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Anusandhan

Technology & Management Journal of AISECT University

AISECT UNIVERSITY
Where aspiration becomes achievement.

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अनुसंधान

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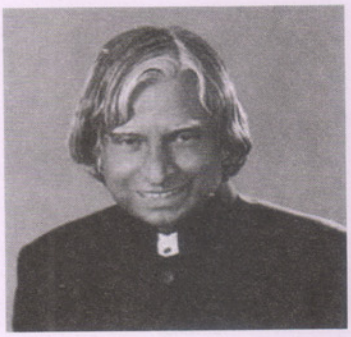

Message

I am happy to know that the All India Society for Electronics and Computer Technology (AISECT) is launching a University at Bhopal on 22nd March 2012. I am sure, the University will endevour to reach the unreached members of the nation. My greetings and best wishes for all the members of AISECT University on this occasion.

Dr. A.P.J. Abdul Kalam
Former President of India

Shekhar Dutt SM
GOVERNOR OF CHHATTISGARH

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No./742/PRO/RS/12
Raipur, 17 March, 2012

MESSAGE

It is a matter of pleasure that the AISECT University, Bhopal is going to publish its first Journal. Since a long time AISECT has been India's leading IT training and education services network. Now as a new University it has a bigger task.

Computer and IT plays a pivotal role in our life. Their increasing utility has made computer education the need of the day so much so that the modern world is incomplete without computer knowledge. It can also be used as tool for improving the quality of life in rural India. I hope the first publication of the University will be able to achieve its goals.

I wish the publication all success.

(Shekhar Dutt)

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Message

It is heartening to know that the AISECT University, Bhopal is being formally inaugurated on 22nd March, 2012. On this momentous occasion you are bringing out the first edition of the AISECT University Journal of Science, Technology and Management, which will house articles and research papers by experts, faculty and students.

Certainely this is a very important event in the history of Madhya Pradesh as `AISECT University' is going to become the first private University of the state.

I wish the event a grand success.

Dr. Raman Singh

लक्ष्मीकांत शर्मा
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संदेश

प्रसन्नता का विषय है कि आईसेक्ट विश्वविद्यालय के उद्घाटन अवसर पर यूनिवर्सिटी जर्नल का प्रकाशन किया जा रहा है।

निजी विश्वविद्यालयों को सरकार ने इस उद्देश्य से प्रोत्साहित किया है कि प्रदेश में उच्च शिक्षा को बढ़ावा मिले। युवाओं को गुणवत्तापूर्ण शिक्षा मिले साथ ही युवाओं को उच्च शिक्षा में पढ़ने के लिए पर्याप्त संस्थान मिले। आईसेक्ट विश्वविद्यालय इन सभी उद्देश्यों को पूरा करने के लिए निश्चित ही समर्पित रहेगा, ऐसी मुझे आशा है।

विश्वविद्यालय के उद्घाटन अवसर पर मैं विश्वविद्यालय परिवार को बधाई और शुभकामनाएं देता हूँ।

(लक्ष्मीकांत शर्मा)

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संदेश

हर्ष का विषय है कि उच्च शिक्षा के क्षेत्र में अग्रणी आईसेक्ट (AISECT) यूनिवर्सिटी 22 मार्च, 2012 को अपने औपचारिक शुभारंभ के अवसर पर विज्ञान, टेक्नॉलॉजी और मैनेजमेंट विषय पर आधारित एक जर्नल का प्रकाशन कर रही है।

रोजगार की संभावनाओं के साथ युवाशक्ति को उचित मार्गदर्शन हेतु आपके जर्नल में प्रकाशित होने वाले आलेख और शोधपत्र उपयोगी एवं संग्रहणीय हो। छात्र हित में विश्वविद्यालय श्रेष्ठ और रोजगारोन्मुखी शिक्षा उपलब्ध कराने के साथ–साथ उन्हें राष्ट्र के सुसृजन से भी जोड़ेगा ऐसी आशा है।

विश्वविद्यालय के शुभारंभ और प्रकाशित होने वाले जर्नल हेतु हार्दिक शुभकामनाएं।

(अर्चना चिटनीस)

Prof. Akhilesh Kumar Pandey
M.Sc. Ph.D. D.Sc. FMA, FNRS
CHAIRMAN

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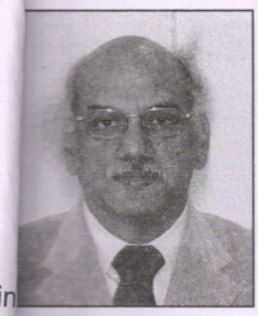
Date : 19.03.2012

संदेश

अत्यंत हर्ष का विषय है कि आईसेक्ट निजी विश्वविद्यालय का दिनांक 22 मार्च 2012 को विधिवत शुभारंभ हो रहा है। विज्ञान तकनीकी एवं प्रबंधन के क्षेत्र में यह विश्वविद्यालय निश्चित ही सभी वर्गों के छात्रों के लिये मददगार एवं उनके उज्जवल भविष्य के लिये अपना सहयोग प्रदान कर रहा है। आईसेक्ट विश्वविद्यालय मध्यप्रदेश में संचालित होने वाला एक अत्यंत महत्वपूर्ण निजी विश्वविद्यालय है। शुभारंभ के अवसर पर यह विश्वविद्यालय एक शोध पत्रिका का भी प्रकाशन कर रहा है। यह शोध पत्रिका निश्चित रूप से विज्ञान, तकनीकी एवं प्रबंधन के शोधार्थियों के लिये अत्यंत उपयोगी होगी।

मैं अपनी तथा समस्त विनियामक आयोग के सदस्यों की तरफ से इस विश्वविद्यालय के उज्जवल भविष्य की कामना करता हूं तथा शोध पत्रिका के प्रकाशन हेतु बधाई देता हूं।

(अखिलेश कुमार पाण्डेय)
चेयरमैन



Santosh Choubey
Chancellor

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Message

To foster research oriented culture is an integral and essential part of vision & mission of AISECT University. In its inception year university has created good research environment through well equipped research labs and excellent library facilities. But the real boost to research culture causes tough motivators in form of different platforms like conferences, workshops etc. A research journal can be really good motivator.

I congratulate all those faculties and staff members who have thought of publishing a research journal –Anusandhan. I am sure that the journal will inspire students for meaningful research. My best wishes are for the entire team engaged in publication of this Journal.

Santosh Choubey
Chancellor
AISECT University
Bhopal (M.P)

TECHNOLGY & MANAGEMENT JOURNAL OF AISECT UNIVERS

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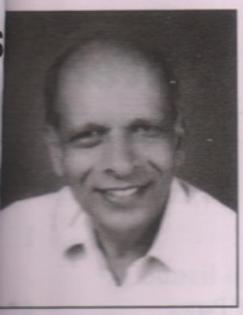

From Editor in Chief Desk

My Dear Readers

World is at the threshold of new economic and industrial order where talent, technologies, techniques and tools will decide not only winners but world leaders too. At this transition stage even developing nations can't be ignored, because the competition hinges on human resource whose competence and qualification level will actually decide fate of this fierce competition. Developing nations like India are really rich on human resource. Competence and qualification directly relate to research environment, innovative contents and quality of education imparted at the institutes of higher learning. Universities and professional colleges thus have great responsibilities and oneness rests squarely on them. Chinese institutions realized this sooner and that's how Chinese universities have taken a big leap in the world ranking list. The awareness has come to Indian universities too although we are almost nonexistent in first hundred rank. Still the picture is encouraging, because seriousness towards quality, innovation, and research in education is visible at many places. At government level also they have realized that the change could be faster with private participation and that's how many private universities and institutes have emerged in last one decade plus.

AISECT University is the first private university of MP. Nurturing talent to promote research driven education and fostering research oriented culture is most essential part of our mission and vision. To underline our seriousness, in very first six month of inception, University organized a mega national conference, on 17-18 Nov. 2011- **"eTrendZ"** where 60 papers from across the country were presented by research scholars, academicians, industry experts and scientists. Now in the later part of the year we are launching our own technology and management Journal. A journal is an effective platform which motivates scholars to publish their findings, results and conclusion, share with others and also get them evaluated and reviewed. Going by overwhelming response we received in terms of contributions from all nooks and corners, I feel we have motivated many scholars. We have selected 21 articles for our inaugural issue. Research has many dimensions. It should not only quench the thirst for knowledge but should also aim at enabling the society and empowering the technology for good of mankind. Nano technology has great potentials to bring in new turning point in energy sector, space technology and medical applications and relates to almost all the disciplines of science and engineering. We have couple of research papers from scientists of CEERI Pilani who are engaged in massive projects in Nano fields. There are papers from other emerging fields in electronics, computing, mathematics, civil and management also but one common aspect which binds them together is strong research component.

Credit for this significant mile stone of launching a journal in AISECT University goes to all team members of the editorial board and faculty/ staff who have put in tremendous efforts. Appreciations go to authors also who contributed to this journal. I am sure; meaningful research papers published in this journal will not only set a bench mark of quality but also motivate students towards research.

Prof. V.K. Verma

Technology & Management Journal of AISECT Universit

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WAVELET TRANFORMATIONS & ITS APPLICATIONS IN DIGITAL IMAGE PROCESSING

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Abstract

Image processing based on the continuous or discrete image transforms are classic techniques. The image transforms are widely used in image filtering, data description, etc. Considering that the Haar and Morlet functions are the simplest wavelets, these forms are used in many methods of discrete image transforms and processing. Wavelets transforms are widely used in many research areas and its advantages over conventional Fourier transform as it takes less time and individual wavelet functions are localized in space but Fourier transform cannot. In this study, similarities and dissimilarities between wavelet transform and Fourier transform are also discussed. Furthermore, the applications of wavelet transform in many areas like face recognition, fingerprint analysis, image compression and image denoising are discussed.

Keywords:- wavelet transform, image filtering, data description.

I. INTRODUCTION

The word "wavelet" has been introduced by Morlet and Grossmann [1] in the early 1980s. They used the French word ondelette, meaning "small wave" originated from the study of time-frequency signal analysis, wave propagation, and sampling theory. Morlet first introduce the idea of wavelets as a family of functions constructed by using translation and dilation of single function, called mother wavelets, for analysis of nonstationary signals. Wavelets are a mathematical tool that can be used to extract information from many different kinds of data, including audio signals and images. The subject of wavelet analysis has recently drawn a great deal of attention from mathematical scientists in various disciplines. It is creating a common link between mathematicians, physicists, and electrical engineers with modern application as diverse as wave propagation, data compression, image processing, pattern recognition, computer graphics and other medical image technology. Sets of wavelets are generally needed to analyze data fully. The wavelet transform decompose the signal with finite energy in the spatial domain into a set of function as a standard in the modular spatial domain of orthogonal. Then we analyze the characteristics of the signal in the modular spatial domain. Compared with the traditional Fourier analysis, the wavelet transform can analyze the function in the modular spatial domain and timing domain which has better local capacity of the frequency and time. It is the development and sublimation of Fourier transform, which has a lot of advantages.

The main objective of wavelet transform is to define the powerful wavelet basis functions and find efficient methods for their computation. Fourier methods are not always good tools to recapture the signal or image, particularly if it is highly non–smooth. Too much Fourier information is needed to reconstruct the signal or image locally. The wavelet analysis is done similar to the Short Time Fourier Transform (STFT) analysis. The signal to be analyzed is multiplied with a wavelet function just as it is multiplied with a window function in STFT, and then the transform is computed for each segment generated. However, unlike STFT, in Wavelet Transform, the width of the wavelet function changes with each spectral component. The Wavelet Transform, at high frequencies, gives good time resolution and poor frequency resolution, while at low frequencies, the Wavelet Transform gives good frequency resolution and poor time resolution. In these cases the wavelet analysis is often very effective because it provides a simple approach for dealing with the local aspects of a signal, therefore particular properties of the Haar wavelet transforms allow to analyze the original image on spectral domain effectively. Wavelet transforms have advantages over traditional Fourier methods in analyzing physical situations where the signal contains discontinuities and sharp spikes. Wavelets were developed independently in the fields of mathematics, quantum physics, electrical engineering, and seismic geology.

The first literature that relates to the wavelet transform is Haar wavelet. It was proposed by the mathematician Alfred Haar in 1909[2, 3]. However, the concept of the wavelet did not exist at that time. Until 1981, the concept was proposed by the geophysicist Jean Morlet [1-10]. Later, Morlet and Grossman invented the term wavelet in 1984. Before 1985, Haar wavelet was the only orthogonal wavelet known to the people[2-3]. Fortunately, the Mathematician Yves Meyer constructed the second orthogonal wavelet called Meyer wavelet in 1985 [4-7]. As

more and more scholars joined in this field, the 1st international conference was held in France in 1987[8].

In 1988, Stephane Mallat and Meyer proposed the concept of multiresolution [9]. In the same year, Ingrid Daubechies found a systematical method to construct the compact support orthogonal wavelet. In 1989, Mallat proposed the fast wavelet transform. With the appearance of this fast algorithm, the wavelet transform had numerous applications in the signal processing field [10].

Summarize the history. We have the following table:

1910, Haar families, which was proposed by the mathematician Alfrd Haar. Haar wavelet is the first literature relates to the wavelet transform, but the concept of the wavelet did not exist at that time[2-3].

1981, Morlet, wavelet concept, which was proposed by the geophysicist Jean Morlet [1-8].

1984, Morlet and Grossman, "wavelet". Morlet and the physicist Alex Grossman invented the term "wavelet"[1].

1985, Meyer, "orthogonal wavelet". Before 1985, a lot of researchers thought that there was no orthogonal wavelet except Haar wavelet. The mathematician Yves Meyer constructed the second orthogonal wavelet called Meyer wavelet in 1985[1-10].

1987, International conference in France, which is the 1st international conference about Wavelet transform [1-10].

1988, Mallat and Meyer, multiresolution. Stephane Mallat and Meyer proposed the concept of multiresolution[1-10].

1988, Daubechies, compact support orthogonal wavelet. Ingrid Daubechies found a systematical method to construct the compact support orthogonal wavelet [3].

1989, Mallat, fast wavelet transform. With the appearance of this fast algorithm, the wavelet transform had numerous applications in the signal processing field [10].

II. BASIC DEFINITIONS AND AN OVERVIEW OF WAVELET TRANSFORMS

A wavelet is a mathematical function used to divide a given function or continuous-time signal into different scale components. Usually one can assign a frequency range to each scale component. Each scale component can then be studied with a resolution that matches its scale. A wavelet transform is the representation of a function by wavelets. The wavelets are scaled and translated copies (known as "daughter wavelets") of a finite-length or fast-decaying oscillating waveform (known as the "mother wavelet").

$$\psi_{a,b}(t) = \frac{1}{\sqrt{|a|}}\psi\left(\frac{t-b}{a}\right), \quad a,b \in \mathbb{R}, a \neq 0 \qquad (1)$$

Where ψ is a wavelet function, a, is a scaling parameter which measure the degree of compression or scale, and b, is a translation parameter which determines the time location of the wavelet.

Wavelet transforms have advantages over traditional Fourier transforms for representing functions that have discontinuities and sharp peaks, and for accurately deconstructing and reconstructing finite, non-periodic and/or non-stationary signals.

A WAVELET VS FOURIER TRANSFORMS

Similarities between Fourier and Wavelet Transforms, the Fast Fourier transform (FFT) and the discrete wavelet transform (DWT) are both linear operations that generate a data structure that contains segments of various lengths. The mathematical properties of the matrices involved in the transforms are similar as well. The inverse transform matrix for both the FFT and the DWT is the transpose of the original. As a result, both transforms can be viewed as a rotation in function space to a different domain. For the FFT, this new domain contains basis functions that are sines and cosines. For the wavelet transform, this new domain contains more complicated basis functions called wavelets. Both transforms have another similarity. The basis functions are localized in frequency, making mathematical tools such as power spectra (how much power is contained in a frequency interval) and scalegrams useful at picking out frequencies and calculating power distributions.

The most interesting dissimilarity between these two kinds of transforms is that individual wavelet functions are localized in space. Fourier sine and cosine functions are not. This localization feature, along with wavelets' localization of frequency, makes

many functions and operators using wavelets "sparse" when transformed into the wavelet domain. This sparseness, in turn, results in a number of useful applications such as data compression, detecting features in images, and removing noise from time series.

III. DISCRETE WAVELETS TRANFORMATIONS

The Wavelet Series is just a sampled version of Continuous Wavelet Transform (CWT) and its computation may consume significant amount of time and resources, depending on the resolution required. If the function being expanded is a sequence of numbers, like samples of a continuous function f(x), the resulting coefficients are called the Discrete Wavelet Transform (DWT) of f(x).In

this case, the series expansion of wavelet transform in one dimension is given below.

$$W_\varphi(j_0, k) = \frac{1}{\sqrt{M}} \sum_x f(x) \varphi_{j_0,k}(x) \qquad (2)$$

$$W_\psi(j, k) = \frac{1}{\sqrt{M}} \sum_x f(x) \psi_{j,k}(x) \qquad (3)$$

for $j \geq j_0$ and

$$f(x) = \frac{1}{\sqrt{M}} \sum_k W_\varphi(j_0, k) \varphi_{j_0,k}(x) + \frac{1}{\sqrt{M}} \sum_{j=j_0}^{\infty} \sum_k W_\psi(j,k) \psi_{j,k}(x)$$

Here, f(x), $\varphi_{j_0,k}(x)$,and $\psi_{j,k}(x)$ are functions of the discrete variable x=0,1,2……M-1.

For Haar wavelets, the discretized scaling and wavelet functions employed in the transform (called the basis functions)correspond to the rows of M×M Haar transformation matrix. The transform is composed of M coeffiecients, the minimum scale is 0,and the maximum scale is J-1.The coefficients defined in equation (2) and (3) are usually called approximation and detail coefficients respectively [11].

The discrete wavelet transform in two dimensions of functions f(x,y) of size M×N is then

$$W_\varphi(j_0, m, n) = \frac{1}{\sqrt{MN}} \sum_{x=0}^{M-1} \sum_{y=0}^{N-1} f(x, y) \varphi_{j_0,m,n}(x, y)$$

$$W_\psi^i(j, m, n) = \frac{1}{\sqrt{MN}} \sum_{x=0}^{M-1} \sum_{y=0}^{N-1} f(x, y) \psi_{j,m,n}^i(x, y)$$

$i = \{H, V, D\}$.

Where in the one-dimensional case, j_0 is an arbitrary starting scale and the $W_\varphi(j_0, m, n)$ coeffients define an approximation of f(x,y) at scale j_0. $W_\psi^i(j, m, n)$ coefficients add horizontal, vertical, and diagonal details for scales $j \geq j_0$ and i is a superscript that assumes the values H,V, and D [11].

The Discrete Wavelet Transform (DWT), which is based on sub-band coding is found to yield a fast computation of Wavelet Transform. It is easy to implement and reduces the computation time and resources required In CWT, the signals are analyzed using a set of basis functions which relate to each other by simple scaling and translation. In the case of DWT, a time-scale representation of the digital signal is obtained using digital filtering techniques. The signal to be analyzed is passed through filters with different cutoff frequencies at different scales[11].

IV. APPLICATIONS OF WAVELET TRANSFORM IN IMAGE PROCESSING

Wavelets are a powerful statistical tool which can be used for a wide range of applications. Wavelet transforms are now being adopted for a vast number of applications, often replacing the conventional Fourier Transform. Wavelet Transforms (WT) can also be used in the field of Image compression, Feature extraction, image denosing and other medical image technology.

Many areas of physics have seen this paradigm shift, including molecular dynamics, astrophysics, density-matrix localization, seismic geophysics, optics, turbulence and quantum mechanics. This change has also occurred in image processing, blood-pressure, heart-rate and ECG analysis, DNA analysis, protein analysis, climatology, general signal processing, speech recognition, computer graphics and multifractal analysis. Some of the important applications of wavelet transform are described here.

A. FINGERPRINT RECOGNITION

Fingerprint verification is one of the most reliable personal identification methods and it plays a very important role in forensic and civilian applications. For automatic identification, it is one of the oldest and most reliable methods because of invariance of the fingerprint features over the age of the subject. Facsimile scans of the impressions are distributed among law enforcement agencies, but the digitization quality is often low. Because a number of jurisdictions are experimenting with digital storage of the prints, incompatibilities between data formats have recently become a problem. This problem led to a demand in the criminal justice community for a digitization and a compression standard, To overcome this problem. Federal Bureau of Investigation (FBI) has proposed a standrard for image compression using wavelets known as wavelet Scalar Quantization (WQS). This widely accepted in the industry as the defacto standard which has collected about 30 million sets of fingerprints [12, 13]. Other papers of wavelets transformation in fingerprint recognition are [14] and [15]. Shashi et al. [15] proposed a Discrete Wavelets Transformation based Fingerprint Recognition using Non Minutiae Features. The features of fingerprint such as Directional Information, Centre Area and Edge Parameters are extracted from DWT. Pokhriyal et al. [15] proposed an algorithm of fingerprint verification based on wavelets and pseudo Zernike moments. Wavelet was used to denoise and extract ridges.

B. IMAGE COMPRESSION

Image compression is one of the most important and successful applications of the wavelet transform. The rapid increase in the range and use of electronic imaging justifies

attention for systematic design of an image compression system and for providing the image quality needed in different applications.

Image compression algorithms aim to remove redundancy in data in a way which makes image reconstruction possible." This basically means that image compression algorithms try to exploit redundancies in the data; they calculate which data needs to be kept in order to reconstruct the original image and therefore which data can be 'thrown away'. By removing the redundant data, the image can be represented in a smaller number of bits, and hence can be compressed. Grgic et al. [16] presented a comparative study of different wavelet-based image compression systems.

Discrete wavelet transform is adopted to be the transform coder in both JPEG2000 [17] and still image coding and MPEG-4 [18] still texture coding. JPEG2000 is the emerging next generation still image compression standard. JPEG2000 is to be delivered and agreed as a full IS0 International Standard by the end of the year 2000. With the inherent features of Wavelet transform, it provides multi-resolution functionality and better compression performance at very low bit-rate compared with the DCT (Discrete Continuous Time)-based JPEG standard [19].

C. IMAGE DENOISING

An image is often corrupted by noise in its acquisition and transmission. Image denoising is used to remove the additive noise while retaining as much as possible the important signal features[20].Wavelet transform provides us with one of the methods for image denoising. Wavelet transform, due to its excellent localization property, has rapidly become an indispensable signal and image processing tool for a variety of applications, including denoising and compression. Wavelet denoising attempts to remove the noise present in the signal while preserving the signal characteristics, regardless of its frequency content.

1) Wavelet Thresholding

Wavelet thresholding (first proposed by Donoho[21]) is a signal estimation technique that exploits the capabilities of wavelet transform for signal denoising.

It removes noise by killing coefficients that are insignificant relative to some threshold. Researchers have developed various techniques for choosing denoising parameters and so far there is no "best" universal threshold determination technique.

Yansun et al. [22] introduced an effective wavelet transform domain noise filtration technique. This filter preserves edges and removes noise. Noise is preferentially removed from the wavelet transform data at a given scale by comparing the data at that scale to the correlation of the data at that scale with those at larger scales. Features are identified and retained because they are strongly correlated across scale in the wavelet transform domain. Noise is identified and removed because it is poorly correlated across scale in the wavelet transform domain. Features remain relatively undistorted because they are very well localized in space in the wavelet transform domain; therefore, edges remain sharp after filtration.

D. FACE RECOGNITION

Face recognition in our life such as identification of person using Credit cards, Passport check, Criminal investigations etc. The human face is an important object in image and video databases, because it is a unique feature of human beings and is ubiquitous in photos, news videos, and video telephony. Face detection can be regarded as a more general case of face localization. In face localization, the task is to find the locations and sizes of a known number of faces (usually one). In face detection, one does not have this additional information. There are several application areas where

Automated face recognition is a relatively new concept. Developed in the 1960s, the first semi-automated system for face recognition required the administrator to locate features (such as eyes, ears, nose, and mouth) on the photographs before it calculated distances and ratios to a common reference point, which were then compared to reference data. In the 1970s, Goldstein, Harmon, and Lesk [23] used 21 specific subjective markers such as hair color and lip thickness to automate the recognition. Face recognition can be used for both verification and identification (open-set and closed-set). [24] Proposed face recognition using Linear Discriminant Analysis (LDA) with wavelet transformation. LDA is one of the principal techniques used in face recognition systems. LDA is well-known scheme for feature extraction and dimension reduction. LDA using wavelets transform approach that enhances performance as regards accuracy and time complexity.

V. CONCLUSION

In this review paper, an attempt has been made to study the wavelet transform and its applications in digital image processing. Some of the equations of discrete wavelet transform are described. The review was conducted to study the different suitable areas of wavelet transforms and its applications in digital image processing.

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SOLUTION OF ALGEBRAIC AND TRANSCENDENTAL EQUATION: A NEW NUMERICAL APPROACH

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Abstract

Numerical analysis is used to solve those algebraic and transcendental equations, which are difficult to solve by usual Mathematical methods. Methods like Bisection, Regula falsi and Newton-Raphson are generally used for this purpose. Among these methods, Newton-Raphson is considered as best, but it fails where the function has the point of inflexion in the domain of interval. The present method removes this difficulty. The main advantage of the developed method is that there is no need of checking the initial abscissas that vanishes the derivative at which the Newton-Raphson method fails.

Keywords:- Numerical analysis, Algebraic equation, Transcendental equation, Conventional numerical method.

I. INTRODUCTION

A frequent problem in defining the theoretical concepts of applied Engineering and allied sciences is the solution of the equations in the form $f(x) = 0$ that especially contain the mixture of algebraic and transcendental functions. However, there may be problems that contains purely non-linear equation and in particular have the terms superior to quadratic order or may be problems of purely transcendental nature. Iterative methods like Bisection, Regula falsi and Newton-Raphson are often applied to obtain the approximation of such non-linear mathematical equations [1-6]. The basic assumptions underlying its evaluation are discussed in the following paragraph.

1.1 Bisection method

Let, $f(X) = 0$ is an equation whose solution needs to be evaluated. If $f(X)$ is a continuous in the closed interval $\{[X_O, X_a]\}$ containing the real root thereby allots opposite sign to $f(X_O)$ and $f(X_1)$ respectively, then there must exists at least one root between these points which can be approximated by their arithmetic mean. The root obtained in this way is more nearer to the real root of the equation. The procedure is repeated to get the final root at the desired level of accuracy.

1.2 Regula falsi method

It is the modified form of bisection method containing the same theoretical bases. This method consists of refining the part of the curve between the domain points by means of the chord joining these points and their intersection with X-axis.

1.3 Newton-Raphson method

This method involves the expansion of Taylor's series by neglecting the terms of second and higher order. Geometrically, the method consists of finding the intersection of tangent line with X-axis. This method works comparatively faster than other two. However, it yields undefined result at the point where the derivative of the function vanishes.

II. THE PRESENT METHOD

The aim of the proposed method is to present an innovative concept to solve all linear and nonlinear or transcendental functional problems free from derivatives. This method remains give the defined result where the best level conventional method of Newton-Raphson fails. The method has been developed by assuming the function f (X) to be continuous and differentiable within each point of its domain and at least in the part of domain in which the real root of the equation lie.

2.1 Principal of the present method

Let the function defining the equation f (x) = 0 is continuous and differentiable in its domain and at least in the part of domain in which the real root of the equation lies. The strategy of basic principal is clear in figure -1. Let

L (X_a, f (X_a)) and M (X_O, f (X_O)) are two points such that f (X_O) and f (X_a) are opposite in sign and the ordinate of the given equation f (x) = 0 follows the inequality | f (X_O) | < | f (X_a) |.

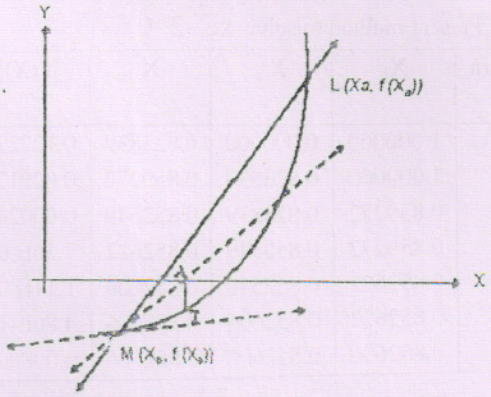

Figure 1: The geometric interpretation of proposed formula

Clearly, the equation of the line LM will be

$$f(X) - f(X_O) = m_1 (X - X_O) + C \quad (1)$$

Where, C is the length of the intercept made by the line on Y – axis, and $m_1 = \frac{f(X_a) - f(X_o)}{X_a - X_o}$ represents the slope of the line.

Let, a tangent is drawn through the point M. The slope bisector of the line containing L & M and the tangent at M is obtained. The equation of this slope bisector will be

$$f(X) - f(X_o) = \frac{m_1 + f'(X_0)}{2}(X - X_0) \quad (2)$$

$$X = X_0 + \frac{2(f(X) - f(X_o))}{m_1 + f'(X_0)} \quad (3)$$

It passes through X - axis and meets it at the point "A". The value of abscissa correspond to this point gives the initial approximation of the root of the given equation which comes out to be,

$$X = X_0 - \frac{2f(X_o)}{m_1 + f'(X_0)} \quad (4)$$

Substituting the value of m_1 we obtain,

$$X = X_0 - \frac{2f(X_0)(X_a - X_0)}{[f(X_a) - f(X_0)] + f'(X_0)(X_a - X_0)} \quad (5)$$

Thus the projection from the point A on the curve meeting it at the point T has the Coordinates,

$$\left[X_0 - \frac{2f(X_0)(X_a - X_0)}{[f(X_a) - f(X_0)] + f'(X_0)(X_a - X_0)}, f\left(X_0 - \frac{2f(X_0)(X_a - X_0)}{[f(X_a) - f(X_0)] + f'(X_0)(X_a - X_0)}\right)\right) \quad (6)$$

These coordinates can be used to find the solution of the targeting type of problems. Here, the abscissa represents the iterative formula whereas; the ordinate defines the value of absolute error for the confronting problem. The method is termed as "Slope bisection method" because it is based on the bisection of the slopes of the tangent and non-tangent lines.

2.2 Iteration Algorithm

The process algorithm has been capsulated in Fig. 2. The basic terminologies assisting the algorithm are discussed below.

1. Choose two points X_0 and X_a such that f (x_0) and f (x_a) are opposite in sign. Here, the nomenclature of the points (X_0, f (x_0)) and (X_a, f (x_a)) are assigned by obtaining the magnitude values of the ordinate at these points for given equation f(x) = 0 such that $|f(x_0)| < |f(x_a)|$.
2. Get the roots of the unsolved equation from equation (6).
3. Abscissa obtained in this step defines either X_0 or X_a of the next step. The choice of new abscissa depends on the magnitude of the distance of the new value of the root from X_0 and X_a. In particular, only the coordinate with greater distance is replaced keeping the other intact.
4. The process is repeated to get the result from next iteration, which in turn will give more exact result.
5. The process terminates when required level of accuracy is obtained.

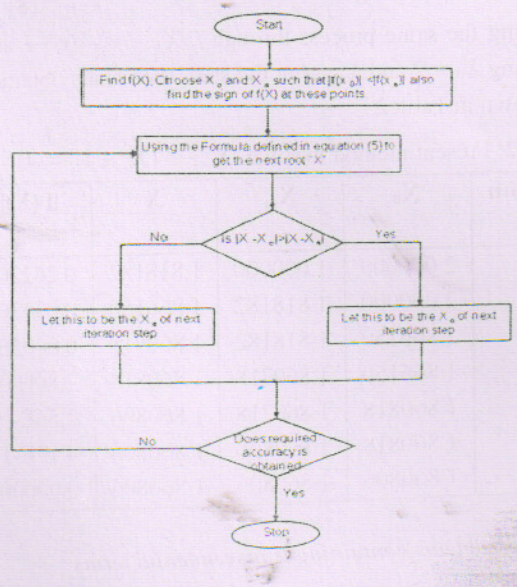

Fig.2 Flow Chart of the Processing steps

III. NUMERICAL RESULTS AND DISCUSSIONS

In this section, the efficiency and accuracy of the method is illustrated by the following examples. This section has been divided to discuss the said two types of problems.

Type1– Problems containing non-transcendental terms or say purely algebraic terms

Example 1. At first consider a general non-linear problem of cubic order

$$X^3 - 2X - 5 = 0 \qquad (7)$$

Here we take $f(X) = X^3 - 2X - 5$. Estimation of $f(2)$ and $f(3)$ prove that their values are opposite signed with $|f(2)| < |f(3)|$. In this regard we allot $X_0 = 2$ and $X_a = 3$ as the initial approximation to start the iteration step. The results are calculated from the defined algorithm and the different outcomes are capsulated in Table1.

Table 1: Present method to solve $X^3 - 2X - 5 = 0$

Iteration No.	X_0	X_a	X	|f (X)|
1	2.000000	3.000000	2.074074	0.225931
2	2.000000	2.074074	2.097800	0.036323
3	2.097800	2.074074	2.094536	0.000176
4	2.097800	2.094536	2.094554	0.000033
5	2.094554	2.094536	2.094551	0.000000

Example 2. Another general problem of same sequence is considered in equation (8).

$$X^3 - 4X + 1 = 0 \qquad (8)$$

Adopting the same process through $f(X) = x^3 - 4x + 1$ and assigning $X_0 = 2$ and $X_a = 1$ at the start, the results obtained are shown in Table2.

Table 2: Present method to solve $X^3 - 4X + 1 = 0$

Iteration No.	X_0	X_a	X	|f (X)|
1	2.000000	1.000000	1.818182	0.262209
2	2.000000	1.818182	1.866150	0.034300
3	1.866150	1.818182	1.860718	0.000558
4	1.866150	1.860718	1.860818	7.80E-05
5	1.860818	1.860718	1.860806	2.56E-09
6	1.860818	1.860806	1.860806	4.17E-10
7	1.860806	1.860806	1.860806	0.000000

Type2–Problems containing transcendental terms

Example 3. Consider a problem incorporating exponential function

$$xe^x - 2 = 0 \qquad (9)$$

The various results for $f(X) = X e^x - 2$ and $X_0 = 1$ and $X_a = 0$ are shown in Table3.

Table 3: Present method to solve $xe^x - 2 = 0$

Iteration No.	X_0	X_a	X	|f (X)|
1	1.000000	0.000000	0.823839	0.122278
2	1.000000	0.823839	0.859272	0.029122
3	0.859272	0.823839	0.852549	0.000244
4	0.859272	0.852549	0.852622	7.36E-05
5	0.852622	0.852549	0.852606	1.11E-09
6	0.852622	0.852606	0.852606	4.80E-10
7	0.852606	0.852606	0.852606	0.000000

Example 4. Another type of problem of non-natural log is considered below.

$$X \log_{10} X = 1.2 \qquad (10)$$

Here, $f(X) = X \log_{10} X - 1.2$. Since $f(2)$ and $f(3)$ are opposite in sign and $|f(3)| < |f(2)|$, so we consider $X_0 = 3$ and $X_a = 2$ at the start. The iterative results are shown in Table 4.

Table 4: Present method to solve $X \log_{10} X = 1.2$

Iteration No. X	X_0 |f (X)|	X_a		
1	3.000000	2.000000	2.734175	0.005641
2	3.000000	2.734175	2.743356	0.002364
3	2.743356	2.734175	2.740646	4.04E-07
4	2.743356	2.740646	2.740646	2.91E-07
5	2.740646	2.740646	2.740646	1.78E-15
6	2.740646	2.740646	2.740646	4.22E-15
7	2.740646	2.740646	2.740646	0.000000

The correct value of the root and the absolute value of error are shown in the corresponding tables at the last two columns. Illustrated examples shows that the proposed formula has a good level of accuracy gives the result within the limited iterative steps.

3.1 Superiority and Advantages over others

In many ways the proposed method is superior to the generally used conventional methods. This is proved by the following discussion. Consider a quadratic equation $X^2 - 1 = 0$. Clearly, we take $f(X) = X^2 - 1$ and hence $f'(X) = 2X$. Let, we require the negative root of this problem. So, we proceed further by finding $f(-2) = 3$ & $f(0) = -1$. Clearly, we assign $X_0 = 0$.

Here Newton's formula becomes undefined at the first iteration and we cannot work further with this initial approximation. In the same case if the method of false position i.e. Regula falsi method is applied by taking the two initial abscissas to be -2 and 0, the first iteration result will be -0.5. Bisection method gives the result for same chosen values to be -1. On the other hand, starting the proposed formula by taking $X_0 = 0$ and $X_a = -2$, the first approximation gives the correct solution i.e. -1. This result shows that the proposed formula runs smoothly in those cases where Newton's methods either diverges or becomes undefined.

Revisiting the same problem by taking two new abscissas to be 0.1 and -2. Since $f(-2) = 3$ & $f(0.1) = -0.99$, so the value of X_0 considered for Newton-Raphson method will be 0.1 that yields the first approximation result to be 5.05. When the same initial approximations are applied on Regula falsi method the first approximation result comes to be -0.420105. The use of bisection method shows the result to be -0.95.

Inspite this, when the same result is obtained by the proposed formula by taking $X_0 = 0.1$ and $X_a = -2$, the first iteration result comes to be -1.0647. Out of these results, proposed model gives the most reliable result which is most near to its real root x = 1. However in this case the result is comparable with bisection method.

IV. CONCLUSION

The sensitive analysis done in this paper suggests that the existing formulas to obtain the roots of the equation through Numerical methods have certain limitations. The present formula overcomes these drawbacks and gives the result comparative to above methods but with faster convergence. The major conclusions are as follows:

1. The result obtained by this formula is highly perceptible. There is no need of checking the initial abscissas that whether the derivative of the function will give well defined result or not as required in Newton-Raphson method.
2. It works uninterruptedly at the point at which Newtons Raphson method fails for example at the point where derivative becomes undefined.
3. The algorithm defining the process is very easy that can be easily coded.
4. Any equation - Algebraic, transcendental or the equations containing the terms of both can be easily solved with the same approach.

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IMPLEMENTING ROUGH SET TECHNIQUE IN SOFTWARE ENGINEERING PROCESS FOR INFORMATION EXTRACTION

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Abstract

Our paper deals on the topic of 'Intelligent Information Retrieval'. There are many processes for extracting knowledge form a complete information system. As observed, in many cases, real life problems are uncertain. We may categorize such problem under the incomplete information system. It is difficult to deal with those systems having knowledge having 'incompleteness' (some values in dataset is missing) and 'inconsistencies' (ambiguities and contradicting values in dataset) in nature. Hence, the process of knowledge and information extraction becomes more challenging where real time data are incomplete. Rough Set can be used as a tool for clustering and handling incomplete information. In this paper we have defined and discussed on some of the known properties of Rough Set and we have implemented the tool to generate information for a software engineering process. Planning for delivery and installation for any software requires planning for procurement of hardware, software, and skilled manpower (software developers). The process of delivering the software also consists of preparing the documentation and manuals, and planning for training. Scheduling for delivery and installation within the deadline and estimated coast, on the other hand, requires the preparation of a time table for putting the system in place. It is desirable in many cases, that the new software is installed while the old system still operates, as the automation system need to be running. We have studied and analyzed our proposed technique for one such software, i.e COA. COA (Control Office Application) runs for CRIS (Centre for Railway Information System) of Indian Railway. COA mainly deals with the automation of Arrival, Departure and running of the trains. Earlier CRIS implemented and succeeded in another project i.e. FOIS (Freight Operation Information System). This is one of the Asia's biggest Networks in any organization. In our analysis, we observed that, selecting Evolutionary Model as SDLC for up gradation and modification of this process may gives a better result. It was also observed that, selection of appropriate skilled manpower (software developers) is one of the key factors for success and in-time delivery, when SDLC-Evolutionary Model is followed. During the process of selection of appropriate skilled manpower, it was found that the dataset consist of some missing, incomplete and uncertain information. Hence, we proposed and used Rough Set as a tool for classification, cluster and to generate knowledge, which can be used for software procurement planning.

Keyword:- SDLC, Evolutionary Model, Incomplete Information System and Rough Set.

