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New Knowledge”*

- Neil Armstrong

# SARJAN

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## *The Journal*

**SARJAN** is a peer reviewed research journal yearly published by **Silver Oak Group of Institutes**. The present issue is the **sixth edition** of SARJAN. It publishes thoughtful contributions from researchers that offers insight and perspective, knowledge and understanding of multi-disciplinary research in areas of various disciplines of Engineering ; Computer Engineering, Information and technology, Electronics and Communications, Mechanical Engineering, Aeronautical Engineering, Civil Engineering, Chemical Engineering, Electrical Engineering and also Applied Sciences and Humanities. The mission of the journal is to foster research culture and increase research productivity of the faculty members in the institute by promoting and publishing their research skills. The institute believes that research in academics can only solve the problem of employability in the country and cater to the needs of the industry. SARJAN has consistently since 2012 provided a platform to researchers and academicians to contribute in this pool of knowledge that helps the aspiring researchers and students to update themselves with latest innovations and knowledge and thus enhance their technical skills.

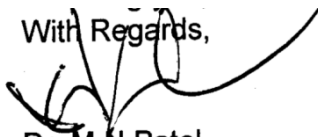
## ***FORWARD***



Dear friends,

I am happy to note that as a regular feature **Silver Oak Group of Institutes** is publishing it's yearly research journal **SARJAN**. Being a young institution and doing such motivating research activities, it's really excellent and indeed a proactive step as it is the need of a day and especially for an academic institute which is aspiring to be a university. We know that 21st century is the *era of knowledge application* and such initiatives will empower the faculty members to exhibit their research skills which will also benefit the student community in present competitive times.

With Regards,

A handwritten signature in black ink, appearing to be 'M N Patel', with a long, sweeping flourish extending to the right.

**Dr. M N Patel**

*Former Vice Chancellor of Gujarat University  
Ahmedabad.*

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# A NEW APPROACH FOR IMPROVING ACCURACY OF MULTI LABEL STREAM DATA USING CLASSIFICATION AND CLUSTERING

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**Abstract:** *Data Stream Mining is the process of extracting knowledge structures from continuous, rapid data records. The recent advances in hardware and software have enabled the capture of different measurements of data in a wide range of fields. These measurements are generated continuously and in a very high fluctuating data rates. It includes in sensor networks, web logs, and computer network traffic. The storage, querying and mining of such data sets are highly computationally challenging tasks.*

## 1.0 Introduction

In recent years, advances in hardware technology have facilitated the ability to collect data continuously. Simple transactions of everyday life such as using a credit card, phone or browsing the web lead to automated data storage. Similarly, advances in information technology have lead to large flows of data across IP networks. When the volume of the underlying data is very large, it leads to a number of computational and mining challenges:

### 1.1 Data Stream

Uninterrupted flow of a long sequence of data, such as in audio and video data files. Simple transactions of everyday life such as using a credit card, a phone or browsing the web lead to automated data storage. Similarly, advances in information technology have lead to large flows of data across IP networks are data streams.

### 1.2 Database Vs Data Stream

In Databases or other conventional programs, data is resident and input rate is under the control of the programmer. In newer applications data input as continuous, ordered data streams.

Examples: Network monitoring and traffic engineering, Telecom call records, financial applications, Sensor networks, Web logs and click streams. Data elements in the stream arrive online, system has no control over arrival order, either within a data stream or across many streams. Data streams are potentially bounded in size, once an element from a data stream has been processed; it is discarded unless otherwise archived.

## 1.3 Stages in Data Analysis.

The intelligent data analysis has passed through a number of stages. Each stage addresses new kind of research issues that have arisen.

### a) Statistical exploratory data analysis:

The goal was to explore the available data in order to test a specific hypothesis. With the advances in computing power, machine learning field has arisen.

### b) Machine Learning:

The objective was to find computationally efficient solutions to data analysis problems. Along with the progress in machine learning research, new data analysis problems have been addressed. Due to the increase in database sizes, new algorithms have been proposed to deal with the scalability issue. Moreover machine learning and statistical analysis techniques have been adopted and modified in order to address the problem of very large databases.

### c) Data Mining:

Data mining is use of automated data analysis techniques to uncover previously undetected relationships among data items. Data mining is that interdisciplinary of (or between more than one branch of learning) field of study that can extract models and patterns from large amounts of information stored in data repositories.

### d) Data Stream Mining:

In this model, data does not take the form of persistent relations, but rather arrives in multiple, continuous, rapid, time-varying data streams. Data Stream Mining is the process of extracting knowledge structures from continuous, rapid data records.

## 2.0 Data Mining

The dictionary meaning of mining is “excavation” or “abundant source (of information etc.)”. It’s about a decade or two years ago advances in hardware and software have enabled the capture of different measurements of data in a wide range of

fields. These measurements are generated continuously and in a very high fluctuating data rates. Examples include sensor networks, web logs, and computer network traffic.

### 2.1 What Is Data Mining?

Data mining (sometimes called data or knowledge discovery) is the process of analyzing data from different perspectives and summarizing it into useful information - information that can be used to increase revenue, cuts costs, or both. Technically, data mining is the process of finding correlations or patterns among dozens of fields in large relational databases.

### 2.2 Applications:

Data mining is primarily used today by companies with a strong consumer focus - retail, financial, communication, and marketing organizations. It enables these companies to determine relationships among "internal" factors such as price, product positioning, or staff skills, and "external" factors such as economic indicators, competition, and customer demographics. And, it enables them to determine the impact on sales, customer satisfaction, and corporate profits. Finally, it enables them to "drill down" into summary information to view detail transactional data. With data mining, a retailer could use point-of-sale records of customer purchases to send targeted promotions based on an individual's purchase history. By mining demographic data from comment or warranty cards, the retailer could develop products and promotions to appeal to specific customer segments. For example, Blockbuster Entertainment mines its video rental history database to recommend rentals to individual customers. American Express can suggest products to its cardholders based on analysis of their monthly expenditures.

## 1. THEORETICAL FOUNDATIONS OF STREAM MINING

Research problems and challenges that have been arisen in mining data streams have its solutions using well established statistical and computational approaches. We can categorize these solutions to data-based and task-based ones. In data-based solutions, the idea is to examine only a subset of the whole dataset or to transform the data vertically or horizontally to an approximate smaller size data representation. At the other hand, in task-based solutions, techniques from computational theory have been adopted to achieve time and space efficient solutions. Figure 3.1 shows the general processing of mining data streams.

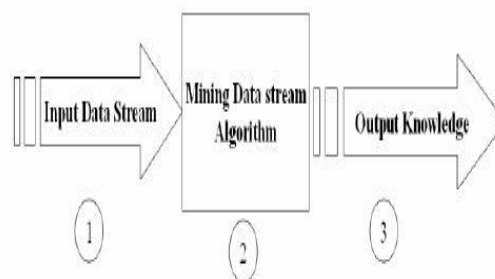


Figure 3.1: Mining Data Stream Process

### 1.1 DATA BASED TECHNIQUES

Data-based techniques refer to summarizing the whole dataset or choosing a subset of the incoming stream to be analyzed. Sampling, load shedding and sketching techniques represent the former one.

Synopsis data structures and aggregation represent the later one.

### 1.2 TASK-BASED TECHNIQUES:

Task-based techniques are those methods that modify existing techniques or invent new ones in order to address the computational challenges of data stream processing. Approximation algorithms and sliding window represent this category.

#### I. APPROXIMATION ALGORITHM:

These algorithms can result in an approximate solution with error bounds. The idea is that mining algorithms are considered hard computational problems given its features of continuity and speed and the generating environment that is featured by being resource constrained. Approximation algorithms have attracted researchers as a direct solution to data stream mining problems. However, the problem of data rates with regard with the available resources could not be solved using approximation algorithms.

#### II. SLIDING WINDOW:

Many of the synopsis structures discussed use the entire data stream in order to construct the corresponding synopsis structure. The inspiration behind sliding window is that the user is more concerned with the analysis of most recent data streams. The sliding-window model of computation is motivated by the assumption that it is more important to use recent data in data stream computation. Thus the detailed analysis is done over the most recent data items and summarized. versions of the old ones. Therefore, the processing

and analysis is only done on a fixed history of the data stream.

#### 4. MINING TECHNIQUES

Mining data streams has attracted the attention of data mining community for the last seven years. A number of algorithms have been proposed for extracting knowledge from streaming information. In this section, we review clustering and classification.

##### 4.1 CLUSTERING:

In Today's world, rapid growth of computer technology also increase the use of data in a distributed environment. To match up this speed of a clustering of data stream becomes a natural process. Clustering is a process of organization objects into groups whose members are similar in some way. In other words" Clustering is a useful and ubiquitous tool in data analysis, is the problem of finding a partition of a data set so that under some definition of similarity similar items are in the same part of the partition and different items are in different parts" The main aim of clustering on streaming data is to partitioning a list of data points into k groups of "similar" objects by scanning the data once.

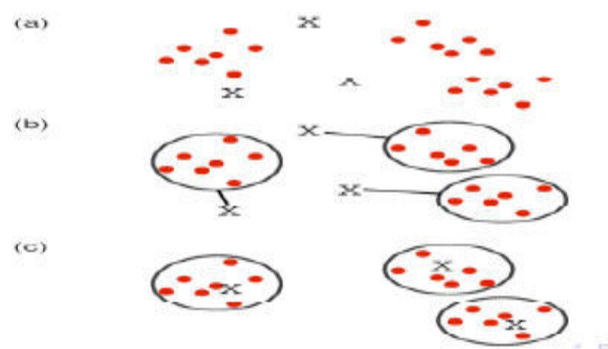
The main challenge in clustering is to determine an intrinsic group in a set of unlabelled data. But there is no perfect criterion which decides the final aim of clustering. It is the user that decides this criterion which supplies the result of clustering that suit their need. The problem of clustering uncertain data streams is especially challenging because the uncertainty in attribute values can significantly affect the clustering behavior of the data points. Our motivation here is to study different procedures or algorithms through which we can cluster data efficiently. Clustering of data stream is not possible every time because the data records generated are noisy or incomplete due to unreliable distributed system.

##### Clustering Algorithms

K-Means Clustering Described by Guha, Mishra, Motwani and O'Callaghan achieve a constant factor approximation for the k-Median problem in a single pass and using small space. It requires  $O(nk)$  time and  $O(n)$  space where "k" is the number of centers, "n" is the number of points and  $\epsilon < 1$ . They have proved that any k-median algorithm that achieves a constant factor approximation cannot achieve a better run time than  $O(nk)$ . The algorithm starts by clustering a calculated size sample according to the available memory into  $2k$ , and then at a second level, the algorithm clusters the above points for a number of samples into  $2k$  and this process is repeated to a number of levels, and finally it clusters the  $2k$  clusters into k clusters. K-

mean is the most frequent used exclusive clustering algorithm. The procedure of k-means follows a simple way. Idea is to determine K centers, one for each centers. The main challenge in this algorithm is to place these centers in a clever way.

1. Choose the number of k clusters
2. Randomly assign items to the k clusters
3. Calculate new centroid for each of the k clusters
4. Calculate the distance of all items to the k centroids
5. Assign items to closest centroid
6. Repeat until clusters assignments are stable



The K-median streaming algorithm

Firstly It solves k-median on  $X_i$  using LSEARCH ,Secondly  $X'$  centers obtained from chunks one through I iterations of the steam where each center c obtained by clustering  $X_i$  is weighted by the number of points in  $X_i$  assigned to c. Lastly output the k centers obtained by clustering  $X'$  using LSEARCH . Experiments shows that the STREAM produces a solution whose cost is almost constant times the cost would get by applying L search directly to stream.

##### 4.2.CLASSIFICATION:

The problem of classification is perhaps one of the most widely studied in the context of data stream mining. The problem of classification is made more difficult by the evolution of the underlying data stream. Therefore, effective algorithms need to be designed in order to take temporal locality into account. Data stream classification algorithms require appropriate and complete evaluation practices. The evaluation should allow users to be sure that particular problems can be handled, to quantify improvements to algorithms, and to determine which algorithms are most suitable for their problem. The goal of classification is to produce a model that can predict the class of unlabeled examples, by training on examples whose label, or class, is supplied. To clarify the problem setting being addressed, several assumptions are made about the typical learning scenario:

1. The data is assumed to have a small and fixed number of columns, or attributes/features—several hundred at the most.

2. The number of rows, or examples, is very large—millions of examples at the smaller scale. In fact, algorithms should have the potential to process an infinite amount of data, meaning that they will not exceed memory limits or otherwise fail no matter how many training examples are processed.

3. The data has a limited number of possible class labels, typically less than ten.

4. The amount of memory available to a learning algorithm depends on the application. The size of the training data will be considerably larger than the available memory.

5. There should be a small upper bound on the time allowed to train or classify an example. This permits algorithms to scale linearly with the number of examples, so users can process  $N$  times more than an existing amount simply by waiting  $N$  times longer than they already have.

- Stream concepts are assumed to be stationary or evolving. Concept drift occurs when the underlying concept defining the target being learned begins to shift over time. The first three points emphasize that the aim is to scale with the number of examples. Data sources that are large in other dimensions,

such as numbers of attributes or possible labels are not the intended problem domain. Points 4 and 5 outline what is needed from a solution. Regarding point 6, some researchers argue that addressing concept drift is one of the most crucial issues in processing data streams.

### The data stream classification cycle

Figure 4.2 illustrates the typical use of a data stream classification algorithm, and how the requirements fit in. The general model of data stream classification follows these three steps in a repeating cycle:

- The algorithm is passed the next available example from the stream (Requirement 1).
- The algorithm processes the example, updating its data structures. It does so without exceeding the memory bounds set on it (requirement 2), and as quickly as possible (requirement 3)

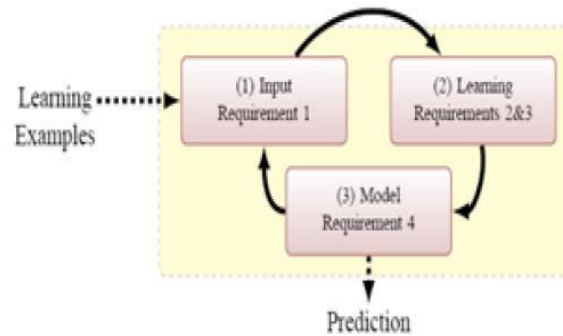


Figure 4.2: The data stream classification cycle.

3. The algorithm is ready to accept the next example. On request it is able to supply a model that can be used to predict the class of unseen examples (requirement 4).

### Classification—A Two-Step Process

- Model construction: describing a set of predetermined classes

Each tuple/sample is assumed to belong to a predefined class, as determined by the class label attribute. The set of tuples used for model construction: training set. The model is represented as classification rules, decision trees, or mathematical formulae

- Model usage: for classifying future or unknown objects

Estimate accuracy of the model. The known label of test sample is compared with the classified result from the model. Accuracy rate is the percentage of test set samples that are correctly classified by the model. Test set is independent of training set, otherwise over-fitting will occur. Common varieties of machine learning approaches to classification fall into several general classes. These classes of method are discussed below, along with their potential for adaptation to data streams:

**Decision trees:** A flow-chart-like tree structure, Internal node denotes a test on an attribute Branch represents an outcome of the test, Leaf nodes represent class labels or class distribution. Use of decision trees to classifying an unknown sample i.e. Test the attribute values of the sample against the decision tree.

**Rules:** Rules are somewhat similar to decision trees, as a decision tree can be decomposed into a set of rules, although the structure of a rule set can be more flexible than the hierarchy of a tree. Rules have an advantage that each rule is a disjoint component of the model that can be evaluated in isolation and removed from the model without major disruption, compared to the cost of restructuring decision trees. However, rules may be

less efficient to process than decision trees, which can guarantee a single decision path per example. Ferrer-Troyano et al. have developed methods for inducing rule sets directly from streams.

**Lazy/nearest neighbor:** This class of method is described as lazy because in the batch learning setting no work is done during training, but all of the effort in classifying examples is delayed until predictions are required. The typical nearest neighbor approach will look for examples in the training set that are most similar to the example being classified, as the class labels of these examples are expected to be a reasonable indicator of the unknown class. The challenge with adapting these methods to the data stream setting is that training cannot afford to be lazy, because it is not possible to store the entire training set. Instead the examples that are remembered must be managed so that they fit into limited memory. An intuitive solution to this problem involves finding a way to merge new examples with the closest ones already in memory, the main question being what merging process will perform best. Another issue is that searching for the nearest neighbors is costly. This cost may be reduced by using efficient data structures designed to reduce search times.

## 5. DATA STREAM SYSTEMS

Recently a new class of data-intensive applications has become widely recognized: applications in which the data is modeled best not as persistent relations but rather as transient *data streams*. Examples of such applications include financial applications, network monitoring, security, telecommunications data management, web applications, manufacturing, sensor networks, and others. In the data stream model, individual data items may be relational tuples, e.g., network measurements, call records, and so on. However, their continuous arrival in multiple, rapid, time-varying, possibly unpredictable and unbounded streams appears to yield some fundamentally new research problems.

### 5.1 DSMS (*Data Stream Management System*):

In the data stream model, some or all of the input data that are to be operated on are not available for random access from disk or memory, but rather arrive as one or more *continuous data streams*. Data streams differ from the conventional stored relation model in several ways:

The data elements in the stream arrive online. The system has no control over the order in which data elements arrive to be processed, either within a data stream or across data streams. Data streams are potentially unbounded in size. Once an element from a data stream has been processed it is

discarded or archived — it cannot be retrieved easily unless it is explicitly stored in memory, which typically is small relative to the size of the data streams. Operating in the data stream model does not preclude the presence of some data in conventional stored relations. Often, data stream queries may perform joins between data streams and stored relational data.

## 6. Future Student Project and Research Scope

Using these Clustering and Classification techniques we try to combine the Data Stream and then apply different Privacy Preserving Data Stream Mining Techniques to Preserve the Privacy of Data Stream.

Article  
On  
“Service improvement in Nodal Failover using Luci  
(Red Hat Cluster System)”

Compiled by: Prof Rahul Shrimali, Head,

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Improving the availability of any services is a key issue for survivability of a cluster system. Now a day, Many IT industries focus on how some useful servers and their useful services can be highly available by 24x7x365 to the clients? Solution is the use of High Availability or failover clusters which provides IT software-based high-availability clustering services used to improve the availability of many kinds of services like web services, file transfer services etc. The main objective of this experimental work is to demonstrate the failure of any server/node i.e. responsible for providing crucial service to number of clients with the help of implementing fail over cluster using Luci-Red Hat Cluster System (RHSC) on RHEL open source environment. The important part of this seminar is decision making while setting failover cluster environment using implementing, testing, deploying with the help of "Luci"- Red Hat Cluster System (RHCS) which is a fully integrated bundle of cluster software stack designed for building, maintaining a fail over cluster for High Performance Computing (HPC).

**I. Introduction**

**1.1. High Availability (HA) Cluster**

High-availability (HA) clusters for improvement of services High-availability clusters also known as Failover Clusters are implemented primarily for the purpose of improving the availability of services that the cluster provides. They operate by having redundant nodes, which are then used to provide service when system components fail. The most common size for an HA cluster is two nodes, which is the minimum requirement to provide redundancy. HA cluster implementations attempt to use redundancy of cluster components to eliminate single points of failure. Figure 1.1 itself demonstrates the use of heartbeat HA cluster in any university campus with help of Microsoft Server.

There are commercial implementations of High-Availability clusters for many operating systems. The Linux-HA project is one commonly used free software HA package for the Linux operating system.

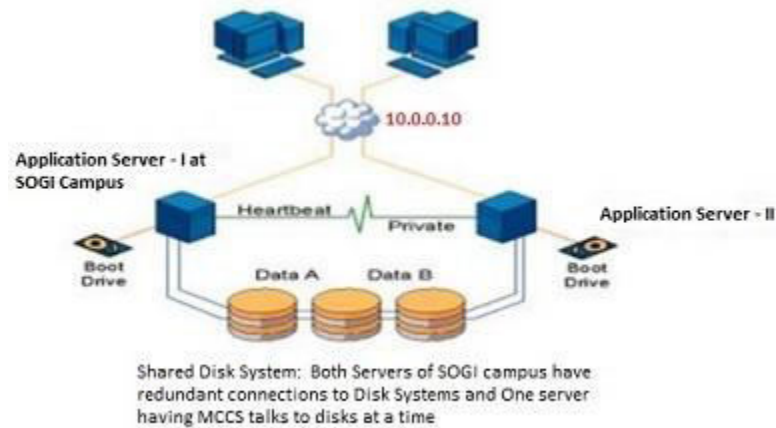


Figure 1.1: HA cluster for disk storage using Microsoft Cluster Control Server (MCCS) in SOGI campus

**1.2 Nodal Failure, Failover and Service Availability**

As shown in fig-1.2, nodal failure problem clearly state that in case of one server gets down other cluster member should take a control for providing data and or service because failure of one system never should terminate critical services. The main objective here is to provide set of critical services by means of 24x7x365 days.

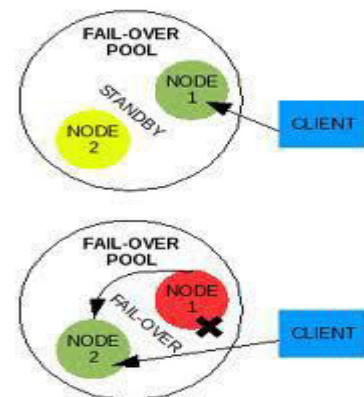


Figure: 1.2 Nodal failure and Stand alone client

(Reference: <http://dev.mysql.com>)

## II. Luci - Redhat Cluster Suite

Red Hat Cluster Suite (RHCS) is an integrated set of software components that can be deployed in a variety of configurations to suit your needs for performance, high-availability, load balancing, scalability, file sharing, and economy. RHCS consists of the following major components:

- a. Cluster Infrastructure (for File management, membership management, lock management, fencing)
- b. High Availability service management (for service monitoring/failover)
- c. RHGFS (Redhat Global File System for shared storage)
- d. Cluster administration tools (for Configuration and management tools for setting up, configuring, and managing a Red Hat cluster.)
- e. Linux virtual server (for IP load balancing component)

When we talk about the use of power fencing device under cluster infrastructure, it can be as shown in Figure 2.1: Also note that we have many other alternatives to administer the cluster like HA-OSCAR Architecture which I will discuss in other article.

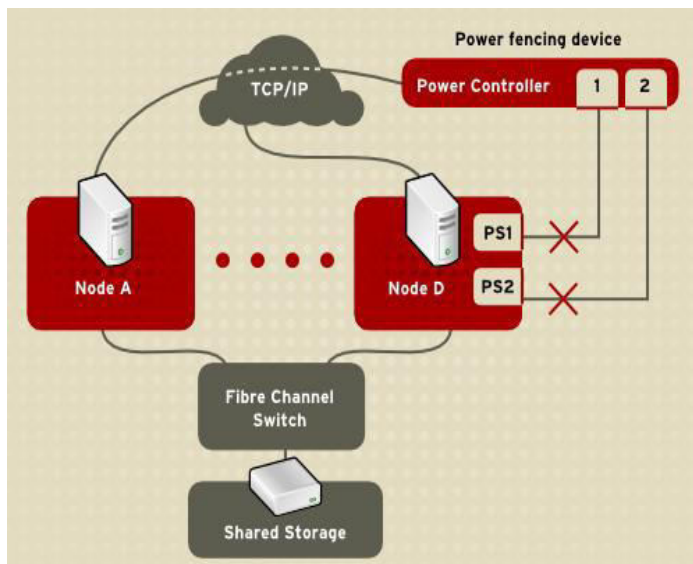


Figure 2.1: Operation of Power Fencing Device

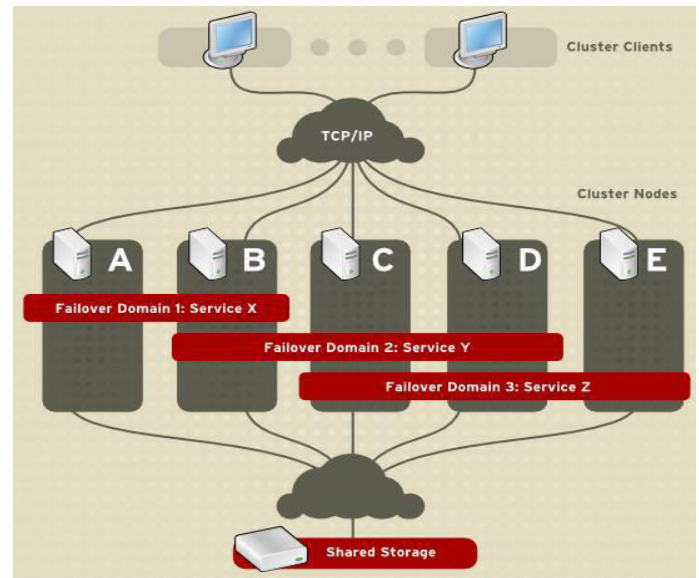


Figure 2.2: Luci Architecture

## II. Future Student Project and Research Scope

After creating and deploying failover domains using luci but obvious also taking the support of ricci service, I can recommend that to establish failover cluster for any crucial service, the number of cluster member should not be more than two. If we have dedicated more number of systems to be participated in failover domain, because of some of configuration you have to define priorities of each cluster member to wake up when server crashes. When primary server (Cluster Head) fails with the first priority, other cluster member with second priority will take control but whenever cluster head recovers, again control goes to Primary server (Cluster Head), means that, activity of failover will be carried out by only member with first and second priorities (Cluster Head and another cluster member) and other cluster members (if we dedicate more) would never be in contributing mode which results in to wastage of resource and power.

Now, let's see the overall architecture Luci - RHCS as indicated in figure 2.2

# A Survey on Facial Expression Recognition Techniques

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**Abstract**— In present era of technology , we need applications which could be easy to use and are user-friendly , that even people with specific disabilities use them easily. Facial Expression Recognition has vital role and challenges in communities of computer vision, pattern recognition which provide much more attention due to potential application in many areas such as human machine interaction, surveillance , robotics , non- verbal communication, entertainment, health-care and psychology study. Facial Expression Recognition has major importance ration in face recognition for significant image applications understanding and analysis. There are many algorithms have been implemented on different static (uniform background, identical poses, similar illuminations ) and dynamic (position variation, partial occlusion orientation, varying lighting )conditions. In general way face expression recognition consist of three main steps first is face detection then feature Extraction and at last classification. In this survey paper we discussed different types of facial expression recognition techniques and various methods which is used by them and their performance measures.

**Keywords**— Facial Expression recognition, Face detection, Feature Extraction, Facial Action Coding System classification,

## I. INTRODUCTION

Facial Expression Recognition(FER) is progressive area of research. It is interesting part of image processing. Emotion recognition can be done by different modalities such as speech, body gesture, facial expression. From all the modalities facial expression has given much attention because of its potential value for practical applications and its theoretical challenges. The challenges associated with face expression recognition is varying faces from one person to another person due to different ages, pose variations, occlusion, illumination conditions etc. Instead of this challenges facial expression has many applications. It plays vital role in non verbal communication. Nonverbal communication is communication between people by sending and receiving wordless clues, in other words the people with disabilities to understand other people emotions. Automatic facial expression recognition has applied in many fields such as ad-like prediction, student automatic e-learning, detection of unlawful activities, face expression synthesis, surveillance, lie detection, music for mood, mental state identification etc. It has been very active over past decades in communicational interests( behavior science, human computer interaction, health-care and security).Many researches covers the design and development of facial expzression surveillance system based on the application domain of security surveillance systems and facial expression recognition. Although there are

recent applications of facial expression recognition in human machine interaction(HCI)-where human machine interaction is ability to automate the capture of emotion personality traits and cognitive intention from facial expression could be a significant advancement.

We begin with overview of facial expression recognition(FER). Facial expression is one or more motion and positions of muscles beneath the skin of the face. According to Chin and Kim(at 2009)[1] "Facial expression is formed by relaxing and contracting different muscles of human face. In 1971 Ekman and Frisen discovers six different expressions such as happy, sad, disgust, fear, surprise, anger along with their neural face. These facial emotions are universally accepted as core emotions. This expressions are shown in figure 1:



Figure 1: Emotion specified Facial Expressions(1-Disgust, 2 Fear, 3-Happyness, 4-Surprise, 5-Sadness, 6-Anger)[44]

FACS is widely used in both psychology and computer science fields. This system described visually distinguished facial movement(face action activities)[2].In regards of FACS every facial expression can be represented or decompose into one action unit or combination of action units. In psychology research study any one can express his feeling and attitude by speaking of message contribute up to 7%, vocal part contribution up to 38% ,while facial expression contribute 55%[3].

## II. FACIAL EXPRESSION RECOGNITION

Facial expression recognition process organize in five basic phases which is shown in figure 1. In first phase take the images as input .Input may be static images or sequences of image(video frames) in expression recognition. The second phase performs various preprocessing techniques such as noise reduction ,image enhancement on the input image. Noise reduction is process of removing noise from image. Noise can be random or white noise with no coherence, or coherent noise introduced by the device's mechanism or processing algorithm. Normalization is one of the preprocessing technique to remove illumination problem. Normalization is the process that changes the range of pixel intensity values.

Next phase described face detection and various approaches of face detection .

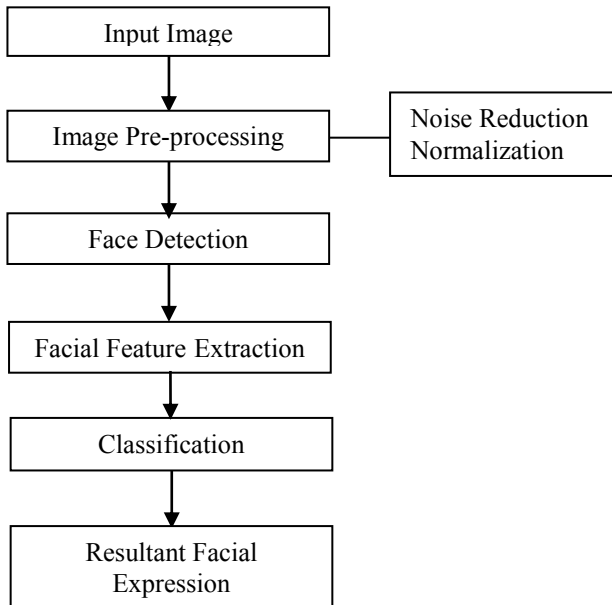


Figure:2 Facial expression Recognition Block Diagram

A. Face Detection

Face detection is essential phase of emotion recognition in light of facial expression. The objective of face detection is utilized to recognize and find any face present in the image , in straightforward words we say that it is process identifying the face from input image. Amid the face detection process different issues experience to be broke down, for example, recognizing geometry(front and non-front ) illumination (colour, shadow and self shadow) the imaging procedure, for example, resolution , occlusion, focus and their related effects.[4]. There are four diverse methodologies of face detection is given as[5]

TABLE I: ABSTRUCTION OF DIFFERENT FACE DETECTION APPROACHES [8]

Sr. No.	Face Detection Approaches	Methods
1	Knowledge based	Multi-resolution rule based method Grouping of edges
2	Feature invariant[6] -Facial feature -Texture -Skin Color -Multiple Feature	Space Gray-level Dependence Matrix of face pattern(SGLD) Mixture of Gaussian (GMM) Integration of skin color, size
3	Template matching[7]	

	Predefined face templates -Deformable Templates	Shape template Active Shape Model (ASM) Eigen Vector decomposition and clustering Gaussian distribution and multilayer Perceptron
4	Appearance based [8] -Eigen face -Distribution based	Ensemble of neural networks Arbitration scheme

B. Facial Feature Extraction:

Feature extraction transform the pixel image data into higher level representation of motion, appearance of inner structures. Feature extraction methods extract holistic features from the initial representation features of face. They map an input representation onto a lower dimensional space to discover a delegate structure from the representation. According to various research study feature extraction has many methods. In this survey paper we categorize feature extraction methods in three categories.

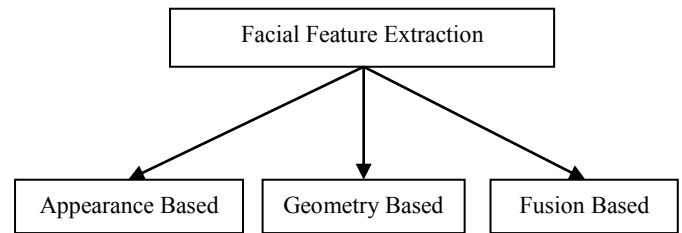


Figure 3: Categorization of Feature Extraction Methods

1. Appearance Based Facial Feature Extraction - Nowadays appearance based feature extraction methods are most commonly used. This methods describe the color and texture of a facial region. This method is depends on the pixel intensities in the texture calculations, and tries to build a model utilizing the learning database of faces[9].

1) Principle Component Analysis(PCA): PCA is widely used statistical technique for dimensionally reduction in facial extraction . PCA is also known as Eigen space projection because it is based on linearly projection the image space to a low dimension feature space that is known as eigen space. The PCA algorithm[10] work as follows for feature extraction: The image of rectangular matrix is converted into column vector which contains the mean value of the each row. Normalization vector is calculated by determining the difference between column vector of an image and the mean vector calculated from all column vectors.

$$\mu = (1/m) \sum_{n=1}^m X_n$$

$$c = (1/m) \sum_{n=1}^m (X_n - \mu)(X_n - \mu)^T \tag{1}$$

The mean and covariance matrix is calculated by using equation (1)[10].

