan for future work includes developing more reliable technique to produce an efficient face quality index, working on real-world based databases and working on more features for efficient quality assessment like human ear etc.

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A Review on Implementation of Reversible Logic Gates

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***Abstract*—An efficient low power and compact sized multipliers are most important for the future computing technologies and having its applications in low power CMOS, quantum computing, nanotechnology and optical computingsystem in these days. Hence designing of the multipliers with the factors of low power, area and delay is prevalent. For this purpose the reversiblelogic multipliers are designed in advantage over that of conventional multipliers. This paper describes the comparative analysis ofdifferent reversible logic gate multipliers in terms of number of gates, number of garbage inputs, garbage outputs and quantum cost. Its main aim is low power dissipation in logicalelements but can have some other advantages like error control and data security. Each of the multipliers operation can be generalized for NxN bit multiplication of their advantages. Thus, this task will be of great importance as the technologies mature.**

Keywords: Reversible Logic Gate, Reversible Logic Circuit, Reversible Multiplier, Quantum Computing, Nanotechnology.

I. INTRODUCTION

A normal general-purpose computing system is logically irreversible unavoidably generate heat. The inputs cannot be generalized from the outputs in irreversible logic. During any computation, the intermediate bits used to compute the final results are erased. Hence, information loss causes energy dissipation in computing system that was demonstrated by R. Landauer in the year 1960. According to Landauer's[1] principle, a computer must dissipate atleast kTIn2 of energy(about 3×10^{-23}J at room temperature) for each bit of information is erased, where k = 1.3806505×10^{-23} $m^2kg^{-2}K^{-1}$is Boltzmann constant and T =273.16 K is absolute temperature.

Gordon. E. Moore [2] in 1965 predicted that the number of transistors onto a chip will double after every 18 months. According to Moore's law as the number of components on the chip increases the power dissipation also increases rapidly. Hence power dissipation has become an important issue in integrated circuits. In 1973, C. Bennett [3], revealed that the reversible logic circuits would not loosekTIn2 joules of energy as outputs can be recovered from inputs. Bennett showed that the computations that are performed on classical machine can be performed with the same efficiency with less power dissipation on the reversible Machine. The research on the reversibility was started in 1980's based on Bennett's concept. Shor [4]in 1994 did are markable research work in creating an algorithm using reversibility for factorizing large numbers with better efficiency than the classical computing theory. After his work on reversible computing has been started in different Fields such as quantum computing, low power CMOS design and nanotechnology.

II. RELATED WORK

Because of extensive use of multipliers in computer system, several reversible circuits for implementing multipliers have been purposed. Reversible multiplier is a computing device, used to multiply two binary numbers by the use of reversible adders. The basic multiplication process involves computing a set of partial products, and then summing the partial products together.

In 2008, Haghparast *et al*. [5] have introduced a reversible multiplier structure. The design uses an array of 16 Peres gates for the generation of partial products and then addition of partial products is accomplished by adder designed with combination of Peres gate and HNG gate. In the same year, Shams *et al*. [6] purposed the similar design with the Peres gates for the partial product generation and MKG for the addition at final stage of multiplication. In year 2010, a new design for reversible 4×4 multiplier is purposed by H.R. Bhagyalakshmi *et al.* [7] it consists of three sections for multiplication; additional is fan-out circuit along with partial product generator and additional circuits. In year 2012, M.Z. Moghadam *et al.* [8] purposed two approaches to design the ultra-area-efficient multiplier, in which partial product generation is carried out with Peres and Toffoli gates respectively. The number of garbage outputs are reduced when partial products are generated using Peres gate and Toffoli gate.

III. REVERSIBLE LOGIC GATES

A reversible logic gate is an n-input, n-output device withone-to-one mapping [3], which helps to retrieve the inputs from the outputs and vice-versa. The main challenges for the reversible logic are reducing the power dissipation, reducing number of gates, delay and quantum cost.

An n-input and m-output Boolean function F(x1, x2, x3…….x4) is called reversible function if:

- Mapping between input and output is one to one.

- The no. of inputs is equal to no. of outputs.
- Fan-out and feedback are not permitted.

A. *Definitions*

1) *Quantum Cost*

The quantum cost defines the total cost of the circuit in terms of cost of primitive gates. The quantum cost of NOT gate (1×1) is 0 and that of CNOT gate is 1.

2) *Constant Inputs/ Ancillary Inputs*

Ancillary/ constant inputs can be defined as the inputs to be retained at constant value of '0' or '1' in order to generate the given logical function [9].

3) *Garbage Outputs*

The garbage outputs are additional outputs in the reversible logic circuit that maintain the reversibility logic but do not perform any useful operation [10].The following formula shows relation between Garbage

Output and Ancillary Inputs:

Input (n) + Ancillary Input = Output (m) + Garbage Output.

4) *Total Logical Calculations*

The total logical calculation [10] is another term in reversible logical circuits, which indicates the XORs, NOTs and ANDs. Total Logical calculations are represents by the (L). Here α= no. of XOR gates, β= no. of AND gates, γ= no. of NOT gates.

B. *Basic Reversible Logic Gates*

An x-input and x-output f^n is said to be reversible if there is one to one correspondence between the inputs and the outputs. An N×N reversible logic gate can be represents as follow:

$I_{vec} = (I_1, I_2, I_3, \ldots..I_x)$,

$O_{vec} = (O_1, O_2, O_3, \ldots\ldots O_x)$.

Where I_{vec} and O_{vec} are input and output vectors respectively. In reversible logic gates, number of inputs (x) are equal to number of outputs (x). In this section we review the Reversible logic gates.

1) *Feynman Gate (FG)*

Feynman gate is 2×2 reversible gate [11], called as CNOT (Controlled NOT) gate. It is widely usedas fan-out purposes. Quantum cost for Feynman gate is 2.The total logical calculations of this gate is T= 1α. Feynman gate circuit is shown in fig. 1 [12].

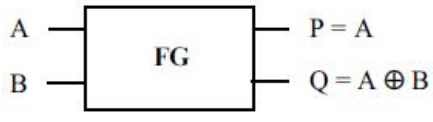

Fig. 1: Feynman Gate

The input and output vectors of 2×2 Feynman gate are as follows:

I_{vec} = (A, B),

O_{vec}= (P=A, Q=A⊕B).

2) *Toffoli Gate (TG)*

Toffoli Gate is also called as CCNOT (Controlled-Controlled NOT) gate is a 3×3 reversible gate [12].TG is a universal reversible gate. If the target input (C) is set to '0', then I the gate will perform AND operation. Quantum cost of Toffoli gate is 5. The total logical calculations for this gate are; T= 1α+1β. TG circuit is shown in fig. 2 as in [13].

Fig. 2: Toffoli Gate

The input and output vectors of 2×2 Feynman gate are as follows:

I_{vec} = (A, B, C),

O_{vec}= (P=A, Q=B, R=AB⊕C).

3) *Peres Gate (PG)*

Peres gate [14] is a new 3×3 Toffoli gate [13]. Quantum Cost for Peres gate is 4. Due to less quantum cost, it is used to implement several logic functions. Peres gate can be used as half adder, and a two-input AND gate. The total logical calculations for Peres gate are; T= 2α+1β.

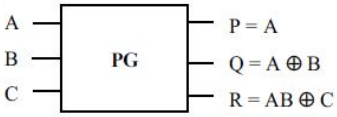

Fig. 3: Peres Gate

The input and output vectors of 3×3 Peres gate are as follows:

I_{vec} = (A, B, C),

O_{vec}= (P=A, Q=A⊕B, R= AB⊕C).

4) *Haghparast Navi Gate (HNG)*

HNG is 4×4 reversible gates. HNG can singly work as reversible full adder [5]. Thus QC of HNG full adder is minimum possible QC for a full adder design. The total logical calculation's in HNG gate are; T= 5α+ 2β. HNG circuit is shown in fig. 4 as in [7].

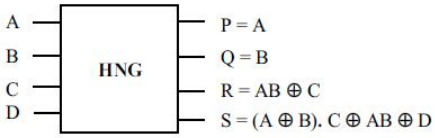

Fig. 4: Haghparast Navi Gate

The input and output vectors of 4×4 HNG gate are as follows:

I_{vec} = (A, B, C, D),

O_{vec}= (P=A, Q=B, R=AB⊕C, S= (A⊕B).C⊕AB⊕D).

A garbage bit is the additional output which is added in order to make the reversible function possible, and it is not used for further computations in the circuit. Therefore, large numbers of garbage outputs are undesirable in a reversible circuit. As shown in [24], the minimum number of garbage outputs required is [log2q], where q is the maximum output pattern multiplicity of the irreversible function.

TABLE 1: REVERSIBLE VS. IRREVERSIBLE "AND" GATE

Irreversible AND Gate		Reversible AND Gate	
Input A B	Output Z	Input A B C	Output X Y Z
0 0	0	0 0 0	0 0 0
0 1	0	1 1 0	0 1 0
1 0	0	1 0 0	1 0 0
1 1	1	1 1 0	1 1 1

Constant input is input of a reversible circuit with arbitrary constant value that must be added as necessary so that the function has the same number of inputs and outputs. An efficient design should keep both the number of garbage outputs and constant inputs to minimum. As an example, TABLE I shows an irreversible and a reversible AND gate. It is evident that the Z output gives us the required output and the other outputs X and Y are garbage. If C is constantly"0", the exact AND function should be found. Therefore, it is important for reversible realization of an irreversible function [23].

IV. QUANTUM COMPUTING THEORY

Quantum gates are defined based on quantum computing theory. Quantum gates works on small units of quantum data, called q-bits (Quantum bits). The q-bit state (q) is superposition of 0 and 1 state, is denoted by |1> and |0>respectively [16]. The q-bit state represents as:

$$q= \alpha |0> + \beta |1> \quad (1)$$

Where α and β are complex numbers so that $|\alpha|^2+|\beta|^2=1$. When the complex numbers α = 1 and β = 0, the case corresponds to the binary state '0'. Similarly when the complex numbers α = 0 and β = 1, the case responds to the binary '1'. All the combinations of α and β are not basic binary (0 or1).So, a q-bit is described by two dimensional vectors, represents as [17]:

$$\begin{Bmatrix} \alpha \\ \beta \end{Bmatrix} + \begin{Bmatrix} u_0 \\ u_1 \end{Bmatrix} = \begin{Bmatrix} 0 \\ 1 \end{Bmatrix} \quad (2)$$

The effect of quantum gates on quantum state can be explained by vector operations, where the quantum gates are represented by unitary matrix. A generalized 2-q-bit controlled U gate [17] is shown in fig. 9. Its unitary matrix is represents as follows:

$$\text{Controlled U} = \begin{pmatrix} 1 & 0 & 0 & 0 \\ 0 & 1 & 0 & 0 \\ 0 & 0 & u_{11} & u_{12} \\ 0 & 0 & u_{21} & u_{22} \end{pmatrix}$$

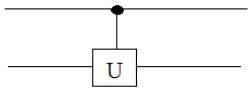

Fig. 5: Controlled U Gate

Two well-known quantum gates are V and V^+ [17]. The gate V, named as square root of NOT or Controlled NOT gate. In Controlled-V gate, when the controlled input (A) is '0', the data output remains same as its data input B. But the data output becomes V (input) when the controlled input becomes '1'.

V. DIGITAL MULTIPLIER

Reversible multiplier is a digital circuit, used to multiply two or more binary numbers. Multiplication is laboriously used arithmetic operations in many computational units. It is necessary for a processor to have high speed multiplier. So, now a day reversible multipliers are in demand. The basic cell for multiplier is a full adder. The multiplier design has two segments which works sequentially:

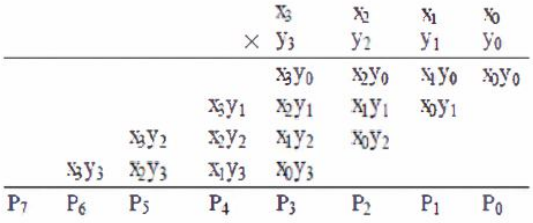

Fig. 6: Operation of 4×4 Multiplication

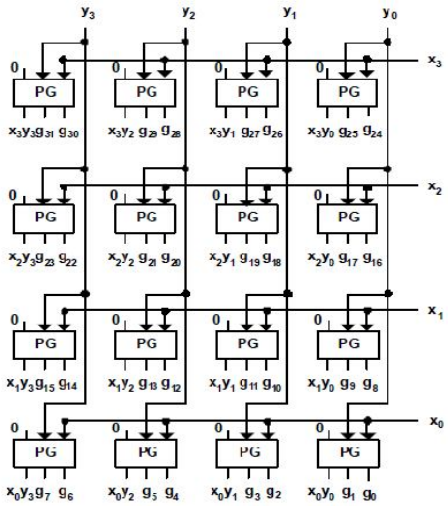

Fig. 7: Generation of Partial Products using Peres Gates

C. Partial Product Generator

Partial product of an n×n multiplier requires n×n 2-input AND operation. 2-input AND Operations can be realized by using reversible gates. As it is not permissible to have a fan-out of a gate, so we have to use reversible gate to produce replications of signals. For the generation of the partial product we use Peres gate, Because of its low hardware complexity. Operation of partial product is shown in fig. 6 and the partial product Generation is shown in the fig. 7 as in [7].

D. Addition of Partial Products

Addition of partial products can be done by any of the digital adder according to the circuit requirement. Reversible gates adders are used for addition purpose. Full adder and half adders can also be in use if the computations are for small values. For designing n×n multiplier, we need n (n-2) full adder and n half adders. Different adders along with the different parameters are shown in the TABLE 2. And Reversible addition circuit is shown in fig. 8[7].

TABLE 2: COMPARISON AMONG VARIOUS REVERSIBLE MULTIPLIERS

Reversible Multiplier	Quantum Cost	No. of Ancillary Inputs	Garbage Outputs	No. of Gates	Total Cost
M.Z.Moghadam,K.Navi (Design I) [8]	136	36	28	32	196
M.Z.Moghadam,K.Navi (Design II) [8]	144	28	24	28	196
Haghparast *et al*. [5]	140	28	28	28	196
Bhagyalakshmi and venkatesha [7]	152	52	52	40	244
Haghparast *et al*. [6]	152	52	52	52	256
Islam et.al [21]	144	28	52	52	290
Banerjee and Pathak [20]	168	76	50	80	298
Thapliyal and Srinivas [19]	239	58	58	53	345

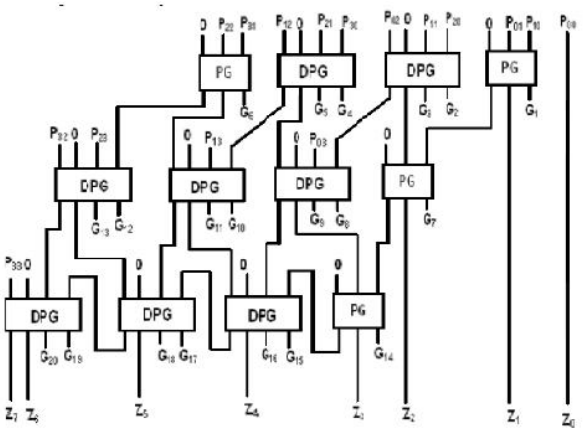

Fig. 8: Reversible Addition Circuit

VI. CONCLUSION

Reversible multiplier can be designed with the different logical design techniques proposed in conventional combinational and sequential logic with the aim to improve the performance of computational units. To improve the performance of the multiplier the following measures like number of gates, number of garbage outputs, number of ancillary inputs, total quantum cost and total logical calculations should be low as possible. In the proposed multiplier we reviewed a reversible multipliercircuit with the help of Peres gate. This circuit can be also helpful for high speed multiplier for dedicated hardware.

In 2006, Thapliyal and Srinivas [19] proposed a reversible multiplier, using TSG gates. Total quantum cost for multiplier was 345. Many researchers then after proposed multiplier using different reversible gates. Quantum cost further reduced to 244 by a new improved design purposed by H.R. Bhagyalakshmi [5] in 2010. In year 2012, a design is purposed by M.Z. Moghadam *et al*. This design reduces the quantum cost to 196 by the use of TG [12] and PG [13] gates for the partial product generation.

VII. APPLICATIONS

Reversible computing is used in areas which require high energy efficiency, speed and performance. It includes the Areas like:

- Design of low power arithmetic and data path for digital signal processing (DSP).
- Low power CMOS design.
- DNA Computing
- Quantum Computer
- Computer Graphics
- Nanotechnology
- FPGA in CMOS Design.

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Performance Analysis of Finite Impulse Response Filter using Window Method

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***Abstract*—Filters are important in digital signal processing. This paper is based on the comparison of different windows like Rectangular Hamming, Hanning, Kaiser, Blackman and Bartlett window used in finite impulse response filter with same parameters. It has been found that Kaiser window has sharp transition time and has less side lobes as compared to other.**

Keywords: Rectangular Window, Hamming Window, Hanning Window, Kaiser Window

I. INTRODUCTION

The most powerful tool of digital signal processing is the digital filter. Digital filters perform mathematical operation on sampled discrete signal. The parameter of digital filter can be changed by software. There are many systems that uses signal filtering to reduce unwanted noise to provide spectral shaping and signal detection and analysis [1]. There are two types of filters based on impulse response: IIR (Infinite Impulse Response) and FIR (Finite Impulse Response). Infinite impulse response filters are most effective filter to implement in digital signal processing. It has impulse response of infinite duration. The IIR filters are recursive and the current input depends upon the current output, past input and past output. It is also expressed as an impulse response of IIR filter does not become exactly zero. Finite impulse response filters are non recursive filters in which current output depends upon the current input and past input. FIR filter is stable and has linear phase, non recursive and arbitrary amplitude frequency characteristics. Infinite impulse response is infinite and is used in the applications where linear characteristics are not important. IIR filter is better for lower order tapping. FIR filters are used for higher order tapping and linear phase characteristics [2].

II. DESIGNING METHODS FOR FIR FILTER

A. Fourier Series Method

In Fourier series a convergence factor may be add finite number of terms. This reduces higher harmonics in order to achieve a time function where the Gibbs rule is minimised. In order to get a frequency response which reduce the effect of the Gibbs rule, the convergence factor is added. It reduces the effect of the higher terms in the impulse response[3].

B. Frequency Sampling Method

This method allows designing recursive and non recursive FIR filters for both standard and arbitrary frequency response. For non-recursive frequency sampling filters, the problem of FIR design is to find a finite length impulse response for desired frequency response. In recursive method, DFT samples for FIR can be regarded as samples of the filters z transform.

C. Optimal Filter Design Method

It is easy to implement and is vastly used in many organisations. Optimal filter design is used to minimize the error in frequency sampling and it is good for FIR filter design. Finding the FIR filter coefficient using this method is not easy.

D. The Window Method

In the processing of a signal, a window method gives zero value of some interval. It is also called tapering function or apodization function. It is characterized by the width of main lobe which can be bandwidth of positive and negative zero crossing and by the ratio of ripple. The width of main lobe and ratio of ripple must be as low as possible. On the basis of adjustable or fixed window, it is categorized into: Hamming, Rectangular, Blackman, and Hanning Windows. Adjustable window has two or more parameters that can control characteristics of window [2].

1) Rectangular Method

In DSP, rectangular window is a mathematical function that has zero value outside some interval. It is constant inside the interval and zero elsewhere [3].

$$w_R(n) = \begin{cases} 1, |n| \leq \frac{M-1}{2} \\ 0, otherwise \end{cases} \quad (1)$$

2) Hanning Window

Hanning function is given by Von hann. Hanning window provides less aliasing and less main lobe. If signal is sampled using hanning function then it is very difficult to regenerate the original signal.

$$w(n) = 0.5\left(1 - cos\left(\frac{2\pi n}{N-1}\right)\right) \quad (2)$$

3) Hamming Window

Hamming window is named by Richard hamming. It is the mixer of hanning window and rectangular window. It provides a minimum side lobe.

$$w(n) = 0.54 - 0.46cos\left\{\frac{2\pi n}{n-1}\right\}\ 0 \le n \le N-1 \quad (3)$$

4) Kaiser Window

Kaiser window is designed to be used with modified Discrete Cosine Transform. High pass filter in Kaiser window is more suitable and stable. It is computationally complex because it use Bessel function. It is adjustable and give control on mail lobe width[4].

$$w(n) = \frac{I_o\left(\pi\alpha\sqrt{1-\left(\frac{2n}{N-1}-1\right)^2}\right)}{I_o(\pi)} \quad (4)$$

III. Literature Review

Gupta S. *et al.* worked on performance analysis of FIR filter design by using rectangular window, Hamming window, and Hanning window method. Hamming window is more stable than hanning window and rectangular window technique. The reason is ripple, because ripple in pass band is less stable than rectangular and hanning window technique. This technique gives linear phase in comparison to both hanning and rectangular window technique [1].

Md. Saiful Islam. *et al.* worked on designing of fir filter using Hamming window. The window function of this type is easy to implement and more stable than Hanning and Rectangular window. The technique of Hamming window gives a small main lobe and hence it can be used in signal processing [2].

Suhaib Ahmed worked on design analysis of high pass filter using Hanning Bartlett and Kaiser Window technique. According to his work, high pass filter in Kaiser Window is more suitable. He considered some other parameters and then Hanning Window provides better pass band. He concluded that Hanning Window was stable as it provided good attenuation and good transition at cut off frequency from stop band to pass band than Kaiser Window and Bartlett Window [3].

Jannatul Ferdous. *et al.* worked on a survey report for performance analysis of finite impulse response digital filter by using different window techniques. They used different window methods such as Rectangular, Hanning, Hamming, Blackman and Kaiser. All techniques have some advantages and disadvantages but Kaiser window was found to be better than the other window techniques. Kaiser window show good results for noise reduction [4].

Smt. D. Swetha *et al.* worked on design of FIR BSF. They designed BSF FIR filter by using modified hamming technique. After applying the modified hamming window technique, they observed a small main lobe sharp transition. This filter provides better results than Hamming and Hanning window techniques. It is used to analyse the signal[5].

IV. Results and Discussion

We have FIR filter using Window Method, on the basis of High Pass Frequency Response and High Pass Phase Response. Different values of FIR filter coefficient ωs = 0.7, 0.9 rad/s and filter order 63, 68, and β=3 are taken for experimentation. The results of the various windows are shown here. Fig. 1(a)-(d) shows the results of the four windows: Kaiser, Hamming, Hanning and Rectangular using filter order of 63 and filter coefficients 0.9 rad/s. Fig. 2(a)-(d), Fig. 3(a)-(d), Fig. 4(a)-(d) shows the results using filter order and filter coefficients 68 and 0.9, 63 and 0.7, and 68 and 0.7, respectively.

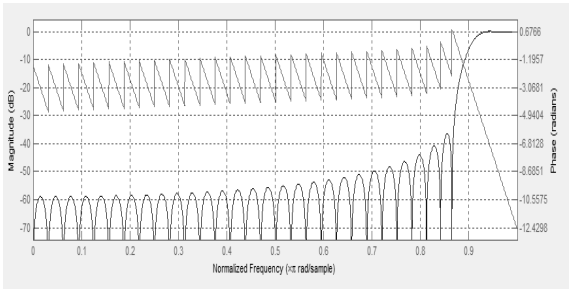

Fig. 1(a): High Pass Frequency Response (in DB) and High Pass Phase Response of FIR Filter using Kaiser Window (Order 63 and Coefficient 0.9)

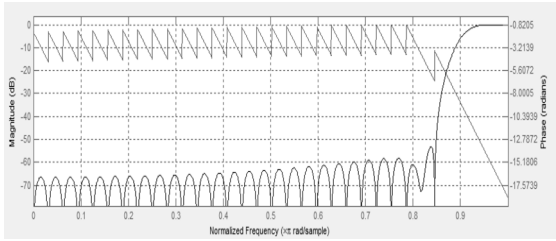

Fig. 1(b): High Pass Frequency Response (in DB) and High Pass Phase Response of FIR Filter using Hamming Window (Order 63 and Coefficient 0.9)

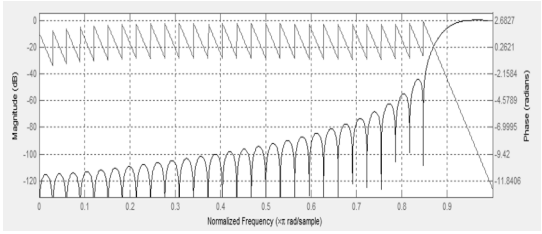

Fig. 1(c): High Pass Frequency Response (in DB) and High Pass Phase Response of FIR Filter using Hanning Window (Order 63 and Coefficient 0.9)

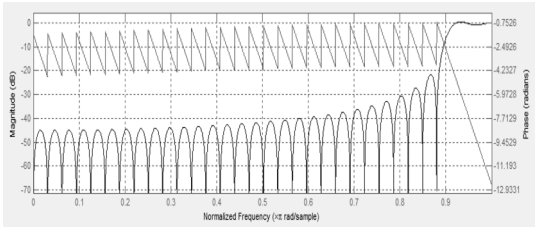

Fig. 1(d): High Pass Frequency Response (in DB) and High Pass Phase Response of FIR Filter using Rectangular Window (Order 63 and Coefficient 0.9)

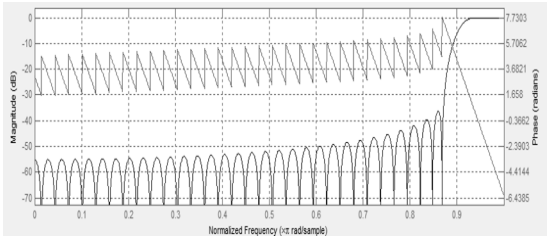

Fig. 2(a): High Pass Frequency Response (in DB) and High Pass Phase Response of FIR Filter using Kaiser Window (Order 68 and Coefficient 0.9)

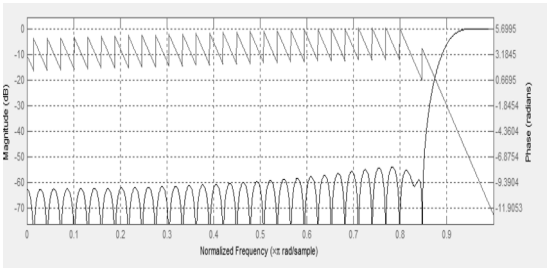

Fig. 2(b): High Pass Frequency Response (in DB) and High Pass Phase Response of FIR Filter using Hamming Window (Order 68 and Coefficient 0.9)

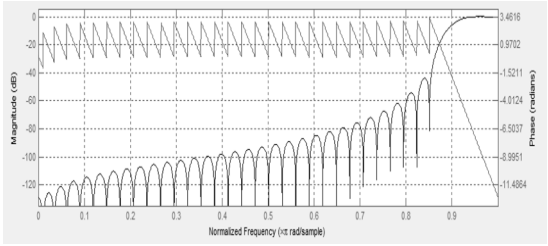

Fig. 2(c): High Pass Frequency Response (in DB) and High Pass Phase Response of FIR Filter using Hanning Window (Order 68 and Coefficient 0.9)

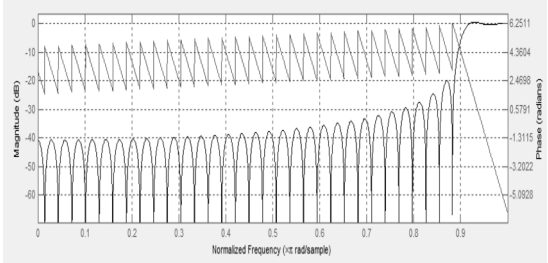

Fig. 2(d): High Pass Frequency Response (in DB) and High Pass Phase Response of FIR Filter using Rectangular Window (Order 68 and Coefficient 0.9)

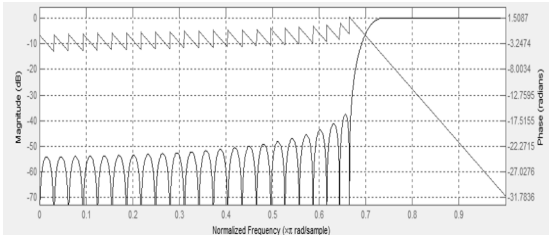

Fig. 3(a): High Pass Frequency Response (in DB) and High Pass Phase Response of FIR Filter using Kaiser Window (Order 63 and Coefficient 0.7)

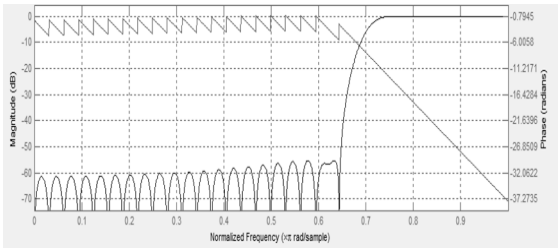

Fig. 3(b): High Pass Frequency Response (in DB) and High Pass Phase Response of FIR Filter using Hamming Window (Order 63 and Coefficient 0.7)

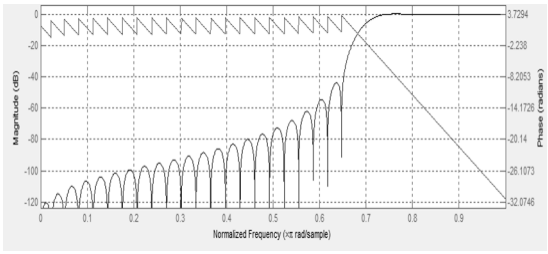

Fig. 3(c): High Pass Frequency Response (in DB) and High Pass Phase Response of FIR Filter using Hanning Window (Order 63 and Coefficient 0.7)

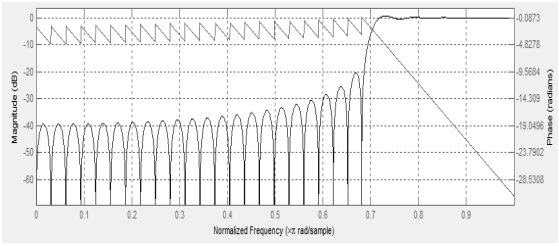

Fig. 3(d): High Pass Frequency Response (in DB) and High Pass Phase Response of FIR Filter using Rectangular window (Order 63 and Coefficient 0.7)

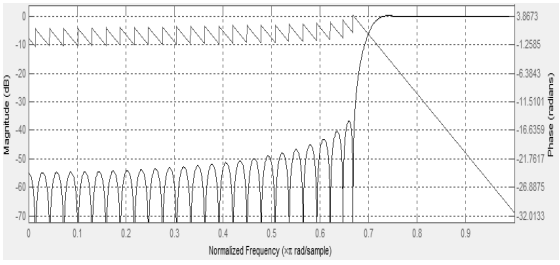

Fig. 4(a): High Pass Frequency Response (in DB) and High Pass Phase Response of FIR Filter using Kaiser Window (Order 68 and Coefficient 0.7)

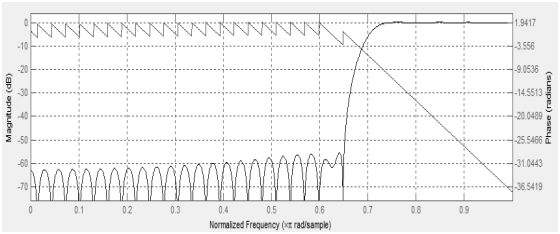

Fig. 4(b): High Pass Frequency Response (in DB) and High Pass Phase Response of FIR Filter using Hamming Window (Order 68 and Coefficient 0.7)

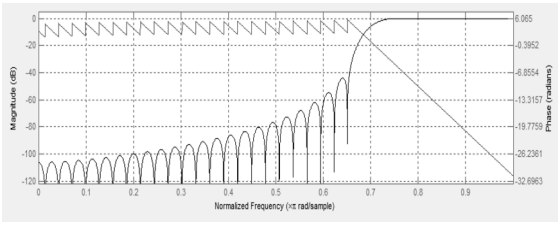

Fig. 4(c): High Pass Frequency Response (in DB) and High Pass Phase Response of FIR Filter using Hanning Window (Order 68 and Coefficient 0.7)

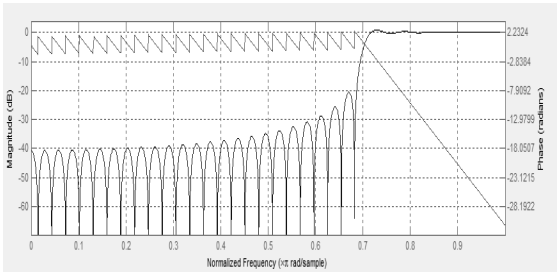

Fig. 4(d): High Pass Frequency Response (in DB) and High Pass Phase Response of FIR Filter using Rectangular Window (Order 68 and Coefficient 0.7)

V. CONCLUSION

Comparison has been drawn on high pass FIR filter with filter order 63 and 68 and filter order coefficient 0.7 and 0.9rad/s. It has been found that the transition time is least in case of Kaiser window as compared to other window techniques. Kaiser Window has better response in pass band. It has less ripple in pass band as well as in stop band.

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A Review on Software Defined Wireless Sensor Network

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***Abstract*—A Software-defined wireless sensor network system whose behavior can be specified evenly after preparation by the implementation of sensor node role by means of wireless network communication. In this paper there are two main technologies are reviewed to develop this system, which are role generation and delivery mechanism and a reconfigurable wireless sensor network with many reconfigurable sensor node. In first technique user can generates roles for sensor nodes based on user-defined programming and then performs the role to appropriate nodes. In second technique consist of ultra-low power field programmable gate array (FPGA) and a microcontroller (MCU) for changing network behavior. By giving heavy tasks like sensor and data processing to the FPGA, overloading of MCU can be avoided. In wireless communication, both the entity data for FPGA and programs that we want to run on the MCU can be inserted as roles from outside of the sensor node, enabling easy modification of sensor node depending upon the situation and application.**

Keywords: WSN (Wireless Sensor Network), MCU (Microcontroller Unit), FPGA (Field Programmable Gate Array), SDSN (Software Defined Sensor Network)

I. INTRODUCTION

A wireless sensor network (WSN) consist of several wireless devise (nodes) capable to gather information like temperature, pressure, sound, light, motions. The wireless connection allows the creation of Ad hoc network without pre-established physical central management. The wireless sensor network can be used for intelligent spaces, surrounding monitoring and tracking. The wireless sensor network used for environmental observation [1].

A. MCU (Micro Controller Unit)

Many hardware structures have been suggested as sensornodes [2-4]. A node has sensors, a microcontroller unit (MCU).For instance, sensor node MCU often cannot perform well owing to limited battery lifetime. One of the most popular sensor nodes, the Crossbow IRIS MOTE [4], is an enhanced version of the MICA MOTE that has been used mainly in academia owing to it open hardware and software specifications and easy customizability. As conventional MCU-based sensor node Implementations have proven unable to deliver High performance with low power Consumption, novel implementations utilizing reconfigurable hardware have been proposed [5-6].

B. FPGA (Field Programmable Gate Array)

A field programmable array (FPGA) is an integrated circuit which is programmable by user or designer. The FPGA consist on hardware description language (HDL), similar used for application specific integrated circuit .FPGA consist of an array of programmable logic blocks and hierarchy of reconfigurable interconnects that allow the block to be "wired together", like many logic gates that can be inter-wired in different configurations. For any complex WSN application which offers FPGA based implementation proposed hardware flexibility and speed matched to the software flexibility offered through processor based sensor node implementation.

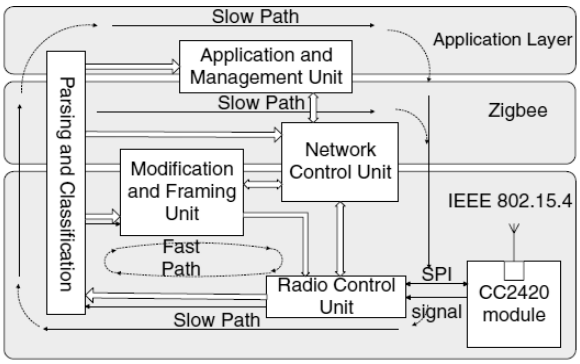

Fig. 1: Block Diagram FPGA based Sensor Node with Wireless Interface [21]

Processor based design, the developers are required to write code for various subtasks, but they not need to divide their tasks to various in dependent subtasks. FPGA based sensor nodes consist of high energy consumption as compare to processors based sensor node implementations. WSNs consist of variety of applications with vastly varying requirements and characteristics [7]. For example, active sensors, like as sonar, need more computational power for signal processing than passive sensors, such as smoke detector. Sensors for applications that support mobility requires more processing power for complex network protocols and algorithms than their fixed comparatives.

Software-defined networking (SDN) is an emerging example that uses a logically centralized software to control the behavior of a network. It is a easily way to reduce the complexity of network configuration and management, enabling research and

innovation in production networks. The first initiatives to implement SDN have targeted wired networks, but this example raised the interest of the wireless networking commun2ity and enterprises working in the field of wireless and mobile communications have joined SDN related initiatives [8]. In fact, there are proposals to use SDN in the context of wireless networks, such as SDN in substitution networks [9].

Considering Wireless Sensor Networks (WSN), an interesting feature that could be achieved through SDN enabled devices is node and resource management. When the controller determines a route to be used, it could consider the energy available in a given node to determine which route will provide the best network lifetime. Furthermore, WSN nodes are usually considered disposable and cheap devices, which could be deployed for a specific task. But consider smart cities, where sensor nodes should collect, process and transmit different types of data for different applications [10]. If these sensor nodes and other devices collecting data could be managed by the SDN paradigm, one could achieve a much better usage of the underlying infrastructure through dynamic node retasking and routing Software-Defined Sensor Networks emerge as a compelling solution to the above issues [11]. SDSN consists of sensors whose functionalities can be dynamically configured by reprogramming [12]. Some SDSN prototypes have been practically realized. Miyazaki *et al*. [13], [14] implement software-defined sensor nodes that can dynamically change their sensing functions at runtime according to the sensingtask requirements.

An SDSN as shown in Figure which consists of one sensor control server and a set of software-defined sensor nodes. To deploy a new sensing task the sensor control server shall reprogram some sensor nodes by distributing a corresponding program to them for the task only the reprogrammed sensors are able to sense the related targets within its coverage area. Since sensor nodes may be frequently reprogrammed, energy efficiency of reprogramming becomes an eye-catching issue in SDSN with battery-powered nodes. On the other hand, each task requires a certain level of quality-of-sensing, e.g., coverage ratio, which is a commonly adopted quality-of-sensing metric describing the portion of targets covered by the reprogrammed sensors. Although reprogramming all sensors can always achieve the maximum coverage, it would lead to high energy consumption due to reprogramming unnecessary sensors for a given quality of sensing Software-defined wireless sensor networks (SDWSN) approaches include Flow-Sensor, Sensor Open Flow and SDWSN (software defined wireless sensor n/w).

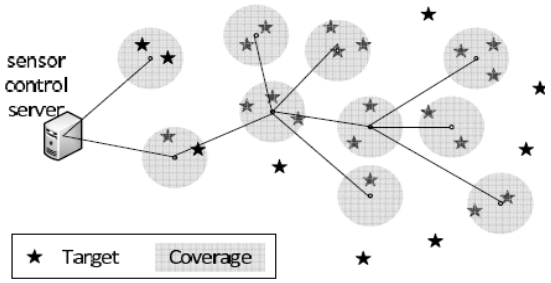

Fig. 2: An Example of Software-Defined Sensor Network [11]

However, these works do not address common WSN characteristics, such as possible disruption and delay in communication, low energy supply and reduced data frame length. Furthermore, typical devices in wireless multi-hop ad hoc networks and WSN have only one radio that either transmit or receive in one given frequency at a given time, and thus in band control is required.

The SDN example consider the separation of data and control plane. Typically WSN device have only one radio that either transmit or receive in one give frequency at a given time. Thus in wireless network, data and control plane must share the same communication link and available bandwidth. This In-band control limit the amount of data that can be forward through a given link, and potentially increase the delay. Therefore, our work is focused on reducing the control traffic on the WSN. The development of wireless network applications is usually an activity of a closed group of WSN experts. Thus, the aim of our approach is to enable the WSN application development for a wider group of users and especially for the end users of the target application in order to increase their involvement and to improve the quality of applications, while reducing the development time and costs.

II. RELATED WORK

Flow-Sensor [15] was the first initiative to apply the SDNconcept to WSN. This architecture goal to provide sensor nodes with OpenFlow [16]. The flow-sensor nodes are very high reliable in comparison with typical sensor nodes since data packets, control packets and the sensor nodes themselves can be easily monitored, regulated and routed whenever required. This management schemes from a cost, energy-effectiveness and overall network performance. The Sensor Open Flow process [17] has two components: an architecture featuring a clear separation between data plane and control plane, and a core component that standardizes the communication protocol between the two planes. Besides providing the basic OpenFlow functionalities, Sensor OpenFlow enables dynamic sensor tasking through the control plane.

SDWN [18] is a more complete process that includes all the features present in Sensor OpenFlow and provides other important features for WSN, such as in-network data aggregation, duty cycles configuration, flexibility to define rules and actions to enable cross-layer optimizations. SDWN architecture defines two types of devices generic node in which the flow tables are instantiated, as well as applications that manage sensing tasks; and a sink node composed of two different modules, one being a device to handle the communication with generic node and another being a Linux based embedded system that combines the tasks of controller and network virtualize.

While there are interesting proposals to apply the SDN example to WSN, none of them enables multiple controller deployment. Most of them do not discuss or take into account differentiation between control flow and data flow. Finally, these proposals are not available to devices running TinyOS [19], the most popular operating system for networked applications in wireless embedded systems compatible with widely used WSN platforms.

III. SDN DESIGN

SDN is architecture to enable multiple controllers for software-defined wireless sensor networks and the SDN paradigm in TinyOS compatible platforms. It transforms the wireless sensor node into a component comprised by an SDN switch and an SDN end device, which we call SDN enable sensor nodes. Then the control plane is programmed through an SDN controller hosted in network components that we call *SDN* controller nod. In Fig. 3 has two types of specified node inTiny SDN architecture: *SDN*-enable sensor node and *SDN* controller node. Each *SDN*-enable sensor node where the data plane is executed, connects through multi-hop wireless communication to an *SDN* controller node where the control plane logic is executed, allowing the interaction between the two planes. Regarding the end-to-end reliability, we consider that the hop-to-hop delivery mechanism of the IEEE 802.15.4 standard [20] is enough and packet loss may occur. End-to-end security services could be achieved using WSN-ETESec.

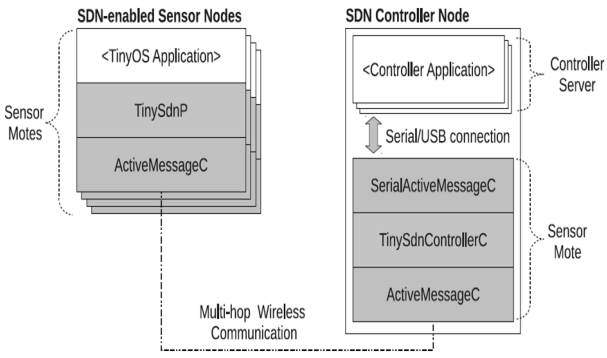

Fig. 3: Architecture Components [20]

Next, we describe the two specified types of nodes, the specification of flows and actions, as well the strategies adopted for the *SDN*-enable sensor node in order to find *SDN* controller nodeand to establish communication with them, and how the network topology information is collected.

A. *SDN-enabled Sensor Node*

This is the component that runs on sensor nodes. As discussed in [19], end devices are considered peripheral to SDN and hence out of the scope of Open Flow [18], the main SDN project nowadays. On the other hand, sensor nodes behave like end devices by generating data packets to transmit data collected by sensing, in addition to merely forwarding data asSDN switches do. Thus, SDN enable sensor node is a type of node that plays both roles: SDN switch and SDN end device.

Each *SDN*-SDN enable sensor node must find an *SDN* controller node to join and then receive flow specifications and perform flow request when necessary. SDN enable sensor node is split into three parts: Tiny OS application, Tiny SDN P and Active Message C. The Tiny OS Application portion is the equivalent to the end device; it generates data packets and then places them on the network using the programming interface provided by the TinySDN component. It is written by the network designer according to the WSN application.

The Tiny SDN P is the main component of Tiny SDN, which is responsible for checking if a received packet matches a flow in the flow table and then performs the related action, or otherwise sends a flow setup request to an *SDN* controller node. Consequently, it is responsible for performing flow table update when receiving a flow setup response (named packet-out). The Active message *C* is a Tiny OS component that manages and provides programming interfaces to interact with the radio module of the sensor node. It is used by the Tiny SDN to perform all tasks related to wireless communication, such as data/control packets forwarding and topology information.

B. *SDN Controller Node*

SDN controller nodeis the node (or nodes in case ofmultiple controllers) that performs SDN controller tasks, i.e., applies definitions of applications, creating and managing network flows. It is composed of two different modules: sensor mote module and controller server module.

1) *Sensor Mote Module*

It runs on a sensor mote and is responsible for communicating with *SDN*-SDN enable sensor nodeusing Active Message C. It uses Serial Active Message C Serial to forward received messages to the controller server moduleand receive messages to be sent to the network from the controller server module.

The Tiny SDN Controller Cportion adapts messages and manages this communication.

2) Controlled Server Module

It contains the control plane Logic i.e. hosts controller applications and manages networkflow and topology information.

IV. CONCLUSION

Software defined sensor network is an efficient architecture to be used in the design of a wireless sensor network for the cognitive (process of knowing) training system. It is consist of already some Wireless Sensor Networks proposals that show that it is suitable and possible to adapt the SDN paradigm to WSNs. There are two main technologies use to develop this system, which are role generation and delivery mechanism and a reconfigurable wireless sensor network with many reconfigurable sensor node. It is low power consumption, high reliable and an efficient performance process.

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A Review on Optical Switches and its Techniques

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***Abstract*—In this paper, the types of optical Switches are reviewed. In optical switching, traffic is directly in the optical domain. These switches are preventing the need of several optical to electrical to optical conversions. It is used to design the optical cross connect (OXC) in various applications. According to their scalability, insertion loss, PLD Polarization-dependent-loss, crosstalk and wavelength dependence, these optical switches are used for designed OXC. Some possible applications and performance data are also described in this paper and which is recently carried out from market analysis. This will provide a valuable support to researchers for conceiving as a possibility for new all-optical switching network architectures.**

Keywords: Optical Cross Connect (OXC), Optical Switches, Optical Add/ Drop Multiplexer (OADM), Wavelength Cross Connect (WEX), Space Switching Elements (SSE), Wavelength Converters (WOC)

I. INTRODUCTION

In these days, an optical cross connect plays a vital role in telecommunication networks. In the future, new generation of all optical networks requires an Optical cross connect (OXC) which is capable for connected the incoming optical signal to multiple output ports without any electronic interfacing. The MEMS (Micro-Electro-Mechanical-Systems) in OXC which are mostly used as optical switches in the telecommunication networks. All optical switches use the concept of combining optical add/drop multiplexing and OXC (optical cross connect) use the concept of wavelength routing between two main transmission lines in telecommunications. Examples of OXCs include optical add drop multiplexers (OADM), Photonics cross-connects (PXC), and reconfigurable optical add/ drop multiplexers (ROADM). Each OXC switch is used to define the route of incoming optical signal in optical networks [1]. The OXCs are based on the optical switches which are used to support and reconfigure the new route [2]. The WXC is an important optical device which is used to provide the switching functionality between the inputs and outputs in (WDM) networks. The wavelength-exchanging cross connect (WEX) is new type of class in cross connects which is used in WDM Networks. The architecture of WEX is the combination of SSEs. and WOCs device [3]. The conjunction is increased in optical fiber with the number of wavelengths per fiber due to increase in the number of SSEs and WOCs device in optical networks [4]. Now these days, mostly all networking devices's functionality is based on electronic signals. It means that optical signal is converted to electrical then amplified, regenerated or switched, then the signal is reconverted to optical signals [5].

In this paper, all types of switching technique are described in detail which are used to design the optical cross connects. The switching technique like MEMS optical switching, bubble-jet switches, liquid-crystal switches, thermo-optical switches, and acoustic-optical switches are used to design the optical cross connects and they are used to design according to scalability, insertion loss, PLD (polarization dependent loss), crosstalk and wavelength dependence. The OXC is defined in terms of architecture and switching algorithms. The incoming optical signal, travelled from input to output through the free space, is determined by the switch architecture. In the optical cross connect, the architecture of that switch is used in that free-space where the free-space propagation distance between the input and output ports is minimum [6]. Demultiplex and multiplex WDM channels are used to make an optical cross connect in optical fiber communications [7]. Many types of cross talk signals are appeared at output port of the optical cross connect. When the signal is propagated through the optical networks, due some mechanical and thermal fluctuations, the performance of optical cross connect is changed time to time [8].

II. OPTICAL CROSS CONNECT (OXC)

Now these days, mostly all networking devices's functionality is based on electronic-signals. It means that first optical signal converted to electrical then amplified, regenerated or switched and then it is reconverted back into optical signals. Optical cross connect is most attractive key components for all types of optical networks. The switching speed of optical cross connect is very high and its reliability is also good. Optical cross connect is used to connect the any two topologies and provides wavelength routing in networks [9]. OXC is two types of switch one is digital switch (hybrid or opaque) OXCs and another is optical switches (transparent) OXCs. In digital OXC switch, incoming optical data streams are converted into electronic data and use electronic cross-connection technology and then it is reconverted into optical data streams. OXC are directly in the photonic domain. Demultiplex and multiplex WDM channels are used to

make an optical cross connect in optical fiber communications as shown in Fig. 1 [10][9]. The capacity of optical networks is raised continuously than the required number of optical cross connect for the design of optical networks. Due to this, cross talk is big problem in OXC networks [11].

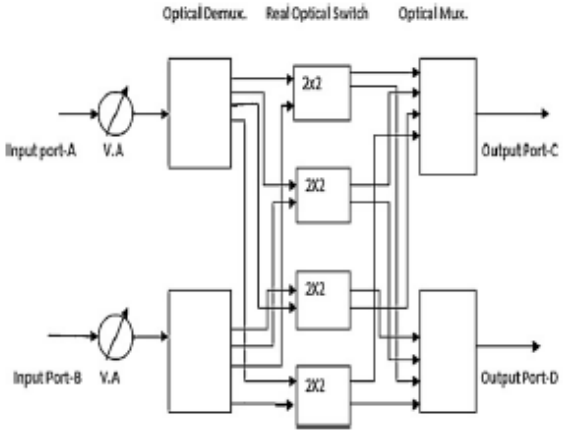

Fig. 1: Structure of OXC

III. Optical Switches

A. *Micro-Electro-Mechanical-Systems Switches*

Now these days, the number of Optical MEMS applications is growing daily. The semiconductor is used to make micro-mechanisms in MEMS switches and in this switch, it uses the movable micro-mirrors which are used to reflect in coming photonic signals from input to output fibres as shown in fig.2 [12]. The large size of MEMS switch creates a problem for making any optical networks. The mirrors, in the switch, are arranged in form of two-dimensional or three-dimensional arrays. The MEMS Switch is also made in small size and the order of micro-mirror is arranged in proper manner for reflect the incoming light beam. The MEMS switches are divided into some parts: Optical Attenuators, Dynamic Gain Equalizers, Optical Switches, Wavelength Tunable Devices and OADM [13].

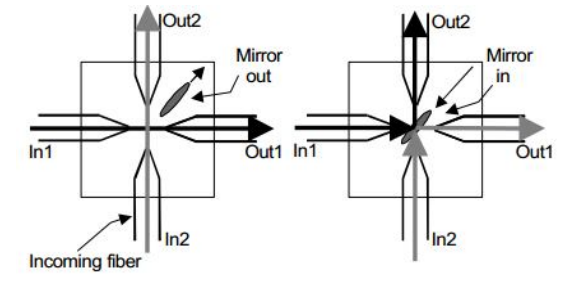

Fig. 2: Structure of MEMS Switch

B. *Liquid-Crystal Switches*

The Liquid-crystal switch (LC_s) is very attractive because of their low drive voltage, large birefringence and low power consumption [14]. The Liquid-crystal switch is based on organic materials. This is used to create a crystal phase in certain temperature ranges. During this process many molecules take certain relative movements in crystal and due to this electrical dipole moment are occurred. This is possible due to applying some voltage across the cell. The liquid-crystal material is filled inside in cell. Due to this orientation in the molecules occur. In this switch polarizing beam splitter is used to split the incoming beam of lights at the input port. The two cells in liquid crystals are active. The polarization states of the incident beams are changed or leave them unaltered is depending on the applied driving voltage in switch and then at the output port the beam of lights is directly combine through the combiner. The structure of Liquid-Crystal (LC) optical switch is shown in Fig. 3 [13].

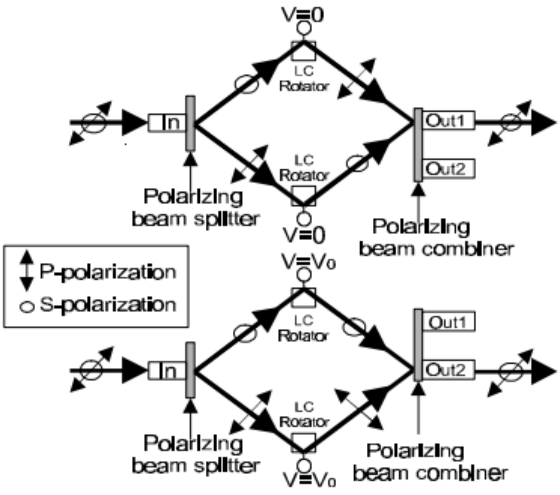

Fig. 3: Structure of Liquid-Crystal Optical Switch

C. *Bubble Switches*

The Optical Bubble Switch is used as an OXC for design the optical network [15]. The principle of Bubble Switches is based on printer's ink-jet. This switch is made with two silica layer: bottom layer and top layer. In this switch the optical signal is travel through the silica bottom layer and top layer based on ink-jet technology. The two arrays of waveguides intersect each other at an angle of 120° at the bottom layer of switch. The cross-point between two waveguides, create a hole which is filled with a liquid and the refractive index of liquid is same as refractive index of silica. This is allowed the propagation of signal in bubble switch in proper manner. In this switch the incoming optical signal travels in one direction through the waveguide and if any bubble is present in cross point in switch than light is deflected from path. The Bubbles are creating due to liquid by placed the electrode in top silicon layer, as shown in Fig. 4 [13].

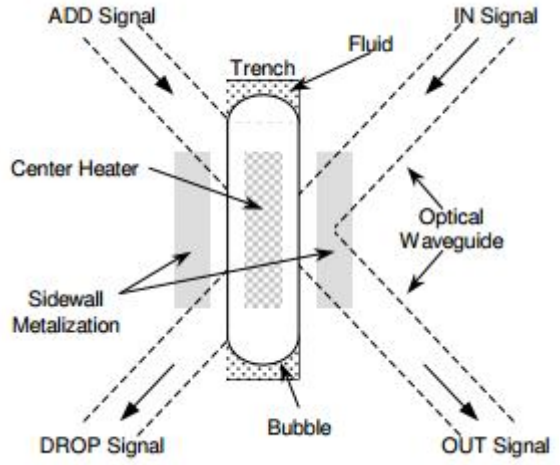

Fig. 4: Top View of Bubble Switch

D. *Thermo-Optic Switches*

The principle of thermo-optic switch is based on thermo-optic effect. In this effect, due to change in temperature, the refractive index of a dielectric material is also changed. Thermo-optic Switches are of two types: Interferometric and digital optical switches.

The principle of Interferometric switches is based on Mach-Zender interferometers, as shown in Fig. 5 [13]. In this switch, 3-dB coupler is used to splits the incoming input optical signal into two beams of light. Then light signal is travelled through two different arms of equal length. Another 3-dB coupler is used to combine the optical signal at output port of the switch and then again splits the optical signal. When the optical signal is propagated through the one arm of Interferometric switch, then refractive index of arm is increased due to heating effects in the switch. In this switch, the phase difference, between the optical signals in one arm of interferometer, is occurred due to heating effects in switch. The output of switch may be destructive or constructive.

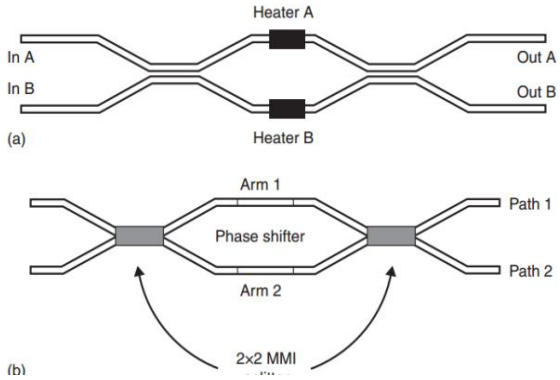

Fig. 5: Structure of Interferometric Switch

The Digital optical switches are made with silica of silicon. In this switch, the incoming optical signal is propagated through the two interacting waveguide arms of switch, as shown in Fig. 6 [13]. In digital switch, the phase error is occurred which is defined by the beams of light at the output port of switch. When the optical signal is propagated in arms of switch, then refractive index is changed due to heating effects and the light goes down to another path. In this switch, electrode is used to monitor the heating effects in switch. In this switch, power consumption is very high [16].

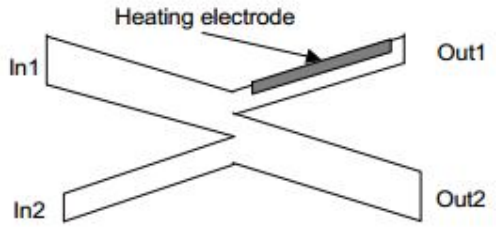

Fig. 6: Structure of Digital-optical Switch

E. *Electro-Holographic Switches*

In this switch, a beam-deflection method, which is based on electric field, is used to control the size of hologram. In this switch, the Holograms are stored in crystals as form of spatial distribution of charge. The incoming optical light signal is deflected from hologram which is activated by using some method of driving voltage. The optical signal is diverted in both states of switch and the output beams are spread beams, as shown in Fig. 7 [13]. When there is no voltage applied across the switch, then optical signals is passing in one direction. When some suitable driving voltage is applied across switch, then optical signals are deflected. This device is used in WDM for dropping the wavelength in optical networks and it's only possible on that time when many holograms are stored in same crystal.

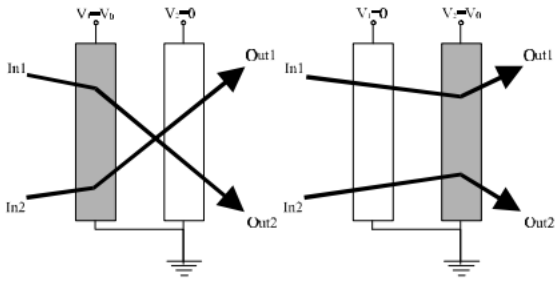

Fig. 7: Structure of Electro-holographic Switch

F. *Acousto-Optic Switches*

It is based on the Acousto optic effect. In this effect, the variation of the refractive index, in switch, is occurred due to mechanical strains. The polarizing beam splitter is used for separate the TM and TE components and then sends through two distinct waveguides. In the absence of resonance phenomena along the waveguides, then the optical signal is received

at first output port of the switch, as shown in Fig. 8 [13]. If the incoming optical signal is directly received at second output port as shown in Fig. 8 [13]. It means the acoustic wave is present in waveguides. This technology can be used to make a both types of switches, small switches and large-size switches. There is still feasibility to particularly shift the beam's dissimilar wavelengths if the light signal contains multi-wavelengths. There is feasibility of having various acoustic waves within the material, owning non-identical frequencies at the same time, in the same way [17].

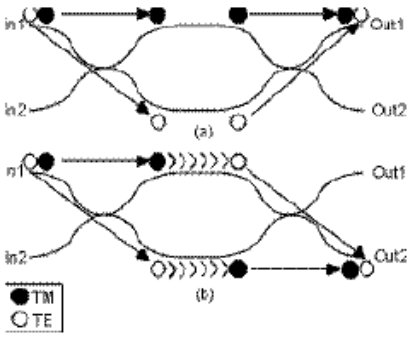

Fig. 8a,b: Structure of Acousto-Optic Switch

IV. Comparison of Optical Switches Techniques

TABLE 1: COMPARISON OF OPTICAL SWITCHES

Parameters	Insertion Loss (dB)	Crosstalk (dB)	PLD (dB)	Switching Time
MEMS 8X8	0.2-3.7	-50	0.4	12ms
Electro-optic 8x8	9	-30		5ns
Thermo-optic 8x8	8		0.5	3ms
Liquid crystal 2x2	1.4	-50	0.2	5ms
Bubble 2x2	2.5-2.7	-50	0.3	10ms
Acousto-optic 1xn	6	-35		3us

V. Application of Optical Switches

Now in these days, the optical switches can be used in a various applications. It's capable for connecting the thousand inputs to the thousand output port in optical networks. In this section, the applications of optical switches are defined briefly.

A. Optical Cross-Connects

The optical Switches play a very important role in optical cross connects which is used to provide the light paths in optical networks. The light path is a connection between two network nodes. These all types of optical switches are used inside in optical OXC. This is used to reconfigure the OXCs and support new lightpaths. In the optical network, OXCs are used for routing the optical signal. Now these days, most of all cross-connects which are used in optical networks is based on electronics switching. In digital Switches, the optical signals are first converted into electrical signals, then switch the signal into different light paths and at last, it is reconverted back into optical signals. This type of switching is called O-E-O switching. The electronic switching is replaced with optical switching due some disadvantages because the switching speeds of electronics switches is less than optical switches.

B. Protection Switching

These switches are capable for the accomplishment of traffic transmission in the event of system or network errors. The smaller port Optical switches is used in optical protection. This technique requires optical switches which are extremely reliable and small size. Optical switches are used to restore optical paths in the optical networks. The steps, which are involved in Protection switching schemes, are followed in proper order and determine the origin and nature of the failure in the nodes of optical networks. These processes take more time than the optical switch.

C. Optical Add/ Drop Multiplexing

The Optical add/drop multiplexers (OADMs) are used, in optical networks, to add or drop the optical channel wavelength from the incoming optical data stream. In the optical networks, OADMs are used to add and drop the multi-channel wavelength without any electronic processing. The optical switch which is used as OADM, the function of that switches is based on wavelength-selective process and it's used for switching the input signals according to their wavelengths.

D. Optical Signal Monitoring

In the optical networks, Optical signal monitoring switches are used for network management. For this process, wavelength-selective switches are commonly used. The optical switches, which are used for signal monitoring, the size of that optical switch is based on the system wavelength density and the desired monitoring thoroughness. The tapped optical signal, which is used for signal monitoring, the optical power of that signal is very low and the interference between ports has very low insertion loss and good uniformity.

E. Network Provisioning

The optical switches are used for providing new data routes and modified existing routes in optical networks. These switches are used for solving the all reconfiguration requests in few minutes. For the automatically and speedily response to the service requests, High-capacity reconfigurable switches are employed. With the help of them, network flexibility can be increased and consequently bandwidth and profitability.

VI. ADVANTAGES

The stability and reliability of Optical switches are very high and there are no moving parts in optical switches. All types of optical switches can be easily integrated with other optical devices in networks. In the OXCs, the design of switches can be easily adjusted according to the desired application. The optical switches, which are designed by using isotropic liquid crystals, provide the short switching times and excellent transparency over a long range. All optical switches are designed by using high precision and planar silicon technology.

VII. CONCLUSION

In this paper, the type of optical switches, which are used for making an optical cross connect architecture in optical networks, was reviewed. The application of switches and comparison are also described in paper, which are based on the market analysis of switches, carried out in the latest months and providing a valuable support for researchers in field of optical switches to make new all-optical switching network architectures.

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LTE-A with Relay Technology: A Review

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***Abstract*—The specification of the Long Term Evolution (LTE) standard is completed by the 3rd Generation Partnership Project (3GPP).In 4G (4th Generation) wireless communication systems the world's operators, making LTE as the market leader. The 3GPP LTE-Advanced (LTE-A) is used to provide sufficient data rates which support the high data services and their applications too. To determine this problem, the relaying technique is recommended. System capacity and coverage are improved by using Relay, as the low signal-to-interference-and-noise ratio (SINR) users handed over to relay Node and handle the system resources conveniently. The different LTE-A technologies are studied to fulfil all these requirements.**

Keywords: 3rd Generation Partnership Project (3GPP), Long Term Evolution Advanced (LTE-A), Orthogonal Frequency Division Multiplexing (OFDM), Multi Input Multi Output (MIMO).

I. INTRODUCTION

The LTE-A is an evolution of cellular networks designed by the 3GPP to achieve 4G requirements proclaimed by International Telecommunication Union-Radio Communications Sector (ITU-R). LTE-A controls more users per cell and provides high spectral efficiency than the 3G technologies**.** The enhancement in the radio link technology does not handle propagation loss for example, due to small SINR capacity at the cell border is small [1]. Generally LTE-A is used to enhance cell edge capacity [2]. LTE-A, offers bandwidth up to multi-megabits, use the efficient radio network, reduce the latency and quality gets improved. LTE is the alteration from 3G to 4G, as we are still in the phase of transition from 2G to 3G.Lastly, it is concluded that the mobile operators should search for such strategies and solutions which enhance their existing 2G and 3G network in such a way that there is no need of complete up gradation of the equipments to moves towards 4G. For this problem LTE-A is a best solution which is based on new radio access network that is called Orthogonal Frequency Division Multiplexing (OFDM) technology [3]. OFDM achieves the high data rate of 300 Mbps in the downlink.

In LTE-A Release 8 the technique used for uplink is Single Carrier Frequency Division Multiple Access (SC-FDMA) and for downlink OFDMA base modulation. OFDM generally separates achievable spectrum into different narrowband carriers. In this technique every signal is enhanced with modulation techniques. Due to these features, performances are improved and increase 5times the throughput than the average value of high speed packet access (HSPA). In 2010 ITU approved the release-10(Rel-10) because it m*et al*l the requirements of International Mobile Telecommunications-Advanced (IMT-Advanced). Rel-10 include various frequency bands with carrier aggregation for transmissions, self-organizing networks (SON), relays and build up multiple input-multiple output (MIMO) techniques. In Rel-10 downlink and uplink peak data rates are 1 Gbps and 500 Mbps [4]. Rel-11 is more developed than the Rel-10. Rel-11 contributes for cooperative multipoint transmission and reception (CoMP); it gives the permission to different cells to cooperate with the serving users. It enhances the cell interference cancellation (eICIC) and mobility management. The standardization moves on Rel-12 LTE-A, after the conclusions of Rel-11. These techniques are generally beyond 4G (B4G). B4G is the advanced technologies of Rel-12 having higher performance. In B4G systems higher frequency bands are used with bands between 3 and 5 GHz and in long term bands are up to 60 GHz. These frequencies have higher path loss, so the coverage area gets smaller.

II. RELAY TECHNOLOGY

LTE-A uses relays to improve the network performance. The basic idea is demonstrated in Fig. 1. A relay node (RN) simply receives and relocates information wirelessly to a donor evolved node base station (DeNB) through the Un-interface. The user equipment (UEs) receives and transmits data to RN through the interface Uu, the same idea used by RN to communicate with eNBs. RN handles the both objectives of eNB (to serve UEs) and UE (to communicate with the DeNB). Within a macro cell the new objective is to get the better response of cell-edge throughput. Because of RNs, superior service is provided to all those users which are located in low signal level areas like near the cell edge, at the cell edge and coverage holes [5].Nowadays relay-assisted LTE-A system is a research hot spot to handle resource allocation problem. A scheduling algorithm depends on buffer-based channel which divides the resources between distinct RNs and direct users [6].

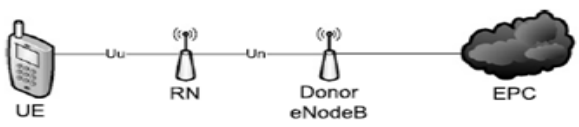

Fig. 1: Basic Relay Scheme

III. Types of Relay

Research association brings an idea of multiple relaying schemes. To support relays 3GPP architecture is same as in Fig. 1. The transmission among the RN and UE look-alike as used to communicate with eNBs, with the Uu interface. So that in LTE devices, the transmission of information from the RN is same as the transmission of information from an eNB. The interface Between the RN and the DeNB is used to support RN-specific functionality. Two types of relays are Type-I [7] or non-transparency [8] and Type-II or transparency.

A. *Type-I*

In Type-I Relay Station (RS) helps the UE unit to access the eNB. The reference signal is transmitted through RS and also the controlled data for the eNB. Its main objective is to broaden the signal and coverage area, as shown in Fig. 2. RSs generally perform forwarding of IP packet in the network layer. The data transmitted for UE units by some contributions to the overall system capacity.

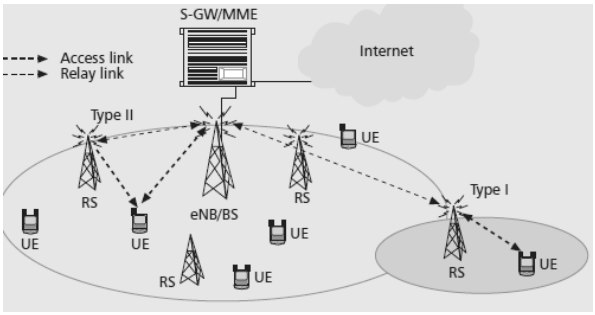

Fig. 2: Network Scheme with Multiple RSs and Multiple UE Units

B. *Type-II*

A Type-II is used to improve service quality and link capacity of an eNB, RS helps to communicate directly with the eNB which is located in the coverage area of eNB. The reference signal or the control information does not transmitted by the RS. It increases the long-term system capacity by accomplishing multipath diversity and transmission gains for UE units [9].

IV. Relay Transmission Schemes

Different relay transmission schemes are used through an RS to establish transmission between an eNB and a UE unit [10–11].

A. *Amplify and Forward*

At the first phase the signal is received by RS from the eNB (or UE). At the second phase it amplifies the received signal and passes it to the UE (or eNB). This scheme is very simple and use short delay, but the noise gets amplified.

B. *Selective Decode and Forward*

At the first phase the received signal is decoded from the eNB (UE) by the RS. At the second phase if by using cyclic redundancy check (CRC) decoded data is correct, then the RS achieve channel coding and lead the new data to the UE (eNB). This scheme has long delays but avoid error propagation through the RS.

C. *Demodulation and Forward*

At the first phase the received signal from the eNB (UE) is demodulated by RS without decoding the received signal. At the second phase RS modulates and led the new data to the UE (eNB). This scheme helps to use low processing delay, but could not remove the error propagation.

V. Paring Schemes

In each cell consider a network with many RSs and many UE units (Fig. 2). One of the main challenges is to handle the relay/cooperative gain of pair nearby RSs and UE unit. The success of this scheme depends on the selection of relay partners. In relay transmissions it is important to develop effective pairing schemes to choose desired RSs and UE units to collaborate, thus for mobile communication networks we get the improved throughput and coverage performance. This pairing can be done in either a centralized or distributed way.

A. *Centralized Scheme*

In a centralized pairing scheme, an eNB act like a control node to carry the appropriate channel and bear the data from all the RSs and UE units in its surrounding, and then for all of them it make pairing decisions. It provides the better performance gain. In this scheme UE unit is enabled to measure the channel qualities toward its neighbouring UE units and then by using a predefined threshold identify a list of relay-capable neighbours [12]. This information is sorted in order of list from different UE units to make the paring decision and information is sent to eNB.

B. *Distributed Scheme*

In a distributed pairing scheme, UE unit is selected by each RS by using local channel information and medium access control (MAC) mechanism is contention-based. Multiple-RS-single-UE and single-RS-multiple-UE scheme both are used by centralized and distributed pairing schemes [13–15]. Limited work has been done by using general multiple-RS-multiple-UE scheme [16]. For the multiple-RS-multiple-UE scheme no distributed pairing scheme has been published.

VI. Radio Protocol Relay

In network layer of relay technology, the RS process the user data [17].In 3GPP the relay station works with the same radio protocols as used by LTE eNB [18].For user ciphering and header compression RS is attached with the Packet Data Convergence Protocol (PDCP) [19].Radio Link Control (RLC) protocol used to control retransmission by automatic repeat request [20]. Medium Access Control (MAC) protocol is used for data scheduling [21]. For security control, quality of service and mobility the Radio Resource Control (RRC) protocol is used [22].

VII. Benefits of Relay

The followings are the benefits of relays which are identified by 3GPP [23]:

- In new areas it provides coverage: Relays are used in those areas where the eNB backhaul solutions are not achievable. In Fig. 3, case (a) and (b), are the areas of strong shadowing effects.
- Temporary deployed network: Instead of using eNBs, RNs has easier deployment and removed faster. So the temporary deployments are done by using RNs.
- Cell-edge throughput: By placing RNs along the cell edge, the cell-edge throughput of UEs must be increased. This is shown in case (c) of Fig. 3.
- Data rate is improved: By increasing desired data rate the quality of signal to surrounding UEs become well by arranging RNs in areas with low signal levels. In case (d), the RNs are arranged to serve underground areas; and in case (e) to improve signal strength in indoor environments RNs are used.
- Group mobility: In Fig. 3 group mobility is shown by case (f) where UEs move in a group. In this problem the co-located relay is used to provide improve mobility performance.

Technically Relays are used to reduce the capital and usable expenses. Due to lesser complexity of relays than eNBs the cost of relays get reduced. Relays are arranged faster in backhaul than the eNBs so it is less expensive.

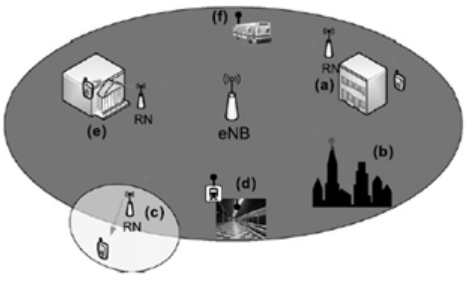

Fig. 3: Relay Deployment Scenarios

VIII. Comparison Between 3G and 4G-LTE

TABLE 1: ILLUSTRATES COMPARISON BETWEEN 3G AND 4G-LTE

Parameters	3G	4G-LTE
Definition	Digital Broadband Packet data	It include quality of service (QOS) and access edge with intelligence
Services	Video calling, mobile TV, destination based service, at faster speed internet access. Universal access and portability across different device types	High definition streaming,IPv6 support and QOS
Throughput/ Speed	3.1 Mbps (peak)/500-700 Kbps	100-300Mbps (peak)/ 3-5 Mbps
Technologies	UMTS as its core network architecture with HSPA protocols	MIMO with backbone of OFDMA and SC-FDMA
Voice and data support	both voice and data supported simultaneously	Use higher data rates than the 3G and support voice and data simultaneously
Switching technique	circuit switched and packet switched network	Use only packet switched network, thus lowering latency and enhancing access quality

IX. Basic Requirements of LTE-A

LTE-Advanced has backward compatibility. Table 2 lists the basic requirements of LTE-A [24].

TABLE 2: ILLUSTRATES REQUIREMENTS OF 4G-LTE

Parameters	LTE-A	
	Downlink	Uplink
Peak spectrum usage efficiency (b/s/Hz)	30	15
Average spectrum usage efficiency (b/s/cell)	2.4-3.7	1.2-2.0
Cell-edge spectrum usage efficiency (b/s/user)	0.07-0.12	0.04-0.07
Operating bandwidth (MHz)	Up to 100	
User plane delay (unidirectional) (ms)	<5	
Connection setup delay (ms)	<50	

Few physical layer enhancement techniques are used to meet these requirements like carrier aggregation, MIMO, relaying, Up to 4 and 8 antennas multiplexing is done for uplink and downlink respectively [25].

X. Conclusion

In this paper, the different types of relays play a vital role in future releases of LTE-A, by extending the coverage area around cell edges and increase the capacity of hot spot areas. Centralized and Distributed relaying systems are used. Relaying architecture leads

to flexible, robust and self-optimizing multi-hop cellular network. Relay use different protocols for security control and quality of service. To meet the demand of higher data rate and large coverage area, a MIMO technology is emerging in LTE-A.

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DQPSK Transmission for Optical System: A Review

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***Abstract*—The perpetual development and increasing demand for capability, high bit rate transmission has become an important part of communication in metropolitan optical networks from past few years. DQPSK modulation is methodical format for the transmission of high speed optical signals over narrow bandwidth channel. The DQPSK modulation format for long haul and Wavelength Division Multiplexing transmission links is the one that has a double narrower spectral width, large dispersion tolerance and low susceptibility to fiber nonlinearity. It has a simple and cost-effective design.**

Keywords: Differential Quadrature Phase-shift Keying (DQPSK), Polarization-Mode-Dispersion (PMD), Reconfigurable Optical Add/ Drop Multiplexer (ROADM), Return-to-Zero (RZ), Non Return-to-Zero (NRZ)

I. INTRODUCTION

Differential quadrature phase-shift keying (DQPSK) has attracted much attention in latest years, as it has narrower spectrum width, receiving sensitivity of approximately 3 dB and strong crosstalk-resistant capability [1]. DQPSK is an effective modulation format which has high spectrum efficiency [2], larger dispersion tolerance, PMD (Polarization-Mode-Dispersion) tolerance and nonlinearity tolerance [3]. Dispersion tolerance and nonlinearity tolerance of the communication system is greatly improved as the symbol rate of DQPSK is just half of differential phase shift keying (DPSK) modulation (for same information rate). Optical fiber communication system of 40 GB/s even 100 GB/s, DQPSK modulation is examined as one of the most effectual methods of dealing with the influence of dispersion and nonlinearity [4-6]. Signal bandwidth is decreased by narrow passband filtering when 40-Gbit/s per channel signals pass through multiple nodes. This makes DQPSK signal attractive for 40 Gbit/s transmission in 50-GHz-spacing ROADM (Reconfigurable Optical Add/ Drop Multiplexer) nodes, because its bandwidth is about half that of conventional NRZ on-off keying format [7].

Nelson *et al.* [8] demonstrated a new approach for the upgradation of metropolitan area networks (MANS) from 10 Gbit/s per channel to 40 Gbit/s per channel, named optical differential quadrature phase shift keying (DQPSK) because of high robustness to optical filtering and enhanced tolerance to residual dispersion and nonlinear impairments. In Differential quadrature phase-shift keying, the symbol information is encoded as change in phase from one symbol period to the next rather than as a definite phase. In this illustration, the receiver has to recognize phase alteration and not the exact value of the phase, which keep away the requirement of a synchronized local carrier.

Masahiro Daikoku and Itsuro Morita *et al.* [9] experimentally analysed the receiver sensitivity of the 100-Gb/s DQPSK signal was about −22 dBm, and the chromatic dispersion (CD), and differential group delay (DGD) tolerances for a 1-dB penalty were about 18 picoseconds per nanometer and 3.3 picoseconds, respectively.

II. DIFFERENTIAL QUADRATURE PHASE-SHIFT KEYING

Differential Quadrature Phase Shift Keying (DQPSK) is a four-level modulation format. In this technique, the two phases of the same optical carrier which are orthogonal to each other are used to twice the spectral efficiency by transmitting two bits at a time. This is done by transforming two incoming electrical data streams into a four phase optical data signal. The incoming data streams *u, v* are pre-coded and sent to the DQPSK transmitter, as shown in Fig. 1[10]. After transmission the DQPSK receiver de-correlates the phase-shifted signal to the output signals *r, s* which should be equivalent to the incoming *u, v* [10].

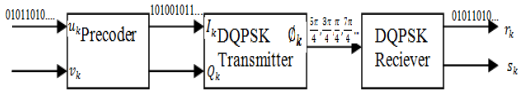


Fig. 1: DQPSK Transmission Scheme

III. GENERATION OF DQPSK SIGNAL

Figure 2 illustrates a structure of a DQPSK transmitter. An optical DQPSK transmission system requires a digital differential precoder. The input data is firstly precoded at the transmitter. The precoder eliminates error propagating at receiver. Furthermore, the precoder allows also direct mapping of the bit sequence of each DQPSK component from the input to the output [11].

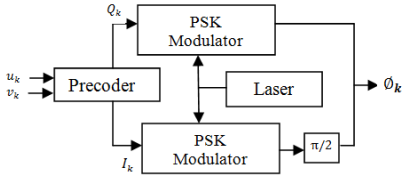


Fig. 2: Structure of DQPSK Transmitter

Assuming that the first bit is transmitted in the in-phase (I) component and the second bit is transmitted in the quadrature (Q) component of the DQPSK signal, direct mapping is achieved by coding the input data (*I* and *Q*) 11, 01, 00 and 10 with the phase differences of 0, π/2, π and-π/2, respectively. The coded data (*I** and *Q**) is firstly modulated by phase modulators. Then, a π/2 phase shift is applied to the I-component of the DQPSK signal. The combination of the I-component and Q component generates the DQPSK signal [12].

The following equation represents the mathematical analogy of dual phase modulators [10]:

$$E(t_k) = E_0.\cos[\frac{\pi.(I_k - Q_k)+\frac{\pi}{2}}{2}].e^{j(\frac{\pi.(I_k-Q_k)+\frac{\pi}{2}}{2})} \quad (1)$$

The following table 1[10] illustrates the resultant phases of the Differential quadrature phase shift keying at the transmitter side:

TABLE 1: RESULTING PHASES OF THE DQPSK SIGNAL AT THE END POINTS OF THE TRANSMITTER

I_k Q_k	$E(t_k)$	$\emptyset_k$
0 0	$\cos\left(\frac{\pi}{4}\right).e^{j\frac{\pi}{4}} \rightarrow e^{j\frac{\pi}{4}}$	$\frac{\pi}{4}$
0 1	$\cos\left(-\frac{\pi}{4}\right).e^{j\frac{3\pi}{4}} \rightarrow e^{j\frac{3\pi}{4}}$	$\frac{3\pi}{4}$
1 0	$\cos\left(\frac{3\pi}{4}\right).e^{j\frac{3\pi}{4}} \rightarrow e^{j\frac{7\pi}{4}}$	$\frac{7\pi}{4}$
1 1	$\cos\left(\frac{\pi}{4}\right).e^{j\frac{5\pi}{4}} \rightarrow e^{j\frac{5\pi}{4}}$	$\frac{5\pi}{4}$

DQPSK Transmission based Fiber optic Communication System

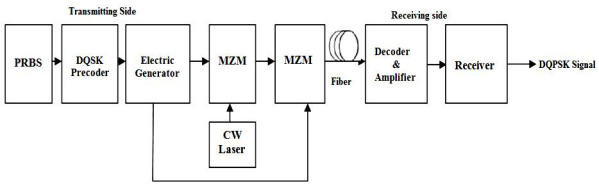


Fig. 3: General Block Diagram of Optical DQPSK Transmission System

The block diagram of a DQPSK transmission based fiber optic communication systems is shown in figure 3. In this case message means an electrical or another form of signal. This message is transmitted by a transmitter and passed via a fiber. It is detected and converted to the required form by the receiver. The electrical part of the DQPSK transmitter comprises a data generator, precoder and a Low Pass Filter (LPF). For transmission, the data generator is mainly a pseudo-random bit sequence that has properties of arbitrary data. To the transmitting side, the major purpose of the precoder is to generate the error-free DQPSK signal. In fiber optic communication system, light emitting diode (LED) or laser are used as an optical oscillator or a carrier signal. The function of low pass filter is to produce the three levels DQPSK electrical signal and then the signal is modulated by MZ Modulator. To travel long distance, they produce signal frequency with sufficient power. The amount of power radiation is proportional to the output current of the modulator. This modulated signal is transmitted via proper channel means fiber optic cable. It may be guided or unguided. This signal is demodulated to the receiving end, decoded and filtered. Receiver detects, amplifies and converts the signal to appropriate form [13].

A. Pseudo Random Binary Sequence (PRBS)

Pseudo-random data generator has three properties that reflect the data's randomness. Firstly, the number of marks and spaces (or "0s" and "1s") in a sequence differ by 1. Secondly, the probability of a continuous string of marks or spaces is inversely proportional to the length of the string. This means that among the number of runs of marks of spaces in the Pseudo-random binary sequence (PRBS), one-half the funds of each kind are of length one, one-fourth are length two, one-eighth are length three and so on. At last, the autocorrelation of the Pseudo Random Binary Sequence is approximately zero everywhere except at the origin. The production of a Pseudo Random Binary Sequence is implemented by using a shift register with feedback has three properties that reflect the data's randomness [13]. In available DQPSK transmission experiments, pseudorandom binary sequences (PRBS) are transmitted and the forecasted data can be arranged into the bit error ratio tester for the measurement of bit error rate [14].

B. DQPSK Precoder

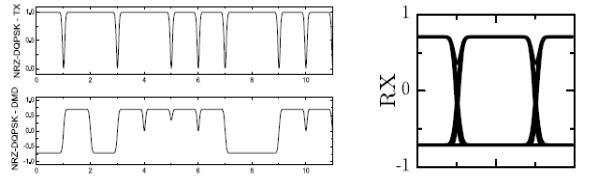
An optical DQPSK system requires a precoder in order to avoid recursive decoding in the receiver, error propagation and reduce hardware complexity. However, transmitting long Pseudo Random Binary Sequence or non-periodic user data is not practicable without a precoder. M. Serbay *et al.* [15] designed a differential precoder, but the precoder can only be used for one specific system, a general way to design the precoder is very helpful for designing DQPSK transmission systems. DQPSK precoder is a combination of serial to parallel converter and decoder. The input of serial to parallel converter converts the input serial sequence to parallel output. The output is further decoded by the decoder and final output appears at the precoder output ports.

C. Mach Zender Modulator (MZM)

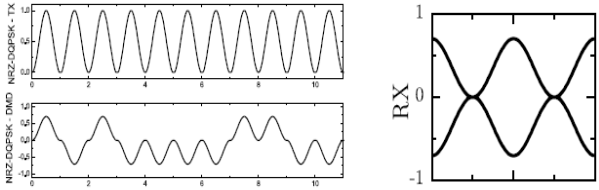
The electrical signal drives the MZ Modulator to generate optical DQPSK signal. A Mach-Zender modulator is proficient of modulating both the amplitude and phase. A continuous wave or pulsed light wave generated by a laser diode is modulated by an external Mach-Zender modulator. The two arms of the Mach-Zender (MZ) modulator are driven by two electrical signals in push-pull fashion. The laser diode and the Mach-Zender (MZ) modulator make up the optical section of the DQPSK transmitter means optical DQPSK signal.

IV. Analysis of RZ-DQPSK and NRZ-DQPSK Waveforms

In on-off keying it is well-known that the use of RZ (Return-to-Zero) coding results in an improved receiver sensitivity, due to better peak power to noise ratio in the receiver. Already in 1977, Personick [16] noted that if the received pulse energy is constant, the best performance is obtained with a pulse width less than the bit slot. About 2 dB improved receiver sensitivity is obtainable with RZ compared to NRZ (NonReturn-to-Zero) [17]. The phase modulated DQPSK signal is converted into an amplitude modulated signal after demodulation. A demodulated RZ-DQPSK (Return-to-Zero Differential Quadrature Phase Shift Keying) signal has a RZ shape while a demodulated NRZ-DQPSK (Non Return-to-Zero Differential Quadrature Phase Shift Keying) signal has a NRZ shape. Thus, it is to be expected that there should be the same 2 Db advantage for RZ coding with DQPSK as with OOK systems. The waveforms of NRZ-DQPSK and RZ-DQPSK are compared in Fig.4 [18]. It is seen that the power-dips in symbol transitions caused by the MZ modulator are no longer visible after the RZ pulse carving.



(a) NRZ-DQPSK



(b) RZ-DQPSK

Fig. 4: Waveforms and Eye Diagrams of Transmitted and Received NRZ and RZ DQPSK Signals

V. Comparison of DQPSK with Different Modulation Techniques

A. *Binary Phase Shift Keying [BPSK]*

When the information signal (input binary data) modulates the phase of the carrier wave then the end product modulation strategy is known as Binary Phase Shift Keying. The simplest form of phase modulation is the digital modulation technique. With BPSK, only two phase states are possible with carrier that is why it is known as binary [19]. Generally, it has an application in high speed data transfer, gives a 3dB power advantage over the Binary Amplitude Shift Keying modulation technique and has a simple design but proves to be an ineffective user of the available bandwidth and is normally termed as a non-linear modulation scheme. It gives an error rates smaller than any other systems [20].

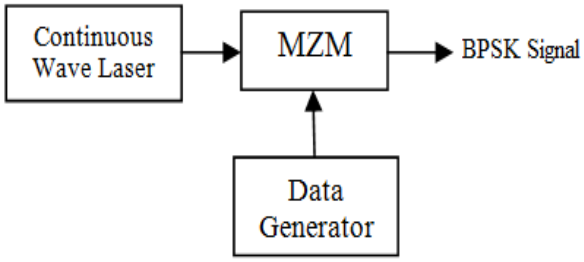


Fig. 5: BPSK Transmitter

B. *Quadrature Phase Shift Keying [QPSK]*

A QPSK is an another addition to the PSK digital modulation technique which splits the phase of the carrier signal sketched by assigning four equally spaced values for the phase angle as $\pi/4$, $3\pi/4$, $5\pi/4$ and $7\pi/4$ thus providing a major advantage over BPSK by doubling the information capacity of it. QPSK is a digital modulation technique which is highly bandwidth efficient. But at the receiver end, it becomes difficult to recover back the exact phase which is a very important factor for the receiver implementation. This may give rise to incorrect detection of the signal and also increases complications in the receiver design [21].

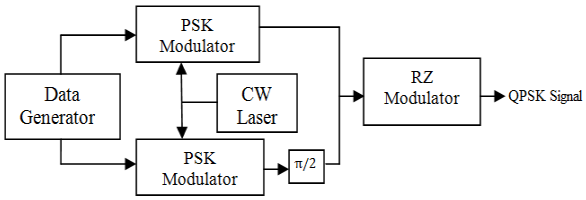


Fig. 6: QPSK Transmitter

C. *Differential Phase Shift Keying [DPSK]*

It become understandable that the receiver requires a coherent reference signal, for the exact detection of a phase modulated signal but if differential encoding and phase shift keying are combined together at the transmitter then the digital modulation technique developed is entitled as Differential Phase Shift Keying [21, 22]. The phase remains unchanged, when symbol 1 is transmitted and the phase of a signal is advanced by 180° when symbol 0 is transmitted. In determining the relative phase change between the symbols transmitted, the track of the phase change information becomes essential. This technique is based on the supposition that the alteration of phase is very steady to an extent that it can be examined to be almost constant over two bit intervals [23].

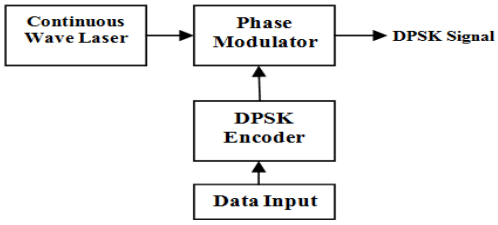


Fig. 7: DPSK Transmitter

The above figure shows the diagram of a DPSK transmitter which is basically a binary phase shift keying with an additional DPSK encoder which encodes the signal.

VI. Advantages of DQPSK Modulation

DQPSK is an effective method in high speed optical transmission systems to improve spectral efficiency, to increase dispersion tolerance and to reduce the sensitivity to nonlinear effects. Its advantages such as smooth average power and exemption from local light source give it a promising future in backbone network. Difference quadrature phase-shift keying (DQPSK) can be suggested for the high-speed long-distance optical transmission system.

VII. Conclusion

Differential quadrature phase shift keying has been presented as a promising modulation format for optical communication systems. DQPSK four-level encoding results in half the spectral width of binary signals at the same bit rate, offering four times larger dispersion tolerance and double spectral efficiency. The use of DQPSK in optical communication systems allows for design of high bit rate systems using lower symbol rate to reduce impact of transmission impairments and electronic bandwidth requirements. Alternatively, DQPSK can be used to generate signals with twice the bit rate of state-of-the-art electronics.

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Analysis of Different Transfer Functions for Cryptography using Chaotic Neural Network

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***Abstract*—The exchange of information among the intended users without any leakage of information to unauthorized users is the aim of any cryptographic system. There are many public key cryptography, which are based on number theory and they demand large computational power. The process involved in generating public key is very complex and time consuming. To overcome this disadvantage, the neural network can be used to generate common secret key. In this paper, chaotic neural network is proposed for data encryption. The main reason of using chaotic system in cryptography is especially noise like non–periodic dynamics of these systems. We have used four different transfer functions (Hard limit transfer function, Triangular basis transfer function, Radial basis transfer function and Hyperbolic tangent sigmoid transfer function) for the analysis of the chaotic neural network.**

Keywords: Neural Network, Chaos, Cryptography

I. INTRODUCTION

Artificial neural network (ANN) is capable of performing on nonlinear input and output systems in the workspace due to its large parallel interconnections between different layers and its nonlinear processing characteristics [1]. An artificial neuron consists of a computing element that performs the weighted sum of the input signal and the connecting weight. The sum is added with the bias or threshold and the resultant signal is then processed for nonlinear function of sigmoid or hyperbolic tangent type. In multilayer neural network (NN) structure, there can be one or many artificial neurons in each layer. In the multilayer neural network or multilayer perceptron (MLP), the input signal propagates through the network in a forward direction, on a layer-by-layer basis [6]. Neural networks have been used in data protection because of complicated and time–varying structures [3]. For example multilayer perception networks are used to construct block cipher [2] and the cellular and clipped Hopfield neural network are used to construct the stream ciphers.

A. Chaos

From a practical point of view, chaos can be defined as bounded steady-state behavior that is not an equilibrium point, not periodic, and not quasi-periodic. A chaotic spectrum is not composed solely of discrete frequencies, but has a continuous, broad-band nature [4]. The chaotic systems is sensitive dependence on initial conditions, given two different initial conditions arbitrarily close to one another, the trajectories emanating from these points diverge at a rate characteristic of the system until, for all practical purposes, they are uncorrelated[5].

A network is called chaotic neural network, if its weights and biases are determined by chaotic sequence. We have considered the following Hopfield neural networks which exhibit chaotic phenomenon.

$$\dot{x}(t) = -Cx(t) + Af(x(t)) + Bf(x(t-\tau(t))) + I, \quad (1)$$

$$\dot{x}_i(t) = -c_i x_i(t) + \sum_{j=1}^{n} a_{ij} f_j(x_j(t)) + \sum_{j=1}^{n} b_{ij} f_j(x_j(t-\tau_{ij}(t))) + I_i, \quad i = 1, 2, \ldots, n,$$

Where, *n* denotes the number of units in a neural network, $x(t) = (x_1(t), x_2(t), \ldots\ldots, x_n(t))^T \in R^n$ is the state vector associated with the neurons, $I = (I_1, I_2, \ldots\ldots, I_n)^T \in R^n$ is external input vector. $f(x(t)) = (f_1(x_1(t)), f_2(x_2(t)), \ldots\ldots, f_n(x_n(t)))^T \in R^n$ is equation corresponds to the activation functions of neurons, $\tau(t) = \tau_{ij}(t)$ ($i, j = 1, 2, \ldots, n$) are the time delays, the initial conditions of (1) are given by $x_i(t) = \phi_i(t) \in C([-r, 0], R)$

with $r = \max_1 \le i, j \le n, t \in R\{\tau_{ij}(t)\}$,

where C($[-r, 0], R$) denotes the set of all continuous functions from $[-r, 0]$ to R. $C = \text{diag}(c_1, c_2, \ldots, c_n)$ is a diagonal matrix, $A = (a_{ij})n*n$ and $B = (b_{ij})n*n$ are the connection weight matrix and the delayed connection weight matrix, respectively. As is known to all that (1) can exhibit chaotic phenomenon.

$$\begin{bmatrix} \frac{dx_1(t)}{dt} \\ \frac{dx_2(t)}{dt} \end{bmatrix} = -C\begin{bmatrix} x_1(t) \\ x_2(t) \end{bmatrix} + A\begin{bmatrix} \tanh(x_1(t)) \\ \tanh(x_2(t)) \end{bmatrix} + B\begin{bmatrix} \tanh(x_1(t-\tau(t))) \\ \tanh(x_2(t-\tau(t))) \end{bmatrix} \quad (2)$$

The algorithm for cryptography using chaotic neural network [9]:

1. Set the value of M.
2. Determine parameter μ and initial point x(0).
3. Generate the chaotic sequence x(1), x(2), x(3)….. x(M) by the formula $x(n+1) = \mu x(n)(1 - x(n))$ and create b(0), b(l),..., b(8M-1) from x(l), x(2),..., x(M) by the generating scheme that 0.b(8m-8)b(8m-7). b (8m-2)b(8m-l) … is the binary representation of x(m) for m = 1, 2,...., M.
4. For n = 0 to M-1

$$g(n) = \sum_{i=0}^{7} d_i 2^i$$

For i = 0 to 7

$$\omega_{ji} = \begin{cases} 1 & j = i, b(8n+i) = 0 \\ -1 & j = 1, b(8n+i) = 1 \\ 0 & j \neq i \end{cases}$$

$$j \in \{0,1,2,3,4,5,6,7\}$$

$$\theta_i = \begin{cases} -\frac{1}{2} & b(8n+i) = 0 \\ \frac{1}{2} & b(8n+i) = 1 \end{cases}$$

End

For i = 0 to 7

$$d_i^{'} = f\left(\sum_{j=0}^{7} \omega_{ji} d_i + \theta_i\right)$$

Where f(x) is 1 if x >=0

End

$$g'(n) = \sum_{i=0}^{7} d_i^{'} 2^i$$

End

II. Encryption and Decryption using ANN Based Chaotic Generator

The cryptography is a process which consists of two parts. First is encryption and second is decryption processes. The encryption process can be defined as converting the original message which is named as plain-text to an inscrutable form which is named as cipher-text by an algorithm with secret keys. The decryption process is the inverse form of encryption process. Figure 1 shows a plain-text was encrypted and then obtained cipher-text was decrypted by using the chaotic dynamics. It is accepted that the initial conditions which were used in the training phase of the ANN model and the system parameters are known by both the transmitter and the receiver[7,8].

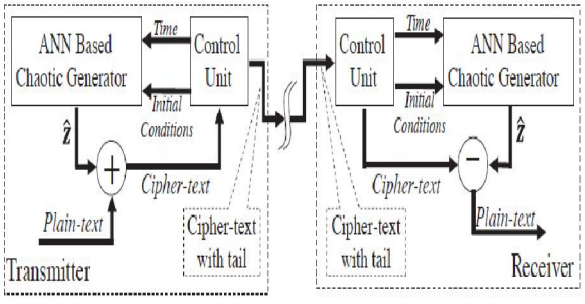
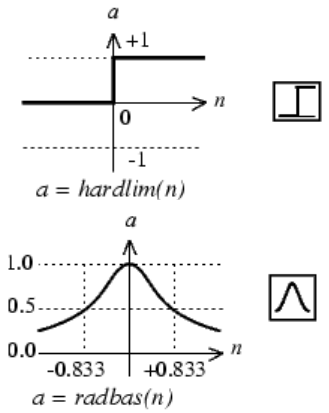
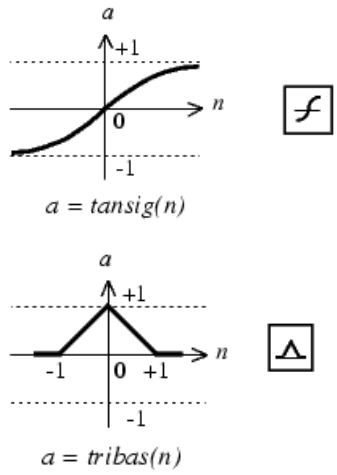


Fig. 1: Block Diagram of ANN based Chaotic Cryptography



(a) Hard Limit Transfer Function (b) Radial Basis Transfer Function



(c) Hyperbolic Tangent Sigmoid Transfer Function (d) Triangular Basis Transfer Function

Fig. 2: Graph and Symbol of Various Transfer Functions

Figure 2 shows the four different transfer functions to calculate a layer's output from its net input. These four transfer functions are used in cryptography by using chaotic neural network.

III. Criteria for Designing Chaotic Cryptosystems

When designing chaotic equations for data encryption, it is important to consider the time for data encryption (and decryption) and the level of security. The several important criteria for the design of a good chaotic cipher [9, 10] are as follows:

A. The Computation Time for Encryption and Decryption

The computation time for encryption and decryption depends on the complexity of equations and the value of state variable.

1) The Complexity of Equations

The lower the complexity of the equations, the shorter the computation time will be. On the other hand, if the complexity of equation was high, a longer time would be needed for data encryption and decryption.

2) The Value(s) of State Variable(s)

From the data complexity point of view, an integral value of state variable is more preferable. If the value of state variable was an integer, it would take a shorter time for computing the value of the next state variable. On the other hand, if the value of state variable was a floating point number, it would need a longer time for computing the value of the next state variable.