I. INTRODUCTION

A. Information System

A special kind of approximation space is require, when classifying objects on basis of their properties and we identify properties with some attributes, characteristics of these objects with each attribute a set of value is associated. Description of an object is given when one value for each attribute is chosen [11], [13]. The above idea can be expressed more preciously by means of the notation of an information system introduced in Pawlak in 1981. By an information system S we mean an ordered quadruple, $S = (U, Q, V, \rho)$, where U is the set called Universe of S – Element of U are called objects; Q is a set of attributes, $V\left(=\bigcup_{q \in Q} V_q\right)$ is a set of values of attributes. V_q will be called the domain of q and $\rho : U \times Q \to V$ is a description function such that $\rho(x, q) \in V_q$ for every q ∈ Q and x∈ U. We introduce function $\rho_x : Q \to V$ such that $\rho_x(q) = \rho(x, q)$ for every q ∈ Q and x ∈ U.; ρ_x will be called the description of x in S. For sake of simplicity, function ρ_x will be written as a sequence of attribute values $v_{i_1}, v_{i_2}, \ldots\ldots, v_{i_n}$ assuming that $v_{i_j} \in V_{q_j}$, of course, the order of values in this sequence is immaterial. we say

that objects $x, y \in U$ are indiscernible with respect to $q \in Q$ in A, iff $\rho_x(q) = \rho_y(q)$, and we shall write $x \overset{q}{\sim} y$, certainly $\overset{q}{\sim}$ is an equivalence relation. Objects $x, y \in U$ are indiscernible with respect to $P \subset Q$ in S, in symbols $\overset{P}{\sim} = \bigcap_{p \in P} \overset{p}{\sim}$. In particular, if $P=Q$ we say that x and y are indiscernible in S and write $x \overset{S}{\sim} y$ instead of $x \overset{Q}{\sim} y$. Obviously, P is an equivalence relation, thus each information system $S = (U, Q, V, \rho)$ defines uniquely an approximation space $A_S = (U, \overset{S}{\sim})$, where $\overset{S}{\sim}$ is the indiscernibility relation generated by the information system. If $x \in U$ and ρ_x is the description of x in S, then we assume that ρ_x is also the description of the equivalence class of the relation $\overset{S}{\sim}$ containing x. we say that the subset $X \subset U$ is describable in S iff X is definable in A_S; if X is undefinable in A_S, X will be called nondescribable in S. Description of a describable set in S consists of all description of its elementary sets. Description of an empty set is denoted by ψ.

B. Data Representation and its Relationship

A data set can be represented by a table where each row represents, for instance, an object, a case, or an event. Every column represents an attribute, or an observation, or a property that can be measured for each object; it can also be supplied by a human expert or user. This table is called an information system.

The choice of attributes is subjective (they are often called conditional attributes) and reflect our intuition about factors that influence the classification of objects. The chosen attributes determine in turn primitive descriptors that provide intensions of primitive concepts.

In many cases the target of the classification, that is, the family of concepts to be approximated is represented by an additional attribute d called decision. Information systems of this kind are called decision systems and they are written down as triples $A = (U, A, d)$.

II. DEFINITION & PROPERTIES OF ROUGH SET

The concept of rough set is another approach to deal with imperfect knowledge. It was introduced by Z. Pawlak in 1982 ([59]). From a philosophical point of view, rough set theory is a new approach to deal vagueness and uncertainty, and from a practical point of view, it is a new method of data analysis [2].

This method has the following important advantages:

- It provides efficient algorithms for finding hidden patterns in data;
- It finds reduced set of data (data reduction);
- It evaluates significance of data;
- It generates minimal set of decision rules from data;
- It is easy to understand;
- It offers straightforward interpretation of results;
- It can be used in both qualitative and quantitative data analysis; and
- It identifies relationship that would not be found by using statistical methods.

Rough set theory overlaps with many other theories, such as fuzzy sets, evidence theory and statistics. Nevertheless, it can be viewed in its own right as an independent, complementary and non-competing discipline. The rough set methodology has found many real life applications in various domains. It seems that the rough sets approaches can also be used in legal reasoning, particularly in drawing conclusions from factual data.

According to the interpretation of Pawlak, knowledge about an universe can be considered as one's capability to classify objects of the universe. By classification of an universe U, we mean a set of subsets

$\{Ci,\ i = 1, 2, ..., n\}$ of U such that $Ci \cap Cj = \varphi$ for $i \neq j$ and $\bigcup_{i=1}^{n} C_i = U$.

Let $R \subseteq UxU$ denote an equivalence relation on U, that is, R is a reflexive, symmetric and transitive relation. The equivalence class of an element $x \in U$ with respect to R is the set of elements $y \in U$ such that xRy. If two elements x, y in U belong to the same equivalence class then we say that x and y are indistinguishable with respect to relation R. The pair $aprA = (U, R)$ is called an approximation space. It is well known that an equivalence relation induces a partition of U into disjoint equivalence classes. Also, corresponding to every partition on U there is an equivalence relation, which has these partitions as its equivalence classes. It defines the quotient set U/R consisting of all equivalence classes of R. The equivalence class $[x]R$, containing x plays dual roles. It is a subset of U if considered in relation to the universe, and an element of U/R if considered in relation to the quotient set. The empty set φ and the equivalence classes are called the elementary sets. The union of one or more elementary sets are called a compound sets. The family of all compound sets is denoted by $Comp(apr)$. It is

a sub-algebra of Boolean algebra $2U$ formed by the power set of U [1],[5],[6].

Given an arbitrary set $A \subseteq U$ it may not be possible to describe 'A' precisely in the approximation space $aprR = (U, R)$ Instead one may only characterise 'A' by a pair of lower and upper approximations. This leads to the concept of rough sets. We define,

$\underline{RA} = \cup\{Y \in U/R : Y \subseteq A\}$; and

$\overline{RA} = \cup\{Y \in U/R : Y \cap A \neq \varphi\}$. Where,

$\overline{RA}$ and $\underline{RA}$ are respectively called the ***R-lower*** and ***R-upper approximation*** of A with respect to R [2]. It can be noted that $\underline{RA} = \{x \in U : [x_R] \subseteq A\}$ and

$\overline{RA} = \{x \in U : [x]_R \cap X \neq \varphi\}$.

The set $BN_R(A) = \overline{RA} - \underline{RA}$ is called the R-boundary of A. The set RA consists of all those elements of U which can with certainty be classified as elements of A, employing the knowledge R. The set $\overline{RA}$ consists of all those elements of U which can possibly be classified as elements of A, employing the knowledge R. Set $BNR(A)$ is the set of elements which cannot be classified as either belonging to A or belonging to $-A$ having the knowledge R. We say that a set A is R-definable if and only if $\underline{RA} = \overline{RA}$. Otherwise A is said to be R-rough [7], [8], [10], [12].

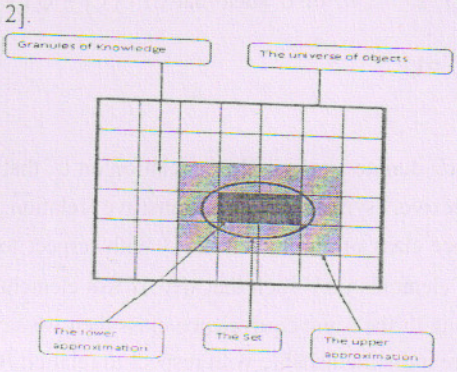

Fig: Lower and Upper Approximation of RS

III. COA (CONTROL OFFICE APPLICATION)

COA stands for **Control Office Application**; here this application is totally projected by the main IT vendor **Centre for Railway Information System** (CRIS) of Indian Railway. This COA project is to computerize the Arrival/Departure of the train. The information generated is used for various purposes by Indian Railways. This project is presently implemented in 67 Division of the Railway. One of the main operations of this project is to generate chart of the trains arrival and departure and other related details information. These information are reflected graphically. Decisions related to Fright and rail controlling are made as per the generated chart of COA. COA has also feature of route and schedule prediction for rails and frights for a given period of time under a division.

IV. INTRODUCTION TO SOFTWARE ENGINEERING

Software Engineering is the process of developing and maintaining of software in a systematic approach. The process from birth to retirement of software is divided vaguely in six phases; they are requirement analysis, designing phase, coding phase, testing phase, implementation and maintenance phase. Various ***SDLC*** Models (Software Life Cycle Development Model) deal with these phases in certain sequential manner. Every SDLC model, namely, Waterfall model or Spiral Model or Evolutionary model has its own advantages and disadvantages. We, in our work will concentrate of Evolutionary Model [3],[4],[9].

A. Evolutionary model

The software requirement is first broken down into several modules that can be incrementally constructed. The core is first developed. Core modules are those module, which do not need services from the other modules. This initial product skeleton is refined into increasing levels of capability by adding new functionalities in successive versions. The layers are built, one above the other in a way that each successive version of the product is a fully functional software capable of performing more work that its previous version.

We have chosen this model for some of its advantages. In this model, the user or client gets a chance to experiment with partially developed software much before the complete version of the system is released.

B. Analysis of the Problem

Software like **COA** needs time to time maintenance and enhancement. Our observation shows that evolutionary model gives a better result, when implemented in a prototype. The phase of maintenance depends on the feedback and involvement of the technical man power. It was further observed that selection of appropriate skilled

manpower (software developers) is one of the key factors for success and in-time delivery, when SDLC-Evolutionary Model is followed. The selection can be done from the pool of people who are associated with the COA. On basic of some of the parameters, we have classified the people into classification for appropriate selection. During the process of selection of appropriate skilled manpower, it was found that the dataset consist of some missing, incomplete and uncertain information. Hence, we proposed and used Rough Set as a tool for classification, cluster and to generate knowledge, which can be used for software procurement planning. The following sub section discuss on our classification and selection process.

For simplicity, we have assumed that, we will make the selection process among the 50 employees, who are serving the organization.

We assume that these 50 employees are distributed over four criteria (say: knowledge to handle the computer, knowledge on Rail movement, knowledge to handle COA and was part of COA up-gradation team).

Apart from regular responsibilities, some of the employee have assign extra and responsibilities to look after the smooth running of particular areas (say: computerized ticket booking counter related, Divisional MIS related, Signal system related and so on.)

Let the Fifty (50) employees distributed over four criteria are mentioned as a_i where: $i = 1, 2, 3, ..., 50$. Hence, If we consider the group of employee as Universal set U then $U = \{a_1, a_2, a_3, ..., a_{49}, a_{50}\}$ such that $a_i \rightarrow a_j$, if they belong to same criteria or of belong to same group.

We assume some arbitrary Conditions, which are very much comparable with the real World: as, some of the employees are also involved are assigned with some added responsibility. It implies that the employees name can be found in more than one section or with more than one group.

But we restrict employees grouping on the basic of criteria that is every employee's reference will be grouped in under only one criterion. However, when grouped on the basic of added responsibilities, it may consist of employees belonging to different criteria. For example, responsibility related to 'computerized ticket booking counter related' may consist of employees, who belongs to 'knowledge to handle the computer' and 'knowledge on Rail movement'.

Let, in our problem, we have four (04) criteria. Let it be mentioned as D_1, D_2, D_3 *and* D_4. Such that $D_1 \cup D_2 \cup D_3 \cup D_4 = U$, and $D_i \cap D_j = \phi$, for any $\{i, j\} = 1, 2, 3, 4$.

The above mathematical interpretation shows that no employees are belonging to more than one criterion. Now, as mentioned, the 50 employees are distributed over four criterion, let us assume, our distribution of employees are: $D_1 = \{a_1, a_2, a_3, ..., a_{15}\}$ $D_2 = \{a_{16}, a_{17}, a_{18}, ..., a_{30}\}$, $D_3 = \{a_{31}, a_{32}, a_{33}, ..., a_{45}\}$ and $D_4 = \{a_{46}, a_{47}, a_{48}, a_{49}, a_{50}\}$. Let C_1, C_2, C_3 *and* C_4 be the group of employees, working for the smooth running of the added responsibilities like 'computerized ticket booking counter related, Divisional MIS related, Signal system related' and so on.

Dividing the employees, on basic of responsibilities, assuming that we presently there are four (04) different type of responsibility, as:

$C_1 = \{a_1, a_2, a_9, a_{13}, a_{14}, a_{19}, a_{39}, a_{49}\}$,

$C_2 = \{a_9, a_{16}, a_{17}, a_{19}, a_{29}, a_{30}, a_{39}, a_{49}\}$,

$C_3 = \{a_9, a_{19}, a_{31}, a_{32}, a_{39}, a_{45}, a_{46}, a_{49}\}$ and

$C_4 = \{a_9, a_{19}, a_{39}, a_{46}, a_{47}, a_{48}, a_{49}, a_{50}\}$.

The physical interpretation of a Lower Approximation of a set $C_i, i = 1, 2, 3, 4$ here is that, it provides the fact whether all the employees belonging to a particular Criteria, works for a particular responsibility or not. Similarly, the Upper Approximation of these set provides the fact whether – there exist any Employee on any particular Criteria, who is involved in any of the Responsibility Group or not. Considering an example from above, $\overline{RC}_1 = U \Rightarrow$ that employees from Every (Four) Criteria's are involved in that particular Responsibility. Similarly, $\underline{RC}_4 = D_4 \Rightarrow$ all the employees belonging to the D_4 is involved for the Responsible group: C_4.

An efficient searching method is required to process queries like: "employee, who had worked in COA and had knowledge in Divisional MIS". Such types of queries need a proper classification to give an efficient search result. As, we not only assume, but have also observed that the profile and other details of the employees are sometime remains uncertain or consist of missing information/data. In such cases, a traditional tool for classifications fails. Classification through Rough Set provides a better result. With having flexible boundary of Lower and Upper Approximation, exact match and possible matched items can be classified to make the result more acceptable and satisfactory. With such generalized concept, an employer / manager can choose the parameters for selection of employees from the pool. A better and suitable selection of employee will make the SDLC process faster and

qualitatively better. As observed, software like COA, need input from the people who have the knowledge of rail movement and knowledge of MIS. A employee having the knowledge of building COA type application without the technical details of the rail movements will not be sufficient enough for enhancement and implementation of such type of application in more qualitatively and scheduled way. A trained user will reduce the time and cost of training and will be quick assets in giving proper feedback, which will be used for developing the next version of such application.

IV. CONCLUSION

We have discussed on 'Intelligent Information Retrieval'. There are many processes for extracting knowledge form a complete information system but for incomplete information system, it is difficult to deal with those systems having knowledge having '**incompleteness**' (some values in dataset is missing) and '**inconsistencies**' (ambiguities and contradicting values in dataset) in nature. Thus, the process of knowledge and information extraction becomes more challenging where real time data are incomplete. We have used Rough Set as a tool for clustering and handling incomplete information. In our work, we have defined and discussed on some of the known properties of Rough Set and we have implemented the tool to generate information for a software engineering process.

Here, we have studied and analyzed our proposed technique for one such software, i.e COA. In our analysis, we observed that, selecting Evolutionary Model as SDLC for up gradation and modification of this process tends to give a better result. Selection of appropriate skilled manpower (software developers) from the pool of employee, that's too when the dataset consist of some missing, incomplete and uncertain information becoming challenging. Using Rough Set, having the boundary of lower approximation and upper approximation for classification, gives a better result for selection of employee, when various criteria and responsibilities were concerned.

V. ACKNOWLEDGEMENT

About **COA**: For COA project, main vendor is CRIS. HP is the second vendor for the development of application and maintenance. This particular application was developed by WIPRO. DBA, Database maintenance and supported is carried out by Sysnetglobal Technology (Pvt) Ltd. Sysnetglobal is the third vendor and is guided by HP. This project is also known as HP_CRIS. The author Prasant Kumar Padhi is presently working on HP_CRIS under Sysnetglobal.)

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A THROAT CHOKING BARRIER TO E-COMMERCIALIZATION OF SCIENCE IN SPREADING PUBLIC BENEFIT

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Abstract

This article presents the back door obstacles and crucial part of e-Commercialization of science in spreading public benefit. It also enlightens the reasons and effects behind the creation of this barrier in transferring the know-how of an innovator to the needful public and illustrates some ways to mute it.

I. INTRODUCTION

Commercialization is the process or cycle of introducing a new product or production method into the market. It is a v-shaped funnel programme that goes through the channeled steps of scientific knowledge gain plans, various production development strategy, advertising and sales promoting ideas. An important discussion on the commercialization in research and technology for different cooperative research programme between R&D, institutional and industrial laboratories can be found in [1,2]. The case study of the same problem in Austria has been made by Wood in the research paper entitled "The Commercialisation of University Research in Australia: issues and problems" [3].The Commercialization of intellectual property has three key aspects [4]:

1. Sustainable long-term business opportunities.
2. Creating an era of its key goals and milestones.
3. Beneficial to human life.

The third aspect of commercialization is the key part that may extend to overlap all other *aspects of commercialization.*

e-Commercialization is the prior Information Technology (IT) based method of transferring knowledge about one's intellectual expert skill or his innovative property, products and services through proper licensing deals. Today the whole scientific community is reaching towards the increase in commercialization of science based knowledge through the said tool that results in the formation of spin-out companies in the targeted direction. But, it has to limit its fluorescence in the light of following implementing mechanisms.

- Technology transfer of the developed processes, strategies and implementation of knowledge
- E-commerce outline and IT guidelines.
- Copywrite protection of script and specific notes of an author.
- Cost and economics of technology licensing.
- The role of direct and foreign investment in technology transfer and competition
- Intellectual property protection: rights, international transactions and agreements
- Policies for licensing of intellectual property and technology acquisitions
- Defence technology transfer and conversion
- Spin-offs from public technology sources
- Patent licensing, intra-firm licensed technology and knowledge transfer
- Technological cooperation patterns: R&D consortia, international strategic alliances
- Commercial applications of technology transfer and associated risks

e-Commercialization permits the fast sharing of ideas and technique through viable permission of the inventor. It leads to revolutionalize the new era of knowledge based researches that climb towards human benefit. The role of management consultants in the development of e-Commercialization were discussed in detail by *Bloomfield et al.* in [5]

II. PROS AND CONS OF INCREASING e-COMMERCIALIZATION IN SCIENCE

Increasing e-commercialization in science is a vital source of uplifting and acquiring the fast track to the knowledge based skill of individual and transferring it to the whole community. It not only serves the particular domain or a region or a nation but it highlights the whole community and human life. It has a Plethora of advantages. Some of them are

1. It is the epitome of progress that extinguishes the long lasting need of requirement.

2. It leads to the growth in economy and suggests the path for further development.
3. It is a boom to medical science. Medical scales, tests, techniques and genetic material developed by a researcher group help other to inculcate and lead the sufferer towards a peaceful life. It also helps to eradicate the vital spread of human epidemic.
4. It fulfills a agrarian society by providing the new concept to agriculture.

Thus the e-commercialization is that tool which helps in handling and shaping many ongoing problems of present scenario.

Beside a number of advantages, there are some back locks thanks to profit of an entrepreneur or a researcher or supremacy of the developer to its competitor [6,7]. They part their labor with the money in exchange for the product benefit they anticipate. Others cannot access the developed product/ideas for implementation due to the following restrictions. [8].

1. Copyrighting or patenting medical scales, tests, techniques and genetic material, limits the level of public benefit from scientific discovery.
2. Most commonly used rating scales are under copyright and researchers have to pay for their use.
3. Some genetic tests also carry patents, which prevent other laboratories from doing the test for a lesser cost. For instance the patents held by Myriad Genetics for the diagnosis of mutations in the BRCA1 and BRCA2 genes (linked to breast and ovarian cancer).
4. Extreme commercialization of science can also lead to patents on medical procedures and techniques.

These tools of commercialization of science restrict the access to vital scientific knowledge and delaying the progress of science. The increasing commercialization of above parameters in terms of patenting can be analyzed in [9]. Based on the data, the worldwide patent position in 2008 is illustrated in Table I, II, and III. The comparative status over year wise ownership through different modes can be observed in chart I and II. The analysis suggests the fair increment in the tendencies of book marking their respective hologram parameter. This suggest that entrepreneur or a researcher or the developer have the motivation more towards their profit specialization rather than public benefit. The case study of the relationship beyween Public research agencies and manufacturing enterprises has been taken by Yencken et al. in the article entitled [10].

III. HOW TO ERADICATE THE PROFIT BASED e-COMMERCIALIZATION IN SCIENCE

Non-profit organizations should come ahead in taking care of crucial field of innovation where profit can be subsidized and human value cannot be put at the risk of pithy. The aim for such knowledge should be that it is freely shared without any boundaries of sharing. This is possible only when academic scientists and researchers consider the prestige of discovery more important than monetary reward.

Medical researches should have the motivation of saving the humanity from the evil effects of diseases, especially those which are non-curable like "cancer". All genome sequences generated by the human genome project should be deposited into a public database freely accessible by anyone.

The fundamental philosophy of Western science should be adopted. Their motivation is only sharing of knowledge. They think that patenting is a useful tool for protecting their investments in industry.

Policies makers should allow patent commercialization for free flow use in public welfare interest concern to prime fields as medical application.

IV. CONCLUSION

e-Commercialization permits the fast sharing of ideas and technique through the means of information technology. A new product will only succeed if,

i. It satisfies a customer's needs, wants and desires
ii. It can be economically produced and sold at the right price.
iii. Delivered to the market through appropriate distribution channels within the window of market opportunity.
iv. Satisfies applicable safety or performance criteria and delivers lasting value.

e-Commercialization helps in sharing the ideas, innovations and market demand to manufacturer and researcher who want to make reputation in market and earn profit by selling their basic ideas. However patents, copy writes and other standards limit their free flow use in market. It is beneficial for the developers and pay for their labor, but in some aspects of need where human value is prime most important, patent should be subsidized from copying. New policies should be formed to make the feasibility of part copying the ideas for public interest.

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Appendix

TABLE 1: TOP 20 COUNTRIES IN FILING PATENT APPLICATIONS (LAST DATA: 2008)

Rank	Country	No. of Patent Applications
1	Japan	502,054
2	United States	400,769
3	China	203,481
4	South Korea	172,342
5	Germany	135,748
6	France	47,597
7	United Kingdom	42,296
8	Russia	29,176
9	Switzerland	26,640
10	Netherlands	25,927
11	Italy	21,911
12	Canada	21,330
13	Sweden	17,051
14	Australia	11,230
15	Finland	10,133
16	Israel	9,877
17	Spain	8,277
18	Denmark	7,719
19	Austria	7,711
20	Belgium	7,592

TABLE 2: TOP 20 COUNTRIES IN GETTING PATENTS (LAST DATA: 2008)

Rank	Country	No. of Patents Granted
1	Japan	239,338
2	United States	146,871
3	South Korea	79,652
4	Germany	55,752
5	China	48,814
6	France	25,535
7	Russia	22,870
8	Italy	12,789
9	United Kingdom	12,162
10	Switzerland	11,291
11	Netherlands	11,103
12	Canada	8,188
13	Sweden	5,453
14	Finland	4,678
15	Australia	4,386
16	Spain	3,636
17	Belgium	2,948
18	Israel	2,665
19	Denmark	2,347
20	Austria	2,306

TABLE 3: PATENTS IN FORCE OF TOP 20 COUNTRIES
(LAST DATA: 2008)

Rank	Country	No. of Patents in Force
1	United States	1,872,872
2	Japan	1,270,367
3	China	828,054
4	South Korea	624,419
5	United Kingdom	599,062
6	Germany	509,879
7	France	438,926
8	Europe	268,384 (E.P.O.)
9	Hong Kong	227,918
10	Spain	166,079
11	Russia	147,067
12	Canada	121,889
13	Australia	107,708
14	Sweden	105,571
15	Belgium	87,189 (2003)
16	Ireland	78,761
17	Mexico	73,076
18	Monaco	50,392
19	Luxembourg	49,947
20	Finland	47,070

CHART 1
YEAR WISE NUMBER OF APPLICANTS CLAIMING THEIR OWNERSHIP IN TERMS OF DIFFERENT PARAMETERS

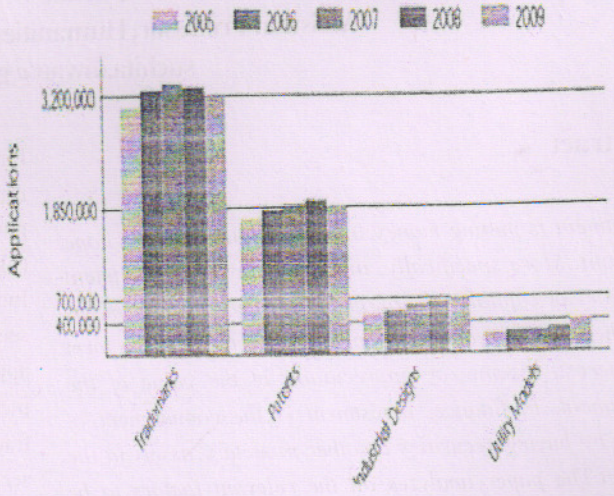
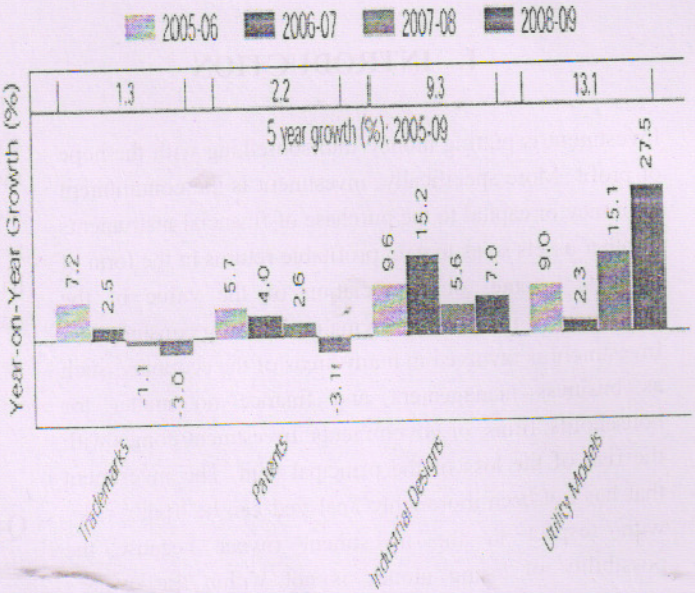


CHART 2
% GROWTH IN APPLICATIONS FOR OBTAINING OWNERSHIP OVER DIFFERENT PARAMETERS



GUIDED WAVE STUDY OF PLANNER SLAB DIELECTRIC OPTICAL WAVEGUIDE

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Abstract

In this paper we establish the fundamental concept of guided wave. Due to the transcendental nature of the eighnvalue equation,. it is very difficulty to find eighnvalue , Practically implemented optical slab waveguide based on traditional techniques . Numerical methods are used to obtain guided wave characteristics. In this paper, we develop an analytical method for modal analysis includes Eigen modes electric and magnetic fields distribution.It is well known that the thin symmetric waveguide support at least one mode. The developed technique can be easily applied to special cases

Keywords:- planar slab dielctric optical waveguide, Eigenvalue equation.

I. INTRODUCTION

Optical waveguide already play important roles in communication system.Develpment in optical communication have demanded the development of new technologyies for performing signal transmission.The simplest optical waveguide structure is the step-index slab waveguide.The slab waveguide ,consists of a high-index dielectric layer surrounded on either side by lower-index mateial.The slab is infinete in extent in the yz palne,but finite in the x direction.The index of refraction of the guiding slab,n_f ,must be larger than that of the cover material,n_c ,or the substrat material,n_s .in order for total internal reflection to occer at the interfaces if the cover and substrate materials have the same index of refelation the waveguide is called symmetric, otherwise the waveguide is called asymmetric.the symmetric waveguide is special case of the asymmectic waveguide. The slab waveguide is clearly an idealization of real waveguide,because real waveguide are not infinete in width.However ,the one-dimensional analysis is directly applicabel to many real problems,and the techniqe form the foundation for further understanding.The fabrication and performance of such waveguides,known as dielectric clad planar waveguide,we start by solving the wave equation using boundary condition for slab waveguide structure we alwayes choose the direction of propagation to be alonge z-axis.in order to understand the performance of a inhomogeneous waveguide structure,it is necessary to understand the simplest planar slab waveguide structure.in this paper ,we derive wave eqvation which determine the modes .we will develop formal mode concepts such as orthogonality,completeness,and model expansion.we will see that a waveguide structure can support only a discrete number of guided modes.

II. MATHEMATICAL BACKGROUND

Consider the waveguide structure shown in fig.1.The three indices are chosen such that $n_f > n_s > n_c$ And the guiding layer has a thickness h.the choice of the coordinate system is critical in making the problem as simple as possible.the appropriate coordinate system for this planer problem is a rectilinear cartesian system, because the three components of the field E_x,E_y and E_z are not coupled by reflections. For example an electric field polarized in Y direction , E_y will still be E_y field upon reflection at either interface ; the reflection does not couple any of the vector field into the X or Z direction. Because this is an asymmetric waveguide structure , we place the X=0 coordinate at one of the interfaces choosing arbitrarily the top interface between n_f & n_c .

We must consider the two possible electric field polarization , transverse electric or transverse magnetic. The axis of the wave guide is oriented in the Z direction. The K vector of the guided wave will ZigZag down the Z axis; the electric field is transverse to the plane of incident established by the normal to the interface , and by the K vector. Because of different boundary conditions that control both fields , the TE and TM cases are distinguished in their mode characteristics as well as their polarization. We will consider the TE case leaving derivation of the TM case.

In the TE case the E field is polarized along the Y axis. We assume the waveguide is excited by a source with frequency w_0 and a vacuume wavevector of magnitude k_0 where $k_0 = w_0/c$. To find the allowed modes of wave guides we must first solve the wave equation in each

dielectric region, and then use the boundary conditions to connect these solutions. For sine wave with angular frequency w_0 the wave equation in each region can be put in scalar form :

$$\frac{\partial^2 E_y}{\partial x^2} + \frac{\partial^2 E_y}{\partial z^2} + k_0^2 n_i^2 E_y = 0 \qquad (1)$$

Where $n_i = n_f$, n_s or n_c depending on the location . $E_y(x,z)$ is a function of both x and z because the slab is infinite in y direction so E_y is independent of y. due to translational invariance of the structure in the Z plane we do not expect the amplitude to vary along the Z axis but we do expect the phase varies. The solution to the above equation can be written as:

$$E_y(x,z) = E_y(y)e^{-j\beta z} \qquad (2)$$

β is the propagation constant along the Z direction putting this solution to the above equation noting that $d^2E_y/dy^2=0$,

$$\frac{\partial^2 E_y}{\partial x^2} + (k_0^2 n_i^2 - \beta^2)E_y = 0 \qquad (3)$$

The choice of n_i depends on the position of X. for X>0, we would use n_c while for 0>X>-h, we use n_f etc. the general solution to the above equation will depend on the relative magnitude β with respect to $k_0 n_i$. consider the case where $\beta > k_0 n_i$. the transverse wave equation have the general solution with real exponential form :

$$E_y(x) = E_0 e^{\pm\sqrt{\beta^2 - k_0^2 n_i^2}\,x} \quad \text{for } \beta > k_0 n_i \qquad (4)$$

Where E_0 is the field amplitude at x=0. We always choose the negatively decaying branch of the above equation.
In case of $\beta < k_0 n_i$ the solution has oscillatory form :

$$E_y(x) = E_0 e^{\pm\sqrt{k_0^2 n_i^2 - \beta^2}\,x} \quad \text{for } \beta < k_0 n_i \qquad (5)$$

So depending on the values of β the solution can be oscillatory or exponentially decaying. If $\beta > k_0 n_i$ we define an attenuation coefficient as ;

$$\alpha = \sqrt{\beta^2 - k_0^2 n_i^2} \qquad (6)$$

And describe the field as $E_y(x) = E_0 e^{-\alpha x}$ Compare this equation for evanescent field of a TIR wave. If $\beta < k_0 n_i$ then we define a transverse wave vector K as

$$K = \sqrt{k_0^2 n_i^2 - \beta^2} \qquad (7)$$

So $E_y(x) = e^{\pm jKx}$ we see that β and K can be geometrically related to the total wavevector $K = k_0 n_f$ in the guiding film.

β and K are called the longitudinal and transverse wavevectors respectively inside the guiding film.

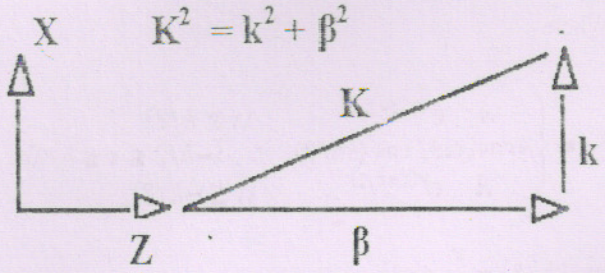

Fig.1. β and k are the longitudinal and Transverse Component ,respectily ,of the wavevector k,

For $\beta < k_0 n_c$ the solution to the wave equation in all regions of space are oscillatory . if $\beta=0$ then the wave travels nearly perpendicular to the Z axis of the waveguide.
For the $k_0 n_c < \beta < k_0 n_s$ then total internal reflection at the film cover interface, but refracting at the lower substrate-film interface takes place. This condition is called substrate mode.
A guided wave must satisfy the condition,

$$K_0 n_s < \beta < k_0 n_f$$

Where it is assumed that $n_c \le n_s$. This is a universal condition for any dielectric waveguide

III. THE SYMMERTRIC WAVEGUIDE

The index of refraction of the guiding slab,n_f ,must be larger than that of the cover material,n_c ,or the substrat material,n_s ,in order for total internal reflection to occer at the interfaces.if the cover and substrate materials have the same index of refelation,the waveguide is called symmetric.Guiding film with index n_f and thickness h is surround on both sides by an index n_s It is convenient to place the coordinate system in the middle of this waveguide since the fienl will reflect the symmetry of structure.

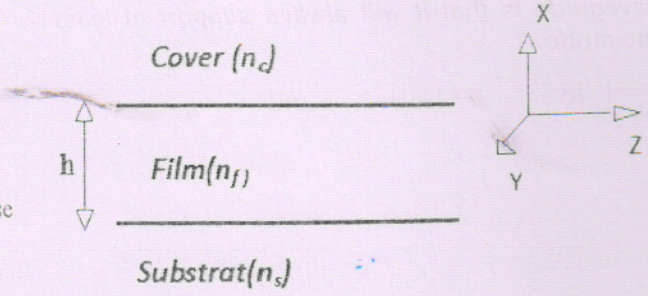

Fig.2. The Planar slab waveguide consist of three materials

General field description of a TE mode within the symmetric structure

Where

$$E_y = \begin{cases} A\ e^{-\gamma(x-h/2)} & (x \geq h/2) \\ A\cos(\kappa x)/\cos(\kappa h/2) & (-h/2 \leq x \leq h/2) \\ A\ e^{\gamma(x+h/2)} & (x \leq -h/2), \end{cases}$$

$$\tan(\kappa h/2) = \frac{\gamma}{\kappa} \quad \text{for even modes} \qquad (9)$$

$$\tan(\kappa h/2) = -\frac{\kappa}{\gamma} \quad \text{for odd} \qquad (10)$$

Unique feature of the symmetric waveguide is that it can always support at least one mode

IV. RESULT AND DISCUSSION

=1.46000 , = 0
=1.47000 , = 10.^-6
=1.46000 , =0

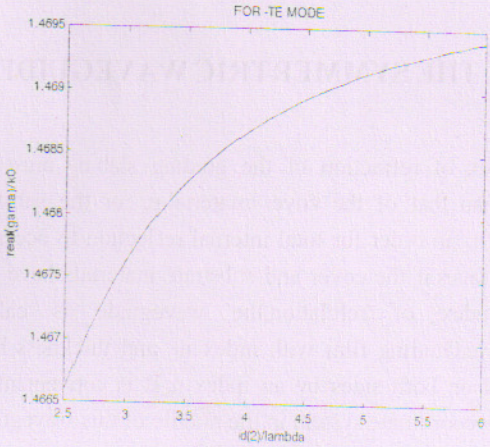

Fig.3.

A unique feature ***A unique feature of the symmetric waveguide is that it will always support at least one mode.***

=1.485 , =1.49 and

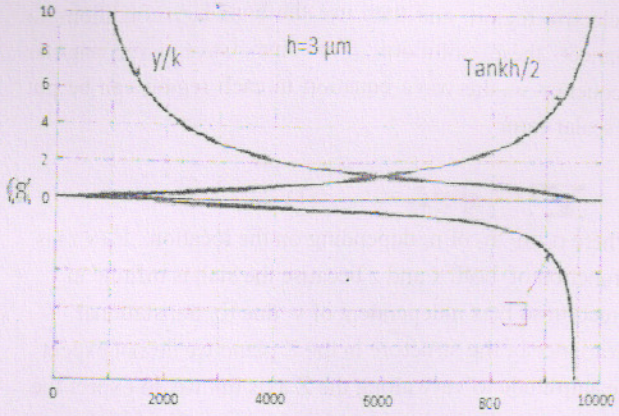

Fig.4. For thin waveguide,there is only one mode near k=6000cm

and difference in index between two layer is very small. wavwlenght 0.8 micrometter and h=3 micron.

fig.4 ,shown to even mode,begin a ∞ and terminate with a value of 0.the two curve will cross,so must be at least one mode.

V. CONCLUSION

In the conclusion, we have applied to solve the wave equation . we establish the fundamental concept of guided wave. Result shown the thin symmetric waveguide support at least one mode.

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STRATEGY - THE LEVEL OF STRATEGIES IN AN ORGANIZATION

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Abstract

An organization is divided in to several functions and departments that work together bring a particular product or service to the market. A company provides several different kinds of products or services, it often duplicates these functions and creates a series of self-contained divisions to manage each different product or service. The CEOs or departmental chiefs of these divisions then become responsible for their particular product line. The overriding concern of CEOs is for the health of the whole company or division under their direction.

Keywords:- Business Strategy, Strategy, Corporate objectives, Functional Level Strategy, Strategic Business Unit.

I. INTRODUCTION

The term strategy has been adopted from war and is used in business to reflect the broad overall objectives and policies of an enterprise. It refers to firms overall plan for dealing with and existing in its environment. It most often denotes a general programme of actions and development/deployment of emphasis and Resources to attain comprehensive objectives. Definition:- "A strategy is the determination of the basis long term goals and objectives of an enterprise and the adoption of courses of action and the alteration of recourses necessary to carryout these goals and objectives." [by Glueek and Jauh]

"The pattern of objectives, purpose, goals and the major policies and plans for achieving these goals stated in such a way so as to define what business the company is in or is to be and the kind of company it is or is to be." [by Kenneth Andrews, 1955]

II. STRATEGIES AT DIFFERENT LEVELS

From the organizational point of view, we may distinguish between the nature and scope of strategic decisions at the (i) Corporate (ii) Business & (iii) Functional levels. Strategy in terms of levels is a convenient way to distinguish among the various responsibilities involved in strategy formulation and implementation. A convenient way to classify levels of strategy is to view corporate level strategy as responsible for market navigation and functional level strategy as the foundation that support both of these. A few aspects regarding the nature of strategies are as follows:

III. CORPORATE LEVEL STRATEGY

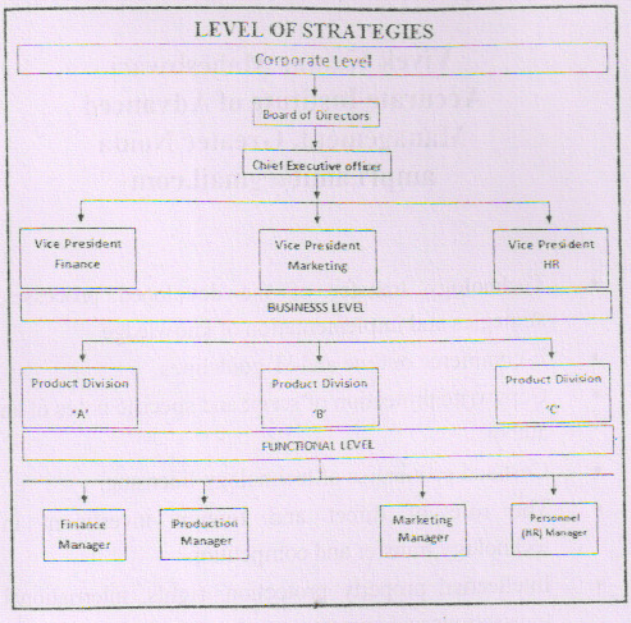
At the corporate level, strategic decisions relate to organization wide policies as in the case of multi divisional companies having wide ranging business operations. Major policy decisions involving acquisition, diversification and structural re-designing belong to the category of corporate strategy.

An organization's strategy provides the overall direction for the enterprise. It clarifies the domain of the organization by specifying what business it is in and the course of action it will pursue. It answers the quations: who are our customers? What product or services will we sale/serve? Where will we sell our product or services? Why are we unique as compared with the competitors? Ideally a corporate strategy should cover three things –

- The basic goals the firm hopes to achieve - for instance, in terms of market share or profit.
- The firm's domain in terms of the product or services it will render to whom. The domain answers the question "What business are we in"?
- The basic strategy moves the firm's plan to make for instance in terms of diversification or expanding overseas business or entering in to new ventures.

Corporate level strategies address the entire strategic scene of the enterprise. This in the 'big picture' view of the organization and include decisions, in which product or service market to compete and in which geographic regions to operate. For multi - business firms, the resources allocation process, i.e. how cash, staffing, equipment and other recourses are distributed is typically established at the corporate level. In addition, it is also in the domain of corporate strategists to decide about the diversification or

the addition of new products or services to the existing one which ultimately also falls under corporate level strategy.



IV. BUSINESS LEVEL STRATEGY

It is the strategy to achieve the specific objectives of the strategic business unit (SBU) so as to help achieve the overall corporate objectives. A SBU is an operating division of a firm which serves a distinct product/market segment or a well defined set of customers or geographic area. The SBU is given the authority to make its own strategic decisions within corporate guidelines as long as it meets corporate objectives.

