# 4th National Conference
# on
# Recent Trends in
# Computer Science & Applications
# and Computational Mathematics

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## *OBJECTIVE OF THE CONFERENCE*

The purpose of the conference is to provide opportunities for students, academicians and industry experts from an assortment of places to meet and to discuss current research in the field of computer science and applications and computational mathematics.

Computer Science is the theoretical study of computation, its implementation and practical application. However, even a cursory glance at a Computer Science book will convince the reader that Mathematics lies at the heart of the subject. Mathematics provides the language of computation and the logical tools to develop the relevant theory – indeed. The link between Mathematics and Computer Science is fundamental and pervasive, continually motivating new concepts and research.

## *SCOPE*

The scope of this Conference is to provide a National Level Platform for researchers, academicians, professionals and students to share their research ideas and results.

The areas of interest include, but are not limited to:

### *Computer Science and Applications:*

- Data Mining and Warehousing
- Cloud Computing
- Software Project Management
- Soft Computing
- Image Processing/Pattern Recognition
- Software and Reliability Engineering
- Learning Technologies
- Computer Graphics and Computer Vision
- E-Commerce and E-Business
- Network Security/Mobile Computing

### *Computational Mathematics:*

- Discrete Mathematics
- Coding Theory
- Cryptography
- Graph Theory
- Fuzzy Mathematics
- Information Fusion
- Lattices, Algebraic Structures
- Logic
- Operations Research
- Mathematical Modeling

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## ABOUT INDIRA COLLEGE OF COMMERCE AND SCIENCE

**Shree Chanakya Education Society** (SCES) was established in February 1994 by Dr. Tarita Shankar with the aim of providing top quality education in the fields of Business Management, International Business and Information Technology.

Under the wings of Shree Chanakya Education Society (SCES), **Indira College of Commerce** and **Indira College of Science** were established in the year 2001 which was merged in the year 2007 as **Indira College of Commerce and Science**.

Indira College of Commerce And Science (ICCS) – affiliated and approved by SPPU, ICCS offers the Bachelor's Program in Commerce, Bachelors in Business Administration and Computer Application, Bachelor's and Master's program in Computer Science.

ICCS has been re-accredited with **'A'** grade by "National Accreditation and Assessment Council" (NAAC).

## CHAIRPERSON'S MESSAGE

Technology in our daily life is no longer a subject of voluntary application. If one desires to keep up with the fast pace of urbanized life, one simply can no longer deny the influence of technology in our way of living. Even as recently as the early part of the twenty-first century, we may not have expected the technology age to be so heavily dominant in our lives. And from the looks of it, it seems it can only become more intensive and extensive in the coming years. In domestic life, for example, computers have taken over household security and conveniences – remotely controlled security apparatus, or mobile phone controlled appliances are a case in point. The picture of computer technology's dominance in corporate life is even more pervasive – with every branch of manufacturing, engineering, medicine, construction or the service sector – be it banking, hospitality, education etc. caught in the all-pervading embrace of technology. Our dependence on Computers rises with more and more applications becoming remotely manageable.

This application of technology would not have been possible but for the strides that computational mathematics has taken with newer and faster algorithms becoming the order of the day. It is extremely heartening that Indian engineers and specialists, working in all parts of the world, are part of this techno revolution that is sweeping the world like a tsunami. We can choose to ignore this flood only at our own peril. I am happy that ICCS has organized the conference for fourth year on RTCSACM which I believe is an important event that will go a long way in familiarizing the student and academic community with the developments in the area of Computer Science and Computational Mathematics.

I wish the Conference all success.

**Dr. Tarita Shankar**

*Chairperson & Chief Patron,*
*Indira Group of Institutes,*
*Pune, India.*

# *GROUP DIRECTOR'S MESSAGE*

Congratulations to Dr. Janardan Pawar and his IT Team for organizing the National Conference on Recent Trends in Computer Science and Applications and Computational Mathematics for the fourth year. Conferences such as this go a long way in getting the best from academia and industry to come together and share cutting-edge research and discuss the emerging trends that will impact the industry. The journal published thereafter will contribute to the creation of knowledge in the said faculty and will remain a source of learning for the academic and industrial community.

**Prof. Chetan S. Wakalkar**
*Group Director& Chief Patron,*
*Indira Group of Institutes,*
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# Computer Science and Applications

# Index

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# Software Based Simulation of Dissolved Oxygen for River Pollution Index– A Case of Bhima River in India

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## ABSTRACT:

*This research article aims to develop the dissolve oxygen model for determine the load of pollution in the river Bhima flowing from the Pune district. Dissolve Oxygen lag equation is used to design the simulation model by applying the C++ language. This model is evaluated in the field data collected at the different locations on Bhima river along with its path. The initial water sample is collected at the Pimpri-Sandas village the place of river confluence i.e. Bhima and Mula-Mutha is selected because the lower amount of Dissolved oxygen in water . The Dissolved Oxygen concentration (mg/lit) is measured at 10 Km interval and same evaluated by using this software simulation. It is interesting to find that, the software gives more accurate results up 70 Km. However, from 80-100 Km the output was varies from the 0.7 to 1.2 mg/lit.*

**Key words:** *dissolve oxygen lag, Bhima river, Mula-Mutha river, river pollution*

## Introduction:

Estimates suggest that nearly 1.5 billon people lack safe drinking water and that at least 5 million deaths per year can be attributing to waterborne diseases. With over 70 percent of the planet covered by oceans, people have long acted as if these very bodies of water could serve as a limitless dumping ground for wastes. Raw sewage, garbage, and oil spills have begun to overwhelm the diluting capabilities of the oceans , and most coastal waters are now polluted. The first major international conference on environment issues was held in Stockholm , Sweden, in 1972and was sponsored by the United States took a leading role, was controversial because many developing countries were fearful that a focus on environmental protection was a means for the developed world to keep the undeveloped world in an economically subservient position. The most important outcome of the conference was the creation of the United Nations Environment Program (UNEP).

Oxygen is produced during photosynthesis and consumed during respiration and decomposition. Because it requires light, photosynthesis occurs only during daylight hours. Respiration and decomposition, on the other

hand, occur 24 hours a day. This difference alone can account for large daily variations in DO concentrations. During the night, when photosynthesis cannot counterbalance the loss of oxygen through respiration and decomposition, DO concentrations steadily declining. They are lowest just before dawn, when photosynthesis resumes. Pollution tends to cause a decrease in stream oxygen concentrations. This change can be caused by addition of effluent or runoff water with a low concentration of DO or chemical or biological constituents that have a high oxygen demand – that is they require large amounts of oxygen before they can be thoroughly decomposed. The latter is often the more typical and more serious case.

The effort of present work is to develop a technological solution for measuring the Dissolve Oxygen in river water for various phases. The C Programming is used for doing the present work.

## Materials and Methods

**Objectives: -** The main aim of this article is to develop a software simulation for detecting the water pollution in river water. Along with this the article study also evaluating the water pollution simulation (software) for measuring and monitoring the Dissolve Oxygen concentration in the river Bhima flows in the Pune district of India.

**Method-**

Through following equation the C-Programming base software system is developed by using following equation-

$$\frac{\partial D}{\partial t} = k_1 L_t - k_2 D$$

This differential equation states that the total change in oxygen deficit (D) is equal to the difference between the two rates of deoxygenation and reaeration at any time.

The Streeter–Phelps equation, assuming a plug-flow stream at steady state is then

$$D = \frac{k_1 L_a}{k_2 - k_1}(e^{-k_1 t} - e^{-k_2 t}) + D_a e^{-k_2 t}$$

Streeter-Phelps DO sag curve and BOD development.

Where

$D$ is the saturation deficit, which can be derived from the dissolved oxygen concentration at saturation minus the actual dissolved oxygen concentration ($D = DO_{sat} - DO$). $D$ has the dimensions $\frac{\mathrm{g}}{\mathrm{m}^3}$.

$k_1$ is the deoxygenation rate, usually in $d^{-1}$.

$k_2$ is the reaeration rate, usually in $d^{-1}$.

$L_a$ is the initial oxygen demand of organic matter in the water, also called the ultimate BOD (BOD at time t=infinity). The unit of $L_a$ is $\frac{\mathrm{g}}{\mathrm{m}^3}$.

$L_t$ is the oxygen demand remaining at time t, $L_t = L_a e^{-k_1 t}$.

$D_a$ is the initial oxygen deficit $\left[\frac{\mathrm{g}}{\mathrm{m}^3}\right]$.

$t$ is the elapsed time, usually $[d]$

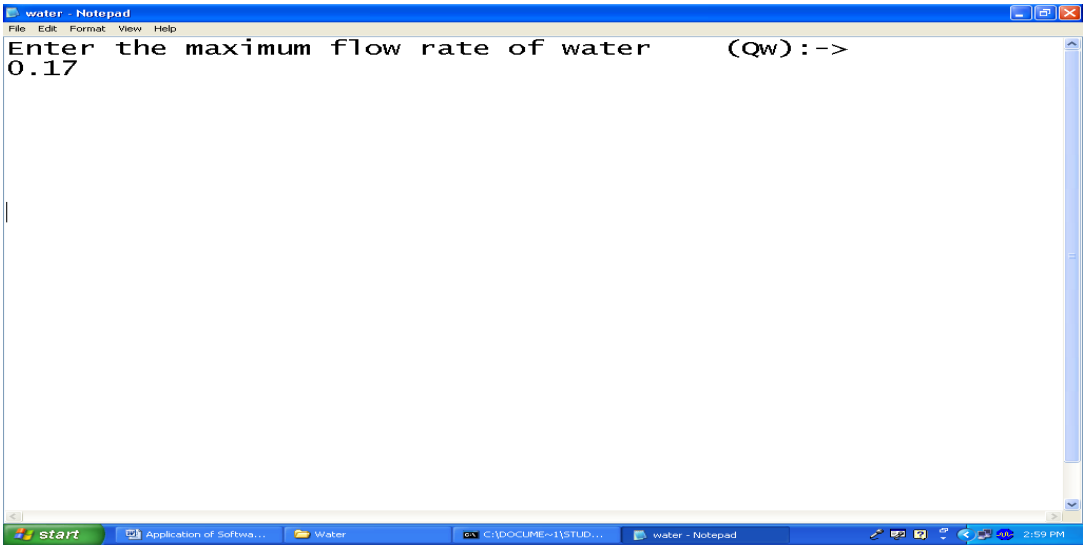
**Study area-**

The Bhima river rises from the Bhimashankar hills near Karjat in Western Ghats at Bhimashankar an altitude of about 945 meter above the sea level. It is known as Sahyadri in Maharashtra. The Bhima river flows in the southeast direction. However at Ujani in Maharashtra the water of Bhima river is tapped by constructing major dam named as Yeshwant Sagar in 1972 .

The famous temple of Bhimashankar on the crest of the Sahyadris twenty- five miles north of Khandala, marks the source of the Bhima. From a height of about 3000 feet above the sea, the river falls over terraces of rock some 600 feet in the first five miles. Further east, with a general course to the south-east, it flows thirty-six miles through the very narrow and rugged valley of Bhimner. On its way it passes the large villages of Vada, Chas and Khed and near the village of Pimpalgaon from the right receives the waters of the Bhama and at Tulapur the waters of the Indrayani. From Tulapur it bends to the south, skirting the Haveli sub-division and after receiving from the left the waters of the Vel about five miles below Talegaon-Dhamdhere, it turns again north-east to Mahalungi, a point sixteen miles east of Tulapur. Then running south for about nine miles, at the village of Ranjangaon it is joined from the right by the Mula-Mutha. This point is 1591 feet above the sea level or 475 feet below the village of Vada. From Ranjangaon the Bhima runs south-east with a winding course of about fourteen miles and on the eastern border of the district, it receives from the left the waters of the Ghod. After meeting the Ghod, the Bhima's course is very winding, the stream at Diksal flowing north-west for some miles. The banks of the Bhima are generally low and after its meeting with the Indrayani are entirely alluvial. Here and there, where the winding stream has cut deep into the soft mould, are steep banks of great height, but in such places the opposite bank is correspondingly low. In places where a ridge of basalt throws a barrier across the stream, the banks are wild and rocky, and the water, dammed into a long deep pool, forces its way over the rocks in sounding rapids. Except in such places the bed of the Bhima is gravelly and in the fair season has but a slender stream. Here and there muddy deposits yield crops of wheat or vegetables and even the sand is planted with melons.

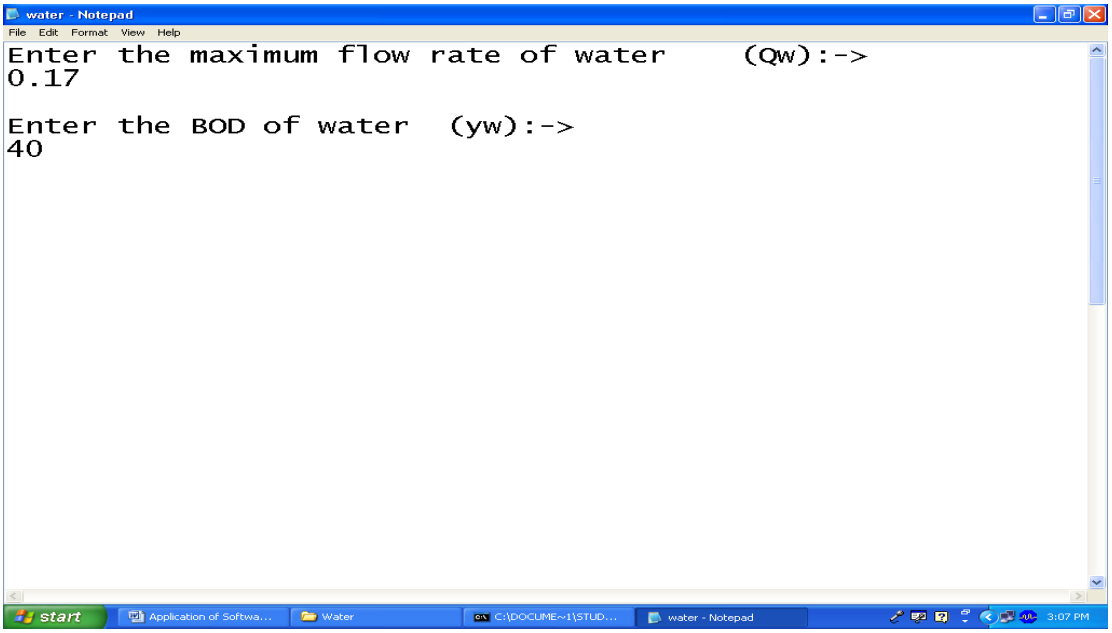
In the course of the journey it meets many small rivers. The major tributaries of this river around Pune are Kundali River, Ghod River, Bhama River, Indrayani River, Mula River, Mutha River and Pawana River. The Indrayani, Mula, Mutha and Pawana flow through Pune and Pimpri Chinchwad City.

## Results And Discussion:



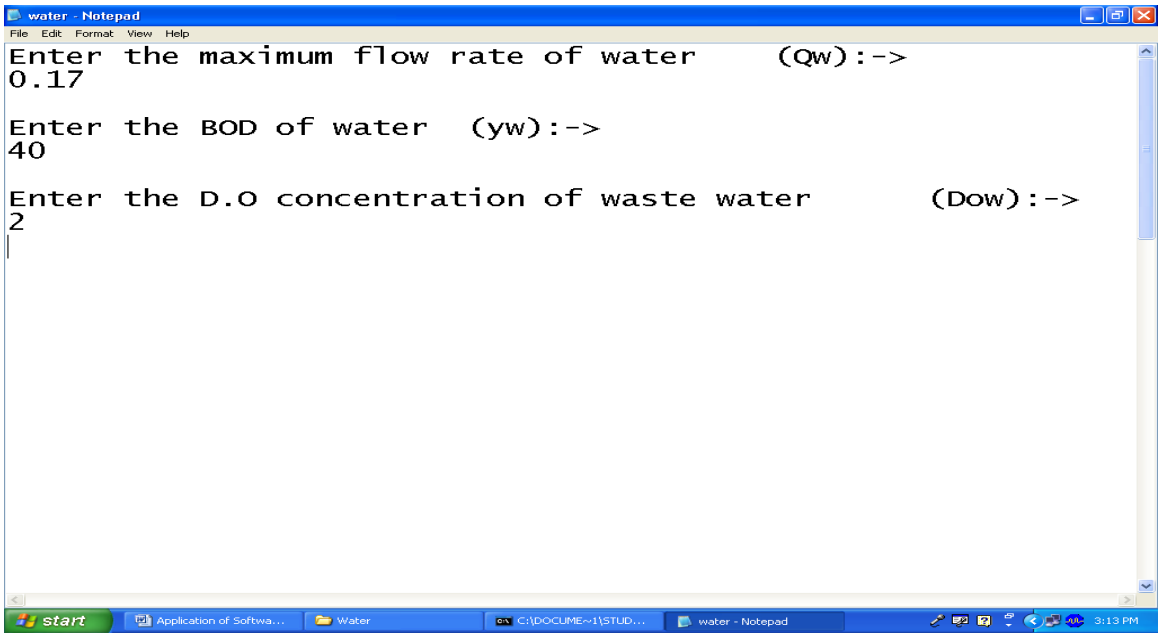

**Picture No.1 Input of water flow rate**

From the Dissolved Oxygen concentration model programme (Pict. No.1).The input for this programme is the maximum flow rate of water, which is 0.17m/s.



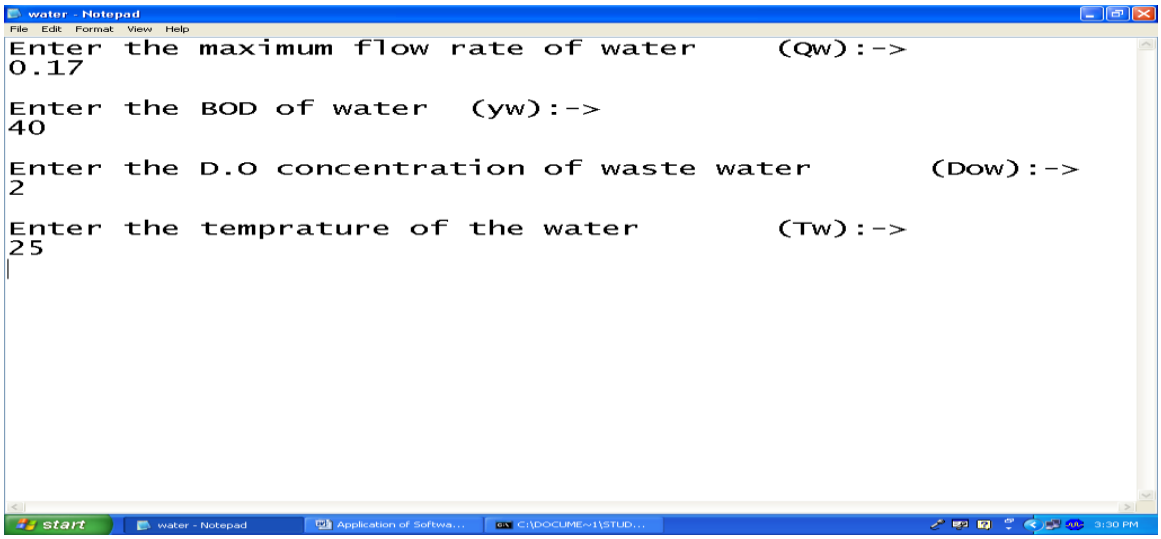

**Picture No.2 Input of BOD.**

From the Dissolved Oxygen concentration model programme (Pict. No.2). The input for this programme is the BOD of water (40ppm).



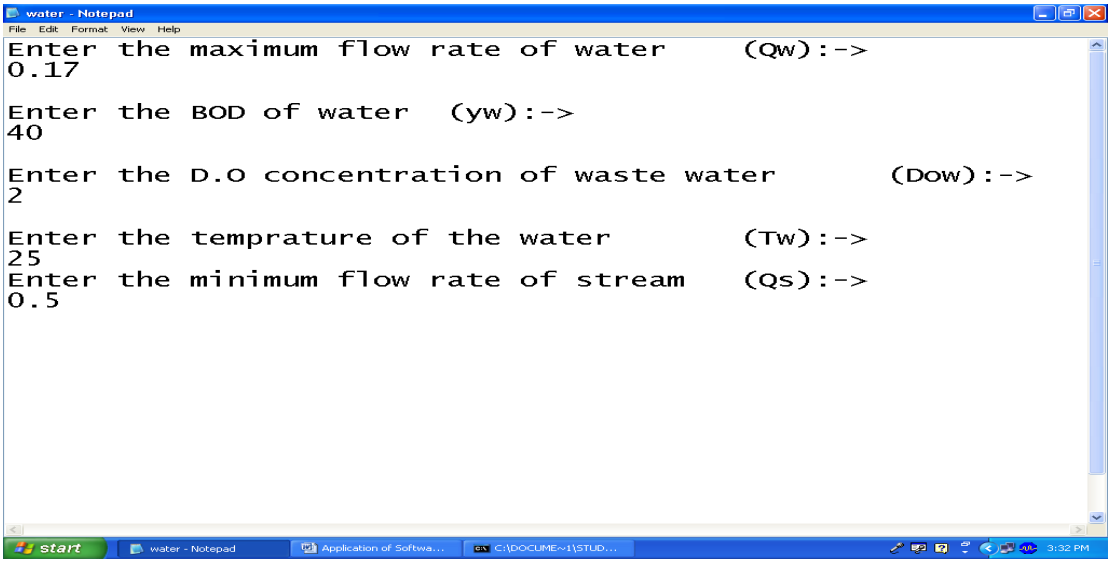

**Picture No.3 Input DO of waste water.**

From the Dissolved Oxygen concentration model programme (Pict. No.3). The input for this programme is D.O concentration of waste water, which is 2mg/lit.



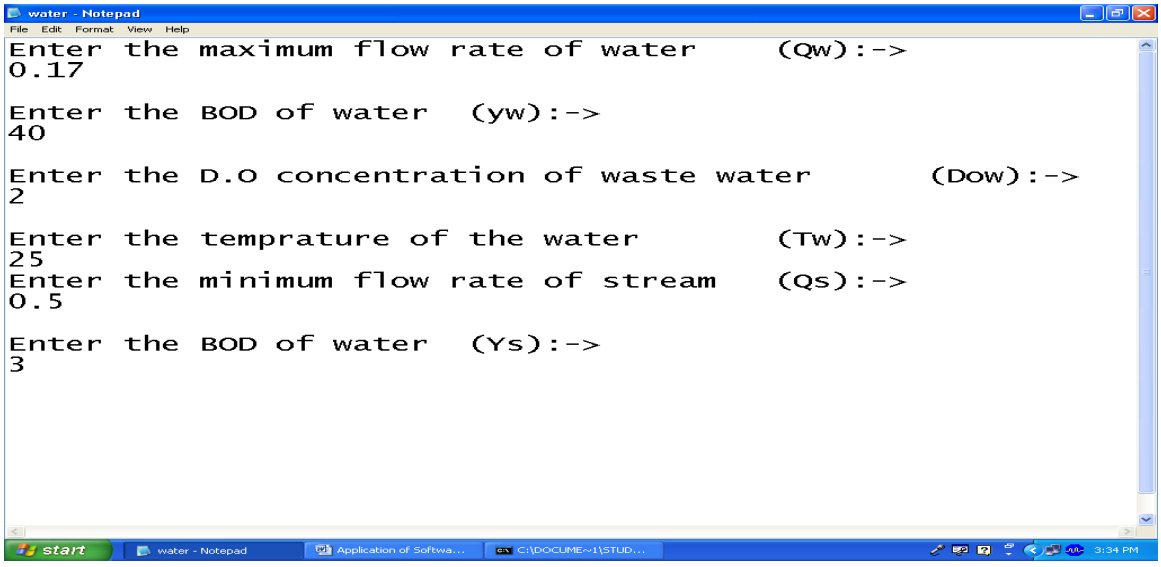

**Picture No.4 Temperature of water.**

From the Dissolved Oxygen concentration model programme (Pict. No.4) The input for this programme is Temperature of water, which is $25^0$C.



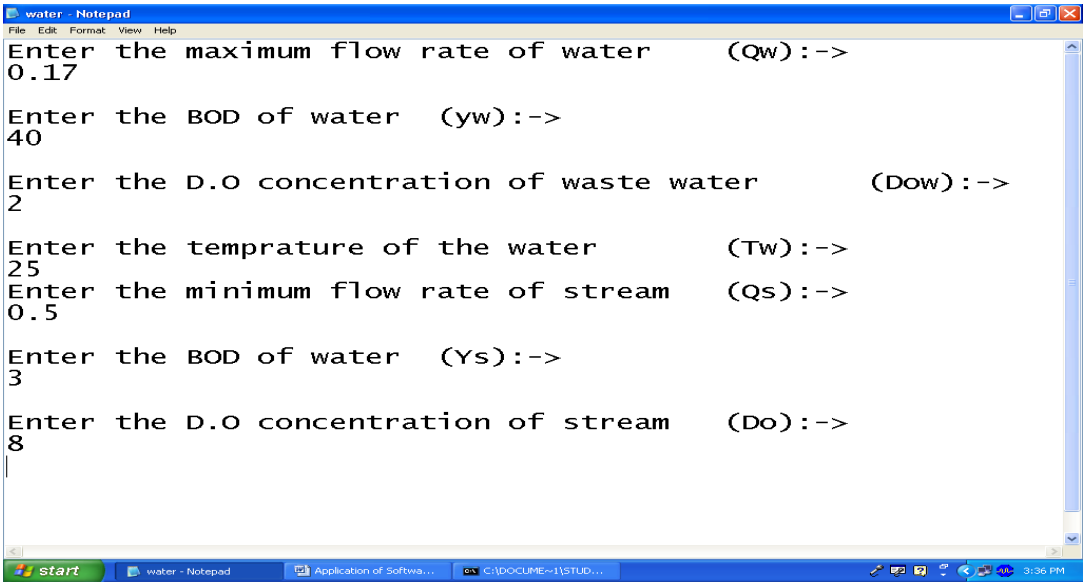

**Picture No.5 Flow rate of stream.**

From the Dissolved Oxygen concentration model programme (Pict. No.5).The input for this programme is minimum flow rate of stream, which is 25m/s.



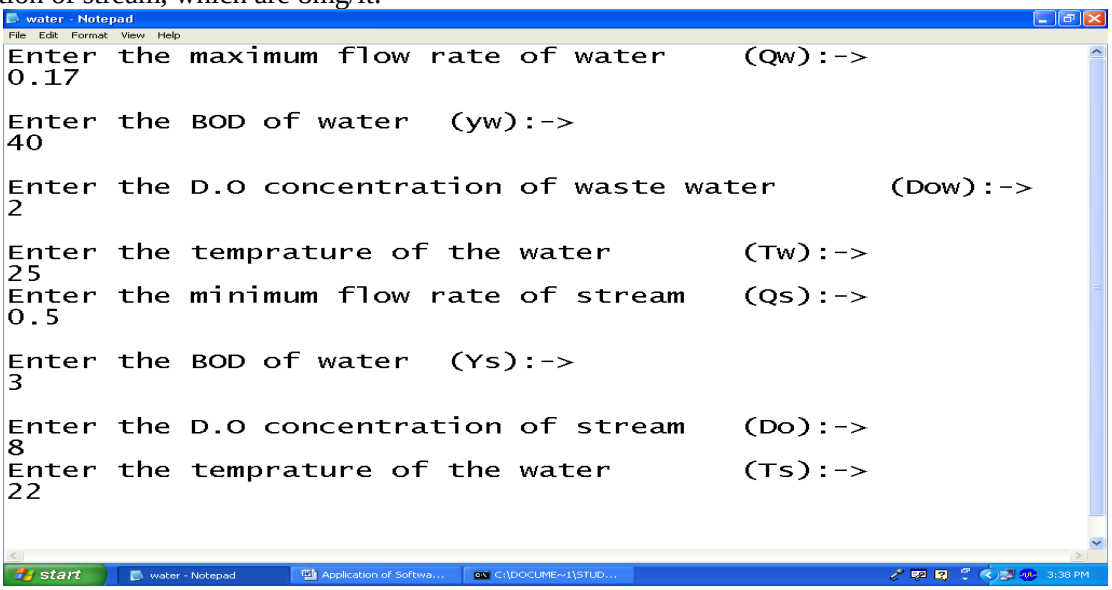

**Picture No.6 BOD of waste water stream.**

From the Dissolved Oxygen concentration model programme (Pict. No.6). The input for this programme is BOD of stream, which is 3mg/lit.



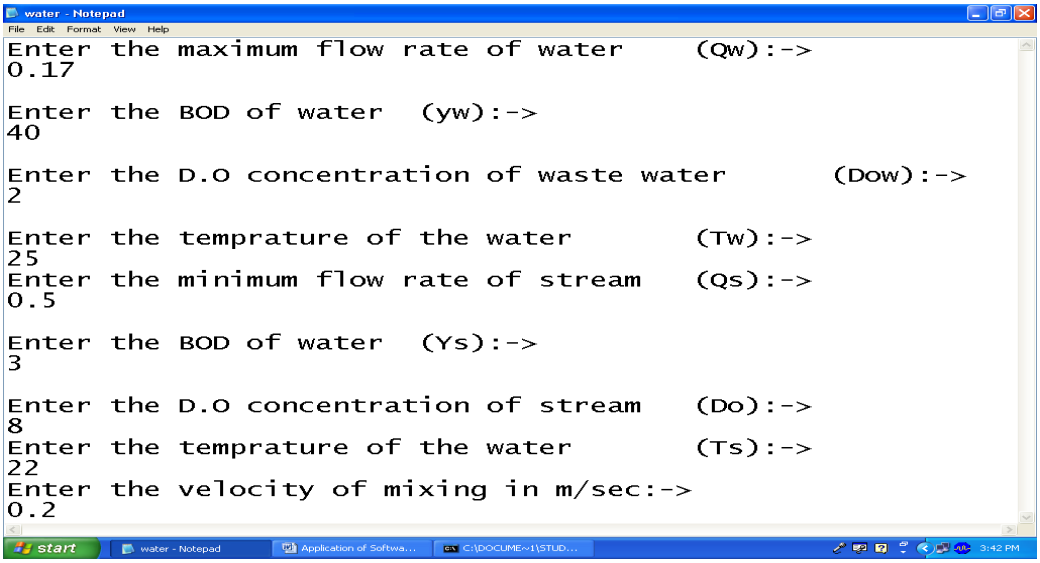

**Picture No.7 DO of stream.**

From the Dissolved Oxygen concentration model programme (Pict. No.7). The input for this programme is DO concentration of stream, which are 8mg/it.



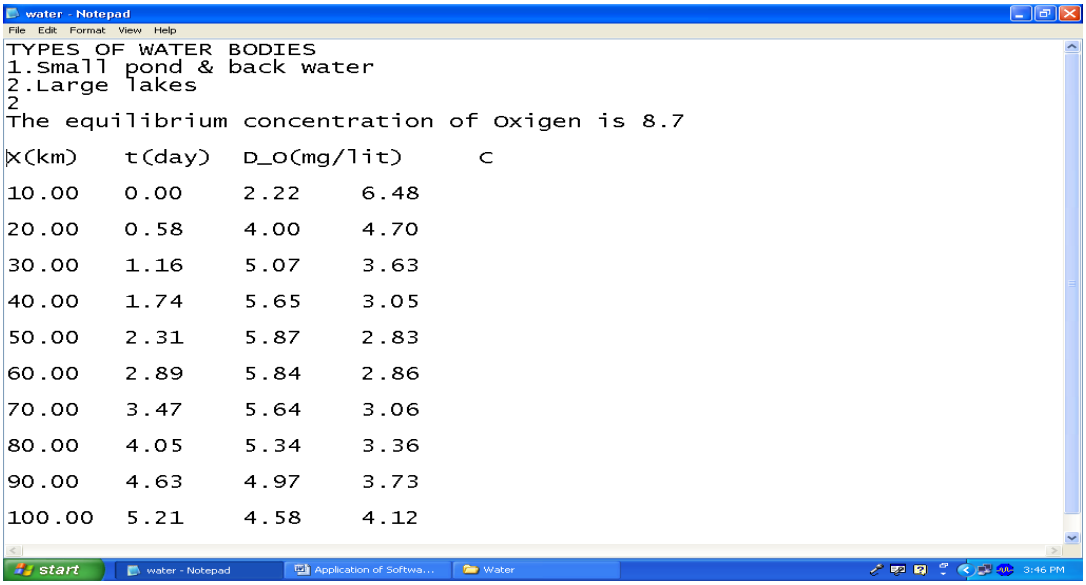

**Picture No.8 Temperature of the stream.**

From the Dissolved Oxygen concentration model programme (Pict. No.8). The input for this programme is Temperature of stream of water, which is 22 $^{0}$C.




**Picture No.9 Velocity of mixing water and stream**

From the Dissolved Oxygen concentration model programme (Pict. No.9). The input for this programme is Velocity of water, which is 0.2m/s.




**Picture No.10 Result of DO concentration at different places.**

From the Dissolved Oxygen concentration model programme (Pict. No.10). The input for this programme is Type of water body, Here large lakes are considered. After adding these Inputs, following results need to obtain, which showed the concentration of Dissolved oxygen at various distance.

**Table No.1: Concentration Of dissolved Oxygen at various distance interval in river Bhima at Pune District.**

| Sampling Nos. | Distance In km. | Time | Dissolved Oxygen (mg/lit) Calculated | Dissolved Oxygen (mg/lit) Measured |
|---|---|---|---|---|
| Initial Sampling at confluence of Bhima with Mula-Multha near Pimpri Sands | 10.00 | 0.00 | 2.22 | 2.22 |
| 2 | 20.00 | 0.58 | 4.00 | 4.00 |
| 3 | 30.00 | 1.06 | 5.07 | 5.06 |
| 4 | 40.00 | 1.74 | 5.65 | 5.64 |
| 5 | 50.00 | 2.31 | 5.87 | 5.87 |
| 6 | 60.00 | 2.89 | 5.84 | 5.84 |
| 7 | 70.00 | 3.47 | 5.64 | 5.64 |
| 8 | 80.00 | 4.05 | 5.34 | 5.54 |
| 9 | 90.00 | 4.63 | 4.97 | 5.14 |
| 10 | 100.00 | 5.21 | 4.58 | 6.10 |

Through it is predicted, the Dissolve Oxygen concentration which will beneficial for suggestion. Through this software, analysis of Dissolved Oxygen is possible. The initial water sample is collected at the Pimpri-Sandas village the place of river confluence i.e. Bhima and Mula-Mutha is selected because the lower amount of Dissolved oxygen in water . The Dissolved Oxygen concentration (mg/lit) is measured at 10 Km interval and same evaluated by using this software simulation. It is interesting to find that, the software gives more accurate results up 70 Km. However, from 80-100 Km the output was varies from the 0.7 to 1.2 mg/lit.

## Conclusion:

This software is useful for government machinery and pollution control boards to measure the concentration of dissolve oxygen in river water at different places. Such kind of technology interventions for mitigating and measuring concentration of various pollutant save the time, money and man power.

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# Edge Detection Methods Using Fuzzy Logic In Image Processing

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**Abstract:**

*Edge detection is an important task in image processing. It is a main tool in pattern recognition, image segmentation, and scene analysis. It could detect the variation of gray levels, but it is sensitive to noise. Edge detection is a process that detects the presence and location of edges constituted by sharp changes in intensity of an image. Edge detection of an image significantly reduces the amount of data and filters out useless information, while preserving the important structural properties in an image.The fuzzy technique is an operator introduced in order to simulate at a mathematical level the compensatory behavior in process of decision making or subjective evaluation. In this paper a novel method based on fuzzy logic reasoning strategy is proposed for edge detection in digital images without determining the threshold value. The proposed approach begins by segmenting the images into regions using floating 3x3 binary matrix. The edge pixels are mapped to a range of values distinct from each other. The robustness of the proposed method results for different captured images are compared to those obtained with the linear Sobel operator. It is gave a permanent effect in the lines smoothness and straightness for the straight lines and good roundness for the curved lines. In the same time the corners get sharper and can be defined easily.*

**Keywords:**

*Edge detectors, Fuzzy logic, Image Processing, Image segmentation, Pattern recognition, Object Recognition*

## Introduction:

Fuzzy logic was first introduced in the 1965 as a new way to represent vagueness in everyday life. The definition of fuzzy logic as a superset of conventional (Boolean) logic that has been extended to handle the concept of partial time values between "completely true" and "completely false" By this definition, fuzzy logic departs from classical two-valued set logic. It uses soft linguistic system variables and a continuous range of true values in the interval [O, 1], rather than strict binary values. It is basically a multivalued logic that allows intermediate values to be defined between conventional evaluations like yes/no, true/false, etc. Fuzzy logic is also a structured, model-free estimator that approximates a function through linguistic input/output associations. Fuzzy logic is a powerful, yet straight forward, problem solving technique with wide spread applicability, special in the areas of control and decision making.

## Structure of Fuzzy Image Processing:

Fuzzy image processing is not a unique theory. Fuzzy image processing is the collection of all approaches that understand, represent and process the images, their segments and features as fuzzy sets. The representation and processing depend on the selected fuzzy technique and on the problem to be solved. Fuzzy image processing has three main stages: image fuzzification modification of membership values, and, if necessary, image defuzzification is shown in figure 2.3(a). The fuzzification and defuzzification steps are due to non availability fuzzy hardware. Therefore, the coding of image data and decoding of the results are steps that make possible to process images with fuzzy techniques. The main power of fuzzy image processing is in the middle step i.e. modification of membership values. After the image data are transformed from gray-level plane to the membership plane (fuzzification), appropriate fuzzy techniques

modify the membership values. This can be a fuzzy clustering, a fuzzy rule-based approach, a fuzzy integration approach and so on.

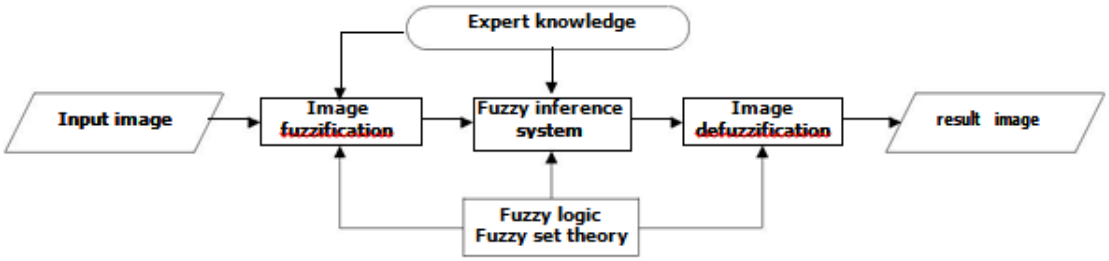



**Fig-1**

## Fuzzy Sets and Fuzzy Membership Functions

A *membership function* (MF) is a curve that defines how each point in the input space is mapped to a membership value (or degree of membership) between 0 and 1. The input space is sometimes referred to as the *universe of discourse*, a fancy name for a simple concept.The system implementation was carried out considering that the input image and the output image obtained after defuzzification are both 8-bit quantized; this way, their gray levels are always between 0 and 255. The fuzzy sets were created to represent each variable's intensities; these sets were associated to the linguistic variables "Black", Edge and "white". The adopted membership functions for the fuzzy sets associated to the input and to the output were triangles, as shown in Fig.3.The functions adopted to implement the "and" and "or" operations were the minimum and maximum functions, respectively. The Mamdani method was chosen as the defuzzification procedure, which means that the fuzzy sets obtained by applying each inference rule to the input data were joined through the add function; the output of the system was then computed as the loom of the resulting membership function. The values of the three memberships function of the output are designed to separate the values of the blacks, whites and edges of the image.

## Inference Rules Definitions

The inference rules is depends on the weights of the eight neighbors gray level pixels, if the neighbors weights are degree of blacks or degree of whites. The powerful of these rules is the ability of extract all edges in the processed image directly.The new fuzzy rule based edge detection system is developed by designing a Fuzzy Inference System (FIS) of Mamdani type using MATLAB toolbox. The algorithm detects edges of an input image by using a window mask of 2x2 size that slides over the whole image horizontally pixel by pixel. The FIS is implemented by considering four inputs which correspond to four pixels P1, P2, P3 and P4 of the 2*2 mask in Figure 2 and one output variable.

| | |
|---|---|
| P1x(i-1,j-1) | P2x(i-1,j) |
| P3x(i,j-1) | Px(i,j) |

**Fig-2 Mask 2*2**

In the first phase of the FIS, the fuzzification of input is performed by defining two trapezoidal membership functions called Black and White as shown in Figure-2. On evaluation of these two functions, all the image

pixels (crisp set) are classified into Black or White fuzzy sets. Once the pixels are fuzzified, in the second phase of the FIS, a rule base is evaluated to get the output .A triangular membership function for the output is defined called As Edge as shown in Figure-3. In the rule base of the FIS,10 numbers of rules have been defined to apply implication on the inputs. The inference rules depend on the weights of 3 neighbors i.e. P1, P2 and P3 and P4 itself , if the weights are degree of Black or degree of White.These weights are combined using AND operator as defined in the rule base.The output of applying implication is again fuzzy. These fuzzy output of all rules are combined into a single fuzzy set by aggregating them with the OR (max) operation.In the final phase of the FIS, the output fuzzy set Edge is defuzzified to get a crisp set and the desired final output. Here the defuzzification operation is performed by calculating the centroid.In order to resolve a single crisp value from the aggregated fuzzy output set we calculate the center of the area under the curve.The block diagram of the FIS designed here is depicted in the Figure-1

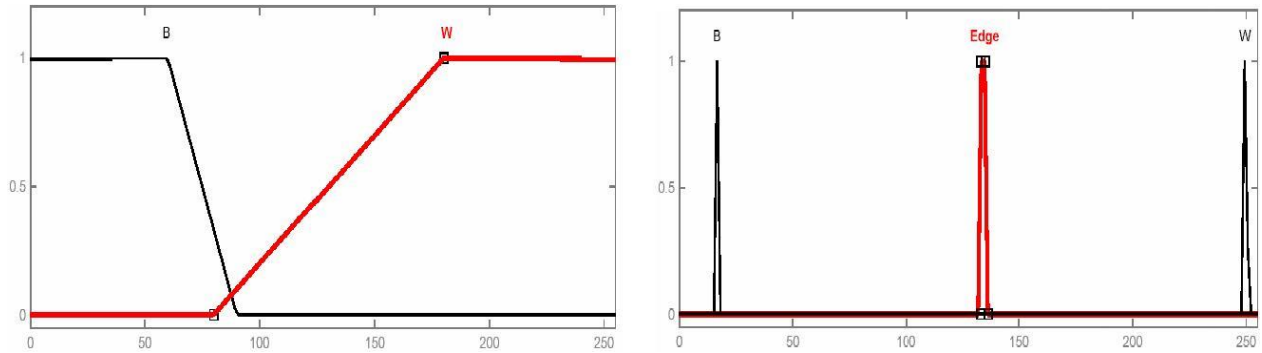



**Fig. 3 Membership functions of the fuzzy sets associated to the input and to the output**

The rule base used in the FIS comprises the following 10 fuzzy rules for considering the weights of the 3 neighbors P1, P2 and P3 with P4.

1. If P1 is Black and P2 is Black and P3 is Black and P4 is White then P4 is Edge
2. If P1 is Black and P2 is Black and P3 is White and P4 is White then P4 is Edge
3. If P1 is Black and P2 is White and P3 is Black and P4 is White then P4 is Edge
4. If P1 is White and P2 is Black and P3 is Black and P4 is White then P4 is Edge
5. If P1 is White and P2 is White and P3 is White and P4 is Black then P4 is Edge
6. If P1 is White and P2 is White and P3 is Black and P4 is Black then P4 is Edge
7. If P1 is Black and P2 is White and P3 is White and P4 is Black then P4 is Edge
8. If P1 is White and P2 is Black and P3 is White and P4 is Black then P4 is Edge
9. If P1 is Black and P2 is Black and P3 is White and P4 is Black then P4 is Edge
10. If P1 is Black and P2 is White and P3 is Black and P4 is Black then P4 is Edge

## ALGORITHM:

1) Read the M x N input gray image say X
2) Set theinitial2x2 mask as P1= X(1,1), P2=X(1,2), P3=X(2,1) and P4=X(2,2)
3 )Map the input pixels to fuzzy set using membership functions White and Black
4) The firing strength of rule is calculated using AND operator (i.e. MIN)
5) Determine the shape of the output membership functions on the basis of the firing strength of the rule using MIN method
6) The output fuzzy sets returned by the above step for each rule are combined using MAX operator.

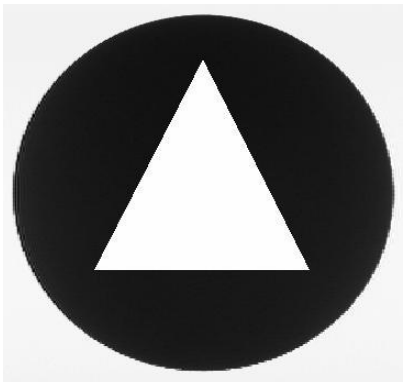
7) Defuzzify the output fuzzy values using centroid
8) Slide the mask window to the next pixel and repeat step 3 to step 7 until last pixel X(M,N) is checked row-wise

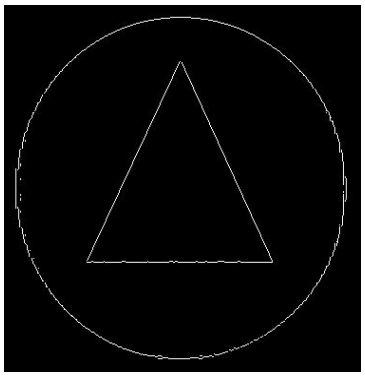
## Experiments:

The proposed system was tested with different images, its performance being compared to that of the Sobel operator and the proposed FIS method. The firing order associated with each fuzzy rule were tuned to obtain good results while extracting edges of the image shown in Fig.4, where we used this image as comparative model for the classical Sobel operator and the FIS method. The original image is shown in part as of Fig.4. The edge detection based on Sobel operator using the image processing toolbox in MATLAB is illustrated at the part b. The white pixels on the map indicate there are edges, thus will be preserved from smoothing. There is obviously some noise left on the edge map and some of the edges are corrupted. By applying the new FIS on the image to detect its edges, it is found that the modified version of edge map has less noise and less edge corruption as shown on the image of Fig.4.c.For the segmentation task, a thin edge is better because we only want to preserve the edge rather than the details in the neighborhood. The values of the edge map are normalized to the interval of 0 and 1 to represent the edginess membership values.

The original captured image is shown in Fig.4.a. We observe, in part b, that the Sobel operator with threshold automatically estimated from image's binary value does not allow edges to be detected in the regions of low contrast. So which results in two edges being detected (double edges) at the left side of part b. The FIS system, in turn, allows edges to be detected even in the low contrast regions as illustrated in part c. This is due to the different treatment given by the fuzzy rules to the regions with different contrast levels, and to the rule established to avoid including in the output image pixels not belonging to continuous lines.

Original Image Edge detection using sobel operator Edge detection using FIS





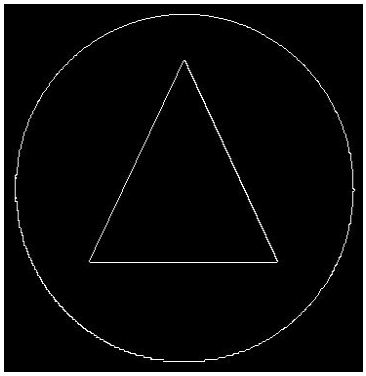


**Fig-4(a)** **Fig-4(b)** **Fig-4(c)**

## Conclusion:

Fuzzy image processing is a powerful tool as the fuzzy sets provide a framework for incorporating human knowledge in the solution of problems whose formulation is based on imprecise concepts.

The algorithm uses a 2x2 window mask, which is of smallest size, thus it minimizes the computation. Besides this no threshold value need to be determined in this algorithm. The algorithm is able to detect edges of various images and produces comparatively better results than some standard edge detection algorithms. The algorithm developed here exhibits huge scope of application in image segmentation and computer vision in general. As presently the algorithm is able to detect edges of gray images only, this work may be extended for colour images suitably. The designed fuzzy rules are an attractive solution to improve the quality of edges as much as possible. One past drawback of this type of algorithm was that they required extensive computation. Further optimization of the FIS can be done by using other soft computing techniques such as ANN, GA etc. These results allow us to conclude that:

The implemented FIS system presents greater robustness to contrast and lighting variations, besides avoiding obtaining double edges. It is gave a permanent effect in the lines smoothness and straightness for the straight lines and for the curved lines it gave good roundness. In the same time the corners get sharper and can be defined easily.

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# M-Commerce Revolution in India – Scope, Growth and Future

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**Abstract:**

*In today's technical era most of people owning smart phones as it has many features. People are enjoying web surfing via mobile. Transactions are done via mobile based internet has increased which has led to a new variant of e-commerce known as m-commerce. Increasing use of smart phone has given boost to m-commerce. Any site that can be viewed via computer can also be viewed via mobile also but compared to computer mobile has unique features as it is movable and having wireless internet support. It has created new opportunity for m-commerce business. M-commerce is an emerging trend in India and an important segment of e-business. It has got good response in Indian market and so as usage of internet has also been increased. People started doing financial transactions using mobile. It is a convinient way to access internet and do required transactions sitting at your favourable place and time. This has helped m-commerce to grow and now m-commerce has successfully captured Indian online market with a big leap which has forced business to plan stretegies to focus more on mobile based business. This shows that India has very good opportunities in m-commerce segment. It has challenges also but if steps are taken it can be overcome. This paper mainly covers how in India mobile based transactions have gain popularity, its growth, future challenges and how to meet it up from technical point of view as well as end-user's point of view.*

**Keywords:** *M-commerce, smart phone, mobile commerce, e-commerce, online shopping*

## Introduction:

M-commerce means mobile commerce which includes online transaction of buying goods and service, online banking, bill payment, data gathering and submitting using wireless and handy device like mobile or tablet. It also includes online process of developing bsiness, marketing, selling, receiving order, tracking an item, deliverying and paying for goods or services.

Now a time is a technological era. Many people do transactions via mobile based internet called mobile commerce. Mobile commerce is e-commerce of new generation as it has evolved from e-commerce. Now days mobile is a device which is used very commonly and not only as a medium of communication but also as a storage device, to transfer data, to use internet etc. Today's smart phone with internet feature is also used for online shopping and to do a transaction which makes it an important entity of e-business. Now people prefer to do shopping using their mobiles or tablets as it has beyond limitation of time as user can use it on desired time. Online shopping is done more using smart phones rather than computers which has noted by business. Rapid development in mobile technology has gave new path to e-commerce by shifting it to mobile based or app only model. It has many benefits and wide scope in India.

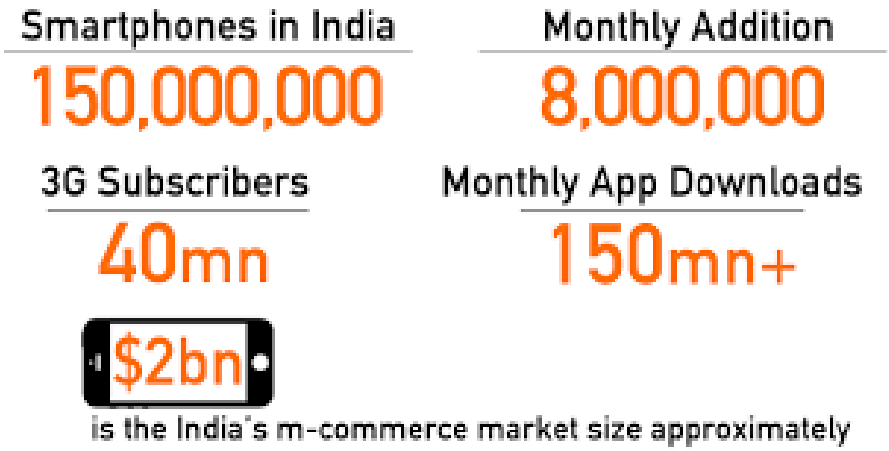
## Body of the paper:

M-commerce is evolved from e-commerce but is absolutely something ahead to it. Transactions done by m-commerce has proved more user friendly and convenient. Here transactions are done using mobile like device with internet connection as wireless technology has become advance. Along with changes in technology, people also would like to upgrade themselves.

Smart phones are now a very popular device as having multiple features and one of it is wireless internet facility. User can have wi-fi connection or can also have data connection. It is a factor affecting increasing use of mobile which had boosted e-commerce. People started doing trasactions using their mobile as they are finding it easier and convinient. Transactions done using mobile is enjoyed by consumer and getting good response. M-commerce has brought a market in customer's hand. Picture of market is shown to customer and giving complete shopping experience. Customer is also enjoying this 'virtual shopping'. Mobile device with internet feature has played a big role in m-commerce field. If you have a smart phone and interent connection, many tasks can be done at thouch of fingers. Nowadays people are having busy work office schedule where at some extent they are not able to do some task but due to m-commerce technology, their work has become easier. Consider a field of retailing, banking, hospitality, medical, education or any other - no field is left where m-commerce has not entered. Let us take an example of retaile industry. Customer view some product online, them he check its price in showroom and finally he find to buy online cheaper option. If one need to do any online transaction, has to arrange for computer or laptop, switch it on and then have to open the specific website to do the transaction but if smart phone is there in hand, same task can be done while walking or whatching tv or while talking to someone or by doing some other activity as mobile is a handy and light weight device. Once it is charged, for few hours one can use it without any problem. Previously it was a luxury but now it is considered as a common device. Popular shopping websites like myntra and flipkart are very good example of progress of m-commerce. They started focusing on m-commerce by seeing customer behavior. These major online retailers have found that their most of orders are coming through mobile. So they decided to promote it more. Some of them decided to be mobile based only. Myntra has shut its website from 1st May, 2015 and now have become app-only and flipkart which is India's largest shopping company has shut its mobile supported website and app is only available and still trying to make it better so that images can be load faster. It is due to increasing usage of smart phone. Not only in urban areas but in rural areas also smart phone has successfully captured market. Smart phones are leading mobile based business as one can place an order sitting anywhere and anytime. As per estimated by "Internet and Mobile Association of India", till Feb 2016, there will be 215 million mobile users in India. In business, mobile contribution is increasing at least by 50% of transactions. M-commerce boost is helping smart phone market to jump and increasing use of smart phone affecting m-commerce to boom.

Now, when companies focus is growth of business, it is derived that it is likely possible due to increasing use of internet. Usage of smart phone is increased which is one of the responsible factor for it. And now one step ahead, apps are getting promoted to increase mobile based transactions and people are also giving good response to it. The image of digital India is improving day by day. Data collected by analysis reveals that most of customers are placing orders using smart phones so as they moved their business as M-commerce which is helping them for cost saving also. Once app is downloaded, next time user don't need to open a web page which make the work faster. Previous transaction details are stored in app which help user to do next transaction. In India, use of app is increasing. As per the survey, the number of Indians using app is expected to be over 500 million by 2020 which is a big number. Many financial transactions are done with use of mobile or web. This system is already in practice by other developed countries and now it has successfully covered Indian market. This has been possible due to increasing use of smart phones and other such devices and internet as well. By seeing present scenario, it is observed that in India scope of m-commerce is very much. Many people own credit card, debit card and smart phones. Therefore it is possible for them to do transaction using mobile instead of personally visiting the market or viewing website even. You can easily pay your electricity bill using your mobile in very less amount of time using your credit card instead of standing in long queue and also be able to save cash in hand as using credit card. Mobile like device can be carried at any place which has overcome the problem of time

limit and consumer can enjoy shopping at 24*7 hours at own convenience. Sellers are also trying to give items at best price to be in competition so that customer will come again. Business is also taking advantages of it by attracting customers by sending messages regarding their promotional offers and discounts. Smart phones are now preferred device to access internet irrespective of age or any other factor. Rather it has overcome factors like time, venue and duration which help consumer to do retailing. Most of the items purchased using m-commerce are garments, fashion apparels, jewelry, electronic device, books, small household appliance etc. Few of the items which are not available in market can easily obtained online. By seeing such advantages people have also gave good response to it as they have found it in their interest. In e-retailing most of the traffic comes through m-commerce. Concepts like M-banking and m-payment are also adopted at vast. As per the survey, in India there are over 800 million mobile users and among them 41% are using m-commerce. This provides a very good opportunity for smart phone industry and business for expansion. Considering its popularity and capability smart phone manufactures are also producing devices with good processors and having wireless features to support internet access. E-commerce companies have started focusing on m-commerce based business strategies. Business like Amazon, ebay, flipkart, myntra, limroad have already witnessed that with launch of their mobile app business has grown more as many people put orders via mobiles only and so they moved ahead in that direction as they have found that almost 60% of their traffic comes from mobile devices and expecting more that that they get on personal computers. Most of the banks have launched app to customers to do transactions. There is no doubt that e-commerce industry is progressed towards m-commerce with good pace and becoming much more mobile-commerce. Compared to desktop, two or three times more growth has been noted by them. Increasing use of smart phones and internet has made it possible. The below figure shows the average use of mobile, apps and internet and its ongoing progress in India.(figures are in million and billion)




**The below figure shows contribution of m-commerce.**

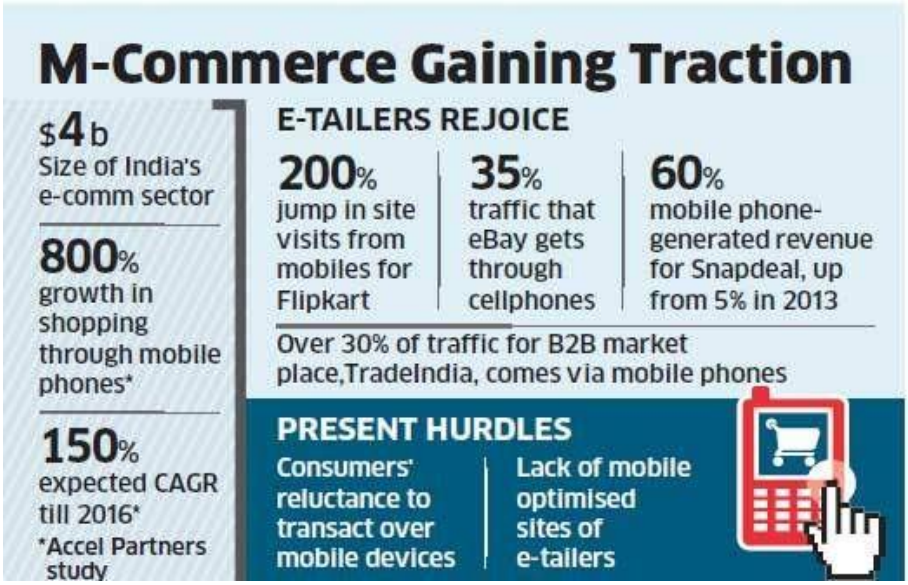



**figure source : [www.digit.in](http://www.digit.in)**

**Scope of M-Commerce in India:**

M-commerce is directly related with mobile and internet technology. Popular transactions done using m-commerce are:

> Online shopping : People find it convenient to shop online using mobile as no need to go to market. Comparison of different brand items is easily done. Along with item, detailed description is provided which make it easier to shop. Most of the websites provide easy exchange or return policy also if not satisfied with the product. Credit card payment option is available with every purchase so buyer don't need to invest hard cash before product is in hand. It is convenient as no time bound is there.

> Money transfer: Money transfer is also most liked and done via mcommerce. It is very convenient to transfer amount from one bank account to other bank account, to some one's account as it take very less time if done using mobile. If proper security of maintained using username and password, it is done quickly. mPayment services are also started in India like paytm, paypal, mpaisa transfer.

> Bill payment: All types of bill like electricity bill, water bill, gas bill, telephone bill, credit card bill etc can be paid easily sitting at home or office. No need to stand in a queue and invest more amount of time. Sometimes extra discount is also offered if online payment is done because online receipt can be generated and it saves printing also. Nowadays 'paperless office' and 'green environment' concepts are popular which supports digital version instead of hard copy.

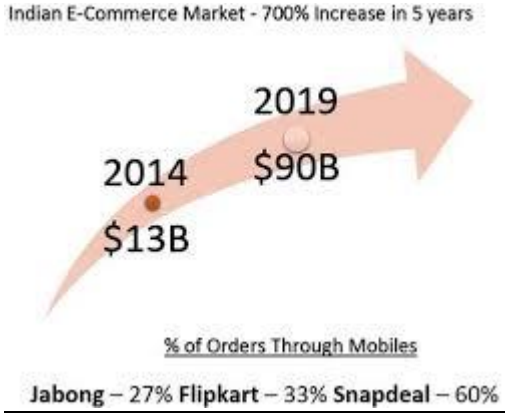
> Ticketing: Again if bus or train or flight ticket is booked or cancelled online, it is very convenient as saves time. And keeping in mind a person's ease, it can be done. One can plan journey at any movement and can do necessary booking also. If such technical help would not be available, may be there will be large queue at railway or bus booking office. Person can arrange connecting journey easily using internet. Different options can be

viewed and as per convenience it is easy to manage. If is found that website of Indian railway is more busy and so people prefer to use mobile website of IRCTC to book ticket successfuly.

> Fee Payment: School and college fees can be paid using mobile. Again a time saver option.

> Appointments and advance booking: Movie booking is one of the popular options implied by people. They can see different movie shows options, theatre option and can enjoy facility.

The term 'digital space' is gaining popularity in India. Along with it, concept of big data, data analysis, cloud computing is also evolved. Even companies have found that their most of business is based on m-commerce instead of computer supported web-site. Researchers are also focusing on m-commerce. Most of the business is providing desktop based as well as mobile based versions of website because they have noted that many users are preffering mobile based versions as nowadays smart phones are used more.

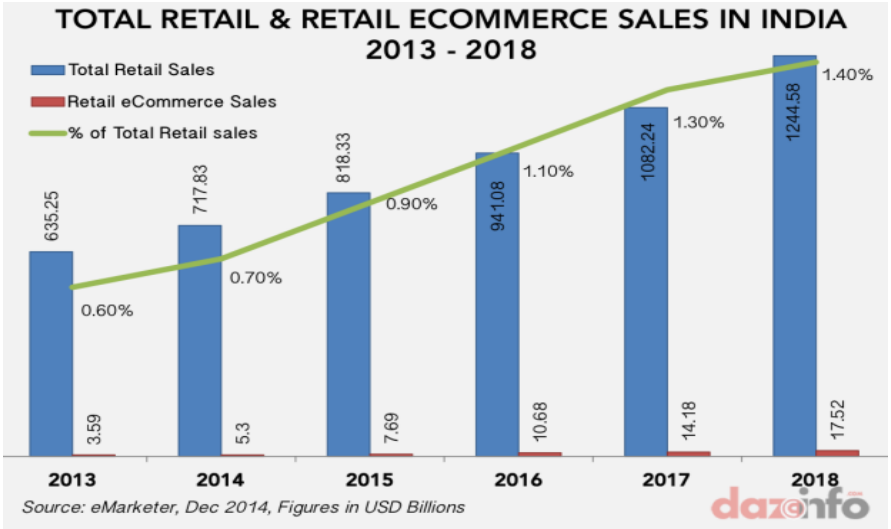



The above figure shows that the popular e-commerce ventures jabong, flipkart and snapdeal has noted their orders are placed using mobile and till 2019 it is expected to be more.

India is going through e-commerce revolution and so can be said that also an m-commerce revolution. It is not fully matured but growing at good pace. It is forecasted by experts that m-commerce in India will grow fourfold by 2020. Indian economy has also improved compared to previous years. Buying power of an average person has increased which give customer a potential to spend more which is affecting commerce. By seeing current trend, it is observed that m-commerce is having good future in India. As per study, every three months sale of smart phone is increased by 50%. And by 2019, it will be fourfold. Internet users via mobile are also increasing year by year. Every year growth of m-commerce in India is increasing potentially. M-commerce has successfully captured fields like banking, finance, hospitality, medical, retailing and many more.

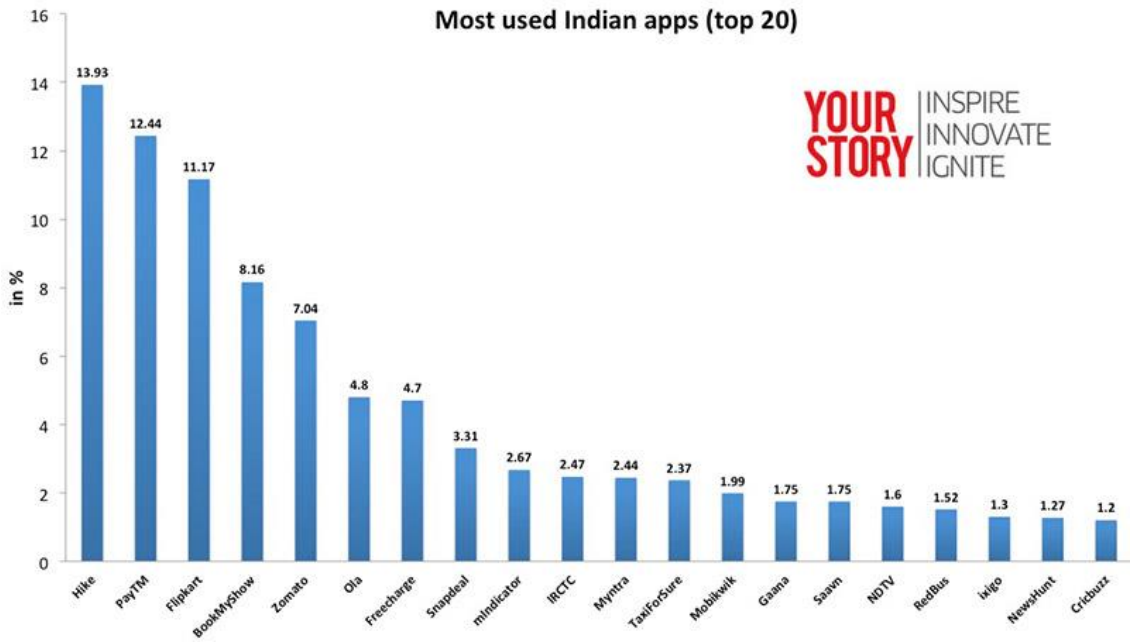
**Growth:**

Study says that e-commerce and m-commerce both are having good growth rate but m-commerce is moving ahead to other. The below chart shows growth of m-commerce in last five years.