B. The Level of Security

Most chaotic encryption methods are symmetric key encryption in which both encryption and decryption key being use the same set of chaotic equations. In most of the case, the parameters of these chaotic equations and their initial values of state variable will be used as the encryption keys (the symmetric keys). Hence, the level of security will depend on two primitive factors: the key length and the output of encrypted cipher.

1) Key Length and Numbers of Keys

If the key length or numbers of keys are small, it would shorten the time of cryptanalysis of the keys. The traditional key value of chaotic equation is floating point number. It means that the key length would be increased based on the precision value of floating point number. However, floating point number would substantially increase the computation time.

C. Number of Set of Chaotic Equations

A large number of sets of chaotic equations will induce difficulties in cryptanalysis (and hence a better security level). If the number of set of chaotic equations was small, it would be easier for cryptanalysis.

IV. Result and Discussion

A chaotic network is a neural network whose weights depend on a chaotic sequence. The chaotic sequence highly depends upon the initial conditions and the parameters, x(0) and μ are set. It is very difficult to decrypt an encrypted data correctly by making an exhaustive search without knowing x(0) and μ.

TABLE 1: SAME INPUT ENCRYPTED WITH DIFFERENT INITIAL CONDITIONS (VALUES OF X (0) AND μ)

Input	Output with x(0)=0.55 & μ=2.5	Output with x(0)=0.75 & μ=3.9	Output with x(0)=1.5 & μ=0.9
63	63	165	192
20	8	129	235
31	15	129	224
60	43	176	195
71	83	234	184
12	25	103	243
248	236	40	7
119	98	119	136
90	79	57	165
1	20	210	1

TABLE 2: ENCRYPTED DATA OF TABLE 1 (COLUMN 2) DECRYPTED USING SAME AND DIFFERENT INITIAL CONDITIONS

Input	Output Obtained using Same Initial Condition	Output Obtained using Different Initial Condition	
	Output with x(0)=0.55 & μ=2.5	Output with x(0)=0.75 & μ=3.9	Output with x(0)=1.57 & μ=0.5
63	63	165	192
8	20	157	8
15	31	145	27
43	60	167	13
83	71	254	103
25	12	114	36
236	248	60	174
98	119	98	39
79	90	44	8
20	1	199	92

It is clear from table 2 that we can decrypt an encrypted data correctly by knowing the exact values of x(0) and μ otherwise we get the wrong data as shown in column 3 and 4 of table 2.

TABLE 3: COMPARISON OF OUTPUT FOR DIFFERENT TRANSFER FUNCTIONS

Input	Output Obtained using Different Transfer Functions (with) Same Value of x(0)=0.55 & μ=2.5			
	Output with Triangular Basis Transfer Function (Tribas)	Output with Radial Basis Transfer Function (Radbas)	Output with Hyperbolic Tangent Sigmoidal (Tansig)	Output with Hard Limit Transfer Function (Hardlim)
63	255	255	0	63
20	255	255	0	8
31	255	255	0	15
60	255	255	0	43
71	255	255	0	83
12	255	255	0	25
248	255	255	0	236
119	255	255	0	98
90	255	255	0	79
1	255	255	0	20

Radial basis function, triangular basis transfer function, hyperbolic tangent function can't use as the output activation function because if we use radial basis function or triangular basis function they provide value of $d_i^{'} = f\left(\sum_{j=0}^{7} \omega_{ji} d_i + \theta_i\right)$ approximately 0.7 and 0.5 respectively for the above input. When we apply these values to find the final output using $g'(n) = \sum_{i=0}^{7} d_i^{'} 2^i$ we get only 255 corresponding each number.

If we use hyperbolic tangent as activation function it provide the value of $d_i^{'}$ is 0.4 or–0.4. Which provide the value of g'(n) is 0 for each number. So we cannot use these transfer function because output either saturates at 255 maximum or at 0 minimum.

V. CONCLUSION

In this paper, we have analyzed Chaotic neural network for different transfer functions. It is noted that Chaotic neural network can used for data encryption. Chaos is statistically indistinguishable from randomness, and yet it is deterministic and not random at all. Chaotic system will produce the same results if given the same inputs, it is unpredictable in the sense that you can not predict in what way the system's behavior will change for any change in the input to that system. It is observed that it is very difficult to decrypt an encrypted data correctly by making an exhaustive search without knowing x(0) and μ. Hence, CNN is one of guaranteed high security. Radial basis function, triangular basis transfer function, hyperbolic tangent function can't use as the output activation function because output either saturates at 255 maximum or at 0 minimum. So, the hard limit transfer function (hardlim) is only used for the cryptography in chaotic neural network.

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Research Issues, Applications and Challenges in Vehicular Ad-hoc Networks: A Survey

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***Abstract*—Over the last few years, research is going on in the field of Wireless Sensor Networks (WSN), so it attracts the large number of researchers to explore this area. Therefore many new fields have been originated in WSN like Vehicular Telematics (VT) and Vehicular Ad-hoc Networks (VANET). VANET is a part of Vehicular Telematics and is being used extensively in Vehicular Telematics due to its important features as discussed in this paper. Now these days VANET has become a developing area in research and emerging field because it provides road and traffic safety by interconnecting the vehicles travelling on the road. The main purpose of VANET is to establish a network of cars for communication purpose, safety and comfort of the driver. This paper includes the new technologies introduced in Vehicular Telematics (VT) and the related research issues and challenges in VANET Applications.**

Keywords: VANET, MANET, VANET Characteristics, Topology and Architecture, Research areas and Challenges

I. INTRODUCTION

There are billions of vehicles travelling all over the world. So providing road safety to drivers and passengers becomes an essential issue. It is the major concern in the research area and that is why tremendous growth had took place in the field of telematics. Systems like VANET play an important role in safety as well as non safety applications [1]. Collision avoidance, Driver drowsiness prevention system, Emergency warning system, Automatic emergency braking systems are included in the safety applications. On the other side the traffic information systems like direction changer, cooperative entertainment, toll service, Internet access falls under the Non-safety applications.[4]

VANET, however, comes under the special category of MANET (Mobile Ad-hoc Networks), where the vehicles are the nodes which communicate with each other or with the infrastructure [2]. The basic difference between the three communication network which consists of cellular, MANET and VANET is shown in the Fig. 1 given below. [2]

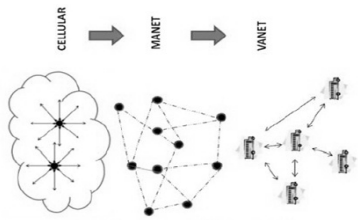

Fig. 1: Comparison of ad-hoc Networks [2]

A radio network spread over land through cells where each cell includes a fixed location transmitter and receiver is known as a Cellular network. On the other hand, to establish a network for information sharing without routers, MANET uses the temporary network of mobile nodes [11]. MANET is a wireless decentralized and self organized network of large number of mobile nodes connected temporarily [11]. But for fast moving vehicles we use VANET, because it is self organized and spread network [2].

Also now-a-days the demand for access the network services at any time from any place is increasing, so VANET is necessary to meet these requirements. This paper is about a detailed overview of the new technologies introduced in vehicular telematics (VT) and the related research issues and various challenges in the VANET Applications.

II. VANET CHARACTERISTICS

VANET is a special type of Mobile Ad-hoc Network (MANET), but it has its unique characteristics as compared to MANET [4]. Some important characteristics of VANET are given below:

A. Topology

In VANET, connection is established only for few seconds, because communication is done between moving vehicles [12]. The vehicles do not move randomly, they moved on a fixed path. So topology of VANET is not fixed [19] and is dynamic in nature. So the system required is highly accurate and efficient [10].

B. Network Disconnection

The vehicles are the nodes in VANET. The connection established between the nodes is for very short time period [12]. So the instant disconnection occurs due to the change in the environment and also due to the speed of the moving vehicles [10].

C. Expected Movement Patterns

In MANETs, the nodes move randomly. But in VANET the movement of the nodes are predictable, because vehicles have some fixed path or pre-defined roads and highways. This helps to use of the expected movement pattern in designing a network [4]-[5]-[19].

D. Changeable Density of the Network

The network density of VANET depends on the nodes only; if there is very large number of nodes the density becomes very high. The density is low in the low traffic area [4].

E. Computational Ability

The computational ability of a vehicle or node depends on the equipments connected in it. The vehicles have number of sensors, communication equipments, processors, memory devices, antenna and the advanced GPS. These devices are responsible for the high computational ability of the VANET [4].

F. Battery Consumption

In VANETs, the nodes have a longer battery life as compared to MANET. It is useful in accurate processing, and to establish a network [10]-[13].

III. VANET TOPOLOGY AND ARCHITECTURE

The aim of VANET is to establish a network for communication between vehicles which is more reliable, accurate and having secure routing protocols. In VANET vehicles do not move randomly like in MANET, there are some fixed paths like highways and roads. So the topology or the architecture used by VANET is not fixed [20]. The topology is variable in nature in VANET. In short we can say vehicles can communicate to each other by three ways:

- Vehicle to Infrastructure architecture (V2I): In this type all vehicles are connected to each other by the use of a Road Side Unit (RSU). This architecture is just like the WLAN (Wireless Local Area Network) [1]-[5].
- Vehicle to Vehicle architecture (V2V): This is the method in which vehicles directly communicate with each other, so no need of the RSU. This architecture is temporary in nature [1]-[5].
- Vehicle to Vehicle to Infrastructure architecture (V2V2I):This is also known as hybrid topology because it is establish by the combination of the V2V and V2I, in this type some vehicles directly communicate with each other and some vehicles communicate with the help of RSU [5].

IV. COMMUNICATION MODES

Vehicular telemetries is an important field which deals with the technology that connect a vehicle to another vehicle or other infrastructure in its surroundings [14]. Connected vehicle communication takes place due to the communication devices (nodes) present in a vehicle that connects to the same type of devices (nodes) present in another vehicles or other infrastructure like RSU, BSS around its surroundings [6]. There are mainly two types of communication modes present in VANET:

A. Vehicle to Vehicle (V2V) Communication

Vehicle to Vehicle (V2V) communication technology is necessary for road and traffic safety, it helps to reduce collisions and improve traffic congestion with the exchange of safety information like speed, location and direction between the vehicles within the range of each other. It has some special safety features like Forward collision warning and blind-spot detection [6]. The vehicles that include

Fig. 2: V2V Communication

Advanced Driver Assistance Systems (ADAS) and Cooperative Intelligent Transport Systems (C-ITS) are considered as the connected vehicles. Connected-vehicle safety applications are designed to increase situation awareness and mitigate traffic accidents through vehicle-to-vehicle (V2V) and vehicle-to-infrastructure (V2I) communications [6].

Another application of V2V communication includes providing an alert signal to the driver when the distance between two vehicles i.e. Inter Vehicular Distance (IVD) becomes less than the safety level but the range of V2V communication is limited [20]. Multi-hop communication is used for direct communication between two vehicles. So it becomes the area of research to enhance or increase the range of communication between the two vehicles.

B. Vehicle to Infrastructure (V2I) Communication

Vehicle to Infrastructure (V2I) communication is just like the Vehicle to Vehicle (V2V) communication, the main difference is that in this type the communication is done between vehicle and its surrounding network. Also in V2I, Single-hop communication [1]-[7] takes place. It is very helpful in some applications like Direction Changer. In V2I communication, the information exchange between vehicles and Infrastructure (RSU) takes place in bulk. Vehicle to Infrastructure communication is used because it establishes a high bandwidth link between car and Infrastructure control unit [Figure no. 4].The roadside control units are placed after a distance of every kilometre or less than a kilometre, to establish

and maintain a network of high data rates between large numbers of vehicles [1]-[20]. The direction changer is the best application of the V2I communication.

C. Direction Changer

In direction changer, a signal may be sent to the driver if heavy traffic is reported by the system and the driver may change the direction and follow another route. The information is provided by one base station to another base station.

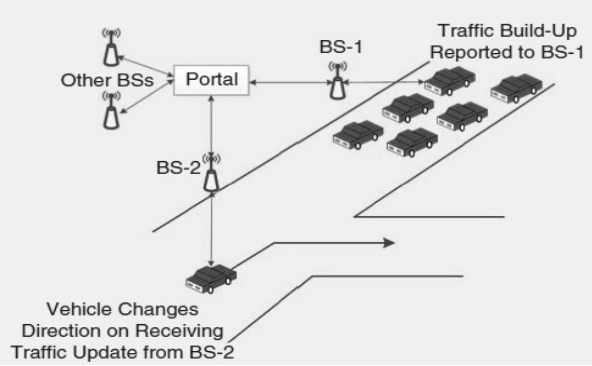

Fig. 3: Direction Changer [7]

Fig. 4: V2I Communication

V. VANET APPLICATIONS

VANET is a special type of wireless network which is necessary to establish a network of cars for communication purpose on highways or urban areas and due to its important features which helps in Collision Avoidance for Road and Traffic safety [4]-[5]-[17]. The application that is not intended for the safety prospective and is comes under the class of non-safety applications also termed as connected vehicles communication [6]-[17]. The applications of VANET that are literally meant for providing safety to the drivers and passengers travelling on the road are placed under the class of safety applications of VANET [17]-[18]. Few of these are discussed below:

A. Forward Collision Warning System (FCWS)

The rear end crashes caused due to drivers following too closely can be reduced by a new technology i.e. 'Forward Collision Warning System (FCWS)' Developed by Volvo. It uses 'heads up' technology to produce some visual signals on the windscreen of the car that alerts when the braking distance falls below a safe level [3]-[9]-[18].

B. Lane Departure Warning System (LDWS)

The Nissan motor company of Japan developed LDWS, to prevent a large number of accidents. Because some accidents are caused due to vehicles straying out of their lane on road or in traffic. This Vehicle Lane Departure Warning System is also known as 'Lane Keep' system [3].

C. Automatic Emergency Braking System (AEBS)

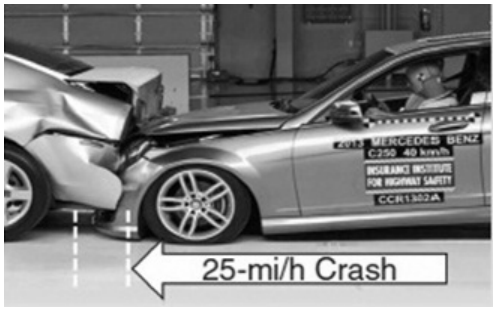

Fig. 5: Normal Vehicle without AEBS [8]

Fig. 6: Vehicle with AEBS Installed [8]

Automatic Emergency Braking Systems (AEBS) is also known as Collision Avoidance system. This technology uses radar sensors; sometimes these are also combined with a camera vision sensor to detect a stopped vehicle present ahead. If the closing speed is increasing very rapidly than the system apply AEBS to avoid the collision or to minimize the effect of the collision [8]-[9]. In the following example [Fig. 6], the effect of Automatic Emergency Braking system is shown. In Fig. 5, the AEBS is absent so collision occurred with its full effect or with full force. But in Fig. 6, the AEBS is used so the effect of collision is reduced due to this reason. In Fig. 5 the collision occurred with force of 25mi/h speed but in Fig. 6 AEBS present system the speed reduces to 12mi/h. Collision occurred produced less effect and therefore safety increases. In this case driver also controls the steering wheel. So the driver has more control on the vehicle. [8]

D. Intelligent Transport Systems (ITS)

The Intelligent Transport System (ITS) plays a very important role in Road and Traffic safety and has ability to develop new ideas and new technologies for same purpose. The main purpose of Intelligent Transport

System is to increase the comfort while driving; also the ALCOLOCK and SEATBELT LOCK systems are developed for the Road safety purpose. On the other hand systems like Advanced Cruise Control and Dynamic Route Information Panels are not specifically intended to improve Road safety [3], but they have some other purpose like the speed of the motor is set by the driver for the sake of the convenience using Cruise control system.

Fig. 7: Intelligent Transport System

VI. VANET Research Areas & Challenges

VANET technology has emerged as an important research area over the last few years. This idea is developed from the concept of establishing a network of cars for a specific need or situation. VANETs have now been established as reliable networks that vehicles use for communication purpose on highways or urban environments. VANET is a new branch of wireless sensor networks. Although lot of research is still going on in VANET, but there are many hot topics left untouched that are yet to be explored. There are many interesting research issues and challenges in this field. Few of them are mentioned below:

A. Quality of Service

In VANET the connection is established between the nodes for a very short time because the nodes are continuously moving. So it is a challenging task to make a network which establish new routes quickly and have high connectivity time. The network must be intelligent enough to make use of full available bandwidth [4]-[5].

B. Scalability

It is one of the VANET challenges which deals with the operability, because VANET has to work in very low density areas like highways and roads as well as in very high density areas like in traffic jams and cities. This variation in the values of nodes is a challenging issue both for researchers as well as developers [4].

C. Routing Protocols

Routing is very important issue in VANET, because we have to establish the network between moving vehicles. The network must have maximum system capacity, less computational complexity and also able to give high throughput. While selecting the protocols many challenges are faced by the researchers to choose the type of routing protocol for example some protocols [Position based routing protocol] require maintenance of unused paths which results in wastage of bandwidth, while other protocol [Reactive routing protocol]may cause disruption in the network because of excessive flooding during peak traffic hours. Due to this selecting a routing protocol in VANET becomes a major challenge for researchers [21].

D. Broadcasting

When the vehicle goes out of range, broadcasting approach is used. Packets are transmitted using different techniques by using extensive resources of bandwidth. It is thus one of the significant research area[5].To ensure the effective information transmission in the low density traffic areas and high density traffic areas, the selection of effective and co-operative broadcasting algorithms becomes a challenge for the researchers[4].

E. Network Security

Security is a major issue in VANET.As in VANET the information is shared between nodes through wireless communication network security becomes very crucial. Any successful attack can cause a great harm or threat for drivers as well as passengers. It can decrease the speed of the whole network [4]-[15] and may put a great impact on the performance of the network. So designing a highly secure network becomes an open research area for researchers and developers. Few challenges that come on the way of researchers are like use of fast cryptographic algorithms, authentication of nodes from external and internal attacks, key distribution for encryption and decryption of a message and high mobility of nodes [20].

VII. Conclusion

Over the last few years lot of research have been done in the field of Wireless Sensor Networks (WSN). Vehicular telematics is one of the fields of the WSN and VANET is type of network used in vehicular telematics for making interconnectivity of vehicles. In this paper an overview of VANET is discussed focussing on various research issues and challenges that come while implementing VANET in vehicular telematics. Comparison is done between VANET and MANET. VANETs characteristics have been described to know the difference between VANET and other wireless ad-hoc networks. VANET topology and architecture is discussed that define the network type

used. Various VANET applications for safety and non safety are mentioned along with different VANET research areas and different challenges that come in the field of vehicular telematics.

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Performance Comparison between Various Dispersion Compensation Techniques using Wavelength Division Multiplexing under Varying Channel Spacing

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***Abstract*—In this paper comparative analysis of dispersion compensation is done using different dispersion compensation techniques for multipoint WDM system in optical fiber communication. This is done by pre compensation, post compensation technique for different wavelengths with different channel spacing by using standard dispersion compensated fiber (DCF) and erbium doped fiber amplifiers (EDFA). It is found that dispersion is greatly reduced to a large extent by using compensation techniques. It has been observed that pre compensation technique is better as compare to post compensation technique with different channel spacing.**

Keywords: OFC; Dispersion; Pre and Post Compensation; DCF; WDM

I. INTRODUCTION

In the era of information theory optical communication system is the necessity of modern communication system. For short distance communication, we use multimode optical fiber and for long distance single mode fiber is used. During transmission on optical fiber from source to destination attenuation and pulse broadening or dispersion added in the optical signal. It is increase with the increase in length. Dispersion is the method to separated spectral parameter from signal [1]. Dispersion is the most vital parameter that degrades the whole performance of optical communication system. Dispersion compensation fiber are achieved by shifting the dispersion of 1310nm window to 1550 nm window. DCF is made for dispersion compensation. It provides a large negative coefficient of dispersion but positive dispersion in the transport fiber. DCF compensate the dispersion on the given length. DCF is used in most compensaton techniques to compensate dispersion. Benefit of DCF is it gives broadband use along with dispersion property [1] [4].By using erbium doped amplifiers the distance of transmission is increased as it was decreased due to fiber losses. Compensation is achieved in three method post compensation, pre compensation and symmetric compensation. EDFA is used in 1.55µm window of optical fiber and it constrained by losses in optical fiber communication. And this type of amplifier gives the non linear effect which bound the bit rate and travelling distance. The power of transmitted light signal is amplified by EDFA before launching signal into fiber [2] [3]. Dispersion is the process of broadening of optical pulses. Amplifier in optical communication system (OCS) can solve the losses present in fiber but cannot solve the dispersion in OCS, dispersion is the phenomenon in which an EM wave travelling in optical fiber is degraded because of various signal parameters. There is different type of dispersion like waveguide dispersion, material dispersion and modal dispersion [1]. Agarwal R. *et al.* worked on comparison pre, post and symmetrical dispersion compensation techniques with subcarrier multiplexing, in this paper, SCM technique is used and symmetrical compensation, pre and post compensation techniques are compared by using dispersion compensated fiber. It is shown that symmetrical compensation is better than pre and post compensation technique [8]. Rabbi S.F. *et al.* compensate dispersion in optical communication system having cascaded optical amplifier. They use chirped Gaussian pulses as input and vary chirp parameter negatively to compensate dispersion and also reduce the power penalty [1]. Srivastava N. *et al.* work on dense WDM system at 1550 nm wavelength to compensate the dispersion and bit error rate by reducing the jitter. They use dispersion compensated fiber in the optical link and found min BER, improved Q-factor and threshold value [6]. Arora O. *et al.* use single channel optical system over SMF. They use different compensation techniques like pre-compensation, post compensation technique and DCF to reduce dispersion. They observe great variation in dispersion on pre and post compensation technique by varying the value of DCF and also improve the system's BER and Q-factor [4]. Kahlon N. *et al.* uses various dispersion techniques like Dispersion Compensating fiber (DCF), Fiber Bragg Grating and

Electronic Dispersion Compensation (EDC), and digital filters. Important requirement in OFC is compensation of dispersion because it spread the optical pulses. Different techniques of dispersion compensation had been used in this paper but there is no comparison between different techniques [3]. Islam K. *et al*. worked on management of optical fiber communication system with optical amplifiers, in this paper, they use pre compensation technique with DCF and the input pulse is the chirp Gaussian pulse which is the method of chirp. During the propagation of pulses in the fiber, pulses are broadening so to compensate the dispersion completely by chirp factor [1]. KALER R. *et al*. worked on comparison of pre, post and symmetrical dispersion compensation schemes for 10 Gb/s NRZ links using standard and dispersion compensated fibers. In this paper, using DCF in optical transmission optimized the high data rate. They compared the result for pre and post and symmetric compensation using length of optical fiber and EDFA power [2].

II. Dispersion Compensation Techniques

A. *Pre Compensation*

In Pre compensation, the input pulses modifies at the transmitter before launched into the optical fiber. In other word chirped input pulse is applied to reduce the dispersion effect. The basic concept behind the pre compensation technique to change the amplitude the input signal in such a manner that the effect of dispersion is totally destroyed or reduced to minimum value and is called pre chirp method.

$$L = \frac{(c+\sqrt{1+2c^2})l_d}{(1+c^2)} \quad (1)$$

where

C= chirp factor

L= fiber length

l_d= dispersion length [1]

B. *Post Compensation*

It is absolutely very easy to reduce the effect of dispersion for heterodyne receiver. The heterodyne receiver gives the constant phase and amplitude by converting the optical signal to microwave signal. In Post compensation, the input pulses modifies before applying into the receiver. In other word chirped pulse is applied to reduce the dispersion effect. The basic concept behind the post compensation technique to change the amplitude the input signals of receiver in such a manner that the effect of dispersion is totally destroyed or reduced to least value [7].

III. Simulations and Result

A. *Pre Compensation*

Using the method of dispersion compensation technique, pre compensation is employed using a multipoint users WDM system with channel spacing of 0.2 and 0.4, single mode fiber (SMF) length equal to 120 kilometer(km) and dispersion compensated fiber (DCF) of 20 km. The eye diagram is an view of performance in transmitted digital signal and BER test is used which gives the result of BER along a particular receiver. The table shows the BER values and eye diagram of different receivers respectively. It has been clearly observed that BER is varying for different channels and increasing directly with wavelength. Also by varying the channel spacing of the transmitter there is large change in BER values and eye diagram also differs. It is observed pre compensation technique with channel spacing of 0.4 is batter as compare to 0.2 channel spacing.

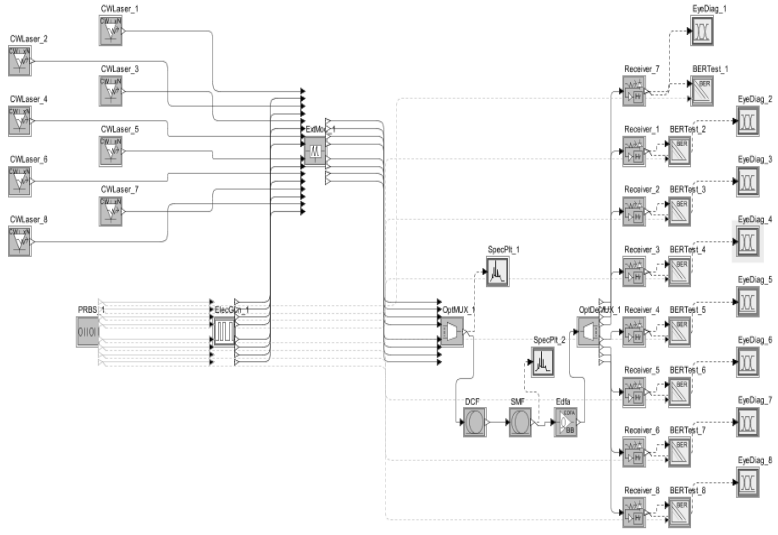


Fig. 1: Pre Compensation with Channel Spacing 0.2

TABLE 1: SIMULATION RESULTS WITH CHANNEL SPACING OF 0.2 FOR PRE-COMPENSATION

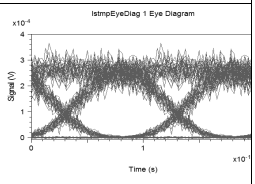
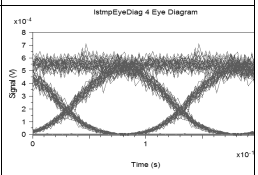
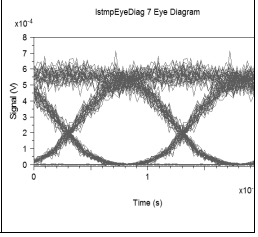
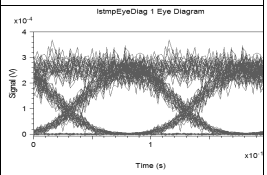
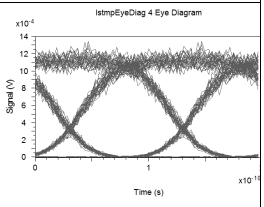
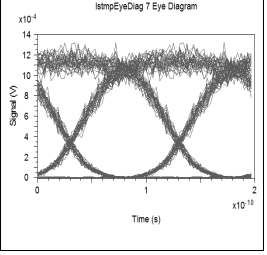
S No.	Pre-Compensation with Channel Spacing=0.2		
	Receiver No /Wavelength (in nm)	BER	Eye Diagram
1.	1 / 1550.0	2.4e-014	
2.	4 / 1550.6	1.3e-030	
3.	7 / 1551.2	8.5e-032	

TABLE 2: SIMULATION RESULTS WITH CHANNEL SPACING OF 0.4 FOR PRE-COMPENSATION

S No.	Pre-Compensation with Channel Spacing=0..4		
	Receiver No. / Wavelength (in nm)	BER	Eye Diagram
1.	1 / 1550.0	2.9e-014	
2.	4 / 1551.6	1.1e-062	
3.	7 / 1552.4	2.6e-063	

B. Post Compensation

By taking into consideration the dispersion management, post-compensation is used by using multipoint users with varying channel spacing and single mode fiber (SMF) length equal to 120 kilometer (km) and dispersion compensated fiber (DCF) of 20 km. The eye diagram is an indication of performance in transmitted digital signal and BER Test is used which gives the result of BER along a particular receiver. The table shows different values of BER for different receiver. The result of post compensation with channel spacing of 0.4 has better BER values. Thus we got that by increasing the channel spacing the BER values also increases.

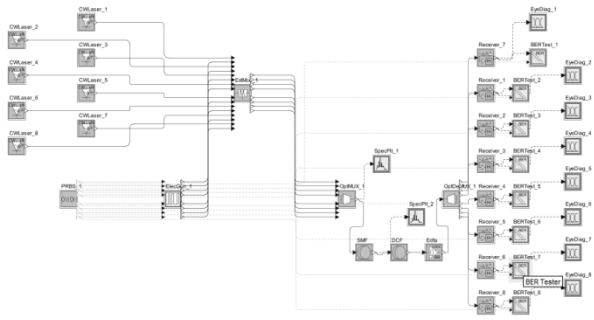


Fig. 2: Post Compensation with Channel Spacing 0.4

TABLE 3: SIMULATION RESULTS WITH CHANNEL SPACING OF 0.2 FOR POST-COMPENSATION

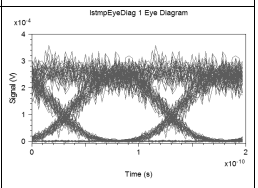
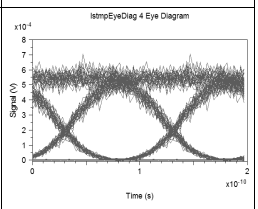
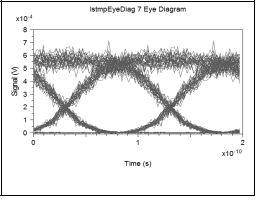
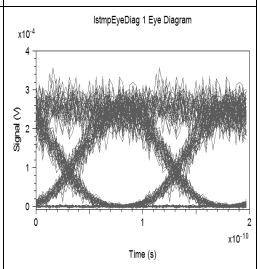
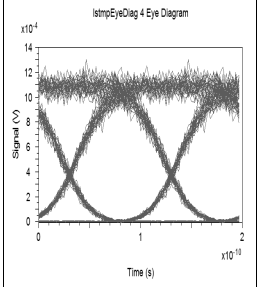
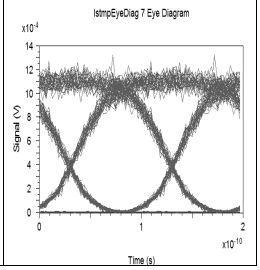
S No.	Post-Compensation with Channel Spacing=0.2		
	Receiver No. / Wavelength (in nm)	BER	Eye Diagram
1.	1 / 1550.0	4.5e-014	
2.	4 / 1550.6	4.0e-031	
3.	7 / 1551.2	2.1e-031	

TABLE 4: SIMULATION RESULTS WITH CHANNEL SPACING OF 0.4 FOR POST-COMPENSATION

S No.	Post-Compensation with Channel Spacing=0.4		
	Receiver No. / Wavelength (in nm)	BER	Eye Diagram
1.	1 / 1550.0	3.8e-014	
2.	4 / 1551.6	4.4e-058	
3.	7 / 1552.4	1.2e-058	

In order to made comparison between pre and post compensation techniques, by taking DCF equal to 20 km and SMF length equal to 120 km, the values of BER are calculated and comparison is drawn.

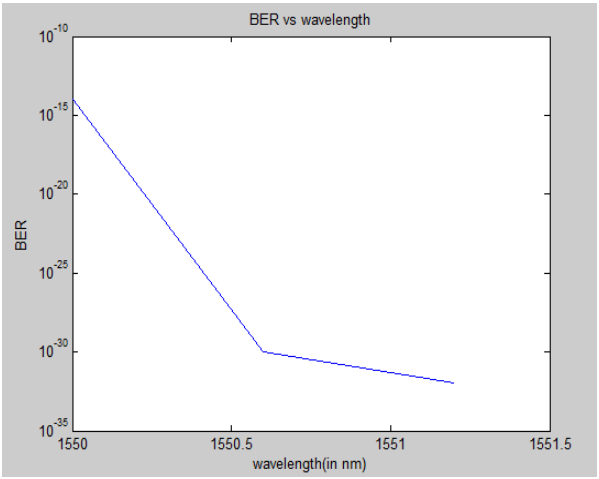


Fig. 3: Plot for Pre-compensation with Channel Spacing 0.2

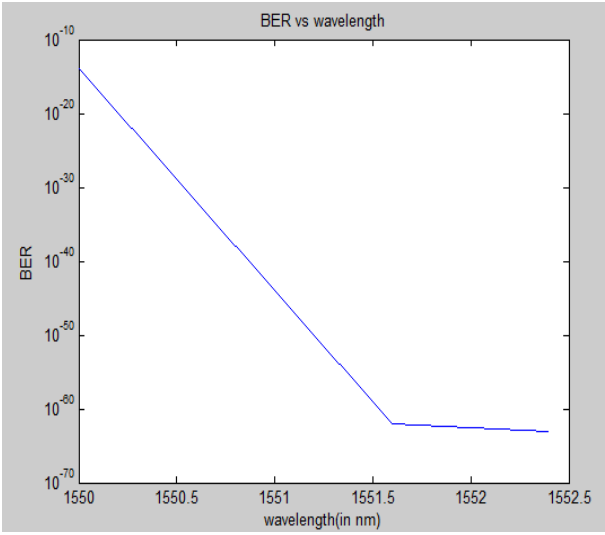


Fig. 4: Plot for Pre compensation with Channel Spacing 0.4

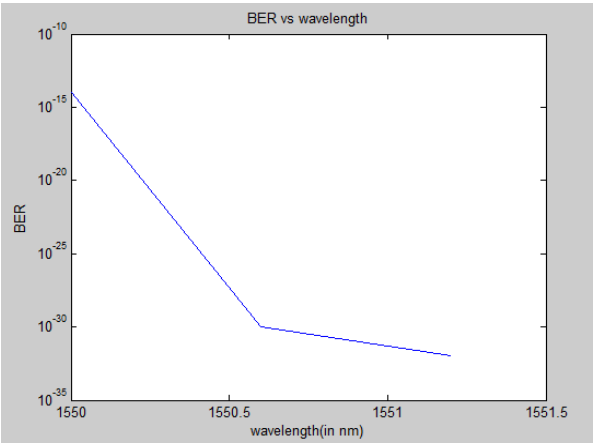


Fig. 5: Plot for Post-compensation with Channel Spacing 0.2

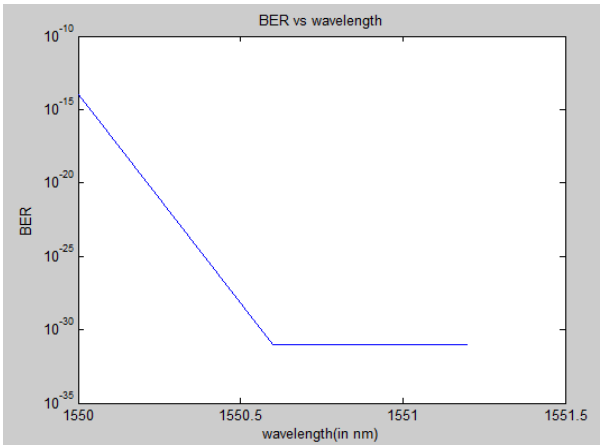


Fig. 6: Plot for Post-compensation with Channel Spacing 0.4

IV. CONCLUSION

In this paper the work is done on different dispersion compensation techniques using DCF. The dispersion is reduced to large extent by using dispersion compensation fiber. From the result of simulation it is

found that as the channel spacing is increased there is also increase in BER and eye diagram. Therefore we can say that channel spacing is directly proportional to BER. It is observed from the result of analysis that pre compensation with channel spacing 0.4 is better than post compensation technique.

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Image Compression Algorithms & their Comparative Analysis: A Review

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***Abstract*—This paper gives an overview of image compression techniques available for easy transmission of data over limited bandwidth. Consider the redundancy factor; lossless proves to be better than lossy technique for compression of images and lossy is suitable for video compression. But now a day's wavelet lossless image compression technique is employed and whole number wave transform is giving higher compression magnitude relation as like lossy compression while not compromising the standard of an image.**

Keywords: Huffman Encoding, LZW, Wavelet Transform

I. INTRODUCTION

Image is a visual representation of something. It is a 2-D discrete signal having N*N array of an element is known as the pixel. Each pixel or element represents the intensity or gray level at any point. Sampling of the image can also be done. It is the process of measuring intensity (brightness information) of the image at a discrete spatial location. Endless sampling of the image operates is done victimization distinct grid of sampling points within the plane. The 2D signal of the image is in the form of analog. But when the image needs to transmit, store or process it is converted into analog to digital signal image is the expressive part in remote sensing, biomedical, video conferencing and many more applications [1].

A. Image Compression Algorithms

The uncompressed image required large storage capacity and transmission bandwidth. To overcome these problems the images and signals needs to be encoded in more efficient ways. Image compression is employed to attenuate the quantity of memory required to represent a picture. Images typically need an oversized variety of bits to represent them, and if the image has to be transmitted or keep, it's impractical to try and do therefore while not somehow reducing the quantity of bits. The problem of transmission or storing a picture affects all people daily. TV and fax machines area unit each sample of image transmission. A common feature in many images is that the neighbouring pixels are correlated and, therefore, contain redundant information. And these redundant bits will remove from the signal because these redundant bits are not read by the receiver called as human visual system (HVS). In general redundancy is identified as following:

1) Coding Redundancy

A code is a representation to represent a set of events or information. Each set of information represented in a particular sequence of code symbols known as the codeword. The number of symbols required to represent the codeword is called as codeword length. To represent the 2-D intensity array required only 8-bit codes but most of them contain more bits than are needed to represent this is coding redundancy.

2) Spatial Redundancy and Temporal Redundancy

The most of the pixels of the 2-D discrete signal are correlated spatially, so because of that the knowledge is eventually become the reproduction of the painted correlative picture element. And these briefly correlative picture element the duplicate data [2]

II. IMAGE COMPRESSION TECHNIQUES

Image compression has various types of techniques. But there are two basic techniques of image compression Lossy and Lossless. In Lossy image compression techniques, the original image is compressed to store or transmit over limited bandwidth and during this compression process some of its information is lost. It provides a high quality of data compression whereas in Lossless image compression image is compressed without losing any information. It provides low compression. Here are different lossless image compression techniques that can help us to get high compression ratio [3].

It is difficult to compare the performance of both the compression techniques unless identical data sets and performance parameter are used. Currently every day a PCA (Principal component Analysis) also found its applications as image compression. PCA may be enforced in 2 forms i.e. either applied mathematics approach or neural network approach. The PCA Neural Network provides a new manner of generating codebook supported applied mathematics feature of PCA transformational coefficients. It ends up in less storage of memory and reduction of calculation [4]. And wavelet Lossless image Compression Technique is also used. Integer Wavelet Transform is giving better compression ratio as like lossy compression without

compromising the quality of the image. Based on Different Technology conclude that the quality of the image can be measured by the important factor as like peak signal to noise ratio and mean square error and Compression ratio [5].

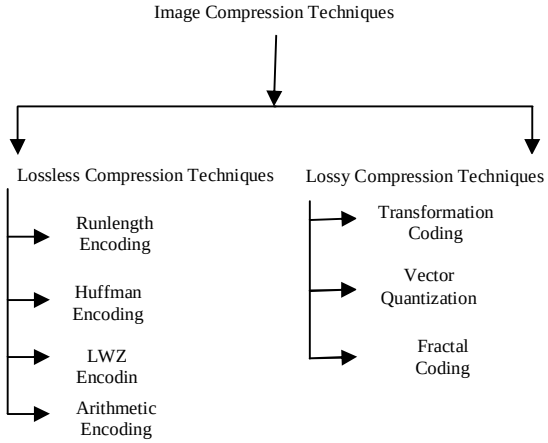

Fig. 1: Image Compression Techniques

B. Runlength Encoding

It is a simplest and very commonly used techniques.RLE is a lossless encoding technique. This technique is used where the sequences having same data value and count. This is very simple data compression technique is used to compress a sequential data like graphical images where data contains repetitive pixels. It replaces the identical symbols or pixels by shorter symbols. RLE provide the best result with the image which contains the large area of neighbouring colour mainly in monochrome images. And multiple colour images such as photograph do not provide the desired results. RLE typically used to code the binary code such as a document, facsimile which contains pixels. In binary coded "1" represents white pixels and "0" represents the back pixels. Gray scale image run length code is represented by (Vi, Ri) where Vi is the intensity of pixels and Ri is the consecutive pixels with intensity Vi instead of encountered the alternating binary codes foe e.g. 11110000111 It is coded as (1, 4), (0, 4), (1, 3). So, it is clear that the RLE technique only applicable in the case of long sequences of consecutive 1's and 0's are present. RLC also used in image compression using transform and wavelet coding techniques. In transform coding using DCT, the DCT coefficients in each N × N block are first quantized to varying levels depending on the required compression. This quantization process results in a large number of zero-valued coefficients, which occur in bursts or in runs. Therefore, it is advantageous to encode the run of zeros using RLC rather than coding each zero-valued coefficient individually. This is a standard procedure in such compression standards as Joint Photographic Experts Group (JPEG) and MPEG.

The most common discrete cosine transform definition of a one-dimensional sequence of length N is given by the equation

$$X[n] = \alpha[n] \sum_{M=0}^{N-1} X[m] \cos((2m+1)n\pi / 2N) \quad (1)$$

$$X[n] = \sum_{M=0}^{N-1} X[m] c(n,m), (n = 0 to N-1) \quad (2)$$

Where $\alpha[n] = \sqrt{(1/N)}$ for n=0 and $\sqrt{2}/N$ for n=1,2…..,N-1

C. Huffman Encoding

Huffman is the most popular techniques for removing coding redundancy. Huffman coding is based on two assumptions:

1. More frequently occurred symbols will have shorter code-words the symbols that occur less frequently.
2. The two symbols that occur least frequently will have the same length.

When coding of the individual symbol needs to be done for getting the information, Huffman procedure will help us to do this. In this smallest source of a symbol are combined and make them in single terms and In terms of Shannon's first theorem the resulting code is fixed and constraint that the source symbols be coded one at a time. Source symbol can be anything it may be the intensities of an image or the output of an intensity of pixel difference, run length [6].

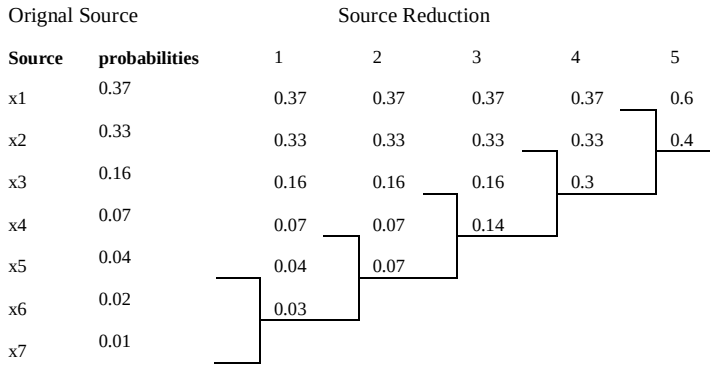

Fig. 2: Huffman Encoding Technique

In Huffman coding process first step is to arrange the probabilities symbols in decreasing order and then combine the lowest probabilities of symbols into single terms that will become the next source reduction probability. This process continues for binary coding like k-ary Huffman codes can also be constructed. A hypothetical set of symbols and their probabilities ordered in decreasing order from top to bottom by combining bottom two values and reduced into in single term for next source reduction the bottom two probabilities are

0.01and 0.02 are combined to form a new term known as "compound symbols" with a probability of the symbol is placed under the first reduction column so that the reduce probability also in ordered form. This process is continued until a reduced source with symbols is reached and second step of Huffman The code is to code each reduced source starting with the smallest source a working back with the original source. The code of the symbol should be in binary i.e. In 0, 1 form these codes are assigned to the symbol in an arbitrary form to make the difference between each symbol code. This operation is then repeated for each reduced source until the original source reduced. The average length of this code is given by [6]

$$L_{avg} = \sum_{i=1}^{n} C(xi)P(xi) \quad (3)$$

Where x_i= discrete random values
$C(x_i)$ = No of bits are required to represent the code
$P(x_i)$ = probabilities o the random values

	Orignal Source		Source Reduction								
Source	Prob.	C1	1	C2	2	C3	3	C4	4	C5	5	C6
X1	0.37	1	.37	1	.37	1	0.37	1	.37	1	.63	0
X2	0.33	00	.33	00	.33	00	0.33	00	.33	00	.37	1
X3	0.16	010	.16	010	.16	010	0.16	010	0.3	01		
X4	0.07	0110	.07	0110	.07	0110	0.14	011				
X5	0.04	01111	.04	01111	.07	0111						
X6	0.02	011100	.03	01110								
X7	0.01	011101										

Fig. 3: Huffman Encoding Technique

L_{avg} = 0.37(1) + 0.33(2) + 0.16(3) + 0.07(4) + 0.04(5) + 0.02(6) + 0.01(6)

L_{avg} = 2.17 $bits/pixel$

$$\text{Entropy(H)} = -\sum_{i=1}^{n} P(xi)\log_2 P(xi) \quad (4)$$

H = $0.3\log_2 1/0.3 + 0.3\log_2 1/0.3 + 0.1\log_2 1/0.1 + 0.07\log_2 1/0.07 + 0.04\log_2 1/0.04 + 0.02\log_2 1/0.02 + 0.01\log_2 1/0.01$

H=1.9819 bits/symbol

D. Huffman Decoding

After allotting codes to the probabilities decoding of Huffman, is one by simply using a lookup table. Code that is allotted to each probability is itself an unambiguously decodable block code. It is known as a block code because; each intensity symbols are mapped into a set sequence of code symbols. Its fast, as a result of every code word in a string of code symbols may be decoded while not referencing succeeding symbols. It's unambiguously decodable, as a result of any string of code symbols may be decoded in one technique. Thus, any string of Huffman encoded symbols may be decoded by examining the individual symbols of the string in a very left to right manner. For the binary code look of the table, a left-to-right scan of the encoded string 01110101111000111000110010 1 reveals that the primary valid code word is 011101, is the code for image x7.The next valid code is 01111, that corresponds to image x5.In the similar ways, sequence is Continuing during this manner reveals the utterly decoded message x7 x5 x2 x6 x4 x3 x1 therefore during this manner the original image or information may be decompressed.

At first we've compressed the probabilities as much as possible a compressor also made the codes for each probability in the table. The decompressed does not use this methodology. It instead keeps the complete Huffman binary tree, and of Course a pointer to the foundation to try and do the rule method. In our implementation, we'll create the tree as was common and then you may store a pointer to last node within the list, which is the root. Then the method will begin. We'll navigate the tree by victimization the tips that could the kids that every node has. This method is finished by an algorithmic perform that accepts as a parameter a pointer to this node and returns the image [6].

E. LZW Encoding

The technique called Lempel-Ziv-Welch (LWZ) coding, assigns fixed-length code words to variable length sequences of source symbols. We tend to contemplate Associate in nursing error-free compression approach that also addresses spatial redundancies in a picture. Key options of LZW committal to writing is that it requires no prior knowledge of the probability of occurrence of the symbols to be encoded. Despite the fact that until recently it was protected under a United States patent, LZW compression has been integrated into a variety of mainstream imaging file formats including GIF, TIFF, and PDF. The PNG format was created to get around LZW licensing requirements. LZW committal to writing is conceptually terribly easy (Welch [1984]). At the one set of the coding process, a codebook or dictionary containing the source symbols to be coded is constructed. For 8-bit monochrome images, the first 256 words the dictionaries are assigned to intensities 0, 1, 2....., 255. As the encoder sequentially examines image pixels, intensity sequences that are not in the dictionary are placed in algorithmically determined (e.g., the next unused) locations. Two pixels of the image are white, for instance, sequence"255-255" might be assigned to location 256, the address following the locations square measure reserved for intensity levels 0 through 255. The ensuing time that 2 consecutive white pixels are encountered, the code word 256, the address of the situation containing sequence 255-255, is used to represent them. if a 9-bit, 512-word dictionary is employed in the coding process, the original (8+8)bits that were used to represent the two pixels are replaced by single 9-bit code word. Clearly, the size of the dictionary is an important system parameter. I it is too small, the detection of matching intensity-level sequences will be less likely; if it is too massive, the size of the code words will adversely have an effect on compression performance.

TABLE 1: LZW ENCODING

Dictionary Location	Entry
0	0
1	1
.	.
.	.
.	.
255	255
256	–
.	.
.	.
511	–

Locations 256 through 511 initially are unused. The image is encoded by processing its pixels in a left-to-right, top-to-bottom manner. Each successive intensity value is concatenated with a variable-column1 of table–called the “currently recognized sequence”. This variable is initially null or empty. The dictionary is searched for each concatenated sequence and if found, as was the case in the first row of the table, is replaced by the newly concatenated and recognized (i.e., located in the dictionary) sequence. This was done in column 1 of row 2. No output codes are generated, nor are the dictionary altered. If the concatenated sequence is found, however, the address of the currently recognized sequence is output as the next encoded value, the concatenated but unrecognized sequence is added to the dictionary, and the currently recognized sequence is initialized to the current pixel value. This occurred in row 2 of the table. The last two columns detail the intensity sequences that are added to the dictionary when scanning the entire 4*4 image. Nine additional code words are defined. At the conclusion of the coding, the dictionary contains 265 code words and the LZW algorithm has successfully identified several repeating intensity sequences–leveraging them to reduce the original 128-bit image to 90 bits (i.e., 10 9-bit codes). The encoded output is obtained by reading the third column from top to bottom. The resulting compression ratio is 1.42:1.

TABLE 2: LZW ENCODING

Currently Recognized Sequence	Pixel Being Processed	Encoded Output	Dictionary Location (Code Word)	Dictionary Entry
	39			
39	39	39	256	39-39
39	126	39	257	39-126
126	126	126	258	126-126
126	39	126	259	126-39
39	39			
39-39	126	256	260	39-39-126
126	126			
126-126	39	258	261	12-126-39
39	39			
39-39	126			
39-39-126	126	260	262	39-39-126-126
126	39			
126-39	39	259	263	126-39-39
39	126			
39-126	126	257	264	39-126-126
126		126		

A unique feature of LZW coding just demonstrated is that the coding dictionary or codebook is created while data are being encoded. Remarkably, an LZW decoder builds an identical decompression dictionary as it decodes simultaneously the encoded data stream from the left. Sometimes dictionary gets full or overflow. The simple solution of this kind of problems in LZW is when it becomes full and continues coding with the newly initialized dictionary. A more complex option is to monitor compression performance and flush the dictionary when it becomes poor or unacceptable. Alternatively, the least used dictionary entries can be tracked and replaced when necessary.

III. LOSSY COMPRESSION TECHNIQUES

A. *Transformation Coding*

In this committal to writing theme, reworks like DFT (Discrete Fourier Transform) and DCT (Discrete circular function Transform) square measure accustomed modification the pixels within the original image into frequency domain coefficients (called transform coefficients).These coefficients have many fascinating properties. One is that the energy compaction property that leads to most of the energy of the first knowledge being targeted in precisely many of the numerous rework coefficients. This can be the premise of achieving the compression. Solely those few important coefficients square measure hand-picked and also the remaining is discarded. The chosen coefficients square measure thought-about for additional division and entropy coding. DCT committal to writing has been the foremost common approach to remodelling committal to writing. it's conjointly adopted within the JPEG compression normal.

B. *Vector Quantization*

The basic plan during this technique is to develop a workbook of fixed-size vectors referred to as code vectors. A vector is sometimes a block of component values. A given image is then divided into non-overlapping blocks (vectors) referred to as image vectors. Then for every set within the workbook and its index workbook is employed because the coding of the first image vector. Thus, every image is depicted by a sequence of indices which will be additional entropy coded [8].

C. *Fractal Coding*

The essential plan here is to decompose the image into segments by exploitation normal image process techniques like colour separation, edge detection, and spectrum and texture analysis. Then every phase is explored in a very library of fractals. The library really contains codes referred to as iterated perform system (IFS) codes, those square measure compact sets of numbers. employing a systematic procedure, a collection of codes for a given image square measure determined, specified once the IFS codes square measure applied to an appropriate set of image blocks yield a picture that's a really shut approximation of the first. This theme is very effective for pressing pictures that have smart regularity and self-similarity.

D. *Block Truncation Committal to Writing*

In this theme, the image is split into non-overlapping blocks of pixels. For every block, threshold and reconstruction values square measure determined. The edge is sometimes the mean of the component values within the block. Then an icon of the block springs by replacement all pixels whose values square measure larger than or equal (less than) to the edge by a one (0). Then for every phase (group of 1s and 0s) within the icon, the reconstruction worth is set. This can be common of the values of the corresponding pixels within the original block.

E. *Subband Committal to Writing*

In this theme, the image is analysed to supply the elements containing frequencies in well-outlined bands, the sub-bands. Afterward, division and committal to writing is applied to every of the bands. The advantage of this theme is that the division and committal to writing well matched for every of the sub-bands may be designed on an individual basis [7].

F. *Integer Wavelet Transform*

The main downside of the DWT is that the wavelet coefficients are real numbers. During this case, economical Lossless writing isn't potential mistreatment linear transforms. The lifting theme (LS) conferred by a Sweden's permits associate degree efficient implementation of the DWT. Another of its properties is that good reconstruction is ensured by the structure of the LS itself. This enables new transformations to be used. One such transformation is that the whole number wavelet transform (IWT) [9], it's a basic modification of linear transforms, wherever every filter output is rounded to the nearest whole number. IWT are often won't to have a unified lossy and lossless codec. It's conjointly of interest for hardware implementations, wherever the utilization of floating purpose continues to be a costly operation. The wavelet Lifting theme may be a technique for decomposing wavelet transforms into a collection of stages. The convolution-based 1-D DWT needs each an outsized variety of arithmetic computations and an outsized memory for storage. Such options don't seem to be fascinating for either high speed or low power image process applications. The most feature of the lifting-based wavelet rework is to break-up the high pass and, therefore, the low-pass wavelet filters into a sequence of smaller filters. The lifting theme needs fewer computations compared to the convolution-based DWT [10]. Therefore, the procedure complexness is reduced to almost a 1/2 those required with convolution approach. With the lifting theme, the inverse wavelet rework can straight off be found by undoing the operations of the forward rework. In observing, this comes right down to merely reversing the order of the operations and dynamic comes in every contrariwise. Because of the superior energy compaction properties and correspondence with a human sensory system, wavelet compression ways have created the superior objective and subjective results. Since wavelet basis consists of functions with each short support (for high frequencies) and long support (for low frequencies), large smooth areas of a picture could also be drawn with only a few bits, and details are another wherever it's required.

IV. CONCLUSION

Here completely different lossless compression Techniques is discussed. Compression plays a major role in reducing the transmission and storage value. All the image compression techniques are helpful in their connected areas and every day new compression technique is developing that gives higher compression magnitude relation. In lossless compression, the image is compressed and decompressed with none lose of information. Currently every day a wavelet lossless image Compression Technique is employed and whole number wave

Transform is giving higher compression magnitude relation as like lossy compression while not compromising the standard of an image. Based on completely different Technology conclude that the standard of the image is often measured by the vital issue as like peak signal to noise magnitude relation and mean sq. error and Compression magnitude relation.

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General Map of Software Defined Networking

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***Abstract*—SDN known as software defined networking referred to as a "Radical new idea in networking". SDN was invented to overcome the shortcomings of traditional networks. It is a latest technology in the field of networking which helps to simplify network management by decoupling control plane and data plane. There are so many applications of SDN which are helpful from industry point of view. This paper provides overview of architecture and some of the applications of SDN that are used in real time environment. This paper also gives a summarized view of controllers and their implementations in various programming languages.**

Keywords: Software-Defined Networking, Architecture, openflow, controllers and applications

I. INTRODUCTION

Traditional Computer networks are complex and difficult to handle. These are built from large number of network devices such as routers, switches and various types of middle boxes such as firewall, network address translators, server load balancers and intrusion detection system [7]. Network operators are responsible for configuring policies and to manually transform high level policies into low level while adapting to changing network conditions which results in making network management and performance tuning quite challenging and error prone. To make it even more complicated, current networks are also vertically integrated. The control plane and the data plane are coupled inside the networking devices, which results in reducing flexibility and hindering evolution of the networking infrastructure [5].

Software-defined networking (SDN) is an emerging networking paradigm that can help to reduce the limitations of current network infrastructures. It is a latest technology which is changing the way in how we design and administer network [7]. It is having two characteristics:

1. First, Data plane and control plane are decoupled from each other. In this network intelligence is logically centralized in software based controller (control plane) and network devices become simple packet forwarding device (data plane) that can be programmed in open interface.
2. Second, traditional computer networks are vendor specific. Network Administrators have to configure these devices using configuration interface which vary across vendors and sometimes different products from same vendors.

Over the last few years, SDN has gained significant popularity in both academia and industry. The field of software defined.

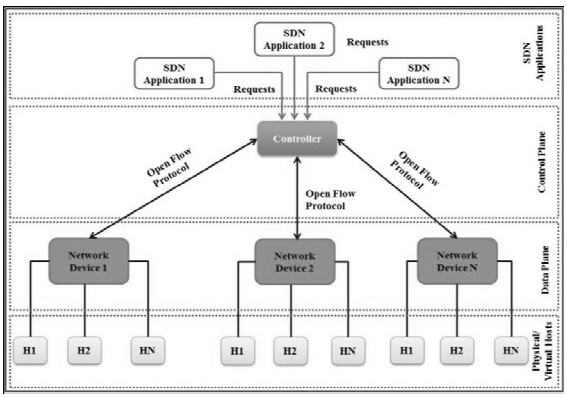

Fig. 1: General Architecture of SDN

Networking is quite recent, but it is growing at a very fast pace. Still there are lot of research challenges which can be addressed. In this paper we survey about the historic Perspective of the software defined networking and its architecture [1].

A. Architecture of SDN

SDN [3] replaces the functionalities of traditional networking devices as just forwarding devices. Control plane decides how and where to make forwarding. Logic of control plane is implemented in software known as controller. Open flow is protocol used for communicating the network devices with controller.

Various SDN controllers that are available in market and research are Floodlight, NOX, POX, Open daylight etc. Architecture of SDN is summarized in Fig. 1:

1) SDN Reference Model

This model consists of three layers, ranging from an infrastructure layer to a control layer to an application layer in a bottom up manner.

The infrastructure layer consists of a switching device e.g. switches, routers etc in the data plane. The control layer bridges application layer and the infrastructure layer, via its two interfaces. The application layer used in SDN model contains SDN applications that fulfill user requirements.

2) Open Flow

In open flow architecture, one or more flow tables are maintained by open flow switch. These flow tables consist of flow entries that determine how packets can be processed and forwarded. Flow entries consist of match field, counters actions, priority and timeout. 1. *Match fields* are used to match incoming packets 2. *Counters* are used to check the number of Open flow controller.

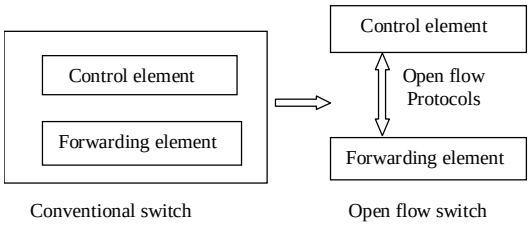

Fig. 2: Specifies Architecture of SDN having Separate Control and Data Plane

Received packets, number of bytes and duration of particular flow and 3. *Set of actions* are used to dictate how to handle matching packets 4. *Priority* decides in which order to process the rule 5. *Timeout*: It specifies when to delete the entries. It can be either hard-timeout or idle-timeout. Communication between controller and switches happen via open flow protocol.

3) Forwarding Device

The underlying network architecture consist of number of different physical network equipment, or forwarding devices such as routers, switches, virtual switches, wireless access point etc. In software defined network such devices are basically represented as basic forwarding hardware accessible via an open interface at an abstraction layer. In SDN terminology these forward device are generally referred to as "switches". In Open Flow switches come in two varieties pure and hybrid. In pure switches there is no on-board control. It completely relies on controller for forwarding decision. Hybrid switches support Open Flow in addition to traditional operation and protocols.

4) SDN Development Tool

It allows rapid development of new services and protocols. In this section for developing SDN protocols and services we provide an overview of currently available tools and environment.

5) Emulation and Simulation Tool

Most important tool use for SDN is mininet. Mininet is network emulator. Mininet is written in python and allows python based user scripts to interface with it. It includes a command line interface (CLI) as well as the ability to display xterm windows and to run commands on individual nodes in your network [1].

By default SDN supports open flow 1.0 that can be implemented in Python language. New services, application and protocols can first be developed and tested using this emulation tool before moving to actual hardware. By using mininet users can implement a new network feature or entirely new architecture, test it on large topologies and then deploy the exact same code into real production environment.

NS-3 network simulator supports Open Flow switches within its environment though the current version only implements Open Flow v0.89. Another simulator is fs-sdn that inherits the fs simulation engine by incorporating a controller and switching components with open flow support.

6) Available Software Switch

For running an SDN and developing services over SDN various SDN switches are available that can be used in software defined network. Table I shows various software switches with their brief description including implementations in various programming language, overview and version that current implementation supports.

TABLE I: VARIOUS SOFTWARE SWITCH WITH OPEN FLOW STANDARD

Software Switch	Implementation	Overview	Version
Open switch	C/Python	Open source software switch aims to implement switch platform in virtualized server environment	V 1.0
Indigo	C	Open source open flow implementation that runs on physical switches and also uses hardware features of Ethernet.	V 1.0
Ofsoftswitch13	C/C++	Open Flow 1.3 compatible user space software switch implementation	v.13

7) Available Controller Platforms

Table II shows overview of various controllers. All the controllers mentioned in the table support Open Flow protocol version 1.0

II. Applications of SDN

Software-defined networking has a lot of applications in different networked environments. By decoupling control and data planes and opportunity to eliminate middle boxes as well as deployment of new network services and protocols software defined network can be implemented in different environment.

A. Enterprise Network

Enterprises [1] often run large number of network also having security and performance requirements for example university network can be considered a special case of enterprise Network. SDN can be used to simplify network by eliminating middle boxes and integrate their functionality within network controller. Some notable examples where SDN include middleware functionality are NAT, Firewall, Load balancers and network access control.

B. Green Networking

Green networking [6] placed a greater impact in network design for economic and environment benefits. Various approaches have been considered to achieve green networking, including energy-aware infrastructure, energy-aware traffic, energy-aware data link adaptation, and energy-aware application.

For minimization of network–wide energy consumption SDN could provide a Promising support. For energy efficient operations SDN provide a mechanism to determine minimum data links and switching devices for a data center network based on network loads and dynamically power down redundant links and switching devices.

C. Home and Small Business

SDN [1] can be used in smaller networks such as home and small businesses. These environments have become increasingly complex with the all-round availability of low cost network devices, the need for compact security and careful network management has respectively increased, but these networks may become hosts for malware, while outages due to network configuration issues may cause resentment or lost business. Unfortunately, it is not practical to have a dedicated network administrator in every home and office.

Different researchers have proposed different techniques to manage these networks. One simplified approach was given by Mortier *et al*. to manage these types of networks. They created a prototype network in which SDN is used to provide users a view into how their network is being deployed while providing a single point of control.

III. Design Guidelines

The success of SDN requires improvements at all the three layers including the control layer, infrastructure layer and application layer [6]. In the preceding paragraph we have mentioned few design guidelines for future research and further development:

1. The switching device used in SDN is relatively simple having separate control and data plane. These devices are easy to manufacture due to low cost because of the use of merchant silicon. But still there are lots of hardware design issues in SDN. Switching device in SDN requires higher processing speed and more memory space. So it is necessary to integrate various new hardware technologies.

TABLE II: Controller Implementation with Open Flow Standard

Controller	Implementation	Open source	Developer	Overview
POX	Python	Yes	Nicira	General, open source SDN controller written in python
NOX	Python/C++	Yes	Nicira	The first Open flow controller written in python and C++
Maestro	Java	Yes	Rice University	A network operating system written in Java that supports open flow switches. It provides interfaces for implementing modular network control application for them to access and modify network state.
Ryu	Python	Yes	NTT group	An SDN operating system that aims to provide logically centralized control and API to create new network management and control applications.
Node flow	Java Script	Yes	Independent developers	Open Flow controller that are written in JavaScript for Node.JS
Ovs controller	C	Yes	Independent Developers	A simple open flow controller implementation with open *vs* witch for managing any number of remote switches through Open Flow protocols
Route Flow	C++	Yes	CPqD	Special purpose controller implementation
Floodlight	Java	Yes	Big Switch	Open source SDN controller written in Java. It supports a broad range of virtual and physical Open Flow switches.

2. To enhance advantages of decoupling the control plane from data plane, various skills related to computer science areas such as theory of programming language, distributed System and formal methods should be applied to enable automated generation from high level language described policies to low level rules without conflicts and to guarantee consistency.
3. SDN provides a platform to implement various SDN applications. SDN controllers ensure that network operation decisions are carried out properly at the infrastructure layer. Still participation of software developers is required to turn innovative ideas to solutions that can bring social, economical and environmental benefits.
4. Network measurement techniques are helpful for network status collection. For large scale networks, various controllers are required. Synchronization algorithms studied in distributed and database systems can be adopted to coordinate collected network status among various controllers.

IV. CONCLUSION

In this paper, we have provided the overview of traditional networks. Traditional networks had some issues and restrictions. To overcome those issues and restrictions, SDN was introduced. This paper also narrated the architecture of SDN in detail. After that, the paper described the applications of SDN that have been developed based on SDN paradigm and presented an overview of controller implementations with openflow standard. At last, this paper summarized various design guidelines which would help in making design of SDN more relevant.

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Authentication with Cloud Computing using OTP

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***Abstract*—The use of cloud computing is increasing day by day in many organizations. As the use of cloud computing is increasing the threats about security is increasing as well. Due to which the protection of data within the cloud is necessary. Cloud computing is used to concentrate on the issues related to data security. In this paper we have proposed the authentication in cloud environment using OTP (One–Time Password). OTP is the best way to authenticate the person's identity as it is generated every time whenever the user requests to login inside the cloud environment. The generated OTP is based on the user's information by applying MD5 algorithm.**

Keywords: Clouds security, One-Time Password (OTP), Message –Digest 5 (MD5), Fragmentation, Replication

I. INTRODUCTION

The emerging technology which is used for providing various computing and storage services over internet is called cloud computing. This allows a user to use software and hardware managed by the third-party at different locations [2]. Cloud computing are well liked because through this people can access social sites and many other applications from anywhere and at any time. It is costless [1]. As cloud computing includes internet usage, security threats like privacy data security confidentiality etc can accurse. To overcome these situations various encryptions algorithms and mechanisms are use. Researcher had chosen many different combinations to make the data in cloud secure. We have used combination of authentication techniques and key exchange algorithms mixed with an encryption algorithm.

Furthermore it also helps incorporates to improve there working ways increased scalability while providing services at distinct levels [4] . These levels are named as Software-as-a-services (Saas), Plateform-as-a-Services (Paas), and Infrastructure-as-a-Service (Iaas) [12]. Software-as-a-service offers a complete application to the customer, as a service on demand. A single instance of the service runs on the cloud and multiple end users are serviced. Plateform-as-a-service that enables developers to write applications those run on the cloud. Infrastructure-as-a-service provides basic storage and computing capabilies as standardized services over the network [12]. The service providers are used to provide these services. This helps in delivering the storage and computing services using the internet. It makes ubiquitous data access possible to store data in cloud computing. Security is the most crucial aspect of cloud computing. Cloud security issues are steamed due to cloud services offering, core technology's implementation and arising from cloud characteristics. To make the cloud secure all the entities should be secure. In the system having multiple units the highest levels of the system security can be considered equal to the security of weakest entity.

The security of asset does-not depend on individual security measures. The movement of data in cloud's virtualized and shared environment may cause various security concerns. The resources that are shared maybe assigned again to other users at some other time methodologies. The outsourced data in any public cloud should be secure [9]. Any weak entity can cause risk to the whole cloud. In this situation the security mechanisms must be made more effective so that the amount of loss can be minimum. Throughput, security and reliability of cloud must be ensured. Data retrieval time is a key factor which determines the throughput of a cloud that stores data [10].As discussed above, we can deduce that security and performance are important for next generation large scale system such as cloud. We proposed the issues related security and performance as a secure data replication problem.

Our main works on this paper are:

- We have achieved solid authentication using OTP.
- Then strong/fast hybrid encryption algorithm is used to encode data automatically.
- We have proffer a scheme that fragments and copies the data file on cloud nodes.
- This scheme ensures that in case of successful attack happens no meaningful information is revealed to the attacker.
- It is ensured that the replication of the file fragmentation is controlled; here each of the fragmentation is replicated one time only for the purpose to provide high security.

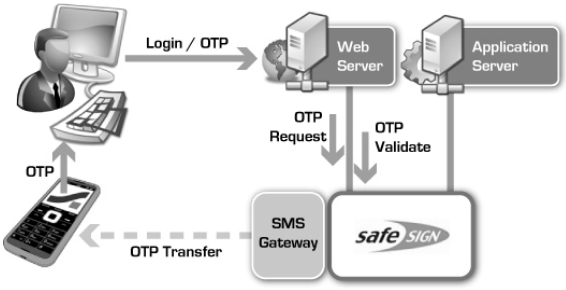

Fig. 1: Antiquation in Cloud Environment

II. RELATED WORK

As per Mr. Prashant Rewagad and Mr. Yogita Pawar [1]: In cloud computing, we have problem like security of data, file system, host security. They have proposed a concept of digital signature with Diffie-Hellman algorithm and Advanced Encryption Standard encryption algorithm (AES) to protect confidentiality of data stored in cloud [1]. This proposed architecture of three way mechanism makes it tough for hackers to crack the security system, thereby protecting data stored in cloud.

The authors in [2] approached divide a file into fragments, and replicate the fragmented data over the cloud nodes. Each of the nodes stores only a single fragment of a particular data file that ensure that even in case of a successful attack, no meaningful information is revealed to the cryptographic technique for the data security thereby relieving the system of computationally expensive methodologies.

Balasaraswathi V.R., Manikandan. S [6]: The goal of cloud security is mainly focused on the issues related to the data security and privacy aspects in cloud computing. This multi cloud model which is based on partitioning of application system into distinct clouds instead of using single cloud service such as a in Amazon cloud service.

As per Teemu Kanstren, Sami Lehtonen, Reijo Savola [7] architecture is based on a set of deployed measurement probes and trusted platform modules across both the host infrastructure and guest virtual machine. This allows us to ensure that the system is running in the expected environment, the monitoring probes have not been tampered with, and the integrity of measurement data provided is maintained.

Eman M. Mohamed, Hatem S. Abdelkader [8] The data security model provides a single default gateway as a platform. It used to secure sensitive user data across multiple public and private cloud applications, including salesforce, Chatter, Gmail and Amazon Web Services, without influencing functionality or performance.

Cong Wang, Qian Wang nd Kui Ren [10]: According to author users no longer have physical possession of the possibly larger size of outsourced data makes the data integrity protection in cloud computing a very challenging and potentially formidable task, especially for users with constrained computing resources and capabilities [10]. Thus, enabling public audit ability for cloud data storage security introduces an effective third party auditor (TPA). The third-party auditors audit the cloud data storage without demanding the local copy of data and introduce no additional on-line burden to the cloud user.

A. *OTP*

As the technology is increasing day by day, everything is becoming online, that's why security is becoming a main issue. It is most important to handle this, as internet is used the most, e.g. In security information through mails, money transfer, net banking etc. earlier only the passwords were used to secure information, which are very easy to hack now a day's [9]. To remove this security threats the OTP's are used now. OTP's can be used once and it is valid for some time only. For example the OTP's are generated while paying bill through net banking which is then sent to the customers mobile or mail, to make the payment which is further used as a code for successful and secured transaction.

B. *MD5*

It is an algorithm which provides high security to the secret data. Using MD5 OTP is encrypted to alphanumeric form. The encrypted OTP usually consist of many letters so few of the letters are picked and sent to the mail or mobile of the client. This whole processing is done on cloud side. These OTP's can be used only for some time, after that the OTP will expire and the new OTP needs to be generated to complete the process. This method is easier, cheaper and more secured way to provide security.

C. *Proposed Work*

OTP is valid only for one login session. Using numbers and alphabets OTP is generated. In over work users firstly register/ login. According to user information 1000 distinct OTP's are generated. After that randomly one OTP is choose for login. But firstly this OTP is encrypted using Message Digest 5 algorithm. After that randomly any 4 digits are selected and send to client on e-mail. Using this user login there account. But this OTP is used only one time for login.

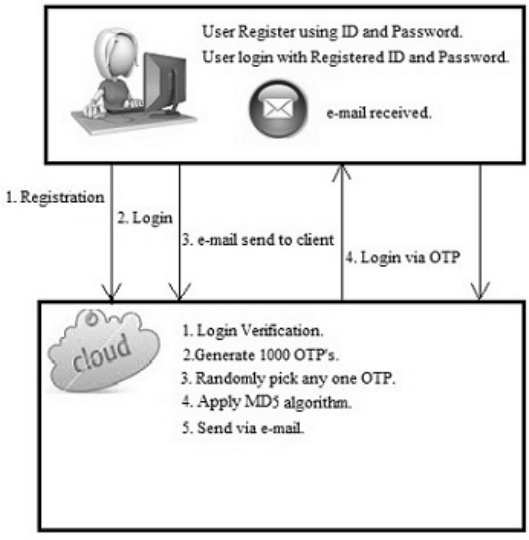

Fig. 2: Login using OTP

In Fig. 2 User Register using ID and Password. After successful registration user login with registered id and password. Cloud verified login, then generate

1000 OTP's. After that cloud randomly pick any one OTP and apply MD5 algorithm to encrypt OTP. Encrypted OTP size is very large so randomly any 4 digits are selected and send to client on e-mail. Using this OTP user login successfully.

```
amanthind59@gmi.amclo
amanthind59@gmi.amcol
amanthind59@gmi.amolc
amanthind59@gmi.amocl
amanthind59@gmi.lacom
amanthind59@gmi.lacmo
amanthind59@gmi.laocm
amanthind59@gmi.laomc
amanthind59@gmi.lamco
amanthind59@gmi.lamoc
amanthind59@gmi.lcaom
amanthind59@gmi.lcamo
amanthind59@gmi.lcoam
amanthind59@gmi.lcoma
amanthind59@gmi.lcmao
amanthind59@gmi.lcmoa
amanthind59@gmi.loacm
amanthind59@gmi.loamc
amanthind59@gmi.locam
amanthind59@gmi.locma
```

Fig. 3: Cloud Generated OTP's

In Fig. 3 Cloud generates 1000 OTP's. Here user firstly Register using ID and Password. After that the user logins with registered ID and Password. Using that information the cloud generate 1000 OTP's randomly.

```
Random No is : 793
Original OTP is : amanthind59@gmiaol.mc
After MD5 is : 2d269679a5b97bc08423d36bf8eb93b3
Generated OTP for Client is : 2d2696
Sending OTP to the client via e-mail
Simulation completed.
```

Fig. 4: MD5 Generated OTP

In Fig. 4 Cloud randomly pick one OTP and using MD5 algorithm they convert the OTP in encrypted form. After that randomly any 4 digits are selected and send to client on e-mail. Using this user login there account. But this OTP is used only one time for login.

III. CONCLUSION

The schema is proposed to enhancement of security of cloud computing during network attacks. Cloud needs a high performance as well as security because the data on cloud is stored at some far place. A novel approach is built by the integration of authentication, OTP and MD5 algorithm. OTP is dynamic in its nature, means it will change every time. It's integrated with MD5 for encryption of data. Experiment is done in Eclipse using Cloudsim simulator and results are shown in above section.

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Different Load Balancing Algorithms in Cloud Computing—A Review

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***Abstract*—The era of cloud computing is existing which provides a way with the help of which access to applications over the network is made possible. While implementing cloud computing the main problem encountered is that it is difficult to distribute adequate resources among multiple jobs in a system. This could be productively controlled with the help of workload balancing. A huge change has been recognized in number of cloud users but resources are insufficient so strategies are essential to fulfil user demands. There occur some projects which are lost due to lesser availability of resources and also some expensive resources are wasted due to inappropriate time. Many strategies and algorithms have been studied here in order to allot customer's requests to all the cloud nodes present in the system. These strategies are aimed to enhance the performance of the system as well as the availability of the resources is fulfilled and also using some algorithms cost and the power consumed can also be reduced. Virtualization technique is also a prominent technique so as to balance the workload and distribute the resources evenly among virtual machines or also on the basis of power consumed. The algorithms are adopted so as to enhance the utilization of resources and to obtain the better performance and stability of the system. The discussion and comparison of various algorithms have been illustrated below.**

Keywords: Load Balancing, Cloud Computing, Cloud Storage, Replication

I. INTRODUCTION

Manipulating, accessing and configuring the applications online is defined as cloud computing. Cloud computing advanced to online applications, infrastructure and data centers. The cloud supplies productive and elastic way to store and access data and files. The computation is of lesser cost as the user does not buy the whole system; the required services are only availed by the user. Cloud computing model provides (a) the benefit of enhanced peak-load balancing and workload balancing (b) efficient ability to the resource providers to SLA complaints to users(c) optimized service location and throughput (d) enhanced reliability. Cloud computing is web based technology and hence it can be accessed from any remote locations. The computation within the cloud is using virtualization technique as its backend. This allows the sharing of resources among number of users.

Cloud architecture is comprised of two parts: (a)Front-end: mainly the client part of the system comprised of infrastructure and applications for accessing the computing platform for instance-web browser(b)Back-end: cloud itself comprises of resources that provide computing services for instance-virtual machines, data centers, servers, models of deployment, security methods.

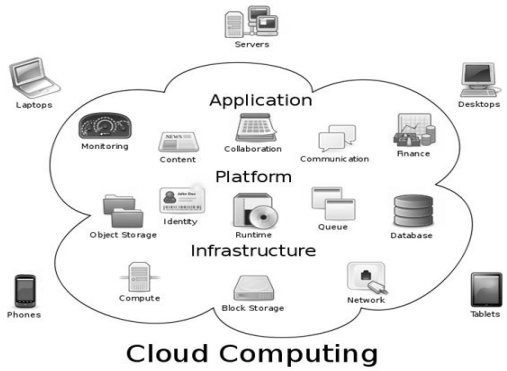

Fig. 1: Cloud Architecture [12]

Cloud Model exhibit 4 different types: (a) Public Cloud: general public can easily access its services for example-Google (b) Private cloud: Services are available to the users within a single organization only(c) Hybrid cloud: public and private cloud together results in the formation of hybrid cloud. Secure jobs are handled in private cloud whereas public cloud handles non-secure jobs (d) Community cloud: Services are available to multiple organizations.Fig.1 depicts the structure of the cloud architecture.

Load Balancing is crucial for distribution of resources among distributed environments. Load Balancing is analyzed to distribute the workload among various computing resources such as its handling users, processing parts and many other units. Load balancing algorithms [11] are the whole part of the following sub-parts: (a) Static Load Balancing: stable for homogeneous and static environments. Algorithms that are embraced in static balancing are Ant Colony algorithm and Central Load Balancing Decision Model (CLBDM) algorithm (b) Dynamic Load Balancing: more flexible and deals with distinct attributes in the system which can be prior to or during the run-time.

Dynamic load balancing algorithms [11] include Load Balancing Min Min (LBMM) algorithm, Index Name Server (INS) algorithm and many contributory. The following paper equally contributes to HP and LP of the resources. Some algorithms depicted here are also based on the scheduling manner. The duplicate copies are generated in this algorithm and whenever required can be allocated to multiple servers at the same time without any delay. The usual structure of load balancer receives requests from the system and responds to the receiving nodes as per requirement. Load Balancer is considered to be more efficient if it balances the workload equally i.e. distribution of the resources is not unequal. Fig. 2 depicts the common working of the load balancer as follows:

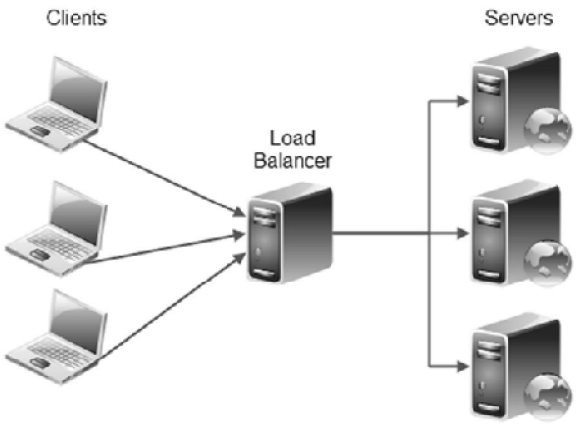

Fig. 2: Working of Load Balancer [13]

II. Load Balancing Algorithms

Load balancing algorithm is a vital aspect included within the cloud computing. Major sub-parts of algorithms of load balancing are detailed below. This paper is inclusive of distinct algorithms used to balance the workload across the system. Some algorithms are dependent upon priorities while other on virtual machines and some also on priority basis. The algorithms based on multiple factors are discussed in the following paper*:*

A. Optimal Load Balancing in Cloud Computing by Efficient Utilization of Virtual Machines

This paper [1] is based on the novel VM assign algorithm. Novel VM assign algorithm means to assign each virtual machine with equal number of resources so that less usage or over usage of the resources can be avoided. The above algorithm assigns incoming requests to all the available virtual machines in a productive way. Throttled algorithm [1] which uses the index table of VM that has been studied here too in which the assigning of the resources occur on the basis of the index number of the virtual machines. Later in this paper the comparison between active VM-Load Balancer and VM-assign Load Balancer is made through which it is concluded that assign balancer equally assigns the resources among various VMs and active balancer provides more resources to VM with initial index number and provides very little resources to other VMs. But the values of response time remain same in both the cases.

B. Model of Load Balancing and Scheduling in Cloud Computing

This paper [2] deals with the study of the elasticity of the clouds i.e. cloud computing has charge to modify the number of resources in the system. The balancer used for such purpose is Elastic Load Balancer. This balancer on its own distributes the in-applications over EC2 objects and accesses the load balancing quantity required to respond to the incoming applications. In this paper [2] workload balancing is done on the basis of priority as well as type of cloud used for the services. Number of resources may change within public cloud but remains same in case of private cloud. But even then if workload balancing is implemented private cloud is comparatively more distributed.

C. A Load Balancing Mechanism Based on Ant Colony and Complex Network Theory in Open Cloud Computing Federation

The workload balancing [3] has been qualitatively analyzed with the usage of ant colony and computer network theory. OCCF uses the above both algorithms to balance its workload evenly. In this the distribution of the plenty of resources is done equally among the complete federation. The ants exhibits very little memory and unique behavior and copes up easily to perform variable complex jobs with good firmness and quality. The algorithm [3] shows very good ability to tolerate faults and can also easily cope with dynamic environment within OCCF.

D. Design and Implementation of an Efficient Load-Balancing Method for Virtual Machine Cluster Based on Cloud Service

This algorithm migrates the VM to some another physical host. The migration occurs on the basis of the status of the nodes and this status is further evaluated on the basis of the threshold value. An on-demand scheduling of the resources is achieved by VMware for the clusters of the VM by the migration of the VMs through PMs. Steps involved to apply this algorithm [4] are: (1) Obtain the status of the nodes (2) judge the nodes' status (3) forecast the flow of load (4) judge the profit (5) select the receiving nodes (6) Migrating heavier load to lighter load.

E. Schedule First Manage Later-Network Aware Load Balancing

This paper helps in the removal of the tedious problem of the data. Firstly the jobs are scheduled by creating multiple copies of the jobs. The multiple replications can easily be assigned to multiple servers so that the server has not to wait for its processing. The rate of the execution is based upon the reasonable number of servers that are in active state. This paper [5] had concluded that more the number of duplications of jobs are there much better is the improved ratio.

F. Efficient VM Load Balancing Algorithm for a Cloud Computing Environment

The following paper [6] has further enhanced VM-active Load Balancing Algorithm [1] by taking into concern the weight concept in the algorithm. Different VMs have different processing powers due to which if the resources are assigned equally the parameters of the performance-response time and time for processing the data cannot be enhanced. So in this algorithm [6] the data center controller assigns weight to the data as per its processing capability. Hence there is a noticeable change in response time and the process time.

G. A Load Balancing Model Based on Cloud Partitioning for the Public Cloud

The paper [7] details about balancing the workload over the public cloud by the help of the partitions of the clouds. The public cloud is divided into multiple cloud partitions and each the cloud consists of the main controller which is used to allot the partition with the suitable incoming requests. Each partition consist multiple nodes of which status is recorded. If the status is idle the further distribution is tasks is based upon the weighted or dynamic round robin algorithm or some simple algorithms are used but if the status seems to be normal then some complex or dynamic algorithms are used such as Game Theory [7]. These steps are followed so as to enhance performance and stability of the system.

H. An Empirical Study of Power Aware Load Balancing in Local Cloud Architectures

The balancing of the workload is done such that power saving of the resources may be done. This paper [8] shows the contrast between conventional round robin load balancing algorithm (RRLB) and power aware load balancing algorithm (PALB). The algorithm [8] is used to balance the power utilization and also the VMs are distributed in such a power efficient manner. The percentage of the usage decides the operating number of computing nodes. Keeping the resource consumption high the power consumption is reduced with the help of this algorithm [8]. The average of the consumption of the power when compared to RRLB is much less in case of PALB and hence cost is saved in PALB.

I. Time Sliced and Priority Based Load Balancer

The Time Scheduling and the priority [9] concepts are used to balance the workloads among various virtual machines. The time is further sliced into multiple proportions. Each node is allotted with a particular slice of time and priority. The node with the highest priority is executed first for the interval of the time allotted to the specified node. But if the execution of the corresponding node is not sufficient within the specific time quantum then it has to wait till its next slot arrives. The node whose execution is complete within the time exits the queue. This [9] helps in the reduction of the waiting time of the node. In this [9] the time quantum is directly dependent on the time for execution and the wait time. The comparison has also been made in the following paper [9] between the proposed algorithm and round robin and equally spread current execution and it has been concluded that the proposed algorithm is better than the other two on the basis of turnaround time, context switching and waiting time. The disadvantage of this is that the highest priority job may be the last to be executed.

J. An Efficient Dynamic Resource Allocation Strategy for VM Environment in Cloud

In this paper [10] various algorithms are used so as to dynamically balance the workload among various virtual machines. The main concepts used are virtualization and skew values. The resources are allocated virtually among multiple virtual machines and skewness is observed to check the unevenness of the distribution of resources. This algorithm is named as skewness algorithm. Load Prediction Algorithm [10] is used to forecast the future requirements of the resources so that overload on the server can be avoided. Resource allocation is dependent on the demands of the applications. These algorithms are adopted so as to reduce the number of servers used and thus reducing the cost and enhancing the utilization.

III. COMPARISON

In [1] the comparison is made between Active VM-Load Balancer and VM-assign load balancer of which assign balancer is better as it uniformly distributes resources among various VMs. In [2] the workload balancing is done on basis of elastic load balancer and also among various types of cloud of which private cloud has comparatively even distribution than the public cloud but the resources within private cloud does not change. In [3] ant colony algorithm is carried out and this paper also introduced the concept of "suicide" of ants. Though ants have limited memory but it easily manages to perform various complex jobs. In [4] Holt-Winter forecasting is introduced which predicts the workload of the system. In [5] data stale problem is used and replicas of the jobs are made previously so

that ratio of improvement is enhanced. In [6] the VM assign algorithm is further enhanced by maintaining the weight of the VMs. Tasks/jobs are allotted to firstly the powerful VM and then to lower powerful VM and so. In [7] the load balancing is mainly carried out within the public cloud which is a very huge cloud and the nodes are present at distinct far-off geographic areas. So in order to obtain good performance workload balancing is done on the basis on the concept-Cloud Partitioning. Main controller is used to assign job to the cloud and various algorithms are used further to allocate resources within portioned cloud. The paper [8] makes a comparison of conventional round robin algorithm and Power Aware algorithm and the cost is reduced too. The discussed paper [9] uses time scheduling and priority based algorithm to balance the workload in cloud. The paper [9] leads to the conclusion that response time as well as overhead can be reduced with the help of the utilization of time quantum and priority levels. The drawback in this [9] is that the highest priority job may be the one that will be executed at the last. The Dynamic Resource Algorithm is carried out in paper [10] which further uses adapt load balancer to adapt to the availability of resources, skewness algorithm to calculate the uneven distribution of resources and load prediction algorithm to forecast the future needs so as to avoid overloading of servers. The algorithm is carried out to reduce number of servers and thus its cost. The comparison of the above studied algorithm has been done in the following table:

TABLE 1: STUDY OF THE VARIOUS LOAD BALANCING ALGORITHMS

Sr. No.	Load Balancing Algorithm	Parameter Analyzed	Performance Evaluation
1	VM-Assign Load Balancer	Incoming Requests	Resources are distributed evenly among all virtual machines of the system
2	Elastic Load Balancer	Types of cloud used in computing	The number of resources may be added or removed as per the requirement
3	Ant Colony Algorithm	Number of tasks	Variety of complex tasks can be performed with good reliability and consistency
4	Virtual-Machine Cluster Algorithm	Status of the nodes	Migrates a virtual machine to another physical host
5	Schedule First-Manage Later Algorithm	Replication of jobs	More replicas are generated more improvement ratio
6	Weighted Active Monitoring Load Balancing Algorithm	Weighting the VMs as per their processing powers	Enhanced Response Time and Data Processing Time
	Model Based on	Partitioned Clouds and	Better performance and
7	Cloud Partitioning	status of nodes within the portioned clouds	stability of the system
8	Power Aware Load Balancing Algorithm	Availability of Resources and Number of Compute Nodes	Reduce Power Consumption and saves cost
9	Time Sliced and Priority Based Load Balancer	Time Quantum and Priority assigned to each node	Reduces the response time, turnaround time, waiting time and context switching
10	Dynamic Resource Allocation	Availability of resources, number of servers, forecast of resources	Avoid the overload of servers, reduce number of servers, enhance the utilization of resources

IV. CONCLUSION

In Cloud computing, the concept of load balancing is very important. Load balancing assists to balance the workload of the system so that no underutilization or over utilization of the resources takes place. If load balancing is not maintained properly some servers may have to perform a huge work while some may be set free which causes the imbalance of the system. In this, various algorithms have been discussed of which Power–Aware Load Balancer [8] is quite a good algorithm as in this the resources are distributed evenly and also the consumption of the power is reduced and hence the cost is reduced. Even paper [9] introduced a prominent technique of resource distribution that is resources are distributed based on the priority basis and time quantum but the drawback in this is that the highest priority job is the last to be executed. In future the resource distribution can be enhanced by reducing the waiting time of the jobs with the higher priorities and if this starvation time is reduced then the performance and the utilization of the resources can be enhanced.

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Comparative Analysis of Image Enhancement Techniques in Spatial Domain

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***Abstract*—This paper provides a comparative study of image enhancement approaches as applied to digital images. Image Enhancement methods which improve the quality (clarity) of images for human perception, removing blurring and noise, increasing the contrast, and revealing the fine details are instances of enhancement operations. The enhancement methods differ from one field to another according to its goal. The existing techniques of image enhancement can be classified into two categories: Spatial Domain and Frequency domain enhancement. This paper provides the study of spatial domain methods.**

Keywords: Digital Image Processing, Image Enhancement, Spatial Domain Methods

I. INTRODUCTION

Image enhancement is basically improving the interpretability of information in images for the viewers and also for using in other image processing techniques. The main motive of image enhancement is to modify one or more parts of an image to make it proper for a specific observer. The choice of parts of an image and the way with which they are modified are specific for given task. Moreover, factors specific to observer, such as the human visual system and the observer's experience, will introduce a great deal of subjectivity into the choice of image enhancement methods [1] [2]. The enhancement methods are broadly classified in two domains that are Spatial Domain Methods and Frequency Domain Methods.

During capturing, transmission and/or acquisition processes, the data value of input images suffers from different kinds of Contaminations. These Contaminations (noise) are mostly of the nature of external interferences like atmospheric disturbances, imperfect instruments which will cause perturbations to the system. These perturbations can produce incorrect information in the system operation. The random disturbances in the images are noise and it is caused by thermal functioning pixels in camera sensors, faulty memory locations in hardware or during transmission through a noisy channel. The noise will not only reduce the quality of images but will also damage the expression of information of images considerably [3].Image enhancement can efficiently reduce the noise and makes the image smooth. Its goal is to suppress the noise while maintaining the integrity of edges and detail information. To reduce the degradation related to noise of any kind, a pre processing or filtering step could be applied. Also to improve the quality of the documents, the interested parties can use digital image processing approaches [4].

II. IMAGE ENHANCEMENT APPROACHES

Different types of enhancement approaches are used to improve the quality of images for some particular applications. To reduce the degradation related to impurity of any kind, a filtering step could be applied [5].There are so many enhancement approaches that it's difficult to provide a comparative study of all the approaches so the approaches of interest are described using spatial domain techniques directly deal with the pixels of the image. The pixel values are manipulated to achieve the desired enhancement [6].

A. Image Negative

Negative transformations are mostly suitable for enhancing grey details within the black regions. The negative transformation of an image is done by reversing the intensity values; that is, subtracting the intensity value of every individual from the maximum value in the original image. This transformation is mostly suitable for medical imaging where the doctors can get valuable information for making the diagnosis [7]. For instance, if the size of an image is MxN, where M represents the number of rows and N represents the number of columns, is represented by input image (M, N) as shown in figure 1.

$$\text{Negative image}(i,j) = 255 - input\ image(i,i) \quad \text{(i)}$$

Where $0 \leq I \leq M$ and $0 \leq j \leq N$.

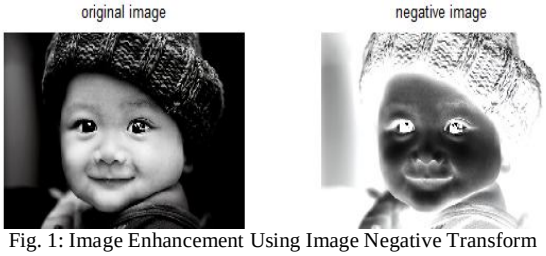

Fig. 1: Image Enhancement Using Image Negative Transform

Fig. 2: Image Enhancement Using Image Log Transform

B. *Log Transformation*

The main feature of log transformation is that it compresses the dynamic range of image with large variations in intensity values. It narrows the range of low input grey level values into wider range of output values [8]. It helps in visualizing the details in dark areas of the image [9]. The Log Transformation is described by the following equation:

$$G(r,c) = Clog(1 + i(r,c) \quad \text{(ii)}$$

One is added to every pixel of an image 'i' so as to avoid occurrence of infinite values. Here C is a constant and defines the scaling factor in determining the level of Enhancement. The log and inverse log transformation techniques perform contrast reverse and contrast inverse function on an image as shown in Fig. 2.

C. *Histogram Equalization*

For a given image X, the probability density function P (x_k) is defined as x_k

$$P(x_k) = x_k \ /n(1) \quad \text{(iii)}$$

For k=0, 1... L-1, where n_k represents the number of times that the level $x_k$appear in the input image X and n is the total number of samples in the input image [10]. P (x_k) is linked with the histogram of the input image which depicts the number of pixels that have a specific intensityx_k. Histogram of an image represents the frequency of occurrence of all levels in the image taken [11] as shown in figure 3. Based on the probability density function, the cumulative density function is defined as:

$$\sum_{j=0}^{k} P(Xj) \quad \text{(iv)}$$

Where x_k= X, for k=0, 1…L-1

D. *Thresholding*

In Thresholding one threshold level is set and pixel values which are below that threshold level are set as 0while those pixel values which are above that threshold level are set as 255 as shown in figure 4.

If A (i, j) < T then B (i, j) = 0;

Else B (i, j) = 255; (v)

Where T is the threshold level and A, B are input and output image matrices respectively.

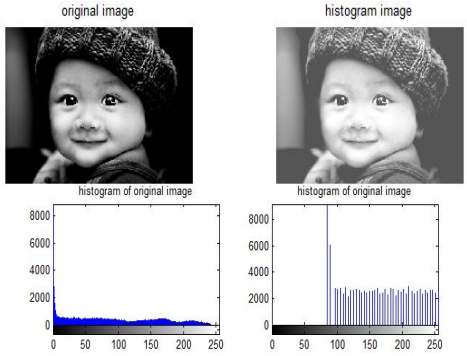

Fig. 3: Image Histogram Equalization under Image Enhancement

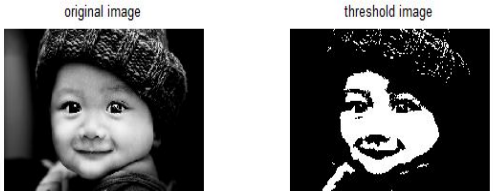

Fig. 4: Image Enhancement using Thresholding Transform

E. *Power Transformation*

The intensity of light produced by devices like CRT is not a linear function of the signal applied. The variation in the value of γ (gamma) varies the enhancement level of the image [12]. Hence different transformation curves can be obtained by changing the value of γ. The intensity generated at the surface of the display is approximately equal to the voltage applied, raised to the power of 2.5 [13].

The power law transformation is given by

$$G(m,n) = [f(m,n)]\text{^}\gamma \quad \text{(vi)}$$

Fig. 5: Image Enhancement using Power Law Transform

III. RESULT AND DISCUSSION

Image enhancement algorithms offer a very wide range of approaches for altering images to achieve visually acceptable images for better human perception

and for using in other processes and techniques. It has presented different techniques that have been use by the researchers. This paper has given a brief description of spatial methods technique. Image Negative is suitable for enhancing white detail embedded in dark regions and has applications mostly in medical imaging. For a dark image, an expansion of the gray levels is done using a power-law transformation with a fractional exponent. Log Transformation is useful for enhancing the details in the darker regions of the image at the expense of detail in the brighter regions the higher-level values.

IV. CONCLUSION

This paper has presented different techniques that have been used by the researchers to enhance the given image by improving its features such as brightness, noise removal and contrast etc. The paper has discussed about the various literatures and works related to image enhancement techniques. The future research work is aimed at a hybrid technique to enhance the image with better quality. There still exists a need to develop more precise hybrid approaches to improve the enhancement processes with better and optimal results.

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ARM Microcontroller: A Review

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***Abstract*—In this paper, we have studied about the ARM Microcontroller. There are different type microcontrollers available. We have studied about AVR, ARM ARDUINO and Raspberry Pie. All these controllers are widely used in different applications such mobile phones. An ARM processor is one of a family of CPUs based on the RISC (reduced instruction set computer) architecture developed by Advanced RISC Machines (ARM). ARM processors provide a variety of electronic devices, including mobile phones, tablets, multimedia players and more.**

I. INTRODUCTION

Microcontroller can be termed as a single on chip computer which includes number of peripherals such as RAM, EEPROM, Timers etc., required to perform some predefined task. There many types of microcontrollers are available such as AVR, ARM7, Arduino, Raspberry Pi, ARM Cortex. A microprocessor uses microelectronic fabrication techniques to shrink the CPU to a very small size; usually a single "chip." The microcontroller market is extremely fragmented, with numerous vendors, technologies, and markets. The advancements in the microcontroller lead to variety of applications.

A. ARM

ARM stands for “Advanced RISC Machines”. ARM machines have a history of living, right from the first ARM machine ever developed. In 1985, the first ARM core dubbed named as ARM1 was delivered by VLSI Technology. This processor used in conjunction with the BBC Micro helped in the development of the next generation called ARM2. The ARM contains a Current Program Status Register (CPSR), plus five Saved Program Status Registers (SPSRs) for use by exception handlers. ARM is programmable as little endian or big endian data alignment in memory. ARM provides the advantage of using a CISC in terms of functionality, along with the advantage of an RISC in terms of faster program implementation. Is has also advantage of reduced code lengths.

ARM is Low power, Low cost, Tiny 8/16/32 bit microprocessor. ARM is a family of instruction set architectures for computer processors based on a reduced instruction set computing (RISC) architecture developed by British company ARM Holdings. A RISC-based computer design approach means ARM processors require fewer transistors than typical CISC x86 processors in most personal computers. This approach reduces costs, heat and power use. These are desirable traits for light, portable, battery-powered devices—including smartphones, laptops, tablet and notepad computers, and other embedded systems. A simpler design facilitates more efficient multi-core CPUs and higher core counts at lower cost, providing higher processing power and improved energy efficiency for servers and supercomputers.