At the strategic Business level unit, strategy is concerned with the product market issue and policies for the co-ordination among functional units of a division or plant. The scope of business strategy is limited as comparedto corporate strategy. Let us take the case of a multi-product corporation of a giant size. Decision taken at the top level regarding diversification or acquisition of other companies are corporate decisions. But decisions taken at the plant or divisional level regarding introduction of a product or development of a new product are business decisions. Business level strategy is primarily concerned with -

- Co-ordinating and integrating unit activities so that they confirm to organizational strategies.
- Developing distinctive competencies and competitive advantage, in each unit.
- Identifying product or service market and developing strategies for competing in each
- Monitoring product or service markets so that strategies conform to the need of the markets at the current stage of evolution.

V. FUNCTIONAL LEVEL STRATEGY

The ultimate success of the SBU level strategy will depend among other things on the effectiveness with which it Is translated into functional areas like marketing, finance, production, HR and R&d etc. For example, if the SBU level objectives are to be achieved by introducing a new product, the R & D, production, finance and marketing department will have to be geared up to develop functional level strategies. Thus, it is obvious that functional level strategies are guided by the SBU level strategy. Functional level strategies are primarily concerned with:-

- Efficiently utilizing specialists within the functional area.
- Integrating activities within functional area
- Assuring that functional strategies mesh with business level strategies and the overall corporate level strategies.

Functional strategies are frequently concerned with appropriate training. They have a shorter time orientation then other level strategies.

VI. CONCLUSION

The level of strategies in an organization is gaining importance in the era of privatization, Globalization, & Liberalization. The table depicted below shows the importance of these strategies (i. e. corporate level strategy, Business level strategy & Functional level strategy) and how close are these strategies interconnected and dependent on each other.

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MAKING WOMEN COMPETENT ENOUGH FOR TOMORROWS SUSTAINABILITY IN INDIA

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Abstract

The population of the world constitutes almost 50% of women. As per as their social status is concerned, they are not treated as equal to men in all the spheres of life. Women are understood as they are not enabling people, they cannot acquire and possess power resources, in order to make decision on their own, or resist decisions that are made by others that affect them. Even it is said that they should be empowered when they have control over a large portion of power resources in society. The extent of possession of various resources such as personal wealth, such as land, skills, education, information, knowledge, social status, position held, leadership trains, capabilities of mobilization. It is widely believed that the women will be competent when they get equal rights, opportunities and responsibilities. The competency will go a long way in removing the existing gender discrimination.

Women competency in contemporary Indian society is in forms of their education, health, media images and work in the context of descendant, their legal status in terms of marriage, divorce and inheritance of property, their participation in social and political activities, rule of residence and household chores, seeking wealth care should be taken into consideration. Similarly, a role of women deals with duties and obligations while empowerment deals with rights. For instance, it is commonly assumed that the most of the woman in India is: wife a cook, a teacher of her children and daughter-in-law and so on.

The paper deals with the status of 20th century women in India and their preventive scales to handle and make women over come from the orthodox customs. The data reflects the gradual changes in 21st century women's' status, and a new look of 21st century women which resulted as India shining among the World.

Woman must not accept; she must challenge.
She must not be awed by that which has been built up around her; she must reverence that woman in her which struggles for expression.

~Margaret Sanger ~

I. INTRODUCTION

The population of the world constitutes almost 50% of women. As per as their social status is concerned, they are not treated as equal to men in all the spheres of life. Women are understood as they are not enabling people, they cannot acquire and possess power resources, in order to make decision on their own, or resist decisions that are made by others that affect them. Even it is said that they should be empowered when they have control over a large portion of power resources in society. The extent of possession of various resources such as personal wealth, land, skills, education, information, knowledge, social status, position held, leadership trains, capabilities of mobilization. It is widely believed that the women will be competent when they get equal rights, opportunities and responsibilities by removing the existing gender discrimination.

Women competency in contemporary Indian society is in forms of their education, health, media images and work in the context of descendant, their legal status in terms of marriage, divorce and inheritance of property, their participation in social and political activities, rule of residence and household chores, seeking wealth care should be taken into consideration.

Women have been portrayed as frail and feeble since time immemorial. This is very strange that this phenomenon is not limited to one civilization or society alone but it is common to most of the culture in this world. Feminity is a Female Gender Role and in sociology the term gender role denotes a set of behavior norms in which society tries to impose these norms upon an individual through a process called socialization and during this process a person accepts these norms, acts according to them and develops a matching sense of gender identity (www worldIQ.com)

Since the antiquity the women has been suppressed and remained underdeveloped. Women were left behind in the process of development in comparison to men because of social evils and traditions. Women perform approx 70% of the total working hours but can earn only 10% of the economy. Two-third of the total population is illiterate-

therefore there is serious need to pay attention to women of the country.

Empowerment as judgment was introduced at the International Women's Conference at Nairobi in 1985. The discussion tangible empowerment as: "A redistribution of amicable power as great as carry out of resources in foster of women. Empowerment is a multi-faceted routine that encompasses most aspects i.e. enhancing awareness, arguing entrance to resource of economic, amicable as great as done at home etc."

Newer technologies and developed instruments have opened the doors for women for safe, reputed and productive work in organized as well as in unorganized sector, now people believe that women are regarded to be more devotional to their ethics.

II. GENDER PREJUDICESC IN WOMEN GROWTH

Sociologically the word gender refers to the socio-cultural definition of man and woman, the way societies distinguish men and women and assign them social roles. The distinction between sex and gender was introduced to deal with the general tendency to attribute women's subordination to their anatomy. For ages it was believed that the different characteristics, roles and status accorded to women and men in society are determined by sex, that they are natural and therefore not changeable.

Traditionally women are confined by the constraints of domestic arena, docile, passive, and inferior, upholding, a feminine ideal of domesticity. In male dominating society it is still the man who has right to question, use weapons and wear a picture of complete confidence. A women is small presupposed to be seek, humble, and submissive.

Any discrimination between men and women are really a matter of concern and endeavor to spread gender equality and gender justice is worth praising. Since days immemorial, women have been bogged down by domestic obligations and compulsions. Their mobility has been confined with the four walls of kitchen. Women have also been submissive to male domination society the reason for them being taken for granted and exploited. On the other side society pays respect to women on various occasions.

III. LITERATURE REVIEW

Gender Diversity: Case Studies in Indian Media

- Female representation Women's access within media has visibly enhanced in the past decades while the state agencies such as Prasar Bharti have stated policies for increasing women's presence following reports to promote gender equity[2]. Private organizations do not have formalized guidelines[3] yet they have a large number of women staff.

Source: Joseph, Ammu (2002), Working ratio of women

Doordarshan Staff Related to News

	Male	Female	Total
New recruiters in DD news service	5	16	21
DD News senior most post	1		1
Director news	5	-	5
News editors	7	3	10
Assistant news editors	9	3	12
Executive producer	1	-	1
Chief producer	1	-	1
Programme executives	12	-	12
Video editors	8	-	8
Camera 'men'	30	3	33

"Participation and Access of Women to the Media, and the Impact of Media on and its use as an Instrument for the Advancement and Empowerment of Women" Beirut, Lebanon 12 to 15 November 2002

	Male	Female	Total
HT City features	1	8	9
Bureau	3	-	3
City reporters	11	3	14
Outstations reporters	19	2	21
Photographers	3	-	3

Source: Hindustan Times Editor Chandigarh edition as on June 1, 2004

The Hindustan Times (Chandigarh Edition)

However, a look at the disaggregate data reveals that women as broadcasters and on desk jobs have a higher representation than as correspondents. While Hindustan Times has only five female reporters out of 35, The Indian Express Chandigarh Edition has six out of a total of 23. The place of women in genuine journalistic role in Indian language newspapers according to Robin Jeffery's was found wanting. "Their numbers... were scant, the jobs few and prejudices against them formidable"[4] No doubt gender discrimination is rampant in the media, but given their increasing presence can women as a 'critical mass' transform media portrayal of gender?

"What worries me is that so many women are coming into television as directors and writers and there is still no change (in the stereotyping of

women in popular television serials)" – Shabana Azmi

- Representation of gender interests minimal Physical imagery of the female form is used in subtle or in a more blatant manner as a product by the media itself. The acceptance of the 'femininity product' with the media can be further gauged through the minimal representation of gender interests. A media survey in 1994 of gender coverage in news found:
- Gender representation to be biased – men were portrayed in diverse roles, women almost always in traditional feminine roles.
- Women accounted for 7 per cent of the time in the hard news section and 14 per cent in all news programmes[6].
- 1999 analysis of two English newspapers found women occupying a marginal space. Coverage relegated to a weekly 'gender page'. Female presence was more through advertisements, news of crime and social events. Cricket news occupied nearly 20 per cent more space than women's issues.

Gender Portrayal within Media

Product creation and proliferation of commodity the portrayal of gender as a product and the accompanying body politic in the media is well-documented. The most common form is the coverage provided to the beauty pageants and mega models. Women's representation has moved beyond female images of the family and home to personal care as dictated by the market agenda in a predominant patriarchy.

Sankar, who consults on gender and microfinance issues for the United Nations Development Programme (UNDP), the United Nations Office for Project Services (UNOPS), Christian Aid, while women can be expected to be provided for, they are assigned a subordinate status within the household and society at large. Their dependent status leaves them vulnerable to 'patriarchal risk', that is, there would likely be an abrupt decline in their economic welfare and social status if they no longer had male guardianship. The greater the dependence, the greater the risk.

Even as the latest UNDP Report ranks India 119 in the Human Development Index, in the Gender Inequality Index, India ranks 122 at 0.748. "Women and children are the most disadvantaged sections of the population in terms of resources, access to healthcare, education, information and communication technology," says Sankar. "Female-male ratio of representation in parliament is a mere 0.1, female-male ratio of population with at least secondary education is 0.5." (Last updated: December 13, 2010)

Women participation in Media:

In the beginning of the media profession the women were given work in the editorial section of the news paper there was no single women in reporting section on the desk at the edit page. The women were receptionist and telephone operators. Over the last few decades larger number of women started employed in the media. The media course offered in the university from the 1960s onwards, the issue based women's movement of the 1970s and the magazine boom in the 1980s. At this time women get job of writing soft stories or features for magazine sections, instead of working as reporters. Women who joined in 1970s were either associated with or sympathetic to the women movement and various movements at grassroots level (Bhavani & Vijaya laxmi 2005:22) the opportunity expanded for women with the economic liberalization and growth of satellite channels and the launching of chain newspaper editions. Now there is a remarkable change, it has been the increasing visibility of women resident editors, news editors, chief reporters, reporters, editors and publishers. This inspired women to enter the media with confidence but few women holds a senior position and still male is dominating in this field.

The Press Institute of India's Study 2004 observed that though an increasing number of women are reporters and the nature of work is not encouraging. Women are still limited to the assignments covering 'soft issues' such as fashion, culture, the arts and the life style while men are assigned political and economic stories, which are considered 'hard issues'.

In the overall development of society and nation, role of women is very significant. It is commonly accepted that a developed society is one, which represents the rights of its female members, where women have equal status, economic, social and all other. In the backdrop we have attempted to evaluate place of women in India in the field of media and empowerment.

IV. OBJECTIVE

The objective of the study is to portray the status and participation of women in media and their process of empowerment.

- Analyze the effect of Government Policies in empowering women.

National Policy 2001

The goal of this Policy is to bring about the advancement. development and empowerment of women. The National Policy includes creating an environment through positive economic and social policies for full development of women to enable them to realize their full potential. It provides all human rights and fundamental freedom by women on equal basis with men in all spheres – political, economic, social, cultural and civil. It ensures Equal access to participation and decision making of women in social, political and economic life of the nation. It also ensures equal access to women to health care, quality education at all levels, career and vocational guidance, employment. equal remuneration, occupational health and safety, social security and public office etc. The policy strengthens legal systems aimed at elimination of all forms of discrimination against women and changing societal attitudes and community practices by active participation and involvement of both men and women.

On the basis of the above interpretation the strategies has been designed in the National policy to enhance the capacity of women and empower them to meet the negative social and economic impacts, which may flow from the globalization process.

The National and State Councils headed by the Prime Minister and the State Councils by the Chief Ministers and be broad in composition having representatives from the concerned Departments/Ministries, National and State Commissions for Women, Social Welfare Boards, representatives of Non-Government Organizations, Women's Organisations were formed to oversee the operation of the Policy on a regular basis. These bodies will review the progress made in implementing the Policy twice a year. The National Development Council has also been informed of the progress of the programme undertaken under the policy from time to time for advice and comments. At the grass-roots, women have been helped by Government through its programmes to organize and strengthen into Self-Help Groups (SHGs) at the Anganwadi/Village/Town level. The women's groups will be helped to institutionalize themselves into registered societies and to federate at the Panchyat/Municipal level. These societies work about synergistic implementation of all the social and economic development programmes by drawing resources made available through Government and Non-Government channels, including banks and financial institutions and by establishing a close Interface with the Panchayats/ Municipalities

Women Empowerment through Five Year Plans

First (1951-56)	Welfare measures for women. Establishment of the Central Social Welfare Board. Organization of Mahila Mandals and SHG and the Community Development Programmes
second (1956-61),	The empowerment of women was closely linked with the overall approach of intensive agricultural development programmes.
Third and Fourth (1961-66 and 1969-74)	Female education as a major welfare measure.
Fifth (1974-79)	Training and capacity building of women for the need of income and protection. In 1976, Women's welfare and Development Bureau was set up under the Ministry of Social Welfare.
Sixth (1980-85)	Shift from welfare to development.
Seventh (1985-90)	Gender equality and empowerment
Eight (1992-97)	Empowering women, especially at the grass roots level, through Panchayat Raj Institutions.
Ninth (1997-2002)	Strategy of women's component plan, under which not less than 30 percent of funds/benefits were earmarked for women-specific programmes.
Tenth (2002-07)	Empowering women through translating the recently adopted National Policy for Empowerment of Women (2001) into action and ensuring Survival, Protection and Development of women and children.
Eleventh (2007-12)	*Meeting the MDGs and is a signatory to many international conventions, including Convention for Elimination of all forms of Discrimination against Women and the Convention on the Rights of the Child.*

- Perception of male and female working as a media professional for female candidates
- Comparative study women working in media in India of secondary data

V. METHODOLOGY

Sample for primary data:

Over all 50 Men including Women were interviewed (working as a media person in over all India).

Secondary Data and Primary Data:

A. Secondary data record of 'women working in media.'

Data related to women participation in India (Secondary Data)

1) *First press commission report by government of India 1954*
   - Nearly 2000 media person were employed.
   - In 189 Indian language newspaper 1,270 journalists were working.
   - In 36 English newspapers 751 journalists were employed.

   Total Women comprised 12 percent of the workforce in India (Bhavani and Vijaya Lakshmi 2005:22)
2) *Eapen's study (1967)* found two-thirds of journalists were from forward castes and from prestigious family.
3) *Joseph (1994)* Studied 200 women journalists. And revealed that gender continued to play an obstructive role in the lives of Indian women journalists both in the professional and in the wider society.
4) *The press Instituute of India report 2004* revealed that over two thirds of women journalist was below 34 years. The study observed that many women journalists (even from established newspapers) work as a daily wage labour, without any appointment letter, signing a muster roll at the end of the month to get Rs. 1,500-3000. They are hired and fired.
5) *Balasubramanyam 2005* studied 835 journalist spread across 14 different states, working in newspapers and magazines in 11 languages. Only 20.12 percent of them were women journalists and among them 38.68 percent were in the age group of 20-30 years and 35.57 percent were in the 31-40 age group.
6) *Bhavani and Vijaya Lakshmi 2005* reported that a majority of women journalists 77 percent in **Andhra Pradesh** were confined to desk as chief sub-editors, desk in charges, senior sub editors and edition in-charge and sub-editors. 4.1 percent in Telugu and 4 percent in the English press reached higher position as editors of newspapers. The study found that only 18.9 percent of respondents were working as reporters in Telugu papers and only 8 percent were working in English newspapers.
7) *In Andhra Pradesh* 35.1 percent of women working in medium newspapers were earning salary of less than 2500 per month. The percentage of women earning a salary of Rs 501-5000 per month was 35.1 percent in medium newspaper and 29.8 percent in large ones. A high percentage 37.4 percent of journalists in prominent newspapers received Rs 500 more per month than woman in medium size newspaper (2.8 percent).

B. Primary data answer to unstructured questions by the media people working in small, large and big media.

Instrument:

Unstructured questionnaire was used for the interview session. During the interview observation was made to check the reactions.

Interpretation:

All human rights-civil, cultural, economic, political and social including the right to development are universal, indivisible, interdependent and interrelated... the human rights of women and the girl child are an inalienable, integral and indivisible part of universal human rights. The full and equal enjoyment of all human rights and fundamental freedoms by women and girls is a priority for governments and the United Nations and is essential for the advancement of women (Beijing Platform for Action, paragraph 213).

The lack of gender sensitivity in the media is evidence by the failure to eliminate the gender based stereotyping that can be found in public and private local, national and international media organizations. Print and electronic media in most countries do not provide a balanced picture of women's diverse lives and contributions to the society in a changing world. (Beijing Platform for Action, paragraph 235 and 236).

Efforts by the government to empower women: the ongoing effort to empower the women is made by the state, voluntary organizations and women group. Women group are also known as autonomous women's group. The main emphasis was to eliminate the discrepancies among genders. If the constitution guarantees equal opportunity and prohibition of discrimination has to become a reality

(put into practice) there has to be a constant effort to identify and gender inequalities

From the Fifth Five Year Plan (1974-78) onwards has been a marked shift in the approach to women's issues from welfare to development. In recent years, the empowerment of women has been recognized as the central issue in determining the status of women. The National Commission for Women was set up by an Act of Parliament in 1990 to safeguard the rights and legal entitlements of women. The 73rd and 74th Amendments (1993) to the Constitution of India have provided for reservation of seats in the local bodies of Panchayats and Municipalities for women, laying a strong foundation for their participation in decision making at the local levels. The strategy of Women's Component Plan adopted in the Ninth Plan of ensuring that not less than 30% of benefits/funds flow to women from all Ministries and Departments will be implemented effectively so that the needs and interests of women and girls are addressed by all concerned sectors. The Department of Women and Child Development being the nodal Ministry will monitor and review the progress of the implementation of the Component Plan from time to time, in terms of both quality and quantity in collaboration with the Planning Commission: rights of women given by the Human Rights are:

- Promoting and protecting the human rights through the full implementation of human rights instruments, especially the Convention on the elimination of All Forms of discriminating against women;
- Ensuring equality and non-discrimination under the law and in practice;
- Achieving legal literacy.

But Women are not aware of their basic rights under national and international law. Interview result shows that men's attitude towards women's working in media, that moreover 70 percent of women reported that they had no job satisfaction. Further 48 percent felt that their colleagues did not give proper encouragements in their area of interest. The study reported that 30 percent felt that they were not given important work, 45 percent claimed that they denied promotions, 45 percent reported that male colleagues found fault with their work and 53 percent said that there was a difference in men's and women's salary.

Interpretation of primary data:

Among the respondents, 45 percent female respondents said they earn less than 1,20,000 rupees per annum. 40 percent said they are getting approx 80,000 per annum further media women who were earning more than 2,50,000 per annum were few in numbers, 2.7 percent have an income in the range of 2,51,000-3,00,000.

The obtained result shows that now the attitude towards shift job have been changed more than 50 percent women are working in night shifts. But still they are having problem because of family responsibilities.

According to the all respondents the motivation for shift work and working in media are scope to express views, the chance to reform others, reform society, to get recognition, power and prestige, according to few of the subjects' salary is also a motivation to work in media.

VI. CONCLUSION

After more than a half century of independence, progressive economic and social policies, more than a decade of economic reforms, we find that our women folk are still not in the position where they ought to be. Illiteracy is a black spot on India's face and when we take case of women literacy situation is further grim. Similarly, unemployment is a cause and outcome of low development and here too, we are not able to utilize half of our human resource simply because they are not properly educated / trained.

It seems not only from pre-existing differences in economic endowments between women and men but also from pre-existing gendered social norms and social perceptions. Gender inequality has adverse impact on development goals as reduces economic growth. It hampers the overall well being because blocking women from participation in social, political and economic activities can adversely affect the whole society

There is a need for new kinds of institutions, incorporating new norms and rules that support equal and just relations between women and men. "Women have to be considered as equal participants in shaping the future society in India," argues Sankar. "It is not enough for poor women to earn more, she must have control over her earnings in order to continue to be productive. She must experience the benefits of that increased income. For many women, the process will involve confronting established social norms and hence the emphasis on striving for social change."

UN Secretary General Kofi Annan has stated, "Gender equality is more than a goal in itself. It is a precondition for meeting the challenge of reducing poverty, promoting sustainable development and building good governance."

The secondary data shows that the government of India and State of Andhra Pradesh has taken special attention for the empowerment of women but due to the social barriers and illiteracy, ignorance and violence due to gender disparity has stopped women to participate in media freely.

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VOLTE: VOICE OVER LTE - CONSIDERATIONS AND DEPLOYMENT IN 4G NETWORKS

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Abstract

For all the mobile network operators, voice and short message service (SMS) have consistently been major sources of revenue. Optimum support of these conventionally circuit switched services in data-oriented LTE is essential. LTE was specified by the 3rd Generation Partnership Project (3GPP) in release 8 and further updates are also in progress. LTE is designed as a pure packet switched system. This implies that support of voice within LTE has to be done with voice over IP. This paper discusses various alternatives to accommodate voice during migration period

Keywords:-4G, VOLTE, IMS,SMS

I. OVERVIEW

Supporting voice over IP in a cellular communication system throws in a lot of new challenges. Mainly the Subscribers expect the same quality of service they know from circuit switched voice services, like in GSM networks.

Voice support in LTE requires the right mechanisms and architecture in radio and core networks, to guarantee quality of service and a good user experience. Nnationwide LTE coverage can hardly be achieved from day one onwards. Hence subscriber mobility between LTE and legacy GSM, UMTS and CDMA networks is also a key requirement.

When it comes to voice support in LTE, the IP Multimedia Subsystem (IMS) is the key technology. IMS provides a framework for supporting IP based services and requires new IMS-specific network elements as part of the dedicated core network architecture. The first version of IMS was standardized in 3GPP release 5, with many enhancements specified in subsequent releases.

In the early days of LTE standardization, it had been assumed that IMS would be commercially available when the first LTE networks were deployed. Voice support was also considered as being addressed by IMS. However, rollout of IMS was slower than expected, with the result that voice support in LTE had become a real challenge for many network operators.

Alternatives and intermediate solutions for supporting voice services in LTE were investigated more deeply. The most important and commercially relevant one is the circuit switched fallback which basically provides subscribers with voice services via the existing networks GSM, or CDMA. The users "fall back" to one of these technologies as soon as they initiate a voice call within LTE coverage or if they accept a terminating voice call.

The first LTE networks are already using CSFB for voice support. CSFB is also supporting a variety of roaming scenarios, ensuring that existing circuit switched roaming agreements can be met.

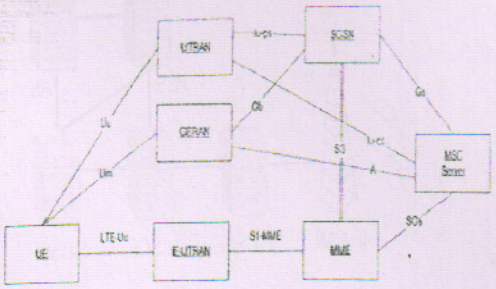
A closely related topic to support of voice is the support of SMS as another key circuit switched service. SMS is a huge revenue driver for network operators worldwide. A non-IMS based solution for SMS was specified by 3GPP, the "SMS over SGs" solution for GSM and UMTS networks, where SGs is the name of a core network internal interface. SMS over SGs allows network operators to support SMS as a circuit switched service within LTE.

In the long run, support of voice and messaging in LTE over IMS remains the major target. A related industry initiative is VoLTE (Voice over LTE). It was formally announced in February 2010 [3] by the network operator organization GSMA (Global System for Mobile Communications Association). VoLTE has developed the framework for optimum support of voice and SMS over IMS in LTE, including roaming and interconnect issues. VoLTE is based on existing IMS multimedia telephony (MMTel) concepts.

II. CIRCUIT SWITCHED FALLBACK (CSFB)

CSFB is the mechanism to move a subscriber from LTE to a legacy technology to obtain circuit switched voice service. This function is only available if LTE coverage is overlapped by GSM, or CDMAT coverage.

CSFB was already specified in 3GPP release 8, with further enhancements defined in 3GPP release 9. A number of different CSFB mechanisms are available, and there are also differences depending on the radio technology the subscriber falls back to.

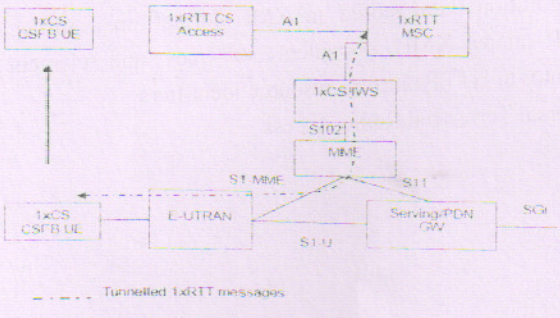


III. CIRCUIT SWITCHED FALLBACK TO GERAN OR UTRAN

CSFB affects the radio and the core networks. 3GPP technical specification (TS) 23.272 [5] is the stage 2 specification of CSFB, providing an overview of the architecture and procedures used. Figure 1 taken from TS 23.272 shows the Evolved Packet System (EPS) architecture for CSFB. It includes the interfaces between the different radio access network types and the core network entities. UTRAN is the UMTS terrestrial radio access network, GERAN is the GSM/EDGE radio access network, and E-UTRAN is the evolved universal terrestrial radio access network of LTE. To support circuit switched services, a connection to the mobile switching center (MSC) server has to be established. The mobility management entity (MME) of the evolved packet system interfaces to the MSC server via the SGs interface. The CSFB mechanism is implemented using this SGs interface.

IV. CIRCUIT SWITCHED FALLBACK TO CDMA

For CSFB to 1xRTT, the UE can establish voice service by falling back from E-UTRAN to the CDMA network. Figure shows the reference architecture for CSFB to 1xRTT [5]. It includes the S102 reference point between the MME and the 1xCS IWS (circuit switched fallback interworking solution function for 3GPP2 1xCS). The S102 reference point provides a tunnel between the MME and the 1xCS IWS to relay 1xCS signalling messages.



V. SMS OVER SGs

SMS over SGs is a mechanism to transmit circuit switched SMS over the LTE radio network. It is based on circuit switched infrastructure and is a transition solution before SMS over IMS is deployed. SMS over SGs was specified in 3GPP release 8. The SGs is the reference point between the MME of the evolved packet system and the MSC server. The protocol used to connect an MME to an MSC server is SGsAP. The protocol for transferring signalling messages is the Stream Control Transmission Protocol (SCTP).

The SGs is used to handle mobility management and paging procedures between EPS and the CS domain and for SMS, to deliver both mobile originating and mobile terminating SMS.

SMS over SGs is independent from CS Fallback; meaning it does not trigger CS Fallback to UTRAN or GERAN. As no fallback takes place, SMS over SGs does not require overlapped coverage of LTE and already existing technologies.Supporting SMS over SGs is mandatory for UE, MME and MSC entities supporting CS fallback. However, entities supporting SMS over SGs are not required to support CS fallback.

VI. SUPPORT OF VOICE AND SMS VIA IMS

The IMS is an access-independent and standard-based IP connectivity and service control architecture. It provides the framework for IP-based multimedia services in a mobile network and is an ideal choice to offer voice over IP services. IMS was first specified in 3GPP release 5 and enhanced in the following 3GPP releases to a powerful feature set supporting a wide range of multimedia applications.

Today, the mobile industry considers IMS as the major solution for supporting voice and SMS services in LTE. A Voice over IMS profile was defined that only contains those network and terminal features that are considered essential for launching IMS based voice. The "One Voice" alliance of several major network operators and manufacturers published their 3GPP-compliant Voice over IMS profile recommendations already. Complying to this profile is the prerequisite for interoperability of different manufacturer's terminal and network implementations.

"Using IP Multimedia Subsystem specifications developed by 3GPP as its basis, GSMA have expanded upon the original scope of One Voice work to address the entire end-to-end voice and SMS ecosystem by also focusing on Roaming and Interconnect interfaces, in addition the

interface between customer and network. GSMA VoLTE will develop the function and technical definitions for the way in which Voice and SMS will work in the future, and will define the interfaces for an end-to-end calling structure that will take into account interconnect and roaming."

Proper consideration of the roaming and interconnect issues will be key to the success of voice over IMS in LTE. From experience with legacy technologies, subscribers are used to seamless service availability and worldwide access to voice and messaging services. GSMA published the IMS profile for Voice and SMS (GSMA Permanent Reference Document IR.92, based on the profile specified by the One Voice alliance. Only the essential set of terminal and network features for supporting voice and SMS services via IMS is listed; the required IMS functions, supplementary services, media characteristics and radio and packet core capabilities. At a later point, more features may be added to terminals and networks. Compatibility between early VoLTE implementation and later releases shall always be ensured.

The first LTE networks are unlikely to offer nationwide coverage. Therefore, the continuity of voice calls needs to be guaranteed by handover to a legacy technology such as GSM. This is achieved by a feature called single radio voice call continuity (SRVCC).

VII. OVERVIEW OF THE IMS FRAMEWORK

The IMS reference architecture provides entities for session management and routing, service support, data bases, and interworking. For LTE, the IP connectivity access network (IP-CAN) as shown in Figure would be composed of the EPS and the E-UTRAN.

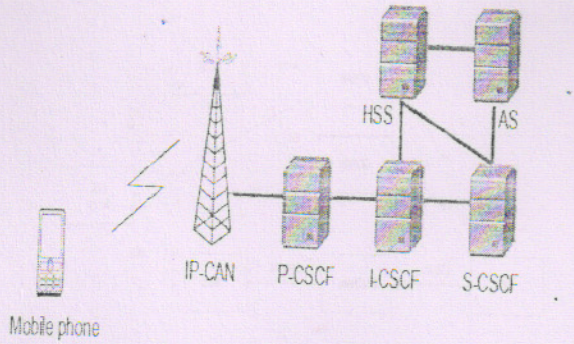
The call session control functions (CSCF) are the core components of the IMS.

There are three CSCF:

Proxy-CSCF (P-CSCF): The P-CSCF is the first point of contact for a user. The PCSCF behaves like a proxy, i.e. it accepts requests and forwards them on.

Interrogating-CSCF (I-CSCF): The I-CSCF is the entry contact within an operator's network for all connections destined to a subscriber.

Serving-CSCF (S-CSCF): The S-CSCF is responsible for handling the registration process, making routing decisions, maintaining sessions, and downloading user information and service profiles from the HSS.



The **home subscriber server (HSS)** is the master database for a user. It is comparable to the home location register in a legacy mobile radio network. The HSS contains the subscription-related information required for the network entities actually handling calls/sessions. For example, the HSS provides support to the call control servers to complete the routing/roaming procedures by solving authentication, authorisation, naming/addressing resolution, location dependencies, etc.

The **application server (AS)** provides specific IP applications, e.g. messaging.The purpose of the IMS architecture and the different CSCF entities becomes clear in the case of roaming: Network providers are unwilling to disclose their internal network structure and want to prevent any access to their own user databases. Since a UE always communicates with the local P-CSCF in the accessed network, this P-CSCF must be denied access to the HSS. The I-CSCF is in charge of hiding the network architecture from other providers. IMS uses a set of internet-based protocols.

The Session Initiation Protocol (SIP) as a text-based protocol for registration, subscription, notification and initiation of sessions

The Session Description Protocol (SDP) as a text-based protocol for negotiating session parameters like media type, codec type, bandwidth, IP address and ports, and for media stream setup.

The Real-Time Transport Protocol (RTP) and RTP Control Protocol (RTCP) for transport of real-time applications (e.g. audio)

The Extensible Markup Language (XML) Configuration Access Protocol (XCAP)

XCAP allows a client to read, write and modify application configuration data, stored in XML format on a server. XCAP maps XML document sub-trees and element attributes to HTTP uniform resource identifiers

Universal Terrestrial Radio Access

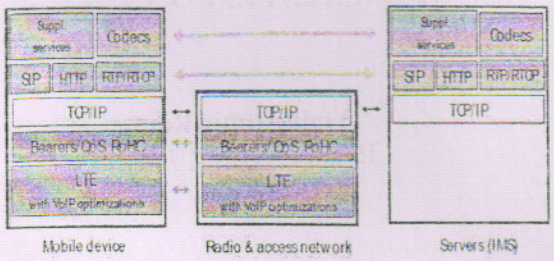


Figure : Depiction of UE and network protocol stacks in IMS Profile for Voice [14]

VIII. CONCLUSION

Efficient support of voice and SMS is a key requirement for LTE networks. Different techniques to support these services in LTE are introduced in this white paper, from circuit switched fallback to IMS-based solutions. Thorough testing of terminal implementations is a must to verify the proper functioning and performance of the new protocol procedures.

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MODELING & SIMULATION OF VECHILE SECURITY SYSTEM

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Abstract

An approach for analysis, design and simulation of advanced security system for any vehicle has been carried out. This system uses GSM or CDMA or GPS. The system is based on conceptual modeling for any vehicle security system models and graph transformation techniques with supportive methodological principles, formal analysis and fine-tuning. With conceptual and real level of modeling and simulation, the approach has direct support applications for potential development of new security system.

Keywords: - GSM, CDMA Modeling and Simulation, Conceptual Modeling.

I. INTRODUCTION

Vehicle robbery in an era of technical advancement is like a rebuke to science. World is going towards a high-tech globalization and vehicle plays a prominent role in saving the time by providing easy and safe transportation. As the business operations and daily activities are getting more robust and smarter, security systems should be much advanced and smarter. Eventually there is huge requirement for different good security systems that can help protect theft and also to navigate a missed/ stolen vehicle. Automobile companies are the one who need to add these most valuable properties in terms of economic and operational values. It is still lagging and so needs constant improvement to keep pace with the requirements. Road accident and vehicle theft is a most common evident that ever happen due to in handling, carelessness and lack of security. In both the cases vehicle identification and navigations are difficult. If this can be made, such miss happening can be averted. In this paper, we are proposing a new system called "ADVANCE SECURITY SYSTEM" which works for all the mentioned requirement has been.

II. HYPOTHESIS PROPOSED

This model is based on communication network (GSM, CDMA, and GPS). The proposed hypothesis is aimed at the easy accessibility of a common person to such services. The basic approach lies on Re-engineering the fundamental phenomenal aspect of CDMA, GSM technologies. At present Mobile Tracker Software is easily available.

III. METHODOLOGY

The new advance security system for any vehicle will be initially based on personal identification detection (PID) system through card reader which will be recognized by a detector having data matching system. This system will have controlled or ignition lock in the first stage and control on fuel supply in the second stage. This innovative device will work on insertion of the pre-recorded magnetic card in the card reader. With the matching data, the device will advance to personal identification number (PIN). The PIN will be physically inserted by the user through a key pad and when the pre set number will be recognized, it will electronically activate the vehicle. The **ignition switch** connected to the device will show "ON" sign on the display (LED screen). The ignition system will then become operative. A better security is added with the protection of fuel system, which will operate through the electronic lock allowing the throat valve (accelerator) or fuel supply (fuel knob), to open/close.

The system will be connected to a receptor (full duplex microwave device) embedded with the vehicle as a "black box" having the connectivity with CDMA or GSM or GPS networking, enabling the vehicle to receive and send signal as per the requirement. The system will have two connectivity

1) Emergency and
2) Public protocol.

The emergency system will be under regulatory network service provider and police control room. The public protocol system will be on a paid basis with different service providers as per the existing governing terms and conditions. Addition of these systems will provide the vehicle high security protection and surveillance.

IV. SYSTEM TECHNOLOGIES

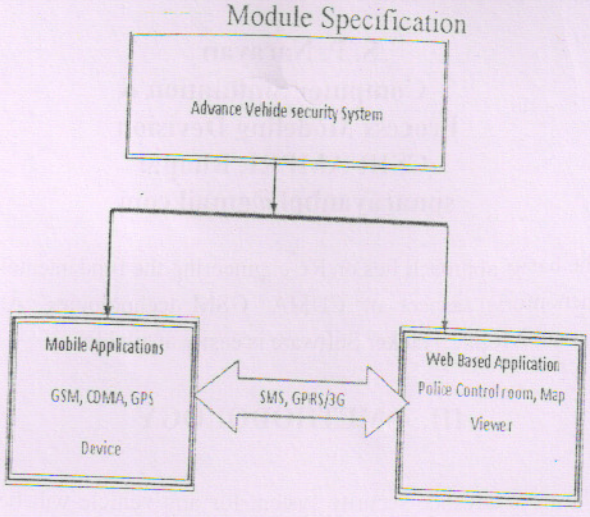


Figure 1 :System Technology

This figure (1) show *System Technology* advance vehicle security system supports all type communication networks GSM /CDMA and also GPS.

GSM Technology

GSM (Global system of Mobile) is a popular Mobile communication system provided by Cellular service providers or GSM Operators in most countries internationally. GSM Mobile communication system can be intelligently used by electronic devices which can collect some data and send it to the central place using SMS or GSM data call. Combination of GPS and GSM is required in vehicle tracking system. GSM is required in Vehicle tracking systems because GPS system can normally only receive location information from satellites but cannot communicate back with them. Hence some other communication system like GSM is needed to send this location information to central control room or police control room.

GPS Technology

The Global Positioning System (GPS) is a worldwide, satellite-based, radio navigation system that gives the exact position of vehicles, no matter where they are, what time it is, or what the weather is like. A total of 24 satellites orbit the Earth, are monitored continuously by earth stations. The satellites transmit signals that can be detected by GPS receivers located in vehicles and used to determine their location with great accuracy.

GPRS

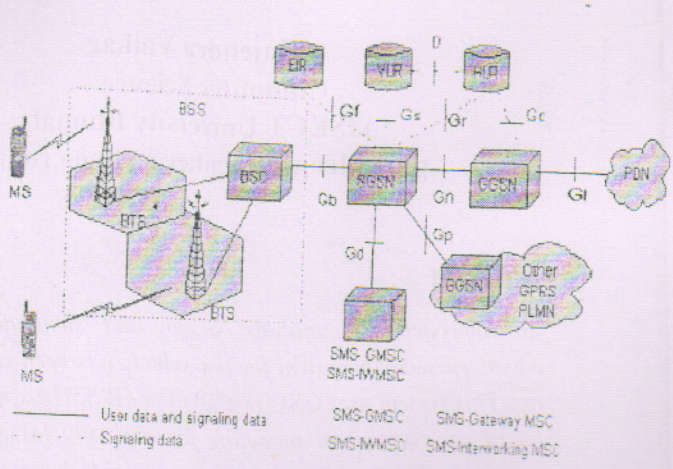


Figure 2:-GPRS

V. MAIN COMPONENTS OF A GPRS NETWORK

Mobile Station (MS), Base Station Subsystem (BSS), Serving GPRS, Support Node (SGSN), Gateway GPRS Support Node (GGSN), Packet Data Network (PDN), Equipment Identity Register (EIR), Visitors Location Register (VLR), and Home Location Register (HLR)

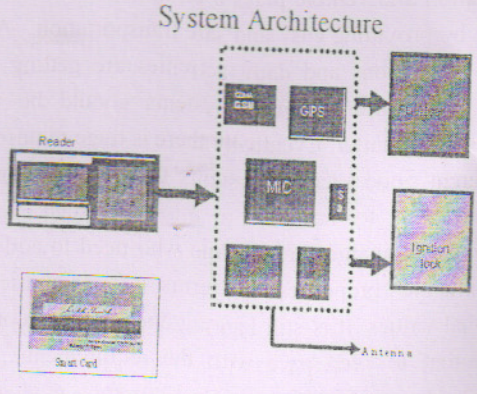


Figure 3: System Architecture

Advance vehicle tracking system components:-

Vehicle Tracking Black Box, Reader, Smart Card, Ignition lock, Fuel lock, Sensor Module and, Power system module

Block Diagram

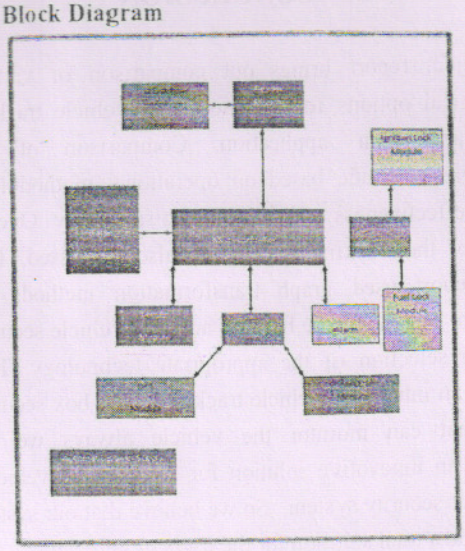
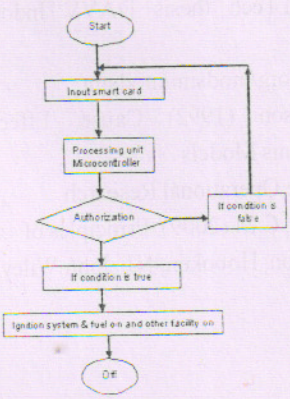


Figure 4: System Block Diagram

Advance vehicle tracking system Algorithm flow chart



System module

This system principally has four modules

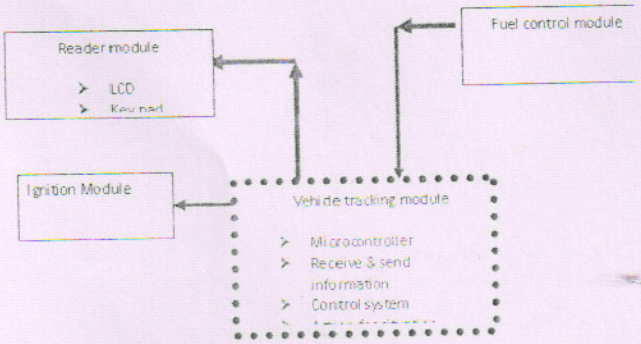


Figure 5.- system module

The brief descriptions of each module of Advance vehicle Tracking Black Box are as follows

Vehicle tracking module: -

This module is a combination of microcontroller & vehicle tracking black box.