Pic source: track.in

The below figure shows most used Indian apps which supports m-commerce growth.




**Future:**

India is leading in e-commerce today. Companies in India have seen good opportunities in m-commerce. Business has successfully diverted people towards m-commerce and now it is growing. Study shows that very soon it will be overtaken by e-commerce. There is no doubt that positive changes will still needed to do. Research shows that future of m-commerce is very bright in India.

In India, many companies have found that most of their business is happening on mobile phone. Increasing use of smart phone shows that large number of people in India is happily accepting this

change. Due to competition, smart phone manufacturers as well as internet providers are trying to keep the cost factor law which has tend to make maximum use of mobile based internet and has helped m-commerce to grow. People download mobile apps and make use of it. Companies are experiencing good growth rate in m-commerce which proves its prospectus. As reported by IAMAI, there will be 236 million mobile internet users by 2016, and 314 million mobile internet users by 2017. It shows remarkable growth and a factor for booming m-commerce. Smart phone is a ready source to do a transaction or get information. It is a very good alternate of computer and is handy and personal. Today India is 3rd largest smart phone market in the world and with more than 300 million internet users, India is the 2nd largest internet user base. Other devices have been noted popularity decline but not smart phones. It is a main factor affecting m-commerce growth as consumer has a facility to buy at any time, anywhere. Using smart phone, consumer can view different options, check features of competitor's product and compare price. As per the study it is noted that smart phone users spend an average of 169 minutes per day on their device. Business has also learned how to reach to consumers and how to attract them. Business is focusing on m-commerce from e-commerce. Mobile-commerce is growing 300% faster than e-commerce which is showing wide scope for it in future also. Business has also found good prospectus with investment. On August 20, 2015 "The Financial Express" has published that Indian mobile app industry has grown by 131%. The number of smart phone owners using mobile apps of e-commerce companies has one up from 21% in May, 2014 to 54% in May, 2015. Compared to US companies or Chinese companies or other companies and countries, the percentage of revenue that is driven from m-commerce in India is significantly high. Already there are some giant business is in the market but still good opportunities are there for new business to enter. As estimated, a global market of online commerce is ready to hit 1 trillion dollars in next few years. It is also said that the next generation e-commerce will be m-commerce which shows the bright future of not only India but for everyone as it has potential to reach to consumer. By seeing above figures there is no doubt that mobile commerce is a future business.

**The challenges and how to meet them**

The changes in customer's buying pattern and technical advancement has created both challenges and opportunities for business. Despite of its popularity m-commerce in India is still in an infant stage. Some challenges are there and to meet it up appropriate steps should be taken. Estimated by analysts m-commerce is still only a small proportion of commerce though its growing proportion is more. It is not the consumer only who is a responsible. Few of the issues are there which prevents smart phone users to avoid use of their mobile to do online transaction. Research shows that in India, people have found to do online transactions innovative but few of the problems need to overcome. Consumer have to download the app if he want to use it which will consume phone memory and affect the processing speed. If purchased item will not be delivered in time again it will fail to maintain its supply channel. Business also depends on a good network of supply chain which should be synchronized to meet up real time situation so that customer should get advantage and business should get customer. After launching an app or site also constant updation should be there as to change user experience, to understand consumer's way of doing it. The following are the challenges to m-commerce in India. Few of the companies are able to create good user shopping experience as they have learned that if they don't act to improve, their business will be at risk.

->Security : Security is one of the problem as now a day there are more cases of data piracy and account hacking is happening.

->Delivery time : If purchased item will not be delivered in time to the customer due to some or other reason, customer may lose the interest to do transaction with the company next time. Without a good supply-chain management it is not possible.

->Have to give some extra benefit: If some extra benefit may not be given, customer may not be interested to do online shopping. Lucrative offers are main point to attract customers to do m-commerce.
->Process should be simple enough: Site development should be in a way which helps the customer to do the transactions. It should not be much complex and should be attractive enough. Experts say that according to the requirement, design the web site. For that important questions are:
What do you need? – Do you have got it? -payment process.
-> Touch and feel factor is missing which may be hurdle to attract one group of buyer as they want to touch and feel the product before to buy it.

-> Poor branding and marketing: if branding and marketing is poor, it may not be that much helpful to sustain in industry.

-> Speed issue: processor of mobile is not equal lent to computer, which may be a factor affecting online transaction

To meet up the challenges following steps should be useful.

**Solution:**

Some issues are there but it can stop customer to do m-commerce transaction. If affirmative steps will be taken, there is no doubt that growth rate will still be more.
Companies should keep the process easier so that consumer can easily adopt it. Purchasing instructions and/or transaction instructions should be properly given on home page, which can guide user to avoid any chances of mistake. Business should try so that faith of customer can be maintained which will be helpful to get loyal customer. The matter of security and safety can be solved by using good antivirus. Customer should also use well networked device to do the transaction to avoid problem like transaction failure, piracy or data theft. This eliminates a factor of small screen size and complete product description should always be provided along with a product which help consumer to understand it. Good resolution of mobile will help to solve this matter. Doing online transaction using smart phones customer can compare the different brands and take the decision which if done physically will be a cumbersome process. Most of the e-retailers are offering 15 days cash back policy if customer is not happy with the product which help the customer to have dare to buy the product as it is convenient method. Simplified payment methods are also helping m-commerce to boom the market. And this is why buyers are still stick to buy their products and services using m-commerce. It is expected that in few years smart phones will overcome desktop computers and all e-retailing like web sites will be diverted to m-commerce. It is also noted that network and connectivity issues in India will improve a lot in next five years which again help m-commerce. Business players are expecting that by switching over to app only based format will help them to gain the market as they are aware that opportunities are still many more to come.
This shows that there is no time when India will become
The advantages of m-commerce in India are as follows:

**Advantages:**

- It is more convenient to do transaction using smart phone, sitting at your place and favourable time. Person does not need to go physically to the place which saves time and energy. Market comes in front of customer.

- Mobiles are offering good process speed and ease of access and also available in affordable price. All the features which a computer posses, are found in mobile also; which makes

work easier. It is cheaper to purchase smart phone with standard features compared to purchase a laptop or desktop. This is also helping m-commerce business.

- To make the concept more popular, sometimes business offers some discounts and coupons and lucrative offers on their products. This attracts the buyer to do more purchase. Some sites offers special discounts if it is done through mobile app.
- M-commerce site development and maintenance is comparatively cheaper than web sites.
- More payment options like credit card, debit card, cash on delivery, gift vouchers make it more popular and easy.
- No time limit is there. Consumer can take shopping experience for desired duration.
- Customer's purchase history is available with companies, which can be useful to engage him to do shopping next time also by showing him different offers and different options.
- It has feature to track user's location and based on it, nearby available service options are made available to them which has made it very popular.
- Along with the desktop based web site, other advertisements are also keep on displaying which could be distracting but on app based model this problem can easily be solved which is a big advantage.
- Personalized shopping experience can be created. Buyer can send selected item's image and description with other people before buying and could be more interesting buying experience by sharing. Flipkart has already started with same concept.
- App upgradation in made available so that consumer can have up to date information about market.

**The disadvantages of m-commerce in India are as follows:**

**Risk factor**: Advancement in technology is very fast. So one time investment is risky.

**Hacking and cybercrime**: risk of hacking and data piracy is also there. Number of cyber scam is increasing day by day.

**Limitation of smart phone as screen size is small**: mobile screen size is limited so user may not find it exciting to visit the 'virtual market'.

**Fake sites**: if user is diverted to fake sites, there are chances of fraud.

**Conclusion:**

In few years mobile technology will be more advanced and will be available at less cost. Internet speed will also improve which will help m-commerce to expand more to different fields. Its future seems very bright as it has covered a good amount of e-commerce in less amount of time. So I can conclude here saying that m-commerce revolution in India is a role player in e-business and still there is a way to cover. It has diverted people to use internet facility on mobile more by making

it an innovative. Issues in mobile commerce are there but e-commerce companies have also started offering solutions to the customers as they know their importance and there is no doubt that m-commerce will be at top in India market in next few years.

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# Study of Noise Reduction Using Median Filtering

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## Abstract:

*One of the noise types that is normally degrades digital images, including grayscale digital images, is impulse noise. Therefore, researches regarding to impulse noise removal have become one of the active researches in the field of image restoration. Median based filter is normally becoming the choice to deal with this type of noise.*

## Introduction:

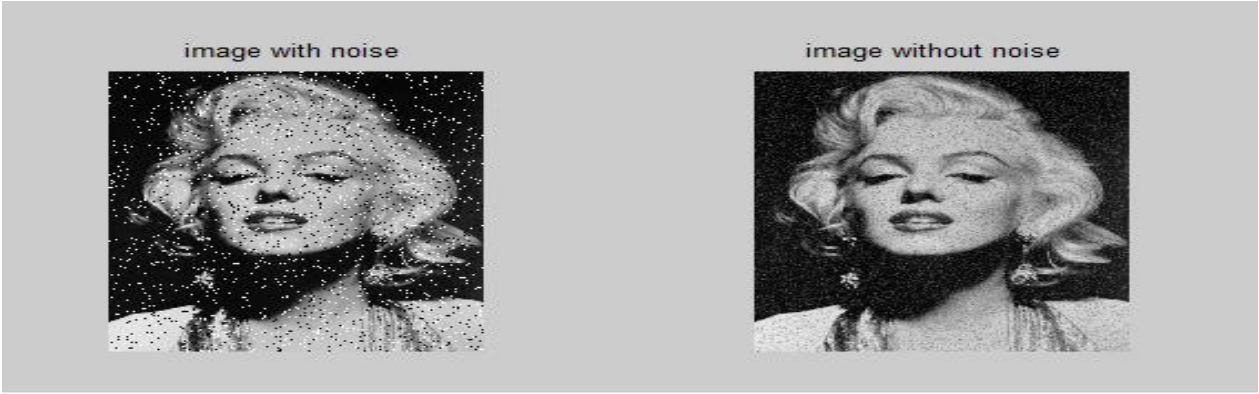
In signal processing, it is often desirable to be able to perform some kind of noise reduction on an image or signal. The **median filter** is a nonlinear digital filtering technique, often used to remove noise. Such noise reduction is a typical pre-processing step to improve the results of later processing (for example, edge detection on an image). Median filtering is very widely used in digital image processing because, under certain conditions, it preserves edges while removing noise (but see discussion below).

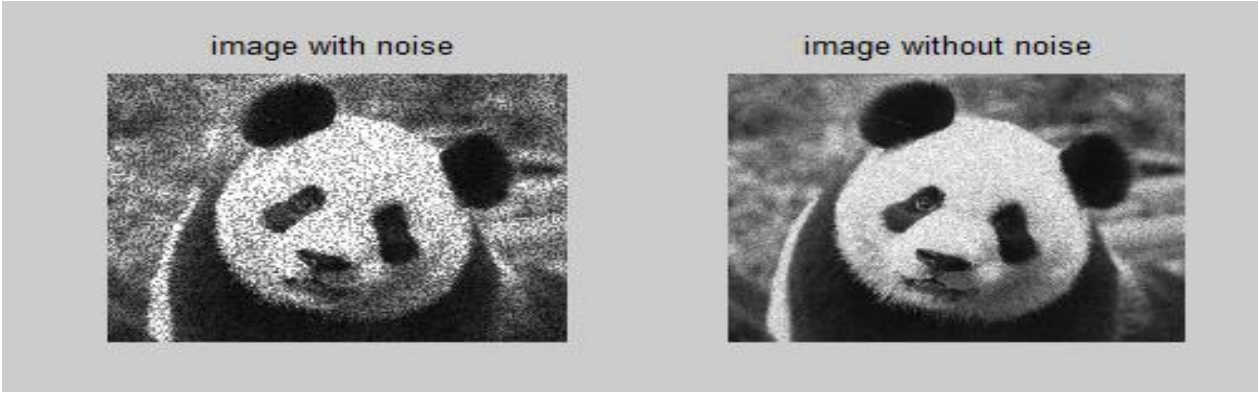
The main idea of the median filter is to run through the signal entry by entry, replacing each entry with the median of neighboring entries. The pattern of neighbors is called the "window", which slides, entry by entry, over the entire signal. For 1D signals, the most obvious window is just the first few preceding and following entries, whereas for 2D (or higher-dimensional) signals such as images, more complex window patterns are possible (such as "box" or "cross" patterns). Note that if the window has an odd number of entries, then the median is simple to define: it is just the middle value after all the entries in the window are sorted numerically. For an even number of entries, there is more than one possible median, see median for more details.

## Motivation:

In order to get a clean and sharp image, noise reduction is the main issue in image pipeline. Many filters were used to reduce noises but also blur the whole image because image details and noises are difficult to distinguish by computer. Filtering is the most popular method to reduce noise. In the spatial domain, filtering depends on location and its neighbors. In the frequency domain, filtering multiplies the whole image and the mask. Some filters operate in spatial domain, some filters are mathematically derived from frequency domain to spatial domain, other filters are designed for special noise, combination of two or more filters, or derivation from other filters.

**Examples:**




**Result:**

The **median filter** is a nonlinear digital filtering technique, often used to remove noise. Such noise reduction is a typical pre-processing step to improve the results of later processing (for example, edge detection on an image). Median filtering is very widely used in digital image processing because, under certain conditions, it preserves edges while removing noise .

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# Study and Analysis of Failures of Software Project

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## Abstract:

*Most software projects can be considered at least partial failures because few projects meet all their cost, schedule, quality, or requirements objectives. Failures are rarely caused by mysterious causes, but these causes are usually discovered post-mortem, or only after it's too late to change direction. This research paper is based on survey carried out on different software consultants, developers and practitioners who were asked to provide reasons of failed projects with which they have been acquainted. Many factors has been considered in this research which generally leads to failure of software project and after analysis it has been proven that "Lack of user involvement' in the requirement phase leads more impact on software project failures. Hence, in this research, researcher has recommended that user should get involved completely in requirement gathering, designing phase.*

**Keywords:** *Software project, factors responsible for software project failures etc.*

## Introduction:

21st century known for computerization of all manual works, that human being was doing so far. Computerization made man life easy and this computerization become possible because of integration of hardware and software. Software plays most important role in the automation of most of electronic appliances. Hence, in current market, demand for all types of software is increasing day by day. This demand leads to development of thousands of software applications in turn increase in software industries.

Every year many software industries are spending billion on IT application development. Statistically, 31% of projects will be cancelled before they ever get completed. 53% of projects will cost twice as of their original estimates, overall, the success rate is less than 30% [1]. Why did the project fail? From symptom to root cause -what are the major factors that cause software projects to fail? What are the key ingredients that can reduce project failure?

Project failure can be defined as one or a combination of cost overruns, late deliveries, poor quality, and/or developing a product that does not get used. Regardless of their involvement during the planning stages, more often than not, software developers bear the brunt of the responsibility for such situations; after all, they're the ones who built the application. However, closer examinations of the projects do not always show evidence of incompetence [2].

In this paper various points has been considered. Following points are majorly seen impacting factors for software project failure. [3]

1. Lack of user involvement
2. Long or unrealistic time scale
3. Poor or No Requirements

4. Inadequate Documentations
5. Scope Creep
6. No Change Control System
7. Poor testing
8. Lack of foresight in building efficiency markets
9. poor managerial decisions
10. Cost overrun.
11. Lack of an experienced project manager
12. Well-defined Schedules.

## 1. Scope of the Study

The study is related to the study and analysis of failures in software project. Pune city has been considered for this research work. As this research mainly focused analysis of failures in software project, the scope of this research is decided to have software companies resides in following two areas of Pune City.

1. PMC area
2. PCMC area

Pune is the second largest city in Maharashtra and well known for educational facilities, research institutes and software industry. Due to the good educational facilities, Pune is called as "**The Oxford of the East**" and hence students from all over the world are getting attracted towards pune city. Due to big software industry, pune is transforming into vibrant modern city with bubbling activities in the IT and Hi-Tech sectors. Thousands of software companies can be found in pune city. And as there is software development industries, SDLC process surely gets followed by all software companies.

During the course of the present study the main focus has been given on the study and analysis of failures in software project. In this research, survey has been carried out for analysis of current scenarios which leads to software project failures in many software industries.

The geographical location of Pune city and software companies present in PMC and PCMC are indicated by the map 2.1, 2.2 and 2.3 as follows

Map 2.1 Map of Pune city.

Map 2.2 Map of the software companies present in PMC area

Map 2.3 Map of the software companies present in PCMC area

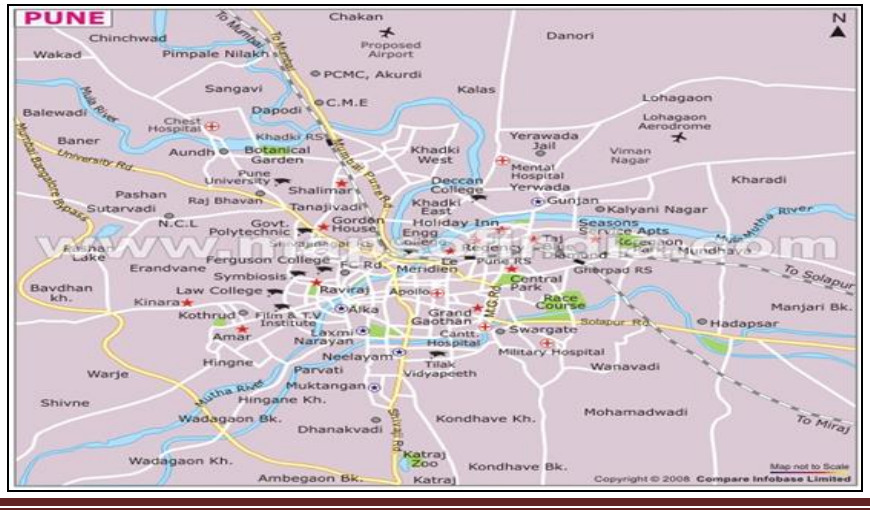

**Figure 1.Source: http://www.mapsofindia.com/maps/maharashtra/pune.htm (23/7/2008) [4]**

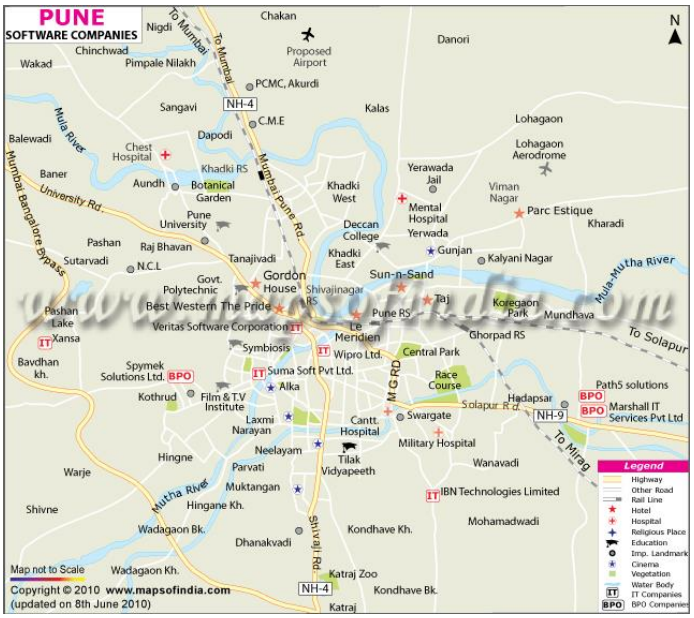


**Figure 2 : http://www.mapsofindia.com/pune/software-company-pune.html[5]**

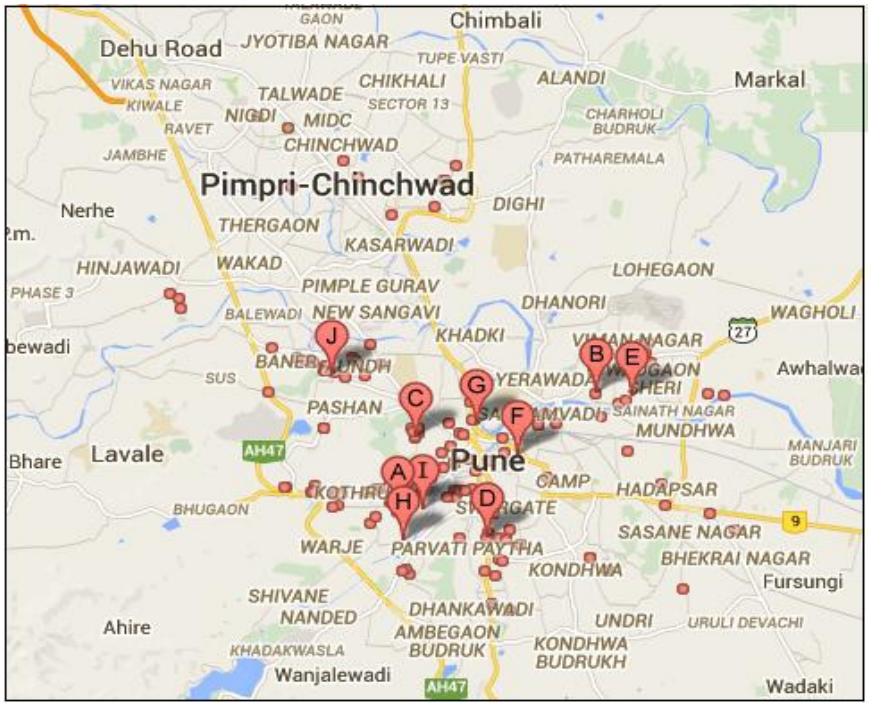


Figure 2.3 :Source : https://maps.google.co.in/maps?hl=en-IN&gbv=2&ie=UTF-8&fb=1&gl=in&q=software+companies+in+pune&hq=software+companies&hnear=0x3bc2bf2e67

461101:0x828d43bf9d9ee343,Pune,+Maharashtra&ei=av_nVKH6O86IuwSvrIL4Bw&ved=0CB4QtQM&output=classic&dg=brw[6]

## 3. Objectives of the study

The main objective is to study and analysis of failures of software project.

## 4. Research Methodology

This research study is related to study and analysis of failures of software project. It utilizes both primary and secondary data. The secondary data utilizes already available information both published as well as unpublished. For primary data however such a facility is not available and it has to be collected by using the survey method. The scope of research is limited; the survey is undertaken by obtaining a purposive and quota sample. The description of the research methodology required for the process of obtaining a sample as well as the nature and size of sample should be adequately explained. Purposive, quota and convenience sampling techniques involves the selection of respondents based on the important characteristics under study such as where they work, position in organization, specific knowledge related to the research problem etc.

### 4.1. Primary data

Primary data are obtained through a survey. Such data is first hand and original in nature. Several methods are used for collecting primary data like telephone survey/e-mail survey, mail questionnaire, personal observation and interviews. Particularly in survey, the important ones are – observation, interview, questionnaire, schedules, e-mail survey, telephone survey etc. Each method has its advantages and disadvantages. The primary data collected by the researcher is explained in the following manner:-

### 4.2. Selection of the city

For the present research work Purposive sampling method has used to select the Pune city as Universe of the study. Pune city is also known as “The Oxford of the East" and a center of IT activity. In this research, Pune city is defined as a scope for the study of impact poor requirement gathering on software testing and designing of model to reduce software product failures.

The type of research is **Exploratory Design** in which the **Survey Method** will be used for data collection; the focus will be given to the aspects of tester’s problem in software companies.

### 4.3. Universe of the Study

For the present study Software companies located at Pune area has been treated as a universe of study by using purposive sampling method.

### 4.4. Unit of the Study

21 Software Companies considered as a sample for conducting review to understand the basic problems and technical problems while testing the software.

### 4.5. Sampling procedure

As total respondents are more than 1, 00,000 so according to K. Morgans Law minimum sample size should be 384 so here researcher has considered 400 respondents.
The study units (Hinjawadi , Hadapsar, Kharadi ) approximately covers 400 testers.

### 4.6. Parameters of Development

- **Data collection :**
  **Primary Data Collection:** Primary data for various samples will be collected in the following ways:-
    a. Information will be collected from testers QA Managers and end users through the structured interview schedule.
    b. Data will also be collected through personal field visits to companies and focus group discussions with end users, who are using software for various uses.

  **Secondary Data Collection:** The secondary data will be collected from books, journal articles and websites, newspapers and conferences souvenir.
- **Data Analysis**
  The collected data will be analyzed by quantitative and qualitative ways. The SPSS (Statistical Package for Social Science Research) Version:8 is used for quantitative analysis.

### 4.8. Secondary Data

The Secondary data is used to study the awareness and usage of SDLC models and impact of software requirement gathering process on software testing with the help of earlier research studies made by others. It is also used to find out the merits and demerits and limitations of different SDLC models and awareness of poor requirement gathering process with the help of available data. It is helpful to study the objectives and hypotheses framed for the present study.
The secondary data is collected from reputed journals and magazines, newspapers, articles, internet websites and archives. For collecting this data the researcher has visited various libraries. A few of these libraries are Jaykar Library (Pune University), Yashada, Tilak Maharashtra Vidyapeeth Library, British Library, Indira College of Science Library and Indsearch Library.

## 5. Data Presentation, Analysis and Interpretation

Survey based research methodology has been used to carry out this research. This research is related to the study and analysis of failures of Software project with special reference in Software companies of Pune city. The researcher has tested positively the hypotheses of this research study, with the help of primary and secondary data. For the purpose of the study, samples have covered all software companies present under PMC and PCMC area. Hence, the researcher has selected one sample viz. software companies present under PMC and PCMC area and collected data from the employees working in these software companies.

| Strongly Agree (SA)-5, Agree(A)-4, Neutral(N)-3, Disagree(D)-2, Strongly Disagree(DS)-1 | | | | | | | |
|---|---|---|---|---|---|---|---|
| Sr. No | Factors | SA(5) | A(4) | N(3) | D(2) | SD(1) | Avg |
| 1 | Lack of user involvement | 275 | 91 | 34 | 0 | 0 | 7.39 |
| 2 | Long or unrealistic time scale | 201 | 199 | 0 | 0 | 0 | 7.23 |
| 3 | Poor or No Requirements | 237 | 156 | 7 | 0 | 0 | 7.35 |
| 4 | Inadequate Documentations | 158 | 198 | 44 | 0 | 0 | 6.88 |
| 5 | Scope Creep | 181 | 219 | 0 | 0 | 0 | 7.15 |
| 6 | No Change Control System | 172 | 191 | 37 | 0 | 0 | 6.97 |
| 7 | Poor testing | 231 | 169 | 0 | 0 | 0 | 7.35 |
| 8 | Lack of foresight in building efficiency markets | 222 | 141 | 37 | 0 | 0 | 7.17 |
| 9 | poor managerial decisions | 206 | 178 | 16 | 0 | 0 | 7.19 |
| 10 | Cost overrun. | 184 | 200 | 16 | 0 | 0 | 7.1 |
| 11 | Lack of an experienced project manager: | 141 | 236 | 15 | 8 | 0 | 6.87 |
| 12 | Lack of methodology in the process | 163 | 230 | 7 | 0 | 0 | 7.05 |
| 13 | Well-defined Schedules | 238 | 155 | 7 | 0 | 0 | 7.35 |

**Table No. 1: Various factors responsible for failure of software project**

It is quite important to understand the factors responsible for software project failure. Table No. 1 shows the various factors, which are responsible for software project failure. To meet the objective of this research a questionnaire has been designed by using various factors which define the various points responsible for failure of any software project. It is observed that for each document the average scale is in between 1 to 5 that is in between strongly disagree to strongly agree. In fact all the values are above 3.5 which mean that with respect to all the parameters much approval is observed. In a 5-point Likert scale, having categories like strongly agree, agree, neutral, disagree and strongly disagree clubbed into three categories. The reason for using Likert scale is that the responses by the respondents should not become monotonous while answering the questions. Hence researcher has also applied 5-point Likert scale and calculates weighted average value. There is very less difference between the comparative value of rank order average value and 5-point Likert scale value. [7]

It is seen that the highest average value is 7.39 for the 'Lack of user involvement' followed by 'Poor or No Requirements', 'Poor Testing' and 'Well-defined Schedules' which are 7.35. The average value for factor 'Long or unrealistic time scale' is 7.23 followed by 'poor managerial

decisions' is 7.19. The average value of 'Lack of foresight in building efficiency markets' is 7.17, followed by 'Scope Creep' is 7.15. The average value of 'Cost overrun' is 7.1 followed by 'Lack of methodology in the processes is 7.05. The average value of 'No Change Control System' is 6.97 and 'Inadequate Documentations' is 6.88 followed by 'Lack of an experienced project manager' is 6.87.

As per most of respondents, it is clear that 'Lack of user involvement' followed by 'Poor or No Requirements' is most important factor responsible for the failure of software project. Off course, user means end user involvement is most important as end user only going to tell his demands or request to business analyst and if end user only unavailable in the requirement gathering meeting then there is no point to discuss anything, anymore. Average 7.39 respondents are agreed to have end user in the requirement gathering meetings or sessions.

Even if end user is available in requirement gathering meeting or session but requirements quality remains poor then also it leads to failure of software project. Poor requirements can get collected if business analyst having less domain knowledge. Also if end user does not have understanding what exactly he wants then also quality of requirement becomes poor. Poor or non-qualitative requirement can become base for any software project and it creates failure throughout SDLC process. Hence, in this research 7.39 responds recommended to have good quality of requirements.

If end user is available and quality of requirement is also good but if testing team executes test cases wrongly then also it creates failures in software project. As per 7.39 respondents, testers should always execute test cases based on the business functionality and requirements written in Functional Requirement Document (FRD). Hence, in this research recommendation needs to provide to testing team to follow testing best practices for the test case execution and in turn to reduce software failures.

Project management is the key factor for the success or failure of any software project. For qualitative project management, well-defined schedule is mandatory factor. If project will have well- defined schedule then all the teams like requirement team, development team, designer team, testing team etc. will follow the same time lines to meet the project success. Hence, 7.39 respondents agreed to have well-defined schedule to reduce failure in software project.

As we saw well-defined schedule for software project plays vital role in the success of project, but well-defined schedule mean short and realistic. If project schedule becomes long and unrealistic then it surely leads to failures in software project. About 7.23 respondents agreed to this point and hence researcher strongly recommends that project schedule time scale should be short and realistic.

In software project execution, many situations can come where managerial level people need to take decision and provide answer to client. If project goes in RED situation where customer is not happy and he is demanding software in very short period of time then in that case managerial decision plays very important role to keep customer calm and happy. But if managerial decision becomes poor then customer won't allow us to work and can take break deal with Software Company. Hence, as per average 7.19 people poor managerial decision leads to failures in software project and therefore, there is need to improve managerial decision skills to increase success rate of software project.

If we developed any product then for selling that product marketing plays vital role. But if we don't have foresight about our project efficiency then in the market product won't get sell. The average 7.17 respondents saying 'Lack of foresight in building efficiency markets' is most important factor and software companies need to focus on this point. Also there is need to have future knowledge about the market of developed software project.

Around average 7.15 respondents is giving importance to 'Scope Creep' factor. Scope creep means project scope should not get creep if we are dealing with success of software project. Scope

creep generally happens if project schedule is long and unrealistic. Hence, as discussed above to avoid scope creep there is need to have well-defined, short and realistic project schedule.

If there is lost of changes in requirements or development team created faulty software component or taken too much time to developed software product, also testing team could not finish testing within specified time then project cost can get overrun. The average 7.1 respondents agreed that 'Cost overrun' could lead to failures in software project. Hence, project management or team lead needs to focus on work status of requirement, development and testing team. Need to resolve all the issues coming throughout SDLC phase so that it cannot overrun cost of the software project.

For error free SDLC process there is standard defined by software engineering for each phase. Requirement team should follow the best standard practices for requirement engineering process, development team should follow best development practices for the coding of software components, and testing team should follow the best testing practices. But if there is lack of methodology present in these best practices then it will lead to project cost overrun and in turn lead to failure of software project. Average 7.05 respondents are agreed with 'Lack of methodology in the process' lead to failure of software project and hence this research recommends best practices and methodology should be followed throughout SDLC process.

To record the changes taken place in requirements by the end user or customer, software management should create change control system and update it as and when required. The average 6.97 respondents agreed that 'No Change Control System' always lead to failure of software project. If project management do not use Change Control System then it won't be possible to record changes made in requirements and it will miss out few important functionality in proposed software project. Hence this research recommends that change control system should be mandatory and gets updated as and when required.

Documentation throughout SDLC process plays vital role to transfer knowledge from one team to another. If requirement team does not provides adequate documents to development team then development team cannot come up with component design and specification documents appropriately and if development team does not provides FRD, component design and specification documents to testing team, then testing cannot come up with appropriate test cases. Hence, each team should provide adequate documents to other team. Because Inadequate Documentation can lead to the failure of software project and in survey around average 6.88 respondents agreeing that 'Inadequate Documentations' lead to software failures and there is need to have adequate documentation throughout SDLC process.

Experienced resources always play vital role in the success of software project. If resources are fresher or new joiners then they don't have product/domain knowledge and hence they cannot understand business functionality easily and quickly. Experienced person can easily communicate with customer on the domain knowledge, business functionality issues etc. Hence, around average 6.87 respondents are agreeing that 'Lack of an experienced project manager' lead to software failure. Therefore, there is need to have experienced resources in the all the teams of software company.

## Conclusion:

In this research paper, different factors have been considered for the study and analysis of failures of software project. The factors of failures of software project have been documented and analysed. Analysis showed that due to these factors software project leads to failures and based on analysis result, researcher has recommended that user should get involved more in requirement engineering phase for clear understanding of customer requirements.

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# Study of image segmentation for archaeological images

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**Abstract:**

*This paper presents an evaluation of two variants of single-level and multi-level thresholding image segmentation algorithm with respect to their performance on segmenting test images.The very basic type of segmentation called thresholding is classified into two namely single and multiple thresholding. Single threshold segment the image into two homogeneous regions which are shown in black and white. In the multiple threshold shown in Figure, the image is segmented into three homogeneous regions; the pixels with gray level intensity less than 100 are replaced by 0 (black);the pixels with gray level intensity greater than 100 are replaced by 255 (white); the remaining pixels are assigned the gray level value 150 (light shade of gray). This approach will aid the teacher to teach the thresholding based segmentation in a simplified way.*

**Keywords***: Thresholding, image segmentation,*

## Introduction:

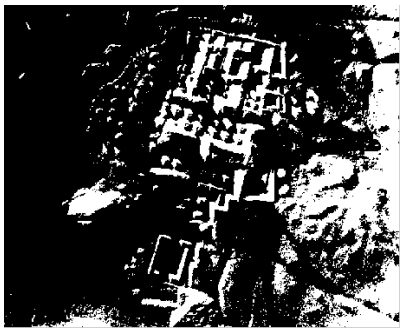
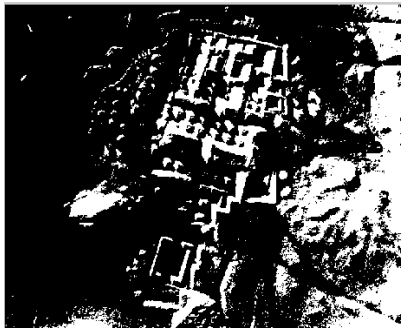
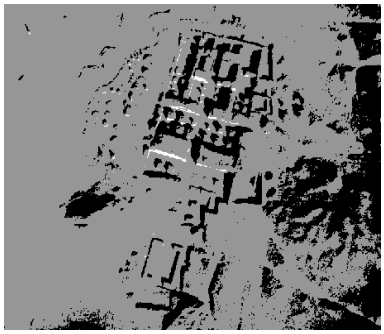
Image segmentation algorithms are widely used in various fields including optical character recognition, machine vision systems,infrared it recognition, automatic target recognition and medical image applications. Image thresholding is a simple, yet effective, way of partitioning an image into a foreground and background. This image analysis technique is a type of image segmentation that isolates objects by converting grayscale images into binary images. Image thresholding is most effective in images with high levels of contrast.Thresholding is an important technique for image segmentation. Because the segmented image obtained from thresholding has the advantage of smaller storage space, fast processing speedMultilevel thresholding is a process that segments a gray level image into several distinct regions. This technique determines more than one threshold for the given image and segments the image into certain brightness regions, which correspond to one background and several objects. The method works very well for objects with colored or complex backgrounds.

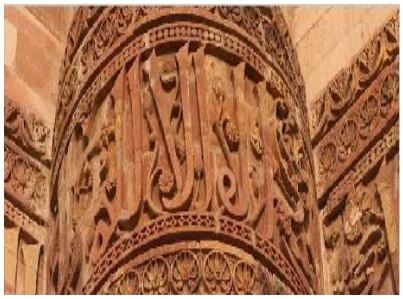
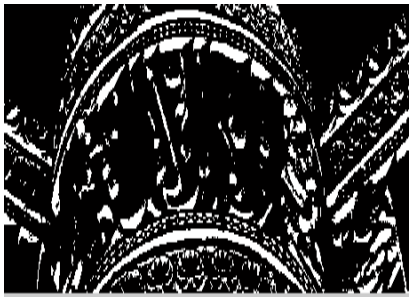
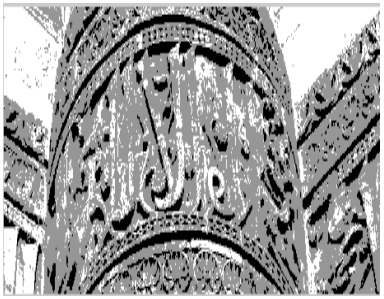
**Experiment Result:**

ORIGINAL SINGLE LEVEL THRESHOLDING MULTI LEVEL THRESHOLDIN



ORIGINAL SINGLE LEVEL THRESHOLDING MULTI LEVEL THRESHOLDIN

**Body of Paper:**

The simplest thresholding methods replace each pixel in an image with a black pixel if the image intensity $I_{i,j}$ is less than some fixed constant T (that is, $I_{i,j} < T$), or a white pixel if the image intensity is greater than that constant. Image segmentation is a process of identifying homogeneous regions in a digital image. The basic idea behind segmentation is called thresholding which can be classified as single thresholding and multiple thresholding. Selecting an optimal

threshold is a crucial process in segmentation. In single thresholding, a simple thresholding strategy is followed as given in equation .

$$g(i,j)= \begin{cases} 1, f(I,j)>T \\ 0, f(I,j)<=T \end{cases}$$

'T' is a predefined threshold, and the pixels replaced by '1' belong to the object and the pixels replaced by '0' belong to the background of the image. If it is required to identify more than two homogeneous regions in the image, the multiple thresholding technique may be adopted. For example, two threshold values T1, T2 with T1<T2, can segment the entire image into three homogeneous regions and for each region, distinct gray level (G1, G2 and G3) may be assigned. The multiple thresholding technique is mathematically represented as equation.

$$g(i,j) = \begin{cases} G1, f(i,j)<T1 \\ G2, <=T1<=g(I,j), T2 \\ G3, f(i,j)>T2 \end{cases}$$

## Conclusion:

In the given paper we compare Single level thresholding and Multi level thresholding .In single level thresholding edges are same as original image and Multi level thresholding the image is not clear. So, single level thresholding is better.

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# Comparative Analysis of ERP Institute Vs. Non ERP Institute; Teacher Aspect

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**Abstract:**

*It has been observed that the Non ERP institutes are lacking behind the ERP institutes. Enterprise Resource Planning (ERP) is one of the answer or solution for improving and raising the standard of the Non ERP institute. This paper describes the introduction of ERP and concentrate on the factor which leads to the better results of ERP. For analyzing the data in this paper, we have been used factor analysis of SPSS software.*

**Keywords:** *CCS's IBMR (Non ERP institute), Indira College of Commerce & science (ERP Institute), SPSS, Teacher Perspective, Enterprise Resource Planning; survey;*

## Introduction:

ERP software for Colleges has been designed to cover the in depth functionalities of any Educational Institute/ University/ Group of Institutions, from the perspective of various users carrying different roles and responsibilities such as Students, Teachers, Staff, Principal, Management, Parents, Alumni etc. All the data is managed in a time sensitive manner along with the rules and policies applicable at that time, so whenever required, the exact information can be re-produced as it is. The strength of ERP software increases many fold with the integration of our other ERP packages like HR, Payroll, Accounts & Inventory, Library etc. However, the entire solution is designed based on a modular approach that gives flexibility to our clients to choose desired modules as per their requirements [1]. The primary purpose of our Education ERP is to provide mechanisms for automated processing and management of the entire institution. It reduces data error and ensures that information is managed efficiently and is always up-to-date [2]. ERP software has been developed after an in-depth analysis of the requirements of various education institutes and in close coordination with the educationists, chartered accountants and quality management personals of distinction, to help you to run all your Institute related functions in more efficient, productive and comfortable manner [3]. Complete student histories for all college years, can easily be searched, viewed and reported on press of button with the help of our solution. ERP software solution continues to serve educational institutions by developing additional programs and updating solutions with new, more efficient and customized versions that incorporate new administrative features requested by different Colleges.

## Why there is need of ERP Software in Colleges:

a) Accessing information from paper files is a difficult task
b) Improper means of exchanging information between various departments
c) Lack of interconnection between departments
d) No quick or easy way to keep the records of students and staff error free and up-to-date
e) Wastage of hundreds of hours by staff each month manually entering information or performing administrative tasks that could be handled automatically such as evaluation and generating results

f) Lack of accuracy in maintaining the financial records such as Fees, Salary and Expenses
g) Lack of automation in calculating Fee balances or to find Fee defaulters
h) Lack of automation for computing the staff's salary
i) Lack of easy means or quick way to access old records
j) Administrators spend too much time in creating Time-Table and in daily assigning the substitutes for free periods

## Objectives and Scope of the study:

a) To compare between ERP institute Vs Non ERP institute.
b) To compare the knowledge about ERP from Teacher Perspective.
c) To test the relevance of the ERP implementation in Non ERP institute.
In view of the certain constraints like cost and time, the study is confined to Non ERP institute such as CCS'S IBMR college and ERP institute Indira College of Commerce and Science. These institutes were selected because they offer similar courses and have around equal number of students.

## Research Methodology:

### Sampling scheme

This research involves the data collection from the teachers of the selected Colleges. The total number of respondents in these Colleges, the sample size selection and application of the statistical stratified sampling technique has been followed.

### A. For the organization

1. Universe of study
Affiliated colleges of SPPU running UG and PG courses of commerce and science faculty
2. Sample selection
CCS's IBMR (Non ERP institute), Indira college of Commerce & science (ERP Institute)

| Sr. No | College | Designation | Population | Sample |
|---|---|---|---|---|
| 1 ERP | Indira college of Commerce & science | Asst. Prof. | 69 | 15 |
| 2 NON-ERP | CCS's IBMR College | Asst. Prof. | 63 | 15 |

**Table 1 : Sample distribution for Teachers**

### B. For the respondents

### 1. Universe of study

All the teachers teaching in these Colleges.

### 1. Sample selection

A number of respondents (i e 30) from the above Table I is selected from the two Colleges is selected using stratified random sampling. The primary data were collected via questionnaire-cum-interview with the selected respondents. Statistical Package for the Social Sciences (SPSS) statistical tool was used for the statistical analysis. The norms were formalized for the choice of respondents from the participating Colleges on the basis of detailed discussions with a number of academicians, researchers and experts. It was observed that increase in sample size will affect the

results only marginally, whereas effort for it will be considerable. The sample size from a stratum was determined on the basis of the following criterion:

• 25% of the population

### C. Data collection tools

Primary data has been collected through a questionnaire- cum-interview method from the selected respondents. The questionnaire was designed based on the literature survey, and detailed discussion with many teachers, students, researchers and industrial experts. As a result, a total of 30 relevant factors were identified that have been depicted in Table II. Further, the sensitivity of the questionnaire was found good as the liker scales were used to record the responses of the participants. The respondents were both identified at random and basis by the researchers.

### D. Processing of data

The responses of the 15 teachers of the ERP and Non ERP of the selected Colleges under study were recorded on five-point liker scale with scores ranging from 1 to 5[8] .The valid responses were entered in Microsoft Excel software. Thus, this data formed was the basis for the corresponding files on the SPSS software .After that Principal Component analysis technique has been applied in the SPSS software.

### Analysis and Interpretation

The analysis has been made on the basis of the Principal component analysis technique. The responses of the teachers of the NON ERP and ERP institutes differ in terms of their responses. In the ERP institutes, it has been observed that teachers are aware of ERP implementation. They know the advantages ,pre-requisite and the challenges involved in the ERP because they have already using ERP in their institute practically .But in the case of Non ERP institutes, it has been found that teachers know about ERP theoretically only. They know some parts of benefits, requirements and issues and challenges involved in ERP. In nut shell, we can also say ERP institute teachers know the practical and theoretical aspect of ERP but Non ERP institute teachers know the theoretical aspect of ERP. The collected responses were subjected to the factor analysis technique to identify and pinpoint the most important factors for alignment. Principal component analysis and varimax rotation of factor analysis techniques were applied to extract the most important sub-objective and the underlying factors.

### Conclusion:

From the teacher perspective, it has been observed that teachers of ERP institute know the both sides of ERP ie Theoretical and Practical. This is the result of awareness generated by the institute regarding ERP. Also, they have studied about ERP in their research work or seminars. When we talk about Non ERP institute, the marginal difference in response from ERP institute is result of individual studies carried out by them. But due to lack of resources or knowledge, the institute has not implemented it. So the teachers have not got the practical knowledge about ERP.

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# Study of Opening, Closing: Morphological Operation

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**Abstract:**

*This paper purely deals with image processing methods. In this paper we studied two fundamental operations of Morphological Image processing which is opening and closing. The opening operation smoothes contours breaks narrow isthmuses,and eliminates small islands and sharp peaks were as Closing contours fuses narrow breaks and long thin gulfs and eliminates small holes. Our main motto is conclude the better image processing strategy by comparing the opening and closing operation so that we can reach to particular conclusion.*

**Keywords:** *Morphological Methods, Opening Operation, Closing Operation.*

## Introduction:

### 1.1 Morphology:

The word morphology commonly denotes a branch of biology that deals with the forms and structure of animals and plants .we use same word here in the context of mathematical morphology as a tool for extracting image component that are useful in the representation and description of region , shape such as boundaries ,skeleton and the convex hull. morphological operations are erosion, dilation, closing and opening.

A and B are set (Structuring element).

The Erosion of A and B denoted by A Θ B and defined as $A \Theta B = \{z | z(B) \subseteq A\}$.

The Dilation of A and B denoted by A ⊕B and defined as $A \oplus B = \{z | (B)z \cap A\}$

Opening generally smoothes the contour of an object, breaks narrow isthmuses, and eliminates thin protrusions.The opening of set A by structuring element B,denoted $A \circ B$ *and defined as* $A \circ B = (A \Theta B) \oplus B$.

Opening smoothes contours breaks narrow isthmuses, and eliminates small islands and sharp peaks . Closing also tends to smooth sections of contours but, as opposed to opening, it generally fuses narrow breaks and long thin gulfs, eliminates small holes, and fills gaps in the contour. The closing of set A by structuring element B denoted by $A \bullet B$ *and defined as* $A \bullet B = (A \oplus B) \Theta B$. Closing contours fuses narrow breaks and long thin gulfs and eliminates small holes.

### 1.3 Closing operation performed on bellow images: -

Closing is so called because it can fill holes in the regions while keeping the initial region sizes. Like opening, closing is idempotent: $(f \bullet s) \bullet s = f \bullet s$, and it is dual operation of opening (just as opening is the dual operation of closing). Closing is opening performed in reverse. It is defined simply as a dilation followed by an *erosion using the same structuring element for both operations.* Closing can sometimes be used to selectively fill in particular background regions of an image. Whether or not this can be done depends upon whether a suitable structuring element can be found that fits well inside regions that are to be preserved, but doesn't fit inside regions that are to be removed. Closing selectively or we can say it closes the gap between the two letters as shown in the image it firmly merge letters by merging nearby pixels which are close to each other.

- ORIGNAL IMAGE:


- AFTER APPLYING CLOSING OPERATION:


**1.2 Opening operation performed on bellow images**

Opening is so called because it can open up a gap between objects connected by a thin bridge of pixels. Any regions that have survived the erosion are restored to their original size by the dilation. Very simply, an opening is defined as an erosion followed by a dilation *using the same structuring element for both operations.* Ie .A o B = (AΘB) ⊕ B. Where ⊖ and ⊕ denote erosion and dilation. Opening is an **idempotent** operation: once an image has been opened, subsequent openings with the same structuring element have no further effect on that image.as we have seen that closing operation has merge content so opening performs reverse operation against closing operation . In shown image the input to the matlab closing code is opened image ie output of closing operation it reconstruct the original image by destructing the pixcels.

- ORIGNAL IMAGE:


- AFTER APPLYING OPENING OPERATION:


**Conclusion:**

In this paper we studied Morphological Operation with comparative study on opening and closing. By doing this analytical study the experiment shows better performance on restoring structure and texture in a damaged image.

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# Connotation of modeling and simulations in the field of electronics research

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## ABSTRACT

*The simulators are not always helpful before actual testing of the complex electronic systems because such simulation does not run in real time mode with actual continuous and discrete signals. The simulation and modeling are used in the various fields of science and technology. The virtual idea of the concept can be implemented using simulators. The mathematical model of any system can be written with the help MATLAB and simulated using same tool. Control System Design and Analysis Technologies are widely held back and very useful to be applied in real-time development. Some of them could be solved by hardware technology and by the advance used of software, control system are analyzed easily and detail. The modeling of systems can be analyzed with control techniques of step response, impulse response and bode plot by using MATLAB Simulink. All data based on the internal circuit of a simple electrical circuit. Its features can be analyzed both by Control System design calculation and by MATLAB software. By the effect of MATLAB modeling results of electrical circuits. Combination of Control technology and Robot technology are now become real-time challenges. By the advance control analysis of easiest way, high-tech can be solved with the help of modeling and simulations. In this research paper work attempt is made to study modeling and simulations for filter circuits.*

**Keywords***: modeling, simulations, filter, MATLAB.*

## INTRODUCTION:

Advancement of knowledge through original research is the core component of the Ph.D. education. It must also facilitate additional skills development opportunities. Certain set of skills are essential for any researcher irrespective of branch or field of research. One can develop these skills through their research and additional learning modules. The development and availability of skill development opportunity must reflect student and discipline needs. Control System Design and Analysis Technologies are widely held back and very useful to be applied in real-time development. Some of them could be solved by hardware technology and by the advance used of software, control system are analyzed easily and detail. Modeling of systems can be analyzed with control techniques of Step response, Impulse response and Bode plot by using MATLAB Simulink. All data based on the internal circuit of a simple electrical circuit. Its features can be analyzed both by Control System design calculation and by MATLAB software. Combination of Control technology and Robot technology are now become real-time challenges. By the advance control analysis of easiest way, high-tech can be solved with the help of Modeling and Simulink using MATLAB. All these processes are design in this research and it is mainly focus to analyze the AC/DC circuits and their analysis by using MATLAB PSPICE and LabVIEW. Modeling and simulation not only help researcher to get a better understanding of how real-world systems function, they also enable us to predict system behavior before a system is actually built and

analyze systems accurately under varying operating conditions. **Modeling and Simulation of Systems using different software like PSPICE, MATLAB and LabVIEW** provide comprehensive, state-of-the-art coverage of all the important aspects of modeling and simulating both physical and conceptual systems. Various real-life examples show how simulation plays a key role in understanding real-world systems. This paper explains how to effectively use of these software's.

Simulation is the imitation of the operation of a real-world process or system over the time. The act of simulating something requires development of a model. Simulation is also used for scientific modelling of natural systems to gain insight into their functioning. By changing different input and control variables in the simulation, predictions can be made about the behaviour of the system. Simulator is a tool to investigate the behaviour of the system. Modelling is nothing but a system whose behaviour can be interpreted in terms of physical /empirical /block diagram/ mathematical systems /or any equivalent by considering variable inputs and outputs. Modelling environments include the simulation function. Some of the most commonly used environments are LabVIEW, Matrix or system build and MATLAB or Simulator. The Modelling of the systems are needed because of the following reasons.

1. When a system is too large for direct experimentation
2. When a system is too complex for direct experimentation
3. When a system is too fast or slow for direct experimentation.
4. When a system consist of all above combination.

Steps involved for modeling of any general system

1. Represent behavior of system mathematically.
2. Identify which type model is convenient to the system.
3. Identify input and output variable.
4. Draw block diagram of the system.
5. Interpretation with suitable example.
6. Write program and check the result for various inputs.

Simulation is the process of solving a block diagram model on a computer or Simulation is the process in which model equations are solved and which has three steps: Initialization, Iteration and Termination. All visual simulation environments perform two basic functions like graphical editing and simulation. Graphical editing used for creation, editing and retrieval of models whereas simulation gives numerical solution of the model.

Following are the steps involved in modeling and simulation of any general system

1. Write mathematical equation of the model.
2. Identify which type of model to be implemented i.e. Mathematical, empirical etc..
3. Select type of language for implementation
4. Identify variable inputs and output variables of model.
5. Draw block diagram with input and output variables.
6. Interpret with suitable example and comment on the result.
7. Write program in software tools like MATLAB, C, PSPICE or LabVIEW.

**RESEARCH IMPLEMENTATION STEPS**

The flow sheet of traditional and experimental research is shown in the fig1 and fig.2 respectively.

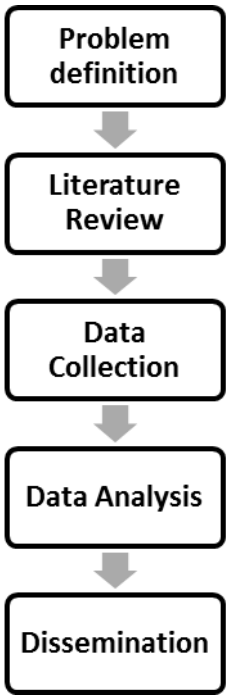


**Fig 1:Traditional research**

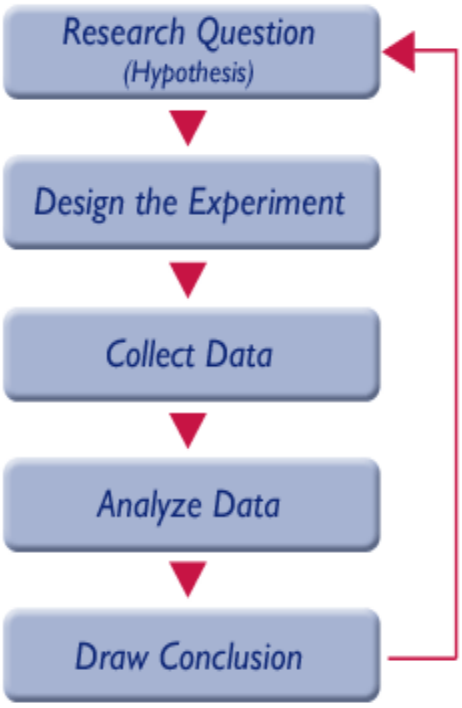


**Fig. 2: Experimental research**

The fig no.1 elaborates the processes in the course of research in any domain whether it is a traditional or experimental research. Like other complex skills, there is no single minimal level of competency needed, but increasing skills at all levels results in more effective and efficient implementation of research project. In addition, it can be assumed that these skills will change and evolve as the project progresses. The experimental research includes actual experimentation for generations of the data for satisfy the proposed hypothesis. The experimentation is done according to the hypothesis. A systematic acquisition and understanding of a subject is the most important aspect of field of learning. The creation and interpretation of new knowledge through original research should be of a quality to satisfy review by peers. It should also demonstrate a significant range of principal skills, techniques, tools, practices and literature for the field of learning. The researcher should acquire an ability to respond abstract problems that expand and redefine existing knowledge. Development of competence to handle complex and unpredictable situations is an essential skill. This also requires communicating the results of research or innovations to peers engage in front line research.

## MODEL OF ELECTRICAL SYSTEM

The dynamic models generally used for specific control and diagnostics purposes. These developed models can be used for simulation purpose.

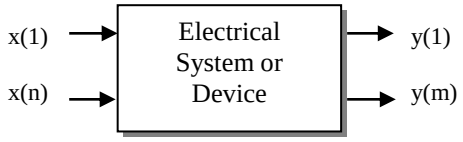


**Fig 3 : General model of system**

The block diagram of general model is given in figure 3,which includes inputs x(1)…x(n) and outputs are y(1)…..y(n).The sample example is consider is filter design using MATLAB software. The low pass and high pass filter is considered as a case study for this research paper. The proposed system model of the filter can simulated for the effect of the black box on the frequency spectrum of input frequencies x(n), where x(n) represents entire input signal and system generates y(n) as a output frequencies. This system can be considered as a filter block diagram and transfer function of the system decides type of the filter.


Fig 4 **:** Filter model of system

Low pass filter consisting of resistor in series with capacitor. The ratio of the output voltage verses input voltage of the signal is given for low pass filter by the equation (1) and high pass filter is given by (2) respectively.

$$\frac{VOUT}{VIN} = \frac{1}{1 + 2\pi jfRC} \qquad (1)$$

$$\frac{VOUT}{VIN} = 1 + 2\pi jfRC \qquad (2)$$

Where, Vin is a sinusoidal input voltage of frequency f, R be the resistance and C be the capacitance in farad. The amplitude response of the filter is given by equation (3)

$$Amplitude\ response\ = \frac{amplitude\ of\ output}{amplitude\ of\ input} \qquad (3)$$

The phase response of the filter is nothing but difference between phase of output voltage and phase of input voltages. It is the plot of theta verses frequency. MATLAB software tool becomes more popular because of its powerful mathematical computational as well as visualization ability along with its add-on powerful simulation tools or simulink like fuzzy logic, signal processing, Neural network, instrumentation, etc. Predefined functions in MATLAB can be directly written in programming for modeling of DC or AC electronic circuits.

## Result and Conclusion

In almost all experimental research, it is necessary to deal with variety of data. Data acquisition, analysis and visualization are the basic steps in handling the experimental parameter. Modeling of any experimental conditions and verifying the dependence of output parameters on experimental parameters can be simulated. MATLAB has been used as a modeling and simulation tool for harnessing data representation and analysis skills of the researcher. simulated results of low pass and high pass filter are given in the following figures no.5 and figure no. 6 respectively. The capacitor is considered as 1 microfarad and resistor is of 16KΩ.The frequency response of the filters are calculated from frequency 1Hz to 1KHz with step of 2 Hz.

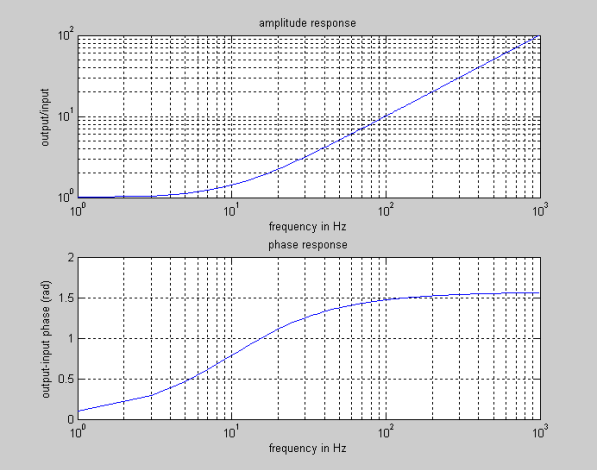


**Fig 5 : Amplitude and phase response of high pass filter**

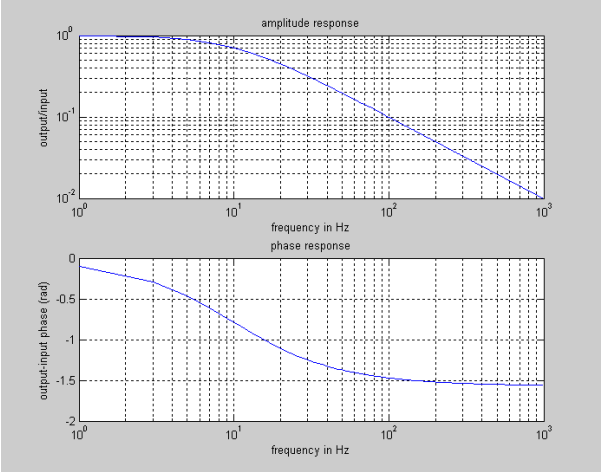


**Fig 6 : Amplitude and phase response of high pass filter**

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# A Study of Failure of Blackberry Operating System In The Market.

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## Abstract:

*In this decade we all observed the hike of the Mobile world, how day by day the mobile industry became one of the biggest profit makers but simultaneously we also observed several mobile phones operating systems had to shut down after being the brand makers of the same world and qnx or BB or BlackBerry is one of them. In this paper we have studied and discussed about how BB mobile phones operating system which was a big hit then how they lost everything they had and why they had to face such a failure in the market.*

**Keywords***: BlackBerry 10, BB messenger, QNX*

## Introduction:

BlackBerry is a line of wireless handheld devices (commonly called smartphones) and services designed and marketed by BlackBerry Limited, formerly known as Research In Motion Limited (RIM). The original BlackBerry devices, the RIM 850 and 857, used the 'DataTAC ' network. In 2003, the more commonly known convergent smartphone BlackBerry was released, which supports push email, mobile telephone, text messaging, Internet faxing, Web browsing and other wireless information services. BlackBerry gained market share in the mobile industry by concentrating on email. BlackBerry began to offer email service on non-BlackBerry devices, such as the Palm Treo, through the proprietary BlackBerry Connect software.

## Issues of BB 10 : -

A new operating system, BlackBerry 10 was released for two new BlackBerry models (Z10 and Q10) on January 30, 2013. At BlackBerry World 2012, RIM CEO Thorsten Hein's demonstrated some of the new features of the OS, including a camera which is able to rewind frame-by-frame to allow selection of the best shot, an intelligent, predictive, and adapting keyboard, and a gesture based user interface designed around the idea of "peek" and "flow". Apps are available for BlackBerry 10 devices through the BlackBerry World storefront. Tough BlackBerry 10 failed in several factors , According to an editorial by *eWeek*, writer Don Reisinger looks to prove why BlackBerry 10 has been a failure. Reisinger gives the following reasons:

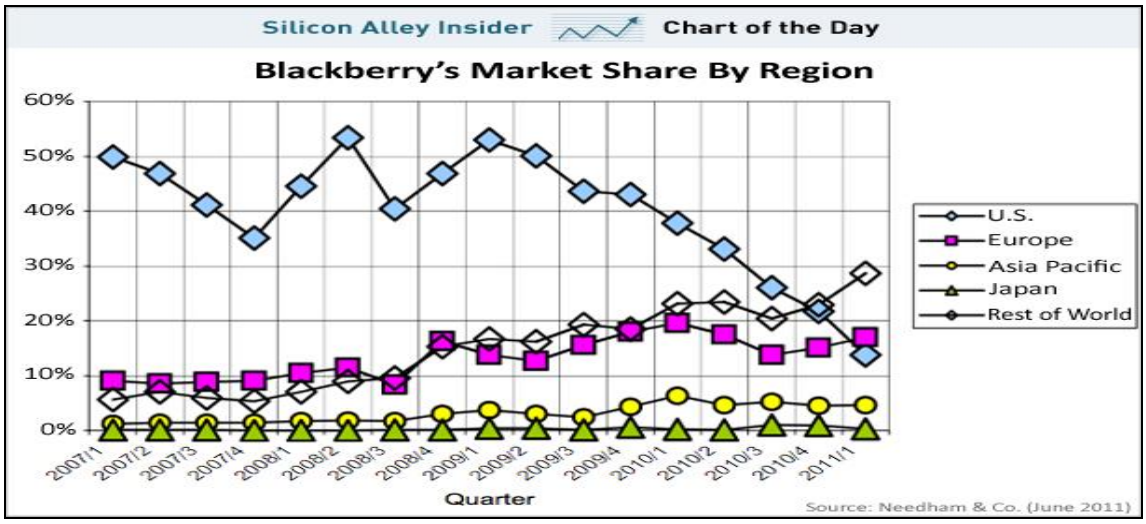
- The Marketing Was All Wrong
- Blame It On the Apps
- The Software Isn't Impressive
- The Enterprise Doesn't Care
- Consumers Really Don't Care
- A Single Company Can't Win on Its Own

According to CNN Money BlackBerry 10 had to face failure because BlackBerry needed a phone that could stand up against any other new device. But this is not a flagship phone. It's a device anyone else would be giving away for free with a two-year contract by the end of the year. And for BlackBerry, that obviously is not enough.
Still, even if the Z10 had the latest and greatest hardware, it would only be part of the equation.
Since BlackBerry maintains its own operating system, the company should be able to differentiate itself through software-centric design and features.
BlackBerry certainly improved its platform this time around, but even with the addition of its best new features**,** the update feels conservative. It's as if the company is wary of alienating its existing user base of corporate and government devotees.
So it doesn't matter that the new BlackBerry Hub feature is a wonderful way to keep track of every social network, messaging service, and communication platform in one fell swoop.
Nor does it matter that the new BlackBerry 10 operating system has one of the best multitasking solutions since Palm's ill-fated webOS -- which BlackBerry borrows generously from. No matter where you are in the OS, you can swipe up and you are taken to the home screen, where all your open apps are represented by tiles.
The problem is there are no apps you're going to want to use.
Sure there's Facebook and Twitter. But those are standard at this point.
BlackBerry was already facing many problems with their apps and which al;so affected their response with the particular rapps and which resulted to shut down with them. Following are the applications of blackberry which certainly were called off by BlackBerry themselves

- BlackBerry Messenger Music,
- BlackBerry link,
- BlackBerry Classic,
- Text messaging,
- BlackBerry desktop software,
- My camera,
- Automatically receiving email function,
- BlackBerry curve 3G track pad

This failure of BlackBerry was actually working in favor to two of the other mobile operating system which namely were Google’s android and Apple’s IOS .They started experimenting with lots of new things as a operating system and in return they got a huge amount of positive results which actually affected the failure of BlackBerry. According to the latest study of worldwide mobile users in the year of 2008 Symbian had 47% of world users and BlackBerry had 19.8% users and according to the research Made in the year 2014 66.6% users use Android and Blackberry have only 5.1% users all around the world.