B. ARM7

ARM7 is a generation of ARM processor designs. ARM7 has Princeton memory architecture. The most of ARM7 designs, implement the ARMv4T architecture. But some designs uses ARMv3 or ARMv5TEJ. All these designs use a Von Neumann architecture, thus the few versions comprising a cache do not separate data and instruction caches. The original ARM7 was based on the earlier ARM6 design and used the same ARMv3 instruction set. The ARM710 variant was used in a CPU module for the Acorn Risc PC, and the first ARM based System on a Chip designs ARM7100 and ARM7500 used this core[6]. The ARM7 TDMI processor is a 32-bit RISC CPU designed by ARM. In 2009, it remains one of the most widely used ARM cores, and is found in numerous deeply embedded system designs. The ARM7 TDMI-S variant is the synthesizable core.

The ARM7DI is a low-power, general purpose 32-bit RISC microprocessor with integrated debug support. It comprises the ARM7D CPU core, and ICE breaker module and a TAP controller. It is simple, elegant and fully static design, suitable for cost and power sensitive applications. The ARM7DI is suited to those applications requiring RISC performance from a compact, power-efficient processor. The ARM7DI is similar to the ARM6 but with the following enhancements such as advanced debug (integrated ICE)

support for faster time to market, fabrication on a sub-micron process for increased speed and reduced power consumption, higher clock speed for faster program execution.

Its main features are : 32-bit RISC processor (32-bit data & address bus), fully integrated ICE, High performance RISC, Low power consumption, Fully static operation, Fast interrupt response, Virtual Memory System Support, Excellent high-level language support.

C. ARM Cortex

The ARM Cortex™-A9 processor is the power-efficient and popular high performance choice in low power or thermally constrained cost-sensitive devices. ARM9 processor has Harvard architecture. It is widely used in smart phones, digital TV, consumer and enterprise applications enabling your connected life. Cortex-A9 is available as a single processor solution offering an overall performance enhancement of better as compared to ARM Cortex-A8 solutions. Cortex-A9 MPCore offers up to 4 processors delivering when needed, on lightweight workload as well as peak performance. Its configurability and flexibility allows Cortex-A9 to scale across a wide variety of markets and applications.

Cortex-A9 is available as either synthesizable or hard-macro implementations. ARM Physical IP is available to support a synthesizable flow optimized for lowest power or highest performance, as well as a choice of hard-macros reducing risk and shortening time-to-market to a minimum. Enhanced ARM Graphics IP like Mali-624 as well as ARM System IP such as CoreLink NIC-400/301 network interconnect and CoreLink DMC-342 dynamic memory controller allow a rapid system design. ARM Development Suite 5 (DS-5™) tools and enhanced CoreSight Debug & Trace IP like CoreSight SoC-400 and CoreSight Design Kit for Cortex-A9 (DK-A9) allow instant software development that is backed by a broad software ecosystem. The ARM Cortex-A9 processor delivers exceptional capabilities for less power than consumed by high performance computer platforms, including: Scalable up to four coherent cores with advanced MPCore™ technology, Increased power efficiency with higher performance for lower power consumption, Increased peak performance for most demanding applications, Low power targeted single core implementations for cost sensitive devices.

Cortex-A9 is a high performance ARM processor implementing the full richness of the widely supported ARMv7 architecture. It is designed for the high efficiency, dual-issue superscalar, out-of-order, speculating dynamic length pipeline (8–11 stages). Cortex-A9 delivers exceptional levels of performance and power efficiency with the functionality required for leading edge products across the broad range of consumer, networking, enterprise and mobile applications. The Cortex-A9 micro-architecture is supporting the configuration of 16, 32 or 64KB four way associative L1 caches, with up to 8MB of L2 cache through the optional L2 cache controller[5]. Cortex-A9 applications range from mobile handsets through to high-performance consumer and enterprise products, for example: Mainstream Smartphones, Tablets, Set top boxes, Home Media Player, Auto Infotainment, Residential Gateway, 1st generation ARM low power server.

D. Cortex–A15

The ARM Cortex-A15 processor is the high-performance engine for highly connected devices, delivering unprecedented flexibility and processing capability. The processor is designed with advanced power reduction techniques as well as reliability features which make the Cortex-A15 ideal for networking infrastructure and other enterprise applications. The Cortex-A15 processor is architecturally aligned with the Cortex-A7 processor. It enables next-generation devices based on the big. LITTLE™ technology.

The ARM Cortex-A15 processor is an increasingly popular choice in networking infrastructure, delivering high-performance processing capability combined with low power consumption. In mobile configurations, the Cortex-A15 processor delivers twice the performance of smartphones based on the Cortex-A9 processor. In advanced infrastructure applications, a Cortex-A15 processor running at up to 2.5GHz enables highly scalable solutions within constantly shrinking energy, thermal and cost budgets.

To achieve the best performance, the Cortex-A15 processor has a multi-issue, out-of-order superscalar pipeline with a tightly-coupled low-latency, ECC-protected, L2 cache which can be up to 4MB in size. Large Physical Address Extensions (LPAE) enables the Cortex-A15 to address up to 1TB of physical memory, meaning it can meet the needs of server and networking applications. A big. LITTLE configuration pairs a high-performance core like the Cortex-A15 processor with a power-optimized companion core like the Cortex-A7 using a fabric such as Corelink™ CCI-400 or the new CoreLink CCI-500. Tasks are then instantaneously assigned to a processor by the big. LITTLE technology based on the computational requirement, with demanding tasks undertaken by the big Cortex-A15 processor. This pairing solves the contradictory challenges of increasing performance while increasing battery life, by ensuring that the right processor core is assigned to the right task.

The Cortex-A15 processor is the engine that powers not just smartphones but also the infrastructure that they rely on. From servers to networking to your high-end digital home entertainment systems, the Cortex-A15 processor is the right solution for a very

diverse set of solutions. Its main target includes: Low-power servers, Advanced smartphones, Mobile computing, High-end digital home entertainment, Wireless infrastructure.

II. Other Microcontrollers

A. AVR

The AVR is modified Harvard architecture 8-bit RISC single chip microcontroller **(**Alf-Egil Bogen Vegard Wollan RISC **(**Reduced instruction set computing) microcontroller, also known as **A**dvanced **V**irtual **R**ISC). The AVR was one of the first microcontroller families to use on-chip flash memory for program storage, as opposed to one-time programmable ROM, EPROM, or EEPROM used by other microcontrollers at the time. The AVR is a modified Harvard architecture machine where program and data are stored in separate physical memory systems that appear in different address spaces, but having the ability to read data items from program memory using special instructions. AVR microcontroller can executes most of the instructions in single execution cycle [2]. AVRs are about 4 times faster than PICs, they consume less power and can be operated in different power saving modes.

AVR microcontrollers are divided in three categories: (1) Tiny AVR–Less memory, small size, suitable only for simpler applications, Limited peripheral set. (2) Mega AVR–These are the most popular ones having good amount of memory (upto 256 KB), higher number of inbuilt peripherals and suitable for moderate to complex applications. (3) Xmega AVR–Used commercially for complex applications, which require large program memory and high speed. The main features of AVR are: Multifunction, bi-directional general-purpose I/O ports with configurable, built-in pull-up resistors, Multiple internal oscillators, including RC oscillator without external parts, Internal, self-programmable instruction flash memory, Internal data EEPROM, Internal SRAM, 8-bit and 16-bit timers, 10 or 12-bit A/D converters, 12-bit D/A converters, I²C compatible Two-Wire Interface (TWI), Serial Peripheral Interface Bus (SPI)

B. Arduino

The Arduino is a programmable microcontroller. It is designed to read data from sensors, compute the data, and either send the data to a PC (or raspberry Pi), or output them to LEDs or LCD screens you have attached and programmed. By controlling relays, you can control high powered components via relays and control motors. Arduino is a single-board microcontroller. The hardware consists of an open-source hardware board designed around an 8-bit Atmel AVR microcontroller, or a 32-bit Atmel ARM. Pre-programmed into the on-board microcontroller chip is a boot loader that allows uploading programs into the microcontroller memory without needing a chip (device) programmer [4]. An Arduino's microcontroller is also pre-programmed with a boot loader that simplifies uploading of programs to the on-chip flash memory, compared with other devices that typically need an external programmer.

The Arduino integrated development environment (IDE) is a cross-platform application written in Java, and is derived from the IDE for the Processing programming language and the Wiring projects. A program or code written for Arduino is called a "sketch". Arduino programs are written in C or C++. The main applications of Arduino are: Xoscillo: open-source oscilloscope, Scientific equipment, Arduinome: a MIDI controller device that mimics the Monome, Ardupilot: drone software / hardware, ArduinoPhone.

C. Raspberry Pi

The Raspberry Pi board contains a processor and graphics chip, program memory (RAM) and various interfaces and connectors for external devices. RPi operates in the same way as a standard PC, requiring a keyboard for command entry, a display unit and a power supply. It also requires ‘mass-storage’, but a hard disk drive of the type found in a typical PC is not really in keeping with the miniature size of RPi. It features a fully fledged operating system loaded on an SD card. It also has audio out, HDMI and RCA video output and an Ethernet port. This allows you to use your Raspberry Pi as a computer, complete with internet browsing, games and more. The Raspberry Pi projects are more software based than hardware based. Its main features are : CPU: 700 MHz ARM1176JZF-S core (ARM11 family, ARMv6 instruction set), Audio outputs: 3.5 mm jack, HDMI, and, as of revision 2 boards, I²S audio, Video input: A CSI input connector allows for the connection of a RPF designed camera module, Video outputs: Composite RCA (PAL and NTSC), HDMI (rev 1.3 & 1.4), raw LCD Panels via DSI, USB 2.0 ports: 1 (direct from BCM2835 chip), Memory (SDRAM): 256 MB (shared with GPU), Operating systems: Arch Linux ARM,[2] Debian GNU/Linux, Gentoo, Fedora, FreeBSD, NetBSD, Plan 9, Raspbian OS, RISC OS, Slackware Linux.

D. Comparison between 8051, PIC, AVR and ARM

- 8051, PIC and AVR have Harvard architecture (separate memory spaces for RAM and program memory). ARM has von Neumann architecture (program and RAM in the same space).

- ARM has a 16 and/or 32 bit architecture. The others are byte (8-bit) architecture.
- 8051 and PIC have limited stack space-limited to 128 bytes for the 8051, and as little as 8 words or less for PIC. Writing a C compiler for these architectures must have been challenging, and compiler choice is limited.
- 8051, AVR and ARM can directly address all available RAM. PIC can only directly address 256 bytes and must use bank switching to extend it, though using a C compiler conceals this. You still pay a speed penalty though.
- AVR and ARM execute most instructions in a single clock cycle. 8051 and PIC need multiple clock cycles per instruction.
- 8051 and AVR are sufficiently similar that an AVR can usually replace an 8051 in existing products with practically no hardware change. Some AVRs are made with 8051 pin-outs to drop right in. The Reset polarity is the main difference.
- 8051 and AVR instruction sets are different but sufficiently similar that it's possible to translate 8051 assembler to AVR assembler line by line (I have done that). Because an 8051 takes 12 (sometimes six) clocks per instruction and an AVR takes only one, you have to modify timing critical routines.
- AVR and ARM have the best compiler and application support, including free GCC compilers.

TABLE 1: MICROCONTROLLER COMPARSION TABLE

	ARM	8050	AVR	PIC
Bus Width	32-bit mostly also available in 64-bit	8-bit for standared core	8/32-bit	8/16/32-bit
Communicatin Protocols	UART, USART, LIN, I2C, SPI. CAN, USB, Ethemet. I2S, DSP, SAI (serial audio interface), IrDA	UART, USART, SPI, I2C	UART, USART, SPI, I2C, (special purpose AVR support CAN,USB, Ethemet)	PCI, UART, USART, LIN CAN, Ethemet, SPI, I2S
Speed	1 clock/ instruction cycle	12 clck/ instruction cycle	1 clock/ instruction cycle	4 clock/ instruction cycle
Memory	Flash, SDRAM, EEPROM	ROM, SRAM, Flash	Flash, SRAM, EEPROM	SRAM, Flash
ISA	RISC	CISC	RISC	Some feature of RISC
Memory Architecure	Modified Harvard architecture	Von Neumann architecture	Modified Harvard	Harvard architecture
Power Consumption	Low	Average	Low	Low
Families	ARMv4.5.6.7 and Cortex series	8051 variants	Tiny, Atmega, Xmega, special purpose AVR.	PIC16, PIC17, PIC18, PIC24, PIC32

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CSRZ System Analysis with Fiber and without Fiber (FSO)

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***Abstract*—Free space optics is a line-of-sight technology. It provides enhancements in 'last-mile' part of the communication. In this paper, we have analyzed the performance of Carrier-Suppressed Return-to-Zero (CSRZ) optical system using optical fiber and also in free space optics environment. We have analyzed the response of CSRZ optical system for higher bit rate and worst weather conditions. In this paper, we have used a chain of amplifier and fiber for achieving the maximum reach of the optical system.**

I. INTRODUCTION

Free-space-optics (FSO) is a technology which provides optical connections between two points without the optical fiber. FSO has emerged as a technology that has the potential to bridge the 'last-mile' gap that separates homes and offices from high speed access to the Internet. FSO units consist of an optical transceiver with laser (transmitter) and photo detector (receiver) to provide full duplex (bi-directional) capability of communication [1]. FSO systems use invisible infrared laser light in the 750nm to 1550nm wavelength range. FSO is a wireless technology, operates via line-of-sight, transmitting the data through the air, over distances on the order of 1 km [2].

The FSO systems must be designed such that the harsh atmospheric effects of turbulence and aerosol scattering can be mitigated [3]. The traditional solutions include increasing the link margin, and keeping the link distances small. The medium could be a near-vacuum, as it is for satellite-to-satellite communication, or it could be the atmosphere, which includes atmospheric and other natural obstructions that come into the path of the light signal[4][5]. Fig. 1 shows the concept of free space optics communication.

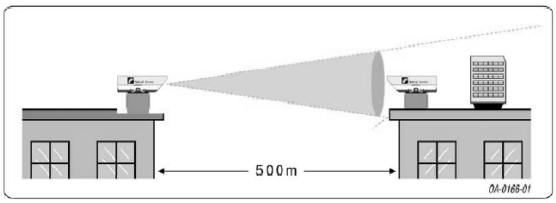

Fig. 1: Free Space Optics Communication

Atmospheric turbulence can degrade the performance of free-space optical communication systems, over ranges longer than 1 km. Atmospheric turbulence is also known as scintillation. Inhomogeneities in the temperature and pressure of the atmosphere lead to variations in the refractive index along the transmission path of the system. There are two commonly used models for fading. One is the log-normal distribution, the other is the Rayleigh distribution. There are many sources of noise that must be considered when doing analysis on photodetection circuits. The first source is optical shot noise, which occurs because of the randomness of the creation of photoelectrons.

In a terrestrial FSO system, background noise will enter the receiver along with the signal. The sources of background noise include the sun and artificial lighting, and can enter the receiver's aperture directly or by reflecting off of other surfaces. Thermal noise is also called Johnson noise, and is a result of thermally induced random fluctuations in the charge carriers in a resistive element [6]. The FSO system is accounted by various factors such as Beam dispersion, Atmospheric absorption, Rain, Fog, Snow, Scintillation, Interference from background light sources (including the Sun), Shadowing, Pointing stability in wind, Pollution/ smog [7].

Carrier-Suppressed Return-to-Zero (CSRZ) is an optical signal format. Carrier Suppressed Return to Zero (CSRZ) is a special case of Return to Zero (RZ) modulation, where, as the name states, the optical carrier will be suppressed, much like its electrical counterpart Double Sideband modulation. The CSRZ lacks the carrier, only the sidebands are present. In CSRZ, the field intensity drops to zero between consecutive bits (RZ), and the field phase alternates by π between neighbouring bits, so that if the phase of the signal is 0 in even bits (bit number $2n$), the phase in odd bit slots (bit number $2n+1$) will be π, the phase alternation amplitude. Figure 2 shows the optical spectrum of CSRZ signal transmitted from the CSRZ transmitter.

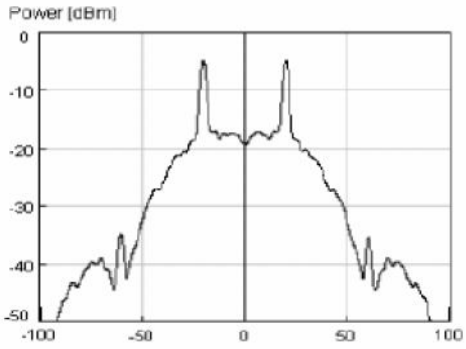

Fig. 2: Optical Spectrum of CSRZ Signal

CSRZ signal is very less sensitive to fiber nonlinear effects and provides very good robustness against transmission impairments. The robustness of CSRZ modulation to narrow-band filtering can be improved, which can be beneficial for DWDM systems. Dispersion tolerance of the transmission can be improved by CSRZ modulation, due to its reduced spectral width. Its disadvantages are (a) It does not resist well against dispersion on/off keying (CS-RZ-OOK) (b) wavelength spacing limited to 100 GHz (c) Suitable for short-haul transmissions only.

II. Experimental Set up and Results

For the simulation purpose, we have designed two experimental setup. First is CSRZ optical fiber communication system using EDFA and fiber chain. Second is CSRZ free space optics system. As shown in figure 3, CSRZ transmitter provides output to loop of EDFA-Fiber chain. This chain consists of two single mode fiber (SMF) of 25km length, three Erbium doped fiber amplifiers (EDFA), Dispersion compensating fiber of 10km. The SMF has attenuation =0.2dB/km, Dispersion =17 ps/nm/km and dispersion slope =0.075 ps/nm^{2}km. The DCF has attenuation =0.5dB/km, Dispersion = -85 ps/nm/km and dispersion slope = - 0.3 ps/nm^{2}km. EDFA gain is 5dB and noise figure is 6 dB.

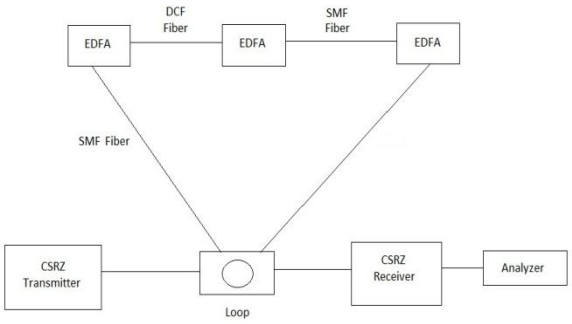

Fig. 3: CSRZ System with Fiber Span

A free-space optical communication system is composed of three basic parts: a transmitter, the propagation channel and a receiver as shown in figure 4. Analyzer is used for the observation purpose.

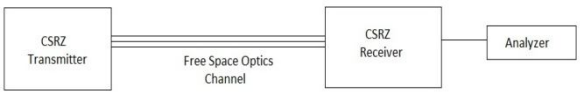

Fig. 4: Single Channel FSO System

At transmitter side, CSRZ transmitter is used. The free space between two connecting free space is considered as FSO channel which is the propagating medium for the transmitted light. This FSO channel is used for simulation purpose which provides the all effects of the channel such as environment conditions, range, etc. The receiving end of the optical wireless communication link signal consists of a photodiode, a low pass filter and BER analyzer for observation purpose. The attenuation for different weather conditions is as shown in Table 1.

Table 1: Attenuation According to Weather Conditions

Weather Condition	Attenuation (db/km)
Clear weather	0-3db
Light rain	3-6db
Heavy rain	6-17db
Snow	6-26db
Light fog	20-30db
Heavy fog	50-100db
Clouds	300-400db

A. *Analysis of Bit Rate for CSRZ Optical Fiber Communication System*

In this simulation, we have analyzed CSRZ FSO system for different bit rates (20 Gbps and 40Gbps). This analysis is done for the different fiber loops i.e. 2, 4, 6, 8 and 10. The results for this simulation are as shown in figure 5. It is observed that the performance of the CSRZ OFC system is good at 20 Gbps as compared to 40 Gbps. For fiber loop =10, CSRZ system has Q-factor =28 (at 20 Gbps) and 10 (at 40 Gbps). It shows that EDFA-Fiber chain provide good maximum reach. Clearly, CSRZ system has better response at 20Gbps.

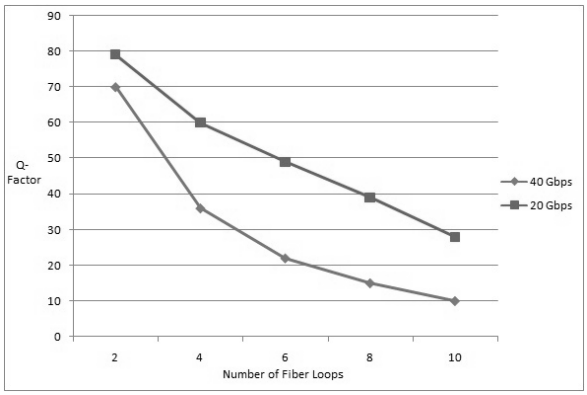

Fig. 5: Performance of CSRZ System for Different Bit Rates

B. *Analysis of CSRZ Free Space Optics System*

In this simulation, we have used CSRZ FSO communication system. The system parameters are as follows: wavelength 900nm, receiver aperture diameter 7.5cm, transmitter optics efficiency 1, receiver optics efficiency 1, beam divergence 0.25mrad, transmitter loss 1db, additional losses 0db and modulation format CSRZ at transmitter side. The attenuation parameter is varied for analysis.

As shown in figure 6, for the high attenuation (200dB/km) the maximum range is 160m. For the attenuation (150dB/km), the maximum range of FSO system is above 200m. For the range bellow 140m, the CSRZ FSO system has shown better response (Q-factor above 15). It is observed that, for above parameters, set for simulation, for high attenuation CSRZ system has

better results. Maximum reach for CSRZ system is more for attenuation below 180dB/km and decreases with increase in bit rate.

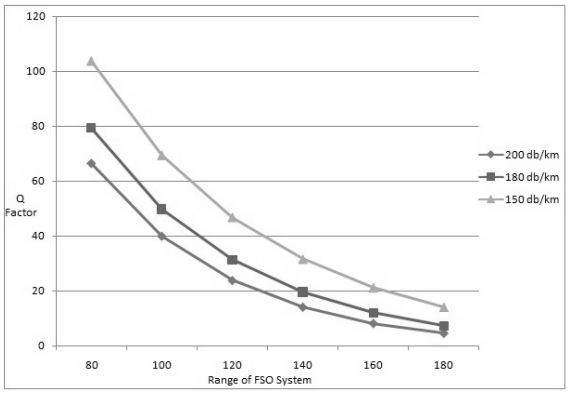

Fig. 6: Q-Factor Performance of CSRZ Free Space Optics System for Different Environmental Conditions

III. CONCLUSION

In this paper, we have done simulation for CSRZ system analysis with fiber and without fiber (FSO). We have used EDFA-Fiber chain to obtain maximum reach. The simulation results shows that the performance of the CRZ optical fiber communication system is better at 20 Gbps, but at 40Gbps it has also acceptable response. We have also investigated CSRZ FSO system. Here, we have chosen worst attenuation values for analysis, but the system has shown better performance to the parameter values. We have simulated this FSO system for attenuation values (200dB/km, 180dB/km and 180dB/km). Clearly, CSRZ system has better results (acceptable response at maximum reach Loop=10 for 40Gbps).

It is reported that for higher bit rate and attenuation, performance degrades. From the simulation, it is observed that CSRZ system has beneficial response for system using optical fiber or with free space optics. Further, new modulation formats can be used to enhance the performance in free space environment. The main problems of these FSO systems are working outdoors in the atmosphere result from attenuation and fluctuation of optical signal at a receiver. After considering all its advantages and disadvantages it is clear that these systems have good prospects for widespread implementation.

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Analysis of Optical Bidirectional Star Topology for Different Optical Modulators using Optimized Raman-EDFA Hybrid Optical Amplifier

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***Abstract*—Bidirectional optical star network topology using Electroabsorption, Phase & Frequency Modulators is analyzed at bit rate of 15 Gbps with input signal power of -40dBm. Quality Factor is used as parameter to analyze the performance for a given number of users. The bits are generated in pseudorandom manner with order 2. Hybrid Raman-EDFA optical amplifier is optimized and is used at the receiving end. It is observed that Frequency modulator performs better in terms of high quality factor than other modulators for a given number of users.**

Keywords: Modulators, Raman-EDFA Hybrid Optical Amplifier, Star Optical Network Topology

I. INTRODUCTION

Suppression of the carrier at transmission side plays great role in communication system in order to transmit at small input signal power [1]. Carrier suppression improves the performance of the communication systems in terms of long distance transmission and less addition of noise. Light source like laser diode that is driven by current can be modulated in a simple manner. In optical networks, it combines the light source with pulse generator and bit generator. WDM could be preferred for long distance transmission [2].

Modulators can be divided as absorptive in which absorption coefficient varies and reflective in which refractive index varies [3]. The various optical modulators are Mach-Zehnder, Electroabsorption Modulator, Amplitude Modulator, Phase Modulator and Frequency Modulator. In Mach Zehnder, refractive index of waveguides is varied with respect to applied external voltage using electro-optic concept. In Electroabsorption modulation, optical carrier is modulated externally by electrical modulation signal. In Amplitude Modulation, optical carrier is modulated externally by electrical modulation signal. In Phase Modulation, the electrical modulation signal imposes a phase modulation on an optical carrier. In the Frequency Modulation, the electrical modulation signal imposes a frequency modulation on an optical carrier.

Hybrid optical amplifiers provide improvement in performance by the addition of two amplifiers. In terms of Raman-EDFA Hybrid optical amplifier, EDFA amplifier gives terrific performance by the data rate amplification because of its large gain bandwidth [4] and Reduction in non linear penalty with enhanced noise figure is given by Raman amplifier [5]. Raman-EDFA hybrid optical amplifier performs better in terms of increased output power and reduced BER than in EDFA, SOA and hybrid EDFA-SOA [6]. Simranjeet Singh [7] revealed post amplifier scheme of Hybrid Raman-EDFA gives better results in terms of reduced BER and increased output power than in other schemes. Compensation in range loss and chromatic dispersion is balanced by Hybrid Raman-EDFA amplifier.

Optical topology is proper arrangement of optical couplers, splitters and so on to form a network. Topologies can be divided as active i.e. optical signal is converted to electrical and passive i.e. optical signal without conversion used for transmission. Optical star network topology makes the data transferrable from one node to all the receiving nodes. Links are created through the combiners and splitters in order to carry information from transmitters to receivers. Y.K. Chen [8] reported possibility of 64 users in star topology. Y.N. Singh [9] investigated that the presence of SOA can bring increment in the number of users. He revealed that efficiency can be increased by using SOA as preamplifier. Surinder Singh [10] investigated that 16 users could be supported by the optimization of SOA at 10 Gbps.

In this paper, we proposed optical star network topology using Optimized Raman-EDFA amplifier for -40dBm input signal power at bit rate of 15Gbps. Performance of different modulators is evaluated for a given number of users. The results in this paper are coincidence with previous results [10] where it was observed that star topology by QPSK modulation using optimized SOAs is able to carry out 16 users at bit rate of 10Gbps with signal input signal power of -40dBm for a distance of 5 Km. In this paper, the work is extended using different modulators in the presence of optimized Raman-EDFA hybrid optical amplifier with

distance of 6Km with bit rate of 15Gbps for 16 users and is observed that Frequency modulator performs better than other modulators.

This paper is planned as follows. In Section II, theory is presented. In Section III, system setup is presented. In Section IV, Results & Discussions are presented. Conclusions are made in Section V.

II. TRANSMITTER, RECEIVER AND HOA USED

A. *Transmitter*

The transmitter used in this topology is made up of CW laser array to generate continuous wave optical signal. PRBS generator is used to generate pseudo random sequences as per operation modes and not return to zero coded signals is generated by NRZ pulse generator. Optical modulators are used for the purpose of modulation.

B. *Hybrid Optical Amplifier*

The HOA used is made of the combination of Raman and EDFA in which EDFA is following Raman. An external pump i.e. pump laser is added to the Raman amplifier for backward pumping. The combination is used at receiving ends. To enhance the performance of HOAs, optimization is carried out in terms of length of both the amplifiers.

C. *Receiver*

At the receiving end, Photo detectors PIN is used to detect the signals coming and then are transmitted to the Low pass Bessel Filter to filter with Bessel Frequency transfer function. 3R regenerator is used to regenerate the signal. BER analyzer is used to analyze the Quality Factor.

III. SYSTEM SETUP

In star topology, the data transmitted is distributed among all the receivers. The star topology is made here bidirectional in order to make a two way communication. Bidirectional optical Star topology made up of splitters and combiners is shown in Figure 1. For the uplink, the signals having frequency spacing of 0.1Thz are transmiited through the transmitters marked Tx u1, Tx u2, Tx u3….Tx u8 at the bit rate of 15 Gbps. The transmitted signals are fed to the 8 x 1 power combiner where the output powers of the transmitters are combined. The output of the power 8 X 1 combiner is given at the input of 1 X 8 bidirectional splitter which in turn splits the power into 8 parts and 8 outputs of bidirectional splitter is made to pass through the Optimized Raman-EDFA Hybrid optical amplifiers. Output of the amplifier is fed to different receivers marked as Rx u1, Rx u2, Rx u3…….. Rx u8. For the downlink, the bidirectional splitter acts as combiner. The signals are transmitted through the transmitters marked Tx d1, Tx d2……..Tx d8 are fed to 1 X 8 bidirectional splitter which in turns combines the power of the signals. The combined signal is then passed to the 1 X 8 power splitter to split the power into 8 parts. The output generated through the 1 X 8 power splitter is fed to Amplifiers before being received by the receivers Rx d1, Rx d2……Rx d8. The distance between the nodes is taken as 6 Km.

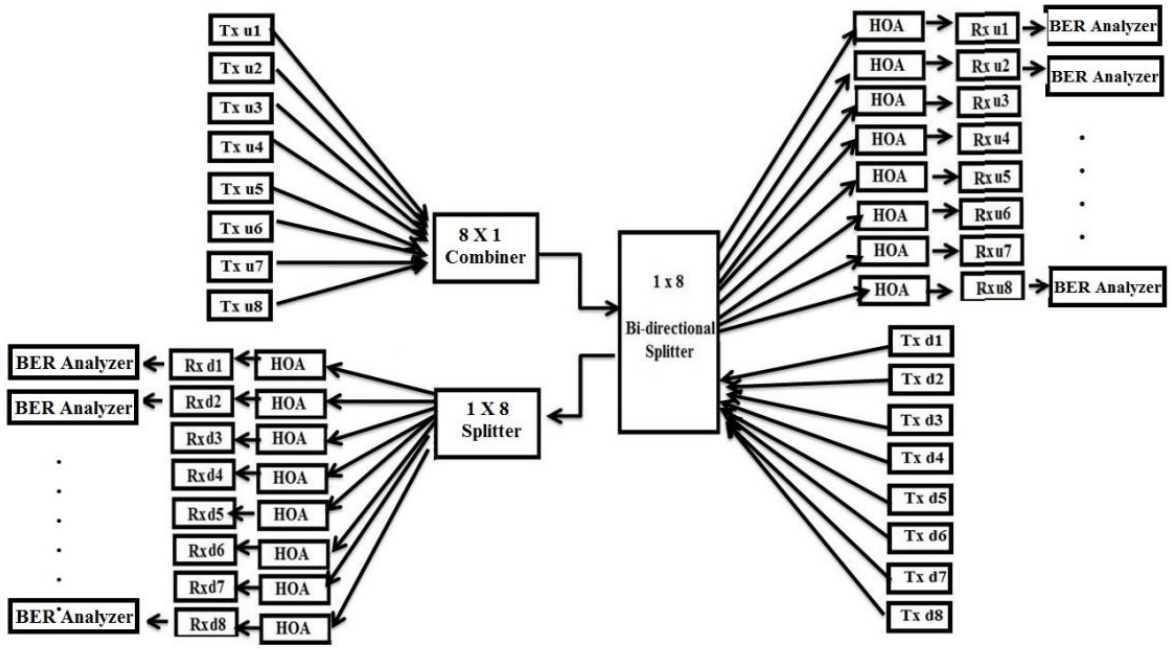

Fig. 1: Bidirectional Star Topology

IV. Results & Discussions

The simulation is performed at signal input power of -40dBm for different modulators i.e. Electroabsorption Modulator, Phase Modulator & Frequency Modulator. The bits are generated in pseudorandom manner with order of 2. Optimized Raman-EDFA hybrid optical amplifier is used at receiving end. Performance of different modulators is evaluated for a given number of users. The results in this paper are coincidence with previous results [10] where it was observed that star topology by QPSK modulation using optimized SOAs is able to carry out 16 users at bit rate of 10Gbps with signal input signal power of -40dBm for a distance of 5 Km. In this paper, the work is extended using different modulators in the presence of optimized Raman-EDFA hybrid optical amplifier with distance of 6Km at bit rate of 15Gbps for 16 users and is observed that Frequency modulator performs better than other modulators.

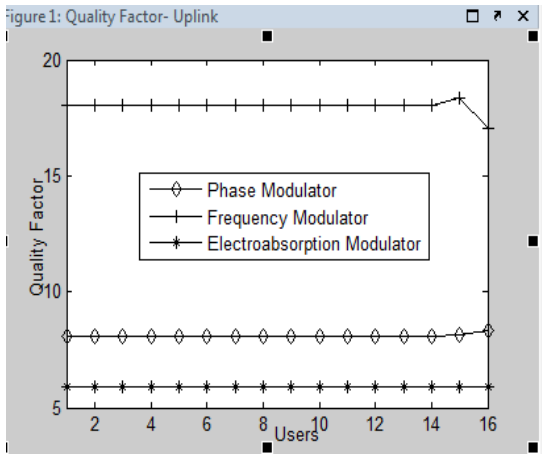

Fig. 2: Quality Factor at Receivers (Uplink) for Different Modulators

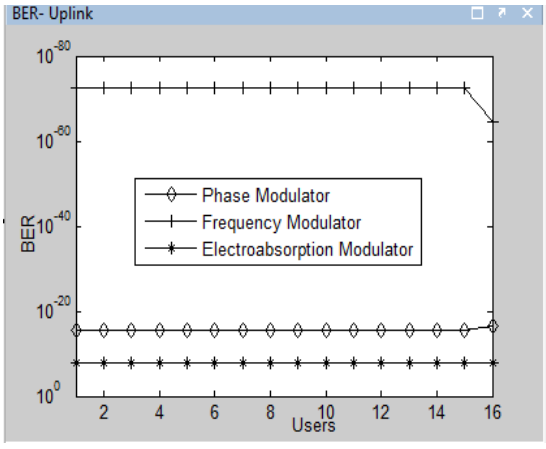

Fig. 3: BER at Receivers (Uplink) for Different Modulators

The quality factor and BER of the at different receivers i.e Rxu1, Rxu2…..Rxu8 is represented in figure 2. It is observed that Frequency Modulator provides high quality factor of 18.04 with BER of 4.83099e-073 for a given number of users whereas Phase Modulator provides the quality factor of 8.10 with BER of 2.9017e-016.

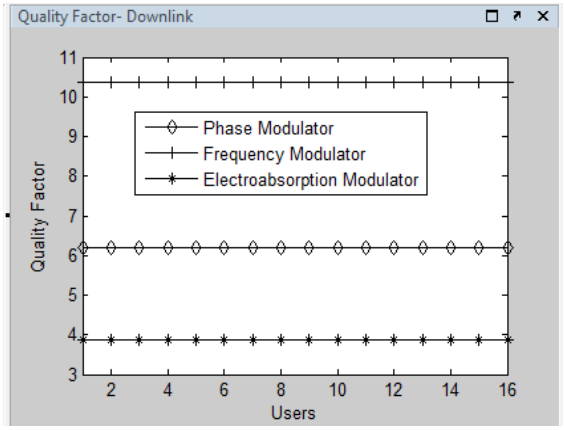

Fig. 4: Quality Factor at Receivers (Downlink) for Different Modulators

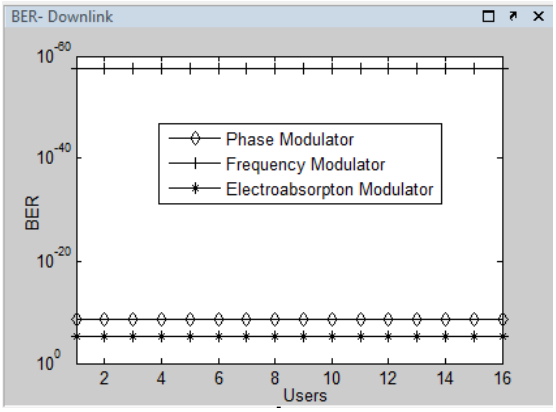

Fig. 5: BER at Receivers (Downlink) for Different Modulators

The quality factor and BER of the signals received at Rxd1, Rxd2…..Rxd8 is represented in figure 4 & 5. It is observed that Frequency Modulator provides high quality factor at receiver of 10.36 with BER of 2.29017e-058 for a given number of users whereas Phase Modulator provides the quality factor of 6.19 with the BER of 5.15623e-009.

Frequency Modulator provides better results in terms of Quality Factor and BER because of its capability to immune amplitude variations caused by optical loss.

V. Conclusion

The simulation results show that Frequency modulator performs better than other modulators at input signal power of -40dBm with bit rate of 15 Gbps for Bidirectional star topology at distance of 6 Km in the presence of optimized Hybrid Raman-EDFA amplifier because of its capability to immune amplitude variations caused by optical loss. Frequency Modulator is capable to support 16 users with the Quality Factor of 18.04 with BER of 4.03899e-073 for uplink and Quality Factor of 10.36 with BER of 2.29017e-058 for downlink.

ACKNOWLEDGEMENT

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BCI System and its Classification Methods—A Review

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***Abstract*—A brain computer interface is a communication system that does not depend on the brain's normal output path of peripheral nerves and muscles. It allows the user to interact with external environment using just brain power without any muscular activity evolved. This paper addresses the various techniques used in BCI (invasive, partially invasive and non-invasive). Practical implementation of BCI is based on the recognition of specific users, their needs and requirements. The objective of this paper is to provide a clear view into the various aspects of BCI and its techniques.**

Keywords: Brain Computer Interface (BCI), Electroencephalograph (EEG), Invasive and Noninvasive, Electrocorticography (ECoG)

I. INTRODUCTION

A Brain–Computer Interface (BCI), sometime called a Mind-Machine Interface (MMI), or called a direct neural interface or a Brain–Machine Interface (BMI). It started with Hans Berger's inventing of electrical activity of the human brain and the development of electroencephalography (EEG) [3].Brain Computer Interface (BCI) is a system that acquires and analyzes neural signals from brain with the goal of human mobility restoration. To achieve this goal, it establishes a communication channel directly between the brain and the external device or computer. So to make this interface friendlier we use two adaptive controllers, one is the user's brain, which produces signals as input, and the second is a BCI system which produces corresponding output from the acquired signal through translation. In BCI, people just think of the task to happen and it will happen. So Human-Computer Interaction (HCI) area related to BCI considering that BCIs will be part of interactive systems in the near future [2]. BCI supports communication for people with little motor disability due to accidents or diseases such as amyotrophic lateral sclerosis (ALS), brainstem stroke, cerebral palsy etc.

There are three main requirements while implementing the BCI framework. 1) A wearable computer in the form of chips mounted on the outer skull of the brain, which capture the EEG signals when any thought come. 2) A decoder to decode received signals and performs the related task correctly. 3) A display to give feedback whether the task is accomplished or not. BCI's have maximum information transfer rates of 5–25 b/min [1]. BCI broke down the problem of BCI signals and recording techniques into four interrelated domains: 1) applications; 2) signal classes 3) methods and features; and 4) classifiers and algorithms [8]. Achievement of greater speed and accuracy of the BCI system is directly dependent on signal processing, translation algorithms, and user training. These improvements depend on increased interdisciplinary cooperation between neuroscientists, engineers, computer programmers, psychologists [5]. A system that simply records and analyzes brain signals, without providing the results of that analysis to the user in an online interactive fashion is not a BCI [5]. BCI helps in doing many tasks which we usually perform day to day like turning lights on/off, fan, TV, toasters, heat. The immobile person can also control his/her wheelchair and environment. It also has a huge impact in controlling monitor screen based applications like web browsers, computer spellers and gaming. We also have some other fields as it is also used in controlling the entertainment like playing music, controlling photographs, influencing visual art and music, but this feature is highly speculative [2].

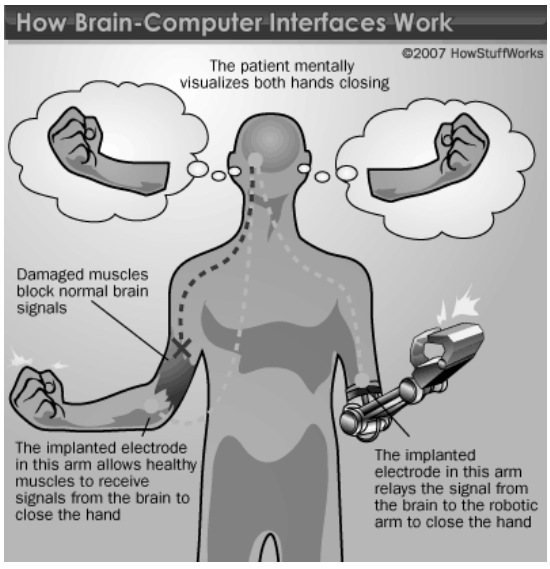

Fig. 1: Working of BCI

II. DEFINITION AND FEATURES OF BCI

A BCI replaces nerves and muscles and the movements they produce with electrophysiological signals and the hardware and software that translate those signals into actions [4]. It allows us to perform with motor impairments to provide the brain with a

unique, non-muscular communication and control channel, a direct brain–computer interface (BCI) for conveying messages and commands to the external world. We have 2 classes of BCI, Independent and dependent BCI [4]. Dependent BCI uses a path other than the brains normal path. Activity path required to generate brain activity through VEP [13] in form of EEG. Letters flashed one at a time; user selects a particular letter by focusing directly on it where as independent BCI doesn't depend on brains normal path. Path activity is not needed in this case. Here EEG generation will not depend on eye movement (P300 potential used). Independent BCI very useful in case of locked inpatient.

Current BCI is accepting EEG signals recorded at scalp as an input, further uses some translation algorithm to convert the signals passed by the user and give output in the form of some activity.

A. *Signal Acquisition*

It is the process of measuring the neurophysiology state of the brain in the form of signals by using some interface (i.e. Electrodes). In addition to dependent and independent electrophysiological BCIs can be categorized by whether they use non-invasive (EEG) or invasive (e.g. intracortical). They can also be categorized by whether they use evoked or spontaneous inputs. Evoked inputs (e.g. EEG produced by flashing letters) result from the stereotyped sensory stimulation provided by the BCI. Spontaneous inputs (e.g. EEG rhythms over sensorimotor cortex) do not depend for their generation on such stimulation. These acquired brain electrical signals are amplified, digitized and pre-processed to increase the signal-to-noise ratio [5].

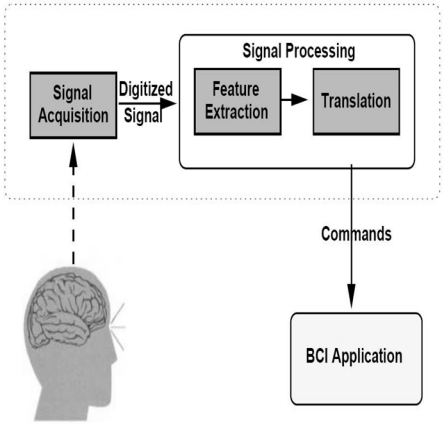

Fig. 2: Block Diagram of BCI

B. *Signal Processing*

Digitized signal from first phase is taken as input and subjected to the various feature extraction procedure and then use some algorithm to translate extracted features.

1) *Feature Extraction*

The processed input from EEG contains large amount of information. What is needed from data is distinctive feature. A feature is that part of the data that gives the best interpretation and most valuable information relating to the user's intent [5]. Some analyses are required to extract these features.

2) *Translation Algorithm*

The first part just extracts the features. Now we use some algorithms to convert these signal features to some commands which relate to user intent. It might use linear or non-linear translations. Whatever its nature, each algorithm changes independent variables (i.e. Signal features) into dependent variables (i.e. Device control commands) [4].

C. *Output Device*

In current BCIs, mostly computer screen is used as an output device. Output is displayed on screen in the form of letters, alphabet, shapes, etc. In addition to being the intended product of BCI operation, this output is the feedback that the brain uses to maintain and improve the accuracy and speed of communication [4]. In some BCI applications, the output device is user's own hand.

D. *BCI Applications*

The features extracted and translated are converted into commands that provide assistance for communication (spelling on a computer screen); movement control (robotic arm); environmental control (e.g. TV, light, temperature, etc.); locomotion (e.g. Electric wheelchair); or Neurorehabilitation [5].

III. TYPES OF BCI

We have major 3 types of BCI (Brain Computer Interface) according to the nature of BCI device. These techniques are differing on the basis of 1) how signal is observed by BCI device 2) which algorithm is used to translate the captured signal from user brain into the correct output i.e. Invasive, partially invasive, and non-invasive. We also classify the BCI in the form of two groups on the basis of type of signals they work with. 1) Endogenous electrophysiological activity2) exogenous electrophysiological activity [7].

TABLE 1: BCI GROUPS ON BASIS OF TYPE OF SIGNALS

Endogenous	Exogenous
The EEG recorded over the specific cortical area	Signals evoked by specific stimuli
It requires extra efforts for training	Do not require as much effort
It allows the cursor movement to any point	It constraint user, two choices shown in the display
Trained user has direct control over the environment.	Do not have direct control
Example: Beta and mu rhythms recorded over sensory motor	Example: P300 potential

A. *Invasive BCI*

In invasive BCI, device is directly implanted inside the gray matter of the brain through costly surgery with high risk. Invasive BCI generates a strong signal with high speed control, but have scar tissue problems which affect the signal quality. Because of their high cost and scar tissue problem invasive BCI is not so popular.

B. *Partially Invasive BCI*

Partially invasive capture, implants is placed beneath the Skull without drilling the brain. Despite its lower quality signals, this method of signal capturing presents lower risks to health as compared with invasive approach [2]. It is less prone to scar tissue build up problem. Electrocorticography (ECoG) measures the electrical activity of the brain taken from the skull in a similar way to non-invasive. ECoG is a very promising method because it has high resolution, better SNR, wider frequency range, and less training requirements than scalp-recorded EEG, and at the same time has lower technical difficulty, lower clinical risk, and probably superior long-term stability than intracortical single-neuron recording.

C. *Non Invasive BCI*

In non-invasive BCI scanner device and sensors are mounted on a headband and placed on the visual cortex (scalp) of the brain. It is safe as compared to invasive and partial invasive because it does not require any costly surgery. Here EEG electroencephalography helps to capture the brain activity. In spite of weak signal generation non-invasive BCI is very popular as it is cheap and easy to use. It also provides the feature of portability. It is considered to be a successful approach in increasing the capability to move muscles and restore the movement [5]. Further non-invasive is bound up with four different technologies 1) P300 potential 2) SSVEP (steady state visual evoked potential) 3) IGUI (eye gaze input and intelligence) 4) UAI (universal application interface)

1) *P300 based BCI*

In P300, devices are just controlled by brain signals (no other parameter in considered). It is based on ERP (event related potential) which can be visual or auditory with a latency of 300ms [2]. In this real object or image is shown to the user to generate the stimuli. For switching on the light, to make such thought light image or light itself is needed to be shown to the user. Then these thoughts are captured with the help of EEG, later decoded to perform task. There exists a problem of object identification due to noise.

2) *SSVEP based BCI*

In SSVEP, we capture brain signal along with visual stimulation at some frequencies. When the flickering stimuli are shown to the subject the visual stimulus is excited in the range of 3.5Hz to 75 Hz, Brain generates the electric signals of the same frequency of the visual stimulus. This helps in distinguishing between which device the user is looking at. Compared to P300 this technique is more robust as it takes one more parameter on visual input for measuring the brain activity and thoughts generated.

3) *IGUI and UIA based BCI*

This is used for performing domestic applications like controlling window, doors, etc. This uses SSVEP stimulation too. It is based on sending and receiving the packets to perform the required task. When a user thinks of something BCI will raise the command to IGUI. It will search in XML file for distinguishing between the devices that the user is thinking of, based on the context. IGUI sends notification to UAI to perform the action.XML file is updated. IGUI is informed task completion and thus display will be updated. It is a hierarchy based structure which is causing latency. Researchers are also doing research on using this for expressions like playing music by looking at the notes, controlling photographs, but it is very difficult to achieve and it is just a speculation right now.

4) *Eye Gaze Input based BCI*

Till now we have studied that BCI works on principle of user thinks and tasks happen. But there exist some fields where this principle can't execute well (clicking with the mouse). So eye gaze is the solution to this problem. Click action is performed by fixating at a point. So when the user wants to perform clicking action for selection, the user has to fix on it for a certain time, then the target is considered as selected. This technique has 1 major problem "Midas touch problem". It means confusion between attention and intention of a user. In this use case user accidently performs clicking action by looking at object for too long. To overcome this if we vary fixation time problem remain the same.

TABLE 2: EFFECTS OF FIXATION TIME

Fixation Time	Effect
Decrease time	Make system frustrate to use
Increase time	Increase error problem in Midas touch

Proposed Solution to Midas touch problem: We can combine Gaze input with active BCI. Where eye gaze used to control the mouse cursor and BCI signals will control the clicking action. So it will not select anything when the user is unintentionally looking at it. Further, combining gaze input with voice command. This will make technology more effective and robust. Example gaming option for physically challenged people.

IV. TECHNIQUES TO MEASURE CEREBRAL INFORMATION

Nowadays, many methods are available for capturing brain activity. The most important of them are

electroencephalography(EEG),functional near-infrared spectroscopy (fNIRS), Electrocorticography (ECoG), Magnetoencephalography (MEG), positron emission tomography (PET), regional cerebral blood flow (rCBF), functional magnetic resonance imaging (FMRI), magnetic resonance imaging (MRI)

A. Magnetoencephalography (MEG)

It measures the cortical magnetic field produced by electric current. Such a measurement is possible only when amplifiers utilizing the low noise properties of superconductors are used [1]. The advantages of MEG are good temporal resolution and high probability of the exact location of signal emission sites. However the equipment is extremely expensive and the field is very small and difficult to measure [5].

B. Positron Emission Tomography (PET)

PET indirectly measures the metabolism of the patient at the cellular level. In this we eject the radioactive element in patient blood. Radiation detectors are put around the scalp, to point out the marker [1]. It works on the principle that in a more active area we find higher level, metabolism carried by the blood flow. The advantage of this method is it helps to learn the structural as well as functional aspects. It also has certain disadvantages 1) Unlike MEG it has a poor temporal resolution. 2) Use of radiation makes this method harmful.

C. Functional Magnetic Resonance Imaging (fMRI)

Functional magnetic resonance imaging is a much safer method. It is a version of magnetic resonance imaging based on imaging changes of oxygenated and unoxygenated hemoglobin in the magnetic field [1].It is a non invasive technique that measure blood oxygen dependent level changes correlating with neural activity of the brain. For proper functioning of the active area of the brain, need more oxygen is needed, as the cells which are more active require more energy than usual ones.

D. Electrocorticography (ECoG)

Electrocorticography (ECoG), or intracranial EEG (iEEG), is the method of using electrodes placed directly on the exposed part of the brain to record electrical activity from the cerebral cortex. ECoG may be performed either outside of surgery (Extraoperative ECoG) or in the operating room during surgery (Intraoperative ECoG). Because a surgical incision into the skull is required to implant the electrodes, ECoG is an invasive procedure.

- It provides greater proximity and sensitivity than EEG recordings and gives a better spatial resolution and improved signal to noise ratio.

E. Functional near-infrared Spectroscopy (fNIRS)

fNIRS measure brain activity through blood oxygenation and flow, but it is based on identifying variation of optical properties in brain images [2]. With the help of light detectors, we measure the near infrared light which is passed through user brain. And these reflected rays are picked up and correlated to specific concentrations of oxygen. So this enables to gather cerebral information in a real usage scenario due its relative low-cost and portability.

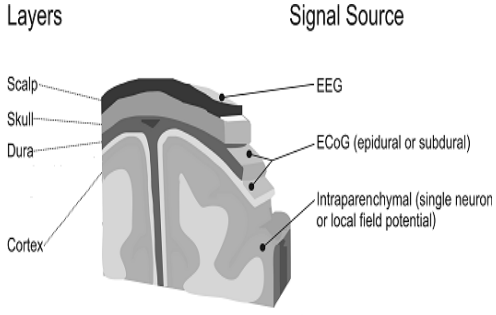

Fig. 3: Signals Measured from Different Layers

F. Electroencephalography (EEG)

Electroencephalography (EEG) is the method of recording the electrical potentials that are spontaneously generated in the cerebral cortex through the activity of cells during physiologic activity. Significant fluctuations occur only while neurons are discharged, and thus when these cells simultaneously generate or conduct electric impulses [1]. It is used to diagnose sleep disorders, coma, and brain death. Though it has a large number of advantages, but also has some weak points.

- EEG requires intense interpretation just to hypothesize what areas are activated by a particular response. So it has a Low spatial resolution on the scalp.
- Activity below the upper layers of the brain (the cortex) is measured poorly in EEG
- Unlike other techniques like MRS or PET, cannot identify specific locations in the brain at which various drugs can be found.

Most of the signal observed in the scalp EEG falls in the range of 1–20 Hz. Waveforms are subdivided into bandwidths to some frequency range to signify the majority of the EEG used in clinical applications. So we have different bands based on frequency range like alpha, beta, theta, delta etc.

TABLE 3: BRAIN WAVES/ RHYTHMS

Bands	Frequency (HZ)	Activity
Delta	<4	Deep sleep, waking state
Theta	> 4 and < 8	Emotional stress, deep meditation
Alpha	> 8 and < 14	Relaxed awareness, Inattention
Beta	>14	Alert, Active attention

V. CHALLENGES

The main problem in real time application of BCI is a sensory interface problem and translation algorithm used. Both factors directly affect the reliability and accuracy of BCI. In order to make a clinically useful BCI the accuracy of the detection of intention needs to be very high and certainly much higher than the currently achieved accuracy with different types of BCI [6]. There is a tradeoff between accuracy and safety. We know well that implanted micro electrodes are best when we consider accuracy. But the signal will gradually deteriorate because of the defensive mechanism of the brain tissue reacting to these foreign objects. This causes the formation of fibrous tissue, which makes the sensors useless after 6 months [6]. Second is EEG based BCI, it is non – invasive (safe) but provide low Spatial resolution. Third is ECoG based BCI, it partially satisfies both the factors. As it is a partial invasive technique so provide better resolution. For robust BCI, cheap, portable, fast and accurate fMRI is a good candidate. Another challenge is the algorithm used (linear or nonlinear). In case of large data complexity increases, so non-linear algorithms are preferred over linear ones.

VI. SUMMARY

Current BCI operation work with two adaptive commands. A BCI can be invasive, partially invasive (i.e. The electrophysiological activity) and the system controllers, the user's brain, which produces the input or itself, which translates that activity into output non-invasive, and can be based on electrophysiological signals (EEG, ECoG, intra-cortical recordings) or other signals such as MEG, PET, fMRI controllers, the user's brain, which produces the input or itself, which translates that activity into output non- invasive, and can be based on electrophysiological signals (EEG, ECoG, intra-cortical recordings) or other signals such as MEG, PET, FMRI. Further linear and non-linear algorithms are used for translation on the basis of complexity.

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Study of CloudSim Simulator to Model and Simulate Cloud Computing Environment

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***Abstract*—Cloud computing is a computing paradigm which provides a variety of services to the users that may be in form software services, hardware services or infrastructure services. Now, it has also started providing Ethernet as a service, IT as a Service. Cloud services are available all over the internet and you just need a web-enabled device for it. In order to provide higher QoS to the users, Cloud providers find new ways to improve the services and achieve higher levels of user's satisfaction. This requires to develop new service policies or improve existing ones. But, the testing of new techniques in a real cloud environment is quite expensive. So, researchers are developing various simulators to model and simulate the cloud computing environment. This paper is a study of the CloudSim simulator to model and simulate the cloud computing environment.**

Keywords: Cloud Computing, CloudSim, Host, Datacenter, Virtual Machine, Cloudlet

I. INTRODUCTION

Cloud computing is an emerging paradigm that offers various types of services based on pay per use model. These services are in the form of software, hardware and infrastructure. This allows users to access and deploy applications from anywhere across the world at competitive costs based on QoS requirements of users. There are various applications which are cloud-based such as social networking, real time data processing and content delivery. But each of these applications has their different configuration as well as deployment requirements. Quantifying the performance of various scheduling and allocation policies under different conditions becomes difficult since cloud environment is dynamic and user's requests may increase or decrease anytime. Also, the nature of the cloud system is variable and heterogeneous [1].

It is very expensive to carry out testing of scheduling policies and allocation strategies in a real cloud environment. So an alternative solution is to use simulators. The use of simulators allows the results to be used and reduces the risk of failure due to some error in the programming. Various simulators are being developed by researchers such as CloudSim, GridSim, SmartSim, CloudAnalyst. The paper explores CloudSim simulator in detail and discusses its architecture.

After the introduction, the paper is categorized as: Section II discusses about Cloud Computing and its layered architecture, Section III discusses the CloudSim modeling, describing its architecture and modelling components, Section IV discusses the design of CloudSim describing the building blocks of the simulator, finally Section V gives the conclusion.

II. CLOUD COMPUTING

A. What is Cloud Computing

Cloud computing is a pay per use model that allow the users to access the data being at any place across the world. The users of the cloud only need an id and password to enter the cloud system and avail the cloud services (IaaS, PaaS or SaaS) at competitive cost based on their quality of service (QoS) requirements [2]. This model offers the users, a large pool of resources based on their demand and user need not buy the expensive hardware or software rather he may take it on rent from the cloud provider and pay per use.

B. Cloud Computing Architecture

Cloud Computing has a service oriented layered architecture design [3]. It consists of three layers: user level middleware, core middleware and system level. The physical Cloud resources and core middleware form the basis of infrastructure as a service (IaaS). The user-level middleware form the basis for platform as a service (PaaS). The top layer forms the basis of software as a service (SaaS). This layer uses the services of the lower layers to run the applications. Figure 1 shows the layered architecture of Cloud Computing.

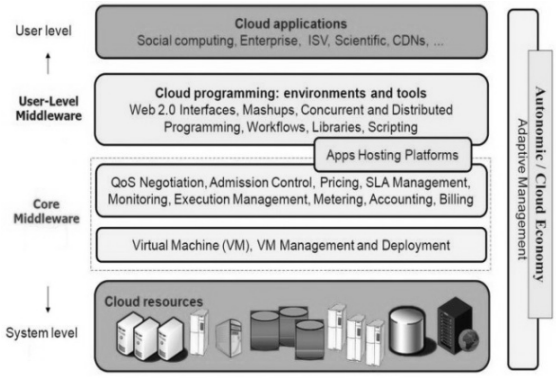

Fig. 1: Layered Cloud Computing Architecture

1. *User-Level Middleware:* This layer includes the Cloud programming: environment and tools such Web 2.0 Interfaces, Mashups, which help the developers to create cost user interfaces for web-based applications. It includes programming environments and tools.
2. *Core Middleware:* This layer provides the platform level services to the upper layer, i.e. user-level middleware which includes run-time environments. The services provided by this layer include QoS negotiation, SLA management, and Admission control. Examples of services are Google App Engine, Amazon EC2.
3. *System Level:* This layer includes the actual physical resources such as collection of data centers, which are installed with hundreds of thousands of servers. These servers are transparently managed through virtualization. This layer provides the computing power to the higher layers.

III. CLOUDSIM MODELLING

CloudSim is a simulation toolkit for modeling and simulating the cloud computing environment.

A. *CloudSim Architecture*

Fig. 2 shows the layered architecture of CloudSim [4]. The lowest layer is of SimJava which is a discrete simulation engine and implements the core functionalities like event handling, management of the simulation clock. Then on top of this layer, there are libraries for implementing the GridSim toolkit.

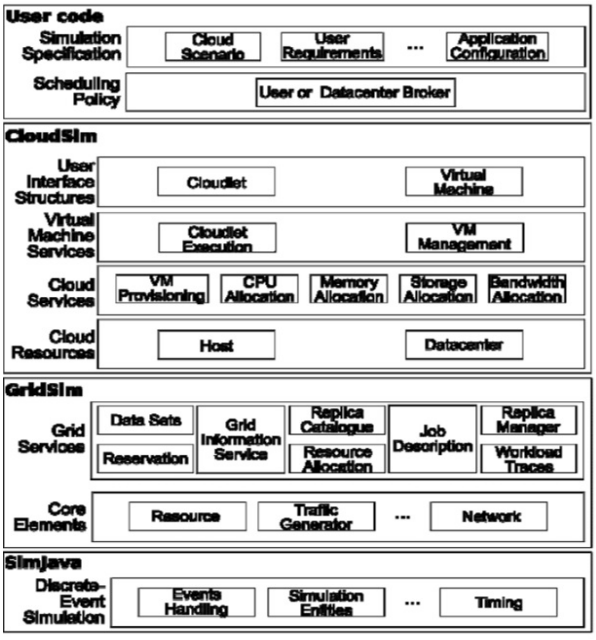

Fig. 2: Layered CloudSim Architecture

The topmost layer is that of User Code, which include configuration related functionalities for hosts (number of hosts, their characteristics), applications (number of tasks and their requirements), number of users and application types, virtual machines (number of virtual machines, their specifications).

Programmers and developers can extend the core functionalities of CloudSim to develop new allocation strategies and perform testing for different configurations and conditions.

B. *Modelling the Cloud*

The infrastructure level services of cloud can be modeled by extending the Data Center entity of CloudSim. The datacenter entity manages the various host entities. It allows specifying the characteristics of the data center. The hosts can be assigned to one or more virtual machines based on the allocation policy.

The data center manages the host and in turn host manages the virtual machines. The data center can be thought of as a room which contains a large number of servers or hosts.

The host is a physical computing server having a pre-defined capacity called MIPS (million instructions per second). It implements the interfaces to support the modeling and simulation of nodes. The cloudlet model the application based services such as social networking, content delivery.

C. *Modelling the VM Allocation*

VM allocation is the process the creating the VM instances that match the datacenter characteristics such as storage, RAM, configuration and assigning them. CloudSim supports the custom application models and it allows the users to extend the cloudlet object for implementing their services. The allocation of specific VMs to a host is done by the Virtual Machine Allocation Controller Component called as VM Allocation Policy. It allows the researchers to apply custom methods for implementing new policies for VM allocation. By default, VMs are allocated to the hosts by First Come First Basis. The researchers can add their own policy by just extending the class VM Allocation Policy [5] [6].

Figure 3 (a) shows that space-shared policy is used for both VMs and task units. It means that VM2 will be given the core only when VM1 finishes execution of tasks.

Figure 3 (b) shows that space-shared policy is used for VMs, but a time-shared policy is used for individual task units within a VM. This means that all the tasks would dynamically switch till completion.

Figure 3 (c) shows that a time-shared policy is used for VMs, and a space-shared policy is used for tasks. Here, each VM will be given the processor for a particular time slice and then the slices are distributed to the tasks in space-shared basis.

Figure 3 (d) shows that time-shared policy is used for VMs as well as tasks. Here the processing power is concurrently being shared by the VMs and these shares are divided between the tasks which are assigned to each VM.

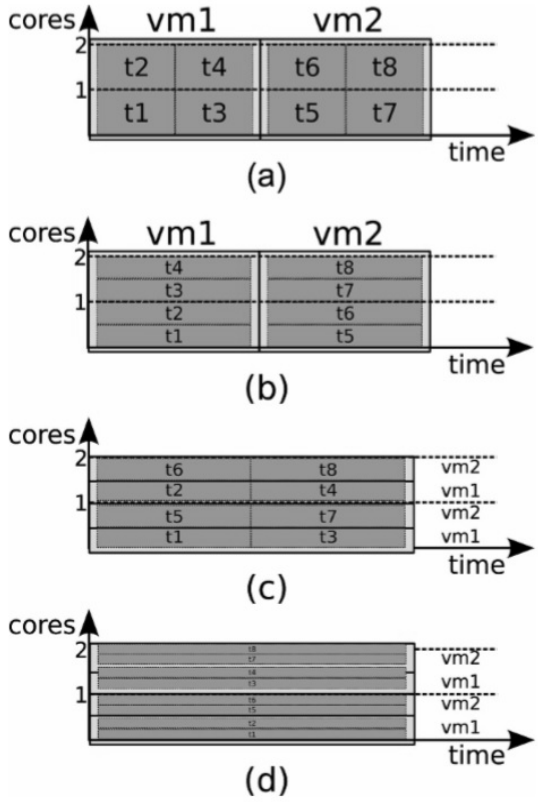

Fig. 3: Different Scheduling Policies for VMs and Tasks Execution: (a) Space-shared for VMs as Well as Tasks, (b) Space-shared for VMs but Time-shared for Tasks, (c) Time-shared for VMs but Space-shared for Tasks, and (d) Time-shared for VMs as Well as Tasks

D. Modelling the Dynamic Workloads

To quantitatively analyze the performance of some strategy implemented by a researcher, it is needed to test it using workload traces from the real system. Therefore, it's required that dynamic workload must be modeled. The CloudSim models the workload dynamically using the class Utilization Model Stochastic.

E. Modelling the Data Center Power Consumption

Power consumption by the working nodes in the data center is dependent upon CPU, memory, storage, cooling systems, power supply. Recent studies have found that power consumption can be clearly defined as the linear relationship between power consumption and CPU utilization. CloudSim provides us various methods which show a linear relationship between the power consumption and CPU utilization such as Power Model Sqrt, Power Model Cubic, Power Model Square, Power Model Linear.

To Analysis and to Build a precise model is research problem. Therefore, instead of using an analytical method, CloudSim uses a model called Power Model Spec Power, which uses the real data of power consumption provided by the Spec Benchmark.

IV. DESIGN OF CLOUDSIM

The class design diagram of CloudSim [6] [7] is shown in Figure 4. Here we discuss about the fundamental classes/entities of CloudSim, which act as the building blocks of the simulator.

A. Data Center

It forms a core part of the infrastructure level services provided by the Cloud. It consists of a collection of hosts which may be heterogeneous or homogeneous. Datacenter receives the requests for creating Vms, implements the policies for allocating bandwidth, storage, memory.

B. Datacenter Broker

This class models the broker which acts as an intermediate between the users and the Cloud and provides based on their QoS requirements and deploy tasks onto the cloud. It is responsible for negotiating the QoS requirements between the users and the cloud providers. Researchers extend this class for implementing their new allocation policy.

C. SAN Storage

This is a storage area network storage class which provides the cloud data centers to save large chunks of data. It is a high speed network which connect storage devices to the server. It implements a simple interface for storage and retrieval of data.

D. Virtual Machine

This class models the instance of a virtual machine which is managed by the host during its life cycle. The host creates instances of virtual machine and allocates cores based on pre-defined processor allocation policies. The

E. Cloudlet

It models cloud based services such as content delivery, social networking. It represents the complexity of the application. Every application has a pre-defined instruction length and amount data to be transferred. It is actually the user's task which is named as cloudlet in CloudSim.

F. Cloud Coordinator

It provides the federation capacity to a datacenter. It not only responsible for communicating with the other Cloud Coodinator and Service brokers, but it also maintains the internal state of the datacenter which is very important.

G. Memory Provisioner

This class models the provisioning policy for allocating memory to the VMs. This model allocates the physical memory to the VM component. Also, it checks whether the host has the required memory free which is required by the virtual machine that has to be created on users' request.

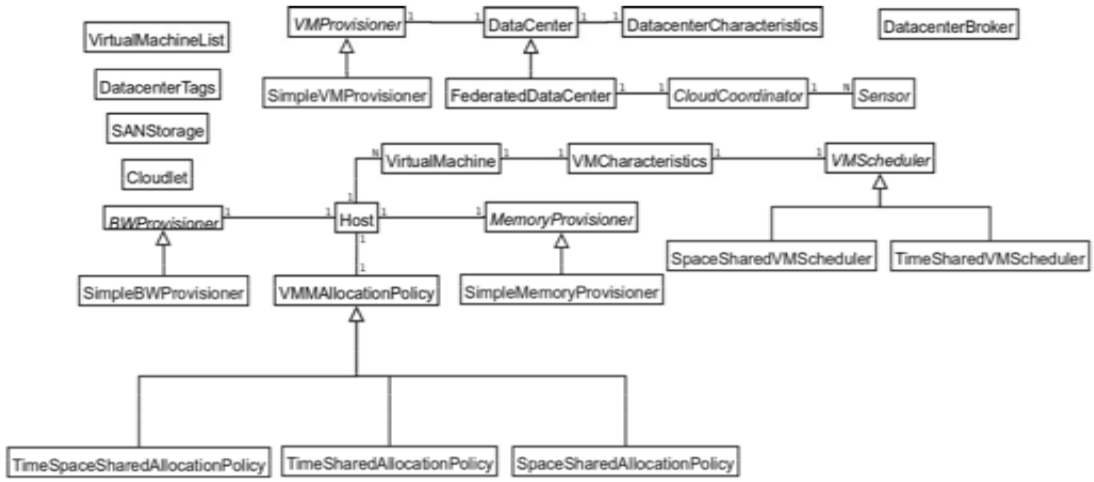

Fig. 4: Class Diagram of CloudSim

H. VM Provisioner

This class models the provisioning policy that is used by the VM monitor to allocate VMs to the host. Its functionality is selecting the host that meets the requirements of the VM component. The Simple VM Provisioner allocate the VMs to the first available host. Hosts are selected in a sequential order.

I. BW Provisioner

This class models the provisioning policy for allocating bandwidth to the Vms. This component is responsible for allocating network bandwidth a set of competing Vms.

J. VMM Allocationpolicy

This class models the functionalities of the allocation policies i.e space shared or time shared. The functionalities could be easily over-ridden to accommodate the new policies. This policy is used by the host for allocating the virtual machines.

V. Conclusion

The modeling and simulating the cloud computing environment using CloudSim simulator saves time, effort and money spent on configuring a real cloud environment. If one needs a cloud environment merely for testing purposes, then the cloud simulators are the best choice. The paper studies the CloudSim architecture, how it works, various policies and algorithms and its design. In the future, we would be implementing a new policy for VM allocation by extending the classes of CloudSim project.

Acknowledgment

The Success of this work would have been uncertain without the support and guidance of a dedicated group of people in our institute SBS State Technical Campus, Ferozepur. We feel immense pleasure to express the deepest appreciation to my guide. We also thankful to our college friends for their support.

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Analysis and Study of WPA and its Security Issues

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***Abstract*—One of the fastest growing technologies in today's life is wireless communication. The demand for connecting devices wirelessly is increasing exponentially. In college campus, office buildings and many public areas, we mostly found wireless LAN's. So with increase in its usage, its security has become vital. there are number of protocols that have been proposed in this respect that are WEP,WPA,WPA2.In this paper we will study WPA protocol its working and security issues in WPA, how IV(initialization Vector)is used in it.**

Keywords: WPA, MAC, IV, MIC

I. INTRODUCTION

By 2001, number of attacks has been successfully done on WEP. The IEEE then started to work on 802.11i. In 2003, the Wi-Fi Alliance created Wi-Fi Protected Access (WPA), WPA was carefully designed so that upgrading in the hardware was not required. The RC4 cipher was in the choice for WEP because it does not require a CPU with a powerful configuration. A comparison between WPA and Earlier has been explained in following figure.

WPA continues the use of RC4 but also added the features designed to address the loopholes in the way that WEP uses the cipher:

1. *More powerful authentication*: Radius server, is used to authenticate users individually.
2. *Lengthy key*: WPA increases the length of Initialization Vector (IV) to 48 bits and the master key to 128 bits.
3. *Temporal Key Integrity Protocol (TKIP):* It generates different keys for each client and alters keys for each successive packet.
4. *Message integrity code (MIC), or cryptographic checksum*: It verifies that messages have not been altered in the mid way and protects against replay attacks.

II. WPA

WPA use Temporal Key Integrity Protocol (TKIP) whereas encryption key was used by WEP for encrypting the data which remained same for every packet, whereas TKIP makes a dynamic encryption key scheme. This was the first change within WPA. The second change in WPA was to replace the CRC Checksum method used in WEP with message integrity check (MIC) algorithm called Michael. The purpose of MIC algorithm is to prevent an attacker from changing and resending data packets. Michael is much stronger than CRC.WPA has two versions and either can be installed depending on customer needs, WPA-Personal and WPA-Enterprise.

WPA-Personal: It is also known as WPA-PSK (Pre-shared key) mode. It is mostly designed for home and small p\office networks because it doesn't require an authentication serv9er. In this, the network traffic is encrypted using a 256-bit key0by every device as shown in Fig. 2.

Features	Static WEP	802.1x WEP	WOA
Identity	User, machine or WLAN card	User or machine	User or machine
Authentication	Shared key	EAP	EAP or pre-shared keys
Integrity	32-bit integrity check value (CV)	32-bit ICV	64-bit message integrity code (MIC)
Encryption	Static keys	Session keys	Per packet key rotation via TKIP
Key distribution	One time, manual	Segment of PMK	Derived from PMK
Initialization vector	Plain text, 24-bits	Plain text 24-bits	Extended IV-65-bits with selection/ sequencing
Algorithm	RC4	RC4	RC4
Key strength	64/ 128-bit	64/ 128-bit	128-bit
Supporting infrastructure	NONE	RADIUS	RADIUS

Fig. 1

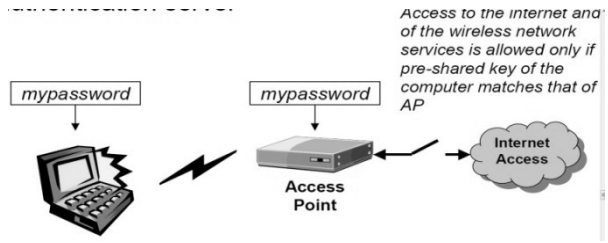

Fig. 2

WPA-Enterprise: It is also known as WPA-802.1X mode RADIUS-Authentication server is required and designed for enterprise networks. In this, Extensible Authentication Protocol are used for authentication as shown in Figure-3.

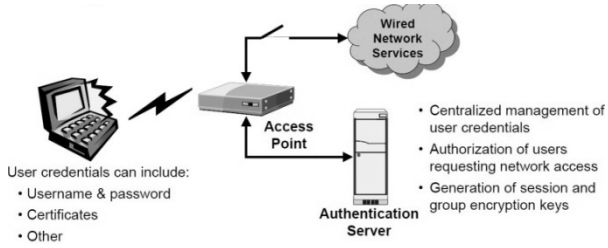

Fig. 3

MAC (Message Authentication Code): The concept of MAC is quite similar to that of a message digest. However, there is one difference. A message digest is simply a fingerprint of a message. There is no cryptography process involved in case of message digest. In contrast, a MAC requires that sender and receiver should know a shared secret key, which is used in preparation of MAC. Thus, MAC involves cryptographic processing.

Let us assume that sender A wants to send a message M to a receiver B. How the MAC processing works:

1. A&B show a secret key, which is not known to anyone else. A calculates the MAC by applying key K to the message M., as shown in Figure-4

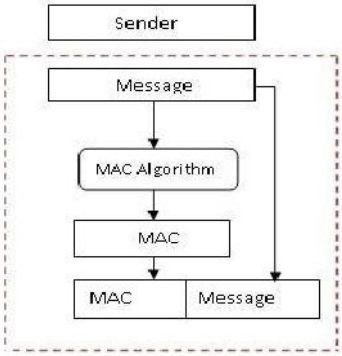

Fig. 4

2. A then sends the original message M and MAC H1 to B.
3. When B receivers the message, B also users K to calculate its own MAC H2 over M.
4. B now compares H1 with H2.If two match, B concludes that message M has not been changed during transmit. If H1 not equal to H2, B rejects the message, realizing that message was changed during transmit, as shown in Figure-5.

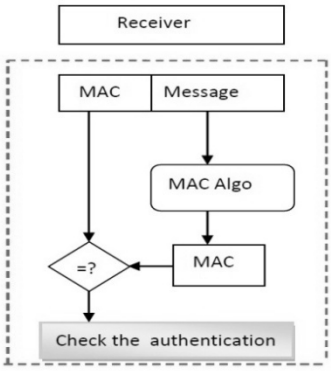

Fig. 5

TKIP (Temporal Key Integrity Protocol): The encryption protocol included as part of the IEEE 802.11i standard for WLANs is temporal key integrity protocol. Its purpose is to provide more secure encryption as compared to WEP.TKIP includes four additional algorithm to increase key strength :To protect packets, a cryptographic message integrity check is used, An IV sequencing mechanism, To increase Cryptographic strength, per-packet key-mixing function is used, to provide key generation every 10,000 packets, a re-keying mechanism is used. Three new security features implemented in TKIP to resolve security problem faced in WEP. First, TKIP Implements a key mixing function that combines a secret root key with IV before passing to the RC4 initialization Second, WPA implements a sequence counter to protect against replay attacks. Packets received out of the order will be rejected by access point. Third, TKIP implements a 64-bit Message integrity check. The following figure-5 depicts TKIP Encapsulation and de-capsulation are shown in following figures.

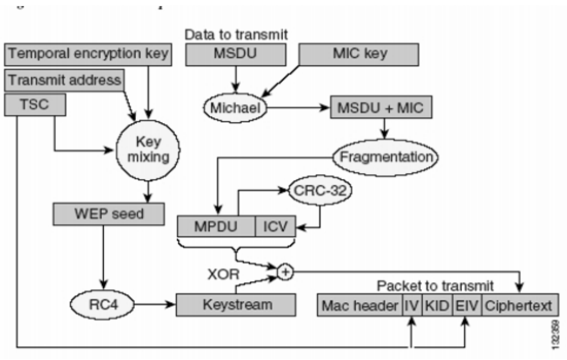

Fig. 6: TKIP Encapsulation

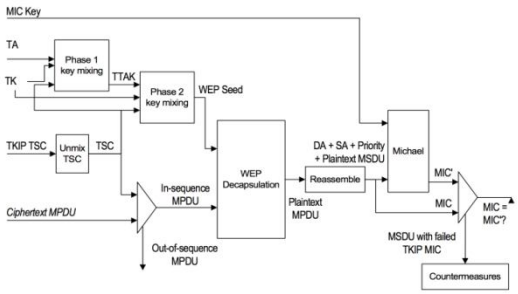

Fig. 7: TKIP De-capsulation

III. Security Issues in WPA

It is possible to have Recovery attack on temporal key with the time complexity of $O(2^{105})$.The idea of the attack is to brute forcing two different RC4-keys with 104-bit in each and then applying attack to recover 128-bit Temporal key and Message Authentication key of 64-bit. Thus the loss of few RC4-keys give permission to the attacker to easily recover Temporal Key and the contents of compromised packets. The attacker may get all secret keys the user have. So WPA doesn't provide any forward secrecy since the attacker can use earlier formed RC4keys and can generate the new ones.

There are various kind of attacks have been found, that performed on WPA, and provide us the various loopholes of WPA. Generating the need of advance version of WPA. These can be explained as follows:-

A. Beck-Tews Attack

The attack is an extension of the chop- chop attack on WEP.TKIP implements MIC &so if two MIC failures are observed within 60 seconds then both client and access point are shut down and then TKIP session key is rekeyed. Thus the attacker waits for 60 seconds to avoid countermeasures in case of a failure. Packet can be decoded at a rate of one byte per minute with the help of this attack. After plaintext has been retrieved by attacker, he has access to MIC and key stream of packet. This can be used to construct and transmit a new packet on network which enables attacker to execute of Denial of service attacks. This attack can be executed only against TKIP and not against WPA implementing AES.

B. Royal Holloway Attack

TKIP uses a similar key structure to WEP with low 16-bit value of a sequence counter being expanded into 24-bit 'IV' and this sequence counter always increment on every new packet. An attacker can use this key structure to improve existing attacks on RC4.

IV. Conclusion & Future Scope

In this paper, we studied a detailed Architecture of WPA, How it works. What are the various kind of attacks found to occur on it. We can say that by improving in small amount of WPA, We can easily enhance its Power. Though, WPA 2 has been proposed, and it has already been in use, but sill use of new Cryptographic hash functions like SHA-1, SHA-2, SHA-3, can be used thus achieving major success with limited resources.

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An Optimized Cost Based Load Balancing Algorithm in Cloud Computing

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***Abstract*—Load balancing is one of the central issues in the cloud computing. In a cloud computing environment, load balancer distributes the workload to different nodes so it avoids the situation where some nodes are heavy loaded and some nodes are under-loaded. In this paper, cost based load balancing algorithm is used for balancing the load by considering the cost. The user selects the package from available packages. Scheduler processes these tasks on a virtual machine and efficiently maps these tasks to available package so it is beneficial to service provider and the user.**

Keywords: Cloud Computing, Load Balancing, Virtual Machine

I. INTRODUCTION

Cloud computing is a type of computing, which means accessing and storing data and programs over the Internet instead of computer hard drive.

Cloud computing is also called internet based computing that offers heterogeneous services such as application, servers and storage to different peoples. There are four deployment models in the cloud computing. Public Cloud is a standard cloud computing model that provides services to the general public. A private cloud is a data center or network that provides hosted services to limited people. Hybrid cloud is a combination of public and private cloud. Community cloud is accessed and controlled by a group of companies that have similar requirements. [1]

A. Issues in Cloud Computing

There are some issues in cloud computing.

1. *Load Balancing*: Load balancing is one of the challenging areas in the cloud computing. Numerous algorithm is used to allocate the workload to different nodes in a manner no node is under-loaded and overloaded.
2. *Security*: Security is the biggest issue of cloud. Cloud computing to face many issues like privacy, authentication and loss of data and data theft. Many other computer attacks such as man in middle attack and denial of service.
3. *Energy Consumption*: Cloud data centers house the thousands of servers and set up the cooling infrastructure to remove heats generated 1by these servers. The cooling infrastructure and servers consume a large amount of energy and produces greenhouse gases so it is the main issue in cloud computing. There are some other issues in cloud computing like trust management, task scheduling.

II. LOAD BALANCING

Load balancing is the main issue in cloud computing that balance the workload across the different nodes. The load is assigned in such a way no node is under-loaded or overloaded. It helps to improve the response time of the task and also helps to achieve the resource utilization of task. [3,5]

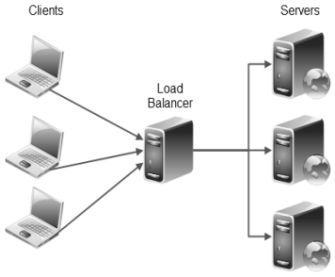

Fig. 1: Load Balancing

A. Goals of Load Balancing

There are some of the goals of load balancing algorithms:

1. Have a backup plan in case system fails.
2. To improve the performance substantially.
3. To allow future modification in the system.
4. To maintain stability of the system.
5. To increase the user satisfaction.

B. Types of Load Balancing Algorithms

They are two types based on classification:

1) Static

The algorithm does not depend upon the current state of the system so prior knowledge of the system is needed. There are various algorithms in the cloud computing that are static in nature, such as round robin and first come first serve.

2) Dynamic

The algorithm depends upon the current state of the system. It varies as the state of the system changes. Honey bee algorithm and active clustering algorithm are dynamic in nature.

3) Policies in Load Balancing Algorithms

There are various policies available for dynamic load balancing:

1. *Transfer Policy*: It selects the job to be transferred from the local node to some node at the remote place.
2. *Selection Policy*: It specifies the processes participating in load exchange.
3. *Location Policy*: The selection of the destination node for the transferred task is the location strategy.
4. *Information Policy*: It is responsible for collecting information about the nodes.
5. *Load estimation Policy*: It tells how to estimate the load of any particular node.
6. *Process transfer Policy*: It decides whether to execute the process locally or remotely.

III. System Architecture

In the simplest form a cloud user connects to the cloud via a cloud provider/server or a cloud broker. The user interacts with the provider for receiving the service/ resource. When the cloud provider receives the request it forwards it to the virtual machine (VM) for processing through the scheduler. Fig 2 gives an overall view of the scheduling process.

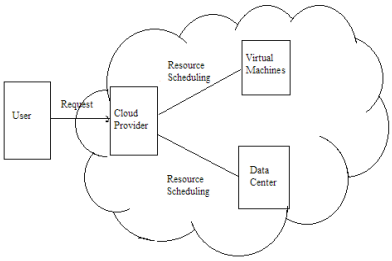

Fig. 2: Cloud Scheduling Architecture

The Cloud's users request for the Services to cloud servers and load balancer mapping the user request to virtual machine based on service. Fig 3 shows the architecture of load balancer with optimal scheduler.

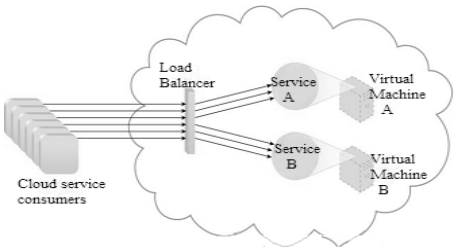

Fig. 3: Architecture of Load Balancer with Optimal Scheduler

IV. Cost based Load Balancing Algorithm

In this algorithm, the workload is distributed evenly across all the virtual machines in the cloud to avoid a situation where some nodes are heavily loaded while the others hardly work. It is one of the Resource Scheduling Algorithm that optimizes the cost and schedules the resources based on the cost. [9]

In this algorithm, resources are grouped as a package. When user request for the package then the virtual machine consisting that package is executed and it is beneficial to both user and service provider.

Algorithm:

Step1: Create the users and packages.

Step2: Initialize the u_cost and time.

Step3: S_cost = C_cost * time;

Step4: Profit = u_cost - S_cost;

Step5: User request for package and allocate the user request to the VM which consist that package.

Where u_cost is user cost and S_cost is service provider cost and C_cost is client cost and Client cost is combination of package cost and virtual machine cost.

V. Simulation/ Experiment Results

A CloudSim simulator is used to test the algorithm The CloudSim simulator consists of cloud components like Virtual Machines (VM), Data Center (DC), Host and Cloudlet. The configuration of the different components (Bandwidth, MIPS (Million Instruction per Second) etc. is mentioned.

A. Features of CloudSim

There are many features of CloudSim that are presented in the following:

1. Support for simulation and modelling of large scale cloud computing data centers.
2. Support for simulation and modelling of irtualized Server hosts, with customizable policies for provisioning host resources to virtual machines.
3. Support for simulation and modelling of energy-aware computational resources.

B. Modules

Some modules of CloudSim are:

1. *Virtual Machines*: Each data center consists of virtual machines (VM) which provide the packages requested by the clients.
2. *Service Package*: Each virtual machine consists the package such as VMl contains a service pack for software; VM2 contains a service pack for software and network resources and so on. Each package has a price fixed.
3. *Cloudlets*: The tasks currently running in the VM are cloudlets. According to the request of the client, the package is executed and the service is provided to the client.

4. *Load Balancer*: This component models the load balance policy used by data centers when serving allocation requests.

Firstly, users register themselves on the cloud and login. Once they login, the list of packages is available with cost. The user selects the package and time duration, user wants the service.

The user sends the request for the package and if the cloud service provider accepts the request, the user has to pay for the service. If user pays rupees 10 then the actual cost to serve this request is 5 means actual cost is reduced by half. Fig 4 shows the list of packages available with cost.

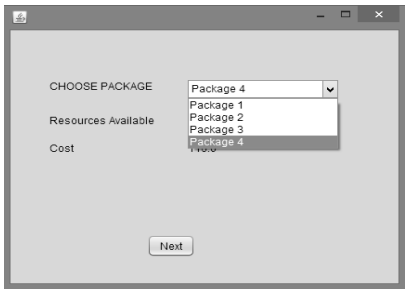

Fig. 4: List of Packages

Fig 5 shows the details of user request form in which user can request for the package and the time duration of the package.

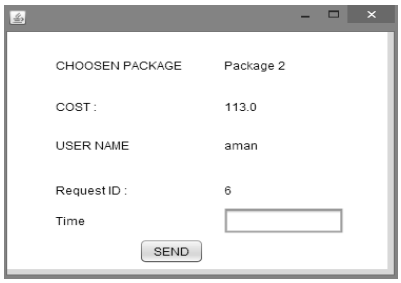

Fig. 5: User Request form

Once user enters the details, request is sent to virtual machine for the execution of request.

Fig 6 shows the log file that contains the details of users and request id and package etc.

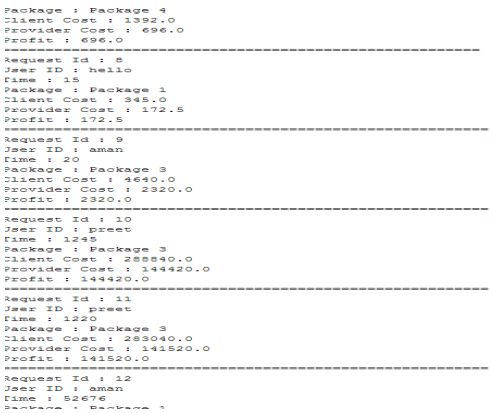

Fig. 6: Log File

VI. Conclusion

Resource scheduling is the important task in a cloud computing environment. The optimal cost based load balancing helps to reduce the cost so it is beneficial to user and service provider. This algorithm work fine when VM in data center are idle and when all the data center are busy then incoming request are in waiting state.

Acknowledgment

The research work is possible through the help and support of our guide Mr. Navtej Singh Ghumman. We would also convey sincerest gratitude to our entire facility members and Staff of the department of Computer Science and Engineering, SBSSTC, FZR who bestowed their efforts and guidance at appropriate times, without which it would have been very difficult on our part to do research work.

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DDoS Attacks Incidents—A Study

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***Abstract*—A Denial of Service (DoS) is such an intentional attempt by malicious users/attackers to completely disrupt or degrade (compromise) availability of service/resource to legitimate or authorized users. Distributed denial-of-service attack is one such kind of attack, which poses an immense threat to the availability of the Internet. DDoS attacks are very common in the world of internet. This paper describes the important types and methods of the Distributed Denial of Service attacks. In this paper, we have studied the overview of DDoS attacks and different DDoS incidents and their impact.**

Keywords: DoS, Legitimate, DDoS, Zombies, Botnets

I. INTRODUCTION

A Distributed Denial of Service attack is a DoS attack which uses multiple distributed attack sources. Typically, attackers use large number of controlled bots (also referred to as zombies) that are distributed in different locations [1]. Then they launch a large number of DoS attacks against a single target or multiple targets. With the rapid development of botnets in recent years, the attack traffic scale caused by DDoS attacks has been increased. The targets not only include business servers, but also Internet infrastructures such as firewalls, routers. They also contain DNS systems as well as network bandwidth. The attack causes sphere has also become vast [1].

II. OVERVIEW OF DDOS ATTACK

A Distributed Denial of Service attack is commonly characterized as an event in which a legitimate user or organization has distrupt the services, like web, email or network connectivity. DDoS is basically a resource overloading problem. The resource can be bandwidth, memory, CPU cycles, file descriptors, buffers etc. The attackers bombard scare resource either by flood of packets or a single logic packet which can activate a series of processes to exhaust the limited resource [2]. Simplified Distributed DoS attack scenario is given in Fig 1. The figure shows that attacker uses three zombie's to generate high volume of traffic to flood the victim over the Internet thus rendering legitimate user unable to access the service.

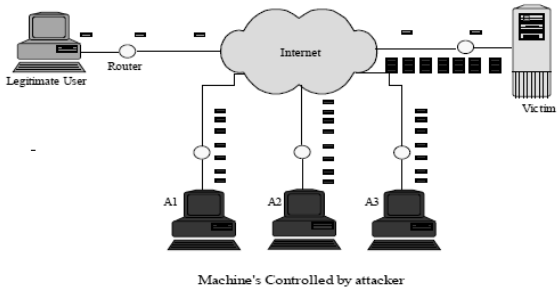

Fig. 1: DDoS Attack Scenario

A. How DDoS Attacks Work

A website is technically a "service", a software-based system that responds in a particular way to incoming requests which can be a web browser from client software. But request of web browser can be faked [3]. To a certain number of requests for pages, graphics and other website elements, a web server can only respond efficiently at once. Up to a certain limits of number it traps down. After this, system may become entirely complex and will not respond. Due to these vast floods of traffic, server may disable due to attacker. Involvement of DoS attacks in a single computer from attacker at once may cause flooding to a web server. As shown in fig 2 When that became insufficient, DDoS advance conscripted thousands of virus-infected computers, known as zombies at once to bombard the victim with bogus requests from many locations [4][5]. This is impossible to block without severing the server's internet link altogether.

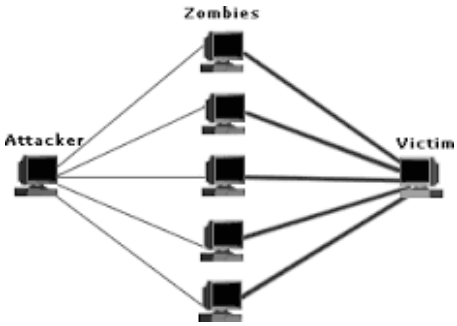

Fig. 2: DDoS Attack Working

For better understanding how DDoS attacks work, let's analyze them from a criminological point of view. A crime has three elements: method, opportunity and motive. DDoS attacks using the three elements:

a. DDoS Attack Method
b. DDoS Attack Opportunity
c. DDoS Attack Motive

III. DDoS Attacks Method

In general, network packets are used to TCP/IP protocol for transmission. The packets themselves are harmless, but if there are too many unusual packets, it will cause the network devices or servers to overload. This can quickly consume the system resources. In another case if the packets take use of certain protocols defects (e.g. artificial, incompleteness) causing the failure of network devices or servers. Both cases will result in denial of service. These are the basic concepts of DDoS attacks. The key reason behind difficult prevention of DDoS attacks to distinguish legitimate traffic from illegal traffic. In general according to the characteristics *DDoS* attacks can be divided into the following types*:*

A. Bandwidth-based Attacks

This type of DDoS attacks send mass discarded data messages to cause an equipment overload, leading to the more consumption of network bandwidth or equipment. Commonly the attacked routers, servers and firewalls processing resources are limited. Overload attacks lead to their failure in handling normal legal access. This results in either a sharp decline in the quality of service or a complete denial of service.

B. Traffic-based Attacks

The most common forms are traffic flooding attacks, which send large amount of legitimate TCP, UDP, ICPM packets to target the hosts. Some attacks may also avoid detection system monitoring through source address forgery technology.

C. Application-based Attacks

This type of attacks commonly send application-layer data messages according to business-specific features resulting in the reduction of certain resources in the application layer (such as the number of users, connections, etc.) and the system's services are no longer available. Such attack does not occur usually but low-rate traffic can also results to a serious declination.

IV. DDoS Attack Opportunity

The awareness of the convergence of application service providers (ASP) and network service providers (NSP) and traditional telecom networks and IP networks increases, as well as the growth and maturity of "cloud" services, and the explosion of network-capable mobile devices. This results not only new business models and business growth points, but also a wide range of security threats. In recent years, the rapid

Advancement of bandwidth also provides convenience to the attackers.

V. DDoS Attack Motive

From the effect brought by so many DDoS attacks, it can be seen that the motive of attacks has changed intensively. The formation of illegal groups has been a problem that people in the network security field have to work with terms. According to recent study of Symantec on internet security threats such groups is increasingly upgrading, and have seen a rapid growth in both the tools employed and methods which are used.

VI. Related Work

DDoS attacks based on number of agent machines performing the attack and whether the attack was rejected or not. This classification focuses on computer attack and does not sufficiently highlight features particular to DDoS attacks. The work provides a important discussion of the DDoS problem. To measure the effect of DDoS defence approaches, evaluation of impact of DDoS attack is also important [6],[7].

A Denial of Service attack is an attempt by a person or a group of persons to spoil an online service. This can have serious outcomes, especially for companies like Amazon and eBay which really on their online availability to do business. Recently there have been some large scale attacks targeting high profile internet sites [8][9][10] and [11]. Accordingly, there are now a lot of efforts being made to come up with mechanisms to detect and reduce such attacks. Even though the first denial of service attacks did not take place a long time ago there is a large quantity of denial of service attacks that have been used.

The attacks can be of three types:

a. Attacks utilizing some bug in the software performance of a service to lead that down.
b. Attacks that use up all the available resources at the target machine.
c. Attacks that contain entire bandwidth available to the victim machine. The third form of attacks is called bandwidth attacks. A distributed framework becomes preferred for such attacks as a reasonable amount of data directed from a number of hosts can create a lot of traffic at and near the target machine, block all the paths to the victim.

VII. Recent Incidents

There are many incidents observed in various companies and websites which experiences DDoS attacks [12][13]. They have different consequences and have different descriptions which can be observed in the table.

TABLE I: RECENT DDOS ATTACKS (2014–2015) [14]

Sr. No.	Attacks Date	Name of the Company	Impact
1.	July 31, 2015	FBI NEWYORK	Scamming due to DDoS attack
2.	July 30,2015	International Planned Parenthood Federation (IPPF) US	Disturbance in Planned Parenthood websites
3.	June22,2015	Warsaw's Frederic Chopin Airport POLAND	Cancellation of carrier flights
4.	May 26, 2015	West Ada school district, Idaho, US.	Inaccurate conduction of online tests and classes
5.	May 9,2015	Hong -Kong bank, China	Bit coin payment demand
6.	April 14,2015	Belgian media Company	Network temporarily disturbed and shut down
7.	Dec 27,2014	Sony company	Impact on play-station games
8.	Jan 11,2014	Extra torrent website	Site unavailable for 23 hours
9.	Nov 30,2014	Internet in South Korea(SK)	Disturbance in internet network
10.	Nov 7,2014	Contra Costa County Department of Elections(US)	In accessible website during elections
11.	Oct 11,2014	Internet portal In Serbia News, Serbia	News unavailable due to DDoS attack
12.	Sep 12,2014	CodeSpaces.com website,	Service runs out of Business

VIII. CONCLUSION

There is rapid enhancement in DDoS attack incidents.

Protection of such networks should be done in order to avoid attacks. In this paper, different DoS and DDoS problems have been discussed. It gives a deep view of DDoS problem and its origin. Important information about DDoS incidents has also provided. It also contain recent scenario of DDoS incidents on various sites. Taking this into consideration, need for DDoS attack information using systemized approaches should be synthesized.

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Comparative Analysis of Energy Efficient Routing Protocols

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***Abstract*—The rapid development in network multimedia tools have permit extra real-time digital services as an example video-conferencing, online games and distance education to produce to be the standard internet tasks. WSNs are becoming major section of research in computational theory due to its wide selection of applications. But consequently of limited battery the vitality consumption has become major drawbacks of WSNs protocols. Though various protocols has been proposed until now to improve the energy efficiency further however much improvement might be done. This paper suggests that the GSTEB quite important results on the available WSNs protocols.**

Keywords: Wireless Sensor Network (WSN), Heed, Leach, DWEHC, Panel

I. INTRODUCTION

Network lifetime is important in Wireless Sensor Network (WSN) systems since recharging or exchanging the sensors is difficult and expensive. The more recent networks are bi-directional, also enabling *control* of sensor activity. An instant sensor network contains insignificant sensing devices, which normally function on battery power. Sensor nodes are strongly structured in the region of interest. Each device has sensing and wireless communication capabilities, which will make it to sense and gather information from environmentally friendly surroundings and then transmit the info to additional nodes in the sensor network. Earlier days, this has been received excellent attention from both academic circles and industry area.

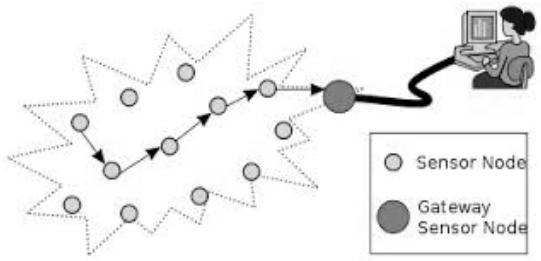

Fig. 1: Architecture of Wireless Sensor Network

A WSN relating includes enormous degree of low-cost, less-power, and multifunctional wireless sensor nodes, with sensing, wireless interactions and computation capabilities. These sensor nodes communicate over small remoteness inside a wireless means and work jointly to attain a normal task like surroundings monitoring, military examination and industrial process control .The fundamental element of WSNs is, the capacity of each individual sensor node is constrained, and the collective power of the whole network is enough for the mandatory task. Long lasting numerous applications of WSNs, these networks have numerous limitations, e.g., limited energy supply, restricted computing power, and limited bandwidth of the wireless links linking sensor nodes. The biggest thing aspire of WSNs is to put on out data communication while wanting to enlarge the expected life of the network and avoid connectivity degradation via aggressive energy management approaches. The look of routing protocols in WSNs is subjective by a lot of dangerous factors. These risk factors might be accomplishment over sooner than capable communication might be attained in WSNs [9].