- 2) *Local Discriminate Analysis (LDA)*: Linear discriminate analysis (LDA) is a generalization of Fisher's linear discriminate, a method used in statistics pattern recognition and machine learning to find a linear combination of features that characterizes or separates two or more classes of objects or events. The resulting combination may be used as a linear classifier, or, more commonly, for dimensionality reduction. LDA explicitly attempts to model the difference between the classes of data. The goal of LDA is to maximize the between-class scatter while minimizing the within-class scatter[11].
- 3) *Local Binary Pattern*: Local Binary Pattern (LBP)[12] [27] is a simple yet very efficient texture operator which labels the pixels of an image by thresholding the neighbourhood of each pixel and considers the result as a binary number. It can be seen as a unifying approach to the traditionally divergent statistical and structural models of texture analysis.
2. *Geometric Based Facial Feature Extraction*  
This approach extract the features by using relative positions and sizes of the important facial components such as eyes, nose, mouth and other important face components. It is also detect the track changes of facial components in near frontal face images. Tian et al researcher developed multi-state models to extract the geometric facial features[13].
- 1) *Point distribution Model*: The Point Distribution Model (PDM) is a shape description technique that is used in locating new instances of shapes in images. It is also referred to as Statistical Shape Model. It basically tries to "understand" the shape, as opposed to just building a rigid model. It is very useful for describing features that have well understood general shape, but which cannot be easily described by a rigid model[14].
- 2) *Gabor Filters*: Gabor Filter is named as linear filter used for texture analysis which means that it basically analysis whether there are any specific frequency content in the image in specific directions in a localized design and the point and region of analysis frequency and orientation represented of Gabor filter are similar to those of human visual system and they have been found to be particularly appropriate for texture representation discrimination. In the spatial domain, a 2-D filters a Gaussian kernel function modulated by sinusoidal plane wave[15]. A feature vector corresponding to each landmark point, as well as feature vectors from each pair of landmarks, are now created, and considered as a feature pool[16].
- 3) *Landmark Initialization and Tracking Using Elastic Bunch Graph*:-The elastic graph matching (EGM) method

was first proposed by Lade set al.[17], and applied to face recognition. It is extracted more than one feature on one landmark point, called it EBG, and applied it to face recognition This goal is achieved by first localizing the face region in the image using the Haar-like feature based face detection method proposed in[18]. The movements of facial landmarks, as a particular expression evolves, are not independent of each other.

### 3. *Fusion Based Facial Feature Extraction methods*

Feature level fusion has vital role in process of data fusion. Fusion of features is process of merging different features which describes different characteristics of images, to gain the superiority of all the features .According to the researchers it is capable of deriving and gaining the most effective and least-dimensional feature vector sets that benefit the final decision. According to this survey paper some of them discussed below .

- 1) *Fusing of LDA and PCA(PCA + LDA)*: This method propose dimensionality reduction by linear combining features. In effect, linear methods project the high dimensional data onto a lower dimensional space, we call it feature compression[19]. These two classical approaches are finding effective linear transformations. PCA(Principal Component Analysis) seeks a projection that best represents the original data in a least-squares sense, and LDA(Linear Discriminate Analysis) seeks a projection that best separates the data in a least-squares sense. PCA and LDA Discussed above section in detailed.  
Fusing of PCA and LDA propose that PCA maps the original t-dimensional feature  $x_i$  to the  $f$ -dimensional feature  $y_i$  as an intermediate space, and then LDA projects the PCA output to a new  $g$ -dimensional feature vectors  $z_i$ . More formally, it is given by [11]

$$z_i = W_{lda}^T W_{pca}^T x_i (i = 1, 2, 3, \dots, N)$$

Where  $W_{lda}$ ,  $W_{pca}$  is linear transformation matrix for  $X_i$  features.

When using PCA+LDA method, the dimensionality drastically reduced to 6 dimensions[21] and the recognition performance is improved several percent compared with PCA.

- 2) *Fusing LBP and LGC*: The fusing method proposed comparison of the neighbouring pixels with central pixel as well as with other neighbouring pixels at the same time in the binary form. The decimal values are calculated from the both and the maximum of the two is put as the new value. The matrix obtained from this process is divided into blocks and histogram of each block calculated separately and then concatenated. LBP is discussed above in detailed.

LGC (Local Gradient Code) [20] is another method which extracts the local information. This method compares the neighbouring pixels horizontally, vertically and diagonally instead of only with central pixel value.

### C. Facial Expression Classification

This is the last and resultant step of facial expression recognition which uses the features extracted from the previous step and tries to classify the features set based on the similarities between the feature data. According to past researches, there are a lot of approaches discovered for the facial expressions classification such as K-Nearest Neighbour(K-NN), Support vector Machine( SVM), Hidden Markov Model(HMM) etc.

1. *K-Nearest Neighbour(K-NN)*: K-Nearest Neighbour (K-NN)[33] is a simple algorithm that stores all available cases and classifies new classes based on a similarity measure (e.g. distance functions). K-NN has been used in statistical estimation and pattern recognition already in the beginning of 1970's as a non-parametric technique [21].
2. *Multilayer Perceptron(MLP)*: MLP is a feed forward artificial neural network that maps sets of input data onto a set of appropriate output. MLP follows supervised learning technique. This supervised learning method also called back propagation for training the network. MLP is an improvisation of the standard linear Perceptron and can distinguish data that are not linearly separable. Hayet Boughrara ·Mohamed Chtourou Chokri Ben Amar and Liming Chen [22] in their study of facial expression recognition based on a MLP neural network using constructive training algorithm works with MLP of three layer input layer, hidden layer, output layer. The learning algorithm used this study is the standard back-propagation [23]. MLP requires the network architecture definition before the training.
3. *Support Vector Machine(SVM)*: Data Classification is one of the major parts in machine learning. SVM is one of the most important classification techniques discovered in 1995[24]. The idea of Support Vector Machine (SVM) is creating a hyper plane in dimensional feature space and separate two classes of data with a maximum margin of hyper plane. The separating hyper plane maximizes the distance between two parallel hyper planes [25]. SVM has basically four types of kernel functions linear , polynomial, RBF, and sigmoid. Recently several studies have reported that support vector machine (SVM) delivers higher accuracy in terms of data classification compared with other classifier[26].
4. *Hidden Markov Model(HMM)*: Hidden Markov Model (HMM) is a statistical Markov model in which the system being modelled is assumed to be a Markov process with

unobserved (i.e. *hidden*) states. The hidden Markov model can be represented as the simplest dynamic Bayesian network. In simpler Markov models (like a Markov chain), the state is directly visible to the observer, and therefore the state transition probabilities are the only parameters, while in the hidden Markov model, the state is not directly visible, but the output, dependent on the state, is visible[27].

### III CONCLUSION

Facial expression brings related to human emotion and play an important role in human communication. It is observed that development of an automated system that accomplished facial expression recognition with state of art methods have good classification accuracy for limited types of datasets under uncontrolled conditions(like occlusion, posed, illuminations and expression variations ). while the advance approaches(higher level feature extraction) which involved machine learning statistical techniques improve the performance and accuracy of recognition system. This paper provides a survey based on timeline view which performs an analysis on different face detection, feature extraction and classification techniques to handle facial expression to recognize face.

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# Real Time Application Based Approach for Customizable Log Mining

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**Abstract :** Analyzing Web data has become a must-have for businesses. Significant research has been done in studying clickstream data to understand the navigation behavior of users after visiting a Web site. Analyzing clickstream data is not easy for most companies because Web logs are stored in a form that is not suited for analysis. Before any meaningful analysis can be done, much effort is spent in transforming server logs to the right form so that they can be analyzed. This is one of the reasons why companies often use third-party services (such as Webtrends, Adobe, or Google Analytics) to analyze their Web log data. This paper demonstrates applying programming to prepare a data set from raw Web logs and to generate summary reports.

**Index Terms**—Component, formatting, style, styling, insert.  
(key words)

## I. INTRODUCTION

Advancement in technology and growing use of the internet has opened up different study areas for statisticians. Every time users visit websites; clicks are saved that can be used for extracting useful patterns [2]. Clickstream data could be considered as a very rich source of information, because they contain behavioral information of the web site visitor. However it is difficult to analyze since it is available as unstructured data [3] and many different formats depending on the web server. Many companies have their specific ways of collecting and analyzing data; for example, e-commerce companies can measure the sales and demand of their products and identify behavioral patterns of consumers. Even non-profits such as universities are using their web data to market their courses [4]. At times' clickstream data may be very difficult and costly to manage for e-commerce companies who would be using data for their businesses. Dealing with these challenges has compelled companies to purchase web analytical tools [6]. These tools range from simple reporting applications to much advanced analytical software applications like Google Analytics. Web Analytics tool is among the popular sophisticated tools which help companies in analyzing and visualizing their web log data.

Most of the web analytics tools directly take web logs and give end users information in the form of charts, plots and reports. The end user lacks control over the raw data which if they had in an useful format (such as data set) can be used for various other types of analysis which are not available in the tool. For example, one can get excellent insights by using Google Analytics for your website. However, businesses

cannot perform advanced analytical methods like sequence analysis or social network analysis because they do not have the data in the right form. Nowadays companies have started integrating customer-level behavior data from a website into their analytics environment. In such cases it is important that companies have control over their web log data and make it available in the right form for other enterprise applications to use it. The discussed in this paper provides a user with a dataset of weblogs processed in a form that can be used easily for any type of statistical analysis or modeling.

## II. DATA COMPONENTS

### 2.1 SERVER WEBLOGS

Weblog can be defined as an electronic record of internet usage collected by web servers. Each web server has a separate configuration and settings which sometimes distinguishes weblog information from one server to another. The W3C maintains a standard format for web server log files, but other proprietary formats exist. Each record in the log usually contains IP address, html page name, date and time, referrer and additional information based on how it is setup. But these are the main elements that one will find in any setting. These logs can be stored as single file or can be separated as access logs, error logs, distinct logs etc. Site administrators usually have complete control over these files. We used a weblog collection with 6,633 entries collected over a week's time from a website. The name of the website is masked for confidentiality reasons.

The information contained in the web log for each user includes following items.

**Visitor Identification Number:** This is a unique identification number for each user visit. In the case of this client company, the server was configured to create two separate variables that capture the unique identification number.

**Date and time:** Timestamp of the page visit.

**IP Address:** Every machine has a unique address. This field captures the IP address of the machine from where the page request is originating.

**Page URL:** URL of the current page the user is viewing.

**Referral Page Information:** Referral page captures the URL of the source page from where the request has originated

**Browser and device information:** Browser and device column provides information on type of browser and device used for accessing the web pages. Earlier we have just seen these requests coming from desktops or laptops. Now we find

various mobile devices like smart phones and tablets that are used for accessing web pages.

Sample weblog

```
41521390 2011-01-01 00:25:42 2.111.94.18 Mozilla/5.0 (Macintosh; U; Intel Mac OS X 10_6_5; en-us) AppleWebKit/533.19.4 (KHTML, like Gecko) Version/5.0.3 Safari/533.19.4 "http://www.cokstate.edu/welcome/"
"https://www.google.com/#sclient=psy-ab&hl=en&source=hp&q=oklahoma+state&pbx=1&oq"
```

Figure 1 Sample web log

Figure 1 shows a sample web log record. A Data Step program can be used to prepare a Data set from this raw weblog. Table 1 shows the values in the Data set after identifying variables for the elements in the web log.

Variables	Information
Visitor Identification Number	41521390
Date and time of visit	2011-01-02 00:55:13
IP Address of the system	2.111.94.18
Page URL	"http://www.cokstate.edu/welcome/"
Referral Page Information	https://www.google.com/#sclient=psy-ab&hl=en&source=hp&q=oklahoma+state&pbx=1&oq"
Browser and device information	Mozilla/5.0 (iPad; U; CPU OS 4_2_1 like Mac OS X; en-us) AppleWebKit/533.17.9 (KHTML, like Gecko) Version/5.0.2 Mobile/8C148 Safari/8533.18.5

Table 2 Categorization of weblog information

III. RELATED WORK

3.1 Implementation Tool

This tool is implemented in ASP.NET 2010. it is one of the popular Platform used for developing web-based application. This study focuses on this language in order to develop the application that can manipulate the server logs. The tool for preprocessing is shown in Fig.4. Using this tool we can upload three different log file format like W3C,IIS and NCSA log file.

After uploading all three log file format user can select any important columns or attributes from gridview as per the user requirements.

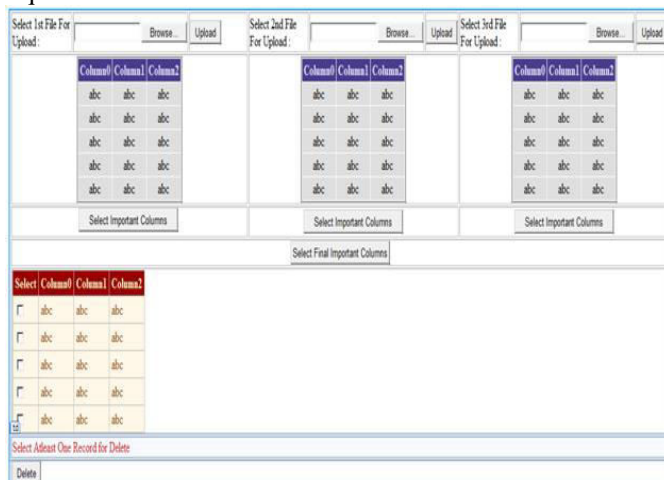


Figure 5 : Implementation tool

Figure 5 shows the implementation tool created in ASP.NET 2010.Using this tool user can upload their log files and this tool displays that log file in gridview and user grab important or useful attributes from that gridview. And at the end we got combined log file .After that user can remove unnecessary data from combined file.

3.2 Used Algorithms

1) This algorithm read the data from different web log file from web server log

**Input:** Log File

**Output:** Data Source(CSVTable)

1. Create an instance of *StreamReader sr* to read from a file.
2. Give the file path in the *StreamReader* constructor.
3. Declare *String Line* variable to read the data line by line.
4. If *String Line* found “,” then replace with “ ” (Space) and data row split with “ ”(space).
5. Take *While loop* to Read and display lines from the file until the end of the file is reached.
6. Records available in *L*.
7. Add records in *Data Source*.
8. Close the instance *Sr* of *StreamReader* class.

Client_IP	UserName	Date_Time	Request	Status_code	Bytes	Referrer
10.5.0.3	Jack	13/Feb/2012:14:50:12	GET/syllabus.aspx	200	8365	http://www.gtu.edu.in
10.5.0.3	Fredy	13/Feb/2012:14:25:42	GET/Circular.aspx	200	6289	http://www.gtu.edu.in
10.5.0.12	Luis	13/Feb/2012:14:41:16	GET/Papers/SRSEExample-webapp.doc	200	5843	http://www.cse.msu.edu
10.6.0.20	Jackson	13/Feb/2012:13:05:03	GET/Drupal-Intro.ppt	200	9357	http://www.silverfoxinteractive.com
10.6.0.22	Smith	13/Feb/2012:14:25:42	GET/copperhill/image/tnlp.jpg	200	4685	http://www.pbase.com
10.6.0.27	Cooper	13/Feb/2012:11:51:04	GET/admission.aspx	200	8014	http://www.ignou.ac.in
10.8.0.13	Marshal	13/Feb/2012:15:06:42	GET/cert05/dotnetfx/dotnetfx.exe	200	9687	http://www.installengine.com
10.8.0.15	Ryder	13/Feb/2012:10:26:53	GET/PMS/PMS.doc	200	1029	http://www.rakshainfotech.com
10.8.0.16	Styen	13/Feb/2012:12:26:53	GET/facebook/images/flower.gif	404	1256	http://www.facebook.com

Figure 6 : NCSA log file in Gridview

Figure 6 shows one example of NCSA log file which can be read using algo 1 and it displays log file in gridview

2) This algorithm used to add Checkbox in the header of Gridview For Mining Data and Integration of Multiple Data Source.

**Input:** Gridview's Data source(dtAll)

**Output:** New Data Source(dtFinal)

**Steps:**

1. Add *Checkbox* control to Gridview Headers Cell.
2. Bind *Data Source* to Gridview Control.
3. Take *for loop* to check *checkbox* in Gridview Header Cell.
4. Using *If* condition to check whether the checkbox is checked or not.
5. *If true* then take *for loop* to calculate the *Rows* for selected Columns.
6. Add *Selected Column's* and *Rows* in to Data Source.
7. *Copy* one Data Source data to another Data Source
8. *Merge* multiple Data Sources.
9. *Bind* Data Source to Gridview Control.

Output Ex 1: NCSA Customizable Log File

Client_IP	UserName	Date_Time	Request	Status_Code	Bytes	Referrer
10.5.0.3	Jack	13/Feb/2012:14:50:12	GET/syllabus.aspx	200	8365	http://www.gtu.edu.in
10.5.0.3	Fredy	13/Feb/2012:14:25:42	GET/Circular.aspx	200	6289	http://www.gtu.edu.in
10.5.0.12	Luis	13/Feb/2012:14:41:16	GET/Papers/SRSEExample-webapp.doc	200	5843	http://www.cse.msu.edu
10.6.0.20	Jackson	13/Feb/2012:13:05:03	GET/Drupal-Intro.ppt	200	9357	http://www.silverfoxinteractive.com
10.6.0.22	Smith	13/Feb/2012:14:25:42	GET/copperhill/image/hiup.jpg	200	4685	http://www.pbase.com
10.6.0.27	Cooper	13/Feb/2012:11:51:04	GET/admission.aspx	200	8014	http://www.ignou.ac.in
10.8.0.13	Marshal	13/Feb/2012:15:06:42	GET/cert05/dotnetfx/dotnetfx.exe	200	9687	http://www.installengine.com
10.8.0.15	Ryder	13/Feb/2012:10:26:53	GET/PMS/PMS.doc	200	1029	http://www.rakshainfotech.com
10.8.0.16	Styen	13/Feb/2012:12:26:53	GET/facebook/images/flower.gif	404	1256	http://www.facebook.com

**Figure 7 : NCSA Customizable log file**

Figure 7 shows customizable NCSA log file after uploading file into the tool

Output Ex 2: Combined Customizable Log File

Select	Date	Client_IP	Server_IP	Port	Method	URI_Stein	Status_Code	Server_Name	Request	UserNA
<input type="checkbox"/>	2012-02-13	10.8.0.15	202.71.129.26	80	GET	/Papers/SRSEExample-webapp.doc	200	NA	NA	NA
<input type="checkbox"/>	2012-02-13	10.8.0.13	202.71.129.26	80	GET	/syllabus.aspx	200	NA	NA	NA
<input type="checkbox"/>	2012-02-13	10.5.0.3	172.30.255.255	80	GET	/images/picture.jpg	200	NA	NA	NA
<input type="checkbox"/>	2012-02-13	10.5.0.3	209.85.135.109	80	GET	/gmail.com	200	NA	NA	NA
<input type="checkbox"/>	2012-02-13	10.5.0.12	59.162.23.130	80	GET	/academic/rsrchiprgn.html	200	NA	NA	NA
<input type="checkbox"/>	2012-02-13	10.6.0.20	67.218.96.251	80	GET	/downloads/index.htm	200	NA	NA	NA
<input type="checkbox"/>	2012-02-13	10.6.0.22	67.218.96.251	80	GET	/products/W52XXX-series.aspx	200	NA	NA	NA
<input type="checkbox"/>	2012-02-13	10.6.0.27	67.218.96.251	80	GET	/it/experienced/index.htm	200	NA	NA	NA
<input type="checkbox"/>	2012-02-13	10.6.0.15	202.190.126.85	80	GET	facebook/images/flower.gif	404	NA	NA	NA
<input type="checkbox"/>	02/13/2012	10.5.0.3	202.71.129.26	NA	GET	NA	200	GIT	/syllabus.aspx	NA
<input type="checkbox"/>	02/13/2012	10.5.0.3	202.71.129.26	NA	GET	NA	200	ALPHA	/Circular.aspx	NA
<input type="checkbox"/>	02/13/2012	10.5.0.12	172.30.255.255	NA	GET	NA	200	KIT	/Papers/SRSEExample-webapp.doc	NA
<input type="checkbox"/>	02/13/2012	10.6.0.20	209.85.135.109	NA	GET	NA	200	AIT	/Drupal-Intro.ppt	NA
<input type="checkbox"/>	02/13/2012	10.6.0.22	59.162.23.130	NA	GET	NA	200	UNIVERSAL	/copperhill/image/hiup.jpg	NA
<input type="checkbox"/>	02/13/2012	10.6.0.27	67.218.96.251	NA	GET	NA	200	NIRMA	/admission.aspx	NA
<input type="checkbox"/>	02/13/2012	10.8.0.13	67.218.96.251	NA	GET	NA	200	JNU	/cert05/dotnetfx/dotnetfx.exe	NA
<input type="checkbox"/>	02/13/2012	10.8.0.15	67.218.96.251	NA	GET	NA	200	GTU	/PMS/PMS.doc	NA
<input type="checkbox"/>	02/13/2012	10.8.0.14	202.190.126.85	NA	GET	NA	404	FB	facebook/images/flower.gif	NA

**Figure 8: Combined customizable log file**

In the above Fig 8 shows all three combined log file. In such columns shows NA ,which describes that the columns are not relevant or not belongs with such log file format.

3) This algorithm used to removing irrelevant or unnecessary records

**Input:** Data Source(dtFinal)

**Output:** Final Data Source(dtFinalXml)

**Steps:**

1. Read record in data source.
2. For each record in data source.
3. Read fields URL Field//In web server Log the requested object is the URL field
4. If requested URL field Contains/end with Substring = {\*.gif,\*.jpg,\*.css,\*?} then
5. Remove records
6. Else if Response code is
7. >299 or <200 then
8. Remove records
9. Else if Request method
10. not in {GET, POST}
11. Remove records
12. Else
13. Save records in output
14. End if
15. Next record.

Select	Date	Client_IP	Server_IP	Port	Method	URI_Stein	Status_Code	Server_Name	UserNA	Request
<input type="checkbox"/>	2012-02-13	10.8.0.15	202.71.129.26	80	GET	/Papers/SRSEExample-webapp.doc	200	NA	NA	NA
<input type="checkbox"/>	2012-02-13	10.8.0.13	202.71.129.26	80	GET	/syllabus.aspx	200	NA	NA	NA
<input type="checkbox"/>	2012-02-13	10.5.0.3	172.30.255.255	80	GET	/images/picture.jpg	200	NA	NA	NA
<input type="checkbox"/>	2012-02-13	10.5.0.3	209.85.135.109	80	GET	/gmail.com	200	NA	NA	NA
<input type="checkbox"/>	2012-02-13	10.5.0.12	59.162.23.130	80	GET	/academic/rsrchiprgn.html	200	NA	NA	NA
<input type="checkbox"/>	2012-02-13	10.6.0.20	67.218.96.251	80	GET	/downloads/index.htm	200	NA	NA	NA
<input type="checkbox"/>	2012-02-13	10.6.0.22	67.218.96.251	80	GET	/products/W52XXX-series.aspx	200	NA	NA	NA
<input type="checkbox"/>	2012-02-13	10.6.0.27	67.218.96.251	80	GET	/it/experienced/index.htm	200	NA	NA	NA
<input type="checkbox"/>	2012-02-13	10.6.0.15	202.190.126.85	80	GET	facebook/images/flower.gif	404	NA	NA	NA
<input type="checkbox"/>	02/13/2012	10.5.0.3	202.71.129.26	NA	GET	NA	200	GIT	NA	NA
<input type="checkbox"/>	02/13/2012	10.5.0.3	202.71.129.26	NA	GET	NA	200	ALPHA	NA	NA
<input type="checkbox"/>	02/13/2012	10.5.0.12	172.30.255.255	NA	GET	NA	200	KIT	NA	NA
<input type="checkbox"/>	02/13/2012	10.6.0.20	209.85.135.109	NA	GET	NA	200	AIT	NA	NA
<input type="checkbox"/>	02/13/2012	10.6.0.22	59.162.23.130	NA	GET	NA	200	UNIVERSAL	NA	NA
<input type="checkbox"/>	02/13/2012	10.6.0.27	67.218.96.251	NA	GET	NA	200	NIRMA	NA	NA
<input type="checkbox"/>	02/13/2012	10.8.0.13	67.218.96.251	NA	GET	NA	200	JNU	NA	NA
<input type="checkbox"/>	02/13/2012	10.8.0.15	67.218.96.251	NA	GET	NA	200	GTU	NA	NA
<input type="checkbox"/>	02/13/2012	10.8.0.14	202.190.126.85	NA	GET	NA	404	FB	NA	NA

**Figure 9 : Combined log file with like unnecessary data like .jpg, error page etc..**

Fig 9 shows removing unwanted records from combined log file

Select	Date	Client_IP	Server_IP	Port	Method	URL_Stem	Status_Code	Server_Name	UserName	Request
<input type="checkbox"/>	2012-02-13	10.8.0.15	202.71.129.26	80	GET	/Papers/SRSEExample-webapp.doc	200	NA	NA	NA
<input type="checkbox"/>	2012-02-13	10.8.0.13	202.71.129.26	80	GET	/syllabus.aspx	200	NA	NA	NA
<input type="checkbox"/>	2012-02-13	10.5.0.3	209.85.135.109	80	GET	/gmail.com	200	NA	NA	NA
<input type="checkbox"/>	2012-02-13	10.5.0.12	59.162.23.130	80	GET	/academic/rsrchprgm.html	200	NA	NA	NA
<input type="checkbox"/>	2012-02-13	10.6.0.20	67.218.96.251	80	GET	/downloads/index.htm	200	NA	NA	NA
<input type="checkbox"/>	2012-02-13	10.6.0.22	67.218.96.251	80	GET	/products/W52XXX-series.aspx	200	NA	NA	NA
<input type="checkbox"/>	2012-02-13	10.6.0.27	67.218.96.251	80	GET	/it/experienced/index.htm	200	NA	NA	NA
<input type="checkbox"/>	02/13/2012	10.5.0.3	202.71.129.26	NA	GET	NA	200	GIT	NA	NA
<input type="checkbox"/>	02/13/2012	10.5.0.3	202.71.129.26	NA	GET	NA	200	ALPHA	NA	NA
<input type="checkbox"/>	02/13/2012	10.5.0.12	172.30.255.255	NA	GET	NA	200	KIT	NA	NA
<input type="checkbox"/>	02/13/2012	10.6.0.20	209.85.135.109	NA	GET	NA	200	AIT	NA	NA
<input type="checkbox"/>	02/13/2012	10.6.0.22	59.162.23.130	NA	GET	NA	200	UNIVERSAL	NA	NA
<input type="checkbox"/>	02/13/2012	10.6.0.27	67.218.96.251	NA	GET	NA	200	NIRMA	NA	NA
<input type="checkbox"/>	02/13/2012	10.8.0.13	67.218.96.251	NA	GET	NA	200	JNU	NA	NA
<input type="checkbox"/>	02/13/2012	10.8.0.15	67.218.96.251	NA	GET	NA	200	GTU	NA	NA
<input type="checkbox"/>	NA	10.5.0.3	NA	NA	NA	NA	200	NA	Jack	GET/syllabus.aspx
<input type="checkbox"/>	NA	10.5.0.3	NA	NA	NA	NA	200	NA	Fredy	GET/Circular.aspx
<input type="checkbox"/>	NA	10.5.0.12	NA	NA	NA	NA	200	NA	Luis	GET/Papers/SRSEExample-we

Figure 10 : Cleaned combined log file

Fig 10 shows Cleaned combined log file After removing unnecessary records.so we have got finally cleaned data

#### IV. PROPOSED SCHEME OF ANALYSIS TOOL

##### 3.1 READING FROM WEBLOG

Weblogs can be extracted as .txt files from the server. If you are analyzing only access logs then all other types of logs like error logs should be filtered before you start making a data set. This task can be easily performed by your system administrator. The discussed in this paper only works with access logs. The first step in the is to read and convert the .txt files to a data set. The takes information from the log file and assigns appropriate data types and formats. It is required you understand the structure of the data in your web log so that you can modify the to suit your server environment. The full code is reported in appendix. Figure 2 displays a sample of web log entries after these were converted into a data set. As mentioned before, in the case of this client company, we had two variables representing the unique identification number. This may not be the case with other servers. Due to the differences in the way web logs are structured, you may have to tweak the slightly in this step to accommodate these differences.

Client_IP	UserName	Date_Time	Request	Status_code	Bytes	Referrer
10.5.0.3	Jack	13/Feb/2012:14:50:12	GET/syllabus.aspx	200	8365	http://www.gtu.edu.in
10.5.0.3	Fredy	13/Feb/2012:14:25:42	GET/Circular.aspx	200	6289	http://www.gtu.edu.in
10.5.0.12	Luis	13/Feb/2012:14:41:16	GET/Papers/SRSEExample-webapp.doc	200	5843	http://www.cse.msu.edu
10.6.0.20	Jackson	13/Feb/2012:13:05:03	GET/Drupal-Intro.ppt	200	9357	http://www.silverfoxinteractive.com
10.6.0.22	Smith	13/Feb/2012:14:25:42	GET/copperhall/image/tulip.jpg	200	4685	http://www.pbase.com
10.6.0.27	Cooper	13/Feb/2012:11:51:04	GET/admission.aspx	200	8014	http://www.ignou.ac.in
10.8.0.13	Marshal	13/Feb/2012:15:06:42	GET/cert05/dotnetfx/dotnetfx.exe	200	9687	http://www.installengine.com
10.8.0.15	Ryder	13/Feb/2012:10:26:53	GET/PMS/PMS.doc	200	1029	http://www.rakshainfotech.com
10.8.0.16	Styen	13/Feb/2012:12:26:53	GET/facebook/images/flower.gif	404	1256	http://www.facebook.com

You can also see from figure 2 that the identifies appropriate formats for the variables. Web logs in this stage are still in a form that cannot be used for data mining or web analytics. Each record in the data set represents a single page visit per user with the latest visit at the bottom. Each entry captures the time of visit for a page. In order to calculate the time spent on a page you should know the time of visit for the next visited page and this goes on for all other pages until the visitor exits the web site. Therefore, you can never calculate the time spent on the last visited page in any session.

#### V. CREATING OUTPUT DATASET

Once the raw data are available so we have to store all those data into database for permanently storage.Once the raw data set is available, we can use programming to transform the raw data set into a form that can be used for analysis. The structure of the output data set can be formulated based on the type of analysis an analyst wants to perform. New variables need to be created in order to extract insights from the data. This can include creating simple variables such as “Browser Type” and “Date” to complex variables like “Session Duration” and “Percent Page Duration”. The developed and reported in this paper creates these new variables with processed information but also retains the raw variables from the input data set. The new variables that are created by this are explained below:

**Time Spent:** This variable captures the time spent by the visitor on each page. The time spent on the page can be calculated only by knowing the start time of the next visited web page which is available only in the next following observation. We used SORT procedures to reverse the order of data along with RETAIN statements to calculate the time spent on a page.

**Session:** A session is defined as a series of page requests from the same uniquely identified client with a time of no more than 30 minutes. We track the time spent information to calculate the session for a visit.

**Session Duration:** Session duration captures the total time spent on all the pages visited in a session.

**Page Name:** Page Name is the actual page visited by the user. The identifies this page as the name with .htm or .html extension as found in the complete URL. If there is not .an html or .htm page, the last string in the URL is taken as the page name. Table shows two different examples for page names.

URL	Page
http://www.athletics.okstate.edu/page/TV/LiveMatches/010268.html	010268.html
http://www.osu.okstate.edu/welcome	welcome

Table 2 Example of URL page and page name

**Exit Page:** This is the last page visited by user. This value is identified based on the session.

**Percent of Pages Visit:** This variable captures the number of times a page was visited in a particular session in percentage.

#### VI. FILTERS – WEB ROBOTS

Multiple filters need to be applied to processed web log datasets prior to doing any kind of analysis on the data. One of the most important filters would be exclusion of web robots from the dataset. Web Robots are machine-generated search

engines that provide necessary service to sites like Google and the other search engines by providing fast access to the internet resources[7]. Access to resources is possible by creating a worldwide index of available information. Identification and removal of robot becomes the vital part when activities like reporting the web site metrics is to be done. Variety of methods is used for removing robots; important ones of them is including user agent string exclusion. Usage of user agent string with the conjunction of IP addresses exclusion list could be one of the best ways to remove web robots. Sometimes, just using IP exclusion list may not solve the purpose as Internet Servers and IP addresses keep on changing. Code for some of the important exclusion list is mentioned in Appendix.

## VI. REPORT GENERATION

The other important function of the is to generate relevant reports using the processed data. Reports help in answering various questions related to the website and visitor behavior like:

- Which is the most visited web page?
- Where are the visitors spending most of the page?
- Which is the most frequent exit page?
- What is the average time spent by a visitor on a particular page?

The processed data set can be used to answer these types of questions. The currently generates only basic reports. The can be modified to generate different types of reports according to the analyst's requirements.

The reports that the generates are:

- Top Ten visited pages
- Top Ten web pages where visitors spent most of the time
- Number of pages visited on a daily basis
- Top ten exit pages

## VII. CONCLUSION

Clickstream data has a lot of valuable information about web site visitor's online behavior. However the server log data are not available in the right format for analysis. Asp.net programming can be used to prepare data in a form that can be reported and used for various modeling analysis. The programming in this paper can be easily used to prepare a dataset from server access logs and generate all user require reports. More sophisticated reports can be obtained by using any commercial web analytics applications that charge a lot of money (such as Adobe) or do not give researchers control over their data (such as Google Analytics).But, the data set that is created by this free gives more control to analysts in terms of applying wide range of advanced analytics techniques and defining customized variables. This can also be customized by uses to include more reporting capabilities. We hope many users can use this free and tweak it to create data sets from their own web logs and the apply sophisticated analytic techniques on those data set.

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# Emerging Trends of Clustering in Web Usage Mining and It's Business Applications

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**Abstract**— Clustering is the process of grouping objects together in such a way that the objects belonging to the same group are similar and those belonging to different groups are dissimilar. Clustering technique can be used in many applications for example biological, financial applications and many more. One of these application types is Web clustering where different types of objects can be clustered into different groups for various purposes. This paper deals with the different aspects of Web data mining and provides an overview about the various techniques used in this field.

**Key words** - Data Mining, Clustering, Web Usage Mining, Web Usage Clustering.

## I. INTRODUCTION

Web mining is the application of data mining techniques to extract knowledge from Web data - including Web documents, hyperlinks between documents, usage logs of web sites, etc. Two different approaches were taken in initially defining Web mining. First was a 'process-centric view', which defined Web mining as a sequence of tasks. Second was a 'data-centric view', which defined Web mining in terms of the types of Web data that was being used in the mining process. The second definition has become more acceptable, as is evident from the approach adopted in most recent papers that have addressed the issue. In this paper we follow the data-centric view, and refine the definition of Web mining as, **Web mining** is the application of data mining techniques to extract knowledge from Web data, where **at least one of structure (hyperlink) or usage (Web log) data is used in the mining process** (with or without other types of Web data)[1].