This smart card access only personal identification number

Vehicle tracking black box

The Vehicle tracking black box is well protected from environment (we dand, Heat) well protected from damage and

Characteristic

Environment Friendly (Cooled, Heat), Internal Battery, Automatic power Supply, Hide properties Working Temperature: -20 degree to +50 degree C.

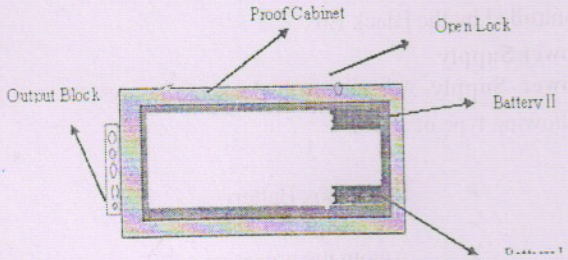


Figure 6: Vehicle tracking black box

Microcontroller work Advance vehicle security system

S.no	Work Name	Part Name	Operational
1.	Reader Control	Smart Card Reader	This device work is special match data& vehicle authorization
2.	Ignition Control	Ignition system	If information is true then permit to start ignition system if information is not match that situation ignition lock mode
3.	Fuel control	Fuel system	If information is true then permit to start Fuel system s if information is not match that situation Fuel system lock mode
4.	Authorization	Permission	This is a choice for vehicle use single use ,double use , multi use
5.	Send SMS	Microcontroller	This is send SMS or Prerecord voice SMS on number
6.	Action	Future aspect	This system capable future update

TABLE 1: ADVANCE VEHICLE SECURITY SYSTEM

Reader module

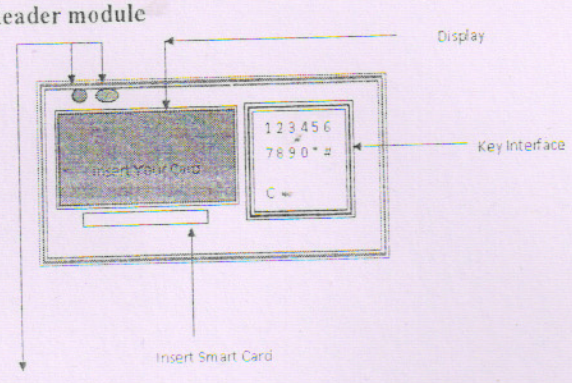


Figure 7: Reader module

Smart Card

This smart card stores vehicle information such as

- Vehicle owner
- Vehicle Engine number

Hidden information (security data)

Fuel control valve

Fuel control valve: - That is an electronic control device, it is control through microcontroller

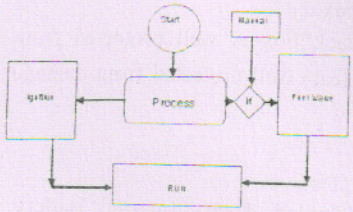


Figure 8: Algorithm for ignition & fuel module

Ignition system: - Switching of Ignition system (on /off) is controlled by the Black Box

Power Supply

Power Supply Advance vehicle security system mange following type of power

- Black Box Battery
- Vehicle power battery
- Automatic power switch
- Power cell

Vehicle tracking box battery

S.no	Name	Work	Remark
1.	Vehicle Black Box	Automatic recharge a	
2	Vehicle Battery	This vehicle battery supply automatic	
3	Automatic power switch	this system power switching ,'ON' condition VVB use vehicle power	System
4.	Power cell	Circuit cell	use all power failure

Table 2: Vehicle tracking box battery

VI. CONCLUSION

This project report brings out comparison of various technological options for selection of a vehicle tracking system and their application. Comparison of the technologies is made based on operational methodology and cost effectiveness to bring out the suitability. Overall benefits of the tracking system are also discussed. This project report used graph transformation methods for simulation. This helps the build to advance vehicle security system in selection of the appropriate technology. This system is an intelligent vehicle tracking black box security system that can monitor the vehicle always we are providing an innovative solution for the theft of vehicles through our security system. So we believe that our system will provide a total solution for the users of vehicle.

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AN APPROACH FOR SOIL CLASSIFICATION THROUGH NN TECHNIQUES

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Abstract

In these days, the content from an image retrieval system has become a challenging task. Many systems based on the text based retrieval systems but the need of an image based retrieval system that takes an image as a input query and retrieves data. Content Based Image Retrieval is an approach for retrieving semantically-relevant images from an image database based on automatically-derived image features. The aim and Objective of the Paper is classifying the soils using Adaptive resonance theory, a Neural Network concept for more efficient and effective results. Forthcoming problems or disasters are easily studied and predicted with help of FL .So that priory we can rescue the human kind and mother earth.

Key words:- BPN, CBIR, Clustering.

I. INTRODUCTION

This section gives an introduction to content based image retrieval system (CBIRS) and the technologies used in them. Image retrieval has been an extremely active research area over the last 10 years, but first review articles on access methods in image databases appeared already in the early 80s[1]. Enser [2] gives an extensive description of image archives, various indexing methods and common searching tasks, using mostly text based searches on annotated images. In [3], an overview of the research domain in 1997 is given and in [4], the past, present and future of image retrieval is highlighted There are several reasons why there is a need for additional, alternative image retrieval methods apart from the steadily growing rate of image production. It is important to explain these needs and to discuss possible technical and methodological improvements. Image retrieval is the process of browsing, searching and retrieving images from a large database of digital images. Advances in data storage and image acquisition technologies have enabled the creation of large image datasets. In order to deal with these data, it is necessary to develop appropriate information systems to efficiently manage these collections. It is simple to identify a desired image from a small collection simply by browsing, but we need more effective techniques with collections containing thousands of items. Image searching is one of the most important services that need to be supported by such systems. In general, two different approaches have been applied to allow searching on image collections: one based on image textual metadata and another based on image content information. The first retrieval approach is based on attaching textual metadata to each image and uses traditional database query techniques to retrieve them by keywords [5,6]. However, these systems require a previous annotation of the database images, which is a very laborious and time-consuming task. Furthermore, the annotation process is usually inefficient because users, generally, do not make the annotation in a systematic way. In fact, different users tend to use different words to describe a same image characteristic. The lack of systematization in the annotation process decreases the performance of the keyword-based image search. Image retrieval systems have not kept pace with the collections they are searching. The shortcomings of these systems are due both to the image representations they use and to their methods of accessing those representations to find images. The problems of image retrieval are becoming widely recognized, and the search for solutions an increasingly active area for research and development.

In recent years, with large scale storing of images the need to have an efficient method of image searching and retrieval has increased. It can simplify many tasks in many application areas such as fingerprint identification biodiversity information systems, digital libraries, crime prevention, medicine, historical research, artificial intelligence, military, education, web image searching. Content-Based Image Retrieval (CBIR) systems [7-9] shown in Fig-1.In these systems, image processing algorithms (usually automatic) are used to extract feature vectors that represent image properties such as color,

texture, and shape. In this approach, it is possible to retrieve images similar to one chosen by the user (query-by-example).

There by we can overcome the disadvantages of the text based retrieval systems .The main advantages of this approach is the possibility of an automatic retrieval process, contrasting to the effort needed to annotate images. In this paper it was focused on soil classification of various fields on the earth map/remote sensed image. Generally classification can be done with aid of various filter techniques but in order to calssify the soils we are using an advanced platform called Neural Networks.

II. DIGITAL IMAGE DEFINITIONS

A digital image a[m,n] described in a 2D discrete space is derived from an analog image a(x,y) in a 2D continuous space through a sampling process that is frequently referred to as digitization. The mathematics of that sampling process will be described in Section 5. For now we will look at some basic definitions associated with the digital image. The effect of digitization is shown in Figure1.1

The 2D continuous image a(x,y) is divided into N rows and M columns. The intersection of a row and a column is termed a pixel. The value assigned to the integer coordinates [m,n] with {m=0,1,2,...,M-1} and {n=0,1,2,...,N-1} is a[m,n]. In fact, in most cases a(x,y)--which we might consider to be the physical signal that impinges on the face of a 2D sensor--is actually a function of many variables including depth (z), color (λ), and time (t). Unless otherwise stated, we will consider the case of 2D, monochromatic, static images in this chapter.

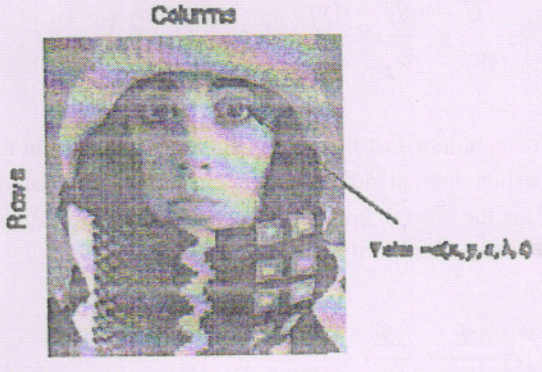


Figure1.1: Digitization of a continuous image. The pixel at coordinates [m=10, n=3] has the integer brightness value 110.

The image shown in Figure 1 has been divided into N = 16 rows and M = 16 columns. The value assigned to every pixel is the average brightness in the pixel rounded to the nearest integer value. The process of representing the amplitude of the 2D signal at a given coordinate as an integer value with L different gray levels is usually referred to as amplitude quantization or simply quantization.

- Common Values
- Characteristics of Image Operations
- Video Parameters
- Common Values

There are standard values for the various parameters encountered in digital image processing. These values can be caused by video standards, by algorithmic requirements, or by the desire to keep digital circuitry simple. Table1.1 gives some commonly encountered values.

Parameter	Symbol	Typical values
Rows	N	256,512,525,625,1024,1035
Columns	M	256,512,768,1024,1320
Gray Levels	L	2,64,256,1024,4096,16384

Table1.1: Common values of digital image parameters

Quite frequently we see cases of M=N=2K where {K = 8,9,10}. This can be motivated by digital circuitry or by the use of certain algorithms such as the (fast) Fourier transform The number of distinct gray levels is usually a power of 2, that is, L=2B where B is the number of bits in the binary representation of the brightness levels. When B>1 we speak of a gray-level image; when B=1 we speak of a binary image. In a binary image there are just two gray levels which can be referred to, for example, as "black" and "white" or "0" and "1".

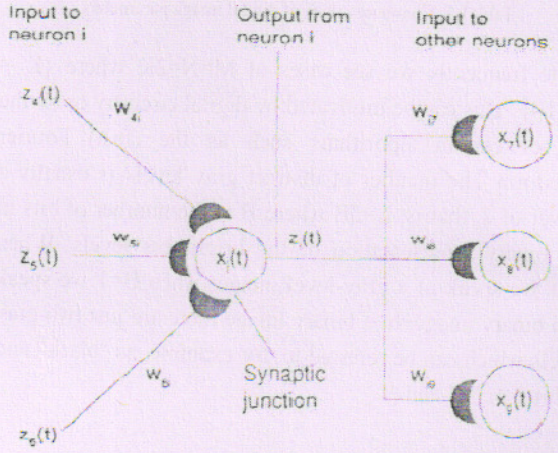
III. PROPOSED METHOD

This systems based on features like color, shape, texture, spatial layout, object motion, etc., are cited in[11],[12].Color is one of the most widely used features for image similarity retrieval, Color retrieval yields the best results, in that the computer results of color similarity are similar to those derived by a human visual system that is capable of differentiating between infinitely large numbers of colors. One of the main aspects of color feature extraction is the choice of a color space. A color space is a multidimensional space in which the different dimensions represent the different components of color [13]. Most

color spaces are three dimensional. Example of a color space is RGB, which assigns to each pixel a three element vector giving the color intensities of the three primary colors, red, green and blue. The space spanned by the R, G, and B values completely describes visible colors, which are represented as vectors in the 3D RGB color space. As a result, the RGB color space provides a useful starting point for representing color features of images.

IV. BACK PROPAGATION NETWORK – MATHEMATICAL APPROACH

Units are connected to one another. Connections correspond to the edges of the underlying directed graph. There is a real number associated with each connection, which is called the weight of the connection. We denote by Wij the weight of the connection from unit ui to unit uj. It is then convenient to represent the pattern of connectivity in the network by a weight matrix W whose elements are the weights Wij. Two types of connection are usually distinguished: excitatory and inhibitory. A positive weight represents an excitatory connection whereas a negative weight represents an inhibitory connection. The pattern of connectivity characterises the architecture of the network. Fig 2.2



A unit in the output layer determines its activity by following a two step procedure.

First, it computes the total weighted input xj, using the formula:

$$X_j = \sum_i y_i W_{ij}$$

where yi is the activity level of the jth unit in the previous layer and Wij is the weight of the connection between the ith and the jth unit.

Next, the unit calculates the activity yj using some function of the total weighted input. Typically we use the sigmoid function

$$y_j = \frac{1}{1+e^{-x_j}}$$

Once the activities of all output units have been determined, the network computes the error E, which is defined by the expression:

$$E = \frac{1}{2}\sum_i \left(y_i - d_i\right)^2$$

where yj is the activity level of the jth unit in the top layer and dj is the desired output of the jth unit.

The back-propagation algorithm consists of four steps:

1. Compute how fast the error changes as the activity of an output unit is changed. This error derivative (EA) is the difference between the actual and the desired activity.

$$EA_j = \frac{\partial E}{\partial y_j} = y_j - d_j$$

2. Compute how fast the error changes as the total input received by an output unit is changed. This quantity (EI) is the answer from step 1 multiplied by the rate at which the output of a unit changes as its total input is changed.

$$EI_j = \frac{\partial E}{\partial x_j} = \frac{\partial E}{\partial y_j} \times \frac{dy_j}{dx_j} = EA_j y_j \left(1 - y_j\right)$$

3. Compute how fast the error changes as a weight on the connection into an output unit is changed. This quantity (EW) is the answer from step 2 multiplied by the activity level of the unit from which the connection emanates.

$$EW_{ij} = \frac{\partial E}{\partial W_{ij}} = \frac{\partial E}{\partial x_j} \times \frac{\partial x_j}{\partial W_{ij}} = EI_j y_i$$

4. Compute how fast the error changes as the activity of a unit in the previous layer is changed. This crucial step allows back propagation to be applied to multilayer networks. When the activity of a unit in the previous layer changes, it affects the activities of all the output units to which it is connected. So to compute the overall effect on

the error, we add together all these seperate effects on output units. But each effect is simple to calculate. It is the answer in step 2 multiplied by the weight on the connection to that output unit.

$$EA_i = \frac{\partial E}{\partial y_i} = \sum_j \frac{\partial E}{\partial x_j} \times \frac{\partial x_j}{\partial y_i} = \sum_j EI_j W_{ij}$$

By using steps 2 and 4, we can convert the EAs of one layer of units into EAs for the previous layer. This procedure can be repeated to get the EAs for as many previous layers as desired. Once we know the EA of a unit, we can use steps 2 and 3 to compute the EWs on its incoming connections.

Working with Back Propagation

The application of the generalized delta rule thus involves two phases. During the first phase the input x is presented and propagated forward through the network to compute the output values yp o for each output unit. This output is compared with its desired value do, resulting in an error signal δp o for each output unit. The second phase involves a backward pass through the network during which the error signal is passed to each unit in the network and appropriate weight changes are calculated.

Weight adjustments with sigmoid activation function.

- The weight of a connection is adjusted by an amount proportional to the product of an error signal δ, on the unit k receiving the input and the output of the unit j sending this signal along the connection:

$$\Delta_p w_{jk} = \gamma \delta_k^p y_j^p.$$

- If the unit is an output unit, the error signal is given by

$$\delta_o^p = (d_o^p - y_o^p) \mathcal{F}'(s_o^p).$$

Take as the activation function F the 'sigmoid' function as defined

$$y^p = \mathcal{F}(s^p) = \frac{1}{1 + e^{-s^p}}.$$

In this case the derivative is equal to

$$\begin{aligned} \mathcal{F}'(s^p) &= \frac{\partial}{\partial s^p} \frac{1}{1 + e^{-sP}} \\ &= \frac{1}{(1 + e^{-sP})^2} (-e^{-sP}) \\ &= \frac{1}{(1 + e^{-sP})} \frac{e^{-sP}}{(1 + e^{-sP})} \\ &= y^p (1 - y^p). \end{aligned}$$

such that the error signal for an output unit can be written as:

$$\delta_o^p = (d_o^p - y_o^p)\, y_o^p (1 - y_o^p).$$

The error signal for a hidden unit is determined recursively in terms of error signals of the units to which it directly connects and the weights of those connections. For the sigmoid activation function:

$$\delta_h^p = \mathcal{F}'(s_h^p) \sum_{o=1}^{N_o} \delta_o^p w_{ho} = y_h^p (1 - y_h^p) \sum_{o=1}^{N_o} \delta_o^p w_{ho}.$$

V. REFERENCE DATA OF SOIL CLASSIFICATION

Table 2.1: Sample training data for soil classification

Table 2.2: Inference results for the soil classification

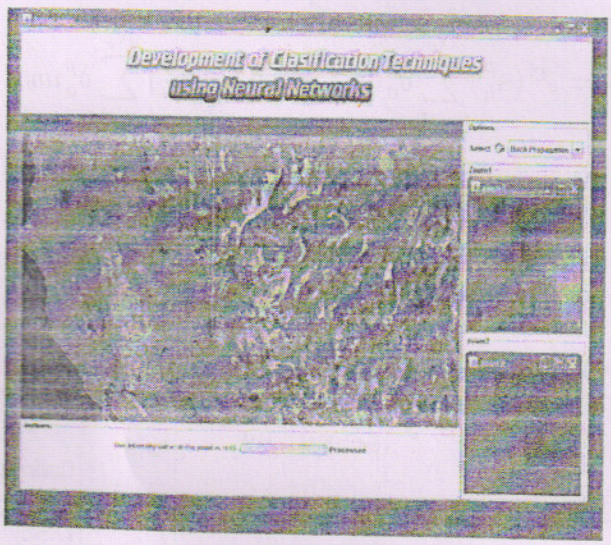
Color of the soil	(Gravel %) 18	(Sand %) 82	(Fine grained particles %) 84	(liquid limit %) 59	(plastic limit %) 34	I.S Classification
0.1	0	0.329	0.869	0.711	0.735	0.203(0.2)
0.1	0	0.341	0.857	0.694	0.705	0.195(0.2)
0.2	0.111	0.682	0.5	0.508	0.529	0.1(0.1)
0.2	0.222	0.682	0.476	0.508	0.529	0.0842(0.1)
0.2	0	0.548	0.654	0.576	0.647	0.289(0.3)
0.3	0	0.756	0.452	0.491	0.529	0.129(0.1)
0.3	0	0.585	0.619	0.61	0.823	0.594(0.6)

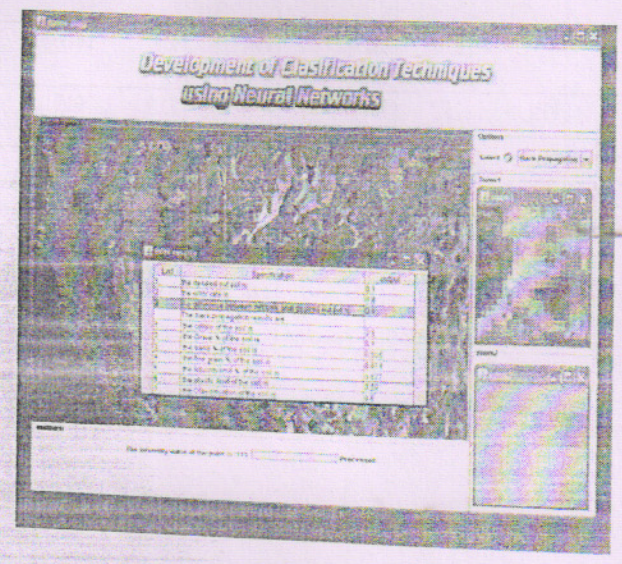
(untrained data)

Table 2.2: Inference results for the soil classification (untrained data)

Color of the soil	(Gravel %) 18	(Sand %) 82	(Fine grained particles %) 84	(liquid limit %) 59	(plastic limit %) 34	LS Classification
0.1	0	0.304	0.892	0.728	0.734	0.204(0.2)
0.1	0	0.951	0.261	0.627	0.676	0.0912(0.1)
0.2	0.222	0.638	0.5	0.525	0529	0.0887(0.1)
0.2	0	0.536	0.666	0.576	0.647	0.392(0.3)
0.5	0	0.597	0.607	0.61	0.0823	0.592(0.6)

VI. EXPERIMENTAL RESULTS





VII. CONCLUSION

This paper is embedded with Three different domains of sciences i.e Basics of Digital image Processing, Soil Fundamentals, Neural Networks. So in order to study the two important learning techniques (Supervised) we are using the concepts of BPN algorithms. The algorithm which are used in the project are predefined functions, which cannot be altered according to our task .The most important algorithms that are used in this paper is BPN for soil classification as well as image recognition. The BPN algorithm is completely mathematical based tools i.e the functions that are used in these algorithms are predefined one. Presenting these algorithms in java is really a challenging task, working with dynamic image and collecting the relevant data such as position of the pixel, RGB values and converting it into the intensity values and then giving these values as the inputs to the these algorithms through java and verifying the output values with the trained data ends the project.

Even though a large number of commercial and open source applications exist to process remote sensing data. According to an NOAA Sponsored Research by Global Marketing Insights, Inc. the most used applications among Asian academic groups involved in remote sensing are as follows: ESRI 30%; ERDAS IMAGINE 25%; ITT Visual Information Solutions ENVI 17%; MapInfo 17%; ERMapper 11%. Among Western Academic respondents as follows: ESRI 39%, ERDAS IMAGINE 27%, MapInfo 9%, AutoDesk 7%, ITT Visual Information Solutions ENVI 17%.

It is an attempt to study two important learning techniques which plays a vital role in the image processing through these algorithms makes the project more interesting and challenging using Neural Network and Java Flat form.

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LATEST TRENDS IN THE DESIGN CONSIDERATIONS OF ECO FRIENDLY ELECTRONICS AND COMMUNICATION DEVICES

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Abstract

Electronics and Communication devices have changed the human life styles tremendously comfortable with many advantages, but they have brought in some side effects on our environment.

The aim of this theoretical research paper is to select one of the main factors, study, analyse, discuss and propose some design considerations for eco friendly electronic devices. One of the main factors in the design of these devices causing biggest harm to environment is the usage of hazardous materials for manufacture of computers and related electronic products.

In this paper an attempt is made to present and discuss some design considerations and implications on the usage of environmental friendly materials in the design and fabrication of these devices. Also, in this paper some proposals are included for further research and usage of newer materials which does not contain hazardous substances for design and fabrication of electronic and communication devices.

Keywords:– Eco friendly Electronic Devices, Green Electronics, ECCIT devices

I. INTRODUCTION

Electronics and communication devices have revolutionalised society after innovations of semiconductors, IC's. Chips through VLSI technologies. Modern man has many devices in his office, home and on mobility. In India there are about 600 million cello phones and there number will reach 870 million in near future excluding laptops, home appliances and desktop PC's. These devices have changed the human life styles tremendously comfortable with many advantages, but they have brought in some side effects on our environment which is termed as e-pollution. Hence there is an inescapable requirement to plug this problem at the design stage for eco friendly electronic devices.

It is well known fact that hazardous materials such as brominated flame-retardants, PVCs and heavy metals like lead, cadmium and mercury are commonly used for manufacture of computers and related other electronics equipment which are known to cause harm to the environment and human lives. Hazardous substances are contained within components such as printed circuit boards, cables, wiring, plastics, casings, displays monitors, cathode ray tubes (CRT) ,, batteries, capacitors, resistors, relays and connectors and so on the land filling of these hazardous materials risks the leaching of heavy metals like lead, cadmium and mercury into ground water or evaporation of mercury into air. The main factors contributing for increase the usage of hazardous material through Electronics, Communication, Computers and IT ECCIT devices into the world are follows.

(a) Technology innovation for IT equipment is tremendously advancing.
(b) Consumption and sales of ECCIT devices is increasing in an exponential scale.
(c) These devices have become more affordable and accessible due to mass production.
(d) The rate of introduction of new devices/models in large numbers is just 15 days.
(e) There is an urgent need to find suitable newer materials for design and manufacture of environmental friendly electronics and communication devices for future of human kind.

II. PROPOSED METHODOLOGY

Performance and profit making should not be the main criteria for any Electronics and Communication product. Also along with this the ill effects they bring must be environmentally sustainable. Methodologies for designing, manufacturing, using and disposing of these products such as computer peripherals, storage media, printers, monitors, consumer electronics, networking equipment and communication equipment should be such that it is efficient and effective at the same time with minimum or no impact on environment.

Designing, manufacturing, using and disposing of these products along with associated subsystems efficiently and effectively with minimum or no impact on environment can be termed as Green Electronics. One of the main goals of

this Green Electronics is similar to green chemistry; reduce the use of hazardous materials during design and manufacturing. The proposed methodology in this paper envisages some design considerations and implications for environmental friendly electronic devices.

Design Considerations for ECCIT materials

(a) The materials used for design and manufacture should be able to be broken down by natural processes.
(b) They should be more sustainable and less toxic plastics and bio-plastics (monitor casings).
(c) Consider usage of biodegradable corn-based plastic case for printers.
(d) Consider wood and bamboo wood encased designs for desktops in computer towers, monitors and mouse controls.
(e) There is need to consider design of monitors which do not emit toxic radiations.
(f) Materials used are required to consume as less power as possible. Intel's core 2 Duo processor draws power only for the parts of the chip which are actually in use.
(g) Fast forward the research and bring in the nanotechnology products which are eco friendly into the design.
(h) They must emit less dioxins.
(i) Material should be such when it is disposed of in to landfills, ground water should not get affected and in case of burning must emit less harmful fumes.
(j) Before using the material for design it must undergo biodegradability test which need to be developed by research.
(k) Adhere to any legislation for not to use banned substances at the design stage itself.

Sl No	Component/ equipment	Existing materials	Proposed materials eco friendly
1	Computer parts	Copper, lead, mercury, steel	Gold/silver/ bronze/ copper/ steel
2	Mother Board	Beryllium	Wooden composites
3	Chips & semi conductors	Cadmium	Hafnium or composites
4	PCB's	Lead	Lead free solder
5	Cathode Ray Tube	Barium, mercury, lead	LCD/ LED technologies are suitable composites
6	Wires & cables	Copper and aluminium	Super conducting materials
7	Toner cartridge	Toner	Bio based resins
8	Plastic housing of electronic components	Brominated flame retardant	Copper based flame retardant composites

Table 1. Hardware with materials used and proposed

Implications of Proposed ECCIT Materials

With introduction of eco friendly materials for design of ECCIT devices the following factors will have to be accepted.

(a) Cost considerations will certainly go high.
(b) Size and weight factors are most likely will increase.
(c) Imposition of strong legislation attracts protests from designers/manufacturers because they need profits and resentment from consumers since they need performance.

III. DISCUSSION

The issue of hazardous material pumped in to the world through ECCIT devices is assuming alarming proportions. It is estimated that approximately 20 kg of this material is put into market every year per inhabitant which is about 10 million tonnes per year. An estimated 50 million tonnes of E-waste is produced every year.

This implies 400 kg of hazardous material is used by designers which is pumped into the market every year per inhabitant which is almost 2500 million tonnes every year in form of new products. The introduction of hazardous material in the form of new products is likely to increase by 500 percent in India in near future. It is estimated that USA produces about 3 million tonnes of E-waste and introduces 9 million tonnes of this material in the form of new products. In case of China it introduces 2.3 million tonnes of E-waste and 7-9 million tonnes in new products.

It is estimated that 70% of e-waste is put in to landfills where as 30% is either burned out or re-cycled.

Inference from this research is that entry of hazardous material into the society in the form of new products is exponentially rising compared to E-waste production.

Even though the size, weight of eco friendly ECCIT devices will be slightly inconvenience to use but they eliminate harmful effects on society is great preventive act.

The harmful effects and the overheads involved in the disposal of e-waste will more than compensate for the cost and weight factors in usage of eco friendly materials for design of ECCIT devices.

IV. CONCLUSION

The main contribution of this paper is the idea of plugging the hazardous material usage problem at the design stage itself. This is to ensure that prevention of creation of e-waste into the environment and society.

The present methodology of usage of harmful materials such as lead, cadmium barium for design and manufacture of ECCIT devices must have to be replaced by the Eco friendly materials which are proposed in this paper.

It may not be very easy to design, develop and manufacture the ECCIT devices with Eco friendly materials, but there is no escape for protection of environment. If not followed by ECCIT manufacturers, there is a need for comprehensive strong legislation covering all aspects of ECCIT devices.

Research continues at a very large scale in many organizations across the world into many areas of making use of ECCIT devices energy efficient, designing algorithms, manufacturing, designing and usage methods for eco friendliness as far as possible.

The case of difficulty in designing the Eco friendly ECCIT products is understood but recent advances in galloping technologies including material s will go a long way in solving the usage of less hazardous material for design of ECCIT devices. The following proposals are made through this research paper.

(a) Manufacturers have to accept the hazards to environment leaving the desire for profits alone.

(b) Consumers also have to compromise on performance factor for usage of environmental friendly materials.

(c) Extended producer responsibility must be encouraged whereby those who produce ECCIT goods are responsible for the environmental impacts throughout the whole life cycle.

(d) Use of nanotechnology for the design.

(e) Based on electrical (permittivity) and mechanical properties (Permeability) research has to be carried out for determination of environmental friendliness of materials and then use for design of ECCIT devices.

(f) A strong standard legislation is required to be imposed after comprehensive research into the issues of eco friendly ECCIT devices.

(g) Discipline of consumers in usage methods goes a long way in ensuring environment friendliness.

V. FUTURE SCOPE

Future scope exists for comprehensive research for investigation and development of environmental friendly composite materials and also for defining standards.

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ACID TEXTURIZATION OF POLYSILICION FOR SOLAR CELL APPLICATIONS

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Abstract

In the fabrication of polysilicon solar cell, efficiency of the solar cell is the key issue. We have used the polysilicon wafers obtained directly from the manufacturer, which have lots of saw damages on its surface. We have removed the saw damage using HF : HNO_3 : H_2O solution in different proportions. After saw damage removal texturization on the same wafers were carried out using the mixtures of acid solutions of HF, HNO_3, H_2O and H_2SO_4 in with different combinations. The solution preparation and texturization are the exothermic reactions. Since the process of texturization is highly sensitive for temperature, therefore, a constant temperature bath was designed and fabricated in house to carry out the reaction at constant temperature. The textured surface was analyzed by high resolution optical microscope, surface profiling and scanning electron microscope. We have achieved the reflectance of light up to 18%, while the initial bare wafers were having the reflectance of 30%. As a consequence the light reflected on the wafer is less that leads to the solar cell to utilize maximum illumination for the conversion of the optical energy into electrical energy. The micrographs and etch rate etc were studied thoroughly and have been presented.

Keywords --- Etching, Texturization, Saw damage, Polysilicon, Multi-Crystalline

I. INTRODUCTION

The multi-crystalline silicon wafer surface texturization is a crucial issue before the processing of solar cells. Texturization can be done by alkaline etching or reactive ion etching; we have chosen the acidic etching. At first the saw damage has to be removed followed by acid texturization. Most of the acidic etching and hence the texturization process are of empirical in character depending on the constituents ratio, temperature and physical agitation. Texturization of mc-silicon (polysilicon) wafers is a well known method to improve the solar cell efficiency [1]. Apart from the improvement in the reflectance, increasing the light trapping by the textured surface becomes more important when the silicon wafers become thin [2]. The parameters of solar cell significantly improve by the textured surface [3-5]. The complex acidic etching behavior requires a detailed knowledge of every parameter like temperature, physical agitation, constituents involved and their ratio which influence the texturization. The texturization process depends on the temperature; we have studied the process at room temperature without any agitation for better control [6]. The texturization can be carried out in an automatic in-line process [7]. We have used *HF, HNO_3, H_2O and H_2SO_4* in different ratios to study the etch rate, surface roughness and surface morphology to achieve minimum surface reflectance.

II. EXPERIMENTAL DETAILS

The 5"×5" multi-crystalline silicon wafers of around 200 microns thickness were taken for the experiments. The wafers were first degreased using acetone and trichloroethylene and than dried using nitrogen. The saw damage removal and texturization experiments were carried out at room temperature (21oC) without agitation in the constant temperature bath as shown in Figure 1.

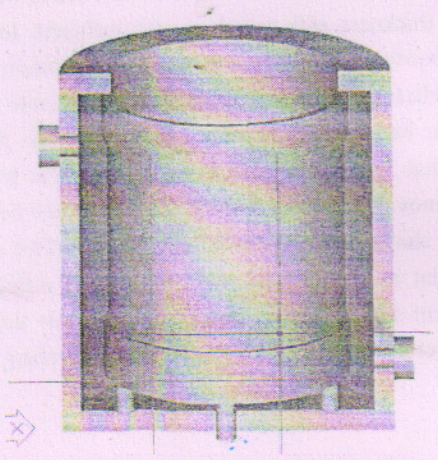

Fig.1 Constant Temperature Bath

The grains were seen using microscope and CCTV on the monitor. The magnification of the microscope was 50x and CCTV monitor 50x. So total it was 2500 magnification. The roughness was measured using Dectak 6M surface

profiler. The saw damage removal was done in four different solutions as shown in Table-1.

Table 1: Solutions for Saw Damage and Texturization

Solution No.	Saw Damage Removal	Texturization
	Ratio HF : HNO3 : H2SO4 : H2O	Ratio HF : HNO3 : H2SO4 : H2O
Sol.1	1 : 5 : 0 : 1	10 : 10 : 16: 20
Sol.2	1 : 20 : 0 : 1	10 : 10 : 80 : 0
Sol.3	1 : 1 : 1 : 10	5 : 5 : 80 : 2
Sol.4	1 : 10 : 0 : 1	1 : 1 : 18 : 2

Thickness and surface roughness of the wafers were measured before saw damage removal, after saw damage removal and finally after texturization. Micrographs of the textured surfaces were done using scanning electron microscope.

III. RESULTS & DISCUSSION

It was found that the saw damage were completely removed in HF, HNO3, H2SO4 and H2O solution in all the four types of the solutions we have used. The etched thickness with time is shown in Figure 2. It is clear from the graph that etching rate is maximum in solution 1 and minimum in solution 2. However, the saw damage is removed in all the solutions as it is clear from the grains shape and surface roughness shown in Figure 4.1 to Figure 4.4. Since the silicon wafers are already thin hence we want minimum thickness etch which is just sufficient for saw damage removal. Therefore, solution 2 and solution 3 are most suitable for our purpose where control etch rate is less hence can be controlled more easily. It was further observed that 3 to 4 microns etching is sufficient for saw damage removal. The etched thickness versus time behaves linearly as shown in Figure 3. Although the surface seems to be similar in all the four solutions but the reflectance measurement shows that the reflectance not only depends on the solution used but also on the time of etching. It is also noticed that the surface reflectance has no direct relationship with the surface roughness but depends on the grains structure on the surfaces. The reflectance and surface roughness data is shown in Table-2.

IV. CONCLUSION

On 5"×5" polysilicon wafers of 200 microns thick saw damage has been removed successfully. The acid texturization has been carried out resulting into reduction of the surface reflectance from 30% to 18% on texturization. We found that the solution no. 1 i.e. HF : HNO3 : H2SO4 : H2O in the ratio of 10 : 10 : 16 : 20 gives the minimum surface reflectance on texturization on polysilicon wafers. The textured surface has uniform grains structure having granular shape on the whole surface.

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Fig 4.1 Sol.1

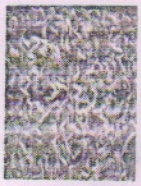
Fig.4.2 Sol.2

Fig.4.3 Sol.3

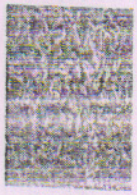
Fig.4.4 Sol.4

Saw Damage Removed Surfaces

Fig.5.1 Sol.1

Fig.5.2 Sol.2

Fig.5.3 Sol.3

Fig.5.4 Sol.4

Texturized Surfaces

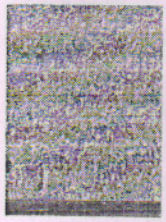
Fig.6 Micrograph

Fig.7 Micrograph

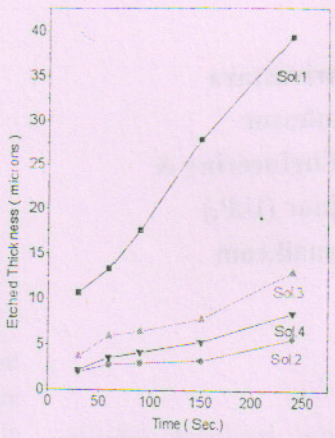

Figure 2. SawDamage Removal

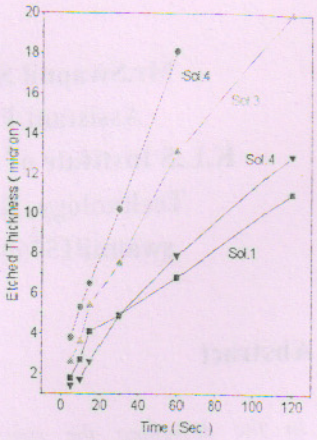

Figure3. Texturization

	Saw Damage Removal				Texturization			
	Sol. 1	Sol. 2	Sol. 3	Sol. 4	Sol. 1	Sol. 2	Sol. 3	Sol. 4
Roughness (nm)	644	558	310	522	340	392	1168	494
Reflectance (%)	-	-	-	-	18.21	21.2	33.2	23.0

Table-2: Reflectance and Roughness

PERFORMANCE EVALUATION OF MIMO OFDM SYSTEM ON GUARD PERIOD INCLUSION

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Abstract

Orthogonal frequency-division multiplexing (OFDM) is the technique of choice in the modern digital communication system, which divides a channel with a higher relative data rate into several orthogonal sub-channels with a lower data rate. This very special & unique feature of the technique attracts the new generation of communication, which is widely called as "4th generation technology". The paper has been divided into two parts dealing with one of the most important aspect/ performance parameter of OFDM. The 1st part will talk about the key role of Guard Period in MIMO OFDM system in subsiding Inter-Symbol Interference (ISI). Where else the 2nd part will elucidate the different method of guard period Insertion & MATLAB simulation result will illustrate how the different guard period insertion method Impact the performance of MIMO OFDM system in different ways.

Keywords:- OFDM, Guard Period, Zero Padding, Cyclic Prefix (CP), Cyclic Suffix (CS).

I. INTRODUCTION

The Orthogonal frequency division multiplexing (OFDM) is becoming widely applied in wireless communications system due to its high rate transmissions capability with high bandwidth efficiency and its robustness with regard to multipath and delay [1] It has been used in digital audio broadcasting systems (DAB), digital video broadcasting (DVB) systems, digital subscriber line (DSL) standards, and wireless LAN standards such as the American IEEE std. 802.11(WiFi) and WiMAX (stands for Worldwide Interoperability for Microwave Access), are one of the standards of IEEE which utilizes the idea of OFDM, and is aimed to provide high throughput broadband connections over long distances. The basic idea of OFDM is to divide available bandwidth into N narrow sub- channel at equidistant frequencies. The sub-channel spectra overlap each other but the subcarrier signals are still orthogonal. The single high-rate data stream is subdivided into many low-rate data streams for the sub-channels. Each sub-channel is modulated individually using 64-bit QAM Technique and will be transmitted simultaneously in a superimposed and parallel form. But like other technology OFDM also has its own advantages & disadvantages like High peak to average power ratio (PAPR), Inter-channel/ Symbol interference (ISI/ICI), Sensitive to Doppler Shift & Sensitiveness to frequency synchronization problem. In-spite of these disadvantages, the popularity of OFDM is still far above the other techniques due to its Praiseworthy advantages. This gave rise to find the solution for overcoming or reducing these lacunas in OFDM to the extent possible to design a cost effective high performance system. There has been many studies has been done in this direction to deal with the different aspect of improving OFDM system performance. One of the principal advantages of OFDM is its utility for transmission at very nearly optimum performance in un-equalized channels and in multipath channels. Inter-symbol interference (ISI) and inter-carrier interference (ICI) can be entirely eliminated by the simple expedient of inserting between symbols a small time period known as guard period. In this paper, based on some simulation result, we will demonstrate how the introduction of guard period is playing a key role is optimizing the Inter-Symbol Interference, which will be abbreviated as ISI in the paper for ease of usage. There are several questions about the how much benefit can be avail by implementing this optimizing technique? Also how efficiently, the OFDM can be used with other technique to come-up with less complex & value-adding system?