Wireless sensor networks are widely ideal for gathering information inside an independent fashion. Since sensors are power constrained devices, it's quite important to permit them to minimize the energy consumption. A story tree-based clustering (TBC) approach for energy efficient wireless sensor networks, the nodes in a group form a tree with the main as the cluster-head, whilst the height of the tree is chosen the foundation of the length of the member nodes to the cluster-head. Computer simulation suggests that the proposed scheme effectively decreases and balances the vitality consumption among the nodes, and thus importantly extends the network lifetime set alongside the prevailing schemes such as for instance like LEACH, PEGASIS, and TREEPSI [12].

Sensor networks came out as a revolutionary technology for querying the physical world and hold promise in a broad choice of applications. However, the tremendously energy constrained nature of the networks necessitate that their architecture be designed in a energy-aware manner. Clustering could function as architecture of preference as it remains the traffic local; sensor nodes would send in order to nearby cluster-head in the fixed radius, sovereign of the network size. The problem of clustering in WSNs, vulnerable to upper bounds on the absolute most latency the vitality consumed by intermediate nodes, and clusters size, those constraints are necessary for the reliability of the unit and for extending its lifetime. A polynomial time algorithm consisting of recursively computing minimum weighted dominating sets, while respecting latency and energy consumption constraints. We compare our algorithm to other alternatives and show therefore it consistently outperforms them [13].

A. Components of WSN

1) Sensor Nodes

The Sensor Node can be a basic part of WSN and it contains Sensing, Computation and wireless Communication element. Therefore sensor nodes have the capability to observe physical phenomenon, development the observed and received data and communicate the scrutinized or processed information to the nearby sensor nodes to produce a network of sensor nodes called Wireless Sensor Networks (WSNs). The wireless networking ease of the sensor enabled nodes, have resulted in many interesting applications including disaster detection surveillance, precision agriculture, smart homes, and supply chain management applications. An alarm node might vary in proportions from that of a shoebox down to how big a grain of dust. The cost of sensor nodes is identically variable, including several to a huge selection of dollars, regarding the complexity of the average person sensor nodes. Size and cost constraints on sensor nodes result in corresponding constraints on assets such as for instance as an example computational speed, communications bandwidth, energy and memory. The topology of the WSNs may change from a simple star network to an enhanced multi-hop wireless mesh network. The propagation method relating to the hops of the network might be routing or flooding.

2) Base Station (BS)

The bottom stations are multiple the various areas of the WSN with much more computational, energy and communication assets. They become a door way among sensor nodes and the conclusion user since they typically forward data from the WSN to a server. Other special components in routing based networks are routers, developed to calculate, compute and distribute the routing tables.

B. Clustering

The key intention of hierarchical routing or cluster based routing is definitely to capably maintain the vitality using sensor nodes by connecting them in multi-hop communication in only an exacting cluster. Cluster construction is commonly on the foundation of the power reserve of sensors and sensors closeness to the Cluster Head (CHs). Clustering plays a vital role for energy saving in WSNs. With clustering in WSNs, energy consumption, duration of the network and scalability might be improved. Since only cluster head node per cluster is very important to execute routing task and the former sensor nodes just forward their data to cluster head. Clustering has main applications in high-density sensor networks, because it's greatly easier to regulate some cluster representatives (cluster head) from each group than to regulate complete sensor nodes. In WSNs the sensor nodes are resource controlled what this means is they've restricted energy, transmit power, memory, and computational capabilities. Energy consumed by the sensor nodes for communicating data you start with sensor nodes to the bottom station will be the central reason behind energy exhaustion in sensor nodes [11].

II. Energy Efficiency Protocols

A. LEACH

Low-Energy Adaptive Clustering Hierarchy (LEACH) is one of numerous revolutionary clustering routing approaches designed for WSNs. The central scheme of LEACH is just a huge motivation for numerous succeeding clustering routing protocols. The key goal of LEACH is to choose sensor nodes as CHs by revolution, and therefore the high energy dissipation in communicating with the BS is spread to every one of sensor nodes within the network.

The method of LEACH is broken onto a lot of rounds, where every round is split into two phases, the set-up phase and the steady-state phase. In the set-up phase the clusters are structured, whereas in the steady-state phase data is provided for the BS. Through the whole set-up phase, everyone node decides whether to be became a CH for the recent round. This decision is on the basis of the recommended fraction of CHs for the network and the total amount of times the node is really a CH so far. This decision is prepared via the node selecting a arbitrary number between 0 and 1.

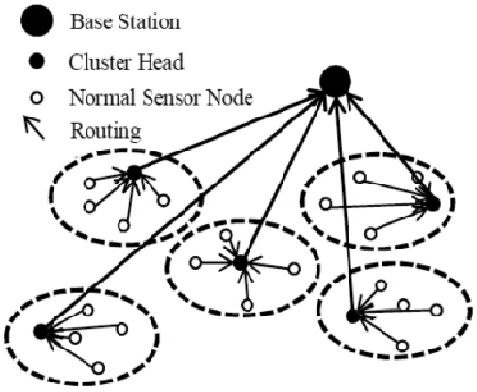

Fig. 2: Basic Topology of LEACH

The advantages of LEACH include the following:

1. Any node that served such as for instance for example a CH in definite round can't be selected since the CH another time, so everyone node can uniformly divide up the strain imposed upon CHs to varying degrees;
2. Utilizing a TDMA schedule prevents CHs from pointless collisions.
3. Cluster members can open or close communication interfaces in fulfillment utilizing their allocated time slots to prevent too much of energy dissipation.

B. HEED

Hybrid Energy-Efficient Distributed clustering (HEED) is usually a multi-hop WSN clustering algorithm which brings an energy-efficient clustering routing through explicit concern of energy. Distinctive from LEACH in the performance of CH determination, HEED doesn't pick nodes as CHs at random. The way of cluster assemble is completed on the cornerstone of the hybrid grouping of two parameters. One parameter relies mostly on the node's remaining energy, and another parameter could be intra-cluster communication expenses. In HEED, chosen CHs have quite high average remaining energy in comparison to MNs. Furthermore, on the list of principle objectives of HEED is to have even scattered CHs through the networks. Furthermore, aside from phenomenon that two nodes, inside each other's communication range, become CHs jointly, but the possibility with this specific phenomenon is minimal in HEED. In HEED, CHs reach regular intervals chosen focused on two important parameters: residual energy and intra-cluster communication rate of the candidate nodes.

The merits of the HEED protocol are like follows: (1) It's often a wholly distributed clustering procedure that advantages of the utilization of both important parameters for CH determination; (2) Low power quantities of clusters encourage a boost in spatial reuse whereas high power quantities of clusters are mandatory for inter-cluster communication. This permits similar CH distribution within the network and load balancing; (3) Communications in a multi-hop approach among CHs and the BS help more energy preservation and scalability in mean the single-hop approach, *i.e.*, long-range communications directly from CHs to the sink, within the LEACH protocol.

C. DWEHC

Distributed Weight-based Energy-efficient Hierarchical Clustering protocol (DWEHC), is often a distributed clustering algorithm like HEED. The principle intent behind DWEHC is obviously to progress HEED by building balanced cluster sizes and optimize the intra-cluster topology in the design of position awareness of the nodes. Both DWEHC and HEED share numerous similarities including no assumptions regarding network size and concentration, and taking into account remaining energy in the technique of CH selection. All nodes implements DWEHC separately and the algorithm ends after numerous iterations which is often implemented in a dispersed manner. Distinctive from LEACH and HEED, DWEHC creates a multi-level organization for intra-cluster communication and restricts a parent node's quantity of children. Additionally, the only locally calculated.

The following could be the merits of DWEHC:

1. Exactly like HEED, it is often a wholly distributed clustering technique that's influenced by way of a intent behind the sensor's energy reserve and the closeness to the neighbors for CH determination.
2. Taking into consideration energy reserves in CH determination, DWEHC generates additional well-balanced CHs distribution and get a lot lower energy consumption in intra-cluster and inter-cluster routing than HEED.
3. The clustering means of DWEHC terminates in a few iterations, and doesn't be determined by network topology or extent.

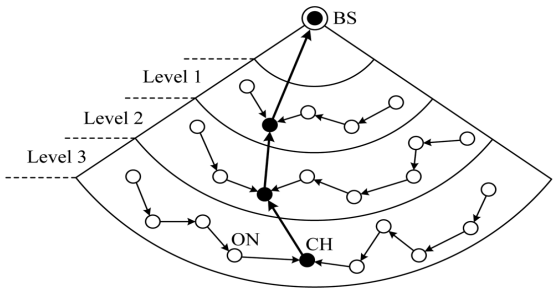

Fig. 3: Structure of Multi-level Cluster in DWEHC

D. PANEL

Position-based Aggregator Node Election protocol could be a position-based clustering routing protocol created for WSNs. Regarding previous CH selection protocols; PANEL supports asynchronous sensor network applications where actually the sensor node readings are fetched via the BSs. The key intent behind PANEL is to decide on aggregators, i.e., CHs, for reliable and persistent data storage applications.

The following are the main advantages of PANEL:

1. This protocol is surely an energy-efficient protocol to manage to ensure load balancing since everyone node is selected aggregator, i.e., CH, almost equally commonly. Moreover, data aggregation is completed and communication load is condensed, therefore PANEL can lengthen the network lifetime.
2. The wonderful attribute of PANEL which means it's diverse from previous data-aggregation based clustering protocols is that besides synchronous scenes, it as well supports asynchronous applications.

E. TL-LEACH

Two-Level Hierarchy LEACH (TL-LEACH) is just a development to the algorithm of LEACH. TL-LEACH uses the next two techniques to perform energy and latency efficiency: randomized, adaptive, self-configuring cluster creation and localized control for data transfers. In TL-LEACH, a CH gathers data from MNs as original LEACH, but alternatively of

transmitting data to the BS straight, it uses some CHs that lay among the CH and the BS being an exchange station.

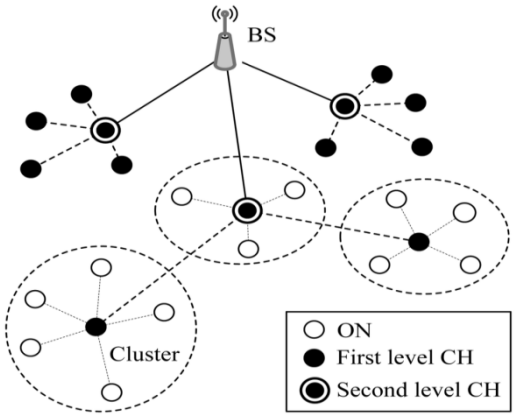

Fig. 4: Two-level Hierarchy in TL-LEACH

The merits of TL-LEACH are the following: (1) TL-LEACH uses random rotation of local cluster BSs, *i.e.*, primary CHs and secondary CHs, which brings about better energy load distribution through the entire network; (2) TL-LEACH uses localized coordination, that will be conductive to scalability and robustness in the network; (3) Weighed against LEACH, the scheme of two-levels clustering results in less average transmission distance, and less nodes are expected to transmit far distances to the BS via TL-LEACH. This effectively reduces the entire total energy consumption [1].

III. Related Work

Z.han *et al.* [10] has presented a General Self-Organized Tree-Based Energy-Balance routing protocol (GSTEB) which builds a routing tree having an activity where, for every and each round, BS assigns a root node and broadcasts this selection to any or all sensor nodes. Subsequently, each node selects its parent by considering only itself and its neighbour's information, thus making GSTEB an energetic protocol. Simulation results demonstrate that GSTEB carries a better performance than other protocols in balancing energy consumption, thus prolonging the duration of WSN. J. Peng *et al.* [2] Energy efficiency is one of the very most crucial issues of wireless sensor network (WSN). Since the capability mainly dissipates on data transmission, the data transmission has transformed into probably the most crucial problem of WSN recently. Otherwise, the data accuracy is another key factor of data transmission. To optimize these factors, a noble routing protocol is proposed in this paper. The proposed algorithm was arises from LEACH, and energy efficiency and latency was considered since the researching parameters. The overlap of detect regions was discussed and a nodes-adaptive schedule was designed to lessen the sum total amount of data with LEACH protocol. B.S. Mathapati *et al.* [3] developed a new energy efficient routing protocol called An Energy Efficient Reliable Routing Protocol for Wireless Sensor Networks (WSN) which be cluster based. Data aggregation was essentially used to gather and aggregate data in a power efficient manner to make sure network life was enhanced. Data aggregation protocols inclined to eliminates redundant data communication. Power consumption was an essential aspect to be viewed in the data aggregation that has been a restricted resource and we were holding irreplaceable. Along with power consumption, reliability was also of main concerned in data aggregation. Initially we created clusters and a coordinator node (CN) was selected near to the cluster to own the capability to examine the nodes in the cluster. The CN select friends head (CH) in each cluster on the basis of the ability level and the precise distance to the CN. The packets sent via the sensor nodes are aggregated at the CH and transmitted to the CN. The CN calculated losing ratio and compared it by way of a threshold value of loss ratio. Based with this value, the forwarded node calculation was incremented or decremented and the cluster size was adaptively changed, ensuring reliability and balanced energy consumption. S. Rani *et al.* [4] proposed EEICCP (Energy Efficient Inter Cluster Co-ordination Protocol) which adopted a layered approach for the clusters and communication on the group of clusters throughout cluster heads and cluster coordinators is prepared. They investigated the impact of uniform densely deployed network with new approach of layering of clusters with inter cluster coordination in relation to energy, time, reliability and complexity in wireless sensor networks of hierarchically clustered. Assumptions are created as it pertains to the nodes that individuals were holding arbitrarily distributed and were static, they'd identical quantity of energy, the coordinates of the BS and the dimensions of the sensor field were well-known. Selection sort with divide and conquer approach was used to transport out the preceded work of EEICCP. A. Jain *et al.* [5] aimed to define a whole new centrality metric "cluster optimal degree centrality "Our proposed centrality metric addressed the suitable degrees of member nodes alongside energy efficiency of a cluster. Finally in relation to the defined centrality metric, a Fuzzy Inference System based cluster head selection method has been proposed. The current results had established that the technique can successfully

prolonged the network lifetime and enhanced cluster head selection and generated high throughput when compared to LEACH, CHEF and LEACH-ERE. They'd proposed a whole new procedure of clustering in relation to cluster optimal degree centrality and expected residual energy. M. Saxena *et al.* [6] proposed an electric aware algorithm centred on clustering for longer time of MANET. In this technique network was split into small and self controllable groups for enhanced network lifetime. The proposed algorithm will be considered a power efficient clustering algorithm which used both scalability and energy metric for cluster layout. Maxheap was employed for collection of cluster head. The Clusters were designed using max-heap on the foundations of level of energy; the node which had the maximum energy in the cluster will behave as friends head. M. Samanta *et al*. [7] proposed a means to hold fault tolerant by function division. Firstly, the entire network was considered as some clusters. One cluster head was selected from all clusters and later numerous its functions were spreaded among its two neighbours. That is achieved this way that the vitality usage of the network gets minimised. In the span of reproduction they'd recognized that proposed schema reduced the cluster head load and prolonged the network life span. K. Nitesh *et al*. [8] proposed an algorithm for introduction of minimum degree of relay nodes with complete coverage and connectivity of the WSN with the limit of minimizing the conventional communication price. The algorithm was specialized in spiral sequence generated for randomly deployed sensor nodes. The simulation results established the potency of the algorithm. The proposed algorithm was specialized in spiral series generated from the handful of coordinates of the sensor nodes. The investigated results is likely to be on the other hand to the prevailing algorithm CRNSC and the suitable solution. They'd shown that the outcomes of our algorithms were very near to that one of the suitable solution and improved than CRNSC under various scenarios of sensor scope and density.

IV. Conclusion

This paper suggests that the GSTEB has neglected the using the three things: - (a) The effectuation of the mobile sink has been neglected by the all the prevailing researchers (b)The clustering has been neglected, one will offer level wise clustering to improve the outcomes further. (c) The effectuation of the compressive sensing has been neglected as the GSTEB is proactive routing protocol. To manage to overcome the constraints of the sooner work a fresh improved technique will be proposed in this near future. The proposed technique has the capacity to overcome the limitations of the GSTEB routing protocol utilising the compressive sensing and level based clustering. The proposed technique will be designed and implemented in the MATLAB tool. Various metrics is likewise used to measure the improvement of the proposed technique over GSTEB.

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The Concept of Rooting an Android Device and Issues

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***Abstract*—In this paper I have put my effort to describe the various aspects regarding the rooting process on Android devices like phones and tablets. A number of web pages are there that sys about rooting. A user having Android device wants to go for root his/her device without going into the details of this process. The rooting process must be done by an expert. In this paper the various pros and cons of the rooting process are discussed in detail. The steps to perform this process are also explained. The rollback of rooting is also discussed. Finally the various legality concerns are highlighted. If the user has already rooted the device then the various safety measures are highlighted. The main motive of this paper is to alert the users and force to think twice before root the device.**

I. INTRODUCTION

The process of rooting is not very difficult today but one must take some time to get the various aspects of this process. The various topics about this process that are discussed in this paper are:

1. What is rooting
2. Why rooting is performed
3. What are the possibilities of a rooted device
4. What are the risks involved with rooting
5. Is it possible to un root a rooted device
6. How rooting can be performed
7. Whether rooting is legal or not
8. How can be a rooted device is used without risks
9. Conclusion

II. WHAT IS ROOTING

Anyone with Unix/Linux background understands or is familiar the term *root access* that is a privileged access to maintain the system. The rooting is the same thing in case of an Android device. So by the term rooting means that full access to the device that means full control on the device. It can be seen as the administrator account in windows operating system. A rooted device or phone is highly customizable or in other words one can say that one can be the true owner of one's phone. The term rooting is sometimes related with jailbreaking, unlocking the boot loader and flashing (installing) ROM, but these terms are very different. The term jailbreaking is used as a process of bypass of Apple prohibitions for the device owner that includes modify the OS, installing unofficial applications etc. the term unlocking the boot loader is not the rooting but the essential condition for gain the root access. Normally it is the first step of rooting an Android device. After that one can get the root access by installing a Superuser application or by installing a custom ROM that has built in root access. The custom ROM is nothing but a modified version of Android operating system that has more capabilities than default ROM.

III. WHY ROOTING IS PERFORMED

It is said in the previous section that one can be the actual owner of the device only after gaining the root access. Think if someone gets the root password of a UNIX system. To get the optimum benefit from the device rooting is preferred. The next section describes the various advantages of a rooted device.

IV. WHAT ARE THE POSSIBILITIES OF A ROOTED DEVICE

A. Install a Custom Kernel

The kernel is a component of the operating system that communicates with the hardware and software. The default kernel has very limited access rights but the user can install a custom kernel that can be used for maximum utilizations of the device hardware. For example a custom kernel can be used to improve the battery life, charging speed, CPU speed and lots more. The *Kernel Manager* can be used for installing a custom kernel in very easy steps [2].

B. Install a Custom ROM

The custom ROM is the modified version of Android and a custom ROM can give a better life to the device than the preinstalled one. With the custom ROM the user can over clock the CPU, upgrade the phone even if the manufacturer has abandoned, change the appearance, enhance the battery life etc. One can get the best custom ROMs for almost every device from *XDA Developers* [3]. It is a best web site for those who have never rooted there device. The detailed documentations are given there with questions and answers that are very helpful for the beginners.

C. Uninstall Default/ System app /Crapware/ Bloatware

It is true that most of the android device comes with a number of preinstalled app that are not of use or consume the battery and other resources like storage space, internet etc. There is no other way to get off these crap wares until the device is rooted. The

Tittanium Backup is the app that can be used to get rid of these bloat wares but it requires the root access [2] [3] [4].

D. Block the Ads in apps

It is very common in every app whether it is a game or online shopping store it shows a lot of third party adds. These ads are getting better over time due to the maturity on computer graphics. Today one can see a walking beauty girl on the browser and flying birds etc. these ads slow down the browser's speed, consumes the internet data of one's limited data plan etc. one can get rid of these ads with the help of some ad blocking apps like Ad Free, Ad Block Plus, and Ad Away. These apps can work only on rooted devices. The Google Play has removed these apps so one has to find these apps from alternative web store but be sure before installing that these are not harmful in any way [5].

E. The Device can Support OTG Pen Drive

Today a new type of pen drive is available that comes with two point (micro/macro USB). Such type of pen drives can directly be plugged in the mobile phones. If the micro USB pint is not even then with the help of a cable (micro to macro USB cable) the pen drive can be attached. Some manufacturer like Apple/ Samsung/Google etc. does not provide this features but Sony provides this by default in some model like Xperia Z/Z1/Z2/Z3/Z3+ etc. To get this feature on every Android device root permissions are required. With this feature not only pen drive but keyboard, mouse, game controller and hard disk can be connected. Such feature can extend the storage capacity to much large amount and also the capability of the device [3].

F. Full Backup/ Restore Capability

Most of the new and almost every old android device do not provide the full backup/restore capability. Here full backup means system level apps and data along with user installed apps and data. It is a very useful facility that helps in a case like system crash/rolling back etc. Titanium Backup is very popular app for these kinds of activities and this app requires the root access rights. Backups are always handy because these backups save a lot of effort, time and money also. It may not seems necessary to backup the system apps and data but suppose you 2 years old baby has tried to unlock your phone with multiple tries and now the phone is locked and the option of internet data is not on at that time, you have no other option to erase all of your phone's data of internal storage. Consider and another scenario, if you have updated a very important app and the new one is not too useful then you have to roll back it. Titanium Backup is an app that is useful in such conditions [2].

G. Boost the CPU Speed and Improve Battery Life

The battery life can be enhanced of the rooted Android phone indirectly by uninstalling the unnecessary system apps and by making the CPU faster with set CPU app (available on Google Play Store). The set CPU app is useful to over clock the CPU so that processor can be utilized up to maximum level for better performance and under clock for better battery life.

H. Increase the Internal Memory

There are apps like Link2SD that are used to use a partition of the external storage as an internal memory (just like swap space in Linux). To work this app the phone must have root permissions. The steps to increase the RAM are shown on this link "http://www.droidiser.com/2012/05/howtoincreaseinternalmemoryandram.html"

I. Install a Firewall

On a rooted device one can install Droidwall app to create a firewall that gives user the choice which app can connect to the internet and which cannot. It saves a lot of data of one's internet plan [5].

J. Controlling on the Permissions of an Application

Every application installed on the Android device requires some permission. So before installing a particular application, its permission must be checked. For example if a wallpaper app requires the contacts detail etc. then you don't have any other option but to uninstall that app. But if the device is rooted then the app like Permission Denied can be very helpful to control the permissions of an individual application totally without uninstalling.

K. Better anti theft Solutions

A number of antitheft apps are available in the Play Store but the default configuration is not too secure for anti theft solutions, but if the phone is rooted then the user can have more control on the device e.g. the thief cannot uninstall any app. The thief will not be able to know even the device has anti theft is enabled or not.

L. Conversion between System App and user App

There may be a time when the default app is not suitable to your needs and the user installed version is more appropriate for the you, e.g. a keyboard, messaging, video player etc. if the device is a rooted one then it is possible to convert a user installed app into a system app and vice versa[5].

M. Improve the Speed of External Card

On rooted device an app named SD Speed Increase is used to increase the read/write speed of the SD card that can improve the quality of some applications if the SD card is used as RAM etc [7].

N. Others

A lot of other advantages of a rooted Android phone include change of boot animation, create own themes, change font, change the device name and a lot.

V. WHAT ARE THE RISKS INVOLVED WITH ROOTING

A. The Rooted Phone has no Warranty

It is true that the owner of a rooted android device cannot claim any warranty from the care centre. But a rooted phone can be unrooted and then everything is solved. However it is not true for every device. For example Samsung is using the KNOX security for S3, S4, Note 2, Note 3 etc. these devices void warranty even after unroot so please read some documentation before starting the root process.

B. Blocking the Installation of New Firmware

Some manufacturers like Samsung block the installation of new firmware on a rooted device with the help of a new concept KNOX Void Warranty. In such case one cannot update its device with new official versions [7].

C. Bricking the Device

The rooting process can be a little bit risky if not properly handled. There is a chance that the device is not in working condition and becomes a brick. But one has backed up the data or if one has some internet knowledge he can cope up with this situation. Even some good web sites are available to help in unbricking the device e.g. unbrick.itcse.com etc. if the process of rooting is performed as the documentation says than the chances of bricking is very low.

D. Risk in Online Transactions

Every online transaction redirects you to the banking sites for authentication. Some lazy users save the authentication details within the browsers files that are stored somewhere in the device storage and any malicious app can read these details and can send to the app maker. But if the device is not rooted then no app can have tools to access these files [1]. The users must also carefully read the privacy policy and the terms and conditions before installing any banking app.

E. Attacks of Hackers

A rooted device is more open to hackers because it has now root access and any app that is maliciously coded can get the root privileges that are very dangerous. It is same as the root account is used for normal operations all the time on a computer system [4].

F. Virus Attack

Even the unrooted devices are not safe from virus attack but the chances are more on a rooted device because apps from unauthentic recourses can get the files that are not available in unrooted device and infect the operating system. This risk can be minimized by installing apps only from authentic web store and carefully examining the permissions required by an app even on an authentic web store [4].

G. Performance Degradation

It is there because of one's negligence i.e. if the user continues to install unnecessary, buggy and incompatible apps then these apps will slow down the overall system. Install only the required apps from well known app store and also check the compatibility of the app with the operating system version.

H. Is it Possible to un Root a Rooted Device

Yes it is possible to unroot the rooted device with the same application that is used to root it. On the software like KINGO ROOT that is used to root most of the devices has a link to "Unroot" or "Remove Root" to unroot the device as it was before rooting process. After unroot one can reclaim the warranty of the device [5]. However some of the manufacturers like Samsung permanently void the warranty even after the unrooting is done. They use Knox Void Warranty 0x1 as an eFuse [6] that is permanently set when the device is flashed with a custom ROM. It cannot be reset to 0x0. So before rooting is done one must go through the detailed documentation about the particular device on the web.

I. How Rooting can be Performed

There are a number of applications software available e.g. Framaroot, Towerlroot, CF-Auto-Root, Kingo Android Root etc. These apps provide one click facility to rot almost any Android device. The steps to root Sony Xperia Z device are highlighted below:

1. First of all download and install Kingo root Android from www.kingoapp.com[10].
2. Now launch this application by just double clicking on it. (internet connection is required)
3. Now plug the Xperia Z with the laptop or desktop. The Kingo Android Root will automatically download and install the driver required for the device. (for windows 8 some configurations must be changed that can be known on the www.kingoapp.com)
4. Now enable the USB Debugging Mode on the device. If the device has Android Lollipop version then these are the steps to enable USB Debugging:
    a. From home screen open the apps and select Settings app
    b. Scroll down and click on About Phone
    c. Click 76 times on Build number till a message "You are now a developer!" appears.

5. Again go the Settings then go the Developer Options and here a on the check box USB Debugging.
6. Now rooting is just one step ahead so read the each notification very carefully before going to the next step.
7. Finally click on the ROOT button on the Kingo Android Root software.
8. After the successfully rooting process click the "Finish" button the restart the Android device. Normally the device will open up a window to get Superuser permissions that must be granted by the user. The Kingo Android Root will show the ROOT status YES. Note that this application allows the user to one click way to unroot the device by pressing "Remove Root" link.

VI. Whether Rooting is Legal or Not

In most of the countries like Australia, United Kingdom, India, European Union, Singapore and Canada rooting is not an illegal process if it is used for legal and non-copyright-infringing purposes. In United State this rooting is illegal except for some exemptions for tablets [11] [12] [13] [14] [15] [16] [14].

VII. How can be a Rooted Device is used without Risks

The rooting is not a black magic that does all adverse by itself. Actually rooting is a process that opens up the super user account to do any task in the system. Android is a Linux based operating system in which everything is a file. After rooting the super user account is open and any malware can see these files that are not possible if the device is not rooted. The layer of security is weak on a rooted phone but there are some points to remember for those users who like to root their device:

a. Never install any app from non trusted app store.
b. Read permissions details carefully before installing an app even on trusted app stores (specifically rot only app)
c. Don't use any banking app or browser to make banking transactions.
d. Use only those browsers that support encryption.

VIII. Conclusion

In these days rooting is very popular on web. A number of links are in favor of this process. A number of advantages are discussed with details. But it is also true that rooting cannot do any miracle. It is a funny process that makes the operating system. Some new feels but as far as the security is concerned this process must be avoided because it weakens the security layer of the device. If the user is not a sophisticated one that he can try this process but it is also very true that more power comes with more responsibility. In case of rooting process this is the fact.

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Pyretic: SDN Programming Language

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***Abstract*—Software Defined Networking (SDN) SDN has made network management easier and better by decoupling control plane from the data plane. The programmable controller which represents the control plane has direct control over data plane which represents underlying switches using Open Flow protocol. But current controllers offers assembly language type low level programming interface. In this paper, we are introducing high level programming interface called Pyretic. Pyretic is python embedded domain specific language. It offers higher level of programming abstraction, modularity enabling creation of quality SDN applications. It uses multiple independent modules for building applications.**

Keywords: SDN, Open Flow, Pyretic, Frenetic, Domain Specific Language

I. INTRODUCTION

The management of network is very complex and tedious task. The computer network consists of large number of network devices such as routers, switches and various middle boxes such as firewalls, load balancers, network address translators having complex protocols on them. Network operators are responsible for configuring individual network devices using configuration interface.

The problem with traditional networks is that software is bundled with the hardware and interfaces are vendor specific. Vendors write the code and there are long delays in introducing new features and functions. Implementing networks is expensive. In Traditional switches there was tight coupling between control and forwarding planes. In this type, due to tight coupling introduction of new applications and functionality was very difficult. Configuration of network devices was also very difficult due to lack of common control interface.

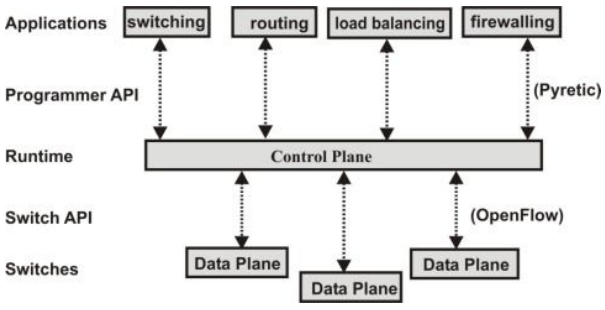

Fig. 1: SDN Architecture

SDN [2,3] separates the data plane (forwarding plane) from the control plane. SDN was developed to enable innovation and simple programmatic control of forwarding plane as shown in Fig 1. Separation of forwarding plane from control plane allows easier deployment of new applications and simplified protocol management.

Software Defined Networking (SDN) is futuristic architecture that is powerful, easy to manage, less expensive and flexible, making it suitable for today's dynamic, high bit rate applications. SDN allows control plane to be programmable. It abstracts underneath infrastructure. The SDN controller instructs the switches as to what actions they should perform through southbound API. Open Flow is rapidly becoming the most efficient way for communication between SDN controller and switches.

The development of first generation SDN controller platforms offer software engineers a low level API to interact with the Open Flow switches. This allows programmers to program the switches using low level language called "assembly language," by changing bit positions in packets.

Frenetic [5,6,7] family of SDN programming language offer software engineers a high-level API. Pyretic is one part of the frenetic family. This allows programmers to create SDN Applications with high level abstraction. The abstractions cover the principle of managing the packet forward policy, checking network conditions and update policy to react to network events. In this paper, we will explain SDN programming language Pyretic [8], that is python based platform and allows software engineers to create complex SDN applications. Pyretic is both domain-specific and programmer friendly language embedded in Python. Although previous work doesn't address a way to build one application out of multiple independent modules, reusable network policies that have an effect on the process of an equivalent traffic.

The outline of this paper is as follow. In section II we introduce Open Flow protocol. In section III we describe pyretic programming language. In section IV we introduced Pyretic applications final Section contains conclusion.

II. OPEN FLOW PROTOCOL

The Open Flow [1,10] specification allows software applications to program flow table of different switches. The Open Flow architecture consists of three main components: an Open Flow enabled or native switch, controller and a secure channel to connect switch to the controller. Switches use flow tables to

forward packets. There are number of flow entries are contained in each flow table. Flow entry contains large number of rules, instructions, counters which decides how packets belonging to particular flow will be handled. Flow entry consists of 1) Rules used to match incoming packet. Match field can be ingress port, dst IP, dst MAC address. 2) Set of instructions determines how to handle matching packets. 3) Counters are used to collect parameters such as number of received packets, duration of flows. When packets arrive at switch, they are matched against flow table entries. If match is found, appropriate action is performed according to flow table entry. If no match is found, action is taken as specified in table-miss entry. The action could be dropping the packet or forwarding the packet to the controller over secure channel.

Each Open Flow switch has a flow table [4], where each flow entry includes:

- *Bit pattern (matching fields):* There are number of matching fields that are used for matching the incoming packets. The matching fields could be source MAC, dst MAC, src IP address, dst IP address, src port, dst port etc.
- *Priority*: To Relative importance of flow table entries. High priority means more important entry.
- *Actions*: for example, flood, drop, forward to output port, send to controller, modify header field, etc.
- *Counters*: It is used to collect statistics regarding various parameters such as number of bytes and packets received on per port.

When packet enters into the switch, switch matches the packet with matching fields, apply the action on packet and update the counter. There are more number of matching fields are available in next versions of Open Flow protocol.

Pyretic is a domain specific language that forces network programmer to write policies with high level of abstraction and combine the number of policies with different ways. The main advantages of pyretic are that we can develop a complex SDN applications from large number of independent modules. In Open Flow programming, the development of SDN control application from different modules is very complex task because module might interfere with one another. Traditional programming forces the network programmer to carefully combine the number of modules by hand but Pyretic program combine a large number of policies with the help of composition operator that may be serial and parallel composition operator.

III. PROGRAMMING LANGUAGE PYRETIC

The combination of large number of independent modules where every part specifies how the packets should be handled is necessary of building standard SDN applications. The serial and parallel composition operators provide straightforward, powerful, ways to combine policies generated by completely different modules [9].

A. *Pyretic Policies*

Pyretic strategy is a function that takes a packet as input and returns collections of packets. This function describes what the network switches must do with incoming packets. For example a function that takes any packet and returns the empty set once applied because the overall network policy can cause the network to drop all packets. List of policies are shown in Table 1.

TABLE 1: LIST OF POLICIES

Policy	Syntax	Example
match	Match(f=v)	Match(dstmac=EthAddr (00:00:00:00:00:01))
drop	drop	drop
identity	identity	Identity
Modify	Modify(f=v)	Modify(srcmac=EthAddr (00:00:00:00:00:01))
Forward	Fwd(a)	Fwd(1)
Flood	Flood()	Flood()
Parallel Composition	A+B	Fwd(1)+fwd(2)
Sequential Composition	A>>B	Modify(dstip=IPAddr('10.0.0.2') >>fwd(2) match(switch=1) >> flood()

For example a function that takes any packet arriving at a given location and returns the collection of packets which are similar to the original packet however situated severally at the ports at that switch that lie on the network spanning tree, applied because the overall network policy can cause the network to flood all packets. However, Pyretic policies are often designed from different policies using composition operators such as parallel and sequential composition operators.

B. *Bit Patterns to Boolean Predicates*

In Open Flow standard, the packets are matched using bit design in the header fields, wherever each bit may be 0, 1. But, expressing a policy using bit design is very complex task. Consider an example; we want to match all packets that do not go towards destination IP address "10.0.0.1" needs two rules. The first rule matches all packets that go towards destination IP address "10.0.0.1". All other remaining packets are included in second rule. Matching either 10.0.0.3 or 10.0.0.4 needs two rules, one for each IP address.

Instead of changing the bit patterns in packet header fields, Pyretic permits network programmers to write simple predicates in the form "match(field=value)", means that a field f match with value v. They can then construct more difficult predicates using standard Boolean operators such as or (|), and (&) and not (~). All these predicates act as filters. Incoming packet is first match with the

predicate, if it is match with the predicate, then packet is processed by next predicate of the policy. If the packet does not match with the predicate, it is dropped. For example, in Pyretic we can simply write the following predicate:

~match (dstip='10.0.0.1')

(match (dstip='10.0.0.3') | match(dstip='10.0.0.4'))

C. Policy Composition Operators

In traditional Open Flow programming, controller runs multiple applications that have an effect on handling same traffic. Instead of writing one application, network programmers should be able to combine multiple independent applications. The main problem with traditional Open Flow programming is that, these applications can easily interfere with each other. One application can easily overwrite the rules installed by another application. To solve these problems pyretic provides two composition operators that allow network programmer to combine policies in parallel and in series.

1. *Serial Composition*: In Serial composition (>>), the output of one policy act as an input to another policy. Consider an example:

match(dstip='10.0.0.1') >> fwd(1)

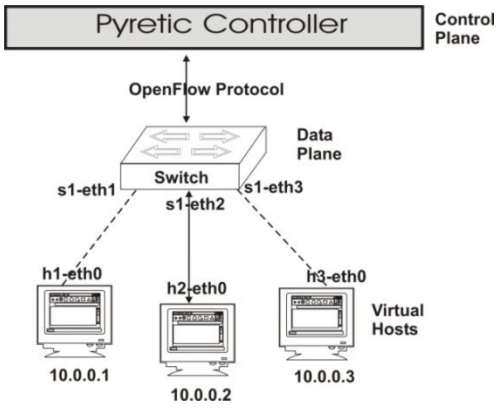

Fig. 2: Network Topology

In this policy, all packets whose destination IP address is '10.0.0.1' are filtered out by the match predicate. The (>>) operator place the output of first predicate in sequence with the forwarding policy named fwd(1). So that all packets that are pass through the match predicate are forwarded to output port 1. We can also write the policy in following way.

Match (switch=1) >> match(dstip='10.0.0.1') >> fwd(1)

It means that packet placed at switch 1 and destination IP address '10.0.0.1' should be forwarded to output port 1. This code uses serial composition operator to combine the three independent policies. Packet filters by first predicate and then by second is equal to conjunction (&) of two predicates.

2. *Parallel Composition*: The result of Parallel composition (+) is the sum of applying two policy functions on the same packet. For example, a policy P can be defined as:

P = (match(dstip='10.0.0.1') >> fwd(1)) + (match(dstip='10.0.0.2') >> fwd(2))

```
from pyretic.lib.corelib import *
def main():
    return flood()
```

Listing 1 Hub Application Code

The packets are forwarded to output port 1 whose destination IP address is '10.0.0.1'. While those forwarded to output port 2 whose destination IP address is '10.0.0.2'.

IV. Pyretic Applications

Using Pyretic controller, we can develop various applications. The application could be a switch, router simple hub or could be complex middle boxes such as firewall, intrusion detection system or load balancer. Here we will only explain the simple hub and firewall applications written in Pyretic language.

A. Hub Application

The simple open flow device is converted into a hub device by adding a flood action into the flow entry of flow table. In the topology shown in Fig. 2, all hosts belong to the same network. If host h1 wants to communicate with host h3, then host h1 first send a packet at port 1 of Open Flow device. After receiving the packet, Open Flow device match this packet against flow entry. If match is found, packet is send to all ports except the incoming port. If match is not found, then packet is send to controller.

#mn --mac --topo single,3

Run the hub code (code file name is hub.py) shown in Listing 1 by using the following command.

$./pyretic.py pyretic.modules.hub

The amount of code needed to implement hub application in Pyretic is very less as compared to POX [11].

B. Firewall Application

According to the Firewall application, the controller inserts the flow entries into the flow table of switch to disable the communication between each mach pairs that are specified in the firewall policy file.

Run the firewall code (code file name is firewall.py) shown in Listing 2 by using the following command. Firewall Policies are shown in Listing 3 contains MAC pairs to disable all communication between host (h1) and host (h2).

$ pyretic.py pyretic.examples.firewall

```
from pyretic.lib.corelib import *
from pyretic.lib.std import *
import os

from pyretic.modules.mac_learner import mac_learner as act_like_switch
policy_file = "%s/pyretic/pyretic/examples/policies.csv" % os.environ[ 'HOME' ]

def main():
    rules = []
    with open(policy_file, 'r') as f:
        for line in f:
            try:
                rule = line.strip().split(',')
                if rule[0] != 'id':
                    rules.append((MAC(rule[1]), MAC(rule[2])))
            except:
                pass

    not_allowed = none
    for mac_0, mac_1 in rules:
        not_allowed = not_allowed | match(srcmac=mac_0,dstmac=mac_1) | match(srcmac=mac_1,dstmac=mac_0)

    allowed = ~not_allowed

    return allowed >> act_like_switch()
```

Listing 2 Firewall Application

```
1 id,mac_0,mac_1
2 1,00:00:00:00:00:01,00:00:00:00:00:02
```

Listing 1 Firewall Policies

If everything has been done and setup correctly then host (h1) is not able to ping with host (h2). But Host (h1) is able to ping with host (h3) because there is no flow entry installed to disable the communication between them.

V. CONCLUSION

Pyretic is a domain specific language that is used for creating large, complex and sophisticated controller applications out of small self contained modules. Pyretic is called next generation Openflow programming. In traditional OpenFlow programming, the low level language is used to provide the instructions to the OpenFlow switch for handling the incoming packets. But pyretic programming is high level language to instruct the OpenFlow switch is to what to do with the packet. Instead of changing the bit pattern of the packet, pyretic allows the programmer to write a basic predicates. The development of control application using pyretic is much easier than the traditional OpenFlow programming.

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Real World Applications of Brain Computer Interface—A Review

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***Abstract*—Brain Computer Interface(BCI) also called as mind machine interface(MMI).Brain computer interface is a technology which allows a human to control a computer, peripheral or another external device just by a thought. It is a communication system that does not depend on the peripheral nerves and muscles. BCIs are often directed at assisting, augmenting, or repairing human cognitive or sensory-motor functions. The brain signals are recorded by EEG. Various real world applications of BCI have been reviewed in this paper.**

Keywords: Brain Computer Interface (BCI); Electroencephalograph (EEG)

I. INTRODUCTION

Brain computer interface is a state of art technology which translates brain signals to predefined commands that can be used to communicate with other people and a peripheral device [2]. Brain computer interface (BCI) was introduced in the early 1970's. It is a direct pathway for communication between brain and an external device, where the communication is based on the neural activity. The research and development field of BCI has been focused on the neural prosthetics that aim at restoring sight, hearing and movement. Neural activity of brain is measured by either of the two techniques a) Invasive technique b) Non Invasive technique. Invasive technique need surgery to place electrodes directly inside the cortex and Noninvasive use electroencephalogram (EEG),Blood Oxygen Level Dependent (BOLD), DE oxyhemoglobin but EEG is preferable because of its low cost and convenience. Most of the people have misconception that BCI read minds but no, rather BCI systems are trained on subject specific EEG data before real time BCI use is possible, depending upon the type training time can vary from minutes to hours. Review based BCI articles have defined a number of BCI goals. Some of these goals are a) Expansion and improvement of technologies used for signal processing, feature extraction, and classification b) Expansion and improvement of BCI existing paradigms c) practical application of BCI technologies. Percentage of EEG based BCI articles related to the BCI techniques development have decreased but the papers introducing new paradigms and practical applications are more than doubled between 2007 and 2011. Number of BCI studies has significantly increased with the goals of development of practical applications [6]. BCI tools help user in communication, daily activities, movement, and environmental control. In this paper we will have a review on the applications of BCI.

II. CLINICAL APPLICATIONS OF BCI

BCI has its applications in various fields like medical, entertainment, research and development and many more. Different applications of BCI are generalized in two categories a) Clinical Applications b) Non Clinical applications. Clinical applications include the services provided to the patients suffering from ALS, cerebral palsy, brainstem stroke, spinal cord injuries. Potential BCI users are categorized on the basis of their extent of disabilities. Patients are categorized in 3 groups a) People who are completely locked in b) People who retain only a limited capacity of neuromuscular control such as weak eye movement or sometimes muscle twitch c) People who retain substantial neuromuscular movement.BCI serving to patients is not clear to a particular extent; it needs each individual to be evaluated on the aspects like alertness, attention, visual or auditory capacities. This is issue is not resolved. The second group includes most of the patients who are at the last stage of ALS, BCI system provide communication and control which is more reliable than conventional technologies. People in the last group are not best served with BCI. They are served best with conventional technologies [4]. BCI has following important aspects.

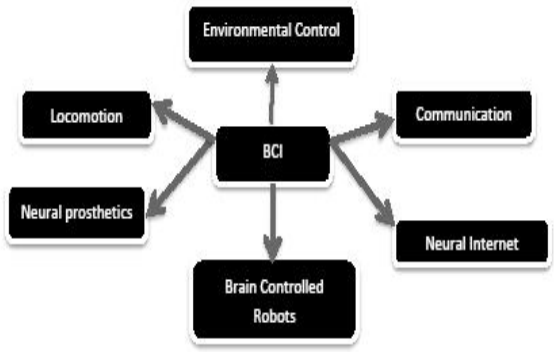

Fig. 1: Applications of BCI

A. Communication

Locked in person cannot communicate as they are completely paralyzed and unable to speak they can only move eyes. BCI paradigms help those patients to

communicate by using simple binary (yes/no) capabilities, virtual keyboards which work as a mental speller. P300 is one such type of speller. P300 is a neural evoked potential component of EEG. The P300 is endogenous component. In this patients are subject to events that can be categorized into two different categories events in one of these categories are rarely displayed, when an event from rare category is displayed it elicits a P300 component. In P300 speller patient can input text just by a thought. Online experiments showed that this speller has significantly improved performance P300 based articles given two types of P300 speller which are a) FD speller it is also named as Farewell Donchin paradigm in this speller patient is presented a six by six matrix of characters, the patient is supposed to focus on the alphanumeric symbols one at a time, according to the articles based on p300 speller rows and columns of the matrix are intensified for 100 ms followed by 80ms of non-intensification. EEG signal is sampled at 250 Hz. 25 channels around central scalp are chosen out of the 64 channels to acquire required data.

b) SD speller is also known as single display paradigm, in this speller all letters and numbers are displayed first and when the speller starts, each single character is flipped randomly for 60ms[5].

Fig. 2: Mental Speller

B. *Environmental Control*

Paralyzed person to some extent is dependent on others for their daily activities. They most of their time at home. Recent studies has integrated BCI technologies with a domestic environmental control patient can easily operate lights, bulbs, motorized beds, alarm, computer etc. So many experiments have been performed on this one of the validation of this system had taken place in a simulated home environment and fourteen normal person and four person suffering from spinal muscular atropy are tested, the patients had performed this with 60-75% accuracy[4].

C. *Locomotion*

Another application of BCI is locomotion that is helping a disable person to move from one place to other by themselves only. Many BCI research and development groups have tried to develop BCI driven wheelchairs. EEG detects directional commands and applies to direct control of the BCI driven wheel chair. Patient is supposed to select destination from a menu of destinations. But adding new directions to it is difficult so these wheelchairs are hardly demanded. One such type of wheelchair is called aware chair, it is a context aware intelligent power wheelchair which integrates environmental control, communication, and multilevel prediction based on user history [5].

Fig. 3: BCI based Wheelchair

D. *Neural Internet*

In BCI, neural internet is a new advancement which can help locked in patient to operate a web browser directly with their brain signals. The university of Tubingen developed a web browser controller to be used with their thought translation device, but for this users are required to select from an alphabetized set of links, but it can cause problem if the link names are identical [3].

E. *Neural Prosthetics*

Neural prosthetics is another application of BCI, it supports subject with motor disability to restore movement. Cortical signals have been used to control hand orthosis. Locked in subject use neural signals to control virtual hand to restore movement.

F. *Brain Controlled Robots*

Robots based on BCI also help disable patients in their daily and professional lives. An EEG based robots use EEG based BCI's to receive human control. Brain controlled robots are divided into two group first group is directly depended upon BCI and the second group depends upon intelligence of robots. In the first group robot user is the in charge of his movement as much as possible along with this these robots do not need any additional robot intelligence their cost is low. Performance of these robots depends on the noninvasive BCI's which is slow and uncertain so ultimately it limits the performance of robots. Second group based on shared control of BCI user and the intelligent controller share the control over the robots. Unlike first group second group depends upon the intelligence of robots and have high cost because of the laser sensors [5].

III. Non Clinical Applications

A. *Neurogaming*

Neurogaming is one another application of brain computer interface and also it is a new field in gaming. In neural gaming as its name suggests, users interact with the console without using any conventional controller. Some of the neural gaming software use user's brain waves, expressions, heart rate, eye movement to complete the tasks. This interaction between player and gaming software help the user to have more realistic experience of gaming. Neural gaming allows users to utilize their psychological state and have their reactions transfers to games in real time.

Fig. 4: Neurogaming

IV. Creative Expressions

Along with communication and control with/of external devices BCI is improving quality of life by creative expressions. It has been studied in the context of music and visual art.

A. *Music*

The Plymouth Brain Computer Music Interface (BCMI) project provides a control interface to generate music from EEG signals. The BCMI piano study incorporates the BCI with music engine and that is influenced by the output of a classifier that identifies the most prominent frequency in the brain signal [3].

B. *Visual Art*

The Brain painting application was originally developed for an artist who was locked by ALS. She was able to create visual art by imagining language tasks to influence the colors and shading of abstract act with a painting program [3].

V. Conclusion

In this paper we have reviewed about brain computer interface and real world applications of brain computer interface. Applications are divided into two categories a) clinical and b) Non clinical applications. Brain computer interface (BCI) is helping people with motor disability to do their daily activities without anyone's help. Applications include environmental control, communication, locomotion, neural prosthetics, neural internet and neural gaming.

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Image Stitching using Fuzzy RANSAC with Multimodel Fitting

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***Abstract*—This paper represents the enhance method of image stitching based on hybrid of two stitching algorithms. Image stitching includes three main mechanisms. Firstly feature points are detected through speeded up robust feature (SURF) and scale invariant feature transform (SIFT) algorithms and feature points are matched by finding normalized cross correlation between them. Secondly random sample consensus (RANSAC) with homography constraint is used to remove the outliers. In this article Ransac works on multiple data sets generated from sift and surf, increase the number of extracted features and number of correctly matched features and remove the outliers by using multi model fitting method. Thirdly the image is merged by using blending technique to overcome the problem of color differential in the image. This experimental result corroborate that this method has supercilious quality of image stitching.**

Keywords: SIFT, SURF, Hybrid Approach, RANSAC, Fuzzy RANSAC

I. INTRODUCTION

The process of image stitching consist of many steps which cause lot of challenges for the researchers as to create a high quality image. The stitching process must be efficient in terms of lowering the noise level, reducing distortion, reducing blur, reducing unwanted artifacts and most critical is pixel unwanted color matching along with geometric dimensions at 360 degree. Each of these problems can be solved in multiple ways. Different researchers have approached and solve this problem differently. However in this research paper we will discuss the steps that can be taken to reduce no. of residuals and outliers which occurs while creating a trend line. It helps to match the features of the images in question. It is commonly found that major thrust in this area is on algorithm like ransac, least square method etc. The ransac algorithm is most widely used method for removing outliers for processing image stitching task. The ransac algorithm basically works on taking two inputs which needs to have some level of correlation. If this correlation is reaching zero, the essence of ransac fails. Sometimes it needs to deal with lot of non linear datacurve which is hard to fit. It is essentially a process of fitting line in two dimensions to the set of observations, one dimension comes from the first image and the second comes from the second image to be stitched. These set of observations are feature sets which are computed from algorithm like sift or surf the problem may occur if we need to build a hybrid system. In that case we have two sets of observations which needs fitting or way to remove outliers. In that case fuzzy Ransac needed.

This article presents an improved image stitching algorithm based on fuzzy Ransac which will do multimodel fitting. The flow chart of image stitching is shown in Fig 1.

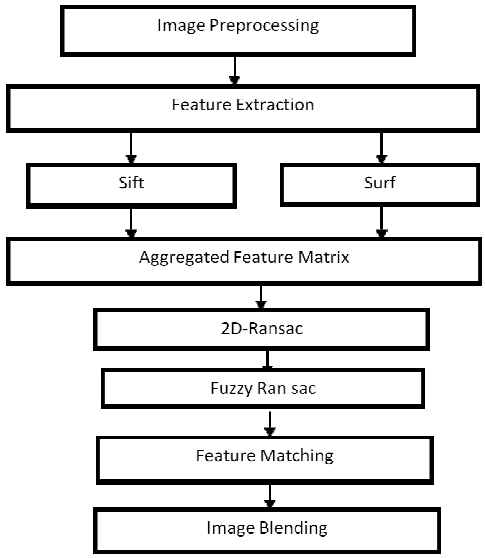


Fig. 1: Image Stitching

The research design of these steps is based on proven methods solicited from high impact journal research and it try to overcome the limitations of previous algorithms in terms of feature extraction

II. IMAGE STITCHING BASED ON FUZZY RANSAC

A. Implementation

The methodology is based on implementation steps of flowchart. This flowchart includes every single step of image stitching.

1) Image Preprocessing

Image preprocessing is the process of rectification of bending, corruption and noise in the imaging process. Image preprocessing includes:-

a. Matching dimensions of images
b. Matching color space models of images
c. De noising of images

In the proposed methodology we have matched the dimensions of an image by bilinear method. After that matching the color space model [3] of image by using novel method [7]. Finally the removal of noise of image by using linear filter. The above method are only used when an image requires preprocessing.

2) Hybrid Feature Extraction

In this we will extract the features by using SIFT and SURF. For image stitching it is important to extract the features. The steps for implementing the SIFT [5] and SURF [5] are defined below:-

1. Implementation of SIFT:

SIFT basically involves four stages for the feature detection:-

a. Scale Space Extrema Detection
b. Key point Localization
c. Orientation Assignment
d. Key Point Description

2. Implementation of SURF:

SURF is basically an image detector and descriptor. SURF feature point extraction basically includes two stages:-

a. Feature detection
b. Feature points description

3) 2-D RANSAC

In this step we will apply Random sample consensus (RANSAC)[8]. This is an iterative method to estimate parameters of a mathematical model from a set of observed data which contains outliers. There are two problems which will be solved by RANSAC:

a. First there is the problem of finding the best match between the data and one of the available models.
b. Second there is problem of computing the best values for the free parameters of the selected model (the parameter estimated problem).

4) Fuzzy RANSAC

In the fourth step top 50 strongest features from SIFT and SURF are collected and a feature matrix is developed. The two matrix are processed based on set theory and secondly similarity distance between these two matrix is processed.

5) Feature Matching

By comparing the descriptors found by the said algorithm matching pairs are found. If the Euclidean distance between the matching pairs is close to zero. The matching points are considered same and image stitching is possible.

6) Image Blending[9]

After removal of outliers we have to merge the image to make the seam invisible. This is called image blending. In this step we will use gradating in and out amalgamation algorithm to make the edge seam invisible.

7) Image Mosaic

Finally in the last step, we paste the warped images and blend them on a common mosaicing surface [1] to build the panorama result and properly stitched panorama came out.

B. Implementation of RANSAC[2]

The steps for this algorithm can be given as:

a. A model is fitted to the hypothetical inliers, i.e. all free parameters of the model are reconstructed from the inliers.
b. All other data are then tested against the fitted model and, if a point fits well to the estimated model, then considered as a hypothetical inliers.
c. If many points are obtained from the hypothetical inliers, the model is re-estimated very accurately.
d. Finally, the model is evaluated by estimating the error of the inliers relative to the model.

This procedure is repeated a fixed number of times, each time producing either a model which is rejected because few points are classified as inliers or a refined model together with a corresponding error measure. The output of the RANSAC algorithm can be shown as given below in Fig. 2.1

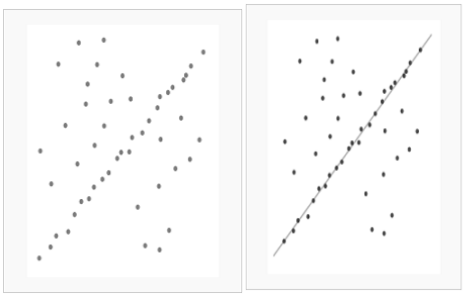


Fig. 2.1: Outlier Elimination using RANSAC

C. Implementation of FUZZY RANSAC

a. Let ‘A’ be matrix representing SURF features $\{n \leq 50\}$.
b. Let ‘B’ be matrix representing SIFT features where the size of set ≤ 50.
c. Now apply formula $|A \cup B| = |A| + |B| - |A \cap B|$.
d. Let ‘C’ be the matrix received after applying this formula.
e. Now get (index, value) from A,B matrix.
f. Now compute cosine similarity between these matrix. If the distance is close to zero, keep the values index pair, else discard.
g. Let D be the final matrix. This is hybrid matrix which will be used for stitching.
h. Now run RANSAC to eliminate outliers from matrix ‘D’.
i. Find anti correlation if anti correlation is close to 1 then process further.

This algorithm find out the strongest feature points which has been done better matching and stitch the image with better accuracy.

III. Results and Discussion

In the previous work researchers calculate the accuracy of stitching, time taken for image stitching, cost incurred for stitching and computation speed required for image stitching along with other objective parameters like PSNR etc. In the current research work it is wise to evaluate the feature characteristics of the feature extraction algorithms. Since we are fusing them together to build a hybrid dataset of features. The idea must be valid and must offer better accuracy in the proposed hybrid scheme. Therefore to evaluate this process we propose following performance evaluation parameters.

A. Performance Evaluation

The performance of proposed algorithm is calculated by using following two parameters:-

1. Number of features extracted
2. Number of correct matched features
   a. *Number of features extracted*: These are basically points of interest in image where the image is transformed in to coordinates and that help to match points from other image. These points may be weak or strong depending on their location with respect to its neighbouring points.
   b. *Number of correct matched features*: By comparing the descriptors found by the said algorithm matching pairs are found. If the Euclidean distance between the matching pairs is close to zero, the matching points are considered same and image stitching is possible.

B. Comparison of Existing System and Proposed System

The comparison between existing system and proposed system is done by comparing the parameters as number of features extracted, number of correct matched features of the existing and proposed system. The objective of proposed system is to increase the number of extracted features and number of correct matched features so that the image is stitched with better accuracy and well stitched panorama comes out.

TABLE 1: EXTRACTED KEY POINTS IN IMAGE 1

Sl. No.	Existing System Feature Points Extracted		Proposed System Feature Points Extracted
Dataset1	Extracted Surf points	Extracted Sift points	Extracted Hybrid points
Image 1 (building-a1.jpg)	200	200	400

TABLE 2: CORRECTLY MATCHED KEY POINTS IN IMAGE 1

Sl. No.	Existing System Correctly Matched Points		Proposed System Correctly Matched Points
Dataset1	Correctly matched Sift points	Correctly matched Surf points	Correctly Matched Hybrid points
Image 1 (building-a1.jpg)	30	40	100

1) Graphical Interpretation

It is clear from the graphs that the hybrid method of feature collection is yielding better results in term of visualizing image. It is also clear from the graphs and their values show that the more no. of features are extracted and are evaluated for matching. Since more features are extracted, more accurate matching points are received. The algorithm runs on three multi images. It is clear that fuzzy theory is helpful in getting most common matching points. The fuzzy RANSAC eliminates more wrong inliers as compared to the previous algorithm. There is not much addition overload of fuzzy operation as this overload is offset when accurate points are matched.

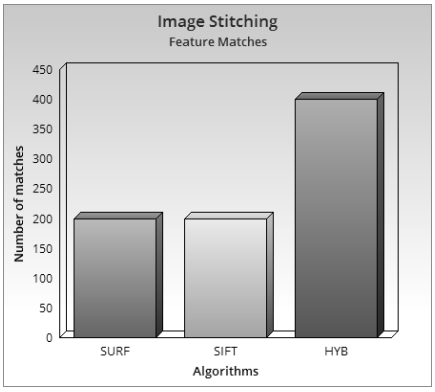


Fig. 3.3: (Building_a1.jpg) Graph of Number of Matches of Existing System *vs*. Proposed System

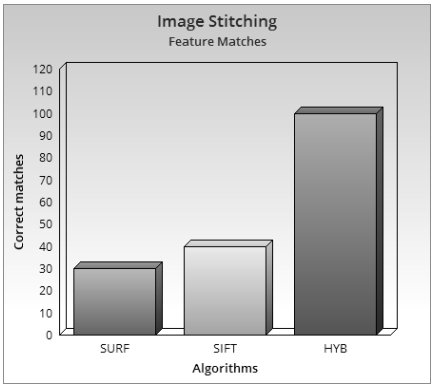
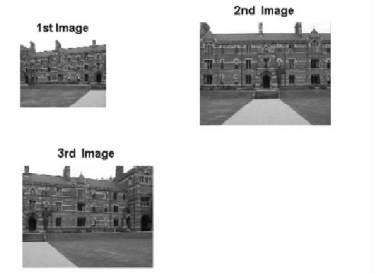


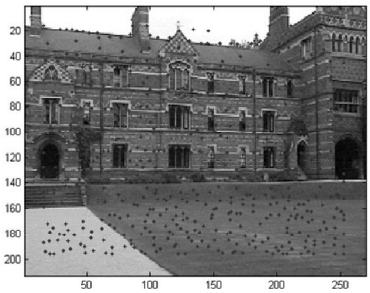
Fig. 3.4: (Building_a1.jpg) Graph of Number of Correct Matches of Existing System *vs*. Proposed System

2) Experimental Analysis

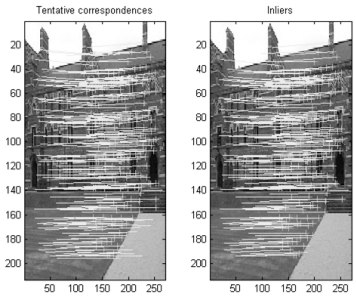
Our experimental environment consists of MATLAB R2013a



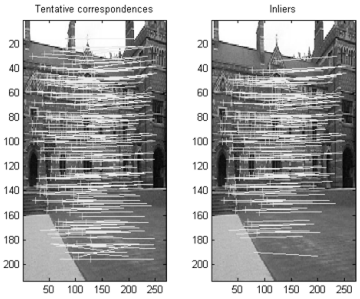
Original Images



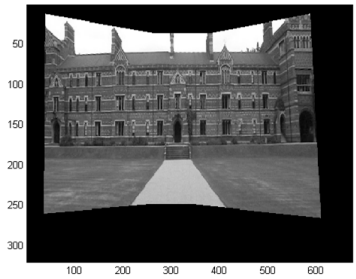
Strongest Feature Point Detection



(c) Common Feature matching in 1 and 2 image



(d) Common Feature matching in 2 and 3 image



(e) Output Image

Fig. 3.5

IV. Conclusion

In this research paper we have used a hybrid algorithm (SURF+SIFT) [4] for feature extraction and Fuzzy RANSAC has been used to remove the outliers. This created an opportunity for better matching. Now more strong points are available for image stitching. The number of outliers are also reduced by using fuzzy set operations which are applied to get common inliers. In this way the proposed algorithm has provided us with better stitched image and enabled us to use the fuzzy RANSAC algorithm in a better way.

V. Future Scope

The proposed algorithm Fuzzy RANSAC may not do full coverage or may also run in to problem of over fitting etc. For this we suggest the use of regularization method along with neural network based data fitting model, So that we may not encounter any complication in the future.

Acknowledgment

The paper that deals with new technology of image stitching would not have been possible without the gratitude of Er. Jyoti Rani Assistant Professor. The authors would like to thank number of fellows that helped in completing this work.

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Network Research Validation using GENI Platform

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***Abstract*—The internet is a global computer network of interconnected autonomous systems which use standardized protocols for communication and providing various kinds of services like e-commerce, banking, websites etc. There are ever increasing number of threats to such global inter-networking infrastructure. DDoS is one such kind of threat that interrupts the availability of these services or resources in the internet. In this paper, we have investigated various Network Research Validation Techniques like Simulation, Emulation and Real-Time Experiments used for the validation of various DDoS detection methods. Out of these Validation Techniques, GENI is extremely used in Network Related Research based on real time experiments. GENI (Global Environment for Networking Innovation) has a set of network and computer resources which are managed by aggregates that provide real or virtual resources for scalable experiments. In this paper, we have explored GENI project Office, Flack, Omni, INSTOOL etc.**

Keywords: Simulation, Emulation, Real-Time, GENI, DDoS

I. INTRODUCTION

A. Internet

The *Internet* is a global system of interconnected computer networks that use the inter protocol suite (TCP/IP) to link several billion devices worldwide. It's a Network of Networks that consists of millions of private, public, academic, business and government networks of a local to global scope, linked by a broad array of electronic, wireless and optical networking technologies.

B. Use of the Internet

- The Internet is a fantastic place to research information for a project or piece of homework. It doesn't matter what topic you have been set, you can guarantee that will find something on the subject.
- Communication the Internet opens up many different possible ways to communicate with others. Such as: E-mails, Social Networking.
- In the use of Internet have many services that help to explore the world. Such as satellite and mapping applications, travel sites providing details.

C. Internet Attacks

When you are using internet Resources, hardware and software components are the target of malicious attempts to gain unauthorized control to cause interruptions or access private information. A computer user can be tricked into downloading software onto a computer that is of malicious intent. Such as software comes in many forms, such as viruses, Trojan horses, spyware and worms. There are various attacks on the internet resources such as: Passive attacks, Active attacks, and Distributed attacks.

In *GENI* platform the experimenters perform own works on the DDoS (Distributed Denial of service) attacks.

Denial of Service (DoS) attacks is a kind of attacks against Computers connected to the internet. The Distributed Denial of Service (DDoS) is defined as an attack in which multiple compromised and vulnerable system are used to attack a single target or victim machine to make the service unavailable to the intended users.

The goal of DDoS attacks are first it overloads the server with unwanted traffic and Second goal is to acquire the bandwidth by generating the large volume of unwanted traffic [8].

II. NETWORK RESEARCH VALIDATION TECHNIQUES

In DDoS attacks has been for following Validation Techniques used.

A. Simulation

The Research area of Communication and Computer networks, Simulation is a useful technique. Since the behavior of a network can be modeled by calculating the interaction between network components. Network simulation is typically program which runs on a single computer, and takes a abstract description of network traffic. Simulation has Ns2 and Ns3 network simulators. They are Open source simulators.

- *NS2:* NS2 is implemented using a combination of oTCL (for scripts describing the network topology) and C++ (The core of the simulator).

This system was chosen in the early 1990s to avoid the recompilation of C++ as it was very time consuming using the hardware available at that time; oTCL recompilation takes less time than C++. A packet consists of 2 distinct regions; one for headers, and the second stores payload data. NS2 never frees memory used to store. The total computation time required to run a simulation scales better in NS3 than NS2 [7].

- *NS3:* NS3 is implemented using C++ with modern hardware capabilities, compilation time was not an issue like for NS2, and NS3 can be developed with C++ entirely. A simulation script can be written as a C++ program, which is not possible in NS2. There is a limited support for Python in scripting and visualization. NS3 performs better than NS2 in terms of memory management. NS3 has an emulation mode, which allows for the integration with real networks [21].

B. Emulation

Emulation had differ from the simulation in that network emulator appears to be a network end system such as computers can be attached to the emulator and will behave are attached to a network. A network emulates the network which connects end systems which emulate the end systems are called traffic generators. An emulated experiment allows you to specify an arbitrary network topology, giving you a controllable, predictable and repeatable environment, including PC nodes on which you have full root access running an operating system of your choice.

Network Emulation is a technique where the properties of an existing, planned and non ideal network are simulated using emulation of specific routers and other network equipment as network simulation where simplified mathematical models of data sources channel and protocols are applied. The aim of educational, to develop skills in configuring network equipment or scientific to order to assess performance, predict impact of change or optimize technology decision-making.

In emulation has much kind of testbeds using.

- *EMULAB*: Emulab is a network testbed, giving researchers a wide range of environment in which to develop, debug and evaluate their systems. The name Emulab refers both to a facility and to a software system. The Emulab installation is run by Flux group, part of the school of computing at the University of Utah. There is also installation of the Emulab software at more than two dozen sites around the world, ranging from testbeds with handful of nodes up to testbeds with hundreds of nodes. Emulab 802.11 testbed is deployed on multiple floors of an office building. Nodes are under your full control and may act as access points, clients, or in adhoc mode. All nodes have two wireless interfaces, plus a wired control network.

Emulab is a public facility available without charge to most researchers worldwide. If you are unsure if you qualify for use, please see our policies document or ask us. If you think you qualify, you can apply to start to start a new project [13].

- *DETER LAB*: DETER testbed is an open for security experimentation, hosted at USC Information Sciences Institute and UC Berkeley. It runs Emulab software for shared testbeds, and consists of more than 400 machines. Users receive exclusive access to a number of machines they need, and set up topologies, OS and applications of their choice. The DETER testbed is shared infrastructure designed for medium scale repeatable experiments in computer security, especially those experiments that involve malicious code.

The testbed provides unique resources and a focus of activity for an open community of academic, industry and government researchers working towards better defenses against attacks on networking infrastructure.

C. Real-Time Experiments

In which provide a real Platform for performing your work. Real-time is more flexible word. If there is a network work with a speed 1kbits/s and the designed system can give an output by speed more than 1kbits/s, it will be a real time system with respect to the network.

Planetlab and GENI is also Real-Time experiment based testbeds. They are user friendly testbeds. In using planet lab they are able to experiment with new services under real-wotd conditions. In GENI using various cross layer measurement capabilities to perform real time experiments.

- *Planet Lab:* Planetlab is a global research network that supports the development of new network services. Planetlab is a group of computers available in a computer networking and distributed system. The top most Industrial researchers, universities and Top level academic institutions have used Planetlab for developing new technologies. In planetlab has support real users and clean slate design. Using the Planetlab testbed provides you with a full featured environment for deploying, running and controlling your application at hundreds of sites around the world [13].

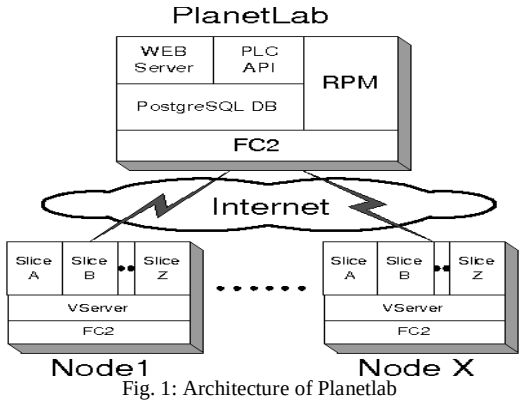

Fig. 1: Architecture of Planetlab

In planetlab has various key concepts done his work to attracts real users.

In Distributed Virtualization has each physical node hosts any number of virtual nodes and collection of virtual nodes a slice.

In programmability has virtual nodes are freely programmable.

Limitations

- Commodity PC hardware, no way to incorporate other nodes or link technologies.
- The underplaying network may affect experiments.
- Largely designed and supported by graduate students.
- It has less Security as compare to GENI Testbed.
- *GENI Testbed:* The GENI is a suit of research infrastructure rapidly taking shape in prototype from across the United States. It is sponsored by the National Science Foundation, with the goal of providing a laboratory environment for networking and distributed systems research and education.

III. GENI AND ITS ARCHITECTURE

GENI is a new network testbed, nationwide suite of infrastructure supporting research in networking, distributed systems, security and novel application. Global Environment For Network Innovation is a distributed virtual laboratory sponsored by the U.S NSF (National Science Foundation) and available without charge for research and classroom use.

It is well suited for exploring networks at scale, thereby promoting innovation in network science and services. GENI allows experimenters to:

- Obtain compute resources from location around the United States.
- Connect resources using Layer 2 topologies in network best suited to their experiments.
- Install custom operating systems and software on these compute resources.
- Control network switches in their experiment handle traffic flows.
- Run layer 3 and above protocols by installing protocols software in their compute resources and providing flow controllers for their switches [14].

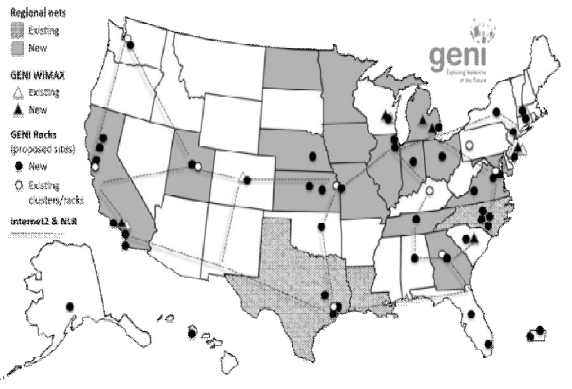

Fig. 2: Resource Available to GENI Experiments Include GENI Racks, Regional and National Backbone Networks and WIMAX base Station

A. *Use of GENI*

GENI might br right for you if your experiment requires.

- GENI has *Large scale experiment infrastructure*. GENI can potentially provide you with more resources than is typically found in any one laboratory. GENI gives you access to hundreds of widely distributted resources such as virtual machine and bare machines and network resource such as links switches and Wimax base stations.
- GENI has *Non-IP connectivity across resources.* GENI allows you to set up layer 2 connection between resources and run own layer 3.
- In GENI has *Deep programmability*. With GENI you can program not only the end hosts of your experimental network but also the switches in core of your Network.
- You can get exclusive access to certain GENI resources including CPU resources and network resources by using Reproducibility.
- In GENI has two instrumentation and measurement systems that you can use to instrument your experimements. These provide active and passive measurements, data storage and tools for visualizing and analyzing measurement data.

B. *GENI Key Concepts*

GENI key concepts introduces various terms you will need to know before you use GENI. GENI experimenter workflow that ties together these concepts and terms.

1) GENI Project

In GENI a project organizes research both people and their experiments. GENI provide a portal for a indiviuals Researcher. The project is created by a single Resposible individual. The individual lead the peoject. A project have many experimenters as its members and experimenter may be a memmber of various projects. In geni has provide a unique account for the researcher. The researcher must have project leader and privileges to create projects but only any senior Professor of any organization can leads only. For examples: Students cannot be project leads.

2) Slice

GENI is a Shared testbed in which muliple experimenters may be running multiple experiments at the same time. A slice is a container in which you perform multiple experiments such as make topologies. The project head is automatically member of the slice. The experimenter only used that resources they will provide by GPO(GENI project office). GENI used the concept of slicesbility from the planetlab testbed. GENI supports multiplemodels of virtulization even for a single resource type.

3) GENI Aggregates

The Global Environment for Networking Innovation has provides aggregates resources to GENI experimenters. In which Experimenters may request to the resources from this GPO aggregate and then add to slice. GENI has muliple aggregates. Each aggregate provide its own resources. Some aggregates provide Virtual Machines or bare machines for compute resources and some provide networking resources that experimenters can be used to compute resources. There are muliple aggregates in GENI. Shown in Figure.

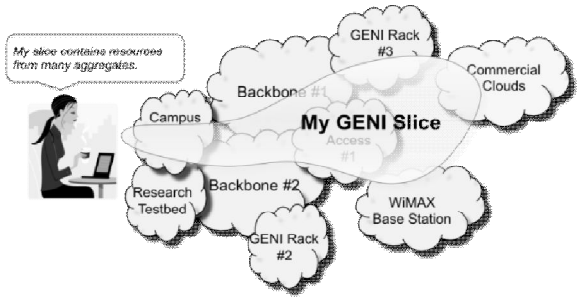

Fig. 3: GENI Aggregates

4) GENI RSpecs and GENI AM API

GENI RSpecs is Resource specification document that is used to request the resources from aggreates and AM API is Aggregate Manger that provide the availble aggregates to back the experimenter.

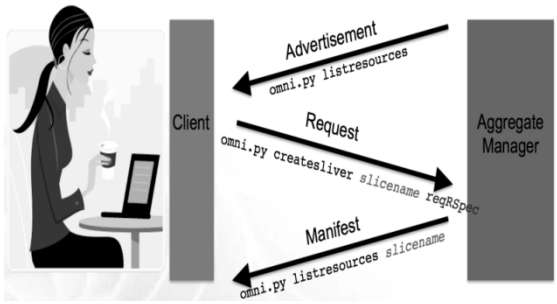

Fig. 4: GENI RSpec and AM API

Advertisement RSpec

This is the document that is returned by AM that describes the resources that the AM has.

Request RSpec

This is the document that a user sends to an AM to describe the resources that wants to reserve.

Mainfest RSpec

This is the document returned by an AM that describes the resources that a user has reserved at an AM.

C. GENI Design

GENI has heavily builds on idea from Planetlab and takes some ideas to the next level. In GENI design has Two Components.

- Physical Network Substrate.
- Global Management Framework

GENI borrows the concept of sliceability from the planetlab testbed. Slice has central concept the management framwork virtualizes the physical substarte and makes it available to experiments as slices.

Physical Network Substrate has expandable collection of building blocks.

- The Node Technologies contain
  - PC clusters supporting virtual machines, very similar to planetlab.
  - Hight-speed routers.
  - Optical Switching.
- Network Links.
  - National Lambda Rail(US Universities).
  - Provides ingress points for edge site to GENI.
- Wireless Subnets.
  - In GENI has various wireless technologies used such as 802.11, 3G/WiMax, Sensor Subnets.

In *Global Management Framworks* has embeds the slices tnto GENI layered design to substrate and controls them on behalf of experiments.

- Component Manager in Framwork.
  - The Controls on building block.
  - Framework provides interface to virtualized capabilities.

- (GMC) GENI Management Core.
  - Collections of slices across building blocks.
  - Slices manage by remotely.
  - Stable GENI lifetime.
- GENI infrastructure Services.
  - GENI provides the user/administrator interface.
  - Allocate Resources, Monitor and Manage slices and provide development tools.
  - Expected to change Geni during technology progresses.

D. GENI Racks

The GENI racks is basic unit of GENI computation and storage resources in GENI enable campus. The racks comprises multiple compute nodes, storage and open flow switches. All the GENI racks have layer 3 connection to the Internet and layer 2 connection to the GENI core networks. The racks commodity internet for control access to rack resources and VLANs share for the application and connections of data for experiment.

GENI racks are implemented to meet the goals specified by The GPO. Current racks projects can be characterized as follows:

- *ExoGENI*: A higher cost, flexible virtual networking topologies solution including Openflow, that is powerful plateform for multi-site clound application. These are integrated part of a campus network.
- *InstaGENI:* A mid range cost, that can will be deployed at a large number of campuses, along with OpenFlow and VLAN networking. These racks are normally deployed outside a site of firewall.
- *OpenGENI:* Its also a mid range, Internet cloud application support, along with OpenFlow and VLAN networking [11].

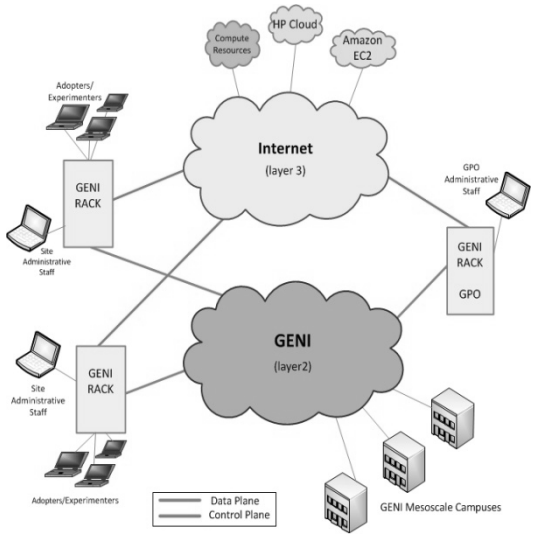

Fig. 5: GENI Racks

E. Experimenter Tools

GENI has available several experimenter tools exist to assit an experimenter in resource selection and configuration for networking Topologies.

Resource Reservation Tools

- *FLACK* is a web based graphical experiment cinfiguration tool and resource discovery, in with drag and drop interface and creating a experimenter specific topologies. In a Flack show a map that show the available resources.
- *OMNI* is a low level tool. A command line interface that closely mimics the AM API supporting and calls scripting operation.

Instrumentation and Measutement Tools

- *GENI Desktop and LabWiki* are the INSTOOLS in a GENI plateform. In GENI Desktop measure and graph statistics on your slice. In LabWiki an experiment orchestration tools.

Services Running on GENI

- *GENI Experimenter Engine(GEE)* is designed as a restricted, easy-to-use programming platform on GENI. It is start an experiment in under 5 Minutes.
- *Intelligent Data Movement Service(IDMS*) experiment allows other users to attack at shared VLAN sites, granting access to the available storage resources. Users may upload and download their experiment data using a set of client tools.
- *Virtual topology Service(VTS)* is a basic single-site topology. In which creating a simple VTS topology with one forwarding element connected to two virtual machines provides by the site compute aggregates [10].

F. GOALS

- The goal of the session is to review, the perspective of an experimenter, how one can and how one should conrol operation in network on the GENI provided data plane.
- The security community in GENI's design and prototyping to ensure that security isuues are properly considered.
- The GENI operation will be require careful palnning to enable communication among the federated organization to handle problems.
- The isfrastructure of GENI should support security, testing to ensure that security breaches can be handked quickly and effectively.

IV. CONCLUSION

There are Network Research Validation Techniques evaluating in literature like Simulation, Emulation and Real-Time but out of these summery

GENI is very Promising distributed testbed. The Global Environment for Networking Innovation (GENI) testbed is virtual laboratory provides capable environment and flexible for exploration the networking topologies. GENI is a Real time experiment platform that is fully user-friendly and secure. In which GPO provide your own portal and framework to compute resources in a networking. In which used various tools and validation techniques. In which used deeply programming and provides large amount of aggregates for providing the available resources. GENI must provide the capabilities to enable experimenters to capture all the data needed to enable others to reproduce the experiment. GENI research mission enabling research in a wide varity of application areas. GENI leading the attraction as compare another testbeds. GENI has advanced features as compare to anothor simulators, emulations and real time experiments.

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Feature Extraction in Content based Image Retrieval—A Survey

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***Abstract*—From the last decade CBIR is a very important & vast research area in the field of image processing. Content-based Image Retrieval helps the user to solve the problem of searching for digital images in the large database. CBIR is used for the retrieval of the images based on the content of the images generally known as features. These features may be low level features or high level features. The low level features of an image are color, shape, texture and spatial relationship. The high level features use the concept of human brain. Out of all the low level features Shape is the most specific feature since it look for the exact shape or object in the image and color is the least specific feature as in that two colors may have the same component value but totally different colors. This paper gives an overview about extracting the features of the given image mainly by using different types of Color Models available to us. In this we mainly describes Image content descriptors, color spaces and various color descriptors like color moments, color histogram, color coherence vector, color correlogram etc.**

Keywords: Content Based Image Retrieval (CBIR), Color Coherence Vector (CCV), Hue Saturation Value (HSV)

I. INTRODUCTION

With the development of the internet and the advancement of the quality of the digital images it become necessary to organize, store, process & retrieve them successfully. Digital images are currently used in medicines, fashion, architecture, face recognition, finger print recognition and bio-metrics [1]. Now a day's CBIR is in trend. CBIR is a search engine used to retrieve the images from the large database according to the user's query [3]. It is also known as query by image content (QBIC) and content-based visual information retrieval (CBVIR). Earlier text-based image retrieval systems were used. It was started in 1960 but originally implemented in 1970's. This technique was based on the textual annotations of images and it uses traditional database techniques to manage the images. The images are organized by topical or semantic hierarchies to ease navigation and searching based on Boolean query. Most system requires manual annotation of images, which is inconvenient and expensive task for large databases.

In 1992 National Science Foundation (NSF) organized a workshop for CBIR since then it has developed rapidly. 'Content-based' means that search the images by its content rather than its metadata. Here 'Content' refers to the information derived from image like its color, shape, texture and spatial layout. CBIR mainly works in two phases- first phase related to feature extraction and another one is for similarity matching [4]. Feature extraction mainly depends upon Low-level features or High-level feature. The distinction between the information drawn out from visual data and elucidation provided by the user is known as semantic gap. The system having less semantic gap is efficient for use. The design and development of effective and efficient CBIR system are still a research problem because the advancement in digital images involves two well known problems i.e. semantic gap and the computational load to manage large file collections. Content-based visual features have two domains first is Common Visual Content and other is Field Specific Visual Content like task dependent applications and face recognition. Whereas high level features include semantic base image retrieval which are computed by complex algorithms of visual contents.

II. WORKING OF CBIR SYSTEM

The proposed CBIR system takes input as images or a query from the user and produce output as images relevant to the user's need. The diagram is given below –

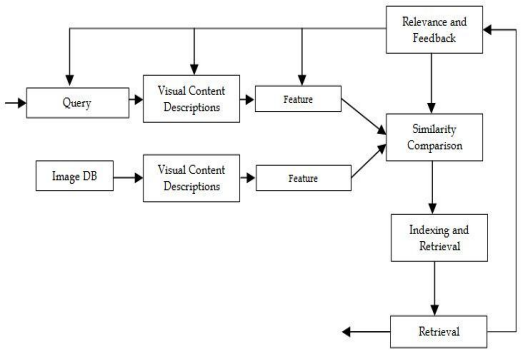

Fig. 1: Representation of CBIR System

Step-I: The visual content of the images present in database are extracted and described by multi-dimensional
Feature vector.
Step-II: This feature vector form feature database.
Step-III: To retrieve images, user provide retrieval system with Example images or sketched figures.
Step-IV: This system changes the given images into internal Representation of a feature vector.
Step-V: The similarity/distance between the feature vectors of query example and database images are calculated and retrieval is performed with indexing scheme.
Step-VI: The indexing scheme provide efficient way to search For image databases.
Step-VII: Recent systems incorporate user's relevant feedback To modify the retrieval process to generate
Semantically more meaningful retrieval skills.

A. *Structure of the System*

1. Image Database: It will consist of number of images with any number of formats i.e..jpg,. bmp,. tiff.
2. Query Formation: User provides a query of a sampled image or sketched figure.
3. Feature Database: It is the collection of all the multi-dimensional feature vectors of the images in the database.
4. Similarity Comparison: The features are matched to yield a result that is visually similar. The common method used for similarity measure is Distance method [5].
5. Indexing and Retrieval: After similarity matching the retrieved images are arranged in the decreasing order of similarity.
6. Retrieval Results: After indexing all the images are displayed to the user as the output of the system on the screen.
7. Relevance Feedback: In this the user states that whether the retrieved images are according to user's perception or not. It is mainly done for enhancing the search results.

III. LOW LEVEL FEATURE EXTRACTION

A. *Shape*

Shape feature extract the geometric details of an image. It does not refer to the shape of an image but to the shape of a particular region that is being sought out. These are extracted when the segmentation process or edge detection of an image is done. Some other methods identify given shape of an image. Object image has superior shape feature which are translation variant, rotation invariant and scaling invariant along the axis.

1) *Shape Retrieval*

1. Let all the object images in the database are same with respect to query.
2. Every image in the database has distance function computed equal to the query shape.
3. Shape identification and representation- it tells whether the images are similar to image or not.
4. Shape arrangement and listing: Changing one shape image fully or partially into one of the most similar shape images.
5. Shape estimation and simplification: make the shape image to query image in according to features like point, segment and triangles.

TABLE 1: IMAGE RETRIEVAL BY USING SHAPE FEATURES [8]

Shape Feature	Pros	Cons	Result
Fourier Descriptor	Fast Fourier Transformation can also be used for efficient results	The DC coefficient is discarded because of its dependency on shape and position.	Rotation, scale and translation in variants are the results computed.
Axis orientation	Increases the user interaction for meaningful efficiency of shape features.	Higher values of it show the elliptical shape which is not easy to compute.	Efficient and faster results.

B. *Texture*

Texture measures look for visual patterns in images and how they are spatially defined. Texture is an image or a part of image containing repeating patterns [1]. The identification of specific textures in an image is achieved primarily by modeling texture as a two dimensional gray-level variation. The relative brightness of a pair of pixels is computed such that degree of contrast, regularity, coarseness and directionality may be estimated. The problem is in identifying patterns of a co-pixel variation and associating them with particular classes of textures like silky or rough. These are extracted using gray-level co-occurrence matrix (GLCM), Gabor Transform and Tamura Features.

TABLE 2: IMAGE RETRIEVAL BY USING TEXTURE FEATURES [8]

Texture Features	Features	Limitation	Result
Gabor Transform	Reduce the joint ambiguity issue in space and frequency domain [8] Used as tuned and scaled edge detector [8]	Mainly effective for man-made objects only	Uncertainty in space is minimized thus giving better result
Tamura Features	Coarseness, contrast, directionality, line-likeness, regularity, roughness [7]	Highly complex computational method to extract images	Used in CBIR systems like photo book, QBIC

C. Color

It is extensively used visual content having three dimensional values which make its discrimination potentially superior to single dimension gray value of images.

2) Color Space

Different color spaces used are RGB, Munsell, CIE L*a* b*, CIE L*u*v*, HSV (Or HSL, HSB) opponent color space.

The desirable characteristic is uniformity. It refers to two color pairs that are equal in similarity distance are perceived equal [12].

RGB Space: It is widely used for image display. It is composed of three color components – red, blue, green. These components are called as "additive primaries". It is device dependent and perceptually non-uniform.

CMY Space: It is primarily used for printing. It is composed of three color components i.e. cyan, magenta and yellow. These are called as "subtractive primaries". These colors re-produce through light absorption. These are device dependent and non-uniform.

*CIE L*a*b* and CIE L*u*v**: These are device dependent and perceptually uniform. They consist of luminance or brightness component 'L' and two chromatic components- a, b, u, v. L*a*b* is designed to deal with subtractive colorant mixture. L*u*v* is designed to deal with additive colorant mixture [11].

HSV (Or HSL, HSB): These are widely used in computer graphics. The three components are hue, saturation (lightness), brightness (value).

Hue is invariant to change in illumination and camera direction hence more suited to object retrieval [9].

Opponent Color Space: It accounts the opponent color axis (R-G, 2B-R-G, R+G+B). This representation provides the favor of isolating the brightness on the third axis. The other two are the chromaticity axes and they are down sampled as humans are more sensitive to brightness than to chromatic information.

3) Color Descriptors

Color Moment

It characterizes the color distribution in image which mainly consists of just an object. These are mainly used for color indexing purposes to retrieve images. Each comparison between images tells the similarity measure. Lessen the similarity measure more close are images. Color moments are invariant to scaling and rotation [15]. The most of the color distribution information is contained in the low-order moments so the first three moments are mainly used as a feature of image retrieval.

First Order Color Moment:

$$\mu_i = \frac{1}{N}\sum_{j=1}^{N} f_{ij}$$

Second Order Color Moment:

$$\sigma_i = \left(\frac{1}{N}\sum_{j=1}^{N} (f_{ij} - \mu_i)^2\right)^{\frac{1}{2}}$$

Third Order Color Moment:

$$s_i = \left(\frac{1}{N}\sum_{j=1}^{N} (f_{ij} - \mu_i)^3\right)^{\frac{1}{3}}$$

It performs better if defined by both L*u*v* and L*a*b*. Since only nine numbers are used to represent color content, a very compact representation is there. Due to compactness it lowers the discrimination power [16].

Color Histogram: It is effective to use if the color pattern is unique with rest of dataset. It is easy to compute and effective in characterizing both local and global distribution of color. A histogram i.e. distribution of number of pixel for each quantized bin can be defined by each component. More number of bins a color histogram contains, more discrimination power it has. More bins increase computational cost, inappropriate for building indexes for image database. The opponent color space is used to reduce the number of bins. Another way is clustering method to determine the K best color in given space for the given set of images [17].

Color Coherence Vector: It is a way of incorporating spatial information into color histogram. Each bin is divided into two parts i.e. (i) coherence if it belongs to large uniformly colored region. (ii) in-coherence if it is not. Let α_1 is the number of coherent pixel in the color bin. β_1 is number of incoherent pixel in the image. The CCV of an image is defined as vector $< (\alpha_1, \beta_1), (\alpha_2, \beta_2) \ldots (\alpha_N, \beta_N)>$. $<\alpha_1+\beta_1, \alpha_2+\beta_2 \ldots \alpha_N+\beta_N>$ is the color histogram of image. It provides better retrieval results than color histogram especially for those images having uniform color or mostly texture regions. For both color histogram and CCV, HSV gives better result than L*u*v*, L*a*b*[18].

Color Correlogram: It characterizes not only the color distribution of pixels, but also the spatial correlation of pair of colors. In histogram there are three axes in which first two dimensions specify colors of any pixel pair and third dimension tells about spatial distance. Where the k^{th} entry for (i, j) specifies the probability of finding a pixel of a color j at a distance k from a pixel of color i in the image [10].

IV. Conclusion

This paper provides an overview about the Content-based image retrieval (CBIR) system. Since 1960's Text-based image retrieval systems were used. As the time passes this system become obsolete. From 1990's CBIR becomes popular. This paper describes the working and structure of the CBIR system. It mainly discusses the feature extraction part of the system. It

mainly focuses on the low-level features extraction of an image. Shape is the most significant low-level feature of image. It uses Fourier Descriptor and Axis orientation to extract the shape. Texture feature finds the repeating patterns in an image. It mainly uses Gabor Transform and Tamura Feature for extraction of texture. Color is the least significant feature of an image. Different color spaces like RGB, CMY and HSV are used for this. It also describes the color descriptors like Color Moment, Color Histogram, Color Coherence Vector and Color Correlogram to extract the color feature from the given images.

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Detection of DDoS attack using Entropy—A Review

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***Abstract*—The DDoS attacks are serious problem to the internet. The DDoS attacks are increasing very fastly. As recent studies observed more than 120,000 DDoS attacks in 2014 and the actual number is even higher. On the other hand, launching of DDoS attacks made very easy by the variety of friendly attack tools. Survey also found that the peak of DDoS attacks nearly doubled today as compared to the previous years, So due this some detection methods are required to solve this issue. This paper represents the various DDoS attack detection approaches based on Entropy including with their strength and weaknesses of each approach.**

Keywords: DDoS, Entropy based, Attacking Detection

I. INTRODUCTION

The DDoS is the Distributed Denial of Service attack. These attacks are harmful security threat to the internet. These attacks are becoming increasingly more harmful. This attack don't let the authorized user to take the services by sending huge amount of attack packets to the server. These attack packets ingests the network resources and also occupy the transmission capacity of the network. See the figure1

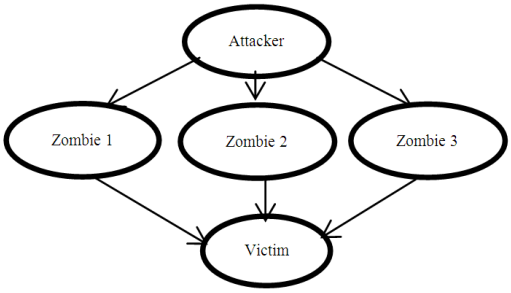

Fig. 1: Structure of Typical DDOS Attack

From the fig. 1, Firstly, the attack tools are being installed on the vulnerable systems. Then those systems are turned into zombies and these zombies attack the victim by generating large volume of attack packets at the target. The attacks can be in wired network or wireless network. Sometimes it becomes very difficult to differentiate between attack traffic and attack free traffic. The DDOS attack is basically of two types: low rate DDoS attack and high rate DDoS attack. The low rate attack traffic is similar to the authorized traffic and the high rate DDoS attack looks similar to flash crowds. Both the attacks has some characteristics of legitimate traffic so hard to detect and reduce their effect within short time interval is difficult. The recent work was based on detection of the DDoS attack that is being generated by the Botnets. A botnet is basically large number of network that consists of two types of hosts i.e. master and slave hosts. The master host is a main controller that controls the slave hosts to send the attack packets to the victim host. As mentioned in [1], The DDoS flooding attack is being generated in two different ways: Direct DDoS attack and Reflector based DDoS attack. Firstly, In Direct DDoS attack, the attacker sends the large amount of the attack packets directly to the victim as shown in figure 2.

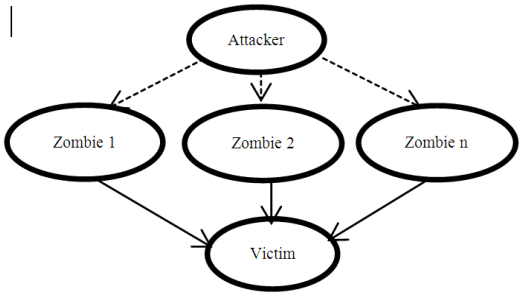

Fig. 2: Architecture of Direct DDOS Attack

And, In Reflector based DDoS attack, the reflector is the component which is used to send huge amount of attack traffic by fake ips of victim hosts as shown in Fig. 3

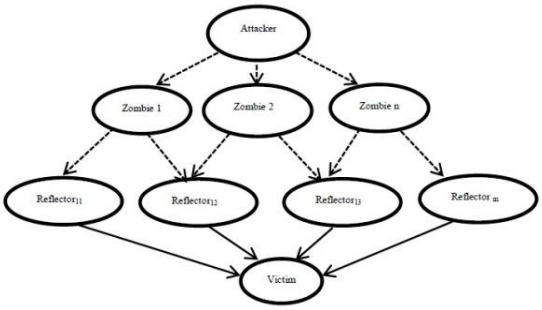

Fig. 3: Architecture of Reflector DDOS Attack

II. KEY CHALLENGES IN DDOS DETECTION

The critical measure of performance for any detection scheme is its coverage, that is what percentage of actual attack can be detected. DDoS attacks are hard to detect. Secondly, false positive are serious issues for DDoS attack detection. The effectiveness of DDoS attacks depends on the volume of attack traffic. DDoS packets need not to be for medab normally, as a result the DDoS attack traffic looks very similar to the normal traffic. This means that any detection scheme has the high risk of treating normal traffic as attack traffic, which is called the false positive.

The attack detection is based on two groups: first, DDoS attack specific detection, it is based on special features of attack. Second, Anomaly based detection, which modifies the behavior of legitimate traffic and report if any anomaly exists.

A. *Challenges*

1. It is very difficult to detect the low rate DDoS attack as they are quite similar to the normal traffic.
2. To detect the flash crowds mimicking DDoS attacks from genuine flash crowds.
3. It is difficult to set the threshold value during entropy analysis.
4. The detection measures i.e. Detection time should be less and false positive rate should be low for good detection technique.

In this paper, we have chosen the Entropy analysis for detecting DDoS attack.

III. ENTROPY AND ITS TYPES

Entropy is the measure of randomness Acc. to [2].In simple words, Entropy is calculated by profiling the analysed behavior of the network servers. The entropy can be based on source address or destination address. Another important term in entropy is deciding the window size. There are two types of window i.e. Packet sliding window and time window. In packet window we set the range for number of packets and in Time window we set the time frame.

In [1] given the Formula for calculating the entropy *H*is,

$$H = -\sum_{i=1}^{n} \text{pi} \log pi \quad (1)$$

Where,

*i*is the flow id

*n*is the maximum number of flow ids or sources

$p_i$is the distribution of probability of flow i

$p_i = x_i$(each unique symbol)/$\sum_{i=1}^{n} xi$(total number of symbols)

Now we will illustrate this by a simple example,

In this, we will calculate entropy at source address, and will work with Packet sliding window.

Suppose there are number of sources *n* at the server, $x_i$is the number of packets captured of flow *i* and p_i.Packet sliding window size | 45 packets |

Where,

n= S1, S2, S3, S4,S5,……..S100

x_i= 5, 10,15,10,5…….15 resp.

$\sum_{i=1}^{n} xi$ = 45, first 45 packets are received from first five sources.

therefore,

p_i =5/45, 10/45,15/45, 10/45, 5/45 resp.

$\log_2 pi = \log_2 5/45, \log_2 10/45, \log_2 15/45, \log_2 10/45, \log_2 5/45$ resp.

Similarly, rest of sources will be calculated and Threshold value will be set by analysing the whole sources. If the range of threshold exceeds then there will be attack traffic.

There are number of ways of DDoS attack detection that are based on entropy, described in next section.

Types:

1. *Hartley entropy*: It is the measure of uncertainty, introduced by Ralph Hartley in 1928. If we pick a sample from a finite set A uniformly at random, the information revealed after we know the outcome is given by the Hartley function.

$H_0(A) := \log_b |A|.$ (2)

The uniform means when the distribution is equal i.e. every source have same probability and the same probability means it gives the max. entropy value.