**Following are some of the graph study done by various researchers which shows the drastic way down for BlackBerry which led them to shut down many of their applications.**


Silicon Alley Insider
Chart of the Day
Blackberry's Market Share By Region
60%
50%
40%
30%
20%
10%
0%
2007/1
2007/2
2007/3
2007/4
2008/1
2008/2
2008/3
2008/4
2009/1
2009/2
2009/3
2009/4
2010/1
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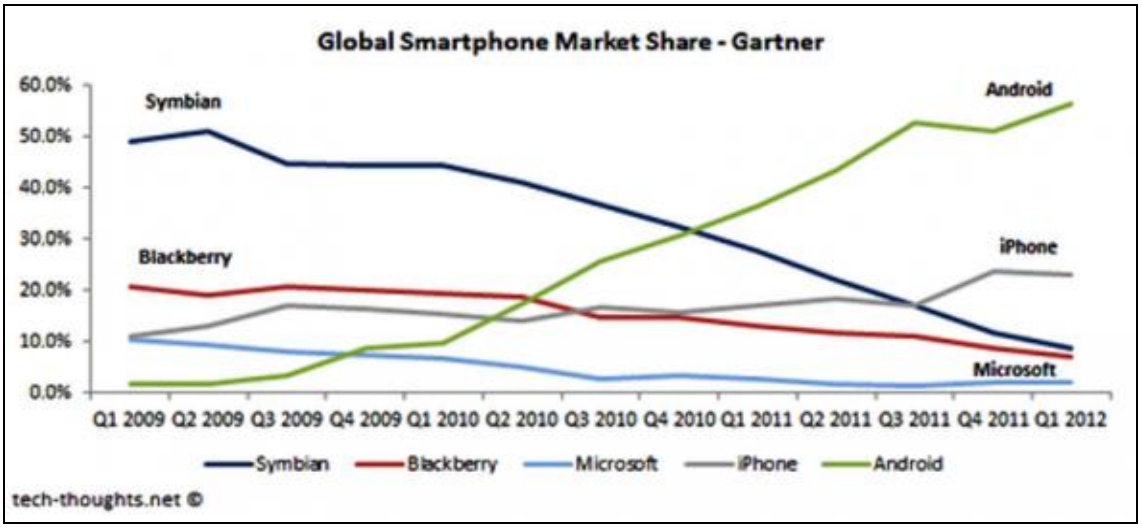
2010/4
2011/1
Quarter
U.S.
Europe
Asia Pacific
Japan
Rest of World
Source: Needham & Co. (June 2011)


Global Smartphone Market Share - Gartner
60.0%
50.0%
40.0%
30.0%
20.0%
10.0%
0.0%
Symbian
Android
Blackberry
iPhone
Microsoft
Q1 2009 Q2 2009 Q3 2009 Q4 2009 Q1 2010 Q2 2010 Q3 2010 Q4 2010 Q1 2011 Q2 2011 Q3 2011 Q4 2011 Q1 2012
Symbian
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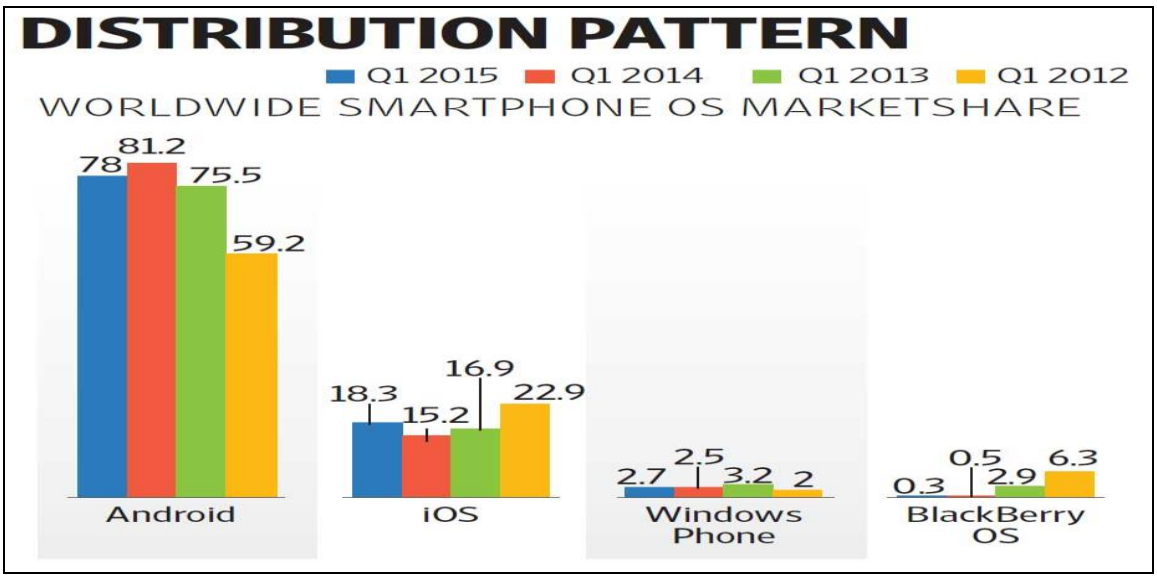


**Conclusion :**

BlackBerry operating systems was one of the best operating system but ultimately it failed, and the failure would not have been occurred if these precautionary measures have been taken into consideration at the appropriate time . BB os had very limited exposures to the customers and the business was very money oriented rather than customer/user oriented. Once BB realized they are loosing their market and their majority customers of business people they decided of making BB apps available on IOS and android platforms but it failed again. At certain they thought of getting control over the situation but it was too late because of the hike of Apple's IOS and Google's Android.

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# Analytical Study of Cloud Data Center Network Architectures and Their Comparisons

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## Abstract:

*Data Centers have become increasingly essential part of recent trends of computing environment. For efficient application performance on Data Center Networks it is needed to understand their design and performance differences. The load on Data Centers is growing day by day and accordingly the Servers requirements are increasing with various issues on Data Center. The aggregate bandwidth requirement is major issue for Data Center performance as Server's demands are high for end-to-end aggregate bandwidth. In this paper the comparative analysis on selected Data Center Network Architectures are considered based on parameters like scalability, path diversity, hop count, throughput, cost and power consumption for better selection of Data Center.*

**Keywords:** *Data Center, oversubscription ratio, scalability, path diversity, hop count, throughput, cost, power consumption*.

## Introduction:

A Data Center is a pool of computing resources clustered together using communication networks to host applications and store data. Most of the internet communication in future is expected to take place within the Data Centers. Many applications hosted by Data Center are communication intensive, e.g. more than 1000 Servers may be touched by a simple web search request. Communication pattern in a Data Center may be one-to-one, all-to-all or one-to-all. Data Centers are experiencing tremendous growth in Servers. For example, number of Servers is doubling every 14 months in Microsoft Data Centers [6].

Data Center network needs to be agile and reconfigurable in order to respond quickly to ever changing application demands and service requirements. Significant research work has been done on designing the Data Center network topologies in order to improve the performance of Data Centers [5][11].

Major Challenges in Data Center network design includes: scalability, agility, fault tolerance, maximum end-to-end aggregate bandwidth, automated naming and addressing and backward compatibility [6].

Even when deploying the highest-end IP switches/routers, resulting topologies may only support 50% of the aggregate bandwidth available at the edge of the network, while still incurring tremendous cost. Non-uniform bandwidth among Data Center nodes complicates application design and limits overall system performance [8].

As Data Center network sizes are increasing exponentially, there is big challenge in front of Data Center operators to minimize the overall system infrastructure cost with simultaneously achieve higher performance. For compute-intensive workloads, Data Center networks should have powerful processing Servers. For communication-intensive workloads, Data Center networks should have good performance in terms of throughput. Bandwidth, reliability, throughput, power consumption, latency and cost these are some interrelated metrics, which can be used to characterized Data Center network performance [1][5].

In next section we described about classification of Data Center network architectures. Section three contains comparative analysis of some selected Data Center network architectures. Last section contains conclusion.

## Data Center Network Architecture Classification:

Data Center networks are categorized into three classes:

i) Switch-based architectures: Packet forwarding is implemented using switches. Multi-tiered network, fat-tree, flattened butterfly are the examples of switch-based architectures.
ii) Server-based architectures: Servers are used for packet forwarding. Servers have two responsibilities, first to process applications and second to forward packets between Servers. Camcube is Server-based architecture.
iii) Hybrid architectures: Both switches and Servers are used for packet forwarding. DCell and BCube are examples of hybrid architecture [4].

### i) Switch-based architectures:

### A) Multi-tiered Network:

Multi-tiered design is a traditional Data Center architecture that is commonly used in many medium-to-large enterprises. A three-tiered topology contains core switches at the root level, aggregation switches at the middle level, and access level switches connected to the hosts. Oversubscription ratio is the basic parameter in multi-tiered network. Oversubscription can be calculated as a ratio of worst-case aggregate bandwidth available to end host and the total bisection bandwidth of the network topology. For instance, oversubscription 4:1 means that the communication pattern may use only 25% of the available bandwidth [6].

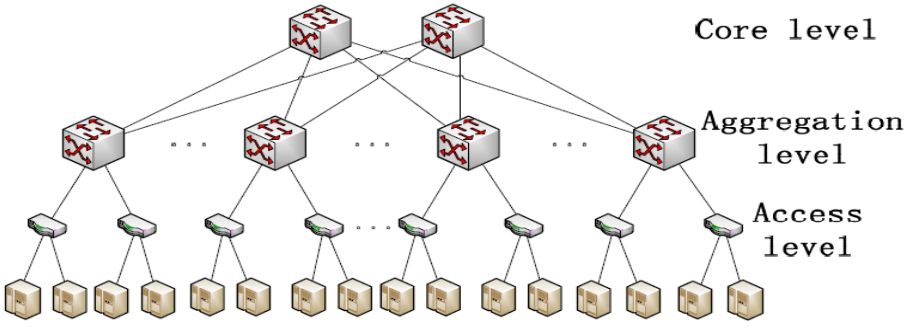


***Figure-1: Multi-tiered Network Architecture***

### B) Fat-tree Network:

In fat-tree network high-end switches are replaced with low-end switches. The number of uplinks and number of downlinks for each pod are equal. Fat-tree offers full bisection bandwidth

(maximum bandwidth that can be transferred across the midpoint of system). Fat-tree network topology is highly scalable and economical [2].

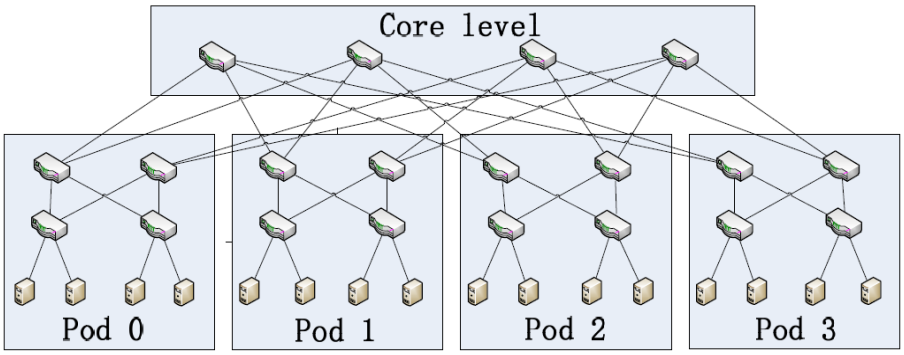


**Figure-2: Fat-tree Network Architecture**

**C) Flattened Butterfly Network:**

The k-ary n-flat flattened butterfly (FBFLY) is a multi-dimensional symmetric topology. In FBFLY k is the number of switches in each dimension and n is the dimension of topology.

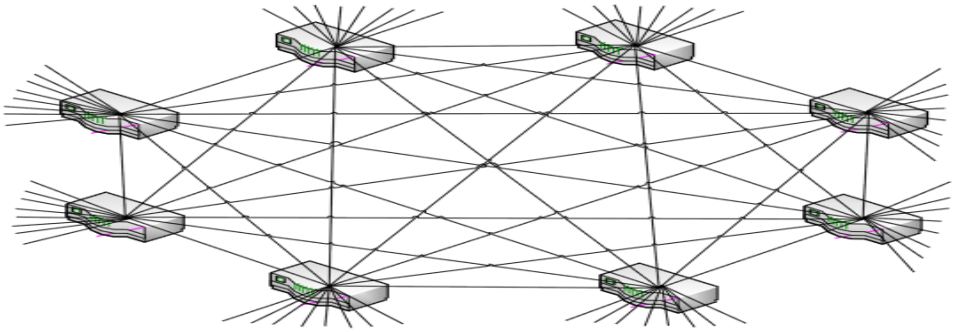

***Figure-3: 8-ary 2-flat Flattened Butterfly Network***

A k-ary n-flat flattened butterfly is constructed from a k-ary (n-1)-flat flattened butterfly and a k-ary 2-flat flattened butterfly. For example, 8-ary 3-flat FBFLY can be constructed by copying the 8-ary 2-flat 8 times, then interconnecting each switch in one group with the corresponding 7 switches, one switch in each of the other 7 groups [2].

**ii) Server-based Architectures:**

**A) Camcube Network**:

In Server-based Data Center architectures, the Data Center is created using a set of Servers, where each Server typically has a multi-core processor, and a high performance network interface card (NIC) with multiple ports. The Servers are not only end hosts, but also perform packet forwarding and routing. In Camcube each Server port is connected directly to another port on another Server [3].

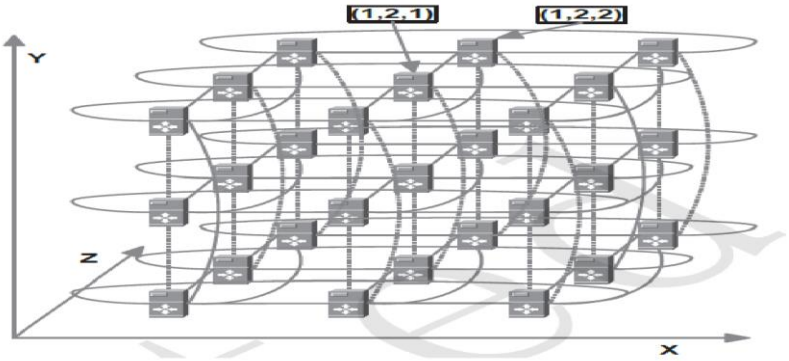


***Figure-4:*** **Camcube** ***Network Architecture***

**iii) Hybrid Architecture:**

**A). BCube Network**:

BCube architecture uses both switches and Servers for routing traffic. In BCube there are no direct connections between any two Servers. A $BCube_k$ network can be constructed using n $BCube_{k-1}$ topologies and $n^k$ n-port switches. In $BCube_k$, there are k+1 levels, and $N=n^{k+1}$ Servers and k+1 ports for each Server, each port connecting a switch at each level [2].

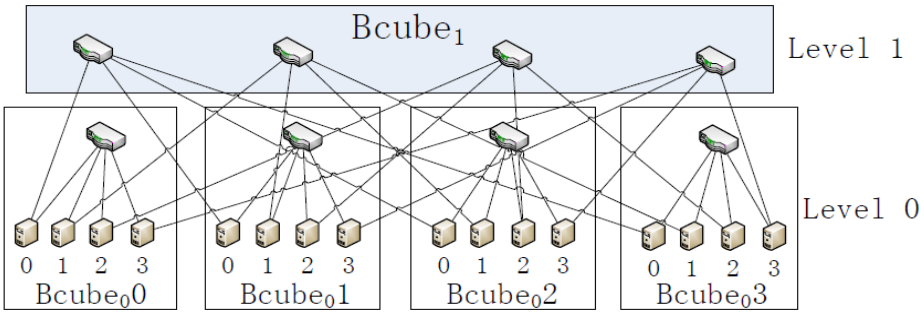


***Figure-5:*** **BCube** ***Network Architecture***

**B) DCell Network:**

DCell is recursive Data Center network architecture. In DCell switches are used to communicate among the Servers in same $DCell_0$. The communication with Servers in other DCells is performed by Servers acting as routers. A level 0 cell ($DCell_0$) comprise of n commodity Servers and a switch. Higher levels of cells are built by connecting multiple lower level ($level_{l-1}$) DCells. Each $DCell_{l-1}$ is connected to all other $DCell_{l-1}$ in same $DCell_l$. The DCell provides an extremely scalable architecture [6].

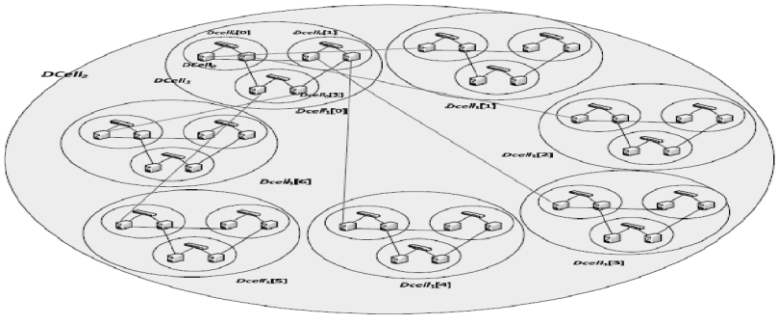

**Figure-6: DCell Network Architecture**

**Comparison of Data Center Network Architectures:**

Data Center Network Architectures are differed based on following metrics: Scalability, Path diversity, Hop count, Throughput, Cost, Power consumption.

**i) Scalability:**

Scalability is the ability of a system, to handle a growing amount of work in a capable manner or its ability to accommodate that growth [8]. The scalability of Data Center network architecture is depends on switch port count per host. The table-1 shows switch port count per host for different Data Center network architectures [2].

**Table-1: DCN architectures with switch port count per host**

| DCN Architecture | Switch port count per host |
|---|---|
| Multi-tiered | 5 |
| Fat-tree | 5 |
| Flattened Butterfly | 4 |
| BCube3 | 5 |

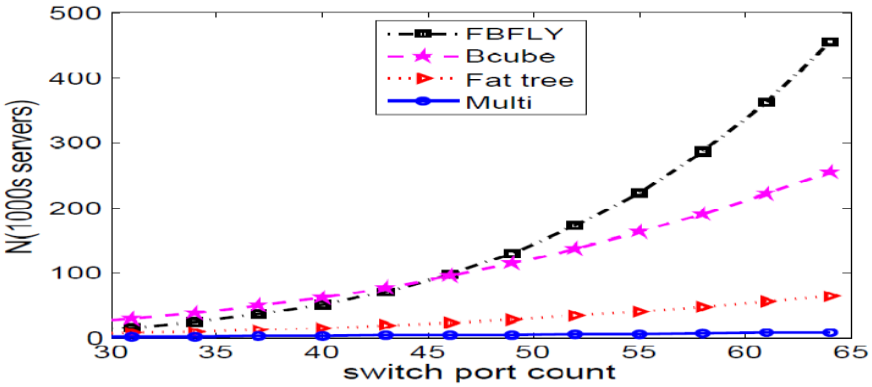


**Figure-7: Number of hosts VS switch port count**

As in Figure-7, flattened butterfly supports more hosts for a given switch port count, compared to BCube, Fat-tree and Multi-tiered network hence flattened butterfly is more scalable network architecture.

**ii) Path Diversity:**

Multiplicity of paths can improve load balance and it enhance throughput by distributing the traffic load. The network is more immune to link and switch failures. Path diversity means number of different shortest paths between a pair of hosts.

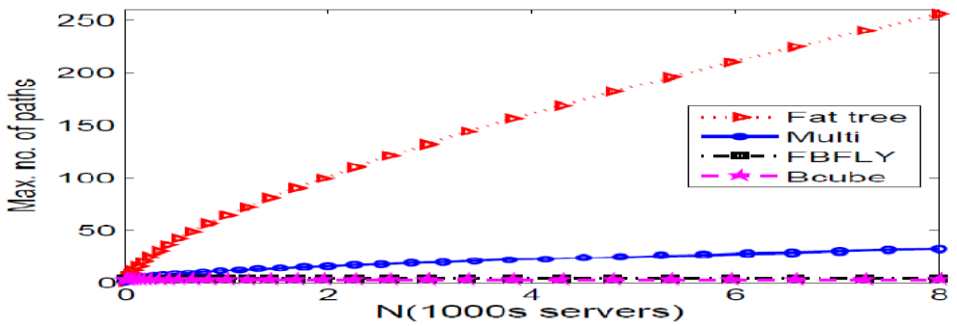


**Figure-8: Maximum number of shortest paths between a pair of hosts**

The graph of figure-8 shows maximum number of shortest paths offered by different topologies between a pair of hosts [2]. Fat-tree network supports maximum number of disjoint paths between each pair of hosts hence it is more fault tolerant network architecture.

**iii) Hop Count:** As hop count is minimum, packet latency is decreased.

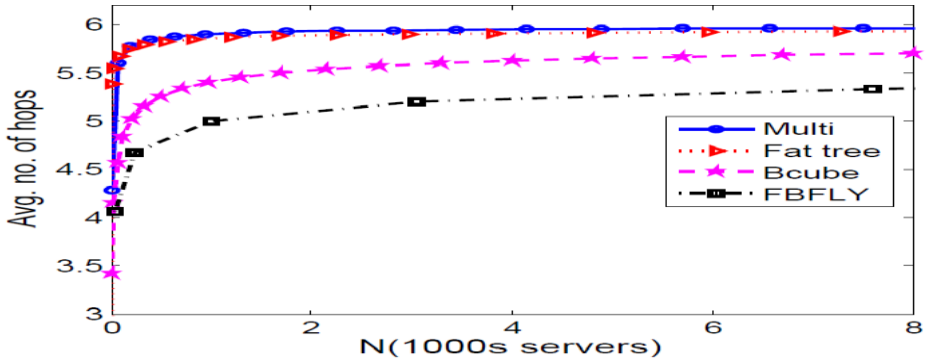


**Figure -9: Average hop count**

In Figure-9, Multi-tier network architecture has higher hop count while Flattened butterfly have lower hop count. Hence Flattened butterfly network architecture provides very low latency [2].

**iv)Throughput:**

Throughput is the rate (bits/sec) at which traffic is delivered to the destination nodes. Fat-tree has good throughput since larger number of disjoint paths available between nodes, that helps to balance the load and reduce traffic congestion [2].

iv) **Cost:**

Cost of a network topology can be modeled as the capital cost for the network infrastructure (i.e. switches, NICs, CPUs).

Table-2 shows cost (K$) of different Data Center network architectures with approximately 4K hosts [2]. BCube has total cost 4095 (K$) and it is cost effective Data Center network architecture as compared to other Data Center network architectures.

***Table-2: Cost* comparison *for Data Center network architectures.***

| DCN Architecture | Total Cost (K$) |
|---|---|
| Multi-tiered | 14050 |
| Fat-tree | 9496 |
| Flattened Butterfly | 6629 |
| Camcube | 6962 |
| BCube | 4095 |

**vi) Power Consumption:**

Power consumption of a network topology can be modeled as power consumption of network components like switches, NICs, CPUs.

As per table-3 the power consumption (KW) of different Data Center network architectures with approximately 4K hosts, Multi-tiered network architecture consumes less power i.e. 156 KW than other Data Center network architectures [2].

**Table-3: Power consumption comparative for Data Center network architectures.**

| DCN Architecture | Power Consumption (KW) |
|---|---|
| Multi-tiered | 156 |
| Fat-tree | 308 |
| Flattened Butterfly | 223 |
| Camcube | 407 |
| BCube | 221 |

The above selected Data Center network architectures can be scaled as very low, low, moderate, high and very high using scalability, path diversity, latency, throughput, cost, power consumption parameters and is tabulated in table-4. One can select the Data Center for specific application requirements looking this table-4.

**Table-4: Comparison table of different Data Center network architectures.**

| Metric→ DCNA | Scalability | Path Diversity | Latency | Throughput | Cost | Power Consumption |
|---|---|---|---|---|---|---|
| **Multi-tiered** | Low | High | High | Moderate | Very High | **Very Low** |
| **Fat-tree** | Moderate | **Very High** | Low | **Very High** | High | High |
| **FBFLY** | **Very High** | Moderate | **Very Low** | High | Low | Low |
| **Camcube** | Very Low | Very Low | Very High | Very Low | Moderate | Very High |
| **BCube** | High | Low | Moderate | Low | **Very Low** | Moderate |

**Suggestions:**

For online applications where throughput and latency are important parameters, Fat-tree and Flattened butterfly are the better options. But in case of real-time online applications latency is

the major concern then Flattened butterfly is to be selected. In case of some applications like railway reservation, online retailing etc. where path diversity (multiplicity of paths) is important factor then Fat-tree and multi-tier network architecture meet the requirement.

When server requirements to a specific applications like search engine is dynamic, the scalability parameter is the concern. For such applications Flattened butterfly network architecture may be good choice. BCube network architecture can be used for applications which are demanding minimum cost and high scalability.

Applications where cost is important concern, for such applications BCube network architecture can be used. Applications running on cost effective and better performance Data Centers, should consider Flattened butterfly network architecture as one of the good choice. Multi-tier network architecture consumes low power hence it is suitable for such applications where less power consumption is required.

## Conclusion:

There are several Data Center Network Architectures like Multi-tier, Fat-tree, Flattened Butterfly, Camcube, BCube, DCell, etc. available. For specific application requirements and based on particular metrics like scalability, path diversity, hop count, throughput, cost and power consumption, one can select best among the available network architectures.

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# A STUDY- ROLE OF IOT IN DIGITAL INDIA

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## Abstract:

*As all of you aware about the digital India concept which is officially get born in India on historical speech of 15th aug 2014 by our honorable prime minister and after that the actual concept of the digital India take a pickup and now everyone is aware about the mean of the concept and with that concept so many new things are comes in highlight in India those are like smart city, IOT(Internet of Thing), IoE(Internet of Everything),etc so these are all key things born when digital India concept come in the existences*

*Smart city is the Biggest application of the Digital India and for the implementation of the same government are taking the steps ahead in this paper we will focus on how IoT become a back bone for the Implementation of the digital India concept ,we will also focus the IoT services implementation challenges and technological trends and IoT development tools. .*

## Keywords:

*Digital India, Internet Of Things (IOT), Smart city, Policies, tools, Internet of Everything (IOE)*

## Introduction:

Smart devices. Smartphones. Smart cars. Smart homes. Smart cities. A smart world. These concept have been espoused for many years. Achieving these goals has been investigated today by many diverse and often disjoint research communities. Five such prominent research communities are: Internet of Things (IoT), Mobile Computing (MC), Pervasive Computing (PC), Wireless Sensor Networks (WSN), and most recently, Cyber Physical Systems (CPS). However, as technology and solutions progress in each of these fields there is an increasing overlap and merger of principles and research questions. Narrow definitions of each of these fields are no longer appropriate. Further, research in IoT, PC, MC, WSN and CPS often relies on underlying technologies such as real-time computing, machine learning, security, privacy, signal processing, big data, and others.Greater interactions among these communities will speed progress[1]

## 1. Digital India

Now a days everyone is speak and aware about the concept call as smart city but basically that concept is come from the historical speech of 15 aug 2014 by our honorable prime minister he said

**" I stand before you not as Prime Minister but Prime servant"**
**" I tell the world - Come, Manufacture in India. We have the skill and talent"**
**" Digital India "e-governance is easy governance, efficient governance, and that is important"**

And along with these he also given some policies for the sec of implementation of the concept call as digital India policies are in Fig 1.

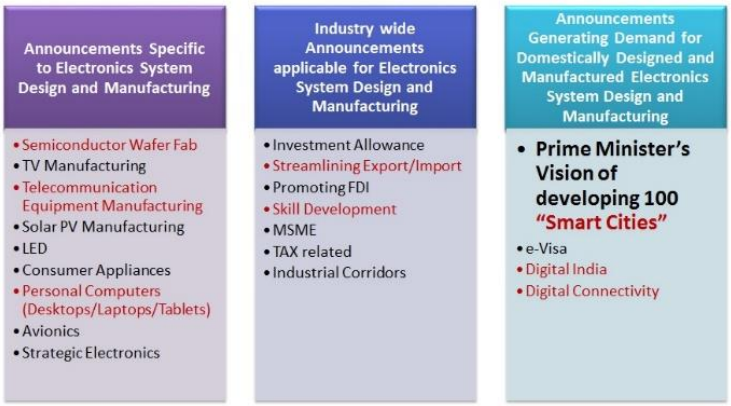


**Fig 1: Government policies**

Depend on these policies government decided so many things and taken so many steps towards reaching to the goal call as digital India and in that one concept or one example of digital India is smart city which is very big application of the digital India concept.

Smart city means not only people or citizens are smart but it means everything will be smart from living things to non living things and when that will be happened or comes in existence then we will able to say that the smart city and that will happened only in one condition if communication will be in proper manner or we can say if everything is talkative and able to communicate with each other and that communication is possible in living things but challenge will be comes when it comes to the non living things and hear the concept of IOT comes in existences.

## 2. Internet Of Things(IOT)

Everyone is aware about the word known as Internet. internet is not a computer network it a network of network and from this term next term is get evaluate and it is known as Internet of things officially so many definitions are given by different researchers and different organization but meaning of all definition is like making the connectivity of every indivigwal object it may be living object or non living object if every object is interlinking with each other then we are able to go beyond the IOT that is internet of things and able to say that Internet Of Everything (IOE)

### 2.1 Types of Services

There are an exceptional number of applications that can make use of the Internet of Things, from home and office automation to production line and retail product tracking. The number of applications is endless. For each application, a particular IoT service can be applied in order to optimize application development and speed up application implementation. Note that the categorizations that follow come from [3].

#### 2.1.1. Identity-Related Services

Identity-related services can be divided into two categories, active and passive, and can serve either individuals or enterprise, which can lead to a number of different kinds of applications. The general identity-related service consists of two major components: 1) the things, all of which are equipped with some kind of identification identifier, such as an RFID tag; and 2) the read device(s), which read the identity of the thing based on its label, in this case reading the information encoded into the RFID tag. The read de vice would then make a request to the name resolution server to access more detailed information about that particular device. Active identity-related services are services that broadcast information, and are usually associated with having constant power, or at least under battery power. Passive identity-related services are services that have no power source and require some external device or mechanism in order to pass on its identity. For example, an active RFID tag is battery powered and can transmit signals once an external source has been identified. A passive RFID tag, on the other hand, has no batteries, and requires an external

electromagnetic field in order to initiate a signal transmission. In general, active identity services can transmit or actively send their information to another device, whereas passive services must be read from.

### 2.1.2. Information Aggregation Services

Information aggregation services refer to the process of acquiring data from various sensors, processing the data, and transmitting and reporting that data via IoT to the application. These types of services can be thought of, more or less, as one way: information is collected and sent via the network to the application for processing. Information aggregation services do not have to implement a single type of communication channel in order to work together. With the use of access gateways (Figure 1), an information aggregation service could make use of different types of sensors and network devices and share their data via a common service to the application. For example, an application could make use of RFID tags to be aware of the identity of some devices, while also using a ZigBee network to collect data from sensors, then use a gateway device to relay this information to the application under the same service, say a Web Service such as JSON or XML. Not only would this allow a developer of an application to incorporate a number of different technologies into the application, but it could also allow the application to access various IT and enterprise services that may already be in place.

### 2.1.3. Collaborative-Aware Services

Collaborative aware services are services that use aggregated data to make decisions, and based on those decisions perform an action. As IoT takes shape, it should bring about the development of complicated services that make use of all of the data that can be retrieved from the extensive network of sensors. This will require not only being able to retrieve information, but to relay back responses to the collected information to perform actions. These services will thus require "terminal-to-terminal" as well as "terminal-to-person" communication. By providing collaborative aware services, the IoT infrastructure naturally requires greater reliability and speed, and will require the terminals to either have more processing power or be linked with some other device that does.

### 2.1.4. Ubiquitous Services

Ubiquitous services are the epitome of the Internet of Things. A ubiquitous service would not only be a collaborative aware service, but it would be a collaborative aware service for everyone, everything, at all times. In order for IoT to reach the level of providing ubiquitous services, it would have to overcome the barrier of protocol distinctions amongst technologies and unify every aspect of the network. There is no particular system architecture for the Internet of Things, but there have been numerous papers written about the use of Web Services or REST (representational state transfer) APIs (application programming interfaces) to unite loosely coupled things on the Internet under a single application so that they can be reused and shared. IPv6 is also a protocol that could greatly benefit the increase in ubiquitous services. Reference [4] proposes such an architecture that, if implemented, would be considered a ubiquitous service

## 2.2 challenges

- Who assigns the identifier to a thing? (the assigning authority)
- How is a thing identification structured? (the object naming)
- How and where can additional information about that thing be retrieved, including its history? (the addressing mechanism and the information repository)
- How is information security/privacy/trust/safety ensured?
- Which stakeholders are accountable for each of the above questions, what is the accountability mechanism?
- Which ethical and legal framework applies to the different stakeholders?
- What are uniform thing naming scheme, communication protocols between various things, thing's data collection, storage, query management, processing, visualization, use, security, privacy.[5]

## 2.3 Trends

Several technology trends will help shape IOT. Here are seven identified macro trends:

- The miniaturization of devices
- Advances in RFID technologies
- Internet protocol version six (ipv6)
- Improvements in communication throughput and latency
- Real-time analytics
- Adoption of cloud technologies and security.

## 2.4 IoT Development tools

There are so many tools available now a days in market for IoT development some of them are as follows [6]

**1. Arduino :**Arduino is both a hardware specification for interactive electronics and a set of software that includes an IDE and the Arduino programming language. The website explains that Arduino is "a tool for making computers than can sense and control more of the physical world than your desktop computer." The organization behind it offers a variety of boards, starter kits, robots and related products for sale, and many other groups have used Arduino to build IoT-related hardware and software products of their own.

**2. Eclipse IoT Project:** Eclipse is sponsoring several different projects surrounding IoT. They include application frameworks and services; open source implementations of IoT protocols, including MQTT CoAP, OMA-DM and OMA LWM2M; and tools for working with Lua, which Eclipse is promoting as an ideal IoT programming language. Eclipse-related projects include Mihini, Koneki and Paho. The website also includes sandbox environments for experimenting with the tools and a live demo.

**3. Kinoma :** Owned by Marvell, the Kinoma software platform encompasses three different open source projects. Kimona Create is a DIY construction kit for prototyping electronic devices. Kimona Studio is the development environment that works with Create and the Kinoma Platform Runtime. Kimona Connect is a free iOS and Android app that links smartphones and tables with IoT devices.

**4. M2MLabs Mainspring :** Designed for building remote monitoring, fleet management and smart grid applications, Mainspring is an open source framework for developing M2M applications. It capabilities include flexible modeling of devices, device configuration, communication between devices and applications, validation and normalization of data, long-term data storage, and data retrieval functions. It's based on Java and the Apache Cassandra NoSQL database.

**5. Node-RED:** Built on Node.js, Node-RED describes itself as "a visual tool for wiring the Internet of Things." It allows developers to connect devices, services and APIs together using a browser-based flow editor. It can run on Raspberry Pi, and more than 60,000 modules are available to extend its capabilities.

**6. Arduino Yún:** This microcontroller combines the ease of an Arduino-based board with Linux. It includes two processors—the ATmega32u4 (which supports Arduino) and the Atheros AR9331 (which runs Linux). Other features include Wi-Fi, Ethenet support, a USB port, micro-SD card slot, three reset buttons and more. They are available for purchase from the Arduino website.

**7. BeagleBoard:** BeagleBoard offers credit-card sized computers that can run Android and Linux. Because they have very low power requirements, they're a good option for IoT devices. Both the hardware designs and the software they run are open source, and BeagleBoard hardware (often sold under the name BeagleBone) is available through a wide variety of distributors.

**8. Flutter:** Flutter's claim to fame is its long range. This Arduino-based board has a wireless transmitter that can reach more than a half mile. Plus, you don't need a router; flutter boards can communicate with each other directly. It includes 256-bit AES encryption, and it's easy to use. Both the hardware and the software are completely open source, and the price for a basic board is just $20

## Conclusion:

Though we have so many tools and techniques and technological trend for implementation of the IOT for the purposed of the digital India then also its not up to the mark and so lot of scope for evaluation/research and depend on that able to achieved the Dream India.

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# Social Engineering

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## Abstract:

*Social engineering is a non-technical method of intrusion hackers use that relies heavily on human interaction and often involves tricking people into breaking normal security procedures. It is one of the greatest threats that organizations today encounter. It is the art of Convincing people to reveal Confidential Information's. Social engineering depends on the fact that people are unaware of their valuable information and are careless about protecting it.*

**Keywords:** *Threats, Rebecca and Jessica, Shoulder Surfing, Eavesdropping, Dumpster-Driving, phishing.*

## Introduction:

***" There is no patch to Human Stupidity"***

Human Nature Trust is the Basis of any social engineering Attack. Ignorance about social engineering and its effects among the workforce makes the organization an easy target .it is difficult to detect social engineering attempts. There is no specific software and hardware for defending against a social engineering attack. Social engineering is the art of manipulating people so they give up confidential information. The types of information these criminals are seeking can vary, but when individuals are targeted the criminals are usually trying to trick you into giving them your passwords or bank Credentials, card details, Company's information's or access your computer to secretly install malicious software–that will give them access to your passwords and bank information as well as giving them control over your computer. Criminals use social engineering tactics because it is usually easier to exploit your natural inclination to trust than it is to discover ways to hack your software. For example, it is much easier to fool someone into giving you their password than it is for you to try hacking their password. Security is all about knowing who and what to trust. Knowing when, and when not to, to take a person at their word; when to trust that the person you are communicating with is indeed the person you think you are communicating with; when to trust that a website is or isn't legitimate; when to trust that the person on the phone is or isn't legitimate; when providing your information is or isn't a good idea. Ask any security professional and they will tell you that the weakest link in the security chain is the human who accepts a person or scenario at face value. It doesn't matter how many locks and deadbolts are on your doors and windows, or if have guard dogs, alarm systems, floodlights, fences with barbed wire, and armed security personnel; if you trust the person at the gate who says he is the pizza delivery guy and you let him in without first checking to see if he is legitimate you are completely exposed to whatever risk he represents.

**Phases in Social Engineering :**

-Research on target Company (Dumpster Driving, websites, employees, tour Company, etc….)
-Select Victim (Identify the frustrated employees of the target company)
-Develop Relationship (Develop relationship with the employee or the target)
-Exploit the Relationship (Collect sensitive account information, financial information's, and current technologies)

- **Impact on organization :**

-Economic Loss
-Loss of Privacy
-Damage of goodwill
-Temporary or Permanent Closure
-Lawsuits and Arbitrations

- **social engineering attacks types :**

**Online** – Internet connectivity enables attackers to approach targets from an anonymous Internet sources and persuade them to provide information through a believable user.
Examples – fake online pop-ups and add, Phishing attacks, SMS etc are the common examples of online attacks.
**Telephone –** Request information, usually through the imitation of a legitimate user, either to access the telephone system itself or to gain remote access to computer system.
Examples - hi I am john brown. I'm with the external auditors Arthur Sanderson. We've been told by corporate to do a surprise inspection of your disaster recovery procedures. Your department has 10 mins to show me how you would recover from a website crash.
**Personal Approaches -** In personal approaches, attackers get information by directly asking for it.

- **Shoulder Surfing :**

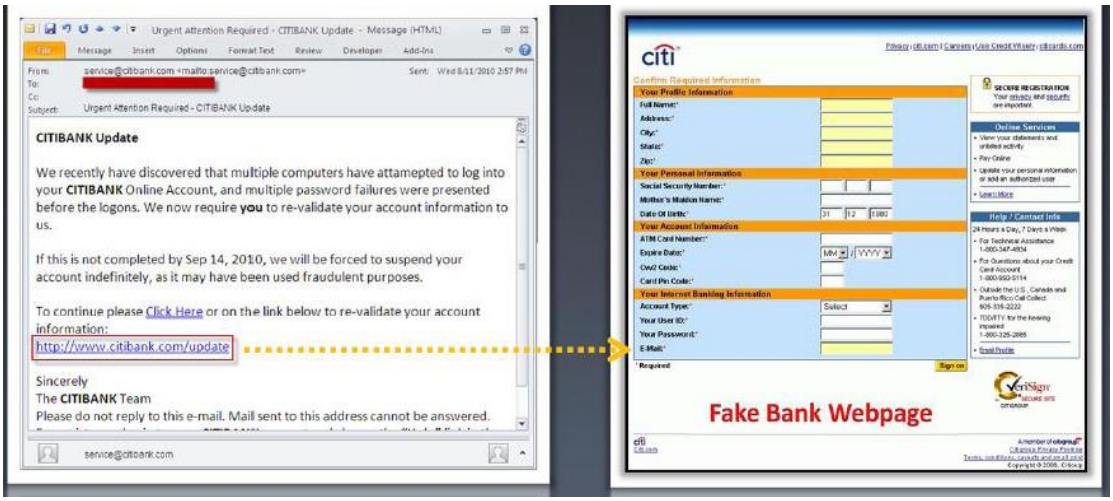
Shoulder Surfing is a name given to a procedure that thieves use to find out passwords, personal identification number, account numbers etc…
Thieves look over your shoulder—or even watch from a distance using binoculars etc in order to get those pieces of information.

- **Dumpster-Driving :**

Dumpster-Driving is looking for treasure in someone else's trash. Like phone-bills, mail boxes, sticky notes, contact information's etc.

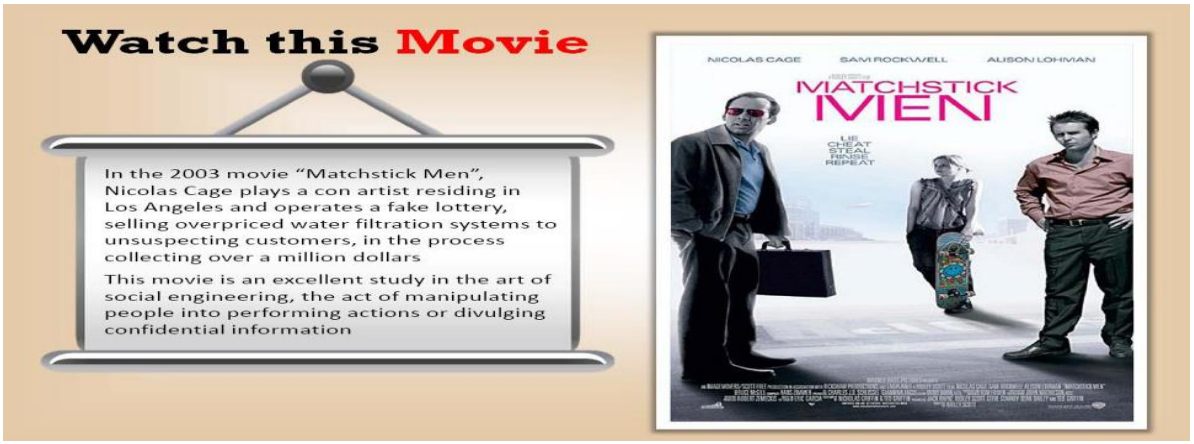

- **Phishing *:***

An illegitimate email falsely claiming to be from a legitimate site attempts to acquire the user's personal or account information. Phishing emails or pop-ups redirect users to fake WebPages of mimicking trustworthy sites that ask them to submit their personal information.




- **Rebecca and Jessica :**
  Attackers use the term "Rebecca" and "Jessica" to denote social engineering victims. Rebecca and Jessica means a person who is an easy target for social engineering, such as the receptionist of the company.
  Example:
  -"There was a Rebecca at the bank and I'm going to call her to extract the privileged information"
  -"I met Ms. Jessica, she was an easy victim for the social engineering.
  -"Do you have a Rebecca in your company?."

**Movie Example:-**




- ***Precautions:***
  - **Slow down.** Spammers want you to act first and think later. If the message conveys a sense of urgency, or uses high-pressure sales tactics be skeptical; never let their urgency influence your careful review.
  - **Don't let a link in control of where you land.** Stay in control by finding the website yourself using a search engine to be sure you land where you intend to land. Hovering over links in email will show the actual URL at the bottom, but a good fake can still steer you wrong.
  - **Delete any request for financial information or passwords.** If you get asked to reply to a message with personal information, it's a scam. Crosscheck it and then take the action.

- **Foreign offers are fake**. If you receive email from a foreign lottery or sweepstakes, money from an unknown relative, or requests to transfer funds from a foreign country for a share of the money it is guaranteed to be a scam.
- **Secure your computing devices.** Install anti-virus software, firewalls, email filters and keep these up-to-date. Set your operating system to automatically update, and if your Smartphone doesn't automatically update, manually update it whenever you receive a notice to do so. Use an anti-phishing tool offered by your web browser or third party to alert you to risks.

## Conclusion:

If u think technology can solve your security problems, then you don't understand the problems and you don't understand the technology. So **Don't become a victim and Be Safe.**

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# Strategic Alignment of Talent Management to Software Project Management is the Key to Project Success

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## ABSTRACT:

*Talent management is an emerging discipline that promises to capitalize on organizations' resources. This systematic review identifies empirical studies of talent management initiatives in software project management. If we adopt Talent management in nutshell, create an asset which can be used at different knowledge areas in software project management. Our model shows the strategic alignment of talent management with project management knowledge areas. This alignment assures improvement in performance and minimization in risk, which is the key to project success. The organization which adopts talent management as an umbrella activity will cultivate their talent asset.*

## KEYWORDS:

*Talent Management, Software Project Management (SPM)*

## INTRODUCTION:

People are the best resources of an organization. Sourcing the best people from the industry has become the top most priority of the organizations today. In such a competitive scenario, talent management has become the key strategy to identify and filling the skill gap in a company by recruiting the high-worth individuals from the industry. It is a never-ending process that starts from targeting people. The process regulates the entry and exit of talented people in an organization. To sustain and stay ahead in business, talent management cannot be ignored. Three critical project management skillsets needed for Successful projects are: technical project management skills, Leadership skills and strategic and business management Skills. These skillsets are essential for Project managers, HR Managers, Business Managers and Top Management. The software project management process aligned with talent management process will lead to project success and finally organization success.

## OBJECTIVE OF THE RESEARCH

To show importance of talent management in software project management for making project successful.

## RESEARCH METHODOLOGY

Methodology used in this research is review. Data is collected from the secondary resources like, books, magazine, journals, websites, which cited in the references.

## SOFTWARE PROJECT MANAGEMENT

Project management is "the application of knowledge, skills tools and techniques to project activities to meet project requirements." [3]

### Project Management Knowledge Areas [3]:

**1. Project Scope management** involves defining and managing all work required to complete the project successfully.
**2. Project time management** includes estimating how long it will take to complete the work, developing an acceptable project schedule, and ensuring timely completion of the project.
**3. Project cost management** consists of preparing and managing the budget for the project.
**4. Project quality management** ensures that the project will satisfy the stated or implied needs for which it was undertaken.
**5. Project Human Resource management** is concerned with making effective use of the people involved with project.
**6. Project Communications management** involves generating, collecting, disseminating and storing project information.
**7. Project Risk management** includes identifying, analyzing and responding to risks related to the project.
**8. Project procurement management** involves acquiring or procuring goods and services for a project from outside the performing organization.

## TALENT MANAGEMENT

Talent management is a driver of organizational success an organization's ability to meet project goals, timelines and budgets significantly impacts its ability to flourish [1].

In order to understand the concept better, let us discuss the **stages included in talent management process [2]:**

- **Understanding the Requirement:** It is the preparatory stage and plays a crucial role in success of the whole process. The main objective is to determine the requirement of talent. The main activities of this stage are developing job description and job specifications.
- **Sourcing the Talent:** This is the second stage of talent management process that involves targeting the best talent of the industry. Searching for people according to the requirement is the main activity.
- **Attracting the Talent:** it is important to attract the talented people to work with you as the whole process revolves around this only. After all the main aim of talent management process is to hire the best people from the industry.
- **Recruiting the Talent:** The actual process of hiring starts from here. This is the stage when people are invited to join the organization.
- **Selecting the Talent:** This involves meeting with different people having same or different qualifications and skill sets as mentioned in job description. Candidates who qualify this round are invited to join the organization.
- **Training and Development:** After recruiting the best people, they are trained and developed to get the desired output.
- **Retention:** Certainly, it is the sole purpose of talent management process. Hiring them does not serve the purpose completely. Retention depends on various factors such as pay package, job specification, challenges involved in a job, designation, personal development of an employee, recognition, culture and the fit between job and talent.

- **Promotion:** No one can work in an organization at the same designation with same job responsibilities. Job enrichment plays an important role.
- **Competency Mapping:** Assessing employees' skills, development, ability and competency is the next step. If required, also focus on behaviour, attitude, knowledge and future possibilities of improvement. It gives you a brief idea if the person is fir for promoting further.
- **Performance Appraisal:** Measuring the actual performance of an employee is necessary to identify his or her true potential. It is to check whether the person can be loaded with extra responsibilities or not.
- **Career Planning:** If the individual can handle the work pressure and extra responsibilities well, the management needs to plan his or her career so that he or she feels rewarded. It is good to recognize their efforts to retain them for a longer period of time.
- **Succession Planning:** Succession planning is all about who will replace whom in near future. The employee who has given his best to the organization and has been serving it for a very long time definitely deserves to hold the top position. Management needs to plan about when and how succession will take place.
- **Exit:** The process ends when an individual gets retired or is no more a part of the organization.

## FINDINGS:

In Software Project Development Major Resources are human capital. Sourcing the best people from the industry has become the top most priority of the organizations today. Three critical project management skillsets needed for successful projects are technical project management skills, leadership skills, and strategic and business management skills. Talent management process is responsible for providing skillful resources in right time for right position.

These resources are available in Talent Pool coming from Internal Talent or External Talent. Talent management job is to find right person for the pivotal position from the talent pool.

Talent Management Process applicable for **External Talent** as:

- **Understanding Requirement:** Understand the Job Description for pivotal position. Understand the essential and special skills required for that position.
- **Sourcing the Talent:** After understanding job description search the talent from all the resources available to us and apply specific recruiting process.
- **Recruiting the Talent:** Apply the specific recruitment process for testing the skills required for that. Use specific interviewing technique and expert as an interviewer.
- **Selecting the Talent:** Select best suitable talent for pivotal positon. As per the Job Requirement it should be available to specific team on specific time.
- **Training and Development:** After selecting talent if job description and project need special training, provide training for the selected talents which should be effectively used for improving performance.

Talent Management process applicable for **Internal Talent** as:

- **Understanding Requirement:** Understand the Job Description for pivotal position. Understand the essential and special skills required for that position.

- **Sourcing the Talent:** After understanding job description search the talent which most appropriate for the pivotal position from Internal Talent pool and apply specific recruiting process.
- **Selecting the Talent:** If there are more internal talent available, select best suitable talent for pivotal positon. Use specific interviewing technique and expert as an interviewer. As per the Job Requirement it should be available to specific team on specific time.
- **Training and Development:** After selecting talent if job description and project need special training, provide training for the selected talents which should be effectively used for improving performance.
- **Retention:** Use effective retention policies for retaining such internal talents so that they will be motivated and concentrate on job. This will help them to improve performance.
- **Promotion:** If internal talent is deserves promotion for fitting into the new pivotal position, give him what he deserves.
- **Competency Mapping:** Assessing employees' skills, development, ability and competency of the internal talent. Also focus on behaviour, attitude, knowledge and future possibilities of improvement. It help us to find that the person is fir for promoting further.
- **Performance Appraisal:** Apply effective performance appraisal Measuring the actual performance of an employee is necessary to identify his or her true potential. It will help us to check whether the person can be loaded with extra responsibilities or not.
- **Career Planning:** The management needs to plan the career if individual can handle the work pressure and extra responsibilities well, so that he or she feels rewarded. It is good to recognize their efforts to retain them for a longer period of time.
- **Succession Planning:** The employee who has given his best to the organization and has been serving it for a very long time definitely deserves to hold the top position. If the talent has the potentials and capabilities he can be considered for replace other talent in near future. If Management plan and execute about when and how succession will take place.

If the organization and Project management process adopt this strategic alignment of talent management to software project management, will be effective for improving performance of the team. This research explores the link between strategic alignments of talent management strategy to software project management. It improves performance and minimizes the risk which leads to project success.

**Greater project success rates ➞ Lesser the Project at risk**

**Fig 1 : Project management : New Knowledge Areas**

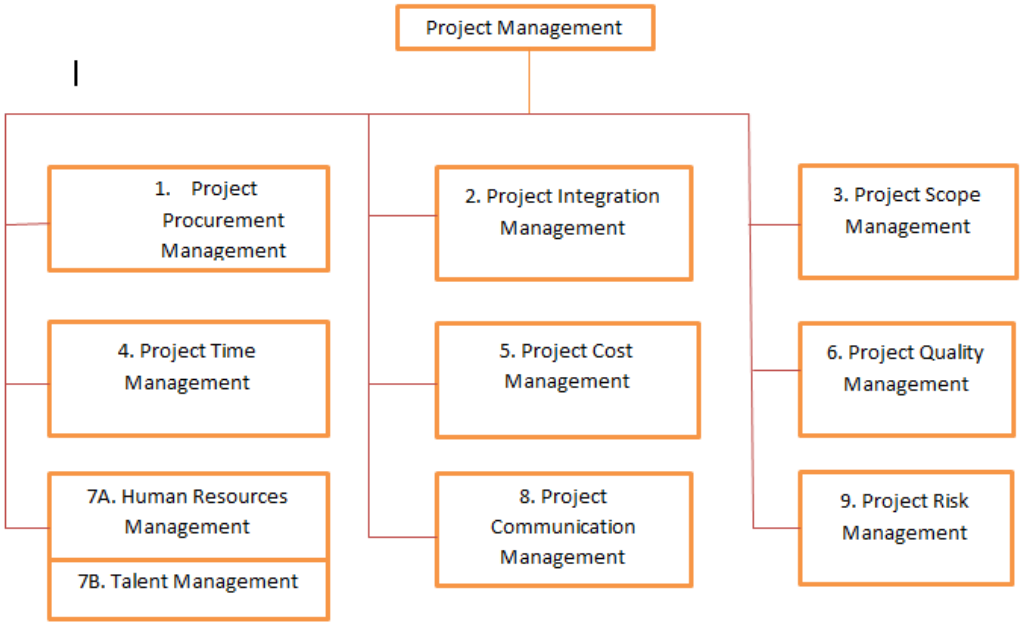
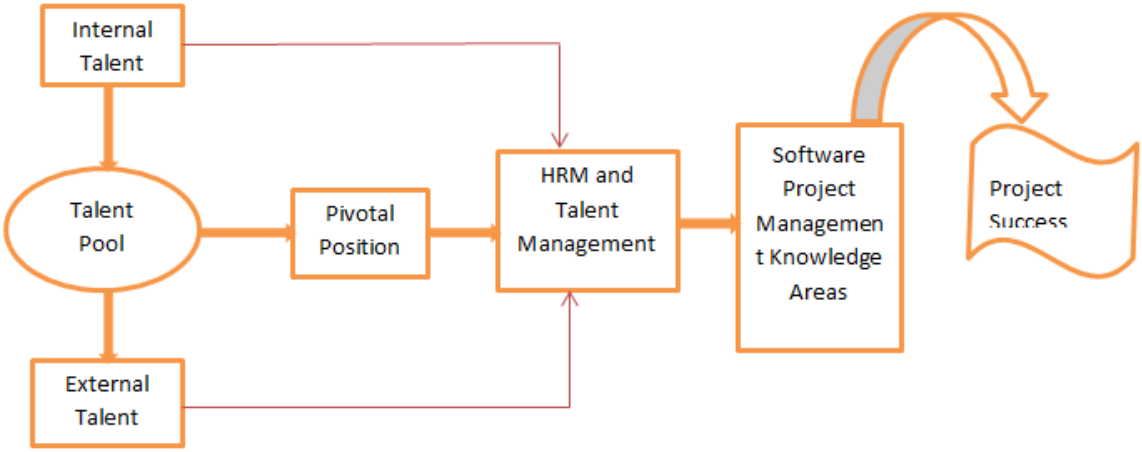



**Fig 2: Strategic Alignment of Talent management**



## CONCLUSION:

In this paper, the talent management process and Software management knowledge areas are studied. The talent management activities are added with HRM basic activities.

If we adopt Talent management, create an asset which can be used at different knowledge areas in software project management. Our model fig: 2 shows the strategic alignment of talent management with project management knowledge areas. This alignment assures improvement in performance and minimization in risk, which is the key to project success. The organization which adopts talent management as an umbrella activity will cultivate their asset.

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# An Improved Round Robin based CPU Scheduling Algorithm with Dynamic Time Quantum

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**Abstract:**

*The Round Robin CPU Scheduling Algorithm is most popular and widely used algorithm which gives equal chance to all processes for execution. The main factor of Round Robin algorithm is time quantum. The performance of Round Robin algorithm is based on size of time quantum. This paper introduces a new algorithm which minimizes the waiting time and turnaround time as compared with Round Robin. This paper also presents the comparative analysis of Round Robin algorithm and proposed algorithm.*

**Keywords:** *cpu scheduling, round robin algorithm, time quantum, waiting time, turnaround time, context switch*

## Introduction:

CPU scheduling is the basis of multiprogramming operating system. The objective of multiprogramming is to have some process running at all times, to maximize CPU utilization. The concept of multiprogramming suggests that use time productively. Several processes are kept in memory at one time. When one process has to wait, the operating system takes the CPU away from that process and gives the CPU to another process. This pattern continues. Every time one process has to wait, another process can take over use of the CPU. Scheduling of this kind is a fundamental operating-system function. Almost all computer resources are scheduled before use. The CPU is, of course, one of the primary computer resources. Thus, its scheduling is central to operating-system design.

### CPU scheduling Algorithms :

- **FCFS (First Come, First Serve) CPU Scheduling:** In this scheduling the process that request the CPU first is allocated to CPU first.
- **SJF (Shortest Job First) CPU Scheduling :**In this scheduling the process with the shortest CPU burst time is allocated to CPU first.
- **Priority Scheduling:** In this scheduling the process with high priority is allocated to CPU first.
- **Round Robin Scheduling :**RR scheduling is used in timesharing systems. It is same as FCFS scheduling with preemption is added to switch between processes. A staticTime Quantum (TQ) is used in this CPU Scheduling.

### Scheduling Criteria's :

Many criteria's have been suggested for computing CPU scheduling algorithm that judge which algorithm is best. The criteria's include the following :-

- **CPU utilization :** It is defined as the fraction of time cpu is in use. Usually, the maximize the CPU utilization is the goal of the CPU scheduling
- **Throughput**. If the CPU is busy executing processes, then work is being done. One measure of work is the number of processes that are completed per time unit, called

throughput. For long processes, this rate may be one process per hour; for short transactions, it may be ten processes per second.

- **Turnaround time**. From the point of view of a particular process, the important criterion is how long it takes to execute that process. The interval from the time of submission of a process to the time of completion is the turnaround time. Turnaround time is the sum of the periods spent waiting to get into memory, waiting in the ready queue, executing on the CPU, and doing I/0.
- **Waiting time:** The CPU-scheduling algorithm does not affect the amount of time during which a process executes or does I/0; it affects only the amount of time that a process spends waiting in the ready queue. Waiting time is the sum of the periods spent waiting in the ready queue
- **Response time:** Response time is the time from the submission of a request until the first response is produced.

**Round Robin CPU Scheduling Algorithm :**

The performance of the RR algorithm depends heavily on the size of the time quantum. At one extreme, if the time quantum is extremely large, the RR policy is the same as the FCFS policy. In contrast, if the time quantum is extremely small (say, 1 millisecond), the RR approach is called processor sharing

**Proposed Algorithm (RRDTQ) :**

The RRDTQ is based on selecting the size of Time Quantum as average of burst time of the processes present in ready queue. RRDTQ first sort the process according to burst time and execute it in sorted order**.** In this way one execution cycle will get completed. Then for the next cycle , Time Quantum is calculated as average of remaining burst time of all processes present in ready queue. The same mechanism is continued till the end of execution of all the processes.

**Algorithm:**

Step 1: Start

Step 2: Processes enter in ready queue.

Step 3: Sort the processes in ascending order to the burst time.

Step 4: Count the number of processes in ready queue.

Step 5: If count > 1 then Time Quantum = Average (Burst Time of all the processes) go to 7 otherwise go to step 6.

Step 6: If Burst Time of Process < 5 then Time Quantum = Burst Time of Process otherwise Time Quantum = Burst Time/2

Step 7: Complete the execution cycle of all processes in ready queue.

Step 8: When all processes of ready queue are finished their execution then go to step 9 otherwise go to step 2.

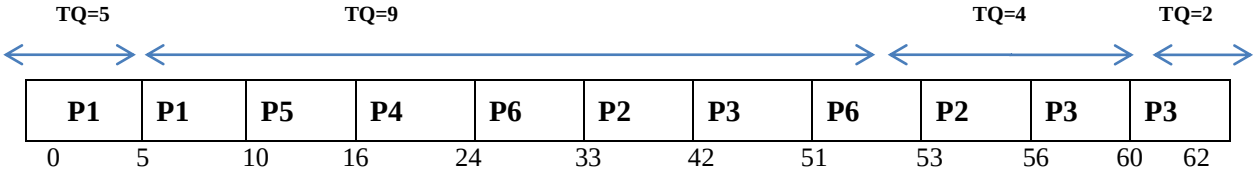
Step 9 : END.