The attention paid to Web mining, in research, software industry, and Web-based organizations, has led to the

accumulation of a lot of experiences. It is our attempt in this paper to capture them in a systematic manner, and identify directions for future research.[2]

## II. WEB MINING

Web mining is the Data Mining technique that automatically discovers or extracts the information from web documents. It consists of following tasks[4]:

1. *Resource finding*: It involves the task of retrieving intended web documents. It is the process by which we extract the data either from online or offline text resources available on web.
2. *Information selection and pre-processing*: It involves the automatic selection and pre processing of specific information from retrieved web resources. This process transforms the original retrieved data into information. The transformation could be renewal of stop words, stemming or it may be aimed for obtaining the desired representation such as finding phrases in training corpus.
3. *Generalization*: It automatically discovers general patterns at individual web sites as well as across multiple sites. Data Mining techniques and machine learning are used in generalization
4. *Analysis*: It involves the validation and interpretation of the mined patterns. It plays an important role in pattern mining. A human plays an important role in information on knowledge discovery process on web[3].

## III. WEB MINING TAXONOMY

Web Mining can be broadly divided into three distinct categories, according to the kinds of data to be mined:

### A. Web Content Mining

Web content mining is the process of extracting useful information from the contents of web documents. Content data is the collection of facts a web page is designed to contain. It may consist of text, images, audio, video, or structured records such as lists and tables. Application of text mining to web content has been the most widely researched. Issues addressed in text mining include topic discovery and tracking, extracting association patterns, clustering of web

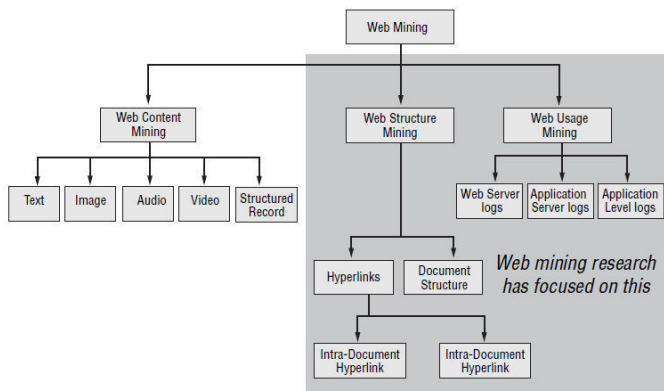


Fig. 1 . Web Mining Taxonomy

documents and classification of web pages. Research activities on this topic have drawn heavily on techniques developed in other disciplines such as Information Retrieval (IR) and Natural Language Processing (NLP). While there exists a significant body of work in extracting knowledge from images in the fields of image processing and computer vision, the application of these techniques to web content mining has been limited.

Web content mining is related but different from data mining and text mining. It is related to data mining because many data mining techniques can be applied in Web content mining. It is related to text mining because much of the web contents are texts. However, it is also quite different from data mining because Web data are mainly semi-structured and/or unstructured, while data mining deals primarily with structured data. Web content mining is also different from text mining because of the semi-structure nature of the Web, while text mining focuses on unstructured texts. Web content mining thus requires creative applications of data mining and/or text mining techniques and also its own unique approaches.

The various contents of Web Content Mining are

- Web page
- Search page
- Result page

**Web Page:** A Web page typically contains a mixture of many kinds of information, e.g., main content, advertisements, navigation panels, copyright notices, etc. For a particular application only some part of the information is useful and the rest are noises.

**Search Page:** A search page is typically used to search a particular Web page of the site, to be accessed numerous times in relevance to search queries. The clustering and organization of Web content in a content database enables effective navigation of the pages by the customer and search engines.

**Result page:** A result page typically contains the results, the web pages visited and the definition of last accurate result in the result pages of content mining.

## B. Web Structure Mining

The structure of a typical web graph consists of web pages as nodes, and hyperlinks as edges connecting related pages. Web structure mining is the process of discovering structure information from the web. This can be further divided into two kinds based on the kind of structure information used.

### Hyperlinks

A hyperlink is a structural unit that connects a location in a web page to a different location, either within the same web page or on a different web page. A hyperlink that connects to a different part of the same page is called an *intra-document hyperlink*, and a hyperlink that connects two different pages is called an *inter-document hyperlink*. There has been a significant body of work on hyperlink analysis, of which Desikan, Srivastava, Kumar, and Tan (2002) provide an up-to-date survey.

### Document Structure

In addition, the content within a Web page can also be organized in a tree-structured format, based on the various HTML and XML tags within the page. Mining efforts here have focused on automatically extracting document object model (DOM) structures out of documents (Wang and Liu 1998; Moh, Lim, and Ng 2000).

It derives information and knowledge mainly from the Web and the links between the organizational structures. Based on scientific citation analysis theory, the interconnection between the data in the document contains a wealth of useful information. The usual search engines consider only the Web as a flat collection of documents because of taking into account the complexity of the structure, ignoring the structure of information. Mining of structure and Web page structure, guides the classification and clustering of pages to find authoritative pages, center pages, to improve retrieval performance. Web page also can be used to guide the collection work to improve collection efficiency.

The various contents of Web structure mining are

- Links Structure Mining
- Internal Structure Mining
- URL Mining

**Links Structure:** Link analysis is an old area of research. However, with the growing interest in Web mining, the research of structure analysis had increased and these efforts have resulted in a newly emerging research area called Link Mining. It consists Link-based Classification, Link-based Cluster Analysis, Link Type, Link Strength and Link Cardinality.

**Internal Structure Mining:** It can provide information about page ranking or authoritativeness and enhance search results through filtering i.e., tries to discover the model underlying the link structures of the web. This model is used to analyze the similarity and relationship between different web sites.

**URL Mining:** It gives a hyperlink which is a structural unit that connects a web page to different location, either within the

same web page (intra\_document hyperlink) or to a different web page (inter\_document) hyperlink.

*C. Web Usage Mining*

Web usage mining is the application of data mining techniques to discover interesting usage patterns from web usage data, in order to understand and better serve the needs of web-based applications (Srivastava, Cooley, Deshpande, and Tan 2000). Usage data captures the identity or origin of web users along with their browsing behavior at a web site. web usage mining itself can be classified further depending on the kind of usage data considered:

*Web Server Data*

User logs are collected by the web server and typically include IP address, page reference and access time.

*Application Server Data*

Commercial application servers such as Weblogic,<sup>1,2</sup> StoryServer,<sup>3</sup> have significant features to enable E-commerce applications to be built on top of them with little effort. A key feature is the ability to track various kinds of business events and log them in application server logs.

*Application Level Data*

New kinds of events can be defined in an application, and logging can be turned on for them — generating histories of these events. It must be noted, however, that many end applications require a combination of one or more of the techniques applied in the above the categories.

*D. Text Mining*

Due to the continuous growth of the volumes of text data, automatic extraction of implicit previously unknown and potentially useful information becomes more necessary to properly utilize this vast source of knowledge. Text mining, therefore, corresponds to extension of the data mining approach to textual data and its concerned with various tasks, such as extraction of information implicitly contained in collection of documents or similarity- based structuring. Text collection in general, lacks the imposed structure of a traditional database. The text expresses the vast range of information, but encodes the information in a form that is difficult to decipher automatically[2].

It focuses on techniques that could predict user behavior while the user interacts with the web and also it discovers the meaningful pattern from data generated by client server transaction on one or more web localities. A web is a collection of interrelated files on one or more web servers. Web usage mining aims at utilization of data mining techniques to discover the usage patterns from web based application. It automatically generates the data for the server access logs, refers logs, agent logs, client sides cookies, user profiles, metadata, page attributes, page contents & site structures. It is a technique to predict user behavior when the

user interacts with the web. Web usage mining is categorized into three phases:

- Preprocessing
- Pattern Discovery
- Pattern Analysis

**Preprocessing** : According to the client, server and proxy server, the preprocessing is the first approach to retrieve the raw data from web resources and process the data. It automatically transforms the original raw data to the next process.

**Pattern Discovery** : According to the data preprocessing, the raw data is used to discover the knowledge and to implement the techniques which will be used for machine learning. This makes use of data mining procedures.

**Pattern Analysis** : It is the process after pattern discovery. It checks whether the pattern is correct on the web and guides the process of extraction of the information/ knowledge from the web.

Web Mining				
	Web Content Mining		Web Structure Mining	Web Usage Mining
	IR view	DB View		
<b>View of Data</b>	-Unstructured -Structured	-Semi Structured -Web Site as DB	-Link Structure	-Interactivity
<b>Main Data</b>	- Text documents -Hypertext documents	-Hypertext documents	-Link Structure	-Server Logs -Browser Logs
<b>Representation</b>	-Bag of words, n-gram Terms, -phrases, Concepts or ontology -Relational	-Edge Labeled Graph, -Relational	-Graph	-Relational Table -Graph
<b>Method</b>	-Machine Learning -Statistical (including NLP)	-Proprietary algorithms -Association rules	-Proprietary algorithms	-Machine Learning -Statistical -Association rules
<b>Application Categories</b>	-Categorization -Clustering -Finding extract rules -Finding patterns in text	-Finding frequent sub structures -Web site schema discovery	-Categorization -Clustering	-Site Construction -adaptation and management -Marketing -User Modeling

TABLE: 1 Web Mining Categories

**IV. WEB MINING AND IT’S APPLICATIONS**

There are many benefits that can be obtained through the applications of web mining technology.

*Application areas of Web Mining:*

- E-Commerce
- Search Engines
- Personalization
- Website Design

*How Web mining is different from classical data mining?*

**Web mining:**

- The web is a collection of interrelated files, even though it is not a relation.
- Web mining is the discovery of knowledge from the web.
- Usage data is huge and growing rapidly.
- Ability to react in real-time usage of patterns.

**Data mining:**

- Textual information and linkage structure.
- Google's usage logs are bigger than their web crawl.
- Data generated per day is comparable to largest conventional data warehouse.
- No human in the loop.

The attention paid to Web mining, in research, software industry and Web-based organizations, has led to the accumulation of lot of experiences. It is our attempt in this paper to capture them in a systematic manner and identify the directions for future research.:

The various fields where web mining is applied are:

- E-Commerce
- Information filtering
- Fraud detection
- Education and research
- 

#### **E-Commerce:**

In e-commerce, web mining helps in generating user profiles by customizing the choice of users. For example, web mining enables a user to search for an advertisement and information regarding a product of his interest. Internet advertising is one of the major fields in e-commerce, where web mining is widely used. Advertising in a specific domain of an e-commerce web site or a general web site and is considered as one of the major application area of web mining.

#### **Information filtering:**

Information filtering is the method to identify the most important results from a list of discovered frequent set of data items for which you can make use of web mining.

#### **Fraud detection:**

Fraud detection can be performed using web mining by maintaining a list of signatures of all the users. Web mining is also applied for plagiarism detection and research works.

## **V. CONCLUSION AND FUTURE WORK**

Web data is growing at a significant rate. Web mining is a fertile area of research with many successful applications. As the Web and its usage continues to grow, so grows the opportunity to analyze Web data and extract useful knowledge from it. To extract the specific data from web warehouse, the three categories (Web Content Mining, Web Structure Mining and Web Usage Mining) of web mining play a major role. Web mining is one of the most important applications of data mining. It is having its own benefits and successful applications with which we can overcome the problems or difficulties faced in data mining. In this paper a clear picture of how web mining is efficiently different from data mining has been highlighted. As the usage of the internet in the present day is growing in faster rate, the personalization process of the web mining provides us a great opportunity of maximizing the efficient usage of the internet.

Cloud mining is a new approach to apply data mining to the customer data by using web mining process. By a cloud, we mean an infrastructure that provides resources and/or services over the Internet. In fact among all the potential use of web mining in future, the growing online shopping activities, e-services industry and e-commerce are important domains. Hence the future of the web mining can be seen in the field of Cloud Mining architectures and algorithms that can exploit and enable a more effective integration and mining of content, usage, and structure data from different sources promise to lead to the next generation of intelligent Web applications.

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# Rotation Perturbation Technique for Privacy Preserving in Data Stream Mining

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**Abstract**—Diagnosis of the health condition is a very challenging task in field of medical science. In computer-aided diagnosis (CAD), machine technique is widely used. It is real processing. Data mining technique classification is one of the most important technique, in this paper is to classify the data as thyroid improve the classification accuracy, we have used ensemble model for classification of thyroid data. Randomization process added to privacy sensitive data after next process reconstruction to the main data from the perturbed data. Principal Component Analysis (PCA) is used to preserve the variability in the data. Rotation transformation can enlarge the increase the base classifiers and improve the accuracy of the ensemble classifier. In this survey paper, we analyses a rotation perturbation technique for PCA find eigenvector and Z score-Normalization method using to dimension in stream mining.

**Keywords**— Classification, Data Mining, PCA, Privacy, Thyroid disease, Z score – Normalization

## I. INTRODUCTION

The Data Mining is the system of examining large pre-existing database in order to develop new information. Data mining algorithm like clustering, classification work on this data and provide crisp information for analysis [1]. In recent year data mining as a powerful data analysis tool in many areas and wide application with the development of data base technology and network technology, a large number of useful data, which contains much individual privacy information has been gain in various fields, such as condition information, customer preferences, personal

background information etc. Privacy is becoming an increasingly important issue in data mining applications that deal with health care, security, financial, behavioural, and other types of sensitive data[11].Data Stream is concerned with extracting knowledge structure in models and patterns continuous streams of information. Data stream can data sizes many times greater than recollection, and can be extended to objection actual time applications by machine information or data mining [14].

## II. NEED FOR PRIVACY PRESERVING

Privacy preserving is one of the most extensive investigation fields in the data protection field and it has become in the protected conversion of intimate data. A number of algorithmic techniques have been designed for privacy preserving data mining. The ongoing privacy preserving data mining procedure are classified based on distortion, association rule, hide association rule, taxonomy, clustering association, classification outsourced, data mining scattered.it is used to easily protect individual privacy in data sharing. Privacy preserving data mining has become it allows sharing of privacy sensitive data for analysis purposes. Privacy preserving data mining have three types of methods: Reconstruction based method, Heuristic based method, and Cryptographic based method. In this paper we are using Reconstruction based method.

## III. RECONSTRUCTION BASED METHOD

There are three types of reconstruction based approaches: Data perturbation, Data randomization, Data Swapping. Reconstruction based approaches generate privacy appreciative database by extracting sensitive data from the original database. These approaches generate

insignificant side effects in database than heuristic approach. Reconstruction based techniques perturb the original data to achieve privacy preserving perturbing the data for privacy preserving is very conducive technique used by reconstruct the distributions at an aggregate level in order to perform the mining.

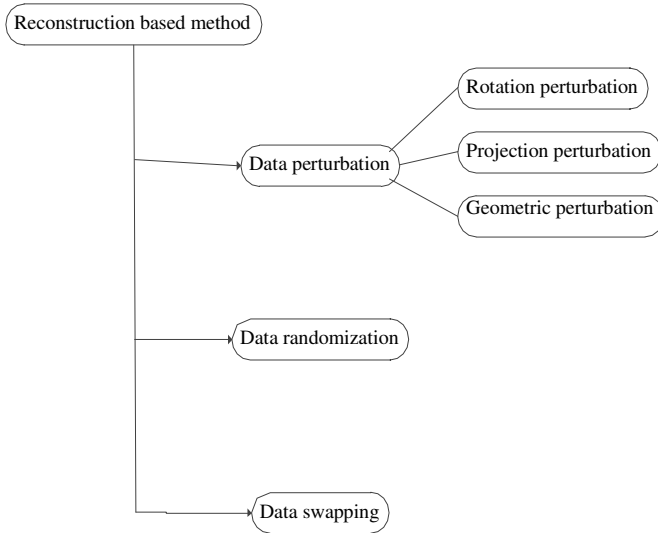


Fig.1.Reconstruction Based Approach

IV. RELATED WORK

In this paper, we are using data perturbation techniques. This section presents Rotation perturbation, projection perturbation, Geometric data perturbation. The classification of thyroid diseases has come under heated discussion among in recent years. The accuracy of combined classifiers increased and processing time reduced

A. Data Perturbation

Data perturbation three section it is a rotation perturbation, projection perturbation, geometrics perturbation. Data perturbation approaches can be grouped into two main categories the probability distribution approach and value distortion approach [11]. The work in proposed classification data perturbation. The data reconstructs to original data from its classification models.

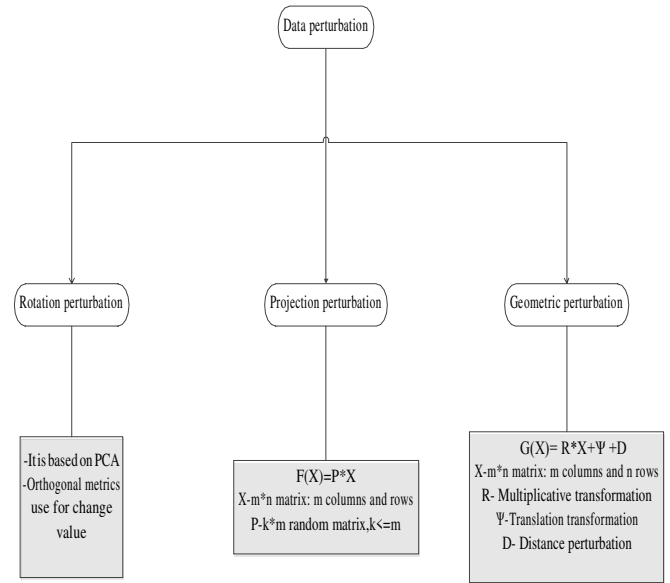


Fig.2.Classification Data Perturbation Techniques

*Level-1 Rotation Perturbation:* Rotation perturbation is used for classification and clustering for privacy preservation. Rotation perturbation is used in based on principal component analysis (PCA). It is orthogonal metrics use for change values. It is also used geometrics data transformation as  $G(x) = RX$ . Where R is a rotation metrics X is original dataset. Rotation perturbation is also distance preserving.

*Level-2 Projection perturbation:* In projection perturbation we project the set of original data from original space to random space. Suppose  $F(X) = P*X$ , Where X is m\*n metrics: m columns and n rows, P is random metrics.is applied to original dataset X for the perturbation.

*Level-3 Geometric perturbation:* Geometric perturbation is used in privacy preserving in collaborative data mining.it is most widely used. Many popular data mining models are steady in geometrics perturbation. K- Nearest neighbor classifier, linear classifier, support vector machine classifier are steady means classifier with geometrics data perturbation has almost same accuracy as the original data. Suppose  $G(X) = R*X+ Ψ + D$ , Where X is m\*n metrics, R is multiplicative transformation, Ψ translation transformation, D is distance perturbation.

*B. Principal Components Analysis (PCA)*

PCA is a numerical process that uses an ethical metamorphosis to convert a set of measurement of probably revised variables into a set of values of linearly incorrect variable called PCA. A method of analysis which involved finding the linear combination of a set of variables that has maximum variance and removing its effect repeating this successively. PCA is used to perturb the multidimensional data into dimensions. It is used to reduce dimensionality of the dataset, Find patterns in high dimensional data, Visualize data of high dimensionality. PCA application are Text processing, Image processing, Speech recognition, Recommendation engine. In this paper we find principal components using eigenvector and eigenvalue.

Now we are selecting some data set D into N\*N metrics and we find eigenvectors and eigenvalues.

An eigenvector of an N \* N matrix A is a nonzero vector X such that AX = λX for some scalar λ. A scalar λ is called an eigenvalue of A if there is a nontrivial solution X of AX = λX; X is an eigenvectors comparable to λ.

λ is an eigenvalue of N \* N matrix A if and only if the equation:

$$(A-\lambda I)X = 0 \dots\dots\dots (1)$$

The A - λI has the form

A-λI=

$$\begin{bmatrix} a_{11} & a_{12} & a_{13} \\ 0 & a_{22} & a_{23} \\ 0 & 0 & a_{33} \end{bmatrix} - \begin{bmatrix} \lambda & 0 & 0 \\ 0 & \lambda & 0 \\ 0 & 0 & \lambda \end{bmatrix}$$

=

$$\begin{bmatrix} a_{11}-\lambda & a_{12} & a_{13} \\ 0 & a_{22}-\lambda & a_{23} \\ 0 & 0 & a_{33}-\lambda \end{bmatrix}$$

This λ equals one of the entries a<sub>11</sub>, a<sub>22</sub>, and a<sub>33</sub> in A After compute eigenvector VI. Gaussian elimination mathematical technique is used.

*C. Normalization*

In Data Mining, Normalization is scaling techniques or a mapping technique or a pre-processing stage. The technique which provides linear transformation on original range of data is called Min-Max Normalization. Also technique keeps relationship among original data is called Min-Max Normalization. Min - Max Normalization is a normalization scheme which linearly change completely X

to Y = (X - Min)/ (max -min), where min and max are the minimum and maximum values in X, where X is the set of observed values of X. it can be easily seen that when X=min, then Y=0. In this paper we are using Z score normalization it is very useful statistic because it allows us to calculate the probability of a score occurring within our normal distribution and enables us to compare two score that are from different normal distributions. Z score equation is:

$$Z \text{ score} = \frac{x-\mu}{\sigma}; \dots\dots\dots(2)$$

Where μ is mean, x is data, σ standard deviation. In this equation using first we find values. After we get data then we are putting in numerical data of normalization. Standardized data is part of the derivation process similar data received in various formats is transformed to a common format that enhances the comparison process for example contains directions. Standard deviation σ;

$$\sigma = \sqrt{\frac{\sum(x-X)^2}{n-1}}$$

Where x is data value, X is mean value, n is number of value. Database Normalization is the process of organizing the attributes and relations of database to reduce data redundancy and improve data integrity.

V. CONCLUSION

Thyroid classification is very important in the field of medical science. In this paper we discussion in data perturbation techniques in rotation perturbation based on PCA. Thyroid disease scatter data improve classification machine technique widely used. Approaches can be useful find perturbation technique to maintain privacy of data.

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# Analysis and Design of WR75 Coaxial to Rectangular Waveguide Adapter for KU Band

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**Abstract**— Rectangular waveguides are commonly used for high power radar application. A proper emphasis has given to minimize the insertion loss and to improve the return loss of the adapter. A model has been developed by using coaxial to rectangular waveguide (WR75) with frequency of Ku band at 13.75 to 14.50 GHz. with 50 Ohm impedance. High Frequency Structural Simulator (HFSS 16.1) software has been used to design the adapter.

**Keywords**— Coaxial to Rectangular Waveguide Adapter; Coaxial line; Rectangular Waveguide; HFSS.

## I. INTRODUCTION (HEADING 1)

The transition is an important part of most microwave systems, however, since solid state components are usually constructed on microstrip transmission lines and interconnected with coax, while microwave antennas normally use waveguide techniques. A typical transition consists of a coaxial connector on the broad side of a rectangular waveguide with the center conductor extended as a probe into the waveguide, with one end of the guide ending in a short circuit, like Fig. 1. [1]

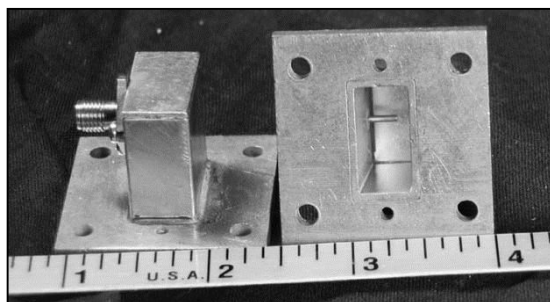


Figure 2: Figure 1: WR75 waveguide to coax adapter

In circular waveguide, the characteristic impedance is a function of the guide wavelength:

$$Z_0 = 377 \times (\lambda_g / \lambda_0) \dots\dots\dots \text{Eq. (1)}$$

While in rectangular waveguide, the characteristic impedance is modified by the aspect ratio:

$$Z_0 = 377 \times (\lambda_g / \lambda_0) \times 2b/a \dots\dots\dots \text{Eq. (2)}$$

Where a and b are the large and small inner dimensions, respectively. The guide wavelength,  $\lambda_g$ , is easily measured with the slotted line, but it can also be calculated:

$$\lambda_g = \lambda / \sqrt{1 - (\lambda / \lambda_c)^2} \dots\dots\dots \text{Eq. (3)}$$

Where the cut-off wavelength,  $\lambda_c = 2a$ , or twice the large inner dimension of the waveguide.

A coaxial line can be matched to a waveguide by means of a probe antenna located ahead of a short-circuiting plunger. An impedance match can usually be achieved by varying any two of the following three dimensions: (a) the off-centre position of the probe, (b) the probe length (Depth) and (c) the piston position (Backshot), as shown in fig.2. [2]

## II. STRUCTURE AND SIMULATION

The proposed model as shown in fig.2 is composed of a coaxial probe and a section of waveguide with one face shorted. Here the waveguide has a height smaller than that of a standard waveguide. The probe penetrates into the waveguide

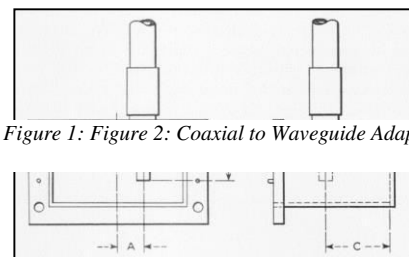


Figure 1: Figure 2: Coaxial to Waveguide Adaptor

from the upper wall of the waveguide there is a step lowering down the bottom wall and makes the height of the waveguide bigger.

When the initial parameters of the adapter was set, HFSS was used to optimize the design. The parameters of the developed model are as shown in Table 1.

Table 1: Parameters of the Adapter

Parameters	Size (mm)
a	19.0500
b	09.5200
A	02.1400
B	00.6375
C	05.0000

Designing model of adaptor from the HFSS and Simulated insertion loss and return loss of the frequency ranges from 13.75 GHz to 14.50 GHz. are as shown in fig.3.

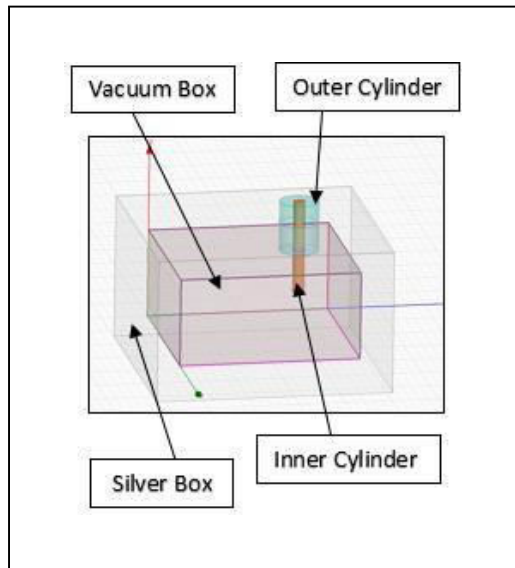


Figure 3: Designing Model in HFSS

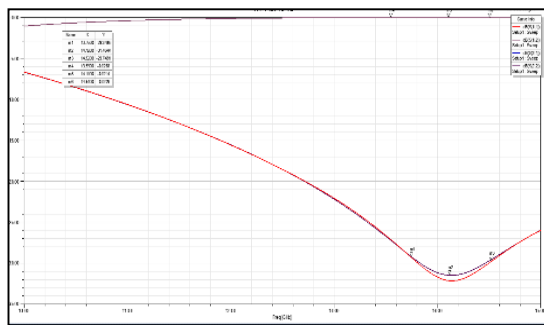


Figure 4: Simulation Results in HFSS

### III. FINDINGS & DISCUSSIONS

From the study it is found that if there is a change in the off-centre position at the same time the characteristics impedance ( $Z_0$ ) also changes. Furthermore if there is a change in the probe length of the inner cylinder the frequency bands also varies with it. Additionally, if there is a change in the piston position, return loss & insertion loss also changes its values accordingly. This study has been carried out at frequency ranges between 13.75 to 14.50 GHz, however coaxial to waveguide adaptor can be used for whole KU band. (12.00 to 18.00 GHz).

### IV. CONCLUSION

It was experimentally proved that the coaxial to waveguide adaptor assure the high impedance matching of 50 Ohm coaxial line with the standard rectangular waveguide

(WR75) at frequency ranges between 13.75 to 14.50 GHz. The study concludes that prepared designing model of adapter in HFSS at frequency ranges between 13.75 to 14.50 GHz, following simulated results were obtained. Insertion Loss was 0.02 dB, Return Loss was 29 dB and Isolation Loss was also 29 dB. Below mentioned Table-2 shows the same.

Table 2: Simulation Results of the Model

Bandwidth (MHz)	Return Loss (dB)	Insertion Loss (dB)	Isolation Loss (dB)
750	29	0.02	29

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# *Techniques in Driver Fatigue Recognition Using Image Processing: A Review*

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*Abstract –Many systems are available nowadays that can guide the drivers to find the route such as navigation systems. Similarly intelligent warning alarm systems are also available which assist the driver. Driver’s fatigue is a major problem which leads to many car accidents. Various techniques are there to detect driver’s drowsiness. A study on various fatigue detection techniques using image processing has been done in this paper. Fatigue is detected based on eye’s state whether eye is opened or closed and based upon yawning.*

## I. INTRODUCTION

With increase in no. of technologies and infrastructure, transportation by roads has increased. Nearly each and every person has his/her own car nowadays. But with increase in no.of vehicles, accidents are increased. One of the reasons for car accidents is driver’s fatigue. We can know the behaviour of drowsy drivers through person fatigue expressions. Fatigue describes tiredness and/or a lack of energy level. These type of accidents takes place mainly during night. We can approximately considered timing during mid night and early morning. [1] mentions that drowsiness has caused 30% Of all traffic accidents. Due to traffic accidents, peoples do not just have to suffer physically but also mentally as well as financially. Drivers and passengers may sometimes suffer from injuries and sometimes may result into death. This has inspired me a lot to choose this topic and to do study on various researches done upto now on this topic.

According to the study carried out by Large Truck Crash Causation Study, 13% of crashes occur due to driver’s tiredness [3]. U.S. National Highway Traffic Safety Administration reports that every year driver’s fatigue and sleepiness causes approximately 60,000 traffic accident [4]. Driver distraction is another major concern besides driver’s drowsiness for drivers and passengers safety [5][6]. Many researches and studies are carried out on human fatigue/drowsiness and they are trying to find out the level of fatigue [7][8][9]. Based on such studies, many active safety

systems have been developed in which they monitor human drowsiness or fatigue [10].

## II. DRIVER DROWSINESS DETECTION TECHNIQUES

Possible techniques for detecting drowsiness in drivers can be broadly divided into three major categories [18]: methods based on driver’s state conditions, methods based on driver performance and methods based on combination of the driver’s current state and driver performance.

### A. Methods Based on Driver State Conditions

It includes intrusive techniques and non-intrusive techniques.

#### 1) Intrusive techniques:

It measures physiological conditions, such as brain waves, heart rate (ECG) and pulse rate. Physiological signals measurements are very much annoying and difficult because of its intrusive and complex functions. Above mentioned first technique is not realistic since the sensing electrodes would have to be attached directly to the driver which will distract the driver. If they are used for a long time, it would result in perspiration on the sensors and so they won’t be able to sense accurately.

#### 2) Non-Intrusive techniques:

It measure visual behaviors such as, eye conditions (open or close), head tilting, eye blinking rate and also includes mouth and yawning analysis.

### B. Methods Based on Driver Performance:

It includes techniques based on monitoring of vehicles in road, vehicle speed etc. Studies on this method have mainly employed lane tracking alone or in combination with tracking of the distance between the driver’s vehicle and the car in front. One problem is micro-sleeps: when a drowsy driver falls asleep for some seconds on a very straight road section without changing the lateral position of the vehicle.

Such happenings would not be detectable by a system only based on lane-position measure[11].

### C. Methods Based on Driver State and Performance:

The approaches that combine driver state and driver performance will improve the sensibility and reliability in fatigue detection. [12] uses a range of measures to detect driver fatigue. They use eye-closure, lane tracking and changes in physiological state to predict fatigue-related crashes.

### III. COMPARATIVE STUDY

Skin color model is used for face detection and after that eyes are detected by using Circular Hough transform, and then eye state is estimated by using developed distance logic. Designed system detected face as well as eyes with an accuracy of 80%. The system does not detect eyes and face properly during dark background[13].

Region of interest for eye is extracted from high-wide information of face. This extraction reduces computational complexity and improves system performance. Chrominance and luminance components are calculated to build eye map which indicates eye region. Actually the main difference is the area of the mouth during normal and yawning condition. In mouth area, red component dominates over blue colour. So that Cb component gives lower value than Cr component relative to other face region [14].

Face is detected by AdaBoost algorithm then, it detects eyes and mouth. Then, two special algorithms PATECP and PATMIO are designed. Results can be made more accurate[15]. In [16], the system uses skin color pixels detection and Viola Jones method for face detection. For accurate detection of yawning and eyes status a threshold value is calculated dynamically and each coming frame is compared to the threshold value for drowsiness detection. The accuracy level of the whole system is increased due to the hybrid method. The system works in daytime only. It does not work during night time because VGA camera is used in image acquisition.

In this paper, the system is based on eyes closer, blinking rate of eye & yawning detection of the user. The system continuously captures the image of the subject on site and detects face region, then eyes and lips are detected. If eyes are found to be closed for 4-5 consecutive frames or blinking rate is found to be abnormal or lips are found to be open for long duration (yawning) for 3-4 consecutive frames then it is concluded that the subject is falling asleep or having state of drowsiness therefore fatigue is detected and a warning alarm issued. The system works in real time without requiring extra hardware. It also works with users wearing eye glasses[17].

In [18], this research has been made robust and efficient because of lane departure detection, head tilting along with facial expression detection. Skin color

segmentation is used in face detection procedure that helps to avoid challenges due of face size, color and orientation. The proposed work uses region of interest for eye detection from detected face image. This extraction reduces computational complexity and improves system performance. Chrominance and luminance components are calculated from Eyemapc and EyemapL to build eye map which indicates eye region.