From (1), A is the uniformly random value. Now suppose we have number of sources: 1,2,3,4 and *A* i.e. distribution of packets among them is 10 each so the $H_0(A)$=log ¼ for each source. Hence max. entropy will be 2.

If the base of the logarithm is 2, then the unit of uncertainty is the shannon. If it is the natural logarithm, then the unit is the nat. Hartley used a base-ten logarithm, and with this base, the unit of information is called the hartley in his honor. It is also known as the Hartley function. Hartley function depends only on the number of elements in a set. It is actually a special case of the Rényi entropy since:

$$H0(X) = \frac{1}{1-0} \log \sum_{i=1}^{|X|} p_i^0 = \log|X| \quad (3)$$

2. *Rényi entropy*: It generalizes the Hartley entropy, the Shannon entropy, the collision entropy and the min-entropy. Entropies quantify the diversity, uncertainty, or randomness of a system. As mentioned in [10], The Rényi entropy of order α, where $\alpha \geq 0$ and $\alpha \neq 1$, is defined as

$$H\alpha(X) = \frac{1}{1-\alpha} \log \left(\sum_{i=1}^{n} p_i^{\alpha} \right) \quad (4)$$

Here, X is a discrete random variable with possible outcomes1,2,…,n and corresponding probabilities p_i = Pr(X = i) for i = 1,….,n and the logarithm is base 2. If the probabilities are p_i = 1/n for all i = 1,…n, then all

the Rényi entropies of the distribution are equal: $H_\alpha(X) = \log n$. In general, for all discrete random variables X,$H_\alpha(X)$ is a non-increasing function in α, it is a measure of uncertainity i.e. missing information. It contains additional parameter α which can be used to make it more orless sensitive to the shape of probability distributions.

3. *Tsallis entropy*: Tsallis defined his entropy as:

$$S\alpha = \frac{1}{\alpha-1}1 - \left(\sum_{i=1}^{n} p_i^{\alpha}\right) \quad (5)$$

As mentioned in[11], The parameter α clearly defines what type of splits are going to be created. If α has large positive value this measure is more sensitive to events that occur often, while for large negative α it is more sensitive to the events which happen seldom.

4. *Conditional entropy*: In information theory, the conditional entropy quantifies the amount of information needed to describe the outcome of a random variable Y given that the value of another random variable Xis known. Here, information is measured in shannons, nats, or hartleys. The entropy of Y conditioned onX is written as H(Y|X).

The entropy of Y among only those in which X has value *v* i.e.

H(Y|X=v).The average conditional entropy of

Y= SjProb (X=vj) H(Y | X = vj) (6)

Let suppose an example,

If I know the student's major could I predict if he likes computer games?

Input X=college major

Output Y= likes computer games

TABLE 1

X	Y
Math	Yes
History	No
CS	Yes
Math	No
Math	No
CS	Yes
History	No
Math	Yes

TABLE 2

X Y	Yes	No	Marginal Distribution of X:
Math	0.25	0.25	P(X=Math)=0.5
CS	0.25	0	P(X=CS)=0.25
History	0	0.25	P(X=History)=0.25
Marginal distribution of Y:	P(Y=yes)=0.5	P(Y=No)=0.5	1

H(X)=-0.5 log 0.5-0.25 log 0.25-0.25 log 0.25 = 1.5

H(Y) = -0.5 log 0.5 – 0.5 log 0.5 = 1

Now, H(Y|X=v)

Y?{Yes, No}

Therefore, for H(Y|X=Math) = - S p(y|X=Math) log p(y|X=Math)

=-p(Yes|X=Math) log p(Yes|X=Math)–p(No|X=Math) log p(No|X=Math)

=-0.5 log 0.5 – 0.5 log 0.5 =1

H(Y|X=Math) = 1

H(Y|X=History) =-S p(y|X=History) log p(y|X=History)

=-p(Yes|X=History) log p(Yes|X=History)

-p(No|X=History) log p(No|X=History)

=-0 log 0 – 1 log 1 =0

H(Y|X=History) = 0

H(Y|X=CS) =-S p(y|X=CS) log p(y|X=CS)

=-p(Yes|X=CS) log p(Yes|X=CS) -p(No|X=CS) log p(No|X=CS)

=-1 log 1 – 0 log 0 =0

H(Y|X=CS) = 0

So,H(Y|X=Math) = 1

H(Y|X=History) = 0

H(Y|X=CS) = 0

H(Y|X) = The average conditional entropy of Y = SjProb(X=vj) H(Y | X = vj)

TABLE 3

Vj	Prob(X=vj)	H(Y|X=vj)
Math	0.5	1
History	0.25	0
CS	0.25	0

H(Y|X) = 0.5 * 1 + 0.25 * 0 + 0.25 * 0 = 0.5

5. *Joint entropy:* Is the amount of information contained in both events X and Y

$$H(X,Y) = -S_{X,Y}\, p(x,y) \log p(x,y) \quad (7)$$

i.e. H(X,Y) = H(X) + H(Y|X)

= H(Y) + H(X|Y) (8)

For Example:

As mentioned in Table 3,

H(X) = 1.5

H(Y) = 1

H(Y|X) = 0.5

H(X,Y) = H(X) + H(Y|X)=1.5+0.5=2

IV. REVIEW OF ENTROPY BASED DDOS ATTACK DETECTION

In this section, we will discuss the DDoS attack detection methods based on Entropy proposed by different researchers with their strength and weaknesses.

Firstly, *"Statistical Approaches to DDOS Attack Detection and Response"* was proposed. According to [2], The main Purpose of these approaches is to propose the methods that can detect the attacks not only at the edge of the network but also at the core of the network. It also tries to detect the stealthy or can say hidden attacks in the network. In this paper mainly two detection algorithms are being used to detect the network:

Entropy to detect the attack traffic by evaluating sudden change in the randomness. The entropy of the source will be calculated through Packet sliding window of fixed size. The threshold value is being set and the entropy value is being analysed before and after the attack. If the entropy value exceeds the threshold, there is a attack. Entropy detector is somewhat better.

Chi square statistics will be used to find the sudden change in the network traffic by estimating the flow of traffic. As mentioned in [12], It is used for distribution comparision where measurement involved discrete values. Eg. Flag value or protocol. It uses bin values and provides the useful measure of deviation of current traffic profile from baseline. If the number of packets in a particular bin exceeds dramatically then, there is a attack.

A. Detector Evaluation

Prototype evaluation: It uses SNORT that is offline processing and the simulated attack is being generated to check different methods evaluation. The prototype detector is able to determine the network is under attack and deploy the accurate filtering rule.

Network trace data: for exposing the detectors to traffic from variety of network environment. The different detectors works differently in different environment.

B. Response

1. Constant filter rule, drops the packet by matching the packet protocol header's value with the specified attack rule.
2. Random filter rule, specifies the attack with the random numbers of the protocol header and drops them. Disadvantage of this rule is that, it drops first few packets.
3. Allow filter rule, allows the amount of traffic to pass through the network as a normal traffic.

Strength of this Approach: It detects the attack by estimating the flow of packets in the network by defining threshold value, Results are consistently more representative of core internet traffic that is our target environment.

Weakness of this Approach: performance is slow, Some low rate attacks may be missed.

"An Advanced Entropy-Based DDOS Detection Scheme".

According to [3], The normal entropy based detection was suitable only for low rate DDoS detection. So advanced entropy based scheme was proposed that divides the DDoS attack into linear fields and each field is treated with different methods. AEB detects the DDOS attacks with higher accuracy. Different approaches are being proposed by different researchers but each having a significant drawback. Compared to these different approaches based on volume and features, Detecting DDOS attacks based on the entropy provides various advantages: simple calculating, high sensitivity, low false positive rate, no need of additional network traffic and device. Key Challenge is that how to determine the suitable threshold to detect the DDOS attacks accurately. But finding optimum threshold is not enough, sometimes the legal traffic breaks the threshold and trigger alarm. So Advanced entropy based scheme is proposed that divides the attack traffic into different fields and treats each field with appropriate method. AEB uses the Hc value that is computed window value Hn is normal range.

if Hc(X)- Hn(X)I >a * d then attack is true.

Where "a" determines the threshold.AEB scheme is superior in 3 facts: Identify the legal traffic, Differentiate between DDOS attack and flash crowds, Internet traffic pattern varies with time: we divide the whole network into four fields-Normal, Lv1,Lv2,Lv3. And "a" into a1, a2, a3.Whenever Hc(X) ct. Normal, DDOS attacks may occur. That leads to one of the three cases.

Strength of this Approach: It divides the DDoS attack traffic into fields and each field is treated with different methods, The packet of each flow are collected in time window.

Weakness of this Approach: There is no difference between AEB and original entropy-based scheme when detecting high rate DOSAttacks, As AEB take more time to identify waves of legal traffic, flash crowds and LDOS, its response time is longer than original scheme which varies between 100-200ms i.e. it is still difficult to differentiate between the normal traffic and LDOS.

*"DDOS Detection Method Based on Chaos Analysis of Network Traffic Entropy."*According to [4].The proposed anomaly detection method based on the Tsallis Entropy and Lyapunov exponent. Entropy is being compared between source ip and destination ip by analysing the rate of exponent separation. Contribution is to combine the effect of source ip and destination ip in network traffic while common entropy only based on only separate field. Exponent separation detection algorithm can detect the DDoS attack effectively, the *Entropy time sequence*is also being set i.e. Source is Hs(k) and destination Hd(k)

When value of exponent is λ_k**>0,** orbit is unstable &chaotic, Source ip is greater than destination ip. Anamoly is based on burst traffic and DDoS attack.

When λ_k **= 0,** orbit is neutral fixed point, Source ip and destination ip has the same distribution which is normal traffic mostly.

When λ_k**<0,** attracts to stable fixed point, Destination ip is greater than source ip. Anomaly is based on network scanning.

Strength of this approach: It combines the effect of source ip and destination ip in the network, Lyapunov exponent detects the anomaly effectively.

Weakness of this approach: we see that several traffic anomalies happened in some time point. This can

be explained by burst attack, but there is no more detailed information we can get from this, lack of well structured DDOS data set.

*"An empirical evaluation of information metrics for low-rateand high-rate DDoS attack detection "*was proposed. According to [5], It is very difficult to detect the low rate DDoS attacks because that looks very similar to legitimate traffic and high rate DDoS attack because that looks similar to flash crowds. It is important to use a minimum number of traffic features to detect low rate and high rate DDoS attack efficiently. In this paper 3 parameters are being used: source IP i.e. to find source hosts even they are spoofed, destination IP i.e. to identify the traffic flowing to a particular target and protocol i.e. to identify the protocols that attacker may use to send malicious traffic.

Then, Several major *INFORMATION METRICS* overcome the existing DDoS detection methods namely, Hartley entropy, Shannon entropy, Renyi's entropy, generalized entropy, Kullback–Leibler divergence, in which Shannon entropy and kullback-leibler are best suitable for detecting abnormal traffic based on ip address or packet size distribution. *INFORMATION THEORY BASED MATRICS* has ability to differentiate the authorized traffic from attack traffic with low computation complexity. The appropriate information metric measures helps to magnify the spacing. *SPACING* is used to distinguish the attack traffic from legitimate traffic i.e.

More space = More difference between these two traffics.

The methods for protecting against DDoS attack can be classified into 4 categories: Source end, victim end, intermediate network, distributed. Victim end based method is the best.

Strength of this approach: It is easy to detect low rate and high rate DDoS attack with the help of information metrics, Spacing is used to differentiate between legitimate traffic and attack traffic.

Weakness of this approach: Detection of high rate and low rate DDoS attacks at the same time is difficult.

A method for "*Detecting an Anomalous Traffic Attack Area based on Entropy Distribution and Mahalanobis Distance."* According to [6], There are 3 methods been used for detecting the anomalous traffic from normal one.

1st one ENTROPY to detect the abnormal traffic from normal one by defining Data set.

2nd MAHALANOBIS distance to not only find similarity between the normal and abnormal traffic but also find the point features with their distances. It estimates the threshold value also.

3rd Chi square method used to find the goodness of fit with the help of estimation of traffic with probability matrix and if the packets increases suddenly from expected value then there will be the traffic area or malicious data.

These three techniques used with different idea and formula.

Strength of this approach: It Defines the similarity among the unknown traffic and normal traffic, The distance between the normal and unknown traffic and also their point features, With the help of chi square it finds the sudden change in the flow of traffic

Weakness of this approach: If the traffic or malicious data is so small then the traffic will not be easy to detect "*Traceback of DDoS Attacks Using Entropy Variations*" According to [9,14],However, the memory less feature of the Internet routing mechanisms makes it extremely hard to trace back to the source of ddos attacks. So IP TRACEBACK Scheme is proposed to find the actual source from which the DDOS attack packet entered in the Internet to find the zombies.

Two major methods for IP TRACEBACK:

1. Probabilistic packet marking (PPM): operate only in local range of ISP network
2. Deterministic packet marking (DPM): needs to update al routers for packet marking.

The proposed method needs no marking on packets, and therefore, avoids the inherent shortcomings of packet marking mechanisms..Both PPM and DPM strategies are vulnerable that causes *Packet pollution.* To avoid this packet marking scheme, in this paper we used *entropy variation.* The entropy variation uses the Pushback process which includes, Victim, Attack tree, Upstream routers, Attacker sources.

This process works in parallel and distributed fashion until it reaches the attack sources. This strategy has many advantages over the PPM & DPM scheme. Typical DDOS and DRDOS DDOS attack are critical for effective traceback. Once a DDoS attack has been identified by the victim via detection algorithms, the victim then initiates the pushback tracing procedure The proposed method deals with the packet flooding type of attacks perfectly.

C. Strength of this Approach

1. Accurate trace back is possible within 20 seconds (approximately) in a large-scale attack network with thousands of zombies.
2. Proposed strategy overcomes the inherited drawbacks of packet marking methods, such as limited scalability, huge demands on storage space, and vulnerability to packet pollutions.
3. Proposed method brings no modifications on current routing software Ip trace back method is memory non intensive, efficiently scalable, robust against packet pollution, and independent of attack traffic patterns.
4. Proposed strategy can ttrace back fast in larger scale attack network

D. Weakness of this Approach

1. Location estimation of attackers with partial information is not possible with this approach.
2. If the attack strength is less than seven times of the strength of non attack flows, then the current metric cannot discriminate it.
3. Proposed method may treat flash crowd as a DDoS attack, and therefore no Differentiation of the DDoS attacks and flash crowds.

V. SUMMARY

In this paper, we have described about what are the DDoS attacks along the impact of these attack on the vulenerability of the Internet and also gives the review of different detection methods that are being used over different environment on different types of attacks then describes the challenges that we face during the detection of DDoS attacks. We chose the Entropy based DDoS attack detection method so in this paper various detection methods has been described based on Entropy along with their strength and weaknesses.

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Overview of Facial Pose Estimation and its Methods

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***Abstract*—Face pose estimation is an issue in many vision systems such as face-based bio-metrics, scene understanding for humans, and others. It is a robust approach that performs facial pose estimation by examining the behavior of key facial features over a wide range of poses. Such methods are useful in intelligent vision systems for entertainment, human computer interaction, and security. The methods used for face pose estimation are based on different features such as mutual information which depends on information contained in two consecutive video frames. In another method, active shape models are used in symmetrical feature model for extraction of feature of faces. The Synergetic computer approach is another approach for estimation of facial pose. In this, modified basic synergistic computer, such as SC-MELT (Synergetic Computers with Melting) is used. The methods based on dense reconstruction and sparse representations are also important. Sparse representation of the input signal can be determined by a linear combination of a sparse subset of the bases. Dense reconstruction is a linear regression model for the training samples.**

Keywords: Mutual Information, Active Shape Model, Manifold Learning, Linear Regression

I. INTRODUCTION

Estimation of pose of faces and extraction of faces from video can be done by various methods. This also includes further analysis and modification in various methods. Facial pose topic is the issue which is concerned with the cameras that further depends on human behaviour. Face pose estimation has advance applications in biometrics, medical imaging. The advantages in biometric recognition of human pose have been greatly increased now. In this, camera vision system has the main role. Due to this more accurate identification system is needed for various security reasons. A number of works can be found in the literature that attempt to estimate facial pose or to use this information for a number of different applications [1].

When variation of types of head poses occurs in a video, then analysis of face similarity distribution can be done. In this work, the use of Gabor filters and principal component analysis (PCA) as the transformation of prototype images is done in order to emphasize pose differences [2]. Facial pose Estimation is also based on other properties such as illumination, shadows. 3D accession systems have standard of reliability such that range single images (Range imaging is the name for a collection of techniques that are used to produce a 2D image showing the distance to points in a scene from a specific point, normally associated with some type of sensor device)have been utilized to overcome difficulties [3]. For small pose range estimation, analysis of images was not well described. Therefore, manual computation is needed. Sometimes tracking of pose over multiple frames can also be done**.** Tracking methods may have many limitations. They need a training phase and also require e manual interaction [4].

Also, various methods have been developed for automatic and real time facial pose detection for past unseen faces. It was important for variation in large pose changes (frontal view, left view, right view), facial variations (e.g., expressions such as smiling pose), partial occlusions (e.g., due to glasses or hair), and to frame drop-outs (e.g., due to complete occlusions).

Basically, in pose estimation different active appearance methods can also used. Pose of 2D image can be used [5] as a reference in a 3Dimensional model. Now with the help of morphing 2D image, head pose can be estimated [6]. Estimation is basically derived from face recognition, then verification and then localization and then extraction. The basic process of facial poses estimation can be shown as [4]

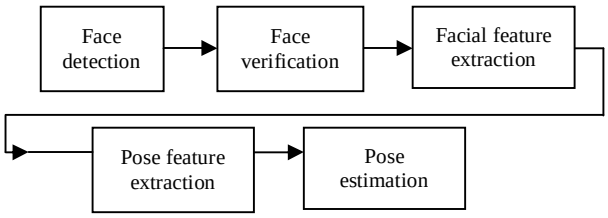

Fig. 1: Basic Block Diagram for Pose Estimation

II. LITERATURE SURVEY

Today, many methods are used for facial pose estimation. In face recognition there are different methods, but for accurately finding some feature points, pose estimation come into account. Therefore, for evaluating facial pose estimation, different methods based on different features are given as

A. Based on Mutual Information

Mutual information measures the dependency of the information contained in two consecutive video

frames [7]. When the mutual information between two frames is very close then it is said to zero, the less information one frame contains about the other and vice versa [8] [9]. In this, a method for automatic facial pose extraction on MI has been proposed. The information for random variable A and B given as

$$I(A, B) = H(A) - H(A/B)$$

Where H (A) is entropy which measures the information, content or "uncertainty" and is given by

$$H(A) = -\sum P(X) \log P(X)$$

Using this, information in video frames is compared. This has been done with the contained information in a ground original image that represents the needed pose. For experimental procedure and analysis, an audio video data base (XM2VTS) is used as shown in Fig 2. Video database contains complicated back-grounds which show that whenever tracker information is used the algorithms are able to perform very well for a number of different requested poses. For each pose class, PCA model was constructed. The method proved to outperform a PCA [10] reconstruction method which was used as a benchmark. This technique of pose detection found to be robust in small variations of scale and illumination. [7]

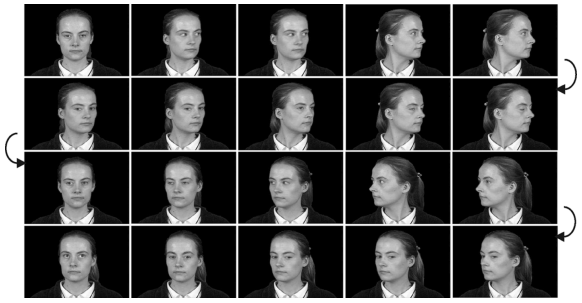

Fig. 2: Sample of XM2VTS Video Sequence. The Person Starts from the Frontal Pose, Turn his head from Right to left, and Returns to the Frontal Pose

B. Based on Symmetrical Feature Model

The other method is based on symmetrical feature model [11]. With the increase in computing power, smart vision systems have been designed to perform face detection and pose estimation in an accurate manner. In this method for extraction of features of faces ASMs are used. This results in a regression model that determine facial pose. In this reduction of number of ASM points have been done to accelerate performance as shown in Fig 3 and Fig 4. The pose model's performance under manifold conditions was needed to be computed. The ASM algorithm has been created by taking eyes and a vector of feature positions which was simplified for the eyes, eyebrows, nose, mouth, ears and face boundary. The section of each feature point was placed. These textures have features such as edges and corners on key facial features. Depending on the application, the number of ASM points may vary. Additions of points have been done to stress the uniqueness of a particular feature. But if addition occurs more time, than complexity and computational load increases. Therefore 82 feature points were used [12]. The 82 ASM feature points were manually adjusted for 20 subjects, each subject at 21 poses, to create a ground truth set of feature points as a function of pose. ASM points evaluate many features as eye width and so on. Therefore, they have been used to generate several geometric models to predict pose features, along with facial symmetry.

Fig. 3: Sample Pose Positions used to Collect ASM Ground Truth. Yaw Angles Correspond to [-45,-30,-15,0,+15,+30,+45]. Pitch Angles Correspond to [+30,0,-30].[11]

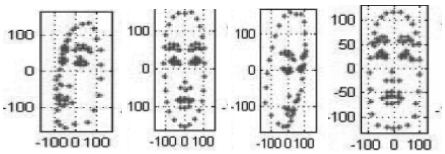

Fig. 4: ASM Feature Points Corresponding to Fig. 3.[11]

The ASM algorithm produces 82 feature points in 2-D space to yield a 164 dimension input space. There is manifold learning in which high dimensional feature have been parameterized by a lower dimensional embedded manifold [13]. The derived dimensional manifold representation is more compact to subsequent classification analysis, and easier to visualize [14]. Many reduction methods are there, but SLPP is prefer only a few of them. SLPP is the preferred method, because of its high accuracy and execution speed. Employing manifold methods instead of geometrical models takes the guess work out of feature extraction and enables quick and accurate retraining.

C. Based on Synergetic Computer Approach

This method is different from the other given methods. In this method, estimation depends on the synergistic computational approach [15]. Synergetic principle focuses on the self-organization or global competition of individual parts within a system. The basic synergistic computer was not sufficient to support advanced tasks, especially in the field of face pose estimation problem, which require a single system comprises of a combination of more models. Therefore, the advancement of basic synergistic computer, SC-MELT (Synergetic Computers with Melting) was used. In this, for a combination of ('melt') more learning prototypes into single adjoint prototype have been done as shown in Fig 5 but there is lack of losing the relevant information arises. Original SC-MELT exhibits over fitting phenomenon due to its inverse matrix method which may deteriorate the classification analysis. Moreover, its inconvenience for adapting the "melting

lever' necessitates modification. For modification, the concept of MPOD (Most probable optimum designs) [16] penalty function have been introduced which results in Modified SC-MELT. As shown in fig 5, this method was applied to design a view-based, adjoint prototype from each facial pose cluster [17].

Thus, a query image is projected to each adjoint prototype to derive the result for facial pose estimation. Experimental results determined that Modified SC-MELT presents more improvement in the classification rate as compared to original SC-MELT. Pose estimation based on maximum responses which is determining from order parameters is shown in Fig 6.

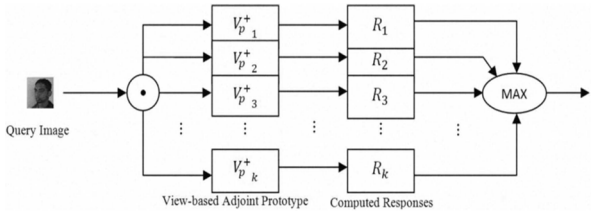

Fig. 5: Adjoint Prototypes for Pose Estimation. [17]

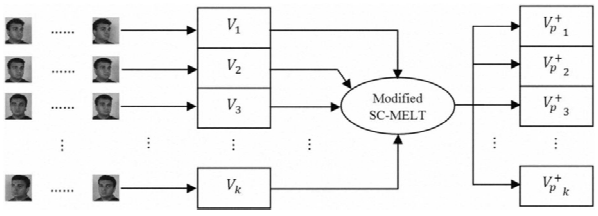

Fig. 6: Pose Estimation based on Maximum Response Determine from Order Parameters. [17]

D. Based on Dense Reconstruction and Sparse Representation

The other method used for face poses estimation is via dense reconstruction and sparse representation [18]. The dense reconstruction method reconstructs the facial pose based on the linear combination of the pose dictionary. It has approximately reconstructed the query poses, but has less reliability. It was noticed that pose with the same angle, but opposite view points have similar reconstruction errors in some cases.

Sparse Representation (SR) has given the strong results in field of computer vision, especially face recognition [19, 20]. It learns a dictionary of basis functions, so each input signal has been determined by a linear combination of a sparse subset of the bases. Let there be C classes of facial poses with each class being formed by n training samples of facial poses. These C classes of poses are formed as over-completed dictionary denoted by a matrix X, $X = [x,..., x_i]$. The test facial poses are expected to be expressed as a sparse representation of samples of the matrix X. The objective function given as follows:

$\hat{w} = \arg\min\|y-Xw\| + \lambda\|w\|$

where λ is a parameter which have been used to regularize the residual and the sparsity.

Each element of the learnt weight vector $\hat{w}$ has been associated with C class labels of the training samples. Thus, $\hat{w}$ was expressed as $\hat{w} = [\hat{w},\ldots\ldots,\hat{w}_i]$. Specifically, those nonzero entries of $\hat{w}_i$ represent a subset of the weighting factor for the class corresponding to training samples X_i. With these weighting parameters $\hat{w}_i$, the pose have been reconstructed as follows:

$\hat{y}_i = X_i\hat{w}_i$

The query pose y was classified according to the minimal error between y and the reconstructed $\hat{y}$:

$e_x = \| y-\hat{y} \|/N$

where N is the total pixel number of the face image.

The error calculated verifies the prediction. This prediction was about query face. Fig. 8 illustrates the reconstruction errors of poses-90̊.

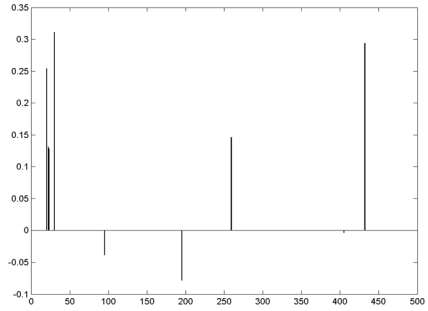

Fig. 7: Visualization of the Sparse Weight Vector W for the Query Pose-90̊ [18]

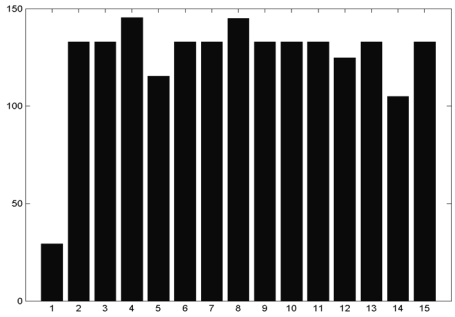

Fig. 8: Examples of Reconstruction Errors using the Sparse Representation Method. Figures Illustrate Error of Poses of Identity with Pose being-90̊ [18]

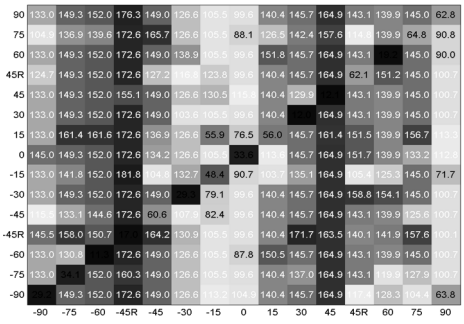

Fig. 9: Examples of Dissimilarity Matrix of Pose Estimation. Fig Demonstrate the Reconstruction Errors One Poses for one Identity [18]

The dense reconstruction of a given facial pose is actually a linear regression model for the training samples. Various methods have been proposed in reconstruction of faces or facial expressions for different applications [21, 22].

III. Conclusion and Future Scope

As there are many methods given for pose estimation. For each and every method there are different approaches to be followed. Based on mutual information, extraction of poses has been done automatically and classifies them according to view angle. Demonstrated experimentally on the XM2VTS video database and on a database created for the needs indicated a pose classification rate of 99.2% while it was shown that it outperforms a principal component analysis reconstruction method that was used as a benchmark. The method via ASMs having future studies was further explore the creation of a pitch geometric model and was consider reducing the number of ASM points to accelerate performance. For another method, experimental results clearly show that modification of SC-MELT has better performance than the original SC-MELT and it was likely to be implemented as facial pose classifier. In Modified SC-MELT, irrelevant low classification rate on front cluster classification is sacrificed but obtaining considerable higher classification rate on the profile view clusters have been done. Extension of this has been considered the deployment of the developed facial pose estimation. Depending upon sparse representation and dense reconstruction, it has experimentally proved that sparse representation has better performance than the dense reconstruction in facial pose estimation.

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Iterations Influence on Genetic Algorithm using Benchmark Function

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***Abstract*—These instructions Genetic Algorithm (GA) is one of the Bio-inspired techniques used for optimization problems. This paper describes a Genetic Algorithm that is based on Evolutionary Optimization Algorithm. A comparison is performed between different iterations and the influence of iterations over global and average fitness for genetic algorithm is shown for optimization. We have used benchmark function (Sphere) to evaluate the fitness of population. GA is one of the best Algorithms used in various Applications and shows the ultimate results.**

Keywords: Genetic Algorithm, Bio-inspired, Evolutionary Optimization Algorithm, Benchmark Function, Iterations, Global and Average Fitness

I. INTRODUCTION

Evolutionary computing which is a fast growing area of artificial intelligence where as Genetic Algorithm is one of the method among them. Genetic Algorithm is inspired by Darwin's theory about evolution [1]. Charles Darwin firstly represents the Theory of evolution [2]. It is the procedure by which organism change over time as a result of changes in heritable, physical or behavioral traits. Change that allows an organism, better adapt to its environment which help to survive more. John Holland at the University of Michigan in the early 1970s developed the Genetic Algorithm.

The common concept behind all these technique is same as given a population of individuals the environment causes survival of fittest [3]. Based upon fitness, best chromosomes are chosen for next generation by applying recombination and mutation. Execution of recombine and mutate leads to a set of new offspring) that compete based on fitness [4]. The procedure can be iterated until a chromosome with sufficient result is found [5].

This paper involves various sections describing genetic algorithm. Section I describe brief about genetic algorithm and section II is about biological background of genetic algorithm. Section III describes the Basic concept for genetic algorithm and Section IV describes the Benchmark Function. In section V explain the operators used in GA. Section VI describe results. At last section VII consist of conclusion.

II. BIOLOGICAL BACKGROUND

A. Chromosome

All living creatures consist of cells. Each cell consist pair of chromosomes. Chromosomes are threads of DNA and serves as a model for the whole living beings. Genes, blocks of DNA form chromosomes. A particular protein is encoded from genes. Gene gives features to human beings, for example hair colour, etc. Alleles are possible settings for a trait (e.g. blue, brown). Locus is the position for gene in the chromosomes. All chromosomes are called genome. Genotype is particular set of genes in genome. Phenotype is physical and mental features, such as eye and hair colour, etc.

B. Reproduction

Crossover (or recombination) is first step for reproduction. New chromosome is formed by crossover of parent genes. The new formed offspring can then be mutated. The elements of DNA are a bit changed, is called mutation. The fitness of living beings is measured by success of the living creature in its life.

III. BASIC CONCEPT OF GENETIC ALGORITHM

Genetic Algorithm is used for optimization problem in various fields. The process of genetic algorithm contains various steps to optimize the fitness. The procedure contains evaluation, selection and genetic operators to optimize the solution [6]. In evaluation the population is evaluated by using fitness function. Then the selection method is applied, in which the population is selected for further process. Genetic operators (crossover, mutation, etc) are applied to get the optimize results [7]. Elite is a selection method in which less number of species with the best fitness values is chooses to pass to the next generation [8]. The random destruction by crossover or mutation operators of species is prevented by elitism. The various step involved in genetic algorithm is mentioned below in pseudo code and the cyclic diagram illuminate various step of genetic Algorithm in figure 1.

Pseudo code for Genetic Algorithm
BEGIN
INITIALIZE (population with random number)

EVALUATE (each chromosome)
REPEAT UNTIL (condition is satisfied) Do
1. SELECT parent;
2. REPRODUCE pairs of parents;
3. MUTATE the result of offspring;
4. EVALUATE new candidates;
5. SELECT individuals for next generations;

Do
END

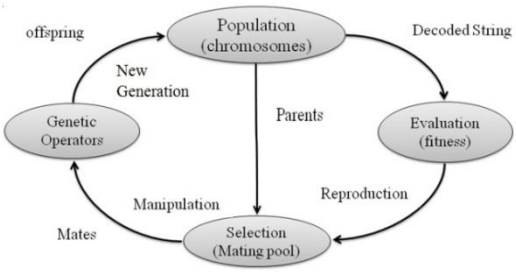

Fig. 1: Cyclic Diagram for Genetic Algorithm

IV. BENCHMARK FUNCTION

It is the measure of the quality of an individual [9]. The fitness function should be designed to provide assessment of the performance of an individual in the current population. Optimization Algorithms are validated and compare the performance using test function. Fitness function is helpful in evaluating the chromosomes performance. There are many fitness functions used for evaluation purpose [10]. Among them sphere is the most used fitness function to evaluate the performance of chromosomes [11]. The minimum and maximum value used in this experiment is -2.048 $\leq x_i \leq$2:048. The simplest test function is Sphere function. It is continuous, convex and unimodel.

Function Definition:

$$F_1(x) = \sum_{i=1}^{2} x_i^2$$

V. OPERATORS

The operators are the most important part of GA. Mutation is another recombination technique [12]. It is used to make sure that all the elements in a population are not homogeneous and diversity is maintained [13]. The Selection and other operates used in Genetic Algorithm is discussed below.

C. Selection Method

In selection the individuals producing offspring are chosen [14]. The fitness is used for actual selection process. There are many types of selection methods used in genetic algorithms but we used Roulette wheel selection method.

1) Roulette wheel Selection

Different chromosomes according to their fitness values are placed on a wheel, with the criteria that a better chromosome will occupy a big area. Then a marble is thrown to select the chromosomes [15]. A chromosome that belongs to a bigger area obviously will have more winning chances [16]. It is shown in Fig. 2.

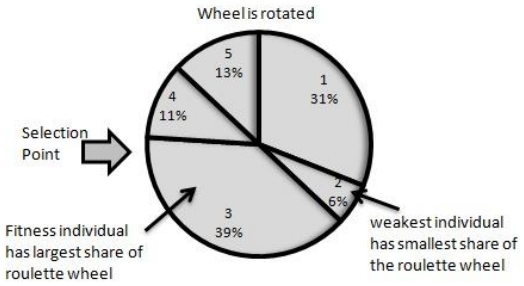

Fig. 2: Roulette wheel Selection

2) Tournament Selection

Tournament selection is also known as rank-based selection methods [17]. Randomly selects a set of k chromosomes [18]. These chromosomes are then ranked based on their relative fitness and the fittest chromosome is selected for reproduction. The whole procedure is repeated n times for the entire population.

3) Elitism Selection

To arrange the individuals in the decreasing order according to their fitness values. Then apply the selection with each two individuals in the arranged set. Genetic Algorithm will be applied between strong individuals or between weak individuals.

D. Crossover Methods

Creating offspring's by interchanging genes between chromosomes. Figure 3 shows various crossover methods [19]. Types of Crossover are

4) Single Point Crossover

New offspring's are produced by interchange of parent chromosomes. The crossover point within chromosomes is selected randomly.

5) Two Point Crossover

Two points are randomly selected and between these points, interchange of two parent's genes takes place.

6) Uniform Crossover

The parent contribution in the offspring chromosome is based upon probability. If the mixing ratio is matched to 0.5 this means 50 percent of genes in the offspring will come from parent 1 and the other will come from parent 2.

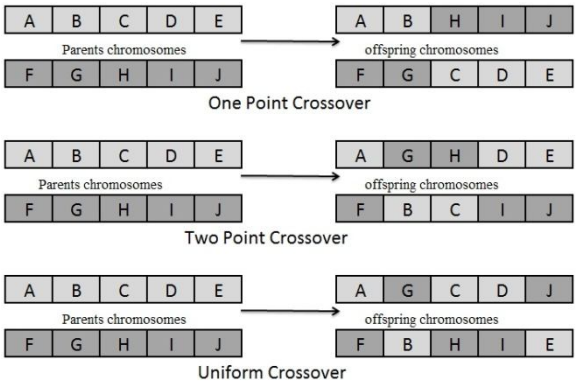

Fig. 3: Crossover Methods

E. Mutation Methods

In this the randomly selected gene value is changed. Mutation is shown in figure 4. Types of Mutation methods are.

7) Flip Bit

Choose one gene randomly and flip the value of the chosen gene.

8) Uniform Mutation

Choose one gene randomly and then replace the value of chosen gene with uniform random value selected. In this the new features are added to the child chromosomes.

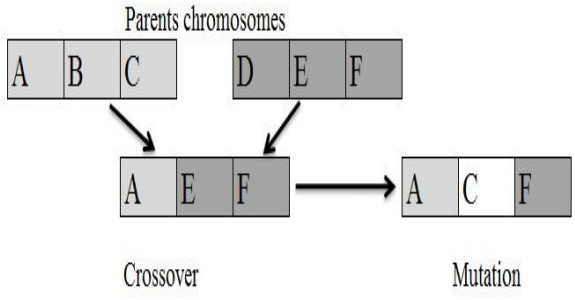

Fig. 4: Mutation Methods

VI. IMPLEMENTATION AND RESULTS

Entire GA code is written in C language using Visual Studio C++ (2010 release mode). The result of above experiment is evaluated using two different population sizes of 32 and 64. The other parameters of experiment are kept fixed. The iteration size is varied from 100 to 1000 with interval of 100 and the comparison is done among the iterations. The Table I shows the parameters used for the experiment. The performance shown in results table is average value of 20 trials.

TABLE 1: PARAMETERS FOR GENETIC ALGORITHMS

Population size	32 & 64
Pair crossover Rate	0.9
Mutation Rate	0.001
Fitness Function	Sphere
Selection Method	Roulette Wheel
Crossover Method	Uniform Crossover
Iterations	100 to 1000

Table II shows the results taken for population size 32. In this the average and global fitness is evaluated for different iterations starting from 100. The graph is shown in figure 5. The best value for Global Fitness executes at iteration 900 i.e. 0.49062 and time taken for execution is 0.3594.The best value for Average Fitness executes at iteration 800 i.e. 1.24274946 and time taken for execution is 0.3184. In the graph it shown that the global and average values optimized as we increase the number of iterations.

TABLE 2: RESULTS FOR POPULATION SIZE 32

Iterations	Global Best	Average Best
100	0.565762	1.34086959
200	0.535101	1.295903685
300	0.5399835	1.26382887
400	0.5385615	1.305558145
500	0.512836	1.276528955
600	0.51466	1.34698515
700	0.526849	1.311873765
800	0.4998535	1.24274946
900	0.49062	1.258100245
1000	0.515131	1.289419435

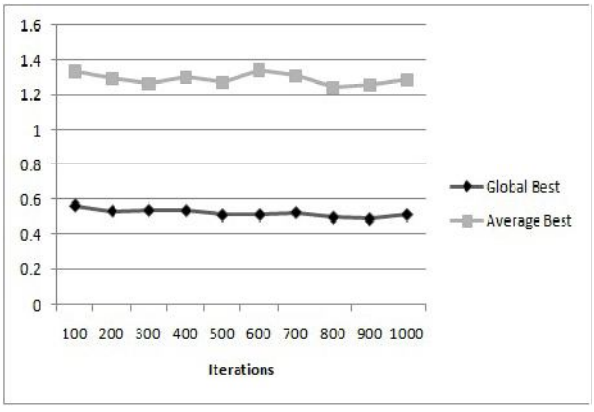

Fig. 5: Global and Average Fitness Graph for 32 Population Size

Table III shows the results taken for population size 64.The graph is shown in figure 6. The best value for Global Fitness executes at iteration 1000 i.e. 0.500322 and time taken for execution is 0.7645. The

best value for Average Fitness executes at iteration 1000 i.e. 1.417453 and time taken for execution is 0.7643. In this the best optimization solution for global and average fitness comes at iteration 1000. Optimization is best when the iteration size is more as well as population size as shown for 32 and 64 chromosomes, the best result comes for more population size and iterations. It shows less optimization when the iterations are less.

TABLE 3: RESULTS FOR POPULATION SIZE 64

Iterations	Global Best	Average Best
100	0.563998	1.51823152
200	0.5679425	1.430412365
300	0.5255045	1.46484793
400	0.5405335	1.46578109
500	0.5259505	1.42088764
600	0.520593	1.47396168
700	0.525645	1.459672765
800	0.504817	1.44572126
900	0.5121635	1.44824826
1000	0.500322	1.41745316

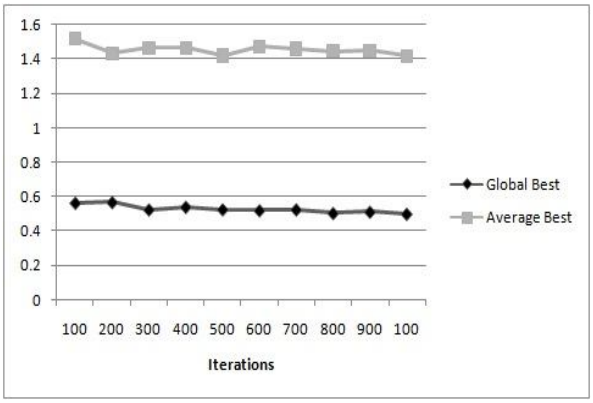

Fig. 6: Global and Average Fitness Graph for 64 Population Size

Table IV shows the Time taken for population size 32 and 64. The graph for time difference between 32 and 64 is shown in figure 6. The 32 chromosomes take less time than the 64 chromosomes and in both cases the time increases as the iteration value is increases. But the optimization is better for 64 chromosomes then 32 chromosomes.

TABLE 4: EXECUTION TIME FOR 32 AND 64 POPULATION SIZE

Iterations	Time for Chromosomes	
	32	64
100	0.07	0.1065
200	0.08989	0.177
300	0.1464	0.244666667
400	0.1856	0.3275
500	0.2181	0.391666667
600	0.2602	0.473333333
700	0.2825	0.539333333
800	0.3184	0.652666667
900	0.3594	0.696833333
1000	0.4228	0.7645

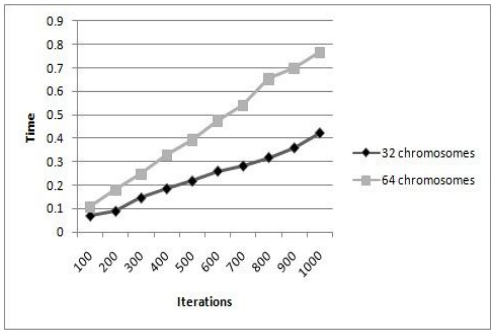

Fig. 7: Graph for Execution Time

VII. CONCLUSION AND FUTURE WORK

In this paper, the implementation of GA using C language is carried out. It shows it best at iterations 900 and 1000 for sequential execution on CPU using Sphere benchmark function. From this result it is concluded that, the algorithm can be made more optimized for several search problems to enhance its wide variety of features. In future work, the performance of GA model will be more improved by modifying single objective GA to multi-objective GA. Further improvement of this model will be done by implementing multi-objective GA model with Fuzzy logic system and parallel execution using CUDA can be done so that execution time can be reduced.

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Design of Electrically Small Antenna with Metamaterial: A Review

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***Abstract*—Miniaturization of the antenna is quite difficult because it requires sizes of the order of quarter wavelengths. Because of the difficulties in designing of antennas below the size of wavelength, electrically small antennas are of interest in a variety of applications. An electrically small antenna is defined as an antenna with a volume smaller than a radian sphere that is an imaginary sphere of radius equal to (λ is free space wavelength). Microstrip patch antennas are a good choice where small sized antenns are reuired. But these antennas have limited performance. The performance of these antennas can be improved by metamaterials. Metamaterial antennas are the class of antennas which use metamaterials to increase performance of electrically small antenna systems and step up the antennas radiated power. This class of antenna incorporates metamaterials, which are materials engineered with novel, often microscopic, structures to produce unusual physical properties (negative permeability and negative permittivity in certain frequency range called left handed materials). A metamaterial antenna behaves as if it is much larger than its actual size, because its novel structure stores and reradiate energy. This paper reviews the limitations of designing electrically small antenna and its design with MTM.**

Keywords: Electrically Small Antenna (ESA), Q Factor, Metamaterial (MTM), Double Negative (DNG), Left Handed Materials (LHM), Metamaterial Small Antenna (MSA)

I. INTRODUCTION

The development and growing need of personal communications and handheld devices such as smart phones, tablets, computers, navigation devices, etc. uses wireless access points to exchange and transfer data and hence, gathered large interest in research and development of small antennas and antenna miniaturization techniques. Electrically Small Antenna (ESA) has many advantages due to light weight and small size. An antenna is defined as a part of a transmitting or receiving system which is designed to radiate or to receive electromagnetic waves [1]. Antenna is a necessary part of any hand-held or mobile wireless devices from the engineering point of view. While, for the designers and users an antenna on the device is something uncouth and should be evaded or at least should be made invisible. With the evolution of small antennas above invocations are merged and usually integrated in the handheld device body.

Antenna size and its performance are strongly fastened together. The first fundamental results showing the link between antenna size and its maximum bandwidth and gain were presented in the late 1940s [2][3]. The antenna size is also determined by physical laws rather than only by the technology used for its fabrication (like in electronic chips). Good performances of an antenna are obtained when the antenna is resonant and when its size is comparable to the wavelength. Several techniques and approaches have been introduced to reduce antenna dimensions and maintain good radiation properties [4-7].

A. Electrically Small Antenna

An electrically small antenna is defined as an antenna with a volume smaller than a radian sphere defined by H. A. Wheeler [8]. Radian sphere is an imaginary sphere of radius equal to λ/2π (λ is free space wavelength) as shown in equation (1).

$$\frac{2\pi r}{\lambda} < 1 \quad (1)$$

where r is the sphere's radius, and λ is the free space wavelength.

The far-field radiation pattern of an antenna is the sum of its near-field spherical modes (expressed using spherical Bessel functions and Legendre functions). This far field radiation pattern is omnidirectional with no alteration in the azimuth plane. The radiation Q is given by the equation (2).

$$Q \propto \frac{1}{r^3} \quad (2)$$

The Wheeler's concept is illustrated in Fig. 1. The electrically small antenna is in free space and may be enclosed in a sphere of radius 'a' such that

$$ka < 1 \quad (3)$$

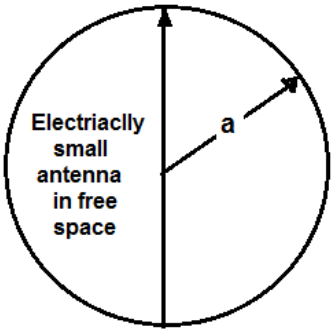

Fig. 1: Sphere Enclosing an Electrically Small Radiating Element

Here k=2π/λ (radians/meter)

λ=free space wavelength (meters)

a=radius of the sphere enclosing maximum dimension of antenna (meters)

The hitch of designing an electrically small antenna includes:

- Impedance matching
- Insertion loss
- Low radiation efficiency and small radiation aperture

In 1987 Fujimoto, Henderson, Hirasawa and James summarized the approaches used to design electrically small antennas [2]. They also surveyed the theoretical limits of electrically small antennas. It has been established that for an electrically small antenna, contained within a given volume, the antenna has an inherent minimum value of Q. This places a limit on the attainable impedance bandwidth of an Electrically Small Antenna. Higher the antenna Q, the smaller is the impedance bandwidth. So the challenge in designing a small antenna is optimizing the operating bandwidth, which is often characterized using the antenna's Q-factor. Recent efforts in this area have demonstrated that small antennas can be designed to achieve a Q that closely approaches fundamental limits.

The four fundamental limitations of antennas are:

1. Electrically small antennas.
2. Super directive antennas.
3. Super resolution antennas.
4. High-gain antennas.

The theoretical limitation of an electrically small antenna and its bandwidth was first investigated by L.J.Chu [4]. Wheeler first proposed the idea of miniaturization of antennas. In 1947, Wheeler introduced the fundamental limits of electrically small antennas [3] .Wheeler and Chu both had made contributions to the theory of electrically small antennas in terms of Q factor. The basic difference between Wheeler and Chu contributions was highlighted by Lopez [9].

B. Wheeler and Chu Small Antenna Limitations

According to Wheeler (1945 and 1947 papers)

$$Q_{\text{Wheeler}} = 9/2\ (\frac{V_{RS}}{V_E}) = 9/2\ (\frac{V_{RS}}{kV_{OC}}) \quad (4)$$

Where V_{RS} = Volume of radian sphere = 4/3 radianlength

V_E= Effective volume

k =Effective volume factor

V_{oc}= Wheeler occupied volume

According to Chu (1948 paper)

Q_{chu} = Lower bound on Q

$$Q_{chu} = V_{RS}/V_{chu} \text{ for } V_{chu} << V_{RS} \quad (5)$$

V_{Chu} = Chu volume (Volume of sphere whose diameter is maximum dimension of the small antenna)

Wheeler's formulas yield accurate values, and are vital for the design of small antennas. Whereas Chu's lower bound assumes no stored energy within the sphere and can only be realized in theory. It is a very useful theoretical reference point. As the conventional antennas are governed by the 'right hand rule' which determine how electromagnetic wave should behave, their applications are always limited. However, a metamaterial substrate offers a substitute to wider antenna applications using the 'left hand rule' [10]. Metamaterials are composite materials with unique electromagnetic properties. Due to the interaction of electromagnetic waves with the finest scale periodicity of conventional materials [6], many names have been suggested such as "electromagnetic metamaterials", "backward-wave media (BW media)" "Double-negative (DNG) metamaterials" to name a few. Metamaterials have opened an exciting field to realize unexpected physical properties and applications, which are not possible from naturally occurring materials.

Conductive or dielectric inclusions in metamaterials can be tailored in shape and size, periodicity, and defects to produce unusual yet exciting properties. Unusual properties such as, negative permittivity and permeability, negative refraction at the interface of two (RH and LH) media, reversal of Snell's law, reverse Doppler effect, and amplification of evanescent waves can be realized. The concept of metamaterials was first proposed by Veselago in 1967 [11]. He considered plane-wave propagation of an unknown material that has a negative permeability and permittivity in the same frequency range which shows the abnormal electromagnetic properties [11-13]. As a result, the left-handed material (LHM) has a reverse basic feature of light, such as negative refractive index (NRI) [12-13]. Physical experimentation did not occur until 33 years, the idea got only little attention until came to the year 2000 when Smith explored the LHM and realized this material was a periodically-arranged conducting concrete and also shows exceptional properties [13]. In the year 2001, Shelby Smith and Schultz from the University of California invented the

split ring structure that was the first structure to prove the existence of metamaterial [14]. After that, in the year 2005 another three new structures were propose- the symmetrical ring structure, omega structure and S structure [15].

C. Antenna Design using Metamaterial

Microstrip patch antennas are most widely used today. A microstrip antenna in its elementary form consists of a radiating patch and a ground plane on either side of a dielectric substrate. The radiating patch may have several configurations like square, rectangular, thin strip (dipole), circular, elliptical, triangular or any other configuration. Many configurations can be used to feed microstrip antenna [16].

The "patch" is a low-profile, low gain, narrow bandwidth antenna. Radiation from the patch is from two slots, at the left and right edges of the patch. The "slot" is the narrow gap between the patch and the ground plane. At the centre of patch the electric field is zero, maximum at one side, minimum on the opposite side. The salient parameters of any type of antenna are impedance bandwidth and return loss. Metamaterial based rectangular microstrip patch antenna improves the bandwidth and return loss in remarkable way.

Patch antennas have following advantages and disadvantages [16] [17]:

Advantage:

- Light weight and have a small volume.
- Low fabrication cost. Easier to integrate with other MICs on the same substrate .They allow both linear and circular polarization.
- Used in personal mobile communication as patch can be made compact.
- Dual and triple frequency operations are allowable.

Disadvantage:

- Low bandwidth.
- Low gain.
- Low power handling capability.

MSA have low gain and narrow bandwidth which is the degrading for wide spread application. So increasing the bandwidth of MSA is important today. Metamaterial as a substrate or cover can enhance the gain and can also increase the bandwidth and directivity of patch antennas [18]. Hence we can improve the bandwidth by increasing the substrate height, reducing the dielectric constant or by using MTM as a cover [19-21]. Directivity can also be increased by using left handed metamaterial. Left handed metamaterial used as a slab, will act like a lens and it will focus the energy.

D. Applications of Metamaterial Antennas

In antennas, the various applications are:

1. *High gain antennas*: In metamaterials, some materials have low permittivity ε, may be near zero, so is the refractive index. This feature can be used to design high gain antennas. Used in Wimax applications.
2. *Small antenna*: Metamaterials enhance the performance of electrically small antennas and step up the radiated power because of its unusual behavior.
3. *Compact antenna*: High impedance surface metamaterials Or AMC (artificial magnetic conductor) that produce in phase reflections proposed compact size and wider bandwidth antennas.
4. *Antenna substrates*: Metamaterials are used for miniaturization, sensing, bandwidth enhancement and for controlling the direction of radiation.
5. *Array antennas*: Metamaterials improve the impedance matching of planar phased array antennas over a broad range of scan angles [23] and can be used to provide broadband, compact and non-radiating, feed-networks.

II. Future Scope of Electrically Small Antenna

In future, as per need many new shapes can replace the conventional shapes. A design of small antennas have very good future aspects in designing reconfigurable antennas such as reconfigurable rectangular patch antenna, reconfigurable wheel antenna etc.

Moreover, metamaterial research at microwave and radiowave frequencies is expected to improve the antenna designing within the next few decades by reducing the antenna size and better performance for satellite communication and personal mobile devices.

III. Conclusion

From this survey, it is clear that metamaterials can refine the performance of conventional patch antennas. Electrically small antennas with metamaterials are one of the most innovative topic which have application in modern microwave systems. This new approach design due to its interesting and unusual properties arrives with a new solution to the problems of conventional antennas. By this review, Metamaterials can be used for the designing of electrically small antennas. There are different kinds of metamaterial substrates and change in the metamaterial substrate will change the parameters of antenna. So miniaturization, improved bandwidth and gain can be achieved by using metamaterial.

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Performance Evaluation of S-band 16×10Gbps WDM System over + NZDSF with NRZ, RZ, CSRZ, SSB, Duo-binary Modulation Formats

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***Abstract*—In the present era of data using devices everywhere the need of high capacity and high bandwidth systems is there. C-band and L-band are the most used bands for the Wavelength Division Multiplexing (WDM) transmission systems. Beyond these C and L Band to increase the system capacity we can use O-Band, E-Band and S-Bands. Out of these bands S- band has an edge over others because of availability of good response of Thulium doped fiber amplifier for this band and relative low attenuation loss < 0.3db/km, In this paper the performance of different modulation formats, Non-return to zero (NRZ), Return to zero (RZ), Carrier suppress return to zero (CSRZ), Duobinary, Single sideband (SSB) in S-band 16×10Gbps WDM system over Non zero dispersion shifted fiber +D NZDSF has been evaluated. The performance of the system in terms of Q-factor and BER has been evaluated. In 16×10Gbps WDM system maximum transmission distance is 130 km and acceptable Q-factor (9.25 dB at 1st channel, 7.45 dB at 8th channel and 9.84 dB at 16th channel) has been observed. Also for duobinary BER (1.07×10-20 at 1st channel , 4.45×10-14 at 8th channel and 3.64×10-23 at 16th channel) has been observed which are in acceptable range. Except duobinary modulation format all other considered modulation formats could not produce acceptable Q-factor at the receiver**

Keywords: S-band, WDM, RZ, NRZ, CSRZ, SSB, Duobinary, Q-factor, BER and Transmission Distance

I. INTRODUCTION

The S-band is very promising band for future WDM systems, other alternatives to S-band are O, E and U band. As the O and E bands lacks the availability of high gain optical amplifier, Praseodymium-doped glass fiber amplifiers have gain in these regions but it yields very low gain [1]. And for these bands Raman amplifier is also not as attractive as the Raman pump wavelength lies in high attenuation region. Recently Thulium doped fiber was previously reported with up to +27 dB gain in S-band [2] which is quite good and is comparable to EDFA in C band (EDFA gain = 27 dB)[3]. Also the advances in SOAs, Raman amplifiers and enables the S-band transmission [4]. So S-band emerges as the best out of these bands. There are different modulation formats which are having distinctive advantages. In this paper NRZ, RZ, CSRZ, Duo binary, and SSB modulation formats have been considered. It is reported in the literature that the SSB is immune to the chromatic dispersion [5, 6]. Also electronic dispersion compensation (EDC) can be implemented with SSB. In this paper electronic dispersion compensation is not considered. Other modulation formats like Duobinary modulation format were reported for dispersion reduction in high capacity optical systems modeling , experiment and field trial concluded that duobinary modulation format duobinary is very spectral efficient and immune to dispersion [7]. Carrier-suppressed return-to- zero (CSRZ) increases the spectral efficiency up to > 0.4 bit/s/Hz [8].

II. SIMULATION SETUP

For the simulation Optiwave9.0 simulator has been used. At the transmitter side equally spaced 16 wavelengths ranging from 203.3 THz to 204.8 THz (S-Band) with 100 GHz channel spacing have been used.

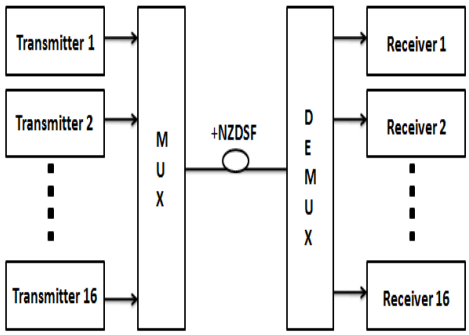

Fig. 1: Simulation Setup

In each case different modulation formats have been implemented on these wavelengths. Laser Power has been set to be 0 dB at all wavelengths for all the modulation formats. A multiplexer (MUX) has been used to multiplex all the wavelength signals. Optical Fiber NZDSF+ has been used in this work. In NZDSF+ the GVD dispersion for the S-band is less than the C-

band which leads to less signal degradation in S-band as compared to C-band. Effective area of fiber has been kept constant at 60 µm2. And at the receiver side demultiplexer (DEMUX) separates different wavelengths, At each DEMUX output an PIN photo detector has been used with responsivity of 1A/W and Dark current of 10nA, also a band pass Bessel filter with 0.75×bit rate has been used to remove the noise from the signal. The BER and Q-factor have been calculated for varied fiber length from 80 km to 150 km.

III. Results and Discussion

The different modulation formats have been investigated for S-band 16×10Gbps WDM system over NZDSF+. To analyse the system Q-factor and minimum BER have been calculated at 1st channel, 8th channel and 16th channel.

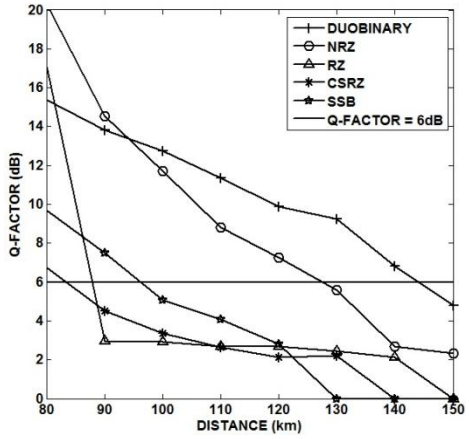

Fig. 2: Q-Factor *vs.* Distance at 1st Channel

Figure no. 2 shows the graphical representation of Q-factor as the function of transmission distance. At the 1st channel all the considered modulation formats have Q-factor > 6 dB at 80 km and at 90 km NRZ has highest Q-factor of 20.36 dB as compared to others, Also 100 km onwards Duobinary has highest Q-factor. For Duobinary Q-factor remains > 6db till 140 km.

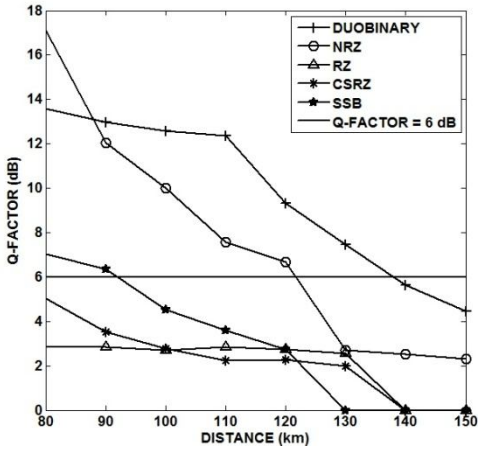

Fig. 3: Q-Factor *vs.* Distance at 8th Channel

In figure 3 we have plotted Q-factor vs. transmission distance for channel no.8. The trend is almost the same as that of channel no. 1, it is clear from the figure that only Duobinary survived at 130 km with 7.45 dB Q-factor. And at 140 km for all modulation formats Q-factor goes below 6dB level which is unacceptable.

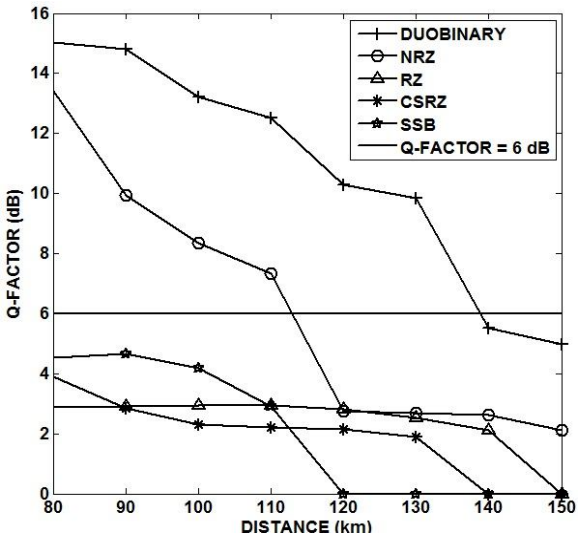

Fig. 4: Q-Factor *vs.* Distance at Channel 16

In the figure no.4 Q-factor vs. distance is plotted for channel no. 16 .In this figure Duobinary provides better and highest among all Q-factor of 9.84 dB at 130 km but at 140 km its Q-factor is less than 6 dB

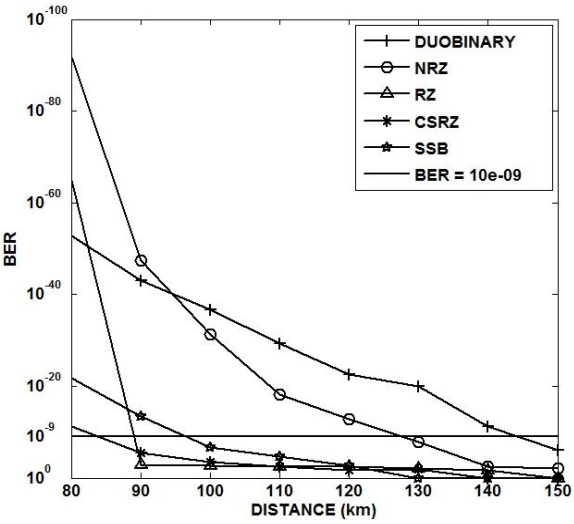

Fig. 5: BER *vs.* Distance Channel at 1

In this figure the BER is plotted vs. transmission distance. Duobinary has the least BER in distance ranging from 100 km to 150 km but it is less than 10^{-9} only upto 140 km.

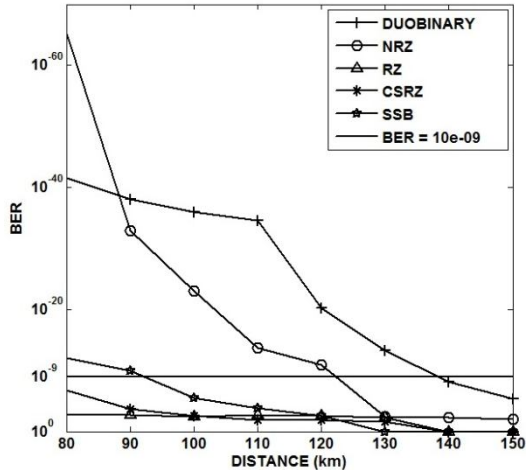

Fig. 6: BER *vs.* Distance at Channel 8

In Figure no. 6 BER is plotted vs. transmission distance at channel no. 8. It is clear from the figure that Duobinary has the least BER in distance greater than 90 km. at 130 km BER is $<10^{-9}$,and at 140 km BER is $>10^{-9}$ which is unacceptable.

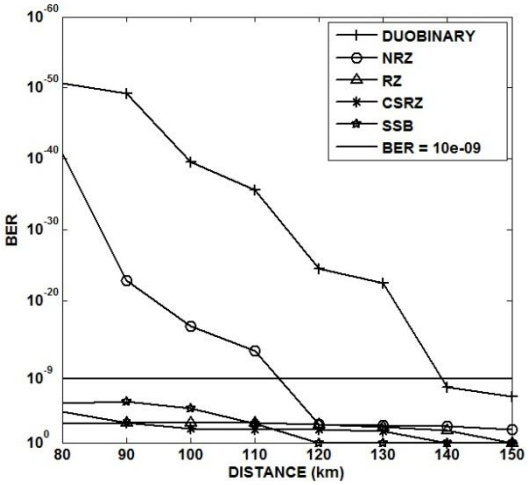

Fig. 7: BER *vs.* Distance at Channel 16

In the figure.7 BER vs. distance for 16 th channel. At channel no.16 again CSRZ, RZ and SSB have BER $> 10^{-9}$. NRZ has BER $< 10^{-9}$ upto 110 km. and Duobinary has the best and minimum BER among all which is $< 10^{-9}$ even at 140 km. at 150 km all modulation formats have BER$>10^{-9}$

IV. Conclusion

This paper investigates the performance analysis of different modulation formats such as NRZ, CSRZ, RZ, SSB, in 16×10Gbps WDM system over + D NZDSF. It is concluded that the Duobinary modulation format is the best modulation format among, Duobinaru, NRZ RZ, CSRZ and SSB in S-band 16x10Gbps WDM system,. It has high Q-factor and minimum BER among all. Also it has been noticed that in the 16×10Gbps S-band WDM optical transmission with acceptable results is feasible up to 130 km over +D NZDSF without any amplifier and without any dispersion compensation.

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Image Enhancement in the Spatial Domain

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***Abstract*—Image enhancement techniques are designed to improve the quality of an image as perceived by a human being. The aim of image enhancement is to improve the visual appearance of an image. Many images like medical images, satellite images, aerial images and even real life photographs suffer from poor contrast and noise. It is necessary to enhance the contrast and remove the noise to increase image quality. The main purpose of the Image enhancement is to improve the image appearance so that the resultant image is better than the original image for a specific application or set of objectives. Image enhancement technique is defined as a process of image processing such that the result is much more suitable than the original image for a specific application, which can be done by either suppressing the noise or increasing the image contrast. Image enhancement algorithms are employed to emphasise, sharpen or smoothen image features for display and analysis. This paper focuses on different image enhancement techniques in the spatial domain.**

I. INTRODUCTION

The objective of image enhancement is to improve the interpretability of the information present in images for human viewers, or to provide `better' input for other automated image processing techniques [1].

Image Enhancement is among the simplest and most appealing areas of digital image processing. Basically, the idea behind enhancement techniques is to bring out detail that is obscured, or simply to highlight certain features of interest in an image. A familiar example of enhancement is when we increase the contrast of an image because "it looks better." It is important to keep in mind that enhancement is a very subjective area of image processing. Enhancement methods are application specific and are often developed empirically. Image enhancement techniques emphasise specific image features to improve the visual perception of an image.

Fig. 1: The Original Image and its Enhanced Image

II. TECHNIQUES OF IMAGE ENHANCEMENT

Image enhancement techniques can be divided into two main categories:

- Spatial domain techniques: These are the techniques which operate directly on pixels.
- Frequency domain techniques: These are the techniques which operate on the Fourier transform of an image.
- There is no general theory for determining what `proper' image enhancement is when it comes to human perception. If it looks good, it is good. However, when image enhancement [5] techniques are used as pre-processing tools for other image processing techniques, then quantitative measures can determine which techniques are most suitable.

III. SPATIAL DOMAIN TECHNIQUES

In spatial domain techniques [4], we directly deal with the image pixels. In spatial domain for getting desired output, the pixel values are manipulated. Basically in spatial domain the values of pixel intensity are manipulated directly as equation (1)

$$F' = g(x,y) = T[f(x,y)] \quad (1)$$

Where f(x, y) is input image, g(x, y) is output image and T is an operator on f, defined over some neighborhood of f(x, y).

The idea of blurring an image by reducing its high frequency components or sharpening an image by increasing the magnitude of its high frequency components is intuitively easy to understand. However, computationally, it is often more efficient to implement these operations as convolutions by small spatial filters [3] in the spatial domain.

The value of a pixel with coordinates (x, y) in the enhanced image F' is the result of performing some operation on the pixels in the neighborhoods of (x, y) in the input image. Neighborhoods can be any shape, but usually they are rectangular.

Some of the common image enhancement techniques in spatial domains for grayscale images are:

- Point processing operations
- Spatial filter operations
- Histogram processing operations

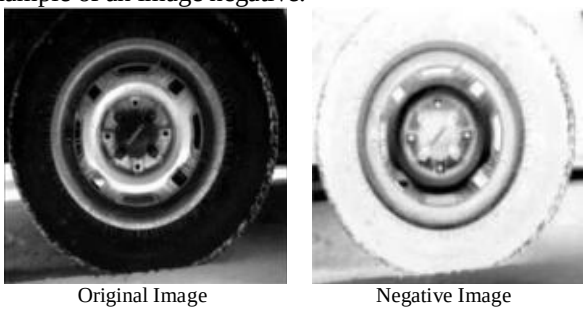
A. Point Processing Operations

1) Image Negative Transformation

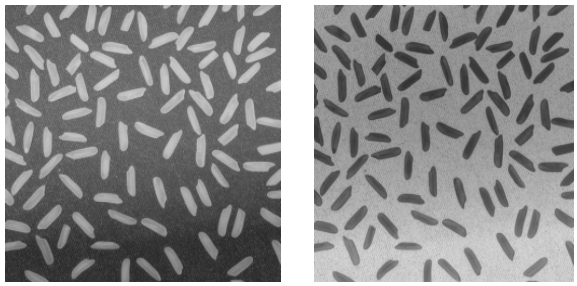
Consider an 8 bit digital image of size M x N, then each pixel value from original image is subtracted from 255 as

$$g(x, y) = 255 - f(x, y) \quad (2)$$

In a normalized gray scale, s = 1.0 – r. Negative images are useful for enhancing white or gray detail embedded in dark regions of an image. Fig.2 shows an example of an image negative.



Original Image Negative Image



Original Image Negative Image

Fig. 2: Original Images and its Negative Images

2) Image Thresholding Transformation

Another technique is Image Thresholding transformation in which let rth be a threshold value in f(x, y). Image thresholding can be achieved as in a normalized gray scale As pixel values of threshold image are either 0's or 1's, g(x, y) is also named as binary image. These are particularly useful in image segmentation to isolate an image of interest from back ground. Moon image can be isolated from black ground in binary image as shown in Fig. 3.

Original Image Threshold Image at (0.7)

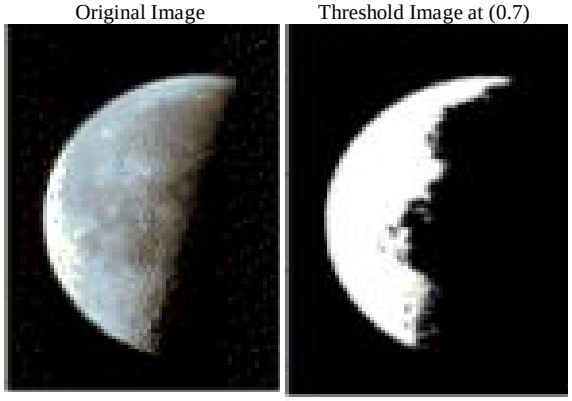


Fig.: 3: Original Image and its threshold Image

3) Log Transformation

Next kind of transformation is the Log transformation which maps a narrow range of low gray levels into a wider range of gray levels i.e. expand values of bright pixels and compress values of dark pixels. If C is the scaling factor, then log transformation can be achieved as $s = C \log (1+|r|)$. Logarithmic image of a cameraman reveal more detail as shown in Fig. 4.

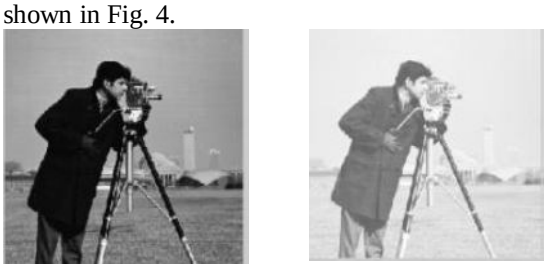


Fig. 4: Original Image and its Logarithmic Image

B. Spatial Filter Operations

As spatial filtering [2] operations are performed on a pixel along with its immediate neighbors, this is also called as neighborhood operations. Based on type of operations performed on the pixels, spatial filters [6] are classified into two categories: Linear and Nonlinear spatial filters.

4) Linear Spatial Filter

This process involves convolving a mask with an image i.e. passing a weighted mask over the entire image. Mask is also referred as window, template, or kernel.

Fig. 5: The Original Image and Output using 3x3 Mask and 5x5 Mask

5) Non Linear Spatial Filter

In this filter, enhanced image g(x,y) at (x,y) is not linearly related to pixels in the neighborhood of original image f (x, y).

C. Histogram Processing Operations

1) Histogram Equalization

Histogram equalization is a common technique for enhancing the appearance of images.

Suppose we have an image which is predominantly dark. Then its histogram would be skewed towards the lower end of the grey scale and all the image detail is compressed into the dark end of the histogram. If we could 'stretch out' the grey levels at the dark end to produce a more uniformly distributed histogram then the image would become much clearer [1].

Fig. 6: The Original Image and Equalized Image

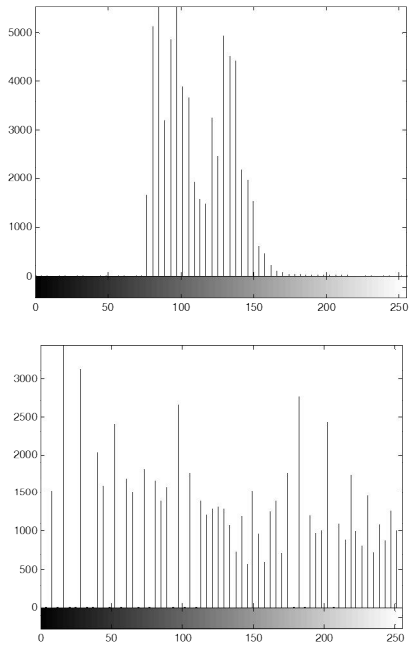


Fig. 7: The Histogram of the Original Image and Equalized Image

IV. Applications

Image enhancement has contributed to research advancement in a variety of fields. Some of the areas in which IE has wide application [4] are noted below:

1. In forensics, IE is used for identification, evidence gathering and surveillance. Images obtained from fingerprint detection, security videos analysis and crime scene investigations are enhanced to help in identification of culprits and protection of victims.
2. In atmospheric sciences, IE is used to reduce the effects of haze, fog, mist and turbulent weather for meteorological observations. It helps in detecting shape and structure of remote objects in environment sensing. Satellite images undergo image restoration and enhancement to remove noise.
3. Astrophotography faces challenges due to light and noise pollution that can be minimized by IE. For real time sharpening and contrast enhancement several cameras have in-built IE functions. Moreover, numerous software, allow editing such images to provide better and vivid results.
4. In oceanography the study of images reveals interesting features of water flow, sediment concentration, geomorphology and bathymetric patterns to name a few. These features are more clearly observable in images that are digitally enhanced to overcome the problem of moving targets, deficiency of light and obscure surroundings.
5. Medical imaging uses IE techniques for reducing noise and sharpening details to improve the visual representation of the image. Since minute details play a critical role in diagnosis and treatment of disease, it is essential to highlight important features while displaying medical images. This makes IE a necessary aiding tool for viewing anatomic areas in MRI, ultrasound and x-rays to name a few.

Numerous other fields including law enforcement, microbiology, biomedicine, bacteriology, etc., benefit from various IE techniques. These benefits are not limited to professional studies and businesses but extend to the common users who employ IE to cosmetically enhance and correct their images.

V. Conclusion

Image enhancement techniques offer a wide variety of approaches for modifying images to achieve visually acceptable images. The choice of such techniques is a function of the specific task, image content, observer characteristics, and viewing conditions. The point processing methods are most primitive, yet essential image processing operations and are used primarily for contrast enhancement. Image Negative is suited for enhancing white detail embedded in dark regions and has applications in medical imaging. Image Thresholding transformation is particularly useful in image segmentation to isolate an image of interest from back ground. Log Transformation is useful for enhancing details in the darker regions of the image at the expense of detail in the brighter regions. The histogram of an image

provides important information regarding the contrast of an image. Histogram equalization is a transformation that stretches the contrast by redistributing the gray-level values uniformly. Only the global histogram equalization can be done completely automatically.

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Performance Investigation of Bidirectional Dense Wavelength Division Multiplexed Passive Optical Network in the Scenario of Different Fiber Standards

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***Abstract*—In this paper performance comparison of bidirectional dense wavelength-division-multiplexed passive optical network for different fiber standards has been done. The fiber standards under investigation are Single Mode Fiber (ITU-T G.652), Zero Dispersion Shifted Fiber (ITU-T G.653), Cut-off shifted low attenuation Fiber (ITU-T G.654), Non Zero Dispersion Shifted Fiber (ITU-T G.655) and Alcatel 6910. It has been found that the Alcatel6910 performs best among others. The performance has been compared on the basis of Q-factor and bit error rate (BER) for 16 channels for 1.25 Gbps downstream and 622 Mbps upstream data rates.**

Keywords: International Telecommunication Union (ITU), Array Waveguide Grating (AWG), Bit Error Rate (BER), Dense Wavelength Division Multiplexing (DWDM), Passive Optical Network (PON), Optical Line Terminal (OLT), Optical Network Terminal (ONT).5

I. INTRODUCTION

Dense wavelength division multiplexing passive optical networks (DWDM-PONs) are viewed as the future-proof solution for next-generation networks. Several WDM access network architectures have been proposed to meet the enormous bandwidth demand due to the rapid growth on all kinds of video centric internet services for business and individual home users [1-4]. However, most of these approaches require additional light sources for video broadcasting channels, which is not cost efficient, and end users have no privilege to select or order specific video programs with high definition on their demands. Due to the trend toward higher bandwidth demand and advances in wavelength division multiplexing (WDM) device technology, the WDM passive optical network (PON) and hybrid wavelength and time division multiplexing (WDM/TDM) PON can be considered as good candidates for next-generation broadband access networks. In addition, urban areas are densely populated and consequently it may be necessary to cover thousands or even tens of thousands of users by a single PON. To meet this demand, work in [5-7] proposed a PON architecture based on a cascaded arrayed wavelength grating (AWG) utilizing the cyclic wavelength routing property of an N×N AWG, which can substantially increase the number of users. The International Telecommunication Union (ITU) is the United Nations specialized agency in the field of telecommunications, information and communication technologies (ICTs). The ITU Telecommunication Standardization Sector (ITU-T) is a permanent organ of ITU [8]. ITU-T is responsible for studying technical, operating and tariff questions and issuing recommendations on them with a view to standardizing telecommunications on a worldwide.

II. SIMULATION SETUP AND FIBER STANDARDS

In this paper five types of Single mode fibers have been placed in the simulation setup for performance investigation of bidirectional DWDM PON, which includes Standard Single Mode Fiber (ITU-T G.652), Zero Dispersion Shifted Fiber (ITU-T G.653), Cut-off shifted low attenuation Fiber (ITU-T G.654), Non Zero Dispersion Shifted Fiber (ITU-T G.655) and Alcatel 6910. For the simulation of the setup Optisystem software has been used. In this simulation setup of bidirectional DWDM Passive Optical Network the performance of these fibers has been compared for both upstream and downstream channels. In the BPON network, a 16 channel WDM transmitter has been used with NRZ (non return to zero) modulation format. The system uses extinction ratio (ER) of 4 dB with bit rate of 1.25 GB/s for the downstream signals and again ER of 4 dB with 622 MB/s bit rate for the upstream signals. The simulation setup has been analyzed in C-band for both downstream and upstream with channel spacing of 0.8 nm. Following are the specifications of single mode fibers that have been used for comparison purpose in the simulation setup.

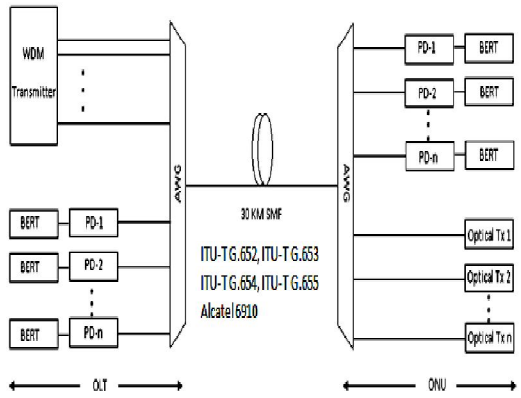

Fig. 1: Simulation Setup for Different Types of Fibers to be Placed in Bidirectional Dense Wavelength Division Multiplexed PON

A. Standard Single Mode Fiber–ITU-T G.652

Recommendation ITU-T G.652 describes the geometrical, mechanical and transmission attributes of a single-mode optical fiber and cable which has zero-dispersion wavelength around 1310 nm [9]. The ITU-T G.652 fiber was originally optimized for use in the 1310 nm wavelength region, but can also be used in the 1550 nm region. The parameters used for the analysis of Standard Single Mode Fiber are taken as per ITU-T G.652 recommendation. Standard Single Mode Fiber has been simulated for the dispersion of 17.5379ps/nm/km and the attenuation coefficient of 0.275dB/km. The standard Single Mode Fiber has an effective area of 80 µm2. Simulation results based on these parameters are shown in the result and discussion section of this paper.

B. Zero Dispersion Shifted Fiber–ITU-T G.653

This Recommendation [10] describes a dispersion-shifted, single-mode optical fiber and cable which has a nominal zero-dispersion wavelength close to 1550 nm, and a dispersion coefficient which is monotonically increasing with wavelength. This fiber is optimized for use in the 1550 nm region, but may also be used at around 1310 nm subject to the constraints outlined in this Recommendation. Zero Dispersion Shifted Fiber has been simulated for the dispersion of 0ps/nm/km and the attenuation coefficient of 0.275dB/km. The Zero Dispersion Shifted Fiber has an effective area of 80 µm2.

C. Cut-off Shifted and Low Attenuation Fiber–ITU-T G.654

This Recommendation [11] describes a single-mode optical fiber and cable which has the zero-dispersion wavelength around 1300 nm wavelength, which is loss-minimized and cut-off shifted at a wavelength around 1550 nm, and which is optimized for use in the 1530-1625 nm region. This very low loss cut-off shifted fiber (CSF) can be used for long-distance digital transmission applications such as long-haul terrestrial line systems and submarine cable systems using optical amplifiers. Cut-off Shifted Fiber has been simulated for the dispersion of 20ps/nm/km and the attenuation coefficient of 0.25dB/km. This Fiber has an effective area of 65 µm2.

D. Non Zero Dispersion Shifted Fiber–ITU-T G.655

This Recommendation [12] describes a single-mode fiber with a chromatic dispersion coefficient (absolute value) that is greater than some non-zero value throughout the wavelengths larger than 1530 nm. At lower wavelengths, the dispersion coefficient can cross zero, but chromatic dispersion coefficient values at these wavelengths may be specified to support coarse wavelength division multiplexing (CWDM) systems that do not have significant impairments due to non-linear effects. These fibers were originally intended for use at wavelengths in a prescribed region between 1530 nm and 1565 nm. Fiber has been simulated for the dispersion of 3.43405ps/nm/km and the attenuation coefficient of 0.275dB/km. The NZ-DSF has an effective area of 72 µm2.

E. Alcatel 6910

Alcatel's Non-Zero Dispersion Shifted Fiber (NZ-DSF) [13] is one of the most technically advanced fibers available in the market. It is optimized for wavelengths greater than 1440nm and it has been specially designed for long-distance, high-bit rate transmission. Alcatel 6910 provides increased capacity and superior performance. It gives more cost effective bandwidth deployment, maximizing utilization of the C band significantly. The cost of the system decreases by deferring the need to deploy the more costly L band. Alcatel 6910 Fiber has been simulated for the dispersion of 8.0ps/nm/km with dispersion slope of 0.058ps/nm2/km and the attenuation coefficient of 0.205dB/km. Alcatel 6910 Fiber has an effective area of 63 µm2.

III. RESULTS AND DISCUSSION

In the simulation setup 16 channel WDM transmitter produces the downstream signals in the 1500 nm range with 100 GHz channel spacing.

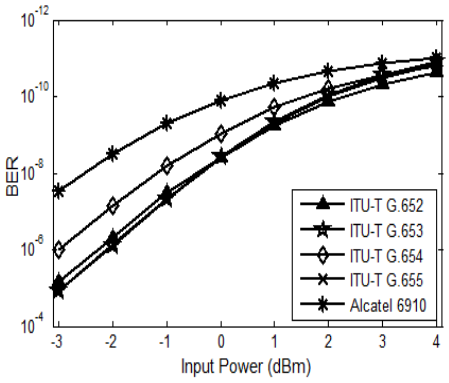

Fig. 2: Input Power *vs.* BER for Different Fiber Standards at Downstream

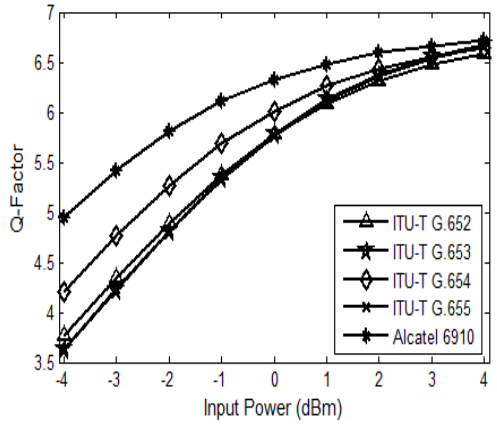

Fig. 3: Input Power *vs.* Q-factor for Different Fiber Standards at Downstream

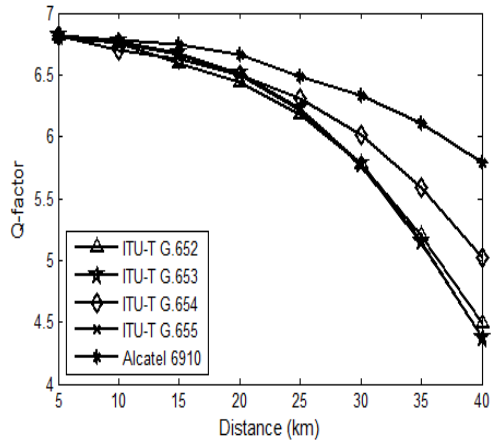

Fig. 4: Relation between Distance and Q-factor for Different Fiber Standards at Downstream

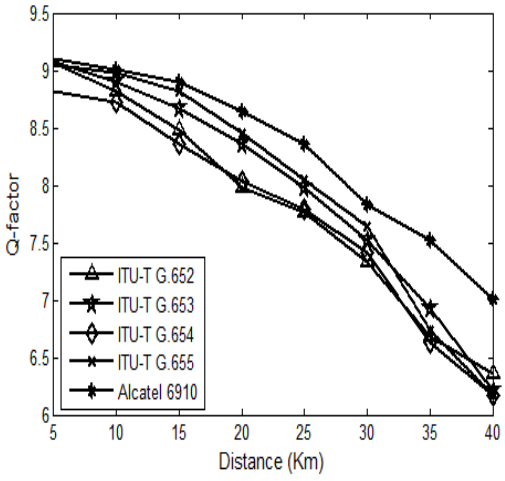

Figure 5: Relation between Distance and Q-factor for Different Fiber Standards at Upstream

An extinction ratio of 4 dB has been used for the downstream signal. WDM transmitter produces the 16 downstream channels at input power of 0dBm. The driving amplitude has been modulated by a 1.25Gbps non return to zero (NRZ) format. As discussed above five types of single mode optical fibers have been compared for the performance investigation of the simulation setup. Using ITU-T G.652 standard single mode fiber 30 km distance has been achieved with acceptable bit error rate 10^{-9} and Q-factor 5.77 at 0dBm input power. And by using Alcatel 6910 single mode fiber 40 km distance has been achieved with bit error rate 10^{-9} and Q-factor 5.79 at 0dBm input power

IV. Conclusion

To improve the system performance comparison of different fiber standards has been done. The conventional single mode fiber is replaced with ITU-T G series (652, 653, 654 655) and Alcatel 6910 single mode fibers. The ITU-T G.655 Non Zero Dispersion Shifted Fiber and other single mode fibers used for the simulation give acceptable results upto 30 km distance. From the simulation results it is observed that Alcatel 6910 single mode fiber provides Q-factor 5.79273, Bit error rate 10^{-9} at 40 km distance (i.e. acceptable) and by using ITU-T G.655 Non Zero Dispersion Shifted Fiber at 40 km Q-factor 4.37438 and bit error rate 10^{-6} (i.e. not acceptable) has been obtained. Alcatel 6910 is best suitable fiber as it supports long-distance, high bit rate and provides high gain. It has been concluded that as compared to conventional single mode fiber and other fibers Alcatel 6910 fiber is best suitable for bidirectional DWDM PON.

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Research Issues & Challenges in Wireless Sensor Networks: A Survey

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***Abstract*—Wireless sensor networks (WSNs) have gained increased attention from both the research community and actual users during the last few years. A wireless sensor network consists of sensor nodes deployed over a field or some selected area for keeping an observation of different types of physical phenomena like temperature, humidity, vibrations, and other such events. Due to increase in interest of researchers in this field, numerous developments are taking place in terms of security, routing, synchronization, deployment, quality of service, power management, localization and fault tolerance for sensor nodes etc. This paper presents an overview of various research issues and challenges in wireless sensor network.**

Keywords: WSN, Sensor Nodes, Issues, Challenges, Sensor Deployment, Ad-Hoc

I. INTRODUCTION

A Wireless Sensor Network (WSN) is a network of dispersed sensors that can accumulate information from a physical environment. Over the last few years wireless sensor networks (WSNs) have drawn the awareness of the researchers, driven by a possession of theoretical and convenient challenges [1]. In Wireless Sensor Networks (WSN) thousands of sensors are deployed at dissimilar locations operating in dissimilar modes [2]. In these networks [Fig.1 (3)] large number of nodes takes measurement of ecological data and transmits them to a core data sink. These sensor nodes are able to sense, measure, and assemble information from the ecological system and based on some confined decision process, they can spread the sensed data toward the client. The sensor node is a small device which senses the information as well as passes the same information to gather important data. Sensors are used to evaluate the changes in physical environment like rain, humidity, earthquake, storm, sound, vibration and changes to the health of person like blood pressure, fever and heartbeat. These sensor nodes correspond to short distance through a wireless medium and communicate to each other to accomplish a common assignment, for example, atmosphere monitoring, military surveillance, and industrialized process control [4].

A wireless sensor node is equipped through sensing and computing devices, a broadcasting transceiver and power instrument. Wireless Sensor Networks (WSN) are used in variety of fields which includes military, healthcare, environmental, biological, home and other commercial applications. Energy consideration has also been remained a major concern for the researchers.

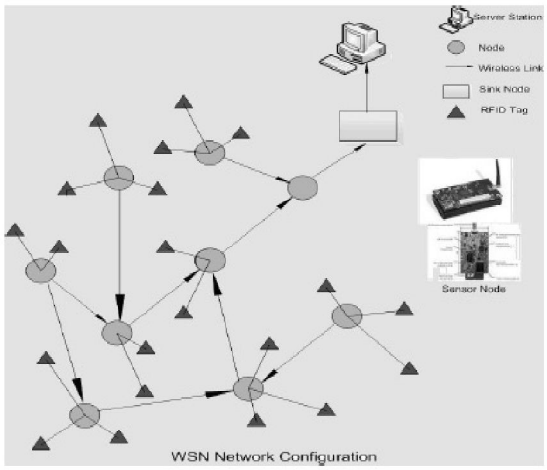

Fig. 1: A View of a WSN Network [19]

II. ARCHITECTURE OF WSN

Wireless sensor Network architecture is a combination of hardware and software circuit design. The main components of WSN are as follows:

- *WSN Field:* It is the region in which sensor nodes are deployed. Wireless sensor network can observe the air temperature and light intensity in a WSN field. The system consists of nodes equipped with small size application and radio frequency module. Sensor data is transmitted from radio frequency link to centrally localized computer terminal for data logging. The design includes alternative scheme for storage of sensor data.
- *Sink node:* The sink node is used to collect data from different sensor nodes in wireless sensor network. This is a sensor node which performs a unique task of receiving, processing and storing from sensor nodes. It is the responsibility of a node to send and forward the data and to receive and collect the data and make it available to the destined receiver. For this purpose it sometimes uses the multi-hop transmission and reception.
- *WSN Nodes*: The sensor nodes are source of information and forwards message in the network. The sensor nodes are responsible for collecting the information and routing this information to a sink.

- *Cluster Head:* The cluster head collects the information from sensors of its own cluster and passes on information to the base station. The role of the cluster head is to distribute energy to all sensor nodes randomly allover in the network. The clustering can contribute the overall system scalability, lifetime and energy efficiency. The clustering was proposed an efficient tool for pinpointing object location and decreasing energy consumption.
- *Task Manager:* It is a federal point of control inside the network used to extract information from the network and passes the necessary information and reverses it to the network as well when required.

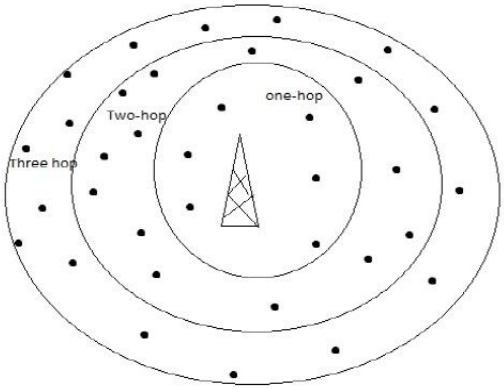

Fig. 2: Layered Architecture of WSN [20]

Few of the applications of wireless sensor network are as mentioned in the next section:

- *Monitoring Engineering Systems:* The detection of damage to any engineering system vizz. Aerospace and other manufacturing systems can be detected by using WSN. The monitoring system includes low power, long-term monitoring of a structure to provide periodic updating of the health condition of any manufacturing system. In case of natural disaster such as earthquakes, floods etc. structural conditional screening can be done using laid wireless network system. A wireless sensor network application for online fitness monitoring based information processing is presented in [5]. The construction of wireless sensor network with vibration sensing and Global Positioning System for fitness monitoring application has been presented in [6].
- *Ecological:* Ecological applications include the monitoring of impressive parameters like tracking of the activities of birds and animals, ecological pollution, forest fire detection, flood fire detection, habitat supervision etc. In a afforest fire recognition, sensor nodes might be deployed tactically, arbitrarily and densely. Sensor nodes help to locate out the precise position of fire just before spreading of fire.
- *Vehicular Telematics:* Wireless sensor network may also be deployed for communication between two vehicles. It is the convergence of telecommunications and information processing, the term refers to automation in automobiles as invention of the emergency warning system for vehicles. Vehicles can communicate to each other by different ways Vehicle to Infrastructure (V2I), Vehicle to Vehicle (V2V), Vehicle to Vehicle to Infrastructure (V2V2I) [7].

III. VARIOUS ISSUES

There are several issues related to wireless sensor network. Few of them are discussed below:

- *Sensor Nodes:* Wireless sensor network consists of hundreds or sometimes thousands of small devices called nodes. The selection of nodes puts a great impact on the architecture of the WSN. The major issue in selection of sensing nodes is the power requirement, radio range, cost, use of inexpensive non-volatile memory chips for storage of information [8].
- *Quality of Service:* The QoS is the level of service that wireless sensor network provides to its users [9]. Since the nodes in WSN may leave, break and re-establish again and again it becomes difficult to use the algorithms developed for wired networks in WSN. Providing good Quality of service is thus a major issue in WSN and it may gets affected due to variation in the requirement of bandwidth by the nodes, unbalanced traffic, routing of the traffic requiring more energy level thereby reducing QOS, change in network topology as the information travel from one network to another along with the buffering of information at various nodes may put a great impact on the QOS. Sometimes the addition or removal of more nodes in the network may adversely affect the performance of wireless sensor network [10].
- *Deployment:* Wireless sensor network can be deployed in areas without infrastructure support in the hostile fields and environment. [11]. Recently with advancement of digital signal processing, microelectronics and low power radio frequency techniques the deployment of large wireless sensor network has been made possible. A wireless sensor

network deployment can generally be categorized as either a dense deployment or a sparse deployment. Various issues involved while deploying a wireless sensor network may include the dissipation in power level due to short circuits leading to fading away of the node. Laid down position of the nodes may also affect the performance of the WSN as the two nodes that are mutually close to each other may not be able to communicate while the nodes that are at the remote end may be able to communicate with each other due to physical inference. As the nodes may be dropped down randomly in the field, self configuration of the nodes is also a major issue for deployment.

- *Medium Access Control Protocols:* MAC protocols should be deigned to increase the life time of the network at low energy level requirement [12]. Medium access schemes provide fine-grained control of transceiver and allows on or off switching of the broadcasting. The design of the medium access protocol should have switching method to decide when and how often the on and off mechanism should be done.
- *Security Issue:* Confidently, Authentication, Lack of integrity, Privacy, Non-repudiation and Anti-playback are the basic security requirement in wireless sensor network. Security in wireless sensor network is an important factor which improves the system performance at low energy consumption in different types of applications. A wireless sensor network is vulnerable to threats and risk.
- *Network Layer:* Wireless sensor network are built for particular applications and routing is significant for sending the data from sensor nodes to Base Station (BS). Routing protocol should integrate multi-path drawing technique. Wireless Sensor Networks collects the information from physical environment and with the high data centric. Network layer provides a good choice for maximizing energy savings and thereby providing a flexible platform for routing and data management. Hence finding the energy efficient routes, incorporating multi-path design so that other path may be utilized if the main path fails, providing provision for path repair, selection of a routing protocol to remove redundancy and thus enhancing the better utilization of bandwidth are the major issues involved in the network layer. As the routing protocols are heterogeneous in behavior that means all nodes have different characteristics and different intelligence level, this factor has also to be considered during the selection of the routing protocols[13]. Sensor Protocols for Information via negotiation (SPIN), Low Energy Adaptive Cluster Hierarchy (LEACH), Sequential Assignment Routing (SAR), Threshold sensitive Energy Efficient sensor Network protocol (TEEN) are some of the protocols preferred at the network layer.
- *Transport Layer:* A work of transport layer is to provide end to end delivery of message. As the data is fragmented into parts at the sender end and then reassembled at the receiver end, the role of transport layer becomes very crucial for orderly receiving of data and in WSN this task requires more attention. Reliable delivery of data to large group of sensor is required in WSN. As the nodes are deployed randomly in WSN there may be problem in end to end delivery of a message. Few nodes may not be active due to depletion of the battery thereby affecting the communication at transport layer. The traditional UDP and TCP protocols cannot be used in WSN. Therefore the protocol proposed by Chien Yih Wan [14], "Pump Slowly Fetch-Quickly (PSFQ) is used widely in WSN. More efficient protocol may be developed in future that may be used in WSN.

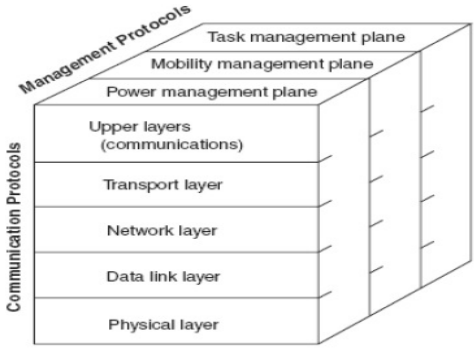

Fig. 3: Protocol Stack for WSN [21]

IV. Research Challenges

A. Power Constraints

The power constraint in WSN is a major issue to be dealt by the researchers and till date it is unlikely to be solved due to slow progress in developing battery capacity. Moreover, the unpredictable nature of sensor nodes and in the hazardous environments in which they are deployed it is more suitable to go for battery replacement as a more feasible solution On the other hand, the surveillance nature of many sensor network applications requires a long lifetime; therefore, it is a very important research issue to provide a form of energy-efficient surveillance service for a geographical area [15]. Hence development of energy efficient routing protocols becomes a challenge for the researchers.