**Experimental Analysis:**

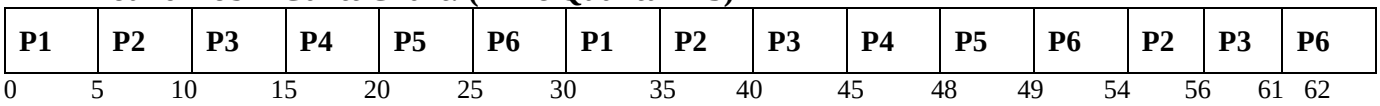
**Example 1**

| Process | Burst Time | Arrival Time |
|---|---|---|
| P1 | 10 | 0 |
| P2 | 12 | 1 |
| P3 | 15 | 2 |
| P4 | 8 | 4 |
| P5 | 6 | 5 |
| P6 | 11 | 6 |

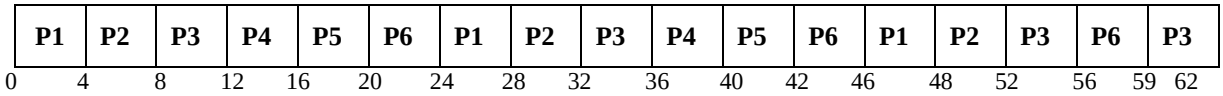
**RRDTQ Gantt Chart:**



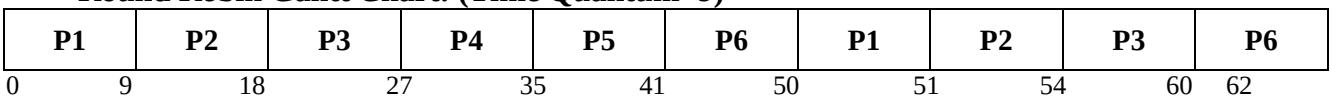

**Round Robin Gantt Chart: (Time Quantum=5)**




**Round Robin Gantt Chart: (Time Quantum=4)**



**Round Robin Gantt Chart: (Time Quantum=9)**



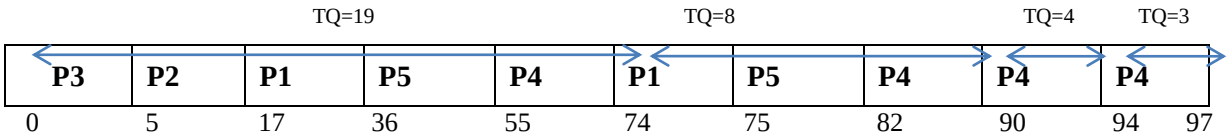

**Comparative Analysis of RRDTQ and RR CPU scheduling Algorithm for Example 1 :**

| Algorithm | Average Waiting Time(WT) | Average Turnaround Time(TAT) |
|---|---|---|
| RRDTQ | 23.5 | 33.83 |
| RR (TQ=5) | 38.5 | 48.83 |
| RR (TQ=4) | 37.16 | 47.5 |
| RR (TQ=9) | 37.66 | 48 |

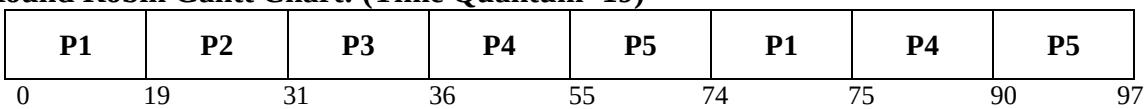
**Example 2**

| Process | Burst Time | Arrival Time |
|---|---|---|
| **P1** | **20** | **0** |
| **P2** | **12** | **0** |
| **P3** | **5** | **0** |
| **P4** | **34** | **0** |
| **P5** | **26** | **0** |

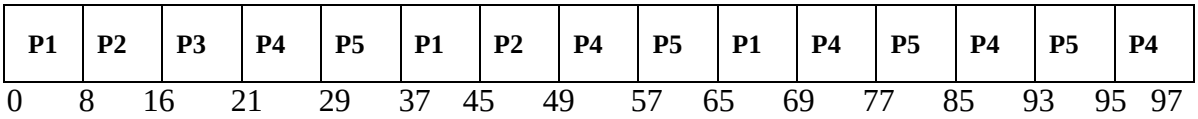
**RRDTQ Gantt Chart:**




**Round Robin Gantt Chart: (Time Quantum=19)**



**Round Robin Gantt Chart: (Time Quantum=8)**




**Comparative Analysis of RRDTQ and RR CPU scheduling Algorithm Example 2:**

| Algorithm | Average Waiting Time(WT) | Average Turnaround Time(TAT) |
|---|---|---|
| RRDTQ | 35.8 | 55.2 |
| RR (TQ=19) | 46.4 | 65.8 |
| RR (TQ=8) | 46.8 | 66.2 |

**Conclusion:**

From the comparative analysis of both the algorithm i.e Simple Round robin and RRDTQ, it is concluded that the proposed algorithm i.e RRDTQ is more efficient because it gives less average waiting time and average Turnaround Time as compared to simple Round Robin. Also it reduces the problem of starvation as the processes with less remaining CPU burst time are assigned with the higher priorities.

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# DESIGNING OF REMOTE FOOD ORDERING SYSTEM USING ANDROID BASED APPLICATION

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## Abstract:

*With rapid increase in the use of mobile phones, the desire for people to access mobile internet to get information and services from anywhere and everywhere has increased. There is an increase in number of restaurants and restaurant-goers which necessitates enhancement of the hospitality industry.*

*This research work aims to design a remote food ordering system, through which one can order food before visiting a restaurant, book table, and also make payment.*

*The android application on user's mobile will have all the menu details. The order details from customer's mobile are wirelessly updated in central database and subsequently sent to kitchen and cashier respectively. The restaurant manager can manage the menu modifications easily. The wireless application on mobile devices provide a means of convenience, improving efficiency and accuracy for restaurants by saving time, reducing human errors and real-time customer feedback. This proposed system would over comes the drawbacks in earlier PDA based food ordering system and is less expensive and more effective.*

**Keywords:** *Remote ordering, Automated food ordering system, Android application, Wi-Fi, PDA.*

## Introduction

In hospitality industry such as restaurants can be improved with the combination of wireless and mobile technologies. The competition in restaurant business is increased with the advancements in food ordering techniques. The prior food ordering system was entirely a manual process which involved waiters, pen and paper. The waiter had to note down orders from customers, take these orders to kitchen, update them in records and again make bill. Even though this system is simple it may involve human errors in noting down the orders. To rise above these limitations in labor-intensive traditional system some systems were developed later like PDA based systems to automate food ordering process.

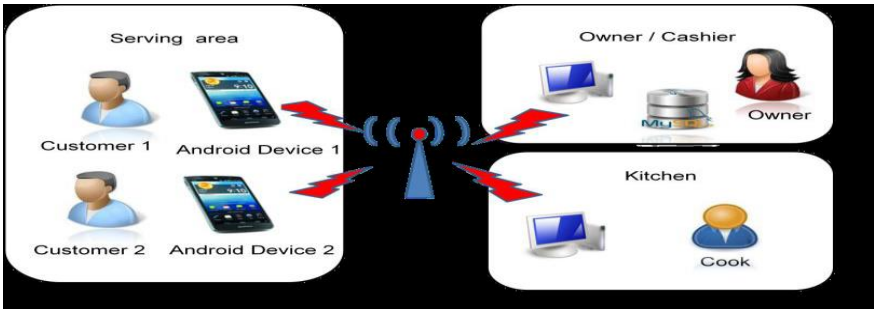


**Figure 1: System Modules**

The proposed system comprises of three different applications. The first application is implemented on customer's mobile device. Through this application, customer can search for restaurants based on a particular dish, vicinity, price, quality of food, or previous customers' reviews. After choosing a restaurant, customer can view a digital menu. After confirming the order, customer can proceed to payment. Customers can also book tables beforehand. Customers are given the facility to register themselves. Upon registering, the customer gets to have a profile of his own, with the help of which customer can record his previous transactions, and also provide feedback in the form of rating, and also personalize his account.

The second application is used by the kitchen units of various restaurants. Kitchen staff can view details of current orders, closed orders and table numbers. When a customer completes payment to a particular restaurant, all the information is sent to the central database.

The third application is used by the managers of various restaurants. Manager is the person who controls every move in a restaurant. Manager is sent notifications when a customer places order and makes payment to a particular restaurant. Manager can also update the menu, provided there have been any changes in the dishes, quantity, or prices.

## Literature Review

**Traditional paper-based system:**

One of the widely used food ordering schemes is the traditional paper based system. In this system all records are stored on paper. The main drawback of this system is papers can get easily lost or damaged. There is also wastage of money, time and paper. Paper-based systems do not provide any form of dynamicity. Even a small change requires the entire menu-card to be re-printed. Since large manpower is required, this system is error-prone and is time consuming from a customer's point of view.

**Personal Digital Assistant (PDA):**

When new technologies and approaches being introduced to automate the food ordering process a number of wireless systems like WOS, i-menu, FIWOS were developed. All these systems were PDA- based. The feature of PDA systems was that customers or waiters key in ordering process. There was easy communication between the PDA's and server due to wireless technology.

But this system also had several drawbacks. PDA-based system increased the restaurants expenditures as many PDA's were required during peak hours. PDA systems also did not provide any real time feedback from customers. Menu cards in the PDA's were unattractive and uninformative as it did not support images.

**Limitations in PDA based Order Processing Systems**

Even though the PDA based system provided a better option to conventional food ordering system they possess some limitations:

1. A number of PDAs are to be prepared to serve the number of customers during peak hours. Causes increase in the restaurant expenditures.
2. PDAs do not provide provision to order from workplace. Thus the customer has to be physically present in restaurant to place order.
3. It lacks real time feedback between restaurant owner and customers.
4. Pose health problems as the PDAs are to be shared with public customers. If any customer is suffering from infectious disease like flu, then the other customers using the same PDA are exposed to similar health hazards.

5. The user interface consist only textual information. UI has become unattractive and uninformative due to lack of images.

## Proposed Work

To overcome the limitations of above system, we proposed this remote ordering system based on android technology. It is a wireless food ordering system using android devices. Android devices have gained immense popularity and have revolutionized the use of mobile technology in the automation of routine task in wireless environment. Android is a Linux based operating system for mobile devices such as smart-phones and tablets. Considering the promising future of Android market, it is beneficial and worth to write applications for android that target masses of people.

## The Objectives of our proposed system are:

- To combine Wireless technology and Android OS to automate food ordering process.
- To minimize the flaws in conventional system by atomizing the working of a restaurant.
- To make provisions for obtaining feed-back from the customers and provide the restaurant a means of review of their service
- To triumph over the limitation in PDA based system we proposed an automated food ordering system for restaurants using android devices. Android smart phones attract both the general and commercial users.

## Solution to PDA based System:

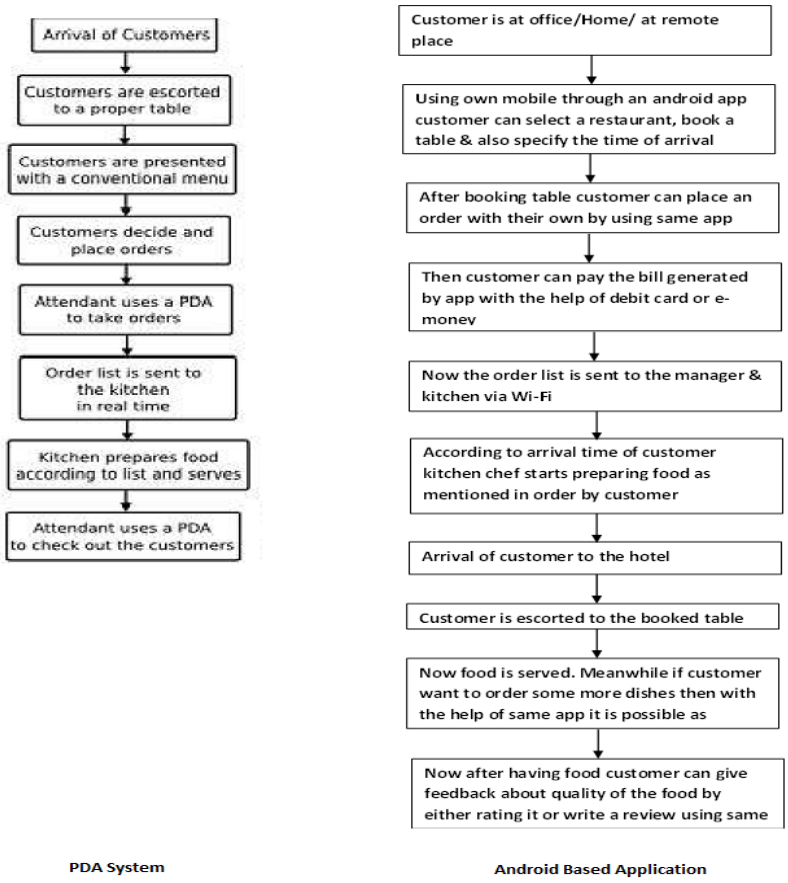


**Figure 2: Comparison of Food Ordering System using PDA and Android based Application**

**Working of Proposed Android based Remote Food Ordering System**:

We proposed to build an application that efficiently handle and manage various activities of restaurants. Currently in restaurants, customer places order to waiter and then waiter assign this order to respective cook. So every restaurant needs an employee for taking the order and processing the payment. Labor rates are increasing every now and then and it is difficult to find employees in the middle of the highway, hence to solve this problem we plan to design an application. This application will be equipped with a user-friendly screen and complete the order process. When the customer is at remote location he will place his order with the help of the android application Customer will select from the food options according to choice and the system will display the payment amount he has to make.

This system will provide service facility to restaurant and also to the customer. The services provided by the system will include food ordering, customer information management and restaurant information management, menu information management etc.

After the order is built and read, the user may go ahead and place the order. The staff will automatically and almost instantly be notified about the new order so that they can act on it.

## SYSTEM ARCHITECTURE

The system architecture of Remote Food Ordering using Android App is shown in figure 3:

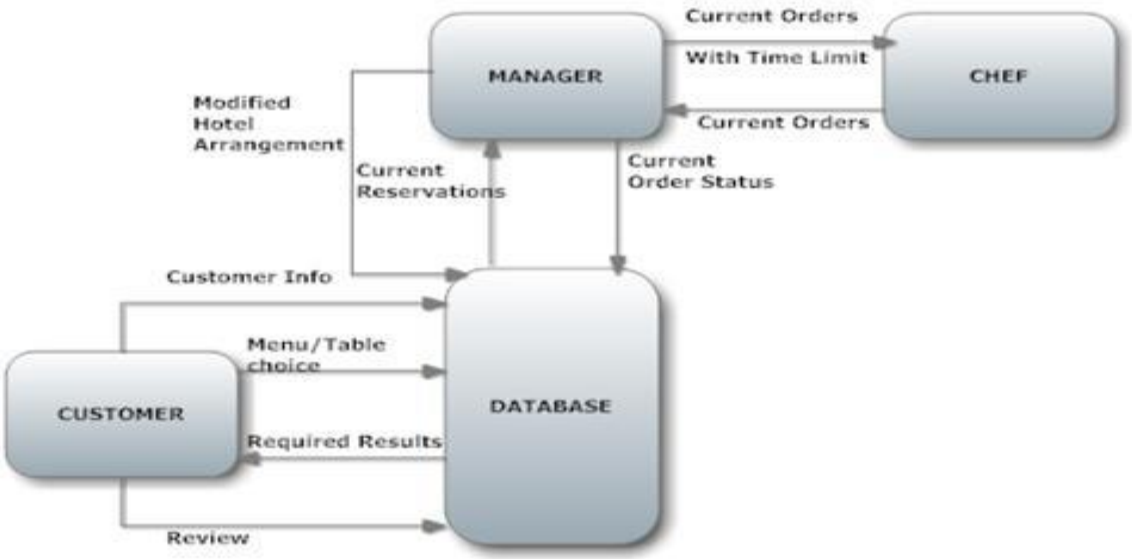


**Figure 3: System Architecture**

The architecture covers the three main modules: the Customer, the Manager, the Kitchen section.

- The android application on the smart phones of customer.
- The server application on the restaurant-manager's mobile or tablet to customize keep track of customer records, table bookings and time required to reach. The central database for restaurant manager to store updated menu information and order details.
- Wireless connectivity between the manager and the kitchen area of restaurant.

## IV. Conclusion

The proposed android based system would attract customers who always have busy schedule, regular customers also and as well as add to the efficiency of maintaining the restaurant's ordering and billing section. This system will be able to store customer's information, restaurant information, menu's information, ordering and reservation information and customer's feedback. This application offers Automated System to make order processing task simple, and keep up to date information. This application will give customer easy to make ordering and reservation table and hopefully can smoothen up the job of administration of restaurant.

## Suggestion

This proposed system requires android based mobile having internet facility. If speed of internet is poor may reduce system efficiency.

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# A Study – Big data analytics Types, tools its Potential and Challenges

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## Abstract:

*This research paper deals with analyzing big data in modern business and government applications requires query languages that allow for the specification of complex data processing tasks. The goal of this paper is to share new opportunities and Challenges of Big Data Analytics This paper also demonstrates the potential value of big data, analytics and keys to success with big data analytics include a clear business need, strong committed sponsorship, alignment between the business and IT strategies, a fact-based decision-making culture, a strong data infrastructure, the right analytical tools, and people skilled in the use of analytics. In this study we will be talking about, Big Data Analytics,itsTypes and Challenges of Big Data Analytics*

**Keywords**: *Big Data, Analytics, Challenges, Tools*

## 1 Introduction:

### 1.0 General Background

"Big Data" originally emerged as a term to describe datasets whose size is beyond the ability of traditional databases to capture, store, manage and analyze. Big Data not only refers to the data itself but also a set of technologies that capture, store, manage and analyze large and variable collections of data to solve complex problems.

Many organizations are collecting, storing, and analyzing massive amounts of data. This data is commonly referred to as “big data” because of its volume, the velocity with which it arrives, and the variety of forms it takes. Big data is creating a new generation of decision support data management. Businesses are recognizing the potential value of this data and are putting the technologies, people, and processes in place to capitalize on the opportunities. A key to deriving value from big data is the use of analytics. Collecting and storing big data creates little value; it is only data infrastructure at this point. It must be analyzed and the results used by decision makers and organizational processes in order to generate value. Big data and analytics are intertwined, but analytics is not new. Many analytic techniques, such as regression analysis, simulation, and machine learning, have been available for many years. Even the value in analyzing unstructured data such as e-mail and documents has been well understood.

The rise of Big Data has been caused by increased data storage capabilities, increased computational processing power, and availability of increased volumes of data, which give organization more data than they have computing resources and technologies to process. The unmanageable large Volume of data poses an immediate challenge to conventional computing environments and requires scalable storage and a distributed strategy to data querying and analysis. However, this large Volume of data is also a major positive feature of Big Data. Many companies,

such as Facebook, Yahoo, Google, already have large amounts of data and have recently begun tapping into its benefits .

Working with the Variety among different data representations in a given repository poses unique challenges with Big Data, which requires Big Data preprocessing of unstructured data in order to extract structured/ordered representations of the data for human and/or downstream consumption. In today's data-intensive technology era, data Velocity – the increasing rate at which data is collected and obtained – is just as important as the Volume and Variety characteristics of Big Data. While the possibility of data loss exists with streaming data if it is generally not immediately processed and analyzed, there is the option to save fast-moving data into bulk storage for batch processing at a later time. However, the practical importance of dealing with Velocity associated with Big Data is the quickness of the feedback loop, that is, process of translating data input into useable information. This is especially important in the case of time-sensitive information processing.

### 1.1 Big Data analytics

Big data analytics is the process of examining large data sets containing a variety of data types to uncover hidden patterns, unknown correlations, market trends, customer preferences and other useful business information. The analytical findings can lead to more effective marketing, new revenue opportunities, better customer service, improved operational efficiency, competitive advantages over rival organizations and other business benefits**.**

The primary goal of big data analytics is to help companies make more informed business decisions by enabling data scientists, predictive modelers and other analytics professionals to analyze large volumes of transaction data, as well as other forms of data that may be untapped by conventional business intelligence(BI) programs. That could include Web server logs and Internet clickstream data, social media content and social network activity reports, text from customer emails and survey responses, mobile-phone call detail records and machine data captured by sensors connected to the Internet of Things.[1]

Big Data Analytics faces a number of challenges beyond those implied by the four Vs. While not meant to be an exhaustive list, some key problem areas include: data quality and validation, data cleansing, feature engineering, high-dimensionality and data reduction, data representations and distributed data sources, data sampling, scalability of algorithms, data visualization, parallel and distributed data processing, real-time analysis and decision making, crowdsourcing and semantic input for improved data analysis, tracing and analyzing data provenance, data discovery and integration, parallel and distributed computing, exploratory data analysis and interpretation, integrating heterogenous data, and developing new models for massive data computation.

**Figure 7: Big Data Analytics Market Size by Business Category**


*Source: Heavy Reading*

## 2.0 Types of Big Data Analytics

It is useful to distinguish between three kinds of analytics because the differences have implications for the technologies and architectures used for big data analytics. Some types of analytics are better performed on some platforms than on others.

### 2.1 Descriptive analytics

This Analytics is at the bottom of the big data value chain, but they can be valuable for uncovering patterns that offer insight. A simple example of descriptive analytics would be assessing credit risk; using past financial performance to predict a customer's likely financial performance. Descriptive analytics can be useful in the sales cycle, for example, to categorize customers by their likely product preferences and sales cycle.

Descriptive analytics such as reporting/OLAP, dashboards/scorecards, and data visualization, have been widely used for some time, and are the core applications of traditional BI. Descriptive analytics are backward looking (like a car's rear view mirror) and reveal what has occurred.[4]

### 2.2 Predictive analytics,

Predictive analytics such as forecasts of future sales, on dashboards/scorecards. Predictive analytics suggest what will occur in the future (like looking through a car's windshield). The methods and algorithms for predictive analytics such as regression analysis, machine learning, and neural networks have existed for some time. Recently, however, software products such as SAS Enterprise Miner have made them much easier to understand and use. They have also been integrated into

specific applications, such as for campaign management. Marketing is the target for many predictive analytics applications; here the goal is to better understand customers and their needs and preferences. Some people also refer to exploratory or discovery analytics, although these are just other names for predictive analytics. When these terms are used, they normally refer to finding relationships in big data that were not previously known. The ability to analyze new data sources that is, big data creates additional opportunities for insights and is especially important for firms with massive amounts of customer data. Golden path analysis is a new and interesting predictive or discovery analytics technique. It involves the analysis of large quantities of behavioral data (i.e., data associated with the activities or actions of people) to identify patterns of events or activities that foretell customer actions such as not renewing a cell phone contract, closing a checking account, or abandoning an electronic shopping cart. When a company can predict a behavior, it can intercede, perhaps with an offer, and possibly change the anticipated behavior. Whereas predictive analytics tells you what will happen.[4]

### 2.3 Prescriptive analytics

Prescriptive analytics suggests what to do (like a car's GPS instructions). Prescriptive analytics can identify optimal solutions, often for the allocation of scarce resources. It, too, has been researched in academia for a long time but is now finding wider use in practice. For example, the use of mathematical programming for revenue management is increasingly common for organizations that have "perishable" goods such as rental cars, hotel rooms, and airline seats. For example, Harrah's Entertainment, a leader in the use of analytics, has been using revenue management for hotel room pricing for many years. Organizations typically move from descriptive to predictive to prescriptive analytics. Another way of describing this progression is: What happened? Why did it happen? What will happen? How can we make it happen? This progression is normally seen in various BI and analytics maturity models.[4]

## 3.0 Big data analytics Tools

### 3.1 PIG

Pig was initially developed at Yahoo Research around 2006 but moved into the Apache Software Foundation in 2007. Pig consists of a language and an execution environment. Pig's language, called as Pig Latin, is a data flow language - this is the kind of language in which you program by

connecting things together. Pig can operate on complex data structures, even those that can have levels of nesting. Unlike SQL, Pig does not require that the data must have a schema, so it is well suited to process the unstructured data. But, Pig can still leverage the value of a schema if you want to supply one. PigLatin is relationally complete like SQL, which means it is at least as powerful as a relational algebra. Turing completeness requires conditional constructs, an infinite memory model, and looping constructs. [2]

### 3.2 HIVE

Hive is a technology developed at Facebook that turns Hadoop into a data warehouse complete with a dialect of SQL for querying. Being a SQL dialect, HiveQL is a declarative language. In PigLatin, you specify the data flow, but in Hive we describe the result we want and Hive figures out how to build a data flow to achieve that result. Unlike Pig, in Hive a schema is required, but you are not limited to only one schema. Like PigLatin and the SQL, HiveQL itself is a relationally complete language but it is not a Turing complete language. It can also be extended through UDFs just like Piglatin to be a Turing complete. Hive is a technology for turning the Hadoop into a data warehouse, complete with SQL dialect for querying it.[2]

## 4.0 Challenges in Big Data analytics

Big data and the analytics that we use to try and understand it are still in their infancy. As big data grows bigger, so too will its importance in our everyday lives – business and personal. But with great opportunity comes great challenges, and there is a host of upcoming obstacles which we must tackle as we seek to unlock the full potential of analytics. Outlined below are the six biggest challenges that analytics will run into in the not so distant future.

### 4.1 Accurate Financial Risk Assessment:

Corporate Performance Management (CPM) programs have now existed for decades, but they still struggle to truly match the complexities of the real world. Financial forecasting must be integrated with better business intelligence and predictive analytics to prove its value proposition. Markets move based on a vastly complicated and interconnected web of causalities pretending that we can accurately model risk with an all-too-static discount rate will, by necessity, become a thing of the past. The pieces to solve this puzzle already exist today, but someone must first connect the dots

between predictive analytics, CPM and a friendly user interface. Blue Hill believes that IBM, SAP, Adaptive Planning, and Board have taken interesting steps in this direction.[3]

### 4.2. Uniting business and analytics in real time

This issue is admittedly more of a design issue than it is a technical one. Analytics capabilities are fast approaching the ability to provide insight at the speed in which businesses demand them. However, there is a mismatch between where businesses need this capability and where they apply the resources to create it. In some instances, data and business intelligence come in faster than employees have a need for it, while other areas that create workflow bottlenecks (such as monthly accounting rollups) still lag behind what is truly useful. As the speed of analytics continues to increase, business will have to keep pace with their efforts at managing data quality and integration as well. Likely this issue will be solved on the analytics side within the next 12 months, but we are still a decade away from a solution on the data management side. Artificial intelligence capable enough to enact quasi-human judgments in identifying data sources based on business relevance is a tall task. But in solving these tasks, Blue Hill is especially intrigued in the visions that Tableau, Informatica, Snaplogic, and Adaptive Planning have unveiled to solve these problems.[3]

### 4.3. Employee Performance Metrics that Actually Matter:

Analytics has the daunting task to accurately measure employee performance without the biases that so often plague employee reviews. An accurate and objective measure of performance and productivity could give rise to more rational insights on an array of matters ranging from compensation to retirement. A major challenge will be of course defining and quantifying the measurements of employee performance. Standardizing such inputs is much harder than the measures of performance that we already use to analyze such things as sports. However, the basic concept of judging performance from objective information isn't too far off base. We are perhaps three to five years away from measuring standardized outputs, but still many more years from meaningfully incorporating less tangible dynamics such as leadership or collaboration into our models. However, HR solutions ranging from Cornerstone to interesting acquisitions such as Salesforce's acquisition of Rypple to the megavendors such as IBM (Kenexa), SAP

(Successfactors), and Oracle (Taleo) provide guidance to how employee performance can become more data drvein over time.[3]

### 4.4. Unlocking Big Data's True Potential

To some groups like social networks, telecommunications carriers and online retailers the appeal of managing and crunching enormous streams of data is obvious. But what about those of us who crunch numbers, not by the petabyte, but rather on the gigabyte scale? The true potential of Big Data will be unlocked when we get a personalized view. In the same way that we each have a personal profile on Google, we will eventually have a personally tailored view of each source of data that we interact with. Instead of peering into a vast array of incomprehensible data, our personal profiles will direct us to significant subsets of data that we can actually manage. Although search technologies are almost to this point, it will take the better half of the next decade for the assortment of enterprise solutions to consolidate and deliver this promise. To unlock Big Data, analytic application vendors such as Actuate, Alteryx, Logi Analytics, and Pivotal will all provide differentiated value.[3]

## 5.0 Conclusion:

From this study, it is concluded that Big Data provides opportunities and challenges for better analysis of the large volumes of data that are becoming available, there is the potential for making faster advances in many scientific disciplines and improving the profitability and success of many enterprises.Big data has spawned a variety of new data management technologies, platforms, and approaches. These must be blended with traditional platforms such as data warehouses in a way that meets organizational needs cost effectively. The analysis of big data requires traditional tools like SQL, analytical workbenches like SAS Enterprise Miner, and data analysis. All of this is for naught, however, unless there are business users, analysts, and data scientists who can work with and use big data. As organizations make greater use of big data, it is likely that there will be increased concerns and legislation about individual privacy issues.

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# Electronic wastes generation / Handling and their recycling Innovative Entrepreneurships through E- commerce.

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**Abstract:**

*Presently in India, about 960 million tonnes of solid waste is being generated annually as by-products during industrial, mining, municipal, agricultural and Electronic Waste (E- waste). Out of this , 24 Mn tons are contributed from Electronic waste. It is a point of concern considering that many components of such equipments are consider Toxic and are not biodegradable. To safeguard the environment, efforts are being made for recycling different wastes and utilize them in value added applications. In this paper, will present status on Electronic waste generation, effective handling and disposal of the waste generated by floating populations which is emerging in India due to Urbanizations. This paper gives details information on new Entrepreneurship by solving the problem for society through effective handling and disposal of Electronic waste with the help of Information Technology.*

**Keywords:** *Electronic waste ( e-waste ); Recycling; Market Size, Subscription plan, Business Model; Breakeven point; environment*

## Introduction:-

Today's newspaper after you have read it, that abandoned DVD of your last year's favorite film, vegetable peels that remain after preparations for a meal are made, torn jeans that you can no longer use, the aluminum foil in which your tiffin is packed… All these and more is 'waste'. Left over, useless materials that remains after any activity is waste.

Electronic Waste, "e waste "or "waste electric and electronic equipment" is a waste consisting of any broken or unwanted electrical or electronic appliance

**Facts to think about**. In urban areas each person produces about 500 g of waste per day, Whereas in rural areas each person produces 100 g of waste per day .7 million tonnes of hazardous waste are produced every year in India, mostly from the states of Andhra Pradesh, Bihar, Uttar Pradesh, and Tamil Nadu According to a 1999 data India generated 1.5 kg of medical waste per bed per day. This figure is now almost three times that amount. About 73 to 96% of the typical family's waste comprises bio-degradable material in the lower income groups while in higher income groups; it is only about 26%. A large portion of the untreated waste that industries generate is liquid and it ends up in our water bodies – rivers, ponds, lakes etc. A study conducted by Toxics Link says that Mumbai alone generates 19,000 tons of e-waste every year.

## Types of Wastes:-

Municipal:- Household waste vegetables, fruits, preservatives, dairy pro-ducts, wood, plastics, kitchen waste, waste from our toilets.

Industrial: - Raw materials like wood, cotton, fruits, vegetables, spices, metals, processed

commodities like paper, sugar, chips, masalas, metal sheets, pens, cds, computers etc

Electronic: - Old used computers, remote controls, switches and plugs, tv sets etc. Components of electronic waste such as lead, mercury and cadmium are extremely dangerous

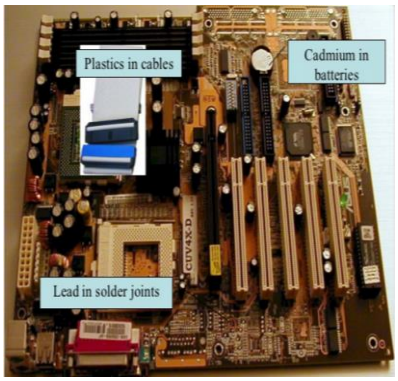
Medical: - Leftover bits of cotton, band aid, disposable syringe, phial of medicine etc. Hospitals also generate a lot of other extremely harmful waste that can spread diseases to others who handle this waste.

**Construction**:

Products like cement, concrete, wood, iron and other metals from various kinds of buildings and structures.

Hazardous: - Types of waste those are harmful to human health, or to the environment, either immediately or over an extended period of time. Radioactive, toxic and infectious waste like batteries etc that contain chromium, arsenic, uranium etc.

**Contributor of E waste:**




**Steel; Copper; Brass; Aluminum; PVC; Lead; Glass Other materials.**

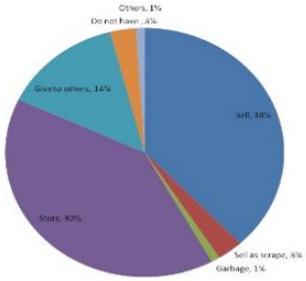
How it affects you: - **Plastic & PVC** from cabling

and computer housing affects reproductive system, immune system and leads to **hormonal disorders**; **Brominated flame retardants** from electronic equipment and circuit boards disrupts the **endocrine system**; **Mercury** from relays and switches causes chronic damage to the brain and **respiratory & skin disorders**; **Beryllium** from motherboards is carcinogenic in nature, causing **skin diseases Lead** from printed circuit boards and computer monitors causes **Chromium** from **g**alvanized steel plates and **d**ecorator or hardener for steel **housing causes bronchitis**. **Barium, Phosphorus and Heavy Metals** from front panel of Cathode ray tube causes muscle weakness and damage to heart.

**E-waste distribution in India :-**

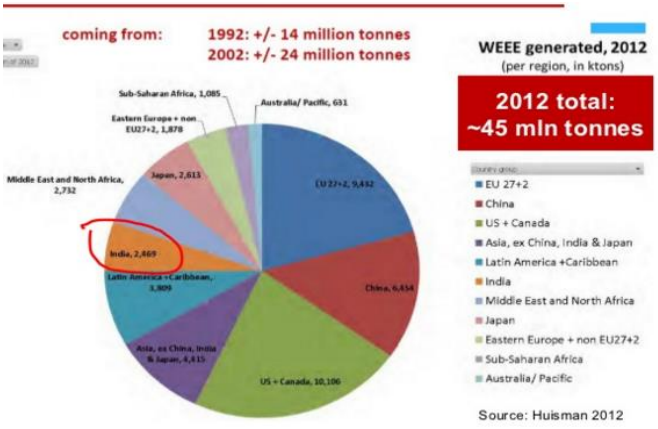
Increase in waste generation (Why??) Increase in floating population; Renovation of homes; Increase in waste generation Revolution in IT / Financial services/ BPO / Hospitality / Tourism generated ample opportunities in and around Pune. This resulted increase in Floating Populations. There is 32.4% increase in pune's population in last three years.

End life of Computer:- Today a major amount of e-waste is generated by the old computer and its accessories. In the developed western and European countries, there is a new trend of donating their old computer and equipment to nearly third world countries. Because of it people feel good at having helped the under privileged. But it turns out to be a big problem as it passes downstream costs (waste removal) to under-developed countries, which most often do not have adequate environmental regulations. Poor countries simply accumulate the dangerous hazards of electronic waste. The "donations" end up not being recycled, but as hazardous




**Major cities generating E wastes in Tons:-**

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| Mumbai | 50000 | Delhi | 35000 | Banglore | 30000 | Chennai | 25000 |
| Kolkatta | 19000 | Ahmedabad | 14000 | Pune | 12000 | | |




## E-waste disposal problems in India:

Most of the e-waste is collected and disposed by unauthorized people. They collect the e-waste from the household and market and then separate the useful and useless part by breaking the e-waste in improper way, this is very harmful to the environment because they keeps the useful part and either dump the remaining waste or burn it . They also do not use any safety measures which increase the risk to the health of the worker. They do this work in slum area of big metros and in metro cities either by making small workshop or from their home which pollute the surrounding

**New Start Up Clean.com:-**

Clean.com removes junk from your door steps, when you need it. We pick up junk from your offices, apartment complexes, communities, homes and more. We also ensure that your junk gets recycled or disposed in a responsible manner. This will also our small social contribution towards Swatch Bharat Mission.

**HOW IT WORKS- Solution**

*The current system of electrical & electronics waste disposal is broken. We are fixing this by providing Hassle-free disposal, with doorstep pickup and responsible recycling.*


What we take: - Indicative List

Computers and Laptops Mouse, keyboard, Accessories, DVD, CD, Floppy Drives, Mobile Phones, Telephones, Fax machine, modem, Radios,Vacuum cleaner, coffee machine, Inverters, televisions,

VCR,Hi-Fi sets, Cassettes, Drills Electric Saws, sewing machine,Bio medical waste ,Electronic Toy, Plastic &metal, Furniture, printers & cartridge, Cable wires, paper garbage, Glass

**Business Model of Clean.com**

**Enquiry:** Log on to www.clean.com, Receive confirmation of order placed.

**Pickup:** Receive call to schedule the pickup time; Pick up is free for one time

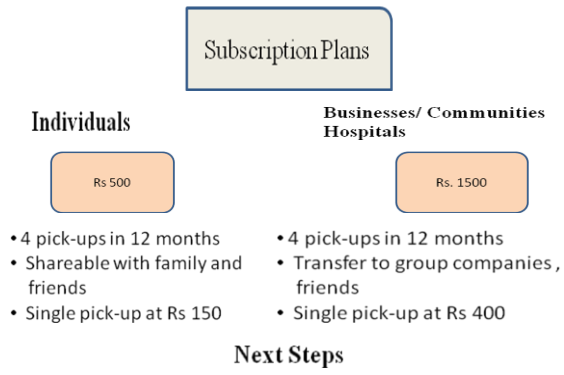
**Revenue**: For offices, apartments Rs 550 +taxes for single trip Annual subscription also available with Rs 1000 + taxes for four pick up for offices, apartments .

**Customer Benefit**: Clean.com don't pay anything cash to customers, we pass gift vouchers once deal is completed

Market Overview: - **Competition**: The informal sector forms the biggest competitor. However, it has several systemic weaknesses. As of today with regulations becoming more effective and overall awareness increasing, collection is becoming a problem for the unorganized sector. Within the organized sector, the competition is still limited to just about 10 recyclers in India.

**Opportunity**: Based on various research studies, the total e-waste production in India was about 400,000 Tons in 2009 and is likely to reach 800,000 tons in 2012. Only about 19,000 tons was recycled officially in 2009.Various other research papers and data points on the internet highlight the following facts:

- Given the size of our population any fraction of any demographic unit is a large chunk in itself.
- PC penetration in India is estimated to be 40 per 1000 as compared to 995 in the US. This shows the immense potential for refurbished PC market.
- High technology penetration in Urban areas (>70%). This means that the highest source of e-waste is here.
- Moderate penetration in semi urban areas but a high growth rate(~100%).
- Very low rural penetration and medium growth rate, but accelerating very fast.
- Large companies refresh PCs every 4 years(avg).
- E-waste was a US$2 B worldwide business in FY2009 (only partially tapped)
- In India, organized e-Waste recycling is a nascent industry.




**Conclusion:**

Most of the developing countries, especially India faces a problem of continuous rise in the amount of e-waste due to the change in the lifestyle of the people which now more depends on electrical and electronic equipment in which continuous improvement has been made and the products are becoming obsolete rapidly especially in case of computer and its peripheral devices . This has arises a big challenge of managing the e-waste. A major amount of ewaste is managed through informal sector which done the ewaste management job in the way which has bed effect on the environment and very small amount of e-waste are managed by formal sector in environment friendly way. Unfortunately there is no large scale organized sector to do the recycling work and it is performed only by unorganized sector. Because of it the risk of damage to human health and natural environment increases as no precaution is taken while performing the recycling work and also the involvement of women and children has worsen the condition. The import of e-waste from other countries has ill-effect on environment. Due to lack of awareness among people about e-waste, the measures like ERP and Take back policy is very difficult. The legislation work regarding ewaste had been done lately in time and it is not performing well. Therefore the awareness of the people about e-waste need to be increase and the rules should be properly implemented to control the rise in e-waste in future.

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# Localized Mobile Detectors (LMD)

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**Abstract:**

*This paper seeks to suggest application which can control cell functions. Cell phones have become now basic need of our day to day life. They are very useful to us. But sometimes they disturb our privacy and peaceful life. So this application will control cell function according to place and time e.g. – The cell phones uncontrolled are causing a lot of problem when the classes are conducted in college or even in meetings. In such situations the new device will control the use of cell phones but in canteen , parking or on ground all cell phone functions can be activated. So the application developed will control cell functions as per need.*

**Keywords:** *GSM, Mobile detector, Cell phone jammer, RF,IF*

## Introduction:

Innovations are always for the welfare of people and act as a humble servant for the gentleman, making his life comfortable and simple. But, things always don't function as per gentleman's wishes and the mechanisms begin acting as his owners.

One of such innovations is a cell phone which in addition to all its appliances and benefits begins acting as the gentleman's owner invading his privacy.

Mobile phones are a part and parcel of our day-to-day life. It is considered to be very useful for communication but sometimes this device becomes the cause of many problems.

Mobile phones are everywhere these days. India had 851.70 million mobile phone subscribers at the end of June 2011.[1]. It's great to be able to call anyone at anytime. Unfortunately, restaurants, movie theaters, concerts, shopping malls and churches, temples, colleges, libraries, public places all suffer from the spread of cell phones because not all cell-phone users know when to stop talking. Who hasn't seethed through one side of a conversation about an incredibly personal situation as the talker shares intimate details with his friend as well as everyone else in the area?

Thus, sometimes use of mobile disturb peaceful life and it leads to many problems for the society, youth and for all.

## Motivation:

While working as a teacher it has been experienced that there are frequent disturbances in classrooms and labs. Such instances generated the idea of undertaking research that would result in development of new device. This acted as a motivation.

## Objectives:

The objectives of the project are to design and build a mobile detector that can fulfill the following requirements.

**A.** It is capable of selecting and blocking the controller channel in the restricted area.
**B.** It has an intelligent controller that controls all operations of the detector system.
**C.** It consumes less power than the jammers.
**D.** It is designed to cover area of 20 m radius.

## Literature Survey

Mobile Phone Jammer : A **mobile phone jammer** is an instrument used to prevent cellular phones from receiving signals from base stations. When used, the jammer effectively disables cellular phones. These devices can be used in practically any location, but are found primarily in places where a phone call would be particularly disruptive because silence is expected. Cell phone jammers are device that create a temporary "dead zone" to all cell phone traffic in their intermediately proximity.[2]

## Jamming Techniques :

There are different approaches to prevent mobile phones from ringing in specific area, the main five approaches used oe being developed are described in RABC mobile & Personal Communications Committee's (M & PCC) meetings. [2]

## A. Jammers

In this device we overpower cell phone's signal with a stronger signal, This type of device comes equipped with several independent oscillators transmitting 'jamming signals' capable of blocking frequencies used by paging devices as well as those used by cellular PCS system's control channels for call establishment. When active in a designated area, such devices will prevent all pagers and mobile phones located in that area from receiving and transmitting calls. This type of device transmits only a jamming signal and has very poor frequency selectivity, which leads to interference with a larger amount of communication spectrum that it was originally intended to target. There are two types, one is called brute force jamming, which just block everything. And other puts a small amount of interferences, and you could potentially confine it within a single cell block. You could use lot of little pockets of small jamming to keep a facility under controls."

## B Noise Jamming:

The carrier signal is modulated with noise to insert noise into the receiver. By this the jammer can emit multiple tones, usually; the placement of these tones is based on some knowledge of the target or targets to be jammed.

## C. Broadband Noise (BBN) Jamming:

Broadband noise (BBN) jamming places noise energy across the entire width of the frequency spectrum used by the target system radios. It is also called full band or barrage jamming.

The limitation of this jamming that is result in low **jo** jamming signal power) and this low power is spread very wide. The BBN can effect on synchronization as Fast Frequency Hopping (FHSS) which typically need resynchronize on every transmission attempt.

### D. Partial- Band Noise (PBN) Jamming:

PBN jamming places noise-jamming energy across multiple, but not all channels in the spectrum used by the targets

### E. Narrowband Noise (NBN) Jamming:

NBN jamming places all the jamming energy in a single channel. The bandwidth of this energy injection could be the whole width of the channel or it could be only the data signal width or the complementary signal width.

### F. Tone Jamming:

In tone jamming, one or more jammer tones are strategically placed in the spectrum. Where they are placed and their number affects the jamming performance. There is two type of tone jamming.

**I.** Single tone jamming where signal tunes are placed where it's needed.

**II.** Multi tone jamming distributes the jammer power among several tones.

The phase of the jammer tone relative to the target signal can be important parameter, When there is a single tone jamming signal its well be either at the mark or space frequency. If it's at the mark frequency, then the phase can present a problem when the jammer tone is sufficiently out of phase with the symbol signal. If it's at the space frequency, then if the *JSR* is large enough the symbol is jammed independent of the phase relationship.

### G. Swept Jamming:

In swept jamming a relatively narrowband signal which could be as narrow tone but more often PBN signal, is swept or scanned in time across the frequency band of interest. At any instant in time, the jammer is centered on a narrow region around this frequency. However, since the signal is swept, abroad range of frequencies can be jammed in a short period.

### H. Pulse Jamming:

This technique is similar in concept to partial band noise jamming. Pulse jamming can have lower average power than some of other jamming techniques discussed here, and be just as more effective. The duty cycle determines the relationship between the average power and peak power. The jamming effects depend on the peak power and how often that signal returns to the receiver.

### I. In Construction phase:

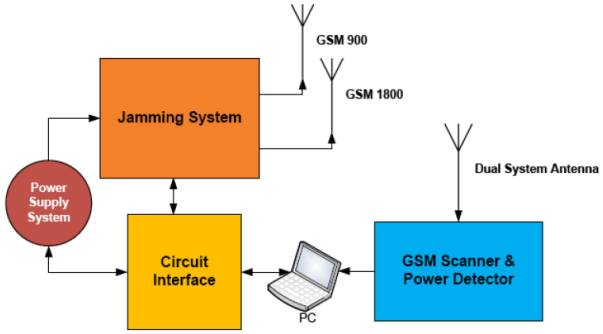
While constructing the buildings or temples, mosques or conference halls we can include a sufficient amount of metal in the walls. Because of this the RF signals (Incoming or outgoing ) are become weak and we can produce effect as cell phone jammer.

While this method is costly and we cannot modify the structure as per our requirement.

## Proposed System :

So after studying pros and cons of these various available techniques , and combining them to build a device which is best suitable foe civilian use the following system is proposed.

The proposed system i.e. Localized Mobile Detector attempts to disrupt portions of digital signals only, selecting only those portions necessary to deny communications, if possible.
To describe the system in a block diagram shown in Figure




**Here following two cases are possible.**

First case, the GSM Scanner and Power detector Systems detects a mobile phone in the restricted area and gives information to computer about the frequency used by mobile phone, and then the computer gives the circuit interface system an instruction to prepare the jamming system to block the mobile phone.
Second case, when the GSM scanner and power detector
systems are not detecting mobile phone in the restricted area for a time specified in computer, the computer gives the circuit interface an instruction to shift the jamming system into standby mode.

Proceeding from the intelligently of the project it is important to find or design a circuit that can detect calling process and give a warning to the control system to shift the jamming into power on mode.

The circuit can detect both the incoming and outgoing calls, SMS and video transmission even if the mobile phone is kept in the silent mode. The moment the bug detects RF transmission signal from an activated mobile phone, it starts sounding a beep alarm and the LED blinks. The alarm continues until the signal transmission ceases. An ordinary RF
detector using tuned LC circuits is not suitable for detecting signals in the GHz frequency band used in mobile phones. The
transmission frequency of mobile phones ranges from 0.9 to 3 GHz with a wavelength of 3.3 to 10 cm. So a circuit detecting
gigahertz signals required for a mobile bug.
The circuit consists of four main stages
1. Capturing RF transmission stage.
2. Current to voltage converter
3. Trigger stage

4. Timer stage

**Capturing RF transmission stage**

This stage can capture all frequencies in the mobile communication spectrum from 0.9 to 3 GHz with a wavelength of 3.3 to 10 cm. To do the detection job this stage uses a 0.22μF disk capacitor , this capacitor stores energy and transfers the stored energy in the form of minute current to the inputs of the stage of current to voltage converting.

**Current to Voltage converter Stage**

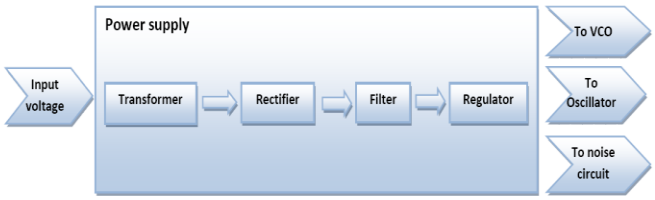
The aim of this stage is to convert the minute current from the previous stage into the corresponding output voltage by using a current to voltage convertor (CA3130).

**Trigger stage**

This stage used to trigger the timer stage and provide an Invisible alert about the transmission mobile data occurrence this trigger used a monostable timer (NE555).

**Power Supply**

The main operator of the jamming system from the electricity point of view is the electrical power because it will bias and feed each stage in the system. In general the power supply consists of transformation, rectification. Filtration and regulation.




1. The transformer is used to step down the input voltage from 220 to the desired values.
2. The rectifier stage is used to convert the signal from AC to DC.
3. Filter is used to reduce the ripple of voltage that results from rectifier stage.
4. The regulator is used for safety and to ensure a fixed voltage across a certain load in the circuits in case the input values or the load are changed so it have the concept of the zener diode principle. As example on the regulators L200 IC with high voltage.

## Conclusions:

The LMD is designed to be an intelligent mobile detector system for GSM-900 and DCS-1800 systems with an ability to be controlled by computer and to have a standby mode.

The main stages in the system are such as the IF stage, and the RF stage components are imported and it will be implemented on printed circuit board (PCB) in the earlier future.

The main problems may came in RF stage, because the dealing with the high frequency signal needs special components such as surface mount (SMD) capacitors and resisters, also the PCB needs microstrip lines, so the problems appear in matching the stages with each other; where sometimes a power attenuator between two stages was needed.

The coverage area of the calling detector was not sufficient; so an in improvement must be done to give the needed coverage. There is a problem appears in determining the controller channel that may be changes due to power level, so the system must be configured to block the controller channel with its neighbors.

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# A study of Transducers and Sensors: A review

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**ABSTRACT:**

*This review paper focuses on the study of sensors, transducers and their different types in brief, as this is an emerging field which places lot of contribution in automobile industry. Physical and chemical principles behind the operation of these devices vary so much across different fields of science and technology that the common features present in all devices are often overlooked. The concept of conversion of one form of energy into another form of energy is introduced in specific order as per classification. Sensors and transducers find many applications in designing different modules which requires conversion of energy from one to another.*

**Keywords:** *electroacoustic, electrochemical, electromagnetic, electromechanical, electrostatic, energy, mechanical, optical, photoelectric, sensors, transducers.*

## 1 Introduction:

The words 'sensor' and 'transducer' are both widely used in the description of measurement systems. A dictionary definition of 'sensor' is `a device that detects a change in a physical stimulus and turns it into a signal which can be measured or recorded; a corresponding definition of 'transducer' is 'a device that transfers power from one system to another in the same or in the different form'.

A sensible distinction is to use 'sensor' for the sensing element itself and 'transducer' for the sensing element plus any associated circuitry. All transducers would thus contain a sensor and most (though not all) sensors would also be transducers.

Fig.1 shows the sensing process in terms of energy conversion. The form of the output signal will often be a voltage analogous to the input signal, though sometimes it may be a wave form whose frequency is proportional to the input or a pulse train containing the information in some other form.

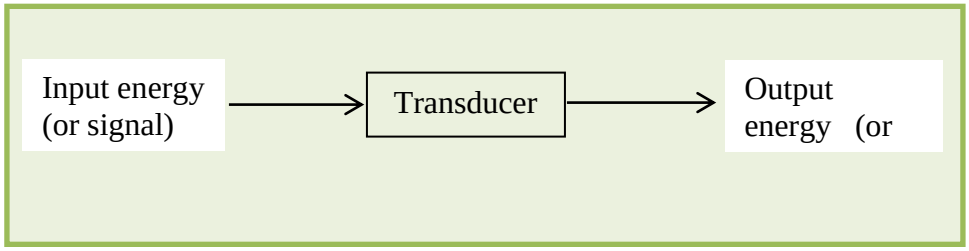


**Fig.1 The sensing Process**

A transducer is any device which converts one form of energy into another. Examples of common transducers include the following:

- **a.** A microphone converts sound into electrical impulses and a loudspeaker converts electrical impulses into sound (i.e., sound energy to electrical energy and vice versa).
- **b.** A solar cell converts light into electricity and a thermocouple converts thermal energy into electrical energy.
- **c.** An incandescent light bulb produces light by passing a current through a filament. Thus, a light bulb is a transducer for converting electrical energy into optical energy.
- **d.** An electric motor is a transducer for conversion of electricity into mechanical energy or motion.

An actuator is a device that actuates or moves something. An actuator uses energy to provide motion. Therefore, an actuator is a specific type of a transducer.

A sensor is a device that receives and responds to a signal. This signal must be produced by some type of energy, such as heat, light, motion, or chemical reaction. Once a sensor detects one or more of these signals (an input), it converts it into an analog or digital representation of the input signal. Based on this explanation of a sensor, you should see that sensors are used in all aspects of life to detect and/or measure many different conditions.

Human beings are equipped with 5 different types of sensors.

Eyes detect light energy, ears detect acoustic energy, a tongue and a nose detect certain chemicals, and skin detects pressures and temperatures. The eyes, ears, tongue, nose, and skin receive these signals then send messages to the brain which outputs a response. For example, when you touch a hot plate, it is your brain that tells you it is hot, not your skin.

This unit describes the basic concepts of transducers, sensors, and actuators and introduces the different types in both the macro and micro scales.

## 2 Basic Concepts of Transducers

There are many variables which affect our everyday lives: the speed of a car, the velocity of the wind, and the temperature in a home. In most situations these variables are continuously monitored. It is these variables that are the feedback that is used to control the speed of a car, the operation of an air conditioner, heater levels, and oven temperatures. The elements that sense these variables and convert them to a usable output are transducers. For example, a transducer known as a thermocouple is able to sense changes in temperature and produce output voltages representative of those changes.

A transducer is defined as a substance or a device that converts (or transfers) an input energy into a different output energy. Because of this broad definition, transducers come in many varieties converting many different types of energy. Following are different types of transducers.

## 2.1 Electrochemical Transducers

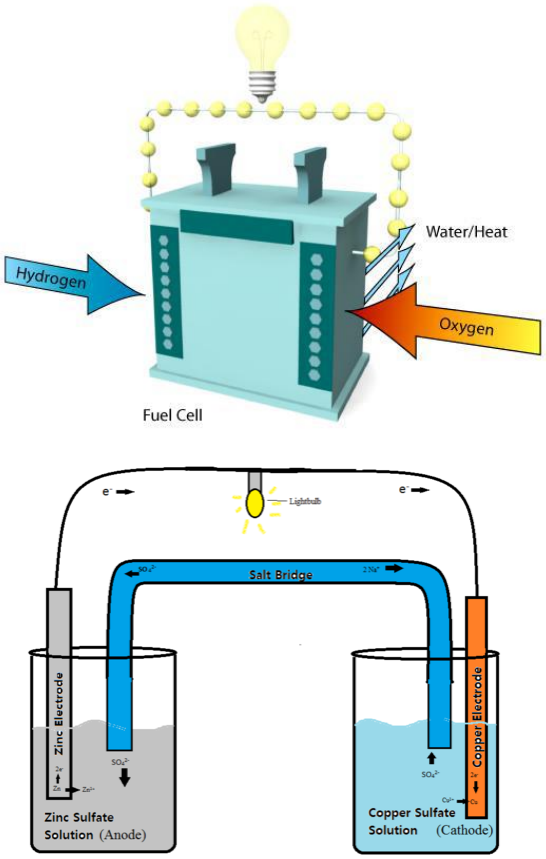


Fig.2 Converting a Chemical Reaction to Electrical Energy (left: Fuel Cell, right: battery)

Some common electrochemical transducers include the following:

2.1.**a** pH probe – Converts chemical energy into an electrical energy

2.1.**b** Molecular electric transducer – Converts motion in an electrolytic solution into electrical energy

2.1.**c** Battery – Converts chemical energy directly into electrical energy

2.1.**d** Fuel cell – Converts the energy from a reaction within a fuel cell to electrical energy

Let's take a closer look at the electrochemical battery illustrated above in fig 2. This battery converts chemical energy directly into electrical energy. A cathode and an anode (typically two dissimilar metals) are each immersed in an electrolyte solution containing salts of their respective metals. A medium (the salt bridge) separates the two electrodes, but allows ions to flow between the two solutions. Due to the flow of ions between the two solutions a potential difference (or voltage) is created. An electrical current flows if a wire is connected between the two pieces of metals. The amount of voltage developed between the cathode and the anode depends on the materials that make up the battery.

The fabrication of microbatteries has been a challenge but a challenge that needs to be met. Microsized sensors require micro-sized batteries in order to operate, especially when those sensors are placed in remote areas such as the ocean floor or embedded below the surface of bridges and roads.

"Traditional batteries have a two-dimensional array of positive and negative electrodes stacked on top of one another like sheets of paper. Increasing battery power means adding more electrode

layers, more weight and more size."1 One solution to this problem is to fabricate 3-dimensional microelectrode arrays consisting of high aspect ratio (tall and thin) carbon posts. These posts serve as the electrodes for electrochemical micro-sized batteries.2

## 2.2 Electroacoustic, Electromagnetic, and Electrostatic Transducers

2.2.a Common electroacoustic transducers:

- Loudspeaker – Converts an electrical signal into sound
- Microphone – Converts sound waves in air into an electrical signal
- Hydrophone - Converts sound waves in water into an electrical signal.

2.2.b Common electromagnetic transducers:

- Magnetic cartridge – Converts motion in a magnetic field into an electrical energy
- Generator – Converts motion in a magnetic field into electrical energy

2.2.c Common electrostatic transducers:

- Electrometer – Converts static or energy from a vibrating reed into electricity
- Van de Graaf generator – Converts static into high voltage

MEMS hydrophones are currently being used to detect various sounds within our oceans. Anchored to the bottom of the ocean or dragged behind a ship, micro-sized hydrophones detect the sounds generated by ships, submarines, ocean waves and marine animals. They also hear tertiary waves created by earthquakes or any movements within the earth's crust

## 2.3 Electromechanical Transducers

Electromechanical Transducers –

2.3.a Strain gauge – Converts the deformation (strain) of an object into electrical resistance
2.3.b Galvanometer – Converts the electric current of a coil in a magnetic field into movement
2.3.c Generators – Converts mechanical energy (motion) into electrical energy.
2.3.d Motor – Converts electrical energy into mechanical energy.

As with other types of transducers, electromechanical transducers come in all sizes from macro to micro. Microgenerators have been developed that may someday replace batteries. A Georgia Tech MEMS Project has developed a 10 millimeter wide generator that spins a micro-sized magnet above a mesh of coils fabricated on a chip. The micromagnet spins at 100,000 rpm, producing 1.1 watts, enough power for a cell phone.

## 2.4 Other Types of Transducers

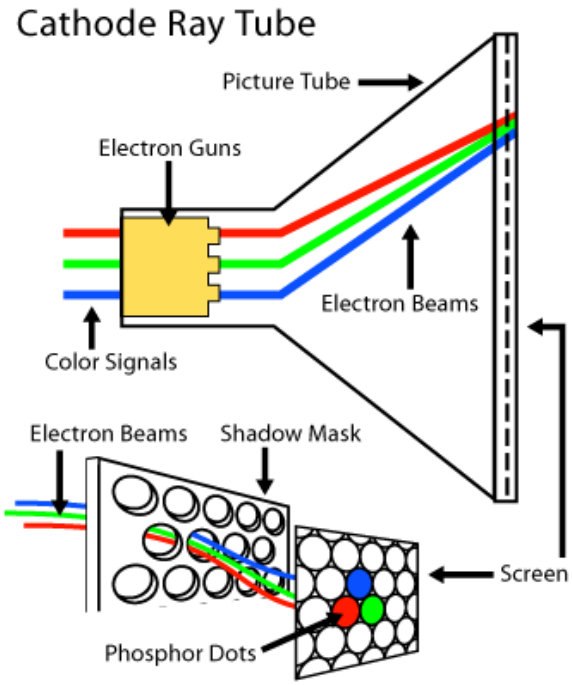


**Fig.3 Converts Electrical Signals into Light Energy**

2.4.1 Photoelectric Transducers:

- Cathode ray tube (CRT) –Converts electrical signals into light energy for a visual output
- Light bulb –Converts electrical energy into visible light and heat
- Laser diode – Converts electrical energy into light energy
- Photodiode - Converts light energy into electrical energy

2.4.2 Thermoelectric Transducers:

- Thermocouple – Converts heat energy into electrical energy
- Temperature sensitive resistor (Thermister) – a variable resistor affected by temperature changes (heat energy to electrical energy)

2.4.3 Other types of Transducers:

- Geiger-Müller tube – Converts radioactive energy into electrical energy
- Quartz Crystal – Converts mechanical stress into electricity (electrical energy)

Micro-sized transducers that use temperature, chemical reactions, and mechanical stress to produce changes in voltage, resistance, resonant frequency, or light are used throughout microsensors. Such transducers are used in MEMS pressure sensors, temperature sensors, chemical sensor arrays, and optical modulators.

## 2.5 The Incandescent Light Bulb (a transducer)

Light bulbs convert electrical energy into light and heat. Specifically, an incandescent light bulb consists of a vacuum chamber (the glass bulb), a filament (typically made of tungsten), and a positive and a negative terminal. The negative terminal is the part that screws into the socket to prevent electrical shock. A voltage source is placed across the positive and negative terminals causing current to flow through the filament. Due the electrical resistance of the tungsten filament, the filament heat up and gives off light (i.e., electrical energy, to heat energy, to light energy).

## 3. Basic Concepts of Sensors

Sensors detect the presence of energy, changes in or the transfer of energy. Sensors detect by receiving a signal from a device such as a transducer, then responding to that signal by converting it into an output that can easily be read and understood. Typically sensors convert a recognized signal into an electrical – analog or digital – output that is readable. In other words, a transducer converts one form of energy into another while the sensor that the transducer is part of converts the output of the transducer to a readable format.

Consider the previous examples of transducers. They convert one form of energy to another, but they do not quantify the conversions. The light bulb converts electrical energy into light and heat; however, it does not quantify how much light or heat. A battery converts chemical energy into electrical energy but it does not quantify exactly how much electrical energy is being converted. If the purpose of a device is to quantify an energy level, it is a sensor.

So let's take a look at a sensor that should be familiar to everyone – a temperature sensor.

An environmental energy condition that is commonly sensed is temperature. A thermometer senses and converts temperature into a readable output, thus it is a sensor. This output can be direct or indirect. A mercury thermometer which uses a level of mercury against a fixed scale is a direct output. A digital readout thermometer is an indirect output. For a digital readout thermometer, a converter is used to convert the output of the temperature transducer to an input for the digital display. The measured temperature is displayed on a monitor. The thermometer is both a transducer (usually a thermocouple that transfers heat energy to voltage) and a sensor (quantifies the transducer output with a readable format).

The mercury thermometer utilizes mercury's property of expanding or contracting when heated or cooled, respectively. In a mercury thermometer a temperature increase is sensed by the mercury contained in a small glass tube. The thermal energy from the temperature increase is transferred into the mercury (the transducer) causing the mercury to expand. The expansion of mercury is scaled to numbers on the tube indicating the temperature.

Following are different types of sensors which are classified by the type of energy they detect.

### 3.1 Thermal Sensors

- Thermometer – measures absolute temperature
- Thermocouple gauge– measures temperature by its effect on two dissimilar metals
- Calorimeter – measures the heat of chemical reactions or physical changes and heat capacity

A thermocouple is a device that directly converts thermal energy into electrical energy. When two dissimilar metal wires are connected at one end forming a junction, and that junction is heated, a voltage is generated across the junction. If the opposite ends of the wires are connected to a meter, the amount of generated voltage can be measured. This effect was discovered by Thomas Seebeck, and thus named the Seebeck Effect or Seebeck coefficient. The voltage created in this situation is proportional to the temperature of the junction.

### 3.2 Mechanical Sensors

- Pressure sensor – measures pressure
- Barometer – measures atmospheric pressure
- Altimeter – measures the altitude of an object above a fixed level
- Liquid flow sensor – measures liquid flow rate
- Gas flow sensor – measures velocity, direction, and/or flow rate of a gas
- Accelerometer – measures acceleration

### 3.3 Electrical Sensors

- Ohmmeter – measures resistance
- Voltmeter – measures voltage
- Galvanometer – measures current
- Watt-hour meter – measures the amount of electrical energy supplied to and used by a residence or business

A Galvanometer is a specific type of ammeter used for sensing an electrical current. Current flows through a coil (the red wire wound around a metal cylinder) creating a magnetic field.
Permanent magnets surround the coil. The interaction of these two magnetic fields causes the coil/cylinder combination to pivot around its central axis. The amount and direction of the pivot moves the needle on a readout left or right, indicating the level of current and its polarity (negative or positive, respectively). This device uses two energy conversions to sense and quantify an electric current: electrical to magnetic and magnetic to mechanical rotation.

### 3.4 Chemical Sensors

Chemical sensors detect the presence of certain chemicals or classes of chemicals and quantify the amount and/or type of chemical detected.

- Oxygen sensor – measures the percentage of oxygen in a gas or liquid being analyzed
- Carbon dioxide detector – detects the presence of CO2
-

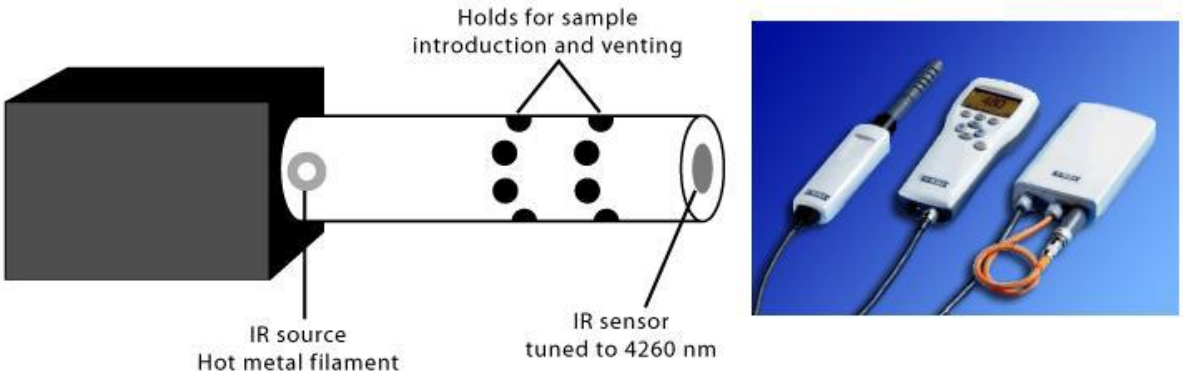


**Fig.4 Schematic and Photo of a Carbon Dioxide Sensor**

Chemical sensing is an application that really benefits from the use of microtechnology. Just like the macro-sized components, MEMS chemical sensors can detect a wide variety of different gases. The advantage of the MEMS sensors is that they can be incorporated into objects for continuous sensing of a gas or selection of gases. These devices have numerous medical, industrial, and commercial applications such as environmental, quality control, food processing, and medical diagnosis. Such devices are sometimes referred to an ENose or electronic nose.