The paper has been divided into two parts. In the first part we have put forward the different way of adding guard period to OFDM system. In the second part, a brief analysis of simulation result to demonstrate the impact of guard period insertion technique on MIMO-OFDM.

II. COMBATING ISI WITH GUARD PERIOD

To optimize the performance of an OFDM link, time and frequency synchronization between the transmitter and receiver is of absolute importance. This can be achieved by using known pilot tones embedded in the OFDM signal or attach fine frequency timing tracking algorithms within the OFDM signal's cyclic extension (guard Period/ Period). To prevent ISI, the individual blocks are separated by guard periods wherein the blocks are periodically extended. In

addition, once the incoming signal is split into the respective transmission sub-carriers, a guard period is added between each symbol. Each symbol consists of useful symbol duration, T_s and a guard period, Δt, in which, part of the time, and a signal of T_s is cyclically repeated. This is shown in Fig. 1.

As long as the multi path propagation delays do not exceed the duration of the period, no inter-symbol interference occurs and no channel equalization is required.

For a delay spread that is longer than the effective guard period/ Period, the BER (Bit Error Rate) rises rapidly due to the inter-symbol interference. The maximum BER that will occur is when the delay spread is very long (greater than the symbol time) as this will result in strong inter-symbol interference.

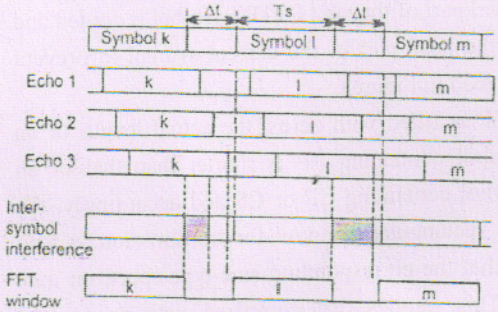


Fig.1. Combating ISI using a guard period [19]

In a practical system the length of the guard period can be chosen depending on the required multipath delay spread immunity required.

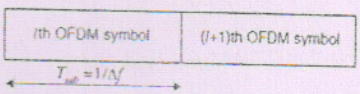


Fig. 2(a) OFDM symbol without guard period [2]

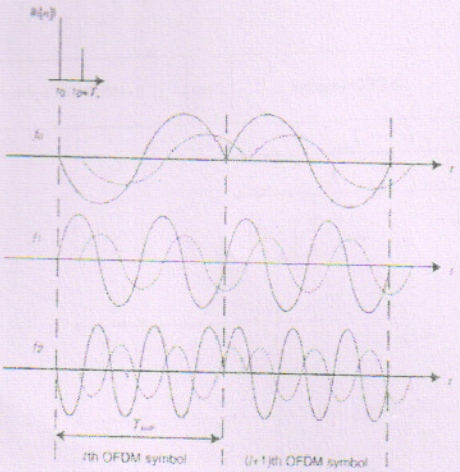


Fig. 2(b) Effect of a multipath channel on the received signal without guard period [3]

Figure 2 illustrates an ISI effect of the multipath channel over two consecutive OFDM symbols. Let T_{sub} denote the duration of the effective OFDM symbol without guard interval. Since $W = 1/T_s$ and thus, $\Delta f = W/N = 1/(NT_s)$ and $T_{sub} = NT_s = 1/\Delta f$. By extending the symbol duration by N times (i.e., $T_{sub} = NT_s$), the effect of the multipath fading channel is greatly reduced on the OFDM symbol. However, its effect still remains as a harmful factor that may break the orthogonality among the subcarriers in the OFDM scheme. As shown in Figure 2(b), the first received symbol (plotted in a solid line) is mixed up with the second received symbol (plotted in a dotted line), which incurs the ISI. It is obvious that all subcarriers are no longer orthogonal over the duration of each OFDM symbol.

The Guard Period in OFDM System can be inserted in two different ways. One way is the zero padding (ZP) i.e. pads the guard period with zeros. The other way is the cyclic extension of the OFDM symbol (for some continuity) by insertion of CP (cyclic prefix) or CS (cyclic suffix). CP is to extend the OFDM symbol by copying the last samples of the OFDM symbol into its front while the opposite is done in case of CS.

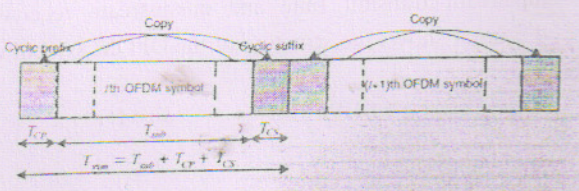
A. Cyclic Prefix

Let T_G denote the length of CP in terms of samples. Then, the extended OFDM symbols now have the duration of $T_{sym}=T_{sub}+T_G$. Figure 3(a) shows two consecutive OFDM symbols, each of which has the CP of length TG, while illustrating the OFDM symbol of length $T_{sym}=T_{sub}+T_G$. Meanwhile, Figure 3(b) illustrates them jointly in the time and frequency domains. Figure 3(b) shows the ISI effects of a multipath channel on some subcarriers of the OFDM symbol. It can be seen from this figure that if the length of the guard interval (CP) is set longer than or equal to the maximum delay of a multipath channel, the ISI effect of an OFDM symbol (plotted in a dotted line) on the next symbol is confined within the guard interval so that it may not affect the FFT of the next OFDM symbol, taken for the duration of T_{sub}. This implies that the guard interval longer than the maximum delay of the multipath channel allows for maintaining the orthogonality among the subcarriers. As the continuity of each delayed subcarrier has been warranted by the CP, its orthogonality with all other subcarriers is maintained over T_{sub}, such that:

$$\frac{1}{T_{sub}}\int_0^{T_{sub}} e^{j2\pi f_k(t-t_0)} e^{j2\pi f_l(t-t_0)} dt = 0, k \neq l \qquad (1)$$

for the first OFDM signal that arrives with a delay of t_0, and

$$\frac{1}{T_{sub}}\int_0^{T_{sub}} e^{j2\pi} \qquad (2)$$



for the second OFDM signal that arrives with a delay of t_0 $+T_s$.

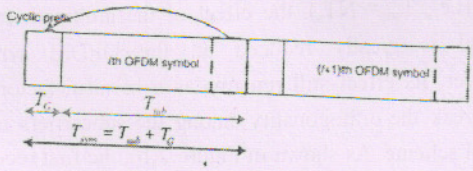


Fig.3 (a) OFDM symbol with CP [2]

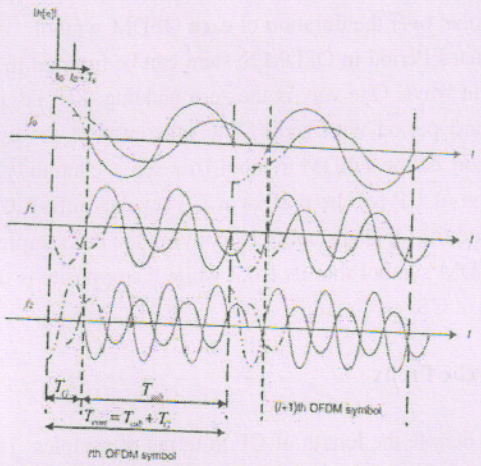


Fig. 3(b) ISI Effect of a multipath channel for each sub-carrier [3]

B. Cyclic Suffix (CS)

Cyclic suffix (CS) is also a cyclic extension of the OFDM system. It is different from CP only in that CS is the copy of the head part of an effective OFDM symbol, and it is inserted at the end of the symbol. CS is used to prevent the interference between upstream and downstream, and is also used as the guard interval for frequency hopping or RF convergence, and so on. Both CP and CS are used in Zipper-based VDSL systems in which the Zipper duplexing technique is a form of FDD (Frequency-Division Duplexing) that allocates different frequency bands (subcarriers) to downstream or upstream transmission in an OFDM symbol, allowing for bidirectional signal flow at the same time. Here, the purpose of CP and CS is to suppress the ISI effect of the multipath channel, while ensuring the orthogonality between the upstream and Therefore, the length of CP is set to cover the time dispersion of the channel, while the length of CS is set according to the difference between the

upstream transmit time and downstream receive time. Figure 4 shows the structure of the OFDM symbol used in

Fig 4. OFDM Symbol with CP & CS [6]

Zipper-based VDSL systems, where the length of the guard interval is the sum of CP length T_{CP} and CS length T_{CS}.

C. Zero Padding (ZP)

We may insert zero into the guard interval. This particular approach is adopted by multiband- OFDM (MB-OFDM) in an Ultra Wide-band (UWB) system. Figures 5 (a) and (b) show OFDM symbols with ZP and the ISI effect of a multipath channel on OFDM symbols for each subcarrier, respectively. Even with the length of ZP longer than the maximum delay of the multipath channel, a small STO causes the OFDM symbol of an effective duration to have a discontinuity within the FFT window and therefore, the guard interval part of the next OFDM symbol is copied and added into the head part of the current symbol to prevent ICI as described in Figure 6.

Since the ZP is filled with zeros, the actual length of an OFDM symbol containing ZP is shorter than that of an OFDM symbol containing CP or CS and accordingly, the length of a rectangular window for transmission is also shorter, so that the corresponding sine-type spectrum may be wider. This implies that compared with an OFDM symbol containing CP or CS, an OFDM symbol containing ZP has PSD (Power Spectral Density) with the smaller in-band ripple and the larger out-of-band power, allowing more power to be used for transmission with the peak transmission power fixed.

Fig. 5(a) OFDM Symbol with ZP [2]

Note that the data rate of the OFDM symbol is reduced by $T_{sub}/T_{sym}=T_{sub}/(T_{sub}+T_G)$ times due to the guard interval.

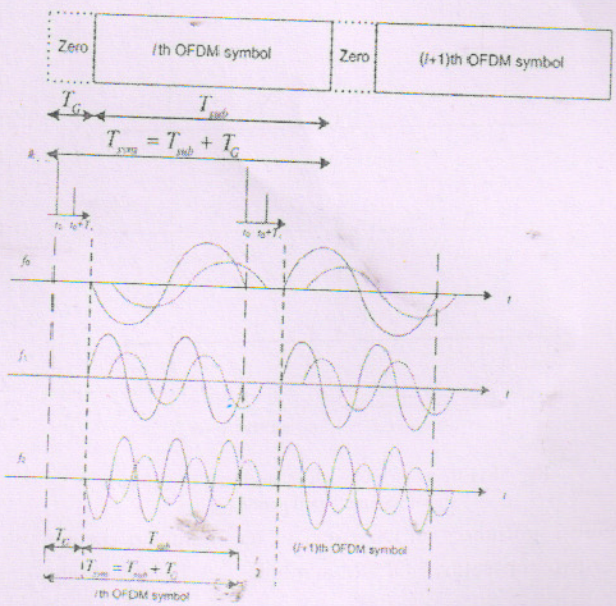


Fig. 5(b) ISI Effect of a multipath channel on OFDM symbols with ZP [3]

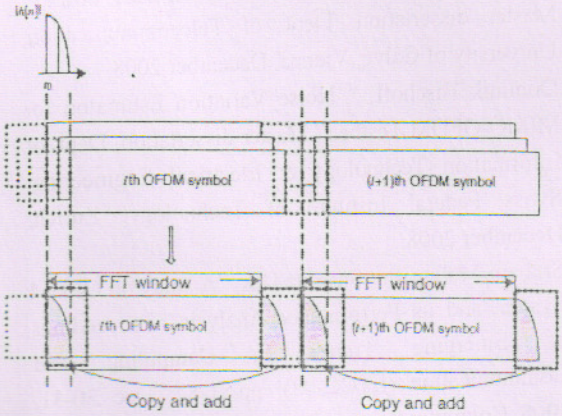


Fig.6. Copying and adding the guard interval of the next symbol into the head part of the current symbol to prevent ICI. [10]

III. BER ANALYSIS OF OFDM SYSTEM

The analytical BER expressions for M-ary QAM signaling in AWGN and Rayleigh channels are respectively given by equation (3) & equation (4) [12]as:

$$P_e = \frac{2(M-1)}{M \log_2 M}\left(\sqrt{\frac{6E_b}{N_0}\cdot\frac{\log_2 M}{M^2-1}}\right) \quad (3)$$

$$P_e = \frac{(M-1)}{M \log_2 M}\left(1-\sqrt{\frac{3\gamma \log_2 M/\left(M^2-1\right)}{3\gamma \log_2 M/\left(M^2-1\right)+1}}\right) \quad (4)$$

Where, γ and M denote E_b/N_0 and the modulation order, respectively, while Q(x) [20] is the standard Q-function defined as:

$$Q(x) = \frac{1}{\sqrt{2\pi}}\int_x^{\infty} e^{-t^2/2}dt \quad (5)$$

Note that if N_{used} subcarriers out of total N (FFT size) subcarriers (except $N_{vc}=N/N_{used}$ virtual subcarriers) are used for carrying data, the time-domain SNR, SNR_t [20], differs from the frequency-domain SNR, SNR_f, as follows:

$$SNR_t = SNR_f + 10\log\frac{N_{used}}{N}[dB] \quad (6)$$

IV. RESULTS

The Performance of MIMO OFDM system has been evaluated for two cases, one is without Guard period inclusion and the other one with Guard period inclusion. This has been shown by comparing the simulation result obtained by plotting Bit Error Rate (BER) against the Signal to Noise Ratio (SNR) for different value of Guard Period in the MIMO OFDM System.

Figure 7(a) & 7(b), it is clear that the BER performance with CP and ZP respectively of length of 16 samples is consistent with that of the analytic result in the Rayleigh fading channel. This implies that the OFDM system is just subject to a flat fading channel as long as CP or ZP is large enough. It is also clear that the BER performance in an AWGN channel is consistent with the analytical results. This is true regardless of how long GP is, because there is no multipath delay in the AWGN channel & also that CP gives better result than ZP at GP=16. As illustrated in Figure 7 (c), however, the effect of ISI on the BER performance becomes significant in the multipath Rayleigh fading channel as the length of GP decreases, which eventually leads to an error floor.

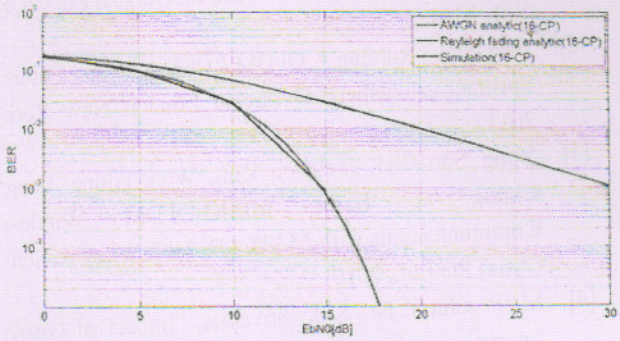


Fig. 7(a) GP length: Ng = N/4 = 16 for CP

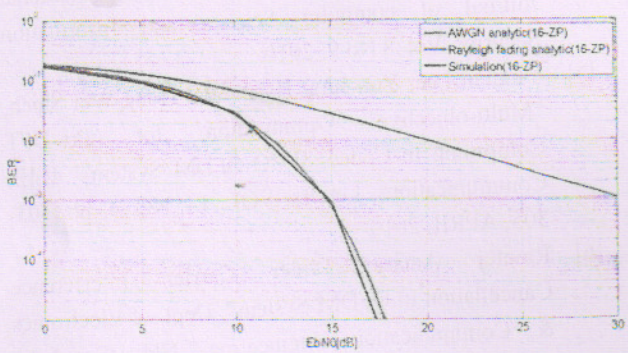


Fig. 7(b) GP length: Ng = N/4 = 16 for ZP

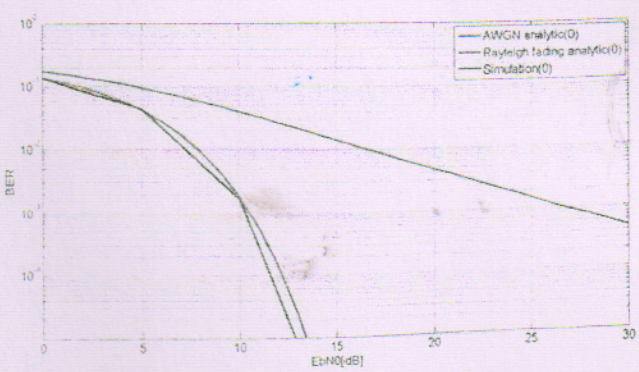


Fig 7(c) GP length: Ng = 0 (i.e. no CP & ZP)

Fig.7. BER performance for OFDM system with 16-QAM.

V. CONCLUSION

Thus the above Analysis & results divulges the fact the Guard Period, if selected properly can optimize the system performance by subsiding Inter-Symbol Interference to the extent that it does not impart significant loss in the System Operation. Also the results infers that the for the same value of Guard Period, Cyclic-Prefix Technique is better-off as compared to Zero-padding technique of Guard Period Inclusion.

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WIDEBAND MICROSTRIP PATCH ANTENNA WITH REDUCTION OF CROSS POLARIZATION

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Abstract

In the designing the size and bandwidth reduction mechanism improves the performance of a conventional microstrip patch antenna on a relatively thin substrate. The design adopts contemporary techniques L-probe feeding, inverted patch structure with slotted patch and air-filled dielectric. The simulated impedance bandwidth of the proposed antenna is about 23%. The proposed patch has a compact dimension of 0.554λ0 × 0.285 λ0. The design is suitable for array applications with respect to a given frequency of 1.85-2.31 GHz. The composite effect of integrating these techniques and by introducing the slotted patch, offer a low profile, broadband, high gain and compact antenna element.

Keywords:- Microstrip patch antenna, Broadband antenna, Slotted patch antenna, L-probe fed.

I. INTRODUCTION

The design of an efficient wide band small size antenna, for recent wireless applications, is a major challenge.With the ever-increasing need for mobile communication and the emergence of many systems,it is important to design broadband antennas to cover a wide frequency range. Microstrip patch antennas have found extensive application in wireless communication system owing to their advantages such as low profile,conformability,low-cost fabrication and ease of integration with feednetworks. However, conventional microstrip patch antenna suffers from very narrow bandwidth,typically about 6% bandwidth with respect to the center frequency. This poses a design challenge for the microstrip antenna designer to meet the broadband techniques.There are numerous and well-known methods to increase the bandwidth of antennas, includingincrease of the substrate thickness, the use of a low dielectric substrate,the use of various impedance matching and feeding techniques, the use of multiple resonators, and the use of slot antenna geometry.However, the bandwidth and the size of an antenna are generally mutually conflicting properties, that is, improvement of one of the characteristics normally results in degradation of the other.

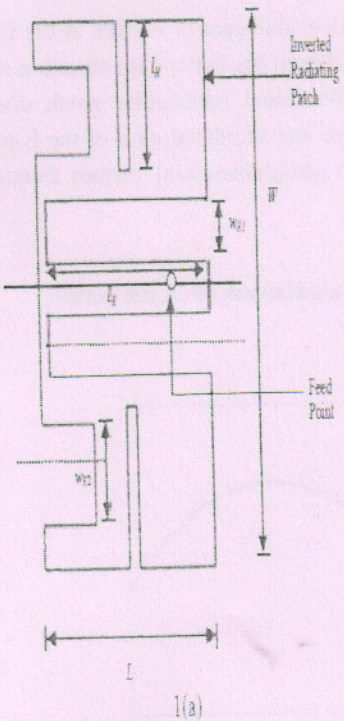
Recently, several techniques have been proposed to enhance the bandwidth. A novel single layer wide-band rectangular patch antenna with achievable impedance bandwidth of greater than 21% has been demonstrated.Utilizing the shorting pins or shorting walls on the unequal arms of a U-shaped patch, U-slot patch, or L-probe feed patch antennas, wideband and dual-band impedance bandwidth have been achieved with electrically small size in.Other techniques involves employing multilayer structures with parasitic patches of various geometries such as E, V and H shapes, which excites multiple resonant modes. However, these antennas are generally fabricated on thicker substrates.A slotted shape patch is investigated for enhancing the impedance bandwidth on a thin substrate.The design employs contemporary techniques namely, the L-probe feeding, inverted patch, and slotted patch techniques to meet the design requirement.In this paper, the design and simulations results of the novel wideband microstrip patch antenna,is described.

II. DESIGN AND STRUCTURE

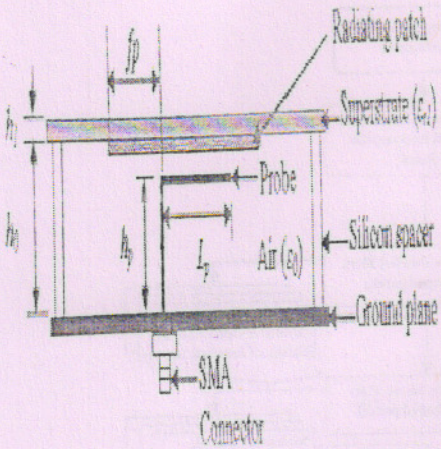
A patch antenna design that can reduce the probe inductance will enlarge the impedance bandwidth. It is known that increasing the thickness of the patch antenna will increase the impedance bandwidth.However, the thicker the substrate of the antenna, the longer the coaxial probe will be used and, thus,more probe inductance will be introduced,which limits the impedance bandwidth. Figure depicts the geometry of the proposed patch antenna. The inverted rectangular patch, with width W and length L is supported by a low dielectric superstrate with dielectric permittivity $\varepsilon 1$ and thickness $h1$. An air-filled substrate with dielectric permittivityεo and thickness ho is sandwiched between the superstrate and a ground plane.

The proposed patch integrates the E- and H-shaped patch on the same radiating element. For the E-shaped, the slots are embedded in parallel on the radiating edge of the patch symmetrically with respect to the centerline of the patch and for the H-shaped the slots are embedded in serial on the non-radiating edge of the patch. The E- and H-shaped are shown in figure, where, *l* and *w* are the length and width of the slots. The patch is fed by an L-shaped probe with height, *hP* ,and horizontal length, *lP* along the centerline at a distance *fP* from the edge of the patch as shown in figure. Table shows the optimized design parameters obtained for the proposed patch antenna. A Rogers RT 5880 Duroid™ dielectric substrate with dielectric permittivity, $\varepsilon 1$ of 2.3 and thickness, *h1* of 0.02λ0 has been used in this paper. The thickness of the air-filled substrate, *ho* is 16.6 mm. An Aluminum plate with dimensions of 1.388λ0 × 1.24λ0 and thickness of 1 mm is used as the ground plane. The proposed antenna is designed to operate in the 1.89 GHz to 2.23 GHz region.The use of Lprobe feeding technique with a thick air-filled substrate provides the bandwidth enhancement, while the application of superstrate with inverted radiating patch offers a gain enhancement, and the use of parallel and series slots reduce the size of the patch. The use of superstrate on the other hand would also provide the necessary protections for the patch from the environmental effects. By incorporating extra slots in radiating edges, the gain and cross polarization has been improved.

Figure 1: The L-probe fed proposed patch antenna. (a) Top view and (b) side view.



1(a)



1(b)

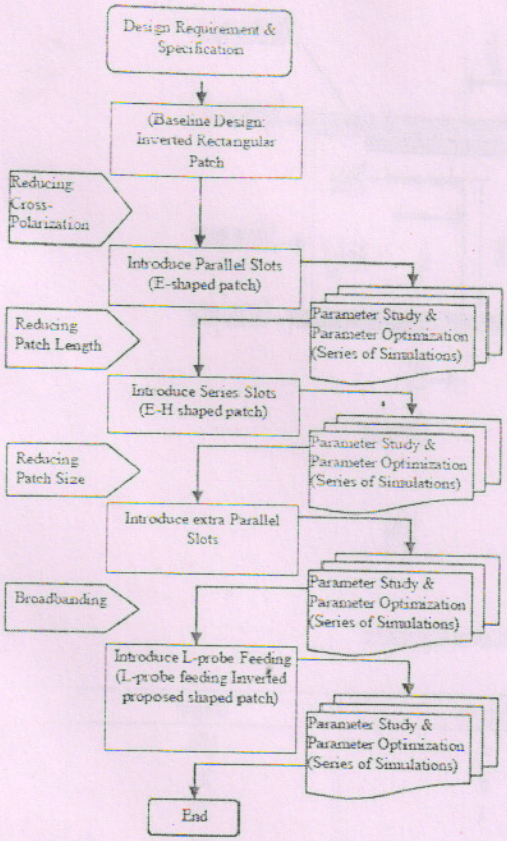
Table 1: Proposed patch antenna design parameter.

Parameters	Value [mm]
h_1	1.5748
H_2	16.5
W	79.0
L	38.9
l_H	18.0
lE1	37.0
w_{E1}	4.0
w_{E2}	11
f_P	7.0
h_P	13.5
l_P	25.0

III. SETUP

The design flow diagram is shown in Figure 2, starting with a baseline design of the inverted rectangular patch with an air-filled dielectric, the baseline parameters are determined at centre frequency, *fo* and dielectric permittivity $\varepsilon 1$. The H- and double E-shaped are then introduced on the patch with the initial values slots parameters to reduce the patch size and crosspolarization level. Next, the L-probe is introduced to feed the patch and its parameters are adjusted to achieve the broadband requirement. The resonant properties of the proposed antenna have been predicted and optimized using a frequency domain three- dimensional full wave electromagnetic field solver.

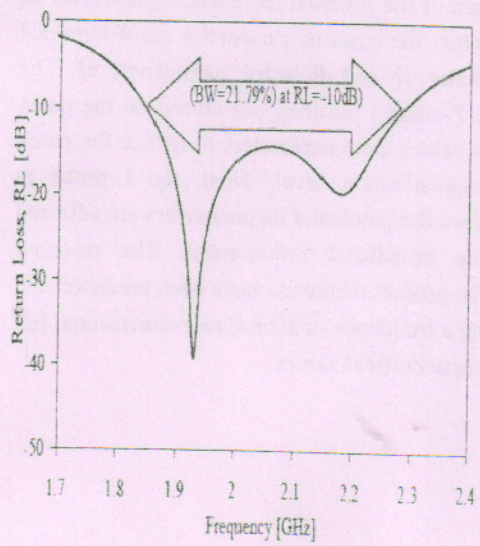
Figure 2: Design flow diagram for the proposed patch antenna



IV. RESULTS

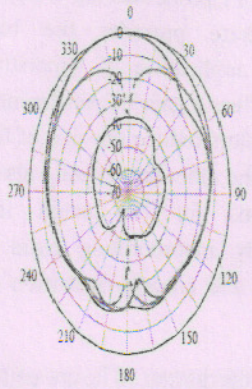
The two closely excited resonant frequencies at 1.94 GHz and at 2.19 GHz as shown in the figure gives the measure of the wideband characteristic of the patch antenna.The simulated impedance bandwidth of 21.80% from 1.85 GHz to 2.30 GHz is achieved at 10 dB return loss.

Figure 3: Simulated return loss of the proposed patch antenna.



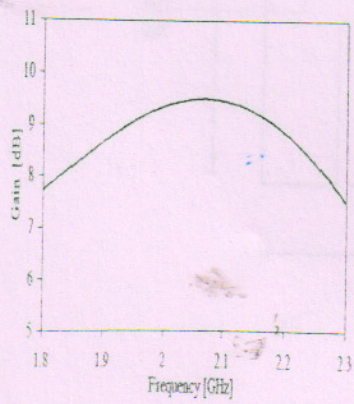
For the sake of brevity, only calculated radiation pattern for second resonance frequency is given in this paper. The simulated radiation patterns at the second resonant frequency in the *xz*-plane and *yz*-plane are plotted in figure and the designed antenna displays good broadside radiation patterns in the *xz*-plane and *yz*-plane at upper resonant frequency. The L-probe inverted proposed patch antenna exhibits better crosspolarization than the design reported in.Notable, the radiation characteristics of the proposed antenna are better to those of the conventional patch antenna.The radiation patterns at other bands, which are similar to those at 1.94 GHz, are not presented here in detail. It can be seen that 3-dB beamwidth of 65° and 50° for xz-plane and yz-plane respectively at 2.19 GHz. The crosspolarization pattern is lower than about -35dB in *xz*-plane.

Figure 4: Radiation pattern of proposed patch antenna at 2.18 GHz for xz-plane and yz-plane.



The maximum achievable gain is 9.6 dBi at the frequency of 2.09GHz. The design has better gain variation of 0.9dBi compared to conventional rectangular patch due to the embedded slots and the simulated gain of the L-probe fed inverted proposed patch antenna at various frequencies is shown in figure.

Figure 5: Simulated gain of proposed patch antennas at different frequencies.



V. CONCLUSION

This technique for enhancing bandwidth of microstrip patch antenna is designed successfully in this research. Simulation results of a wideband microstrip patch antenna covering 1.895 to 2.23 GHz frequency have been presented.The proposed microstrip patch antenna achieves a fractional bandwidth of 21.80% at 10 dB return loss. The maximum achievable gain of the antenna is 9.5 dBi with gain variation of 0.9dB. The proposed patch has a compact dimension of 0.554λ0 × 0.285λ0.The wideband characteristic of the antenna is achieved by using the L-shaped probe feeding techniques, the use of series slots and use of another pair of parallel slots lead to the patch size reduction. Better radiation performance is achieved by embedding parallel slots onto the patch while the use of inverted patch improves the gain of the antenna. The composite effect of integrating these techniques offer a low profile, broadband, high gain, and compact antenna element suitable for array applications. Techniques for microstrip broadbanding, size reduction, and crosspolarization reduction are applied with significant improvement in the design by employing proposed slotted patch shaped design, inverted patch, and L-probe feeding.

VI. ACKNOWLEDGMENT

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RESONANT FREQUENCY AND EFFECTIVE RADIUS OF CIRCULAR SHAPE MICROSTRIP PATCH ANTENA

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Abstract

In this paper the resonant frequency f_r and effective radius a_e are obtained in analytical form for a planner, circular shape microstrip patch antenna which is etched on a printed- circuit board so that the low profile antenna from the ground plane only by a thin layer of dielectric material: The formulas are found to have an error of less than 2.5 percent when compared with experimental data.

I. INTRODUCTION

In the last few years, wireless communication along with its various forms has become a part of everyday life. This dependency on wireless devices made it necessary to find antennas of small size antennas[1].Microstrip patch antennas are used in communication systems due to simplicity in structure, low manufacturing cost, small size and ease of installations[2][3].

II. CIRCULAR MICROSTRIP PATCH ANTENNA

Circular microstrip antenna consists of very thin metallic strip placed a small fraction of a wavelength above a ground plane[2].

Or, a circular microstrip antenna in its simplest form consists of a sandwich of two parallel conducting substrate. The lower conductor function as a ground plane and the upper conductor is a simple circular patch [5].

Referring to the dimensions of the circular patch, only one degree of freedom to control the radius, a of the patch. This would not change the order of the modes but the absolute value of the resonant frequency [2]-[3].

III. RESONANT FREQUENCY OF CIRCULAR MICROSTRIP ANTENNA

The modes that are supported by a circular microstrip antenna whose substrate height is small ($h<<\lambda$) are TM^Z where z is taken perpendicular to the circular patch. For TM^Z we need to first find the magnetic vector potential A_Z, which must satisfy in cylindrical coordinates, the homogeneous wave equation [2]

$$\nabla^2 A_z(\rho,\emptyset,z) + k^2 A_z(\rho,\emptyset,z) = 0 \qquad (1)$$

Where are cylindrical coordinates of a point on the circular disk and $K^2 = \omega^2\mu\varepsilon$

For TMZ modes the electric and magnetic fields are related to the vector potential AZ by[2].

$$E_\rho = -j\frac{1}{\omega\mu\varepsilon}\frac{\partial^2 Az}{\partial\rho\,\partial z} \quad H_\rho = \frac{1}{\mu}\frac{1}{\rho}\frac{\partial Az}{\partial\emptyset}$$

$$E_\emptyset = -j\frac{1}{\omega\mu\varepsilon}\frac{1}{\rho}\frac{\partial^2 Az}{\partial\emptyset\,\partial z} \quad H_\emptyset = -\frac{1}{\mu}\frac{\partial Az}{\partial\rho}$$

$$E_z = -j\frac{1}{\omega\mu\varepsilon}\left(\frac{\partial^2}{\partial Z^2} + k^2\right)A_Z H_Z = 0 \qquad (2)$$

Subject to the boundary conditions of

$$E_\rho \le (0 \le \rho \le a, 0 \le \emptyset \le 2\pi, z = 0) = 0 \qquad (3)$$

$$E_\rho \le (0 \le \rho \le a, 0 \le \emptyset \le 2\pi, z = h) = 0 \qquad (4)$$

$$H_\emptyset \le (\rho = a, 0 \le \emptyset \le 2\pi, 0 \le z \le h) = 0s \qquad (5)$$

Where ais the radius of circular patch and h is thickness of substrate.

The solution of equation (1) is given by

$$A_Z = E_{mnp} J_m(k_p \rho)[C\cos(m\emptyset) + D\sin(m\emptyset)[A\cos(k_z z) + B\sin(k_z z)] \qquad (6)$$

Where E_{mnp} , A,B,C,D are constants and $J_m(x)$ are Bessel function of first kind of order m

Using equation (2) and boundary conditions given by equations (3), (4) and (5) we get

$C\neq 0, B=0$ (7)

$$k_z h = p\pi \; while \; A \neq 0 \qquad (8)$$

$J'(k_\rho a) = 0$and D=0, which gives

$$k_\rho a = \square_{mn} ; \qquad (9)$$

Where $_{mn}$represents the zeroes of the derivative of the Bessel function $J_m(x)$

Now equation (11) reduces to

$$A_Z = E_{mnp} J_m(k_p \rho) C \cos(m\emptyset) A \cos(k_z z) \quad (10)$$

With the constraint equation of

$$k^2{}_p + k^2{}_z = k^2 = \omega^2 \mu\varepsilon \quad (11)$$

$$k_p = \frac{mn}{a} \quad (12)$$

$$k_z = \frac{p\pi}{h} \quad (13)$$

m=0,1,2,3.....,n=1,2,3.....and p=0,1,2,3.....

The resonant frequencies of microstrip antenna are found using equation (11) to (13). Since for most typical microstrip antennas the substrate height h is very small, the fields along z are essentially constant and are presented by p=0 which gives k_z =0. Therefore the resonant frequencies for $TM^z{}_{mn0}$ can be written using equation (11) as [2]-[4]

$$(f_r)_{mno} = \frac{1}{2\pi\sqrt{\mu \in}} \frac{mn}{a} \quad (14)$$

The dominant mode is the $TM^z{}_{110}$ whose resonant frequency is

$$(f_r)_{110} = \frac{1}{2\pi\sqrt{\mu \in}} \frac{mn}{a}$$

The value of $\square_{mn}$ =1.8412 so resonant frequency is given by

$$(f_r)_{110} = \frac{1.8412}{2\pi a\sqrt{\mu\varepsilon}} = \frac{1.8412\vartheta_0}{2\pi a\sqrt{\epsilon_r}} \quad (15)$$

Where a is radius of circular patch $\epsilon_r$is dielectric constant of substrateϑ_0 speed of light in free space.

IV. EFFECTIVE RADIUS OF CIRCULAR MICROSTRIP ANTENNA

Due to the fringing fields between the patch and the ground plane, the effective dimensions of the antenna are greater than the actual dimensions. The fringing effect was larger due to the fact that some of the waves travel in the substrate and some in the air[2]-[3]. The above equation (15) derived for resonant frequency does not take into account fringing. So, for the circular patch a correction is introduced byusing an effective radius ae to replace the actual radius a.

The expression for effective radius a_e can be obtained as [2]-[4]

The zeroth-order resonant frequency of circular microstrip antenna for $TM^z{}_{110}$ mode is given by eq. (15)

$$f^{(0)} = \frac{11.8412}{2\pi a\sqrt{\mu\varepsilon}} \quad (16)$$

Where a is the radius of circular patch and μ and ε are the permeability and permittivity of the dielectric substrate.

The zeroth-order capacitance of the circular disk over a ground plane is

$$C^{(0)} = \frac{\pi a^2 \in}{h} \quad (17)$$

Since the zeroth-order frequency is given by eq.(16)

$$f = \frac{1}{2\pi\sqrt{LC}} \quad (18)$$

The Zeroth-order inductance is given by

$$L^{(0)} = \frac{\mu h}{\pi \square^2{}_{11}} (19)s$$

Where $\square_{11}$ = 1.841corresponds to the first-order capacitance is derivative of the Bessel function of order 1. A simple algebraic formula for the first-order capacitance is available when the dielectric substrate is replaced by air

$$C = C_0(1 + \Delta) \quad (20)$$

Where

$$\Delta = \frac{2h}{\pi a}\left[\ln\left(\frac{\pi a}{2h}\right) + 1.7726\right] for\ \varepsilon = \varepsilon_0 \quad (21)$$

For ε different than ε_0 the capacitance is expressed by

$$C = \frac{\pi a^2 \varepsilon}{h}(1 - C_0 + C'_0 - C''_0 + \cdots) \quad (22)$$

For small h/a ,C'_0,C''_0 can be neglected and

$$C_0 = \frac{-2\left(\frac{h}{a}\right)}{\left(\frac{\varepsilon}{\varepsilon_0}\right)}\left[\ln\left(\frac{\pi a}{2h}\right) + 1.7726\right] \quad (23)$$

Comparing the eq. (23) with eq. (21) suggests the following approximate formula for C_o

$$C_0 = -\Delta = \frac{-2h}{\pi\left(\frac{\varepsilon}{\varepsilon_0}\right)a}\left[\ln\left(\frac{\pi a}{2h}\right) + 1.7726\right] \quad (24)$$

The first-order resonant frequency f for TM^{z}_{110} mode is given by

$$f = \frac{1}{2\pi\sqrt{L^{(0)}C^{(0)}}(1+\Delta)} \qquad (25)$$

Now putting the value of $L^{(0)}, C^{(0)}$ and Δ from eq.(19),eq.(17) and eq.(24) in eq.(25) then we get

$$f = \frac{\square_{11}}{2\pi\sqrt{\mu\varepsilon a\sqrt{1} + \frac{2h}{\pi a\,\varepsilon_r}\left[\ln\left(\frac{\pi a}{2h}\right) + 1.7726\right]}} \qquad (26)$$

Let

$$a_e = a\sqrt{1} + \frac{2h}{\pi a\varepsilon_r}\left[\ln\left(\frac{\pi a}{2h}\right) + 1.7726\right] \qquad (27)$$

This eq. (27) gives the expression of effective radius a_e

Now eq.(26) reduces to

$$f = \frac{1.8412}{2\pi a_e\sqrt{\mu\varepsilon}} = \frac{1.8412\vartheta_0}{2\pi a_e\sqrt{\varepsilon_r}} \qquad (28)$$

Where ε_r is dielectric constant of substrate and ϑ_0 is speed of light in free space.

V. CONCLUSION

Thus using cavity model for analysis, the expression of resonant frequency is obtained. The expression of effective radius a_e is also resonant frequency it is found that for circular patch there is only one degree of freedom to control which is radius of circular patch. This does not change the order of the modes but it does change the absolute value of the resonant frequency.

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<310> TRINGULAR CORNER COMPENSATION AND ETCH FLOW MECHANISM FOR ANISOTROPIC TMAH ETCHING OF (100) SILICON

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Abstract

Anisotropic wet chemical bulk-micromachining is a simple and cost-effective method for fabricating silicon microsensors. In anisotropic etching, convex corners are attacked; therefore, a proper compensating structure design is often required when fabricating microstructures with sharp corners (convex corners). In the present work, <310> triangular compensation structures have been used for convex corner compensation with 25% wt. TMAH-water solution at 90±1^{0}C temperature. Design and etch flow morphology of the compensating structure is presented. This type of compensation is useful for the applications like microcantilevers, where protection of convex corner is required and space is not a constraint. For 25% wt. TMAH-water solution, it was observed that throughout the etching, {311} planes were responsible for etching in all the directions and no other planes were observed. Etch-front-attack angle remains the same as that of <310> angle. This compensation can give perfect convex corner and mesa, but requires more space. The compensation structure is simple to design and analyze among all other types such as <110> square, <100> bars, and <110> bars of compensating structures.

Keywords:- Corner Compensation (CC), Anisotropic TMAH etching, Bulk-micromachining.