B. Cost

Cost of the sensors deployed in WSN is very high and it is a challenge for the researches to deal with this issue. The current cost of a normal sensor varies from 5000 to 15000 for a sensor which contains all type of sensors like humidity, mobility tracker, temperature etc., so lot of work is yet to be done in this area to reduce the cost of sensors.

C. Connectivity

In WSN the connectivity of the various nodes becomes a major issue and challenge for the researchers. Due to presence of other wireless devices present indoors may create an interference with the sensors deployed. For example presence of elevators, machinery, computers etc. may produce electromagnetic field thereby causing interference with the sensors and thus causing trouble in making connectivity. It all happens when sensors are being operated at low power level to save energy. Thus connectivity also becomes a constraint in reducing energy levels which becomes a challenge for the researchers.

D. Fault Tolerance

As WSN comprises of number of nodes, a fault in one node may lead to affect the performance of the entire network. So a network must have capability of self-correction or fault tolerance. Therefore, fault tolerance also becomes one of the challenges for the researchers for establishing the network. Fault tolerance enables a system to continue operating accurately in the event of the failure of several of its components. As mentioned a sensor node may possibly fail due to hardware or software trouble or energy collapse. If a sensor node fails, operational protocol should handle this kind of fault tolerance. The failure of sensor nodes should not have any cause on the overall performance of the sensor network [16]-[17].

E. Secure Transmission

In WSN the transmission is done through sensor nodes through wireless medium. So authentication of data becomes a challenge for researchers. The integrity of data is essential to ensure that same packets have been received as those were transmitted by the sender. Moreover, cryptography techniques need to be used for making the data to be understood by the intended receiver only. Another point that is a challenge in this work is to know the freshness of the data. Redundant data or the data that already has been expired may have been sent by the attacker. So these things are to be kept in mind while designing the WSN. Different types of attacks may be done on the wireless medium like Denial of Services (DOS) attack that prohibits the user form accessing the network. Few more attacks are Black Hole attack, Warm hole attack, flooding, Sybil attack [18]

V. CONCLUSION

In this paper a survey on the various issues related to wireless sensor networks has been done. The study on the architecture of a WSN along with its applications in various areas is described. Then different difficulties in implementation of a WSN are studied and the challenges that come in the path of researchers working in this area are also described. Wireless Sensor Network is one of the rising fields in research area. The field of Wireless sensor network of sensing, computation and communication has attracted research efforts and huge investment from different type of fields. So to conclude in Wireless sensor network energy efficient routing protocols may be developed and it seems to be one of the best areas for future work.

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Microstrip Line Loaded with Single Split Ring Resonator with Multiple Gaps and Different Orientations to Control Magnetic Resonance

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***Abstract*—This paper presents the different circuit approaches of the electric and magnetic interaction of Single Split Ring Resonator (SSRR) loaded microstrip line. We loaded the microstrip line with planar square split ring resonator in different configurations and multiple gaps orientations. The modeling behavior of metamaterials based microstrip lines loaded with split ring resonator is analyzed numerically in two orientations (with gap of SRR parallel and perpendicular to the line). The full wave simulations are performed for the single split ring resonator loaded microstrip inside a waveguide with 'High Frequency Structure Simulator' software. The equivalent circuit parameters are obtained for the single split ring resonator loaded with microstrip line with the gap parallel and near to the line from transmission line theory.**

Keywords: Split Ring Resonators (SRR), Single Split Ring Resonators (SSRR), Metamaterials (MTMs), Microstrip Line

I. INTRODUCTION

Metamaterials are artificially materials, revealing exotic unnatural features, engineered by metallic inclusions in the host media like substrate. The shape, dimensions, alignment, arrangement of the inclusions and electromagnetic features of the host medium determine the nature of the interaction between the metamaterials and an electromagnetic field. These materials gain their efficient properties from its structures rather than inheriting them directly from its constituents. The phase velocity and group velocity in these materials are anti-parallel to each other. Metamaterials created an indelible sign in microwave engineering applications like waveguides, antennas, filters, phase shifters, delay lines etc.

The novel idea of metamaterials was given by Victor Veselago in 1968 when he examined incident uniform plane-wave propagation in a media in view of both permittivity and permeability to be negative [1]. He named these materials as Left Handed Metamaterials (LHM) or Double Negative Metamaterials (DNG). If only permeability (μ) is negative or permittivity (ε) is negative is termed as Mu Negative (MNG) and Epsilon (ENG) metamaterials respectively and termed as single negative (SNG) metamaterials. Pendry proposed SRR to achieve negative permeability [2] and thin wire to achieve negative permittivity [3] and a combined structure of SRR and thin wire to realize LHM [4]. Later then, Smith and his colleagues established metamaterials to demonstrate negative permittivity and permeability simultaneously and carried out microwave experiments to test its remarkable properties in 2000.

In 2001, Smith *et al* showed negative refraction experimentally, using a metamaterials with repeated unit cells of SRR and copper strips [5-7]. In 2002 bianisotropic behaviour of the SRR unit cell structure was investigated and a tailored version of SRR i.e. broadside coupled (BC-SRR) suggested that avoid bianisotropy. A comparative analysis of the conventional (or edge-coupled) SRR and BC-SRR is shown with printed metallic rings of the BC-SRR on both sides of the dielectric [8]. In 2005 Baena *et al* proposed a new approach for the development of planar metamaterial structures with split-ring resonator and complementary split-ring resonators (CSRRs) coupled to planar transmission lines and evaluated the stop band/pass band characteristics of the SRR/CSRR loaded transmission lines [9]. In 2008, Pencui *et al* presents the individual and coupled split ring resonators (SRRs) structures of a single rectangular ring with one, two and four gaps and magnetic resonance is shifted to the higher region [10]. In 2011, a multiband delay line with broadiside coupled and the single split-ring resonator have been proposed that exhibits two left-handed bands and can be shifted by twisting the split rings for certain angle or by changing their lengths [11]. In 2012, Martin *et al* suggested the use of SRR in coupled transmission line as compared to microwave components, to achieve better performance parameters [12]. In 2013, a model with the electromagnetic properties of transmission lines loaded with SRR and CSRR have been proposed [13]. In 2014, Jokanovic *et al* presented an enhanced equivalent circuit approach for the magnetic/electric interaction of SSRR with printed lines and extract the different parameters of microstrip line with parallel and perpendicular gap to line [14].

The aim of present work is to design a microstrip line loaded with metamaterials and examine shifting of resonant frequency with different orientations of SSRR

and with multiple cuts. The outline of paper is as follows: Section I gives the brief literature review of the work done in the relevant area. Section II describes the proposed SSRR loaded microstrip line model with different orientations. Section III presents results and discussions. Section IV gives the conclusion of the paper.

II. PROPOSED SRR LOADED MICRO-STRIP LINE MODEL

In the proposed model, a conventional microstrip line is loaded with planar square SSRR with the gap parallel to the line. The square shape SSRR is coupled to microstrip line by placing it at distance's', in the same plane. Fig.1 shows layout of SRR coupled to microstrip line in the same plane with gap parallel to the line. This coupled line is modeled on Rogers RO3010 substrate of thickness (h) 1.27 mm, dielectric permittivity εr =10.2 and Loss tangent =0.035.

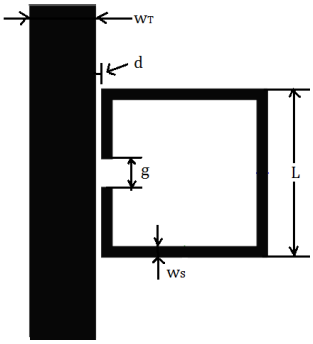

Fig. 1: Layout of SSRR Loaded Microstrip Line

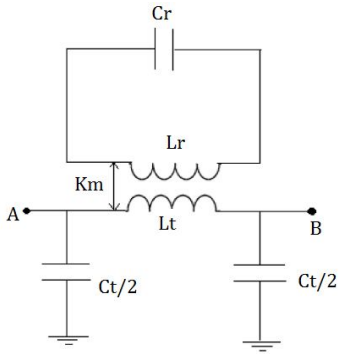

Fig. 2: Equivalent Circuit of SSRR Loaded Microstrip Line

The dimensions of SRR coupled to rectangular microstrip line are given in Table I.

TABLE 1: DIMENSIONS OF SRR LOADED MICROSTRIP LINE

S. No	Parameters		
	Name of Parameter	Representation	Dimensions (mm)
1	Width of microstrip line	W_T	1.2
2	Length of SRR	L	3.0
3	Width of SRR	Ws	0.2
4	Gap of split	g	0.5
5	Gap between microstrip line & SRR	d	0.1

Microstrip lines loaded with SSRR for different configurations are examined. For each topology, resonance frequency and the minimum reflection frequency can be obtained.

1. SSRR loaded microstrip line with gap parallel to the line:
   - Gap near orientation
   - Gap far orientation
2. SSSR loaded microstrip line orientation:
   - With gaps parallel to the line orientation
   - With gaps perpendicular to the line orientation
   - WITH micro cuts orientation

A. SSRR Loaded Microstrip Line with the Gap Parallel to the Line

Microstrip line loaded with SSRR with gap parallel to the line is shown in Fig. 3 and Fig.4. Fig. 3 depicts the microstrip line loaded with SSRR with gap parallel to the line and near to the microstrip line. In Fig.4 the gap of SRR loaded microstrip line is parallel and far from the line.

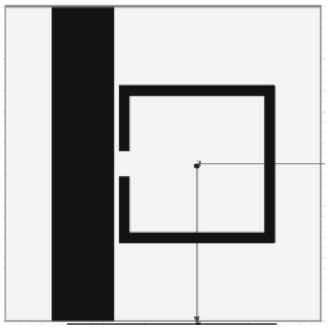

Fig. 3: Microstrip Line Loaded with SSRR with Gap Parallel and Near to the Line

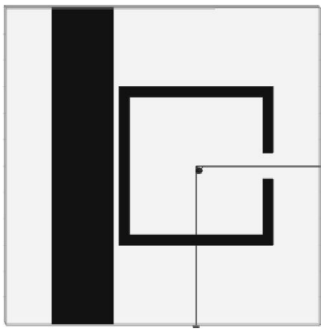

Fig. 4: Microstrip Line Loaded with SSRR with Gap Parallel and Far from the Line

The parameters L_t and C_t of the transmission line are determined taking into account the coupling between the line and the nearest SSRR arm, inductance is modeled as if there were two inductances. One is coupled with the transmission line or second is isolated transmission line with length equal to the remaining uncoupled part of the SRR length. Fig. 2 shows the equivalent circuit of microstrip line coupled to SRR where Ls and Cs is

inductance and capacitance of SRR respectively and L_t and C_t is inductance and capacitance of microstrip line respectively. The A and B are two ports and K_m is mutual inductance. The capacitance C_r is attained from the SRR resonance frequency f_r as follows:

$$f_r = \frac{1}{2\pi\sqrt{LrCr}} \quad (1)$$

Where resonance frequency is also calculated as:

$$f_r = \frac{w_r}{2\pi} \quad (2)$$

The mutual inductance K_m is then achieved as a function of f_{min}, the resonance frequency f_r, and the line parameters L_t and C_t as follows:

$$K_m^2 = \left(1 - \frac{w_r^2}{w_{min}^2}\right)(1 - a_1) \quad (3)$$

The term mutual inductance K_m is also affected by variation of gap of split of split ring resonator with respect to microstrip line. Where a_1 correspond to the circuit with one cell and $f_{min} = w_{min}/2\pi$. These coefficients are given by

$$a_1 = \left[\frac{L_t}{C_t} Y_0^2 + 2b\right] \quad (4)$$

Where Y_0 is the characteristic admittance of the microstrip line and

$$b = \left(\frac{w_{min}}{w_0}\right); w_0^2 = \frac{8}{L_t C_t} \quad (5)$$

B. *SSRR Loaded Microstrip Line with Two Gaps Parallel/ Perpendicular to the Line*

Microstrip line loaded with SSRRs with gaps parallel/perpendicular to the line is shown in Fig. 5 and 6. Fig. 5 depicts the microstrip line loaded with SSRR with gap parallel to the line with one gap is near and other is far from the microstrip line. In Fig. 6 the gap of SSRR loaded microstrip line is perpendicular to the line.

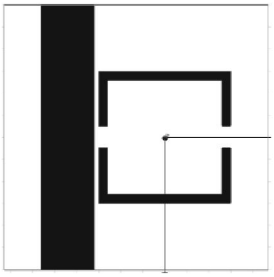

Fig. 5: Microstrip Line Loaded with SSRRs with Gaps Parallel to the Line

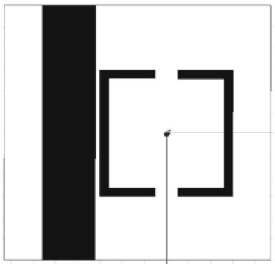

Fig. 6: Microstrip Line Loaded with SSRRs with Gaps Perpendicular to the Line

C. *SSRR Loaded Microstrip Line with Micro Cuts*

Microstrip line loaded with SSRRs with micro cuts are shown in Fig. 7. The width of the each micro cut is smaller than the gap of split i.e. 0.1mm.

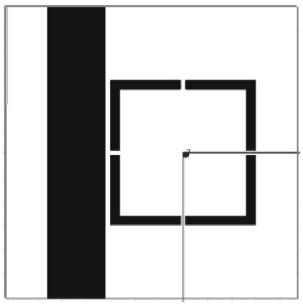

Fig. 7: Microstrip Line Loaded with SSRRs with Four Micro Cuts

III. Results and Discussions

The SRR loaded microstrip line is simulated inside a waveguide to attain the resonating frequency region. The Perfect Electric Conductor (PEC) boundary conditions are employed on the z-faces of the unit cell. The Perfect Magnetic Conductor (PMC) boundary conditions are used on top and bottom y-faces of the unit cell so that the negative permeability behavior of SRR would be excited. The two wave ports 1 and 2 are assigned to the both sides of microstrip line on the x-faces of waveguide. The proposed structure is simulated with Ansoft software HFSS. Fig.8 shows the reflection and transmission coefficient of SRR loaded microstrip line with the gap parallel to the line. It shows that resonant frequency is shifted to the right as the gap of SRR is changes from near to the line to far from line.

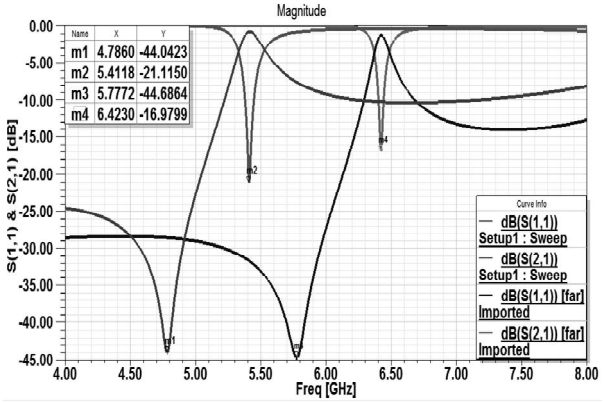

Fig. 8: Reflection Coefficient S11 and Transmission Coefficient S21 of SRR Loaded Microstrip Line with the Gap Parallel and Near to the Line and Far from the Line

Figure 9 shows the reflection and transmission coefficient of SSRR loaded microstrip line with the two gaps and both are parallel to the line.

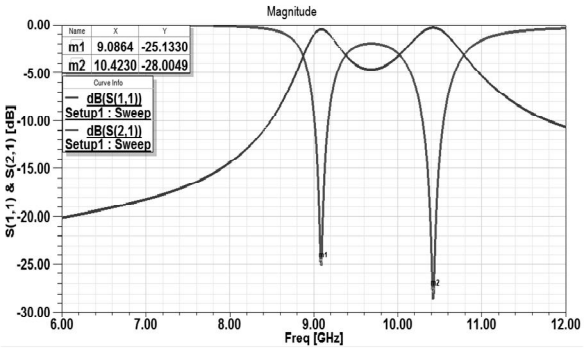

Fig. 9: Reflection Coefficient S11 and Transmission Coefficient S21 of SSRR Loaded Microstrip Line with the Gap Parallel the Line

Figure 10 shows the reflection and transmission coefficient of SSRR loaded microstrip line with the two gaps and both are perpendicular to the line. This shows that the resonant frequency is shifted to the higher region as the position of the both gaps is rotated by 180 degree.

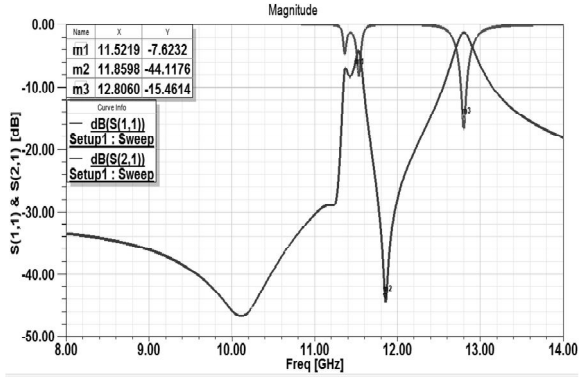

Fig. 10: Reflection Coefficient S11 and Transmission Coefficient S21 of SSRR Loaded Microstrip Line with the Gap Perpendicular the Line

Figure 11 shows the reflection and transmission coefficient of SSRR loaded microstrip line with four micro cuts. It depicts that the resonant frequency is much higher than one or two cuts because there are four distribution capacitors in micro cut model that increase the resonant frequency.

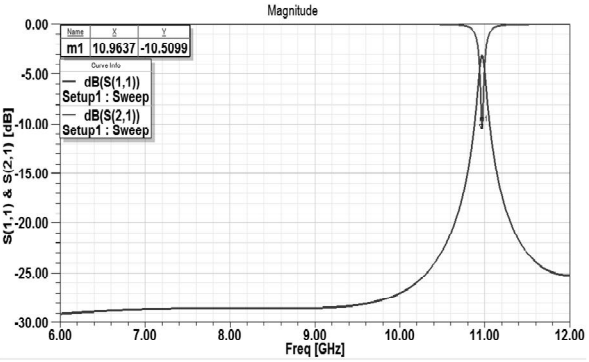

Fig. 11: Reflection Coefficient S11 and Transmission Coefficient S21 of SSRR Loaded Microstrip Line with Micro Cuts

IV. Conclusion

In this paper, microstrip lines loaded with single split-ring resonators in different orientations have been proposed. These orientations of SSRR with respect to the line are analyzed with parallel and perpendicular to the line. The transmission line is loaded with SSRR with one, two and four micro cuts of gaps with respect to the line. The improved equivalent circuit of proposed model moves the resonance to higher frequencies. These types of structures are used to control the magnetic resonance.

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Photonic Processing of Semiconductor Optical Amplifier based NOT Gate

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***Abstract*—Optical communication technology has developed rapidly to achieve larger transmission capacity and longer transmission distance and for this data rates can be achieved if the data remain in the optical domain eliminating the need to convert the optical signals. The SOA based all-optical logic gates offer good results when compared with other non-linear media such as optical non-linear fibre. This is because of its high power efficiency, fast switching time and photonic integration capability. This paper investigates the performance of SOA-MZI based NOT gate by using couplers instead of modulators. The results are evaluated in terms of accuracy in case of received logic and quality factors.**

Keywords: Semiconductor Optical Amplifier, Cross Gain Modulation, Cross Phase Modulation, Four Wave Mixing

I. INTRODUCTION

The increasing demand for high speed forced the modern research trends to ultra-fast all-optical signal processing. All-optical signal processing enhances speed and capacity of the core optical networks by avoiding expensive, time consuming and power hungry optoelectronic conversions [1]. Recent developments in optical signal processing and in photonic switching have made it possible to reach bit rates in the order of gigabits per second per wavelength and terabit per second per fibre [2]. All-optical logic become key elements in the realization of node functionalities, address recognition and signal processing. Semiconductor optical amplifiers are the most promising amplifiers for achieving various logic outputs, because they exhibit a strong change of refractive index together with high gain [3].

The tradition of converting all the optical information into the electric domain for the processing and then again transforming back into optical format has important drawbacks: complexity (need of regeneration, buffering), can't be done in real time, has bit rate limitations and elevated cost [4]. SOA is the best choice to overcome the electronic bottleneck because of its non-linear characteristics, simple structure, small size, and agreement with various formats of modulation at high biasing currents too [5]. All-optical logic operations using non-linear processes of SOA like cross gain modulation, cross phase modulation and four-wave mixing omits the requirement of expensive optoelectronic (OEO) conversion [6]. A semiconductor optical amplifier (SOA) is a modified version of semiconductor laser, which typically has different facet reflectivity and device length [7]. SOA is a very similar to a laser except it has no reflecting facets. A weak signal is guided through the active region of the SOA, which results in a stronger signal emitted via stimulated emission [8].

In the survey, single-port-coupled semiconductor optical amplifiers with multi-quantum-well (MQW) materials are specially designed to improve the output extinction ratio as well as output performance of the logic operation [9]. The logic functions are simulated on the basis of a rate equation model at a data rate of 10 Gb/s. A Gaussian filter of 15GHz FWHM is used [10]. All-optical gates are better option if the setup requires a very high speed operation but if higher extinction ratio is required then the digital gates are dominating [11].. Optical OR and NOT logic gates are realized by using cross-gain modulation in SOA. AND and XOR gates are implemented by using four wave mixing and SOA-MZI methods [1]. All-optical XOR gate has been realised but not from the point of pulse wavelength as it is more complicated since the wavelength correlates with so many SOA parameters [12].This paper focuses on the analysis of the SOA based NOT gate. The modulation of the pump signal according to the probe signal is performed by using couplers instead of modulators in the architecture. The whole setup is implemented at 10Gbps data rate and an improvement is observed in case of logics received and quality of received signal.

II. PRINCIPLE OF OPERATION

For the NOT gate operation one of the data signals, either A or B along with the probe signal, is shot simultaneously into SOA, then the gain of the probe signal is modulated with a polarity inverted output, resulting in a logic NOT output.

In the simulation, the input power level for the data signal is.316mW and the probe signal is.158mW. 10GHz bandwidth is sufficient for the NOT operation, quite evident from Fig. 1.

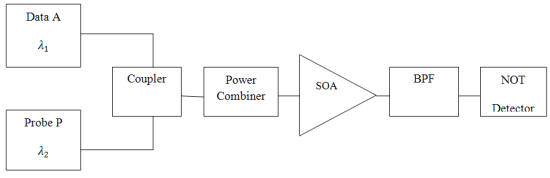


Fig. 1: Block diagram of all-optical NOT Gate, BPF-Band Pass Filter

III. System Setup

All optical gates may be constructed using the non linearity effect which is introduced without SOA or with SOA. Numerous ways of designing all optical gates without SOA are using length of the fiber, waveguide, circulators, filters, acoustic optic waves, and changing the refractive index of the optical waveguide. All optical logic gates are indispensable modules for making feasible the concept of signal processing exclusively by means of light in order to take full advantage of the potential of optical fibers in modern networks without problematic conversion in electronic domain. The two data streams (A and B) with different wavelengths (i.e., 1550 and 1555 nm respectively) are generated using continuous wave (CW) laser sources having 0.31 mW of power. Another CW laser is generating the probe signal at a 1540 nm wavelength. In this simulation a travelling SOA is used for nonlinear operation. The SOA is biased at 300 mA with a linewidth enhancement factor of 5.

The combined data stream along with probe signal (where required) is introduced into the SOA, which acts as an active nonlinear element. Inside the SOA, the XGM, XPM, or FWM takes place depending on the system design. Then it is followed by an optical filter whose bandwidth and wavelength is adjusted according to the desired gate operation; for instance, to achieve optical NOT logic detection, the optical filter requires a bandwidth of 10 GHz at a new generated wavelength due to cross gain modulation (XGM).

Thus, for detection of different optical logics, an optical filter at a proper wavelength and bandwidth must be selected appropriately. The various SOA parameters that need to be adjusted for optimum SOA performance are shown in Table-1:

TABLE 1: THE LIST OF SEMICONDUCTOR OPTICAL AMPLIFIERS (SOAS) PARAMETERS USED IN THE SIMULATION

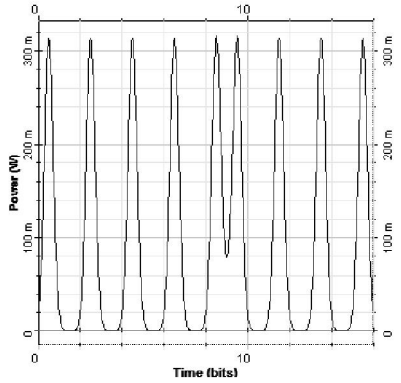
Parameter	Value
Bias current	0.3A
Length	0.0005m
Width	$3x10^{-6}m$
Height	$8x10^{-8}m$
Optical confinement factor	0.35
Linewidth enhancement factor	5
Carrier density at transparency	$1.4x10^{24}m^2$
Initial carrier density	$3x10^{24}m^{-3}$
Differential Gain	$2.78x10^{-20}m^2$

IV. Results and Discussion

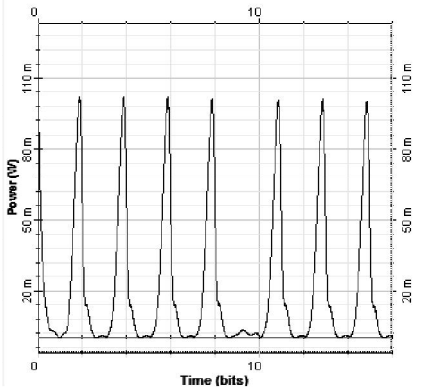
SOA exhibits high nonlinearity characteristics for input optical signals. Optical OR and NOT logic gates are realized by using XGM in SOA. On the other hand, the AND and XOR gates are implemented by using FWM and SOA-MZI methods, respectively. For the NOT logic the pump consists of data pulse and perturbs the SOA gain in a way inverse to its binary content so that its compliment is mapped on probe at wavelength λ which is selected using optical band-pass filter. The improvements in case of quality factors of received signal can be clearly seen in Table 2. The input/output waveforms and respective eye diagram are shown in Fig. 2 and 3.

TABLE 2: IMPROVEMENT IN THE QUALITY FACTOR

Reported System (Q-factor) S. Singh *et al.*		Current System (Q-factor)
Input Power (dBm)	**Not**	**Not**
-5	11.85	16.23
0	36.49	35.17
5	45.45	65.08
10	44.8	59.26



(a)



(b)

Fig. 2: Waveforms of (a) Input Data (b) NOT Output

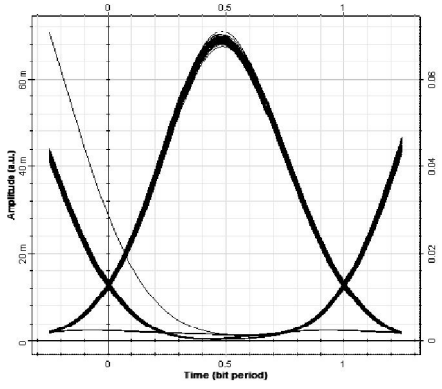


Fig. 3: Eye Diagram of NOT Output with Q-factor of 65.08

V. CONCLUSION

All-optical NOT gate has been evaluated using SOA-MZI method. Cross-gain modulation nonlinear process in SOA has led to the achievement of NOT output at 10Gbps data rate. The substitution of modulators with couplers has led to the improvement in Q-factor of the received signals.

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Case Study on Technical and Non-Technical Losses in Distribution System using ETAP

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***Abstract*—India faces endemic electrical energy and peaking shortages. These shortages have had a very detrimental effect on the overall economic growth of the country. As total distribution system losses equals technical losses plus non-technical losses. The reasons cited for such high losses are; lack of adequate T & D capacity, too many transformation stages, improper load distribution and extensive rural electrification etc. This paper presents a study on technical losses in distribution system and analysis of the impact of losses in power sector. The technical losses caused by material properties and its resistance to the flow of electrical current in distribution system will be analyzed and simulated through electrical transient analysis program.**

Keywords: Distribution System, Technical Losses, Non-Technical Losses

I. INTRODUCTION

Power is generated for the consumer utilization. From when power is generated it is transmitted through transmission lines via grids & then distributed to the consumer. Power distribution is the final and most crucial link in the electricity supply chain and most visible part of the electricity sector, according to Power Grid Corporation of India Limited current distribution losses is about 30%. Distribution losses can be caused by theft of electricity, low metering levels and poor financial health of utilities with low cost recovery, which generally causes power quality issues and increase in the cost to electricity supply [5,6]. Loss of power in distribution sector also causes increase in cost to produce more power, and the global warming concerns. Distribution losses can be classified into categories of Technical losses and Non-Technical losses. The technical losses are most visible losses because it is related to material properties and its resistance to the flow of current that is also dissipated as heat [4]. The technical losses can be clearly classified as the losses in power dissipated in distribution lines and transformers due to their internal resistance. The deregulation and privatization are posing new challenges to the distribution systems. System elements are going to be loaded up to their thermal limits, and wide-area power trading with fast varying load patterns will contribute to an increasing congestion. About 30 to 40 % of total investments in the electrical sector go to distribution systems, but nevertheless, they have not received the technological impact in the same manner as the generation and transmission systems. Nevertheless, there is an increasing trend to automate distribution systems to improve their reliability, efficiency and service quality [1]. Ideally, losses in an electric system should be around 3 to 6%. In developed countries, it is not greater than 10%.However, in developing countries, the percentage of active power losses is around 20%; therefore, utilities in the electric sector are currently interested in reducing it in order to be more competitive, since the electricity prices in deregulated markets are related to the system losses [2]. In India, collective of all states, in 2008 the technical and non-technical losses are accounted as 23% of the total input energy. To manage a loss reduction program in a distribution system it is necessary to use effective and efficient computational tools that allow quantifying the loss in each different network element for system losses reduction.

II. DISTRIBUTION SYSTEM

The modern distribution system begins as the primary circuit leaves the sub-station and ends as the secondary service enters the customer's meter socket by way of a service drop. Distribution circuits serve many customers [3]. The voltage used is appropriate for the shorter distance and varies from 2,300 to about 35,000 volts depending on utility standard practice, distance, and load to be served. Distribution circuits are fed from a transformer located in a substation, where the voltage is reduced from the high values used for power transmission. Conductors for distribution may be carried on overhead pole lines, or in densely populated areas, buried underground. Urban and suburban distribution is done with three-phase systems to serve both residential, commercial, and industrial loads. Distribution in rural areas may be only single-phase if it is not economical to install three-phase power for relatively few and small customers [7]. Only large consumers are fed directly from distribution voltages; most utility customers are connected to a transformer, which reduces the distribution voltage to the relatively low voltage used by lighting and interior wiring systems. The transformer may be pole-mounted or set on the ground in a protective enclosure. In rural areas a pole-mount transformer may serve only one customer, but in more built-up areas multiple customers may be connected. In very dense city areas, a secondary network may be formed with many transformers feeding into a common bus at the utilization voltage [9]. Each customer has a service drop connection and a meter for billing.

III. TECHNICAL LOSSES

Technical losses are due to energy dissipated in the conductors and equipment used for transmission, transformation, sub transmission and distribution of power. Technical losses on distribution systems are primarily due to heat dissipation resulting from current passing through conductors and from magnetic losses in transformers [4,5]. Losses are inherent to the distribution of electricity and cannot be eliminated. The major part of this loss is heat dissipation or I2R loss in the distribution conductors. Since this loss depends upon the value of current, it is the maximum during peak load. Other causes of the technical loss are low power factor, phase imbalance, improper joints, and extraneous factors like tree touching etc. This loss difference between in the transformer output and the sum of all invalid consumption [4]. Losses occur on sub transmission lines, distribution lines, station transformers, distribution transformers and secondary services to customers. Transformer losses include no-load losses that are independent of transformer loading and load losses that are dependent on the loading.

IV. NON–TECHNICAL LOSSES

TABLE 1: LOSSES IN ELECTRICAL DISTRIBUTION EQUIPMENT

S. No	Equipment	%Energy Loss at Full Load Variation	
		Min	Max
1	Outdoor circuit Breaker (15 to 230 KV)	0.002	0.015
2	Medium voltage switchgears (5 to 15 KV)	0.005	0.02
3	Transformers	0.40	1.90
4	Load break switches	0.003	0.0 25
5	Bus ways less than 430 V	0.05	0.50
6	Cables	1.00	4.00

Non-technical losses, sometimes called “commercial losses”, are very important because they often contribute to a large extent to the power that the utility is not paid for [5]. Non-technical losses are often related to metering errors, inaccurate meters, improperly read meters and estimated consumption due to lack of meters. Unauthorized connections as well as administrative errors are other possible sources of non-technical losses. Most nontechnical losses are associated with low voltage distribution networks. At medium voltage distribution level, nontechnical losses are primarily caused by inaccurate meters and tampering with measurement transformers. On transmission level, nontechnical losses are rare and can be neglected. Non-Technical losses are more difficult to measure because these losses are often unaccounted for by the system operators and thus have no recorded information. Non-technical losses (NTL), on the other hand, occur as a result of theft, metering inaccuracies and unmetered energy. NTLs, by contrast, relate mainly to power theft in one form or another. Theft of power is energy delivered to customers that is not measured by the energy meter for the customer. This can happen as a result of meter tampering or by bypassing the meter. Losses due to metering inaccuracies are defined as the difference between the amount of energy actually delivered through the meters and the amount registered by the meters.

V. PROCEDURE TO DETERMINE LOSSES

The total energy loss in a distribution feeder is in general defined as the difference between the energy input and energy supplied (billed). The following expressions are true:

Total energy loss = Loss in HT feeder + Loss in LT feeder, kWh

Where,

Loss in HT feeder = Energy input to HT feeder-(energy sent out on LT feeders + billed energy of consumers), kWh and,

Loss in LT feeder = Energy input to LT feeder– billed energy of LT consumers, kWh. From the above, it is evident that the total loss estimation requires accurate measurement of energy input to the HT (11 kV) and associated LT (440 V) feeders, feeder wise consumption of energy by HT and LT consumers, all recorded simultaneously for the same period of time. The estimated losses will be dependable only if all the energy meters are in good working condition [8,9]. In reality, certain percentage of meters at LT feeder and LT consumer may be non-functional [3] due to some reason or the other. While there is no standard procedure followed by distribution companies to account for the unread energy input to the LT feeders, for HT and LT consumers’ average consumption based on the previous few month’s consumption is considered for billing. The same data is also considered for loss estimation. As exact meter reading date and time is not generally recorded by distribution companies, the conventional method does not account for the non-simultaneous reading of the energy meters and assumes that the data is gathered for the same duration and hence suitable for loss estimation.

VI. OCCURRENCE OF LOSSES

1. Sub Transmission Lines
2. Distribution Lines
3. Station transformer
4. Secondary Service to Customer

Note: Transformer have losses due to core always, so it is considered as no-load loss.

VII. REASON FOR OCCURRENCE OF LOSSES

1. Inadequate investment on transmission and distribution, particularly in sub-transmission and distribution.
2. Haphazard growths of sub-transmission and distribution system with the short-term objective of extension of power supply to new areas.
3. Large scale rural electrification through long 11kV and LT lines.

4. Too many stage of transformations.
5. Improper load management.
6. Inadequate reactive compensation
7. Poor quality of equipment used in agricultural pumping in rural areas, cooler air-conditioners and industrial loads in urban area.

VIII. Case Study on 33KV Feeder

Border road-SS distribution network, fed from a main Intake of 220 KV which is fed to two main loads to zones of 33KV for Industrial User & 11KV for residential users. A typical distribution network, fed from a Main Intake Substation which supply loads to two zones, through three voltage levels (33 kV overhead lines and 11 kV overhead lines) is used to test the methodology. The base case data for the distribution network is given below.

A. Technical Data

Units from Transmission Grid=220KV
Peak Load=26MW
Load Factor=1.1

1) 33KV Feeder

No of Feeders:-2
Length of Feeder 1: 2 to 4 KM approx.-industry area,
Length of Feeder 2: 6-8 KM approx.-hot line area
Peak Demand/ feeder: 1.6MW/feeder.

2) 11KV Feeder

No. of Feeder: 4
Length of Feeder 1: 5 to 8 KM approx.-Urban area
Length of Feeder 2: 8-10 KM approx.-Khai Feeder
Length of Feeder 3: 7-9 KM approx-Air Feeder
Length of Feeder 4: 10-12 KM approx-Border area
Peak Demand/ feeder: 2MW/feeder

3) 110KV/33KV Transformer Data

Total Installed Capacity: 25MVA Average Peak Demand: 14 to 15 MW Amperes : HV-131.2
LV-437.5 Frequency-50 Hz Phase: 3 (Both HV-LV)

4) 110KV/11KV Transformer Data

Total Installed Capacity: 16MVA Average Peak Demand: 13MW Amperes: HV-64
LV-280 Frequency-50 Hz Phase:-3 (Both HV-LV)

IX. Results

The result presented here is analysed by the use of ETAP (Electrical Transient Analysis Program) using standard values. The result shows the base losses of the equipment used in the particular feeder. Losses shown here are in KW.

TABLE 2

Components	Losses [KW]	
	Base Losses	**Studied Losses**
U/G Cables	1.00	5.6
Transformers	1.11	3.6
LV Network	1.65	0.32
Over All Losses	3.76	9.52

1. The losses found in Border Road is 128 KW including all elements.
2. The maximum loss is found in the transformers. Transformers have maximum losses of 8.9 KW.
3. The average power factor is 0.9.
4. The losses is simulated with the standard values.
5. The maximum loss in a cable is10.3 KW.
6. The maximum line loss is 0.8.

X. Conclusion

In this paper we studied about the technical and non-technical losses in distribution system. in the technical losses the flow of current through cables causes the loss and in non-technical it will be caused by inaccurate meters, improperly read meters, unauthorized connections as well as administrative errors. as we see the transformer, its efficiency depends upon the operating load. it has two type of losses: no-load loss and load loss. no-load loss is also called core loss & it occurs when the transformer is energized, it does not vary with load. Load loss is called as copper loss & it is the power loss on primary and secondary windings. we can reduce the losses by locating the transformer closed to the load centre. The additional energy needs to be produced and transferred to cover the technical losses. By installing the capacitor bank, resizing of conductors, shortening the distances and by phase balancing, the losses can be reduced.

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Enhanced Mechanism for Data Security on Cloud

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***Abstract*—The cloud computing is one of the fast growing sector of IT industry as well as a promising concept to the end users. Cloud computing is an network based service in which it allows its clients to store enormous data on the cloud in multitenant environment and use as and when required, from any part of the world via any terminal equipments. It is a pay as per go service. As Cloud computing is a shared provision and is accessed distantly, the data stored in it is vulnerable to various threats by hackers or crackers and becomes extremely difficult to maintain its security and privacy. As a solution to these problems our research paper throws light on existing "Three Way Mechanism" system that ensures all the three defence schemes of authentication, data security and verification using Diffie Hellman key exchange incorporated with(AES) Advanced Encryption Standard encryption algorithm to protect confidentiality of data stored in cloud. In this paper we have proposed a new architecture which further enhances the data security at user as well as on cloud side. The model we have proposed makes it difficult for hackers to breach the security system, thereby protecting data of intended users stored on cloud.**

Keywords: Cloud Computing, Data Security, Authentication, AES, Digital Signatures, Authorization

I. INTRODUCTION

Cloud is an effective and powerful computing platform that provides individual users and professional organizations to exhibit variety of tasks such as use of online storage for storing data at remote places, development of highly customized computer softwares that helps in adoption of business applications and creation of a real networking based environment. Cloud computing virtually and dynamically scatter or distribute the computing and data resources to a large number of clients, depending upon their requirements, with the usage of various technologies and uses medium such as public and private APIs (Application Programming Interface). It provides facility to utilize the resources efficiently and hence results in reduced developing and access cost. Cloud is used as the medium to store massive amount of data of users. Data outsourced by the users, can get the information from anywhere efficiently and has no burden on information storage or the softwares present in available system and also avoid additional expense on hardware results in more efficient maintenance and use. The data memory is made available to the other users by sharing it on the cloud. Cloud services are furnished by different cloud providers such as Google, Microsoft, IBM, Amazon, etc. Cloud storage is utilized as a primary technology for many online based services [2].

The information stored at robust places on the Cloud are accessible anywhere using the internet and therefore there is a need of some security requirements [3]:

- *Authentication*: It is used for identification of intended or legitimate users using cloud services.
- *Privacy/ Confidentiality*: Only legitimate users can view the data exchanged between cloud and client during transmission.
- *Integrity*: Data is protected from whatever form of modification or change.
- *Non–repudiation*: Assurance that someone cannot deny something or we can say that the communication or interaction between two parties for any purpose cannot be denied and ensurance is done by the authenticity of their signature on a document or the sending of a message that they originated.

Cryptography is the terminology that deals with the science of enciphering and deciphering of messages or text that is the art of hiding and changing information into scrambled format [4]. Encryption is the main aspect of cryptography for the secure and efficient transmission of data over the network and also data can be stored in the same format on the cloud storage to enhance its security [3].

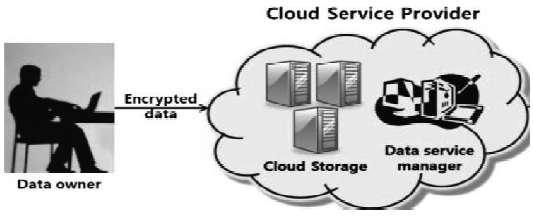

Fig. 1: Encrypted form of Data on Cloud [5]

II. RELATED WORK

Dan Boneh1, Craig Gentry2, and Brent Waters1 [6] has mentioned two public key broadcast encryption systems for stateless receivers. Broadcast encryption so described, a mechanism in which broadcaster change the format that is encrypts a message for some subset of users who are available for listening on a broadcaster channel.

Any user other than of S that is subset cannot receive any information about the message of the broadcast. In the paper so described, they have built fully collusion protected broadcast encryption systems with short length ciphertexts and generated private keys for arbitrary receiver sets. Their first part of construction issued a system in which both the broadcast information and users' private keys are of fixed size and broadcast ciphertext contains only two group elements. Each user's private key is just made up of single group element. Therby, when broadcasting to small sets, far shorter ciphertexts are built than the trivial solution and in the second part of the system both the public key and the ciphertext are of size $O(\sqrt{n})$. This defines that client can attach the public key to the encrypted broadcast and still achieve ciphertext size of $O(\sqrt{n})$ [6].

Dongyoung Koo [a], Junbeom Hur [b], Hyunsoo Yoon [a] [7] have offered a mechanism for information retrieval using attribute-based encryption (ABE). This scheme so proposed, was the best suited for storage systems provided by the cloud with massive amount of data. In this paper, they have discussed a new searchable encryption scheme that used ABE with scrambled attributes to handle the security problems specifically, the presence of successive encrypted data for the same message, poor expressiveness regarding ingress policy, and the concentration of computational overhead on the searching data entity. In ABE, the access policy can be represented as Boolean expressions which consist of logical operators such as AND or OR with number of attributes describing who is allowed to use the data content. Under this approach, the receiver built index terms from its private key fulfilling the access policy made up of keywords associated with the content of the message, where these index terms are simply applied for data accessing in the cloud storage system. Therefore, the Cloud Service Provider(CSP) cannot know which keywords are connected to the retriever's query. This system was suitable for one-to-many content distribution without a forfeit of the nature of ABE that leads to main advantage of this in case of one-upload-many-download situation [7].

According to Parvez khan Pathan, Basant Verma[3], Encryption is the main feature of cryptography for the secure transmission of data over the cloud storage system and also Avalanche effect is the term that describes the effect in the output cipher text if a single or few bits of text or message are changed in the plain text. This change that occurs at the output should be adequate if we want to design a secure algorithm. In this paper, they are exhibiting a new encryption key architecture and there decryption part which will improve avalanche effect as well as execution time as compared to various encryption algorithms designed so far. The model so proposed will secure information from all the anomalies or changes which constantly follow-up over public domain network. In this paper they have defined the study of TEA encryption and MTEA encryption algorithms with their drawbacks and also comparing these algorithms with their proposed model which will further improve the avalanche effect of data thereby improving data security on cloud [3].

Authors Kamlesh Kumar Hingwe, S. Mary Saira Bhanu[10], has narrated about Database as a service (DBaaS) security of Cloud Computing. According to the paper, in DBaaS cloud service providers allot services for storing customers or clients' data. As the data are overseen by an un-trusted storage server, the service is not fully reliable. So, the proposed framework performed database encryption, query encryption and also provide great range query over encrypted databases. The proposed framework focused on protecting database as well as storing confidential information without any leaks or alteration. A double layered encryption system is used for sensitive data and a single layer encryption is applied for non-sensitive data. Order Preserving Encryption (OPE) is used for single layer encryption. OPE so described maintains the order in an encrypted database and so the range query can be performed over encrypted database using encrypted query. OPE has a drawback of making available personal information and so for sensitive data, a double layered encryption using Format Preserving Encryption (FPE) followed by the OPE, symmetric key encryption algorithm is proposed [10].

Authors R. Sivaranjani, R. Radhika[8], have proposed Cloud Security Framework (CSF), been built to provide sufficient security to the data throughout the process of cloud computing. In this system, multiple procedures and available techniques are applied to safegaurd the crucial information from unauthorized parties. The proposed Cloud Security Framework (CSF) is divided into two phases. The first phase deals with process of transmitting and storing data available from diverse locations securely into the cloud. Second phase deals with the retrieval of data from cloud and exhibits the generation of requests for data access, double authentication, verification of digital signature and integrity, thereby providing intended authorized users with data on satisfying all security mechanisms[8].

III. EXISTING SYSTEM

In Existing "Three Way Security Mechanism " system, the entire process of security deals with

authentication, encryption and data verification in to a single system in which authentication is provided by digital signature, session encryption key is provided by AES encryption algorithm and user data file is encrypted and saved in cloud for the use by the trusted cloud user [12].

In this model, keys are generated and exchanged between cloud server and client using Diffie Hellman algorithm. Then authentication is run out by digital signature and thereafter the user information file is provided in encrypted or decrypted format using AES encryption algorithm. This system has provided user and cloud, a trusted computing environment.

The existing framework has sustained two separate servers known as computing platform and storage server for encryption and storing user data respectively [12].

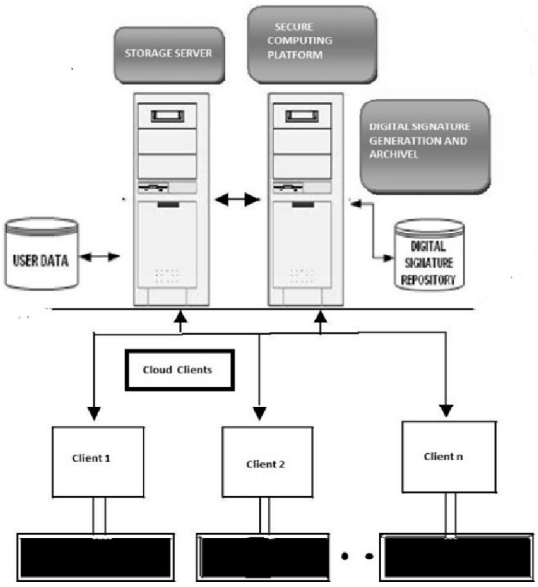

Fig. 2: Existing System Architecture [12]

In this model, when a user wants his file to be uploaded a the cloud storage server, first keys are exchanged among client and server using Diffie Hellman key exchange algorithm at the time of login, then the client is authenticated using digital signature.

Finally user's data file is encrypted using AES and is uploaded to cloud storage server. When client wants his data to be retrieved from cloud the same process is described above is repeated that is first encryption keys are exchanged during login then file which is to be downloaded is selected, authentication takes place using digital signature and then data is decrypted using the same algorithm, AES and client can access that text file [12].

IV. Problem Statement

The cloud computing environment has number of cloud storage severs to store the data. The legitimate clients or the users can access the resources provided by the cloud after the proper verification of their identity. Since it provides massive space for the sorage of user's data the level of security should be high enough to provide secure service to intended users and that can be imparted after proper authentication and authorization.

Crackers can enter into the pivotal section without knowledge of the owner. Cloud Service Provider himself can breach the security, also can damage owner access rights, as data is kept in their location. Any kind of security and privacy violation is crucial and can produce serious consequences. The Cloud Service Provider (CSP) stores the user's data in encrypted form at its storage servers. The encrypted data can be altered into original data by the appropriate key and algorithm. The encrypted data will be stored anywhere on cloud servers and can be accessed by users from any robust places. The owner or the client is not aware of the data location where it is stored so it is important to provide security at both the ends, user as well as on cloud server so that no attacker can breach the security to have illegitimate access to users' private data.The Cloud Security Framework so developed should provide the enhanced end to end security from the owner to the user with the help of checked authentication and authorization so as to maintain the integrity and confidentiality of user data [8].

V. Proposed System

The proposed framework has been structured to provide complete and sufficient security to the data stored at both user and cloud server ends. In this system, multiple mechanisms are applied to shield the critical data or information stored at robust places from unintended users for their purposes.

This system provides the scheme in which firstly the user who want to use the cloud storage service, registers to the cloud using its respective userID and password and Login to the cloud via same and at client and on cloud server end the public keys and exchanged in encrypted format between client and cloud using Diffie Hellman and final private keys are generated.

At the server end the "One Time Password" (OTP) is produced by the combination of client's login time, date commonly known as TOTP and sent in encrypted format to the client side and is received by him via his email address and when clients want to login to the cloud it can do with his respective OTP and if the login is successful then authentication is completed. After this the client can use the cloud storage for uploading or downloading the data and the client can send the data in encrypted format along with Digital Signatures and the authorization will be provided to the client if the digital signatures of the client so sent matches with digital signatures stored in the cloud.

CloudSim is the simulator tool is used to carry out this experiment. Other minimum requirements that need to be specified are [1].

A. Hardware Specifications

- Pentium Core.
- RAM Size 128mb.
- Processor 1.2GHz

B. Software Specifications

- Supporting OS: Windows XP, VISTA, LINUX: Red Hat, Ubuntu, Fedora.
- Java Development Kit-jdk1.6.0_02.
- Java Runtime Environment-jre1.6.0_06.
- Netbeans
- Web Browser like Google chrome with Java Plug-in installed.
- Wireless connectivity driver.
- SOAP
- Glassfish Server

C. Algorithms and Techniques Used

- Public Keys of client and cloud is generated and exchanged among client and cloud using Diffie Hellman and using SHA-512 algorithm keys are encrypted.
- Diffie-Hellman key exchange, also called exponential key exchange, is a method of digital encryption that uses numbers raised to specific powers to produce decryption keys on the basis of components that are never directly transmitted, making the task of a would-be code breaker extremely difficult [11].
- For encryption and decryption One Time Password so produced and data to be sent and received by the client onto and from the cloud is done using Advanced Encryption Standard (AES) algorithm.
- The AES encryption and AES decryption occurs in blocks of 128 bits. The maximum block size can be 256 bits however the key size has no maximum limit. The AES cryptography uses the same key to encrypt and decrypt data [9].
- For authorization purpose Digital Signatures are produced by cloud server using Rivest Shamir Adleman (RSA) algorithm.
- One Time Passwords (OTP) are produced in the form Time Based One Time Password that is TOTP algorithm and ecrypted using MD5 and AES.

Based on time-synchronization between the authentication server and the client providing the password (OTPs are valid only for a short period of time) [9].

D. Execution Steps during the Process

- Register by the user on the cloud.
- Login from client on the cloud storage
- Using UserID and Password
- Public keys are generated using SHA-512
- Key Exchange–Diffie Hellman
- Private Keys are generated on client and cloud
- User finally Login via OTP
- One Time Password at server using TOTP Algorithm
- Encrypted using MD5 and then AES.
- Uploading / Downloading of Data Encryption-AES
- Digital Signatures are generated using RSA Algorithm on private key present on client as well as on cloud and sent to cloud along with data.
- Signatures matched, Authorization completed.
- Data is stored / retrieved from Storage server.
- Logout.

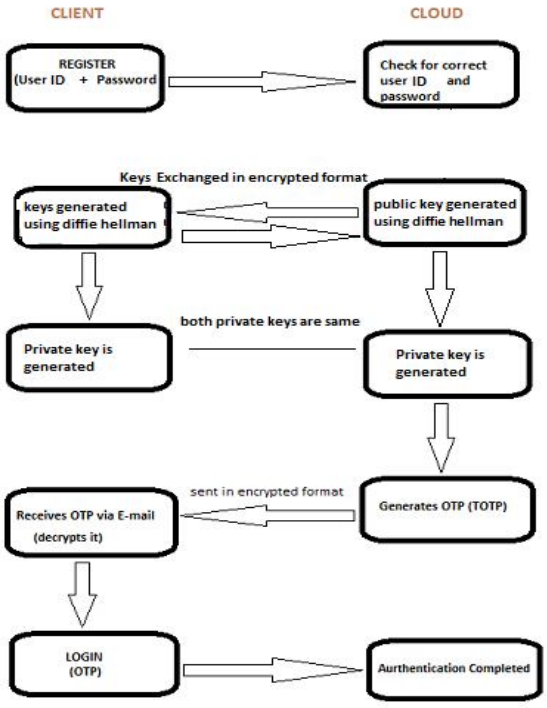

Fig. 3: Process in Proposed System

Fig. 4: Authorization Completed

VI. CONCLUSION

In this paper, we have proposed a new framework to strenghthen the security of data stored at robust or distant places on the cloud servers by incorporating the use of generation and exchange of : private keys, One Time Passwords and digital signatures, among client and cloud resources and these are transmitted in

encrypted form for the proper authentication, verification and authorization purposes and all this is in a single standalone system and also data is sent and received in encrypted form which permit only intended or legitimate users to access the data stored on cloud thereby preserving its availability, privacy and integrity.

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Task Scheduling Algorithms: A Review to Utilize Cloud Resources

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***Abstract*—Cloud computing provides us a way through which we can access applications over the network. Cloud provides the services on user demand. Cloud users demand guaranteed services. There is a vast change in number of cloud users but the cloud resources are limited so resource allocation strategies are required so that resources can be utilized and SLA can be followed[11].While scheduling tasks onto the cloud resources the main motive is to increase the performance of the system, decrease the cost of the system and all the tasks are completed according to the criteria specified by the user. There are various QoS parameters like cost, bandwidth, priority, execution time, completion time, task size which are considered while scheduling the tasks. This work studies various resource allocation algorithms and makes a comparison of strength and weakness of each algorithm. This study focuses on identification of an efficient resource allocation strategy so that resources can be utilized and SLA can be fulfilled.**

Keywords: Resource Allocation Algorithms, SLA, Task Scheduling

I. INTRODUCTION

Cloud computing means manipulating, accessing and configuring the applications online and availing online applications, infrastructure and data storage. The users are not required to install a software on their computers, they can have the services of software over the network through cloud. It is less expensive because users don't need to purchase the whole system, they will pay as per their use. It is entirely web-based so it can be accessed from anywhere or at any time over the network. Virtualization is a technique which is used behind the cloud computing. It allows to share single physical object of a resource or application among multiple number of users. Fig 1 shows the services provided by cloud.

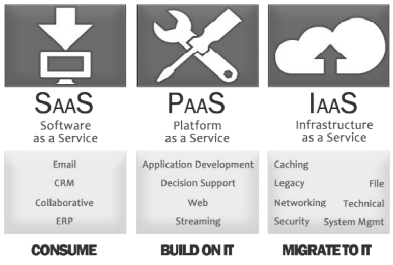

Fig. 1: Sevices Provided by the User

Cloud architecture consists of two parts:-(a)Front End: is the client part of cloud computing system. It is composed of applications and infrastructure that are essential to access the cloud computing platform for example web browser.(b)Back end: It is cloud consisting of all the resources essential to provide cloud computing services that are data storage, virtual machines, security mechanisms, servers, deployment models.

There are four cloud models.(a)Public cloud model: The services are easily accessible to general public for instance google (b) Private cloud model: The users engaged with the particular organization can access the services of private cloud.(c)Hybrid cloud model: It is combination of public and private cloud. Decisive tasks are handled in private cloud and non decisive tasks are handled in public cloud (d) Community cloud group of organizations is allowed to access its services.

Task scheduling is the process of allocating tasks onto available resources in time following the constraints described by the user and the resource provider which is the SLA(Service Level Agreement). The excess of resources or under utilization of resources should not be there. SLA monitor checks the request submitted by user for QOS requirements before determining whether to accept or reject the request. The input to the task scheduling algorithms is the abstract model of tasks without specifying the location of the resources they would require to execute. Fig 2 shows task scheduling.

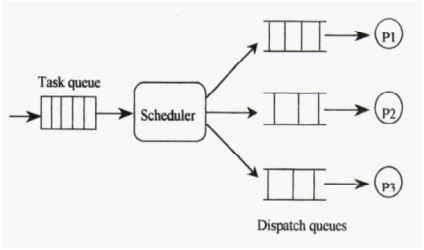

Fig. 2: Task Scheduling

There are various algorithms for task scheduling. This study consists of following algorithms. (a)Credit based scheduling algorithm [1].(b)Multi objective task scheduling algorithm[2].(c)Improved cost based algorithm. [3](d)A task scheduling algorithm based on QOS-driven. [4] (e) Efficient task scheduling algorithm [5].

II. RESOURCE ALLOCATION ALGORITHMS

Resource allocation is required to manage the number of user request. The requests of the tasks are accepted by the broker. Then broker is responsible for

mapping tasks onto the resources. Broker has information about the tasks and resources they required and resources that are available. Then broker will use particular criteria to allocate resources to the tasks. The allocation of resources should be done in such a way that resources are utilized and SLA is followed.

A. Credit based Scheduling Algorithm

In this paper[1] both the task length and task priority are considered to schedule the tasks over the virtual machines. In the min-min algorithm of task scheduling you use only task length which does not consider the task priority and then this algorithm will not work efficiently. Priority based algorithm does not consider the shortest task first, that is why starvation may occur. Thus these two algorithms are combined to propose a credit based task scheduling algorithm. In this algorithm credits are assigned to tasks based on both task length and task priority. Then total credit is evaluated and the task with highest credit is scheduled first.

B. Multi-Objective Task Scheduling Algorithm

By applying this algorithm[2] you can achieve better performance and improved throughput. The list of tasks is submitted to the broker. The broker asks the cloud provider about VMs so that the required QoS of tasks can be satisfied. The sorting of the tasks is done according to minimum size of task and minimum value of QoS of the task. VMs are sorted in descending order according to the QoS provided by them. Then VMs are assigned to the tasks sequentially in the list, if all the VMs are allotted in the list then first VM in the list will be assigned to the next task. This will repeat until the task set is empty.

C. Improved Cost based Algorithm

This algorithm [3] improves the computation performance and reduces the resource cost as compared to activity based algorithm. The grouping of tasks is done according to the computation capability of cloud resources. The scheduler receives the tasks and then calculates their priority levels. The tasks are sorted in high, middle and low priority levels. The processing capability of resource and processing requirements of user tasks are used to group the tasks. If processing requirements of the task is greater than the processing capability of the resource then resource cannot be allocated to that task. The tasks are grouped until the total processing requirements of the tasks exceeds the processing capability of the resource.

D. A Task Scheduling Algorithm based on QoS-driven

This algorithm[4] uses the batch system that is tasks do not execute as soon as they arrive. They are scheduled according to the priority and completion time. The priority of the tasks is computed according to some specified attributes like user privileges, priority expected by the user, length of the task and task's workload. This algorithm also calculates the completion time of each task over the services. Then task with minimum completion time is scheduled first so that all the tasks could be completed in less time and load on the system is balanced.

E. Efficient Task Scheduling Algorithm

This algorithm[5] guarantees the good performance under heavy workload. This algorithm works over the private cloud. Private cloud is owned and operated within the firewalls of a single organisation that provide services to the users who are local to that organisation. The main aim of proposing this algorithm is to minimize the make span. This algorithms uses two approaches.(a)Longest Cloudlet Fastest Processing Element:-While making scheduling decision, the computational complexity of cloudlet is considered. The cloudlet with larger workload are assigned to the processing element that has high computational power as a result of which make span is minimized.(b)Shortest Cloudlet Fastest Processing Element:-The shorter cloudlets are assigned to the processing element that has high computation power so that the total completion time of job set is reduced.

Longest Cloudlet Fastest Processing Element gives better results.

F. Dynamic Scheduling using Genetic Algorithm

In this algorithm[6] the tasks are scheduled dynamically according to the memory usage and computation. The scheduler knows nothing about the task request arrival in advance and the tasks are scheduled on the run time. This algorithm follows six steps to utilize the resources. (a)Initial population: It provides solution to the problem.(b)Fitness function: It specifies how effective the solution is according to the objective. It decides which chromosome will retain in population. (c)Selection: It randomly picks the chromosome and compares its value with all other existing chromosomes and then selects the chromosome to produce the next generation. (d) Crossover: It is used to combine two parent chromosomes to produce new chromosome. (e)Mutation: It is used to keep diversity from one generation to the next generation of population.

When new task arrives it is encoded and the value obtained from encoding is compared with the fitness function if it does not match then the selection procedure is followed to generate the next generation from the selected chromosome. Crossover and mutation is performed so that worst chromosomes can be removed and population size is maintained constant. Fig. 3[6] shows the algorithm.

G. Dynamic Scheduling using Genetic Algorithm

In this algorithm [7] virtual machines are assigned to the cloudlets in such a way that the average execution time and average waiting time for cloudlets is minimized. The cloudlets are sorted in descending order according to the number of instructions and VMs are also sorted in descending order according to the MIPS. Grouping of the tasks is done.

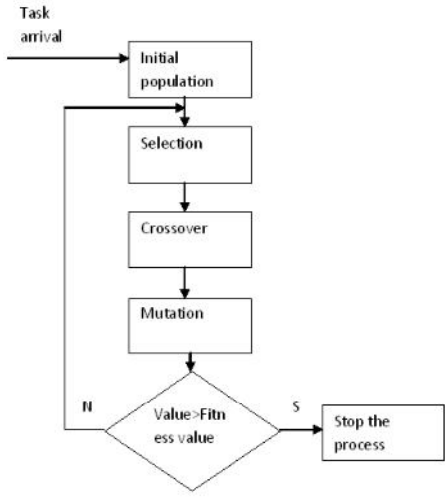

Fig. 3: Workflow of Genetic Algorithm

Then each group of cloudlets is allocated to each virtual machine and members of each group are served by VM according to round robin scheduling. By using this method it conclude that computation power required at each layer varies.

It states that if the standard deviation in MIPS increases then more number of cloudlets can execute on same VM. When using unary tree means one cloudlet is assigned to one VM then execution time decreases but it is case of less number of machines but as the number of machines increase binary and ternary trees can be used and hence K-way trees can be implemented.

H. Deadline Guaranteed Scheduling Algorithm

This algorithm[8] guarantees the resource utilization and the completion of task before its deadline. It uses two approaches EDF(Earliest Deadline First) and LWF(Largest Weight First).Jobs are sorted in ascending order according to their deadline and VMs are allocated to them. If the cloudlet has enough resources to execute the scheduled job then the VM will be allocated to the job and job will be removed from the waiting queue and machine status will be changed to busy from idle. But if the required resources are not available then this algorithm will use the backfilling algorithm, for the backfilling the algorithm will use LWF approach to select the job with maximum wait. This job will be selected only if it will complete its execution before the deadline of job ahead in the queue and if this kind of job is not found then it will use EDF as backfill algorithm.

I. Dynamic Scheduling using Greedy Strategy

This algorithm[8] computes the resources required by the applications and then dynamically adjusts the virtual resources as a result of which resource utilization and load balancing is achieved. This algorithm uses the improved greedy strategy so that distributed tasks can be mapped to appropriate computing resources so that user request can be served a s soon as possible. The task mapping is divided into four modules.(a)Service Request Module(SRM) (b)VMs Monitoring and managing module(VMM) (c)Routing Analysis Module(RAM) (d)Task Scheduling Module(TSM).

In dynamic resource allocating VMM create new virtual resources by using pre prepared image file 1)If there is no VM Or the computation power of VM is limited. 2)If VM is overloaded 3)If VMM finds that some VMs are in critical state. But if some VMs are idle then it will release them and avoid the waste of resources.

In task scheduling based on greedy strategy SRM sorts the tasks in decreasing order according to the computation capacity.TSM calculates the completion time of task and sort them in ascending order. Then the high computation capacity required task will be allocated to the virtual machine having high computation power. But if the VM having more computation power has already a task to compute the current task's completion time will include completion time of task being assigned and execution time of already assigned task before this task. When there are more number of optimal solutions then the task will be assigned to the VM that has the lower resource utilization rate.

J. Job Classification Technique to Enhance Scheduling

This algorithm[10] improves the performance of the system and utilizes the available resources. It considers that when there are number of requests during peak hours then it is difficult utilize the resources thus job classification is done according to the job size and job priority. The Queues are made according to the job classification and jobs are inserted into the queue according to the queue characterstics. Then jobs are allocated resources according to their requirements. Hence the performance of the system is increased and resources are made utilized.

III. COMPARATIVE STUDY OF ALGORITHMS

Credit based algorithm[1] helps to reduce the makespan, increases the performance. It considers the task size and priority as QoS parameters but it does not consider the deadline of the task. In multi objective task scheduling algorithm[2] both the task size and priority are considered. VMs are classified according to the type of service they provide. Hence it is easy to determine which VM should be allotted to which task. Because this algorithm considers the QoS first then the number of required VMs can be determined in advance thus cost of extra VMs is reduced. Improved cost based algorithm[3] decreases the communication ratio and cost. This algorithm considers only static environment of cloud but it does not work upon the dynamic environment of cloud. A task scheduling algorithm based on QoS-driven[4] uses various parameters like user privileges, urgency of the tasks, and waiting time

in queue to assign priority to various tasks. Efficient task scheduling algorithms [5] Schedules tasks according to the computational complexity. But it does not consider priority of the tasks. Genetic algorithm [6] schedules tasks dynamically and nodes in the cluster are balanced in such a way that there is no node with extra tasks and no node is idle. In k-way tree based scheduling[7] number of tasks assigned to each VM varies according to the variation in standard deviation in MIPS, as a result of which average execution time decreases. The deadline guaranteed scheduling algorithm [8] is useful to utilize the resources when task at the front end of the queue does not have enough resources to get executed. At this stage another job is selected according to a criteria and hence deadline and resource utilization is achieved. Dynamic Scheduling algorithm based on greedy strategy [9] helps to reduce the load on VM by creating new VMs as required release the VMs if they are idle. Then it minimizes the load on the nodes and resource utilization is achieved. But it does not consider the cost of Vms and prediction of user request. Job classification technique [10] classifies the resources according to priority and size. Table 1 shows the comparison.

TABLE 1: COMPARATIVE STUDY OF ALGORITHMS

S. No	Resource Allocation Algorithm	Parameter Considered	Performance Evaluation
1	Credit Based Scheduling Algorithm	Priority, Task size	Reduced makespan,Increased performance
2	Multi objective task scheduling algorithm	Execution time, cost of resources, bandwidth	Reduced cost,decreased execution time
3	Improved cost based algorithm	Priority,task size, resource computation capability	Improved communication ratio
4	A task scheduling algorithm based on QOS driven	Priority of task according to user privileges,expected priority and waiting time in queue	Overall completion time decreases
5	Efficient task scheduling algorithm	Works on private cloud, Computation power of resources	Minimizes make span
6	Genetic algorithm	Memory usage, Computation	Reduced execution time
7	K-way Tree based scheduling	Number of cloudlets assigned to each VM varies	Minimized execution time
8	Deadline guaranteed scheduling algorithm	Deadline of task, Task weight	Deadline guarantee, resource utilization.
9	Dynamic scheduling based on greedy strategy	Computation capacity and computation power	Resource utilization and load balancing
10	Job classification technique to enhance scheduling	Job size, job priority	Resource utilization, improved performance

IV. CONCLUSION

In cloud computing resource allocation is the major part because less number of resources are available as compared to resource users. Thus to utilize the resources various strategies should be followed to allocate resources. The cloud service provider must assure the SLA will coincide as well as maintain the agreed QoS. This work has studied various resource allocation algorithms to find the efficient strategy. The study conclude that the credit based algorithm may provide better performance if it considers the deadline of the task to allocate the resources.

ACKNOWLEDGMENT

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Bandwidth-MIPS Aware Task Scheduling in Cloud

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***Abstract*—Scheduling plays a key role in allocation of resources in cloud computing systems. There are many ways of Scheduling of jobs in cloud environment. Cloud consists of a number of resources such as firewall, network, cups etc. that are dynamically allocated according to the order and necessities of the task and subtasks. So, the dynamic scheduling of task is major issue in cloud computing environment where more attention is payed because of different services (SaaS, PaaS, IaaS) by cloud service provider. The task scheduling problem can be viewed as the finding or searching an optimal mapping/assignment of set of subtasks over the available set of resources (processors/computer machines) so that we can achieve good performance of the cloud resources. In this paper we are performing comparative study of the different algorithms in the context of cloud scenario, after that we try to find optimal algorithm for task scheduling in cloud computing environment that can be adopted to enhance the existing platform further. So that it can facilitate cloud-providers to provide better quality of services.**

Keywords: Cloud Computing, Scheduling, CloudSim, Virtualization

NOMENCLATURE

IaaS:	Infrastructure as a Service
PaaS:	Platform as a Service
SaaS:	Software as a Service
IT:	Information Technology
MIPS:	Million of instruction per second
VMM:	Virtual Machine Monitor
VM:	Virtual Machine

I. INTRODUCTION

Cloud computing [1] environment uses virtualization [3] concept and provides resources to application by creating and allocating virtual machine to specific application. Therefore resource allocation and load balancing policies play very vital role in allocating and managing the resources among various application in cloud computing life cycle. The efficient scheduling of task helps to improve proper utilization of resources. Cloud is categorized as private cloud, public cloud and hybrid cloud which provides specific service such as IaaS, PaaS and SaaS to client.

Scheduling refers to the set of rules to control the order of work to be performed by a computer system to maintain proper utilization of resources. Job scheduling is not very easy task in cloud computing because it is parallel and distributed architecture. The job completion time determination is difficult in cloud because the job may be distributed between more than one virtual machine and virtual CPUs are assigned to each virtual machine.

CloudSim [16] is a Cloud Simulation Software which enables seamless modeling, simulation and experimentation of cloud computing and application services. The performance estimation of task scheduling policies, cloud provisioning policies, cloud services, web based cloud application workload, data models and resource performance models under varying system, user configurations and requirements is big challenge,. To overcome this challenge, CloudSim can be used for single and inter-networked clouds. In simple words, CloudSim is a simulation and development toolkit for cloud scenarios such as task scheduling, load balancing, performance evaluation of VMM [22] and energy and cost estimation of virtual machines.

II. SCHEDULING TYPES

1. Static scheduling: In this method, information about task such as structure, mapping of resources and execution/running time are known before the execution of task.
2. Dynamic scheduling: In this method, tasks are scheduled dynamically on the basis of priority of task in cloud environment but also the current states of system and computer machines to make scheduling decision.

CPU schedulers [4] can also be classified as pre-emptive and non-preemptive. In preemptive scheduling, all tasks are scheduled on the basis of priority, each task is assigned priority and if the new task has the higher priority than running task then the CPU scheduler will force it to stop the running task and executes the new arrival task. In non preemptive scheduling the CPU scheduler allows every and every task to complete its

execution without any restriction and condition, that is scheduler cannot stop forcibly running task to run a new task from ready queue. As fig 1 shows number of task to be scheduled are listed in queue called task queue and scheduler will select task from queue to allocate cups to it. More than one task can be scheduled by single cpu such as P1, P2 and P3 and these tasks are placed in dispatch queue for execution one by one, scheduling can be preemptive or non preemptive for scheduler.

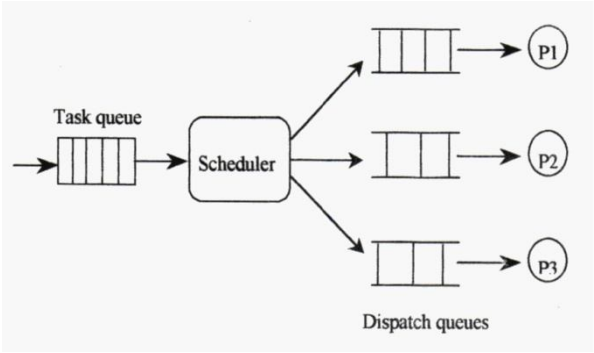

Fig. 1: The Scheduler Model

CPU scheduler decides how the processing cycles should be allocated to the task to accomplish superior performance. In a simple system if there are number of processes, then scheduling algorithm allows one process to use the CPU while another is waiting for I/O, which makes full utilization of CPU cyclest. In case of multiple processors there is more than one CPU, so scheduling of task may be more complicated. The scheduling algorithm should be designed such that it is capable of balancing the load between multiple processors [7]. Multi-processor systems can be Homogeneous and Heterogeneous [5][23] whereas heterogeneous system is a set of cores which may differ in area, performance, power dissipated etc and homogeneous system where each core is same as the other. The challenge is to make the overall system as "efficient" and "fair" as possible. Whenever the CPU becomes idle, it is the job of the CPU Scheduler to select another process from the ready queue to run next task. The storage structure for the ready queue and the algorithm used to select the next process are not necessarily a FIFO queue.

Task scheduling [2] plays an important role to improve flexibility and reliability, utilization of systems in cloud. The scheduling of task to resources involves finding out best and proper way in which various jobs can be executed to provide the satisfactory results to the client. The scheduling of tasks in cloud means choosing the best suitable resource available for execution of tasks or to allocate computer resources i.e cpu, memory etc to tasks in such a manner that the completion time is minimized. In scheduling, number of algorithms are available in which lists of tasks are created and each task is scheduled according to algorithm scenario.

Tasks in IaaS model of cloudare the resources requests which are completed by means of Virtual Machines(VM). In IaaS when a cloud user requests for resources, then these requests are accepted by the broker which then uses the task scheduling to assign the tasks to different VMs. These VMs are then placed over the physical hosts which are scheduled by the VM scheduler. The scheduler at the broker level will decide the provisioning of resources to the VMs. More than one task can be assigned to a single VM. These tasks are then scheduled by the task scheduled in a time-shared or space-shared environment.

The various Scheduling policies of these schedulers are:

1. Time-Shared Policy:
   In a time-shared environment task scheduler will distribute the capacity of core among different tasks dynamically.
2. Space-Shared Policy:
   In a space-shared environment the scheduler assigns specific CPU cores to specific task.

The various scheduling algorithms depend on number of input parameters like the computing power of vm, bandwidth of vm, number of vm, size of tasks, and number of tasks. Though most of the algorithms generally consider computing power as the main factor for designing an effective scheduling policy but in our algorithm we have considered both as factors (MIPS and Bandwidth) [15] that affect the scheduling making it more efficient.

III. Description of Algorithm

Since in Bandwidth and MIPs aware task scheduling algorithm both MIPs and bandwidth are taken into consideration, so value of both parameters is passed to the solver model for optimistic task scheduling:

1. The algorithm can be described as:
2. The number of tasks along with the size are submitted to broker for scheduling.
3. The computing power (in mips) and bandwidth of the resource are obtained.
4. A problem solver model is created with the Choco and its constraints are defined.
5. The bandwidth and computing power of the vms obtained and then passed on to the solver
6. The solver then finds the optimized strategy of number of tasks to be allocated to which vm.
7. The tasks are then bound to the vms for execution.
8. Choco Problem solving model considers the user defined constraints that are:
   - All the tasks to be scheduled should be of same size
   - The computing power and bandwidth of VM should be greater than 0

- Time spent by each task on a Vm should be less than or equal to total processing time.
- The sum of bandwidth of each vm should be less than upper bound of bandwidth.

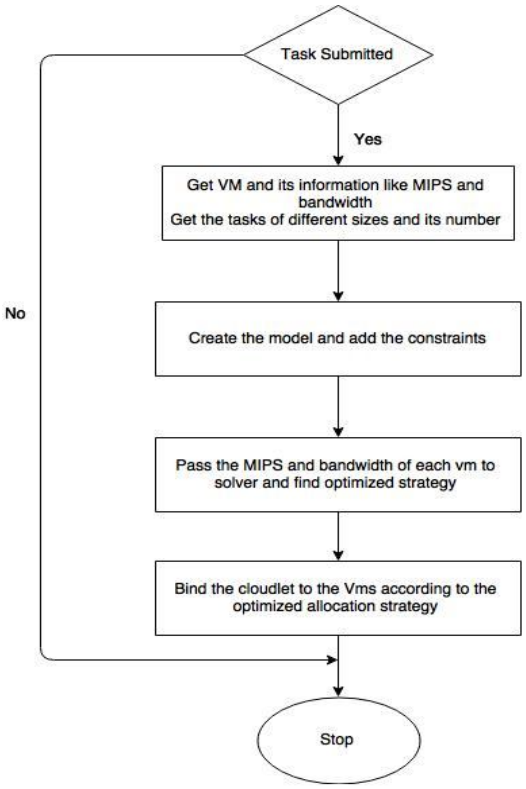

Fig. 2: Flow Chart of Proposed Scheduling Algorithm

The Pseudo code of the Algorithm is :

```
bw = getBandwidth(); mips = getMips();
Model m = new CPModel();
m.addconstraints(); Solver s =new CPSolver();
s.getoptimisedsolution(); for v in Vm:
n_bw = length*(s/(s-length/MIPS));
v.setBw(n_bw);
for v in Vm:
For task in Cloudlet: getcloudletlist(task).setVm(v);
```

IV. Experiment and Evaluation

In this section, we present experiments and evaluation that we undertook in order to quantify the efficiency of task scheduling algorithm in cloud computing environment. The experiments were conducted on a Ubuntu machine having configuration: 4 GB of RAM running a standard Ubuntu Linux version 14.04 and JDK 2.5.5. The task scheduling experiments were performed on CloudSim which is a simulation tool for cloud computing.

A Datacenter broker class was created in which the problem solving model with constraints was defined. Also we created a bindAll() function to implement the optimized strategy made by our model.

A Free and open source Java library named Choco is used which is dedicated to Constraint Programming. It aims at describing real combinatorial problems in the form of Constraint Satisfaction Problems and to solve them with Constraint Programming techniques.

The performance of our algorithm is analyzed by comparing the results with MIPS-aware and Bandwidth-aware task scheduling algorithm. To do this comparison various experiments are performed with no of task 20, 30, 40, 50 and 5, 10 numbers of Vms.

Experiment 1: No. of Vms: 5

TABLE 1: COMPARISON OF ALGORITHMS WITH DIFFERENT NO. OF TASKS

No. of tasks	Bandwidth-MIPS Aware	Bandwidth Aware	MIPS Aware
20	200.21	266.63	265.63
30	300.21	400.44	387.82
40	375.12	432	487.66
50	446.48	590.11	500.55

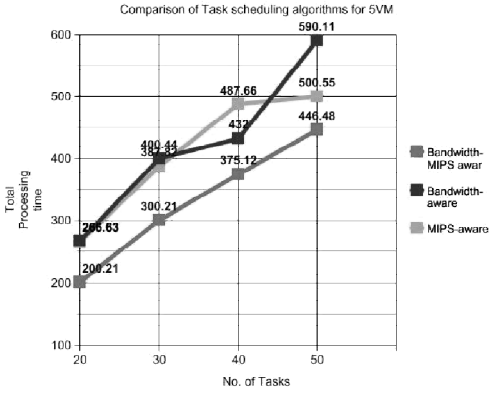

Fig. 3: Graph of Comparison for 5 Vms

Experiment 2: No. of Vms: 10

TABLE 2: COMPARISON OF ALGORITHMS WITH DIFFERENT NO. OF TASKS

No. of tasks	Bandwidth-MIPS Aware	Bandwidth Aware	MIPS Aware
20	101.21	119.3	128.66
30	163.11	191.77	200.21
40	192.12	230.88	246.61
50	233.25	300.32	300.31

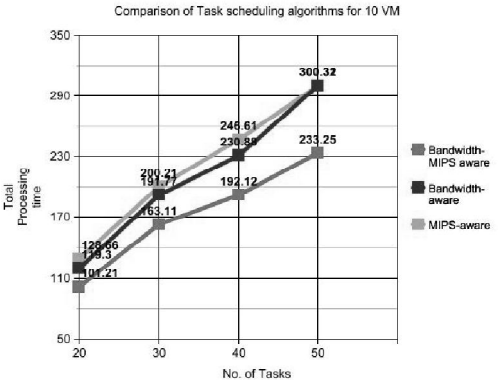

Fig. 4: Graph of Comparison for 10 Vms

V. Results and Discussion

Based on the above table and graphs summary for the comparison with our proposed model with bandwidth-aware and MIPS-aware task scheduling algorithms, the results show that the Bandwidth-MIPS aware scheduling algorithm shows the best performance. The processing cost of our proposed model is low in comparison to other scheduling algorithm.

These results shows that both the Bandwidth and MIPS can be used to improve the performance of the task scheduling algorithm in comparison to the algorithms that use only Bandwidth and MIPS values.

VI. Conclusion

Cloud Computing is basically used due to its reliability and scalability features and the ability to efficiently schedule the number of tasks of users on the cloud resources. For the better efficiency of task scheduling, the load of users is optimally shared among the resources and the aim is to get the best performance with this. For this to obtain best results, a non linear programming model is built which is solved using Choco library with the Bandwidth and MIPS of VM as the parameters. The solver gives the optimized solution for binding the cloudlets with the Vms. This algorithm is implemented on CloudSim. The results obtained with this algorithm are then compared with the two other algorithms and the results prove that our model is best of all the three as the processing time is less in our algorithm.

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A Policy on Net Metering for Grid Interactive Roof-Top Solar Photo Voltaic Power Plants in Punjab

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***Abstract*—Punjab has good irradiation levels for a solar power plant, with 5.32 kWh/m^2 radiation per day. In the year 2013 the installed capacity of SPP in Punjab is only 9.3 MW but there has rapid increase in the installed capacity of Solar Photovoltaic Power plants in Punjab in proceeding year. It has reached to 239 MW. Main reason behind this advancement is the Punjab government, who invited various private companies to install SPV power plants in Punjab. Now Punjab government is looking to encourage the people about the growth of green energy. So Government of Punjab has released one very interesting policy in 2012. In this paper detail study about that policy has been carried out. Its advantages and whole processor to avail it, has studied to understand its benefits for the consumers.**

Keywords: Rooftop Solar PV System, Punjab Energy Development Agency, Punjab State Power Corporation Limited

I. INTRODUCTION

India's solar installed capacity has reached the 4,000 MW. Rajasthan is on top with installed capacity of 1128 MW. It has overtaken Gujarat, which has 957 MW installed capacity. Some other states like Madhya Pradesh, Maharashtra and Tamil Nadu are closely behind. Besides these states few regular solar power-rich states, Uttar Pradesh, Punjab and Telangana have now joined the solar power plant installation race. In the end of 2015, an additional of 1.7 GW is supposed to be installed in India. The table has showed the growth of installed capacity in different states of India. The [1] Punjab state has drastically increased their capacity of solar power plants but still there are some hazards in it such as capital investment is very high and power supply reliabilities. Although government provides subsidies but most of the people are unaware of these subsidies. To encourage the people to install photovoltaic system, Government introduce a policy on net metering for grid interactive roof-top solar photo voltaic power plants**.** Net metering is the process through which a solar power project is installed on the roof, open space, walls of the building to generate electricity. The generated power is first used to fulfil needs of that building and the remaining power is fed into the grid to PSPCL. A bi-directional meter is installed in the supply line to register import and export of power.

Net metering elements of captive consumption and exchange of power with the utility. During power cuts, the Rooftop Solar PV System will continue to supply power to the building.

TABLE 1: GROWTH OF PER YEAR IN INSTALLED CAPACITY OF SPP IN INDIA

State Name	2012–13	2013–14	2014–15
Rajasthan	301.15	666.7	1128
Gujarat	824.09	860.4	953
Madhya Pradesh	11.75	130	637
Maharashtra	75.5	150	354
Punjab	NA	9.3	239
Andhra Pradesh	76.95	92.9	228
Tamil Nadu	19.11	31.8	164
Karnataka	79	31	104
Telangana	NA	NA	83
Uttar Pradesh	NA	NA	73
Total Installed Capacity	1387.55	2208*	4000*

*Minor installations in other states also added in final total.
Source: Ministry of new and renewable energy [6]

II. POLICY ON NET METERING FOR GRID INTERACTIVE ROOF-TOP SOLAR PHOTO VOLTAIC POWER PLANTS

A. Introduction

Under Net Metering policy, solar photovoltaic plant is installed on the roof of the building. During day time sun rays fall on solar panels to generate electricity. The generated power is used in the building for running electrical appliances and the remaining power is supplied to the grid of PSPCL. In case the power requirement of the building is more than the power being generated, then extra power requirement is drawn from the grid. On the other hand, in case the power generated is more than the power requirement of the building, the surplus power is exported to the grid. A Bi-directional Meter is installed in the supply line for reading the import and export of power and the bill is issued by PSPCL after the adjustment of import and export of power. The below diagram showed the energy flow under the net metering scheme.

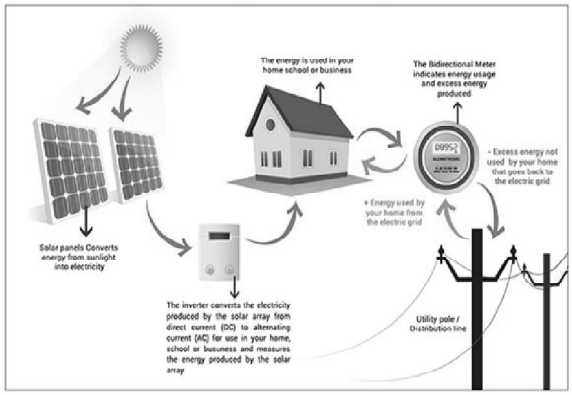

Fig. 1: Energy Flow Diagram under Net Metering

B. *Salient Features of Policy*

Under Net Metering Policy, Roof top solar power plants of capacity ranging from 1 KW_{Peak} to 1000 KW_{Peak} can be installed. The solar power is generated in excess of the owner's electricity consumption is fed into [2] the grid through a bi-directional energy meter which is capable of registering both import and export of electricity. Surplus power exported by the SPV Generator to PSPCL will be banked and set-off in the Settlement Period ranging from October to September. PSPCL will take energy meter readings for import/drawl and export/injection of power and generate the bill. If the net energy flow is from the PSPCL, then the consumer will be issued the bill for units consumed minus units generated.

C. *Eligibility for this Policy*

All consumers of electricity having electricity sanctioned load more than 1.25 KW can avail this policy. Who wished to produce their own electricity and want to contribute towards environmental can install Solar PV plants on Roof tops area of individual households, industries, commercial establishments, institutions, residential complexes, schools, Colleges, Hospitals, sheds, cold stores, govt. and semi-govt. buildings, etc. Eligible candidate can follow the following steps to install solar photovoltaic power plant on the realm.

D. *Timelines to Set-up Grid Interactive Roof-Top Solar Photovoltaic Power Plants*

For installation of solar power plant the applicant has to registered online with copy of latest electricity bill and available shadow free area at the top of roof/ walls/ open space within the compound. After verification, PSPCL/ PEDA will give online approval to the applicant for installation of required capacity Solar Power Plant. After approval from PSPCL, applicant will contact and install solar power plant from selected suppliers/ manufacturers of solar power plants for facilitation.

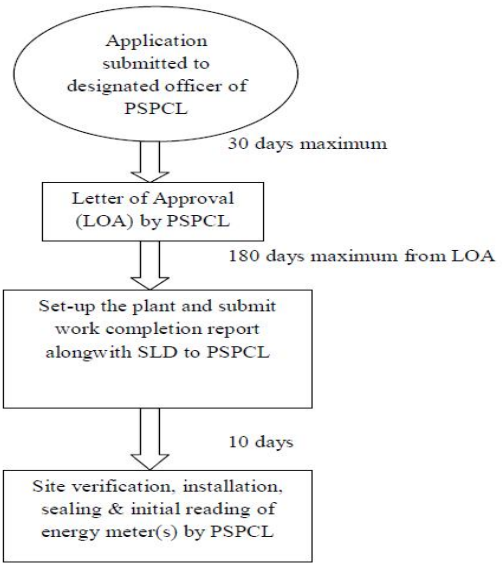

Fig. 2: Time Flow Diagram for Roof top SPP Installation Net Metering

After installation of solar power plant, submit the work completion report along with photograph of the system and single line diagram of the synchronizing and protection arrangements. After receiving project completion report, the Bi-directional meter would be installed at the premises of the beneficiary by PSPCL. After installation of Bi-directional meter the plant shall be treated as [2] commissioned and the beneficiary will apply for release of subsidy online with PEDA along with the work completion report duly verified by PSPCL. Within 7 days after submission of Application subject to availability of funds of MNRE, GOI.

E. *General Technical Specifications of the Roof Top Solar Power plant*

All the equipment associated with solar plant installation like solar PV panels, inverters; synchronizer, MPPT, batteries, transformers, cables, junction boxes etc shall be brand new and as per latest specified Indian/IEC standards. Bidirectional energy meter with CTs and PT, if required, having the feature of recording both the import and export of energy, besides other parameters shall be as per CEA [5] metering regulations/ State Grid code as applicable and of the make & specifications as approved by PSPCL shall be installed at the cost of the SPV plant owner at the point where interconnection is made between Consumer system and PSPCL system.

III. METER CONFIGURATION OPTIONS

The metering system for rooftop solar system, under net-metering arrangement, shall be explained as below which should be applicable till such time the Central Electricity Authority notifies the standards in this matter.

A. Two Meter Configuration without Storage

The metering protocol for 'Grid connected rooftop solar PV system without storage' and location of solar meter and consumer meter shall be in [2] accordance with the schematic below.

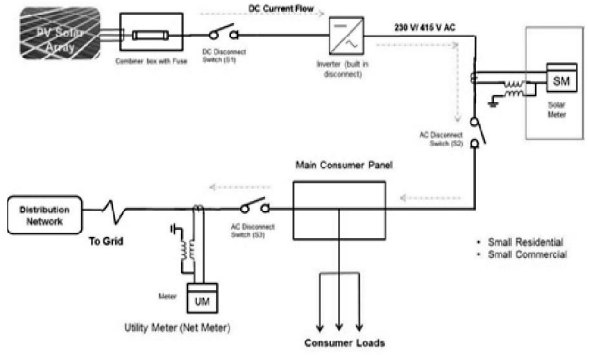

Fig. 3: Two Meter Configuration without Storage

The utility meter has to be bi-directional meter to register both import grid electricity amount as well as export solar electricity amount.

B. Two Meter Configuration with Storage

The metering protocol for 'Grid connected rooftop solar PV system with storage' and location of Solar Meter (SM) and Utility Meter (UM) shall be in accordance with the schematic below. The utility meter (Net-meter) has to be bi-directional meter to register both import grid electricity amount as well as export solar electricity amount.

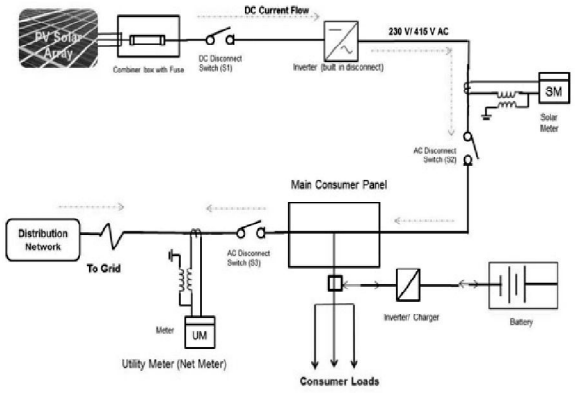

Fig. 4: Two Meter Configuration with Storage

C. Net Metering Calculation of Plant Capacity 2KW

Let us assume if the plant has capacity of 2KW. It is generating 10 units of electricity daily so its monthly generation is 300 Units. If we assume consumer's average monthly electricity consumption is 350 units. In Punjab domestic tariff slab is given below.

- 0 to 100 units-Rs. 4.56 per unit
- 101 to 300 units-Rs. 6.14 per unit
- 301 and above-Rs. 6.56 per unit

So after adjusting the net consumption and net generated units of power the average electricity bill during the month shall be calculated as under:

- 0 to100 units = 100×4.56-Rs. 456/-
- 101 to 300 units = 200×6.14-Rs. 1,228/-
- 301 to 350 units = 50×6.56-Rs. 3,28/-
- Total-Rs. 2012/-

Generation of Solar PV Plant shall be prepared for as under:

- First 200 units = 200×6.14-Rs. 1,228/-
- Next 100 units = 100×4.56-Rs. 456/-
- Ave. monthly saving on energy bill-Rs. 1684/-
- Net Bill - Rs. 328/-

D. Net Metering Calculation of Plant Capacity 5KW

Let us assume if the plant has capacity of 5KW. It is generating 25 units of electricity daily so its monthly generation is 750 Units. If we assume consumer's average monthly electricity consumption is 850 units (approx.). In Punjab domestic tariff slab is given below:

- 0 to 100 units-Rs. 4.56 per unit
- 101 to 300 units-Rs. 6.14 per unit
- 301 and above-Rs. 6.56 per unit

So after adjusting the net consumption and net generated units of power the average electricity bill during the month shall be calculated as under:

- 0 to 100 units = 100×4.56-Rs. 456/-
- 101 to 300 units = 200×6.14-Rs. 1,228/-
- 301 to 850 units = 550×6.56-Rs. 3608/-
- Total-Rs. 5292/-

Generation of Solar PV Plant shall be prepared for as under:

- First 500 units = 500×6.56-Rs. 3,280/-
- Next 250 units = 250×6.14-Rs. 1535/-
- Av. monthly saving on energy bill-Rs. 4815/-
- Net Bill-Rs. 477/-

E. Net Metering Calculation of Plant Capacity 10KW

Let us assume if the plant has capacity of 10 KW. It is generating 50 units of electricity daily so its monthly generation is 1500 Units. If we assume consumer's average monthly electricity consumption is 1550 units. In Punjab domestic tariff slab is given below:

- 0 to 100 units-Rs. 4.56 per unit
- 101 to300 units-Rs. 6.14 per unit
- 301 and above-Rs. 6.56 per unit

So after adjusting the net consumption and net generated units of power the average electricity bill during the month shall be calculated as under:

- 0 to100 units = 100×4.56-Rs. 456/-
- 101 to 300 units = 200×6.14-Rs. 1,228/-
- 301to 1550 units = 1250×6.56-Rs. 8200/-
- Total-Rs. 9884/-

Generation of Solar PV Plant shall be prepared for as under.

- First 1000 units = 1000×6.56-Rs. 6560/-
- Next 300 units = 300×6.14-Rs. 1842/-
- Next 250 units = 250×4.14-Rs. 1035/-
- Av. monthly saving on energy bill-Rs 9437/-
- Net Bill-Rs. 447/-

IV. Cost and Subsidy on Roof Top Solar Power Plants

It very important to analysis and understand the total cost investment by the consumer and the subsidy give by Punjab government. Below table explain the cost and subsidy on roof top solar power plants. The price depends on make, quality and storage solution also. The last [3] column shows the area required to install solar photovoltaic power plant.

30% subsidy was available from the Government till 31st March' 2015 which was reduced to 15% from 1st April' 2015. Calculations are made on the bases of 30%. Roof top solar power plants up-to maximum of 80% capacity of sanctioned electricity load can be installed but solar plant as per actual requirement should be installed. Capacity of required plant shall be calculated as under.

Total electricity consumption = **X** KWh of house/building in one year

Per day electricity consumption =X /365 = **W** KWh

Actual Plant capacity = W/4 = …...KW

TABLE 2: CHANGE IN COST AND SUBSIDY ON ROOF TOP OF SPP

Sr. No.	Capacity	Cost	Subsidy	Area Required
1	1 KW	Rs. 85000 to 110000	15000	120 $feet^2$
2	2 KW	Rs. 170000 to 210000	26000	240 $feet^2$
3	3 KW	Rs. 260000 to 315000	40000	360 $feet^2$
4	5 KW	Rs. 430000 to 510000	65000	600 $feet^2$

V. Conclusion

This policy will definitely attract to the consumers to set up solar power plants at their residence and office or work areas. Consumer can generate electrical power to fulfil their own electricity demands. It will help to reduction in electricity expenditures. It will decrees risk of discontinuous supply of power in the building during power blackouts. Solar power is the green energy because it does not cause any pollution in the environment. It also causes reduction in global warming saving of fossil fuels like coal, petrol etc. Calculation of payback period for Roof top SSP will be carried out in our future research.

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Role of High Temperature Superconductor Motor in Traction System

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***Abstract*—In this paper we have tried to conserve energy by the replacement of conventional industrial motors with energy efficient High Temperature superconductor Motor. The demand of electrical energy is increasing day by day so it will become necessary to conserve energy by use of excellent performance of HTS motors. Traction system consumes major power which is almost equal to industrial sector. To improve the power consumption in traction system it is necessary to use HTS motors. The key feature of HTS motors is smaller, lighter, energy efficient and generates less noise. Hence by the use of HTS motor whole traction system become energy efficient or we can say that the length of electrical traction system can be increased.**

Keyword: High Temperature Superconductor, Traction System, Critical Temperature, Critical Magnetic Field

I. INTRODUCTION

Indian railway traction system is the largest one in the world, and so it becomes the major energy consuming sector. The energy consumption of railway system includes the energy for electrical traction as well as energy for non traction locomotive application that is, lights, heater, etc. The power consumed by the system is not fully utilized as the efficiency of conventional motors used for traction is in the range of 80%-85%. There are considerable losses in the transmission of energy for locomotive application too. It's responsibility of engineers to provide a solution to avoid this energy wastage. The HTS motor operates at an efficiency of 98.6%. This eliminate approximately 50% of power consumption as compared to other conventional motors

II. BASICS OF SUPERCONDUCTORS

Superconductors can pass electricity without the loss of energy. When current flow in a normal conductor, for example copper wire, some energy lost. In metals such as, copper, aluminum, electricity conducted as outer energy level electrons transfer as individual from one atom to another These atom form vibrating lattice with in metal conductor, as the metal attains high temperature, its vibrations starts increasing. As the electrons being moving through the complex network, they collide with small impurities. When the electrons bump in these obstacles they fly off in all directions and loss energy in form of heat. But inside superconductor the behavior of electrons is extremely different. The impurities and lattice are still there but the movement of the super conducting electrons through the obstacle course quit different. As the superconducting electrons travel through the Conductor they pass unobstructed through the complex lattice. Because they bump into the nothing and create no friction, they transmit electricity with no appreciable loss in the current and without loss of energy. The ability of electrons pass through superconducting material unobstructed has rattled scientists for many years. The warmer a substance is, the more it vibrates and vice versa. Early researchers suggested that less atomic vibration would permit electrons to pass more easily. However this anticipates a slow decrease of resistivity with temperature. The understanding of superconductivity with the help of BCS Theory. This explains superconductivity at temperature close to the absolute zero. Copper realized that the atomic lattice vibrations were directly responsible for unifying the entire centre current. They forced electrons to pair up into teams that could pass all the obstacles which create resistance in the conductor. These collections of electrons are known as copper pairs. As the superconductor attains heat energy the vibrations in the lattice become more violent and break the pairs. As they break superconducting diminishes. Superconducting metal and alloy have characteristics transition temperature from normal conductor to superconductors called critical temperature (Tc). below the superconducting transition temperature the resistivity of material exact zero. Superconductor made from different materials, have different Tc values. Among ceramic superconductor for Y $Ba_2Cu_3O_7$ the values of T_C is about 90K while for $H_g\,B_{a2}\,C_{a2}\,C_{u3}\,O_8$ it is 133K. Fig. 1 shows the resistance against temperature curve for Y $B_{a2}\,C_{U3}\,O_7$

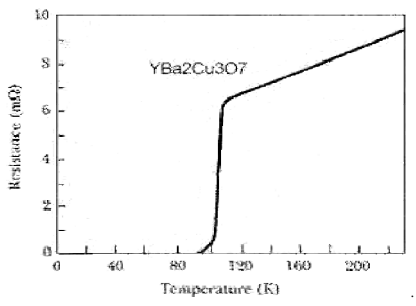

Fig. 1: Resistance *vs.* Temperature Curve for Y $B_{a2}\,C_{U3}\,O_7$

Since there is no loss in electrical energy when superconductor carry electrical current, relatively narrow wires made of superconducting material can be used to carry huge currents. However there is a certain maximum current that these materials can be made to carry above which they stop being as superconductors. If too much current is pushed through a superconductor, it will revert to the normal state even though it may be below it transition temperature. The value of critical current density (J_c) is also a function of temperature.