### 3.5 Other Types of Sensors

3.5.1 Optical

- Light sensors – detects light and electromagnetic energy

- Photocells– a variable resistor affected by intensity changes in ambient light.
- Infra-red sensor – detects infra-red radiation

3.5.2 Acoustic

- Seismometers – measures seismic waves
- Acoustic wave sensors – measures the wave velocity in the air or an environment to detect the chemical species present

3.5.3 Other

- Motion – detects motion
- Speedometer – measures speed
- Geiger counter – detects atomic radiation
- Biological – monitors human cells

Biological sensors in another area being expanded with the use of microtechnology. Already on the commercial market are biological sensors that detect and measure the amount of glucose in one's blood. The glucometer shown in the picture monitors glucose (C) using a chemical transducer and delivers insulin on an as-needed basis (A/B) using a micropump. D is the transmitter that relays the information from the glucose sensor (C) to the computer (A).

## 3 Conclusion:

Transducers are used in all aspects of life to measure changes in the environment, to enhance everyday applications, and to learn more about the world around us. An actuator is a device that converts energy into motion. Therefore, it is a specific type of a transducer. When the output of the transducer is converted to a readable format, the transducer is called a sensor.

A sensor is a device that receives and responds to a signal. This signal must be produced by some type of energy, such as heat, light, motion, or chemical. Once a sensor detects one or more of these signals, it converts it into an analog or digital representation of the input signal.

Transducers, sensors and actuators can be found in the macroscale (those visible to the naked eye) and the microscale (microscopic). Nanotechnology is enabling such devices in the nanoscale.

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# "The Study and an Assessment of the Influence of Electronic Books and Traditional Books on Reading Ability, Eye Lethargy and Sensitivity"

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**Abstract:**

This study examines the effect of electronic books and traditional books on reading ability, eye lethargy and sensitivity of the patrons. The study reveals that electronic books motivate and engage all users, help strengthen struggling readers, text comprehension, provide supportive features forward reading but also have potentially distracting features that is eye tiredness and compassion whereas regular books are tedious to handle and carry but not required any supportive instrument such as eBook readers, computers, laptop and tablets etc.

**Keywords:** Electronic book, eBook, Optical issues, reading ability, eye lethargy, sensitivity etc.

## Introduction:

Ancient era there were only traditional books but now a days there are two types of books to read.

1) Traditional Paper books
2) Electronic books (E-books) which can be viewed on a computer or via apps on tablets.

E-books have been around for many years. The recent rapid improvements in the versatility and affordability of e-readers and tablets is the difference between reading in print and reading on screen has grown as devices and software facilitating reading on screen become a greater part of everyday life. It ultimately influenced on the health of human eyes. The digital reading devices are more tiring on the eyes.

## Objectives:

1) To study the evolution of book lending and optical issues.
2) To assess the usability of e-books and traditional books.
3) To study the user comprehension, eye lethargy and sensitivity.

**Need of the Research:** this paper aims to measure evaluate the usability of electronic books and traditional books with influence of eye feebleness and sensitivity.

## Methodology/Techniques:

- Respondents: Students, Faculties, Librarian and Library staff etc.
- Data Collection Instrument: Interviews to understand the user satisfaction perception through interaction.
- Secondary data: analysis of transaction reports and eBooks access report.

**Data analysis**:

The researcher has gone through the interviews of patrons and perceived the following facts:

- **Evolution of Book Lending:**

In recent years, improvements in e-reader technology and the convenience of smartphone reading have made digital books an ordinary phenomenon. Rise in demand for digital books has been largely unmet by libraries. Currently, libraries most often purchase e-books under licenses that expire after a certain amount of time or a certain number of loans, limit or prohibit downloading and printing, or prevent a title from being loaned to different users simultaneously. i.e. INFLIBNET (N-LIST Programme), IEEE, J-Gate, Science Direct, Emerald, ACM digital library etc. databases provide access of e-journals as well as e-books having all mentioned facilities for downloading and printing the topics it makes the databases user friendly. And users become more satisfied through this facilities which was absent in the form of traditional books.

The improving economics of e-book lending of course presents libraries with an opportunity to keep pace with an increasingly technology-driven culture, to provide patrons all-hours access to even more reading materials through their online accounts. Technology surrounds us. It affects almost all aspects of our daily lives including types of books, reading material.

- **Optical Issues: (LCD's, Electronic Papers, and Print):**

The visual focus required when reading, whether it is done on paper or a computer screen, requires a reduction in the frequency of eye blinks (open and close the eye). And the possibility of attendant fatigue, headache, blurred vision, and light sensitivity. When the optical ill effects of reading on paper and computer screens are compared the digital text consistently rates far worse.

To the extent that the visual distress caused by dry eye impacts reading comprehension or conception, printed books will continue to be superior to computer screens, especially when one is trying to read longer, more challenging texts.

There have been several studies about e-books over the past decade, and they have revealed both advantages and disadvantages to e-books. Whereas E-books are becoming more and more popular among people. But everything has two sides; in this article let us learn the advantages and disadvantages of E-book.

**Merits and Demerits of E-books:**

**Merits of E-books:**

1) An eBook is a book in electronic format. It is downloaded to a computer, PC, laptop, or any other kind of computer and is read on the screen. It can have numbered pages, table of contents, pictures and graphics, exactly like a printed book.
2) It is very simple and easy to purchase and download eBooks through the Internet.
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**Demerits of E-books:**

1) Not convenient to read: who wants to sit in front of a computer or screen for hours just reading your eBook it causes gaining weight, sitting for prolonged periods of time can cause muscles strain, backache, and even an elevated cholesterol level and the most important is optical disease .
2) Printing Cost: It's painful to read off a screen, and some people prefer to read text on paper. And if eBook is quite long, the printing cost will be shouldered by your readers.
3) Piracy: In the printed book world, people who want to "share" your book will photocopy it, and then send it to their friends. With eBooks, your file can be easily emailed to someone living thousands of miles away. It can even be placed in a public server for anyone to download. With paper books, you can easily read even while standing. That's not the case with eBooks.

**Findings:**

- While studying the collected data from users including students and faculties through interviews and by understanding the user satisfaction perception through interaction it is found that most of the users used the eBooks for their projects as well as several tests and examinations. They are very much satisfied by this databases and eBooks because of easily accessible and user friendly nature as searching facility is very simple. It gives them reading material on their study area through retrieving by the system of that particular database or consortia. Most of the Commerce and science students search the reading material on the INFLIBNET (N-LIST) program. It gives access for the e-resources (6000+ ejournals and 97000+ eBooks) it's quite useful for all.
- While analyzing the transaction reports and eBooks access report it is found that the use of print material (i.e. traditional books) is much enough for the examination whereas the eBooks can be used for increasing the knowledge and creating new ideas and investigating new things.

- This paper found that there is a noteworthy "book effect" received from interviewee compared to e-books, traditional books seem to enable better reading comprehension. Regarding eye feebleness. Students had significantly greater eye fatigue after reading e-books than after reading traditional books. Students were satisfied with the e-books, but they preferred traditional books.

## Suggestions:

While it is possible that future improvements in screen technology could bring the incidents of dry eye to zero. So that the disadvantages can be removed.

## Conclusion:

It reveals that electronic books increased student motivation and engagement for all students, strengthened the comprehension skills of struggling readers and provided supportive features for word reading. However electronic books had potentially distracting features as well. An electronic book cheers students for innovating new thoughts, ideas and creative things whereas traditional books are useful for only academic purpose as well.

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# Impact of Training: A Comparative Study of Management and computer Based Methods

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## Abstract:

*Though today's world is world of technology, no technology is going to replace the human employees in an organization. Employees are considered as most important asset of an organization. It is very necessary to understand the employee's technical know-how and skills before assigning task to them. According to capability they try to complete their task but quality in work is always expected and required. Their performance needs to be evaluated and according to that they must be provided with some training. Now a days along with some traditional techniques modern methods (Computer Based-Online and Offline) are also implemented to increase their knowledge.*

*So upgrade their technical know-how and skills different types of training are provided to them. What kind of training should be given that will depend on many factors?*

**Keywords:** *Employee, Training, SAP, ERP, CBT, WBT, Video Based, Mobile*

## Introduction:

Employees are the most important asset of an organization. When an employee is selected for the job he/she will have basic knowledge about the aspect (Not in case of experienced). Even though an employee is experienced but when he changes the organization the nature, culture, methodology, processes are changed even though same type of job is being offered.

Every organization including IT always wants their employee to be perfect and accurate in their jobs. To get the best from their employees organization provides positive work environment, high trust, collaborative teamwork, encourage creative problem solving, be responsive to the needs of the group that represents the organization's most valuable assets that is customers, and the employees. Now a days various computer based online as well as offline methods are used . The return on such nominal investments will come in the form of higher levels of employee motivation, creativity, productivity, and commitment that will move the organization forward with greater profitability.

But along with the above factors it is necessary to upgrade their technical knowledge and skill to cope with changing trends, technologies and most important to face the challenges that are emerging every day. So employees are provided with different types of training to upgrade their technical know-how and skills.

## Objectives:

- To understand the scale of technical know-how and skills of the employees.
- To upgrade the knowledge of the employees.
- To make them capable enough to face the emerging challenges.
- To introduce them with latest tools, techniques and software's implemented in organization.
- To teach basic knowledge and skills,

- To raise awareness for change and learning processes in organizations

When an employee is appointed he/she has basic knowledge, which can be gradually increased with experience. But whatever work they do must evaluate to know what kind of level knowledge they have

- Past Oriented Methods
- Future Oriented Methods

## Past Oriented Methods

**1. Rating Scales:** Rating scales consists of several numerical scales representing job related performance criterions such as dependability, initiative, output, attendance, attitude etc. Each scales ranges from excellent to poor.

**4. Critical Incidents Method:** The approach is focused on certain critical behaviors of employee that makes all the difference in the performance. Supervisors as and when they occur record such incidents.

**5 Performance Tests & Observations:** This is based on the test of knowledge or skills. The tests may be written or an actual presentation of skills.

**6 Simulation Exercise:** An artificial environment is created in which training is given to the employees. It consists of different methods such as

**a) Case study:-** A critical case is given to the trainees. They have asked to collect the data , analyze the same, and arrive at some decision /conclusion. IT helps to enhance/develop analytical, logical, practical thinking of employees.

**b) Role playing:** as the name its suggest employees are requested to play the role and preform their assigned responsibility. It also helps in their development as person which also helps to develop organization.

**c) In-basket Training: It is also called as in tray training.** In basket training is a training method to explain employees about their job where a number of problems are kept in the "in basket ". The Employee has to look at the problems which could also be complaints from different employees and simultaneously deal with those problems. The problems that the employee solves, he keeps transferring it to the "out-basket".

**11. Comparative Evaluation Method (Ranking & Paired Comparisons):** These are collection of different methods that compare performance with that of other co-workers. The usual techniques used may be ranking methods and paired comparison method.

- **Ranking Methods:** Superior ranks his employees based on merit, from best to worst.
- **Paired Comparison Methods:** In this method each employee is rated with another employee in the form of pairs. The number of comparisons may be calculated with the help of a formula as under.

N x (N-1) / 2

## Future Oriented Methods

**1. Management by Objectives:** It means management by objectives and the performance is rated against the achievement of objectives stated by the management.

**2. Psychological Appraisals:** These appraisals are more directed to assess employees potential for future performance rather than the past one.

**3. Assessment Centers:** This technique was first developed in USA and UK in 1943. An assessment center is a central location where managers may come together to have their participation in job related exercises evaluated by superior.

**4. 360-Degree Feedback:** It is a technique which is systematic collection of performance data on an individual group, derived from a number of stakeholders like immediate supervisors, team members, customers, peers and self.

With these methods lacking areas of employees will improve. To increase their knowledge, skill and their technical know-how they must be trained.

Whatever the latest trends, tools, and techniques implemented that needs to be known to them which can be possible through training. Training always help employees to learn new things as it helps in upgrading their knowledge. It helps in upgrading and motivating employees to put their best to make organization successful. It can be done through

- Giving employee the responsibility
- Training employee to accept responsibility
- Communicating and giving feedback
- Giving rewards and recognition

Now a days different software are used in most of organization to sustain in competition. Number of computer based methods are used for updating the technical knowhow and skills of the employees.

SAP and ERP are one of the most important used software's in many organizations.


Ref. http://www.webopedia.com

SAP is especially well-known for its Enterprise Resource Planning (ERP) and data management programs. SAP is an acronym for Systems, Applications and Products.

An important goal of ERP is to facilitate the flow of information so business decisions can be taken which are based on data. ERP software are built to collect and organize data from various levels of an organization to provide management with insight into key performance indicators (KPIs) in real time.

## Computer based training methods are:

**Online Training:** Also known as computer based training (CBT), distance learning, or e-learning, online training is a form of instruction that takes place completely on the internet. It involves a variety of multimedia elements, including graphics, audio, video, and web-links, which all can be accessed through one's internet browser.

An online training system is a facility that delivers digital courseware over the network to client devices such as desktop PCs, laptops and many kinds of mobile platforms. This allows users (learners) to receive their online training at times and places they choose and eliminates the need for classrooms, live instructors and rigid schedules.

## Various benefits of online training are:

- **Expedient**

The Internet provides online training participants with easy and convenient access. Classes can be offered live or recorded in advance and giving participants secure access to the event to learn at their own pace. For instance, if you create a series of online presentations that consist of many volumes, you can provide a log-on access to your participants.

- **Immediate and Cost-Effective**

Online training is immediate, cost effective and easily affordable. With all the software tools available including slideshow and screen capture software that can record computer activity, participants can learn how to use a specific software or program.

- **Easy and Fun**

People enjoy using the Internet to learn new things because it's fun. It's a new way to learn. Learning online is much more comfortable than sitting in a class. It saves money on transportation and doesn't require the participant or the student to "dress-up" or go anywhere to learn. With simple instructions, most anyone can access your presentation quickly and easily.

- **Good Return on Investment**

The return on your investment for creating an online presentation is much higher when you use the Internet. Most people receive at least a 90 percent return on the time spent and cost to host such training. If you create a website and offer people access to the training for a fee, you can easily automate their signup, use an email service to provide them logon information and you don't have to be present. This makes your online presentations or training available to your participants 24/7 around the world. While you are sleeping, you could be earning a return on your original investment.

- Save time and money on travel and venues for classroom-based training
- Increase workforce productivity
- Access a wider global audience
- Manage and build on your current training material

- Create dialog and discussion around training topics
- Business-centric learning

David Grebow of the Brandon Hall Group offers these characterizations of the three types of learning:

- **Just-in-case learning is content-centric**. This is the one-size-fits-all model that made up the training landscape for many years, particularly with the widespread implementation of e-learning. As Grebow notes: "We took the instructor completely out of the picture, and ended up with nothing but content."
- **Just-in-time learning is learner-centric.** Here the learners' needs are the focus of course development, and learners can access the information when, where, and how they need it.
- **Just-for-me learning is business-centric.** Grebow writes: "There is no point in focusing on just-in-case learning when the business case for the learning has not been made. No need to get that content out there just in time if the learner has no time to waste finding an answer to a question with no relationship to the business needs. What makes the most sense strategically, as well as operationally, is to provide the exact information that is just for me, when and where I need it, as long as it supports the business needs of the company."

## Video-based learning

Video on the Internet for learning almost any skill, in most languages of the world. With user preferences clearly towards "on the go" videos, organizations are moving quickly to migrate and develop their training content to use this new medium and reach out to all their employees, even in remote locations. Video-based learning is being used more and more, not just in online courses but in traditional and blended courses as well.

## Multiple learning formats

In addition to more video, training was usually delivered either one way or another—either instructor-led training *or* eLearning, in a seminar *or* as a tutorial. Technique BYOD that is (bring your own device) movement, in which employees use their personal smartphones and tablets for business purposes, and new multimedia technologies (from screen casting software to simulations), training formats can be tailored both to the content and to the needs of the learners. Blended courses, responsive design (i.e., content that works on any device or operating system), and mobile learning are three of the ways this trend is currently manifesting.

## More social media

The use of social media in training has been somewhat controversial, as organizations are understandably concerned about the privacy of their proprietary information
Video or micro-blogs—which are more effective—to improve their learning functions."
Competency-based training
Finally, the competency-based education model is making huge waves at all levels of education, and companies are also realizing that what is really important is not that employees sit through training, but that they can do something useful at the end of it. Competency-based training requires reorganizing training programs around demonstrable skills, which requires clearly articulating the desired learning outcomes and developing assessments that validly measure those outcomes. Organizations that adopt a competency-based approach will find themselves much better able to cope with the skills gaps currently affecting many industries.

To increase efficiency and boost bottom lines, the business community is increasingly turning to the devices already found in the pockets and purses of millions of Americans – the Internet-connected smartphone or tablet.
Smartphones provide tremendous amounts of knowledge by allowing users to access information from nearly anywhere at any time. Tablets provide the same benefits, albeit with a screen that's typically friendlier to the eyes.
When United-Continental Airlines purchased 11,000 iPads for its pilots to replace in-flight manuals, the company cited increased efficiency in accessing flight material. The estimated 326,000 gallons of fuel savings due to decreased weight onboard doesn't hurt either.
But its implementation requires updated knowledge to employees which can be given to them with the help of various training methods. These methods will always help them to increase their technical knowhow and skills.
As such there many methods which can be used for knowing technical knowhow and upgrading skill set of employees. List will go on.

**Conclusion: -** Change is the law of nature. For every organization to sustain in competition and market it is necessary to have workforce with good technical knowhow and upgraded skills. With the various methods of performance evaluation, organization is able to come to know their lacking areas. If organization uses latest tools and techniques, it must be learned by the respective employees that is only possible by given them proper training .Various techniques and methods of training will always help in upgrading the knowledge of employees. Comparative to the traditional methods of training, modern methods are more beneficial. By using WBT, training can be available to participants 24/7 around the world

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# A Study of Factors which affect the cost of Software Projects Maintenance

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**Abstract:**

*The software industry has had significant progress in recent years. The entire life of software includes two phases: production and maintenance. Software maintenance cost is increasingly growing and estimates showed that about 70% of software life cost is related to its maintenance phase. Extraction and considering the factors affecting the software maintenance cost help to estimate the cost and reduce it by controlling the factors.*

**Key words:** *Health information systems, Cost, Effective factors, Software maintenance, AHP model*

## INTRODUCTION:

Software production and maintenance issues, costs estimation, project schedule and knowledge of the process have always been complicated cases in software engineering. Cost depends on the creation and maintenance of the software. Thus, continuous monitoring and control of maintenance costs, and software optimization, are really important. Taking into account this statistic, also leads to careful software maintenance to reduce costs. Software maintenance costs are rising and based on the estimations about 70% of the cost related to the software life is in the maintenance phase.

### Methods

In this study, the factors affecting software maintenance cost were determined then were ranked based on their priority and after that effective ways to reduce the maintenance costs were presented. This paper is a research study. The software's related to health care centers information systems in Pune District of Medical Sciences and hospitals function were studied in the year's 2014 to2015.

### Results and discussion

Among Medical software maintenance team members, 40 were selected as sample. After interviews with experts in this field, factors affecting maintenance cost were determined. In order to prioritize the factors derived by analytic hierarchy process (AHP), at first, measurement criteria (factors found) were appointed by members of the maintenance team and eventually were prioritized with the help of EC software. Based on the results of this study, 25 factors were

obtained which were classified in six groups. “Project” was ranked the most effective feature in maintenance cost with the highest priority. By taking into account some major elements like careful feasibility of IT projects, full documentation and accompany the designers in the maintenance phase good results can be achieved to reduce maintenance costs and increase longevity of the software.

The estimations show 50 percent increase over the past two decades. This increase is shown in the Figure 1.

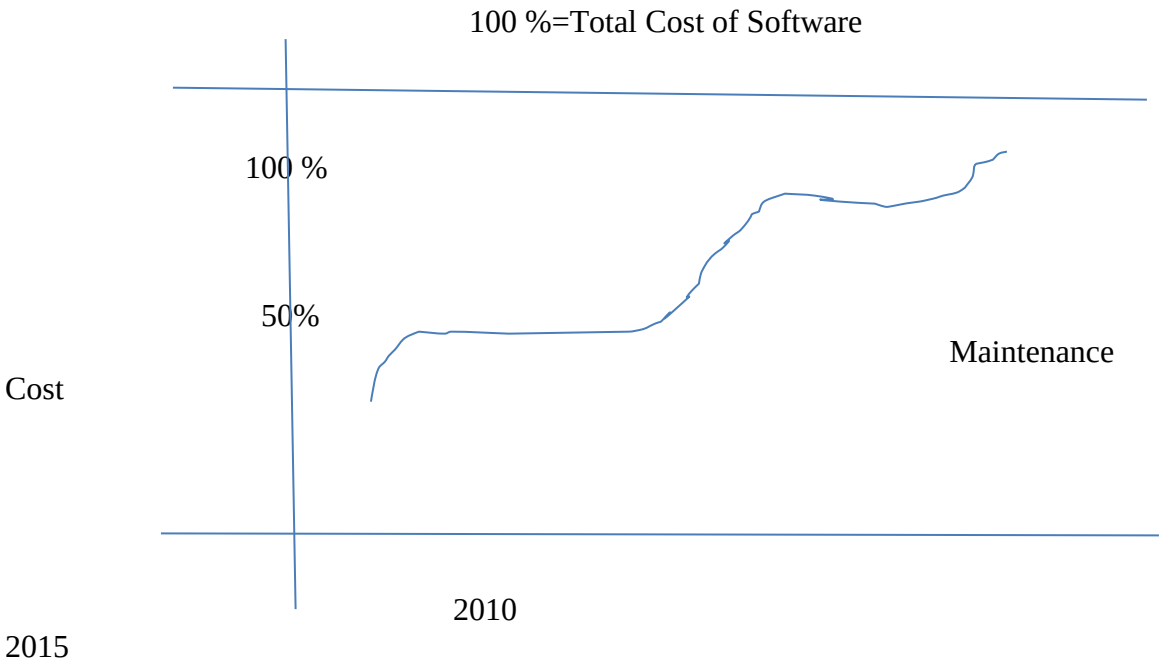


**Figure 1. Development of Software Maintenance costs as percentage of total cost**

In another study, the relative costs of maintenance and software development management were estimated more than 70% of the total cost of the software life.

By study introduced incomplete documentation and low maintenance as the factor to increase the cost. Therefore the defect makes it difficult for the maintenance team to expand or rebuild the product. Because the production team members may have left the company, be retired or replaced by another person who are unaware of the production process.

Since quality improvement and reduced software lifecycle time are among rapid application development techniques, the use of common-sense approach in the production shows that using individual techniques is not a threat to high availability, acceptable performance and quality of projects.

In a study researchers introduced support and maintenance software to estimate the maintenance effort. In these researchers' point of view support and maintenance software were a set of activities to support IT. According to conclusion that 43 to 44% of the estimations are mentally done by the experts and using such models results in the estimations complexity.

Therefore in this research software is introduced that due to the simplicity and ease of use is a replacement for the estimation models and experts' mental estimations.

Because the design and implementation of medical software is growing in Iran, and today most medical centers and health centers like to set up this system, it seems to be a growing and effective trend in automation of hospitals and medical and healthcare centers.

The study used the estimation techniques along with the knowledge of the project team, project manager and the president to design a predictive model for estimating the software. This model suggests that the maintenance plays an important role in the success of IT projects. Though the effective use of technology for estimating the time and cost is necessary but is not sufficient. To predict the exact time and cost, the management needs the knowledge, knowledge integration and sharing it.

## HISTORICAL PERSPECTIVE TO THE STUDIES WITH AIM OF ESTIMATING THE EFFORT

- Identify the factors affecting the cost of software maintenance.
- Prioritize each of the factors affecting the cost of software maintenance.
- Provide solutions to reduce the maintenance costs of medical software

## METHODOLOGY

The scope of this study is all the software produced in the years 2014 to 2015. 15 maintenance team members were kept as a community in this study. After sampling 40 members were selected randomly. In this study, a checklist- designed based on software engineering standards, researcher's experiences and experts' confirmation- was used for data collection. SPSS software and Expert Choice software were used for data analysis.

## RESULTS

Environments to run 14 software were Windows and 1 other one was DOS. System operational dates were from 2000 until 2014 and the operational period has been variable from 20 months to 102 months. Current status of all systems was active, and only one of them had been disabled.

The results of the first research objectives are as follow:

* Based on studies from reputable books and literature in the field of software engineering, well-

known sites and interviews with informatics experts, 25 effective factors were obtained and examined in the software maintenance cost estimations.

Cost factors were classified in 6 groups, which are as follow:

In line with the second goal (to prioritize each of the factors affecting the cost of medical software maintenance) the following results were obtained:

* For prioritization of the factors, at first and before modeling, the measurement criteria are needed to be identified. Then six found characteristics and their measurement criteria should be estimated and finally entered into the EC application.

To achieve this goal, the first measurement criteria (25 factors) were determined based on the importance in the software maintenance.

This questionnaire was prepared for a five-degree Likert scale and distributed among specialists in this field. After naming and ordering the information, the information was entered in the software. The list of measurement criteria and results after the interview are presented. Ranking of the influencing factors are displayed in Table 4 with the help of EC software.

The following results obtained regarding the third objective of the study:

* Based on the results of the current study and deficits in production and maintenance process, it seems that by following the guidelines that have been mentioned, one can reduce the cost of software maintenance to achieve desired results found in increasing productivity as well as making benefit of limited financial resources and manpower available in the country.

1) Providing an effective tool for Software Maintenance:

* Use appropriate language for system maintenance (especially in developing application systems) and develop tools to use these languages.
* Optimal use of system implementation such as CASE tools.
* The use of programming standards and protocols.
* The use of the principles, methods and modern programming techniques.

2) Using proper techniques in software development:

[12] Designing on the basis of independent modules.
[13] Designing and programming using methods consistent with the effective software engineering principles in software development.
[14] Prototyping before making the full system.

3) Having the right people for the software maintenance:

Select professionals familiar with the project language and programming language.
* Enough familiarity of project group with the host machine and the target machine.
* Having experienced group to offset the effect of the product increasing complexity on development and maintenance costs.
* Selecting individuals with the ability to adequately analyze the project and coordinate teamwork.

* Having individuals with experience in the similar work like this project and the host machine.
* Having individuals aware of the application and familiar with the expectations of the system.

4) Considering future

* Consider the program structure and acceptability of changes.
* Careful analysis of the needs based on the present situation and future trends for software maintenance.
* Doing changes in environment regarding software conditions, the efficiency increase rate and maintenance costs.

When the COCOMO model was accurately described the use of structured programming was not like today and software tools were not much available. Nowadays use of tools, has increased and structured techniques are common. Therefore, the factors that may have initially been defined are not important anymore. So some of the factors identified by Mr. Boehm (such as computer memory limitations factor) are outdated, but the overall coefficients of the product categories, computer, personnel and project are still fit. Given that all HIS systems are linked in a network, computer network factor has been added. Bohemia took these factors into consideration at his time, but today with such the technology, no scholar has examined and updated these factors. In this study we updated factors extracted by Boehm. According to the results, the validity of all these factors were confirmed and importance of the factors related to "project" and "computer network" was higher than other attributes, this means that project managers must estimate the cost of maintenance software, taking into account these two characteristics.

## CONCLUSION:

Based on interviews, 25 factors were identified in the cost estimation of medical software maintenance and were approved by informatics specialists. Using AHP model parameters, *6* groups were ranked. Since in each research a problem is stated and examined and at the end solutions are proposed, in this study, we also provide solutions to reduce maintenance costs. What the Informatics experts agree on for reducing maintenance costs, is that "with respect to some important factors such as accuracy in projects feasibility, along with complete documentation and helping the design and implementation mechanisms in the maintenance phase ,favorable results can be achieved in reducing the cost."

Generally we can conclude that for an accurate assessment and reduce the cost of software maintenance, software maintenance factors determining is essential. This will lead to the longer life of software. Evaluation of these factors and their influence on each of the maintenance costs, help the project manager in making decisions and planning, and is essential in the success of software maintenance. Project managers must consider these factors for success in their projects and decisions:

* Software is generally in a network and for giving a better service to applicants; data

collection is done on the central server. As a result, software should be developed in a network and maintainers should give their service in a network. In other words, if the software is single that costs less, but for network applications, computer network costs are added to the costs. So in designing this software these costs should also be noted.

* To reduce maintenance costs and increase the longevity of HIS software determining the cost estimation factors is necessary, this can help to increase productivity and provide a native model to estimate the system maintenance cost. It will make the project manager able to estimate the real cost at any time in the system.

**Table 1.**

List the factors affecting the cost of software maintenance

| No | factors affecting the cost of software maintenance |
|---|---|
| 1 | Required Software Reliability |
| 2 | Database size |
| 3 | Product Complexity |
| 4 | Computer Characteristics |
| 5 | Execution Time Constraint |
| 6 | Main Storage Constraint |
| 7 | Virtual Machine Volatility |
| 8 | Computer Turnaround Time |
| 9 | Annalist Capability |
| 10 | Application Experience |
| 11 | Programmer Capability |
| 12 | Virtual Machine Experience |
| 13 | Programming language Experience |
| 14 | Modern Programming practice |
| 15 | Use Of Software Tools |
| 16 | Schedule Project Maintenance |
| 17 | Software Experience |
| 18 | Application Understanding |
| 19 | Document Quality |
| 20 | Software Old |
| 21 | Structure Independency |
| 22 | Cost of Computer Networks |
| 23 | Security |
| 24 | Back Up Data |
| 25 | Computer’s Virus’s |

**The list of measurement criteria and after the interview**

| No | factors affecting the cost of software maintenance | Very Littele | Litele | Mormal | Much | Very Much |
|---|---|---|---|---|---|---|
| 1 | Required Software Reliability | 5.5 | 9.5 | 57.5 | 27.5 | 0 |
| 2 | Database size | 30 | 40 | 20 | 10 | 0 |
| 3 | Product Complexity | 0 | 3 | 10 | 40 | 47 |
| 4 | Computer Characteristics | | | | | |
| 5 | Execution Time Constraint | 0 | 0 | 2.5 | 30 | 67.5 |
| 6 | Main Storage Constraint | 17.5 | 80 | 2.5 | 0 | 0 |
| 7 | Virtual Machine Volatility | 4 | 16 | 42 | 35 | 3 |
| 8 | Computer Turnaround Time | 10 | 40 | 40 | 10 | 0 |
| 9 | Annalist Capability | 0 | 0 | 0 | 50 | 50 |
| 10 | Application Experience | 0 | 5 | 15 | 32.5 | 45 |
| 11 | Programmer Capability | 0 | 2.5 | 42.5 | 40 | 20 |
| 12 | Virtual Machine Experience | 20 | 30 | 20 | 15 | 15 |
| 13 | Programming language Experience | 15 | 27.5 | 42.5 | 15 | 0 |
| 14 | Modern Programming practice | 0 | 15 | 15 | 42.5 | 52.5 |
| 15 | Use Of Software Tools | 0 | 20 | 27.5 | 35 | 42.5 |
| 16 | Schedule Project Maintenance | 15 | 30 | 30 | 15 | 10 |
| 17 | Software Experience | 0 | 0 | 7.5 | 27.5 | 65 |
| 18 | Application Understanding | 0 | 0 | 5 | 30 | 65 |
| 19 | Document Quality | 0 | 5 | 0 | 25 | 70 |
| 20 | Software Old | 7 | 28 | 50 | 5 | 10 |
| 21 | Structure Independency | 45 | 35 | 20 | 0 | 0 |
| 22 | Cost of Computer Networks | | | | | |
| 23 | Security | 0 | 0 | 0 | 10 | 90 |
| 24 | Back Up Data | 0 | 0 | 42.5 | 35 | 22.5 |
| 25 | Computer's Virus's | 0 | 5 | 30 | 30 | 35 |

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# Cloud computing – Services need in our life (IaaS, PaaS, SaaS)

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**Abstract:**

*With the day to day improvements in everybody's life with Information and Communication Technology (ICT) with of course, internet. (Without internet one cannot be able to connect online and do the needful things like shopping, booking, purchasing, gaming (Offline gaming is not concern here).etc). IaaS, PaaS & SaaS will become the advancement in the service sector. Through cloud computing one can avail a specific cloud with virtual machines (VMs) from various vendors around the globe and meet their individual needs online with fewer efforts. Some of the benefits of using these services are like reducing capital cost (no need to spend big money on hardware, software or licensing fees), Improve accessibility (have access anytime, anywhere, making your life so much easier), Monitor projects more effectively (Stay within budget and ahead of completion cycle times). etc.*

**Keywords:** *IaaS, PaaS, SaaS, Cloud Computing, Grid Computing*

## I) Introduction:

Computer, now-a-days is very common term used in our life just like our important needs for surviving into the world. E.g. Food, Water, Shelter, Electricity, Gas etc. Just like that computer and its various services offer a great and wide variety of support systems in our life such as IaaS (Infrastructure as a Service), PaaS (Platform as a Service), SaaS (Software as a Service) in cloud computing, where services are hosted by various vendors on pay basis. In cloud computing the word 'Cloud' denotes businesses and users are able to access various applications from anywhere in the world on demand. To run a particular application on a single machine, one can get direct access of the same through this service.

IaaS – After designing and developing a website for commercial organizations, giving it to the vendor for hosting was very clumsy in early days. They must have to choose storage space as either a dedicated server or shared server, but with the cloud like IaaS, Organizations make use of the unlimited storage potential of the cloud infrastructure. They can expand and shrink their storage space as needed without having to worry about dedicated servers on site.

PaaS – Early days of computing was like to install the applications individually onto the dedicated computer's hard drive or a server, where user / operator use the same applications on that machine/s. With the help of Paas, Companies can run their applications on the cloud service's platform without having to worry about maintaining hard drives and servers.

SaaS – In the commercial organizations progress process, a good software plays a very vital role. But if the software which is installed on the machine behaves differently as some of the parameters changed with time, then it becomes a chaos for that organization. With the help of SaaS, It allows people to access the functionality of particular software without worrying about storage or other software application issues. In cloud computing the capabilities of various business applications provide excellent services which can be accessed over a network i.e. internetwork i.e. internet.

Cloud computing has been widely established by Amazon, Google, Salesforce, IBM, Microsoft, Sun Microsystems and introduced their new data centers for hosting various applications on cloud in various locations across the globe to provide duplicity and making sure that reliable service should be provided in case of any mishap happens. Following figure 1 indicates various services provided by cloud computing.

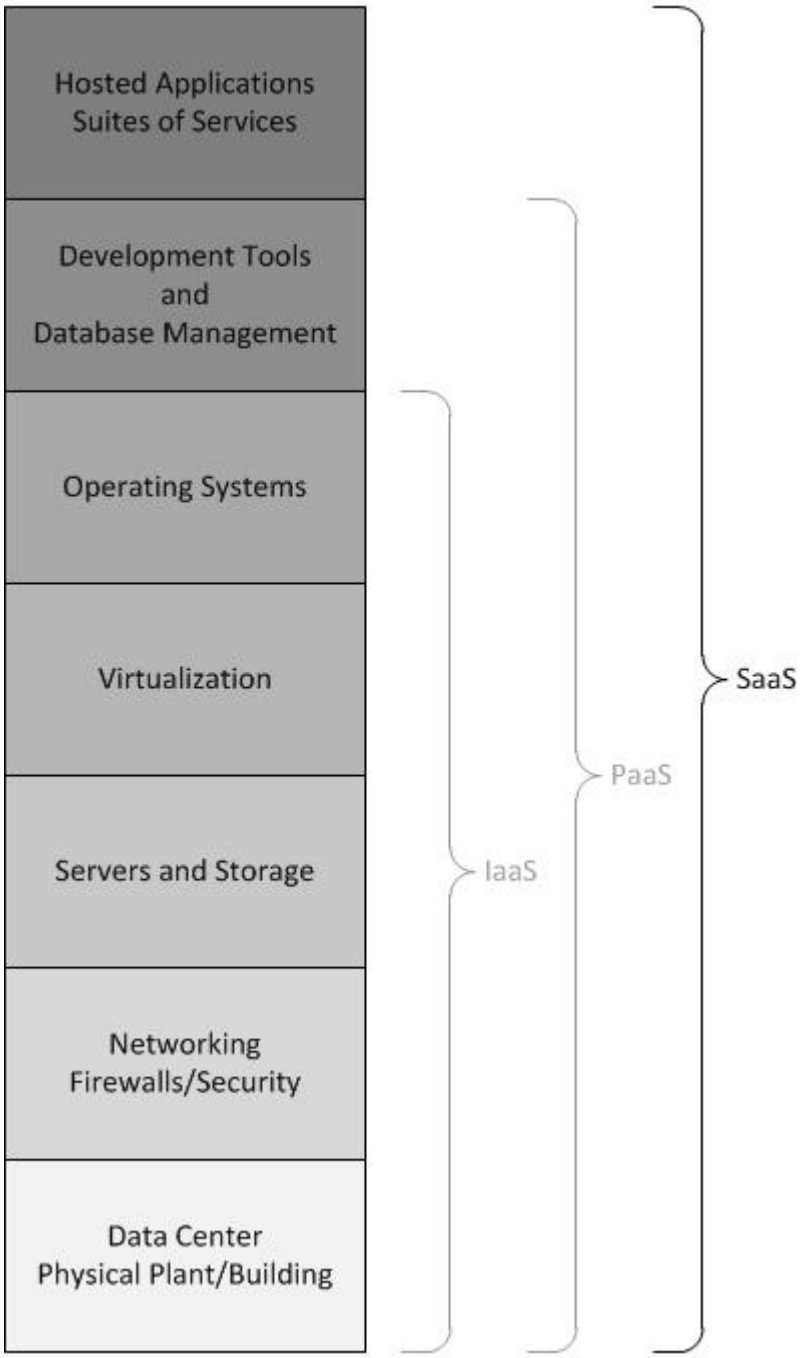


**Figure 1 – various services offered by cloud computing**

## II) Literature Review

In 1969, Leonard Kleinrock, one of the chief scientists of the Advanced Research Projects Agency Network (ARPANET) project which started the Internet, said: "As of now, computer networks are still in their infancy, but as they grow up and become sophisticated, we will probably

see the spread of `computer utilities' which, like present electric and telephone utilities, will service individual homes and offices across the country". This vision has changed the entire lookup towards computer fraternity in which computer services will be available on demand like other services e.g. electricity, gas, water etc. These services are based on demand pay services. Sun Microsystems co-founder Bill Joy stated that "It would take time until these markets to mature to generate this kind of value. Predicting now which companies will capture the value is impossible. Many of them have not even been created yet". Apart from this Grid computing enables the sharing, selection, and aggregation of a wide variety of geographically distributed resources including supercomputers, storage systems, data sources, and specialized devices owned by different organizations for solving large-scale resource-intensive problems in science, engineering, and commerce. Peer-to-Peer (P2P) computing allows peer nodes (computers) to share content directly with one another in a decentralized manner. In pure P2P computing, there is no notion of clients or servers since all peer nodes are equal and concurrently be both clients and servers. The goals of P2P computing include cost sharing or reduction, resource aggregation and interoperability, improved scalability and reliability, increased autonomy, anonymity or privacy, dynamism, and ad-hoc communication and collaboration.

A service computing focuses on the linkage between business processes and IT services so that business processes can be seamlessly automated using IT services. Examples of services computing technologies include Service-Oriented Architecture (SOA) and Web Services. The SOA facilitates interoperable services between distributed systems to communicate and exchange data with one another, thus providing a uniform means for service users and providers to discover and offer services respectively. The Web Services provides the capability for self-contained business functions to operate over the Internet.

Today, the latest paradigm to emerge is that of Cloud computing which promises reliable services delivered through next-generation data centers that are built on virtualized compute and storage technologies. Consumers will be able to access applications and data from a ``Cloud'' anywhere in the world on demand. The consumers are assured that the Cloud infrastructure is very robust and will always be available at any time. Computing services need to be highly reliable, scalable, and autonomic to support ubiquitous access, dynamic discovery and composability. In particular, consumers indicate the required service level through Quality of Service (QoS) parameters, which are noted in SLAs established with providers. Of all these paradigms, the recently emerged Cloud computing paradigm appears to be the most promising one to leverage and build on the developments from other paradigms.

## III) Objective

In which way the above called services like IaaS, PaaS and SaaS are useful in our life with its advs and disadvs.

## IV) Research Methodology

Basically there are three major methods of research methodology in computer science these are a) Experimental method – it clearly indicates that experiments should be done in order to extract results from real world implementations, b) Simulation method – it is used especially in computer science because it offers the possibility to investigate systems or regimes that are outside of the experimental domain or the systems that is under invention or construction. and c) Theoretical method – are based on classical methodology as they are related to logic and mathematics. Some ideas are the existence of conceptual and formal models (data models and algorithms). Here secondary data used which helps to find the actual usage of the various services used in cloud computing like IaaS, PaaS and SaaS.

## V) Findings

**V.1.1) IaaS** - Instead of ready-made applications or services, development tools, databases, etc., IaaS provides the underlying operating systems, security, networking, and servers for developing such applications, services, and for deploying development tools, databases, etc.

### V.1.2) Advantages

- You or your organization are responsible for the versioning/upgrades of software developed
- Various pricing models may allow paying only for what you use. This, for example, can allow an individual or a small organization to use sophisticated development software that they could not afford if it was installed on an internal, dedicated server.
- If you have events such as high seasonal sales activity, then the elasticity of the Cloud with IaaS might provide an opportunity.
- The IaaS Cloud Provider may provide better security than your existing software (security - or inadequate security - can also be a disadvantage). Better security may come in part because it is critical for the IaaS Cloud Provider and is part of their main business. In-house security, on the other hand, is not usually an individual's or a organization's main business and, therefore, may not be as good as that offered by the IaaS Cloud Provider.
- No need to manage the introduction of new releases of the development or underlying software. This is handled by the IaaS Cloud Provider.
- No need to manage the underlying data center. This is handled by the IaaS Cloud Provider.
- Usually, there is no need to manage backups. This is handled by the IaaS Cloud Provider.
- If the IaaS Cloud Provider supports failover should the software (for example, the database management software) or the data center become unavailable, that failover is a concern of the IaaS Cloud Provider and you do not need to plan for it.

### V.1.3) Disadvantages

- The maintenance and upgrades of tools, database systems, etc. and the underlying infrastucture is your responsibility or the responsibility of your organization.
- When it is mandatory that the underlying hardware be of a specific type or the underlying software be modified to support the deployed application.
- There may be legal reasons that preclude the use of off-premise or out-of-counry data storage.
- Security features of the IaaS Cloud Provider may not adequate for your needs.
- If you have a need for high-speed interaction between your internal software or software in another Cloud and the IaaS Cloud Provider, relying on an Internet connection may not provide the speed that you need.

**V.2.1) PaaS -** Instead of ready-made applications or services, PaaS provides the platform for developing such applications and services. Here you find various development tools and such things as database management systems, enterprise service buses (ESBs), application servers, business intelligence (BI)/business analytics, and so on that could be used to support the applications and services developed.

### V.2.2) Advantages

- The maintenance and upgrades of tools, database systems, etc. and the underlying infrastucture is the responsibility of the PaaS Cloud Provider.
- Various pricing models may allow paying only for what you use. This, for example, can allow an individual or a small organization to use sophisticated development software that they could not afford if it was installed on an internal, dedicated server.
- Some PaaS Providers provide development options for multiple platforms: mobile, browser, and so on. If you or your organization want to develop software that can be accessed from multiple platforms, this might be an easy way to make that happen.
- If you have events such as high seasonal sales activity, then the elasticity of the Cloud with PaaS might provide an opportunity.
- The PaaS Cloud Provider may provide better security than your existing software (security -or inadequate security - can also be a disadvantage). Better security may come in part because it is critical for the PaaS Cloud Provider and is part of their main business. In-house security, on the other hand, is not usually an individual's or a organization's main business and, therefore, may not be as good as that offered by the PaaS Cloud Provider.
- No need to manage the introduction of new releases of the development or underlying software. This is handled by the PaaS Cloud Provider.
- No need to provision servers. This is handled by the PaaS Cloud Provider.
- No need to manage the underlying data center. This is handled by the PaaS Cloud Provider.
- Usually, there is no need to manage backups. This is handled by the PaaS Cloud Provider.
- If the PaaS Cloud Provider supports failover should the software (for example, the database management software) or the data center become unavailable, that failover is a concern of the PaaS Cloud Provider and you do not need to plan for it.

### V.2.3) Disadvantages

- When it is mandatory that the underlying hardware be of a specific type or the underlying software be modified to support the deployed application.
- There may be legal reasons that preclude the use of off-premise or out-of-counry data storage.
- Security features of the PaaS Cloud Provider may not adequate for your needs.

- If you have a need for high-speed interaction between your internal software or software in another Cloud and the PaaS Cloud Provider, relying on an Internet connection may not provide the speed that you need.

**V.3.1) SaaS -** Software as a Service (SaaS) is what most people mean when they say "the Cloud". SaaS provides a complete software solution. This software could be email management, calendaring, Enterprise Resouce Planning (ERP), customer relationship management (CRM), documentation management, and so on. The easiest way to think about SaaS is that it is some type of standard software package that can be used on demand and is paid for by subscription, by use, by advertising, or by sharing information (such as email addresses) of users.

**V.3.2) Advantages**

- Various pricing models may allow paying only for what you use. This, for example, can allow an individual or a small organization to use sophisticated software that they could not afford if it was installed on an internal, dedicated server.
- SaaS Cloud Providers often take into account multiple platforms: mobile, browser, and so on. If you or your organization want software that can be accessed from multiple platforms, this might be an easy way to make that happen. As part of this, SaaS Cloud Providers may also provide apps for mobile devices.
- If you have events such as high seasonal sales activity, then the elasticity of the Cloud with SaaS might provide an opportunity.
- The SaaS Cloud Provider may provide better security than your existing software (security - or inadequate security - can also be a disadvantage). Better security may come in part because it is critical for the SaaS Cloud Provider and is part of their main business. In-house security, on the other hand, is not usually an individual's or a organization's main business and, therefore, may not be as good as that offered by the SaaS Cloud Provider.
- No need to manage the introduction of new releases of the software. This is handled by the SaaS Cloud Provider.
- No need to provision servers. This is handled by the SaaS Cloud Provider.
- No need to manage the underlying data center. This is handled by the SaaS Cloud Provider.
- Usually, there is no need to manage backups. This is handled by the SaaS Cloud Provider.
- If the SaaS Cloud Provider supports failover should the software (for example, the database management software) or the data center become unavailable, that failover is a concern of the SaaS Cloud Provider and you do not need to plan for it.

**V.3.3) Disadvantages**

- More than typical packaged software, using a SaaS Cloud Provider will require your or your organization to use a "vanilla" version of the software. Minimal customization is typically offered. (This is also an advantage.)
- There may be legal reasons that preclude the use of off-premise or out-of-counry data storage.

- Security features of the SaaS Cloud Provider may not adequate for your needs.
- If you have a need for high-speed interaction between your internal software or software in another Cloud and the SaaS Cloud Provider, relying on an Internet connection may not provide the speed that you need.

## VI) Conclusion:

Even though most of the organizations seem to have lot of interest in availing these facilities, there are advantages and disadvantages both. But after looking at the advantages over disadvantages, they seem to be very much useful and have a lot of things which can be taken as a positive perspective view. Now a days, Our life has been extended to more than computer and smart phones, the technology of these services now can be on our fingertips and we can easily avail these facilities provided by cloud computing.

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# Internet of Things: Applications Area

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**Abstract:**

*In today's era ubiquitous sensing by sensor network is enormous. The tremendous increase in sensor devices in communicating -actuating network leads to Internet of Things. Fueled by the recent adaptation of a variety of enabling wireless technologies such as RFID tags and embedded sensor and actuator nodes, the IoT has stepped out of its infancy and is the next revolutionary technology in transforming the Internet into a fully integrated Future Internet. As we move from www (static pages web) to web2 (social networking web) to web3 (ubiquitous computing web), the need for data-on-demand using sophisticated intuitive queries increases significantly. This paper presents application overview of Internet of Things*.

**Keywords:** *Internet of Things, Ubiquitous sensing, Cloud computing, Wireless sensor networks, RFID Smart environments, Future Internet.*

## Introduction:

Internet of Things (IoT) is an integrated part of Future Internet and is a dynamic global network infrastructure with self-configuring capabilities based on standard and interoperable communication protocols where physical and virtual "things" have identities, physical attributes, and virtual personalities and use intelligent interfaces, and are seamlessly integrated into the information network.

Internet of Things hosts the vision of ubiquitous computing and ambient intelligence enhancing them by requiring a full communication and a complete computing capability among things and integrating the elements of continuous communication, identification and interaction. The Internet of Things fuses the digital world and the physical world by bringing different concepts and technical components together: pervasive networks, miniaturization of devices, mobile communication, and new models for business processes.

The Internet of Things will create a dynamic network of billions or trillions of wireless identifiable "things" communicating with one another and integrating the developments from concepts like Pervasive Computing, Ubiquitous Computing and Ambient Intelligence and hosts the vision of ubiquitous computing and ambient intelligence enhancing them by requiring a full communication and a complete computing capability among things and integrating the elements of continuous communication, identification and interaction. The Internet of Things fuses the digital world and the physical world by bringing different concepts and technical components together: pervasive networks, miniaturization of devices, mobile communication, and new models for business processes.

In the IoT, "things" are expected to become active participants in business, information and social processes where they are enabled to interact and communicate among themselves and with the environment by exchanging data and information "sensed" about the environment, while reacting autonomously to the "real/physical world" events and influencing it by running processes that trigger actions and create services with or without direct human intervention.

The Internet of Things will bring tangible business benefits, such as the high-resolution

management of assets and products, improved life-cycle management, and better collaboration between enterprises; many of these benefits are achieved through the use of unique identification for individual things together with search and discovery services, enabling each thing to interact individually, building up an individual life history of its activities and interactions over time.

The Internet of Things allows people and things to be connected in the context where there is seamless interconnection between people and things and/or between things and things elements **as defined in figure-1.**

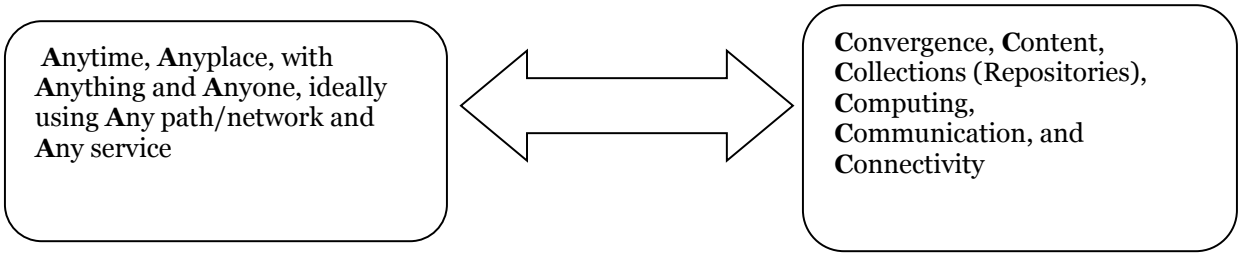



**Figure-1: Internet of Things**

**Internet of Things fundamental characteristics:**

**The fundamental characteristics of the IoT are as follows :**

• **Interconnectivity:** Anything can be connected anything with global communication infrastructure.

• **Things-related services:** The IoT is capable of providing thing-related services such as privacy protection and semantic consistency between physical things and their associated virtual things.
To achieve thing related services along with semantic consistency, both the technology in physical world and information world will change.

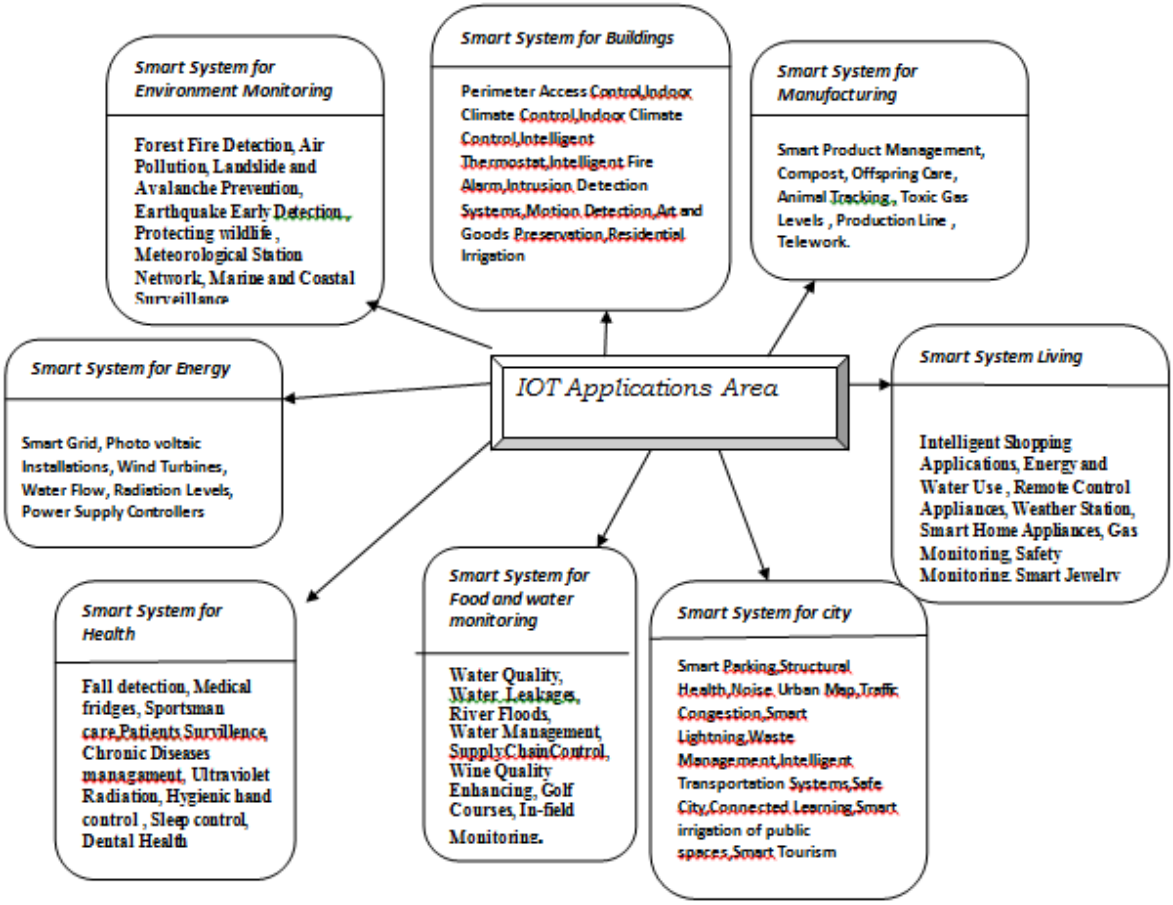
• **Heterogeneity:** The devices in the IoT are of different hardware platforms and networks.
• **Dynamic changes:** The state (sleeping and waking up, connected and/or disconnected as well as the context of devices including location and speed) of devices change dynamically. Also, the number of devices varies.
• **Enormous scale:** The number of devices that need to be managed and that communicate with each other will be much more than devices connected to current internet. Device-trigged communication will outnumber human trigged communication in this case.

**IOT Application Domain Areas**

There are the domains and the environments where IOT is improving the quality of our lives may at home, while travelling, when sick, at work, while exercising, at the gym, while playing. These environments are now equipped with intelligent things or objects, with or without any communication capabilities. Giving these objects the possibility to communicate with each other and to find out the information received from the surroundings gives different environments with very wide range of applications can be deployed.
These can be grouped into different domains like:
_ Transportation and logistics domain.
_ Healthcare domain.
_ Smart environment (home, office, plant) domain.

_ Personal and social domain, etc.

IOT application presented below in figure-2 includes examples of application from various different domains.




**1)Smart System for food and water monitoring**:

Water quality is checked for eligibility of drinkability, water leakage can be automatically checked to avoid water wastage, water level can be monitored to detect flood situation if

any, residential water management, in context with food also quality can be monitored such as sugar in grape wine and what not.

**2)Smart System for Health:**

Physically disabled and senior citizen can be helped out by smart fall detection system, physical activity monitoring for aging people etc.

**3)Smart System for Living:**

IOT will also assist in smart living through remote appliances control system, smart home applications such as intelligent refrigerator telling you what is inside and what need to buy, home alarm system, baby monitoring system, Bluetooth enabled jewelry help to track if stooled etc.

**4)System for smart environment monitoring:**

forest fire can be detected through fire sensors to avoid further disaster ,air pollution is detected to take further preventative measures, earthquake can be detected early to avoid further life arm.

**5)Smart System for Manufacturing:**

Control of rotation of products in warehouses, control of humanity, temperature in microbial contaminants, control of growth conditions of offspring of animal farm, animal tracking, toxic gases level in farms etc.

**6)Smart system for Energy:**

Smart grid will assist in monitoring energy consumption, performance in solar energy plants, radiation level measurement in nuclear plants to check for leakage, to avoid energy wastage for electronic things.

**7)Smart System for Buildings:**

Liquid detection in data warehouses, data centers can be done to prevent corrosion, intelligent thermostat can be used to energy wastage and control, intelligent fire alarm is used to detect fire threat if any.

**8) Smart System for city:**

Real time monitoring parking spaces availability can be checked by smart parking system, historical monuments can be monitored, smart roads, intelligent highway, and improvement in teacher utilization, production improvement.

**Summary and conclusions:**

The proliferation of devices with communicating–actuating capabilities is bringing closer the vision of an Internet of Things, where the sensing and actuation functions seamlessly blend into the background and new capabilities are made possible through access of rich new information sources

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# Digital Equality, the right of every citizen

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**Abstract:**

*Nowadays a very strong debate is flowing in the air that is related to the concept of digital equality. But the sad fact is very few of us know the actual meaning of digital equality. Our main aim in taking this topic for our project is not solving or giving any answer to the debate, but just to make the concept of digital equality or free basics clear for the public, so that they can take correct decision regarding the same.*

## Introduction:

To begin with the concept of digital equality, it conveys a very simple principle which says that every human being has the equal right to get digitally satisfied. In simple words every individual should be given a right to free basic that means free internet usage. As in today's world it is believed that internet is one of the important requirements for the sustainability of the humans similar to that of food, clothing and shelter. It is very clear that the intelligent society or the ones who are able to reach up to the internet facility is in support of digital equality as if free basics become available lot of their pocket money can be saved. Supporters also believe that with digital equality the pace of the county's run towards becoming a developed country from its tag of still being in the developing stage can be fastened. But is this really going to happen? The concept of digital equality is also criticized by many.

## Research problem:

According to the criticizers the concept of digital equality clashes with the norm of net neutrality. Net neutrality is a concept that states that net should be provided at equal price irrespective of its usage but certainly not for free. In simple words people who can afford it, can get it. If digital equality comes into picture it would be impossible to follow the norm of net neutrality. This will detach the involvement of government and other internet service providers totally, which will lead to unemployment and other related issues as the total concept will be left with the free market. The main challenge is to create a linking bridge between the two concepts and balance it so that digital equality can be achieved along with ensuring to follow the norms of net neutrality.

## Objectives:

1. To make the concept of free basics clear.
2. To understand the proper meaning of the concept of net neutrality.
3. To find out the benefits of implementation of digital equality.
4. To understand the importance of digital equality among various age group of people.
5. To find out whether digital equality can any way help the society to improve in its way.
6. To provide proper guidelines for the public to take correct decision when it comes to the fight between digital equality and net neutrality.

## Research methodology:

The primary data of the study is collected by conducting a survey between different age group of people. The secondary data is gathered from related articles, journals, books, websites etc.

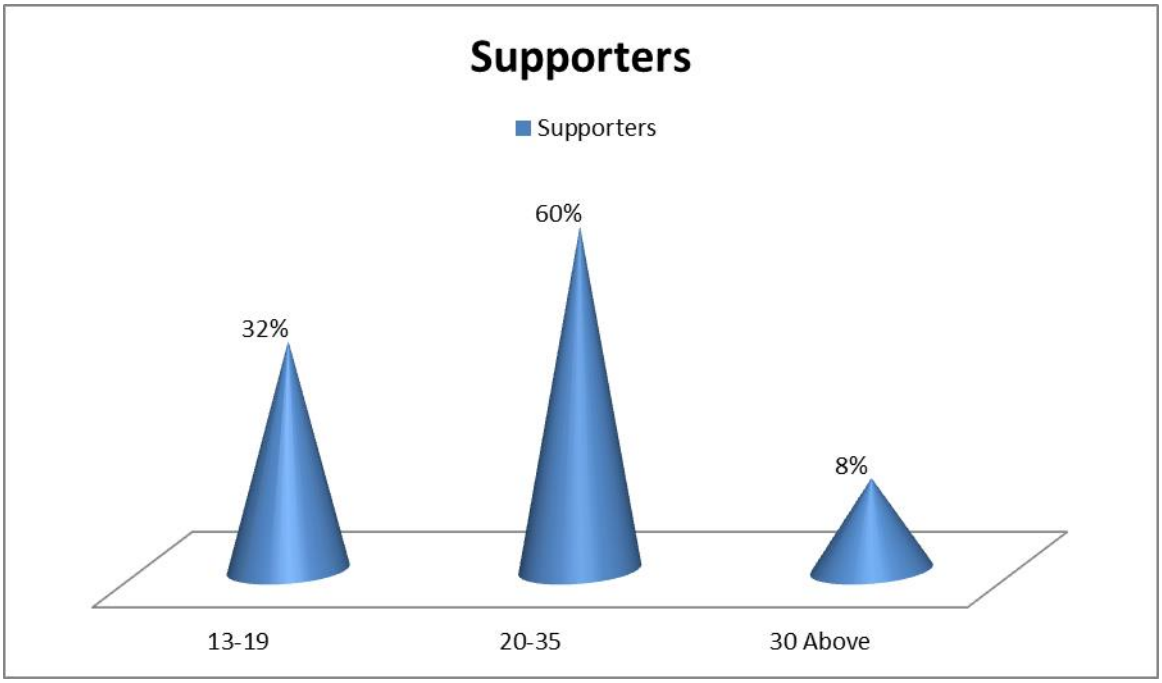
## Discussion:

1. **Disadvantages of digital equality over net neutrality-**

   - First of all digital equality will totally wipe off the concept of net neutrality.
   - This may lead to a major problem for interfering part of the governing bodies as well as the internet service providers.
   - If we take the example of Maslow's theory of need hierarchy, human wants increases with the every bit they receive. With this concept in mind, will the concept of digital equality be affordable measure. Today if we give 1 mbps speed for free people will start demanding for 100 mbps in few days.
   - Also we will not be able to control the usage of internet.

2. **Supporters of digital equality-**

   In order to find out that which age group of people are supporting digital equality in a better way, we conducted a survey. For doing this we categorized people into three categories of age limit from- 10-19, 20-35, 30 above. The result can be seen in the figure below-



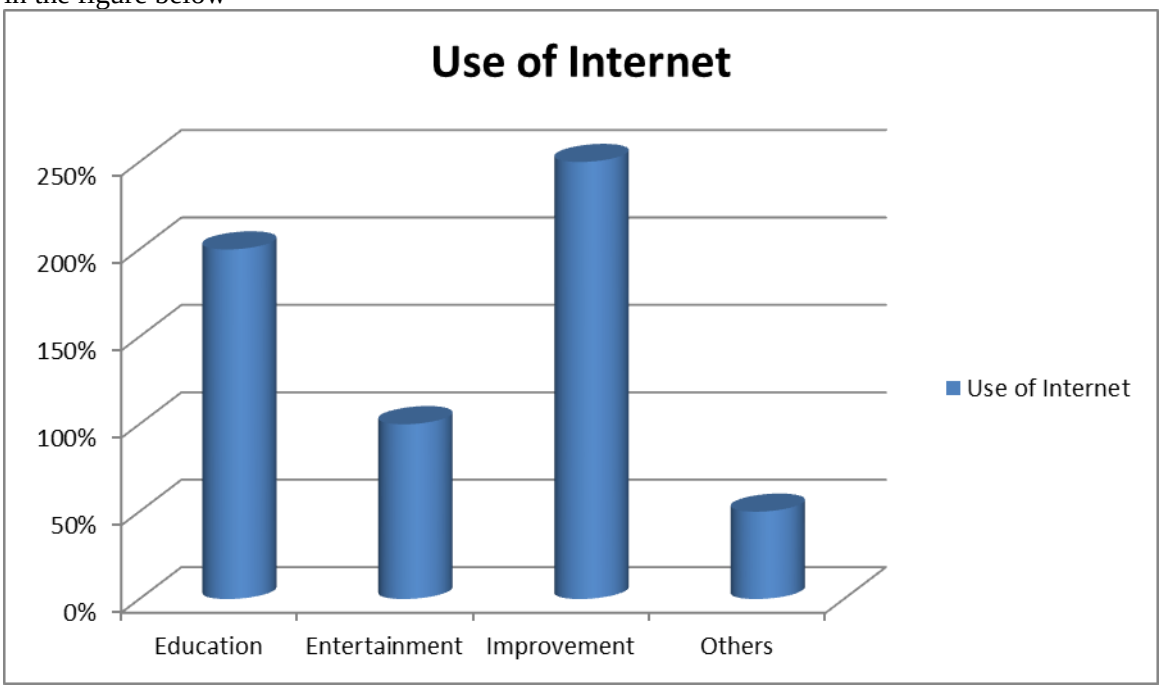
This chart clearly states that more supporters of this concept lie in the age group of 20-35 as they are the people who are more into internet.