I. INTRODUCTION

In general, convex corner structures and non {111} crystal planes are undercut during wet anisotropic etching [1, 2]. These characteristics have been extensively exploited to fabricate freely suspended microstructures. On the other hand, these effects have to be reduced or prevented in various applications, where structures with convex corners are desired. Experimental study has been successfully carried out to protect convex corners and non {111} crystal planes from undercutting for KOH etching [3-6]. To preserve the shape of convex corners when etching in anisotropic etchants, corner compensation structures have to be used. The etching of convex corners is due to the fact that some planes etch faster than others, resulting in a loss of the desired structure [2, 3]. Addition of extra structures at these convex corners, which will be removed during etching, results in the desired convex corners.

Most of the early works on the corner compensation were mainly related to the anisotropic KOH etching for which undercutting facets have been identified as {411} planes [4]. Square patterns or combinations of square or rectangular patterns are superimposed on the convex corners on the mask for compensation [7, 8]. Another straightforward compensation is triangular structure added to the convex corner, in which angles are bounded by lines in <310> directions [9]. The area required for this compensation is largest [7]. Other compensation structures involve adding <100> bars to the convex corners [4-6]. Though, these <100> bar structures give perfect convex corners, the space requirement is more than the square compensation [7, 10]. In many applications, where perfect convex corners are not required and space is limited, square compensation structure is suitable. Some other structures are also reported in which many <110> strips are added to protect the convex corner [8]. These types of structures are not practical as they leave undesired masses and imprint on the bottom. Among the many etchants tetra methyl ammonium hydroxide (TMAH)-based solutions are the only solution which offers CMOS compatibility and less toxicity [11]. However, pure TMAH shows a very high undercutting ratio. In this paper, analysis and feasibility of <310> triangular compensation structure, as shown in

Figure 1, for CMOS compatible TMAH-water etchant, have been investigated, which is easy to design and analyze. The vertex of the triangle is in <100> direction and sides are in [310] direction, which make an angle of ~18.5° with [110] direction of the mesa. Based on the experimental results and analysis, empirical design equations are formulated.

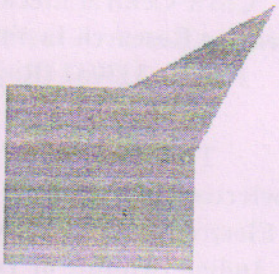


Fig. 1. Mask for mesa type structure with <310> triangular compensation.

II. EXPERIMENTAL DETAILS AND MORPHOLOGICAL STUDIES

In our experiments, 4-inch diameter n-type (100) silicon wafers with resistivity of 8-10 Ω-cm and 500±25 μm thickness were used. Thermally grown silicon dioxide of 1 μm thickness was used as etch mask. Convex square mask with edges aligned to <110> wafer flat were defined on this thermally grown SiO_2 layer with <310> triangular compensation structure, as shown in Figure 2. Wagon-wheel based structure was used for accurate alignment of the structure edge to <110> of the wafer. Thermally grown SiO_2 masking layer was preferred over PECVD Si_3N_4 because of its good adhesion and compressive nature of stress which helps to minimize shape deterioration and deformation near the convex corner of mask [12]. Commercially available Honeywell's 25% wt. TMAH solutions were used in our experiments. 25% wt. TMAH was used to achieve hillock-free smooth surface [11]. All experiments were carried out at 90±1°C temperature in a constant temperature bath without stirring. Constant 25% wt. TMAH concentration was maintained by frequently adding suitable amount of water. Compensation structure was designed for TMAH anisotropic etching based on <310> triangular corner compensation used for KOH anisotropic etching [7, 9]. Dimensions of <310> triangular compensation structure (Figure 2) used in experiments were: length L = 1920 μm, and width W = 2715 μm. During the experiments, etch depth was measured mechanically using a digital micrometer with an accuracy of ±2 μm. Process parameters during the experiments were:

- etch rate of (100) plane R(100) = 0.67 μm/min,
- anisotropic ratio R(311)/R(100) = 2.23,
- anisotropic ratio R(111)/R(100) = 0.071,
- minimal side separation width W_s = 10 μm.

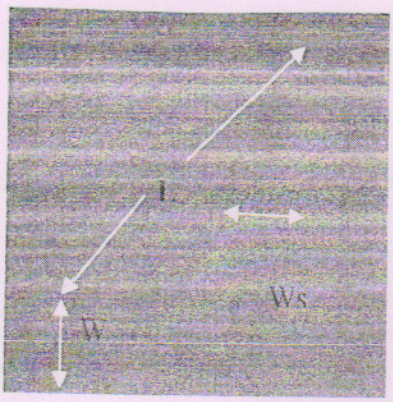
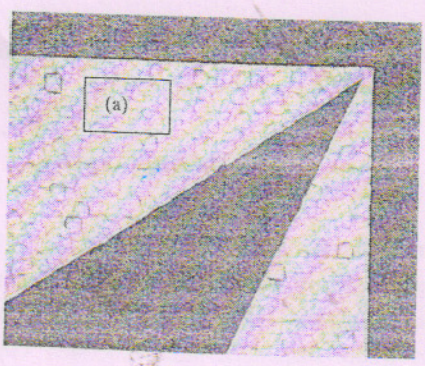


Fig. 2. <310> Triangular corner compensation structure patterned on silicon (100).

To understand the etch flow mechanism and profile, samples were taken out of the etching solution, cleaned and examined. Etching mechanisms around the (111) planes are different in KOH and TMAH solutions [14]. Etch flow profile of <310> triangular compensation structures for TMAH is same as that of for KOH except for etch-front-attack angle, maximum etch rate direction and the difference in anisotropic ratios [4, 6, 14, 15]. The etch attack angles were measured to be 24°-25°, which is the propagation direction of the etch front and determined using a square mask aligned to <110> without any compensation structure, which is in agreement with the reported work [14, 15]. For KOH, {411} planes are responsible for convex corner undercutting [4], while in TMAH {311} planes are responsible [14, 15]. Stepped etching morphology of the compensation structure is shown in Figure 3 for different etch depths. The structure is undercut in TMAH along the two sides in <310> directions. Etch flow is symmetric along both the sides of the triangle. It is observed and verified that this compensation structure is suitable to obtain perfect top-to-bottom convex corner.



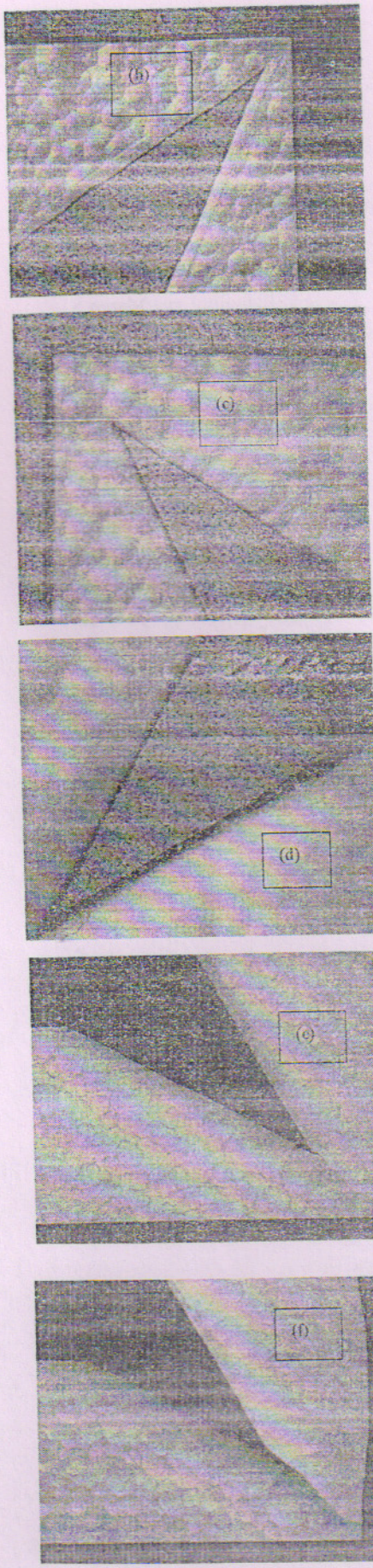


Fig. 3. Etch flow morphology of the compensating structure.

III. RESULTS AND DISCUSSION

As shown in Figure 3, <310> compensation structure gives well-defined and uniform under etch throughout the etching to protect convex corner at the mesa structure attached to membrane. It is clear from the experiments that with this compensation structure, mass and corner can be protected perfectly at the same time, but it leaves large area of the mass attached to the bulk. Based on experiments and analysis, basic design equations (empirical) have been formulated and given by

$$L = 3\,D_e \quad (1)$$

$$W = 1.414\,L \quad (2)$$

where, D_e is the etch depth and all other symbols have same meaning as given in Section 2.

IV. CONCLUSION

Convex corner undercut during wet anisotropic etching of (100) silicon is a well-known problem. In this paper, <310> square compensation structure has been investigated for CMOS compatible TMAH wet anisotropic etching. Based on experiments and analysis, general design equations have been formulated. {311} planes are found to be responsible for fast etching at the convex corners. It is not the space efficient compensation but gives perfect convex corners with well-defined etch profile and same for other anisotropic etchants as EDP, KOH and Hydrazine [7-9]. Etching morphology is also presented in Section 2, which is similar to that of other anisotropic etchants.

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A STUDY ON FACTORS INFLUENCING INVESTMENT IN TAX SCHEMES

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Abstract

Tax Avoidance, Tax Exemption and Tax Evasion are the most talked of topics in India these days. But due to lack of time and information the investors tend to make their investments in unfruitful schemes which may not yield them proper returns upto their worth. So in our study we have tried to collect and analyze the various factors used by the successful investors to decide upon their investments and make the general public also aware about the same. And above all we have made a comparison between the various investment schemes available in Indian Market.

I. INTRODUCTION

The history of taxation dates back to time immemorial and it is not a recent development by any account. A thorough research on the history of taxation system shows that taxes were levied on either on the sale and purchase of merchandise or livestock.

Further, the history of taxation suggests that the process of levying and the manner of tax collection were unorganized. But it suggests that all historical leaders and head countrymen collected taxes to run its authority. In other words taxes on income, sale, purchase and properties were collected to run the ruling Government machineries. Further, these taxes were collected to meet their military and civil expenditure and also to meet the common needs of the subjects like maintenance of roads, drainage system, government buildings, administration of justice and other functions of the region. day India tax machinery is very much based on that laid down foundation. In India, the tradition of taxation has been in force from ancient times. It finds its references in many ancient books like 'Manu Smriti' and 'Arthasastra'. There was a perfect admixture of direct taxes with indirect taxes and they were varied in nature. India's history of taxation suggests existence of a large and composite taxable population. With the advent of the moguls in India the country witnessed a sea of change in the taxation system of India. Although, they also practiced the same norm of taxation but it was more homogeneous in structure and collection. The period of British rule in India witnessed some remarkable change in the whole taxation system of India. Although, it was highly in favor of the British government and its exchequer but it incorporated modern and scientific method of taxation tools and systems. In 1922, the country witnessed a paradigm shift in the overall Indian taxation system. Setting up of administrative system and taxation system was first done in the history of taxation system in India. The period thereafter witnessed rapid growth and modernization of the Indian taxation system and the present.

II. TAX PLANNING

Tax Planning India is an application to reduce tax liability through the finest use of all accessible allowances, exclusions, deductions, exemptions, etc, to trim down income and/or capital profits.

Salaried individuals in India are not fully aware of the tax planning exercise which is why they rush at the end of the tax-planning season and make investments to reduce their tax liability. This has negative effect on tax payable by them and they eventually end up paying more taxes than they are required to.

Tax-planning tips that can assist salaried people to reduce their tax accountability

1. Make full use of the entire Section 80C deduction

The maximum reduction available in Section 80C is ` 100,000 and salaried citizens whose gross salary is ` 250,000 or more are entitled to use the full ` 100,000 limit. Individuals who make monetary infusions of over ` 100,000 in Section 80C in selected areas fail to understand that the advantages are limited. In spite of investing ` 70,000 and ` 40,000 in Public Provident Fund and ELSS respectively, the amount entitled by the investor is only ` 100,000.

Following investments/contributions meet the criteria for Section 80C reduction:

- Public Provident Fund
- Accrued interest on National Saving Certificate
- Life Insurance Premium
- National Saving Certificate
- Tuition fees paid for children's education (maximum 2 children)

- Principal component of home loan repayment
- 5-Year fixed deposits with banks and Post Office
- Equity Linked Savings Schemes (ELSS)

2. Reduction of tax liability beyond Section 80C deductions

If your salary surpasses ` 250,000 pa and the reductions under Section 80C are not enough to minimize the general tax liability consider the following:

- **Home loan**: Interest payments of upto ` 150,000 pa are entitled for reduction under Section 24.
- **Medical insurance**: A deduction of upto ` 15,000 pa under section 80D is applicable under this.
- **Donations**: Tax advantages under Section 80G entitle the donations to particular funds/institutions.

3. Assert tax advantages on house rent paid

If HRA is not included in the salary structure then the salaried individuals can asset rent paid by them for residential lodging. This reduction is accessible under Section 80GG and is smallest amount of the following:

- 25% of the total earnings or,
- 2,000 every month or,
- Surplus of housing charge paid over 10% of total salary

4. Reorganize the salary

Reorganizing the salary and incorporating certain apparatus can help in the long run in minimizing the tax liability. In order to assert tax benefits salary reform is a more competent measure. The following can be included in an individual's salary structure:

- Food coupons can release up to ` 60,000 per year from tax.
- Medical expenses which are compensated by the employer spare up to ` 15,000 per year.
- House Rent Allowance (HRA) should be incorporated in the salaries of individuals who stay in rented houses.
- Transport allowance discharge upto ` 800 per month.

5. Go for a combined home loan

The primary reimbursement on a home loan is entitled for a reduction of up to ` 100,000 pa and the interest rewarded is entitled for a reduction of up to ` 150,000 pa. When a home loan is for a considerable amount then the interest and chief reimbursement surpass the allotted limit. A salaried individual can go for a combined joint home loan with his parent, spouse or sibling, to guarantee the best utilization of tax advantages.

III. ABOUT TAX SAVING

An income tax is imposed on an individual or a company by the Government of India only if his or her income is included in the slab of taxable income. The Indian Income Tax Act of the year 1961 governs the levy whereas C. B. D. T. (Central Board for Direct sections of this Act like Section 80 C, 80 CCF, 80 D etc., exemptions are given on certain incomes. There are many tax saving options, investing on which, one can get a deduction on his or her total income tax.

Tax Saving Options

India has got several government as well as private sector organizations offering numerous tax saving options to the residents of this country. Some of them are as follows:

Instrument	Minimum Contribution	Maximum Contribution	Lock-in Period	Risk	Liquidity	Return	Tax Relief u/s
PPF	Rs.500.00	Rs.100,000.00	5 years	Moderate	Moderate	8.6% annual	80C
ULIP	Rs.5,000.00	Unlimited	3 years	Always Present	High	As per Market situation	80C
ELSS	Rs.500.00	Unlimited	3 years	Always Present	High	As per Market situation	80C
FD	Rs.100.00	Unlimited	scheme to scheme differs	No	Moderate	9-9.5% annual	80C

IV. OBJECTIVES OF THE STUDY

1) To analyze the various factors that influences the salaried assessee to invest in different tax saving schemes.
2) To identify which factors has highly influenced the salaried assessee to invest in tax saving schemes.
3) To identify preference of investors in different schemes.
4) To make a comparison between different tax savings schemes for the investors.
5) To suggest better strategies for tax planning and investment schemes.

V. RESEARCH METHODOLOGY

Tools & Techniques

Tools & techniques means the methods & ways that how the data for the research is collected and analyzed in order to fulfill the objectives of the research work. In our study we have confined ourselves basically to primary data but when their was lack of information we referred to secondary data. For the purpose of collecting primary data we have focused on interview and observation method Therefore the details are given below

Primary Data collection through

1) Interviews

2) Observation

Secondary Data collection through

1) Internet

2) Magazines

Method of Analysis

1) Balanced Score Card

2) Likert Scale

3) Ranking Scale

VI. BY THE USE OF LIKERT SCALE & RANKING METHOD DATA CAN BE ANALYZED

1. Balanced Score Card

The Balanced Scorecard (BSC) is a strategic performance management tool - a semi-standard structured report, supported by proven design methods and automation tools, that can be used by managers to keep track of the execution of activities by the staff within their control and to monitor the consequences arising from these actions. It is perhaps the best known of several such frameworks (it is the most widely adopted performance management framework reported in the annual survey of management tools undertaken by Bain & Company, and has been widely adopted in English-speaking western countries and Scandinavia in the early 1990s). Since 2000, use of the Balanced Scorecard, its derivatives (e.g., Performance Prism), and other similar tools (e.g., Results Based Management) has also become common in the Middle East, Asia and Spanish-speaking countries

2. Likert Scale

Likert type scales are developed by utilizing the item analysis is approach wherein a particular item is evaluated on the basis of how well it discriminates between those persons whose total score is high and those whose score is low. Those items or statements that best meet this sort of discrimination test are included in the final instrument.

Thus, submitted scales consist of number of statement which expresses either a favorable or unfavorable attitude towards the given object to which the respondent is asked to react. The respondents indicate his agreement or disagreement with each statement in the instrument. Each response is given a numerical score, indicating its favorable or unfavorable, and the scores are totaled to measure the respondents attitude. In other words, the overall score represents the respondent's position on the continuum of favorable or unfavorable towards an issue.

3. Ranking Scale

Under ranking scales or comparative we make relative judgment against other similar .The respondents under this method directly compare two or more objects and make choices among them. There are two generally used approaches of ranking scales-

1) Method of paired comparison

2) Method of rank order

In our study, method of rank order is used which is as follows;

Under this method of comparative scaling, the respondents are asked to rank their choices .this method is easier and faster than the method of paired comparisons stated above.

Sample Size

A total number of respondents for our study were 600 from Agra region.

VII. DATA ANALYSIS & INTERPRETATIONS

The collection of information based upon the interviews given by the respondents at the initial level were of varying nature some gave policies as their primary investment needs while on the other hand others focused on factors such as NSC's,PPF and Infrastructural Bonds. Therefore we tabulated the results for all of them separately on various factors which are given below for Comparative analysis:-

1. Life Insurance Policy

Influencing factors the sample assessee to invest in the insurance policy

From-Table 1.1, it is found that tax benefit (mean score 5.152) is the main factor that influenced the sample assessee to invest in Life Insurance Policy. Other factors

that influenced the assessee to invest in this scheme, according to their priority are Risk Coverage (4.268), Old age need (3.577), High return (3.098),Safety(2.880) and liquidity(2.303).

Table 1.1	Scale and Score Value for factors influencing the sample assessee to invest in insurance policy ;scaling the ranking technique								
Rank Scale * Value Factors	I 6	II 5	III 4	IV 3	V 2	VI 1	Total Score	Mean Score	Rank
{f} Tax Benefit	424	46	25	37	38	30	600	5.152	I
{fx}	2544	230	100	111	76	30	3091		
{f} High Return	25	45	92	326	26	86	600	3.098	IV
{fx}	150	225	368	978	52	86	1859		

Hence, it could be concluded that the sample assessee invest in insurance policy mainly for the tax benefit and then for risk coverage.

2. Provident Fund Scheme

Influencing factors the sample assessee to invest in provident fund schemes.

From-Table 1.2, it is found that tax benefit (mean score 4.436) is the main factor that influenced the sample assessee to invest in Provident fund scheme. Other factors that influenced the assessee to invest in this scheme, according to their priority are High return (3.427), Old age need (2.600), Safety (2.562) and liquidity (1.980).

Table 1.2	Scale and Score Value for factors influencing the sample assessee to invest in insurance policy ;scaling the ranking technique							
Rank Scale * Value Factors	I 5	II 4	III 3	IV 2	V 1	Total Score	Mean Score	Rank
{f} Tax Benefit	392	127	44	25	12	600	4.436	I
{fx}	1960	508	132	50	12	2662		
{f} High Return	63	316	96	64	61	600	3.427	II
{fx}	315	1264	288	128	61	2056		
{f} Safety	62	55	106	312	65	600	2.562	IV
{fx}	310	220	318	624	65	1537		
{f} Liquidity	41	66	42	142	309	600	1.98	V
{fx}	205	264	126	284	309	1188		
{f} Old age need	42	36	312	57	153	600	2.6	III
{fx}	210	144	936	114	153	1557		
Total	600	600	600	600	600	-	-	

Hence, it could be concluded that the sample assesses invest in provident fund scheme for High return (8.5% per annum), next to tax benefit.

3. National Saving Schemes

Influencing factors the sample assessee to invest in National saving schemes.

From-Table 1.3, it is found that tax benefit is the main factor that influenced the sample assessee to invest in National Saving Schemes. Other factors that influenced the assessee to invest in this scheme, according to their priority are High return (2.536),Old age need(1.822),Safety(3.629) and liquidity(3.132).

Table 1.3	Scale and Score Value for factors influencing the sample assessee to invest in insurance policy ;scaling the ranking technique							
Rank Scale * Value Factors	I 5	II 4	III 3	IV 2	V 1	Total Score	Mean Score	Rank
{f} Tax Benefit	342	72	56	34	96	600	3.883	I
{fx}	1710	288	168	68	96	2330		
{f} High Return	78	44	56	365	57	600	2.536	IV
{fx}	390	176	168	730	57	1521		

Hence, it could be concluded that the sample assesses invest in National Saving Scheme for safety next to tax benefit.

4. Infrastructural Bonds

Influencing factors the sample assessee to invest in National saving schemes.

From-Table 1.4, it is found that tax benefit(mean score 4.640) is the main factor that influenced the sample assessee to invest in Infrastructure Bonds. Other factors that influenced the assessee to invest in this scheme, according to their priority are High return(3.022),Old age need(1.443),Safety(3.595) and liquidity(2.300).

Table 1.4	Scale and Score Value for factors influencing the sample assessee to invest in insurance policy ;scaling the ranking technique							
Rank Scale ValueFactors	I 5	II 4	III 3	IV 2	V 1	Total Score	Mean Score	Rank
{f} Tax Benefit {fx}	507 2535	32 128	21 63	18 36	22 22	600 2784	4.640	I
{f} High Return {fx}	19 95	45 180	486 1458	30 60	20 20	600 1813	3.022	III
{f} Safety- {fx}	32 160	436 1744	38 114	45 90	49 49	600 2157	3.595	II
{f} Liquidity {fx}	28 340	52 208	25 75	462 924	33 33	600 1380	2.300	IV
{f} Old age need {fx}	14 70	35 140	30 90	45 90	476 476	600 866	1.443	V
Total	600	600	600	600	600	-	-	

Comparative Analysis of various Investment Schemes

Table 1.5 : Distribution of factors influencing investment in tax –saving schemes on the basis of their mean score

	Tax – Saving Schemes						
Factors	Insurance Policy	Provident Fund	Saving Certificate	Infrastructure bond	Total Score	Mean Score	Rank
Tax Benefit	5.512	4.436	3.883	4.640	18.111	4.528	I
High Return	3.038	3.427	2.536	3.022	12.089	3.021	III
Safety	2.880	2.562	3.629	3.595	12.666	3.167	II
Liquidity	2.303	1.980	3.312	2.300	9.715	2.429	IV
Old age Need	3.577	2.690	1.822	1.443	9.442	2.361	V

For this purpose, the factors influencing investment in four tax saving schemes are classified and ranked on the basis of their mean scores obtained in Table 1.5 exhibits that Tax benefit (mean score 4.528) is the predominant factor that influenced the sample assessee to invest these tax saving schemes .the other factors that influenced the respondents to invest in these tax saving schemes ,according to their rank are Risk coverage(4.268).High return (3.021),Liquidity(2.429) and old age need (2.361).

Findings

It is found that tax benefit is the main factor that influences the assessee to invest in tax –saving schemes. Further it is found that other factors that influence investment in tax – saving schemes, according to the assessee in order of priority are-

1. Insurance policy; risk coverage, old age benefit, high return safety and liquidity.
2. Provident fund scheme; high return, safety ,old age benefit and liquidity
3. National saving certificate; safety,liquidity,high return and old age benefit
4. Infrastructure bonds; safety, high return liquidity and old age benefit
5. Choice pf priority for further investment in tax schemes is Provident Fund, Insurance Policy, Infrastructure bonds and National saving certificates.
6. Reasons for tax planning; In the order of importance on the basis of assessee choice are increasing income, high income tax rate, problems in income tax payment and increasing income of family members
7. Main cause of tax planning is increasing income of assessee

Recommendations and Suggestions

1. Assesses may be a risk taker to get a high return
2. The institutions have to provide full information about tax saving schemes
3. Assesses have to invest more and more in tax saving schemes because at the time of recession these will be helpful
4. Emphasis on better corporate governance
5. Introduction of financial planners who can provide need based advice.

VIII. CONCLUSION

It is found that only 16% of the sample assesses eave invested in the infrastructure bonds and units of mutual funds. There may be various reasons for this poor response. One reason may be that assess are not aware of the merits of these investments. Another reason maybe that they fear the safety of these investments

Hence it is suggested hat the sponsoring institutions should create awareness' among the assesses through various programmers such as print mass media, electronic mass media, meetings and conferences to popularize these tax saving investment schemes and remove the fear among assess about the safety of investments. The financial institutions which manage these investment schemes are autonomous bodies ands have high reputation and efficiency. Moreover these investment schemes are continuously monitored and controlled by Semiannual dividend is automatically credited in the assess electronic

bank account. Investment in these bonds and units give excellent return

It is found that 100% of the sample assessee has contributed to statutory provident fund. However no salaried assessee has contributed to statutory provident fund scheme. This may be because there is no agent canvassing for that.

Hence it is suggested that State Bank of India and post offices which are operating under this scheme may appoint agents to mobilize under this scheme. The investment in this scheme may increase the governments revenue and generate more employment oppurtuinites.It is also noticed that assess should be given priority .

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ORGANIC MATERIALS FOR MICROSENSOR APPLICATIONS : A BRIEF REVIEW

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Abstract

Organic electronics has evolved in these years and now commercial aspects are slowly coming up. A lot of researches were done to use polymers and their nanocomposites as gas sensing materials. Review of literature gives glimpses of various domains connected to the polymer nanocomposites.

Keywords:- Organic electronics, polymer nanocomposite, conducting polymers.

I. INTRODUCTION

The importance and potential impact of conducting polymers, a new class of materials, was recognized by the world scientific community when Hideki Shirakawa, Alan J. Heeger and Alan G. MacDiarmid were awarded the Nobel Prize in Chemistry in 2000 for their pioneering research in this field [1-4]. Although these materials are known as new materials in terms of their properties, the first work describing the synthesis of a conducting polymer was published in the nineteenth century. Flexible electronics circuits, displays, and sensors based on organic active materials will enable future generations of electronics products that may eventually enter the mainstream electronics market. Organic / plastic electronics will, on the whole, become a winning technology platform not by 'beating' silicon but by complementing silicon technologies or by facilitating the development of new products (like rollable displays) where silicon just cannot be used. The global market for plastic electronics is under $2 billion now, but is forecast to grow at an astonishing rate to as much as $330 billion in 2027.

The motivations in using organic active materials come from their ease in tuning electronic and processing properties by chemical design and synthesis, low-cost processing based on low-temperature processes and reel-to-reel printing methods, mechanical flexibility, and compatibility with flexible substrates [5-7]. Resulting technologies will include ultra thin television sets delivering crisper pictures than today's LCDs, inexpensive RFID tags, chemical and biosensor, OFET, OLED, low-cost solar panels integrated into buildings, cars, clothing fabrics etc.

II. CONDUCTION IN POLYMERS / TYPES OF POLYMERS

An organic polymer that possesses the electrical and optical properties of a metal while retaining its mechanical properties and processability, is termed an 'intrinsically conducting polymer' (ICP). The conductivity of ICPs lies above that of insulators and extends well into the region of common metals; therefore, they are often referred to as 'synthetic metals.' The common feature of ICPs is the presence of alternating single and double bonds along the polymer chain, which enable the delocalization or mobility of charge along polymer backbone [8]. There are two types of organic semiconductors based on the type of majority charge carriers: p-type (holes as major charge carriers) and n-type (electrons as major charge carriers). To facilitate charge transport, the organic semiconductor layer usually consists of π-conjugated oligomers or polymers, in which the π–π stacking direction should ideally be along the current flow direction. The conductivity is thus assigned to the delocalization of p-bonded electrons over the polymeric backbone.

III. DEPOSITION TECHNIQUES

Materials can be deposited in the form of thin film (up to a μm thick) on a substrate by a variety of methods such as physical vapour deposition, chemical vapour deposition, wet-chemical processes such as sol-gel and electrochemical deposition, thermolysis and flame spray pyrolysis etc. Structural properties and composites of the nanocomposite films are strongly dependent on deposition techniques and deposition parameters. There are many more challenges to deposit composite films consisting of materials of very different nature such as a metal with a polymer or a metal

oxide with a metal, than to deposit films of only one type of material. Any deposition process that can be used to prepare nano-composite films should be able to simultaneously vaporize or coat materials of different nature onto the same substrate to form the composite films. To deposit composite materials of different natures by precisely controlling their chemical composition surface morphology, microstructure, and phase, remains a challenge.

IV. APPLICATIONS OF POLYMERS

In order to improve and expand the use of organic materials in devices like organic field-effect transistors (OFET) and to implement new technologies, not only new materials and manufacturing processing have to be developed, but also a fundamental understanding of the properties of organic interfaces is needed. Organic interfaces formation process is rather complex and no reliable interface-design criteria are available yet.

Organic electronics is a multidisciplinary field, where complementary knowledge form the sources is necessary and combined efforts from chemists, physicist, material scientists and engineers can truly make a difference. Nanotechnology has revolutionized the various areas of existing technologies. Development of nano-materials and integrating those materials into functional nano-devices along with organic materials is highly demanding and involves cutting-edge technologies.

In recent years, there has been growing interest in research on conducting polymer nanostructures (i.e., nano-rods, -tubes, -wires, and -fibers) since they combine the advantages of organic conductors with low-dimensional systems and therefore create interesting physicochemical properties and potentially useful applications [9-14].

Nano-composite films are thin films formed by mixing two or more dissimilar materials having nano-dimensional phase(s) in order to control and develop new and improved structures and properties. The properties of nano-composite films depend not only upon the individual components used but also on the morphology and the interfacial characteristics. Nano-composite films that combine materials with synergetic or complementary behaviors possess unique physical, chemical, optical, mechanical, magnetic and electrical properties unavailable from that of the component materials and have attracted much attention for a wide range of device applications such as gas sensors. Design of the nano-composite films for gas sensor applications needs the consideration of many factors, for example, the surface area, interfacial characteristics, electrical conductivity, nano-crystallite size, surface and interfacial energy, stress and strain, etc., all of which depend significantly on the material selection, deposition methods and deposition process parameters [15-23].

Nowadays Graphene is also coming up as one of the promising materials due to its outstanding physical properties and its practical applications such as field-effect transistors, chemical sensors and composite reinforcement [24-33]. There is tremendous importance of development of transparent electrodes, which can withstand bending, and in flexible displays, these days graphene-based organic photoelectrical devices have come up and graphene is in its early stage to replace ITO as a transparent electrode.

Recently, several reports have been made on incorporating graphene into polymer matrices to produce novel nano-composite materials. It was found that a homogeneously dispersed graphene nanofiller in a polymer matrix provided nano-composites with enhanced mechanical, electrical, thermal, and other properties due to the high aspect and surface-to-volume ratios of the nanofiller. It was also suggested that graphene nano sheets can provide more active nucleation sites for polyaniline as well as excellent electron transfer pathways [34-35].

Polymer and polymer nano-composites have also shown to have applications in the area of organic resistive memory devices [36]. The reviews by Scott et al. [37] and Ling et al. [38] offer excellent discussions on various organic resistive memory devices based on polymer and their nano-composites.

Miniaturization of portable systems creates unique opportunities to expand the microsensor technologies to polymer microsystems. The integration of a polymer MEMS device and organic electronics has open new avenues. Traditionally, microsystems have been fabricated using silicon-like semiconductor substrates by micromachining techniques. Silicon (or thin-film in general) may be the ideal substrates for semiconductor devices, but they may not be suitable for all microsystem applications. Polymer / polymer nanocomposite is known as a good sensing material and is a key element in microsensor developments. Attempts are being taken for the integration of conductive polymer nanomaterials technologies with MEMS processes for sensing and other applications. This type of integration has mainly two advantages (i) CMOS-compatible material deposition process for large-scale integration and (ii) multi-functional and site-specific detection utilizing different nanocomposite materials at different detection positions on a single chip.

In particular, silicon-based wafer level technology may not be suitable for cost effective manufacturing and packaging of microsystems for large-area and large-volume applications. The driving force for developing organic field-effect transistor (OFET) or organic thin-film transistor

(OTFT) based electronics is in fact that they are flexible, light weight and have the prospect of low-cost manufacturing. Major barriers in the practical realization of OTFT-based electronic systems are the need for larger power supplies, lower gain, lower switching speeds and reliability problems. New directions leading to changes in the design of transistors, materials used in the fabrication, and processing techniques are warranted for developing processes and equipment that can lead to the manufacturing of OTFT based electronics. OTFTs are being investigated in utilization of OTFTs to control polymer MEMS actuators [39]. They are currently controlled manually. Silicon-based transistors do not have the capability to withstand the high actuation voltages [40-43]. Polymers are also attracting material for RF applications as they have low insertion losses [44-46]. The low dielectric constants, high resistivities and low dissipation factors [47-48] are very attractive for high quality-factor RF applications. Processing polymer does not involve toxic materials nor high thermal budget for annealing. The high thermal stability, high degree of planarization and chemical resistances are compatible with existing IC processing technologies [47-48]. Polymers can also be conformal reducing processing complexity. Many polymers have versatile micromachining abilities which are very attractive for MEMS applications. 3-D microstructures can be realized by photolithography, deep reactive ion etching (DRIE), plasma etching [49] or hot embossing processes. Organic electronics is still under development and new concepts are continuously being tested all over the world.

V. CONCLUSION

Based on literature, the exploration of organic electronics is slowly maturing. Applications of conducting polymers in biosensing, chemical/gas sensing and Solar cell applications, micro devices are being explored worldwide and in future some proven technology will come up.

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DISCOVERY TIME- SERIES DATA USING TIME INTERVALS CLUSTERING IN TRAFFIC CONTROL SYSTEM

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Abstract

This is proposed research on sequence mining of transactional data. However, there are many applications where it is important to find significant intervals in which some events occur with specified strength. We study approaches to convert point-based data into intervals, thereby predicting the next occurrence of the event.. We compare the performances of various approaches in terms of computation time, number of passes, coverage and interval statistics like density, interval-length and interval-confidence. We propose an approach to clustering using the significant intervals produced. Furthermore, we use these intervals, which serve as representative areas of the dataset as input to a Hybrid A-priori algorithm to mine for sequential patterns. We present the two types of interval semantics that can be used with sequential mining. We formulate Hybrid A-priori sequential algorithm that accepts intervals as input. Finally, we summarize the results and use these results in traffic control system.

I. INTRODUCTION

Discovering the hidden knowledge is not a straightforward task. To compete effectively in today's market, decision makers need to identify and utilize this information buried in the collected data and take advantage of the high return opportunities in a timely fashion. The key here is the generation of previously unknown knowledge from huge datasets. The process of mining is driven by the outcome requirements. Based on what we want, a specific data mining technique is employed. The different data mining techniques and their outcomes are briefly discussed below [1]:

The focus of our approach lies between clustering and sequential mining since both kinds of information are required to discover frequent patterns and answer queries related to intelligent environments. As mentioned above, our approach has enormous potential in intelligent environments where the key is to continuously learn from the surroundings and automate the inhabitant's activities

II. CLASSIFICATION

This is a process of grouping items based on a classifying attribute. A model is then built based on the values of other attributes to classify each item to a particular class. A training dataset is typically used for validating and tuning the model. The classification technique may be used, for example, to identify the most probable consumers for a product, based on their spending patterns.

III. CLUSTERING

The process of clustering tries to group the data set in such a way that the data points in one cluster are more similar to one another while the data points in different clusters are more dissimilar. A similarity measure needs to be defined and the quality of the outcome, to a large extent, depends on the appropriateness of the similarity measure for the data set. The technique of clustering, for example, can be used to divide the market into distinct groups, so that each group can be targeted with a different strategy.

The basic difference between classification and clustering is that in classification, the classifying class is known previously (also known as supervised), whereas clustering does not assume any knowledge of clusters (unsupervised).

IV. PREDICTION

Data mining typically makes use of statistical analysis when it comes to predicting the next value of a continuous variable rather than a categorical label. Prediction of continuous values can be modeled by statistical techniques of regression [6]. Many problems can be solved by linear regression and even more by applying transformations to the variables so that a non- linear problem can be converted into a linear one. Linear regression is the simplest form of regression where the data is modeled as a straight line. Bi-variant linear regression models a random value Y, as a linear function of another random value X, that is,

$Y = a + bX$

Where a and b are regression coefficients specifying the Y intercept and slope of the line respectively. Many times, although the application cannot be modeled as a straight line to predict the value of Y given X, it can be viewed as Y=F(X). We focus on prediction of Y given X, which is a series of events changing with time. This can be described as a time-series database. Sometimes, there are several other variables that affect Y as it can have multiple values over a range of X. Multiple variables and the classification of the variables given below can make regression overtly complicated.

There are four major characteristics that are used to categorize time- series data [6].

Long- term or trend movement: This indicates the general direction over which the time- series graph is moving over a long interval of time.

Cyclic movements or cyclic variations: These refer to the cycles, or long-term oscillations about a trend line or curve, which may or may not be periodic.

Seasonal movements or seasonal variations: These movements are due to the events that recur annually. In other words, seasonal movements are the nearly identical patterns that a time-series appears to follow during corresponding months of each year.

Irregular or Random movements: These characterize the sporadic motion of the time - series due to random or chance events.

The common method of determining trend is to calculate the moving average, also referred to as smoothing of time-series. The concept of seasonal index is introduced to show the relative values of the variables in each group. To form the index, the data is divided into a set of partitions such as groups of months or groups of hours and the variation of the variable is monitored over each group to identify recurring patterns. However without any predefined knowledge, the above grouping is very arbitrary. An interesting solution would be to identify the groups from the data and look for patterns.

V. MINING SEQUENTIAL PATTERNS

The sequential associations or sequential patterns can be represented as follows:

When A occurs, B also occurs within a certain time. The difference between traditional association rules mining and sequence mining is that the time information is included both in the rule and also in the mining process in the form of constraints. In general three attributes characterize the sequence data: object, timestamp, and event. Hence, the corresponding input records consist of occurrences of events on an object at a particular time. Depending on the data and the problem in hand, various definitions of the objects and events can be used. As an example, an object can be a customer in a book store and events are the books bought by the customer. As another example, an object can be a day and the events a switch- alarm pair of telecommunications network.

The major task associated with this kind of data is to discover sequential relationships or patterns present in these data. This can be very useful for prediction of future events. Several approaches have been proposed to tackle the problem. However the problems they assess, and the resulting solutions are very much problem dependent and often not suitable for other types of sequential data.

VI. FOCUS OF THIS PAPER

The predominant problem domain for this work is a traffic control system where discovery of patterns and their automation is of prime interest. However, the solution proposed by this concept is not restricted to traffic control system alone but can be used for other domains where the need is to extract useful segments from the data based on user specified parameters. Some of the characteristics of a traffic control system.. to accomplish this the traffic control system reacts to the changes in inhabitant's behavior by automating the operations of traffic light system instead of waiting for the inhabitants to manually interact with them. Following are some of the questions for which the answer is needed to accomplish the goals of a traffic control system.

- When does A Traffic Light turn on?
- When does A Traffic Light turn on for particular days or between particular time periods.
- When does A Traffic Light turn on every day for long period for particular route?
- When does A Traffic Light turn on Sunday for long period for particular route?
- Of these, which are the most frequently occurring patterns?
- What are the times during which the patterns occur?
- How many times patterns occur during a given time interval.

This work proposes to answer most if not all of the above questions raised by traffic control system. In addition to intelligent environments, many applications such as telephone logs, security logs and other time or numerical applications want to know, 'Illustrate intervals in terms of groups of time or activity which best represents the data' or 'Illustrate intervals in terms of groups of time or activity which have the following characteristics'. With telephone logs, periods of high activity are useful information for

making informed business decisions. Magazine subscription logs can also be mined to determine the age groups that subscribe the most to the magazine. Security logs can also be mined to extract intervals with certain characteristics. These intervals can be compared to values associated with normal conditions, to raise alerts when abnormal conditions are discovered.

The characteristics of an interval can be its density, length or the strength. Given the above general problem domain, we divide our task into two phases: Identify the intervals which best represent based on interval characteristics provided by the user and use the intervals to identify frequently occurring patterns of different sizes and strengths

VII. RELATED WORK

The following sections provide a survey of the existing algorithms. WINEPI [3], MINEPI [3], GSP [4] are described in detail in sections. Provides a brief overview of several other algorithms, which are related to the current domain. Finally, we provide a brief introduction to our proposed solution in section.