The current in wire creates a magnetic field around a wire. The strength of magnetic field increases as the current in the wire increases. Because superconductor is able to carry large current without loss of energy, they are well suited for making strong electromagnets. When a superconductor is cooled below its transition temperature (T_c) and a magnetic field is increased around it, the magnetic field remain around the superconductor. If magnetic field (H) is increased to a certain point, the superconductor will go to the normal resistive state. The maximum value of the magnetic field at a given temperature is known as the critical magnetic field and is denoted by the symbol (H_C).For all superconductors there exist a region of temperature and magnetic field within which the metal behaves as superconductor Outside this region the material is normal. Fig. 2 shows the critical magnetic curve.

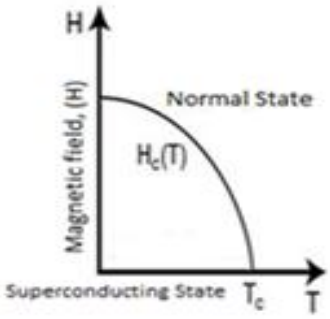

Fig. 2: Critical Magnetic Curve

III. HTS Motors Configuration

The rotor assembly includes HTS field winding operating at 32k, its support structure, cooling loop, cryostat and electromagnetic (EM) shield. Fig.3 shows the schematic view of an HTS motor shows its various parts. The stator assembly includes an A.C. Stator winding, back iron, stator winding support structure, bearing and housing. An external cryo-cooler module used to cool the field winding is located at the non drive end of the shaft. The field winding consists of several HTS coils that are conduction cooled through the support structure.

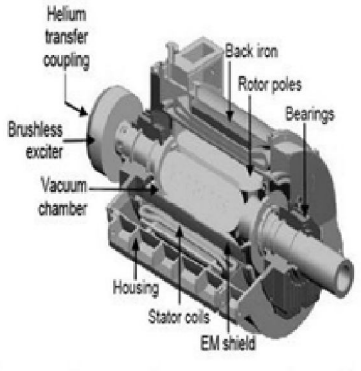

Fig. 3: Schematic View of HTS Motor

The primary parts of the rotor assembly are given below

1. HTS Field winding
2. Cooling system
3. Torque tube (for transferring torque from the "cold" cryogenically – cooled environment to the "warm" shaft ends)
4. Room temperature EM shields.

The field winding is an assembly containing six pole sets, each fabricating using first generation (1G) HTS wire that is designed to withstand in the powerful magnetic field and mechanical forces experienced in the rotor. The HTS pole sets are attached to the metallic support structure which provides not only mechanical support but also path for conduction cooling. The pole sets and the support structure are enclosed in vacuum sealed cryostat that minimize radiant heat input and provides the insulated operating environment required by the HTS field coils. An EM shield which is located at the outside surface of the cryostat performs following functions:

1. Protection of the field winding by attenuating asynchronous field produced by the stator winding.
2. Movement of high transient torque during a fault.
3. Provision of damping for low frequency oscillations.

A. Design Detail of HTS Motor

The EM shield which transfers torque directly to the warm shaft, is designed to be mechanically robust to withstand the large forces generated during faults and designed to absorb heating caused by negative sequence currents. A refrigeration system which uses cold circulating helium gas in closed loop maintains the HTS field winding at cryogenic temperature. Helium gas circulated through the cooling channels located inside the rotor. The stator winding employs no magnetic iron teeth and is designed with class F insulation but operates at class B insulation temperature. The stator coils Litz conductor which made up of small diameter insulated and transposed wire strands. Because the stator winding bore surface experience a high magnetic

field that would saturate the iron teeth of the conventional stator the HTS motor stator armature winding does not employ iron teeth. With no iron teeth in the winding region the support and cooling of the stator coils require special attention. The back EMF in this motor is nearly a pure sine wave and harmonic field components are much smaller than those observed in conventional motors

B. Rotor Mechanical Design for HTS Machines

The rotor support structure is designed to support the cold mass and maintain HTS coils within their strain limits. The thermal system is designed to keep HTS field coils within their allowable temperature limit during all operating modes of the motor. The current 1G HTS wire has reached the practical level of robustness for wire handling during manufacturing and subsequent operation in practical high speed rotor application. A key advantage of the recently developed 2G HTS wire is expected to improve further with added mechanical characteristics.

C. Coolent Transfer to Rotor

Cooling systems for larger machines can be built by using the GM cryo-coolers as the building block. A system employs gaseous helium as a working fluid to transport heat from the HTS windings to the cyro-coolers. The cryogenic cooling system must be as robust and reliable as possible so that no practical limitation is derived from it and customer not involved in additional maintenance. The cooling transfer systems have been built successfully and used in different companies. In all cases this cooling system does not create any problems.

D. Stator Mechanical Design for HTS Machines

An HTS superconductor field winding generating a high intensity magnetic field in small volume. Use of a traditional iron toothed stator is possible. However it degrades naturally the power density of the machine due to the inability of iron teeth to carry high magnetic flux. The optimal design of the stator has no magnetic teeth that is air-core winding. This design allows the entire space between the inner diameter of the back iron and inner diameter of the stator region to be filled by the stator winding. In the absence of iron teeth the stator coils are subjected to very strong alternating magnetic fields. To reduced eddy current losses to acceptable levels the stator coils need to be constructed out fine Litz wire.

The structural model of the stator of HTS electrical machines is different significantly from its conventional counterpart. The key difference is in the fact that the stator coils are actually the sole recipients of the Lorenz magnetic force. This is in contrast to the conventional stators where most of the forces is reacted through the iron teeth instead. There are three fundamental technical challenges come to when developing the stator for HTS based electrical machines and those are given below:-

1. Selection of an effective liquid cooling method for the stator coils
2. Adequate structural support for the stator coils

Development of the economical manufacturing techniques for coil manufacture and stator assembly Iron teeth in a conventional stator provides a thermal path for cooling a stator coil from its sides. In an air core winding this capability is lost. Two possible choices for forced liquid cooling are discussed here under

E. Dielectric Oil

Oil cooling while thermally less attractive is much more practical in implementation. It provided also a substantial advantage to the stator insulation system. Oil cooling of high voltage devices is very good technology, commonly used in transformers and cables. Advanced environmentally safe transformer oils offer high fire retardant capability with excellent chemical long term stability. In addition the presence of oil around the high voltage stator coil has demonstrated “healing” properties in case of cracking of the solid insulation layers. The oil normally penetrates the failed section of the coil providing insulation characteristics. Flowing oil can also extinguish electrical discharge on the surface of coil.

F. Deionised Water

The apparent benefit of the water cooling is its high thermal performance stemming from the very high heat transfer coefficient across the boundary layer of the internal cooling channel. The problem of de-ionized water cooling however that is it requires water tight channels to be embedded within volume of the stator winding.

G. Working of HTS Motor

The working of an HTS motor is similar to a conventional slip ring induction motor which is currently being used in the traction system. When A.C. supply given to the stator of motor, by an induction principle the rotor rotates at the slip speed. In addition to this for superconductivity of motor a cryo-cooling system employed to maintain the temperature of HTS conductor used in stator and rotor of HTS motors. The cyro-cooling system circulates the liquid to dissipate heat transfer.

IV. COMPARISON BETWEEN HTS MOTOR AND CONVENTIONAL MOTOR

Superconducting motors are A.C. synchronous motors that employ HTS (high temperature superconductor) winding in place of conventional cooper coils in their rotor. Because HTS wire can carry significantly larger current than cooper wire these

winding are capable of generating much more powerful magnetic fields in a given volume of space. Advance technology in a coil design makes it possible for a superconducting machine to match the power output of an equally rated conventional motor with as little as one third sizes and half of the weight. The smaller size and compact nature of superconductor motors allow them to be manufactured at lower cost than the equivalent conventional motors. Additionally the replacement of conventional copper rotor winding with non-resistant HTS coils result in sharply reduced electrical losses in the rotor. The increased electrical current in the motor rotor results ultimately increased in the power density hence size of HTS motor reduced. The HTS motor smaller size means it is significantly lighter and therefore can be utilized in new and innovative ways. In addition the motor increased efficiency results in lower operating cost than the conventional motor s. The HTS A.C. Synchronous motor may have no iron teeth in the stator windings not only contributing to their smaller size and lighter weight but also reduced a significant source of motor noise.

V. Benefit of HTS Motors

Large number benefits of HTS motor are noticed a few of which are given below

A. High Power Density

The HTS field winding produces magnetic fields higher than conventional machines resulting smaller in size and weight

B. High Partial Load Efficiency

The HTS motors have higher efficiency at part load (down to 5% of full load) that result in savings fuel and reduced operating cost. The advantage in efficiency can be over 10% at low speed. motors have lower sound emissions than the conventional machines.

C. Low Synchronous Reactance

The HTS air core motors are characterized by a low synchronous reactance which results in operation at very small load angles. Operating at small load the angle provides greater stiffness during transient and hunting oscillations which produces Harmonics The HTS motors tolerate power grid with high harmonics content.

D. Cyclic Load Insenstivity

The HTS motor field windings operate nearly constant temperature unlike conventional motor is therefore are not subject to normal fatigue.

E. Maintanance

The HTS motors compared to conventional motors will not required common overhaul rewinding or re-insulation.

VI. Role of HTS Motor in Traction System

Along with the increase of population and expansion in living zones, automobiles and air services cannot afford mass transit anymore. Accordingly demands for innovative means public transportation have increased. In order to meet the requirement for public transportation must need certain requirement s such as rapidity, reliability and safety. In addition it should be convenient environment friendly, low maintenance, compact, light in weight and suited to mass transportation. The use of HTS motor breaks law the “law of conservation of energy “with superconductors solving traction energy requirement. It uses principle of fifth element that is taking any amount of energy from space or releasing same into the space. Theoretically there is no voltage drop when superconductors in the circuit are used. Hence with superconductor it is logically possible to design a D.C. Series motor which has field (stator) coils and armature that can be operate at very low voltages for example like 2V/200V or 1000A. For example a normal 270 KW D.C. traction motor is considered which may run at 1000 V-1500 V D.C. at 200-275 A. If the same design is converted into a superconductor design the same motor can operate at 2 V/200 A and deliver the same power. This means one can build an A.C HTS superconductor motor with an arbitrary power which can operate at low voltage and con be used for traction system effectively.

VII. Conclusion

In addition to above if a HTS generator is used and is coupled with the HTS motor of traction system, power requirement in rails other than for traction can also be supplied with the same. Once such a system is designed the composite set consisting of a superconductor motor and generator can contribute significantly to traction power conservation.

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To Design a Standalone Photovoltaic System for a Building using PVsyst Software

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***Abstract*—The objective of this work is to design a suiting photovoltaic system for a flat roof in bgiet college library, Sangrur. The production of the photovoltaic system is found with the use of the simulation software PVsyst. Input to the simulation software such as meteorological data has been evaluated. The energy production of the final two or three alternative systems is evaluated with respect to the energy consumption within the building where the installation is to be located.**

Keywords: PVsyst, Meteonorm, Optimal

I. INTRODUCTION

These are known as so called time-step simulation programs. All of the mentioned simulation programs except DASTPVPS apply for grid-connected systems. SOLDIM, PVS, PV*SOL, Greenius, PV Design Pro and PVsyst all apply for standalone systems, hybrid systems, PV pumping systems and some apply for other technologies such as wind, fuel cells, solar thermal plants etc. All provide an economical overview of viability. PVS, PV*SOL, PVsyst, PV Design Pro and SOLDIM provide shading calculations down to intervals of one hour. In addition PVS, PVsyst, PV Design Pro and SOLDIM provide a solar radiation generator.

PVsyst is considered one of the most comprehensive programs of the ones listed, and also one of the most complicated to use. PVsyst has a higher accuracy of shading calculations than PVS and PV*SOL, and is the only program which provides a 3D representation of the PV field. Greenius provides an extensive economical calculation, while the other programs are fairly similar with varying degrees of functionality.The simulation software PVsyst was used in this study in order to calculate the production of the PV installation and to estimate the installation. PVsyst is developed at the University of Geneva by Andr e Mermoud. PVsyst has the option of simulating a preliminary design or a project design. In addition PVsyst has a tool option, where background data management and didactic tools are located.

A. Outline of the Work

First structured in chronological order of the steps that are necessary in order to perform a simulation of a stand alone PV system in the simulation software PVsyst:

1. Project
2. Orientation
3. System
4. Module layout

In order to perform the simulation, all of these steps has to have defined parameters. In order to define the parameters some background information will be provided..

II. PROJECT: GEOGRAPHICAL LOCATION AND METEOROLOGY

The geographical location of the project and the local weather conditions influence the optimal tilt of the PV modules and is, therefore, of great importance. The building in this study is located in sangrur,india at a latitude of approximately 30.3◦N.

A. Solar Radiation and Meteorology

The amount of effect produced by a PV module relies on how much radiation it receives at its precise location. The energy produced by the sun at a temperature close to 5800 K (5526.85◦C) is emitted primarily as radiation. When the radiation enters the atmosphere it can collide with clouds and air molecules and the radiation can then scatter or be absorbed. The beam or direct radiation is the radiation which is not reflected or absorbed and reaches the surface of e.g. a PV module in a direct line from the sun. The radiation after a scattering can either be re-emitted into the atmosphere or reach the surface of the module, this is called diffuse radiation. Albedo radiation is the radiation reaching the module surface after being reflected by the ground. Global radiation consists of all three components: beam, diffuse and albedo radiation.

On account of the absorption and scattering, the amount of solar radiation that reaches the Earth's surface decreases. The radiation passes through gases when entering the atmosphere, as a result the radiation at Earth's surface has a different spectral composition than the radiation which has not passed through the atmosphere.

The PV modules are rated at Standard Test Conditions (STC),

which are:

- Solar radiation = 1000 W/m2
- Cell temperature = 25◦ C
- Ambient temperature = 20◦ C
- Wind speed = > 1 m/s

Although the global irradiance can be as high as 1000 W/m2 and even somewhat higher, the available irradiance is usually considerably less because of the rotation of the Earth and adverse weather conditions. Naturally much stronger over-irradiances may be expected for the lower latitudes near the Equator, with magnitudes exceeding 1800 W/m2. However, the contribution of over-irradiance events to the annual irradiation is very small.

Position of the sun

The location of the sun is defined by two angles:

- Altitude (α)
- Azimuth (ψ)

The altitude of the sun is the angle between the sun and the ground. This angle is always between 0◦ and 90◦. The sun rises in the east and sets in the west. Azimuth is the angle between north and the point where the sun is positioned. Altitude and azimuth can be determined from the following equations:

$\sin \alpha = \sin \delta \sin \varphi + \cos \delta \cos \varphi \cos \omega$

$\cos \psi = \sin \alpha \sin \varphi - \sin \delta / \cos \alpha \cos \varphi$

where δ is the declination and ω is the hour angle. The declination is the angle of deviation of the sun from directly above the equator. The hour angle is the difference between noon and the desired time of day in terms of a 360^{o} rotation in 24 hours. The equation describing the declination is often given as an approximation since a year is not exactly 365 days.

National Aeronautics and Space Administration (NASA) and the astronomical applications department under the U.S. Naval Observatory (USNO) both provide information concerning the azimuth and altitude angles of a given location described with coordinates. The USNO site takes as an additional input the time zone of the specific site. NASA gives monthly average hourly altitude angles and azimuth angles. The azimuth and altitude numbers provided by USNO and NASA are, therefore, not exactly the same.

Meteorological data sources

Within PVsyst there are possibilities to define new monthly meteorological values and re-define the location of the project as well as import both monthly and hourly meteorological data from a number of other databases, seen in Table 3.1.4. A comparison of the free web based databases was done alongside with local meteorological data where possible. When opening the meteorological file the latitude and longitude of the location is defined in decimals as well as in degrees and minutes. The altitude above sea level and time zone are also displayed. The monthly meteorological values are displayed along with the data source. The monthly meteorological values which are required are the horizontal global irradiation and the ambient temperature. Extra data which could be provided are data for the horizontal diffuse irradiation and the wind velocity. A custom-made second meteorological set was assembled, with a focus on monthly irradiance and temperature values, since these are the ones compulsory in order to run a PVsyst simulation.

Database	Region	Values	Variables	Availability
Meteonorm	Worldwide	Monthly	Gh, Ta, WindVel	Software
Meteonorm	Worldwide	Hourly	Gh, Dh, Ta, WindVel	Software
Satellight	Europe	Hourly	Gh, NO Ta	Web free
US TMY2	USA	Hourly	Gh, Dh, Ta, WindVel	Web free
ISM-EMPA	Switzerland	Hourly	Gh, Dh, Ta, WindVel	Included in PVsyst
Helioclim (SoDa)	Europe Africa	Hourly Hourly	Gh, NO Ta	Web restricted
NASA-SSE	Worldwide	Monthly	Gh, Ta	Web free
WRDC	Worldwide	Hourly Daily Monthly	Gh, NO Ta	Web free
PVGIS-ESRA	Europe Africa	Monthly	Gh, Ta, Light turbidity	Web free
Helioclim -1 (SoDa)	Europe Africa	Monthly	Gh, NO Ta	Web restricted
RETScreen	Worldwide	Monthly	Gh, Ta, WindVel	Software, free
SolarGIS	Europe Africa Asia, Brazil, West Australia	Hourly	Gh, Dh, Ta	Web, paid access

III. ORIENTATION

For this project it was chosen to use fixed tilted PV modules. Other options are seasonal tilted modules, tracking systems, one or two axis tracking systems or BIPV such as roof tiles or shades. Systems with one or two axis tracking are mostly used for ground mounting. In addition, such systems are assumed to require more maintenance since there are more mechanical parts, and thus not very practical for roof installations. Furthermore, such mounting systems are more expensive. The modules should be directed towards south in order to obtain as much irradiation as possible. This corresponds to an azimuth angle of 0◦. Magnetic and geographical south should in theory be the same. Due to the magnetic flux lines on Earth they deviate with varying degree depending on location. The modules should be directed towards geographic south, and not magnetic south, since this would affect the system yield.

A. Optimum Tilt Angle

The amount of radiation collected on the solar modules should be as large as possible. The tilt angle of fixed modules can be maximized with regards to seasonal performance or annual performance. The optimum tilt angle βopt, illustrated in Figure is defined as the tilt angle of highest annual irradiation and depends on both latitude (φ) and local climate. The rule

of thumb with regards to the highest annual performance is a tilted angle approximately equal to the latitude of the site. This corresponds to an azimuth angle of 0◦. Magnetic and geographical south should in theory be the same. Due to the magnetic flux lines on Earth they deviate with varying degree depending on location. The modules should be directed towards geographic south, and not magnetic south, since this would affect the system yield. The larger the latitude, the larger the difference between summer daytime and winter daytime and, therefore, the larger the difference between the summer and winter irradiation. As a result it can be anticipated that as the latitude increases, the optimal tilt angle should give priority to the collection of summer over the collection of winter irradiance.

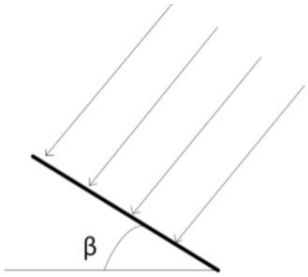

Fig. 1

B. Horizon and Near Shadings

In PVsyst there has been made a distinction between far and near shadings. The far shadings are defined as shades cast by the horizon while the near shadings are defined as shades cast by near objects which change during the day.

C. Horizon

The far shadings are supposed to act globally on the PV plane. Acting globally would mean that it would not give any partial shading on the installation. The sun would either be or not be visible on the field. Horizon defining shadows would naturally consist of surrounding environment such as mountains and are defined with a horizon line in PVsyst. The obstacles should be limited to approximately twenty times the PV-array size. The length of the PV installation is approximately 40 meters, which gives a radius of approximately 800 meters before obstacles could be defined as horizon. The reason for this is that the horizon line is supposed to be viewed in the same way from any point of the field.

When a horizon line is accounted for in PVsyst the beam component of the irradiance is or is not visible on the field. PVsyst determines the exact time when the sun crosses the horizon line and weights the beam hourly value before performing the transposition. The diffuse part of the irradiance is assumed isotropic in the program. The diffuse part does, therefore, not depend on the position of the sun, it is the same irradiance which is coming from any direction of the sky and is therefore a constant factor during the year. The albedo contribution in PVsyst is considered to be linearly decreasing according to the horizon height. When using meteorological data from ground stations the horizon effect is already taken into account for that station. A comparison of the measuring station horizon with respect to the field horizon could be accounted for.

D. Near Shadings

Shadings which change during the day and the season and only partly affect the PV field are the near shadings. The fraction of how the PV field is effectively shaded is defined in PVsyst by shading factors. In order to calculate the shading factor at any time as a function of the position of the sun requires a full 3D representation of the field and its surroundings.

The 3D representation of the building was constructed mainly by the help of drawings of the building and Google Earth. Some assumptions were in addition made when considering the height of roof top shading elements with the assistance of photos taken during the site assessment. As mentioned there is a 800 meter radius where near shading objects should be taken into account. Inside this radius the twelve storey building is located. This building was, therefore, represented in 3D, with measurements. Moreover, Google Earth was used in order to place the building in approximate accordance with the PV field.

IV. SIMULATIONS

This chapter documents the process of finding the final three systems providing the best PR and energy production. Parameters which have been altered are the modular tilt angles, pitch distance, fraction of electrical effect and multiple inverters. A base case was used in order to compare the effect of varying these parameters. These figures also illustrates how a general simulation report is presented in PVsyst.

Stand Alone System: Simulation parameters PVsyst Evaluation mode **Project** : Stand Alone system College library **Geographic Situation-** Latitude 30.3°N Longitude 75.9°E Time defined as Legal Time Time zone UT+5.5 Altitude 241 m
Simulation parameters Collector Plane Orientation Tilt 25° Azimuth 20° Models used Transposition Perez
PV Array Characteristics PV module Si-poly Model Poly 60 Wp 36 cells Manufacturer- Generic Total area- Module area 9228 m² Cell area 7758 m²
Battery Model S-460 Manufacturer Surrette Battery Pack Characteristics Voltage -96 V Nominal Capacity 224943 Ah Nb. of units 16 in series x 773 in parallel
Regulator Model Generic Default with MPPT converter Technology Converter Maxi and EURO efficiencies 97.0/95.0 % Battery Management Thresholds Charging 108.0/104.6 V Discharging 94.1/100.8 V

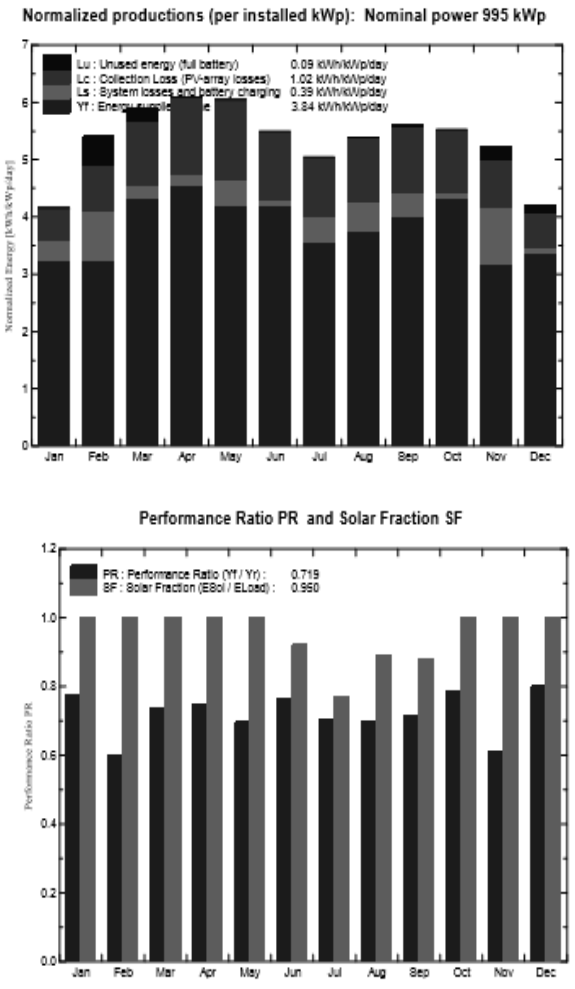

Fig. 2

TABLE 1

Month	KWH
January	99627
February	90570
March	133588
April	136038
May	129855
June	136038
July	142222
August	129855
September	136038
October	133588
November	95099
December	104156

TABLE 2

	Glob Hor kWh/m²	Glob Eff kWh/m²	E Avall MWh	EUnused MWh	E Miss MWh	E User MWh	E Load MWh	Sol Frac
January	97.5	125.2	106.9	0.05	0.00	99.6	99.6	1.000
February	119.0	147.6	124.5	14.43	0.00	90.6	90.5	1.000
March	160.1	177.3	141.2	6.42	0.00	133.6	133.6	1.000
April	175.2	177.6	135.6	0.17	0.00	136.0	136.0	1.000
May	194.9	181.8	137.3	0.01	0.00	129.9	129.9	1.000
June	1745.5	199.4	122.7	0.01	10.54	125.4	136.0	0.922
July	165.2	151.3	117.4	0.05	32.67	109.6	142.2	0.770
August	168.9	161.9	125.8	0.11	13.81	116.0	129.9	0.894
September	154.8	163.2	125.6	0.21	16.52	119.5	139.0	0.879
October	141.8	166.7	131.3	0.08	0.00	133.6	133.6	1.000
November	115.1	153.0	126.9	6.92	0.00	95.1	95.1	1.000
December	93.6	127.2	107.9	4.86	0.00	104.2	104.2	1.000
Year	1762.5	1892.2	1504.3	33.31	73.54	1393.0	1466.7	0.950

Legends: GlobHor Horizontal global irradiation
GlobEff Effective global, corr. For IAM and shadings
E Avall Available Solar Energy
E Unused Unused energy (full battery) loss
E Miss Missing energy
E User Energy sup pilled to the user
E Load Energy need of the user (Load)
SolFrac Solar fraction (Eused/ Eload)

V. ECONOMICS

A simple overview of the economic aspects of the final alternatives should be done in order to get an idea of the costs of such an installation. All manufacturers of modules and inverters should receive a request concerning the selling price of the module or inverter used in order to give the most realistic picture of the price situation per now. However, such prices could change in a possible next phase of implementation and would only be valid for the time when or if such a request was to be answered. The income aspect of the installation would depend on whether the installation would cause the Hafslund customer to become a surplus customer in accordance with the definition given by NVE. Two methods which take into consideration the economic aspects of the installation are:

1. Simple payback
2. Life cycle costing

Simple payback is calculated by the following formula

T =C/ S

Where T is the payback period in years, C is the initial investment cost and S is the annual cost savings of electricity that does not need to be purchased. In order to perform life cycle costing, a life cycle cost analysis is used in order to determine the cost per kilowatt-hour for the PV system. The life cycle cost analysis has been made in order to determine the investment cost of the equipment, the operation and maintenance cost. In addition component life time and replacement costs should be taken into consideration. To determine the cost per kWh the following equation is used :

cost/kWh =Present value of the system over X years/ Yield (kWh) generated over X years

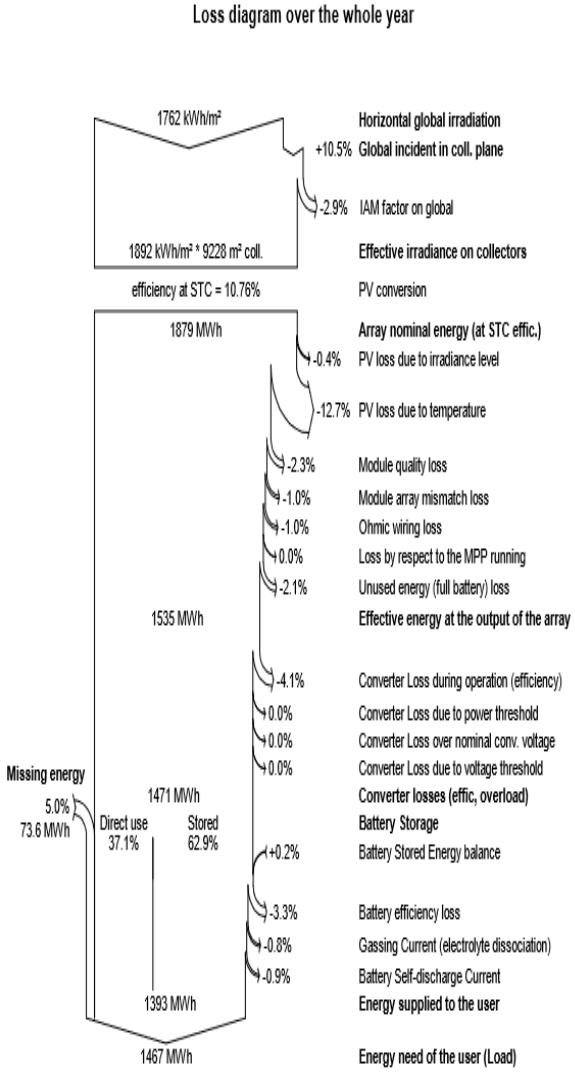

Fig. 3

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Review of Enhnacement Power System Transient Stability

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***Abstract*—This paper presents the review of various techniques which are used for enhancement of power system transient stability. Various FACTS devices including UPFC, STATCOM, SSSC, TCSC, TCBR, FCL which are used for enhancing transient stability in power system are reviewed in this paper. Survey up to 2013 is done and the information collected in this paper is sufficient for finding out relevant references in the field of power system stability. This paper shows which device is mostly used for improving transient stability.**

Keywords: FACTS, Transient Stability, UPFC, TCSC, SSSC, TCBR, FCL

I. INTRODUCTION

As the population of the world is increasing day by day so directly load on our power system is increasing and stability is the main problem which is occurring now which is very serious. Whenever a power system is subjected to a large disturbance, control actions need to be taken to limit the extent of the disturbance. The various methods have been taken to improve the transient stability of power systems, such as high-speed exiting, steam turbine fast-valving and dynamic braking. The wide usage of FACTS controllers is another method that helps to enhance power system transient stability. FACTS are system comprised of static equipment's conditions and regain the equilibrium after being subjected to disturbance. In power system stability the restoring forces are equal or greater than the disturbing forces. Instability in the system can be classified into many ways depending upon system configuration and system which includes thousands of electric elements.

Advantages of interconnected power system

It provides us large amount of power and increases the reliability. It helps in reduction of machine size that is required for peak load and spinning reserve. It provides economical power to consumers.

This paper presents review of various techniques used for enhancement of power system stability. Various FACTS devices including UPFC, SSSC, TCBR, FCL which are used for enhancing transient stability in power system are reviewed in this paper. Survey up to 2013 is done and the information collected in this paper is sufficient for finding out relevant references in the field of power system stability

II. LITERATURE REVIEW

Chi-Shan Yu, this paper explains the improvement of the optimal aim strategy (OAS) for the design of a thyristor controlled series compensator controller has to design the improved OAS command. Shaping of the reduced order model involves the real-time measurements which are available from phasor measurement units (PMUs). Finally, some simulation studies are employed to test the controller.

Souza, C.L, this technique aims to analyze the transient stability of electrical power systems including the influence of induction generators driven by prime movers whose primary fuel is the industrial wastes of sugar cane alcohol plants. In a steady state these machines work with the synchronous generators attending part of the active power demand (cogeneration) and during disturbances they also act to improve the system transient stability. Used an existing transient stability program; some simulations are run to compare the performance of a typical electrical system with and without the presence of induction generators.

P. Kumkratug and M.H. Haque, in this paper SSSC has been applied to different power system studies to improve the system performance. There has been some work done to utilize the characteristics of the SSSC to enhance power system stability. Wang investigated the damping control function of an SSSC installed in power systems. The linearized model of the SSSC integrated into power systems was established and methods to design the SSSC damping controller were proposed. Kumkratug and Haque demonstrated the capability of the SSSC to control the line flow and to improve the power system stability. A control strategy of an SSSC to enlarge the stability region has been derived using the direct method. The effectiveness of the SSSC to extend the critical clearing time has been confirmed though simulation results on a single machine infinite bus system.

Prof. Ahmed A. Hossam-Eldin Prof. Hesham Elrefaie Eng. Gaballah Kfvlobamed (2006) presented a paper in which study and investigation is done on how UPFC affects the transmission system having series voltage and shunt current injection. UPFC provides better results than other devices and its advantages are also discussed. Various features of UPFC are discussed and some of them include improvement of the system characteristics, power factor, control of voltage and power flow thus providing the best transient and dynamic stability. UPFC is also used for improving the transient stability in power system. Simulation is done for various loads and system voltages.

Yuning Chen, M.E. El-Hawary, in this paper a new braking resistor approach using the equal area criterion (EAC) is used to improve the transient stability of power systems. The conventional and a fuzzy logic controller have been developed and compared. This proposed approach was tested on a single machine system and on the WSCC multimachine test system. The simulation results indicate that the proposed approach provides a simple and effective method for the transient stability improvement.

Sidhartha Panda Ramnarayan N. Patel, in this paper the used of Shunt Flexible AC Transmission System (FACTS) devices can be placed at the mid-point of a long transmission line and they give a important role in controlling the reactive power flow to the power network and hence both the system voltage fluctuations and transient stability. In this paper deals with the location of a shunt FACTS device to improve transient stability in a long transmission line with predefined direction \of real power flow This validity of the mid-point location of shunt FACTS devices is verified with different shunt FACTS devices, namely static VAR compensator (SVC) and static synchronous compensator (STATCOM) in a long transmission line by using the actual line model. It is observed that the FACTS devices when placed slightly off-centre towards sending-end and give better performance in improving transient stability and the location depends on the amount of local/through load.

KA Folly, Member, IEEE, B. S. Limbo, this paper discusses the experience of the authors in using Matlab Power System Toolbox for the transient stability studies of an AC/DC Interconnection power system. This modified two-area power system model with HVDC Link is used in the investigation. It shown that the AC line became weaker (as compared to the DC line); the transient stability of the interconnected AC/DC system is negatively affected. The use of power system stabilizer (PSS) was critical in maintaining the stability of the system.

Mansour A. Mohamed George G. Karady Ali M. Yousef, this paper discusses the proposes of transient angle stability agents to enhance power system stability. The transient angle stability agents divided into two strategy agents. This first strategy agent is a prediction agent that will predict power system instability. The prediction agent's output the second strategy agent which is a control agent is automatically calculating the amount of active power reduction that can stabilize the system and initiating a control action. The new proposed strategies are applied to a realistic power system, the IEEE 50- generator system. The results show that the proposed technique can be used on-line for power system instability prediction and control.

Prechanon Kumkratug, in this paper investigation is done for problem for controlling and modulating power flow in transmission line using static synchronous series compensator (SSSC). One of the major interests of power utilities is the improvement of power system transient stability behavior. Static Synchronous Series Compensator (SSSC) is a power electronic based device is used for capability of controlling the power flow through a line. The study of the SSSC to improve transient stability of power system. SSSC is represented by variable voltage injection with associate transformer leakage reactance and the voltage source. These series voltage injection model of SSSC is modeled into power flow equation and thus it is used to determine its control strategy. We can study the uses machine speed deviation to control it. These swing curves of the three phase faulted power system without and with a SSSC is tested and compared in various cases. The swing curve of system without a SSSC gets increases monotonically and thus the system can be considered as unstable whereas the swing curves of system with a SSSC can be considered as stable. SSSC can improve transient stability of power system.

Dr. Tarlochan kaur and Sandeep kakran, in this paper to improve the transient stability of long transmission line system by using SVC. In the present time power systems are being operated nearer to their stability limits due to economic and environmental reasons. The maintaining a stable and secure operation of a power system is a very important and challenging issue. Transient stability has given much attention by power system researches and planners in recent years and being regarded as one of major sources of power system insecurity. Shunt FACTS device an important role in improving the transient stability and increasing transmission capacity and damping low frequency oscillations. In this paper to describes the shunt FACTS device SVC is used in a two area power system for improving the transient stability. MATLAB software is used.

Kumar, Arun, this paper presents a comprehensive review on enhancement of power system stability such as rotor angle and frequency stability and voltage stability by using different FACTS controllers such as TCSC; SVC; SSSC; STATCOM; UPFC; IPFC in an integrated power system networks. Also the presents the current status of the research and developments in the field of the power system stability such as rotor angle stability, frequency stability and voltage stability enhancement by using different FACTS controllers in an integrated power system networks. Authors strongly believe the useful to the researchers for finding out the relevant references in the field of enhancement of power system stability by using different FACTS controllers in an integrated power system network.

Gundala srinivasa rao, in this paper to improve transient stability by using Fuzzy controlled TCSC. When power system is subjected to sudden changes in load levels. The important concept of the stability to which determines the stable operation of power system. In the rotor angle stability is taken as index but the concept of transient stability which is the function of

operating condition and disturbances deals with the ability of the system to remain intact after being subjected to abnormal deviations. The system is said to be synchronously stable (i.e., retain synchronism) for a given fault if the system variables settle down to some steady-state values with time after the fault is removed.

In this paper, in order to improve the Transient Stability margin further series FACTS device has been implemented. In a fuzzy controlled Thyristor Controlled Series Compensation (TCSC) device has been used here and the result highlight the effectiveness of the application of a TCSC improving the transient stability of a power system.

In this paper also used of trajectory sensitivity analysis (TSA) to measure the transient stability condition of the system. TCSC is modeled by a variable capacitor the value of which chande with the firing angle. TSA can be used in the design of the controller. The location of the TCSC controller for different fault conditions can also be identified with the help of TSA. The advantage of the use of TCSC with a fuzzy controller over fixed capacitor operation.

Carlo Cecati and Hamed Latafat, to study the transient stability of a two machine infinite bus system when affected by large disturbances by comparison of time domain approach versus transient energy function. Then decentralized nonlinear controller is embedded within the power system and simulation results show that the transient stability has been greatly enhanced. Based on existing transient energy function of uncontrolled power system the controlled power system has been represented as a forced Hamiltonian system. The Lyapunov function is suitable for transient stability analysis of this controlled power system has been used for stability. Simulations in different operating points show the enhancement of transient stability of power system with controller in both time domain approach and energy function method.

Manish kumar saini, Naresh kumaryadav, Naveen mehra published a paper in which the applications of UPFC for optimal flow of power and reduction of losses is demonstrated. In this paper to describes the multi machine power system example to demonstrate the features and scope of graphical simulink environment of general purpose of MATLAB software. Unified Power Flow Controller (UPFC) is used to control the power flow in the transmission systems by controlling the impedance, magnitude and phase angle. The advantage of controller in terms of static and dynamic operation of the power system. It is new challenges in power electronics and power system design. It consists of two voltage source inverter (VSI); where one converter is connected in parallel to the transmission line while the other is in series with the transmission line. The designing of a single phase UPFC using Matlab and Simulink software and constructing a lab scale model of the UPFC along with transient stability of multi-machine power system.

UPFC provides better results than other devices and its advantages are also discussed. Various features of UPFC are discussed and some of them include improvement of the system characteristics, power factor, control of voltage and power flow thus providing the best transient and dynamic stability. Simulation is done for various loads and system voltages.

III. Discussions based on Survey

Flexible alternating current transmission system (FACTS) gave up new ways for controlling the power flow and increasing the usable capacity of transmission lines. It is concluded that by reviewing the various papers, among FACTS devices, Thyristor Controlled Braking Resistor (TCBR) and fault current limiter (FCL) strategies are considered to be the most simple and easy way to implement it for stability analysis.

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Effect of Permittivity and Permeability on Different Materials

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***Abstract*—The dielectric properties of any material is the most imperative parameters to judge its microwave absorptive properties. This paper reviews the adequate circumstances for absorption of electromagnetic waves by a material by captivating permittivity and permeability of materials into consideration. At the end of this paper the permittivity and permeability of different materials having single layer and multilayer structure is compared to see the effect of permittivity and permeability.**

Keywords: Permittivity and Permeability

I. INTRODUCTION

Microwave absorbing materials are extensively used nowadays in various fields, whether in defense as radar absorbing materials for aircrafts or for commercial use as television image interference for high rise buildings [1]. These all applications are because of unique property of absorption of electromagnetic waves by the material. There are number of parameters over which absorption of microwave materials depends upon like impedance matching of absorbing material with free space, specific resistance of the material, frequency response and flexibility of material to get operated over different ranges of frequency, dielectric losses, magnetic losses and so on. In the same manner different materials show different response to above define parameters. There is wide variety of microwave absorbing materials available in present scenario but each material show its optimum absorbing characteristics in certain frequency range and under certain control parameters.

Out of all the parameters, there are two most important parameters upon which absorption property of material is dependent. First is dielectric losses and the second one is magnetic losses. The dielectric losses are defined by the electric permeability and magnetic losses are defined by the magnetic permeability which are explained ahead.

Microwave absorbers are formed in different shape like conical, spinal, pyramidal etc. and they are fabricated from semiconductors of high resistivity. But these structures have one drawback which is large thickness. Because of this drawback, these materials are not used for shielding purpose for moving objects like aircrafts which require smooth surfaces due to which there are absorbers which are formed in the form of paint or spray so that they can be coated over the surface of moving objects. Thickness is in inverse correlation with magnetic permeability that is more is magnetic permeability; less is the thickness of material. Microwave absorbers are of two types, one with magnetic permeability having value unity i.e. $\mu=1$. These absorbers are called purely dielectric absorbers and another one with magnetic permeability and electric permittivity different to one [2].

Absorbing materials runs on two primary conditions, first one is impedance matching and another one is maximum attenuation at finite thickness [3]. These two conditions are purely dependent upon electric permittivity and magnetic permeability. By determining the electric permittivity and magnetic permeability, the response of material over different frequency range can be determined easily [4].

Existing Electromagnetic materials are very heavy; less durable show heavy reflection characteristics for certain frequency rage, now to improve these characteristics of Electromagnetic materials composite materials are used. Composite materials exploit one characteristic of material to cover another characteristic. This cause formation of core shell structure with novel physiochemical properties. The formations of composite materials are generally by reinforcing some particles in the base structure of some other particle for example. In case of magnetic nano particles when used as fillers, they effect straightly on the conductivity of the material. As conductivity got affected, it lowers down effective permeability at high frequency because of eddy current losses by electromagnetic waves [6]. But sometimes the thickness of these composite materials becomes so large which cannot be placed over moving objects as it may hamper the speed of them. In case of multilayered structures, two layers of different materials are used which give same effect as composite material of single layer does but it have some more added advantages like reduced thickness are more effective absorption and attenuation.

II. FERRITES AS MICROWAVE ABSORBERS

It has been seen that ferrites have better electromagnetic interference suppression properties. There are numerous electric and magnetic properties exhibited by ferrites and among those properties, the permittivity (ε) and permeability (μ) are most important. The permeability and permittivity are further classified into real and imaginary part. The real and

imaginary part forming complex permittivity and permeability. These complex permittivity and permeability are very important in determining high frequency characteristics of the material [5]. Complex part of electric permittivity corresponds to dielectric losses and complex part on magnetic permeability corresponds to magnetic losses. The magnetic losses of spinal ferrites (ferrites individually used as absorbers) are quite less but these materials do not show high absorbing characteristics in high frequency ranges. So large amount of research is carried on to form composite ferrites so that one limitation is compensated by other. Research in ferrite technology is done to get hold over gyromegnetic resonance characteristics over a certain frequency range. Ferrites (mixture of magnetic ferrite) are used as a material which is applied as a very thin layer and is applied as a past or ink over the surface of aircrafts. Now as explained earlier, magnetic permeability (μ) and electric permittivity (ε) exist in their most complex form as (ε=ε'-jε") and (μ=μ'-jμ") whereε' andμ ' represents real part andε" andμ" represents imaginarypart. One relation to thickness with magnetic permeability μ is saw which is already discussed above that magnetic permeability is in inverse relation with thickness. But this relation also determine the relation of thickness with magnetic permeability that greater is μ, lesser is thickness and greater is absorption as given by this formula thickness=λ/ $(\varepsilon''\mu'')^{1/2}$) [2]. The actual significance of ε" andμ" is discussed ahead.

III. Effect of Electric Permittivity and Magnetic Permiability on Absortion

As discussed above, absorption in MA are characterized by (μ) and (ε). (ε) is measure of material effect on the electric field in EM waves and (μ) is measure of material effect on the magnetic component in the EM wave. ε and μ are represented by their real and imaginary counter parts as (ε=ε'-jε") and (μ=μ'-jμ"). ε' is real part of electric permittivity and it varies significantly with the frequency, ε" is the imaginary part of electric permittivity and it represents measure of attenuation of electric field caused by medium. It is also called dielectric heating loss, the EM wave fall over the material got dissipated in the form of heat. Combining these two factors, they for electric loss tangent tanδe which is equal to the ratio of imaginary part to the real part i.e. tanδe =ε"/ε'Greater is the electric loss tangent; greater is the attenuation as wave travel through medium. in case of magnetic permeability, μ' is real part of permeability and it again varies significantly with frequency. μ" is imaginary part and it represents magnetic losses. Together they form magnetic loss tangent tanδm which is given as tanδm=μ"/μ'. Both μ and εcompress wavelength inside material. Loss in either electric or magnetic field attenuate energy in wave.ε is measured in farad/m and of μ in hennery/m.

The complex permittivity and permeability of microwave absorbers play very important part in determining the reflection or attenuation property. To achieve low reflection, there are two methods. Firstly, to make EM waves get attenuated entirely. But this method very difficult to achieve so another method has to choose. Another method is to let EM waves enter into the absorbing material at greater extent. This is achievable when impedance of free space and impedance of material got matched.

The condition for complete impedance matching is μ'/ε' to be equal to 1 i.e. μ'/ε'=1. For most of the magnetic materials, μ' is smaller than ε' at microwave band. Now as by impedance matching, we can let EM waves enter into the material, but then the next step is to attenuate them as much as possible. To satisfy condition of attenuation characteristics, certain requirements must be satisfied for microwave EM parameters. Attenuation constant is given by

$$\alpha \frac{\sqrt{2\pi f}}{c}\left\{\sqrt{\mu''\varepsilon'' - \mu'\varepsilon'}\left(\sqrt{(\mu''\varepsilon' - \mu'\varepsilon')^2 + (\varepsilon'\mu'' + \varepsilon''\mu')^2}\right)\right\} \quad [1]$$

Now higher will be ε" and μ", greater will be attenuation constant and greater will be attenuation. But higher value of ε"leads to greater dielectric heating, which is not desirable.

So, by combining requirement of impedance matching with attenuation, the magnetic material should have lower values of ε" and higher values of μ" and appropriate values of ε' and μ' for μ'/ε'=1. [7] absorbing microwaves. OPF has highest loss tangent calculated because of high imaginary part of permittivity but RH shows highest loss tangent when measured by coaxial probe method.

On measuring EFB, OPF and RH, it is observed that permittivity's of all MUTs are much lesser than calculated. This is for a reason that solid pulverized materials have gap filled with air which drop down values of permittivity. OPF has highest dielectric constant and loss factor because of lowest fractional volume reflecting highest potential in absorbing microwaves. OPF has highest loss tangent calculated because of high imaginary part of permittivity but RH shows highest loss tangent when measured by coaxial probe method.

The author have researched that the coaxial technique is best suitable to determine dielectric properties of pulverized materials. LLL equation method support for calculation of dielectric properties. Solid material permittivity is extracted from air particle permittivity, which is responsible for material to act as absorber. Among all, oil palm fond is best microwave absorber because of high loss tangent, high loss factor and its fibrous structure

IV. CONCLUSION

It has been observed that electric permittivity and magnetic permeability are the most important factors to calculate the microwave absorption of any material. Among all the materials, ferrite has shown remarkable response toward absorption. Along with some regular microwave material, exceptional materials like agricultural waste have also been covered under study and they have also shown very good impedance matching value and magnetic losses, although they were not good as ferrites but they overpower ferrites when cost is to be considered. Almost every material from spinal ferrites to multi-layer structure and pulverized material have tried to maintained the condition for impedance matching as we have already discussed above but every material lags at one point or other. For example Carbonyl iron powder shows exceptionally good magnetic losses from 0-10GHz range on the other hand $MnFe_2O_3Zn$ allow almost every part of EM wave to absorb near 8GHz range while $SrFe_2O_{19}$ was remain unaffected at whole frequency range (0–18 GHz) and Fe_3O_4 has shown weakest impedance matching but highest magnetic losses. There is still more research needed to be done in order to find a material with perfect dielectric characteristics and super microwave absorbing power.

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A Detailed MATLAB/ SIMULINK Modeling of a Solar Photovoltaic Module

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***Abstract*—Extensive works exist in literature about modeling solar power generation by photovoltaic module. This paper focuses on an understandable model of PV module, suitable for upgradability and further use for other designs. Some fundamental aspects of the design making it flexible and understandable for other research works remain difficult and unclear under Matlab Simulink environment. The paper presents a clear modeling under Simulink using mathematical equations. However this paper describes a simple technique of simulation of photovoltaic module in application of single module and analysis the I-V, P-V Characteristics which is done in MATLAB-SIMULINK environment based on PV module model. in which the basic circuit equations are used in the Photovoltaic (PV) cells including the effects of solar irradiation and temperature changes. The analytic model of photovoltaic model is examined under the effects of solar irradiation and temperature changes.**

Keywords: PV Module, MATLAB/ SIMULINK, Photovoltaic, I-V, P-V Characteristics

I. INTRODUCTION

The concentration on the use of fossil fuels for energy supply is the main threat for the stability of the global climate system and our natural living conditions. To conserve our globe, the scientific community gave evidence that mankind has to decrease the green house gases emissions, mainly CO_2 and methane, by 60–70% as a minimum until the year 2050 [1]. In order not to harm our natural living spaces and threaten their resilience, a renewed compatibility would require a suitable form of energy alternatives sources that should be independent, easily accessible, and low in cost and should be environmentally clean.

Photovoltaic systems have been the focus of attention because of being environmentally, renewable and long lasting. Planning of photovoltaic systems must be modeled to be planned and optimal using in order to be used optimum.

A solar cell is an electronic device which directly converts sunlight into electricity. Light shining on the solar cell produces both a current and a voltage to generate electric power. This process requires firstly, a material in which the absorption of light raises an electron to a higher energy state, and secondly, the movement of this higher energy electron from the solar cell into an external circuit. The electron then dissipates its energy in the external circuit and returns to the solar cell. A variety of materials and processes can potentially satisfy the requirements for photovoltaic energy conversion, but in practice nearly all photovoltaic energy conversion uses semiconductor materials in the form of a p-n junction.

The main aim of this paper is to provide a reader with the fundamental knowledge on design and building the blocks of PV module based on the mathematical equations using MATLAB/Simulink environment.

II. PHOTOVOLTAIC MODEL

Many mathematical models have been developed to represent their highly nonlinear behaviour resulting from semiconductor junctions. It describes a PV module with temperature and solar irradiance variation.

A. PV Cell Modelling

The building block of PV module is the solar cell, which is basically a p-n junction that directly converts light energy into electricity. The ideal photovoltaic cell is shown in figure 1. [2]

The mathematical equation for I-V characteristics of the ideal cell is given by equations (1), (2) [2].

$$I = Ipv - Id \quad (1)$$

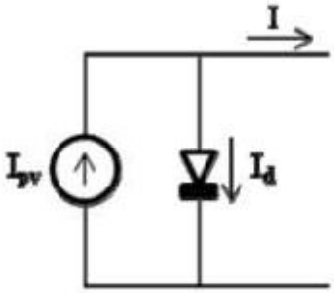

Fig. 1: Equivalent Circuit of Ideal PV Cell. [2]

Where, I_{pv} is photo generated current, I_d is the diode current and it can be expressed as

$$Id = Is\{exp\left(\frac{q}{AKTc}\right) - 1\} \quad (2)$$

B. PV Module Modelling

Based on the general model of solar cell illustrated in figure 1, a solar panel which is a combination of Ns and Np solar cells put in series and parallel respectively, can be modeled as shown in Figure 2.

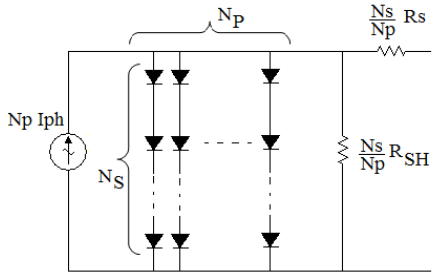

Fig. 2: Model of Solar Panel with Ns Series Cell and Np Parallel Cells [1]

For PV Module modeling we take Np and Ns values equal to one and photovoltaic current is

$$I = Ipv - Is\left\{\exp\left[\frac{q(V+IRs)}{AKTc}\right] - 1\right\} - \frac{V+IRs}{Rsh} \quad (3)$$

With

$$Ipv = [Isc + Ki(Tc - Tref)]G \quad (4)$$

$$Is = Irs\left(\frac{Tc}{Tref}\right)^3 \exp\left[\frac{qEg\left(\frac{1}{Tref} - \frac{1}{Tc}\right)}{KA}\right] \quad (5)$$

and

$$Irs = \frac{Isc}{[\exp\left[\frac{qVoc}{KATc}\right] - 1]} \quad (6)$$

Where,

- *Iph:* photocurrent
- Is: Cell saturation current
- q: Electron charge. q = 1.6 * 10-19C
- k: Boltzmann's constant. k = 1.38 *10-23j/K
- Tc: Cell operating temperature.
- A: Ideal factor dependent of the PV characteristic, A=1.3 for poly-crystalline solar cell
- Rsh: Shunt resistance.
- Rs: Series resistance.
- Isc: Cell short-circuit current at 25oC, 1kW/m2
- Voc: Open-circuit voltage
- ki: Short-circuit current temperature coefficient
- Tref : Cell reference temperature
- G : Solar insolation (irradiance) in kW/m2
- Irs: Cell reverse saturation current
- Eg: Band gap energy of semiconductor used in a cell = 1.11eV

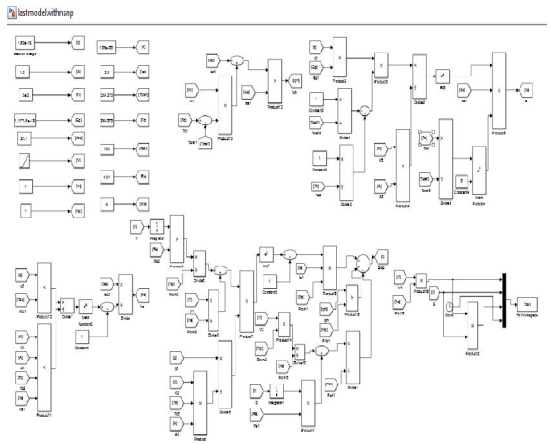

Fig. 3: Model of Solar Module under Matlab/ Simulink

Based on equation (1), the Matlab/SIMULINK model of photovoltaic module "Fig.3" was developed.

We developed a silicon mono crystalline PV module using tags simulation for simplicity of model.

III. Experiment and Result

A. *Parameters Used In MATLAB/ SIMULINK Model*

The values of the parameters used in developing the MATLAB/SIMULINK model for the Photovoltaic module have been tabled below

TABLE 1: PARAMETERS VALUE USED IN MATLAB/SIMULINK

Parameters	Values
Short-circuit current(Isc)	3.8A
Open circuit voltage(Voc)	21.1V
Electron charge(q)	1.6022* 10-19 C
Ideal factor(A)	1.3
Band gap energy of semiconductor(Eg)	1.11 eV
Boltzmann's constant(k)	1.38*10-23j/K
Temperature coefficient of short-circuit current(Ki)	0.047m A/^{0}C
Cell Reference temperature (Tcref)	25 ^{0}C
Cell operating temperature(Tc)	26^{0}C
Shunt resistance(Rsh)	100Ω
Series resistance(Rs)	0.01 Ω
Solar irradiance(G)	4kW/m^2

B. *Simulink PV Model Developments*

Using the equations given in above section, Simulink modeling is done as explained in the following steps:

Step-1: Using equation no. 4, the photo generated current is modeled as shown in "Fig 4".

Step-2: Using equation no. 5, the saturation current is modeled as shown in "Fig 5".

Step-3: Using equation no. 6, the reverse saturation current of the module is modeled as describe in "Fig 6".

Step-4: The output current of the module is obtained in "Fig 3" using equation no. 3.

Step-5: The four models are finally interconnected as shown in Figure 3.

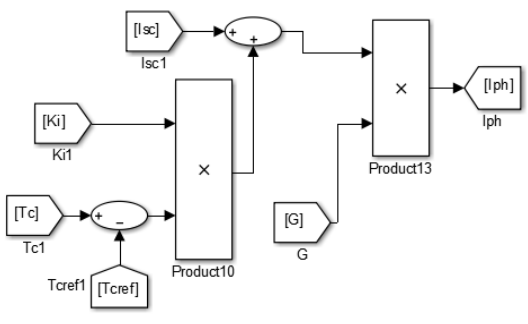

Fig. 4: Simulink Model for Calculation of Photo Generated Current

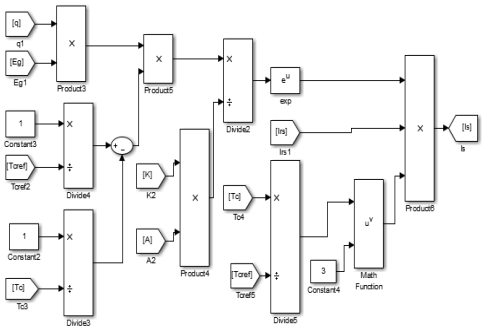

Fig. 5: Simulink Model for Calculation of Saturation Current

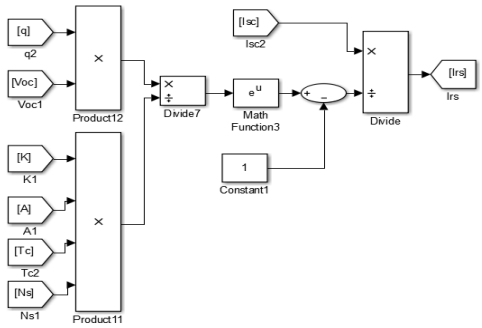

Fig. 6: Simulink Model for Calculation of Reverse Saturation Current

Using the Simulink simulation tool, the model of photovoltaic module illustrated in Figure 3 was first obtained.

C. *How To Plot The Characteristics Curves Of Model*

We can plot the results of various simulations by writing short code in Matlab command window. A multiplexer was used in Figure 5 to collect the results produced by simulation into a variable "Vout" that is later used to plot the different curves under Matlab command mode.

```
>> V=Vout (:,1);
>> I=Vout (:,2);
>> P=Vout (:,3);
>> figure (1)
>> %clf
>>
plot(V,I),xlabel('voltage'),ylabel('current'),title('current characteristic'),grid on, hold on, axis([0 25 0 30]);
>> figure (2)
>> %clf
>> plot(V,P), xlabel ('voltage'), ylabel ('power'), title ('power characteristic'), grid on, hold on, axis ([0 30 0 400]);
```

IV. RESULTS

A. *Output Waveforms Of The PV Module*

The waveforms obtained by varying the solar insolation and temperatures which are fed into the PV Module model have been plotted as shown below:

- First the temperature was kept constant and the insolation was varied within a reasonable range.
- In second instance, the insolation was kept constant whilst the temperature was varied to show the effect of solar radiation on PV cells.

B. *Current Characteristics for Constant Temperature*

The current characteristics of the designed model for a fix temperature of 26^0C and for varying values of irradiation between the ranges of 4 to 6kW/m^2 are shown in "Fig. (a)". From Fig. (a), we observed that the as the irradiation increases, the constant value of the current also increases but the threshold voltage reduces slightly.

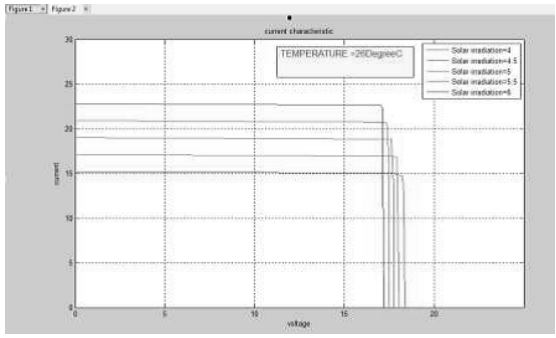

Fig. (a): I-V Curves Obtained at 26°C for Various Irradiance Levels

C. *Power Characteristics for Constant Temperature*

Figure (b) shows the power characteristics of our model for a fixed temperature of 26^0 C and for varying values of irradiation between the ranges of 4 to 6kW/m^2**.**Again increasing solar irradiation impact positively on the power characteristic producing higher power for a constant voltage.

D. *Current Characteristics for Constant Irradiance*

Furthermore, the irradiance was kept constant and the temperature was varied apart from the standard temperature in order to determine the effect on the results. Fig. (c) and Fig. (d) show the impact of temperature variation on the model. It appears that the model develops some small sensitivity to big variation of temperature. However, this effect is negative i.e. as the temperature increases the current and the power characteristics decrease.

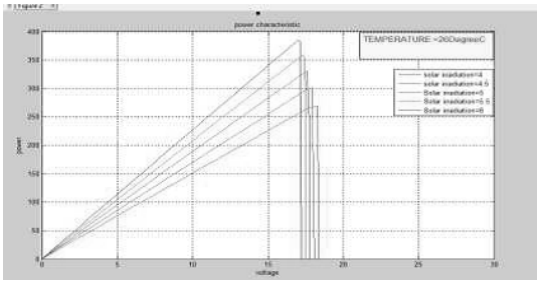

Fig. (b): P-V Curves Obtained at 26°C for Various Irradiance Levels

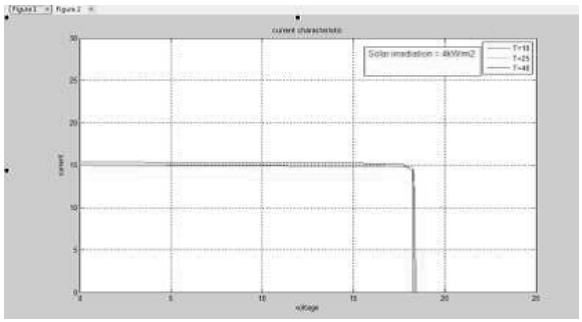

Fig. (c): I-V Curves Obtained at an Irradiance of 4 kW /m^2 for Various Temperatures.

From fig (c), we observed that by increasing the temperature level at constant irradiance, the voltage output from PV module decreases but current output increases slightly with respect to voltage.

E. Power Characteristics for Constant Irradiance

We observed that by increasing the temperature level at constant irradiance, the voltage output from PV module decreases and, hence the power output from PV module decreases. Temperature variation 10°, 25° and 40^0 are used in these cases.

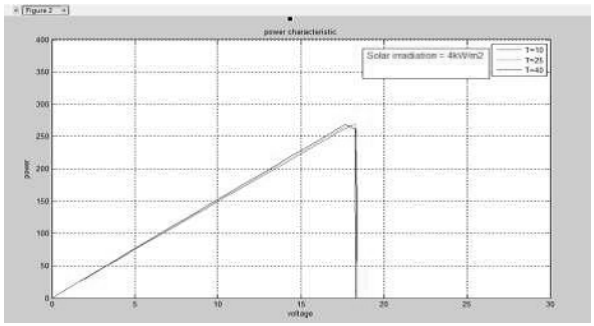

Fig. (d): P-V Curves Obtained at an Irradiance of 4 kW/m^2 Various Temperatures

V. CONCLUSION

This paper described the modeling of Photovoltaic module with photovoltaic effect. A model developed under Matlab/ Simulink environment using simulation tags and simulated for two effects: varying solar irradiance and varying temperature. This results obtained in form of two fundamental graphs namely power characteristic (power over voltage) and current characteristic (current over voltage) are very similar to empirical results known for solar system and this, further confirms the effectiveness of the proposed model.

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SEPIC Converter for Maximum Power Point Tracker for PV Panels

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***Abstract*—This study provides a comprehensive review of the Maximum Power Point Tracking (MPPT) techniques applied to Photovoltaic (PV) power system. Also this study presents a comparative study between two most fashionable techniques such as Incremental conductance (Inc) algorithm and Perturb and Observation (P&O) algorithm and. These three techniques have been applied to converters such as Boost and SEPIC for analyzing the performance in various climatic conditions of PV. The analysis of each technique with converters has been carried out by using algorithm. From the results few comparisons has been made and found that the boost converter with Incremental conductance algorithmic technique offered best and optimum results when compared with other techniques. This PV system can supply the maximum power to the load at all times due to which the entire PV system operates with maximum efficiency and produces its maximum power.**

Keywords: Maximum Power Point Tracking, Microprocessor, PV Module, SEPIC Converter

I. INTRODUCTION

Solar panel is the fundamental energy conversion component of photovoltaic (PV) systems. It has been used in many applications, such as aerospace industries, electric vehicles, communication equipment, etc. As the solar panels are relatively expensive, much research work has been conducted to improve the utilization of solar energy. Physically, the power supplied by the panels depends on many extrinsic factors, such as insolation (incident solar radiation) levels, temperature, and load condition. Thus, a solar panel is typically rated at an insolation level together with a specified temperature, such as 1000 W/m at 25C. Its electrical power output usually increases linearly with the insolation and decreases with the cell/ambient temperature. In practice there are three major approaches for maximizing power extraction in medium- and large-scale systems. They are maximum power point tracking, sun tracking and combination of both. For small-scale systems, MPPT is popular for economical reasons.

A. Maximum Power Point Tracking Tech-Niques

The output power of the solar PV module changes when the changes in direction of the sun, change in solar isolation level and change in temperature. Here the modified and also the most common algorithms of P& O and the incremental conductance methods have been described. The modified Incremental Conductance method offers the main advantage of providing high efficiency, voltage under rapidly changing atmospheric conditions, so it has been employed in the proposed model. However in this study another MPPT algorithm such as modified P&O could be used to formulate the comparative analysis.

1) Modified Perturb and Observation Technique

One of the most simple and popular techniques of MPPT is the P&O technique. The main concept of this method is to push the system to operate at the direction in which the output power obtained from the PV system will be increased. Following Fig.1 shows the flowchart of the P&O which describes the change of output power according to the changes of the PV panel parameters. If the change of power and voltage differentiation is greater than zero, the system will keep the direction of the incremental power (increase or decrease the PV power) as the same direction and if the change is lesser than, the system will change the direction of incremental power command to the opposite direction.

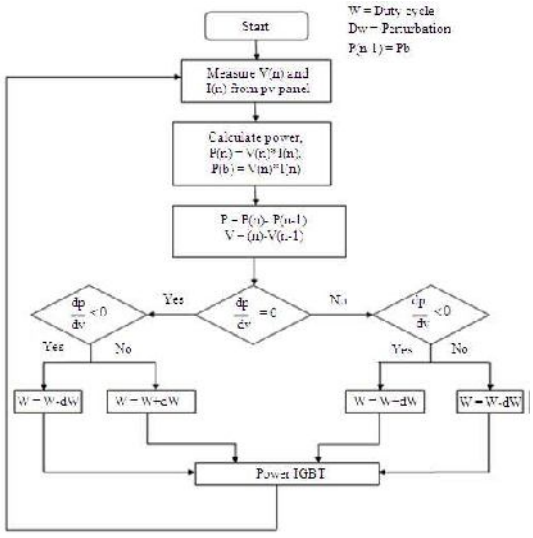

Fig. 1: Flow Chart of the P & O Method

In existing method, measured voltage and current values changes only in minimum level without oscillations. But it produces some error. But in the modified method measured voltage and current values changes in maxi-mum level without oscillations around the maximum power point. So that it reduces the output error in a maximum level. This method works well in the steady state condition according to the solar irradiation and temperature conditions change slowly.

However, the P&O method fails to track MPPT when the atmospheric condition is rapidly changed.

B. Modified Incremental Conductance Technique

This method exploits the assumption of the ratio of change in output conductance is equal to the negative output conductance of instantaneous conductance. In existing method measured voltage and current value changes taking more number of step size. Since its circuit complicity it takes more computational time. Figure 2 shows the flow chart for modified INC method. In this modified measured voltage and current value changes taking less number of step size. The computational time is decreased due to slowing down of the sampling frequency. Thus, MPP can be tracked by comparing the instantaneous conductance to the incremental conductance. It is the same efficient as P&O, good yield under rapidly changing atmospheric conditions. Here also the same perturbation size problem exists as like in the P&O method. But an attempt has been made to solve and increase the output power by using variable conductance technique. Step by step variation of conductance has been made by decrement and increment to track maximum power though the climatic conditions changes. For this method, the algorithmic circuit has been designed according to the flowchart using MATLAB software.

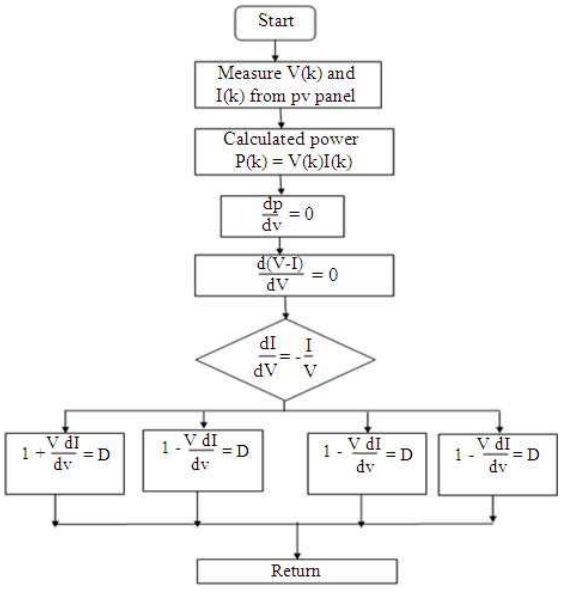

Fig. 2: Flow Chart of the Incremental Conductance Technique

II. PROPOSED SYSTEM

The solar power which can be obtained from solar cell cannot be utilized directly. It is usually stored in the battery and inverter circuit and further it can be used as AC. But the output voltage as well as power from the solar cell depends upon the illumination and intensity of the light. If the light intensity is very low it may produce very low output voltage. The lower output voltage from the solar cell may not charge the battery and the power is wasted. Here an intermediate stage of converter called SEPIC is used to boost the lower output voltage from the solar cell and also buck the voltage if the light intensity is high. The block diagram of proposed system is shown in Fig. 1.

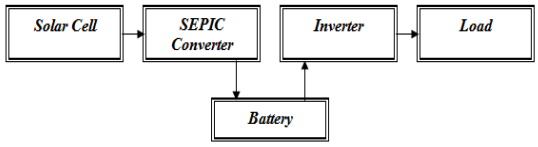

Fig. 1: Block Diagram of Proposed System

A DC–DC converter with simpler structure and higher efficiency has been an active research topic in the power electronics. A SEPIC is similar to a traditional buck-boost converter, but has advantages of having non-inverted output. Non-inverting buck-boost topologies require more active components. SEPICs are useful in applications in which a battery voltage can be above and below that of the regulator's intended output. In this proposed system, a prototype SEPIC converter is designed to Charge the battery from the solar panel. In solar cells, a number of PV modules are arranged in series and parallel to meet the energy requirements. Solar cells have a complex relationship between solar irradiation, temperature and total resistance that produces a non-linear output efficiency which can be analyzed based on the I-V curve. It is the purpose of the MPPT system to sample the output of the cells and apply the proper resistance (load) to obtain maximum power for any given environmental conditions. MPPT devices are typically integrated into an electric power converter system that provides voltage or current conversion, filtering, and regulation for driving variousloads, including power grids, batteries, or motors.

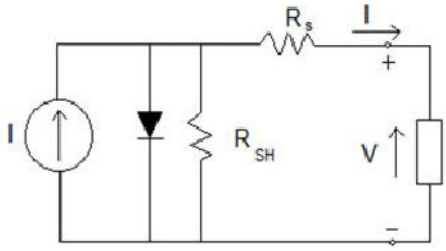

Fig. 3: Single Diode Model of PV Cell

Fig. 3 shows Single diode model of PV cell where I is the current source, Rs is the series resistance and RSH is the shunt resistance. RSH is very high compared with Rs and has a negligible effect in the output current. Where, I is the photovoltaic cell current, V is the PV cell voltage, T is the temperature (in Kelvin) and n is the diode ideality factor. In order to model the solar panel accurately two diode model is used. In this paper

the scope of study is limited to the single diode model. Also, the shunt resistance is very high and can be neglected during the course of our study.

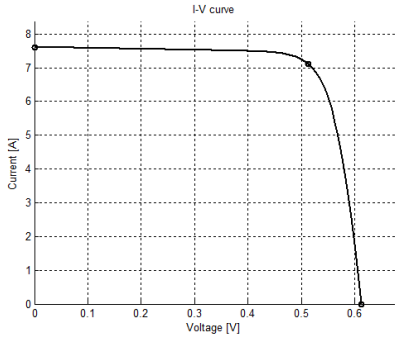

Fig. 4: VI characteristics of a Typical Solar Cell

The VI characteristics of a typical solar cell are as shown in Fig. 4. The PV characteristics are obtained by the voltage and the current characteristics as shown in below Fig. 5.The point indicated as MPPT is the point at which the panel power output is maximum.

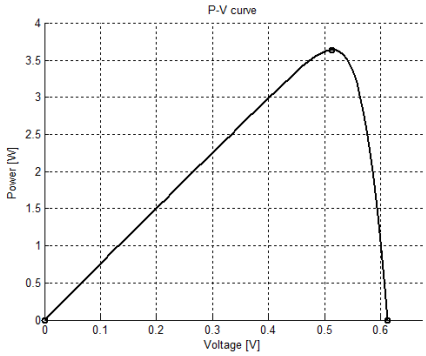

Fig. 5: P-V Characteristics of Solar Cell

III. Analysis of SEPIC Converter

The single-ended primary-inductor converter (SEPIC) is capable of operating from an input voltage that is greater or less than the regulated output voltage. Aside from being able to function as both a buck and boost converter, the SEPIC also has minimal active components, a simple controller, and clamped switching waveforms that provide low noise operation.

A. MPPT using SEPIC

A novel technique for efficiently maximizing the output power of a solar panel supplying to a load or battery bus under varying meteorological conditions is presented. The power conversion stage (PCS), which is connected between a solar panel and a load or battery bus, is a pulse width-modulated (PWM) dc/dc SEPIC converter or their derived circuits operating in discontinuous inductor current mode (DICM) or capacitor voltage mode (DCVM). The equivalent circuit for solar panels generally consists of a current source shunted by a diode and a resistor and with an output series resistor. However, a Thevenin's equivalent circuit is used to represent the solar panel at the maximum power point in this case. The solar panel is represented by a voltage source connecting in series with an output resistance. The input voltage and the equivalent input resistance of the converter are given below.

As the input power Pi to the converter is equal to the output power Po of the solar panel. This type of converter is found to have the input resistance characteristics being proportional or inversely proportional to the switching frequency. Hence, by adjusting the nominal duty cycle of the main switch in the converter, the input resistance of the converter can be made equal to the equivalent output resistance of the panel. This operation ensures the maximum power transfer. By modulating a small-signal sinusoidal perturbation into the switching frequency of the main switch and comparing the ac component and average value of the panel terminal voltage, the MPPT can be located. The tracking capability of the proposed technique has been verified experimentally with a 10 W solar cell panel at different insolation levels and temperatures, and under different largesignal insolation changes. SEPIC type converter is used in this study as DC/DC converter of the MPPT system.

B. Simulation Model for Open Loop Control

MATLAB is an interactive, matrix-based package for scientific and engineering graphical user interface, signal processing, fuzzy logic, and many others. The number optimization, statistics, neural networks, of different toolboxes increases with each newer version of MATLAB numeric computation and visualization. It can solve complex numerical problems in a fraction of the time required. The final simulation model of SEPIC converter is shown in Fig. 6.

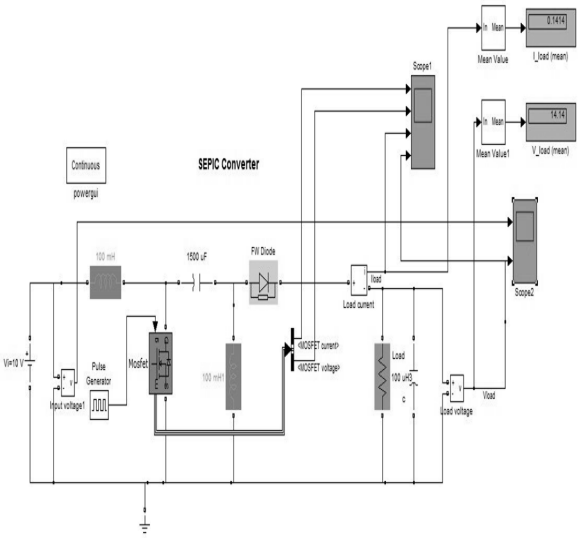

Fig. 6: Simulation Model of SEPIC Converter

Simulations have been performed to confirm the above analysis. Figs. 7 show the Simulation of open loop SEPIC Converter and simulation result of SEPIC Converter.

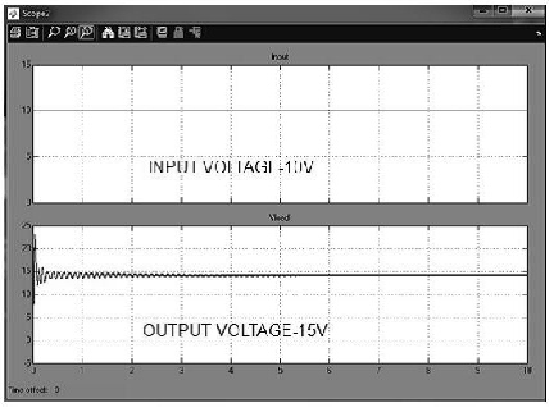

Fig. 7: Simulation Result of SEPIC Converter

IV. CONCLUSION

A novel technique using a SEPIC converter to efficiently track the maximum power point of a solar panel has been presented. The technique is simple and elegant and does not require complicated mathematical computation. The tracking capability of the proposed technique has been verified experimentally with a 12V, 2A converter with input voltages (different radiation levels) and an inverter circuit of 40 W. MATLAB/Simulink software has been used to simulate SEPIC converter. Compared to many existing methods, the proposed technique is unnecessary to

1. Perform digital sampling of the converter parameters.
2. Perform sophisticated mathematical computations of the panel output power.
3. Approximate the panel output characteristics.

Hence, it can be used under a wide range of meteorological conditions.

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Design and Feasibility of Combined Biomass Biogas and Solar Power Plant for Generation of Electric Power

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***Abstract*—This includes the study of combined solar, biogas and biomass hybrid system for generation of electric power. This will help to overcome from global warming effect and statistical impact on prosperity and dependency. Increasing electricity demands, hike in fuel prices and environmental concerns are the main factors which motivate the use of renewable energy in India. In the hybrid system energy has a higher reliability, can be cost effective and improves the quality of life in rural areas. Hybrid power system aims to increase the system efficiency and use of renewable energy based hybrid power system. In order to meet the sustained load demands, different renewable energy sources need to be integrated. In this study we will integrate biomass, biogas and solar energy for generation of electricity, the composite produced will be less and cost per unit of electricity generated will be less comparatively. Solar energy is free of cost, installation cost of solar power plant is high but its operating cost is almost negligible. This paper discuss the renewable biomass biogas and solar pv combined power generation system in northern India to overcome those problems which occurred when they operate standalone.**

Keywords: Biomass Power, Hybrid Plants, Biogas Power, Renewable Energy, Rural Area Electrification, Solar PV Power

I. INTRODUCTION

In India, the most important resource of economic development is Energy. Industrialization and urbanization has led to rapid increase in energy demand. Due to increase in demand of electric power we have need for the growth of non conventional methods for generation of electric power.

A. Availability of Resourses

As materials used for these methods are easy available, cost of electricity will be lesser. Several alternative sources of energy are being thought of, including the nuclear, solar, geothermal, wind, tidal, biogas and the biomass based. Presently, standalone solar photovoltaic systems, biogas and biomass systems have been promoted around the globe on a comparatively larger scale. But they are facing a lot of problems during their operation. Like, in solar plants, solar panels are too costly, energy only produced during daytime and in sunny weather. Similarly, biomass plants may save on carbon dioxide emissions, but it increases methane gases, High ash content, and heat release into environment and in biogas plants some pollutants are produced. So to get optimal generation conditions, we could use the combined operation of the biogas, biomass and solar power plant.

B. Hybrid Power Plants

Hybrid systems are usually a combination of photovoltaic with wind turbines and/or generators running on diesel or bio fuel/biogas is also used. Power generated by PV array during the day is stored in the battery bank through an energy manager, which controls the complete system. Diesel generators are expensive to run and also require frequent maintenance support. A judicious mix of solar and other renewable technologies coupled with a diesel generator/grid can offer a techno-commercially viable solution that will power the backbone of rural connectivity. The resultant hybrid system thus offers an optimal solution at a substantially lower cost. It is ideal for electrification of remote villages in India. The other form of power generation is usually a type which is able to modulate power out function of demand. India is equipped to offer reliable off-grid and hybrid solutions energy needs for small area especially rural areas where powering critical loads are often a challenge. However if more than one form of energy is to be used which can be solar/biogas/biomass, the photovoltaic power generation serves to reduce the consumption of non-renewable fuel.

II. COMBINED BIOMASS BIOGAS AND SOLAR PV SYSTEM

A. Methodology

We will collect the information about the place of work including location, total area, population and the raw material available from the surrounding villages for bio-gas and biomass generation and the Solar Radiation Data of the place where the plant is to be installed is collected.

Secondly we will study about the energy requirements and related problems faced which includes electrical requirements and present modes of energy

sources, problems involved by use of conventional sources and its remedial measures.

Next step will be design of the biogas generation plant which includes generation technique as well as its plant calculations, selection of fuel engines i.e. types of engines, effect of temperature, digester design, height of digester and technology description. The cost evaluation of the plant is also one of the most important factor to be estimated which includes annual plant cost, cost of electricity generation, subsidy provided by government, payback period etc factors. Then selection of batteries, voltage regulators and DC control units etc for hybrid generation.

In next step for biomass plant, collecting experience of farmers, Specification of the electrical equipment required is to be worked out. Calorific value of biomass particles by Bomb calorimeter.

Then finally the whole area will be supplied power with the help of Micro Hybrid solar biogas and biomass Power

B. *Block Diagram of Hybrid Power Plant*

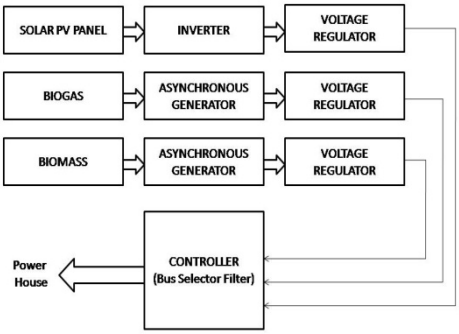

Fig. 1: Hybrid System

Different parts of the Combined Biomass and Solar power system are:

- Solar PV Plant
- Biomass power plant
- Biogas power plant
- Inverter
- Controller

C. *Present Work*

The site proposed for hybrid power generation is Canal View Enclave (JLPL Pvt Ltd)Southern Bypass in Block Dehlon in Ludhiana, Punjab. The villages surrounding the site are Gill and Sangowal also there is a Cow herb (Gaushala) from where the raw material for the plant can be made available. The total number of cattle in the surrounding villages is 2043.The site i.e. the colony and the surrounding villages has abundant quantity of human waste and animal dung, which can be used to generate electricity by installing biogas power plant. Also, from villages of dehlon block, raw material for biomass power plant can be made available. Average solar radiation at the site is 5.11kWh/m^2/day, therefore the site has also a great potential to generate electricity through solar power plant. Three project models, one is of biomass power plant of 1000kW, second is of biogas power plant of 300kW capacity and the last is of solar power plant of 50 kW capacity are hence proposed.

III. Results and Discussion

A. *Percentage Overall Generation*

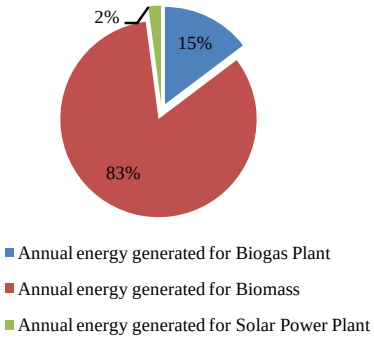

Fig. 2: Percentage Overall Generation

B. *Per Unit Costs*

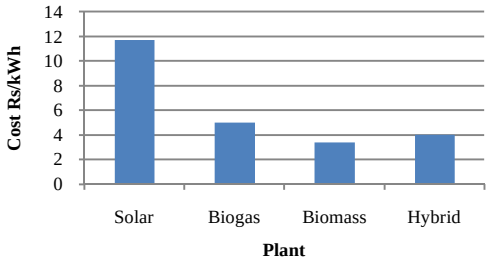

Fig. 2: Per Unit Costs

C. *Payback Periods*

Payback period of all the three power plants has been represented by a bar graph in this paper in Fig.3. it shows that biomass power plant will provide free electricity in a lesser period as comparison to other two elements of hybrid system. The payback period of solar power plant is greater as comparison to others, but it will be recovered by the combined system as the cost of per unit generation will be reduced to a reasonable level.

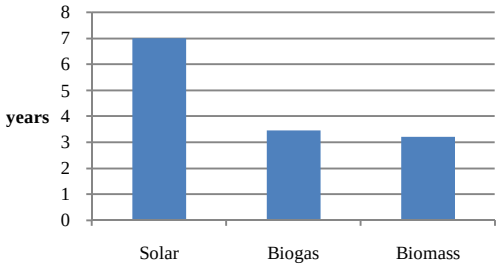

Fig. 3: Payback Periods

IV. CONCLUSION

This study provides a newly approach to renewable technologies and their potential in developing countries like India. This study includes power generation from Biomass Biogas and Solar PV power plants. By use of this study, 1350 kW_p power plant could be set up in the rural areas of the northern India which includes 1000 kW Biomass power plant, 300 kW Biogas power plant and 50 kW_p Solar PV power plant per unit cost generation is Rs. 4.08/ kWh. It utilizes solar energy and; biomass and biogas as fuels in a combined cycle power plant to provide clean energy. It can be concluded that solar, biogas and biomass hybrid system is a viable green technology source for rural electrification. This study presents a biased solution for small to medium scale power generation using non conventional energy in developing nations.

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Encryption Process Throughput Investigation of Symmetric Algorithms

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***Abstract*—Computer Network is an infrastructure of computer and peripheral devices that enables movement of data and sharing of resources. With the development of internet & its applications, the networking technology has not been just confined to resource sharing but has boomed in the arena of online banking, e-shopping, stock market and Bill payments etc. Data transfer between these applications without Security is not reliable. An encryption algorithm provides the security to data which is exchanged over internet. In our paper, performance evaluation of various symmetric encryption algorithms such as AES, DES, 3DES and Blowfish through simulations has attempted using Visual Basic language tool. The performance parameter Throughput (Mb/Sec) has been investigated with varying data packet sizes. From the obtained results it is gathered that the performance of Blowfish is better followed by AES than other algorithms. For the tested simulation scenario 3DES has the least performance than all studied algorithms. These findings will help network administrators to develop better strategies for the security of network. All the Simulation has been conducted using visual basic language as front end and Microsoft access using back end.**

Keywords: AES, DES, 3DES and Blowfish

I. INTRODUCTION

Network architectures within the industries are admiring day by day. The complexity of these systems is often composed of various services running on several remote servers such as mail servers, web servers, database servers, print servers, etc. For system administrators, it's then a daily challenge to secure the data's and protect the network to prevent the loss of functionality. Intrusion detection systems are one of the key tools available to detect malicious attacks and intrusions from a remote host or misuse of the network from a local user. The biggest concern with wireless, however, has been security. The current internet faces escalating threats form more sophisticated, intelligent and automated malicious codes. In the past, we have seen computer worms spread themselves without any human interaction and launched the most destructive attacks against computer networks. Cryptography is the science of writing in secret code and is an ancient art. Some experts argued that cryptography appeared spontaneously sometime after writing was invented, with applications ranging from diplomatic missives to war-time battle plans. It is no surprise, then, that new forms of cryptography came soon after the widespread development of computer communications. In data and telecommunications, cryptography is necessary when communicating over any untrusted medium, which includes just about any network, particularly the Internet. Cryptography, then, not only protects data from theft or alteration, but can also be used for user authentication.

II. SUMMARY OF VARIOUS CRYPTOGRAPHY ALGORITHMS

The brief description of block ciphers is discussed below.

DES: DES (Data Encryption Standard) was the first encryption standard to be recommended by NIST. DES is (64 bits key size with 64 bits block size). Since that time, many attacks and methods recorded the weaknesses of DES, which made it an insecure block cipher [33], [34].

3DES: 3DES (Triple DES) is an enhancement of DES; it is 64 bit block size with 192 bits key size. In this standard the encryption method is similar to the one in the original DES but applied 3 times to increase the encryption level and the average safe time. It is a known fact that 3DES is slower than other block cipher methods [34]. Blowfish is block cipher 64-bit which can be used as a replacement for the DES algorithm. It takes a variable length key, ranging from 32 bits to 448 bits; default 128 bits.

Blowfish: Blowfish is unpatented, license-free, and is available free for all uses. Blowfish has variants of 14 rounds or less. Blowfish is successor to Twofish [10].

AES: AES is a block cipher.It has variable key length of 128, 192, or 256 bits; default 256. It encrypts data blocks of 128 bits in 10, 12 and 14 round depending on the key size. AES encryption is fast and flexible [34].

III. Set-Up Design for Experimental Work

Experimental setup means the things you need to perform an experiment and its arrangement in proper manner for performing experiment is known as experimental setup.

In order to compare the performance of various cryptography algorithms all were implemented using visual basic environment in which visual basic is used as front end and Microsoft access is used as back end. The experiment has been carried out using a laptop having specifications 2.20 GHz. Intel Pentium core 2 Duo processor with 4 GB RAM on windows 7 Home Premium 32-bit operating system. In this experiment software encrypt and decrypts the text files size that ranges from 20 Kb to 99000Kb. Their implementation is thoroughly tested and is optimized to give the maximum performance for the algorithm. The performance matrices are throughput. The throughput of encryption as well as decryption schemes is calculated but one by one. In the case of Encryption scheme throughput is calculated as the total plain text in k bytes divided by the average Encryption time and in the case of Decryption scheme throughput is calculated as total cipher text is divided by the average Decryption time.

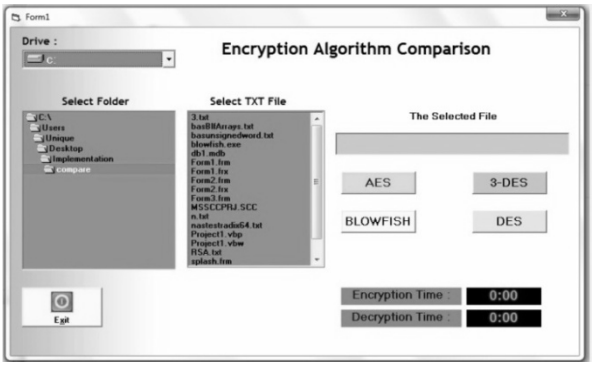

Fig. 1: Screen shot of the Experimental Setup

Snap shots are self-explanatory in nature and provide the solution for the current problem in handsome manner that will be beneficial for the academicians, researchers and all above the enterprises who are encountering new problems day by day in emerging technologies. The fig. 1 shows the screen shot of the software which is used by the user. Firstly the drive has been selected then folder after the particular file (which is to be encrypt or decrypt) and at last when we press the encrypt key; the encryption time and the throughput of encryption time will be calculated automatically and displayed on the defined dialog box and to get the decryption and throughput of decryption time; first of all we reset it and again the same procedure is followed while selecting the file and similarly the value of decryption time and throughput of decryption time is calculated by pressing the decrypt key.

IV. Performance Metric

The performance metric in our research work is throughput.

Throughput: The Throughput of the encryption scheme is calculated as the total plain text in encrypted in Kbytes divided by the encryption time in milliseconds. The unit of throughput is MB/Sec.

The throughput of the encryption scheme is calculated as the ratio of total plain text by encryption time.

$$\text{Throughput of Encryption Algorithm} = \frac{T_p}{E_t} \ldots\ldots \quad (1)$$

Where;

T_p: Total Plain Text (Kbytes)

E_t: Encryption Time (Milliseconds)

V. Results and Discussion

The results obtained from the study of self-comparison of parameter throughput are calculated by varying the text data size.

The comparison has been conducted by running several encryption settings to process different sizes of data blocks to evaluate the algorithm's encryption time, decryption time and throughput. Since our main concern here is the performance metrics of these algorithms under different settings, the presented comparison taken into consideration the behaviour and performance of the algorithm when different data loads are used.

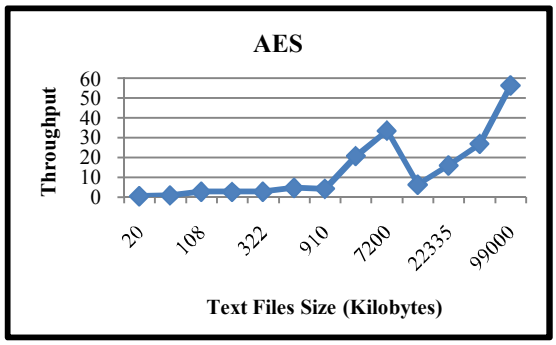

Fig. 2: Encryption Process Throughput Variation of AES with Different Data Packets

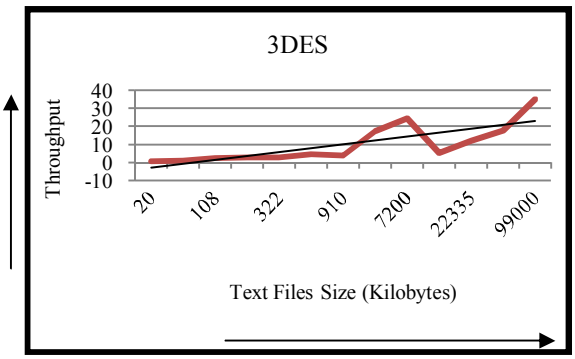

Fig. 3: Encryption Process Throughput Variation of 3DES with Different Data Packets

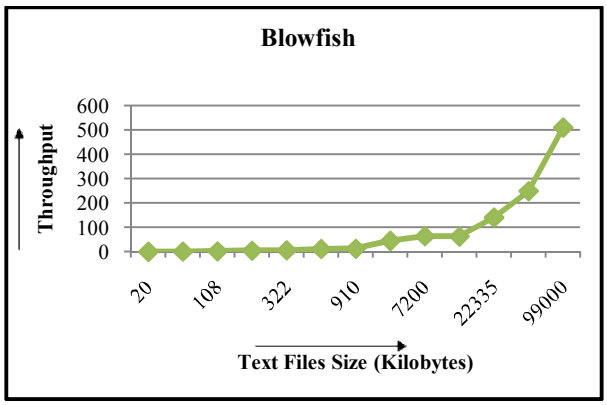

Fig. 4: Encryption Process Throughput Variation of Blowfish with Different Data Packets

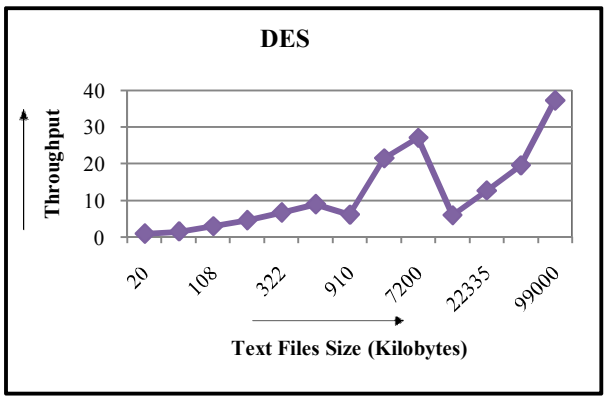

Fig. 5: Encryption Process Throughput Variation of DES with Different Data Packets

VI. Result Analysis

The simulation results for this comparison shown from Fig. 2 to Fig. 5 and the results show that:

- At 20 Kb, DES has better performance of all and thereafter Blowfish, 3DES and AES have performance in decreasing order.
- At 48 Kb, DES has the best performance than Blowfish of all the selected encryption algorithms, and lastly, 3DES and AES are at the same level in terms of performance.
- At 108 Kb, DES has the best performance, and then followed by AES, Blowfish; 3DES are in the descending order.
- At 241 Kb, Blowfish leads of all then followed by DES, 3DES and AES are in descending order in terms of performance.
- At 322 Kb, DES is the best then followed by Blowfish and lastly, 3DES and AES in are at same level in terms of performance.
- From 780 Kb to 5501 Kb Blowfish is the best of all selected encryption algorithms, and then followed by DES, AES and 3DES.
- From 7200 Kb to 99000 Kb Blowfish is the best of all, then followed by AES, DES and 3DES.

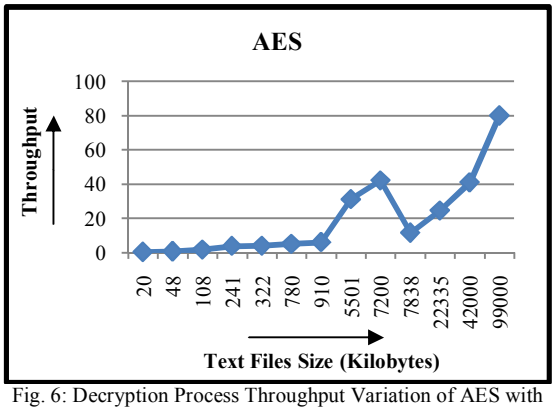

Fig. 6: Decryption Process Throughput Variation of AES with Different Data Packets

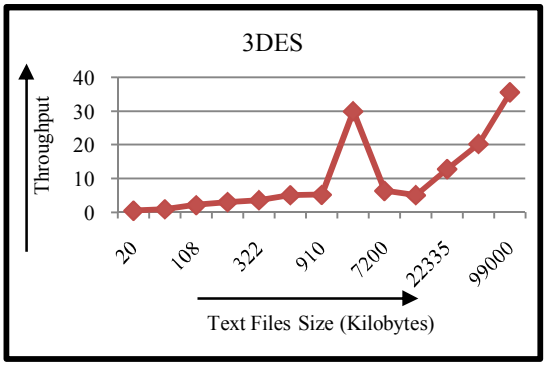

Fig. 7: Decryption Process Throughput Variation of 3DES with Different Data Packets

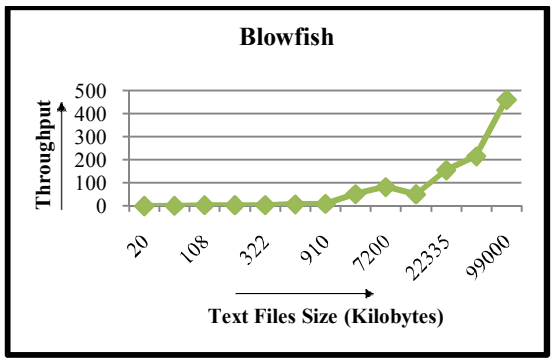

Fig. 8: Decryption Process Throughput Variation of Blowfish with Different Data Packets

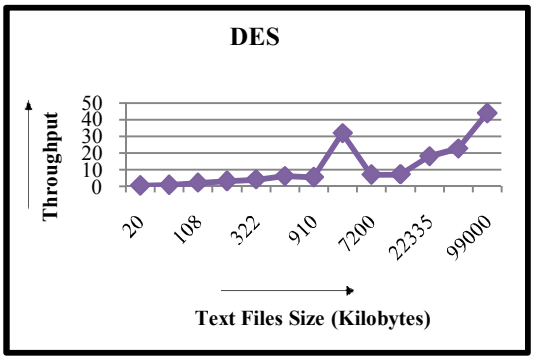

Fig. 9: Decryption Process Throughput Variation of DES with Different Data Packets

VII. Result Analysis

The simulation results for this comparison shown from Fig. 6 to Fig. 9 the results show that:

- At 20 Kb to 108 Kb, Blowfish leads of all then followed by DES, 3DES and AES are in descending order in terms of performance.
- At 241 Kb, Blowfish is the best of all followed by AES, DES and 3DES.
- At 322 Kb to 780 Kb, Blowfish has the best performance than DES of all the selected encryption algorithms, and lastly, AES and 3DES in terms of performance.
- At 910 Kb to 99000 Kb, Blowfish has the best performance, and then followed by AES, DES; 3DES are in the descending order.