### 3. Advantages of digital equality above net neutrality-

- First of all it will allow free basics to come into picture which means that everyone will be able to get free internet services.
- This will help the poor and economically backward people as they will now be able to access internet.
- This will definitely help the country to use its resources to the fullest.
- People who were not in a position to afford internet facility up till now will be able to access it.
- The problems like hike in the internet plans that always becomes the problem for people who are not in a position to avail these services but avail it due to its massive need will diminish.

### 4. How digital equality helps the society to turn better-

To know this in a better way we included few questions in the survey we conducted which was related to a question which says "if free internet is provided to people how it would be helpful?" As our survey result for the previous topic showed that the people in age group of 20-30 are more in number to support digital equality, for this part of the survey we tried taking response of only this age group of people. The result can be seen in the figure below-




This chart clearly shows that the young minds of the country have answered towards the benefit of the society. As according to them if free internet is provided to them, they will majorly use it for educational purposes to enrich their knowledge in different field which

will definitely help the society in the long run. And most of them gave positive review for using internet for improving the various systems of the country like online bill payment, money transfer, and various government services which can now be availed online with faster pace. Because this is how our country can actually develop.

## Conclusion:

1. Definitely digital equality is a better concept.
2. But implementation of digital equality is not easy as even if we make internet facility free the medium of its usage like smart phone or laptop does not come for free.
3. Totally avoiding net neutrality may bring forward many issues, most common of which will be unemployment which is very serious problem when it comes to India.
4. Hence it is very essential to find ways to merge the concept of digital equality along with net neutrality.
5. Digital equality will for sure improve the societal conditions of the country.

## Recommendation:

1. The balance between net neutrality and digital equality may be achieved if government try to create a balance between the two by not making everything free but deciding what exactly is essential to be given as free.
2. This may also help if we provide free internet only in the essential area such as schools, colleges, offices etc. this will reduce the use of internet for entertainment and other related purposes and ensure that it is being used for something good.
3. By doing this also we can have a control on the usage of the internet and the budget relating to it can also be controlled.

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# EDGE DETECTION IN DIGITAL IMAGE PROCESSING

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**Abstract:**

*Edge detection is one of the fundamental steps in image processing ,image analysis, image pattern recognitions . Many techniques of edge detection are introduced i.e canny edge,sobel edge,prewitt. Edges provides important images information that can be use for image interpretation. The focus of this paper is attempt to improve the quality of digital images using edge detection in MATLAB version*

**Keywords:**
*edge detection method, image segmentation, digital image processing*

## Introduction:

Edges characterize object boundaries and are useful features for segmentation, registration and object identification in scenes.There are many problems in signal processing where the detection of a local change in a signal is of great importance. Most of the conventional algorithms for edge detection, such as for example the Sobel and theLaplace algorithms, rely on the estimation of first and second local gradient of the image respectively.**Edge detection** is the name for a set of mathematical methods which aim at identifying points in a digital image which the image brightness changes sharply or, more formally, has discontinuities.

## Illustrations and Photographs:

### Canny images:

Edge detection, especially step edge detection has been widely applied in various computer vision systems, which is an important technique to extract useful structural information from different vision objects and dramatically reduce the amount of data to be processed. Canny has found that, the requirements for the application of edge detection on diverse vision systems are relatively the same. Thus, a development of an edge detection solution to address these requirements can be implemented in a wide range of situations.

The **Canny** edge detector is an edge detection operator that uses a multi-stage algorithm to detect a wide range of edges in **images**.

### Sobel images:

It is named after Irwin Sobel and Gary Feldman, colleagues at the Stanford Artificial Intelligence Laboratory (SAIL). It was co-developed with Gary Feldman at SAIL. Sobel and Feldman presented the idea of an "Isotropic 3x3 Image Gradient Operator" at a talk at SAIL in 1968. Technically, it is a discrete differentiation operator, computing an approximation of the gradient of the image intensity function. At each point in the image, the result of the Sobel-Feldman operator is either the corresponding gradient vector or the norm of this vector. The Sobel-Feldman operator is based on convolving the image with a small, separable, and integer valued filter in the horizontal and vertical directions and is therefore relatively inexpensive in terms of computations. On the other hand, the gradient approximation that it produces is relatively crude, in particular for high frequency variations in the image.

The **Sobel operator**, sometimes called the **Sobel-Feldman operator** or **Sobel filter**, is used in image processing and computer vision , particularly within edge detection algorithms where it creates an image emphasizing edges.

**Prewitt images:**

In simple terms, the operator calculates the gradient of the image intensity at each point, giving the direction of the largest possible increase from light to dark and the rate of change in that direction. The result therefore shows how "abruptly" or "smoothly" the image changes at that point, and therefore how likely it is that part of the image represents an edge, as well as how that edge is likely to be oriented. In practice, the magnitude (likelihood of an edge) calculation is more reliable and easier to interpret than the direction calculation.

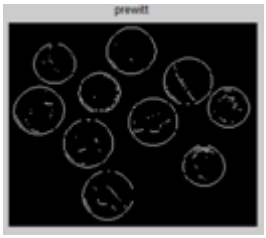
The **Prewitt operator** is used in image processing, particularly within edge detection algorithms. Technically, it is a discrete differentiation operator, computing an approximation of the gradient of the image intensity function.

## Coins

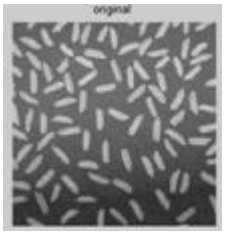

Original images


Canny images


Sobel images


Prewitt images

**Rice**


**Original images**


**canny images**


**sobel images**


**Prewitt images**

## Conclusions:

Edge detection aims at identifying points in digital image at wich image brightness can change sharply or formatted. This is very important steps for extracting features of an images which may be used for image identification. As shown in the figures images under different techniques like sobel edge ,canny edge, prewitt techniques. This three techniques are having the different output and result.

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# STUDY OF POWER LAW TRANSFORMATION FOR COLOR IMAGE ENHANCEMENT

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## Abstract:

*Image enhancement technique plays a vital role in improving the quality of an image. Enhancement technique basically enhances the foreground information and retains the background and improves the overall contrast of an image. In this paper we introduce a novel method of* ***power-law transformation*** *on a color image for binarization. This method works well for images having poor contrast, especially to those images in which the peaks corresponding to the background and the foreground are not widely separated. We show the improvement in image binarization and the consequent increase in the quality performance of the image.*

## Keywords:

Image processing, Image enhancement, Power-law transform and Binarization.

## Introduction:

Power law Transformation is defined by the equation $s = cr^{\gamma}$ where c and $\gamma$ are positive constants. Power law curves with fractional values of gamma map a narrow range of dark input values into wider range of output values with the opposite being true for higher value of input levels.In addition to enhancement of image by contrast and dynamic range modification, images can also be enhanced by reducing degradations that may be present. This area of image enhancement overlaps with image restoration.

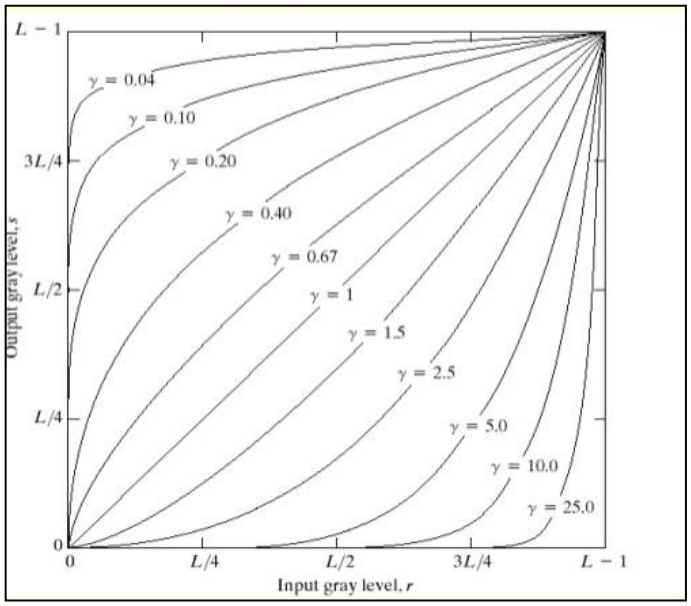


**Figure**: Plots of the equation $s = cr^{\gamma}$

**Gamma Correction**

A variety of devices used for image capture, printing, and display respond according to a power law. By convention, the exponent in the power-law equation is referred to as gamma. The process used to correct these power-law response phenomena is called gamma correction. Gamma correction is important if displaying an image accurately on a computer screen is of concern. Images that are not corrected properly can look either bleached out, or, what is more likely, too dark. Trying to reproduce colors accurately also requires some knowledge of gamma correction because varying the value of gamma correction changes not only the brightness, but also the ratios of red to green to blue

**Low Pass Filtering**

By reducing the high-frequency components while preserving the low-frequency components, low pass filtering reduces a large amount of noise at the expense of reducing a small amount of signal.

Low pass filtering can also be used together with high pass filtering in processing an image prior to its degradation by noise. In applications such as image coding, an original under graded image is available for processing prior to its degraded image can be high pass filtered prior to its degradation and then low pass filtered after degradation. This may result in some improvement in the quality or intelligibility of the resulting image

**Example:**

**Original Image-**

**Figure (A) shows Result after applying power law transformation with value of γ=1.**

**Figure (B) shows Result after applying power law transformation with value of γ=2.**

image and worse for others types. Here by varying the gamma value, we found that our algorithm has given better results that exhibit sharp high contrast images. But sometimes it leads to the loss of few details due to the high contrast. Hence for précised results we must ensure that the dark images with low contrast must use the power law transformations with the gamma values lower than 1 while for light images use the power law transformation with gamma values higher than 1.Therefore we observe that by using power-law transform, we have proposed a novel way that can be effectively used to improvise the color images.

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# Histogram Equalization For X-Ray Images

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**Abstract**

*The aim of image enhancement is to improve the interpretability or perception of information in images for human viewers, or to provide `better' input for other automated image processing techniques. Histogram equalization (HE) is one of the effective & simple techniques for enhancing image quality. However, the conventional histogram equalization methods usually result in excessive contrast enhancement. This paper presents a review of histogram techniques for image contrast enhancement. The major difference among the methods is only the criteria used to divide the input histogram.*

Keywords*: image enhancement, contrast enhancement, histogram equalization, absolute mean brightness error, histogram partition.*

## Introduction:

Contrast enhancement has great significance in digital image processing. Histogram Equalization (HE) is one of the most popular, computationally fast and simple to implement techniques for contrast enhancement of digital images. A histogram is a graphical representation of the distribution of data. An image histogram is a graphical representation of the number of pixels in an image as a function of their intensity. The histogram equalization technique is used to stretch the histogram of the given image. Greater is the histogram stretch greater is the contrast of the image.

In other words if the contrast of the image is to be increased then it means the histogram distribution of the corresponding image needs to be widened. Histogram equalization is the most widely used enhancement technique in digital image processing because of its simplicity and elegancy. In an image processing context, the histogram of an image normally refers to a histogram of the pixel intensity values. The histogram is a graph showing the number of pixels in an image at each different intensity value found in that image.

The gray levels in the image are remapped in order to uniformly distribute intensities of pixels in output image using Histogram Equalization techniques. It flattens and stretches the dynamic range of the images histogram and resulting in overall contrast enhancement. However, there are several cases that are not well managed by BHE especially when implemented to process digital images. Histogram equalization transforms the histogram of the original image into a flat uniform histogram with a mean value that is in the middle of gray level range

## Histogram Equalization:

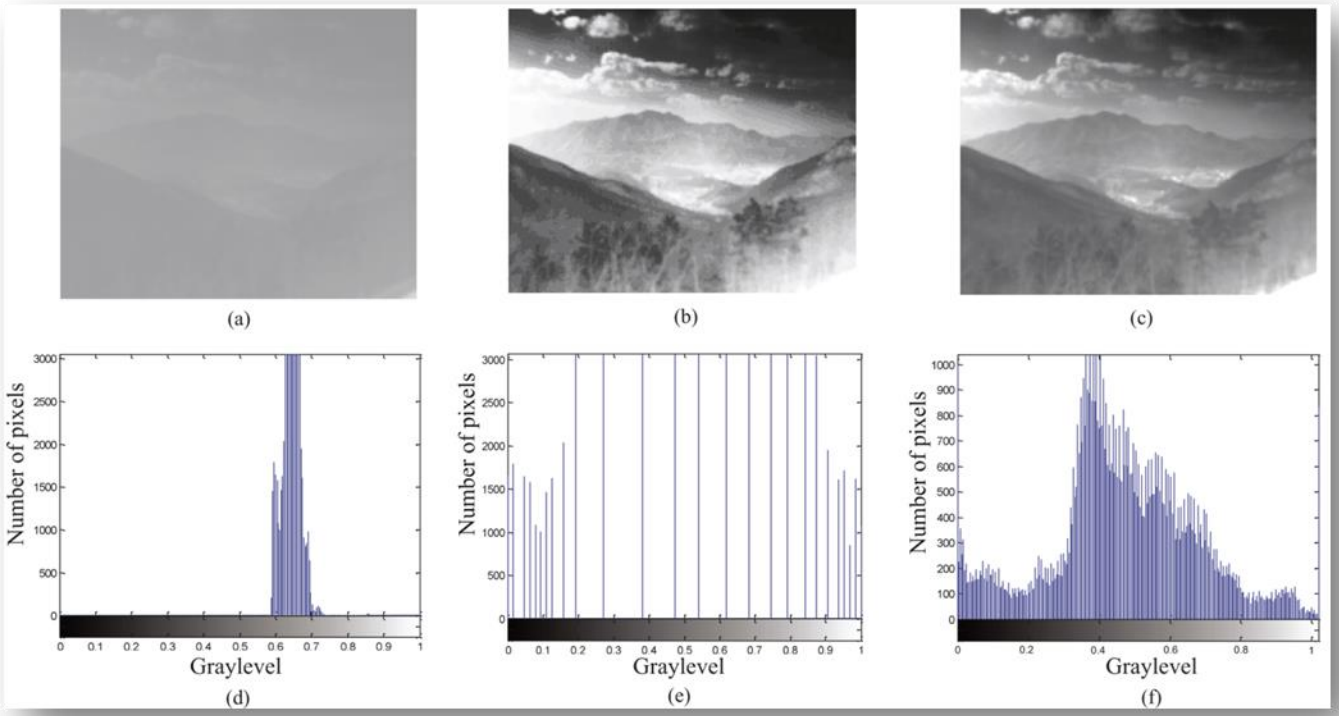
For a given image X, the probability density function P(Xk) is defined as P (Xk) = nk / n (1) For k=0,1,...,L-1, where nk represents the number of times that the level Xk appears in the input image X and „n‟ is the total number of samples in the input image[4] [5]. Note that P(Xk) is associated with the histogram of the input image which represents the number of

pixels that have a specific intensity Xk- Based on the probability density function , the cumulative density function is defined as

*P* Xj *k j*=0 Where Xk= X, for k=0,1,…,L-1. Note that C (xL-1) = 1 by definition. HE is a scheme that maps the input image into the entire dynamic range, (X0, XL-1), by using the cumulative density function as a transform function. Let's define a transform function f(x) based on the cumulative density function as f(x)= X0 +(XL-1-X0)C(x) (3) Then the output image of the HE,Y={Y(i,j)}, can be expressed as Y=f(X) (4) ={f(X(i,j)| ∀X(i,j)€X} (5) The high performance of the HE in enhancing the contrast of an image as a consequence of the dynamic range expansion, Besides, HE also flattens a histogram. Base on information theory, entropy of message source will get the maximum value when the message has uniform distribution property . As addressed previously, HE can introduce a significant change in brightness of an image, which hesitates the direct application of HE scheme in consumer electronics.

### A. Dualistic Sub-Image Histogram Equalization (DSIHE):

Equal area dualistic sub-image HE follows the same basic idea of BBHE method. It decompose the original image into two sub-images and then equalizes the histograms of the sub-images separately[6]. Instead of decomposing the image based on its mean gray level, The input image is decomposed into two sub-images, being one dark and one bright, respecting the equal area property (i.e., the sub-images has the same amount of pixels). In , it is shown that the brightness of the output image O produced by the DSIHE method is the average of the equal area level of the image I and the middle gray level of the image, i.e., L / 2. The authors claim that the brightness of the output image generated by the DSIHE method does not present a significant shift in relation to the brightness of the input image, especially for the large area of the image with the same gray-levels (represented by small areas in histograms with great concentration of gray levels), e.g., images with small objects regarding to great darker or brighter backgrounds.




**B. Brightness Preserving Bi-Histogram Equalization (BBHE):**

This method divides the image histogram into two parts. In this method, the separation intensity is presented by the input mean brightness value, which is the average intensity of all pixels that construct the input image[4].After this separation process, these two histograms are independently equalized. By doing this, the mean brightness of the resultant image will lie between the input mean and the middle gray level. The histogram with range from 0 to L-1 is divided into two parts, with separating intensity. This separation produces two histograms. The first histogram has the range of 0 to, while the second histogram has the range of to L-1.

**C. Minimum Mean Brightness Error Bi-HE Method (MMBEBHE)**

It also follows the same basic principle of decomposing an image and then applying the HE method to equalize the resulting sub-images independently[3][7].The main difference between these technique is that previous consider only the input image to perform the decomposition while the MMBEBHE searches for a threshold level that decomposes the image I into two sub-images I [0, lt] and I [lt +1, L −1], such that the minimum brightness difference between the input image and the output image is achieved, that is called as absolute mean brightness error (AMBE), AMBE = | E(X) − E(Y) | X and Y denotes the input and output image, respectively. Lower AMBE indicates that the brightness is better preserved. Once the input image is decomposed by the threshold level lt , each of the two sub-images I[0, lt], and I[It+1,L-1] has its histogram equalized by the classical HE process, generating the output image. MMBEBHE is formally defined by the following procedures: (1) Calculate the AMBE for each of the possible threshold levels. (2) Find the threshold

level, XT that yield minimum AMBE. (3) Separate the input histogram into two based on the XT found in Step 2 and equalize them independently as in BBHE.

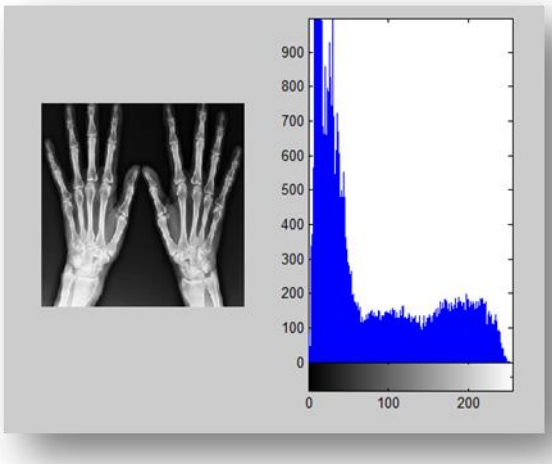
### D. Recursive Mean-Separate HE Method (RMSHE):

RMSHE is an extended version of the BBHE method. The design of BBHE indicates that performing mean-separation before the equalization process does preserve an images original brightness[8].In RMSHE instead of decomposing the image only once, it perform image decomposition recursively to further preserve the original brightness up to scale r. HE is equivalent to RMSHE level 0 (r = 0). BBHE is equivalent to RMSHE with r = 1. The brightness of the output image is better preserved as r increases.

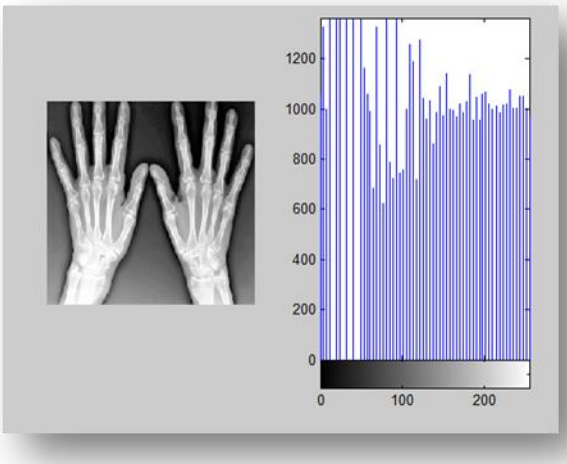
### E. Mean brightness preserving histogram equalization (MBPHE):

The mean brightness preserving histogram equalization (MBPHE) methods basically can be divided into two main groups, which are bisections MBPHE, and multi-sections MBPHE. Bisections MBPHE group is the simplest group of MBPHE[3]. Fundamentally, these methods separate the input histogram into two sections. These two histogram sections are then equalized independently. However, bisections MBPHE can preserve the mean brightness only to a certain extent. However, some cases do require higher degree of preservation to avoid unpleasant artifacts. Furthermore, bisections MBPHE can only preserve the original mean brightness if and only if the input histogram has a quasisymmetrical distribution around its separating point. But, most of the input histograms do not have this property. This condition leads to the failure of bisections MBPHE in preserving the mean intensity in real life applications.

***Experiment*:**




**Input Image With Histogram**




**Output Image With Histogram**

## Conclusion:

This paper made an attempt to study image Enhancements by Histogram Equalization. The Performance of these techniques was carried out with three images using MATLAB version R2007a. Histogram Equalization was carried out on the images. It was observed from the result of Histogram equalization.

## Acknowledgments

Special thank and recognition go to our advisor, Prof. Janardan Pawar, Vice Principal, ICCs who guided us through this research, inspired and motivated us. Last but not least, the students would like to thank the Indira College Of Commerce & Science (ICCS) , Pune, India for supporting this research study.

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# A study and Analysis of Newspaper reading attributes in Pimpri-Chinchwad area

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**Abstract:**

*This research paper deals with the study of various newspaper reading attributes and awareness among the people of Pimpri Chinchwad area on the basis of sample survey. Through this paper, the efforts are made to find out various findings about popular newspaper, gender wise respondent and age wise time spent by people for reading newspaper, the most preferred language read by people in Pimpri Chinchwad area. As there are various section in newspaper like sports, entertainment, horoscope, editorial etc, this paper also tried to find out about the most popular section in newspaper among the people .Also it gives an information about the proportion of people reading newspaper from their busy life schedule as well as about the purpose behind reading the newspaper. Also being a traditional method of reading newspaper, though nowadays there are many e-newspapers and news channels are available, but this paper shows that newspaper reading is still first choice of people.*

**Keywords:** *Newspaper, Awareness, popular, attributes*

## Introduction:

Newspaper is serving the mankind from the very beginning of 17th century, not only in India but also in various parts of the world. Newspaper has its own mark in publishing informative news to the people. It is the best media and it really works for the welfare of the people and for the betterment of the society. Printed newspapers are known to widen the range of public topics, events and issues their audience is aware of. The way print newspapers are structured and used is supposed to lure readers into reading stories they may not have been interested in beforehand. A representative survey of 800 respondents shows it is more complicated than that. Both channels in fact contribute to widening the audience agenda. But whereas online newspapers show this effect only in the highest educated group of society, print newspapers are able to expand the horizon of those whose range of interests is at most average.

Research shows that Newspaper is the best means of acquiring knowledge. It gives us idea about the current affairs of the country and the world. In previous generation mostly all people use to read newspaper but due to rapid change in science and technologies everything has changed. Due to advanced technical facilities such as internet, mass-media, news-channels, e-newspaper, we may think that people might have stopped reading newspaper. But, through this research, it is observed that newspaper are still popular among the people because it is a vital source of information; providing the most recent information to the readers. Newspaper is the best medium of advertisements concerning business, trade and industry. It increases the cultural diversity and provides the social integration.

In this paper various results regarding most popular newspaper, most popular language for reading the newspaper, most popular news section, time spent for reading newspaper, comparative popularity of news paper with e-newsapaper and news channels are tried to find out.

## Objectives:

**The following are the objectives behind this research:**

- ❖ To study the most popular news paper in Pimpri Chinchwad area.
- ❖ To study the most preferred language of Newspaper.
- ❖ To know the time spent for reading Newspaper.
- ❖ To study the popular section of the Newspaper.
- ❖ To know if there is any eating habit while reading Newspaper.
- ❖ To understand the purpose of reading Newspaper.

## Scope and method of the study

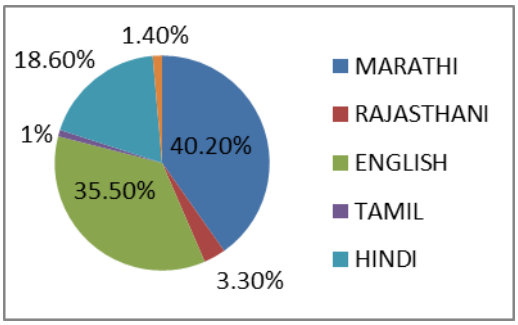
This research is related to the survey based study on various newspaper reading attributes. The survey was made in Pimpri Chinchwad area on 800 individuals by using purposive and cluster sampling method and data was collected by using the interview technique. Purposive sampling for selecting Pimpri Chinchwad area and within this region some societies as clusters were selected from which some families were selected. And then from the selected families, all the family members were interviewed for the said research study. Hence this research is based on only primary data.

## Discussion / Data Analysis

In this paper, the data analysis is done on the basis of Data mining technique and also by using spreadsheet which is the computer equivalent of a paper ledger sheet. Microsoft (MS) Excel is a spreadsheet application that is part of Microsoft Office. It enables the calculation and display of complex mathematical formulas (functions) with a facility for extensive formatting.

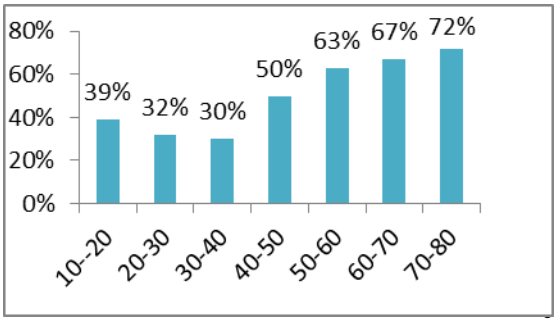
**Analysis of data of population reading newspaper for 800 individuals in the form of various tables, graph, percentage by statistical method are given below:-**

- **Most popular language for reading newspaper:-**



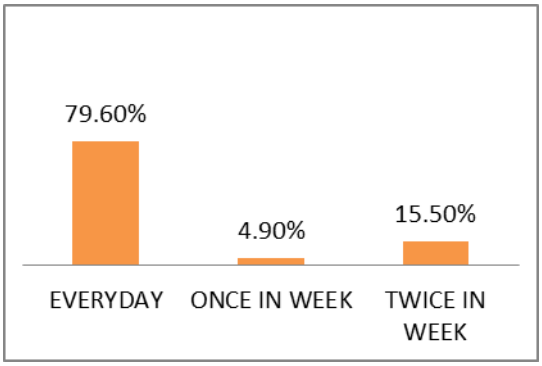

From this diagram, it is clear that, the most common and preferred language is Marathi being a local language which is found to be 40.20%. English is the second language mostly preferred i.e 35.50%. Least preferred language found in pimpri chinchwad is Tamil might be due to preference to communicate in English .

- **Age wise distribution:-**



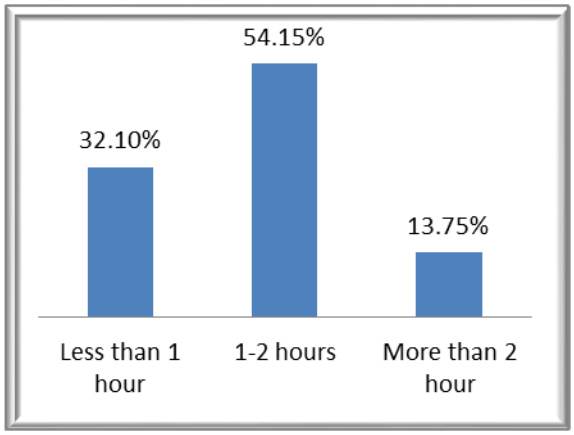

From this graph it is clear that graph increases rapidly at age 50 and above. It means that the old people(Non-working) reads newspaper always. It is great thing to know that percentage of students i.e of age 10-20 is better.

- **Proportion of people reading newspaper:-**



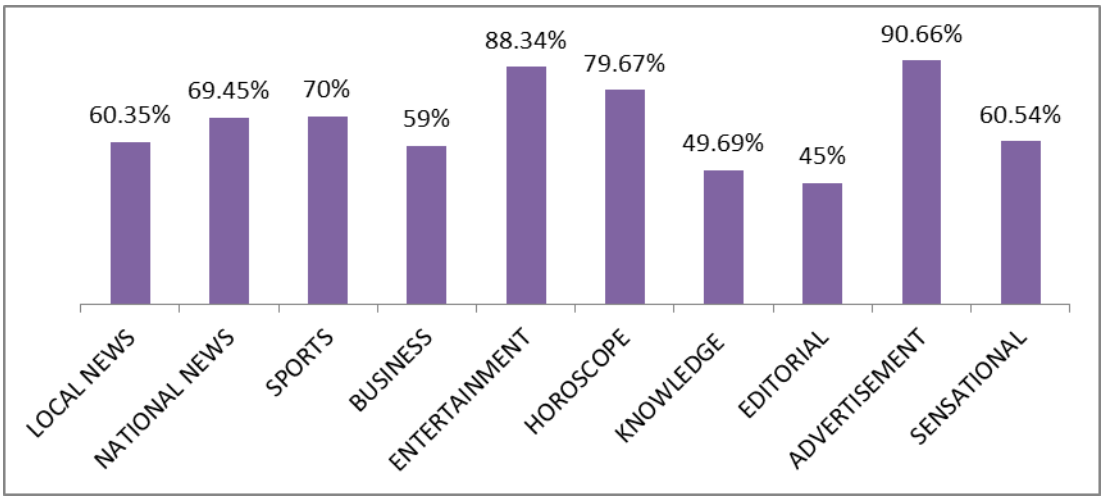

This graph shows that about 79.60% of population reads newspaper daily and only 4.90% of people reads once in week(Sunday). Percentage of people reading twice in a week is 15.50%.

- **Time spent for reading newspaper:-**



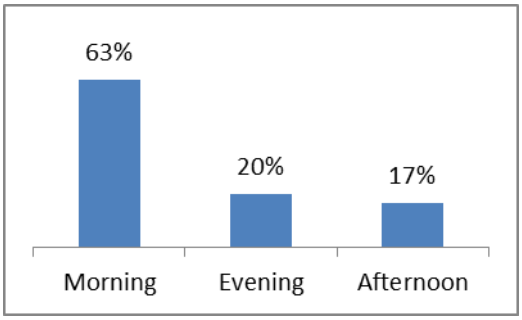

This chart reveals that 54.15% majority respondent spends 1-2 hours per day reading newspaper followed by 32.1% that less than 1 hour and 13.7% more than 2 hours read newspaper daily.

- **Most popular news section of newspaper:-**



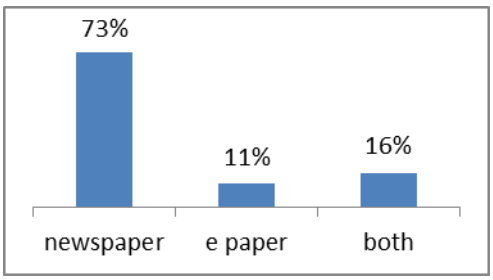

The above information is regarding the section of newspaper that the users usally wish to read in their day to day newspaper reading. Different people prefer to read different sections of newspapers. Highest number of respondent prefer to advertisement i.e.90% followed by entertainment 86%.
Least number of respondent prefer to Editorial i.e. 42% . National news and sports has the proportion i.e 70%.

- **Most popular time of reading news paper:**



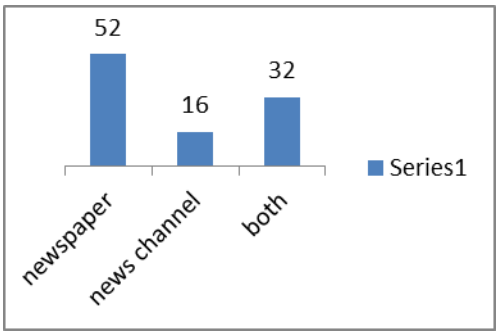

Thus it is clear that maximum people i.e . 63% of people prefer to read it in the morning. Whereas mostly
from among the women, they prefer to read it either in the afternoon or in the evening. Mostly the women who are working are observed to read the news paper in the evening.

- **Choice between News paper and e- News paper:**



When comparison was to be made in between Newspaper and e- newspaper, most of the people i.e. 73% of people had given preference to print newspaper, and 11% people for e- newspaper. Whereas 16% people read both news paper as well as e-news paper.

- **Choice between News paper and News channel:**




From the above graph it is clear that maximunm people i.e.52% people prefer and read newspaper , whereas 16% prefer to watch news channel.

- **Purpose of reading newspaper:-**

From the survey of 800 samples, the purpose behind reading newspaper in percentage is as follows:

| PURPOSE | PERCENTAGE |
|---|---|
| 1)To get the information | 98.60% |
| 2)For educational purpose | 85.30% |
| 3)To broaden the general knowledge | 49.69% |
| 4)For searching new jobs | 69.70% |
| 5)For entertainment | 88.34% |
| 6)To know the sports news | 70.00% |
| 7)As usual task of the day | 64.80% |
| 8)To pass the time | 37.30% |
| 9)To improve the status of the society | 54.90% |
| 10)To improve the health consciousness | 61.30% |
| 11)To keep a updated with happenings of world | 85.30% |

Respondent were asked about the various purposes of reading newspaper and they mentioned different reasons for reading newspaper. Table expresses that majority i.e. 98.60% number of respondents read newspaper to get the information while the second largest i.e 95.80% respondents read newspaper to broaden the horizon of general knowledge. The least number of respondent i.e.37.30% read newspaper to pass time.

## Conclusion:

This study showed that the most popular language of respondent is Marathi. This paper gave us an idea that mostly retired people(Non-working) reads newspaper i.e. of age 60 and above. Also it was observed that nearabout 80% of the respondent(79.60%) reads newspaper everyday. This

paper reveals that majority respondents spent 1-2 hrs per day reading newspaper followed by that less than 1 hr. This study also expresses that majority number of respondents read newspaper to get the information while the second largest respondents read newspaper to broaden the horizon of general knowledge. Newspapers are read more in morning than afternoon and evening by the people. Also among the e-newspaper and news channel, the newspaper is most popular media for news among the people of Pimpri Chinchwad area.

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# Classification of guava fruits *(Psidium guajava)* using electronic-nose

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**Abstract:**

*Presently, the classification of guava fruits is performed by sensory a panel which has significant drawbacks in terms of objectivity and repeatability. In this paper, it is shown how an electronic nose (e-nose) may be successfully utilized for the classification of guava fruits at the time of harvesting. Radar plot and Principal Component Analysis (PCA) were used to classify guava fruit in four different ripening states as green, ripe, overripe and spoiled. The PCA scatter plot revealed a distinct separation between the four groups. An Artificial Neural Network (ANN) was used for a better prediction of unknown samples.*

**Keywords:** *Electronic Nose, Guava fruit, Fruit classification, PCA, Ripening stage, Fruit sorting, Data acquisition*

## 1. Introduction:

In recent years classification and prediction of ripening state of the fruit is becoming a very important issue faced by produces, sellers, food industry as well as consumer due to the sheer volumes handled and the delicate nature of the fruit [1-3]. The state of ripeness during harvest, storage and market distribution determines the quality of the final product measured in terms of customer satisfaction [1]. It is important to evaluate fruit maturation stage and storage shelf life.

Conventionally fruit classification has been done by trained human graders. They classify fruit according to odor and skin color. But this approach has many disadvantages in terms of objectivity and repeatability [2, 4]. Also a human nose cannot sniff high number of samples because it gets fatigues rapidly with increasing number of samples and also there is possibility of eye disease like color blindness etc. [2].

For avoiding failures rate arises in human grader based classifications, researchers started to invent new techniques for classification of fruits. Now these days, there are several methods invented and used for classification of the various types of fruits in which some of them are destructive and non destructive types [5]. The conventional methods are destructive type in which fruit need to puncture, crush or sliced [3]. In some methods chemicals were applied on fruits for classification, which may danger to human health. Hence these methods are not desirable [5]. Testing firmness of a fruit, a slicing and puncture through Penetrometer will damage the fruit resulting in spoilt produce [5]. Other methods include measuring levels of chemical species, pH, TSS content, TTA change and ethylene contents requires crushing of fruit for getting pulp or juice [5]. Besides these destructive conventional methods, there are also non destructive techniques which are used. These methods include NMR, PMR, vision system and acoustics [8]. All above listed methods have some drawbacks and hence another popular non destructive method is the use of electronic nose.

The non- destructive methods are mostly prefers because they do not require to harm fruit for its classification. It includes the e-noses and color based classification which is generally known as machine based classification systems [10-15].

This paper presents how an application specific electronic nose (e-nose) for classification of guava fruit may be used to resolve these issues. An electronic nose tackles many problems associated with the use of human panels. Individual variability, adaptation, fatigue, infections, mental state, subjectivity, and exposure to hazardous compounds all come to mind. In effect, the electronic nose can create odor exposure profiles beyond the capabilities of the human panel or GC/MS measurement techniques [1-7].

Electronic noses are inspired from mammalians olfaction to recognize samples. In e-noses the sensors chosen according to mammalians approach in which sensors do not respond selectively but to respond with partial specificity related to VOC [17]. The sensors are integrated in the form of an array and suitable pattern recognition techniques are used to check their response [4]. The response of e-nose system is normally in comparative and qualitative manner rather than in quantitative nature [1-8].

Now day's scientists and engineers engaged in development of electronic nose technology [8].This grown moderately and it uses different kind of sensor for specific category of applications as metal oxide semiconductor based gas sensors such as $SnO^2$ and $WO_3$[18], surface acoustic wave(SAW)[5], metal oxide semiconductor field effect transistors[15], conducting polymers[4,6], optical sensors[19], gas chromatography–mass spectrometry GC–MS[11], ion mobility spectroscopy[20], infrared spectroscopy[19] etc.Most cases electronic noses commonly use resistive sensors, whose impedance varies with the presence of certain gases .

During several years back electronic noses have been developed for the classification and recognition of different variety of foods products [21], fruits [2] coffees [22], meats [23], fishes [24],oils [25] cheese [26], spirits [27] , wines [28],dairy products [29],environment [20].In this paper, an electronic nose designed for classification and freshness study of guava fruit.

Guava fruit has high respiration rates and a very short shelf life. The information on its respiration pattern is contradictory; some researchers explains how guava fruit shows non-climacteric fruit behavior [7] and some experimentally tried to proves it belongs to climacteric group [3].The past study on guava shows that the ethylene production increases, firmness sharply decreases, TSS gradually increases, pH slowly increases and the skin and pulp color changes during ripening process [7].

Till date several commercial electronic noses available in market such as FOX 2000, 3000, 4000 from Alpha MOS France [40], Cyranose 320 (Cyrano Science, Pasadena, CA, USA) [41], Aromascan A32S (Osmetech Plc, UK)[42] , Airsense PEN2 and PEN3 (Airsense Analytics GmbH, Schwerin, Germany) [42], Libra Nose 2.1 sensor array (Technobiochip, Pozzuoli, NA) [42], many of them are too expensive, bulky, complex odor sensing system and user interface software; hence they are not suitable for widespread adoption and portable applications [4, 6, 9,42].As such, E-Nose products are still difficult to commercialize and the demand for a small, lightweight, and inexpensive system has continued in recent years [1-6].

Consider the demands of multi-target contaminants detection and the low-cost of E-Nose, we select eight Figaro Inc. in Japan made MOS gas sensors. Appropriate sensor selection is very important in e-nose. The TGS series sensors were selected because they have cost-effective, cross sensitive.

In the present study the developed e-nose system hardware and software tested on guava fruit for classify it on the basis of their ripening state as green, ripe, overripe and spoiled. Guava fruit leaves a different smell pattern or odor-print onto the sensors array for different ripening stages.

The main objectives in this study were (1) Evaluate the capacity to measure the change in VOC production of guava fruit during different ripening states in controlled environment using a developed electronic nose device in our laboratory (2) Study Radar plot analysis and principal

component analysis (PCA) to obtain whether the developed electronic nose system is able to distinguish and classify different guava fruits ripening states

## 2. Materials and methods

### 2.1 Origin and collection of experimental material

The Guava (*Psidium guajava*) fruit of Lucknow49 type was selected for the experimental study. The Guava fruits of different ripening levels such as green, ripe, overripe and spoiled class were harvested from guava fruit orchard located in the Rahata tahsil of Maharashtra state, India at altitude 520 m, latitude 19.72° North, longitude 74.28° East.

The fresh fruits were picked up from trees in random manner by three trained human graders having more than 10 years of experience in picking and grading. These fruits were sorted and selected according to uniform size, weight and color approximately by them in four different baskets named as green, ripe, overripe and spoiled based on the fruit maturity as they percept by their experience(24 samples each group).


**Figure 1 Different ripening state of guava fruits for experiment**

### 2.2 Experimental design

The experimental design used was completely random (CRD), with 4 treatments each sample. The experimental sample was composed of 3 fruits and the experiment consisted of 10 repetitions for each treatment. There are 24 fruits in each group hence it resulted in 8 samples per group. All different ripening state fruits were evaluated at the picked day (day 0) using electronic nose technique.

### 2.3 Electronic-Nose data acquisition equipment and analysis

Figure 2 shows schematic diagram of our laboratory made e-nose system that was used for the experimentation[2]. The developed electronic nose system consisting of four functional components that operates serially on an odorant sample- a fruit sample handler, an array of eight MOS gas sensors, a signal conditioning unit and DAQ card connected to laptop which has indigenously developed GUI for data acquisition and preprocessing developed in LabVIEW2012 software.

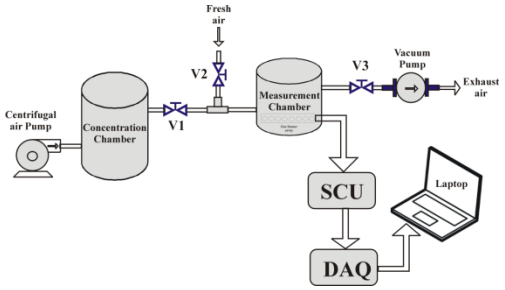


**Figure 2: Schematic diagram of proposed E-Nose system**

The complete working of the electronic nose shown in figure 2 was explained in our previous research paper [2].

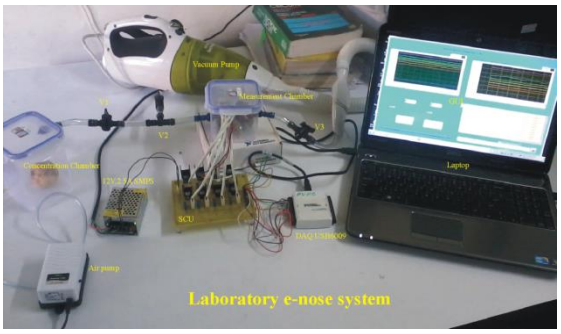


**Figure 3: Laboratory made e-nose system**

## 3. Result and Discussion:

### 3.1 Sensor array response to different ripening states

Fig. 4 shows a typical response of 8 Figaro made gas sensors during different ripening state of guava fruit. The four ripening states were assumed as green, ripe, overripe and spoiled. The pre-processed data obtained are the fractional conductance change ratio between G and $G_0$ (sensors conductance in presence of sample gas and fresh air respectively). Each curve represents a different sensor transient. It can be seen from fig.4 that relative response (S) increases slowly upto overripe state of fruit and then increases sharply when fruit state was spoiled. Each sensor signal generally stabilized and was considered for use in analysis of the electronic nose. The signals are steady state responses of sensor array (sensor was given 60 s to reach its steady state).

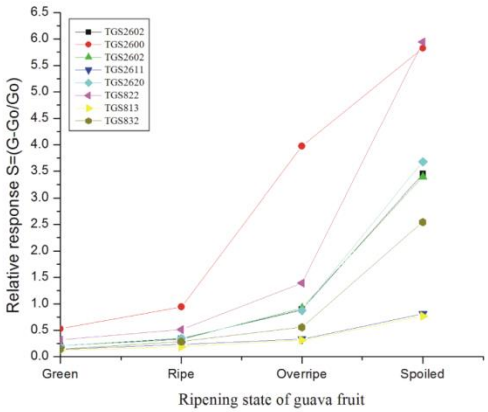


**Figure 4: Sensors array response to aroma of Guava in different ripening state**

Since guava fruit shows climacteric nature [7], respiration increased during their ripening process. Each line represents the signal variation for one sensor of the array.The sensor array detected the increase in VOC vapor generation as guava fruit ripened.

### 3.2 Radar Plot Analysis for e-nose array data validity

Fig. 5 shows the resulting radar patterns for testing the odor of the guava fruit samples. The magnitude of each axis indicates the relative response of sensor to the fruit odor. A unique odor-print was shown for different ripening states of fruit as green, ripe, overripe and spoiled. This indicates the use of non-specific selective gas sensor arrays to construct an odor database.

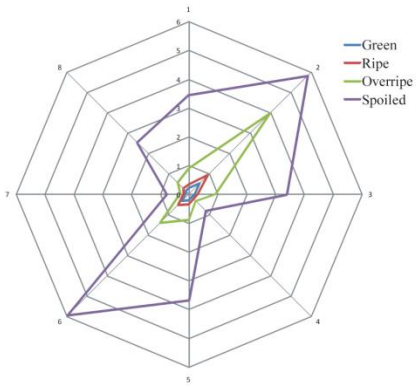


**Figure 5: E-nose sensor array response to different ripening state of Guava by radar plot**

### 3.3 Classification using PCA

The discrimination ability of e-nose was tested using PCA analysis. PCA analysis was applied to 200 data samples(50 data points of each group). PCA is a linear combinatorial method, which reduces the complexity of the dataset. The inherent structure of the dataset is preserved while its resulting variance is maximized. PCA has been performed to describe the aroma changes during the ripening process.

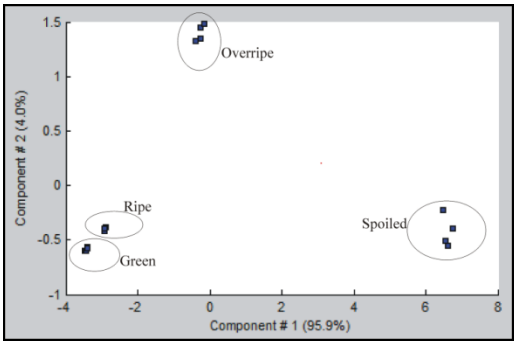


**Figure 6: PCA analysis for analysis of ripening state of guava fruit**

The MATLAB10a software was used for PCA analysis. The results of the PCA analysis for various ripening states of guava fruit is shown in figure 6.The two principal components {$PC_{1,n}$ ,$PC_{2,n}$} was obtained and has the two greatest variances: 95.9% and 4.0% (or total cumulative variance of 99. 9%). The scores of the four groups of fruits was plotted for principal component 2 (PC2) versus principal component 1 (PC1). The discrimination between the different ripening states of guava fruit as green, ripe, overripe and spoiled can be clearly seen from the figure. The processed data show a shift of the different ripening states which coinciding with the classification by trained human graders.

The system has enough resolution to explain the different storage self-lif ripeness states. It was used for exploratory data analysis to show how the multivariate data is clustered and to assess the linear reparability of the classes. Principal components score plot proves the capability of developed e-nose to classify the guava fruit on the basis of their ripening stages as well as different storage self-life.

## 4. Conclusion:

Classification of guava fruits using a laboratory assembled e-nose was tested and provides accurate results which were comparable to traditional fruit grading techniques. The data from e-nose was processed using MATLAB10a and was able to discriminate guava fruits on the basis of their ripening state. The PCA successful in separating the samples into four different groups or clusters of guava as green, ripe, overripe and spoiled with overall good accuracy. The use of dynamic headspace sampling proven to be very useful; signals are stronger because of fruit vapors accumulated long period of time. The results obtained using our laboratory e-nose determines different ripening state of guava fruit successfully.

## Acknowledgements

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# A STUDY AND ANALYSIS OF EXERCISE AWARENESS AMONG THE PEOPLE LIVING IN PIMPRI-CHINCHWAD AREA

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***Abstract:***

*In this paper, we intended to know the awareness of importance of physical exercise and various impacts of it on the people of Pimpri Chinchwad area on the basis of sample survey. Through this paper, the efforts are made to find out various findings about agewise, gender wise working/ non working people spending time for exercise , the most popular type of exercise among the people in Pimpri Chinchwad area. In this paper we wanted to know that how many people know the Importance of EXERCISE and all its good as well as bad effects and also the percentage of people who are really conscious of their Health. .It was seen, many people especially youngsters take exercise as a trend in day to day life. As there are various types of exercise like walking, jogging, yoga , gym and gymnastic , zumba and sports etc. Through this paper it is also tried to find out about the most popular type of exercise form among the people.*

**Keywords***: Exercise , Health , Impact , Prevention, awareness.*

## Introduction:

Exercise is an activity which is an important factor in maintaining good overall health and wellbeing of an individual. It can help in long-term prevention of various health problems such as Heart disease, Stroke, Blood pressure problem, obesity, etc. In this paper, we have intended to get answers of various questions we had in our research. Past study demonstrates that Asian families were the least likely to take regular exercise, and had a lower awareness of cholesterol or dietary content (fibre, sugar, salt) despite public health campaigns and publicity. There is clear evidence of inequalities in the health status of minority ethnic groups in society. This includes a number of conditions which may be alleviated or prevented through increased levels of physical exercise. Other research has shown lower levels of activity and raised body mass among Asian groups. Also previous research shows that Leisure-time exercise, including as much as 35–40 minutes per day of brisk walking, was protective for Coronary Heart Disease (CHD) risk and sedentary lifestyles were positively associated with risk of CHD. Given limited resources for care of CHD in India and the important role of physical exercise in disease risk in urban India, improvements in physical activity should be promoted.

## Objectives:

- To know importance of Exercise and to find percentage of people who do the exercise.
- To know the most popular type of exercise among the people in PCMC area.
- To find the most preferable time for exercise by the people.

- ❖ To find the frequency of monthly illness pattern among the people.
- ❖ To find the exercise awareness in different age group.
- ❖ To know the exercise practicing among the people (choice or recommendation).

**Scope and method of the study:**

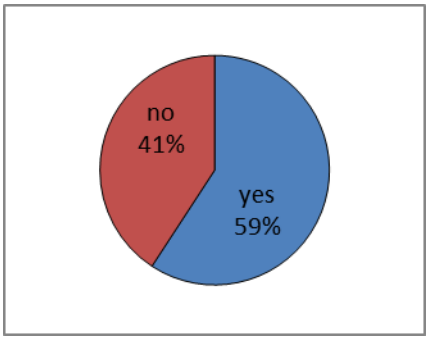
This research is related to the survey based study on various newspaper reading attributes. The survey was made in Pimpri Chinchwad area on 570 individuals by using purposive and cluster sampling method and data was collected by using the interview technique. Purposive sampling for selecting Pimpri Chinchwad area and within this region some societies as clusters were selected from which some families were selected. And then from the selected families, all the family members were interviewed for the said research study. Hence this research is based on only primary data.

**Discussion / Data Analysis:**

In this paper, the data analysis is done on the basis of Data mining technique and also by using spreadsheet which is the computer equivalent of a paper ledger sheet. Microsoft (MS) Excel is a spreadsheet application that is part of Microsoft Office. It enables the calculation and display of complex mathematical formulas (functions) with a facility for extensive formatting.

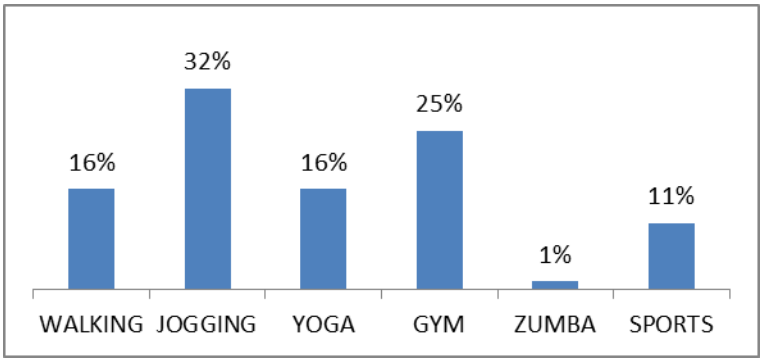
**Analysis of data of exercise awareness among the people for 570 individuals in the form of various tables, graph, percentage by statistical method are given below:**

- **What percentage of people exercise?**



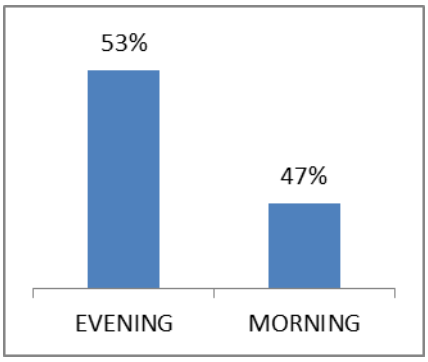

In this, we got to know 59% Individuals Exercise regularly while, rest 41% do not Exercise.

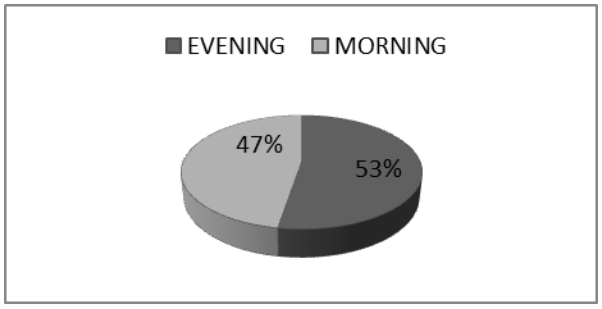
- **Types of Exercise:**




In this bar diagram, from all the mentioned Exercise, it is observed that Maximum individuals(32%) preferred jogging as their regular Exercise, while ZUMBA (a dance form) is preferred very rarely.

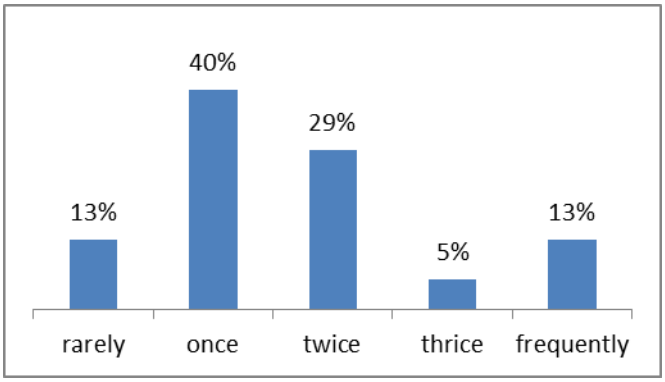
- **Time of Exercise:**



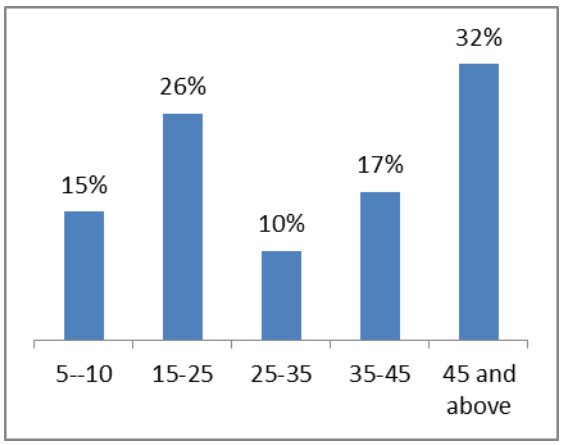

In this it was observed that 53% individuals liked to Exercise in Evening, while 47% individuals liked in Morning. People said that they feel fresh if they Exercise in morning and while some said that they get peaceful sleep if they Exercise in the evening. In this the age group above 60 years preferred both times i.e. Morning as well as Evening walk as their Exercise. The maximum time individuals utilized was 1 hour 30 minutes while minimum time was 30 minutes.

- **Monthly Frequency of illness:**



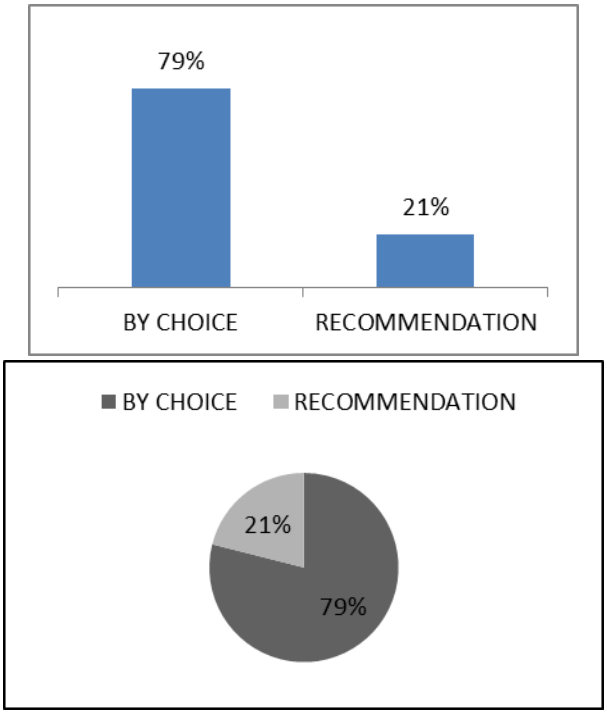

The above graph shows the monthly frequency of illness among people.

- **Age group distribution:**




The individuals between the age group of 15 years to 25 years Exercise more, while individuals between 30 years to 45 years Exercise less. The individuals above 45 years take Exercise as a must part of their daily routine.

- **Individuals doing Exercise by Choice or by Recommendation:**




In this, it was observed that 79% of the individual who Exercise regularly ,they do it by their choice ,while other 21% individual do it by Recommendation of their respective Doctors.

- **Purpose/Reason behind Exercising regularly:**

In this, the answers we got were:

- Individuals Exercise to stay fit,
- To be strong and healthy,
- To tone and maintain their body,
- To keep mind fresh and to keep the body relax.

## CONCLUSION:

- This paper shows that majority of people know the importance of exercise and hence practice it.
- it is observed that Maximum individuals preferred jogging as their regular Exercise, while ZUMBA preferred very rarely.
- Majority of people prefer to do exercise in the evening instead of morning due to their pack and buzy schedule in the morning.
- Since people are aware of importance of exercise, majority of people do exercise on their own without any recommendation by the experts.
- The individuals between the age group of 15 years to 25 years Exercise more.
- It was observed that the Individual who Exercise regularly rarely fall ILL (per month), on the other hand ,the Individual who do not Exercise fall ILL twice or thrice(per month).

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# Computational Mathematics

# INDEX

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# Digraphs of n × n (0, 1)-matrix is isomorphic to $D_{n,k}$ under certain condition

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**Abstract:**

*In this note, we show that the the eigenvalues of the adjacency matrix A = A( Dn,k) of Dn,k are copies of the entire kth unit roots plus, possibly, 0's. Conversely, if B is an n × n (0,1) -matrix whose eigenvalues are copies of the entire kth unit roots plus, possibly, 0's then its digraph D ( B ) is isomorphic to Dn,k if ignoring the acyclic parts in the two digraphs.*

**Keywords:**
*Acyclic Digraph; Eigenvalue; Power Digraph; (0,1)-Matrix*

## Introduction:

A directed graph Gn of n vertices {1, 2,…n} is a directed graph whose edges are oriented from vertex i to vertex j, $1 \leq i, j \leq n$ . In this note, the directed graphs or digraphs to be considered are with loops or cycles, but parallel edges are forbidden. An acyclic digraph is a digraph that has no cycles of any length. Let $D_{n,k}$ be a digraph of n vertices with cycles of length k plus, possibly, an acyclic digraph with n – mk vertices, where m is the number of cycles, and where k is fixed, $0 \leq k \leq n$ . Then it is seen that the cycles in Dn, k are disjoined (therefore all the cycles that it has are simple) and if $k < n$ the digraph is not strongly connected. And, in particular, Dn, n is a Hamiltonian directed cycle of size n and $D_{n,0}$ is an acyclic digraph of n vertices, respectively.

The acyclic directed graphs have been considered by several authors in the past decades. A first related result appeared in the literature seems to be the one described in [1]. It says that a digraph *G* contains no cycle if and only if all eigenvalues of its adjacency matrix are 0. Subsequently, to the best of our knowledge, Robinson [3,4] and Stanley [5] counted the acyclic digraphs independently and showed that if Rn stands for the number of acyclic digraphs of n vertices then

$$R_n = \sum_0^n (-1)^{k+1} \binom{n}{k} 2^{k(n-k)} R_{n-k} \sim n! \; 2^{\binom{n}{k}} / M p^n$$

where p = 1.488... , and M = 0.474.. . Later, in [6,7], Bender et al. considered the asymptotic number of acyclic digraphs with *q* edges, and subsequently, Gessel counted the acyclic digraphs by their sources and sinks in [8]. Most recently, E. Weisstein of Wolfram Research Inc. calculated the number, *Mn,n,* of n-(0, 1)- matrices with real positive eigen values and showed for that n = 1,2,3,4,5 the number *M n* are 1,3,25,543, 29281 because the numbers were observed to coincide with the first five values of the sequence of the number of acyclic digraphs with *n* vertices that is obtained by Sloane in [10]. Weisstein conjectured that the two sequences are identical. The conjecture has recently been proven in [2].

Motivated by the above literature, we extend the acyclic digraphs to consider the directed graphs

*Dn, k* of length *k* in this note, where $0 \leq k \leq n$. Our theorem established in the next section indicates that similar counting theorem holds for more general graphs.

**The Main Results:**

Let us prove the following lemma.

**Lemma 1:** Given a positive integer n , and a nonnegative integer k with $0 \leq k \leq n$ , the eigenvalues of the adjacency matrix A = A( Dn,k) of Dn,k are copies of the entire kth unit roots plus, possibly, 0's. Conversely, if B is an n × n (0,1) -matrix whose eigenvalues are copies of the entire kth unit roots plus, possibly, 0's then its digraph D ( B ) is isomorphic to Dn,k if ignoring the acyclic parts in the two digraphs.

**Proof.**: Assume that Dn, k has m cycles of length k. We show that the eigenvalues of A are m copies of the entire kth unit roots plus n – mk 0's. Since relabeling the vertices of a graph does not change the eigenvalues of its adjacency matrix, and since the m cycles of length k are disjoined, we may number the vertices consistently with the partial order so that A has the upper block-triangular as follows:

$$A = \begin{matrix} \mathbf{A1} & * & * & * & \ldots\ldots\ldots & * \\ \mathbf{0.} & \mathbf{A2} & *. & & \ldots\ldots\ldots & * \\ \mathbf{0.} & \mathbf{0.} & \mathbf{A3} & * & \ldots\ldots & * \\ & & & & \ldots\ldots\ldots & \\ \mathbf{0.} & \mathbf{0.} & \mathbf{0.} & \mathbf{0.} & \mathbf{Am} & * \ldots\ldots * \\ \mathbf{0.} & \mathbf{0.} & \mathbf{0.} & \mathbf{0.} & \mathbf{0.} & \mathbf{0} \ldots\ldots * \\ \mathbf{0.} & \mathbf{0.} & \mathbf{0.} & \mathbf{0.} & \mathbf{0.} & \mathbf{0} \; * \\ \mathbf{0.} & \mathbf{0.} & \mathbf{0.} & \mathbf{0.} & \mathbf{0.} & \mathbf{0} \; \mathbf{0} \end{matrix}$$

where each Ai , i = { 1,2,3,…m} is the adjacency matrix of a (directed simple) cycles of length k, and where '*' is either a block matrix of 0, 1, or 1, or 0's. From linear algebra, it can be easily proven that, for any i ( ≤ m ) the characteristic polynomial of Ai is $| \lambda I - Ai | = \lambda^k - 1$ . So the eigenvalues of Ai are the kth unit roots. Since the eigenvalues of A are collection of the eigenvalues of these Ai and n – mk 0's, its eigenvalues are m copies of the entire kth unit roots plus n – mk zeroes.

Conversely, if B is an $n \times n$ (0, 1) -matrix whose eigenvalues are m copies of the entire kth unit roots plus n – mk 0's, then its graph D(B ) is a digraph and, for any i ( $\leq$ n) , the ith eigenvalues of $B^k$ $\lambda$i (Bk ) is either 1 or 0. We now consider the power digraphs of D( B) with adjacency matrix B. Since for all i = 1, 2, 3, …..

$$\text{trace}\,(B^k) = \sum_{i=1}^{n} B^{k} = mk$$

the number of closed walks of length l in the kth power graph $D_{(B)^k}$ of D ( B ) is mk . Since the eigenvalues $B^k$ are either 1 or 0, the diagonal elements of $B^k$ must be 1 or 0. In fact, from Perron-Frobenius theory (e. g., [9], p. 28, (1,6) Corollary (a)), we have

$B^k$ (i , j ) $\leq$ $\rho(B^k) = 1$, $\rho\,(B^k)$ is the largest eigenvalue of $B^k$ which implies $B^k$ (i , j ) = 1

or 0, and $B^k$ has exactly mk 1's on its diagonal. Thus, counting all the closed walks in the kth power graph $D_{(B)^k}$ . We conclude that D ( B ) is a digraph with m disjoined cycles of length k plus an acyclic graph with n – mk vertices. Putting the thing back to B implies that B is the adjacency matrix of a digraph with m cycles of length k plus, possibly, an acyclic digraph with n – mk vertices. The proof is complete.