### IV. PROPOSED WORK

1. Video Acquisition: Video has to be captured from the webcam. It is done using the code in MATLAB. The purpose of this stage is to obtain high quality video images of the driver's face and eye.

2. Conversion of video into frames.

3. Consider one frame. Detect face4. Face detection:

Skin color segmentation is used to detect face. One of the main use is for detecting the pixels indicating skin regions or areas and non-skin regions or areas. After

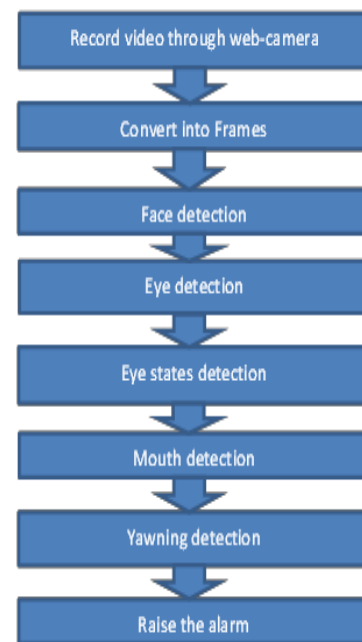


Fig. 2. Flow chart of the proposed work  
 pixels of skin region are detected, the next step is to group up pixels representing faces area and non-faces. Conversion of RGB to YCbCr is done. Each pixel of YCbCr is compared against the limits of Y, Cb and Cr to determine if the skin is present and if so, Use Skin color thresholding to identify and segment the face. Then, Erosion is done to reduce noise, Dilation to enhance the strength of the skin color and Binary image conversion to help image filling operation that fills unwanted holes in face region. Large area of face region is achieved through maximum connected area.

5. Eye detection:

Region of eye is used to extract eyes[18]. Then, Chrominance and luminance components are calculated from Eyemapc and

EyemapL to build eye map which indicates eye region. Then, Erosion and dilation is done. Thresholding is done to eliminate other facial region. Then, it is converted into Binary image for indicating white region as eye. No. of detected eye determines whether eyes are opened or closed.

6. Then, eye states whether eyes are opened or closed will be detected and then mouth and yawning will be detected. If the eyes are found closed and if yawning is detected for 3 to 4 consecutive frames, then the system will generate alarm.

TABLE I

## RECENT STUDIES DONE IN EYE STATE ANALYSIS

Year	Methods	Advantage	Limitation	Accuracy
October 2012 [15]	Adaboost algorithm, PATECP, PATMIO	Adaboost is accurate.	sensitive to light glasses and direction.	Not specified
Mar 2014 [17]	Edge density of eye is calculated.	Works with eye glasses and under different illumination sources	Accuracy can be improved by using more reliable method	90%
May 2014. [18]	Region of Interest(ROI), Eye map is calculated.	Works in poor light intensity of camera,	Complexity increases as it considers lane detection and head tilting detection	84.5%
Dec 2015 [19]	Viola Jones, Haar cascade classifier, Grayscale Conversion, Harris Corner Detector	Simple, works in real time	Do not work with spectacles	94%
Sept 2015 [20]	LBP Classifier and Haar Cascade	Works with glasses	Do not work under poor lighting conditions	Medium-87.5% High-95.83%

TABLE II  
RECENT STUDIES DONE IN MOUTH/YAWNING ANALYSIS

Year	Methods	Advantage	Limitation	Accuracy
May 2011 [14]	Non-skin Segmentation.	Improves detection efficiency, avoid false detection	Sensitive to skin types	Not given
May 2013 [21]	Viola Jones and back projection theory.	Good accuracy in face detection, real time	Do not detect eye states	60%
June 2013 [22]	Local binary pattern	low cost of computation, tested under different lighting conditions	Accuracy can be improved	90%
March 2014 [17]	Calculate Edge density in mouth	Works with eye glasses, under different illumination	Accuracy can be improved by using more reliable method.	90%
May 2014 [18]	Region of Interest(ROI), $L*a*b*$ color space, Non Skin color segmentation	Works in poor light intensity of camera	Conditions to detect face region cannot be applied to all kind of skin texture	84.5%

## CONCLUSION

Review of various drowsiness detection techniques is presented.. Here, approach to detect fatigue is shown using non-intrusive techniques. Non-intrusive techniques measure fatigue by measuring the fatigue symptoms such as eye closure or eye blinking rate and yawning. The main idea is to develop a fatigue detection system that can detect fatigue early enough so that driver can be alerted and accident can be avoided. Thus, the idea is to increase the transportation safety and lessen the personal sufferings which occurs due to the accidents occur due to fatigue.

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# Implementation of wavelength diversity technique on free space optical communication link for mitigating the atmospheric turbulence. A Review

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**Abstract**— The modern day internet technology demands for high data rate and large capacity. Free space optical communication is the technology capable of handling very high data rate and higher capacity. FSO technology is capable of multiplexing voice, data and video in full duplex mode. The FSO technology requires a line of sight path between Tx and Rx in order to make possible transmission. FSO technology faces a lot of challenges due to atmospheric turbulence such as scintillation and beam spreading. The reliability and the quality of link is largely affected due to the presence of atmospheric turbulence. The turbulence presence largely affects the bit error rate of the FSO link. Literature shows multiple techniques to reduce atmospheric turbulence. Diversity based techniques capability to overcome the effect of BER degradation. Diversity helps to improve the reliability and quality factor of the FSO link. This thesis implements a wavelength diversity based technique for mitigating the atmospheric turbulence for having reliable and high quality transmission link in free space optical communication.

**Keywords**—Free space optical; mitigating; BER(Bit error rate); Diversity; Tx(Transmission; Rx(Receiver)

## I. INTRODUCTION

The high cost and other considerations for optical fiber cables, FSO proves to be the more efficient technology than fiber optic communication. Free-space optical communication (FSO) is a technology that uses light propagating in free space to wirelessly transmit data for telecommunications or computer networking. "Free space" means air, outer space, vacuum, or something similar. This contrasts with using solids such as optical fibre cable. The technology is useful where the physical connections are impractical due to some reasons, in various forms, have been used for thousands of years. The Ancient Greeks used a coded alphabetic system of signalling with torches developed by Cleoxenus, Democleitus and Polybius.[1] In the modern era, semaphores and wireless solar telegraphs called heliographs were developed, and using coded signals communication with their recipients done. In 1880, Alexander Graham Bell and his assistant Charles Sumner Tainter created

the photo phone, at Bell's newly established Volta Laboratory in Washington, DC. Bell considered it as his most important invention. The device allowed for the transmission of sound on a beam of light. On June 3, 1880, Bell conducted the world's first wireless telephone transmission between two buildings, at some meters.



Figure:1 History of free space optics.[1]

The invention of lasers in the 1960s, had come with a revolutionized free space optics. Military organizations were particularly taking interest and boost their development. However the technology lost market momentum when the installation of optical fiber networks for civilian uses was at its peak.

## II. FSO COMMUNICATION SYSTEM

FSO communication works on a line of sight technology that utilizes a laser beam for sending the very high bandwidth data from one level to another through atmospheric channel. This can be accomplished by applying a modulated narrow laser beam by transmitting through the transmitter antenna in the atmosphere and subsequently received at the receiver antenna. FSO system is illustrated as in the figure 2 given below. It is the basic block diagram for FSO communication system.

## A. TRANSMITTER

Transmitter transforms the electrical signal to an optical signal and it regulates the laser beam for transmission of data signals to the recipient through the atmospheric channel. The transmitter consists of four characters as indicated in Fig.: 2 laser modulator, driver, and optical source and transmit telescope.

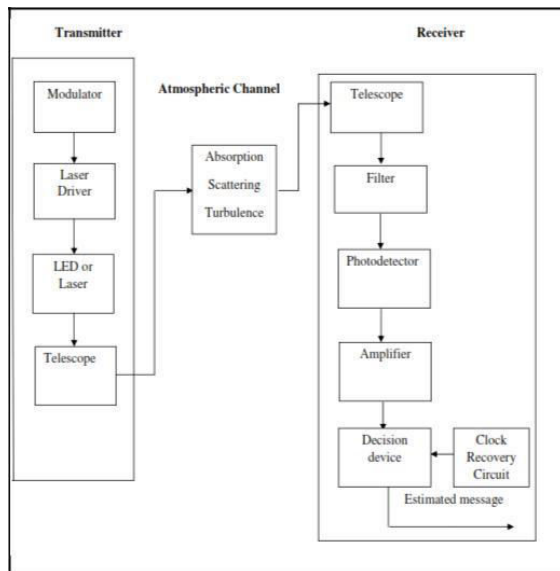


Figure:2 Block diagram of FSO[3]

1) In Laser modulations the data were extended by a laser source. This technique implemented in two common methods first internal modulation and second external modulation[4]. The procedure which passes in the laser resonator is known as internal modulation and it depends on the change the additive components and intensity of the laser beam according to the data signal. In the external modulation occurs outside the laser resonator and it depends on the refractive dual phenomenon and polarization phenomena.

2) Driver circuit is used to convert the electrical signal to

optical signal by varying the current which goes through the light source.

3) Optical source converts the electrical signal to an optical signal. It may a laser diode or light emitting diode in which a

laser diode produces optical radiation by the stimulated emission and also laser diode emits light that is highly non-chromatic and very directional i.e. The laser diode has a narrow spectral width and small beam divergence angle. There are II cases of laser diode ND:

Y AG solid state laser and Fabry- Perot and distributed feedback laser (FP and DFB) [5]. The selection for laser diode in FSO communication depends on various matters.

These include [6].

- Price and availability of ingredients.
- Transmit power, lifetime.
- Modulation capabilities.
- Eye safety.

4) Transmitter telescope is used to collect and climates, directs the optical signal in the direction of the receiver telescope i.e. at the opposite end of the channel.

## B. FSO CHANNEL

In FSO links to collect is the climates, on medium. The aura Consists of serial publication of numerous gas layers surrounding the globe. The atmospheric layers are the homosphere, troposphere, stratosphere and mesosphere [7]. These layers are separated by their temperature gradient with respect to the height. In FSO communication, we are concerned in the troposphere because this is where most weather phenomena occur and FSO links operate at the lower portion of this layer [7]. The troposphere is primarily composed of nitrogen (N<sub>2</sub>, 78%), oxygen (O<sub>2</sub>, 21%), and argon (Ar, 1%), but there are a number of other factors also such as water (H<sub>2</sub>O, 0 to 7%) and carbon dioxide (CO<sub>2</sub>, 0.01 to 0.1%), present in diminished measure. Besides these there are other small particles also such as haze, fog, dust, and soil [8] that contributed to the constitution of the air. The propagation characteristics of FSO through atmosphere drastically change due to the communication environment, especially, the effect of weather condition is substantial. The principal effects on optical wireless communication are absorbed, breaking up, and scintillation [9].

## C. RECEIVER

The receiver optics consist of five sections as indicated in Fig.2 receiver telescope, optical filter, detector, amplifier and demodulator.

1) In the receiver telescope, it collects and focuses the incoming optical signal along the photo sensor. Larger the receiver telescope, then it takes in more multiple uncorrelated radiation and focuses their average on the photo detector [10].

2) By inserting the optical filters that will allow mainly energy at the wavelength of interest to impinge on the detector and reject energy of unwanted wavelengths, the essence of solar illumination can be significantly minimized.

3) The sensor is a semiconductor device which changes the light energy into an electrical signal. The diodes are generally capacitive charged and turn back-biased [11]. The two most commonly used photodiodes are the pin photodiode and the avalanche photodiode (APD) because they have good quantum efficiency and are made of semiconductors that are widely and easily available at commercially [12].

III. Diversity

Diversity technique is one of the most effective techniques to overcome the effect of fading. The main idea behind the diversity technique is that the amount of fading will not be the same for all the optical wavelength, polarization, space, and time in the atmospheric channel which acts as a random media for propagation of signal. If one signal is faded deeply at some point of time then another path which is independent to the first path may have less fade and it may receive stronger signal. As there are more than one paths of received signal to select from, a large amount of improvement can be found in both the average and instantaneous SNR. Various types of diversity techniques are used to overcome the effect of fading which include wavelength diversity, time diversity, spatial diversity, polarization diversity and angle diversity. The SNR improvement is achieved using diversity without increasing the bandwidth and transmitted power [10]. The limitation of this technique is that the system complexity and cost increases.

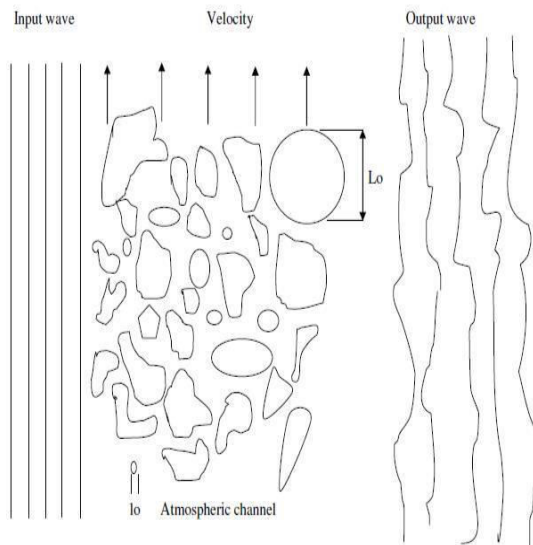


Figure:3 Turbulent channel model[5]

Atmospheric turbulence is induced in this due to the fluctuation of refractive index of the air. In a sunny day, the air near the earth surface areas get warmer than the air at the higher altitude because of solar radiation. This layer of warm air gets to be much less dense and then goes up from the earth to combine with the surrounding cooler air and due to that the air temperature fluctuation is randomly happen. And these variations of the atmospheric refractive index  $n$  arise along the propagation path of the optical ray caused by atmospheric turbulence. This fluctuation of refractive index is resulting from the various changes in atmospheric

temperature which is a fluctuating of the atmospheric air pressure, elevation, and time of the day and also wind flow speed. The environment includes several sizes of cell as shown in below figure.

IV. WAVELENGTH DIVERSITY TO MITIGATE THE EFFECT OF TURBULENCE

Scintillation can be reduced using the wavelength diversity i.e. sending the same signal using more than one laser with different wavelength. The effect of fading due to scintillation can be reduced because of the fading is not the same for different wavelength at the same time. If we put three different lasers having wavelengths  $\lambda_1$ ,  $\lambda_2$  and  $\lambda_3$  and arranging the lasers vertically at different positions (heights) and similarly employing these three separate detectors at the receiver as shown in figure 4, the signals travelling through the turbulent atmosphere undergo different amount of intensity fluctuations for the three different links. At the receiver, the signals are combined by a selective combiner, which results in better overall combined signal intensity.

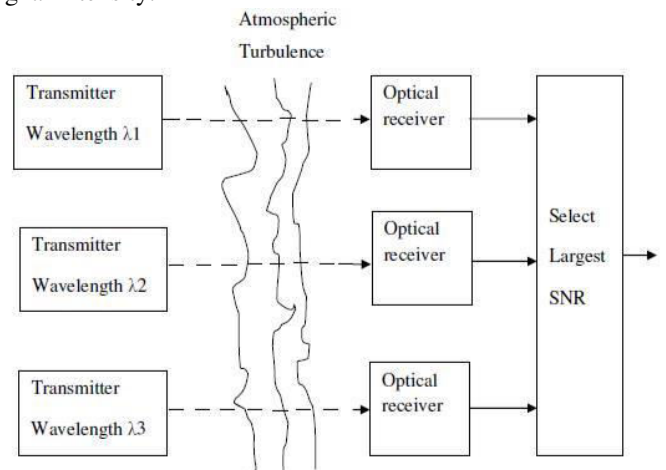


Figure:4 Block schematic of wavelength diversity technique[6]

Intensity fluctuation  $(\lambda_1, t) \neq$  intensity fluctuation  $(\lambda_2, t) \neq$  intensity fluctuation  $(\lambda_3, t)$ , where  $\lambda_1$ ,  $\lambda_2$  and  $\lambda_3$  are the wavelengths of the transmitters. As the normalized irradiation intensity at the receiver acts like a random variable, the SNR also becomes a random variable. Due to that probability of error also becomes a random variable. If the probability of error in link 1 with wavelength  $\lambda_1$ , is  $P_{x1}(x_1)$ , that of link 2 with wavelength  $\lambda_2$ , is  $P_{x2}(x_2)$ , and that of link 3 with wavelength  $\lambda_3$  is  $P_{x3}(x_3)$ , then generally  $P_{x1}(x_1) \neq P_{x2}(x_2) \neq P_{x3}(x_3)$ . By using the diversity technique described here takes advantage of the reality that the atmospheric propagation path of optical communication beam is statistically independent for different operating wavelengths and the intensity fluctuations and BER

performance will be enhanced because of the joint probability of error is always less than the probability of error from individual channels.

$$\begin{aligned}
 P_{x_1x_2x_3}(x_1,x_2,x_3) &< p_{x_1}(x_1), \\
 P_{x_1x_2x_3}(x_1,x_2,x_3) &< p_{x_2}(x_2), \\
 P_{x_1x_2x_3}(x_1,x_2,x_3) &< p_{x_3}(x_3)
 \end{aligned}
 \tag{8}$$

If  $P_{x_1}(x_1)$ ,  $P_{x_2}(x_2)$  and  $P_{x_3}(x_3)$  are independent which the case is generally, then the probability of error is given as,

$$p_{123}(x_1, x_2, x_3) = p_1(x_1) p_2(x_2) p_3(x_3)$$

The wavelength diversity techniques that can be used under this situation are selection diversity, Equal Gain Combining (EGC) and Maximal ratio combining (MRC). Selection diversity which is used in this analysis here is one of the simplest diversity technique in which the signal with largest SNR is selected by the receiver. Let  $\gamma$  is the threshold value of SNR that must be achieved for proper demodulation at the receiver side and  $\gamma_k$  be the instantaneous SNR of the kth branch. If there are M links (M transmitters and M receivers), the probability that bit energy to noise ratio of all the links are below the threshold  $\gamma$  th is

$$P_{out} = P(\max\{\gamma_1, \gamma_2, \dots, \gamma_k\} < \gamma_{th}) \tag{8}$$

where,  $P_{out}$  is the outage probability which is the probability that the instantaneous SNR falls below the threshold i.e. sensitivity of the receiver. The effect of fading is due to the scintillation that can be reduced because of the fading is not same for different wavelengths at the same time. Using this diversity technique, the same communication signal is transmitted with different wavelength. In that case the channel model which is given in equation can be written as [8],

$$P_{out,m} = \left[ 1 - \exp\left(-\frac{\gamma_{th}}{\mu}\right) \right]^M \tag{8}$$

Figure below shows the outage probability for diversity conditions and selection combining. It shows a plot between threshold values of SNR (in dB) versus outage probability for different number of channels. As shown in the figure, for the case of threshold SNR to Average SNR value of -40 dB, the outage probability is on the order of  $10^{-2}$ ,  $10^{-4}$  and  $10^{-6}$  respectively for single link, double link and three links. It is also clear that outage probability decreases with the increase of the number of elements (M) in the communication link. The outage probability can be reduced further by using more number of communication links but

there is a compromise between system complexity and cost.

Intensity variation due to atmospheric turbulence is random in nature but improved performance can be achieved in the proposed technique of wavelength diversity. Wavelength diversity is the case where the same signal modulates laser transmitter of different wavelengths. The probability of fading will not be similar at different wavelengths (i.e. 850 nm, 1330 nm and 1550nm) as the atmospheric turbulence is random in nature. The wavelength diversity can then improve the performance in terms of outage probability. A mathematical expression has been derived for the outage probability for number of independent links. It has been shown that the performance improves in terms of outage probability as we increase number of channels under diverse atmospheric conditions. Strong turbulence comes in to the picture when the link length is of several kilometers. However it increases system complexity and cost.

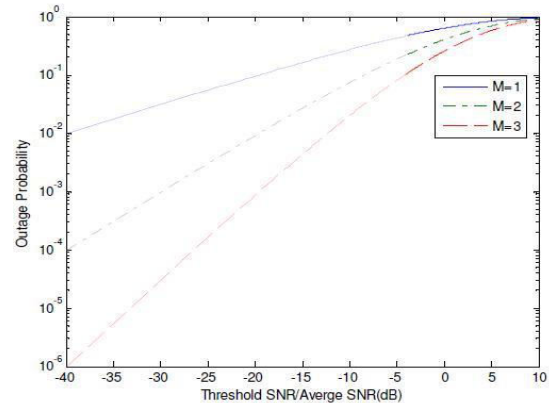


Figure:5 Outage probability under diversity conditions [8]

### V.CONCLUSION

Thus we conclude that the BER and quality factor of FSO communication link can be done better by using this technique of diversity. It is capable of doing full duplex communication for voice data & video. The fundamental challenge in FSO is the performance of transmission link in presence of attenuation & scintillation which decreases the reliability of FSO technology. Wave length diversity is a prospective approach to mitigate the atmospheric turbulence effect. The proposed wave length diversity based FSO technique is capable to provide reliable link between transmitter and receiver with better performance in terms of channel capacity & BER.

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# Survey Of Speaker Identification System Using Watermarking Technology For Spoofing Attack Of Voice Conversion

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**Abstract**— Speaker Identification (SI) technique determines which authorized speaker provides an utterance. Voice conversion (VC) method packs to hide the identity of the speaker. Spoofing attack, manipulates voice is employed as the system input, which is voice conversion. It is obligatory to protect speech samples from Spoofing attacks like one mimicry artist can impersonate the voice of many person so at that time this system fails to provide security. The security check of watermarking pattern juxtaposes speech samples from database to identify speaker at the end of the methodology. This paper discourses the survey of several techniques of Speaker identification, spoofing attack of Voice Conversion and the techniques of embedding watermarking patterns on various speech samples to avoid the false identification of a subject in Speaker Identification System.

**Keywords**—Speaker Identification; Voice Conversion; Watermarking; Spoofing Attack.

## I. INTRODUCTION

In this technological eon, security of any information is necessary. It is very onerous to identify which person is uttered from a group of people. At several large organizations security system deteriorates due to speech interaction. An unrevealed speaker may endeavor to peer with any one of speaker which exists in database. The speaker identification is the method to figure out which person is speaking at that time. Many challenges affect openly or tortuously to the speaker identification system. Several Spoofing attacks that effect the system are replay, impersonation, speech synthesis and voice conversion. Spoofing attack manipulates voice and employ as the system input, which is voice conversion [1].

Human mimicry is an example of impersonation. Speech synthesis is a method of effectuating expound language by machine on roots of written input. In Voice conversion, alteration of a person's original voice is software inaugurated. Replay is a speech played repeatedly. It is very difficult to distinguish natural and synthesized speech. The identification

system is based on security check of watermarking pattern. That gives more desirable identification culmination.

This paper is organized as succeeding: Section II outline speaker identification system. Spoofing attack in speech is discussed in section III. Section IV consists classification of watermarking in spoofing attack.

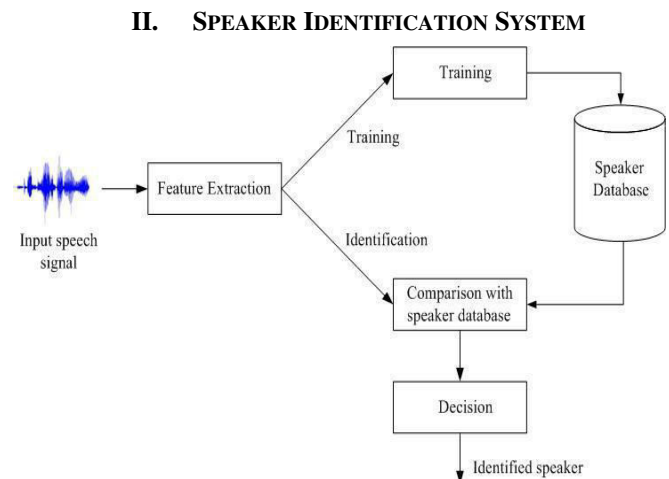


Fig. 1. Rudimentary Model of Speaker Identification System [2]

### A. PRE-PROCESSING

In speech dispensation short interval is called frames and its size is heed as 10 to 40ms. Because of this variation in signal is distinguishable in short time [3]. Various pre-processing techniques are pre-emphasis, framing, silence removal, pre-quantization and windowing.

### B. FEATURE EXTRACTION TECHNIQUES



Mel-Frequency Cepstral Coefficient

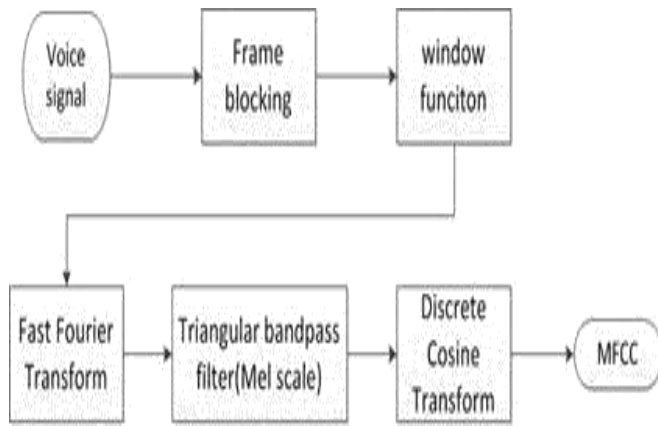


Fig. 2. Block Illustration of MFCC [4]

Framing is an approach of splitting the digitized speech samples into a small frame of span widespread from 20 to 40 ms [4] Several windows used for pre-processing are triangular, hamming, Hanning window. Among them hamming window is best as it changes phase of voice signals to a designated range to make signal more continuous. Fast Fourier Transform transmute each frame contains samples from time to frequency domain. Dispensation Of Mel Filter Bank: The magnitude, frequency which is equivalent to integrity at the center frequency and linearly, it diminishes response of each filter which is found to be triangular in outline and zero at middle frequencies of very adjoining filters. Discrete Cosine Transform is functional to transfigure the logarithmic Mel spectrum into time dominion consuming DCT.

➤ Vector Quantization

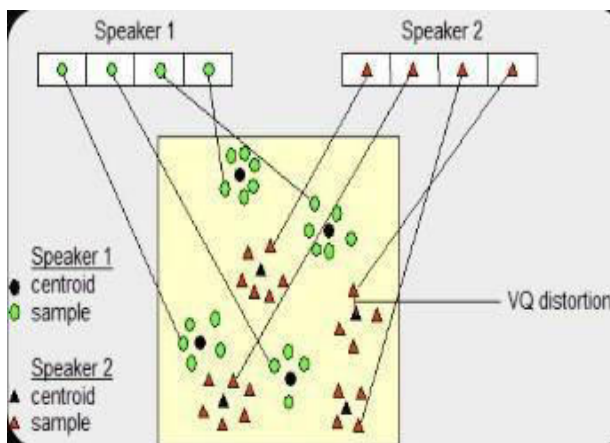


Fig. 3. Vector Quantization [5]

Example of two speakers and two dimensions of the acoustic space are represented by circles and triangles. VQ is a lossy data compression technique that maps vectors from large data sets from space to the finite number of vector from space.

Each region that are mapped are called clusters. Each cluster is represented by its centroid called as codeword. The collection of codewords of all speakers form a codebook.

Other feature extraction techniques are Linear Predictive Cepstral Coefficient[6][7], Perceptual Linear Prediction Coefficient[6][7], etc.

C. CLASSIFICATION TECHNIQUES

➤ Artificial Neural Network

An artificial neural network (ANN), is an interrelated collection of artificial neurons which uses a statistical and computational model for information indulgence based on a connectionist advance to calculation[8]. Mostly an ANN is a system that fluctuate its configuration based on exterior or interior evidence that flows during the network. The model can have different forms, such as multi-layer perceptions. A Multi Layer Percentron consist of one input layer, one hidden layer, and one output layer.

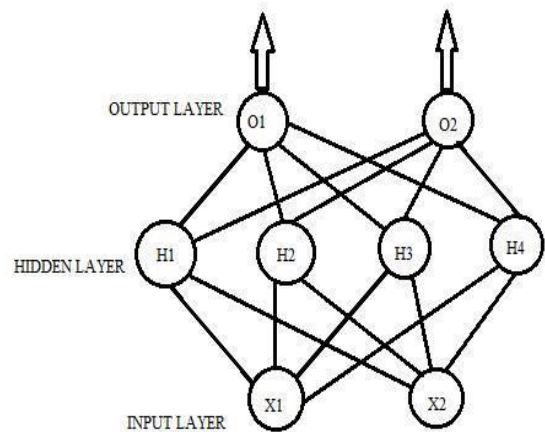


Fig. 4. Basic Model of ANN [8]

➤ Gaussian Mixture Model

In Gaussian mixture model, time consumed to establish using training phase is longer than the test phase. To speed up the process of obtaining the best parameters for Gaussian mixture model, it is obligatory to assess the initial parameters accurately. We use the K-means clustering to cluster the original feature vectors due to its fast, and worthy effect on clustering data.

Various classification techniques are Polynomial Classifier [9], Vector quantization [10], Support Vector Machines [11], Hidden Markov Model [12].

### III. SPOOFING ATTACK IN SPEECH

In Spoofing attack, manipulated voice is employed as the system input which is voice conversion. Numerous types of spoofing attacks are speech synthesis, impersonation, replay, voice conversion. In speech synthesis spoken language is generated on base of written input. In replay valid data transmission is deceptively repeated.

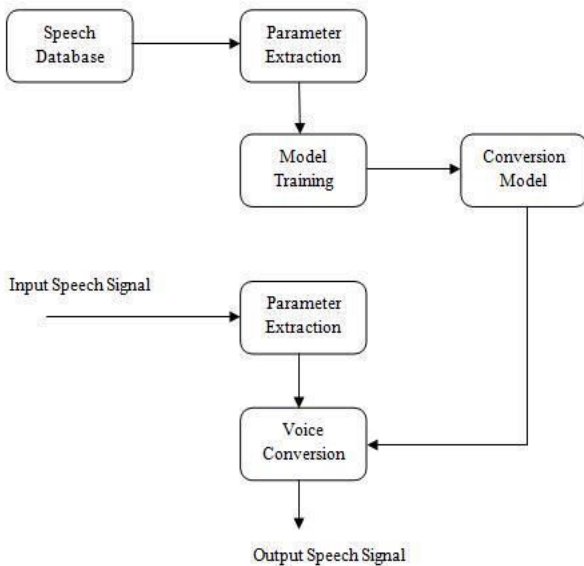


Fig. 5. Basic Block Diagram of Voice Conversion [13]

Voice conversion is constructed by establishing a speech record that reside speech signals both the source and target speaker’s [13]. Various parameters extracted from these signals are pitch frequency, power values and mel-cepstrum. An erudition method is obligatory to construct a conversion model. Model must be able to capture original signals and transform it into target signal. Once model is trained, we test and install it by providing as input the source speaker speech. From this the characteristics are extracted. Subsequently using this model, the target speech is established and the output speech signal is generated.

Various VC techniques are codebook mapping and VQ, HMM, GMM, ANN.

### IV. CLASSIFICATION OF WATERMARKING

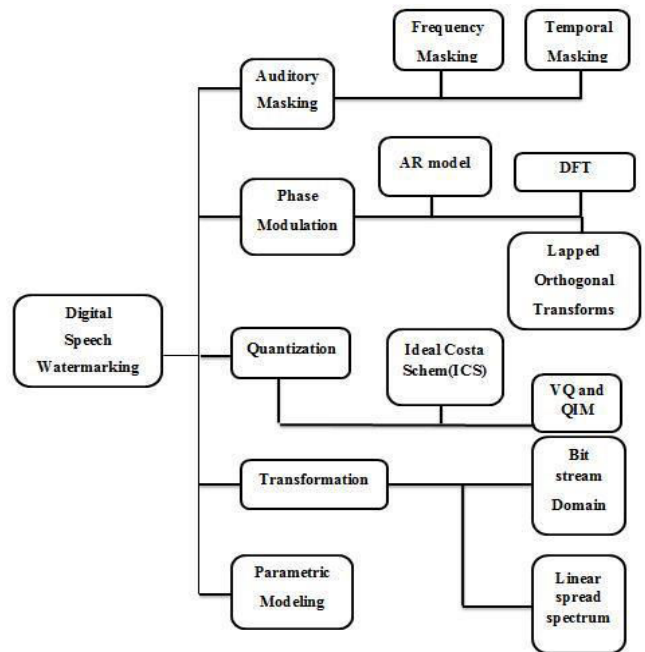


Fig. 6. Outline of techniques of Digital Speech Watermarking [14]

Probability of spoofing attack in the speaker identification system is at the input side or sensor side. The appealed speaker data is already aware about the watermark of the system so that playback attack is possible in input side. Attack is also possible with replay attack or direct attack. To avoid the system from the attack watermark technology.

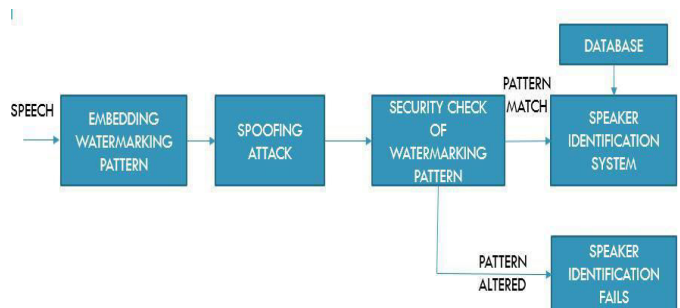


Fig. 7. Block Diagram of Speaker Identification System with Spoofing Attack Using Watermarking Technology

Fig. 7 shows that initially features are removed from claimed speech, moreover this features are feed to classification model formerly judgement is prepared. Entire process is same as speaker identification process. Though once speaker is identified, it is tested for watermark convenience. If watermark is existing in appealed speech, it says that the font of the requested speaker is unaffected. Or else, spoofing attack is occurred. Occasionally, it is probable to way the voice conversion attack for making judgement and finding the source of attack. In proposed system watermarking pattern is embedded which is attacked by spoofing attack. Among various spoofing attack we are going to consider voice conversion as it is a voice manipulated by some person to achieve target speech. Detection of watermarking is occurred and if the system fails to detect the watermarking pattern the Speaker Identification fails. If it is detected then speech signals are compared with already trained signal that are stored in the database, subsequently speaker is identified.