A lot of work has also been done on prediction, from Markov's mth order model to using statistical techniques in time series analysis. Markov's model [5] predicts which event will occur next, or when an event occurs using probabilities. This model is primarily used for pre- fetching of pages in computer architecture and other applications (e.g., speech recognition) from an input sequence; the next event is predicted using probability distribution functions

WinEpi [3] is an algorithm, designed for discovering serial, parallel or composite sequences. Serial sequences require a temporal order of events whereas parallel sequences do not. Composite sequences are generated from the combination of parallel and serial sequences. In addition to the above, events of the sequences must be close to each other, which is determined by the window parameter. A time window is slid over the input data and only the sequences within the window are considered. The support for the sequence is determined by counting the number of windows in which it occurred. Referring to the timing constraints described above, the algorithm finds all sequences that satisfy the time constraints ms and whose support exceeds a user-defined.

Minimum min_sup, counted with the CWIN method. The algorithm makes multiple passes over the data. The first pass determines the support for all individual events. In other words, for each event the number of windows containing the event is counted. Each subsequent pass k starts with generating the k- event long candidate sequences Ck from the set of frequent sequences of length k- 1 found in the previous pass. This approach is based on the subset property of apriori principle that states that a sequence cannot be frequent unless its subsequences are also frequent. The algorithm terminates when no frequent sequences are generated at the end of the pass. WinEpi uses set of counters and sequence length for support counting of parallel sequences and finite state automata for serial.

MinEpi uses the same algorithm for candidate generation as WinEpi with a different support counting technique. In the first round of the main algorithm mo(s) is computed for all sequences of length one. In the subsequent rounds the minimal occurrences of s are located by first selecting its two suitable subsequences s1 and s2 and then performing a temporal join on their minimal occurrences. Frequent rules and patterns can be enumerated by looking at all the frequent sequences and then its subsequences

The GSP (Generalized Sequential Patterns) by [4] is designed for transactional data where each sequence is a list of transactions ordered by transaction time and each transaction is a set of items. It extends their previous work [9] by enabling specification of the maximum time difference between the earliest and latest event in an element as well as the minimum and maximum gaps between adjacent elements of the sequential patterns. Thus the timing constraints included are ws, xg and ng. Support is counted using COBJ method. The algorithm works the same way as WinEpi described in the previous section. The difference is in the way the candidates are generated and their support counted. GSP introduces the notion of contiguous subsequences. The sequence

c is a subsequence of s if any of the following holds:

- c is derived from s by dropping an event from its first or last event- set.
- c is derived from s by dropping an event from any of its event- sets that
- Have at least 2 elements
- c is a contiguous subsequence of c', which is a contiguous subsequence Of s.

The determination of the support of the candidates is done by reading one data sequence at a time and incrementing the support count of the candidates contained in the data sequence. Given a set of candidate sequences C and a data sequence d, all sequences in C that are subsequences of d are found. Our domain considers data to be a series of events with timestamps with frequent patterns discovered between various events, in contrast to GSP, which discovers sequential relationships between items within a set of transactions

CSpade [10] has the same application domain as GSP but involves more constraints that are versatile. CSpade is an extension of the earlier Spade [11] algorithm, which efficiently integrates constraint into the algorithm. The key

features of Spade are the use of vertical layout and idealists, which include the object timestamp tupples of the events. Equivalence classes partition the data set into several classes, which are processed independently. Problem decomposition using equivalence classes is decoupled from pattern search. Depth- first search is used for enumerating the frequent subsequences within each equivalence class. Our approach also considers a vertical database layout similar to that of Spade, partitions the database on the number of events and identifies intervals of occurrences based on user specified 'measure' independently.

Cyclic association rules [12] attempt to find rules, which are very prominent in a segment of data but are lost when the entire dataset is considered for mining. Partitioning the data correctly plays a crucial role in the discovery of these hidden rules. In addition to the mining techniques, many mathematical and statistical models [6, 7] also attempt to predict or discover the intervals by formulating an equation, which best describes the data. However these models have the drawback that they predict one answer based on historical data. One answer may not be adequate in several situations. In order to get multiple answers the data needs to be partitioned thereby predicting the best answer for each partition. This however would introduce some arbitrariness in the choice of best partition in the absence of appropriate guidelines. [13] uses data cubes and Apriori mining techniques for mining segment- wise periodicity with respect to a fixed length period. In [14] MDL (minimum description length) principle, instead of support, is used to find candidate item-sets. The merit of this approach lies in the application of the periodicity of the event to prune unwanted sequences. This approach has some similarity to the first approach of [3] in the use of a sliding window defined by the user to find frequent episodes. Defining the periodicity, however, can be an error prone task. As for [13], the algorithm discovers rules based on different measures for each time partition. Our primary interest is to find partitions which best describe the nature of the data.

One of the distinct disadvantages of using traditional k-means [15, 16] or density based clustering algorithms [17, 18] is the determination of input parameters such as k or threshold density. Determination of the values of these input parameters either requires proficient domain knowledge or sufficient time for re- running algorithms with different inputs. Even though the primary aim of the present study is not cluster identification, to decide a better value for k and the threshold density, the number of clusters identified at the end of interval discovery algorithm along with their density and length can be used as input to the traditional clustering algorithms. Salient points of the work and discussing additional work that can be performed to improve its utility, efficiency and scalability.

VIII. INTERVAL DISCOVERY

Here discuss our proposed solution with Not many data mining algorithms discuss the formation of intervals on time series data based on the interaction of events. The data collected from traffic control exhibits the interactions between the inhabitant. This results in large amount of information stored over a period of time for each route, with data value at every point in the time scale. The primary aim is to coalesce the points and convert them to intervals. Start and end times associated with an event signifies the occurrence of the event within it with certain characteristics of the interval such as its strength, length and density. With large numerical and time series data, events occur with a high degree of certainty not at specific points but within tight intervals (sets of points). Therefore intervals give us more information on the total strength of the device activity during a period as compared to points. Based on this observation, the data related to each route is mined separately to identify the intervals with maximum strength. Traffic system can greatly benefit from an algorithm that can infer the usage patterns of each route as well as interactions between different routs. This system consists of numerous sensors (or manually) deployed around the squire of road that monitor different arrivals of vehicle

Every change large change is recorded in the database. Abstractly such data can be viewed as a collection of events, where each event has an associated time of occurrence Multiple events can occur at the same time, which means different events can have the same timestamp. Discovery of the frequent sequences and automation of the traffic using discovered sequences could reduce the interaction between the inhabitant and the traffic. The crux of the study is to find, when each route load is increase and decrease to determine the interaction between the routes load (such as the causality of their usage), using the intervals. This gives the answer to the exact time of occurrences of each route/event as well as of the frequent patterns (sets of devices).

Even though interval discovery can be used with various applications the traffic control system scenario is used this type of table

Table: Sample of traffic control Input Data for a particular route R1.

Status	Time (per 10 minutes)	Support
R1	08:00 Am	10
R1	09:00 Am	14
R1	10:00 Am	25
R1	11:00 Am	45
R1	12:00 Am	40
R1	01:00 Pm	35
R1	02:00 Pm	30
R1	03:00 Pm	30
R1	04:00 Pm	30
R1	05:00 Pm	45
R1	06:00 Pm	50
R1	07:00Pm	35
R1	08:00 Pm	20

The significant interval discovery algorithm proposed in this study can be partitioned into 3 phases:

- Preprocessing (one time processing)
- Interval Formation (Iterative process)
- Cluster Formation (one time processing)

The interval discovery algorithm accepts a number of parameters from the user (from a configuration file) to compute the set of significant intervals and clusters. The input parameters accepted by the algorithm are:

- Minimum Strength
- Window
- Measure
- Measure Value
- Period
- Interval Semantics
- Sequential Window
- Number of Threads

Minimum Strength and Window are parameters used in the preprocessing phase to prevent the formation of certain first level intervals from the point- based data. They are domain specific and optional; they make the process more efficient and accurate when provided. Minimum Strength ensures that only intervals with strength greater than specified value (threshold) form an interval

IX. CONCLUSION

It is evident that number of algorithms have been proposed for solving the problem of frequent pattern discovery. Approaches that work for one domain do not necessarily form the best solution for another. The focus of our approach lies between clustering and sequential mining since both kinds of information are required to discover frequent patterns and answer queries related to intelligent environments. As mentioned above, our approach has enormous potential in intelligent environments where the key is to continuously learn from the surroundings and automate the inhabitant's activities. The traffic control system (Managing An Intelligent and Versatile light system) patterns enables us to automate device usage and reduce human interaction. For finding patterns, the algorithm uses the intervals derived from various routes based on a user- defined confidence, density or interval length to predict the time of operation of each route. This information is used to answer user queries as well as to find sequential patterns. Representative intervals can be classified as the smallest intervals with highest density satisfying the desired interval-confidence.

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AN ANALYSIS OF INVESTMENT DECISIONS REGARDING CORPORATE FINANCE

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Abstract

Investment is putting money into something with the hope of profit. More specifically, investment is the commitment of money or capital to the purchase of financial instruments or other assets so as to gain profitable returns in the form of interest, income, or appreciation of the value of the instrument. In finance, Investment is the commitment of funds by buying securities or other monetary assets in the market.The paper analyzes all the relevant factors to be considered before making decision regarding an investment. The paper also discusses circumstances under which firms might prefer to raise debt and equity funds as well as situations where an investor may have a preference. Finally, the paper examines all the relevant aspects of investment decisions.

I. INTRODUCTION

Investment is putting money into something with the hope of profit. More specifically, investment is the commitment of money or capital to the purchase of financial instruments or other assets so as to gain profitable returns in the form of interest, income, or appreciation of the value of the instrument. It is related to saving or deferring consumption. Investment is involved in many areas of the economy, such as business management and finance no matter for households, firms, or governments. Investment comes with the risk of the loss of the principal sum. The investment that has not been thoroughly analyzed can be highly risky with respect to the investment owner because the possibility of losing money is not within the owner's control.

II. DEBT AND EQUITY AS A MEANS TO RAISE FUNDS

Equity funds are considered to be the more risky funds as compared to other fund types, but they also provide higher returns than other funds. It is advisable that an investor looking to invest in an equity fund should invest for long term i.e. for 3 years or more.

Funds that invest in medium to long-term debt instruments issued by private companies, banks, financial institutions, governments and other entities belonging to various sectors (like infrastructure companies etc.) are known as Debt / Income Funds. Debt funds are low risk profile funds that seek to generate fixed current income (and not capital appreciation) to investors. In order to ensure regular income to investors, debt (or income) funds distribute large fraction of their surplus to investors. Although debt securities are generally less risky than equities, they are subject to credit risk (risk of default) by the issuer at the time of interest or principal payment. To minimize the risk of default, debt funds usually invest in securities from issuers who are rated by credit rating agencies and are considered to be of "Investment Grade".

III. METHODOLOGY

The basic rationale behind the research paper is to analyze and interprets the various sources so far being used as a means of raising capital and the risk involved with such means. The paper is a blend of descriptive and analytical research where primary and in some spheres secondary data have been used. With the help of certain basic statistical measures interpretations have been drawn.

IV. DATA ANALYSIS AND INTERPRETATION

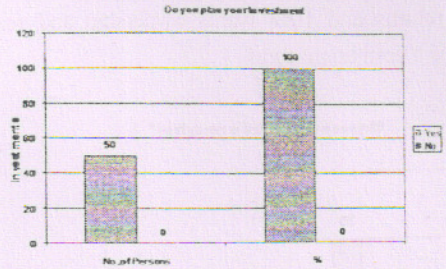
Q-1. Do you plan your investment?
a) Yes b) No

Plan for Investment	No. of Persons	%
Yes	50	100
No	0	0

Interpretation

From the above data, we can simply make out a conclusion that when 100% of people plan for investment. It clearly

indicates that to a greater extent people want planning for their investment. They want utilize their complete investment and also wants the better returns.



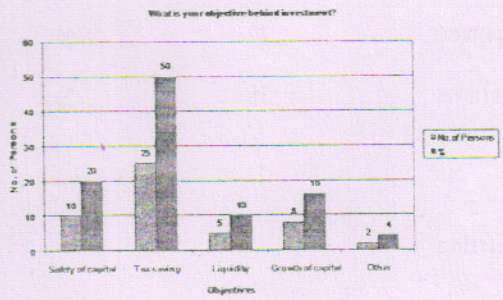
Q-2. What is your objective behind investment?

a) Safety of capital b)Tax saving c)Liquidity d)Growth of capital e)Other

Objectives	No.of Persons	%
Safety of capital	10	20
Tax saving	25	50
Liquidity	5	10
Growth of capital	8	16
Other	2	4

Interpretation

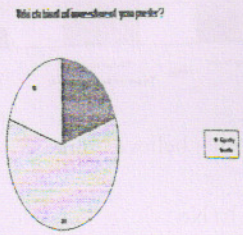
From the above data, the majority of the people i.e. 50% invest their income on funds because of saving of tax and rests of the people take other options for investing their incomes on funds.



Q-3. What kind of investment you prefer?

a) Equity fund b)Debt fund c)Both

Type of funds	No. of Persons	%
Equity funds	10	20
Debt funds	30	60
Both	10	20



Interpretation

From the above data, the majority of the people i.e. 60% prefer debt funds because it having less risk and gives moderate returns to the investors. Rest of the 20% people invest in equity funds they want quick returns and able to take high risk and rest 20% people want to invest in both the funds according to the need of the investment.

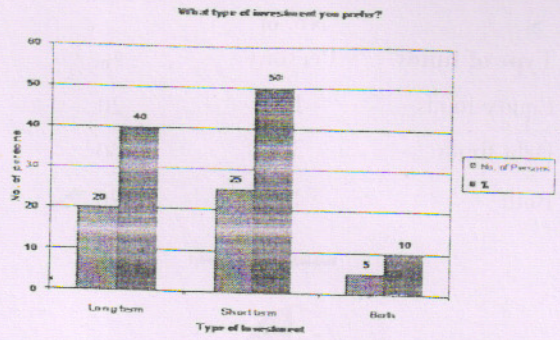
Q-4. What type of investment you prefer?

a) Long term investment b)Short term investment c) Both

Type of Investment	No. of Persons	%
Long term	20	40
Short term	25	50
Both	5	10

Interpretation

The majority of the people i.e. 50% prefer short term investment because they want regular income with a low risk and 40% people prefer long term investment because they want quick and higher returns and remaining 10% people prefer both type of investment because their decision is based on market condition.



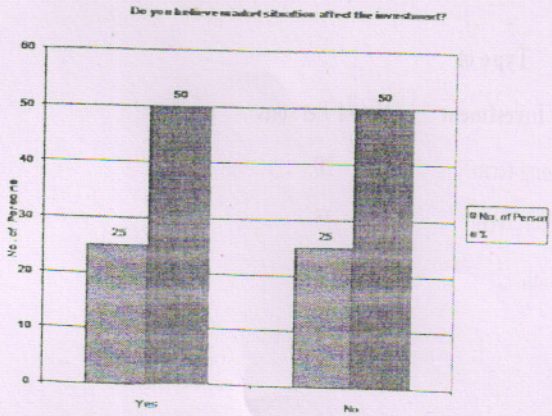
Q-5. Do you believe market situation affect the investment?

a) Yes b) No

Market Situation	No. of Person	%
Yes	40	80
No	10	20

Interpretation

From the above data, the majority of the people i.e. 80% believe that market situation affect the investment if market rises, the investment is increased and if market falls investment is decreased and rest 20% people believe that market situation does not affect the investment.



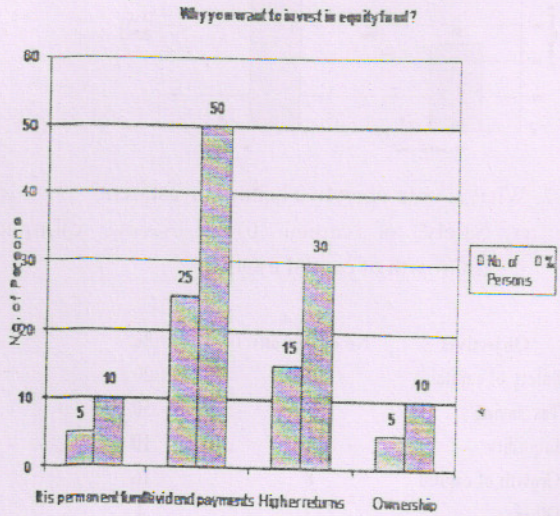
Q-6. Why you want to invest in equity fund?

a) It is permanent funds b) Dividend payments c)Higher returns d) Ownership

Investment	No. of Persons	%
It is permanent funds	5	10
Dividend payments	25	50
Higher returns	15	30
Ownership	5	10

Interpretation

From the above data, the majority of the people i.e. 50% want to invest in equity funds because it gives dividend payments and 30% people invest in this fund because it gives higher returns and 10% wants ownership and rest 10% thinks it is a permanent fund.



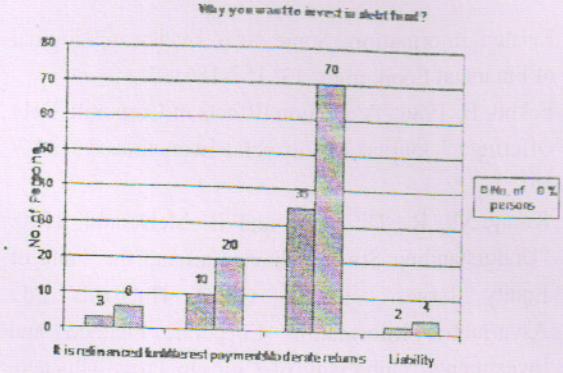
Q-7. Why you want to invest in debt fund?

a) It is refinanced funds b)Interest payments c) Moderate returns d)Liability

Investment	No. of persons	%
It is refinanced funds	3	10
Interest payments	10	20
Moderate returns	35	70
Liability	2	0

Interpretation

From the above data, the majority of the people i.e. 70% invest in debt funds because it gives moderate returns and 20% people invest in debt because interest payments are there and rest 10% people invest in debt because it is refinanced funds.



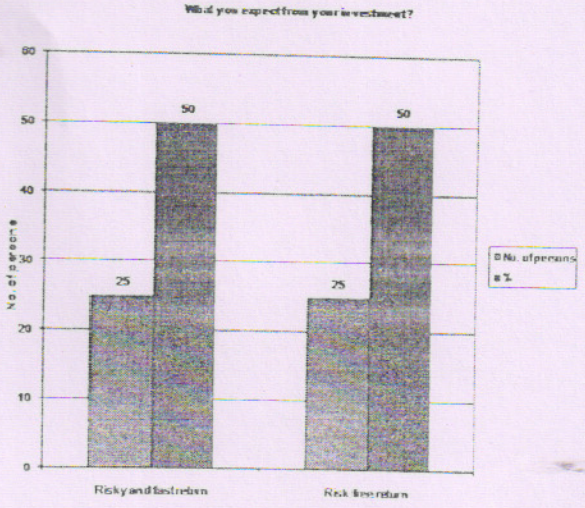
Q-8. What you expect from your investment?

a) Risky and fast return b) Risk free return

Expectations	No. of persons	%
Risky and fast return	10	20
Risk free return	40	80

Interpretation

From the above data, the majority of the people i.e. 80% expect risk free returns and remaining 10% people expect risky and fast returns.



Q-9. What you prefer regarding your investment decisions?

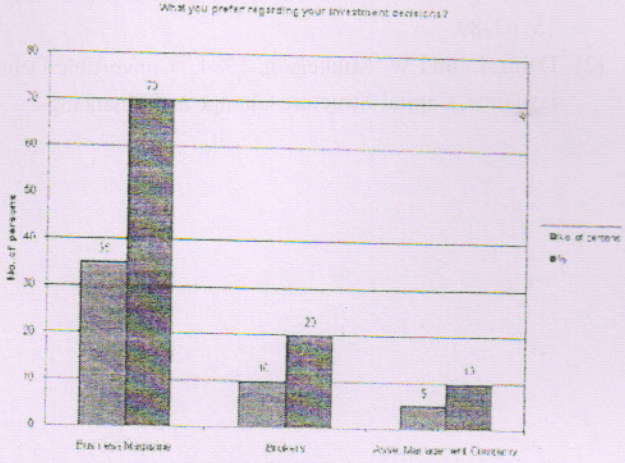
a) Business Magazine b) Brokers

c) Asset Management Company

Decisions	No. of persons	%
Business Magazine	35	70
Brokers	10	20
Asset Management Company	5	10

Interpretation

From the above data, the majority of the people i.e. 70% prefer business magazines regarding their investment decisions and 20% people prefer broker for their investment decisions and rest 10% people prefer asset management companies regarding their investment decisions.



V. CONCLUSION

The last few years have brought an explosion in the number and size of debt funds. Additionally, recent deals by equity funds are much larger than in the past. And debt funds are now doing larger "club" deals. Both types of funds have more money under management than ever before. More cash is chasing deals, causing overlap where both types of funds vie over the same company. Although these funds do not represent long-term threats to each other, secured lenders must recognize that equity and debt funds have markedly different characteristics, goals and behaviors. The most fundamental difference in equity funds seek to buy all of the equity of companies debt funds are not constrained to controlling equity investments. Whether investing in debt or equity, debt funds typically demand a much more rapid exit strategy than equity funds. Debt funds generally seek a quick flip of their investments. The time-hold differences directly affect the exit strategy, risk tolerance and desired rate of return of the two types of funds.

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M^X/G/1 RETRIAL QUEUE WITH TWO PHASE REPAIR

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Abstract

In this study, we provide the analysis of a single unreliable server batch arrival queue with repair in two phases. The arrival rate of jobs at service station varies according to the server's status as server being idle, busy, under setup and under i^{th} (i=1,2) phase repair. We assume that the jobs which find the server busy or broken down and under repair, leave the service station and join the retrial orbit with some probability. The service time taken by the server is general distributed. The server always has the tendency to breakdown and the repairman restores the broken down server in two phases. The life time of server is exponentially distributed but the repair in each phase is performed according to general distribution. The queueing analysis has been done using supplementary variable technique and generating function method. Various performance indices are derived in explicit form which can be computed easily as results depend only upon the first two moments of inter-failure times, phase repair times and batch size distributions. The cost analysis has been attempted successfully. Some special cases of interest have been deduced by setting appropriate parameter values. To show the effect of parameters upon various performance characteristics of the system such as mean queue length, probability that the server is idle, busy, under set up, and under phase repair, etc., the sensitivity analysis is carried out by taking numerical illustration.

Keywords:- M^X/G/1, Retrial queue, Set up, Unreliable server, Two phase repair, Supplementary variable, Queue size, Reliability

I. INTRODUCTION

All manufacturing environments operate under uncertain conditions stemming from uncertainty about processing time of jobs or the reliability of resources, such as machines/servers. The system designer may recommend the proper repair facility for a system wherein an unreliable server is busy in processing various jobs. The study of a queueing model with unreliable server is of relevance to engineering systems as it helps in decision-making. For the machine repair case, the engineering management decisions are required regarding the type and number of machines, number of repair crew, regular maintenance versus repair-or-breakdown philosophies, etc.. Queueing models are needed to have an insight for congestion related issues such as waiting times, idle times, busy times and many other system characteristics.

Retrial queueing systems are characterized by the feature that the arriving jobs, who on finding the server busy join the retrial group/orbit to try again after random intervals for their requests; the reason being that the return of customers plays a special role in many of these systems as well as in other practical applications of these systems. The retrial has a non-negligible negative effect on the performance measures. It also has wide applicability in real world congestion situations such as manufacturing systems, production systems, distribution systems, telecommunication networks and computer systems, etc.. Many queue theoreticians have given performance analysis of retrial queues in different frame works. Reliability analysis of the retrial queue with server breakdowns was performed by [13]. [4] described the analysis of M/G/1 retrial queue with Bernoulli-schedules and general retrial times. [19] made the numerical calculation of the stationary distribution of multi-server retrial queue. The single server retrial queue with batch arrivals was provided by [12]. [9] considered M/G/1 retrial queue with general retrial times. Analysis of a multi-server retrial queue with search of customers from the orbit was made by [23]. [18] derived the busy period of the M/G/1 queue with finite retrial group. An M/G/1 retrial G-queue with preemptive resume and feedback under N-policy vacation subject to the server breakdowns and repairs was investigated by [27].

The queueing systems in which arrivals occur in batches are referred to as bulk arrival queueing system. Queueing systems with batch arrivals are common in a number of real situations such as computer and communication systems; messages which are to be transmitted could consist of a random number of packets. [15] studied a bulk input queueing system with different vacations. The bulk arrival on retrial policy concept has also attracted many

researchers working in the area of queueing theory. [22] considered a batch arrival Poisson queue with N policy $M^X/G/1$ retrial queue with multiple vacations and starting failures was investigated by Krishna [5]. Single server retrial queueing model according to batch Markovian arrival process with general service time was developed by [3]. [16] obtained maximum entropy solutions for batch arrival queue with an unreliable server and delaying vacations. A queue with compound Poisson arrivals, phase type required service times in which a single processor serves according to the processor-sharing discipline was investigated by [11]. [7] discussed the steady-state behavior of an $M^X/G/1$ retrial queue with an additional second phase of optional service and service interruption where breakdowns occur randomly at any instant while the server is serving the customers.

Setup or change over time is the time required by the server/machine while manufacturing one product type to switch over to another product type. The setup time generally includes times required for fixturing, tool changing and preparing the work place. [24] considered priority queues with semi-exhaustive service and class dependent setup times. [25] developed a polling model is a queueing model where many job classes share a single server and a setup time is incurred whenever the server changes class. [6] considered unrelated parallel machine scheduling with setup times using simulated annealing. A vacation queue with setup and close down times and batch Markovian arrival processes was studied by [28]. [1] provided equal processing and equal setup time cases of scheduling parallel machines with a single server. M/G/1 superposed queueing system with setup time under N-policy was studied by [20]. [2] described relevant issues in semi conductor manufacturing.

As exhibited in practical situations, repair stations or repair facilities are also subject to random breakdowns and require repair to resume its assigned jobs. The failure of any machine may cause a sequence of failures, and so a breakdown of the server may require several stages of repair. Unreliable server queueing systems are of interest from the viewpoint of practical applications in real world problems. In this investigation, we develop a retrial queueing model where the server may experience breakdowns, and broken down server requires a finite random number of stages of repair before service is restored. Various authors have analyzed queueing problems of server breakdowns with several combinations. [26] considered manufacturing systems of m identical unreliable machines producing one type of product. [21] investigated a retrial queue where server is subject to breakdown. [14] described an M/G/1 queue with second optional service and server breakdown. M/G/1 system under NT policies with breakdowns, startup and closedown was analyzed by [17]. An M/G/1 retrial queue with active breakdowns and Bernoulli schedule was investigated by [10]. [8] considered an $M^X/G/1$ with an additional second phase of optional service and unreliable server, which consist of a breakdown period and a delay period under N-policy.

Supplementary variable technique is a powerful and elegant technique to provide better solutions of non-Markovian queueing systems. In the supplementary variable technique a non Markovian process in continuous time is made Markovian process by the inclusion of one or more supplementary variables. It is often used in tackling queueing problems for steady state case.

In this investigation, we study unreliable server queueing model with bulk arrivals, retrial, setup time and two-phase repairs. By using the supplementary variable method, we obtain the steady state results for both queueing and reliability measures of interest. Further more, our aim is to illustrate graphically the effect of the various system parameters on the steady state performance measures. The remaining study is structured as follows. Next section II provides the description of model by stating requisite assumptions. Section III presents notations used for mathematical formulation of the queueing model. Section IV contains the steady state equations in terms of supplementary variables corresponding to elapsed service time, elapsed set up time and elapsed repair times of two phases. Section V is concerned with the analysis where we obtain probability distribution of the system state using the generating function technique. Some performance measures are established with the help of queue size distribution in section VI. Section VII facilitates the average total cost function involving various cost elements and some more performance measures. Some special cases, which match with the earlier existing results, are deduced in section VIII. Reliability indices of the unreliable server are obtained in section IX. Section X is devoted to the numerical illustration where sensitivity analysis is also facilitated. Finally, in section XI we conclude the study by stating the noble features and future scope of the model investigated.

II. MODEL DESCRIPTION

Consider a single server retrial queue in which customers arrive in batches according to a Poisson process. The batch size X is a random variable and $P(X=k) = C_k$, $k=1,2,3,\ldots$ with $\sum_{k=1}^{\infty} C_k = 1$. Upon arrival, the customers examine the availability of the server. If an incoming batch finds the server idle, the service of one member of the batch immediately begins and the rest of the customers in that

batch join the retrial group and seek for service individually after a random amount of time. The service time provided by the single server is an independent and identically distributed random variable. The lifetime of the server is considered to be exponentially distributed. If the customers of the incoming batch notice that the server is unavailable on finding it busy, under set up or broken down state, they depart from the service area and join retrial orbit and retry for their demand after some random interval of time. Whenever the server is broken down, immediately it is sent for repair to the repairman who needs set up time before starting the first phase of repair. We assume that repair completes in two phases. After completing the first phase of repair, the server becomes available for service with probability p. However if server is not restored, it goes to second phase of repair with probability q =1-p. When both phases of repair are completed, the server becomes available immediately for service. If the server is busy at arrival epoch, then all the customers join the orbit with probability q where as if the server is free, then one of the arriving customers starts taking the service with probability p and other customers join the orbit. The setup time and repair time of two phases are independent and identically general distributed. All the considered variables are assumed to be mutually independent. To illustrate this concept we consider an example of soft drink bottling plant.

Soft drink bottling plant

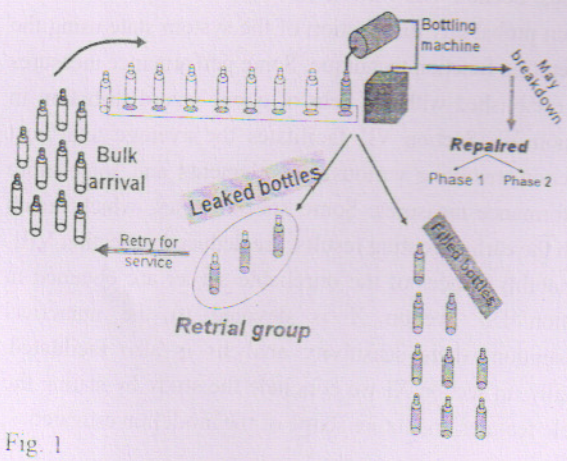

Fig. 1

Let us consider a queueing system in which the arrival occurs in batches and service is provided by an unreliable single server. The empty bottles which arrive at a filling plant (Fig. 1) correspond to bulk arrival, filled according to exponential distribution by a single unreliable machine. During the filling process it may happen that some bottles are not properly sealed and start leaking. These bottles are rejected and join the other group called retrial group, from where they retry for there service. The automatic filling plant is based on the machining system which is always prone to breakdown. If the machine breakdowns, it is repaired by the repairman who takes some setup time before starting the repair. The machine is repaired in two phases. Phase-1 correspond to overall machine inspection. If there is some minor fault, it is immediately removed and machine is restored for further working. And if some major fault is found, machine is repaired in second phase which may require some more time.

III. NOTATIONS

For the mathematical formulation of $M^X/G/1$ queue, we introduce the following notations:

	:	The batch arrival rate
	:	Mean failure rate of the server
b	:	Mean batch size
b_2	:	2nd factorial moment of batch size
C(z)	:	Probability generating function of the batch size X
θ	:	Retrial rate
X(t)	:	Random variable denoting the elapsed service time at time t.
Y(t)	:	Random variable denoting the elapsed setup time and repair time of 1st and 2nd phases, respectively at time t
$b(x), a(y), h_i(y)$	:	Probability density function for service time, setup time and i^{th} (i=1,2) phase repair time, respectively.
$B(x), A(y), H_i(y)$	:	Probability distribution functions for service time, setup time and i^{th} (i=1,2) phase repair time, respectively.
$\overline{B}(x), \overline{A}(y), \overline{H}_i(y)$	:	1-B(x), 1-A(y), $1-H_i(y)$,(i=1,2), respectively.
$b^*(s), a^*(s), h_i^*(s)$	:	Laplace-Stieltjes transform of b(x), a(y), $h_i(y)$, (i=1,2), respectively.
$\mu(x), \nu(y), \beta_i(y)$	:	Repair rate, setup rate and completion rate of i^{th} (i=1,2) phase repair, respectively.
$\gamma_k, \xi_k, \eta_k^{(i)}$	:	k^{th} moment of service time, setup time and i^{th} (i=1,2) phase repair time distributions respectively.
$P_n(t)$	:	Probability that there are n jobs in retrial queue at time t when the server is in idle state.
$W_n(t,x)dx$	:	Joint probability that there are n jobs in the retrial queue at time t when the server is in working state and elapsed service time lies in (x, x+dx)

$S_n(t,x,y)dy$: Joint probability that there are n jobs in the retrial queue at time t when the server is in setup state and elapsed service time is x and elapsed setup time lies in (y, y+dy)

$R_{n,1}(t,x,y)dy$: Joint probability that there are n jobs in the retrial queue at time t when the server is in 1^{th} phase repair state and elapsed service time is x, elapsed 1^{st} phase repair time lies in (y, y+dy)

$R_{n,2}(t,x,y)dy$: Joint probability that there are n jobs in the retrial queue at time t when the server is in 2^{nd} phase repair state and elapsed service time is x, elapsed 2^{nd} phase repair time lies in (y, y+dy)

$L_0(z), L_s(z)$: Steady state probability generating function of the number of jobs in the retrial queue and in the system, respectively.

$R(t)$: Reliability of the server at time t

$R^*(s)$: Laplace transform of $R(t)$

$P_n^*(s), W_n^*(s,x), W_n^*(s,0)$: Laplace transform of $P_n(t), W_n(t,x)$ and $W_n(t,0)$, respectively.

MTTF : Mean time to server failure

$P(I), P(B), P(S)$: Probability of server being in idle state, busy state and setup state, respectively

$P(R_1), P(R_2)$: Probability of server being in 1^{st} phase repair state and 2^{nd} phase repair state, respectively.

$E[I], E[B], E[S]$: Expected length of idle period, busy period and set up period, respectively.

$E[R_j]$: Expected length of j^{th} (j=1,2) phase repair period of the server

$E[C]$: Expected length of the cycle

We present the following hazard rates or instantaneous rates for various states of the server as follows:

- For service state

$$\mu(x) = \frac{b(x)}{\bar{B}(x)} \Rightarrow b(x) = \mu(x)\exp\left\{-\int_0^x \mu(t)dt\right\}$$

- For setup state

$$\nu(y) = \frac{a(y)}{\bar{A}(y)} \Rightarrow a(y) = \nu(y)\exp\left\{-\int_0^y \nu(t)dt\right\}$$

- For first phase and second phase repair states

$$\beta_i(y) = \frac{h(y)}{\bar{H}(y)} \Rightarrow h(y) = \beta_i(y)\exp\left\{-\int_0^y \beta_i(t)dt\right\}, \quad i = 1,2$$

k^{th} moments for the service time, setup time and two phase repair time distributions are determined as

$$\gamma_k = (-1)^k b^{*(k)}(0), \xi_k = (-1)^k a^{*(k)}(0), R_{k,i} = (-1)^k h_i^{*(k)}(0), i = 1,2$$

IV. THE GOVERNING EQUATIONS

By supplementary variable technique, we obtain the following partial differential equations that govern the dynamics of the server's status, namely idle, busy, retrial, setup and two phases repair states as follows:

$$\left(\frac{\partial}{\partial t} + \lambda + n\theta\right)P_n(t) = \int_0^\infty \mu(x)W_n(t,x)\,dx \qquad ...(1)$$

$$\left(\frac{\partial}{\partial t} + \frac{\partial}{\partial x} + \lambda + \alpha + \mu(x)\right)W_n(t,x) = \int_0^\infty p\beta_1(y)R_{n,1}(t,x,y)dy + \int_0^\infty q\beta_2(y)R_{n,2}(t,x,y)dy + \lambda\sum_{k=1}^{n} C_k W_{n-k}(t,x) \qquad ...(2)$$

$$\left(\frac{\partial}{\partial t} + \frac{\partial}{\partial y} + \lambda + \nu(y)\right)S_n(t,x,y) = \lambda\sum_{k=1}^{n} C_k S_{n-k}(t,x,y) \qquad ...(3)$$

$$\left(\frac{\partial}{\partial t} + \frac{\partial}{\partial y} + \lambda + \beta_1(y)\right)R_{n,1}(t,x,y) = \lambda\sum_{k=1}^{n} C_k R_{n-k,1}(t,x,y) \qquad ...(4)$$

$$\left(\frac{\partial}{\partial t} + \frac{\partial}{\partial y} + \lambda + \beta_2(y)\right)R_{n,2}(t,x,y) = \lambda\sum_{k=1}^{n} C_k R_{n-k,2}(t,x,y) \qquad ...(5)$$

The boundary conditions for the transient state are as follows:

$$S_n(t,x,0) = \alpha\, W_n(t,x), \qquad n \geq 0 \qquad ...(6)$$

$$W_n(t,0) = \lambda\sum_{k=1}^{n+1} C_k P_{n+1-k}(t) + (n+1)\theta P_{n+1}(t), n \geq 0 \qquad ...(7)$$

$$R_{n,1}(t,x,0) = \int_0^\infty \nu(y)S_n(t,x,y)dy, n \geq 0 \qquad ...(8)$$

$$R_{n,2}(t,x,0) = q\int_0^\infty \beta_1(y)R_{n,1}(t,x,y)dy, n \geq 0 \qquad ...(9)$$

The normalizing condition for the transient state is given by

$$\sum_{n=0}^{\infty} P_n(t) + \int_0^\infty W_n(t,x)dx + \int_0^\infty\int_0^\infty S_n(t,x,y)dxdy + \int_0^\infty\int_0^\infty R_{n,1}(t,x,y)dxdy + \int_0^\infty\int_0^\infty R_{n,2}(t,x,y)dxdy = 1 \qquad ...(10)$$

For steady state system, we define the probabilities as follows:

$$P_n = \lim_{t\to\infty} P_n(t), \quad W_n(x) = \lim_{t\to\infty} W_n(t,x), \quad S_n(x,y) = \lim_{t\to\infty} S_n(t,x,y)$$

$$R_{n,1}(x,y) = \lim_{t\to\infty} R_{n,1}(t,x,y), \quad R_{n,2}(x,y) = \lim_{t\to\infty} R_{n,2}(t,x,y)$$

Letting $t \to \infty$ in equations (1)-(10), we get the differential equations for the steady state system as follows:

$$(\lambda + n\theta)P_n = \int_0^\infty \mu(x) W_n(x)\,dx \qquad \ldots(11)$$

$$\left(\frac{d}{dx} + \lambda + \alpha + \mu(x)\right) W_n(x) = \int_0^\infty p\beta_1(y) R_{n,1}(x,y)dy + \int_0^\infty q\beta_2(y) R_{n,2}(x,y)dy + \lambda \sum_{k=1}^{n} C_k W_{n-k}(x) \qquad \ldots(12)$$

$$\left(\frac{d}{dy} + \lambda + \nu(y)\right) S_n(x,y) = \lambda \sum_{k=1}^{n} C_k S_{n-k}(x,y) \qquad \ldots(13)$$

$$\left(\frac{d}{dy} + \lambda + \beta_1(y)\right) R_{n,1}(x,y) = \lambda \sum_{k=1}^{n} C_k R_{n-k,1}(x,y) \qquad \ldots(14)$$

$$\left(\frac{d}{dy} + \lambda + \beta_2(y)\right) R_{n,2}(x,y) = \lambda \sum_{k=1}^{n} C_k R_{n-k,2}(x,y) \qquad \ldots(15)$$

The steady state boundary conditions (6)-(9) yield

$$S_n(x,0) = \alpha\, W_n(x) \qquad \ldots(16)$$

$$W_n(0) = \lambda \sum_{k=1}^{n+1} C_k P_{n+1-k} + (n+1)\theta P_{n+1} \qquad \ldots(17)$$

$$R_{n,1}(x,0) = \int_0^\infty \nu(y) S_n(x,y)dy \qquad \ldots(18)$$

$$R_{n,2}(x,0) = q\int_0^\infty \beta_1(y) R_{n,1}(x,y)dy \qquad \ldots(19)$$

For the steady state, the normalizing condition (10) is given by

$$\sum_{n=0}^{\infty} P_n + \int_0^\infty W_n(x)dx + \int_0^\infty \int_0^\infty S_n(x,y)dxdy + \int_0^\infty \int_0^\infty R_{n,1}(x,y)dxdy + \int_0^\infty \int_0^\infty R_{n,2}(x,y)dxdy = 1 \qquad \ldots(20)$$

V. QUEUE SIZE DISTRIBUTION

For the analytic solution to resolve the system of equations (11)-(19), we introduce the following generating functions:

$$P(z) = \sum_{n=0}^{\infty} P_n z^n \; ; \; W(z,x) = \sum_{n=0}^{\infty} W_n(x) z^n \; ;$$

$$S(z,x,y) = \sum_{n=0}^{\infty} S_n(x,y) z^n$$

$$R_i(z,x,y) = \sum_{n=0}^{\infty} R_{n,1}(x,y) z^n, \; i = 1,2 \; ;$$

$$C(z) = \sum_{k=1}^{\infty} C_k z^k, \; |z| \le 1$$

Multiplying both sides of the equation (11)-(19) by appropriate powers of z and summing, we get

$$\lambda P(z) + z\theta P'(z) = \int_0^\infty \mu(x) W(z,x)dx \qquad \ldots(21)$$

$$\left(\frac{\partial}{\partial x} + \lambda(1 - C(z)) + \alpha + \mu(x)\right) W_n(z,x) = \int_0^\infty p\beta_1(y) R_1(z,x,y)dy + \int_0^\infty q\beta_2(y) R_2(z,x,y)dy \qquad \ldots(22)$$

$$\left(\frac{\partial}{\partial y} + \lambda(1 - C(z)) + \nu(y)\right) S(z,x,y) = 0 \qquad \ldots(23)$$

$$\left(\frac{\partial}{\partial y} + \lambda(1 - C(z)) + \beta_1(y)\right) R_1(z,x,y) = 0 \qquad \ldots(24)$$

$$\left(\frac{\partial}{\partial y} + \lambda(1 - C(z)) + \beta_2(y)\right) R_2(z,x,y) = 0 \qquad \ldots(25)$$

$$S(z,x,0) = \alpha\, W(z,x) \qquad \ldots(26)$$

$$W(z,0) = \lambda \frac{P(z)C(z)}{z} + \theta P'(z) \qquad \ldots(27)$$

$$R_1(z,x,0) = \int_0^\infty \nu(y) S(z,x,y)dy \qquad \ldots(28)$$

$$R_2(z,x,0) = q\int_0^\infty \beta_1(y) R_1(z,x,y)dy \qquad \ldots(29)$$

To obtain main results for queue size distribution, we establish following propositions using the system of equations (11)-(19) in terms of the generating functions.