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# STUDY OF SOLUTION OF LINEAR NON - HOMOGENEOUS PARTIAL DIFFERENTIAL EQUATION BY USING LAPLACE TRANSFORM METHOD

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## Abstract:

*The purpose of this paper is to give applications of Laplace Transform to solve the Linear Non – Homogeneous Partial Differential Equation which is applicable in several applications in various fields of Mathematics as well as in real life situations, such as Abel's integral equation, visco-elasticity, capacitor theory, conductance of biological systems.*

**Keywords:**
*Laplace Transform, Convolution, Inverse Laplace Transform, Linear Non – Homogeneous Partial Differential Equation, Step functions,*

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# Estimation of Mean Response Time for M/G/1 to G/M/1 Queueing Network Model

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**Abstract:**

*Response time plays an important role in the analysis of queueing network models. In this paper Pollaczek–Khinchin(P-K) transform equation, Laplace transform and little's formula is used to estimate mean response time . Different confidence intervals based on standard bootstrap, bootstrap-t, percentile bootstrap, bias corrected percentile bootstrap, bias corrected and accelerated bootstrap methods are constructed. To demonstrate performance of the proposed confidence intervals is carried out using numerical simulation.*

**Keywords***: Response Time, Coverage percentage, Relative coverage, Relative average length.*

## 1. Introduction:

Consider the two-stage open queueing network shown in Fig-1. The system consists of two nodes, node-A and node-B**.** The external arrival rate is $\lambda$. The output of the node-A is the input to the node-B. The service time distributions at node-A & at node-B is assumed to be G and exponential respectively

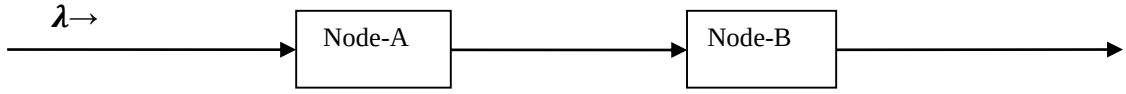


**Fig-1: Two-stage open queueing network.**

For queueing network models response time is defined as the time spent by a customer from arrival until it departs. The statistical inference in queueing networks are rarely found in the literature and the work of related problems in the past mainly concentrates on only parametric statistical inference, in which the distribution of population is with a known form (except perhaps for the parameters). Burke [2] has shown that the output of an M/M/1 queue is also Poisson with rate $\lambda$. Jackson [10] showed that the product form solution also applies to open network of Markovian queues with feedback, also Jackson's theorem states that each node behaves like an independent queue. Ke and Chu [11] constructed various confidence intervals for intensity parameter of a queueing system. For necessary background on bootstrap technique, we refer to Efron and Tibshirani [6], Rubin [14].

So far very few authors have studied the nonparametric statistical inferences. Gedam and Pathare [7, 8, 9, and 12] have studied the nonparametric statistical estimation approaches of various queueing network models.

Chu and Ke [4] examined the statistical behavior of the mean response time for the M/G/1 queueing system using bootstrapping simulation. Chu and Ke [3] studied the interval estimation of mean response time for the G/M/1 queueing system using empirical Laplace function approach. Chu and Ke [5] developed a data based recurrence relation to compute a sequence mean response times and constructed confidence intervals of mean response times for the G/G/1 queueing system using simulation. This motivates us to develop the nonparametric statistical inferences of mean response time for a queueing network model.

In section 2 we described the method of estimation of mean response time. In section 3 we proposed nonparametric estimation approach for mean response time at node-A & B. In section 4 to 8 we proposed Standard Bootstrap, Percentile Bootstrap, Bias Corrected Percentile Bootstrap, Bias-corrected and accelerated bootstrap, Bootstrap-t confidence intervals for response time $R_A$ and $R_B$. In Section 9 numerical simulation study is conducted. All simulation results are shown by appropriate tables for illustrating performances of all estimation approaches. Conclusions are given in Section 10.

## 2. Estimation of mean response time of an M/G/1 to G/M/1 queueing network model

Let $X_{A_1}, X_{A_2}, \cdots, X_{A_n}$ be a random sample from an exponential random variable $X_A$ with a mean $1/\lambda_A$ and let $S_{A_1}, S_{A_2}, \cdots, S_{A_n}$ be a random sample from a continuous random variable $S_A$ with probability density function $f(s_A)$. Further $X_A$ and $S_A$ are assumed to be independent. Then $(X_{A_i}, S_{A_i})$ denote interarrival times and service times for the i[th] customer at node-A. By applying Pollaczek - Khinchin (P-K) transform equation and Little's formula the true value of mean response time $(R_A)$ of a customer is obtained by

$$R_A = E(S_A) + \frac{E(S_A^2)}{2(1/\lambda_A - E(S_A))} \qquad (1)$$

where $E(S_A)$ *and* $E(S_A^2)$ are the first two moments of the service time distribution $f(s_A)$. For a proof see Stidham [15].

Now let $X_{B_1}, X_{B_2}, \cdots, X_{B_n}$ be a random sample from a continuous random variable $X_B$ with probability density function $g(x_B)$, and let $S_{B_1}, S_{B_2}, \cdots, S_{B_n}$ be a random sample from an exponential random variable $S_B$ with a mean $1/\mu_B$. Further $X_B$ and $S_B$ are assumed to be independent. Then $(X_{B_i}, S_{B_i})$ denote interarrival times and service times for the i[th] customer at node-B. Referring to Ross [13] the mean response time $(R_B)$ of a customer is obtained by

$$R_B = \frac{1}{\mu_B(1-\beta_0)}, \qquad (2)$$

where $\beta$ is the unique solution of the equation

$$\beta = H_{X_B}(\mu_B - \beta\mu_B), \quad 0 < \beta < 1. \qquad (3)$$

and $H_{X_B}(t)$ is the Laplace transform of the distribution $X_B$. That is,

$$H_{X_B}(t) = E[e^{-tX_B}] = \int_0^\infty e^{-tX_B} g(x_B)dx_B, \quad t \geq 0$$

Further let $\overline{X}_A$ be the sample mean of $X_{A_1}, X_{A_2}, \cdots, X_{A_n}$. Also let $\overline{S}_A$ be the sample mean and $m_2 = \sum_{i=1}^{n} S_{A_i}^2 / n$ be the second sample moment of $S_{A_1}, S_{A_2}, \cdots, S_{A_n}$. According to the strong law of large numbers $\overline{X}_A, \overline{S}_A$ *and* $m_2$ are strong consistent estimators of $1/\lambda_A$ , $E(S_A)$ *and* $E(S_A^2)$ respectively. Hence

$$\hat{r}_A = \bar{S}_A + \frac{m_2}{2(\bar{X}_A - \bar{S}_A)} \ , \qquad (4)$$

is a natural estimator of mean response time $R_A$ and $\hat{r}_A$ is a strong consistent estimator of $R_A$. According to the central limit theorem and Slutsky's theorem, $\hat{r}_A$ is approximately normally distributed. But in practice the true distribution of $f(s_A)$ is unknown, so we can use the bootstrap method to construct confidence intervals for mean response time $(R_A)$ as shown in section 3.

Similarly when the distribution $X_B$ is specified, then its Laplace transform $H_{X_B}(t)$ can be calculated and $\beta_0$ can be solved from equation (3). From equation (2), we can estimate mean response time $R_B$ by

$$\tilde{r}_B = \frac{\bar{S}_B}{(1-\beta_0)} \qquad (5)$$

where $\bar{S}_B$ is the sample mean of $S_{B_1}, S_{B_2}, \cdots, S_{B_n}$ .

But in practice the true distribution of $g(x_B)$ is unknown, so $\beta_0$ cannot be calculated using equation (3). Hence we consider point estimator of mean response time $(R_B)$ as follows:

Let $(x_{B_1}, x_{B_2}, \cdots, x_{B_n})$ be a sample of $X_{B_1}, X_{B_2}, \cdots, X_{B_n}$ and $(s_{B_1}, s_{B_2}, \cdots, s_{B_n})$ be a sample of $S_{B_1}, S_{B_2}, \cdots, S_{B_n}$ . According to strong law of large numbers (Raussas [24]), $\bar{S}_B$ is a strongly consistent estimator of $1/\mu_B$ . Hence $1/\bar{S}_B$ is a strongly consistent estimator of $\mu_B$ and $\mu_{B_n} = \dfrac{1}{\frac{1}{n}\sum_{i=1}^{n} S_{B_i}} \longrightarrow \mu_B \ \ as \ n \longrightarrow \infty$ .

Define $V_0 = e^{-\mu_B(1-\beta)X_{\mathbf{B}}}$ , $V_{0i} = e^{-\mu_B(1-\beta)X_{\mathbf{B}_i}}$ and $V_{ni} = e^{-\mu_{B_n}(1-\beta)X_{\mathbf{B}_i}}$ $for\ i = 1,2,.....n$ .

Let $V_{01}, V_{02}, V_{03}, ....., V_{0n}$ be a random sample from $V_0$ , by the strong law of large numbers we have,

$$\frac{1}{n}\sum_{i=1}^{n} V_{0i} \xrightarrow{a.s.} E(V_0) = H_{X_B}(\mu_B - \beta\mu_B) \qquad (6)$$

where $\xrightarrow{a.s.}$ denotes converge almost surely. For each $X_{B_i}$ , $V_{ni} \xrightarrow{a.s.} V_{0i}$ as $\mu_{B_n} \longrightarrow \mu_B$ .

Thus we have, $$\frac{1}{n}\sum_{i=1}^{n} (V_{ni} - V_{0i}) \xrightarrow{a.s.} 0 \qquad (7)$$

From equation (6) and (7), we get

$$\frac{1}{n}\sum_{i=1}^{n} V_{ni} \xrightarrow{a.s.} E(V_0) \qquad (8)$$

Therefore we deduce the following result:

$$\frac{1}{n}\sum_{i=1}^{n} e^{-\mu_{B_n}(1-\beta)X_{\mathbf{B}_i}} \longrightarrow E[e^{-\mu_B(1-\beta)X_B}] \qquad as \ n \longrightarrow \infty \qquad (9)$$

Let $H_n(\beta) = \frac{1}{n}\sum_{i=1}^{n} e^{-\mu_{B_n}(1-\beta)X_{\mathbf{B}_i}}$ , $\beta \in [0,1]$

(10)

and $H(\beta) = E[e^{-\mu_B(1-\beta)X_{\mathbf{B}}}] = H_{X_B}(\mu_B(1-\beta))$ , $\beta \in [0,1]$

(11)

then $H_n(\beta) \longrightarrow H(\beta)$, $for\ \beta \in [0,1]$, $as\ n \longrightarrow \infty$.

In formula (5), $\beta_0$ is the fixed point of $H(\beta)$ (refer to Apostol [1]); that is $\beta_0 = H(\beta_0)$. This gives us an idea of building a data based estimator of $R_B$ as

$$\hat{r}_B = \frac{\bar{S}_B}{(1-\beta_n)}$$

(12)

where $\beta_n$ is the fixed point of $H_n(\beta)$; that is $\beta_n = H_n(\beta_n)$.

Since $H_n(\beta) \longrightarrow H(\beta)$, $for\ \beta \in [0,1]$, $as\ n \longrightarrow \infty$, we have,

$$\beta_n \longrightarrow \beta_0$$

(13)

Thus from equation (2) and (13), we can say that $\hat{r}_B$ is a strongly consistent estimator of $R_B$.

## 3. Estimation of mean response time using bootstrap method:

According to the bootstrap procedure, a simple random sample $(X^*_{A_i}, S^*_{A_i}\ i = 1,2,....n)$ and $(X^*_{B_i}, S^*_{B_i}\ i = 1,2,....n)$ called a bootstrap sample can be taken from the empirical distribution function of $(X_{A_i}, S_{A_i}, i = 1,2,....n)$ and $(X_{B_i}, S_{B_i}, i = 1,2,....n)$ respectively. Hence in terms of equation (2) an estimate of $R_A$ can be calculated from bootstrap samples as

$$\hat{r}^*_A = \bar{S}^*_A + \frac{m^*_2}{2(\bar{X}^*_A - \bar{S}^*_A)}$$

(14)

where $\bar{X}^*_A, \bar{S}^*_A$ are the sample means of $(X^*_{A_i}, S^*_{A_i}\ i = 1,2,....n)$ respectively and $m^*_2$ is the second moment of $S^*_{A_i}\ i = 1,2,....n$. Also $\hat{r}^*_A$ is called bootstrap estimate of $\hat{r}_A$.

Similarly in terms of equation (12) and (13) an estimate of $R_B$ can be calculated from bootstrap samples as

$$\hat{r}^*_B = \frac{\bar{S}^*_B}{(1-\beta_0)}$$

(15)

where $\bar{S}^*_B$ is the sample mean of $S^*_{B_i}\ i = 1,2,....n$ , $\beta_0$ is fixed point of $H(\beta)$ and $\hat{r}^*_B$ is called bootstrap estimate of $\hat{r}_B$.

The above resampling process can be repeated *N* and *M* times respectively. The bootstrap estimates $\hat{r}^*_{A_1}, \hat{r}^*_{A_2}, \cdots, \hat{r}^*_{A_N}$ and $\hat{r}^*_{B_1}, \hat{r}^*_{B_2}, \cdots, \hat{r}^*_{B_M}$ can be computed from the bootstrap resamples.

Averaging the *N and M* bootstrap estimates we obtain the bootstrap estimate of $\hat{r}_A$ and $\hat{r}_B$ are as follows:

$$\hat{r}_N = \frac{1}{N}\sum_{i=1}^{N}\hat{r}_{A_i}^* \qquad \text{and} \qquad \hat{r}_M = \frac{1}{M}\sum_{i=1}^{M}\hat{r}_{B_i}^*$$

(16)

Also standard deviation of $\hat{r}_A$ and $\hat{r}_B$ can be estimated by

$$sd(\hat{r}_N) = \left\{\frac{1}{N-1}\sum_{i=1}^{N}(\hat{r}_{A_i}^* - \hat{r}_N)^2\right\}^{1/2} \quad \text{and} \quad sd(\hat{r}_M) = \left\{\frac{1}{M-1}\sum_{i=1}^{M}(\hat{r}_{B_i}^* - \hat{r}_M)^2\right\}^{1/2}$$

(17)

## 4. Standard Bootstrap(SB) Confidence Intervals for mean response time:

The central limit theorem implies that the distribution of $\hat{r}_A$ and $\hat{r}_B$ is approximately normal. Thus $100(1-\alpha)\%$ SB confidence intervals for mean response time $R_A$ and $R_B$ respectively are,

$$\left(\hat{r}_A \pm z_{\alpha/2}\, sd(\hat{r}_N)\right) \text{ and } \left(\hat{r}_B \pm z_{\alpha/2}\, sd(\hat{r}_M)\right)$$

(18)

## 5. Bootstrap-t Confidence Intervals for mean response time:

Considering bootstrap estimates $\hat{r}_{A_1}^*, \hat{r}_{A_2}^*, \cdots, \hat{r}_{A_N}^*$ and $\hat{r}_{B_1}^*, \hat{r}_{B_2}^*, \cdots, \hat{r}_{B_N}^*$ computed from the bootstrap resample, we obtain $Z_{A_i}^* = \frac{(\hat{r}_{A_i}^* - \hat{r}_N)}{sd(\hat{r}_N)}, i = 1,2....N$ and $Z_{B_i}^* = \frac{(\hat{r}_{B_i}^* - \hat{r}_M)}{sd(\hat{r}_M)}, i = 1,2....M$.

Then samples $Z_{A_1}^*, Z_{A_2}^*, \cdots, Z_{A_N}^*$ and $Z_{B_1}^*, Z_{B_2}^*, \cdots, Z_{B_M}^*$ can be considered as an approximate t distribution. Thus we have $100(1-\alpha)\%$ Bootstrap-t confidence interval for mean response time $R_A$ and $R_B$ respectively are,

$$\left(\hat{r}_A \pm \hat{t}_{\alpha/2}\, sd(\hat{r}_N)\right) \text{ and } \left(\hat{r}_B \pm \hat{t}_{\alpha/2}\, sd(\hat{r}_M)\right)$$

(19)

where $\hat{t}_{\alpha/2}$ equals the α/2 percentile of the random sample $Z_{A_1}^*, Z_{A_2}^*, \cdots, Z_{A_N}^*$. $Z_{B_1}^*, Z_{B_2}^*, \cdots, Z_{B_M}^*$

## 6. Percentile Bootstrap(PB) confidence intervals for mean response time:

Now call $\hat{r}_{A_1}^*, \hat{r}_{A_2}^*, \cdots, \hat{r}_{A_N}^*$ and $\hat{r}_{B_1}^*, \hat{r}_{B_2}^*, \cdots, \hat{r}_{B_M}^*$ be the bootstrap distribution of $\hat{r}_A$ and $\hat{r}_B$ respectively. Let $\hat{r}_A^*(1), \hat{r}_A^*(2), \cdots, \hat{r}_A^*(N)$ and $\hat{r}_B^*(1), \hat{r}_B^*(2), \cdots, \hat{r}_B^*(M)$ be the order statistics of $\hat{r}_{A_1}^*, \hat{r}_{A_2}^*, \cdots, \hat{r}_{A_N}^*$ and $\hat{r}_{B_1}^*, \hat{r}_{B_2}^*, \cdots, \hat{r}_{B_M}^*$ respectively. Then utilizing the 100(α/2)th and 100(1-α/2)th percentage points of the bootstrap distribution, 100(1-α) % PB confidence interval for mean response time $R_A$ and $R_B$ respectively are,

$$(\hat{r}_A^*([N(\alpha/2)]),\ \hat{r}_A^*([N(1-\alpha/2)])) \text{ and } (\hat{r}_B^*([M(\alpha/2)]),\ \hat{r}_B^*([M(1-\alpha/2)]))$$

(20)

where [*x*] denotes the greatest integer less than or equal to *x*.

## 7. Bias Corrected Percentile Bootstrap(BCPB) Confidence Intervals:

The bootstrap distribution $\hat{r}_{A_1}^*, \hat{r}_{A_2}^*, \cdots, \hat{r}_{A_N}^*$ and $\hat{r}_{B_1}^*, \hat{r}_{B_2}^*, \cdots, \hat{r}_{B_M}^*$ may be biased, consequently the Percentile Bootstrap confidence interval of intensity method is designed to correct this potential bias of the bootstrap designed. Set $p_1 = \frac{1}{N}\sum_{i=1}^{N} I(\hat{r}_{A_i}^* < \hat{r}_A)$ and $p_2 = \frac{1}{M}\sum_{i=1}^{M} I(\hat{r}_{B_i}^* < \hat{r}_B)$ where $I(.)$ is the indicator function. Define $\hat{z}_1 = \phi^{-1}(p_1)$ and $\hat{z}_2 = \phi^{-1}(p_2)$ where $\phi^{-1}$ denotes the inverse function of the standard normal distribution $\phi$.

Then let $a_1^* = \phi(2\hat{z}_1 - z_{\alpha/2})$ , $a_1^{**} = \phi(2\hat{z}_1 + z_{\alpha/2})$ , $a_2^* = \phi(2\hat{z}_2 - z_{\alpha/2})$ and $a_2^{**} = \phi(2\hat{z}_2 + z_{\alpha/2})$. It follows that 100(1-α) % BCPB confidence interval for mean response time $R_A$ and $R_B$ respectively are given by

$$(\hat{r}_A^*([Na_1^*]), \hat{r}_A^*([Na_1^{**}])) \text{ and } (\hat{r}_B^*([Ma_2^*]), \hat{r}_B^*([Ma_2^{**}])) \quad (21)$$

where $[x]$ denotes the greatest integer less than or equal to $x$.

## 8. Bias-corrected and accelerated bootstrap(BCaB) Confidence Intervals for mean response time:

Except for correcting the potential bias of the bootstrap distribution, we can accelerate convergence of bootstrap distribution.

Let $(\tilde{X}_A(k), \tilde{S}_A(K), k = 1,2,.....n)$ and $(\tilde{X}_B(k), \tilde{S}_B(K), k = 1,2,.....m)$ denote the original samples with the k[th] observations $(X_{A_k}, S_{A_k})$ and $(X_{B_k}, S_{B_k})$ deleted respectively, also let $\hat{r}_{A_k}$ and $\hat{r}_{B_k}$ be the estimator of $R_A$ and $R_B$ calculated using $(\tilde{X}_A(k), \tilde{S}_A(K), k = 1,2,.....n)$ and $(\tilde{X}_B(k), \tilde{S}_B(K), k = 1,2,.....n)$ respectively.

Define $\tilde{r}_A = \frac{1}{n}\sum_{k=1}^{n} \hat{r}_{A_k}$ , $\tilde{r}_B = \frac{1}{m}\sum_{k=1}^{m} \hat{r}_{B_k}$ ,

$$\hat{a}_1 = \frac{\sum_{k=1}^{n} (\tilde{r}_A - r_{A_k})^3}{6[\sum_{k=1}^{n} (\tilde{r}_A - r_{A_k})^2]^{(3/2)}} \quad \text{and}$$

$$\hat{a}_2 = \frac{\sum_{k=1}^{m} (\tilde{r}_B - r_{B_k})^3}{6[\sum_{k=1}^{m} (\tilde{r}_B - r_{B_k})^2]^{(3/2)}}$$

Here $\hat{z}_1$ , $\hat{z}_2$ , $\hat{a}_1$ , $\hat{a}_2$ are named bias-correction and acceleration respectively.

Thus 100(1-α) % BCaB confidence interval for mean response time $R_A$ and $R_B$ respectively are constructed as

$$(\hat{r}_A^*([N\alpha_1]), \hat{r}_A^*([N\alpha_2])) \text{ and } (\hat{r}_B^*([M\alpha_3]), \hat{r}_B^*([M\alpha_4])) , \quad (22)$$

where $\alpha_1 = \phi\left\{\hat{z}_1 + \frac{(\hat{z}_1 - z_{\alpha/2})}{1 - \hat{a}_1(\hat{z}_1 - z_{\alpha/2})}\right\}$ , $\alpha_2 = \phi\left\{\hat{z}_1 + \frac{(\hat{z}_1 + z_{\alpha/2})}{1 - \hat{a}_1(\hat{z}_1 + z_{\alpha/2})}\right\}$

$\alpha_3 = \phi\left\{\hat{z}_2 + \frac{(\hat{z}_2 - z_{\alpha/2})}{1 - \hat{a}_2(\hat{z}_2 - z_{\alpha/2})}\right\}$ , $\alpha_4 = \phi\left\{\hat{z}_2 + \frac{(\hat{z}_2 + z_{\alpha/2})}{1 - \hat{a}_2(\hat{z}_2 + z_{\alpha/2})}\right\}$

## 9. Simulation Study:

A numerical simulation study was undertaken to evaluate performance of the various interval estimation approaches mentioned above for a two-stage open queueing network. Here we consider coverage percentage, average length, relative coverage and relative average length to evaluate performances of interval estimation methods.

Relative coverage is defined as the ratio of coverage percentage to average length of confidence interval. Larger relative coverage implies the better performances of the corresponding confidence interval. Also another approach named Relative Average Length is defined as the ratio of average length to the true value of mean response time. Shorter relative average length implies the better performances of the corresponding confidence interval.

For simulation study we select various queueing network modes such as $M/E_4/1$ to $E_4/M/1$, $M/H_4^{Po}/1$ to $H_4^{Po}/M/1$, $M/H_4^{Pe}/1$ to $H_4^{Pe}/M/1$ where M represents an exponential distribution, $E_4$ represents a 4-stage Erlang distribution, $H_4^{Pe}$ a 4-stage hyper-exponential distribution and $H_4^{P0}$ a 4-stage hypo-exponential distribution. The corresponding density function of interarrival time and service time for the three different queueing network models are shown in Table 1. Also $H(\beta)$ and $\beta_0$ are shown in Table 2.

For each specified queueing network models in Table -1, a random sample *size n( = 15, 25,100, 200)* is generated. Further N=1000 bootstrap resamples are drawn from the original samples. According to equations (20) to (24) we obtain SB, PB, BCPB, BCaB and Bootт confidence intervals for mean response time $R_A$ and $R_B$ with confidence level 90%. The above simulation process is replicated N=1000 times and we compute coverage percentages, average lengths, relative coverage and relative average lengths. These results are shown in Tables 3 to 5 for different sample size n. Note that boldface in tables 3 to 5 denotes the greatest relative coverage and the shortest relative average lengths. Table-6 is prepared by using Tables 3 to 5. Table-6 shows the comparative study of different approaches.

From all simulation results in Table 3 to 5, we observe that, the coverage percentage and relative coverage for the confidence interval of $R_A$ and $R_B$ increase with sample size increases. Both the average length and relative average length become shorter when sample size n becomes larger. The coverage percentage of the SB method increases with sample size increases. Also we find that if $\lambda_A = 0.9$ , the coverage percentage of BCaB method is significantly less than the nominated level 90%. In terms of average coverage percentage the SB method has best performance. In addition to this we find that the various bootstrap methods perform almost equally well on the coverage percentage if $\lambda_A \leq 0.3$. These simulation results shows that almost all methods have decreasing relative average lengths with sample size n but the PB method has the shortest relative average length of confidence interval. In some cases the average length of confidence interval produced by SB, BCPB, BCaB and Boot-t is even 50 to 60 times the length produced by the PB. Table 6 also indicates that the PB method is the best among five bootstrap techniques based on the relative coverage and relative average lengths.

**Table-1: Different M/G/1 to G/M/1 queueing network models simulated are as follows:**

| Queueing network models | Density function of $X_A$ and $X_B$ | Density function of $S_A$ and $S_B$ |
|---|---|---|
| M/$E_4$/1 to $E_4$/M/1 | $f(x_A)=\lambda e^{-\lambda x_A},\ x_A\geq 0$<br>$f(x_B)=\lambda^4 x_B^3 e^{-\lambda x_B}/3!,\quad x_B\geq 0$ | $f(s_A)=\mu^4 s_A^3 e^{-\mu s_A}/3!,\quad s_A\geq 0$<br>$f(s_B)=\mu e^{-\mu s_B},\ s_B\geq 0$ |
| M/$H_4^{Po}$/1 to $H_4^{Po}$/M/1 | $f(x_A)=\lambda e^{-\lambda x_A},\ x_A\geq 0$<br>$f(x_B)=2e^{-2x_B}+4e^{-4x_B}+\frac{16}{3}e^{-16x_B/3}+16e^{-16x_B},\ x_B\geq 0$ | $f(s_A)=2e^{-2s_A}+4e^{-4s_A}+\frac{16}{3}e^{-16s_A/3}+16e^{-16s_A},\ s_A\geq 0$<br>$f(s_B)=\mu e^{-\mu s_B},\ s_B\geq 0$ |
| M/$H_4^{Pe}$/1 to $H_4^{Pe}$/M/1 | $f(x_A)=\lambda e^{-\lambda x_A},\ x_A\geq 0$<br>$f(x_B)=\frac{3}{8}\mu_1 e^{-\mu_1 x_B}+\frac{1}{8}\mu_2 e^{-\mu_2 x_B}+\frac{1}{4}\mu_3 e^{-\mu_3 x_B/3}+\frac{1}{4}\mu_4 e^{-\mu_4 x_B},\ x_B\geq 0$<br>*where* $\mu_1=5/6,\ \mu_2=5/2,\ \mu_3=3/2,\ \mu_4=3/4$ | $f(s_A)=\frac{3}{8}\mu_1 e^{-\mu_1 s_A}+\frac{1}{8}\mu_2 e^{-\mu_2 s_A}+\frac{1}{4}\mu_3 e^{-\mu_3 s_A/3}+\frac{1}{4}\mu_4 e^{-\mu_4 s_A},\ s_A\geq 0$<br>*where* $\mu_1=5/6,\ \mu_2=5/2,\ \mu_3=3/2,\ \mu_4=3/4$<br>$f(s_B)=\mu e^{-\mu s_B},\ s_B\geq 0$ |

**Table-2: Three different queueing network models considered in the simulation study.**

| Queueing network models | Density function of $X_B$ | $H(\beta)$ | $\beta_0$ |
|---|---|---|---|
| M/$E_4$/1 to $E_4$/M/1 | $f(x_B)=\lambda^4 x_B^3 e^{-\lambda x_B}/3!,\quad x_B\geq 0$ | $\beta=(2-\beta)^{-4}$ | 0.0724 |
| M/$H_4^{Po}$/1 to $H_4^{Po}$/M/1 | $f(x_B)=2e^{-2x_B}+4e^{-4x_B}+\frac{16}{3}e^{-16x_B/3}+16e^{-16x_B},\ x_B\geq 0$ | $\beta=\left(\frac{2}{3-\beta}\right)\left(\frac{4}{5-\beta}\right)\left(\frac{16}{17-3\beta}\right)\left(\frac{16}{17-\beta}\right)$ | 0.8800 |
| M/$H_4^{Pe}$/1 to $H_4^{Pe}$/M/1 | $f(x_B)=\frac{3}{8}\mu_1 e^{-\mu_1 x_B}+\frac{1}{8}\mu_2 e^{-\mu_2 x_B}+\frac{1}{4}\mu_3 e^{-\mu_3 x_B/3}+\frac{1}{4}\mu_4 e^{-\mu_4 x_B},\ x_B\geq 0$<br>*where* $\mu_1=5/6,\ \mu_2=5/2,\ \mu_3=3/2,\ \mu_4=3/4$ | $\beta=\frac{1}{16}\left(\frac{30}{11-6\beta}+\frac{10}{7-2\beta}+\frac{12}{5-2\beta}+\frac{12}{7-4\beta}\right)$ | 0.9000 |

**Table-3: Simulation results of queueing network model: M/$E_4$/1 to $E_4$/M/1.**

**$\lambda_A$=0.1 $R_A$=1.0694 $\mu_B$=0.1 $R_B$=10.781**

| Estimation Approaches | Coverage Percentages | | | | Average Lengths | | | | Relative Coverage | | | | Relative Average Length | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | *n*=15 | *n*=25 | *n*=100 | *n*=200 | *n*=15 | *n*=25 | *n*=100 | *n*=200 | *n*=15 | *n*=25 | *n*=100 | *n*=200 | *n*=15 | *n*=25 | *n*=100 | *n*=200 |
| SB1 | 0.877 | 0.880 | 0.885 | 0.906 | 0.494 | 0.375 | 0.189 | 0.135 | 1.775 | 2.347 | 4.685 | 6.738 | 0.462 | 0.351 | 0.177 | 0.126 |
| SB2 | 0.839 | 0.848 | 0.879 | 0.904 | 8.280 | 6.672 | 3.486 | 2.493 | 0.101 | 0.127 | 0.252 | 0.363 | 0.768 | 0.619 | 0.323 | 0.231 |
| PB1 | 0.868 | 0.882 | 0.884 | 0.905 | 0.477 | 0.373 | 0.188 | 0.134 | **1.819** | **2.367** | **4.696** | 6.754 | **0.446** | **0.349** | **0.176** | **0.125** |
| PB2 | 0.843 | 0.851 | 0.887 | 0.901 | 8.232 | 6.640 | 3.471 | 2.483 | **0.102** | **0.128** | **0.256** | **0.363** | **0.764** | **0.616** | **0.322** | **0.230** |
| BCPB1 | 0.869 | 0.878 | 0.883 | 0.909 | 0.478 | 0.373 | 0.188 | 0.134 | 1.819 | 2.351 | 4.686 | **6.786** | 0.447 | 0.349 | 0.176 | 0.125 |
| BCPB2 | 0.835 | 0.848 | 0.883 | 0.898 | 8.213 | 6.639 | 3.474 | 2.484 | 0.102 | 0.128 | 0.254 | 0.362 | 0.762 | 0.616 | 0.322 | 0.230 |
| BCaB1 | 0.869 | 0.877 | 0.883 | 0.909 | 0.478 | 0.373 | 0.188 | 0.134 | 1.819 | 2.349 | 4.686 | 6.786 | 0.447 | 0.349 | 0.176 | 0.125 |
| BCaB2 | 0.847 | 0.850 | 0.888 | 0.899 | 8.360 | 6.710 | 3.486 | 2.489 | 0.101 | 0.127 | 0.255 | 0.361 | 0.775 | 0.622 | 0.323 | 0.231 |
| Boott1 | 0.876 | 0.871 | 0.881 | 0.910 | 0.511 | 0.388 | 0.195 | 0.138 | 1.714 | 2.248 | 4.513 | 6.594 | 0.478 | 0.362 | 0.183 | 0.129 |
| Boott2 | 0.826 | 0.852 | 0.881 | 0.899 | 8.489 | 6.903 | 3.606 | 2.577 | 0.097 | 0.123 | 0.244 | 0.349 | 0.787 | 0.640 | 0.335 | 0.239 |

**$\lambda_A$=0.9 $R_A$=6.6250 $\mu_B$=0.9 $R_B$=1.1979**

| Estimation Approaches | Coverage Percentages | | | | Average Lengths | | | | Relative Coverage | | | | Relative Average Length | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | *n*=15 | *n*=25 | *n*=100 | *n*=200 | *n*=15 | *n*=25 | *n*=100 | *n*=200 | *n*=15 | *n*=25 | *n*=100 | *n*=200 | *n*=15 | *n*=25 | *n*=100 | *n*=200 |
| SB1 | 0.959 | 0.977 | 0.976 | 0.973 | 8959.9 | 1111.9 | 2375.9 | 2491.7 | 0.000 | 0.001 | 0.000 | 0.000 | 1352.4 | 167.84 | 358.63 | 376.10 |
| SB2 | 0.818 | 0.862 | 0.902 | 0.899 | 0.932 | 0.742 | 0.388 | 0.276 | 0.878 | 1.161 | 2.325 | 3.255 | 0.778 | 0.620 | 0.324 | 0.231 |
| PB1 | 0.810 | 0.879 | 0.941 | 0.955 | 23.387 | 29.928 | 51.464 | 57.301 | **0.035** | **0.029** | **0.018** | **0.017** | **3.530** | **4.518** | **7.768** | **8.649** |
| PB2 | 0.821 | 0.865 | 0.899 | 0.897 | 0.926 | 0.739 | 0.387 | 0.275 | **0.887** | **1.171** | **2.325** | 3.258 | **0.773** | **0.617** | **0.323** | **0.230** |
| BCPB1 | 0.449 | 0.513 | 0.648 | 0.746 | 1710.6 | 1718.6 | 4616.2 | 1663.0 | 0.000 | 0.000 | 0.000 | 0.000 | 258.20 | 259.41 | 696.78 | 251.02 |
| BCPB2 | 0.538 | 0.568 | 0.657 | 0.741 | 0.779 | 0.639 | 0.347 | 0.259 | 0.691 | 0.889 | 1.896 | 2.865 | 0.650 | 0.533 | 0.289 | 0.216 |
| BCaB1 | 0.447 | 0.513 | 0.648 | 0.746 | 1602.4 | 1021.5 | 4636.1 | 1669.7 | 0.000 | 0.001 | 0.000 | 0.000 | 241.89 | 154.19 | 699.79 | 252.03 |
| BCaB2 | 0.821 | 0.861 | 0.895 | 0.898 | 0.934 | 0.744 | 0.386 | 0.275 | 0.879 | 1.158 | 2.322 | **3.260** | 0.780 | 0.621 | 0.322 | 0.230 |
| Boott1 | 0.769 | 0.813 | 0.832 | 0.858 | 702.00 | 910.57 | 1808.3 | 1439.1 | 0.001 | 0.001 | 0.001 | 0.001 | 105.96 | 137.44 | 272.94 | 217.21 |
| Boott2 | 0.817 | 0.860 | 0.893 | 0.897 | 0.956 | 0.771 | 0.401 | 0.287 | 0.854 | 1.116 | 2.226 | 3.122 | 0.798 | 0.643 | 0.335 | 0.240 |

**Table-4: Simulation results of queueing network model: $M/H_4^{Po}/1$ to $H_4^{Po}/M/1$.**

$\lambda_A$ **=0.1** $R_A$ **=1.0751** $\mu_B$ **=0.1** $R_B$ **=83.3333**

| Estimation Approaches | Coverage Percentages | | | | Average Lengths | | | | Relative Coverage | | | | Relative Average Length | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | *n*=15 | *n*=25 | *n*=100 | *n*=200 | *n*=15 | *n*=25 | *n*=100 | *n*=200 | *n*=15 | *n*=25 | *n*=100 | *n*=200 | *n*=15 | *n*=25 | *n*=100 | *n*=200 |
| SB1 | 0.861 | 0.883 | 0.886 | 0.882 | 0.591 | 0.450 | 0.227 | 0.161 | 1.456 | 1.962 | **3.902** | 5.480 | 0.550 | 0.419 | 0.211 | 0.150 |
| SB2 | 0.839 | 0.862 | 0.888 | 0.897 | 64.456 | 51.685 | 27.197 | 19.235 | 0.013 | 0.017 | 0.033 | 0.047 | 0.774 | 0.620 | 0.326 | 0.231 |
| PB1 | 0.861 | 0.876 | 0.881 | 0.880 | 0.561 | 0.447 | 0.226 | 0.160 | **1.536** | **1.962** | 3.900 | **5.486** | **0.521** | **0.415** | **0.210** | **0.149** |
| PB2 | 0.840 | 0.863 | 0.890 | 0.897 | 64.078 | 51.405 | 27.085 | 19.164 | **0.013** | **0.017** | **0.033** | **0.047** | **0.769** | **0.617** | **0.325** | **0.230** |
| BCPB1 | 0.854 | 0.871 | 0.878 | 0.879 | 0.563 | 0.450 | 0.227 | 0.161 | 1.516 | 1.938 | 3.877 | 5.477 | 0.524 | 0.418 | 0.211 | 0.149 |
| BCPB2 | 0.835 | 0.857 | 0.889 | 0.894 | 64.094 | 51.486 | 27.111 | 19.177 | 0.013 | 0.017 | 0.033 | 0.047 | 0.769 | 0.618 | 0.325 | 0.230 |
| BCaB1 | 0.856 | 0.871 | 0.878 | 0.879 | 0.563 | 0.449 | 0.227 | 0.161 | 1.520 | 1.938 | 3.877 | 5.478 | 0.524 | 0.418 | 0.211 | 0.149 |
| BCaB2 | 0.839 | 0.862 | 0.892 | 0.897 | 65.055 | 52.009 | 27.178 | 19.203 | 0.013 | 0.017 | 0.033 | 0.047 | 0.781 | 0.624 | 0.326 | 0.230 |
| Boott1 | 0.859 | 0.884 | 0.882 | 0.899 | 0.624 | 0.465 | 0.237 | 0.167 | 1.377 | 1.900 | 3.728 | 5.399 | 0.580 | 0.433 | 0.220 | 0.155 |
| Boott2 | 0.818 | 0.852 | 0.890 | 0.892 | 66.877 | 53.353 | 28.094 | 19.925 | 0.012 | 0.016 | 0.032 | 0.045 | 0.803 | 0.640 | 0.337 | 0.239 |

$\lambda_A$ **=0.9** $R_A$ **=7.0820** $\mu_B$ **=0.9** $R_B$ **=9.2593**

| Estimation Approaches | Coverage Percentages | | | | Average Lengths | | | | Relative Coverage | | | | Relative Average Length | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | *n*=15 | *n*=25 | *n*=100 | *n*=200 | *n*=15 | *n*=25 | *n*=100 | *n*=200 | *n*=15 | *n*=25 | *n*=100 | *n*=200 | *n*=15 | *n*=25 | *n*=100 | *n*=200 |
| SB1 | 0.964 | 0.977 | 0.977 | 0.976 | 906.74 | 1590.2 | 3616.2 | 1993.5 | 0.001 | 0.001 | 0.000 | 0.001 | 128.03 | 224.54 | 510.60 | 281.49 |
| SB2 | 0.839 | 0.866 | 0.881 | 0.886 | 7.201 | 5.775 | 2.982 | 2.132 | 0.117 | 0.150 | 0.295 | 0.416 | 0.778 | 0.624 | 0.322 | 0.230 |
| PB1 | 0.783 | 0.841 | 0.941 | 0.947 | 23.810 | 30.030 | 55.412 | 62.302 | **0.033** | **0.028** | **0.017** | **0.015** | **3.362** | **4.240** | **7.824** | **8.797** |
| PB2 | 0.837 | 0.867 | 0.878 | 0.889 | 7.152 | 5.745 | 2.971 | 2.125 | **0.117** | **0.151** | **0.296** | **0.418** | **0.773** | **0.620** | **0.321** | **0.230** |
| BCPB1 | 0.469 | 0.492 | 0.626 | 0.725 | 969.24 | 2570.4 | 2046.3 | 1529.0 | 0.001 | 0.000 | 0.000 | 0.001 | 136.86 | 362.94 | 288.94 | 215.91 |
| BCPB2 | 0.563 | 0.587 | 0.625 | 0.714 | 6.112 | 4.965 | 2.622 | 1.980 | 0.092 | 0.118 | 0.238 | 0.361 | 0.660 | 0.536 | 0.283 | 0.214 |
| BCaB1 | 0.468 | 0.491 | 0.626 | 0.724 | 924.05 | 2260.4 | 2045.7 | 1558.1 | 0.001 | 0.000 | 0.000 | 0.001 | 130.48 | 319.18 | 288.86 | 219.10 |
| BCaB2 | 0.836 | 0.867 | 0.870 | 0.885 | 7.210 | 5.769 | 2.955 | 2.123 | 0.116 | 0.150 | 0.294 | 0.417 | 0.779 | 0.623 | 0.319 | 0.229 |
| Boott1 | 0.777 | 0.787 | 0.822 | 0.845 | 741.51 | 1051.3 | 2045.6 | 1585.3 | 0.001 | 0.001 | 0.000 | 0.001 | 104.70 | 148.45 | 288.85 | 223.84 |
| Boott2 | 0.826 | 0.857 | 0.879 | 0.887 | 7.446 | 5.874 | 3.074 | 2.196 | 0.111 | 0.146 | 0.286 | 0.404 | 0.804 | 0.634 | 0.332 | 0.237 |

**Table-5: Simulation results queueing network model: $M/H_4^{Pe}/1$ to $H_4^{Pe}$ $/M/1$.**

$\lambda_A$ **=0.1** $R_A$ **=1.1240** $\mu_B$ **=0.1** $R_B$ **=100.0**

| Estimation Approaches | Coverage Percentages | | | | Average Lengths | | | | Relative Coverage | | | | Relative Average Length | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | *n*=15 | *n*=25 | *n*=100 | *n*=200 | *n*=15 | *n*=25 | *n*=100 | *n*=200 | *n*=15 | *n*=25 | *n*=100 | *n*=200 | *n*=15 | *n*=25 | *n*=100 | *n*=200 |
| SB1 | 0.815 | 0.818 | 0.812 | 0.716 | 0.564 | 0.437 | 0.226 | 0.160 | 1.444 | 1.871 | 3.600 | 4.473 | 0.502 | 0.389 | 0.201 | 0.142 |
| SB2 | 0.837 | 0.853 | 0.880 | 0.893 | 78.587 | 62.244 | 31.990 | 23.135 | 0.011 | 0.014 | 0.028 | 0.039 | 0.786 | 0.622 | 0.320 | 0.231 |
| PB1 | 0.818 | 0.831 | 0.830 | 0.731 | 0.553 | 0.434 | 0.225 | 0.159 | 1.480 | **1.913** | **3.695** | 4.586 | **0.492** | **0.387** | **0.200** | **0.142** |
| PB2 | 0.837 | 0.848 | 0.880 | 0.893 | 78.178 | 61.867 | 31.844 | 23.046 | **0.011** | **0.014** | **0.028** | **0.039** | **0.782** | **0.619** | **0.318** | **0.231** |
| BCPB1 | 0.828 | 0.833 | 0.828 | 0.734 | 0.556 | 0.436 | 0.225 | 0.160 | **1.490** | 1.910 | 3.680 | **4.601** | 0.494 | 0.388 | 0.200 | 0.142 |
| BCPB2 | 0.838 | 0.855 | 0.876 | 0.900 | 78.216 | 61.927 | 31.873 | 23.052 | 0.011 | 0.014 | 0.028 | 0.039 | 0.782 | 0.619 | 0.319 | 0.231 |
| BCaB1 | 0.828 | 0.833 | 0.828 | 0.734 | 0.556 | 0.436 | 0.225 | 0.160 | 1.490 | 1.910 | 3.680 | 4.601 | 0.494 | 0.388 | 0.200 | 0.142 |
| BCaB2 | 0.842 | 0.855 | 0.883 | 0.900 | 79.311 | 62.578 | 31.957 | 23.072 | 0.011 | 0.014 | 0.028 | 0.039 | 0.793 | 0.626 | 0.320 | 0.231 |
| Boott1 | 0.802 | 0.803 | 0.816 | 0.729 | 0.585 | 0.454 | 0.233 | 0.164 | 1.371 | 1.770 | 3.496 | 4.440 | 0.520 | 0.404 | 0.208 | 0.146 |
| Boott2 | 0.823 | 0.846 | 0.881 | 0.896 | 80.699 | 63.957 | 33.047 | 23.733 | 0.010 | 0.013 | 0.027 | 0.038 | 0.807 | 0.640 | 0.331 | 0.237 |

$\lambda_A$ **=0.9** $R_A$ **=11.040** $\mu_B$ **=0.9** $R_B$ **=11.1111**

| Estimation Approaches | Coverage Percentages | | | | Average Lengths | | | | Relative Coverage | | | | Relative Average Length | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | *n*=15 | *n*=25 | *n*=100 | *n*=200 | *n*=15 | *n*=25 | *n*=100 | *n*=200 | *n*=15 | *n*=25 | *n*=100 | *n*=200 | *n*=15 | *n*=25 | *n*=100 | *n*=200 |
| SB1 | 0.942 | 0.965 | 0.975 | 0.952 | 749.03 | 1701.3 | 2912.3 | 2335.1 | 0.001 | 0.001 | 0.000 | 0.000 | 67.847 | 154.11 | 263.8 | 211.51 |
| SB2 | 0.833 | 0.853 | 0.885 | 0.912 | 8.670 | 6.917 | 3.606 | 2.570 | 0.096 | 0.123 | 0.245 | 0.355 | 0.780 | 0.623 | 0.325 | 0.231 |
| PB1 | 0.614 | 0.747 | 0.853 | 0.861 | 24.205 | 30.780 | 53.319 | 61.161 | **0.025** | **0.024** | **0.016** | **0.014** | **2.193** | **2.788** | **4.830** | **5.540** |
| PB2 | 0.832 | 0.855 | 0.887 | 0.911 | 8.613 | 6.879 | 3.591 | 2.561 | **0.097** | **0.124** | **0.247** | **0.356** | **0.775** | **0.619** | **0.323** | **0.231** |
| BCPB1 | 0.463 | 0.498 | 0.626 | 0.675 | 1044.3 | 1105.8 | 1935.0 | 1132.3 | 0.000 | 0.001 | 0.000 | 0.001 | 94.595 | 100.16 | 175.27 | 102.56 |
| BCPB2 | 0.561 | 0.565 | 0.676 | 0.724 | 7.396 | 5.969 | 3.262 | 2.384 | 0.076 | 0.095 | 0.207 | 0.304 | 0.666 | 0.537 | 0.294 | 0.215 |
| BCaB1 | 0.463 | 0.498 | 0.627 | 0.675 | 965.08 | 1070.2 | 1923.1 | 1133.8 | 0.001 | 0.001 | 0.000 | 0.001 | 87.417 | 96.934 | 174.20 | 102.70 |
| BCaB2 | 0.827 | 0.852 | 0.885 | 0.905 | 8.697 | 6.926 | 3.580 | 2.552 | 0.095 | 0.123 | 0.247 | 0.355 | 0.783 | 0.623 | 0.322 | 0.230 |
| Boott1 | 0.733 | 0.782 | 0.783 | 0.779 | 573.57 | 2409.4 | 1769.2 | 1858.5 | 0.001 | 0.000 | 0.000 | 0.000 | 51.954 | 218.24 | 160.25 | 168.34 |
| Boott2 | 0.823 | 0.853 | 0.880 | 0.917 | 8.911 | 7.146 | 3.702 | 2.680 | 0.092 | 0.119 | 0.238 | 0.342 | 0.802 | 0.643 | 0.333 | 0.241 |

**Table-6: Performances of the estimation approaches to response time under various queueing networks based on large sample size:**

| Queuing Network models | $\lambda_A$ & $\mu_B$ | Estimation approach with Greatest Relative Coverage | | | | Estimation approach with Shortest Relative Average Length | | | |
|---|---|---|---|---|---|---|---|---|---|
| | | n=15 | n=25 | n=100 | n=200 | n=15 | n=25 | n=100 | n=200 |
| $M/E_4/1$ to $E_4/M/1$ | 0.1 | PB | PB | PB | PB/BCPB | PB | PB | PB | PB |
| | 0.9 | PB | PB | PB | PB/ BCaB | PB | PB | PB | PB |
| $M/H_4^{Po}/1$ to $H_4^{Po}/M/1$ | 0.1 | PB | PB | SB/PB | PB | PB | PB | PB | PB |
| | 0.9 | PB | PB | PB | PB | PB | PB | PB | PB |
| $M/H_4^{Pe}/1$ to $H_4^{Pe}/M/1$ | 0.1 | BCPB/PB | PB | PB | BCPB/PB | PB | PB | PB | PB |
| | 0.9 | PB | PB | PB | PB | PB | PB | PB | PB |

## 10. Conclusions:

This paper provides the interval estimation of mean response time $R_A$ and $R_B$ for a two-stage open queueing network model M/G/1 to G/M/1. Different estimation approaches SB, PB, BCPB, BCaB and Boot-t are applied to produce confidence intervals for mean response time. The coverage percentage, average length, relative coverage & relative average lengths are adopted to understand compare and assess performance of the resulted bootstrap confidence intervals. The simulation results imply that the PB method has the best performance for M/G/1 to G/M/1 queueing network model among almost all estimation methods for different sample sizes.

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# Annual Runoff Computation using "V" Notch method - A Comparative Analysis of Two Micro-watersheds in the Krishna Basin (KR-22) in Maharashtra

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**Abstract:**

India has average annual rainfall is 1170 mm. Annual runoff computation in every watershed is very much important for planning and management of available water. It is requires to be store 70% of available runoff through various water harvesting structures. The V notch method is simple and reliable method to compute runoff available for rainfall. In this research paper an attempt have been made to calculate the available runoffs in two micro watersheds namely Tadsar and Nerli villages in Kadegaon block of Sangli district of Maharashtra in Krishna river basin.

**Key Words:** *Runoff, Watersheds, Watershed treatments.*

**Introduction:**

Weirs are typically installed in open channels such as streams to determine discharge (flow rate). The basic principle is that discharge is directly related to the water depth above the crotch (bottom) of the V; this distance is called head (h). The V-notch design causes small changes in discharge to have a large change in depth allowing more accurate head measurement than with a rectangular weir[1]. Runoff computations have significance in planning and management of available water in particular catchments. Watersheds selected for present study fall in Kadegaon block where annual rainfall of the Kadegaon is 565.22 mm. The annual runoff is computed using V notch method in two micro-watersheds namely Tadsar village and Nerli village. The villages with and without watershed treatments have been selected to compute runoff. The village Tadsar has high number of water harvesting structures, whereas village Nerli has few quantity of water harvesting structures. Watershed development program have been carried out in the experimental village Tadsar in the span of 2002 -2004. The arrested runoff of the village is 177.93 and increased area under irrigation is 178 hectare. The arrested runoff is not arrested in the Control village Nerli because of the no watershed activity. The discharges calculated with V notch method are helpful in planning and management of runoff, soil erosion, agriculture, land and vegetation in control village Nerli.

**Research Methodology –**

The objective of present research work is as follows.

## A. Objectives-

1. To analyze the runoff from the micro-watershed.
2. Identifying the importance of the watershed development and Management.
3. Suggesting the region specific watershed treatment in the soil and water conservation.
4. "V" notch methodology is useful for the measurement of open flows and discharges from both experimental and control villages. This method reveals the importance of the scientific development and management of the soil and water resources. To assess the discharge "V" notch of $120^0$ have been used in the entire study period.

## B. Methodology -

**Demographic details of Study villages -**

Total Population: 4674 (2001 Censes)

Village Tadsar: General information.

| | |
|---|---|
| Geographical Area- 2531 Hectare | Area of Watershed-1359 Hect |
| Area under cultivation 1708.45 Hectare | Water Budget |
| Barren land – 72.45 Hectare | A) Total available Runoff – 1296.49 TCM |
| Forest cover – 57.70 Hectare | B) Arrested Runoff- 22% |
| Watersheds – 1 | |

**Control Village-Nerli**

The control villages have no watershed development work.
Total Population: 2527 (2001 Censes)

Village Nerli: - General information.

| | |
|---|---|
| Geographical Area- 1531 Hectare | Area of Watershed-1260 Hectare |
| Area under cultivation 1208.45 Hectare | Water Budget |
| Barren land – 274.45 Hectare | A) Total available Runoff – 0000 TCM |
| Forest cover – 47.70 Hectare | B) Arrested Runoff- 00 % |
| Watersheds – 2 | |

**Assessment of open flow's using V notch of the $120^0$ to study discharges in the Experimental and Control villages:**

To assess the discharges from the micro-watersheds of the study villages the "V" notch has been used. Assessment of discharge has immense importance in the planning of watershed development, management, computation of runoff, conservation of soil etc. "V" notch reading in the experimental village shows the importance of area treatment in the arresting of runoff and soil conservation, whereas in case of control villages this methodology generates base for scientific planning of the watershed activity to harvest the water and conserve soil.

Following criteria's have been adopted for the selection of the villages.

**i) Criteria for selection of control village:-**

1. Control village should not vary far from experimental village.
2. Control village has relatively same socio-economic and somewhat geographical conditions.
3. Control villages have not implemented watershed management program.

**ii) Criteria for selection of experimental village:-**

1) The experimental villages have come under drought prone region.

The experimental villages have successfully implemented the watershed management project where annual rainfall is less

The equation is developed by the Kinds vaster - Carter equation, from the Bureau of Reclamation, Water Measurement Manual, United States, 2008 is used in this study to measure the flows originated from $I^{st}$ and $II^{nd}$ order streams of the watershed. This equation is used in the conditions, when notch angle is greater than $90^0$ and flow rate is high.

The equations have been given as follows.

5.

$$Q = 4.28\ C_e\ \tan(Ø/2)\ (h + K)^{5/2} \quad \text{---------- (3.18)}$$

Where $Q$ = Discharge (cfs)

$C_e$ = Discharge coefficient

$Ø$ = Notch angle

$h$ = Head (ft)

$k$ = Head correction factor (ft).

$$C_e = 0.607165052 - 0.000874466963\ Ø + 6.10393334 \times 10^{-6}\ Ø^2$$

$$C = 0.6053572$$

$$k\ (ft.) = 0.0144902648 - 0.00033955535\ Ø + 3.29819003 \times 10^{-6}\ Ø^2 - 1.06215442 \times 10^{-8}\ Ø^3$$

$k = 0.0135282$ , where Ø is the notch angle in degrees

**Results -**

On the basis of the above formula discharge variations of the open flows have been calculated to know the discharge of the water from the upper catchment. These readings scientifically proved the discharges and importance of the area treatments in the planning of watershed development. About 17 readings with the V notch of $120^0$ has been recorded in experimental village and 06 readings has been recorded in control village during the entire study period 2009 -2010.

**Table No.1 - Discharge variation in study villages**

| SN | Village | Reading No | Dates | Q in feet $^3$/s | h in cm | h in feet | H+K | $(H+K)^{5/2}$ | Q in meter$^3$ /minute | Q in m$^3$ hour |
|---|---|---|---|---|---|---|---|---|---|---|
| 01 | Tadsar | 1 | 18-Oct-09 | 0.14 | 7.1 | 0.23 | 0.25 | 0.03 | 0.23 | 13.78 |
| 02 | Tadsar | 2 | 02-Nov-09 | 0.02 | 3 | 0.10 | 0.11 | 0.00 | 0.03 | 1.92 |
| 03 | Tadsar | 3 | 02-Nov-09 | 0.05 | 4.5 | 0.15 | 0.16 | 0.01 | 0.08 | 4.76 |
| 04 | Tadsar | 4 | 02-Nov-09 | 0.04 | 4.2 | 0.14 | 0.15 | 0.01 | 0.07 | 4.07 |
| 05 | Tadsar | 5 | 02-Nov-09 | 0.03 | 3.5 | 0.11 | 0.13 | 0.01 | 0.04 | 2.70 |
| 06 | Tadsar | 6 | 09-Nov-09 | 0.05 | 4.5 | 0.15 | 0.16 | 0.01 | 0.08 | 4.76 |
| 07 | Tadsar | 7 | 09-Nov-09 | 0.02 | 3.2 | 0.10 | 0.12 | 0.00 | 0.04 | 2.21 |
| 08 | Tadsar | 8 | 09-Nov-09 | 0.03 | 3.5 | 0.11 | 0.13 | 0.01 | 0.04 | 2.70 |
| 09 | Tadsar | 9 | 09-Nov-09 | 0.02 | 2.95 | 0.10 | 0.11 | 0.00 | 0.03 | 1.85 |
| 10 | Tadsar | 10 | 15-Nov-09 | 0.01 | 2.5 | 0.08 | 0.10 | 0.00 | 0.02 | 1.29 |
| 11 | Tadsar | 11 | 14-Nov-09 | 0.46 | 11.8 | 0.39 | 0.40 | 0.10 | 0.77 | 46.43 |
| 12 | Tadsar | 12 | 13-Dec-09 | 0.02 | 2.9 | 0.10 | 0.11 | 0.00 | 0.03 | 1.78 |

| SN | Village | Reading No | Dates | Q in feet $^3$/s | h in cm | h in feet | H+K | $(H+K)^{5/2}$ | Q in meter$^3$ /minute | Q in m$^3$ hour |
|---|---|---|---|---|---|---|---|---|---|---|
| 13 | Tadsar | 13 | 13-Dec-09 | 0.07 | 5.3 | 0.17 | 0.19 | 0.02 | 0.12 | 6.95 |
| 14 | Tadsar | 14 | 13-Dec-09 | 0.00 | 1.5 | 0.05 | 0.06 | 0.00 | 0.01 | 0.45 |
| 15 | Tadsar | 15 | 13-Dec-09 | 0.12 | 6.7 | 0.22 | 0.23 | 0.03 | 0.20 | 12.02 |
| 16 | Tadsar | 16 | 26-Dec-09 | 0.00 | 1.3 | 0.04 | 0.06 | 0.00 | 0.01 | 0.34 |
| 17 | Tadsar | 17 | 26-Dec-09 | 0.00 | 1.2 | 0.04 | 0.05 | 0.00 | 0.00 | 0.29 |

**Table No.2 Discharge variation in Control Village**

| SN | Village | Reading No | Dates | Q in feet $^3$/s | h in cm | h in feet | H+K | $(H+K)^{5/2}$ | Q in meter$^3$ /minute | Q in m$^3$ hour |
|---|---|---|---|---|---|---|---|---|---|---|
| 01 | Nerli | 1 | 09-Oct-10 | 0.24 | 9.1 | 0.30 | 0.31 | 0.05 | 0.41 | 24.86 |
| 02 | Nerli | 2 | 09-Oct-10 | 0.23 | 8.9 | 0.29 | 0.31 | 0.05 | 0.39 | 23.57 |
| 03 | Nerli | 3 | 18-Oct-10 | 0.21 | 8.59 | 0.28 | 0.30 | 0.05 | 0.36 | 21.66 |
| 04 | Nerli | 4 | 14-Oct-10 | 0.11 | 6.5 | 0.21 | 0.23 | 0.02 | 0.19 | 11.19 |
| 05 | Nerli | 5 | 2-Nov-10 | 0.02 | 3 | 0.10 | 0.11 | 0.00 | 0.03 | 1.92 |
| 06 | Nerli | 6 | 2- Nov-10 | 0.01 | 1.7 | 0.06 | 0.07 | 0.00 | 0.01 | 0.58 |

**(Source- on the basis of field work)**

To compile the results of the watershed development program (WDP), one control village adjoining to experimental villages, namely Khambale – Nerli (KR 22), the expected outcomes have been witnessed in discharge variation. The control village has fast withdrawn the rainwater compared to the experimental village, which earlier affecting the drying of the channels and overall affecting the availability of water. Therefore judicious utilization and management of generated natural resource is required in the both types of villages. V notch methodology generates potential yields of the runoff from study village in both control and experimental village. In experimental village arrested runoff through watershed activities improves the ground water levels.

After monsoon (post condition) the V notch method is used to assess the runoff from the control and experimental micro watersheds in Kadegaon block. Results revealed that, total 17 readings are become possible during entire study period whereas about six readings have been recorded in control village. These readings clearly reflect that drying of streams in control village is fall earlier than experimental village. Q is recorded in experimental village Tadsar is 13.79 m$^3$ in the month of October 2009 whereas it is 24.86 m$^3$ in the Nerli village in the month of October 2010. The readings recorded on next consecutive dates have been given in Table No. 1 and Table No.2. The natural drains in control villages get dry almost in the month of November whereas in

experimental villages the drains are flow up-to month of end of December. This clearly revealed that, much attention is required for management of water resource in control village to protect natural resources such as soil, natural vegetation, water exist in micro watersheds.

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# Some Results on One-Sided Derivatives

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**Abstract:**

*One sided derivatives are important in theory of convergence of Fourier series. In this paper we prove some one-sided derivative results.*

**Keywords**- *Right hand derivative, Left hand derivative, piecewise continuous function*

**Introduction:**

Properties of one sided derivatives are particularly important in the teory of convergence of Fourier series. It concerns the subspace $C_p^{|}(a,b)$ of $C_p(a,b)$ consisting of all piecewise continuous functions $f$ on an interval $a< x <b$ whose partial derivatives $f^{|}$ are also piecewise continuous on that interval. Such a function is said to be Piecewise smooth because, over the subintervals on which both $f$ and $f^{|}$ are continuous, any tangents to the graph of $y = f(x)$ that turn to do continuously.

Piecewise continuous function (Definition): - Let a function $f$ be continous at all the points of a open bounded interval $a< x <b$ except possibly for a finite set of points $a < x_1 < x_2 < \cdots .. < x_{n-1} < b$ If we write $x_0 = a$ and $x_n = b$ ,then $f$ is continuous on each of the n open subintervals $x_0 < x < x_1,\ x_1 < x < x_2,\ldots\ldots\ldots\ldots, x_{n-1} < x < x_n$ .

It is not necessarily continuous, or even defined, at their endpoints. But if in each of those subintervals, $f$ has finite limits as $x$ approaches the endpoints from the interior, $f$ is said to be *piecewise continuous* on the interval $a< x <b$. More precisely, the one sided limits

: $f(x_{k-1}{}^{+}) = \lim_{\substack{x\to x_{k-1}\\ x>x_{k-1}}} f(x)$ and $f(x_k -) = \lim_{\substack{x\to x_k\\ x<x_k}} f(x)$

**The right hand limit of f at $x_0$** is defined as: $f(x_0{}^{+}) = \lim_{\substack{x\to x_0\\ x>x_0}} f(x)$ , provided that the limit here exists.

**The left hand limit of f at $x_0$** is defined as : $f(x_0{}^{-}) = \lim_{\substack{x\to x_0\\ x<x_0}} f(x)$ , provided that the limit here exists.

Definition :- the **right hand derivative** of $f$ at $x_0$ is defined as follows :

$$(f)^{|}{}_R(x_0) = \lim_{\substack{x\to x_0\\ x>x_0}} \left\{\frac{(f)(x)-(f)(x_0{}^{+})}{x-x_0}\right\}$$ ,provided that the limit here exists

Definition :- the **left hand derivative** of $f$ at $x_0$ is defined as follows :

$$(f)^{|}{}_L(x_0) = \lim_{\substack{x\to x_0\\ x<x_0}} \left\{\frac{(f)(x)-(f)(x_0{}^{-})}{x-x_0}\right\}$$ provided that the limit here exists.