## V. PERFORMANCE MEASURING PARAMETER

### ➤ Parameters for watermarking detection

#### A. Bit Error Rate

For sample, bits to be transferred are 11001100 and expected bits are 10000100. Compare both amount of bits. Therefore, the BER in this sample is  $2/8 * 100 = 25$  [15]

$$BER = E/P \times Q \ 100\%$$

#### B. Signal to Watermark Ratio

Signal to watermark ratio is inspecting the effects of watermark on speaker identification system [1].

$$WSR = \frac{\text{Number Of Frame Used For Watermarking In Speech}}{\text{Number Of Total Frame In Speech}}$$

### ➤ Parameters to identify speaker

#### A. Percentage Of Identification Accuracy

$$PIA = \frac{\text{No. Of Correctly Identified Speakers}}{100 \text{ Total No. Of Speakers}} \times 100\%$$

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# Survey on Information hiding in speech signal

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**Abstract** - The purpose of this review paper is to provide concrete information about information hiding in speech signal. In recent years, due to the uninterrupted escalation of network bandwidth and the augmentation of network convergence gravitating, Voice over Internet Protocol (VoIP) is extensively used. This paper addresses the literature survey of information hiding in speech signal in time, frequency and wavelet and spectrum domain. The technique analyzed here are parity coding, echo hiding, phase coding(PE) least significant bits(LSB), spread spectrum(SS) technique, vector quantization(VQ), analysis by synthesis(ABS) based, quantization index modulation(QIM), which deals with information hiding in speech signal. Information hiding is deliberate in terms of embedding capacity, signal to watermark ratio, hiding capacity.

**Keywords**— *Information hiding; speech steganography; stego-signal; embedding; VoIP*

## I. INTRODUCTION

In information society, one of the most important features is information communication. New approaches of secure speech communication are planned to transmit security information via Voice over Internet Protocol (VoIP). In past few years, voice over IP (VoIP) has become a very popular Internet streaming media communication service. VoIP is suitable to enable hidden communication throughout IP networks. The main idea of information hiding derives from early steganography, more strictly called “information cover,” which literally means “covered writing”. Information hiding can also be called “information concealing”. Information hiding technology integrates several research subjects and technologies in various fields, such as communication, cryptography, network signal processing, and voice and image coding.

Information hiding in speech signal is done in time, frequency and wavelet and spectrum domain. Information hiding in the speech stream is distributed into three classifications according to their hiding positions. In first classification information are hidden in the compressed speech

stream directly changing the value of some code element. In second classification information are hidden in the prediction step of the short-term predictor (STP) of the speech codec. In third classification information are hidden in the long-term predictor (LTP), For example, When vector quantization (VQ) process of linear prediction coefficients are done at that time the quantization-index modulation(QIM) technique hide the secret information. In addition, in many codecs the linear predictive analysis-by-synthesis coding model is mostly used, that reduce the deformation by decoding the encoded signal.

The technique analyzed here are parity coding, echo hiding, phase coding(PE) least significant bits(LSB), spread spectrum technique vector quantization, analysis by synthesis(ABS) based, quantization index modulation(QIM), which deals with information hiding in low bit-rate speech codec. This paper presents different information hiding techniques and explores their potential and limitations to insure secure communication.

## II. DIFFERENT HIDING TECHNIQUES

### A. PARITY CODING

One of the prior works in audio data hiding technique is parity coding technique[7]. Instead of breaking a signal down into individual samples, the parity coding method breaks a signal down into separate regions of samples and encodes each bit from the secret message in a sample region's parity bit. If the parity bit of a selected region does not match the secret bit to be encoded, the process flips the LSB of one of the samples in the region. Thus, the sender has more of a choice in encoding the secret bit, and the signal can be changed in a more unobtrusive fashion.

### B. ECHO HIDING

Echo hiding technique [7] embeds secret information in a sound file by introducing an echo into the discrete signal. Echo hiding has advantages of providing a high data transmission rate and superior robustness when compared to other methods. Only one bit of secret information could be encoded if only one echo was produced from the original

signal. Hence, before the encoding process begins the original signal is broken down into blocks. Once the encoding process is done, the blocks are concatenated back together to create the final signal. To hide the data successfully, three parameters of the echo are varied: amplitude, decay rate and offset (delay time) from the original signal. All three parameters are set below the human hearing threshold so the echo is not easily resolved. In addition, offset is varied to represent the binary message to be encoded.

### C. PHASE CODING TECHNIQUE

In phase coding process the phase of an original audio segment is exchanged with a source phase that constitutes the information [8]. The phase of consequent segments is attuned with purpose of protect the comparative phase between segments. Phase coding is used as one of the most efficient coding process regarding the signal-to apparent noise ratio. In this process perceptible phase dispersion will arise due to phase change among each frequency component. On the other hand, given that the variation of phase is adequately small (adequately small depends on the viewer; proficient in broadcast radio can deduce variations that are minor to an average viewer), impossible to hear, that can be accomplished[8].

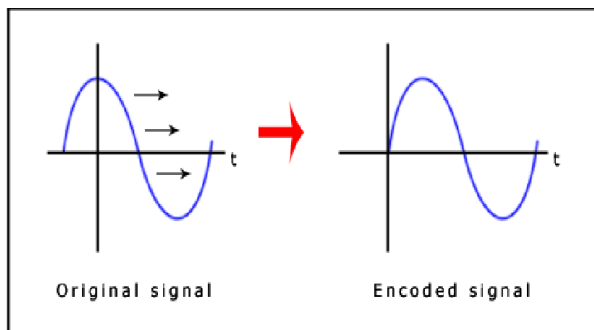


Figure:1 Phase coding technique [8]

### D. LSB CODING TECHNIQUE

LSB coding is one of the most widely used technique in information hiding in speech. LSB coding technique is based on replacing the LSB of binary string of each sample of digitized speech through binary identical of secret message [1]. For example in digitized speech the letter X (binary identical 1011000) is hidden where each of sample is constituted with 16 bits, then of 7 successive samples is replaced with each bit of binary equivalent of the latter X as illustrated in Table.

In data hiding as the number of LSB's can be increased, the resulting noise also increased in speech. By discarding entire LSB plane an attacker can simply perceive the message[2]. For that other bits can be flipped to facilitate a new sample which is closer to original that reduced embedding error. For example, if the original sample value was 4 (equivalent binary 0100) and bit which is hidden into 4<sup>th</sup> LSB layer is 1, then LSB algorithm produced sample contain value 12(equivalent

binary 1100) and result of planed algorithm produces sample which contain value 3(equivalent binary 0011), that is closer to original sample[7]. At receiving side, receiver desires admittance to the string of sample used in embedding method to remove a secret message from LSB encoded speech[4].

Table: 1 Example of LSB coding:[11]

Sampled Speech Stream (16 bits)	'X' in binary	Speech stream with encoded message
1101 1100 1011 1000	1	1101 1100 1011 1001
1000 1100 0011 1011	0	1101 1100 1011 1000
1011 1100 1101 1000	1	1101 1100 1011 1001
1000 1100 1011 1100	1	1101 1100 1011 1001
1011 1100 0111 1101	0	1101 1100 1011 1000
1000 1100 0011 1100	0	1101 1100 1011 1000
1101 1100 0111 1111	0	1101 1100 1011 1000

### E. SPREAD SPECTRUM TECHNIQUE

Spread spectrum technique spreads hidden signal data through the frequency spectrum [8]. Spread Spectrum (SS) is a concept developed in communications to ensure a proper recovery of a signal sent over a noisy channel by producing redundant copies of the data signal. In conventional direct sequence spread spectrum (DSSS) technique was applied to hide confidential information MP3 and WAV audio digital signals. For a better hiding rate of 20 bps, used SS technique in sub-band domain. Appropriately chosen sub band coefficients were selected to address robustness problem and resolve synchronization uncertainty at the decoder.

### F. VECTOR QUANTIZATION TECHNIQUE

The principle of vector quantization is block coding which used to compress media to make systematic use of network bandwidth and data storage space[5]. The hiding method for each watermark bit is accomplished by penetrating the best coordinated codeword for each LSP input and remaining LSP vector under the limitation that randomly selected bits are reliable with the watermark bits to be embedded. In each speech frame as a minimum 1 bits of watermark is hidden. For hiding more information and maintaining the watermarked speech superiority, the location of hiding is chosen for keeping the SNRseg in a fixed range.

In the watermark embedding system encoder penetrates for the codeword which gives the least deformation between the input LSP(remaining) vector and the recognized vector within the restriction of the index. Extremely adjacent reorganization vector may be get under the restriction, and the location preferring block may complete the predictable transaction between the quality and the payload[14].

Later than the replacement, the probability of distorted codeword (reorganization vector) best matches the input vector is extremely small. From Figure 1 it can be explicated

better. If no watermark bits embedded, input vector quantized as  $c1$  but using the perceptually insignificant bit replacement scheme, input vector quantized as  $c3$ ,  $c4$ ,  $c5$  and so on. The probability as  $c2$  should quantized extremely little. Since this is the best match penetrating method of vector quantization method, with this anticipated method  $c2$  would be selected, and that is reduced the distortion after watermark embedding.

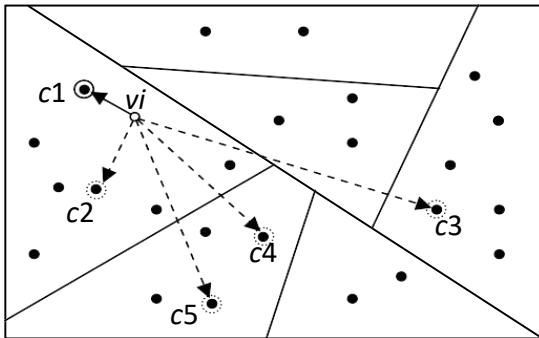


Figure: 2 Vector quantization [5]

G. ANALYSIS BY SYNTHESIS ALGORITHM

The key feature of ABS algorithm presents a speech synthesiser into the speech coder, relating with the speech analyser[9]. The speech coder produced synthesized speech and it would detect at decoder. Difference between the synthesised speech and original speech would be calculated and reduces the error between original speech and synthesized speech[10].

In this algorithm, speech coding data are employ as a carrier and a speech synthesizer is employ to hide confidential information into carrier through coding procedure. After hiding 1 bit of confidential speech into multi-codeword, the original speech and stego(mixed) speech are decoded separately. Difference between the original speech and synthesized speech is calculated as the minimum square error (MSE).

Two speech are recorded first, one is original speech and second is secret speech. The original speech carrier are used in embedding process to embedded the whole secret speech into it. The original speech carrier  $x(n)$  generating a vector or sub frame every five successive samples. An optimal code book's is length is 10bts. To minimize complexity of codebook search, it divided into two vector table in which one is shape codebook which contains 128 independent code vector and second is gain codebook that contain eight unit value that have zero symmetry. The shape codebook vector is selected as embedding parameters. An embedding encoder chooses a code vector depends on an embedded bit: if embedded bit is zero, it select code vector from TABEL-0 and TABEL-Z and if embedded bit is 1, it select code vector from TABEL-1.

ABS algorithm model:

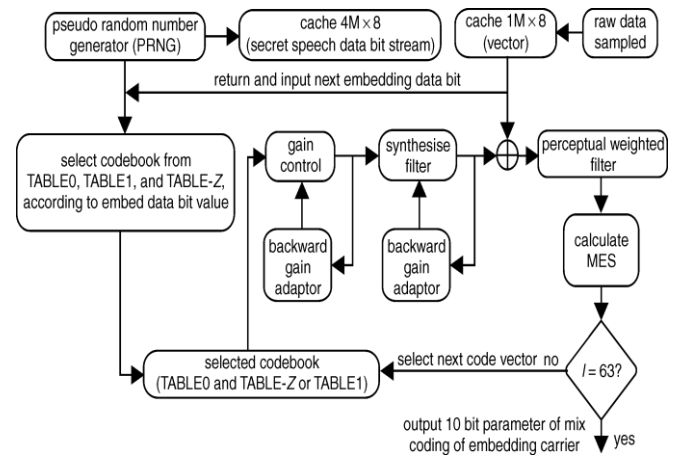


Figure: 3 ABS algorithm block diagram [9]

In gain controller select vector is amplified as an exciter of synthesis filter, forming a local decoded signal. The frequency weighted MSE between the local signal & original signal is computed to maintain minimum error. Using last quantize gain of excitation signal the excitation gain is extract and update one-by-one vector. The frequency weighted MSE is calculated[9].

$$MSE = \|x(n) - \tilde{x}_{ij}\| = \sigma^2(n) \|\hat{x}(n) - g_i H y_j\|$$

Here, H stands for response function of synthesis filter cascade with perceptual weighted filter.  $g_i$  is  $i^{th}$  gain value of TABLE-Z.  $y_j$  is  $j^{th}$  code vector in TABLE-0 or TABLE-1[9].

$$\hat{x}(n) = \frac{x(n)}{\sigma(n)}$$

H. QUANTIZATION INDEX MODULATION(QIM) METHOD

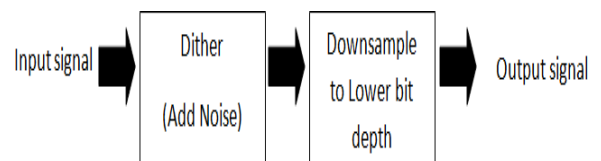


Figure: 4 QIM method [12]

In Quantization index modulation method one confidential bit is hided in each index[10]. The aim of this scheme is to split the entire codebook in two parts and allocate a label '0' or '1' to all codeword. Simply the equivalent part of the codebook is used while a secret bit is embedded. At receiver, the hidden bit is removed by examine where codeword belongs to in entire codebook. The receiver is capable to remove the message directly from the compressed speech stream when the channel is reliable. At same instance instead of searches whole codebook the embedding algorithm

searches only in half of codebook, so additional delay does not appear. The distortion is augmented as the number of code words used in quantization is reduced. To reduced distortion, the most important duty is to discover an ideal codebook divider system. The Complementary Neighbour Vertices (CNV) algorithm is used for that[11].

### III. PARAMETRES SIGNIFYING AMOUNT OF INFORMATION EMBEDDING

The signifying amount of information embedding parameters are listed below[12]:

1) **Data Hiding capacity (DHC)**: it is the ratio between the total summation of number of variable length frames to the number of variable length frames in the unvoiced periods of the speech signal. Data hiding capacity is associated with the number of data keys or a particular pattern signifying the secret data pattern for a particular look up table of different entities to show the steganographic data information to the receiver.

The hiding capacity is defined as:

$$DHC = \frac{\text{Summation of number of variable frame length}}{\text{Total number of variable length frames in silence periods}}$$

2) **Data embedding to signal ratio**: This specific parameter indicates the amount of secret data which can be fetched at the receiver in the form of variable frame of silence speech signal.

Data embedding to signal ratio can be computed as follows:

$$\frac{\text{Number of frames utilized for information embedding in speech}}{\text{Number of total frames in the speech}}$$

3) **Data embedding utility factor**: it is defined as the ratio of no of frames utilized for data embedding to the total number of frames of silence passage. This parameter is associated with the summation of total variable length frame number incorporated in modulo mathematical operation to hide a specific secret data and total number of silence speech samples in the speech wav file. The variable frame length number is always greater than the size of minimum silence interval which is equal to one frame size of the speech It is calculated as following

$$\frac{\text{Number of frames utilized in data embedding}}{\text{Total number of frames of silence intervals of speech signal}}$$

### IV. SUBJECTIVE AND OBJECTIVE MEASURES

In subjective estimation, MOS analysis is being shown[12]. MOS (Mean opinion score) that is used to conclude the superiority of the quantized index modulated speech at the output of transmitter which is nothing but the hybrid steganographic or watermarked speech. The quality of output speech is requested to observe by randomly 5 to 10 persons. They requested to rate the quality of the speech signal according to the options accessible in Table 2 by playing the speech in noiseless environment.

Table:2 MOS rating [12]

Sr No	Choice	MOS
1	Excellent	1
2	Good	2
3	Fair	3
4	Poor	4
5	Unacceptable	5

To analyses the concert of these all techniques, the indiscernibly and detecting rate of hidden information are estimated. Two objectives are used to evaluate difference between original speech and secret speech which are: PESQ (perceptual evaluation of speech quality) and SNRseg (average subsection signal-to-noise ratio).

For anticipating the subjective quality of speech PESQ is used[8]. Perceptual based study is performed by analysis of perceptual evaluation of speech quality (PESQ). PESQ is intended to analyze particular parameters of audio, including time warping, variable delays, transcoding, and noise. Higher the MOS (mean opinion score) value better the subjective speech quality. The rate of SNRseg represent the deformation quantity induced by the embedded information in the original speech  $S_c(m,n)$ . In speech signal noisy signal's SNR is below 20dB as well SNR of 30 dB and above denoted that speech signal is conserved. SNR rate is obtain by following equation[8]:

$$|SNR_{dB} = 10 \log_{10} \left( \frac{\sum_{n=1}^N |s_c(m, n)|^2}{\sum_{n=1}^N |s_c(m, n) - s_s(m, n)|^2} \right)$$

$s_s(m, n)$  is the stego-audio signal where:  $m = 1, \dots, M$  and  $n = 1, \dots, N$ .  $M$  is the number of frames in milliseconds(ms) and  $N$  is the number of samples in each frame.

### CONCLUSION

In recent years due to widely use of internet streaming, security against digitized audio or speech is required. This

paper presents the information hiding techniques to achieve high efficiency and best security. These techniques have their own potential and limitation to insure secure communication. Also, differences between reviewed techniques are based on their application in which they used their hiding capacity and hidden information security level.

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# Survey on Bandwidth Extension Techniques of Speech Signals

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**Abstract**—The narrowband frequency range from about 300 Hz to 3.4 kHz. So, the audio quality of telephone network is restricted. Bandwidth extension(BWE) is used to extend narrowband(NB) frequency range to wideband(WB) frequency range which is 50 Hz to 7 kHz and wideband frequency range to super wideband(SWB) frequency range which is 50 Hz to 14 kHz. This bandwidth extension can be realized with or without side information. The Bandwidth extension is performed by adding missing frequencies artificially at the receiver using information contained in narrowband signal or either using some low bit rate side information. The basic principles of bandwidth extension addresses by this review paper and discuss different methods of bandwidth extension from narrowband to wideband and narrowband to super wideband.

**Keywords**— *bandwidth extension; narrowband; wideband; super wideband*

## I. INTRODUCTION

The main aspect of digital telecommunication systems is quality, clarity and naturalness of the speech. The telephone frequency range is 300 Hz-3400 Hz. Due to this limited bandwidth the speech quality is degraded. To improved speech quality and intelligibility many noise reduction and error cancellation techniques are used still it may sound unnatural and muffled. Human speech includes more frequency components compared to narrowband telephony speech[1]. For that bandwidth extension is used, which extend speech signal from narrowband to wideband, wideband to super wideband and narrowband to super wideband. Where narrow band frequency range is 300 Hz to 3.4 kHz, wideband frequency range is 50 Hz to 7 kHz and super wideband frequency is 50 Hz to 14 kHz.

The bandwidth extension is performed by with or without side information. At user end terminal, the absent frequencies of speech is added artificially using information contained in NB speech. Otherwise, side information is used for bandwidth extension. Artificial bandwidth extension is evaluated by pattern recognition methods, which is Hidden Markov Models (HMMs) and Gaussian Mixture Models (GMMs).

The telephony frequency range has been used in PSTN and also in 2G wireless communication system such as GSM. The narrow band speech quality degradation is mainly due to some

information is lossed in 50 Hz to 300 Hz and 3.4 kHz to 8 kHz[2]. Which creates muffled voice and reduced the speech quality and clarity. These all problems solution is explain in next sections. Now in paper, next section A is an implementation of wideband coder. In section B, implementation of narrowband coder with basic two approaches. And in last super wideband extension and its comparison with wideband.

## II. BANDWIDTH EXTENSION

The Bandwidth extension is perform by adding missing frequencies artificially at the receiver[4,9] using NB speech contents or either using some low bit rate additional information. At user end terminal, natural speech is generated by BWE. There are main two methods for BWE, which is distinguished as:

- └ BWE without additional information
- └ BWE with additional information

Bandwidth extension is applied for receive better quality speech. There is a no requirement of modification at the transmitter and also in network. For reverse process the NB encoder has been replace by WB encoder. Normally, all of the systems described below to generate NB to WB speech signal. This WB speech can be applied another time to achieve super-wideband (SWB) speech signal.

### A. BWE without additional information

BWE without side information means signal bandwidth is widening artificially, by producing missing frequencies at receiver using narrowband signal. So, bandwidth extension without additional information is called Artificial Bandwidth Extension (ABWE). ABWE techniques can be categorized into below two parts :

- Model based methods
- Non-Model- based methods

#### 1)Model based methods

A very good characteristic of this model is that the vocal tract transfer function  $H(z)$  is much alike for persons pronouncing the same sound. That is the position of the formants only varies slightly within a certain region, which makes clustering of envelopes producing a certain wideband

sound feasible. If this was not the case, as for e.g. power spectra, then a requirement would be that an estimation model had to be developed individually for each person. This would not be very feasible. Based on these assumptions, one statistical model based on a priori knowledge would be sufficient. Because the period of the pulses in the excitation signal changes from person to person, this signal is not speaker independent. Because of this changing pitch from person to person, it would not be very feasible to develop a model, to estimate the higher frequencies of the excitation. It would require different models for different pitch periods[3].

The bandwidth extension problem, when applying the source-filter model, can therefore be of the properties of the envelope, extension of the spectral envelope can be done by applying a priori knowledge when estimating. This is e.g. done by simple classification using codebooks or other estimation models based on e.g. a GMM or Hidden Markov Models (HMM).

By exploiting the acoustic theory behind speech production, the source filter model has been derived. This model can now be utilized to extend both the excitation and the envelope of narrowband speech signals. Fig. 2.2 shows how it would be possible to obtain a wideband speech signal by bandwidth extension.

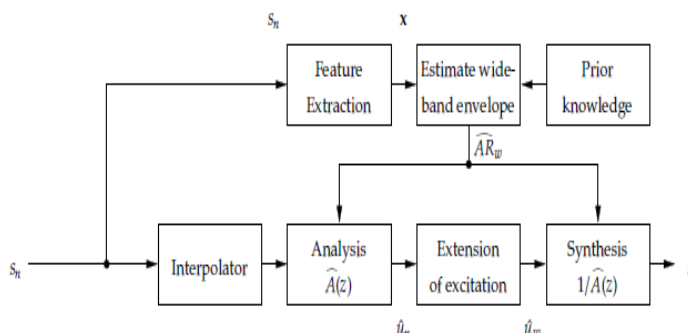


Fig. 1. System overview of how a possible BWE system might work<sup>[11]</sup>

## 2) Model based methods

Feature vectors  $x$  are extracted from the narrowband signal  $s_n$  and from these a set of wideband AR-coefficients are estimated. To obtain a wideband estimate  $\hat{s}_w$ , the narrowband speech is first interpolated and then fed to an analysis filter  $\hat{A}(z)$  obtained from estimation of the envelope. The excitation  $\hat{u}_n$  is then extended and given to the synthesis filter  $1/\hat{A}(z)$ . A wideband estimate  $\hat{s}_w$  of the speech is obtained by this process.

The Artificial Bandwidth Extension is separated into two different functions based on this model is as below:

- a) Extension of envelope
- b) Extension of excitation

### a) Extension of envelope

A set of narrowband features  $x$  for estimating another set of features  $y$  representing the extensionband envelope. This estimate is based on prior knowledge obtained from training different models. The quality of the estimator, which yields the estimate, is highly dependent on the training of prior knowledge. Therefore training and estimation is given the primary focus. Three methods for generating the primary knowledge are presented and implemented. The methods will be presented in the order given below[11]:

**Codebook:** The codebook contains mean values obtained, by clustering the features. The estimate is then obtained by quantizing the narrowband feature vector and using the mean value of the cluster.

**Gaussian Mixture Model:** The GMM is able to model the probability density function of the data and thereby avoid quantization of the data. The quantization of the narrowband feature,  $x$ , can result in valuable information about the extensionband being lost. The GMM method therefore achieves better results than the codebook solution.

**Hidden Markov Model:** The HMM is able to model hidden information, e.g. how a speech sequence evolves over time. Therefore it utilizes information about previous frames to estimate the extensionband. The HMM is the most sophisticated method of the three methods.

### b) Extension of excitation

The input signal to the extension of excitation block is the narrowband excitation signal,  $u_n(k;m)$ , and the output is an estimate of the wideband excitation,  $\hat{u}_w(k;m)$ . An important property of the block, is the block to be transparent, i.e. no modifications are made in the narrowband frequency region. Besides this property it should be able to give a good estimate of the missing excitation signal bands. A good and sufficient estimate would be an estimate, which results in no perceptual differences between the estimate and the original wideband.

In this excitation extension, the important feature is the regeneration of the HB /WB excitation signal. It doubles the sampling rate (8 kHz to 16 kHz), which is the main aim of the excitation extension and also the whole spectrum should be kept flat. The harmonics contained in the NB excitation should also be transferred in the WB excitation.

There are some known technologies which are used to generating HB excitation signal from the given input NB residual signal. Which are spectral folding, spectral translation, non linear processing, noise modulation, full wave rectification[5].

### B. Non-Model-Based Techniques

BWE without make use of source filter model was proposed in the literature Bandwidth Extension of non model based technique not including excitation extension and filter independently was used in several techniques. In Non-linear processing method[6], the HB signal from high pass filter is

send to shaping filter and added to input telephone band pass signal. Yasukawa[7] presents a nonlinear mapping based expansion technique, it uses rectification to generate the spectral components of expansion band. Nonlinear processing is having small computational cost of the implementation and allows robustness. Although the main disadvantage of the nonlinear processing is the quality of expansion. This technique does not regenerate good quality HB signal and furthermore require subjective power level adjustments.

Adaptive Spline Neural Network [8] approach consists of designing a network using neurons containing an adaptive parametric Spline activation function. Each neuron performs a weighted sum of the parametric inputs and computes the output using the spline activation function. This function is a smooth curve whose shape is determined by the control points defined in the construction of the neural network. The weights associated with the input of each neuron are obtained in a learning algorithm that minimizes some error.

Algorithm proposed in [9] uses spectral folding for an initial bandwidth extension, classifies the speech frames roughly into three phonetically motivated categories: sibilants, plosives and the rest of the speech sounds, referred to here as voiced sounds and shapes the magnitude spectrum of the extension band using a Spline curve. H. Pullakka [9] has produced better results than other approaches.

### III. LIMITATIONS OF BWE WITHOUT ADDITIONAL INFORMATION

All techniques of BWE without side information transmission are examined in the prior part. All have major benefit of backward compatibility in legacy telecommunication system and also with regard to receiver[9]. In these all methods, using features of NB speech better estimation of HB envelope. But these all techniques have several drawbacks in implementation point of view.

The drawback of BWE without additional information is that an precise envelope estimation generally includes a difficult speaker-dependent training process of statistical models, which is not possible for real-time application[4]. Although BWE with speaker-independent training process can also be performed which is off-line, at the receiver WB speech recovery degrades the output speech quality. Thus, BWE without additional information is not enough for good quality WB speech reconstruction at user-end terminal.

The superior outcome for stand-alone BWE can be produced, if the networks have an individual training process for an all speakers and also for a particular language. Although, in both the instances, the quality of this method is not good compared to input WB speech signal[4].

### IV. BWE WITH ADDITIONAL INFORMATION

All the techniques studied in above chapter are bandwidth extension without side information. These all methods are used to estimate high band features using only narrow band speech features. So the drawback is that an accurate estimation of envelope requires a speaker dependent training which is not applicable for real time application. BWE without side

information is not enough for better quality wide band signal reconstruction at end terminal.

These all limitation can be control by sending side information at the transmitter and at the receiver wideband speech is retrieve back. High band feature parameters are estimated and encoded at transmitter as a side information of original signal. At receiver side, these parameters are transmitted and estimate high band envelope.

In traditional method is providing side information transmission which is not compatible with network. For that solution data hiding scheme is used. The side information is transmitted as a hidden data inside narrow band speech signal. At the user end terminal this hidden data is decoded and extracted. Which gives estimated the wide band speech and speech quality is improved.

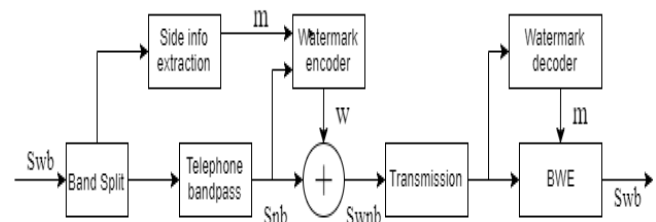


Fig. 2. BWE with additional information algorithm<sup>[4]</sup>

The algorithm of bandwidth extension with side information is shown in fig. 2. At the first original speech(wideband speech) is band spitted and separate narrow band and high band components. This narrow band speech given to narrow band encoder to encode the speech. And high band features are encoded with side information. These encoded speech is watermarked inside the narrowband speech in narrow band coder. At the end terminal this hidden data is reproduced and bandwidth extension is applied to produce WB speech signal.

### V. CONCLUSION

This paper addressed the problem of Artificial Band Width Extension (BWE) of speech. Bandwidth extension is motivated by the limited frequency range in ordinary telephone networks. This limitation in bandwidth is due to standards from the old analogue telephone networks. By reducing bandwidth, we simultaneously reduce the quality of the speech signal. If the receiver is capable of playing wideband signals, quality of the speech signal could be increased by processing the speech before playback. This is attractive as the potential quality improvement comes without increasing the bit rate, i.e. no extra information is required to be transmitted over the channel. In artificial BWE, focus has been to process narrowband speech signals without increasing the amount of information sent over the channel and without modifying the transmitting side. From our point of view, if side information are to be sent, the solution might as well be to use a true wideband codec. The desire was to develop a feasible solution without modifying the existing network, and only introducing modifications at the receiver. It is chosen to use a parametric approach by using the source filter model, and there by

exploiting characteristics in the speech production system. In this way it is possible to utilize statistical tools for estimation.

ABWE is used to enhance the speech quality and intelligibility of bandlimited signal (NB speech) thus the enhanced speech signal reducing the listening effort. One of the earliest ABWE techniques estimates the parameters of a source filter model utilizing only the information available in NB signal. The theoretical performance upper bound on this estimation of ABWE is improved by using additional information extracted from the original speech signal. The additional information when transmitted through a separate channel compromises the backward compatibility of the communication network. Further works done using BWE with embedding additional (side) information solves the backward compatibility problem by embedding the additional information as a digital watermark into the NB speech.

Bandwidth extension as presented here has primarily focused on improving narrowband telephone speech on a wideband capable terminal. Even after a transition phase where true wideband exists in communication systems, there will be a need for BWE. It can be incorporated into wideband speech codecs, in order to maintain low bit rates. Finally historical recordings could be bandwidth extended in order to obtain a wideband version of the recordings.

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# *PVD and HVOF coatings for industrial applications-A Review*

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**Abstract**—A coating is a covering process that is applied to the surface of a material which is referred to as the substrate. When one or two component come in contact through mechanical action wear occur on both surfaces. From a scientific point of view, particle velocity and particle temperature, together with substrate temperature, are the main parameters affecting the deposit formation. Various techniques are employed to protect the material from degradation. High-velocity oxy-fuel (HVOF) spray coatings and Physical Vapour Deposition (PVD) coatings are gaining popularity. The reasons being exceptional hardness, wear resistance and cost effectiveness. In this paper some papers on such coating techniques have been studied for a comparative idea of HVOF and PVD wear resistant coatings.

**Keywords**—HVOF, PVD, Coatings for industrial applications

## I. INTRODUCTION

A coating is basically a covering which is applied to the surface of an object, usually referred to as the substrate. The application of coating can be decorative, functional, or both. The coating itself may completely cover the Substrate, or it may only cover parts of the substrate. Paints and lacquers are coatings that have dual uses of protecting the substrate and being decorative, although artist's paints are used only for decoration, and the paint on large industrial applications are presumably only for the function of preventing corrosion. Some functional coatings are applied to change the surface properties of the substrate, such as adhesion, wet ability, corrosion resistance, or wear resistance. Coating can range from a simple brush for painting a wall, to some very expensive machinery which is used for applying coatings in the industry. Coatings deposited by thermal spraying (TS), physical vapor deposition (PVD) and chemical vapor deposition (CVD) processes are used extensively in industry.

## II. COATING METHODS

### A. Industrial applications of coatings

Many industrial sectors, including transport, power generation, manufacturing, aerospace, and automobiles, are seeking new functional coatings, engineered surfaces, and interfaces in order to meet increasingly demanding performance requirements. Specifically, improvements are sought in the tribological properties (i.e., wear and corrosion resistance) as well as characteristics such as long-term stability in hostile environments.

### B. Most prevalent spray coating techniques

Spray coatings are deposited by different processes viz. high velocity oxy-fuel (HVOF), Physical Vapour Deposition (PVD) Technique, Chemical Vapour Deposition (CVD) Technique, plasma spray technique, etc. The deposition process and process parameters are also seen to have an important influence and this review addresses the effects of these on PVD and CVD overlay coatings.

In the high velocity oxygen-fuel (HVOF) process, liquid or gaseous fuel and oxygen are injected into a confined combustion chamber, then ignited and burned to produce heat and pressure. The velocity of combustion products is accelerated by passing through a convergent-divergent nozzle or a convergent nozzle. The powder feed stocks are injected into the combustion flame jet and subsequently are heated and accelerated through heat and momentum transfer from the flame jet. Compared to other spray processes the HVOF process has special features of higher particle velocity and lower particle temperature, which give it a superior ability in producing denser, more wear resistant and more corrosion-resistant coatings. It has been widely used to deposit carbide-based cements, metals and alloy coatings such as WC-Co, nickel and stainless steel materials.