Proposition-1: The partial probability generating function when the server is in idle state, busy state, setup state, first phase repair state and second phase repair state, respectively are

(i) $$P(z) = (1 - \rho\Omega_1)\exp\left[-\frac{\lambda}{\theta}\int_z^1 C(t)\frac{b^*\{Q(t)\} - t}{t\left[t - b^*\{Q(t)\}\right]}dt\right] \qquad \ldots(30)$$

(ii) $$W(z,x) = \frac{\lambda(C(z) - 1)}{\left[z - b^*\{Q(z)\}\right]} P(z)\exp\left[\{-Q(z)\}x\right]\bar{B}(x) \qquad \ldots(31)$$

(iii) $$S(z,x,y) = \frac{\alpha\lambda(C(z) - 1)}{\left[z - b^*\{Q(z)\}\right]} P(z)\exp\left[\{-Q(z)\}x\right]\exp\left[\{-\lambda(1 - C(z))\}y\right]\bar{B}(x)\bar{A}(y) \qquad \ldots(32)$$

(iv) $$R_1(z,x,y) = \frac{\nu(y)\alpha\lambda(C(z) - 1)}{\left[z - b^*\{Q(z)\}\right]} P(z)\exp\left[\{-Q(z)\}x\right]\exp\left[\{-\lambda(1 - C(z))\}y\right] \times \bar{B}(x)\bar{A}(y)\bar{H}_1(y) \qquad \ldots(33)$$

(v) $$R_2(z,x,y) = \frac{q\beta_1(y)\nu(y)\alpha\lambda(C(z) - 1)}{\left[z - b^*\{Q(z)\}\right]} P(z)\exp\left[\{-Q(z)\}x\right] \times \exp\left[\{-\lambda(1 - C(z))\}y\right] \times \bar{B}(x)\bar{A}(y)\bar{H}_1(y)\bar{H}_2(y) \qquad \ldots(34)$$

Proof: The proof can be found in the Appendix-A.

Proposition-2: The marginal generating functions of the orbit size when the server is in busy state, setup state, first phase repair state and second phase repair state, respectively are given as:

(i) $$W(z)=\frac{\lambda(C(z)-1)\left[1-b^*\{Q(z)\}\right]}{\left[z-b^*\{Q(z)\}\right]}\frac{}{Q(z)}P(z) \quad ...(35)$$

(ii) $$S(z)=-\frac{\alpha\,\overline{a^*}(\lambda-\lambda C(z))}{\left[z-b^*\{Q(z)\}\right]}\frac{\overline{b^*}\{Q(z)\}}{Q(z)}P(z) \quad ...(36)$$

(iii) $$R_1(z)=-\frac{\alpha\overline{h_1^*}(\lambda-\lambda C(z))a^*(\lambda-\lambda C(z))}{\left[z-b^*\{Q(z)\}\right]}\frac{\overline{b^*}\{Q(z)\}}{Q(z)}P(z) \quad ...(37)$$

(iv) $$R_2(z)=-\frac{\alpha q\overline{h_2^*}(\lambda-\lambda C(z))h_1^*(\lambda-\lambda C(z))a^*(\lambda-\lambda C(z))}{\left[z-b^*\{Q(z)\}\right]}$$

$$\times\frac{\overline{b^*}\{Q(z)\}}{Q(z)}P(z) \quad ...(38)$$

Proof: The results given in equations (35)-(38) are obtained using

$$W(z)=\int_0^\infty W(z,x)dx\ ,\ S(z)=\int_0^\infty\int_0^\infty S(z,x,y)dxdy$$

$$R_1(z)=\int_0^\infty\int_0^\infty R_1(z,x,y)dxdy\ ,\ R_2(z)=\int_0^\infty\int_0^\infty R_2(z,x,y)dxdy$$

Theorem-1:

(i) The probability generating function of the orbit size is

$$L_o(z)=\frac{(z-1)(1-\rho\Omega_1)}{\left[z-b^*\{Q(z)\}\right]}\exp\left[-\frac{\lambda}{\theta}\int_z^1\frac{C(t)b^*\{Q(t)\}-t}{t\left[t-b^*\{Q(t)\}\right]}\right] \quad ...(39)$$

(ii) The probability generating function of the system size is

$$L_s(z)=\frac{(z-1)b^*\{Q(z)\}}{\left[z-b^*\{Q(z)\}\right]}\exp\left[-\frac{\lambda}{\theta}\int_z^1\frac{C(t)b^*\{Q(t)\}-t}{t\left[t-b^*\{Q(t)\}\right]}\right] \quad ...(40)$$

Proof: Equations (39) and (40) can be determined by using the following results:

$$L_o(z)=P(z)+W(z)+S(z)+R_1(z)+R_2(z)\ ,$$

$$L_s(z)=P(z)+zW(z)+zS(z)+zR_1(z)+zR_2(z)$$

Theorem-2:

(i) The marginal generating function of the orbit size when the server is available

$$P(z)+W(z)+S(z)=P(z)\left[1+\frac{\lambda(C(z)-1)\left[1-b^*\{Q(z)\}\right]-\alpha\overline{a^*}(\lambda-\lambda C(z))\overline{b^*}\{Q(z)\}}{\left[z-b^*\{Q(z)\}\right]Q(z)}\right]$$

...(41)

(ii) The marginal generating function of the system size when the server is available

$$P(z)+zW(z)+zS(z)=P(z)\left[1+\frac{\lambda z(C(z)-1)\left[1-b^*\{Q(z)\}\right]-\alpha z\overline{a^*}(\lambda-\lambda C(z))\overline{b^*}\{Q(z)\}}{\left[z-b^*\{Q(z)\}\right]Q(z)}\right]$$

...(42)

Proof: The proof of the theorem is straight forward

Theorem-3:

Mean queue length of orbit and mean queue length of system size are

$$E(L_1)=\frac{\lambda}{(1-\rho\Omega_1)}\frac{1}{\theta}\left\{(b-1)+\rho\Omega_1\right\}+\frac{1}{2}\left\{\lambda\gamma_2 b_2\Omega_1^2+\gamma_1(b_2\Omega_1+\alpha b_2\Omega_2)\right\}$$

...(43)

$$E(L_2)=\frac{\lambda}{(1-\rho\Omega_1)}\frac{1}{\theta}\left\{(b-1)+\rho\Omega_1\right\}+\frac{1}{2}\left\{\lambda\gamma_2 b_2\Omega_1^2+\gamma_1(b_2\Omega_1+\alpha b_2\Omega_2)\right\}$$

$$+\rho\Omega_1 \quad ...(44)$$

where $\rho=\lambda b\gamma_1$, $C'(1)=b$, $C^*(1)=b_2$

$$\Omega_1=\left\{1+\alpha\left(\xi_1+\eta_{1,1}+q\eta_{1,2}\right)\right\},$$

$$\Omega_2=\left\{\xi_2+\eta_{2,1}+q\eta_{2,2}+2\xi_1\eta_{1,1}+2\xi_1\eta_{1,2}+2\eta_{1,1}\eta_{1,2}\right\}$$

Proof: Differentiating (39) and the taking limit $z\to 1$, we obtain the mean queue length of the orbit as given in (43). Again, differentiating (40) and the taking limit $z\to 1$, we obtain the mean queue length of the system as given in (44).

VI. PERFORMANCE MEASURES

Some performance measures are derived using propositions and theorems established in previous section.

- The probability of idle period

$$P(I)=\lim_{z\to 1}P(z)=1-\rho\Omega_1 \quad ...(45)$$

- The probability of busy period

$$P(B)=\lim_{z\to 1}\int_0^\infty W(z,x)dx=\rho \quad ...(46)$$

- The probability of setup period

$$P(S)=\lim_{z\to 1}\int_0^\infty\int_0^\infty S(z,x,y)dxdy=\alpha\rho\xi_1 \quad ...(47)$$

- The probability of first phase repair period

$$P(R_1)=\lim_{z\to 1}\int_0^\infty\int_0^\infty R_1(z,x,y)dxdy=\alpha\rho\eta_{1,1} \quad ...(48)$$

- The probability of second phase repair period

$$P(R_2)=\lim_{z\to 1}\int_0^\infty\int_0^\infty R_2(z,x,y)dxdy=\alpha\rho\eta_{1,2} \quad ...(49)$$

VII. COST ANALYSIS

For any queueing system, the cost analysis constitutes an important aspect of the investigation from implementation viewpoint

The expected length of cycle per unit time is given by

$$E(C) = E(I) + E(B) + E(S) + E(R_1) + E(R_2) \quad \ldots(50)$$

where

$$P(I)=\frac{E(I)}{E(C)},\ P(B)=\frac{E(B)}{E(C)},\ P(S)=\frac{E(S)}{E(C)},\ P(R_j)=\frac{E(R_j)}{E(C)},\ j=1,2 \quad \ldots(51)$$

E(B) can be obtained as (cf. Takagi, 1991)

$$E(B) = \frac{b}{1-\rho\Omega_1} \quad \ldots(52)$$

Now E(C) is determined as

$$E(C) = \frac{E(B)}{P(B)} = \frac{b}{\rho(1-\rho\Omega_1)} = \frac{1}{\lambda\gamma_1(1-\rho\Omega_1)} \quad \ldots(53)$$

A queueing system comprises of various cost factors. Here, in order to construct the average total cost function, the following cost elements are taken into consideration:

C_u = Start up cost per unit time

C_i = Cost incurred per unit time when the server is in idle state

C_o = Cost per unit time for keeping the server on and in operation.

C_S = Setup cost per cycle

C_{h_1} = Holding cost per unit time, which is incurred on each customer present in the orbit

C_{h_2} = Holding cost per unit time, which is incurred on each customer present in the system

C_d = Breakdown cost per unit time for a failed server.

C_{r_i} = Cost incurred per unit time when the server is under i^{th} (i=1,2) phase repair

The expected total cost per unit time can be expressed as

$$E(TC) = (C_u + C_d)\times\frac{1}{E(C)} + C_{h_1}E(L_1) + C_{h_2}E(L_2) + C_i P(I) + C_o P(B) + C_S P(S) + C_{r_1}P(R_1) + C_{r_2}P(R_2) \quad \ldots(54)$$

VIII. SPECIAL CASES

In this investigation $M^X/G/1$ model with unreliable server subject to breakdown, setup before repair, and two phase repair states have been considered for some special cases which are deduced by setting appropriate parameters as follows:

Case I: M/G/1 model with unreliable server

In this case, we consider the single arrival of jobs.Now by setting $b=1$ and $b_2=0$ in equations (43) and (44), the mean queue length of the orbit and system respectively are as follows:

$$E(L_1) = \frac{\lambda^2\gamma_1\Omega_1}{\theta(1-\lambda\gamma_1\Omega_1)} \quad \ldots(55)$$

$$E(L_2) = E(L_1) + \lambda\gamma_1 \quad \ldots(56)$$

Case II: $M^X/G/1$ model with reliable server

In this case $\alpha = 0$ so that equations (43) and (44) convert to

$$E(L_1) = \frac{\lambda}{(1-\rho)}\left[\frac{1}{\theta}\{(b-1)+\rho\} + \frac{1}{2}b_2\lambda\gamma_2 + \gamma_1(1+\alpha\Omega_2)\right] \quad \ldots(57)$$

$$E(L_2) = E(L_1) + \rho$$

where, $\Omega_2 = \xi_2 + \eta_{2,1} + q\eta_{2,2} + 2\xi_1\eta_{1,1} + 2\xi_1\eta_{1,2} + 2\eta_{1,1}\eta_{1,2}$ ... (58)

Case III: M/G/1 model with reliable server

If there is single arrival and server is not subject to breakdown, then by putting $b=1$, $b_2=0$ and $\alpha=0$, equations (43) and (44) become

$$E(L_1) = \frac{\lambda^2\gamma_1}{\theta(1-\lambda\gamma_1)} \quad \ldots(59)$$

$$E(L_2) = E(L_1) + \lambda\gamma_1 \quad \ldots(60)$$

Case IV: $M^X/G/1$ model without set up time and no phase repair

For this case, we obtain

$$E(L_1) = \frac{\lambda}{1-\rho(1+\alpha\eta_{1,1})}\left[\frac{1}{\theta}\{(b-1)+\rho(1+\alpha\eta_{1,1})\} + \frac{1}{2}b_2(1+\alpha\eta_{1,1})\lambda\gamma_2 + (1+\alpha\eta_{1,1})\gamma_1\right] \quad \ldots(61)$$

$$E(L_2) = E(L_1) + \rho(1+\alpha\eta_{1,1}) \quad \ldots(62)$$

which coincide with the results determined by Wang et al. (2001).

IX. RELIABILITY ANALYSIS

To determine reliability indices, we consider setup and breakdown states as absorbing states. Utilizing notations and assumptions as already presented in section 3, the transient differential difference equations corresponding to various states are as follows:

$$\left(\frac{\partial}{\partial t} + \lambda + n\theta\right)P_n(t) = \int_0^\infty \mu(x)W_n(t,x)\,dx \quad \ldots(63)$$

$$\left(\frac{\partial}{\partial t} + \frac{\partial}{\partial x} + \lambda + \alpha + \mu(x)\right)W_n(t,x) = \lambda\sum_{k=1}^{n} C_k W_{n-k}(t,x) \quad \ldots(64)$$

$$W_n(t,0) = \lambda\sum_{k=1}^{n+1} C_k P_{n+1-k}(t) + (n+1)\theta P_{n+1}(t) \quad \ldots(65)$$

with the initial condition $P_0(0)=1$.

The differential difference equations in terms of Laplace transform governing the model are:

$$sP_n^*(s) - 1 = -(\lambda + n\theta)P_n^*(s) + \int_0^\infty \mu(x)W_n^*(s,x)\,dx \quad \ldots(66)$$

$$sW_n^*(s,x) + \frac{\partial W_n^*(s,x)}{\partial x} = -(\lambda + \alpha + \mu(x))W_n^*(s,x) + \lambda\sum_{k=1}^{n} C_k W_{n-k}^*(s,x) \quad \ldots(67)$$

$$W_n^*(s,0) = (n+1)\theta P_{n+1}^*(s) + \lambda \sum_{k=1}^{n+1} C_k P_{n+1-k}^*(s) \quad \ldots(68)$$

Multiplying both sides of equations (66) to (68) by appropriate powers of z, and then summing over n=1, 2, 3,.... we obtain

$$(s+\lambda)P^*(s,z) - 1 = -z\theta \frac{\partial P^*(s,z)}{\partial z} + \int_0^\infty \mu(x) W^*(s,z,x)\,dx \quad \ldots(69)$$

$$\frac{\partial W^*(s,z,x)}{\partial x} + [s + \{\lambda + \alpha + \mu(x)\} - \lambda C(z)]W^*(s,z,x) = 0 \quad \ldots(70)$$

$$W^*(s,z,0) = \theta \frac{\partial P^*(s,z)}{\partial z} + \frac{\lambda C(z) P^*(s,z)}{z} \quad \ldots(71)$$

Proposition-3:

(i) Probability generating function in the form of Laplace parameter (s) when server is in idle state is given by

$$P^*(s,z) = \int_z^w \frac{1}{\theta[b^*\{s+\alpha+\lambda(1-C(y))-y\}]} \times \exp\left\{\frac{1}{\theta}\int_y^z \frac{x(s+\alpha)-\lambda C(x)b^*\{s+\alpha+\lambda(1-C(x))\}}{x[b^*\{s+\alpha+\lambda(1-C(x))\}-x]}dx\right\}dy \quad \ldots(72)$$

where α is the root of the equation $z = b^*\{s+\alpha+\lambda(1-C(z))\}$ and $z \neq 0$.

For $z=\alpha$, $P^*(s,\omega) = \frac{1}{\{s+\alpha+\lambda(1-C(\omega))\}}$ ...(73)

(ii) Probability generating function in the form of Laplace parameter (s) when server is in busy state is given by

$$W^*(s,z) = \left[\frac{1}{[z-b^*\{s+\alpha+\lambda(1-C(z))\}]} + \frac{\lambda(C(z)-1)-s}{[z-b^*\{s+\alpha+\lambda(1-C(z))\}]}P^*(s,z)\right] \times \frac{\overline{b}^*\{s+\alpha+\lambda(1-C(z))\}}{\{s+\alpha+\lambda(1-C(z))\}} \quad \ldots(74)$$

(iii) Reliability of the server in term of Laplace parameter (s) is given by

$$R^*(s,z) = \left(\frac{\alpha}{s+\alpha} + \frac{1}{s+\alpha}\right)\int_1^w \frac{1}{\theta[b^*\{s+\alpha+\lambda(1-C(y))-y\}]} \times \exp\left\{\frac{1}{\theta}\int_y^z \frac{x(s+\alpha)-\lambda C(x)b^*\{s+\alpha+\lambda(1-C(x))\}}{x[b^*\{s+\alpha+\lambda(1-C(x))\}-x]}dx\right\}dy \quad \ldots(75)$$

Proof: For proof see appendix B

Theorem 4: Mean time to system failure of the server is

$$MTTF = \frac{1}{\alpha} + \int_1^w \frac{1}{\theta[b^*\{s+\alpha+\lambda(1-C(y))-y\}]} \times \exp\left\{\frac{1}{\theta}\int_y^1 \frac{x\lambda-\lambda C(x)b^*\{\alpha+\lambda(1-C(x))\}}{x[b^*\{\alpha+\lambda(1-C(x))\}-x]}dx\right\}dy \quad \ldots(76)$$

Proof: $MTTF = \int_0^\infty R(t)dt = [R^*(s)]_{s=0}$

Using above relation, we can get the result.

Theorem 5: The steady state availability (A) and failure frequency (W_f) are given by

$$A = 1 - \rho\alpha\left(\xi_1 + \eta_{1,1} + q\eta_{1,2}\right) \quad \ldots(77)$$

And $W_f = \alpha\rho$ ...(78)

Proof: Instantaneous availability A(t) at time t of a system is the probability that the system is operational at time t. The limiting steady state availability is defined as

$$A = \lim_{t\to\infty} A(t)$$

$$= \sum_{n=0}^\infty P_n + \sum_{n=0}^\infty \int_0^\infty W_n(x)dx = \lim_{Z\to 1}\left[P(z) + \int_0^\infty W(z,x)dx\right]$$

Using equations (30) and (46), we get the result given in (77).

The failure frequency of the server is given by

$$W_f = \sum_{n=0}^\infty \int_0^\infty \alpha W_n(x)dx = \lim \int_0^\infty \alpha W(z,x)dx$$

Using equation (46), we get the result given in (78).

X. NUMERICAL RESULTS

In this section, numerical results for the queue lengths in the orbit and in the system are calculated using MATLAB software. The graphical presentation has been done in figs 2- 7. For numerical purpose, we use the following distributions:

- Service time is k-Erlang distributed with k=2
- Batch size distribution of the arrival is geometric with mean 2
- Setup time is exponential distributed
- Repair time is exponential distributed

The effect of arrival of batch of size (b), retrial rate ( ) and server's joining probability (p) on the average number of customers in orbit $E(L_1)$ and in the system $E(L_2)$ by varying the arrival rate ( ) of batch size, mean failure rate ( ) of the server, and first moment of setup time ( ), is demonstrated in figures 2- 7. It is observed that both $E(L_1)$ and $E(L_2)$ increase with the increase in , and . In figures 2(a) and 3(a), we illustrate that the batch size (b) does not affect much the average number of customers in orbit and in the system for smaller values of However for larger value of , both $E(L_1)$ and $E(L_2)$ increase moderately with b (for b=1, b=2) and for b=3 the increment

is significant. In figs 2(b) and 3(b), we see how the average number of customers in the orbit and in the system change with the retrial rate ( ). It is clear that $E(L_1)$ and $E(L_2)$ decrease with the increase in retrial rate but effect is significant only for larger values of . Figures 2(c) and 3(c) depict that $E(L_1)$ and $E(L_2)$ are almost same with the increasing values of joining probability (p) and arrival rate ( ).

Figs 4(a) and 5(a) display the effect of failure rate ( ) on the both queue length $E(L_1)$ and $E(L_2)$ by varying the batch size (b). We see from the graphs that as increases, $E(L_1)$ and $E(L_2)$ remain constant for small values of b whereas for higher value of b, both queue lengths $E(L_1)$ and $E(L_2)$ increase sharply. In figs 4(b) and 5(b) we observe that as increases, queue lengths $E(L_1)$ and $E(L_2)$ increase but as increases, the decreasing trends are noticed for both the queue lengths. In figs 4(c) and 5(c), we illustrate the effect of joining probability p on both queue lengths $E(L_1)$ and $E(L_2)$. It is noted that in both cases queue lengths $E(L_1)$ and $E(L_2)$ decrease slightly when increasing values are taken for p for lower values of , but as increases, this decrease is important. However $E(L_1)$ and $E(L_2)$ increase significantly with .

The effect of batch size b on both queue lengths $E(L_1)$ and $E(L_2)$ by varying setup time ($_1$) are displayed in figs 6(a) and 7(a). We see that $E(L_1)$ and $E(L_2)$ increase with the increasing values of b and $_1$. Figs 6(b) and 7(b) illustrate the effect of retrial rate on the queue lengths. The decreasing trend in both queue lengths $E(L_1)$ and $E(L_2)$ with the increase in retrial rate is found. Figs 6(c) and 7(c) depict the effect of joining probability p on $E(L_1)$ and $E(L_2)$. It is easily observed from the graphs that in case of p=.1 and p=.5, joining probability has almost no effect on the queue lengths $E(L_1)$ and $E(L_2)$ with increasing $_1$ rather increases, these are slightly scattered. However for p=.9, the increase in queue lengths is distinguishable, with increasing $_1$. But the queue lengths $E(L_1)$ and $E(L_2)$ are found to increase as p increases.

From the graphs, overall we conclude that

- Both queue lengths $E(L_1)$ and $E(L_2)$ increase as the arrival rate ( ) and batch size (b) increase
- With the increase in retrial rate, both queue lengths decrease
- Both queue lengths decrease as the joining probability increases.

XI. CONCLUSION

In this investigation, we have incorporated the concepts of retrial, setup time, breakdown and two phase general repair while predicting the performance measures of $M^X/G/1$ queueing system. We have examined the effect of various parameters namely the retrial rate, arrival rate, setup rate, joining probability, etc. by taking the numerical illustration. Retrial queueing models are often used for the performance prediction of unreliable server systems such as manufacturing systems, computer systems and communication networks, etc.. The reliability and availability studies provided, can play important role in improving the performability of these systems. The proposed methodology may be helpful to analyze industrial congestion problems specifically a wide range of production/manufacturing scenarios. The system performance measures, which have been displayed graphically to show the effect of various parameters on them, can be successfully utilized to upgrade the concerned system during development and design phase. A cost function identified by costs elements involved in the system may be helpful to achieve desired goal keeping in mind the techno-economic constraints.

Future research may be conducted on the same lines by generalizing the results to k-phases repair problems or by taking the concept of bulk service.

APPENDIX- I

Proof of proposition 1:-

By using equations (25) & (29), we get

$$R_2(z,x,y) = q\beta_1(y)R_1(z,x,y)\exp\left[\{-\lambda(1-C(z))\}y\right]\bar{H}_2(y) \quad ...(I.1)$$

Proceeding in the similar manner, the equations (24) and (23) can be determined by using equations (28) and (26) respectively, as

$$R_1(z,x,y) = v(y)S(z,x,y)\exp\left[\{-\lambda(1-C(z))\}y\right]\bar{H}_1(y) \quad ...(I.2)$$

$$S(z,x,y) = \alpha W(z,x)\exp\left[\{-\lambda(1-C(z))\}y\right]\bar{A}(y) \quad ...(I.3)$$

From equation (I.1) and with the help of equations (I.2) and (I.3), we get

$$R_2(z,x,y) = q\beta_1(y)v(y)\alpha W(z,x)\exp\left[\{-3\lambda(1-C(z))\}y\right]$$
$$\bar{A}(y)\bar{H}_1(y)\bar{H}_2(y) \quad ...(I.4)$$

Similarly equation (I.2) can be written as

$$R_1(z,x,y) = v(y)\alpha W(z,x)S(z,x,y)\exp\left[\{-2\lambda(1-C(z))\}y\right]\bar{A}(y)\bar{H}_1(y) \quad ...(I.5)$$

Utilizing equations (I.4) and (I.5) in equation (22), we get

$$\left[\frac{\partial}{\partial x}+\lambda(1-C(z))+\alpha+\mu(x)\right]W(z,x) = \int_0^\infty\int_0^\infty p\beta_1(y)v(y)\alpha W(z,x)\exp\left[\{-2\lambda(1-C(z))\}y\right]$$
$$\times\ \bar{A}(y)\bar{H}_1(y)dxdy + \int_0^\infty\int_0^\infty \beta_2(y)q\beta_1(y)v(y)\alpha$$
$$\times W(z,x)\exp\left[\{-3\lambda(1-C(z))\}y\right]\bar{A}(y)\times\bar{H}_1(y)\bar{H}_2(y)dxdy$$

Simplifying the above expression, we obtain

$$\left[\frac{\partial}{\partial x}+\lambda(1-C(z))+\alpha(1-\phi(z))+\mu(x)\right]W(z,x) = 0 \quad ...(I.6)$$

Here $\phi(z) = a^*\{\lambda-\lambda C(z)\}h_1^*\{\lambda-\lambda C(z)\}p + qh_2^*\{\lambda-\lambda C(z)\}$

Using equation (I.6) in equation (27), we get

$$W(z,x) = W(z,0)\exp\left[\{-Q(z)\}x\right]\bar{B}(x)$$

$$= \left[\frac{\lambda P(z)C(z)}{z} + \theta P'(z)\right]\exp\left[\left\{-Q(z)\right\}x\right]\bar{B}(x) \quad \ldots(I.7)$$

Removing the term W(z,x) from equations (21) and (I.7), we find

$$P'(z) = \left\{\frac{\lambda}{\theta} - \frac{C(z)b^*\{Q(z)\} - z}{z[z - b^*\{Q(z)\}]}\right\}P(z) \quad \ldots(I.8)$$

On solving (I.8), we get

$$P(z) = c\exp\left\{-\frac{\lambda}{\theta}\int_z^1 \frac{C(t)b^*\{Q(t)\} - t}{t[t - b^*\{Q(t)\}]}dt\right\} \quad \ldots(I.9)$$

We compute the value of W(z,0) with the help of equations (27) and (I.8) as

$$W(z,0) = \frac{\lambda(C(z)-1)}{z - b^*\{Q(z)\}}P(z) \quad \ldots(I.10)$$

Now we determine of P(1), W(1,0), W(1,x), S(1,x,y), $R_1(1,x,y)$ and $R_2(1,x,y)$. Taking limit $z \to 1$ in equations (I.9), (I.10), (I.7)

$$P(1)=c \quad \ldots(I.11)$$

$$W(1,0) = \frac{\lambda b P(1)}{1-\rho\Omega_1} \quad \ldots(I.12)$$

$$W(1,x) = \frac{\lambda b}{1-\rho\Omega_1}P(1)\bar{B}(x) \quad \ldots(I.13)$$

$$S(1,x,y) = \frac{\alpha\lambda b}{1-\rho\Omega_1}P(1)\bar{B}(x)\bar{A}(y) \quad \ldots(I.14)$$

$$R_1(1,x,y) = \frac{v(y)\alpha\lambda b}{1-\rho\Omega_1}P(1)\bar{B}(x)\bar{A}(y)\bar{H}_1(y) \quad \ldots(I.15)$$

$$R_2(1,x,y) = \frac{q\beta_1(y)v(y)\alpha\lambda b}{1-\rho\Omega_1}P(1)\bar{B}(x)\bar{A}(y)\bar{H}_1(y)\bar{H}_2(y) \quad \ldots(I.16)$$

Also taking the limit $z \to 1$ in equation (20), we find from the normalizing condition

$$c = 1-\rho\Omega_1 \quad \ldots(I.17)$$

To find the equation (30), we put the value of c in equation (I.9). We obtain equation (31), by eliminating W(z,0) from equation (I.7) and (I.10). After using equation (31), we obtain the equations (32), (33) and (34).

APPENDIX- II

Proof of proposition 3:-

Using equations (72)-(73), we get

$$W^*(s,z,x) = W^*(s,z,0)\exp\left[\left\{-(s+\alpha+\lambda(1-C(z)))\right\}x\right]\bar{B}(x) \quad \ldots(II.18)$$

$$= \left[\frac{\lambda C(z)P^*(s,z)}{z} + \frac{\theta\partial P^*(s,z)}{\partial z}\right]\exp\left[\left\{-(s+\alpha+\lambda(1-C(z)))\right\}x\right]\bar{B}(x)$$

$$\ldots(II.19)$$

From equations (69) and (II.19), we find

$$\theta\left[z - b^*\{s+\alpha+\lambda(1-C(z))\}\right]\frac{\partial P^*(s,z)}{\partial z} = 1 + \frac{[\lambda C(z)b^*\{s+\alpha+\lambda(1-C(z))\} - (s+\lambda)]}{z}P^*(s,z)$$

$$\ldots(II.20)$$

Here the coefficient of $F(z) = \left[z - b^*\{s+\alpha+\lambda(1-C(z))\}\right]$

$$F(0) = -b^*(s+\alpha+\lambda) < 0$$

$$F(1) = 1 - b^*(s+\alpha) \geq 0$$

$$F'(z) = 1 - b^*\{s+\alpha+\lambda(1-C(z))\}(-\lambda C'(z))$$

$$F''(z) = b^{*''}\{s+\alpha+\lambda(1-C(z))\}(-\lambda C'(z))^2 + b^{*'}\{s+\alpha+\lambda(1-C(z))\}(\lambda C''(z)) \leq 0$$

Now equation (I.20) becomes

$$\frac{\partial P^*(s,z)}{\partial z} = \frac{1+[\lambda C(z)b^*\{s+\alpha+\lambda(1-C(z))\} - (s+\lambda)]}{\theta[z - b^*\{s+\alpha+\lambda(1-C(z))\}]z}P^*(s,z)$$

or

$$\frac{\partial P^*(s,z)}{\partial z} - \frac{[\lambda C(z)b^*\{s+\alpha+\lambda(1-C(z))\} - (s+\lambda)]}{\theta[z - b^*\{s+\alpha+\lambda(1-C(z))\}]z}P^*(s,z)$$

$$= \frac{1}{\theta[z - b^*\{s+\alpha+\lambda(1-C(z))\}]z} \quad \ldots(II.21)$$

Solving the above equation, we get the equation (72)

Computation of $W^*(s,z)$

Using equation (I.19), we have

$$W^*(s,z) = \int_0^\infty \left[\frac{\lambda C(z)P^*(s,z)}{z} + \frac{\theta\partial P^*(s,z)}{\partial z}\right]\exp\left[\left\{-(s+\alpha+\lambda(1-C(z)))\right\}x\right]\bar{B}(x)dx$$

$$\ldots(II.22)$$

Simplifying the above expression, we obtain the equation (74).

The value of $R^*(s)$

$$R^*(s) = P^*(s,1) + W^*(s,1)$$

$$= P^*(s,1) + \left[\frac{1}{1-b^*(s+\alpha)} + \frac{-sP^*(s,1)}{1-b^*(s+\alpha)}\right]\frac{\bar{b}^*(s+\alpha)}{s+\alpha}$$

$$= \left(\frac{1+\alpha}{s+\alpha}\right)P^*(s,1) \quad \ldots(II.23)$$

After using equation (72),we get equation (75).

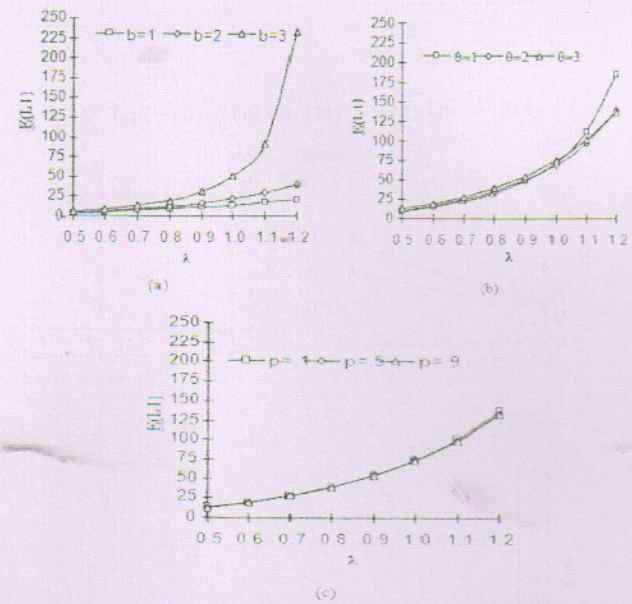

Fig. 2 : $E(L_1)$ vs λ varying (a) b, (b) θ and (c) p

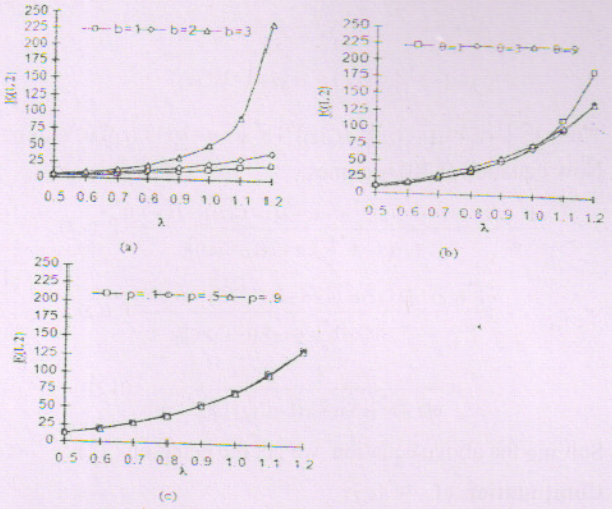

Fig. 3 : $E(L_2)$ vs varying (a) b, (b) θ and (c) p

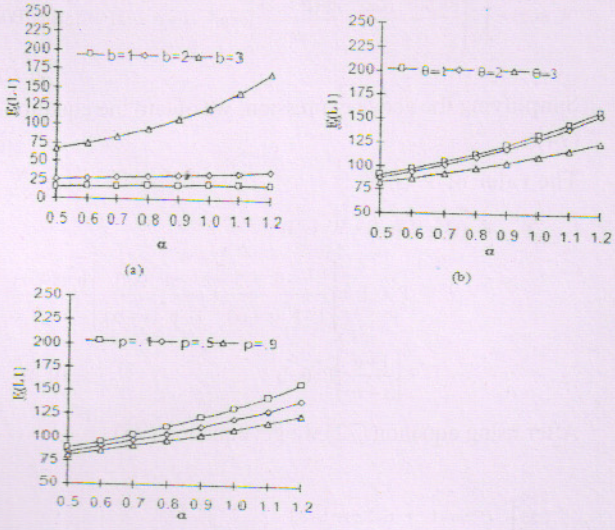

Fig. 4 : $E(L_1)$ vs varying (a) b, (b) θ and (c) p

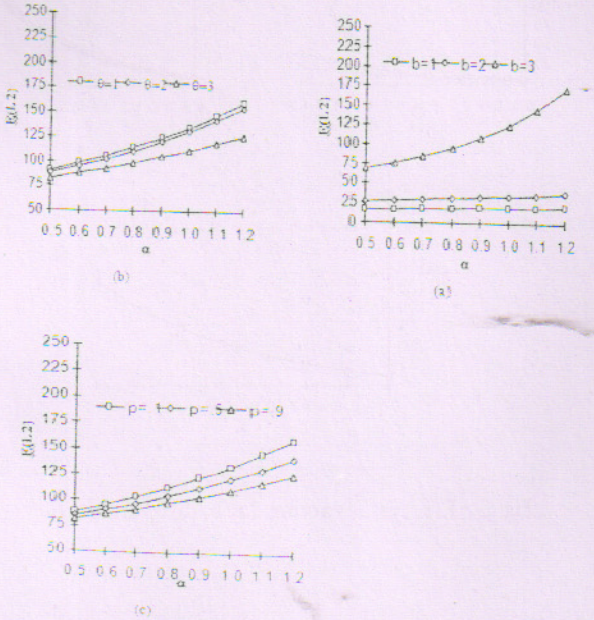

Fig. 5 : $E(L_2)$ vs , varying (a) b, (b) θ and (c) p

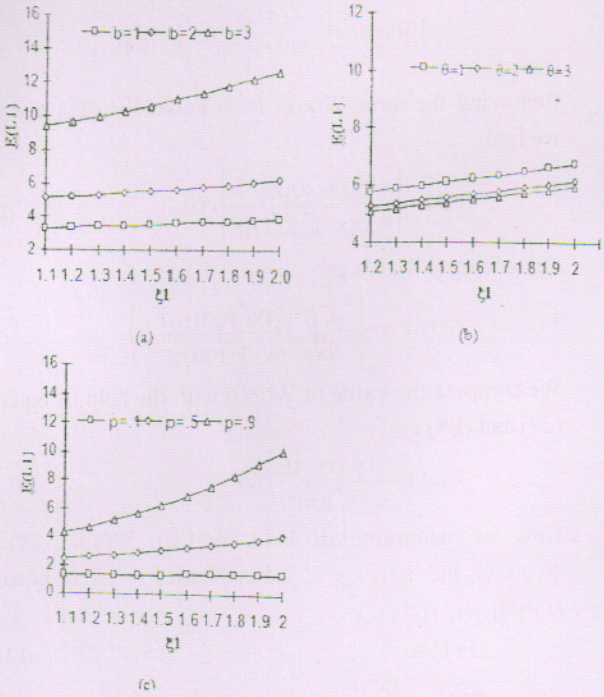

Fig. 6 : $E(L_1)$ vs , varying (a) b, (b) θ and (c) p

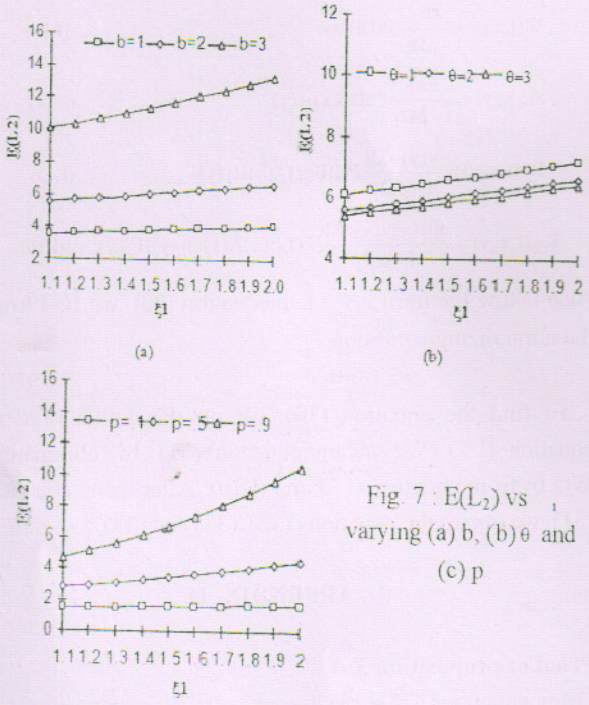

Fig. 7 : $E(L_2)$ vs , varying (a) b, (b) θ and (c) p

XII. REFERENCES

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