VIII. Conclusion & Future Scope of Work

The conclusion drawn from simulation of encryption algorithms can be summed up as: In the case of changing data sizes that ranges from 20 Kb to 99000 Kb, It has been concluded that Blowfish has better performance than other algorithms in terms of throughput. In future the work may be extended by including the schemes and techniques to Study of different data packet sizes over different types of data such as image, sound and video.

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Performance Improvement in ZigBee based Wireless Sensor Network with Multiple Coordinators

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***Abstract*—ZigBee is most widely used technique in wireless sensor network. It is based upon IEEE 802.15.4 protocol stack. The research work is implemented on ZigBee using OPNET modeler 14.5. Three topologies are used to design a network i.e. mesh, tree and hybrid topology, whereas hybrid topology is implemented by the combination of mesh and tree topology in a single network. The performance of these networks has been analyzed using the parameter Throughput, MAC delay, MTR and MTS. The overall results show that hybrid topology is best among other two. As the performance of hybrid topology does not varies as the speed of mobile nodes varies.**

Keywords: ZigBee, Hybrid Topology, Coordinator, OPNE0T

I. INTRODUCTION

Wireless sensor networks (WSN) consists of light-weight, low power and small size sensor nodes. They have capability to monitor, compute and connect wirelessly [1]. ZigBee is a wireless sensor network based on wireless standard 802.15.4 [2]. IEEE 802.15.4/ZigBee is a standard protocol for Low-Rate Wireless Personal Area Networks (LR-WPAN). It will be suitable for an Adhoc network between inexpensive fixed, portable and moving devices. It is intended to be used in those applications which requires low data rate, low cost, flexibility and very low power consumption. The IEEE 802.15.4 protocol defines MAC and PHY layers for personal area network (PAN) [3]. The medium access control (MAC) layer send data frames over radios channels with specified modulation and spreading techniques. It enables the transmission of MAC frames through the use of the physical channel. The physical layer is defined by IEEE 802.15.4 standard. The physical layer is responsible for providing data transmission service. The physical layer offers three operational frequency bands; there are 27 channels allocated in the 802.15.4 range, with 16 channels in the 2.4 GHz band, 10 channels in the 915 MHz band, and 1 channel in 868 MHz band [1].In this paper the performance of three topologies has been evaluated by varying the speed of mobile nodes whereas in [4] the author only analyse the performance of mesh and tree topolgy.

II. IEEE 802.15.4/ZIGBEE ARCHITECTURE

Zigbee builds upon the physical and media access control layers, which are define in IEEE standard 802.15.4 for low-rate WPANs. IEEE802.15.4 is simpler and less expensive than other WPANs, such as Bluetooth. ZigBee has a defined rate of 250 Kbit/s. It is suitable for those applications which Requires low data rates and low power consumption [4].

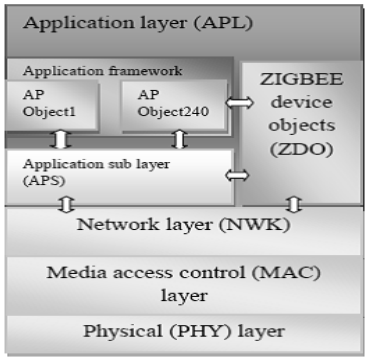

Fig. 1: Protocol Stack of ZigBee (Source [8])

A. Application Layer

The application layer is the highest-level layer defined by the specification and it provides an effective interface to its end users. This layer contains applications running on the ZigBee network and thus provides the effective interface to the user [5, 6].

1. *The Application Support Sub Layer (APS)*: The application support sub layer (APS) provides services, which are necessary for endpoints. The Zigbee Device Object (ZDO) performs data and management services to interface with the network layer.

2. *Application Object (Endpoint)*: An application object defines input and output to the APS. For example, a switch that controls a light is the input from the application object, and the output is the light bulb condition. Each node can have 240 separate application objects. An application object may also be referred to as an endpoint (EP).
3. *ZigBee Device Object (ZDO)*: A ZigBee device object performs control and management of application objects. The ZigBee device objects represents the ZigBee node type of the device; defining the nodes role on the network. It is resident on all ZigBee nodes and provides generic ZigBee device functions.

B. *Network Layer*

The network layer is defined by ZigBee Alliance. it is located between the application support sub layer and MAC layer. The various services provided by this layer are network management, routing management, network message broker, and network security management etc. [1].

C. *MAC Layer*

The MAC layer is responsible for the data addressing in order to determine either where the frame is going, or coming from. This layer also provides multiple access control such as CSMA/CA allowing for reliable data transfer. Beaconing is another feature implemented through this layer [7].

D. *Physical Layer*

The physical layer is defined by the IEEE 802.15.4 standard. The physical layer uses certain radio channel according to a specific modulation, spreading techniques and responsible for data transmission and reception. It operates on 2.4 GHz frequency band with 250 kbps data rate and 16 available channels. [7].

III. TOPOLOGIES OF ZigBee

IEEE 802.15.4 supports three types of topologies: Star, Mesh and Tree.

A. *Star Topology*

In the star topology a unique node operates as a ZC. The communication pattern of the star topology is centralized, i.e. each device (FFD or RFD) joining the network and willing to communicate with other devices must send its data to the ZC, which dispatches it to the adequate destination. The main advantages of star topology are its simplicity and predictable and energy efficient behaviour. The drawbacks are limited scalability and ZC as a single point of failure.

B. *Mesh Topology*

Mesh topology is more flexible than other topologies and covers multiple paths for messages within the network. If a particular router fails, then ZigBee self-healing mechanism will recover the network. Mesh topology is highly reliable and robust. The limitation of this topology is lower end-to end performance [5].

C. *Tree Topology*

A Tree topology consists of a Co-coordinator and this co-coordinator linked with its children, which are basically the set of routers and end devices. A Router also connected with its children kike another routers and end devices [10].

IV. SIMULATION SETUP

The simulation of ZigBee network has been done by using OPNET modeler 14.5.The network area selected on the level of official network scale (45m*45m). The number of node used in the network are 36. We design three scenarios, in which speed of mobile nodes varies from 2m/s to 15m/s using random waypoint mobility model. The nodes are randomly placed anywhere in the network. The simulation duration of the network is 300 sec. The maximum number of routers are 10 and maximum number of children are 10 whereas maximum depth of network is 5.In the first scenario we use tree topology and in second scenario mesh topology is used. In third scenario the combination of tree and mesh topologies are used to implement a hybrid topology.

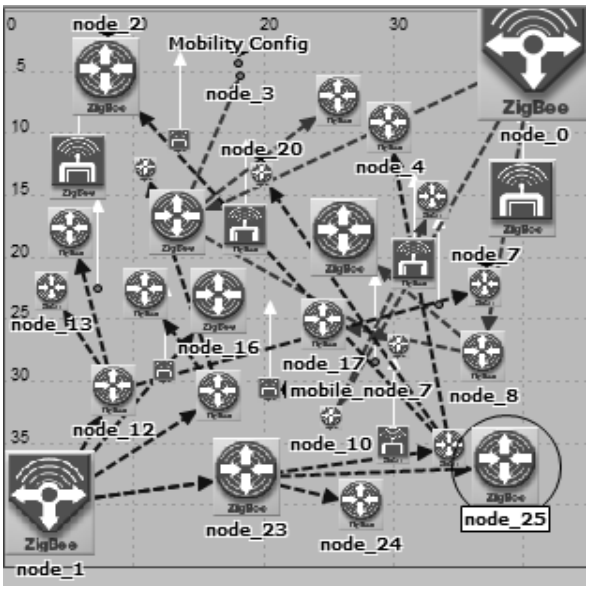

Fig. 2: Hybrid Network using Two Coordinators

V. Results And Discussion

A. *Throughput*

Throughput is the ratio of the total amount of data that a receiver receives from a sender to a time it takes for receiver to get the last packet. Throughput is the data quantity transmitted correctly starting from the source to the destination within a specified time (seconds). A low delay in the network translates into higher throughput. Throughput is quantified with varied factors including packet collisions, obstructions between nodes and the type of used topology. The results shown in Figures 3, 4, 5 and 6conclude that tree topology provide maximum throughput and it goes on increasing as the speed of mobile nodes increase and mesh topology provide minimum throughput but similar in all cases, hence speed of mobile nodes does not affect the throughput in mesh topology. Whereas in case of hybrid topology the throughput varies as speed of mobile nodes increases with very small increment value.

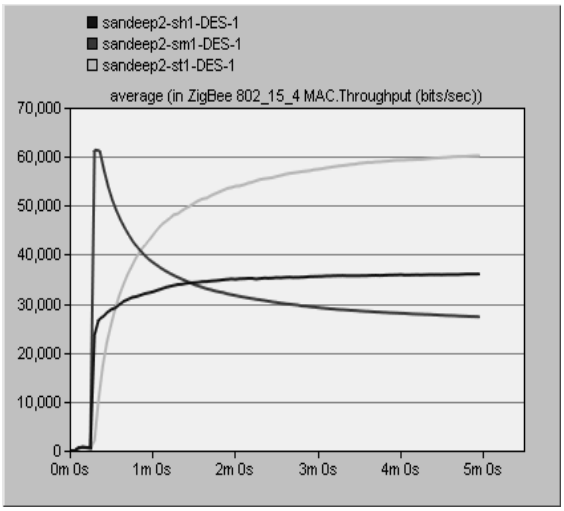

Fig. 3: Throughput of Tree, Mesh and Hybrid Topologies with 2 m/sec Speed of Mobile Nodes

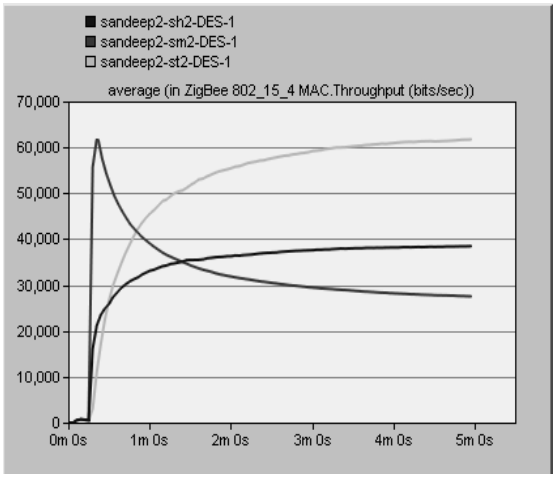

Fig. 4: Throughput of Tree, Mesh and Hybrid Topologies with 5 m/sec Speed of Mobile Nodes

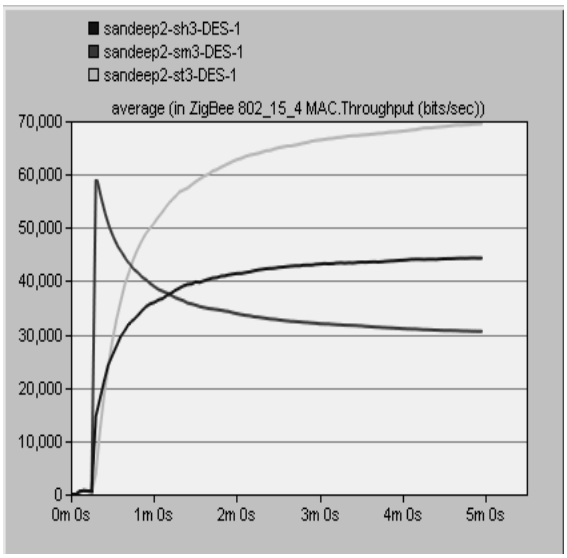

Fig. 5: Throughput of Tree, Mesh and Hybrid Topologies with 10 m/sec Speed of Mobile Nodes

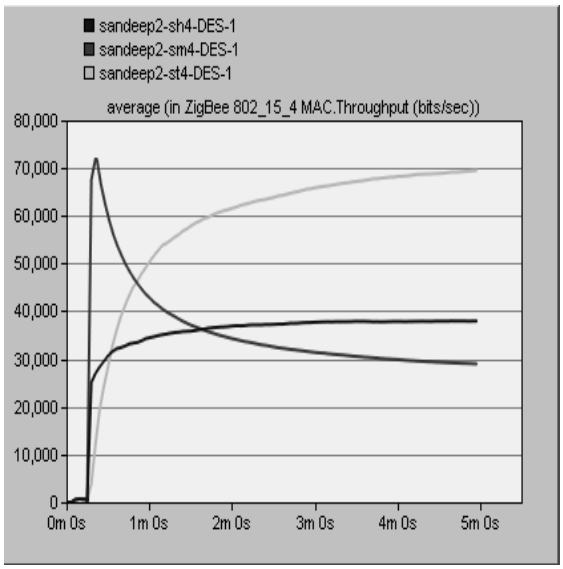

Fig. 6: Throughput of Tree, Mesh and Hybrid Topologies with 15 m/sec Speed of Mobile Nodes

B. *MAC Delay*

Represents the end to end delay of all the packets received by the 802.15.4 MACs of all WPAN nodes in the network and forwarded to the higher layer. The results in Figures 7,8, 9and 10 shows that mesh topology provides minimum MAC delay. Whereas tree topology provides maximum MAC delay. The MAC delay keeps on increasing in all cases of mesh topology. In tree topology MAC delay initially increases in case of 2m/sec and 5m/sec speed of mobile nodes and then keeps on decreasing in case of 10 m/sec and 15 m/sec speed of mobile nodes. Whereas the speed of nodes does not affect the parameter MAC delay in case of hybrid topology.

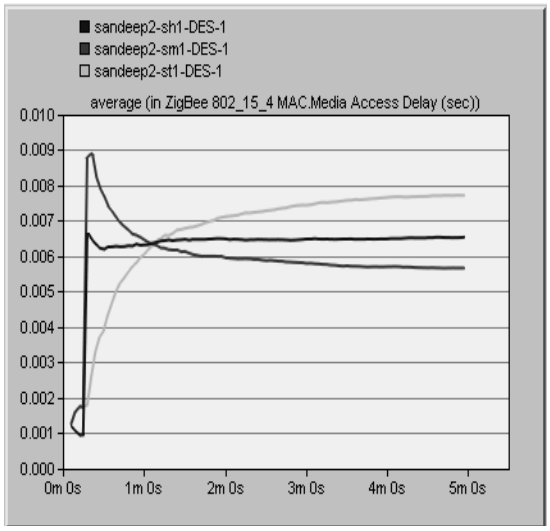

Fig. 7: MAC Delay of Tree, Mesh and Hybrid Topologies with 2 m/sec Speed of Mobile Nodes

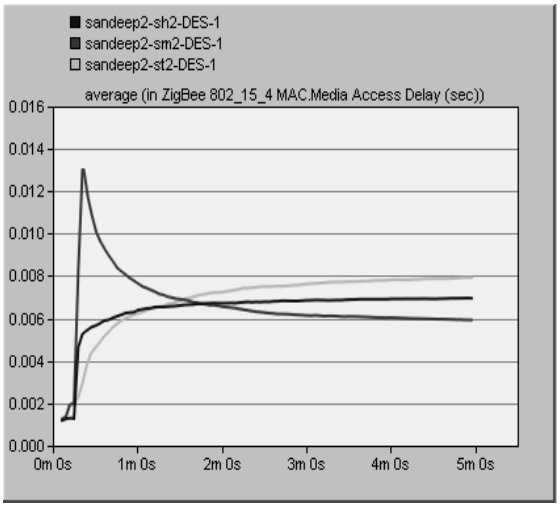

Fig. 8: MAC Delay of Tree, Mesh and Hybrid Topologies with 5 m/sec Speed of Mobile Nodes

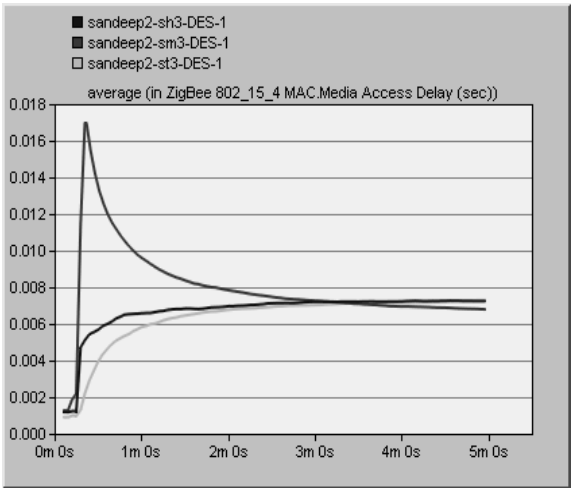

Fig. 9: MAC Delay of Tree, Mesh and Hybrid Topologies with 10 m/sec Speed of Mobile Nodes

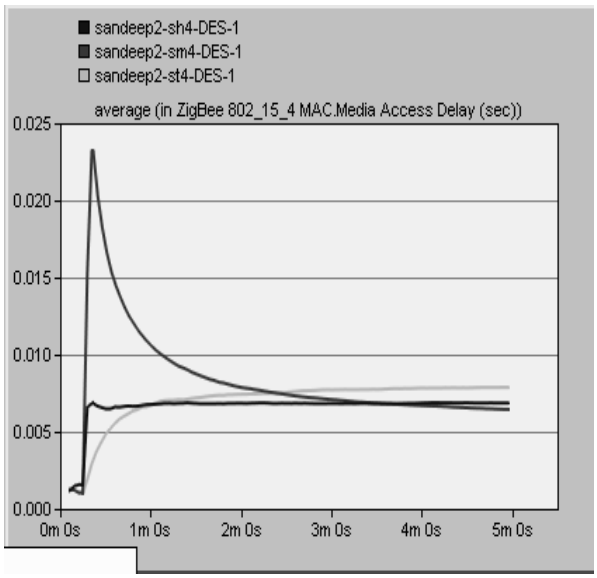

Fig. 10: MAC Delay of Tree, Mesh and Hybrid Topologies with 15 m/sec Speed of Mobile Nodes

C. Management Traffic Received (MTR)

These statistics record the total amount of management traffic (i.e., beacon and Block-ACK frames) received from the physical layer on this network interface. These statistics record successful arrival of management frames even if they are not destined to this interface. When these statistics are reported in units of bits/second, the physical and the MAC header sizes are included in the computation of the total amount of traffic received. The results shown in Figures 11, 12, 13 and 14 conclude that mesh topology provides maximum MTR and tree topology provides minimum MTR. The hybrid topology provides effective MTR. All three topologies shows same result in case of 2m/s,5 m/s and 15m/ whereas in

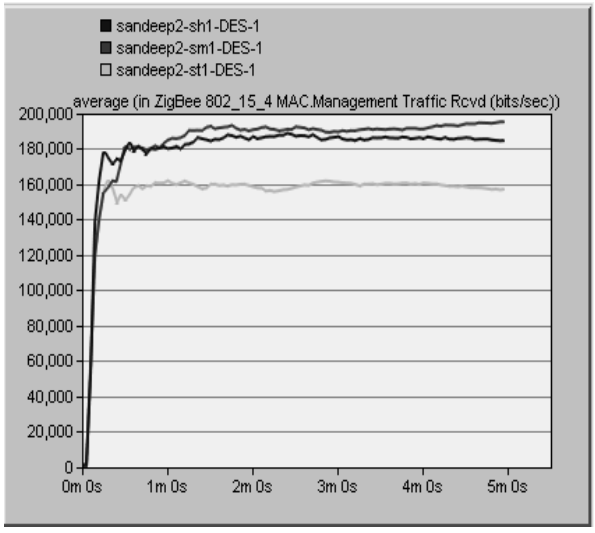

Fig. 11: MTR of Tree, Mesh and Hybrid Topologies with 2 m/sec Speed of Mobile Nodes

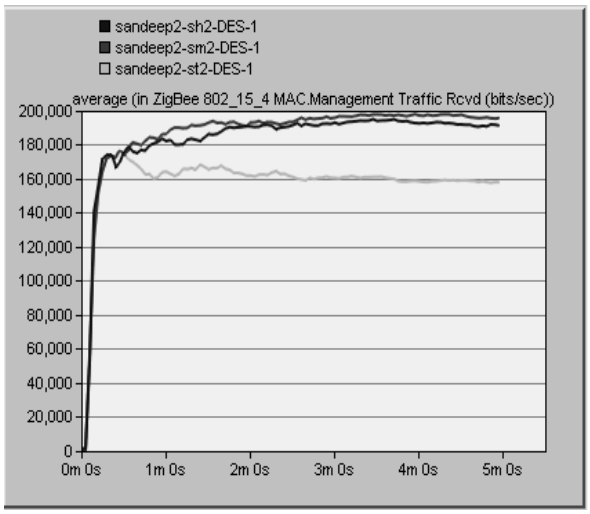

Fig. 12: MTR of Tree, Mesh and Hybrid Topologies with 5 m/sec Speed of Mobile Nodes

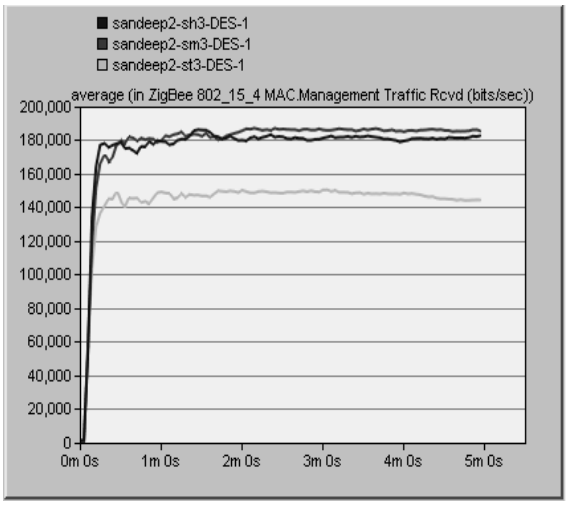

Fig. 13: MTR of Tree, Mesh and Hybrid Topologies with 10 m/sec Speed of Mobile Nodes

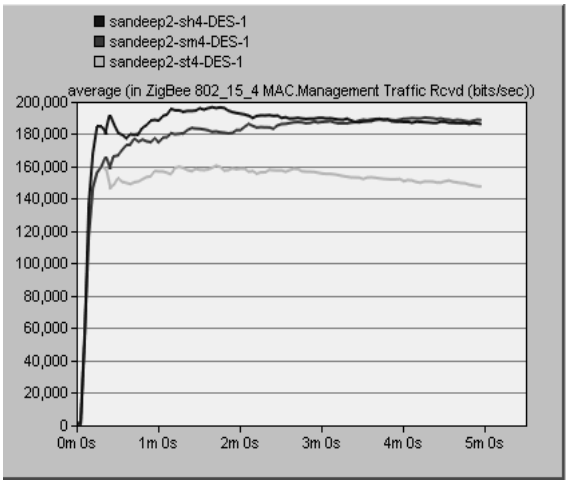

Fig. 14: MTR of Tree, Mesh and Hybrid Topologies with 15 m/sec Speed of Mobile Nodes

D. Management Traffic Send (MTS)

Case of 10m/s speed of mobile nodes MTR decreases then other cases.

These statistics record the total amount of management traffic (i.e., beacon and Block-ACK frames) transmitted by the network interface onto the physical medium. When these statistics are reported in units of bits/second, the physical and the MAC header sizes are included in the computation of the total amount of traffic sent. The results shown in Fig. 15, 16,17 and 18 conclude that mesh topology provides maximum MTS and tree topology provides minimum MTS. whereas hybrid topology provides effective MTS.

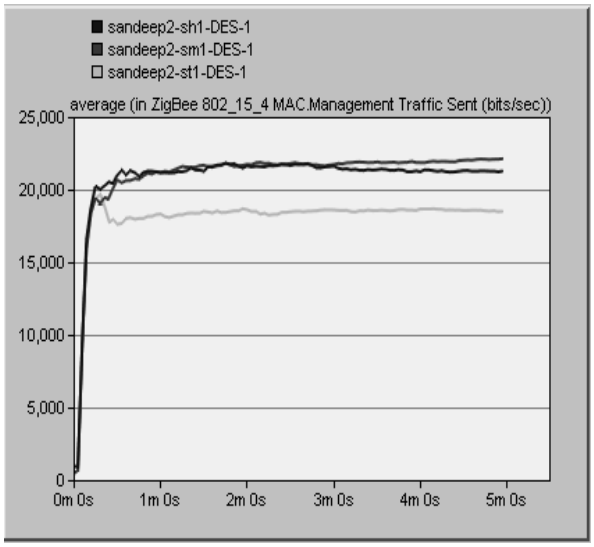

Fig. 15: MTS of Tree, Mesh and Hybrid Topologies with 2m/sec Speed of Mobile Nodes

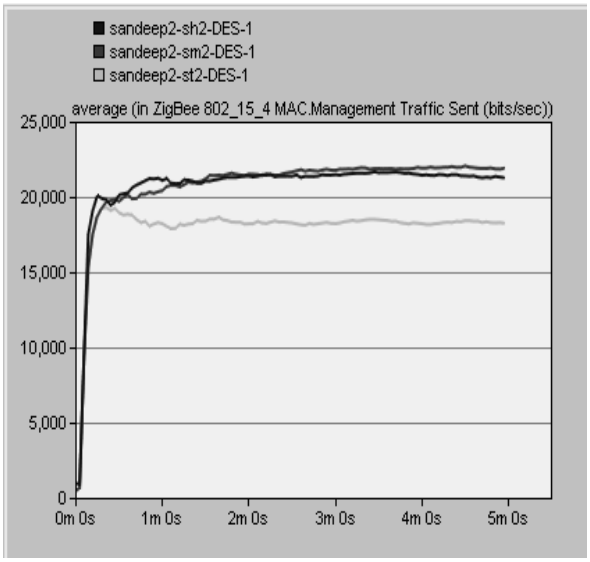

Fig. 16: MTS of Tree, Mesh and Hybrid Topologies with 5m/sec Speed of Mobile Nodes

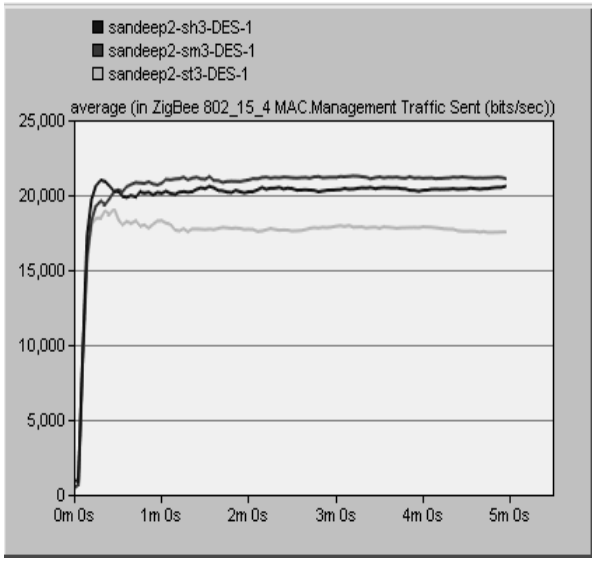

Fig. 17: MTS of Tree, Mesh and Hybrid Topologies with 10m/sec Speed of Mobile Nodes

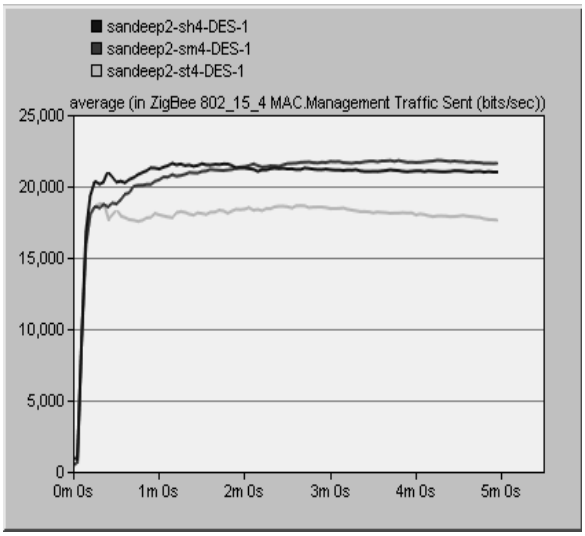

Fig. 18: MTS of Tree, Mesh and Hybrid Topologies with 15m/sec Speed of Mobile Nodes

VI. CONCLUSION

In this paper we have analysed the ZigBee/IEEE 802.15.4 standard using three topologies in ZigBee WSN Networks i.e. tree, mesh and hybrid topology. The simulation results shows that tree topology provide maximum throughput and mesh topology provide minimum throughput. In case of tree topology throughput increases as the speed of mobile nodes increases. Whereas in mesh topology throughput is same in all cases. In case of hybrid topology the throughput varies as speed of mobile nodes increases with very small increment value. The minimum MAC delay is provided by mesh topology whereas tree topology provides maximum MAC delay and speed of nodes does not affect MAC delay in case of hybrid topology. The maximum MTR is achieved by mesh topology and minimum MTR by tree topology. The effective MTR is achieved in hybrid topology. Same result is shown by three topologies in case of 2m/s,5 m/s and 15m/ whereas in case of 10m/s speed of mobile nodes MTR decreases then other cases. The maximum MTS is achieved by mesh topology and minimum MTS by tree topology. Whereas hybrid topology provides effective MTS. Hence hybrid topology also shows the effective response in case of mobility.

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Solution of Economic Load Dispatch Problem using Particle Swarm Optimization and Gravitational Search Algorithm

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***Abstract*—In this paper, Particle Swarm Optimization (PSO) and Gravitational Search Algorithm (GSA) have been proposed to find the optimal solution for constrained economic load dispatch (ELD) problems. Valve point loading effect is considered but transmission losses are neglected. PSO is a stochastic computational technique based on movement and intelligence of swarm. GSA is based on law of gravity and mass interactions to solve ELD. We use MATLAB R2013a to obtain the results. Then the comparison of both methods is done, the results reveal that GSA is easy to implement, converged with less execution time. GSA also provides highly optimal solution with minimum generation cost.**

Keywords: Gravitational Search Algorithm, Particle Swarm Optimization, Economic Load Dispatch, Valve Point Loading Effect

I. INTRODUCTION

An electric power system is an arrangement of electrical apparatus used to deliver, transmit and to utilize electric power and electric power systems are deliberate and operate to meet up the continuous dissimilarity in power demand. The well-organized optimal profitable procedure, conjecture of electric power generation system have always been occupied an important position in electric power industry. Electric energy is a large amount of flexible form of energy which is used to drive various domestic appliances in household and electrical equipment in industries. It is very compulsory to reduce the running cost of electrical energy. Hence, to generate the accurate quantity of power as demanded, meeting the entire losses is critical and it follows composite course of action. Optimal operation of the power system brings about a significant drop in the operating cost as well as in the amount of fuel consumed.

In practical power systems, the power plants are located at a distance from the load centers. Also the generating capacity of the power plants is more than that of the total load demand and the losses. Therefore, many techniques are used for scheduling generation. In an interconnected power system, the aim is to discover power scheduling of each power plant in such a way so as to minimize the operating cost. In this work, effect of the valve point loading is also considered while formulating economic load dispatch problem.

An efficient and optimum economic operation of electric power generation systems has always played an important role in the operation of the electric power line. Low fuel cost and authentic operation of power systems is desired for the available electricity generation resources to supply the load demand on the power system.

The economic dispatch problem (EDP) is related to the optimum generation scheduling of available generators in a power system to minimize total fuel cost while satisfying the load demand and operational constraints. EDP plays a vital role in operation planning and control of modern power systems. Over the last few years, a large number of approaches have been developed for solving EDP using classical mathematical programming methods. Classical methods require incremental cost curves to be monotonically increasing or piece - wise linear but the input/output characteristics of the modern units are highly non-linear (due to valve point effects, rate limits etc.). Also, classical optimization methods are sensitive to starting point and frequently converge to local optimization solution or diverge altogether. Linear programming methods are fast and reliable but suffers from the disadvantages associated with the piecewise linear cost approximation. Nonlinear programming methods suffer from the problem of convergence and algorithmic complexity. Therefore, stochastic search algorithms such as genetic algorithm (GA), Evolutionary programming (EP), Particle Swarm Optimization (PSO), Gravitational Search Algorithm (GSA) etc. prove to be efficient in solving non-linear ELD problem.

In this paper, PSO and GSA method has been proposed to solve economic dispatch problem with valve point effect for 3 unit test system. The results obtained with the proposed approaches were analyzed and compared. This paper is organized as follows:

Section 2 gives overview about economic load dispatch and valve point loading effect. In section 3, the problem formulation is presented. In section 4, the PSO technique is explained. In section 5, the concept and application of GSA is explained. The parameters settings for the test system to evaluate the performance of GSA and results are discussed in section 6.The conclusion are given in section 7.

II. ECONOMIC LOAD DISPATCH

In practical power systems, the power plants are located at a distance from the load centers. Also the generating capacity of the power plants is more than that of the total load demand and the losses. Therefore, many techniques are used for scheduling generation. In an interconnected power system, the aim is to discover power scheduling of each power plant in such a way so as to minimize the operating cost. This is known as "Economic Load Dispatch" problem.

Economic Dispatch (ED) optimization is the most important issue taken into consideration in power systems. The ED problem in power systems is to programme the power output for each devoted generator unit in such a way that the operating cost is minimized and at the same time, matching load demand, power operating limits and maintaining stability. The total generator operating cost includes fuel, labour, supplies and maintenance costs. We consider only fuel cost as the variable cost for simplicity since generally the costs of labour, supplies and maintenance are fixed percentages of the fuel cost. The EDP is to find the optimal combination of power generation that minimizes the total fuel cost while at thermal power units satisfying the total demand subjected to the operating constraints of a power system with a defined interval. The essential operation constraints are the power balance constraint, where the total generated power must be equals to the load demands plus the transmission losses on the electrical network, and the power limit constraints, where individual generator units must be operated within their specified range. For power balance, an equality constraint should be considered. The generated power should be the same as sum of the total load demand and the total line losses.

The modern power systems become very complex for the operation they perform. So in addition to insure the reliability of the power system it is essential to maintain frequency and voltage within the limits. To maintain the voltage and frequency within limits, it is necessary to match the active and reactive power of generating system with that of the load demand. To assure the reliability of power system, it is essential to place some extra generation capacity into the system on occurrence of the failure of the equipment of the substation. Over above, the most important point is to minimize the cost of electric supply. The whole interconnected network of power system is being controlled by the load dispatch centre. The load dispatch centre allots the MW generation to each grid depending upon the existing MW demand in that areas. The load dispatch centre also controls the load and frequency by matching generation with total needed demand plus losses. Thus, the job of the load dispatch centre is to interchange the power between various sectors maintaining the system frequency at desired value.

When multi-valve steam turbines are used for generating unit then it exhibits large variation in incremental fuel cost. The valve opening process produces large number of ripple like effect in heat curve and it looks like sine wave. These "valve point effects" are shown in Fig. 1.

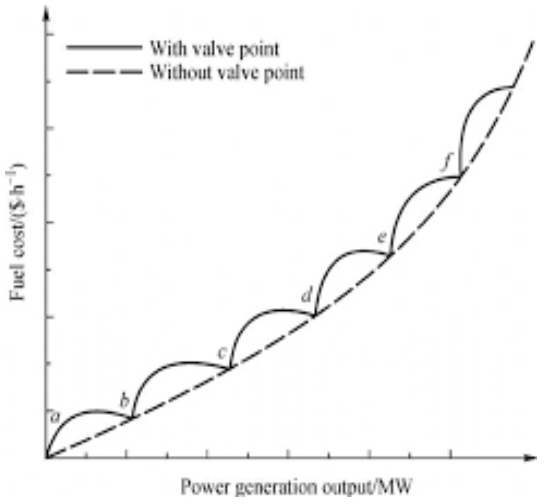

Fig. 1: Valve Point Loading Effect

III. PROBLEM FORMULATION

The main concept behind Economic Load Dispatch problem is to minimize the fuel cost of thermal power plants subject to operating constraints of a power system. The objective function is:

Minimize Operating cost

$$F_i(P_{Gi}) = \sum_{i=1}^{Ng}(a_i P_{Gi}^2 + b_i P_{Gi} + c_i) \text{ \$/h} \quad (1)$$

Subject to:

$$\sum_{i=1}^{Ng} P_{Gi} = \sum_{i=1}^{Nb} P_{Di} + P_{loss} \quad (2)$$

$$P_{Gi}^{min} \le P_{Gi} \le P_{Gi}^{max};\ i = 1, 2, \ldots, \text{Ng} \quad (3)$$

Where,

$F_i(P_{Gi})$- is operating fuel cost of i^{th} unit

P_{Gi}- is the decision variable, i.e. real power generation of the i^{th}generator

a_j, b_j, c_j- cost coefficients of i^{th} generator

P_{Gi}^{min}–Minimum limit of real power output of i^{th}unit

P_{Gi}^{min}–Maximum limit of real power output of i^{th}unit

P_{loss} −Real power transmission loss

The fuel cost function considering valve-point effects of generating unit are given by:

$$f_i(P_i) = a_i P_{Gi}^2 + b_i P_{Gi} + c_i + \left|d_i \sin(e_i (P_{i\,min} - P_i))\right| \quad (4)$$

d_i, e_i - cost coefficients of the i^{th} generating unit reflecting valve-point effects

Then economic load dispatch problem considering valve point effects will be re-defined as:

$$f_i(P_i) = a_i P_{Gi}^2 + b_i P_{Gi} + c_i + \left|d_i \sin(e_i (P_{i\,min} - P_i))\right| \quad (5)$$

Subject to:

$$\sum_{i=1}^{Ng} P_{Gi} = \sum_{i=1}^{Nb} P_{Di} + P_{loss}$$

$$P_{Gi}^{min} \le P_{Gi} \le P_{Gi}^{max};\ i = 1, 2, \ldots, \text{Ng}$$

IV. PARTICLE SWARM OPTIMIZATION TECHNIQUE

Particle swarm optimization (PSO) is a population based stochastic optimization technique developed by Eberhart and Kennedy in 1995, inspired by social behavior of bird flocking or fish schooling. This algorithm is initialized with a population of random solutions, called particles and then searches for optima by updating generations. In every iteration, each particle is updated by following two "best" values. The first one is the best solution (fitness) it has achieved so far. (The fitness value is also stored.) This value is called pbest. Another "best" value that is tracked by the particle swarm optimizer is the best value, obtained so far by any particle in the population. This best value is a global best and called g-best. When a particle takes part of the population as its topological neighbors, the best value is a local best and is called p-best. After finding the two best values, the particle updates its velocity and positions with following equation:

$V_i^{(u+1)} = w * V_i^{(u)} + C_1 * \text{rand}( ) * (\text{pbest}_i - P_i^{(u)}) + C_2 * \text{rand}( ) * (\text{gbest}_i - P_i^{(u)})$ (6)

$P_i^{(u+1)} = P_i^{(u)} + V_i^{(u+1)}$ (7)

In the above equation,

The term rand ( )*(pbest $_i$ -$P_i^{(u)}$) is called particle memory influence

The term rand ( )*(gbest_i -$P_i^{(u)}$) is called swarm influence.

$V_i^{(u)}$ which is the velocity of ith particle at iteration 'u' must lie in the range

$V_{min} \le V_i^{(u)} \le V_{max}$

- The parameter V_{max} determines the resolution, or fitness, with which regions are to be searched between the present position and the target position
- If V_{max} is too high, particles may fly past good solutions. If V_{min} is too small, particles may not explore sufficiently beyond local solutions.
- In many experiences with PSO, V_{max} was often set at 10-20% of the dynamic range on each dimension.
- The constants C1and C_2 pull each particle towards pbest and *gbest* positions.
- Low values allow particles to roam far from the target regions before being tugged back. On the other hand, high values result in abrupt movement towards, or past, target regions.
- Suitable selection of inertia weight '*w*' provides a balance between global and local explorations, thus requiring less iteration on average to find a sufficiently optimal solution.
- In general, the inertia weight *w* is set according to the following equation,

$$w = w_{max} - \left[\frac{w_{max} - w_{min}}{ITER_{max}}\right] * ITER \quad (8)$$

Where w -is the inertia weighting factor

W_{max} - maximum value of weighting factor

W_{min} - minimum value of weighting factor

$ITER_{max}$ - maximum number of iterations

ITER - current number of iteration

V. GRAVITATIONAL SEARCH ALGORITHM

GSA is a heuristic optimization algorithm which has been gaining interest among the scientific community recently. GSA is a nature inspired algorithm introduced by Rashedi *et al.*, in 2009 based on the Newton's law of gravity and the law of motion. GSA is grouped under the population based approach and is reported to be more intuitive. This algorithm is deliberate to improve the performance in the exploration and exploitation capabilities of a population based algorithm, based on gravity set of laws. So far, recently GSA has been criticized for not genuinely based on the law of gravity. GSA is reported to exclude the distance between masses in its formula, but mass and distance are equally integral parts of the act of gravity. Regardless of the criticism, this algorithm is still being explored and accepted by the scientific community. The inhabitants-based heuristic algorithm is based on the law of gravity and mass relations. The algorithm is comprised of gathering of searcher agents that interact with each other in the course of the gravity strength and the agents are considered as objects. Their performance is measured by their masses and the gravity forces cause a global movement where all objects move towards other objects with heavier masses. The time-consuming movements of heavier masses guarantee the exploitation step of the algorithm and correspond to good solutions.

$P_i = (p_{i,} \dots p_i^d, \dots, p_i^n)$, i = 1, 2 …m4.2

$p_i^d$is the position of the i^{th}mass in thed^{th} dimension. Where n is the dimension of the search space and at specific time 't' a gravitational force form mass j act on mass $i$and is given below:

$$F_{ij}^d(t) = G(t)\frac{M_{pi}(t) \times M_{\alpha j}(t)}{R_{ij}(t) + \epsilon}\left(p_j^d(t) - p_i^d(t)\right) \quad (9)$$

M_{pi} is the passive gravitational mass of thei^{th} agent and$M_{\alpha j}$ is the active gravitational mass of j^{th} agents. $G(t)$is the gravitational constant at time t and $R_{ij}(t)$is the Euclidian distance between the two objects $i$and$j$. ϵ is a small constant.

$$R_{ij}(t) = \|p_i(t), p_j(t)\|_2 \quad (10)$$

Now, the total force acting on the agent i in the dimension d is calculated as given below:

$$F_i^d(t) \sum_{j=ij\neq i}^{m} rand_j F_{ij}^d(t) \quad (11)$$

Here $rand_j$is a random number in the interval [0, 1].

According to the laws of motion, the acceleration of the agent i at time t in the dimension d,$\alpha_i^d(t)$is calculated as given below:

$$\alpha_i^d(t) = \frac{F_i^d(t)}{M_n(t)} \quad (12)$$

Moreover, the next velocity of an agent is a function of its current velocity added to its current

acceleration and the next velocity of an agent can be calculated as follows:

$$v_i^d(t+1) = rand_i pv_i^d(t) + \alpha_i^d(t) \quad (13)$$

Position of i^{th} agent in d-dimension can be calculated as

$$p_i^d(t+1) = p_i^d(t) + v_i^d(t+1) \quad (14)$$

Now, the gravitational constant, G, is initialized at the start and then it will be decreased with the time to control the search accuracy. Hence, we can say that G is function of the initial value of (G_0) and time t:

$$G(t) = G(G0, t) \quad (15)$$

$$G(t) = G_0 \exp(-\alpha^{\frac{t}{\bar{T}}}) \quad (16)$$

The masses of the agents are intended using fitness evaluation and a heavier mass means a well-organized agent. This means that superior agents have high attractions, moves more slowly and supposing the impartiality of the gravitational and inertia mass, the values of masses is calculated using map of fitness. The masses are updated using following equations:

$$m_i(t) = \frac{fit_i(t) - worst(t)}{best(t) - worst(t)} \quad (17)$$

$$M_i(t) = \frac{m_i(t)}{\sum_{j=1}^{m} m_j(t)} \quad (18)$$

Where $fit_i(t)$ is the fitness value of agent i at time t, and $best(t)$ and $worst(t)$ represents the strongest and the weakness of agents according to their fitness value.

For a minimization problem following equations are considered:

$$best(t) = \min_{j\in\{L,\cdots m\}} fit_j(t) \quad (19)$$

$$worst(t) = \max_{j\in\{L,\cdots m\}} fit_j(t) \quad (20)$$

For a maximization problem following equations are considered:

$$best(t) = \max_{j\in\{L,\cdots m\}} fit_j(t) \quad (21)$$

$$worst(t) = \min_{j\in\{L,\cdots m\}} fit_j(t) \quad (22)$$

Gravitational Search Algorithm based Economic Load Dispatch

This section provides the complete procedure to solve ELD through GSA.

1. *Initialization:* In the procedure, the candidate solution of each individual is randomly initialized within the range which is feasible such that it should satisfy the constraint given (1). Candidate's component is initialized as P_{it} ~ U (P_{imin},P_{imax}), where U isthe uniform distribution of variables whose range in the interval (P_{imin},P_{imax}).
2. *Fitness Evaluation:* The fitness evaluation in each one agent in the population set is evaluated using the eq. (1) and iteration count up from this step, t = 1. Now, update $G(t)$, best (t), worst (t), $Mi(t)$ for i = 1, 2…m.
3. *Force Calculation of Agent:* Agent*i*'s total force in dimension d is calculated by using eq. (9).
4. *Acceleration evaluation of each agent:* Agent's acceleration in d^{th} dimension over T dispatch period is evaluated using eq. (12).
5. *Agents' Position Updating:* Agent's next velocity is calculated by adding the agent's acceleration to the current velocity and also position of an agent will be updated.
6. *Stopping Criteria:* Steps 3 to 5 are repeated until the iterations reach their maximum limit. The best fitness value at the final iteration is computed as the global fitness while the position of the corresponding agent at specified dimensions is computed as the global solution of that particular problem.

VI. Test System and Results

The results obtained by GSA proved to be better than those obtained by PSO. We obtain the results by considering valve-point effects and without including transmission losses. The 3 unit test system is considered for study. Each proposed gravitational search algorithm and particle swarm optimization technique has been implemented in command line MATLAB R2013a for solution of economic load dispatch problem. The input data for 3 generator system is given in table 1. The maximum total power output of the generator is 850 MW.

The setup for the GSA algorithm is executed with no. of agents =100, Where G0 is set to 100, α is set to 10.

The setup for PSO algorithm is executed with no. of particles=100, where w^{min}=0.4,w^{max}=0.9,c_1 and c_2 =2.0.

Maximum iteration numbers are 100 for this case study.

TABLE 1: INPUT DATA FOR 3-UNIT SYSTEM

Generators	P_i^{min}	P_i^{max}	a_i	b_i	c_i	e_i	f_i
1	100	600	561	7.92	0.0016	300	0.032
2	50	200	78	7.92	0.0048	150	0.063
3	100	400	310	7.85	0.0019	200	0.042

TABLE 2: GENERATOR OUTPUT

Generator	Generator Output with PSO	Generator Output with GSA
1	357.90	477.48
2	76.81	82.62
3	359.06	289.88
Fuel Cost ($/h)	8312.9	8027.0

The convergence characteristics for three unit system using GSA Algorithm is shown in Fig. 2

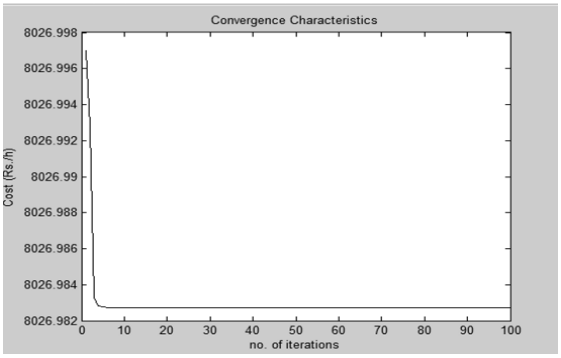

Fig. 2: Convergence Characteristics of 3 Generators with GSA Technique

VII. Conclusion and Future Scope

The use of new approach known as gravitational search algorithm to solve economic load dispatch problem is presented.PSO technique is also applied on the same data. The comparison study of the two methods shows that GSA has better solution in fulfilling the objective of ELD problem and has better convergence, good computation efficiency, robustness etc. Hence, the study shows that GSA can further be implemented when reactive power can be included, transmission losses taken into consideration etc.

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Synchronous Generator Protection using Different Techniques—A Review

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***Abstract*—This paper presents the protection against various types of fault occurring in Synchronous Generator. It describes the types of faults generally occurring in the Generator and there protection techniques using numerical algorithms and different literature surveys related to this. The fault occurs in the Generator causing very adverse effects on the system so the following techniques are being adopted generally artificial Neutral network(ANN) based Differential protection scheme used for Generator stator winding protection and many among other techniques like two negative MHO offset protection for LOE (LOSS OF EXCITATION) are being used.**

Keywords: Synchronous Generators, Protection Schemes, ANN, LOE, Internal or/ and External Faults

I. INTRODUCTION

In power system protection of generators is of utmost paramount. A Generator is subjected to various types of electrical and mechanical forces acting on the insulation and various parts of the machine which leads to rise in temperature. These are the main key point which makes the protection for the generator necessary. The devices used in Generator protection ensure the fault, made dead as quickly as possible. A Generator is subjected to either internal or external fault or both. The number and variety of faults occurring in Generator, are huge that is why Generator is protected with several protective schemes. The Generator protection is of both discriminative and non-discriminative. There are various types of faults occurring in the system related to Synchronous Generator like stator winding fault, inter turn, turn to turn fault, internal and external fault, among other faults which are being protected through techniques that are being reviewed in this paper Like Neutral network based fault detection techniques for Generator protection [1], Loss of-Excitation - Protection and Under excitation Controls Correlation for Synchronous Generators in a Real Time Digital Simulator [2], Two new methods for very fast fault type detection by means of parameter fitting and artificial neutral networks [3] and many more.

1. An Artificial neutral network fault detection analysis

a. The Technique using AAN based differential scheme for stator winding protection detailed in [1]. This scheme includes two feed forward neutral networks (FNN's) in which one AAN is used for fault detection and other for internal fault classification. The fundamental and/or second harmonic present in field current during fault help AAN, used for fault detection to differentiate between Generators states. The direction of negative sequence power flow at Generator terminal is used to differentiate between external and internal faults.

A. Simulation of Generator States

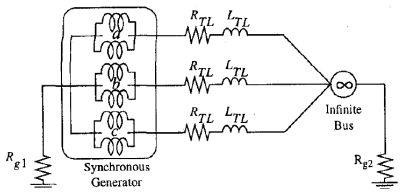

Fig. 1: System Representation of Simulated Model

Simulation is being performed using an electromagnetic transient program (EMPT) [16] build for Simulating three states of Generator (Normal operating state NOP, internal fault state IFS, external fault state EFS.

B. Design of Protection Scheme [10]

In these various modules are used but we discuss few important modules that are needed for the proposed scheme like CT's used at both ends of generator, analog input subsystem (line side currents & neutral end current), Analog interface, Memory, Fault detector module(ANN structure & training process), Trip logic module and Fault classifier module (FFNN fault classifier and fault classifier logic).

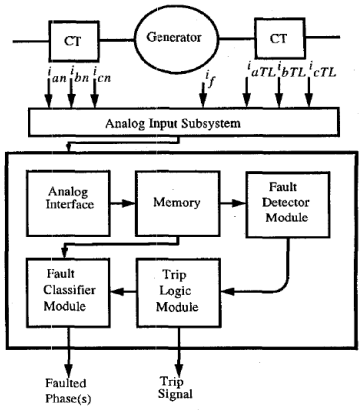

Fig. 2: Important Modules of the ANN based Protection Scheme

C. Test Results

Three different machine parameters were used to generate the training set to insure that the FNN is able to identify the three states for any generator. ANN's are difficult to account for and explain three results the only means of verifying the performance of a trained network is to perform extensive testing [12].

D. Conclusion

A new multi-neutral network [6] based digital differential protection is presented in these two tasks have been performed. First task is to differentiate between normal, external & internal conditions & the second task is to test the stator phases as faulty or healthy. In this fault detection is fast and more reliable.

2. Other AAN based Fault Detection Technique for Generator Windings Protection [2]
   b. This Paper Proposed Fault Detector for Generator Protection. The detector is an ANN based algorithms [12] fed with differences and average of the currents entering and leaving the generator winding. The detector is characterized with high sensitivity in discriminating winding ground fault as well as phase fault. Also, it has high stability for external faults.

E. Testing and Results

The proposed scheme was tested by subjecting it to 3 cases of different types of internal faults (L-L,L-L-L and L-G) covering full range of winding. Also given results in worst condition for the differential scheme and also tested under external fault conditions reveals stable operation against severe external fault case.

F. Comparison between the Proposed and Conventional Differential Algorithm

In proposed algorithm the mismatch of the characteristics of the CT's at both sides of the winding is simulated by adding current errors to the test pattern of external fault cases. Comparing both schemes from the point of view of sensitivity for internal faults reveals that an internal phase faults below 3% of the winding near neutral is not detected by conventional schemes [7].

G. Conclusion

The test results have revealed that higher stability region, for a wide range of CT's errors than that of conventional differential scheme is obtained.

3. Loss of excitation protection and under excitation controls correlation for synchronous generator in a real time digital simulator [3].
   c. When synchronous generator operates within low excitation levels, a first control action is taken by the under excitator limiter(UEL) which is the part of the excitation system[11], by pushing automatic voltage regulator(AVR) and as results the generator return to operate within safe values.

Beyond the control action provided by UEL, system must be equipped with protective relays (ANSI 40) to ensure the system will operate correctly. These relays should not operate for stable power swings or partial LOC [13].

   d. The study aims to provide insight about setting of the ANSI 40 protection and UEL limiter, In order to act in a coordinate and secure way. These study performed in a real time digital simulator (RTDS).

H. LOE Protection Concept

The LOE occurs when the magnetic field produced by the rotor winding is reduced due to the reduction of DC current in the rotor winding.

The under excitation of generator will result in an increase in current that circulate through the stator winding and a voltage drop across its terminals reducing impedance seen in machine terminals during abnormal conditions.

There are several LOE protection schemes [15] using the MHO distance characteristics. The most common methods are negative offset MHO elements, initially proposed by MASON & BERDY with positive offset MHO elements. Some literatures suggest two negative offset MHO impedance circles. Now focused on how to adjust the two offset MHO characteristics, with positive offset in the second zone for Generator protection under partial LOE.

I. Coordination between UEL & LOE Protection

The synchronous machine operation analysis within the under excitation region is done in the capability curve of the generator, build in P-Q diagram, like illustrated in Fig.1. However in cases which the machine operation analysis in this region require a study of LOE protection, it is necessary to represent the machine operation limits and the relay MHO characteristic in the same plan, either in P-Q or R-X plan. For this, it is necessary to establish the equations to coordinate the points represented in both planes.

where R,X,P,Q and V are resistance, reactance, active power, reactive power and line voltage, respectively Fig. 2 shows an example of R-X plane and protection adjusts coordinated with the values of P-Q curve reflected in this plane.

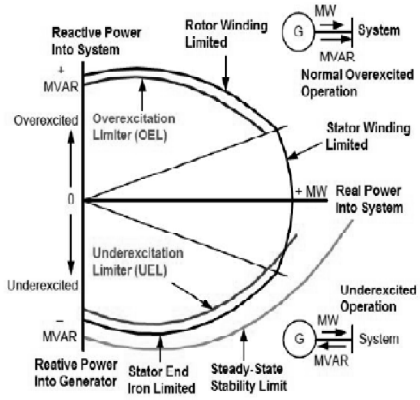

Fig. 3: Typical Generator Capability Curves and Operating Limits

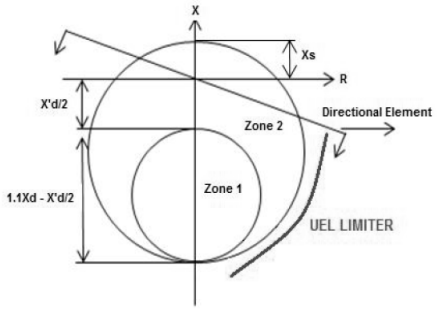

Fig. 2

J. Conclusion

From the results obtained, it was found that the relay under test presented a satisfactory response for the protection adopted, offset-positive MHO characteristic, against the partial and total loss-of-excitation for the synchronous machine analyzed.

However, it is noted that the under excitation limit (UEL) was properly coordinated with the LOE protection settings in the same plane, so that there was not operational conflict between them, as proven in the simulated results [3].

II. CONCLUSION

From the above techniques it is reviewed that

- Generators should be protected from electrical faults [10], as well mechanical faults in adverse conditions so some faults require immediate attention [4].
  - Multi-neural network based digital Differential protection scheme is presented in this paper in which fault detection is fast and reliable [5]. It can be used in an era of very high speed digital relays.
  - An artificial neural network technique valid for stator windings of Generator fault has been viewed [8]. This scheme has given precise detection of various internal phase and ground faults. Also it has higher stability region for protection against external faults.
- Offset-positive MHO characteristic for partial and total loss-of-excitation analyzed that the under excitation limit (UEL) was correctly coordinated with the LOE protection settings in the same plane obtained in simulation results as given in reviewed papers.

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Distributed Generation: Rising Dawn to Modern India

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***Abstract*—From the day of independence till twenty first century India has made a great revolution in the power sector. Starting from the State grids, then regional grids and now progressing toward national grids with transmission voltage going from 132kv upto 720kv in AC system and ±500kv in DC system. The further development resulted in the unbundling of power sector into transmission, distribution and generation entities, enabling private producers to take part in this as distinct entities. This distributed utilities use both renewable and non-renewable resources to achieve its goals to provide electricity in the vicinity of its generation site. Distributed generation is therefore a term use for the decentralized generation or to supplement the generation into the already existing system. The purpose of this paper is to discuss about the basic plans made by the state or Indian government to provide electricity through distributed generation to those remote villages/hamlets which do not have access from the power grids. Today, it is accounting significantly 9% of the total power generation. The major benefits of Distributed generation include line loss reduction, voltage support, environmental impacts, and increased overall efficiency. These benefits are not only limited to utility but also to the consumer as the energy is available at lowest price to them. In this paper, analyses is made about the initiatives and achievements made by Indian government so far using renewable resources as a distributed generation to encourage Rural Electrification.**

Keywords: Decentralized Distributed Generation, Renewable energy resources, Co-generation, captive generation, turbines.

I. INTRODUCTION

India started its journey towards electrical power and energy in 1947 after independence. Based on the five-year plan strategy and priorities defined, initially with the decision taken for rapid industrialization, mechanized agriculture, irrigation, etc., number of river-valley hydro-projects came into existence, like, under Damodar Valley Corporation, Bhakra-Beas Management Board with the concerned states joining the effort with Central Government [1]. And there side by side, to a limited extent private sector remained as such as, Tata Electric Company in and around Bombay, Calcutta Electric Supply Corporation, Ahmedabad Electric Company, to name a few larger ones. But late fifties and sixties saw consolidation and evolution of state grids with the formation of state electricity boards. Transmission voltage too went up to 220 kV and generating unit size crossed 100 MW. By end seventies long distance AC transmission line came within the states or sometime even beyond at 400 kV with unit of rating 210 MW for thermal and 165 MW for hydro units, as in the case of Dehar hydroelectric power station. To utilize optimally the resources available at various regions of the country, national grid is under formation. Already four regional grids, namely, Northeast-North-East-West, forming NEW grid, are in synchronous operation with Southern in asynchronous HVDC (High Voltage Direct Current) mode of interconnection. With this development there came unbundling of power sector in ninties to distinctive generation, transmission and distribution entities, enabling in a large scale private entrepreneurs to take part independently or under joint venture with public sector utilities. To the system also available is the surplus capacity of the industries having captive generation or co-generation. New and renewable type of generation, mostly from wind turbine in specific areas is also feeding in a huge manner to the nearest point in the grid. The input from such source is also now quite significant with an attained level of 9%, quoting Monthly Review of Power Sector published by Central Electricity Authority, corresponding to end-October 2008 [2].The private producers are entitled to put their load center based generating units to supplement their supply to consumers and also depending upon competitive pricing may make choice of receiving power at different part of the day from even a remote generation using a carrier transmission system as permitted under open access by the Central Electricity Regulatory Commission [3].

II. DISTRIBUTED GENERATION

Distributed Generation (DG) is also known as on-site generation, dispersed generation, embedded generation, decentralized generation, etc. It is generally agreed upon that any electric power production technology which combined within distribution systems fits under the distributed generation. The terms “distributed” and “dispersed” are used interchangeably. It varies from country to country. Over the last century, be it developed nation or developing nation, on account of rapid industrialization causing high rate of growth in the demand for electricity, everyone resorted to establishment of large scale centralized generation facility. Distributed Generation is a method, particularly

when unbundling of power sector has come up with generation, transmission, and distribution recognized as distinct entities. Low capital investment, local use of generated power by the load, absence of any high voltage transmission system, etc. lead to developing rapidly of this type of decentralized generation. Advancement of technology with renewable energy sources, gradual reduction in cost, ease of operation and maintainability, etc., all go in favor of Distributed Generation as source of green power. Also if it is not as replacement to centralized large generation, it is at least to supplement the entire effort of generating capacity addition to a great extent.

III. Benefits of Distributed Generation

The basic benefit of distributed or dispersed or decentralized generation is the following:

1. Easy and quicker installation on account of prefabricated standardized components.
2. Lowering of cost by avoiding long distance high voltage transmission.
3. Environment friendly where renewable sources are used.
4. Running cost more or less constant over the period of time with the use of renewable sources.
5. Possibility of user-operator participation due to lesser complexity.
6. More dependability with simple construction, and consequent easy operation and maintenance.

IV. Basic Policy and Perspective Planning

Quoting National Electricity Policy [4] in India for reliable rural electrification system creation of the following has been assumed with a good amount of dependence on Distributed Generation wherever grid supply is not possible or feasible. Decentralized Distributed Generation (DDG) facilities together with isolated and independent local distribution network would be provided so that every household gets access to electricity. This would be done either through conventional or non-conventional methods of electricity generation as per suitability and being economical. Non-conventional sources of energy could also be utilized even where grid connectivity exists provided it is found to be cost effective. Similarly as per provision in the Electricity Act, 2003 [5] setting up of captive power plant under Distributed Generation is not only for securing reliable, quality and cost effective power but also to facilitate creation of employment opportunities through speedy and efficient growth of industry. This enabling provision is primarily aimed at permitting small and medium industries or other consumers who may not individually be in a position to set up plant of optimal size in a cost effective manner, to take advantage.

Further as per Ministry of Power, Government of India following is worth noting for perspective plan again in the Context of rural electricity supply [6].

For a large and dispersed rural country as India, decentralized power generation systems, with electricity generated at consumer end and thereby avoiding transmission and distribution costs, offers a better solution. The main Recommendations of the Gokak Committee [7] in this regard are:

- The concept of Distributed Generation (DG) has been taken as decentralized generation and distribution of power especially in the rural areas. In India, the deregulation of the power sector has not made much headway but the problem of T & D (Transmission & Distribution) losses, the unreliability of the grid and the problem of remote and inaccessible regions have provoked the debate on the subject.
- The DG technologies in India relate to turbines, micro turbines, wind turbines, biomass, and gasification of biomass, solar photovoltaic cells and hybrid systems. However, most of the decentralized plants are based on wind power, hydro power and biomass, and biomass gasification. The technology of Solar Photo Voltaic (SPV) cells is costly and fuel cells are yet to be commercialized.
- The 18,000 villages in remote and inaccessible areas are related to the extension of grid power is not going to be economical. Decentralized plants based on biomass, gasification of biomass, hydropower, solar thermal power, and SPV cells are the appropriate solution for these areas. A decision with regard to the available options will have to be taken depending on the feature of each site / village.
- As regards the remaining non-electrified villages, the responsibility rests primarily with the State Governments. The Government of India would, however, act as the facilitator to them.
- As people in many of the electrified villages are not much satisfied with the quality of grid power, such villages are also encouraged to go ahead with the Distributed Generation Schemes. These should also be the responsibility of the State Governments.
- Though India has made considerable progress in adopting technologies based on renewable sources of energy, these are not yet capable of commercial application on a large scale.
- Association of Village Panchayat (elected body to administer) with Village Level Committees (VLCs) is important for the success of the program.

V. ACHIEVEMENTS MADE BY GOVERNMENT OF INDIA AND INITIATIVE FOR DDG

With the aim of economic development all round, when 80% of population in India lives in rural sector, availability of energy in some form or other to them along with its proper management with high level of efficiency definitely calls for local self-sufficiency in terms of generation matching demand. In general under Distributed Generation embedded nonrenewable applications include also internal combustion engines using diesel, natural gas, etc. In the renewable front options are with wind, SPV cells, geo-thermal, biomass gasification, co-generation with bagasse, etc. The cost of generation of unit of electricity in most of the cases is dependent on load factor and other relevant issues. While gas engines and bagasse-based co-generation (latter particularly with sugar mill industry) have been most cost-effective, Distributed Generation with wind turbine and biomass gasification plant has proved to be capable under certain conditions only [8]. With the achievements in India and projection are concerned, from 9% at present (by end-October 2008 with installed capacity of 13,242 MW against a total of 146,753 MW) [2], it is hoped that Distributed Generation may go up to 10% or so by 2012 when 'Electricity for All' is all assumed [9]. In this regard it is worthwhile to mention that National Thermal Power Corporation (NTPC), a public sector utility of Government of India, has formulated a business model with cooperative journey, termed as "Village Energy Committee"(VEC) so that it operates successfully with proper management of investment and return thereof. Maximum Utilization of local renewable resources, like biomass, SPV cells, micro-hydel on streams, bio-diesel, etc., training and capacity building of local community to operate and maintain have been stressed.

Still NTPC has formulated its business plan of capacity addition of about 1,000 MW through renewable resources. Some of the important moves it has taken in this respect are mostly in and around its existing super thermal power stations in terms of mini-hydro plants, wind farms, solar plants, and biomass, bio-fuel, and geo-thermal based power plants [10].

So the major contribution would be from wind and hydro.

In fact two Ministries of Government of India are involved in the overall progress of Distributed Generation. While Ministry of Power (MOP) is interested for rural electrification, Ministry of New and Renewable Energy (MNRE) is for the development of DG, thus fulfilling the need of each other. Recently MOP has started Extensive village electrification through Distributed Generation under a Scheme of Rural Electricity Infrastructure and Household Electrification, known as Rajiv Gandhi Grameen Vidyutikaran Yojana (Rajiv Gandhi Rural Electrification Scheme) or in short RGGVY [11]. This is for attaining the goal of providing access to electricity to all households, electrification of about 0.115 million which are not electrified villages and electricity connections to 23.4 million households by 2009.

The DDG projects would be owned by State Government. Implementing agencies of the projects shall be either the State Renewable Energy Development Agencies (SREDAs) / departments promoting renewable energy or the State Utilities or the identified Central Public Sector Undertakings (CPSUs). The State Governments will decide the implementing agency for their respective states. The projects under the scheme will be subject to Quality Monitoring Mechanism.

Location, i.e., selection of villages / hamlets would essentially be based on various criteria, like:

- The effort and investment that goes into setting up of DDGs are utilized for the benefit of the target groups and do not become sunk investment once the village is being connected to the grid and that is sufficient intented and support of the local community for this starting.
- The list of villages / hamlets to be electrified through DDG is to be finalized by the State Renewable Energy Development Agency / departments promoting renewable energy in deliberation with state utilities and MNRE.
- Villages / hamlets that incorporate with migratory/floating population may not be considered.
- While finalizing the list, the villages / hamlets are to be prioritized and those villages where grid connectivity is not foreseen in next 5 to 7 years are to be taken up first for setting up DDG projects.
- Villages / hamlets having population of less than 100 shall not be considered under the DDG Scheme and are to be taken up by MNRE for implementation.
- Villages / hamlets that have been provided with solar home lighting systems under the Remote Village Electrification program can also be considered under the DDG scheme (of course depending upon feasibility).

The choice of technology would depend on the appropriateness of the related technology for specific villages / hamlets. Since the DDG projects to be implemented are to be scalable and undertaken within a relatively stiff timeline, options are being considered keeping in mind that the technologies have either reached a stage of commercial maturity or their technical viability is proven under actual field conditions. A list of such options as given below:

- Diesel Generating sets powered by bio-fuels (non edible vegetable oils, like, Jatropha, Pongamia, etc)
- Diesel Generating sets powered by producer gas generated through biomass gasification (100 % producer gas engines)
- Solar Photo Voltaic (SPV) Cells
- Small Hydro

It may be noted that the above list is based on the technologies that are presently being employed and are the preferred options to be considered only where project design includes dedicated energy plantations to ensure sustainable biomass supply for decentralized power generation.

On the other hand Ministry of New and Renewable Energy (MNRE) too has aimed [12] at least 10 per cent power generation installed capacity in the country, with 4 to 5 percent share in the mix, coming from renewable. Out of the overall target of 78,000 MW installed capacity addition in power generation during the *eleventh* plan period, 14,500 MW (little less than 20%) is proposed from renewable. 13,500 MW will be grid connected and 1,000 MW stand-alone (of kW to MW range) with DG Power of 4000 to 5000 MW (2 to 5 MW each) from conventional energy sources. Of course MNRE for Distributed Generation is relying on installation and operation of electric power generation units connected to the local network or off grid generation typically characterized by capacity ranging from kW to MW level with generation at distribution voltages (11kV or below) only. It includes captive plants too.

Under Remote Village Electrification Program villages where grid extension are not feasible, are being attempted to be electrified through locally available renewable energy sources to meet the requirement of electrification. About 6750 villages / hamlets have been sanctioned to be covered mainly through SPV cells. REC on the other hand has identified about 6000 such remote villages / hamlets. It has been reported that about 38 villages have been electrified through 20 biomass gasifier systems in the range of 20 to 500KW.

Ministry of New and Renewable Energy, however, feels that there exist challenges for Renewable Energy based Distributed Generation, some of which are universal and some local, like:

- Inherent intermittent nature of renewable energy sources leading to relatively lower capacity utilization factors.
- Instances of inadequate load needing to couple rural industrial load.
- Relatively high capital costs when compared to conventional power systems which in turn require incentives and financial arrangement.
- For capacity building, promotion and development of energy.
- Requirement of servicing companies for local program implementation.
- Need for adequate mobilization for payment of user charges involving perhaps Non-Government Organizations and local bodies.
- Need for developing sustainable revenue / business models.
- Assistance for project preparation.
- Establishment of sustainable fuel linkages including Fuel Service Agreement.

VI. CONCLUSION

India is moving on right track for development of Distributed Generation with the unbundling of power sector utilities. Efforts has also been made to harness energy from co-generation and various other renewable resources. Private entrepreneurs, big private industries have shown a keen interest to participate in the development of power sector and to access the electricity to all remote villages. Despite of all the challenges, Indian government along with all other regulatory bodies trying its best to achieve their goal in this direction and to provide electricity to all by 2020.

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Software Defined Networking: A New Approach towards Networking

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***Abstract*—Software defined networking is a new approach towards networking. It is a way by which different network administrators can manage networks easily through abstraction of lower level functionality. It is basically programmable networking SDN is a concept that includes programming with networking that helps in making networking a much easier task. This paper includes overview and structure of SDN, its applications in different fields and various challenges and issues that need to be addressed and future directions for it.**

Keywords: SDN, Openflow, Control Plane, Data Plane

I. INTRODUCTION

Computer networks are built from large number of devices that are specialized in different fields like hub, switch, router, firewall, loadbalancer etc. but these devices are really costlier for example CISCO routers can range up to 5 lakh rupees. These devices were tightly coupled as they contained data plane and control plane together in that device but in sdn (software defined networking) these costs can be removed as we can have a dumb device (datapath) and program it to get any of the devices like switch, router, firewall, loadbalancer etc. but as we have control plane also known as ios (internetworking operating system) or NOS (networking operating system) and data path differently (loosely coupled) but there will be a problem of communication between control plane and data plane, so in order for them to communicate there are some protocol available such as Openflow, netflow, sflow etc. which helps in communication between ios and datapath.

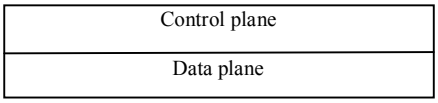

Fig. 1: Tightly Coupled Device (Traditional Approach)

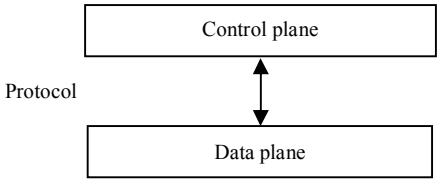

Fig. 2: Decoupled Device (SDN Approach)

The idea of "programmable networking" has been proposed as a way to facilitate network evolution. It promises to dramatically simplify networking and enable innovation and evolution. SDN is currently getting a lot of attention from academic and industry fields. The field of SDN is quite recent and is growing at impulsive speed but there are lot of research challenges and issues to be addressed. This paper is organized as follows in section 2 we will address the structure of SDN, in section 3 we will talk about applications of SDN and in section 4 we will talk about issues and challenges to be addressed.

II. SDN STRUCTURE

SDN is a structure purporting to be manageable, adaptive, and cost effective. SDN structure decouples data plane and decision making plane (control plane) making control plane to be readily programmable according to the need. Openflow is the foundational protocol used for communication between these two planes. SDN structure consists of sdn controller, sdn application and openflow enabled switch (datapath).

A. SDN Controller

SDN controller is basically a control plane that is decoupled from data plane. It interacts with sdn application via northbound interface and with datapath via southbound interface. There are many sdn controllers available such as NOX, POX, RYU, floodlight, opendaylight, trema, pyretic, frenetic, procera, routeflow etc. These controllers are all free and open source. Sdn controller is logically centralized entity that is in charge for interaction between datapath and sdn application. This controller consists of control logic.

B. SDN Application

SDN applications are programs that explicitly, programmatically communicate their network requirements with sdn controller via northbound interface [2]. SDN applications consist of sdn application logic. This application that is programmed can make a dumb device (datapath) work like a specialized network device for example if application is programmed to be a firewall, datapath will work like firewall. If it is programmed to be a loadbalancer datapath will work like a loadbalancer. So it is really important part of structure as it makes a datapath what it is. These applications depend upon programming.

C. SDN Datapath

SDN datapath is basically a dumb device that gives control to controller. It interacts with controller via southbound interface. Various hosts systems, nodes are attached to this datapath and they forward their traffic to this datapath and then datapath sends it to the sdn controller and it replies according to the programmed applications logic.

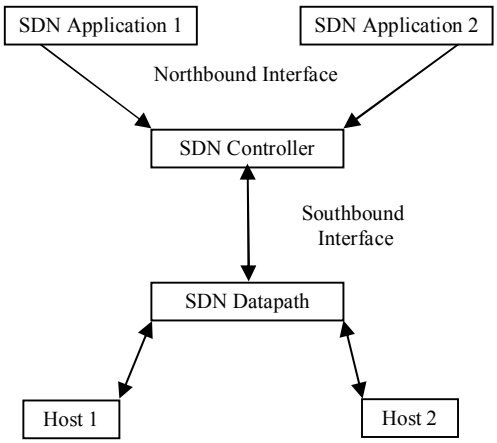

Fig. 2: SDN Structure

III. SDN APPLICATIONS

Software-defined networking has applications in wide variety of network environments. By decoupling control planes and data planes programmable networks enable customized controls, an opportunity to remove middleboxes and simplified development of new protocols in networking. Below given are some of applications of SDN

A. Enterprise Network

Enterprises often run large networks while having have high security requirements. Also different enterprises have different needs and requirements. For example university networks can be considered a special case of enterprise networking in such an environment many nodes are temporary and they have high security requirements [2]. SDN can be used in these cases for easily managing the network systems and also for creating their own new policies as required and also helping them in getting rid of middleware.

B. Data Centers

Data centers have evolved at amazing pace in recent years but increasing important challenge is energy consumption which has non-trivial costs. Heller [3] indicates that much research has been focused on improved servers and cooling (70% of total energy) through better hardware or software management, but the data center's network infrastructure (which accounts for10-20% of the total energy cost) still consumed 3 billion kWh in 2006. They proposed Elastic Tree, a network-wide power manager that utilizes SDN to find the minimum-power network subset which satisfies current traffic conditions and turns off switches that are not needed.

C. Home and Small Business

Several projects have examined how SDN could be used in smaller networks, such as those found in the home or small businesses. As these environments have become increasingly complex and prevalent with the widespread availability of low-cost network devices, the need for more careful network management and tighter security has correspondingly increased. Mortier [1] believe that users desire greater understanding and control over their networks' behavior; rather than following traditional policies, a home network may be better managed by their users who better understand the dynamics and needs of their environment. Towards this goal, they created a prototype network in which SDN is used to provide users a view into how their network is being utilized while offering a single point of control.

IV. CHALLENGES AND FUTURE RECOMMENDATIONS

SDN is spreading and being widely used and its protocols such as openflow there are some issues and challenges that arise that need to be looked. In this part of paper we will discuss various challenges that come along side of SDN such as (1) controller and switch design (2) heterogeneous network support

A. Controller and Switch Design

In more recent work on distributed control, the need for dynamic assignment of switches to controllers is addressed in [4], which proposes an algorithm to increase or decrease the pool of controllers based on controllers' load estimates. They also propose a mechanism to dynamically handover switches from one controller to another as needed. Devoflow [5] proposes to handle "short-lived "flows in switches and "long-lived" flows in the controller to mitigate flow setup delay and controller overhead.

B. Heterogeneous Network Support

The network technologies are changing day by day from wired, infrastructure based wireless to infrastructure less wireless network system [2]. Now a days there has been increase in mobile traffic as number of users are increasing day by day. Self–organized networks are increasing and they are providing us services like cloud services, vehicular communication, but they still lack in dedicated resources.

SDN is type of networking that provides network administrators with resource utilization and higher efficiency in a centralized manner for infrastructure

based networks on the contrary infrastructure less networks present delay, disruption and decentralization. Other studies have tried to incorporate openflow in mesh networks [6]

V. CONCLUSION

In this paper, we have enlightened upon newly emerging field called software defined networking (SDN). We have looked at how sdn is different from other networks and we have also looked at its structure. We have also described about different applications of SDN. We have also taken brief view at various challenges and issues. This paper concludes with discussion of future approach of heterogeneous networks alongside SDN.

ACKNOWLEDGEMENTS

The authors would like to thank Mr. Vipin Gupta from U-Net Solutions, Moga, India for his valuable assistance for this work.

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Voltage Profile Enhancement of Distribution Networks using PSO Approach

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***Abstract*—This paper proposes the particle swarm optimization (PSO) technique to find the optimal placement of multiple capacitors in the radial distribution networks for enhancement in voltage profile of the distribution networks. The capacitors have been widely used in power system to reduce the power losses, improve the voltage sag, and increase the distribution feeder capacity. Capacitors provide reactive power required to low power factor loads, thereby decreasing the line current that reduces the active power loss of the line. The optimal size and location of capacitors are determined using the exact loss formula to minimize the distribution loss. The proposed technique is tested on standard 33-bus test system.**

Keywords: Capacitor, Optimal Size, Optimal Location, Power Loss, PSO

I. INTRODUCTION

Distributed generation has gained a lot of importance in the field of power sector due to its high efficiency, small size, low investment cost, and most significantly, its ability to exploit renewable energy resources. This concept of installing DG near to the load centers has been there for last few decades. However, with the creation of retail electricity markets and pressure laid on all the countries to encourage renewable energy sources such as: wind turbines, solar photo voltaic, biomass gasifier and non-renewable sources such as: internal combustion engine, fuel cell and micro turbine etc. One important benefit of DG and capacitor integration in the network is to avoid transmission and distribution line expansions. The placement of these also improves the voltage profile and minimizing line losses of the system [1]. The capacitor placement problem could naturally be formulated as a mixed integer optimization problem. Various algorithms are used to solve the problem. For example, heuristic constructive algorithm has been presented in [2], in which the integer variables are represented by sigmoid function. Another heuristic method has been adopted to obtain a near optimal solution for realistic sized systems, with an objective of minimizing harmonic levels, losses and capacitor costs [3]. This method has been extended to take unbalanced load into consideration in [4]. Ant colony search algorithm has been used in [5] to study the optimal placement of capacitor as well as the optimal feeder reconfiguration problem in the distribution system. Various objectives have been proposed for the optimal placement of capacitor. The objective function of minimizing the economic cost subject to voltage limits, sizes of installed capacitors at each bus, and power quality limits of harmonics has been considered in [6]. The impacts of capacitor placement on distribution system reliability have been considered in [7] by defining two objective functions. The first one is the sum of reliability cost and investment cost, and the second one is the sum of reliability cost, cost of losses and investment cost. Mixed integer non-linear programming has been suggested by D. O. Leonardo *et al*. [8] for capacitor placement as well as for reconfiguration in order to achieve the objective of minimum energy loss operation of a radial distribution network. M.A.S. Masoum *et al*. [9] applied GA to minimize the cost of power loss and capacitor bank. The solution has been achieved considering various constraints like voltage limit, number and size of capacitors. Baran and Wu [10] presented a method using mixed integer programming for the optimal placement of capacitor. Various other artificial intelligence techniques such as fuzzy logic, PSO and ant colony optimizations have also been used as tools for solving optimal capacitor allocation [11, 12and 163] to minimize the system loss, improvement in voltage profiles and other economic benefits. Recently, S.P. Singh *et al*. [12] employed the optimal placement of capacitors both switched and variable in the distribution system to minimize the real power loss and maximize the saving using PSO technique.

Most of the approaches presented so far model the optimal placement of single or multiple capacitors to minimize the losses only. However optimal placement of multiple capacitors being integrated into distribution systems to enhance the voltage profile of distribution networks by the application of PSO based technique.

The paper is organized as follows: Section II presents brief summary of location and sizing issue for reduction of line losses and improvement of voltage profile. Proposed PSO technique for optimal sizing of Capacitors at optimal locations is introduced in section

III. Section IV presents the numerical results of the proposed approach, interesting observations along with discussions. Finally, the major contribution and conclusions are summarized in section V.

II. Proposed Methodology

A. Optimal Sizing of Capacitor

The total power losses will be formulated as based on real power loss in the system is given by (1).This formula is popularly referred as "Exact Loss" formula [13].

$$Min\, P_L = \sum_{i=1}^{N}\sum_{j=1}^{N}\left[\alpha_{ij}\left(P_iP_j + Q_iQ_j\right) + \beta_{ij}\left(Q_iP_j + P_iQ_j\right)\right] \quad (1)$$

Where,

$$\alpha_{ij} = \frac{R_{ij}}{V_iV_j}Cos\left(\delta_i - \delta_j\right)$$

$$\beta_{ij} = \frac{R_{ij}}{V_iV_j}Sin\left(\delta_i - \delta_j\right)$$

and

$Z_{ij} = r_{ij} + jx_{ij}$ are the ij^{th} element of [*Zbus*] matrix

$P_i = P_{Gi} - P_{Di}$ and $Q_i = Q_{Gi} - Q_{Di}$

P_{Gi} & Q_{Gi} are power injection of generators to bus

P_{Di} & Q_{Di} are the loads.

P_i & Q_i are active and reactive power of the buses.

B. Objective Function

The objective is to determine the optimum size and location of capacitor to improve the voltage profiles and minimization of line losses of the networks using (1) while meeting the following constraints.

- The network power flow equation must be satisfied.
- The American National Standards Institute (ANSI) standard C84.1-1989 has stipulated that voltage variations in a distribution system should be controlled within the range of-13% to 7% [14],

$$V_{\min} \le V_i \le V_{\max}\ \forall_i \in \{\, buses\ of\ the\ networks\ \} \quad (2)$$

III. Particle Swarm Optimization Technique

The Particle Swarm Optimization (PSO) algorithm is one of the Evolutionary Computation (EC) techniques. PSO is a population based and self-adaptive technique introduced originally by Kennedy and Eberhart in 1995 [15]. This stochastic-based algorithm handles a population of a multidimensional space where the optimal solution is searched. The individuals are called particles and the population is called a swarm. Each particle in the swarm moves towards the optimal point with adaptive velocity. Each particle in the population is treated as a mass-less and volume-less point in a *n*-dimensional space.

This modification can be represented by the concept of velocity. Velocity of each agent can be modified by the following equation:

$$v_{id}^{k+1} = \omega v_{id}^{k} + c_1 rand \times \left(pbest_{id} - s_{id}^{k}\right) + c_2 rand \times \left(gbest_{id} - s_{id}^{k}\right) \quad (3)$$

Using the above equation, a certain velocity, which gradually gets close to p*best* and g*best* can be calculated. The current position (searching point in the solution space) can be modified by the following equation:

$$S_{id}^{k+1} = S_{id}^{k} + v_{id}^{k+1}, \quad i = 1,2,3,....n,\ and\ d = 1,2,3,.....m. \quad (4)$$

The following weight function is used:

$$\omega_i = \omega_{\max} - \frac{\omega_{\max} - \omega_{\min}}{k_{\max}}.k \quad (5)$$

Where,

ω_{min} and ω_{max} are the minimum and maximum weights respectively. k and $k_{\max}$ are the current and maximum iteration. Appropriate value ranges for C_1 and C_2 are 1 to 2, but 2 is the most appropriate in many cases. Appropriate values for ω_{min} and ω_{max} are 0.4 and 0.9 [16] respectively.

The position and velocity of the i^{th} particle has been considered as X_i and V_i respectively, these values are initialized according to (4) and (3), i.e., randomly generates an initial population (array) of particles with random positions and velocities on dimensions (Locations of Capacitors, Sizes of Capacitors) in the solution space. For single capacitor placement, the dimensions of search space of the particle will be 2, i.e. [1x2]. The first column represents the location and second column represents the size of capacitor. For two Capacitor placements, the dimension of search space of the particle will be 4, i.e. [1x4]. The first two column will represents the Capacitor locations and third and fourth column represents the Capacitor sizes respectively and so on. In this work, the numbers of particle are taken 10 and number of iteration is taken as 500 in the present work. Evaluate the minimum real power loss with specified number of Capacitors and find the fitness value. PSO is a meta heuristic as it makes few or no assumptions about the problem being optimized and can search very large spaces of candidate solutions. Fig.1 illustrates the flow chart for the optimal placement of Capacitors in the distribution system through applying PSO. The bus no.1 is taken as reference bus.

IV. Numerical Results

A. Test System

The proposed methodology as described in section II & III is tested on 33-bus test system. The system used in this paper is a 33-bus radial distribution system with total load of 3.72 MW and 2.3 MVAr [17]. The proposed PSO technique has been developed in MATLAB environment to run load flow, calculate losses and optimal sizes of multiple capacitors. The

maximum number of capacitor units installed is assumed to be three and the total capacity of the capacitor units is equal to the total load plus line losses.

B. Simulation Results

1) 33-Bus Test System

Table I shows the total active power losses are 211 kW for 33-bus test distribution systems for base case i.e without Capacitor. When optimum size of 1.23MVAr capacitor is placed at bus number 30, then the power losses are reduced to 151.41kW and the improvement in voltage profile of the system is shown in Fig. 2. The reduction in line losses with the placement of two and three capacitor are 32.73% and 34.42% respectively. The enhancements in voltage profile of the system with two and three capacitor placement are shown in Fig.3 and Fig.4 respectively.

TABLE 1: MULTIPLE CAPACITOR PLACEMENT BY PSO APPROACH OF 33-BUS SYSTEM

Case	Installed Capacitor Schedule (MVAr)				Ploss (kW)	Loss Reduction (%)
No Cap					211	0.00
One Cap.	Bus	30				
	Size	1.23			151.41	28.24
Two Cap.	Bus	12	30			
	Size	0.43	1.04		141.94	32.73
Three Cap.	Bus	13	24	30		
	Size	0.36	0.51	1.02	138.37	34.42

It is observed that as the number and total installed capacity of capacitor units increases, the improvement in voltage profiles and reduction in line losses of the test system also increases.

V. CONCLUSION

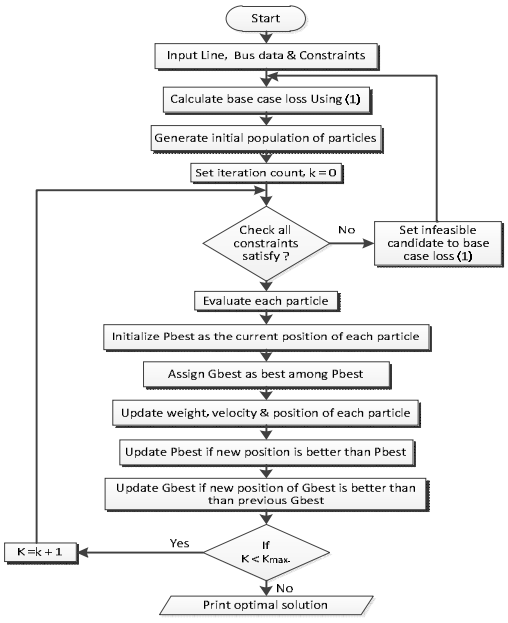

Fig. 1: Flow Chart of Optimal Placement of Capacitors

This paper has presented the allocation of optimal placement of multiple capacitors in the radial distribution networks for enhancement in voltage profile of the distribution networks. The optimal size and location of capacitors are determined by the application of PSO based technique. The proposed PSO approach for optimal placement of multiple capacitors not only improves the voltage profile of the systems but also minimize real power losses with satisfaction of the permissible voltage limits. In the age of integrated grid, the placement and analysis of multiple capacitors give guidance for optimal operation of power system.

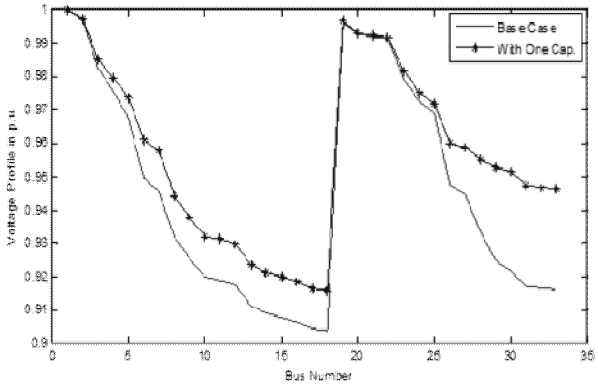

Fig. 2: Voltage Profile with Single Capacitor

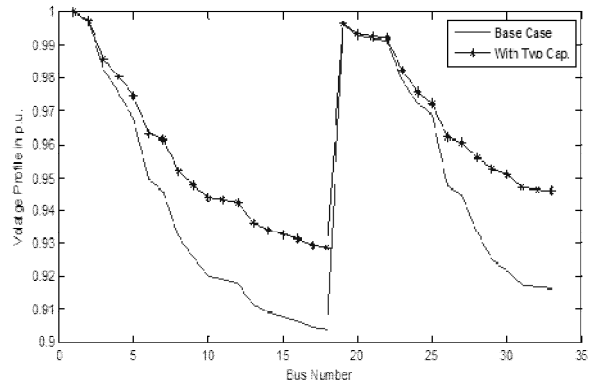

Fig. 3: Voltage Profile with Two Capacitor

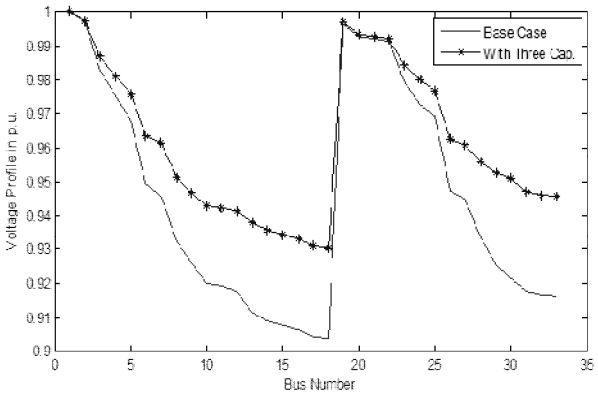

Fig. 4: Voltage Profile with Three Capacitor

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Analysis of Optical Code Division Multiplex System using Fiber Brag Gratings

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***Abstract*—This paper is based on the improvement in performance of Optical Code Division Multiple Access (OCDMA). To improve the Bit Error Rate (BER) of the system the uniform Fiber Bragg Grating (FBG) is using at transmitter and receiver end. With distance, performance of OCDMA decreases. To check the effectiveness of FBG on OCDMA in Optisystem Simulink software, various lengths of optical fiber are taken and bit error rate is checked. Comparison of length, BER, and Quality Factor are done with FBG. The whole work is done on the Optisystem tool.**

Keywords: OCDMA, FBG, WDM, MZI

I. INTRODUCTION

In long haul optical fiber transmission links and networks, the information consists of a multiplexed aggregate data stream originating from many individual subscribers and normally is sent in a well-timed synchronous format [1]. The design goal of the Time Division Multiplexing (TDM) process is to make maximum use of the available optical fiber bandwidth for information transmission, since the multiplexed information stream requires very high-capacity links. To increase the capacity even further, Wavelength Division Multiplexing (WDM) techniques that make use of the wide spectral transmission window in optical fibers are employed [2]. As an alternative to these techniques in a local area network (LAN), Optical Code Division Multiple Access (OCDMA) has been examined. OCDMA is one technique of the multiple access technique to allow several users to transmit simultaneously over the same optical fiber [3]. OCDMA is a highly flexible technique to achieve high–speed connectivity with large bandwidth. This OCDMA combines the large bandwidth of optical with the flexibility of the CDMA technique to achieve high speed connectivity. The OCDMA system is to maintain the performance of the system and offer high bandwidth in case of high number of users at minimum cost [4]. On the other hand, In OCDMA system the BER degrades by the multiple access interference which comes from all other active users. This in turn ultimately limits the number of active users in a given OCDMA networks. OCDMA systems suffered from MAI when the system involved large number of users. However, SAC scheme has been introduced to eliminate the MAI effect and preserve the orthogonality between users in the OCDMA systems [5, 6].

II. SYSTEM SETUP

The aim of OCDMA is to take benefits of radio frequency communications. CDMA technique is to share the huge optical bandwidth. The block diagram for optical code division multiple access is shown as below

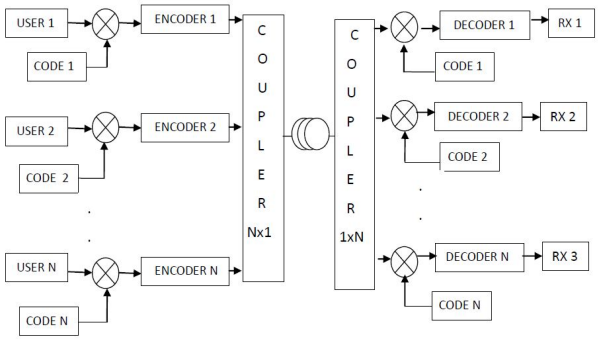

Fig. 1: Block Diagram of OCDMA [7]

An OCDMA system for each user can be described by a data source, containing the data that will be sent, followed by an encoder and then a laser that maps the signal from electrical form to an optical pulse sequence. At the receiver end, an optical correlate is used to extract the encoded data. Many subscribers transmit data simultaneously [6, 7]. Each user has its own codeword, which is approximately orthogonal to all other code words. The encoded data is send to the Nx1 star coupler, from where the optical channel carries the signal through the optical fiber and couples to a 1xN coupler and broadcast to all nodes [8]. All users encoded data are then added together chip by chip and the result, which is called the superposition, are sent over the channel. The individual receivers consisting of optical correlate continuously observe the superposition of all incoming pulse transmission and recover the data from the corresponding transmitter. This is done by correlation between the incoming signal and stored copies of that user unique sequence. The correlate will give a peak, if the incoming stream of optical pulses contains the unique sequence and the presence of other users will be considered as noise [7, 8]. The decoding process is accomplished by using optical correlation.

The receiver performs a time correlation operation to detect only the specific desired codeword [9]. All other code words appear as noise due to de-correlation. For detection of the message signal, the receiver needs to know the codeword used by the transmitter. Each user operates independent with no knowledge of the users [10]. The presence of the light pulse represents the binary bit „1"and the absence of the light pulse represents the binary bit '0' [11].

A. Fiber Bragg Grating

A Fiber Bragg Grating (FBG) is a periodic, or almost periodic, structure consisting of a variation of the refractive index along the length of a fiber. It acts as a band-rejection filter, reflecting any wavelength that satisfies the Bragg condition and passing all wavelengths that are not resonant with the grating [3]. The advantages of FBGs in systems applications include low insertion loss, all fiber compatibility, relative ease of manufacture and low cost; but a major feature is that by changing the grating parameters such as induced index change, length, period chirp, fringe tilt, we can achieve the desired grating spectral characteristics [7]. The FBG has a range of applications in the optical communications area, such as wavelength selection, laser stabilization, dispersion compensation, pulse shaping, etc.

III. RESULTS & DISCUSSION

In the simulation FBG based OCDMA network at 200 Mbit/s. Uniform FBGs are used to implement the codes by spectral amplitude encoding. The signal is generated using an incoherent source modulated with NRZ PRBS data using a Mach-Zehnder Modulator. The optical link is 10 km of single mode fiber. The receiver is comprised of a spectral filter and a photo detector connected in a balanced configuration which performs the decoding with a low-pass filter and a BER analyzer. Figure 2 below shows the data pulse which are to be transmitted ahead. This is modulated with continuous wave laser source.

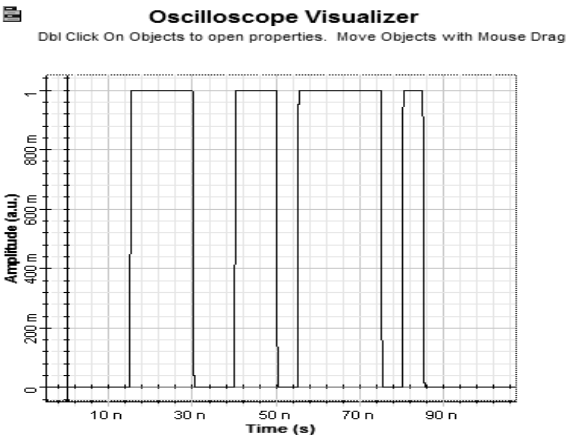

Fig. 2: Input Data to be Transmitted

In the results the whole simulation is compared on comparisons of Different FBG. The below table shows this Comparison.

TABLE 1: LENGTH OF FIBER, BER AND Q FACTOR

Length of fiber	BER on FBG	Q factor
20	4.687*e-023	17.345
40	5.897*e-018	13.981
60	3.134*e-013	11.678
80	5.432*e-009	7.781
100	6.023*e-007	5.321
120	2.901*e-004	4.123
140	3.125*e-003	3.291

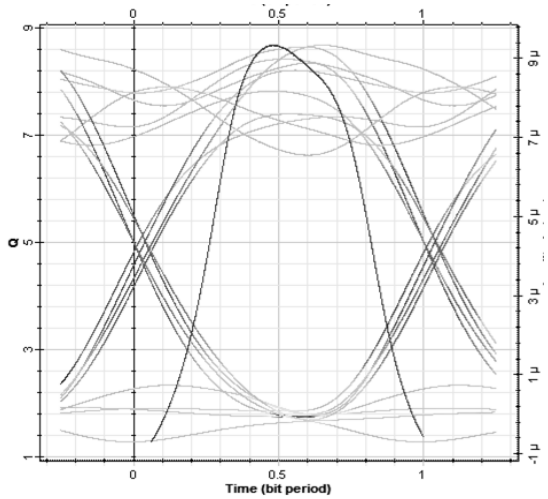

Fig. 3: Eye Diagram of Received Signal for User 1

The figure 3 shows the eye diagram of received signal in time domain and BER graph for 10 FBG at maximum length.

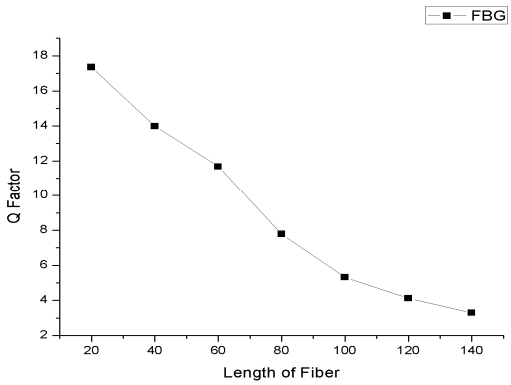

Fig. 4: Length Vs Q Factor

The figure 4 shows the graph between Length and Quality Factor. In which the length is considered at different kilometers. This graph shows by increasing the length the quality factor decreased.

IV. CONCLUSION

In this paper is the analysis performance of OCDMA is done with FBG. To improve the BER of the system the uniform Fiber Bragg Grating using at the

transmitter and receiver end. With distance, performance of OCDMA decreases. The higher BER 4.687*e-023 is considered at distance 20 Km. in the simulation part the comparison is given between the length the Quality factor and BER. By using 10 FBG the length of the fiber is increased and gives the results at 140 Km.

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