PVD coatings were developed in 1852 by Faraday and the process encompasses three different techniques: evaporation, sputtering and ion plating. In terms of industrial applications, blades are coated with PVD coatings in order to extend their life in the gas turbine industry whilst in tool making applications, TiN coatings have been deposited using the PVD techniques onto high speed cutting tools and punches in order to improve their wear resistance[1-2]. In terms of industrial applications, blades are coated with PVD coatings in order to extend their life in the gas turbine industry whilst in tool making applications, TiN coatings have been deposited using the PVD techniques onto high speed cutting tools and punches in order to improve their wear resistance.

CVD coatings were not introduced until the 1950s and involved the deposition of a solid material from the vapor phase onto a heated substrate as a result of a set of chemical reactions. In order to enhance the process a gas plasma was incorporated. This enabled improved control of the residual stresses within the coating, thereby allowing the possibility of relatively thicker coatings to be incorporated at a higher deposition rate.

### III. LITERATURE REVIEW

*Prof. J. D. Majmudar* presented a detailed evaluation of wear and corrosion resistance properties of laser surface alloyed of AISI 304 stainless steel with WC+Ni+NiCr (in the ratio of 70:15:15) has been undertaken. Laser processing has been carried out using a 5 kW continuous wave (CW) Nd:YAG laser (at a beam diameter of 3 mm) by surface melting and simultaneous deposition of precursor powder mixture in the melt zone (at a flow rate of 10 mg/s) and using Ar shroud at a gas flow rate of 5 l/min. Followed by laser processing, a detailed evaluation of fretting wear behavior has been conducted against WC surface. Finally, the corrosion property is measured using a potentiodynamic polarization testing unit in a 3.56 wt.% NaCl solution. The wear resistance property is significantly improved due to laser surface alloying which is attributed to the improvement in surface micro-hardness to 1350 VHN as compared to 220 VHN of as-received -stainless steel substrate. The mechanism of wear is established. The pitting corrosion resistance property is also improved due to the presence of Ni and Cr in solution and homogenization of microstructure due to laser processing. In above present study, a detailed evaluation of wear, corrosion and erosion resistance properties of laser surface alloyed AISI 304 stainless steel with WC+Ni+NiCr (in the ratio of 70:15:15) has been carried out. The effect of laser parameters on the wear and corrosion behaviors has also been investigated in details. From the detailed investigations the conclusions were drawn[3].

*D. Chicot, et. Al.* studied the adhesion and hardness of Diamond-Like Carbon films are improved by nitriding of the steel substrate prior to PVD deposition. Since the mechanical

properties of the nitrided steel layer are not homogeneous, i.e. a significant hardness decrease is observed in the upper nitrided layer close to the surface, an outer surface layer of ~15  $\mu\text{m}$  is removed prior to the film deposition. In the presentwork, a 316L stainless steel substrate is nitrided in a cyanide–cyanate solution at 570 °C during 3 h. The coated system involved the deposition of a hydrogenated, amorphous carbon (a-C:H) solid lubricant of ~2  $\mu\text{m}$  including a chromium carbide interlayer. The comparison between the hardness behavior of the DLC/steel and the DLC/nitrided steel systems reveals the existence of a very important hardness gap, which highlights the benefit of the nitriding treatment prior to coating deposition. In addition, the micro-hardness-depth profile is determined from a load–depth curve, by applying a simple hardness model. The predicted change in hardness is found to be in a very good agreement with the experimental profile, which allows the hardness determination both in the white layer and in the diffusion zone over ~30  $\mu\text{m}$  in total depth. However, only the composite hardness modeling allows the accurate determination of the intrinsic hardness of the film. Nitriding the 316L stainless steel substrate gives rise to an extension of the load-bearing capability of the material up to a depth of ~30  $\mu\text{m}$ , which provides an adequate support for the DLC film deposition. The mechanical characterization of the nitrided steel layer prior PVD coating showed that it is necessary to remove ~15  $\mu\text{m}$  of the layer close to the outer surface, which exhibits a decrease in hardness. The microstructural analysis of the nitrided material showed that this impairment in hardness could be due to the presence of nitrides and carbides, together with deformation bands. The model applied to the Martens hardness values calculated over the entire load depth curve in micro-indentation, allows an accurate determination of the hardness–depth profile. However, in order to determine a precise value of the thin film hardness, two important corrections should be taken into account. Firstly, the frame compliance of the instrument and secondly, the rounded tip effect on the contact area. The DLC film was found to have hardness of ~18 GPa and from the substratecoating interface to the substrate core, over an extension of ~25  $\mu\text{m}$ , the hardness was observed to vary from ~10 to ~2 GPa. Hardness measurements conducted on the cross section of the nitrided and coated steel does not allow the determination of the DLC hardness due to the thickness of the film[4].

*D. Lopez, et. Al.,* studied the effect of particle velocity and mean impact angle on the corrosion–erosion of solubilized AISI 304 and quenched and tempered AISI 420 stainless steels was studied. The tests were performed using slurry composed of 0.5M H<sub>2</sub>SO<sub>4</sub> + 3.5% NaCl and 30 wt% quartz particles with 0.21–0.30mm mean diameter. Potentiodynamic curves, AFM and SEM analyses allowed identification of the wear mechanisms and assessment of the degree of surface damage. The slurry temperature was monitored and pH of solution and solid contents of the slurry were fixed during the tests. The results obtained for AISI 304 steel showed a gentle degradation regime for normal incidence and low impact

velocity ( $4.5\text{ms}^{-1}$ ), while a severe degradation regime was found for grazing incidence and high impact velocity ( $8.5\text{ms}^{-1}$ ). The severe condition was characterized by intense plastic strain and formation of lips and prows. Mechanical effects were predominant over the corrosive ones, and the surface behaved mainly in a ductile manner. The results obtained for AISI 420 steel revealed a marked corrosion influence on degradation mechanisms. Moderate degradation was predominant at low impact velocity, while severe damage arose for higher velocities and both grazing and normal impact. Uniform, inter-granular, pitting corrosion and corrosion-assisted erosion were the main degradation mechanisms. The higher corrosion–erosion resistance of the AISI 304 was attributed to its better response to corrosive attack, this factor being more relevant than hardness. Degradation of AISI 304 stainless steel under corrosion–erosion conditions was mainly determined by the mechanical action of impacting particles. The more severe condition was obtained for grazing incidence and high impact velocity. On the other hand, degradation of AISI 420 stainless steel occurred essentially by chemical action, being observed a severe condition for high impact velocity regardless of the impact angle. Localized plastic strain at the surface of the steels was responsible for reduction in the measured mass loss of the specimens. However, it can be said that the surface damage increased with impact velocity for both steels. For high impact velocities, significant differences between surfaces tested in normal and oblique conditions were observed, being more critical the grazing impact condition[5].

**Darja Kek Merl, et. al.**, A comparison was made between the electrochemical corrosion behavior of chromium carbonitride (Cr-(C,N)) and chromium nitride (Cr-N) coatings produced by evaporation in a thermionic-arc ion-plating apparatus at  $450\text{ }^{\circ}\text{C}$ . These coatings were deposited on substrates in the form of discs of mild-steel (CK 45) and stainless-steel (SS 304). Potentiodynamic polarization tests, electrochemical impedance spectroscopy (EIS), and scanning electron microscopy (SEM) were the techniques used to characterize the corrosion behavior. The potentiodynamic tests revealed the current density versus potential for the coated and uncoated substrates and the difference in their corrosion potentials ( $E_{\text{corr}}$ ). In all cases the  $E_{\text{corr}}$  shifted to a more positive potential after the coatings were applied. The electrochemical impedance spectroscopy measurements as a function of immersion time were carried out in a  $0.5\text{M NaCl}$  solution at the  $E_{\text{corr}}$ . The corrosion properties, lower current density, and higher polarization resistance were found to be two to six times better than the uncoated substrate for the Cr-(C,N) coatings and two orders of magnitude better for the Cr-N coatings[6].

**Lei Shan, et. al.** studied, four CrN coatings deposited on 316L stainless steel by multi-arc ion plating. The tribological behaviors of the CrN coatings were investigated by ball-on-disk tribo-meter in sea water. The microstructure and wear track were investigated by scanning electron microscopy

(SEM), energy dispersive spectroscopy (EDS) and profilometer. The result shows delamination is critical to wear failure of CrN coatings in sea water and micro-cracks play an important role in the evolution of delamination. The most effective approach to eliminate the delamination is fabricating proper multilayer structure, which could limit crack propagation only to the layer. A comprehensive wear model is established[7].

**B. Sun and H. Fukanuma** studied a high pressure HVOF system with combustion chamber pressure up to  $3.0\text{MPa}$ , and with characteristics of higher flame velocity and lower temperature was developed. In-flight particle velocity was measured using the DPV-2000 system at combustion chamber pressures from  $1.0$  to  $3.0\text{MPa}$ , and stainless steel 316L powder was deposited at a combustion chamber pressure of  $3.0\text{MPa}$ . The influence of spray conditions on the coating microstructure, deposition efficiency and micro-hardness were investigated. It was shown that the combustion chamber pressure has significant influence on particle velocity. Dense coatings composed of unmolten or partially molten particles could be deposited by varying the spray parameters. In the experiment, deposition efficiency up to  $90\%$  was achieved at the optimized spray conditions[8].

**N. Jegadeeswaran et. al.**, studied  $25\%(\text{Cr}_3\text{C}_2\text{-}25(\text{Ni}_20\text{Cr})) + \text{NiCrAlY}$  based coatings have been sprayed on to three turbine materials, namely, Ti-31, Superco-605, and MDN-121. Coated and uncoated substrates were subjected to hot corrosion study under cyclic conditions. Each cycle consisted of 1 hour heating at  $800\text{ }^{\circ}\text{C}$  followed by 20 minutes air cooling. Gravimetric measurements were done after each cycle and a plot of weight gain as a function of number of cycles is drawn. Parabolic rate constants were estimated for the understanding of corrosion behaviour. It was observed that coated Ti-31 and MDN-121 were more resistant compared to the uncoated ones. Uncoated superco-605 was undergoing sputtering during corrosion study and hence comparison between coated and uncoated superco-605 was difficult. The cross-sectional analysis of the corroded, coated samples indicated the presence of a thin layer of chromiumoxide scale on the top of the coating and it imparted better corrosion resistance. Parabolic rate constants also indicated that coating is more beneficial to Ti-31 than to MDN-121[9].

**Heikki Sarjas et. al.** studied a  $\text{Cr}_3\text{C}_2\text{-Ni}$  spray powder was produced by mechanically activated thermal synthesis. The following aspects were studied: (a) production and characteristics of spray powders, (b) spraying and characteristics of coatings by HVOF, and (c) abrasive wear resistance. A HVOF spray system Diamond Jet Hybrid 2700 (propane hybrid gun from Sulzer Metco) was used for deposition. Coating thickness was approximately  $350\text{--}400\text{ }\mu\text{m}$ . The structure and composition of the coatings were determined by SEM and the phase composition by XRD methods. Coating surface hardness and micro hardness in the cross section were measured. Abrasive rubber-wheel wear

(ARWW) and abrasive erosive wear (AEW) were tested. The wear resistance of the coatings produced from an experimental powder was comparable to that of a similar commercial one. The results of the study of powder production demonstrated that the mechanically activated thermal synthesis (MATS) technology can be used to produce feedstock materials for the HVOF spray. The HVOF sprayed coatings obtained from the experimental powder are competitive with the coatings from analogous commercial powders: the microhardness of the experimental coating was the same as that of a similar commercial powder. In the wear tests, the results of the experimental coatings were relatively similar to those of the coatings produced from the commercial powder. In the wear studies the coatings from the experimental powder showed better results at abrasion than steel C45. At abrasive erosion, the wear resistance of the experimental and commercial coatings was slightly higher at a low impact angle wear as compared to steel C45; at a normal impact angle, the HVOF sprayed coatings studied did not work: their relative wear resistance was about 0.3–0.4[10].

**B.S. Mann et. al.** studied the water droplet erosion characteristics of high velocity oxygen fuel sprayed (HVOF) coated and laser hardened 12Cr steels along with steels and titanium alloys used in steam turbine blades at two different energy fluxes. For droplet erosion study, round samples as per ASTM G73-98 were used. At low energy flux, the HVOF coated 12Cr steel performed much better than 12Cr and 13Cr–4Ni steels. This is due to integrity of hard carbide particles in cobalt chrome matrix and its ability to absorb shocks due to high hardness of the carbide particles. During incubation as well as in the long run, laser hardened 12Cr steel performed exceptionally well followed by 17Cr–4Ni ‘PH’ and heat-treated 12Cr steel. From the experimental study, it appears that ultimate and modified resilience of materials play significant role to combat droplet erosion. Droplet erosion test results of all these materials and HVOF coating along with their properties and scanning electron micrographs are reported and discussed in this paper[11].

**O. Culha et. al.** focussed on the microstructural, thermal and mechanical properties of NiAl coatings fabricated on 316 L stainless steel substrates by using the high-velocity oxygen fuel (HVOF) method. With this regard, NiAl-based coatings were fabricated on 316 L stainless steel substrates by using HVOF technique. The produced coatings were extensively analyzed with respect to X-ray diffraction (XRD), optical microscope (OM), image analyzer, scanning electron microscope (SEM), micro-hardness and surface roughness testers. Adhesion strength of the coatings was also measured by using a scratch tester. The effect of thermal cycling on the failure behaviour of the Ni–Al-based coating has been carried out without an external load at temperatures between 47 °C and 600 °C for the period of 303 s cycles. XRD study revealed that Ni<sub>3</sub>Al phase is present in the coatings. The metallographic observations showed that all coatings had a similar coating microstructure and consisted of high-quality

contact to the substrate, highly dense structure, low oxide and porosity contents. In addition to microstructural results, micro-hardness values of Ni–Al-based coatings and stainless steel were measured to be 450HV and 220HV before thermal cycling. These micro-hardness values drastically decreased after thermal cyclic tests. The adhesion strength value of Ni–Al-based coating was found that 85.3MPa. In order to determine wear loss, friction coefficient and wear mechanism, wear tests were performed the Ni–Al-coated stainless steel substrates at 49N and 89N under dry sliding conditions through a pin-on plate arrangement against AISI 303 L steel counter body. Regarding as wear mechanism of the coatings, the microstructural analysis of worn surfaces was examined by SEM. It was found that the friction coefficients of NiAl coating for 49N and 89N loads were in the range of 0.289 and 0.329 and the extent of the plastic deformation at 49N was less than that at 89N under dry sliding conditions. Mechanical properties of coating were examined by Shimadzu Dynamic Ultra-micro-hardness test machine for estimating Young’s modulus due to load–unload sensing analysis and in addition to mechanical investigation of hardness–depth curves of Ni–Al-based coatings was obtained [12-13].

Pina Bhatt and H N Shah has applied TiCrN and TiAlN by magnetron sputtering method on steel substrate to study microstructure and hardness analysis. It shows least the stresses and blister free surface at this higher temperature provided by TiAlN coating is beneficial for the engine components[14-18].

#### IV. CONCLUSIONS – COMPARISON OF HVOF AND PVD COATINGS

- Many researchers have investigated the mechanical properties such as hardness, porosity, fatigue, and residual stress in iron based alloy coating. The authors concluded that HVOF process has a potential for commercial applications, since it provides well bonded, wear resistant and corrosion resistant coatings
- Moreover, the application of HVOF coating to the operating components will increase working life of these components. Additionally, the selection of optimized spray parameters and feed stock powder will certainly influence coating microstructure and performance.
- In the current scenario most of the surface coatings are the mixtures of different alloys has to improve the substrate based on coating parameters. As discussed above, it can be seen that coating performance was carried out based on microstructure, in which deposit on melted and un melted particles and spray process parameters employed. Thus, in terms of producing crystalline alloy coatings, it is, therefore, necessary to consider several factors including the presence of amorphous and/or crystalline structure in the original starting powder as well as the spraying parameters employed which influence the crystalline of amorphous

phases in the coating due to reheating effects and cooling process is formed in the phases of coated substrates.

- The greater wear resistance was achieved of the coating was believed to be due to a combination of high hardness, high thermal stability and high corrosion resistance. Thus, improvements based on alloy coating in the present work will need to be further investigated in various wear conditions and environments in order to assess the suitability of applying crystalline/or amorphous coatings to parts of engineering surface applications requiring high wear resistance .
- In this paper, deposition of coatings using different PVD techniques have been reviewed which include a summary of target/cathode materials and various synthesis techniques. Pure metal cathodes/targets or alloy cathodes/target made either by casting or by powder metallurgy were used in PVD processes. Such an investigation can be used to develop a correlation between the coating technology and its properties. By the previous research, it is concluded that the process parameters in PVD hard coating played an important role to optimize the properties for specific application

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# *Vapour absorption refrigeration system using waste heat recovery for engine cooling system*

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## **Abstract—**

Now a days the air conditioning system of cars is mainly uses “Vapour Compression Refrigerant System” (VCRS) which absorbs and removes heat from the interior of the car that is the space to be cooled and rejects the heat to atmosphere. In vapour compression refrigerant system, the system utilizes power from engine shaft as the input power to drive the compressor of the refrigeration system, hence the engine has to produce extra work to run the compressor of the refrigerating system utilizing extra amount of fuel. This loss of power of the vehicle for refrigeration can be neglected by utilizing another refrigeration system i.e. a “Vapour Absorption Refrigerant System”. As well known thing about VAS that these machines required low grade energy for operation. Hence in such types of system, a physicochemical process replaces the mechanical process of the Vapour Compression Refrigerant System by using energy in the form of heat rather than mechanical work. This heat obtained from the exhaust of high power internal combustion engines.

**Keywords:** Waste heat from I. C. Engine, Waste heat recovery system for I. C. Engine, car air-conditioning, absorption refrigeration, renewable energy.

## **I. Introduction**

Refrigeration is the process of removing heat from an enclosed or controlled space, or from a substance, and moving it to a place where it is unobjectionable. The primary purpose of refrigeration is lowering the temperature of the enclosed space or substance and then maintaining that lower temperature as compare to surroundings. Cold is the absence of heat, hence in order to decrease a temperature, one "removes heat", rather than "adding cold."

The basic objective of developing a vapour absorption refrigerant system for cars is to cool the space inside the car by utilizing waste heat and exhaust gases from engine. The air conditioning system of cars in today's world uses “Vapour Compression Refrigerant System” (VCRS) which absorbs and removes heat from the interior of the car which is the space to be cooled and further rejects the heat to be elsewhere. Now to increase an efficiency of car beyond a certain limit vapour compression refrigerant system resists it as it cannot make use of the exhaust gases from the engine. In vapour compression refrigerant system, the system utilizes power from engine shaft as the input power to drive the compressor of the refrigerant system, hence the engine has to produce extra work to run the compressor of the refrigeration system utilizing extra amount of fuel.<sup>[1]</sup> This loss of power of the vehicle for refrigeration can be neglected by utilizing another refrigeration system i.e. a “Vapour Absorption Refrigerant System” i.e low grade heat operated systems. It is well known that an IC engine has an efficiency of about 35-40%, which means that only one-third of the energy in the fuel is converted into useful work and about 60-65% is wasted to environment. In which 28-30% is lost by cooling water and lubrication losses, around 30-32% is lost in the form of exhaust gases and remainder by radiation, etc. In a Vapour Absorption Refrigerant System, a physicochemical process replaces the mechanical process of the Vapour Compression Refrigerant System by using energy in the form of heat rather than mechanical work. The heat required for running the Vapour Absorption Refrigerant System can be obtained from that which is wasted into the atmosphere from IC engine.<sup>[2]</sup> Hence to utilize the exhaust gases and waste heat from an engine the vapour absorption refrigerant system can be put into practice which increases the overall efficiency of a car.

## **II. Possibility of heat recovery and availability from I.C. engine.**

Waste heat is heat, which is generated in a process by way of fuel combustion or chemical reaction, and then “dumped” into the environment even though it could still be reused for some

useful and economic purpose. This heat depends in part on the temperature of the waste heat gases and mass flow rate of exhaust gas. Waste heat losses arise both from equipment inefficiencies and from thermodynamic limitations on equipment and processes. For example, consider internal combustion engine approximately 30 to 40% is converted into useful mechanical work. The remaining heat is expelled to the environment through exhaust gases and engine cooling systems [3]. It means approximately 60 to 70% energy losses as a waste heat through exhaust (30% as engine cooling system and 30 to 40% as environment through exhaust gas). Exhaust gases immediately leaving the engine can have temperatures as high as 842-1112°F [450-600°C]. Consequently, these gases have high heat content, carrying away as exhaust emission. Efforts can be made to design more energy efficient reverberatory engine with better heat transfer and lower exhaust temperatures; however, the laws of thermodynamics place a lower limit on the temperature of exhaust gases [4].

4.	Marine applications	150-220
5.	Trucks and road engines	220

**III. Possible way of using heat recovery system.**

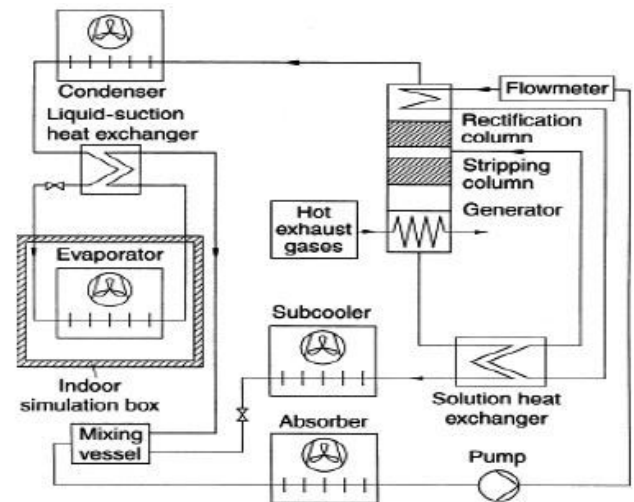
Today’s modern life is greatly depends on automobile engine, i.e. Internal Combustion engines. The majority of vehicles are still powered by either spark ignition (SI) or compression ignition (CI) engines. Small air-cooled diesel engines of up to 35 kW output are used for irrigation purpose, small agricultural tractors and construction machines whereas large farms employ tractors of up to 150 kW output. Water or air-cooled engines are used for a range of 35-150 kW and unless strictly air cooled engine is required, water-cooled engines are preferred for higher power ranges. Earth moving machinery uses engines with an output of up to 520 kW or even higher, up to 740 kW. Marine and locomotive applications usually employ engines with an output range of 150 kW or more. Trucks and road engines usually use high speed diesel engines with 220 kW output or more. Diesel engines are used in small electrical power generating units or as standby units for medium capacity power stations [5].

Table : Various Engine and There Output

S.N	Engine Type	Power Output (kW)	Waste Heat
1.	Small air cooled diesel engine	35	30-40 % of energy waste loss from IC engines
2.	Water air cooled engine	35-150	
3.	Earth moving machineri es	520-720	

**IV. Working principle: Vapour absorption refrigeration system**

The vapour-absorption cycle is similar to the better known vapour-compression cycle in that it employs a volatile refrigerant, e.g. ammonia, which alternately condenses under high pressure in the condenser by surrendering heat to the environment and vaporizes under low pressure in the evaporator by absorbing heat from the medium being cooled. The principal difference between the absorption and the vapour-compression cycles is the mechanism for circulating the refrigerant through the system and providing the necessary pressure difference between the vaporizing and condensing processes. The vapour compressor employed in the vapour-compression cycle is replaced in the absorption cycle by an absorber and a generator or boiler, which compress the vapour as required. The energy input required by the vapour-compression cycle is supplied to the compressor in the form of mechanical work but In the absorption cycle, the energy input is mostly in the form of heat supplied to the generator. In the present case the heat source is the exhaust heat of an internal combustion engine.



**Figure : The essential components of the air-cooled absorption system.**

The boiling point of ammonia is lower than that of water, so it vaporizes, separating the refrigerant from the absorbent. Since

the vapour is not a pure ammonia gas, it must be purified as it flows through a stripping and rectification column. The heat exchangers of the generator rectification system were designed as compact plate-fin heat exchangers and the column was filled with stainless steel Pall rings.

## V. Refrigerant used for the Absorption Refrigeration Systems

A fundamental requirement of absorbent/refrigerant combination is that, in liquid phase, they must have a margin of miscibility within the operating temperature range of the cycle. The mixture should also be chemically stable, non-toxic, and non-explosive. In addition to these requirements, the following are desirable<sup>[7-8]</sup>:

- Refrigerant should have high heat of vaporization and high concentration within the absorbent in order to maintain low circulation rate between the generator and the absorber per unit of the cooling capacity.
- Transport properties that influence heat and mass transfer, e.g., viscosity, thermal conductivity, and diffusion coefficient should be favourable.
- Both refrigerant and absorbent should be non-corrosive, environmental friendly, and economical. There are some 40 refrigerant compounds and 200 absorbent compounds available. However, the most common working fluids are water/ammonia and LiBr/water. Since the invention of absorption refrigeration systems, water/ammonia has been widely used for both cooling and heating purposes.

The main properties are:

- Ammonia (refrigerant) and water (absorbent) are highly stable for a wide range of operating temperature and pressure.
- Ammonia has a high latent heat of vaporization, which is necessary for efficient performance of the system. Its latent heat of vaporization at  $-15^{\circ}\text{C}$  is  $1315\text{kJ/Kg}$ .
- Its boiling point at atmospheric pressure is  $-33.3^{\circ}\text{C}$  & freezing point is  $-77^{\circ}\text{C}$ .
- It has highest refrigerating effect per Kg of refrigerant.
- The leakage of this refrigerant may be quickly & easily detected by the use of burning sulphur candle which in the presence of ammonia will form white fumes of ammonium sulphite.
- It is environmental friendly.

## VI. Advantages

- Uses Engine heat as source of energy hence enhances the efficiency of engine.

- Moving parts are only in the pump, which is a small element in the system hence operation becomes smooth and also wearing and tearing is reduced.
- The system works at low evaporator pressures without affecting the COP of the system.
- Environmental friendly, no release of CFC derivatives.
- Helps in protecting OZONE layer from depletion.
- Helps engine to cool, as it extracts heat from engine.
- Low running cost.
- Higher engine power efficiency.

## VII. CONCLUSION

It is possible to design an automobile air conditioning system using engine heat based on Vapour Absorption Refrigeration System.

Also from the Environmental point of view this system is Eco-friendly as it involves the use of Ammonia as a refrigerant which is a natural gas and is not responsible for OZONE layer Depletion. In this way we can conclude, technically, that Out of the total heat supplied to the engine in the form of fuel, approximately, 30 to 40% is converted into useful mechanical work; the remaining heat is expelled to the environment through exhaust gases and engine cooling systems, resulting in to entropy rise and serious environmental pollution, so it is required to utilize waste heat into useful work. The recovery and utilization of waste heat not only conserves fuel (fossil fuel) but also reduces the amount of waste heat and greenhouse gases dumped to environment. The study shows the availability and possibility of waste heat from internal combustion engine, also describe loss of exhaust gas energy of an internal combustion engine. Possible methods to recover the waste heat from internal combustion engine and performance and emissions of the internal combustion engine. Waste heat recovery system is the best way to recover waste heat and saving the fuel.

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# Design, development and analysis of impeller for sand slurry pumping

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**Abstract**— The centrifugal pump is one of the most used system in the different types industries and various locations as like municipal water circulation, municipal sewage system, pumping river sand etc. This paper deals with the design of impeller of centrifugal pump, where the flowing medium is the mixture of water 60% by volume and sand is 40% by volume. The design calculations of enclosed impeller are done based on volume flow rate, density of sand water mixture, total head required and pump speed. Based on these parameters the impeller is designed. The 3-D model is generated through the BLADEGEN module of ANSYS 16.0 workbench and the analysis is conducted with the water as flowing medium in fluid flow CFX module. The performance for the solid-liquid mixture by head ratio is predicted accordingly. After predictions results are analysed for total head produced and efficiency of the pump.

**Keywords**— Impeller, centrifugal pump, sand slurry, head ratio.

## I. INTRODUCTION

In centrifugal pump the flowing fluid is entering through the inlet of the pump, pump receives the kinetic energy from the rotating impeller; this energy accelerates the fluid to a high velocity and then fluid goes through casing to discharge at high pressure. The centrifugal pump design is complex when there is design for the slurries or mixture applications, the realistic situations are not to be expressed well in the design; hence the design or modification is also done by experience in different fields applications. Solid-liquid mixtures types of centrifugal pumps are lower the cost of the system than transportation by manual or conveyor belt.

Design of the centrifugal pump for transporting of slurry; the physical characteristics are dependent on many factors such as size of the particles, concentration of solids in the liquid etc. After design performance test is done on flowing fluid as water and then it predictions done on the different factors for the different applications. Because of the analysis software's there is time and cost saving in the design,

modification, testing and manufacturing of the pump for the different application.

### 1) Design of enclosed impeller

For the design, properties of the solid-liquid mixture are taken as follow:

- Volume flow rate.  $Q = 0.06 \text{ m}^3/\text{sec}$
- Total head.  $H = 20 \text{ M}$
- Density of the mixture.  $\rho = 1287 \text{ kg/m}^3$
- Gravitational acceleration.  $g = 9.81 \text{ m/s}^2$
- Pump speed.  $n = 2000 \text{ rpm}$

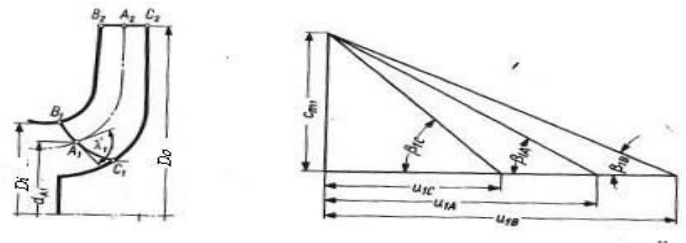


Fig.1: Constructional diagram of the enclosed impeller

Design parameters are as follow:

- The kinematic specific speed.  $n_{sQ} = \frac{n \cdot \sqrt{Q}}{H^{3/4}} = 51.8$
- To determine the hub diameter Calculating shaft input power  $P_{sh}$  with assuming the pump efficiency  $\eta_p = 80\%$ .  $P_{sh} = \frac{\rho \cdot H \cdot Q}{75 \cdot \eta_p} = 24.94 \text{ metric H.P}$
- Allowing a reserve 5 %, the power supplied by drive shaft . $P = 26.1 \text{ metric H.P}$
- Calculate the shaft diameter  $d_{sh} = \sqrt[3]{\frac{3600000 \cdot P}{\tau \cdot \eta_p}}$   
 $= 2.18 \text{ cm} \approx 25 \text{ mm}$
- The hub diameter  $d_h = 1.4 \cdot d_{sh} = 35 \text{ mm}$
- Volumetric efficiency to be considered for design, Assume that volumetric efficiency  $\eta_v = 93\%$ . Hence,  $Q' = \frac{Q}{\eta_v} = 0.065 \text{ m}^3/\text{sec}$

- impeller inlet diameter( $d_o$ )

The velocity  $C_{m1} = k_{cm1} * \sqrt{2 * g * H} = 4.36$  m/sec

From below graph  $K_{cm1} = 0.21$  for  $n_{sQ} = 51.8$

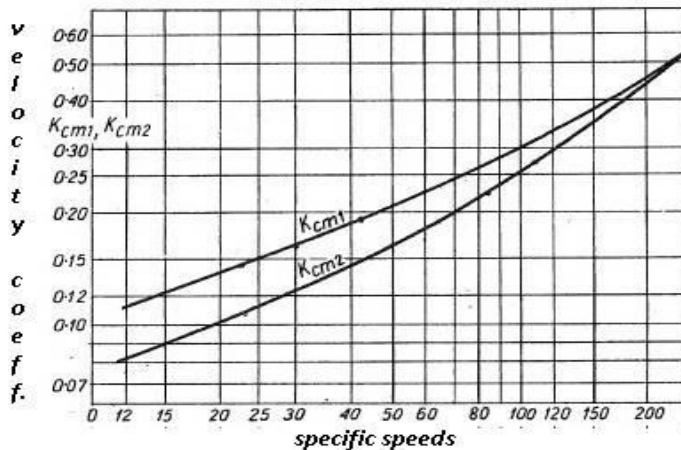


Fig.2: correlation of velocity coefficient  $K_{cm1}$  and  $K_{cm2}$  in relation to the specific speed  $n_{sQ}^{[2]}$

In view of the stable pressure characteristics, we make the blades of double curvature. For this type of blade  $C_o = \frac{C_{m1}}{\phi_1}$ , assume an inlet constriction coefficient  $\phi_1 = 1.25$ , and after calculation check the assumed value is correct or not and if value is not correct change the value and all parameters are calculated.  $C_o = 3.45$  m/sec

$$A_o \text{ (free inlet area)} = \frac{Q'}{C_o} = 0.0188 \text{ m}^2$$

The diameter of hub  $d_h = 35$ mm; the cross sectional area of the hub  $A_h = 0.00096 \text{ m}^2$

$A'$  (total inlet cross sectional area) =  $A_o + A_h = 0.0197 \text{ m}^2$

$$\text{Hence } Di = \sqrt{\frac{4 * A'}{\pi}} = 0.158 \text{ m} \approx 158 \text{ mm}$$

The diameter of the central streamline at inlet  $d_{A1} = \sqrt{\frac{d_o^2 + d_h^2}{2}} = 0.114 \text{ m} \approx 114 \text{ mm}$

Assume the number of blades  $z = 3$  and blade thickness  $s = 15$ mm

Calculation of blade inlet angle( $\beta_1$ )

The peripheral velocity at the point  $A_1$  is  $u_{1A} = \frac{\pi * D_a * n}{60} = 11.93$  m/sec

$$\text{The inclination angle } \beta_1 \text{ of streamlines } A_1A_2, \beta_1 = \tan^{-1} \frac{C_{m1}}{u_1} = 20^\circ$$

Checking the assumed inlet constriction coefficient is correct,

$$\text{using following eq}^n. \frac{1}{\phi_1} = 1 - \frac{s}{t_1} * \sqrt{1 + \frac{\cot^2 \beta_1'}{\sin^2 \lambda_1'}} = 0.67$$

Where  $s = 15$ mm,  $t_1 = \frac{\pi * d_A}{z} = 119.3$ ,  $\lambda_1' = 78^\circ$ ,  $\sin^2 \lambda_1' = 0.95$ ,  $\cot^2 \beta_1' = 5.55, \phi_1 = 1.49$

The value of  $\phi_1 = 1.49$  i.e. it is greater than the assumed value  $\phi_1 = 1.25$ , hence it is necessary to make an adjustment, Now, assume  $\phi_1 = 1.47$

After making the correction, find that  $C_o = 2.96$  m/sec,  $A_o = 0.022 \text{ m}^2$ ,  $A' = 0.023 \text{ m}^2$ ,  $Di = 170$  mm,  $d_{A1} = 122$ mm,  $u_{1A} = 12.79$   $\beta_1 = 19^\circ$

Calculation the  $\beta_1$  for streamlines  $B_1 B_2$  and  $C_1 C_2$

$$u_{1B} = \frac{3.14 * 170 * 2000}{60} = 17.8 \text{ m/sec}, \tan \beta_{1B} = \frac{C_{m1}}{u_{1B}}, \beta_{1B} = 13^\circ$$

$$u_{1C} = \frac{3.14 * 0.065 * 2000}{60} = 6.84 \text{ m/sec}, \tan \beta_{1C} = \frac{C_{m1}}{u_{1C}}, \beta_{1C} = 32^\circ$$

Calculation of outlet diameter of the impeller ( $D_o$ )

Assume  $\eta_h$  (Hydraulic efficiency) =  $\frac{\eta}{\eta_v * \eta_m} = 93\%$ ,  $H_{th}$  (theoretical head) =  $\frac{H}{\eta_h} = 22.2$  M

For calculation of  $u_2$ , value of  $\beta_2$  and  $1 + C_p$  to be assumed and after calculation assumed value checked and adjustment in to the value must be done.

$$\text{Assume } \beta_2 = 20^\circ, 1 + C_p = 1.7$$

The velocity  $C_{m2} = K_{cm2} * \sqrt{2gh} = 3.17$ , from fig.2  $K_{cm2} = 0.16$  for  $n_{sQ} = 51.8$

$$u_2 = \frac{C_{m2}}{2 \tan \beta_2} +$$

$$\sqrt{\left(\frac{C_{m2}}{2 \tan \beta_2}\right)^2 + g * H_{th} * (1 + C_p)} = 23.8$$

$$D_o = \frac{60 * u_2}{\pi n} = 227 \text{ mm}$$

The assumed value of  $1 + C_p$  now be checked by computing the static moment for the central streamline,  $C_p = \frac{r_2^2 * \psi}{z * M_{st}} = 0.66$ , This value of  $C_p$  is closed to assumed value of 0.7 and so it is not necessary to make adjustment to the  $\beta_2$  and  $d_2$

- Outlet width of the impeller ( $b_2$ )

There is practical or on field limitations hence  $b_2 = 60$ mm

## 2) Development of enclosed impeller

By using the above design calculations, 3-D model is constructed using the Blade Gen component system which present in ANSYS 16.0(workbench).