Example : let $f$ denote the continuous function defined by the

$$f(x) = \begin{cases} x^2 \ \ when\ x \le 0 \\ sinx\ when\ x > 0 \end{cases}$$

By using L'Hospital's rule'

$$f_R{}^{|}(0) = \lim_{\substack{x\to 0\\ x>0}} \left\{\frac{sinx}{x}\right\} = 1;$$

and $$f_L{}^{|}(0) = \lim_{\substack{x\to 0\\ x<0}} \left\{\frac{x^2}{x}\right\} = 0;$$

Theorem: If a function $f$ is piecewise smooth on an interval $a<x<b$, then at each point $x_0$ in the closed interval [a, b] the on one-sided derivatives of $f$, from the interior at end points exist,

Result 1) $(f+g)|_R(x_0) = f_R|(x_0) + g_R|(x_0)$

Proof:- $(f+g)(x) = f(x) + g(x)$

$$(f+g)|_R(x_0) = \lim_{\substack{x\to x_0 \\ x>x_0}} \left\{\frac{(f+g)(x) - (f+g)(x_0{}^+)}{x-x_0}\right\}$$

$$= \lim_{\substack{x\to x_0 \\ x>x_0}} \left\{\frac{(f)(x) + g(x) - (f)(x_0{}^+) - (g)(x_0{}^+)}{x-x_0}\right\}$$

$$= \lim_{\substack{x\to x_0 \\ x>x_0}} \left\{\frac{(f)(x) - (f)(x_0{}^+)}{x-x_0}\right\} + \left\{\frac{g(x) - (g)(x_0{}^+)}{x-x_0}\right\}$$

$$= \lim_{\substack{x\to x_0 \\ x>x_0}} \left\{\frac{(f)(x) - (f)(x_0{}^+)}{x-x_0}\right\} + \lim_{\substack{x\to x_0 \\ x>x_0}} \left\{\frac{g(x) - (g)(x_0{}^+)}{x-x_0}\right\}$$

$$= f_R|(x_0) + g_R|(x_0)$$

Similarly,

i) $(f+g)|_L(x_0) = f_L|(x_0) + g_L|(x_0)$

ii) $(f-g)|_R(x_0) = f_R|(x_0) - g_R|(x_0)$

iii) $(f-g)|_L(x_0) = f_L|(x_0) - g_L|(x_0)$

Result 2) $\left(\frac{f}{g}\right)|_R(x_0) = \frac{\left((f)|_R(x_0)g(x_0{}^+) - (g)|_R(x_0)f(x_0{}^+)\right)}{\left((g)(x_0{}^+)\right)^2}$

Proof :- Now we are going to find the right hand derivative of the quotient

$$\left(\frac{f}{g}\right)(x) = \frac{f(x)}{g(x)}$$

$$\left(\frac{f}{g}\right)|_R(x_0) = \lim_{\substack{x\to x_0 \\ x>x_0}} \frac{\left(\frac{f}{g}\right)(x) - \left(\frac{f}{g}\right)(x_0^+)}{x-x_0}$$

$$= \lim_{\substack{x\to x_0 \\ x>x_0}} \frac{\left(\frac{f(x)}{g(x)}\right)(x) - \left(\frac{f(x_0^+)}{g(x_0^+)}\right)(x_0^+)}{x-x_0}$$

$$= \lim_{\substack{x\to x_0 \\ x>x_0}} \left\{\frac{f(x)\,g(x_0{}^+) - g(x)\,f(x_0{}^+)}{g(x)\,g(x_0{}^+)(x-x_0)}\right\}$$

$$= \lim_{\substack{x\to x_0 \\ x>x_0}} \left\{\frac{f(x)\,g(x_0{}^+) - g(x_0{}^+)\,f(x_0{}^+) + g(x_0{}^+)\,f(x_0{}^+) - g(x)\,f(x_0{}^+)}{g(x)\,g(x_0{}^+)(x-x_0)}\right\}$$

$$= \lim_{\substack{x \to x_0 \\ x > x_0}} \left\{ \frac{[f(x) - f(x_0{}^+)]g(x_0{}^+) - f(x_0{}^+)[g(x) - g(x_0{}^+)]}{g(x)\, g(x_0{}^+)(x - x_0)} \right\}$$

$$= \lim_{\substack{x \to x_0 \\ x > x_0}} \frac{\left\{ \frac{[(f)(x) - (f)(x_0{}^+)]}{(x - x_0)} \right\} (g)(x_0{}^+) - \left\{ \frac{[(g)(x) - (g)(x_0{}^+)]}{(x - x_0)} \right\} (f)(x_0{}^+)}{g(x)\, g(x_0{}^+)}$$

$$= \lim_{\substack{x \to x_0 \\ x > x_0}} \frac{\left\{ \frac{[(f)(x) - (f)(x_0{}^+)]}{(x - x_0)} \right\} g(x_0{}^+) - \left\{ \frac{[(g)(x) - (g)(x_0{}^+)]}{(x - x_0)} \right\} f(x_0{}^+)}{g(x)\, g(x_0{}^+)}$$

$$= \frac{\lim\limits_{\substack{x \to x_0 \\ x > x_0}} \left\{ \frac{[f(x) - f(x_0{}^+)]}{(x - x_0)} \right\} g(x_0{}^+) - \lim\limits_{\substack{x \to x_0 \\ x > x_0}} \left\{ \frac{[g(x) - g(x_0{}^+)]}{(x - x_0)} \right\} f(x_0{}^+)}{\lim\limits_{\substack{x \to x_0 \\ x > x_0}} g(x)\, g(x_0{}^+)}$$

$$= \frac{\left( (f)|_R(x_0) g(x_0{}^+) - (g)|_R(x_0) f(x_0{}^+) \right)}{\left( (g)(x_0{}^+) \right)^2}$$

Result 3) $(gof)|_R(x_0) = = (gof)|_R(x_0)(f)|_R(x_0)$

Proof :- Now we are going to find the right hand derivative of the composite function

$$(gof)|_R(x_0) = \lim_{\substack{x \to x_0 \\ x > x_0}} \left\{ \frac{(gof)(x) - (gof)(x_0{}^+)}{(x - x_0)} \right\}$$

$$= \lim_{\substack{x \to x_0 \\ x > x_0}} \left\{ \frac{g\{f(x)\} - g\{f(x)\}(x_0{}^+)}{(x - x_0)} \right\}$$

$$= \lim_{\substack{x \to x_0 \\ x > x_0}} \left\{ \frac{g\{f(x)\} - g\{f(x)\}(x_0{}^+)}{(f(x) - f(x_0{}^+))} \quad \frac{(f(x) - f(x_0{}^+))}{(x - x_0)} \right\}$$

$$= \lim_{\substack{x \to x_0 \\ x > x_0}} \left\{ \frac{g\{f(x)\} - g\{f(x)\}(x_0{}^+)}{(f(x) - f(x_0{}^+))} \right\} \lim_{x > x_0} x \to x_0 \left\{ \frac{(f(x) - f(x_0{}^+))}{(x - x_0)} \right\}$$

$$= (gof)|_R(x_0)(f)|_R(x_0)$$

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# "Fourier Transform representation of the generalized Hyper-geometric Functions "

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**Abstract:**

We present a Fourier transform representation of the generalized Hyper-geometric functions with the help of Gauss and Euler.

In this paper, we provide hyper –geometric proof of certain results and deduce a number of new and known results.

**Keywords and Phrases:** Basis Hyper geometric functions, q-series, continued fractions, Rumanian's theta functions, Fourier series and transform.

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# On the Underlying Mathematical and Quantum Structures of Quantum Cryptography

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**Abstract:**

*Quantum cryptography is a novel approach to provide secure communication, based on the laws of physics. It offers perfect security for the communication between two authorized parties, while assuming very high computational capacity for the eavesdropper, who may be attempting to intrude into this communication. It provides a very high rate of intrusion detection as against the classical systems. Classical cryptography is built on a fundamental assumption that it is difficult to invert some of mathematical functions, in a limited time, with the use of efficient computing resources. While, quantum cryptography is based on formidable laws of nature, making it less prone to attack.*

*With the advent of quantum computing, boundaries between various subjects like quantum physics, computer science and mathematics are getting reduced. In the early seventies, Steven Wiesner made pioneering efforts in the field Quantum Cryptography. In its present form, Quantum Cryptography depends on two essential principles of Quantum Mechanics. One is that no information is available without causing disturbance in the system and other is Principle of No-Cloning. In this paper we present some of fundamental aspects of Quantum Cryptography and the underlying structures that makes it a credible option for providing perfect security of information.*

**Keywords:** *Hilber Space Formalism, No-cloning Theorem, Quantum Entanglement, Quantum Cryptography, Quantum Key Distribution*

## 1 Introduction:

Security provided by *quantum cryptography* does not rely on vulnerabilities like, mathematical sophistication to invert certain mathematical functions, algorithmic swiftness used for decryption, or higher computational resources available at the hand of an adversary. Development in the field of quantum cryptography stems from the quest of having a perfectly secure cryptographic technique. Classical cryptosystems which mainly rely on complexities of mathematical operations and on the assumption of limited computational resources with the intruder, have shortcomings in detecting eavesdropping.

In section 1.1 and section 1.2 of this text we discuss in brief about classical and quantum cryptography. In section 2 we procced to understand the underlying mathematical and quantum mechanical structures which provide strong foundation for developing quantum cryptography. Section 3 focuses on what is quantum cryptography and the notion of quantum key distribution as a perfectly secure method to establish secret key among authorized parties in the communication. Throughout this text we address sender as $A$ (for Alice), receiver $B$ (for Bob) and eavesdropper $E$ (for Eve).

## 1.1 A Note on Classical Cryptography

A critical part in the process of secure communication is the exchange of key or a secret between authenticated parties involved in the communication. A key is a vital secret, compromise of which could be detrimental to the very basis of cryptosystems. Depending on the nature of secure exchange of keying material, classical cryptosystems are divided into following major categories.

Private Key Cryptosystems

Public Key Cryptosystems

One of the example of perfectly secure ciphers in classical cryptosystems is Vernam cipher or One-time pad. There are two important features of this cipher to be noted: First, that the message and the key have the same length and second, each key must be used only once [1]. This cipher has been proven most secure because it does not reveal any information about the plaintext. But it faces two potential problems, one is, if the size of the message grows, the size of the key increases accordingly and second is, since each message requires new key, a large amount of secret keys have to be distributed among the parties involved in the communication.

While execution of private key cryptosystems is very fast yet they suffer from a major drawback of secure key distribution. The problem of secure key distribution is solved by the public key cryptosystems [2]. Public key cryptography deploy mathematical process that is responsible for generating what is known as public key and private key pair, which are computationally related to each other. Private keys are safe in the custody of individual parties involved in communication, while public key is available at large. This cryptosystem is based on unproven mathematical assumption that it is difficult to derive private key from the public key in a limited time [3]. Certainly, this assumption is made on the efficiency of current computational resources. This possible security threat to the ciphers that are based on complexity of solving mathematical function, has led researchers to seek for novel approach to provide secure communication.

## 1.2 A Note on Quantum Cryptography

Quantum Cryptography uses microscopic objects such as individual photons as information car- ries [4]. Main advantages of Quantum Cryptography is in its successful demonstration of perfectly secure data transfer, modalities of which are based on universal laws of quantum mechanics. Quantum Cryptographic systems take advantage of Heisenberg's uncertainty principle, according to which measuring a quantum system in general disturbs it and yields insufficient information about its state before the measurement [5, 6]. This prompts that any attempt of eavesdropping would then cause unavoidable disturbance in the system, alerting about this attempt to the le- gitimate users [7]. What makes Quantum Cryptography superior is *No cloning Theorem*, which states that an unknown quantum state can not be cloned [8]. Thus, absolute security in quantum cryptography is provided based on two major forbidding in quantum physics, one claims that it is impossible to make measurement of quantum state without imposing disturbances and sec- ond claims that it is impossible to clone an unknown quantum state. Based on this, it is very clear that any eavesdropping in data transfer will cause irreversible changes in quantum state and eavesdropping could then be established.

There is another important quantum mechanical phenomenon of *quantum entanglement*, that has added to the design of cryptography based on Quantum Information theory. Entanglement is non-local quantum mechanical correlation in which two quantum systems, that have been inter- acting at some point, can be expressed with reference to each other, even though the individual systems may be spatially separated [9, 10].

These quantum phenomenons have led to the emergence of protocols for Quantum Commu- nication [11]. A survey [12] presents applications of principles in quantum

mechanics to the field of Cryptography. Bennett and Brassard first presented QKD protocol in 1984 which is known as BB84 [13, 14]. First experimental demonstration [15] of this protocol which sought attention of research community for possible wider exploration of this field. In 1992 Bennett [16] proposed

improvements in BB84 coding scheme by utilizing two out of four states in BB84. Six state proto- col [17, 18] added another alternative to existing QKD protocols. Ekert [19] presented innovative method of distributing quantum key through entangled states based on Einstein-Podolsky-Rozen paradox. Gisen et al [20] summarized information on various cryptographic protocols.

In the next section we discuss about mathematical and quantum mechanical structures on which quantum cryptography is based.

# 2 Preliminaries

The observations on quantum systems are stochastic in nature and that calls for the understanding of probabilistic systems. In case of probabilistic systems, it is difficult to have exact knowledge of state of the system and it is expressed as probability distribution of the states. We say that states of the system $x_1, \ldots, x_n$ have probabilities $p_1, \ldots, p_n$ such that,

$$p_1[x_1] + p_2[x_2] + \ldots + p_n[x_n] \tag{2.1}$$

where $p_i > 0$ and $p_1 + \ldots + p_n = 1$ is probability distribution, for the system is in state $x_i$ with probability $p_i$. The quantum systems are expressed in somewhat similar way.

Understanding of fundamental linear algebraic notions like linear operators, vector arithmetic notions, vector space, norm, basis, dimension of vector spaces, normalization, inner product space, eigenvalues, eigenvectors etc., is utmost essential and we refer to [21] for further details. In section 2.1 we cover some of the essential linear algebraic notions.

## 2.1 Mathematical Structures for Quantum Systems

Definition 1. *If $n$ is a positive integer, then a sequence of $n$ real (or complex) numbers $(a_1, a_2, \ldots, a_n)$, is called an ordered-$n$-tuple. The set of all ordered $n$-tuple is called $n$-space and it is denoted by $\mathbb{R}^n$ over real number and by $\mathbb{C}^n$ over complex numbers. For the current discussion we use notation $F^n$ to denote either $\mathbb{R}^n$ or $\mathbb{C}^n$.*

Vector spaces in which scalars are real numbers, are called real vector spaces, and those in which scalars are complex numbers, are called complex vector spaces.

The space of $n$-tuple complex numbers is very important in complex vector spaces. It is denoted as $\mathbb{C}^n$. A vector $u \in \mathbb{C}^n$, $(u = u_1, u_2, \ldots, u_n)$, given as,

$$u_1 = a_1 + b_1 i, u_2 = a_2 + b_2 i, \ldots, u_n = a_n + b_n i$$

The *inner product* of two vectors is equivalent to a row vector of first vector multiplied column vector of the second vector. If $u = (u_1, u_2, \ldots, u_n)$ and $v = (v_1, v_2, \ldots, v_n)$ are vectors in $F^n$ then their inner product is given as,

$$\langle u, v \rangle = u \cdot v = u^t v$$
$$= (u_1, u_2, \ldots, u_n) \begin{bmatrix} v_1 \\ v \\ \vdots \\ v_n \end{bmatrix} 2 |$$

$$= u_1v_1 + u_2v_2 + \ldots + u_nv_n$$
$$= \sum_{i=1}^{n} u_iv_i$$

Definition 2. *An inner product on a vector space $V$ is a function that associates a number $\langle u,v\rangle \in F$, with each pair of vectors $u$ and $v$ in $V$ in such a way that the following axioms hold for all vectors $u$, $v$ and $w$ in $V$ and all scalars $k$.*

1. $\langle v, v\rangle \geq 0$ *and* $\langle v, v\rangle = 0$ *if and only if* $v = 0$ *(positivity axiom)*
2. $\langle v, v\rangle = 0$ *if and only if* $v = 0$ *(definiteness axiom)*
3. $\langle u + v, w\rangle = \langle u, v\rangle + \langle v, w\rangle$ *(additivity axiom)*
4. $\langle ku, v\rangle = k\langle u, v\rangle$ *(homogeneity axiom)*
5. $\langle u, v\rangle = \overline{\langle v, u\rangle}$ *(conjugate symmetry axiom)*

The inner product space is a vector space $V$ along with inner product on $V$.

Definition 3. *If $u = (u_1, u_2, \ldots, u_n)$ and $v = (v_1, v_2, \ldots, v_n)$ are vectors in $C^n$, then their complex Euclidean inner product $u \cdot v$ is defined as,*

$$u \cdot v = \bar{u_1}v_1 + \bar{u_2}v_2 + \ldots + \bar{u_n}v_n$$

*where, $\bar{v_1}, \bar{v_2}, \ldots, \bar{v_n}$ are complex conjugates of $v_1, v_2, \ldots, v_n$.*

Definition 4. *If $V$ is a inner product space, then norm (or length) of a vector $v \in V$ is denoted by "$v$" and it is defined as,*

$$"v" = \langle v, v\rangle^{\frac{1}{2}}$$

Definition 5. *When $S = \{v_1, v_2, \ldots, v_n\}$ be a set of vectors in inner product space, then $S$ is called an orthogonal, if*

$$v_i \cdot v_j = 0 \ \forall\, i \neq j$$

*An orthogonal set in which each vector has norm 1 is called orthonormal.*

Time evolution of quantum states is given by the unitary transformations. We understand in brief about the unitary operators.

Definition 6. *Let $A$ be a matrix with complex entries and matrix $\bar{A}$ is obtained from $A$ by replacing each entry of $A$ by its complex conjugate. Then the matrix*

$$A^* = \bar{A}^t$$

*is called conjugate transpose of $A$. Here $\bar{A}^t$ is transpose of $\bar{A}$.*

Definition 7. *A square matrix $A$ with complex entries is called unitary if,*

$$A^{-1} = A^*$$

The observables (measurable quantities) in quantum systems are described by Hermitian op- erators, which are defined as below.

Definition 8. *A square matrix $A$ with complex entries is called Hermitian, if*

$$A = A^*$$

Mathematically equivalent formalisms for quantum systems were developed further by John von Neumann [22] into *Hilbert space formalism*. The theory of linear operators on Hilbert spaces, forms a very important part of quantum systems. The Hilbert space is thus a central mathematical structure for quantum systems, respresented as $H_n$, which in practice can be treated as an $n$-tuple complex space, $C^n$. The $H_n$ is called as a *state space*

of an $n$-level quantum system. The dimension $n$ of $H_n$ is the number of perfectly distinguishable states of the system.

The states of $n$-level quantum system are described as vectors in $n$-dimensional Hilbert space

$H_n$. A general state of $n$-level quantum system is described by a vector

$$\alpha_1|x_1\rangle + \ldots + \alpha_1|x_1\rangle \tag{2.2}$$

where $|x_1\rangle, \ldots, |x_n\rangle$ is a basis of $H_n$ and term $\alpha_i \in \mathbf{C}$ is called as the ***amplitude*** of $x_i$, such that $|\alpha_1|^2 + \ldots + |\alpha_n|^2 = 1$. The basis $|x_1\rangle, \ldots, |x_n\rangle$ refers to an ***observable*** having certain value. The

probability that the system is seen bearing property $x_i$ is $|\alpha_i|$ . The amplitude distribution as
expressed in equation (2.2) is interpreted as a unit-length vector of Hilbert space.

The fundamental unit of classical information is a *bit* (or *binary digit*) while fundamental unit of quantum information processing systems is called the *qubit* (or *quantum bit*). The classical bit has two states, namely 0 and 1, two basis states of qubits are denoted as $|0\rangle$ and $|1\rangle$. The special notation '$|\rangle$', is referred as *Dirac notation* (or *ket*) and it is a standard notation for states in quantum systems. The Hilbert space structure can be well expressed in terms of *Dirac notations*. The state of a physical system described by a state-vector $v$ is denoted as *ket*, $|x\rangle$, such that for a vector $x = (x_1, \ldots, x_n) \in \mathbb{C}^n$,

$$|x\rangle = \begin{pmatrix} x_1 \\ \vdots \\ x_n \end{pmatrix}$$

Its corresponding *conjugate transpose*, known as Hermitian adjoint is written as *bra*, $\langle x|$ and it is denoted as

$$\langle x| = (x_1^*, \ldots, x_n^*)$$

Linear algebraic notions are instrumental in developing basic framework for quantum systems. We further discuss on the quantum mechanical structures that aid in the development of quantum cryptography.

## 2.2 Fundamentals of Quantum Systems

The theory of *quantum information* deals with storage, transmission and processing of informa- tion based on laws of quantum systems. In the quantum information processing, information is processed in the quantum states of a physical system. In classical information theory there is an underlying assumption that the state of the system in which information is encoded can be perfectly distinguished, it can be copied and it can be measured with an arbitrary precision. Laws of classical physics upheld approximations of system behavior in the classical information theory. Quantum information theory investigates how quantum physical properties of physical systems can be extended to explore limits of efficient storage and transmission of information [23]. We gather information about notions that contribute in building quantum system.

*Quantum postulates* are set of hypothesis which along with mathematical framework, described in section 2.1 enables making theoretical predictions and verify the experimental results for quan- tum systems.

The first postulate is referred to as description of state space of the system.

Postulate 1 Every physical system is represented by a Hilbert space, known as state space of the system. States are represented by linear operators in that space. For every physical system there is associated Hilbert space and vectors in this space represent pure states of the system.

In general, any state of the system would be a vector in the Hilbert space and an arbitrary vector can be expressed in terms of the basis vectors as *superpositions* of basis vectors.

The second postulate describe about evolution of the quantum system with the time.

Postulate 2 The time evolution of the closed quantum system is described by the unitary trans- formations. That is the transition of the state from $|\psi\rangle$ in time instance $t_1$ to some other
state $|\psi'\rangle$ in time instance $t_2$, is given by unitary operator operating on the starting state.

$$|\psi'\rangle = U|\psi\rangle$$

,where $U$ is some unitary operator.

The consequences of unitarity is that the time evolution of the quantum system is *invertible*.

The third postulate deals with the measurement on the quantum systems.

Postulate 3 This states that every physically measurable quantity can be represented by a Her- mitian operator, where the values of the observable are eigenvalues of the operator corre- sponding to that observable.

Fourth postulate deals with the structure of the composite systems.

Postulate 4 If a composite system is composed of the subsystem Hilbert space, say $H_1$ and $H_2$, then the associated Hilbert space of the joint system is described by the *tensor product* of the subsystem spaces $H_1 \otimes H_2$.

We understand about tensor products in section 2.2.3. We now take a closer look at funda- mental unit of quantum information processing.

### 2.2.1 Quantum Bits

Based on the underlying mathematical structures we formally define qubits as below.

Definition 9. *Qubits are described as two-dimensional complex vector space* $\mathbb{C}^2$, *known as* Hilbert space, *denoted as* $H_2$. *The states* $|0\rangle$ *and* $|1\rangle$ *constitute the computational basis,* $B = \{|0\rangle$ *and* $|1\rangle\}$ *and they are orthonormal to each other. For example,* $|0\rangle = \begin{pmatrix}1\\0\end{pmatrix}$ *and* $|1\rangle = \begin{pmatrix}0\\1\end{pmatrix}$, *which is also known as coordinate representation of qubit.*

There are certain interesting comparative facts of properties of bits and the qubits. A classical bit has a definite value whereas qubit need not have a definite value until the moment it is read. A bit can only be 0 or 1, but qubit can be in a superposition of 0 and 1, simultaneously. A bit can be copied without affecting its value on the other hand for qubits an unknown state cannot be copied at all. Reading a qubit which is initially in a superposition may change the qubit, whereas a classical bit can be read without affecting its value. Reading one classical bit can not affect any other unread bit, but reading a qubit entangled with another qubit, does affect the other one.

The major difference to the classical bit is that qubit also allows states in between $|0\rangle$ and $|1\rangle$, which is known as *superpositions*. Superposition of the states $|0\rangle$ and $|1\rangle$ is expressed in the form

$$|\psi\rangle = \alpha|0\rangle + \beta|1\rangle \tag{2.3}$$

where $\alpha, \beta \in \mathbb{C}$. Qubit state is a unit vector, that is its length is normalized to 1, then the scalars
$\alpha$ and $\beta$ satisfy the following equation.

$$|\alpha|^2 + |\beta|^2 = 1 \tag{2.4}$$

### 2.2.2 Photon Polarization

In terms of physical realization of qubits, electronic spin or polarized photons are such examples depicting this. The basis states $|0\rangle$ and $|1\rangle$ of a single qubit are regarded as reliably distinguishable states of the qubit, generally referred as horizontal and vertical polarization of the photon or spin- up ($|\uparrow\rangle$) and spin-down ($|\downarrow\rangle$) of an electron along particular axis. This is sometimes referred as *rectilinear basis*. While in case of a polarized photon, superposition of the basis states correspond to other polarizations. Another commonly used basis is *diagonal basis* which is denoted as $\{|\nearrow\rangle, |\searrow\rangle\}$ for notational convenience. It is given as,

$$|\nearrow\rangle = \frac{1}{\sqrt{2}}(|0\rangle + |1\rangle) \quad \text{and} \quad |\searrow\rangle = \frac{1}{\sqrt{2}}(|0\rangle - |1\rangle)$$

Yet another interesting basis used especially in *quantum cryptography* is known as *circular basis*, denoted as {| ↺⟩, | ↻⟩}. It is given as,

$$| \circlearrowleft \rangle = \frac{1}{\sqrt{2}}(|0\rangle + i|1\rangle) \quad \text{and} \quad | \circlearrowright \rangle = \frac{1}{\sqrt{2}}(|0\rangle - i|1\rangle)$$

A unit three-dimensional sphere, known as Bloch sphere, depicted in figure 1 is a very useful representation of state of a single qubit. In figure 1, the north pole corresponds to the pure state
$|0\rangle$ and the south pole corresponds to orthogonal pure state $|1\rangle$. All other points on the surface of the Bloch sphere correspond to the superposition states of the form $\alpha|0\rangle + \beta|1\rangle$, for all possible
values of $\alpha$ and $\beta$ where $\alpha, \beta \in \mathbf{C}$, such that $|\alpha|^2 + |\beta|^2 = 1$.

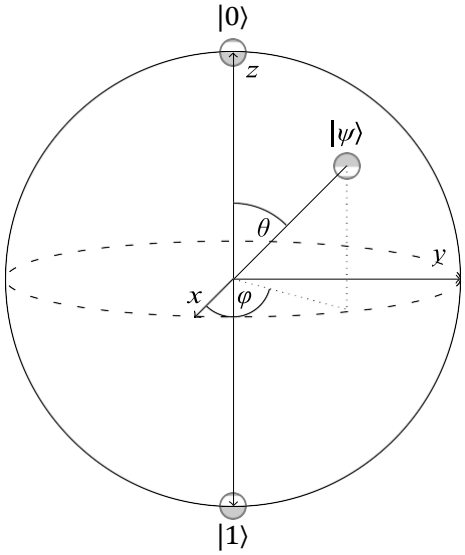


Figure 1: Bloch sphere representation of a qubit

In figure 1, the states $|0\rangle$ and $|1\rangle$ correspond to North and south pole of the Bloch sphere, respectively. Axis that passes through these points is the $z$-axis. By reading the value of a qubit is then measuring the alignment of its spin w.r.t. $z$-axis. The *spin-up* aligned particle is in $|0\rangle$ state and if particle is *spin-down* aligned then it is in $|1\rangle$ state. When a single qubit $\alpha|0\rangle + \beta|1\rangle$ is observed (read or measured), w.r.t. to some axis, its value depends on the values of $\alpha$ and $\beta$, commonly used axis being $z$-axis. Measurement of qubit w.r.t. the axis is called a measurement *in the computational basis*, since the resultant value obtained is $|0\rangle$ or $|1\rangle$. The outcome is not certain but depends upon values of $\alpha$ and $\beta$. Measuring the bit value of $\alpha|0\rangle + \beta|1\rangle$ in the computational
basis yields $|0\rangle$ with $|\alpha|^2$ probability and $|1\rangle$ with $|\beta|^2$ probability.

The standard polarization obtained, are listed as follows.

1. Left circular polarization, $|\circlearrowleft\rangle$
2. Right circular polarization, $|\circlearrowright\rangle$
3. Horizontal polarization, $|\leftrightarrow\rangle = \frac{i}{\sqrt{2}}|\circlearrowleft\rangle - |\circlearrowright\rangle$
4. Vertical polarization, $|\updownarrow\rangle = \frac{1}{\sqrt{2}}|\circlearrowleft\rangle + |\circlearrowright\rangle$
5. Diagonal ($45^\circ$) polarization, $|\nwarrow\rangle = \frac{1+i}{2}|\circlearrowleft\rangle + \frac{1-i}{2}|\circlearrowright\rangle$
6. Diagonal ($135^\circ$) polarization, $|\nearrow\rangle = \frac{1-i}{2}|\circlearrowleft\rangle + \frac{1+i}{2}|\circlearrowright\rangle$

Photons are polarized based on their oscillating electric field and that becomes a base for encoding bit values for photons. In this section we described that photons are either in rectilinear polarization or they are diagonally polarized, which in turn is derived from superposition of spin polarizations, $|\circlearrowleft\rangle$ and $|\circlearrowright\rangle$. The linear and diagonal polarizations are also sometimes denoted as ⊞ and ⊠. There are some conventions followed in encoding photons based on polarization. In ⊞ polarized light, either vertically polarized photons ($|\updownarrow\rangle$) correspond to 0 and horizontally polarized photons ($|\leftrightarrow\rangle$) correspond to 1 or in ⊠ polarized light, 45$^0$ ($|\nwarrow\rangle$) polarized photons correspond to 0 and 135$^\circ$ ($|\nearrow\rangle$) polarized photons correspond to 1.

### 2.2.3 Quantum Entanglement

The *Entanglement* is a very powerful phenomenon that distinguishes quantum information systems from that of classical information systems. Entanglement implies correlation between different parts of a quantum system. The system is in entangled state when the whole system cannot be expressed as a direct product of the states for its parts. For entangled state when action is performed on one subsystem, it may have effect on another sub-system even though other subsystem is not acted upon directly. It is also observed that this phenomenon persists even if the subsystem states are separated apart by some distance. It is essentially due to the phenomenon of entanglement, that the quantum algorithms exhibit exponential speedup over their classical counterparts.

Notion of *tensor product* (or *Kronecker product* or *direct product*) of qubit states is vital in understanding multiple qubits quantum states.

Definition 10 *Consider we have two quantum states as* $|\psi\rangle = \sum_{i=0}^{2^m-1} a_i|i\rangle$, *be an* $m$*-qubit pure state and* $|\phi\rangle = \sum_{j=0}^{2^n-1} b_j|j\rangle$, *be* $n$*-qubit pure state. The compound quantum state is formed by taking a tensor product (or* Kronecker product *or* direct product*),* $|\psi\rangle \otimes |\phi\rangle$, *as follows.*

$$|\psi\rangle \otimes |\phi\rangle = \sum_{i=0}^{2^m-1} a_i|i\rangle \otimes \sum_{j=0}^{2^n-1} b_j|j\rangle$$

Let there be two independent quantum systems with Hilbert spaces $H_m$ and $H_n$, of dimensions $m$ and $n$, respectively. The elements of $H_m$ can then be expressed as $|\psi_m\rangle = a_0|0\rangle_m, +a_1|1\rangle_m + \ldots + a_{m-1}|m-1\rangle_m$ and $H_n$ can be then expressed as $|\psi_n\rangle = b_0|0\rangle_n, +b_1|1\rangle_n + \ldots + b_{n-1}|n-1\rangle_n$. Where $a_0, a_1, \ldots, a_m$ and $b_0, b_1, \ldots, b_n$, are some complex numbers. Hilbert space for the composite system is then given as tensor product, $H = H_m \otimes H_n$. If a pure (mixed) state $|\psi_{mn}\rangle$, of a composite quantum system, defined on a Hilbert space $H_m \otimes H_n$ can be expressed as,

$$|\psi_{mn}\rangle = |\psi_m\rangle \otimes |\psi_n\rangle$$

then it is said to be a separable state. If a state $|\psi_{mn}\rangle$, of a composite quantum system, defined on a Hilbert space $H_m \otimes H_n$, is not a separable state then it is entangled state.

The 2-qubit entangled states, that are obtained from the computational basis are known as Bell State after the name of scientist Bell or EPR pair (or *EPR states*), after the name of researchers

Einstein, Podolsky and Rosen, due to their famous paper [24]. The state $\frac{1}{\sqrt{2}}(|00\rangle + |11\rangle)$, is an example of a entangled state.

### 2.2.4 No-cloning Theorem

Notion of No-cloning [8] highlights limitation of quantum systems and it states that it is not possible to make a copy of unknown quantum state. But this limitation works advantageous in certain situations, like detecting event of eavesdropping in quantum cryptography. No-cloning theorem is stated as below, for its detailed proof we refer to [25].

Theorem 1. *No-Cloning Theorem For an $n$-level quantum system having state space denoted by $H_n$, being an $n$-dimensional complex vector space, then the* no-cloning theorem *states that for $n > 1$, there is no quantum copy machine.*

## 3 Quantum Cryptography

Pioneering effort of Wiesner presented in his paper [26] where he proposed to implant quantum serial number along with a classical serial number, on banknotes, could not receive much attention, until his concepts of using quantum mechanics in making unforgeable banknotes, were applied by Bennett and Brassard in the construction of secure quantum communication. This construction was carried according to laws of nature, in some of then new concept in public key cryptography [27, 28]. Thus born a first paper in Quantum Cryptography [29], providing an impetus to explore the field of quantum cryptography.

The quantum states assume a key role of information carriers, in quantum cryptography. In its very essential form quantum cryptography does not refer to creation of quantum cryptosystem but it offers the most secure way of establishing random secret key. As we have seen earlier that the One-time Pad is a perfectly secure cryptosystem, if the key distribution problem is effectively addressed and quantum cryptography exactly offers to address this critical requirement. A method of *quantum key distribution* claims to provide safest way of exchanging the keys between the authorized parties involved in the communication. In particular, it is about sharing random classical bit strings using quantum states. The security of the quantum cryptography lies in the fact that nonorthogonal quantum states, in terms of photon polarization, in which the bit strings are prepared, are indistinguishable from each other and that any attempt to measure these states induces irreversible perturbations in the system.

There are following few requirements to enable well encrypted and secure communication in any form of cryptography. The legitimate users are authenticated, there is a secure transfer of keying material between authentic users and further, during communication any attempt of interference is discovered successfully. Quantum cryptography is to fulfill these basic requirements. Precisely keeping these criteria in view, Quantum Key Distribution (QKD) technique is developed which facilitates agreement of shared random sequence of bits (viewed as keying material) and leaves very low probability of twisting these bits, by enabling early detection of such intrusion and alerting legitimate users of it. Once the keys are established they can be used to augment the perfectly secure classical cryptosystem like, *One Time Pad*. A practical advantage of combining it with QKD, is that the communicating parties need not meet physically to refresh their keying material, which was one of the major shortfall of One Time Pad cryptosystem.

This quantum distribution scheme is based on transmission of single microscopic particle of photon and value of a classical bit encoded by the polarization of a photon [13, 16, 15].

## 3.1 Quantum Key Distribution

There are various ways of implementing QKD and it depends on the behavior of the quantum systems. Although these different ways do not differ too much and they achieve similar ultimate goal. On broader terms, in one of the approach the classical bits are encoded into the set of non-orthogonal quantum states. In the user perspective, the single quantum states are prepared by Alice and measured by Bob, to exchange the random bits. This way of implementation is there- fore referred as "prepare-and-measure" scheme. Another approach uses quantum phenomenon of entanglement. The entanglement ensures that the simultaneous measurement of states by Alice and Bob will lead to perfectly correlated secret bits. Any attempt of intrusion destroys perfect entanglement.

In "prepare-and-measure" approach of QKD, Alice generates a stream of perfectly random bits from which Alice and Bob distill out a matching private key. Once the stream of random bits are generated they are encoded into the quantum states in the stream of photons. Alice transmits vertically, horizontally and diagonally polarized photons to Bob. This encoding gurantees that any kind of attempt made to measure the encoding, without the knowledge of encoding used, will add up to the quantum bit error rate (QBER), thus revealing attempt of intrusion. If QBER is very low and the tests reveal there is no intrusion attempt succeeded, then communication channel is assumed to be secure while the key distribution and further, the random bits remaining after protocol has ended, used as cryptographic keys. But at any instance if the intrusion is detected then the key exchange is discarded and exchange for fresh key distribution is initiated.

Security measures employed by quantum cryptography is much stronger than one present in classical cryptography. The security of quantum cryptography lies in the indistinguishability of nonorthogonal quantum states and the irreversible disturbance arise due to the measurement of these states by Eve, in a complete absence of knowledge of the encoding states. This is an underline security measure kept in view while developing various QKD protocols. Some of the QKD techniques are listed below.

1. BB84 protocol developed by Bennett and Brassaed, based on two non-commuting observ- ables [13].
2. B92 protocol developed by Bennett based in two non-orthogonal states [16].
3. "Six-state" protocol (extending BB84 protocol) developed by Bruss [17, 18].
4. "Entanglement-based" protocol by Ekert [19].
5. "Orbital Angular Momentum" based protocol by Spefalieri [30].
6. Protocols based on coherent states [31, 32].

### 3.1.1 The BB84 QKD Protocol

The BB84 protocol uses four nonorthogonal quantum states belonging to two conjugate bases and two states in each basis are orthogonal [13]. These four states as we discussed are, $|\updownarrow\rangle$, $|\leftrightarrow\rangle$, $|\searrow\rangle$ and $|\nearrow\rangle$. This is much similar to the selection of bases made by Wiesner in preparing quantum serial numbers for unforgeable banknotes. These basis states are pairs of orthogonal quantum states, with rectilinear or diagonal polarization of photons. Thus the quantum states of one of the pairs are *non-orthogonal* to the ones of the other pair.

Alice and Bob are assumed to be connected via quantum channel, where presence of Eavesdrop- per is not denied. In addition to that they have classical channel where Alice and Bob establish mutual trust with the help of shared secret. In this communication channel access is denied to any unauthorized party (like Eve) who has not established mutual trust.

BB84 protocol works as follows.

1. *Preparation Phase*. Alice prepares truly random qubits encoded in one of four states and sends them to Bob via quantum channel. Alice and Bob agree on the encoding strategy that if Alice is sending 0 to Bob then she transmits either

| ↕⟩ or | ↗⟩ with equal probability and if she is sending 1 then she transmits either | ↔⟩ or | ↘⟩ with equal probability.

2. *Measurement Phase*. For each qubit that Bob receives from Alice, he chooses at random either rectilinear or diagonal bases and measures the qubit with respect to that basis. If Basis chosen by Bob matches to one prepared by Alice to encode the qubit, then Bob is able to determine correct polarization state of the photon. This assist him in ascertaining encoding strategy used by Alice and then further, it helps him determining if Alice has sent a 0 or 1. However, if their basis do not match then Bob would have only 50% chance of determining correct value of qubit sent by Alice. But at this stage Bob do not have idea which bit values measured are correct and which one not correct.

3. *Sifting Phase*. In order to determine the correct bit values, upon completion of measurement Bob communicates Alice the basis in which he measured photons sent to him by Alice. It's only the basis are communicated here and not actual values. This communication can take place on authenticated classical communication channel. Alice conveys Bob where basis of preparation of qubits matching to the basis of measurement used by Bob. They keep those bits where the basis selection coincide. Thus now they have matching sequence of randomly generated bits. These bits form what is called, *sifted bits*.

4. *Error Estimation Phase*. Until this point Alice and Bob do not have knowledge about possible intrusion by an Eavesdropper. To ascertain the presence of Eve, Alice and Bob chooses to sacrifice a subset of sifted keys. If Eve is listening to this, she would prepare basis to measure values of those bits. Just like Bob, Eve would only succeed with $\frac{1}{2}$ probability. But in doing so she would have disturbed the state of the photons, while re-transmitting those photons to Bob. In a consequence to this Bob would measure wrong polarization with $\frac{1}{2}$ probability. Thus for each bit in sifted key there is $\frac{1}{2} \times \frac{1}{2} = \frac{1}{4}$ probability that Eve

is detected. Thus with a small portion of sifted key bits, Alice and Bob would be able to
establish presence of Eve.

5. *Establishing Secret Key*. With the result of above steps, Alice and Bob form a joint secret key from the remaining bits by performing (classical) error correction and privacy amplification.

We list some of subprocesses involved in BB84 protocol that ensure successful distribution of shared secret key.

1. Sifting. It is a process whereby Alice and Bob winnow away all the obvious failed qubits from a series of pulses; as a result leaving only those symbols Bob received and those Bob has calculated using same basis as Alice's.
2. Error Estimation. This process allows Alice and Bob to determine all the error bits among their shared, sifted bits and correct them so that Alice and Bob share the same sequence of error corrected bit. This allows Alice and Bob to measure QBER of ongoing communication, which becomes vital input for the further step of privacy amplification.
3. Privacy Amplification. It is a process that reduces Eve's partial knowledge about Alice and Bob's key. This process uses Alice and Bob's key to produce a new, shorter key, in such a way that Eve has only negligible information about the new key.
4. Authentication. It allows Alice and Bob to guard against man-in-the-middle attacks, ensur- ing Alice that she is communicating with Bob (and not with Eve) and vice versa.

Figure 2 gives schematic representation of basic steps involved in QKD to share secret key. Reading it from bottom to top, these steps play a vital role in successful implementation of QKD [33, 34].

### 3.1.2 BB84 QKD when there is Eavesdropping

Attack that Eve carry on the communication between Alice and Bob is generally termed as *measure and resend*. We have discussed previously that due to No-cloning theorem it is not possible to copy any arbitrary quantum state and because of this reason Eve would not be able to make copy of the states being transmitted by Alice. Eve has to then measure the polarization orientation of the photons emancipating form Alice and retransmit them to Bob to cover her tracking. In order to disguise, Eve adopts same strategy as Bob do. She intercepts the photons underway from Alice and set her own measure of polarization. Eve has no idea about the basis in which Alice has prepared those photon, since Alice announces this information only after Bob has received all the photons. Eve can only guess about the polarizer orientation and make her measurement. If Eve is making measurement on say $2n$ number of photon then for half of them that is for $n$ cases she may succeed in her guesses and for other half result would be in random and not in sync with Alice's preparation. But to hide her attempt of eavesdropping, Eve has to resend those photons to Bob and she does not know the basis in which Alice has prepared them, so Eve send those photons in a basis that she has used to measure photons coming from Alice. In this case there are only $n$ of newly created qubits that are in sync with Alice's measurement. After Bob receives qubits, that are now sent by Eve, Bob makes his measurements on them. Alice and Bob carry out the *sifting phase* described in the execution of BB84 protocol above. At this phase only in $n/2$ cases

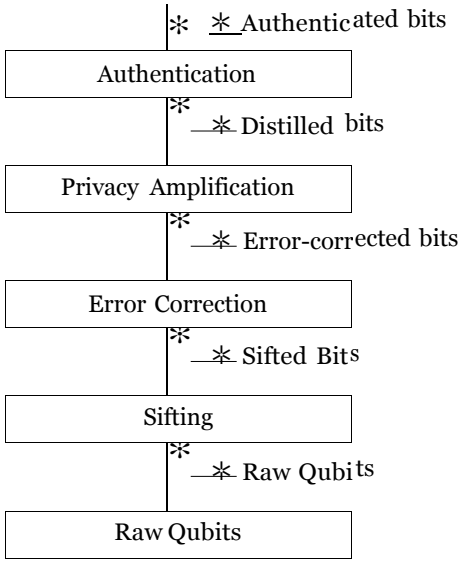


**Figure 2: Stages of QKD**

Bob's measurement would match to that of Alice's and Eve's basis of measurement would disagree there. Bob's measurement for sifted keys will be wrong for $n/4$ number of cases, that is there are chances of 25% error here. In the *error estimation phase* of the protocol if Alice and Bob identify such a high error rate they abort the protocol. The attempt of eavesdropping is established at this stage. This intrusion scenario reveals that more Eve tries to make an attempt to measure quantum states, more errors she would infuse, thus making her attempt of eavesdropping known to the authorized parties in the communication.

## 3.2 Various Protocols based on Quantum Systems

Advances in the study QKD prompted development of several protocols that are based on Quantum System. We take a look at some of them.

### 3.2.1 B92 Protocol

In 1992 Bennett [16] proposed this scheme based on observation that if two quantum states are incompatible, then two states are also sufficient and cannot be recognized unambiguously with- out adding irrevocable disturbance thus maintaining secrecy in quantum cryptography. Major difference with BB84 however is that B92 lets Bob learn bit he get, without further conversa- tion with Alice. Having only two quantum states, this scheme is easier to implement yet certain experimental set up seem be difficult to comprehend.

### 3.2.2 Six State Protocol

This protocol [18, 17] is based on a central theme of having third basis, letting qubits to have three mutually unbiased basis, which is apparently maximum basis per qubit, offered. Compared to BB84, QBER is 33% as against 25% in BB84, if Eve attempts to measure every photon [35].

### 3.2.3 SARG04 Protocol

This protocol uses same quantum states as in BB84 but with a different encoding information [36]. While this does not give any information to Eve, yet it gives Bob full information about a classical bit, if he measures bit in proper basis.

### 3.2.4 Protocol based on Quantum Entanglement

*The Ekert E*91 *Protocol* was proposed by Ekert in his paper [19]. This protocol uses a quantum phenomena of entanglement to produce secret key. The entangled quantum states are distributed between Alice and Bob. It build upon the fact that measurement of both qubits in any basis gives correlated results. In this entangled state every photon is associated with one more synchronized photon, that are created and measured together.

## 4 Conclusion:

With the underlying quantum structures, Quantum cryptography is perceived as a fitting solution towards the development of unconditionally secure cryptosystem. Quantum cryptographic tech- niques are fundamentally strong and they have very high rate of intrusion detection. Due to strong foundations of laws of quantum mechanics, attempts of eavesdropping is established and that the intruder gets no knowledge of the keying material. With inherent advantages, QKD can set its foothold in the field network security and it can well be combined with the internet technology, to provide secure communication for practical purposes.

Over the last decade there have been substantial advances in the field of quantum cryptography, yet there are some limitation for quantum cryptography becoming widely used key distribution techniques for personal, enterprise, academic and research purposes. These challenges include developing hardware resources to enhance rapid delivery of keying material and carry it to the longer distance.

The advances in computer processing and threat factor present for the classical cryptosystems that are widely used, will be a driving factor for more research and development in the field of quantum cryptography. Overcoming certain technological challenges, possibilities of improve- ments into quantum infrastructure and ability of these methods to combine well with the classical methods make quantum cryptography as a promising alternative to be an unconditionally secure cryptographic technique.

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# EXACT CONTROLLABILITY OF PARABOLIC INTEGRO-DIFFERENTIAL EQUATION WITH BILINEAR CONTROLS

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**Abstract:**
*In this chapter we will consider the exact control problem of parabolic integro-differential equation with bilinear control. A multiplicative control is a coefficient like $uy$. Exact controllability result is stated and proved for some particular target states.*

**Key words:** *Exact control, Integro-differential equation, Bilinear control.*

## 1. Introduction:

Differential equations are integral part of various fields of science and engineering. Many physical phenomena are modeled using either ordinary or partial differential equations. If we simplify some assumptions, then we arrive at integral or integro-differential equation. For example, consider the analysis of space time dependent nuclear reactor dynamics. If we consider the reactor model as an infinite rod and the effect of a linear temperature feedback is taken into consideration, then the neutron flux $z(x,t)$ and the temperature $u(x,t)$ in the reactor satisfy the following coupled equation:

$$\begin{aligned} z_t-(az_x)_x &= (bu-c_1-1)fz,\ \ (t>0,\text{-}\infty<x<\infty),\\ \tilde{\rho}c_2u_t &= c_3gz, \end{aligned} \tag{1.1}$$

where $a$ is diffusion coefficient and $c_3$ $f,g,b,\tilde{\rho},c_1,c_2$ and $c_3$ are physical quantities.

By integrating equation second equation in (1.1) over the interval $(0,t)$ and substituting it in first equation in (1.1), we obtain the following parabolic integro-differential equation:

$$z_t-(az_x)_x=\beta bz\int_0^t z(x,s)ds+cz \quad (t>0,-\infty<x<\infty), \tag{1.2}$$

where the constant $\beta$ and the coefficient $c$ are the quantities associated with the initial temperature and various physical parameters.

The simple control problem associated with nuclear dynamics is represented by nonlinear integri-differential equation as follows:

$$\begin{aligned} z_t-(az_x)_x+bz\int_0^t z(x,s)ds+cz&=u, \quad in\ Q,\\ z&=0, \quad on\ \sum,\\ z(x,0)&=z_0(x),\ \ in\ \Omega, \end{aligned} \tag{1.3}$$

where $\Omega=(0,1)\subset\mathbb{R}$, $z_0\in L^2(\Omega), T>0$ is a fixed time, $Q=\Omega\times(0,T)$ and $\sum=\{0\}\times(0,\ T)\cup\{1\}\times(0,\ T)$ is boundary. Here, the state $z$ and the control $u$ are unknowns to be determined for any arbitrary but fixed initial state $z_0$. This type of control amounts to controlling the chain reaction

by somehow adding into or withdrawing out of the chamber certain amount of neutrons at will, which is not realistic. So, we can think of controlling the reactor dynamics by multiplicative control, which enters the system as coefficient of state.

Thus, rather than control system (1.3), in this work we consider the following simple control system with multiplicative control.

$$\begin{aligned} z_t - z_{xx} + b\int_0^t z(x,s)ds &= cz, \quad in\ Q, \\ z &= g, \quad on\ \sum, \\ z(x,0) &= z_0(x), \quad in\ \Omega, \end{aligned} \tag{1.4}$$

where $c$ is a multiplicative control and $g \in C(\bar{\sum})$.

**Remark 1.** *The zero-state is a fixed point for the system (1.4), regardless of the choice of a control $c$, thus system (1.4) cannot be steered anywhere from $z_0 = 0$. Therefore, the duality approach does not apply to system (1.4) and hence **observability** does not make any sense in this case.*

**Remark 2.** *As zero-state is a fixed point for the system (1.4), it is not controllable from $z_0 = 0$ and hence its null controllability is out of question.*

**Remark 3.** *If we take g = 0 on $\sum$, then (1.4) becomes*

$$\begin{aligned} z_t - z_{xx} + b\int_0^t z(x,s)ds &= cz, \quad in\ Q, \\ z &= 0, \quad on\ \sum, \\ z(x,0) &= z_0(x), \quad in\ \Omega, \end{aligned} \tag{1.5}$$

*If $0 \geq z_0 \in L^2(\Omega)$, then by maximum principle, the solution $z$ of the equation (1.4) satisfies $z(x,t) \leq 0$ in $Q$ for any control $c$. Now, if $z_d > 0$, then there exists a constant $\alpha > 0$ such that $z_d \geq \alpha > 0 \in \bar{Q}$, hence system (1.4) cannot be steered from $z_0 \leq 0$ to $z_d > 0$.*

Approximate controllability of the linear parabolic system with memory kernels has been studied by Barbu and Iannelli [1]. Yong and Zhang [2] studied the controllability of parabolic equations with hyperbolic memory kernels. Sakthivel et al. [3] discussed the exact controllability of some nonlinear parabolic integro-differential equations with periodic boundary conditions. Sakthivel et al. [4] studied the local null controllability of nonlinear parabolic integro-differential equations. Null controllability of system (1.3) is studied by Sakthivel et al. [5]. Controllability of parabolic equations with nonlinear memory is studied by Tao and Gao [6]. Lavanya and Balachandran [7] discussed the null controllability of nonlinear heat equation with memory term. Exact controllability of parabolic systems with bilinear control has been studied by Lin et al. [8]. In this paper we are going to study the exact controllability of system (1.4). As far as we know, the stated problem is new for parabolic integro-differential equations.

**Definition 1.** *System (1.4) is said to be exact controllable in time $T_1 > 0$ if, for every initial data $z_0 \in L^2(\Omega)$ and desired profile $h \in L^2(\Omega)$, there exists a control $c \in L^\infty(Q)$ such that the solution $z$ of (1.4) corresponding to $c$ satisfies $z(x,T) = h(x)$ in $\Omega$, for all $T \geq T_1$.*

**Definition 2.** *System (1.4) is said to be null controllable in time $T > 0$, if for every initial data $z_0 \in L^2(\Omega)$, there exists a control $u \in L^\infty(Q)$ such that the solution z of (1.4) corresponding to $c$ satisfies $z(x,T) = 0$ in $\Omega$.*

We need the following results to prove our main result.

**Lemma 1[8].** *Let $\Omega$ be a bounded subset of $\mathbb{R}^n$ and $S(t)$ be the semigroup generated on $L^2(\Omega)$ by $\Delta$ with Dirichlet conditions. Then $S(t)(L^2(\Omega)) \subset L^\infty(\Omega)$ for all $t > 0$ and*

$$\|S(t)u\|_{L^\infty(\Omega)} \leq Ct^{-n/2}\|u\|_{L^2(\Omega)}, \quad \forall u \in L^2(\Omega),\ t > 0,$$

*where* $C$ *is independent of* $u$.

**Lemma 2[5].** *Let* $\Omega$ *be a bounded open set in* $\mathbb{R}$ . *Suppose* $b(x,t) \geq 0$, $b(0,.) = 0$ *and* $b(T,.) = 0$ *in* $\Omega$. *Then for any* $z_0 \in L^2(\Omega)$, *there exists a control* $u \in L^\infty(Q)$ *such that the corresponding solution* $z$ *of (1.6)*

$$\begin{aligned} z_t - z_{xx} + b\int_0^t z(x,s)ds + cz = u, \quad in\ Q, \\ z = 0, \quad on\ \Sigma, \\ z(x,0) = z_0(x), \quad in\ \Omega, \end{aligned} \tag{1.6}$$

*satisfies* $z(x,T) = 0$ *a.e.* $x \in \Omega$ *and*

$$\|u\|^2_{L^\infty(Q)} \leq C\|z_0\|^2_{L^2(\Omega)}.$$

## 2. Main Result

In the following theorem, we will assume that $\int_\Omega by\int_0^t ydsdx \geq 0.$

**Theorem 2.1.** *Let* $h$ *be a function defined on* $\bar{Q}$. *If* $h \in W^{2,\infty}(\Omega)$, $0 < h$ *in* $\bar{\Omega}$, *and* $0 \leq h_{xx}$ *a.e. in* $\Omega$, $g \in C(\bar{\Sigma})$, $g = h$ *on* $\Sigma$. *Suppose* $b(x,t) \geq 0$, $b(0,\cdot) = 0$ *and* $b(T,\cdot) = 0$ *in* $\Omega$. *Then there exists a* $T(h) > 0$ *such that for any non-zero initial state* $z_0 \in L^2(\Omega)$, *there exist multiplicative control* $c \in L^\infty(Q)$ *such that the corresponding solution* $z$ *to (1.4) in* $C([0,\ T];L^2(\Omega)) \cap L^2([0,\ T];H^1(\Omega))$ *satisfies*

$$z(x,T) = h(x)$$

*in* $\Omega$, *for all* $T \geq T(h)$.

***Proof***. Let $y = z - h$. Then $y_0 = y(x,0) = z(x,0) - h(x)$. From (1.4), we obtain

$$\begin{aligned} y_t - y_{xx} + b\int_0^t y(x,s)ds + bht = c(y+h) + h_{xx}, \quad in\ Q, \\ y = 0, \quad on\ \Sigma, \\ y(x,0) = y_0(x), \quad in\ \Omega. \end{aligned} \tag{1.7}$$

It is well know that for given $y_0 \in L^2(\Omega)$, $c \in L^\infty(Q)$, and $h$ the problem (1.7) admits a unique solution $y$ in the space $C^1([0,\ T];L^2(D)) \cap C([0,\ T];H_0^1(D))$.

To prove our Theorem, it is sufficient to prove that system (1.7) is exactly null controllable. We prove the exact null controllability of system (1.7) in following three steps.

**Step 1.** In this step, we prove that for given $T_1 > 0$, there exists a constant $C > 0$ such that the corresponding solution $y$ to (1.7) satisfies

$$\|y(.,T_1)\|^2_{L^2(\Omega)} \leq C.$$

Multiplying the system (1.7) by $y$ and integrating over $\Omega$, we obtain

$$\frac{d}{dt}\int_\Omega y^2dx + 2\int_\Omega |y_x|^2dx + 2\int_\Omega by\int_0^t ydsdx \leq \left(C_bT + \|c\|_{L^\infty(Q)}\right)\int_\Omega h^2dx + \int_\Omega h_{xx}^2dx + \int_\Omega \left(2c + C_bT + \|c\|_{L^\infty(Q)} + 1\right)y^2dx.$$

In this step we obtain the control $c = c_1 < 0$ on $(0,T_1)$.

Suppose $c$ is a negative constant. Then, we have

$$\frac{d}{dt}\int_\Omega y^2dx \le \int_\Omega \left(c+C_bT+1\right)y^2dx+\left(|c|+C_bT\right)\|h\|_{L^2(\Omega)}+\|h_{xx}\|_{L^2(\Omega)}.$$

By taking $r(t)=\int_\Omega y^2dx$, we obtain

$$\frac{dr(t)}{dt}\le \left(c+C_bT+1\right)r(t)+\left(C_bT+|c|\right)\|h\|_{L^2(\Omega)}+\|h_{xx}\|_{L^2(\Omega)}.$$

Let $k=C_bT+1$ and $d=C_bT+|c|$. Then

$$\frac{dr(t)}{dt}\le \left(c+k\right)r(t)+d\|h\|_{L^2(\Omega)}+\|h_{xx}\|_{L^2(\Omega)}.$$

As $r(0) = \|y_0\|_{L^2(\Omega)}$, by Gronwall's lemma

$$r(t)\le e^{(c+k)t}\|y_0\|_{L^2(\Omega)}+\int_0^t e^{(c+k)(t-\tau)}\left(d\|h\|_{L^2(\Omega)}+\|h_{xx}\|_{L^2(\Omega)}\right)d\tau.$$

So,

$$\|y(.,t)\|_{L^2(\Omega)}\le e^{(c+k)t}\|y_0\|_{L^2(\Omega)}+\frac{e^{(c+k)t}-1}{(c+k)}\left(d\|h\|_{L^2(\Omega)}+\|h_{xx}\|_{L^2(\Omega)}\right).$$

Hence, for given $T_1>0$, and $c=c_1<-k$ depending on $y_0$ and $|c|$ sufficiently large, there exists a constant $C>0$, such that the corresponding solution of (1.7) satisfies

$$\|y(.,T_1)\|^2_{L^2(\Omega)}\le C.$$

**Step 2**. In this step, we further prove that for any $\varepsilon_0>0$, we can find a control $c$ and $T_2(h)>0$ sufficiently large such that the corresponding solution to (1.7) satisfies

$$\|y(.,T_2)\|_{L^\infty(\Omega)}\le \varepsilon_0.$$

Select $c_2=-\frac{h_{xx}}{h}$ in $(T_1,\ T_2)$. Then, we have

$$\begin{aligned} &y_t-y_{xx}+b\int_0^t y(x,s)ds+bht=-\frac{h_{xx}}{h}y, \quad in\ \Omega\times(\mathrm{T}_1,\mathrm{T}_2),\\ &y=0, \quad on\ \partial\Omega\times(\mathrm{T}_1,\mathrm{T}_2), \qquad (1.8)\\ &y(x,T_1)=y_{T_1}(x), \quad in\ \Omega. \end{aligned}$$

Multiplying (1.8) by $y$ and integrating over $\Omega$, we have

$$\frac{1}{2}\frac{d}{dt}\int_\Omega y^2dx+\int_\Omega |y_x|^2dx+\int_\Omega by\int_0^t ydsdx+\int_\Omega bhytdx+\int_\Omega \frac{h_{xx}^2}{h}y^2dx=0.$$

Let $\lambda>0$ be an eigenvalue of an operator $-\Delta$ in $H_0^1(\Omega)$. Then we have

$$\frac{d}{dt}\int_\Omega y^2dx\le C_bT_2\int_\Omega h^2dx+\int_\Omega\left(C_bT_2-2\lambda\right)y^2dx.$$

Let $l=C_bT_2\int_\Omega h^2dx$. Using Gronwall's lemma we have

$$\|y(.,t)\|_{L^2(\Omega)} \le e^{(C_bT_2-2\lambda)(T_2-T_1)}\|y_0\|_{L^2(\Omega)} + \frac{e^{(C_bT_2-2\lambda)(T_2-T_1)}-1}{(C_bT_2-2\lambda)}l.$$

As $-\Delta$ has infinite eigenvalues $0<\lambda_1<\lambda_2<\cdots\lambda_n\to\infty$ we can select smallest $\lambda>0$ such that $C_bT_2>2\lambda$. Hence, for any $\varepsilon_0>0$, there exists a $T_2(h)>0$ sufficiently large such that

$$\|y(T_2)\|_{L^\infty(\Omega)} \le \|y(T_2)\|^2_{L^2(\Omega)} \le \varepsilon_0. \tag{1.9}$$

We obtain first inequality in (1.9) by using Lemma 1.

**Step 3**. In this step, we achieve the result by using a controllability result for additive distributive control. Consider the following system

$$\begin{aligned} y_t - y_{xx} + b\int_0^t y(x,s)ds + bht &= c(y+h)+h_{xx}, \quad in\ \Omega\times(\mathrm{T}_2,\mathrm{T}_2+1),\\ y &= 0, \quad on\ \partial\Omega\times(\mathrm{T}_2,\mathrm{T}_2+1),\\ y(x,T_2) &= y_{T_2}(x), \quad in\ \Omega. \end{aligned} \tag{1.10}$$

As $h\in W^{2,\infty}(\Omega)$, we have $h\in C(\bar{\Omega})$ by Sobolev embedding theorem. Also, $h>0$ in $\bar{\Omega}$, there exists a positive constant $\mu>0$ such that $h\ge\mu>0$ in $\Omega$, hence $0\le\frac{h_{xx}}{h}\in L^\infty(\Omega)$. Let $c=-\frac{h_{xx}}{h}+c_3$. Then (1.10) becomes,

$$\begin{aligned} y_t - y_{xx} + b\int_0^t y(x,s)ds + \frac{h_{xx}}{h}y &= c_3(y+h)-bht, \quad in\ \Omega\times(\mathrm{T}_2,\mathrm{T}_2+1),\\ y &= 0, \quad on\ \partial\Omega\times(\mathrm{T}_2,\mathrm{T}_2+1),\\ y(x,T_2) &= y_{T_2}(x), \quad in\ \Omega. \end{aligned} \tag{1.11}$$

In place of (1.11), consider the following system:

$$\begin{aligned} y_t - y_{xx} + b\int_0^t y(x,s)ds + \frac{h_{xx}}{h}y &= v, \quad in\ \Omega\times(\mathrm{T}_2,\mathrm{T}_2+1),\\ y &= 0, \quad on\ \partial\Omega\times(\mathrm{T}_2,\mathrm{T}_2+1),\\ y(x,T_2) &= y_{T_2}(x), \quad in\ \Omega. \end{aligned} \tag{1.12}$$

By Lemma 2, there exists a control $v\in L^2(\Omega\times(T_2,\ T_2+1))$ such that the corresponding solution to (1.12) satisfies

$$y(.,T_2+1)=0 \tag{1.13}$$

Moreover,

$$\|v\|^2_{L^\infty(\Omega\times(T_2,T_2+1))} \le C_2\|y(T_2)\|^2_{L^\infty(\Omega)}. \tag{1.14}$$

Also, solution of (1.12) satisfies

$$\|y\|_{L^\infty(\Omega\times(T_2,T_2+1))} \le \|y(T_2)\|_{L^\infty(\Omega)} + C_3\|v\|_{L^\infty(\Omega\times(T_2,T_2+1))}. \tag{1.15}$$

(1.14) and (1.15) together gives us

$$\|y\|_{L^\infty(\Omega\times(T_2,T_2+1))} \le (1+C_2C_3)\|y(T_2)\|_{L^\infty(\Omega)}. \tag{1.16}$$

We now select

$$\varepsilon_0 < \frac{1}{1+C_2C_3} < \frac{k}{1+C_2C_3}.$$

Here we may assume that $k>1$, and by (1.9), select $T_2$ sufficiently large such that

$$\|y(T_2)\|^2_{L^\infty(\Omega)} \le \varepsilon_0.$$

Hence, we have

$$\|y(.,t)\|^2_{L^\infty(\Omega\times(T_2,T_2+1))} \le k. \tag{1.17}$$

Thus, we can select the multiplicative control for (1.11)

$$c_3 = \frac{v+bht}{y+h} \ a.e.\ in\ \Omega\times(T_2,T_2+1) \tag{1.18}$$

where $y$ is the solution of (1.11). In view of $h \ge k > 0$, and (1.17), we have $c_3 \in L^\infty(\Omega\times(T_2,T_2+1))$. Hence, in time interval $(T_2,T_2+1)$, in view of (1.18), the solution of (1.11) with the control $c_3$, i.e., the solution of (1.10) with the control $c = -\frac{h_{xx}}{h} + c_3$ and the solution of (1.12) with the control $v$ become identical. Hence from (1.13), we have

$$y(.,T_2+1) = 0.$$

By steps 1, 2 and 3, we have for any $y_0 \in L^2(\Omega)$, we can select $T_2(h) > 0$ sufficiently large such that the corresponding solution $y$ to (1.7) with control

$$c = \begin{cases} c_1 & (0,T_1), \\ -\frac{h_{xx}}{h} & (T_1,T_2), \\ -\frac{h_{xx}}{h} + c_3 & (T_2,T_2+1), \end{cases}$$

satisfies $y(\cdot,T_2+1) = 0$, where $T(h) = T_2+1$ depends on $h$ only. This completes the proof of Theorem 1.

**Remark 4.** Main theorem is a direct corollary of Theorem 1 with $b = 0$.

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