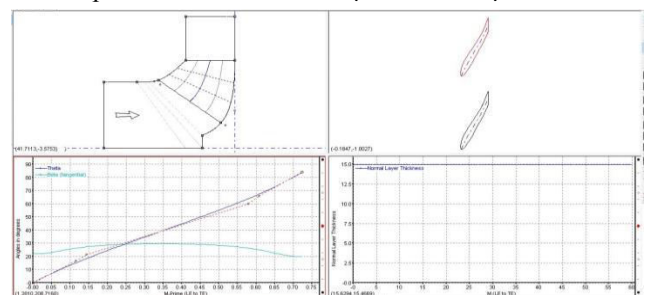


Fig. 3: Blade Gen component system

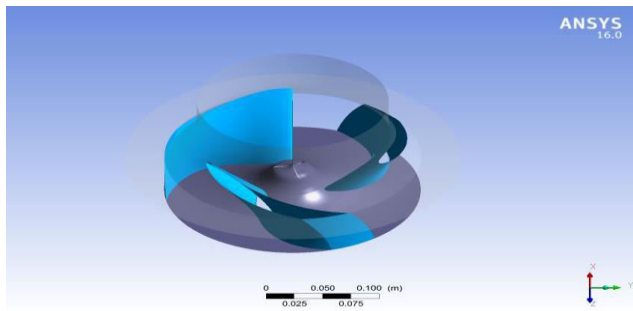
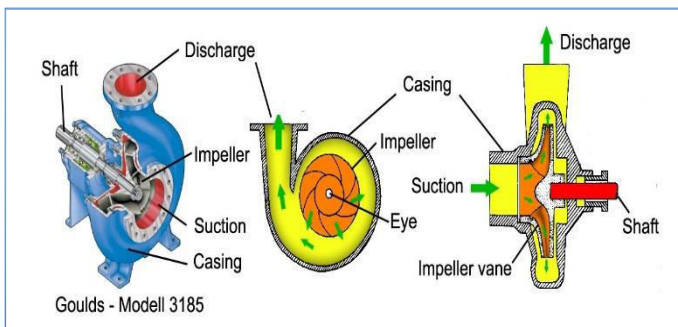


Fig. 4: 3-D Model of the enclosed impeller for CFX

## II. LITERATURE THEORETICAL CONSTRUCTION OF CENTRIFUGAL PUMP BEARING



A centrifugal pump is a roto dynamic pump that uses a rotating impeller to increase the pressure of a fluid, fluid enters the pump near the rotating axis, streaming into the rotating impeller. The impeller consists of a rotating disc with several vanes attached, vanes normally slope backwards, away from the direction of rotation. When the fluid enters the impeller at a certain velocity due to the suction system, it is captured by the rotating impeller vanes. The fluid is accelerated by pulse transmission following the curvature of the impeller vanes from the impeller center (eye) outwards. It reaches its maximum velocity at the impeller's outer diameter and leaves the impeller into a diffuser in Figure-2.

Centrifugal force assists accelerating the fluid individual particles because the radius at which the particles enter is smaller, it will leave the impeller. Now the fluid's energy is converted into static pressure, assisted by the shape of the diffuser or volute chamber. The process of energy conversation in fluids mechanics follows the Bernoulli principle which states that the sum of all forms of energy along a streamline is the same on two points of the path. The total head energy in a pump system is the sum of potential head energy, static pressure head energy and velocity head energy as a centrifugal pump increases the velocity of the fluid, it is essentially a velocity machine, fluid has left the impeller, it flows at a higher velocity from a smaller area into an increasing area, velocity is decreasing & so the pressure increases as described by Bernoulli's principle resulted in an

increased pressure & fluid displacement at the discharge side of the pump.

## III. APPLICATION

Centrifugal Pump bearings are mainly used in Injection Molding machine, Crane Hook, And In vertical pumps. Due to their versatile design, the ready-to-fit units are suitable for many other applications. They can be used, for example in power generation, Ground Water pumps, Aerospace, Sewage and in grinder pumps.

## IV. CONCLUSION

Both Radial and Axial thrusts during running of the pump influenced highly in life of the bearing and also different methods stated by various researchers so it's difficult to predict the correct value of axial thrust. If we predicted correctly then and then we can easily predicted life of bearing. Also different bearing life parameters also depends to be a part of major contribution for predicting life of the bearing in a centrifugal pump. This in turn will improve the reliability of the centrifugal pumps.

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# Finite Element Analysis and Experimentation of Carbon Fiber Chain Drive

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**Abstract**—Chain drives are most important systems used in industry to carry the products and to transmit the power. But limitation is the chain drive suffers premature elongation due to wear and so that the costs of production will increase and ultimately the cost of operations also increases. In case of power transmission chain, the major factor affected on failure of chain is tensile load. It will be helpful to reduce the cost and time of production related to chain assembly of above said industries. The power transmission chain is used to transmit the power which deals with different load conditions. This causes wear and tear of components of chains and hence unexpected failure and costly production.

In present work the study of different failures of chain links under different loading conditions using Mild Steel will be done. It was determined that maximum amount of weight of chain drive is covered by outer link and inner link. The chain is analyzed using Hyper-mesh and ANSYS software. The static loads are applied on the chain drive and analysis is carried out. The test is carried out to check the conformance of the existing design. The chain drive is optimized by changing it to carbon fiber material. Based on these results, best feasible design solution is proposed and validated experimentally).

**Keywords**— Transmission Chain, Chain link, tensile loads, Composite material Carbon fiber, FEA analysis

## Introduction

The chain is most suitable component, which transmits the power by means of tensile forces. It is used to transmit the power and convey the products. In general for power transmission we are using chain, gear or belt drive. But usually chain is most economical part of power transmission machines at low speed having large loads. However, it is also possible to use chain drive system for high speed conditions like automobile engine camshaft drives. This can be accomplished by devising a method of operation and lubrication. Generally, there is lower fatigue strength in chain and gear system, but not in the belt. Besides, if a gear tooth breaks, the gear will stop at the next tooth. Chain is more suitable for continuous running and power transmission with minimum torque fluctuation.

A Composite material is the combination of materials that are mixed together to achieve specific structural properties. The composite individual materials do not dissolve or merge completely, but they become an entity. The properties of composite are more superior than the properties of the individual from which it is constructed.

Are the properties that can be improved by forming a composite material:

- Strength -fatigue life
- Stiffness -temperature-dependent behavior
- Corrosion resistance -thermal insulation
- Wear resistance -thermal conductivity
- Attractiveness -acoustical insulation
- Weight

## I CARBON FIBER

Carbon fiber provides more circumstances for development of PMC's as advanced structural engineering material, as compared to other. Carbon fiber commercially available with variety of tensile moduli ranging, that is for low side it is 207GPa and for high side it is 1035GPa. In general, the advantages of carbon fibers are their exceptionally high tensile strength to weight ratio. It also has high tensile modulus with weight ratio and high fatigue strength.

TABLE1. Material properties for carbon fiber:

Mechanical Properties	Carbon Fiber
Young's Modulus	190 Gpa
Young's Modulus	7.7 Gpa
Bulk Modulus	4.2 Gpa
Poisson's ratio	0.2
Density, $\rho$	1600 Kg / m <sup>3</sup>
Tensile strength	1800MPa

## II PROBLEM SPECIFICATION

Most of the time chain drive used is under tension which causes failure of chain assembly. This is found to be a major problem for automobile sector. Also the performance is

proportional to the power to weight ratio of the vehicle. Hence weight reduction is necessary.

### III OBJECTIVE OF PROJECT

The main objective of the project is to design and analysis optimum solution for the chain links of chain drive in transmission under tensile load and material used will be carbon fiber for the chain links. Thus we will be carrying a linear static analysis under these circumstances and boundary condition. Due to the use of carbon fiber as a material weight will reduce.

#### 1.1 METHODOLOGY

##### CAD Model Generation:

- Getting input data on dimensions of chain links from market.
- Creating 3D model in CATIA.

##### 1.1 Design and Analysis of Chain Link:

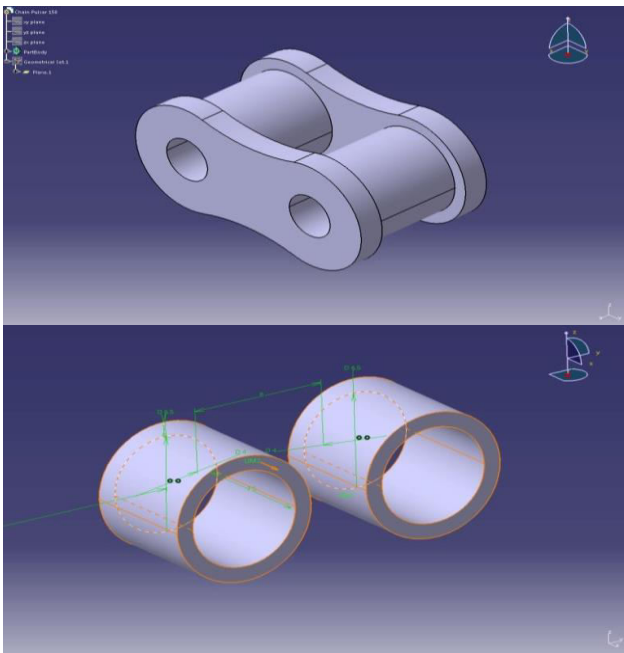


Figure1. CAD model of inner plates with bushes.

Figure 2. CAD model of rollers

Figure3. CAD model of pins

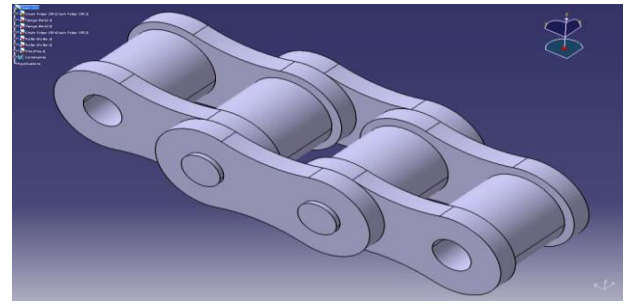
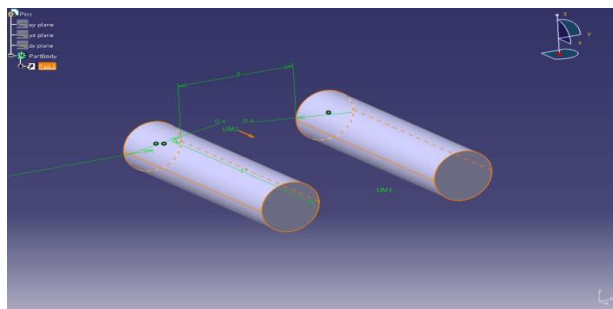


Figure 4. Chain Link Assembly

##### Testing and Analysis of Loads and boundary conditions:

##### BOUNDARY CONDITIONS:

The chain of two wheeler operates under the tensile loading condition. **The maximum tension in the chain will be experienced at maximum torque condition of the engine.**

Overall Gear Ratio =  $G = \text{Primary reduction} \times \text{First Gear Ratio} \times \text{Final Reduction}$

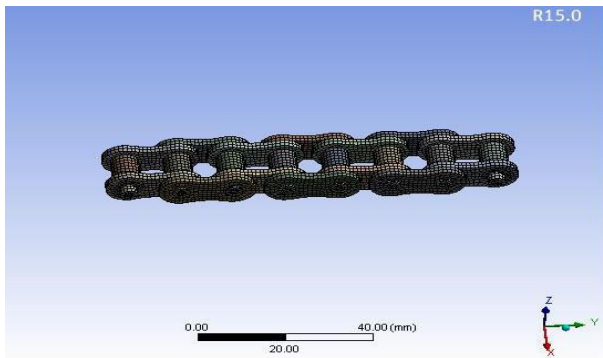
TABLE 2: Bajaj Pulsar 150cc Technical Specifications

Specifications of Bajaj Pulsar 150cc	
Type of Engine	Single Cylinder, 4 -Stroke engine
Displacement of Engine	149CC
Maximum Power	11.08 kW@9000
Maximum Torque	12.28Nm@6500
Transmission	5-Speed Constant Mesh
Weight	144kg
Tyre size front	2.75 -17"
Tyre size rear	110/90-17"
Primary Reduction	3.47
1 <sup>st</sup> Gear	2.92
2 <sup>nd</sup> Gear	1.88
3 <sup>rd</sup> Gear	1.38
4 <sup>th</sup> Gear	1.08
5 <sup>th</sup> Gear	0.92
Final Reduction	2.93
Drive sprocket no of teeth , Z1	15
Driven Sprocket no of teeth, Z2	44
Driven Sprocket Diameter (PCD)	170 mm

Maximum Engine Torque ( $T_{e_{max}}$ ) = 12.28Nm @ 6500  
 Torque available at rear (driven) sprocket ( $T_s$ ) =  $T_{e_{max}} \times G$   
 Tension in the chain ( $F_{max}$ ) =  $T_s / R_s = 4294.12 \text{ N}$

TABLE 3: Existing Material: AISI 304 Stainless Steel

**1.2 Boundary Conditions Applied to the Chain link assembly:**



**Figure 6** von-mises stress for Chain link assembly. Stress value for chain link is 336.91MPa which is below the critical value. Therefore, design is safe.

**Displacement:**

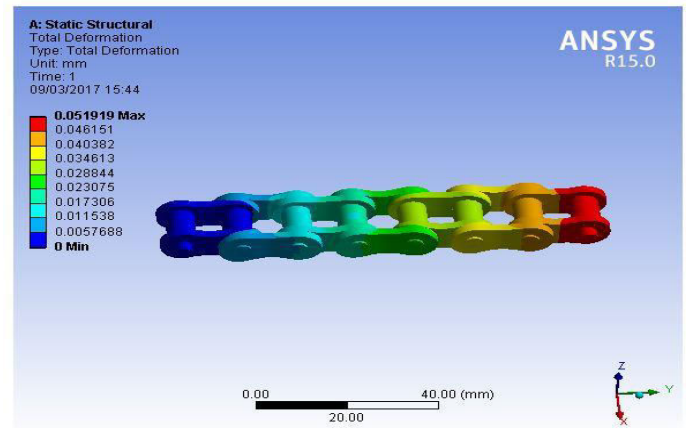


Figure.7. The maximum displacement is coming out to be 0.0519 mm which is less.

**Re-Design, Analysis and Results:**

**Boundary Conditions Applied to the Chain link assembly:**

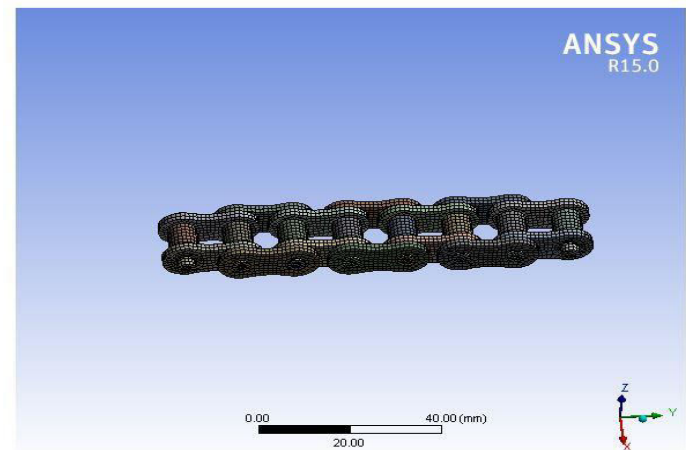


Figure 8 .Meshed model of chain link assembly

The one end of the link is given with fixed support and the force 4295N is applied on the other end.

TABLE 4: Fiber Orientation will be for 2mm thickness Plate (Carbon Fiber)

Sr. No.	Fiber Orientation Angle	Thickness
1	45	0.5
2	-45	0.5
3	45	0.5
4	-45	0.5

Property	Value
Young's Modulus,	200 GPa
Poisson's Ratio	0.29
Density	8000 kg/m <sup>3</sup>
Yield Stress	215 MPa
Ultimate Tensile Stress	505 MPa

Figure.5. Meshed model of chain link assembly

**1.2.2 Von-mises stress:**

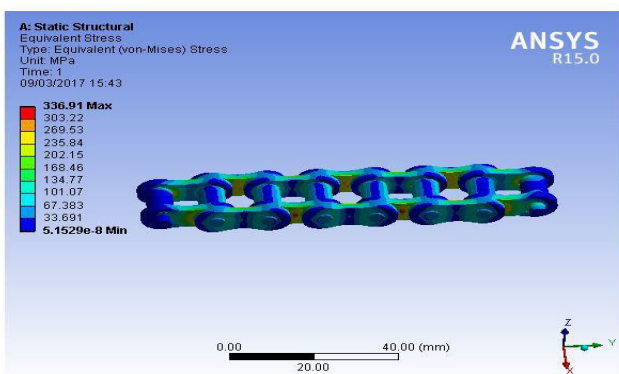
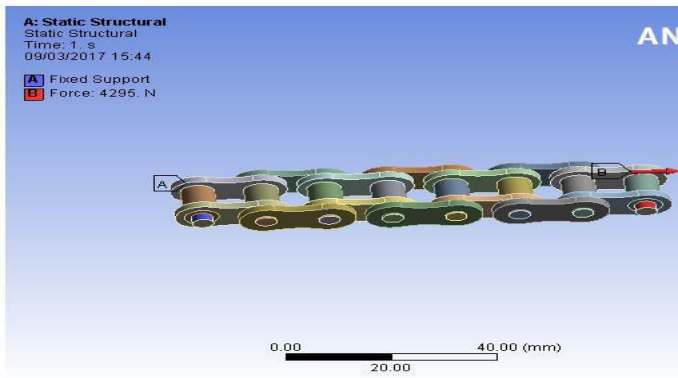


Figure 9 Boundary condition applied in ANSYS



**Von-mises stress:**

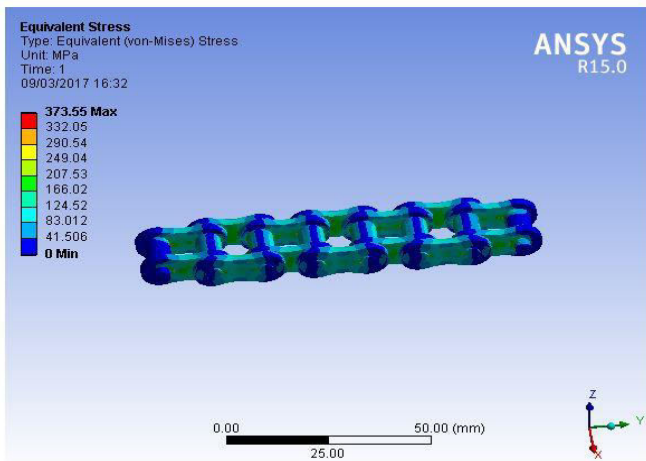


Figure 10 von-mises stress for chain link assembly Stress value for chain link is 373.55.91MPa which is below the critical value. Therefore, design is safe.

**Displacement:**

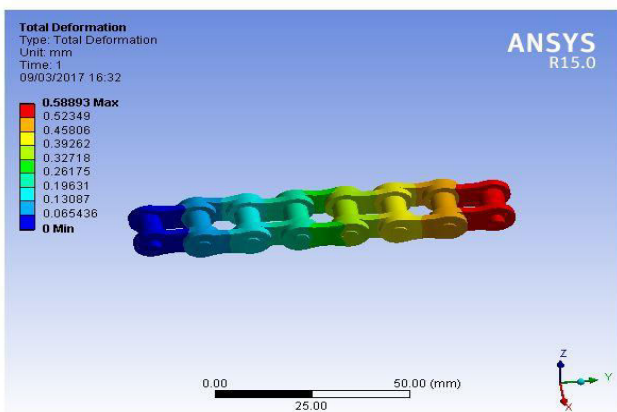


Figure.11 The maximum displacement is coming out to be 0.58 mm which is less.

**Closure:**

The stress and deformations in the existing chain link assembly are very less by using carbon fiber as a material. Hence the design is in the safe condition.

Finally the most optimized gear will be manufactured and the FEA results will be validated experimentally

TABLE 5.Comparison:

Sr.No.	Material	Stress (MPa)	Deformation (mm)	Weight (Kg)
1.	AISI 304 Stainless Steel	336.91	0.0519	0.062
2.	Carbon Fiber	373.55	0.588	0.036

**Fabrication, Experimental validation and Result**

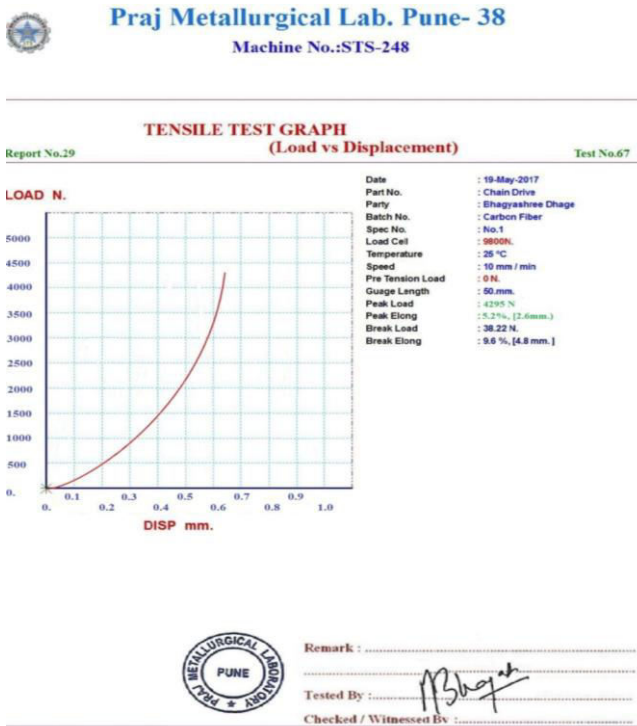
- Fabrication of prototype.
- Suitable experimentation and comparison with present chain links.
- Validation of result by comparing with software results.

IV EXPERIMENT SETUP



Figure 12 Image of UTM

The specimen is placed in the UTM machine between grips and extensometer. If necessary it can automatically record the change in gauge length during the test. If an extensometer is not fitted then the machine itself record the displacement between crosshead on which the specimen is held. This method is used not only to measure the length of specimen but also all other extending elastic components. Its drive system includes any slipping of specimen in the grips. When machine starts it applies increasing load on specimen. During the test the control system and its associate software records the load, displacement or compression of the specimen.



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V RESULT

As per above result deformation will be 0.63mm

Sr . No.	Deformation		
	FEA Result	Experimental Result	Error %
1	0.588	0.63	6.66

VI CONCLUSION

The steel chain link assembly plate has been replaced by carbon fiber plates. The Finite Element Analysis has been successfully performed for both stainless steel and carbon fiber materials. The comparison in the above table for both materials has been listed. There is weight reduction after replacing carbon fiber plates from stainless steel plates. There is slight increase in the stress and deformation after changing material from existing to carbon fiber. Percentage weight reduction is 41.93%. Hence stresses are within the limits and Design is safe.

## An Article on Ancient Indian Mechanical Engineering “Yantrashastra”

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**Abstract—India has developed engineering culture a long ago. It has been proven in some ancient indian literature that this country has create some mechanisim which was previously known as Yantrarnav.. This article represents the similarities of current engineering with ancient time.**

**Keywords—component; formatting; style; styling; insert (key words)**

Mechanical Engineering was known as Yantrarnav in which each machine (Yantra) has expalined five basic physical elements: Pruthwi (Earth) has gravitational force, Jala(water) has Hydraulic Power, Vayu(Air/ Wind) has Wind power, Tej(Fire) has heat/light energy and Akash (Space/Ether). Now a days whole world is depends on all this mentioned principle.

A Sanskrit book Yantra Sarvaswa describes that Indian potter was the first engineer indeed. The wheel used by potter was the first machine that principal is still used in lathe. It also describes that burnt pot and types of clay materials. Now a days we are using Copper Oxide for blue shades, Iron Oxide for bluish-green shades, Manganese for dark maroon shades etc.

At the time of vedic civilization with reference to metallurgy and metal casting lots of unique methods has been applied with the use of Cu, Ag, Au, Fe, Pb, Sn and other metals were known which later on improved at the time of Atharvan period. This metals are widely used by current metallurgy community. Indian steel were imported by Romans due to its high quality and they were using this steel for their armours and other military equipments.

Metal casting-considered to be the oldest of all production techniques-evolved considerably in ancient India. This development are from vedic time. In Rugveda some equipments were used for casting - Dhamatri (Cupola), Bhastr (Blower), Titau (Seives), Gharma Ayanmaya (Crucible) etc., - are mentioned. This machinery are even currently used for casting.

The Indian vedic books has nicely describes basic parts of machines like Danda, Chakra, Danta, Sarani and Bharan which is wellknown as Lever(Rod), Wheel/Pulley, Toothed Wheel(gear), Inclined Plane and Screw respectively. Fig. 1 shows the concept of all this components of ancient Indian machinery.



Figure: 1 Machine Parts

Some forms of metal working such as drilling, drawing, polishing etc., were also in extensive use. In vedic time the skilled gold working exhibited all the minute techniques of drawing, drilling, etching, polishing etc. Various forms of beads of different sizes found in Indus valley throw light on our ancients' skill in carving, shaping, drilling and boring. In India still used now at Cambay for diamond dressing. The Indus people were using Sphatika or magnifying glasses for their precision works. The drills used for these works were 0.93", 0.25", in length and 0.08" in q. Delicate saws were used to cut the beads.

Boring and reaming were also common. Most of the long necked tall vessels were made by spinning knives, arrow heads, razors and others were chiseled out from metal sheets of different thickness. By "sinking", deep pots and pans were obtained. By "raising" techniques, cups and basins were made. Lapping and wire drawing were exactly similar to the modern methods. Metals

etching by using sharp tools and acid-wax process was very common. Even now in many parts of India especially in South India, Orissa, and in Rajasthan, fascinating artistic pieces are produced by the above-mentioned old methods in brass, bronze, copper, silver and gold. The most intricate, minute and attractive filigree work in gold and silver is still prevailing.

Ancient India has also developed various measurement techniques which used by world now a days. *Kautilya* also describes the method of calibration of weights and he describes perfect balances and their standard dimension also. The *Samarvrtta* balance resembles the modern physical balance; *Parimani* still sophisticated one. The *Vyavaharika* is the modern simple balance. *Bhajine*, *Antahpura-Bhajine* were some other types.

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# *A New Approach: Teaching Second Language through Poetry*

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ASOIT  
Ahmedabad

**Abstract:**

*Like other literary genre, poetry –as a genre exists to be appreciated and enjoyed. It is very difficult for the instructor to make class, students centred rather than teacher centred. Poetry has been used as a means of enjoyment being literary genre for a longer period of time, but fortunately in last few decades, literature has been used to teach language in the classroom and poetry is one of the medium of this. Many instructors do not agree with this change, as they think that it is least preferred methodology to be implemented in the classroom for second language learning. However no one can deny this fact that poetry is difficult to understand not only for English as a second language learner but also for the Native Speaker as well. However the role of Instructor is also important for executing poetry in the intermediate classroom. This paper will focus on new approach to teaching English through poetry in the classroom. The purpose is to determine the relative effectiveness of this approach in improving the students' literacy in second language.*

**Key words:** *poetry, language teaching, language learning, new approach, language through literature.*

**Introduction:**

English poetry has been taught in many non-native countries with traditional

approach where teacher deliver a lecture in the classroom and then prepare students for the particular examination, rather encouraging sharing their view on poetry in the classroom.

The main objective of teaching language through different genre of literature is to make students aware about various genres of literature and at the same time introducing them to different culture, society, region and literary intellectual background of other country. Though methodology of teaching poetry in the classroom varies from teacher to teacher, and due to traditional approach, students manage to pass in the examination by memorizing the critical reviews of the poems. Due to this many of students take their literature classes as boring, monotonous and uninteresting.

Although, the attitude of many instructors towards teaching poetry has changed in the past years and even some teachers believe that if approach is chosen properly to teach poetry than students get benefits out of it. However it also

contradicts that some teachers are ready to teach novel, short story and other genera of literature but when it comes to poetry, with old method they cannot make it alive in the classroom. So if methodology currently used in the classroom is not effective, it is worth to experiment with other method, which not only brings different result at educational front but also at attitudinal level as well.

Poetry being versatile form of literature is a great form to be used in the classroom. There are much more variety in his poetry and many forms in it. Through poem, teacher can introduce and teach many new things in the classroom. They can also make them to understand how geographic distance affects his mind and how it affects the culture. Poetry is rich source to make students aware about the world like different region, different culture, social life and so on. Through new methodology, teacher can convert classroom in student centred rather than teacher centred.

#### **Language:**

Poetry is biggest and rich source to introduce language. It can be used to introduced vocabulary, language pattern, structure o the language, rhyming devices. It also gives chance to explore new ideas in ESL classroom.

#### **Culture:**

Poetry is major source through which teacher can give idea regarding different culture of the different people to the students. It opens up rich political, historical, social background to the students and due to this students may get attracted towards it as it also part of their heritage and culture.

#### **Video:**

Teacher can use video related to the poem to make it more interested in the classroom. Poetry offers good opportunity to the students for developing listening, speaking, Reading and writing skills. It also gives chance to students to develop their vocabulary and works with different rhymes and rhyme pattern.

#### **Poetry as a Unit:**

- Teacher needs to ask students what kind of experience that hey have had with poetry.
- Do they know any poetry in their Native language?
- Is there any poem which they like?
- Is there any particular poem from their culture?
- Teacher can ask them regarding any famous poet of their region and country.
- Have they written poem before?

- Is there any difficulty to translate words and phrase in their native language?
- Familiarize students with different kind of poem.
- Talk about difference between story and poetry.
- Teacher can provide copy of poem and ask them to work in group and make a list to difficult words and phrase.
- Teacher must use poem with simple language at initial stage.
- Teacher can recommend using poetry with “predictable language pattern, Repeated words, phrases, lines an identitle rhymes.” So it would be easier for students to grasp it and read it.
- Teacher can motivate students to think about meaning and ask them to discuss it i the group and interpret in their own way.
- Teacher can ask students to share their experience in the class so that everyone can get chance to think in different perspectives.

### **Reading poetry to improve Speaking:**

Reading aloud is the best exercises as it always works as far as fluency and pronunciation is concerned. To increase fluency of the students teacher can give them for classroom practice. These types

of exercises play an important role in classroom. It makes students to understand the difference between prose and rhymes. Through this they also understand how reading a loud out create an image of particular things. Through this they can learn where to pause, take high note, law note, to use coma, etc.

### **Poetry a tool to Increase Vocabulary:**

Poetry is a rich source of vocabulary. There are many words which is new for the learner. Through this learner come to know new words which they can use in other poetic composition. Teacher can also implement vocabulary games in the class. Poetry carries some unusual sentences and sentence pattern is also very important because there are many words which can be used in poetic composition. So, vocabulary games and quiz also play an important role

### **Pre –Reading activity:**

Before starting any poetry, teacher should give pre-activity to make Pre Reading activity.

- Teacher should play background music to create the atmosphere, in the class. They can show some pictures to introduce the topic, and then ask students to think about their personal knowledge or experience which relates to this topic.

- They then talk about the poem, first with a partner and then in small groups. Teacher should monitor the ideas and provides the meaning of the difficult words if necessary. Teacher should give feedback on the language which they used in translating the poem. If it is difficult to do at a time, teacher can later on take a class for the weak students.
- To make the task easier, Teacher should prepare worksheet for Pre Reading activity which might involve fill in the blanks, statements, sentence structure, quizzes, I usually prepare worksheets for pre-reading speaking activities which might involve a quiz, questionnaire, and so on.
- After filling the worksheet, they can talk about their personal response to the poem, discuss the characters and theme, or debate the moral issues.
- Teacher can ask students to do role play which will allow them, interviewing a partner, or even dramatizing the poem and making a video. Students could compare poems on related topics, with different groups working on

different poems and then regrouping to pool their ideas.

#### **Post -Reading activity:**

- Teacher can ask them to write down the theme of the poem as per their perspectives.
- Teacher can ask them to find out synonyms of the words and can ask them to use in the poem.
- Teacher can also ask them to write down new poems as by using the same theme.
- Teacher can ask them to draw picture as per the theme which they have understood through the poem.
- Teacher need to ask students to write down what they like the most about the poem.

#### **Poetry a tool to learn Pronunciation:**

It is always a fun activity for the students to perform a poem in the class, which not only decrease the tension of the students but make the atmosphere of the class lighter. Teacher should read the poem so that they can identify stress, pause, and coma in the sentence. Sometimes they can also sing poem in the class in chorus to feel the emotions which is described through the poem.

#### **Poetry a tool to learn Writing Skill:**

A poem can glimmer off some magnificent creative writing. Students can use their

creativity and add more lines or stanzas individually or in pairs or groups.

- They can write a letter on character of the poem. They can write about what happened before the beginning or after the ending of the poem.
- Students could use the poem as a starting point and model for some parallel writing: Each group might contribute a verse to a collective poem in the beginning else in the ending.
- My students have found reformulation exercises very inspiring, where they can use formal and informal language.
- Longer poems can be describes in fifty words.
- Teacher can also ask students to transform content words to synonyms or antonyms and then discuss the subtleties of vocabulary.

### **Pros and pitfalls:**

‘Every Coin has two sides’ so using poetry to teach language is a wonderful tool but at the same time, there are certain criteria which teacher needs to take care. Teacher need to spend time on choosing poems, as pr the standards and the age group of the students.

Normally teacher should not pick up too short and too long poems which might get difficult to respond by students. Choosing a wrong poem can destroy the class atmosphere and also the interest of the students to learn language. Teacher needs to explain the aim of activity very clearly and students who does not like to learn literature, may need extra motivation. Sometimes it is worth taking the risk and using poems though, because poems can foster a love of English, and they are so versatile. Students find a poem a source of inspiration, which not only helps them in their exams but also in their real life as well. Poems can be involving, motivating and memorable, and they can supplement and enrich just about any lesson.

### **Example:**

Here I have chosen poem of Rober Frost, “The Road Not Taken”

### **Pre-Task:**

Teacher can give them question to write the answer.

1. Why did the poet give this title?
2. What do you think the poem is about?
3. Have you been in any situation where you were unable to take decision and perplexed?
4. Were you in any situation, where you find two options but you have

to pick only one? Mentioned any one situation of your life.

### The Road Not Taken

Two roads diverged in a yellow wood,  
And sorry I could not travel both  
And be one traveler, long I stood  
And looked down one as far as I could  
To where it bent in the undergrowth;

Then took the other, as just as fair,  
And having perhaps the better claim,  
Because it was grassy and wanted wear;  
Though as for that the passing there  
Had worn them really about the same,

And both that morning equally lay  
In leaves no step had trodden black.  
Oh, I kept the first for another day!  
Yet knowing how way leads on to way,  
I doubted if I should ever come back.

I shall be telling this with a sigh  
Somewhere ages and ages hence:  
Two roads diverged in a wood, and I—  
I took the one less traveled by,  
And that has made all the difference.

#### Post-Task:

##### 1. Vocabulary Building:

Which phrase is closer to the italicized word.

1. Two roads *diverged* in yellow wood.
  - a) Departed from common point
  - b) Come to gather
  - c) To meet at one point
2. bent in the *undergrowth*
  - a) Grass in the forest

b) Low growing plants and shrubs under trees

c) No grass at all

3. In leaves no step had *trodden* black.

a) Movement of a foot in walking

b) No foot steps

c) Animal foot step

4. I shall be telling this with *sigh*

a) Tired

b) Deep breath

c) Nervous

##### 2. Writing Skills:

Answer the following questions with complete sentence.

1. What does the speaker do in the poem?
2. What decision speaker has to take in the poem?
3. Describe the mental conflict that speaker feels in the poem?
4. Explain the second theme of the poem.
5. Analyze the last stanza.
6. What are the reasons that he may be 'sighing' in the future?
7. Which interpretation do you prefer? Why?
8. Describe the geography of the poem.

##### Conclusion:

One of the best things to use poem in the

class room is that teacher can create lots of opportunities for personalization. This shows that students have much to say and their interaction is genuine as they talk on their personal experiences which relates to the poem. They are totally involved and engaged in the class, which makes their learning exercises memorable. Being teacher, they should know how to use it properly in the class. Initially it is very difficult for the students to understand new language and grammar, but with the help of poetry, teacher can make it more interesting and creative as per the class needs and intellectual level.

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2017

# *The Evil of Manipulations in the Gold Market*

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## **ABSTRACT**

*The yellow metal, more commonly known as Gold is the most favourable among investors for securing their investments. Gold, though traded across the globe, has most misconceptions in the minds of common people and even among investors regarding how it is traded. Hence in this paper we will briefly see just how easily gold prices can be deflected from showing an accurate balance of the demand and supply. In some cases, such 'deflections' are outright price manipulations without the manipulators buying and selling physical gold.*

## **INTRODUCTION**

As we know, Gold is traded across borders and across time zones; however, there are a lot of factors that affect its pricing differing from place to place. Such as, tax structures, trade restrictions, standards and trading laws. The Gold Market can be categorized as the physical market and the Commodity derivative market. The market participants have the option to either trade in physical gold, obtain exposure to the fluctuating gold prices or transfer the risk associated with the fluctuating prices by hedging the risk. However transparency has to be maintained in all these activities to sustain the confidence of the participants in their respective gold market. Thus the World gold council intervenes in order to ensure that all the trading markets and the infrastructures comply with the broad set of principles comprehending standards, conduct transparency and market access.

## **FACTORS INFLUENCING THE GOLD MARKET**

1. Global crisis: Gold is considered as a secured investment. Global crisis leads to increase in the gold prices as, when there is

a global crisis, people tend to loose their confidence in the governments, and instead center their investments to safer options like gold. This increases the demand of gold and hence prices tend to increase.

2. Inflation: In comparison to the currency fluctuations, time values of gold tend to remain more stable in the long term. Gold is a tentatively low-risk investment as compared to other options.



3. Central bank and policies: Many countries have a central bank governing most of the monetary needs like currency, interest rates and liquidity. Deficit or failures in these and irregular economic policies result in the investors safeguarding their wealth by gold. A recent example of this was, people buying gold in large chunks during the period of Demonetization. Also, sometimes the central bank's increase or decrease the liquidity cash flow), which directly impacts the increase and decrease in the gold prices respectively.
4. Government Reserves: The central banks hold not only paper currencies but also precious metals like gold. And time to time increase or decrease their holdings in gold. Which also results in the gold prices fluctuating.
5. Jewellery: Gold is not only used as an investment to hedge risk, but it is also used as ornaments/jewellery. The demand of over 50% is obtained from jewellery business itself. And USA, India and China are the key players with highest demand.
6. Supply Vs Demand: Only about 2,500 metric tons of gold get produced each year, compared to an estimated 165,000 metric tons in the entire world's gold supply. When production costs rise, miners sell gold for more money to preserve their profits, and those higher costs also get reflected when it comes time to sell coins if they
7. were minted from gold that was originally mined yesterday or thousands of years ago.<sup>1</sup>

These are the basic factors that affect the gold prices globally. However apart from these factors there are certain questions which attracts our attention.

- Why doesn't demand directly influence the

<sup>1</sup> <https://www.sbcgold.com/blog/10-factors-regularly-influence-gold-prices/>

global gold prices?

- China and India being the major physical buyers, Why don't these dominate the global Gold market?
- Though USA having only 7% demand share in the gold market, affect the Gold market on such a high intensity?
- Can the gold prices be managed and manipulated?

These questions point to a very simple conclusion that there are factors that try to manipulate the Gold market's and global or domestic gold prices. So the next question arises is that who all would be interested in manipulating the Gold prices and who can actually have that power to do so and how? The answer is simple. Central banks, Commercial banks, Large investors and the bullion banks can and might manipulate the Gold market. We will see how and why all this is done.

#### *Central Banks*

Central banks can manipulate the gold prices to convince the investors that government securities are the more secured investments and stop them from getting lulled by Gold investments. Also, to hide the deficiencies in their own currencies, they manipulate gold. Also some central banks went on to lease their Gold holdings to Gold dealers who further sell it in the market. However over the years, an artificial market supply is created to match with the demand of gold. Thus the prices get controlled. The Central Banks use the bullion banks as agents to sell naked gold short<sup>2</sup> in the market. Short selling<sup>3</sup> reduces the

<sup>2</sup> **Naked short selling**, or **naked shorting**, is the practice of short-selling a tradable asset of any kind without first borrowing the security or ensuring that the security can be borrowed, as is conventionally done in a short sale. When the seller does not obtain the shares within the required time frame, the result is known as a "failure to deliver". The transaction generally remains open until the shares are acquired by the seller, or the seller's broker settles the trade

gold prices and scares the investors from investing into Gold at that time.

#### *Large Investors*

Large investors can be individuals or institutions who possess an unrightful power to be able to influence the gold prices in their respective markets. They do so only for their own selfish motives of being able to accumulate gold at low prices and sell it at higher ones. These investors not only invest in physical gold but also in derivatives. These institutions perform complex procedures to manipulate the prices.

“The muddier the water, harder to find the mess”.

The basic methods are to conduct naked shorting of the gold futures contract, selling paper gold, never delivering it, and perpetuating the process with more naked shorts. These gold futures are settled in Cash. Massive trades arise with Paper gold. Even when the markets are at their lowest. They are traded to save the positions of the Short Selling when threatened.

#### *Commercial Banks*

The commercial banks invest in gold themselves. However their clients also invest in Gold. Hence there is a conflict of interests. Bullion Banks provide trading in Gold to their clients. However they themselves hold only a small portion of what they sell. With the thinning of economy, Gold prices rise and the demand to invest in gold will also increase. Hence the banks will try to decrease the prices from time to time. This can be done when the supply is greater than the demand. And this is easily achieved by selling more of the Paper gold. The bank is only buying a fraction of the gold that it sells. That is, fake supply of gold in the form of futures have been increased to overwhelm the increase in demand, which will lead to a temporary collapse in price.

<sup>3</sup> **Short- selling**, in the context of the **stock market**, is the practice where an investor **sells shares** that he does not own at the time of **selling** them. He **sells** them in the hope that the price of those **shares** will decline, and he will profit by buying back those **shares** at a lower price

Hence the regularity of this manipulation is unlimited.

#### *Import and Export*<sup>4</sup>

The performance of gold against other comparable financial assets in recent years is another possible reason for the shift towards investment in gold in India. More than 95% of gold imported for the domestic market is in the form of small cast bars weighing 10 tolas (3.75 oz), widely known as TT bars or biscuits. Most imported TT bars are produced by 8 major gold refiners in Switzerland, South Africa, United Kingdom and Australia. Imported gold is distributed nationwide through secondary and lower tier bullion dealers who fall below the primary tier of bank and PSU importers. The most important dealers are located in cities where the state's sales tax is low. Notably, Ahmedabad, Jaipur, Mumbai and Gurgaon. Historically India is one of the largest importers of gold in the world. Gold is held as a family jewel for most families in the country and very rarely families sell gold for pecuniary purposes. Before the early nineties, gold market in India attracted lot of parallel transaction as the imports were restricted combined with high import duties. The hawala market was active, leading to increased black market transactions in gold. However, financial sector reforms in nineties brought much needed reforms to the gold market and market was freed from high import duties and restriction on imports. The international price and domestic market price of gold almost synchronized till Government introduced high import duties on gold imports in 2013.

The Gold imports has been rising unabatedly for the last few years and such large import of gold has become one of the major source of our high trade deficit. The CAD has deteriorated significantly in recent times due to large gold imports. This resulted

<sup>4</sup> [https://www.google.com/url?q=https://www.ccilindia.com/Documents/Rakshitra/2014/sep/Article.pdf&sa=D&ust=1512058583009000&usg=AFQjCNGGhgquMghC9PNOPgG5R\\_vwdoegSA](https://www.google.com/url?q=https://www.ccilindia.com/Documents/Rakshitra/2014/sep/Article.pdf&sa=D&ust=1512058583009000&usg=AFQjCNGGhgquMghC9PNOPgG5R_vwdoegSA)

in depreciation of the Indian currency and in reduction of the foreign exchange reserves. restrictions on gold imports as well as duties on import of Gold. However, the differential pricing between international and domestic prices has resulted in increasing unauthorized market taking shape through hawala route.

Rising global gold prices in recent years did not affect the domestic demand of the gold in India implying that investment in gold is becoming price inelastic.

s. In recent years, the gold loan market in India has grown rapidly. Large number of Non-Banking Financial Companies are involved in gold loan business in India and they source funds from the banking sector

#### *New Markets*

Currently gold prices are set in two places. The London spot market which is controlled by 6 major banks. Other is New York gold futures market which is controlled by COMEX, governed by big clearing members including the major western banks. These western banks have a monopoly on the prices of gold even if they do not possess monopoly on the physical gold. However that could be just about to change. Russia and China currently are not just only building up physical reserves but also exploring for more. They are building up trading systems that would allow price discovery as well as leveraged trading of gold. Once the new exchanges get fully functional, physical gold markets would regain their upper hand being a price maker.

#### **CONCLUSIONS AND RECOMMENDATIONS**

As long as the investors are willing to invest in derivatives, the prices will always be manipulated. If there is a awareness of the same, and a stop is put to the trade of gold in the commodity market, sparing only physical trade feasible. Even if gold is traded in the derivative markets, the actual gold held should be demanded on completion of the said tenure. Also, a limit should be kept by the government on the specified amount of precious metal that can be held by an individual or entity. And lastly like crude

prices the gold market should be made directly correspond to the global prices which are less likely to get manipulated.

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# Study of Aerosol Optical Depth at Udaipur

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**Abstract—** Variation of AOD (Aerosol Optical Depth) at two wavelengths, 380 nm and 500 nm, was studied using the gridded TOMS data for Udaipur for years are 1982, 1992 and 2001. Higher AOD value at lower wavelength throughout the year is observed. Seasonal variation in AOD with higher value in summer months of May and June and lower value in winter months of December and January is observed. Decadal variation is also observed in AOD.

**Keywords—** aerosol, climate

## I. INTRODUCTION

Tiny solid and liquid particles suspended in the atmosphere are called aerosols. Windblown dust, sea salts, volcanic ash, smoke from wildfires, and pollution from factories are all examples of aerosols. Depending upon their size, type, and location, aerosols can either cool the surface, or warm it [2,3]. They can help clouds to form, or they can inhibit cloud formation. And if inhaled, some aerosols can be harmful to people's health. Satellite measurements of aerosols, called aerosol optical thickness, are based on the fact that the particles change the way the atmosphere reflects and absorbs visible and infrared light. An optical thickness of less than 0.1 indicates a crystal clear sky with maximum visibility, whereas a value of 1 indicates very hazy conditions. High aerosol amounts are linked to different process in different places and times of year [1].

## II. DATA SET

Earth Probe TOMS along with OMI (Ozone Monitoring Instrument) onboard (AURA) are the only NASA's spacecraft specializing in ozone retrieval. The data obtained by EP TOMS were intended to complement data obtained from (Advanced Earth Observing Satellite) ADEOS TOMS, which gave complete equatorial coverage due to its higher orbit. EP TOMS instrument launched in July 1996 has a nadir angle field of view 39 km on a side. Instrument is on a 500 km orbit rather than originally planned 950 km orbit due to 2 years delay, which provides data with higher horizontal resolution and increased ability to make measurements over cloudless scenes but compromised with not providing full daily global coverage and that's why 2 days are required to produce a global map [5]. The lower orbit was chosen to make measurements of UV absorbing aerosols in the troposphere. Instrument is able to make 35 observations every 8 seconds, each covering 30 to 125 miles width. 205,000 daily observations cover every single spot on earth except for polar region. Instrument also measures SO<sub>2</sub> released in volcanic eruptions. Total Ozone maps are created once a day.

## III. RESULTS AND DISCUSSION

Variation of AOD at two wavelengths, 380 nm and 500 nm, was studied using the gridded TOMS data for Udaipur for three

representative years, separated by a decade. The years are 1982, 1992 and 2001. Figure 1 shows monthly mean value of AOD measured by TOMS at two wavelengths, 380 nm and 500 nm for the year 1982. In this figure, the AOD values have been multiplied by 1000 and are plotted. The abscissa gives the month number, 1 signifies January and 12 represent December.

Figure depicts higher AOD value at lower wavelength, which is 380 nm, during all the months.

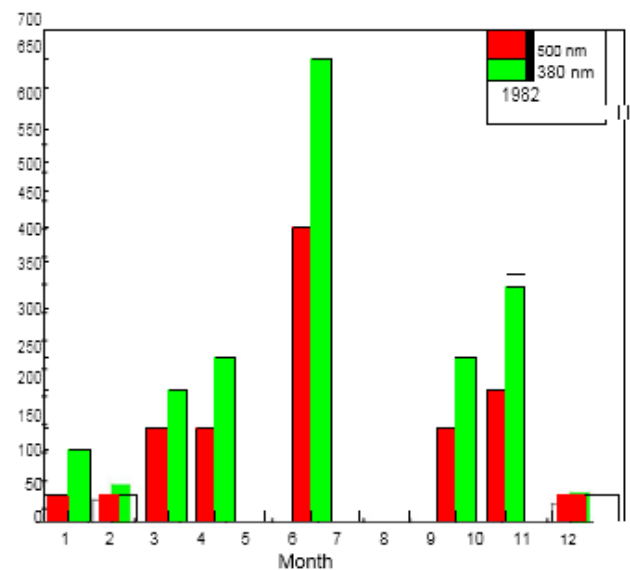


Fig 1: AOD versus months for the wavelength 380 nm and 500 nm at Udaipur in 1982.

Difference in AOD values for two wavelengths is found to be largest in the month of June and least in December. January and February do not show much difference in AOD values at the two wavelengths. Hence, generalization can be made that winter months show nearly same values of AOD at 380 nm and 500 nm.

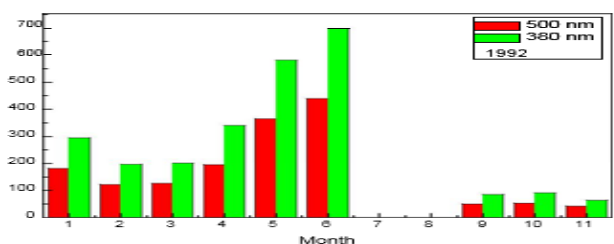


Fig 2: AOD versus months for the wavelength 380 nm and 500 nm at Udaipur in 1992.

Similar features are brought out by figure 2 and figure 3 which are plots of AOD for the years 1992 and 2001, respectively.

January, April, May and June are the months showing maximum difference in the value of AOD at 380 nm and 500 nm whereas September, October and November are the months with least difference. AOD values for year 1982 and 1992 are processed values whereas for the year 2001 processed values were not available. Raw data was however plotted for 2001.

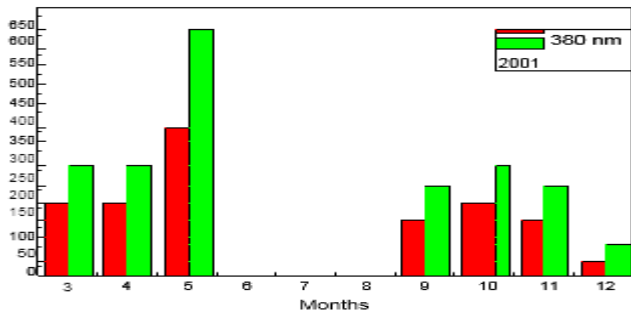


Fig 3: AOD versus months for the wavelength 380 nm and 500 nm at Udaipur in 2001.

Hence, all the three years show higher value of AOD for shorter wavelength. One more important feature highlighted here was that AOD showed higher values of AOD for summer months and lower values for winter months. Thus during the pre-monsoon periods, the aerosol loading takes place. These aerosols are washed down by rains during monsoon months, resulting in lower values of AOD in winter months. A similar seasonal variation was observed at Rajkot, a semi-arid suburban region near the Arabian Sea [4].

Decadal variation in AOD at 380 nm is given in Figure 4. A similar AOD variation at 500 nm is given in fig. 5. From the year 1982 to 2001, the city has witnessed rapid industrial development and increased traffic. This is expected to have an impact on the values of AOD.

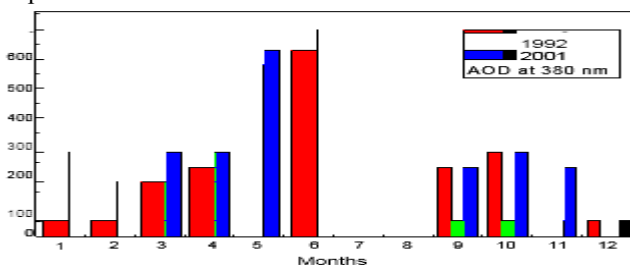


Figure 4: AOD versus months at 380 nm wavelength during 1982, 1992 and 2001 at Udaipur.

To bring out this effect, AOD for a single wavelength during three different years with approximate gap of ten years was plotted. It can be seen from fig. 4 that the AOD values for 1982 are lower than in 1992, and that of 1992 are lower than in 2001 except during the equinoxial months of 1982. Except for equinoxial months of April, September and October, AOD values for the year 2001 are found to be highest in all the months. A similar plot for the AOD at 500 nm for the three years is given in figure 5.

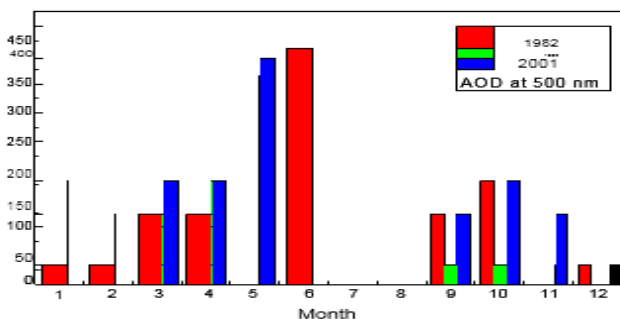


Figure 5: AOD versus months at 500 nm wavelength during 1982, 1992 and 2001 at Udaipur.

AOD values for the year 1982 are seen to be lowest as compared to the other years. Summer months of April and March however shows building up of aerosols due to vertical mixing resulting in almost comparable values of AOD during these months.

AOD values are highest for the month of May and June. Winter months show lower values of AOD for all the three years with value in 1982 a little larger than values in 2002 during October.

IV. CONCLUSION:

Aerosol Optical Depth at two wavelengths, 380 nm and 500 nm, was studied for Udaipur for years are 1982, 1992 and 2001 using the gridded TOMS data. Higher AOD value at lower wavelength viz. 380nm and lower AOD at higher wavelength viz. 500nm is observed. Seasonal variation in AOD with higher value in summer months of May and June and lower value in winter months of December and January is observed. Decadal variation is observed in AOD may be attributed to the fact of rapid industrialization and increased traffic in city in time period of ten years.

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## PEDAGOGY ON ENGINEERING MATHEMATICS AND PURE MATHEMATICS EDUCATION

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**ABSTARCT:** In this paper, we are going to present a very interesting analysis of teaching engineering mathematics over pure mathematics in classroom for engineers the emphasis on leaving of results and their applications are given, whereas in pure mathematics emphasis on leaving the proofs of a result is given.

It appears that these days unadulterated arithmetic takes a secondary lounge to connected science. In numerous colleges arithmetic divisions are called branches of connected science, rather than just arithmetic; such a "down to earth" name should pull in more understudies. Likewise, numerous mathematicians proclaim their examination connected, notwithstanding, when it is simply scientific. This is done with a specific end goal to make the exploration look "down to earth" and "helpful".

This note plans to contend with the conclusion that unadulterated science is excessively hypothetical and pointless. While genuine mathematicians comprehend the significance of unadulterated arithmetic and will most likely gain just the same old thing new from perusing this article, there are still numerous individuals who should be

persuaded in the significance and convenience of immaculate science.

- What is applied mathematics?

Answer: Connected arithmetic creates scientific systems that are utilized as a part of science, business and industry, and applies existing numerical techniques in these fields. The recent part comprises of utilizations of science; without central arithmetic there would be nothing to apply. The previous part means creating immaculate science while taking care of a specific pragmatic issue. For instance, Newton created his math so as to register the circles of divine questions that move as per his law of attractive energy. By the eighteenth century analytics was built up as immaculate arithmetic, and as an unadulterated scientific hypothesis math has numerous a bigger number of uses than the starting use of Newton's.

Connected mathematicians are ordinarily persuaded by issues emerging from the physical world. They utilize arithmetic to display and take care of these issues. These models are truly speculations and, as with any science, they are liable to testifiability and falsifiability. As the measure of data in

regards to the issue expands, these models will perhaps change.

Pure and applied are not necessarily mutually exclusive. There are many great mathematicians who tread both grounds.

This delineates the adage of a noticeable British mathematician Godfrey Hardy (2012): "Immaculate science is overall particularly more valuable than connected". At the end of the day, regularly the value of a numerical hypothesis is because of its relevancy and simplification. For instance, bunch hypothesis has various applications in science, material science and arithmetic itself in light of the fact that it is extremely unique and consequently numerous structures have bunch properties. "There is nothing more reasonable than a decent hypothesis" (James C. Maxwell).

- What is pure mathematics?

Answer: Immaculate science studies conceptual items. On the other hand, these items are models of certifiable marvels and the aftereffects of unadulterated arithmetic end up being reasonable, however this procedure may take years. There is no compelling reason to differentiate unadulterated and connected science; there is frequently cover and common impact. "No human examination can be called genuine science on the off chance that it can't be exhibited numerically" (Leonardo da Vinci). It is even more genuine today: Any genuine examination (even in craftsmanship and sociologies) includes science, and that arithmetic would be viewed as immaculate math previously; a case is parametric outline in structural

planning. All current innovation depends on unadulterated arithmetic.

There are numerous issues sought after by unadulterated mathematicians that have their roots in cement physical issues – especially those that emerge from relativity or quantum mechanics.

Commonly, in a more profound comprehension of such wonders, different "details" emerge (trust me when I let you know these details are exceptionally hard to clarify). These get to be preoccupied away into simply numerical articulations that unadulterated mathematicians can assault.

In (ERCIM, 2008) arithmetic was contrasted with a pyramid: On the highest point of the pyramid are quick uses of science to our regular life. "However the highest point of this pyramid would not be so high if its base were not all that wide. This uncommon component of arithmetic gets from its inside structure. A decent cutting edge utilization of science can commonly draw from differential mathematical statements, numerical examination and direct variable based math. These might just draw from chart hypothesis, bunch hypothesis and complex examination. These thus lay on the firm premise of number hypothesis, topology and geometry. Going more profound and more profound into the bases of the arithmetic, one winds up with such foundations of rationale as model hypothesis and set hypothesis." Purely hypothetical results are essential for building a legitimate numerical hypothesis; a percentage of the outcomes will have down to earth applications and some may not but rather they are still expected to bolster the

pyramid. Basic territories of immaculate science, for example, scientific rationale, don't have numerous quick functional applications yet arithmetic can't create without them.

There are numerous recorded samples of disclosures in unadulterated science that appeared to be pointless at the time however had imperative applications years after the fact. These are some of them.

Negative and complex numbers were viewed as preposterous and futile before the fifteenth century. Presently mind boggling numbers are utilized as a part of electrical designing.

For around 2000 years geometers attempted to derive the fifth Euclid's aphorism from the other four maxims. In 1830 Lobachevski and Bolyai demonstrated the autonomy of the fifth adage. This was a progressive revelation however absolutely hypothetical until Einstein connected it in his hypothesis of general relativity.

Chart hypothesis has discovered numerous applications in science and software engineering.

The Radon change acquainted in 1917 was connected with create Tomography in the 1960's (it was granted Nobel prize in pharmaceutical). This is only one case of numerous uses of science in drug.

Wavelet and Fourier changes are utilized as a part of PC visual depiction and in medicinal hardware, for example, MRA, circulatory strain screen, and diabetes screen.

Topology helps understanding the sub-atomic structures (Flapan, 2000).

Logarithmic Topology has discovered applications in information mining.

Turing's hypothesis of processability gave the hypothetical premise to figuring.

Number hypothesis in the past had been viewed as a sample of futile science. Numerous years after the fact the consequences of number hypothesis, specifically, the hypothesis of prime numbers were connected to planning PC security frameworks (see, for instance, Coutinho, 2009). Each time we do web booking, shopping, or keeping money we are ensured by mouth. We all utilization PCs, Internet and cell telephones, and they are basically uses of immaculate science. Give us a chance to recollect that, and regard and backing immaculate arithmetic.

Another quote from (ERCIM, 2008) stresses the uniqueness and significance of arithmetic: "... A scientific result is legitimate until the end of time. It may drop out of style, or fall outside the present range of use, yet even the most seasoned known numerical formulae -, for example, that since settling quadratic comparisons, known 2400 years prior by the Babylonians, Chinese and later the Greeks... - are the bread and spread of present-day rudimentary arithmet

- What is the point of pure mathematics?

How is "really helping the world run" synonymous with "having a point"? Does music help the world run? Cosmology?

Cricket? Model? Artful dance? Reasoning? 3D Animation? Prehistoric studies? Caper hurls?

Arithmetic is an enormous building of human thought, more excellent and profound than whatever else for those with the preparation and slant to value it. That point is enough.

This shouldn't imply that that unadulterated science doesn't likewise have pragmatic applications - the fact is that it needn't bother with those to matter. Obviously, it has such applications. Over and over we've discovered that scientific deliberations find startling applications, and are actually totally vital for us to comprehend our general surroundings, and to impact it.

Present day speculations of material science - general relativity, quantum field hypotheses, string hypothesis - depend on profound and theoretical numerical thoughts. The investigation of calculations and information structures, framing the establishment of software engineering, requires a sound dosage of "immaculate math", and numerous to a great degree everyday advancements use those thoughts (a frequently cited sample is Google's unique PageRank calculation, which is an example of a thought from chart hypothesis). It is difficult to envision the present day Economics or Earth sciences without measurements, another field that depends vigorously on unadulterated arithmetic.

On the other hand, as I said, most mathematicians - even those working in combinatorics, insights or hypothetical

software engineering, fields that are near the building - needn't bother with those applications so as to make the most of their work, or legitimize it. Indeed, some of them emphatically savor the way that they work in simply dynamic tranquility, untainted, in a manner of speaking, by hardware and advances thus called "applications". Tough broadly communicated this perspective in A Mathematician's Apology.

Thinking about why each normal number is the aggregate of four squares requires just scholarly interest, and fulfilling our craving to seek after such inquiries for the sake of sheer interest is the "point" of unadulterated science.

Example: Matrices [14]

To encode a short message a number can be assigned to each letter of the alphabet according to a given table. The text as a sequence of numbers will be organized into a square matrix A; in the case that the number of letters is lower than the number of elements of the matrix A, the rest of the matrix can be filled with zero elements. Let a nonsingular square matrix C be given. To encode the text the matrix A can be multiplied by the matrix C for example on the left. Let the following table and the matrix C be given:

A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P	Q	R	S	T	U	V	W	X	Y	Z
8	7	5	13	9	16	18	22	4	23	11	3	21	1	6	15	12	19	2	14	17	20	25	24	10	26

$$C = \begin{pmatrix} 2 & 0 & 1 \\ 1 & 0 & 1 \\ 0 & 1 & 0 \end{pmatrix}$$

We put the text "BILA KOCKA" (a white cat) into the matrix

$$A = \begin{pmatrix} 7 & 4 & 3 \\ 8 & 11 & 6 \\ 5 & 11 & 6 \end{pmatrix}$$

and encode the text:

$$Z = CA = \begin{pmatrix} 19 & 19 & 14 \\ 12 & 15 & 11 \\ 8 & 11 & 6 \end{pmatrix}$$

To decode the message we have to multiply the matrix by  $Z$  the matrix  $C^{-1}$  on the left

$$C^{-1}Z = \begin{pmatrix} 1 & -1 & 0 \\ 0 & 0 & 1 \\ -1 & 2 & 0 \end{pmatrix} \begin{pmatrix} 19 & 19 & 14 \\ 12 & 15 & 11 \\ 8 & 11 & 6 \end{pmatrix} = A$$

Since the matrix multiplication is not commutative, it is necessary to keep the order of the matrices in the product. If we multiply the matrices  $C^{-1}$  and  $Z$  in the opposite order, we

Obtain

$$ZC^{-1} = \begin{pmatrix} 19 & 19 & 14 \\ 12 & 15 & 11 \\ 8 & 11 & 6 \end{pmatrix} \begin{pmatrix} 1 & -1 & 0 \\ 0 & 0 & 1 \\ -1 & 2 & 0 \end{pmatrix} = \begin{pmatrix} 5 & 9 & 19 \\ 1 & 10 & 15 \\ 2 & 4 & 11 \end{pmatrix}$$

and it means "CERNY PSIK"(a black dog).

Conclusion: We conclude that both pure mathematics and applied mathematics are individually important and dependent on each other. As well as to solve real life problems we need the knowledge of both the subjects. It is very important to study both the subjects.

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# ***RELIABILITY ANALYSIS OF A STAND-BY SYSTEM WITH ENVIRONMENT FAILURE***

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*Abstract*— In this the author has considered a complex system consisting of two sub-systems connected in series. The sub-system *A* consists of two identical units in series while sub-system *B* consists of two identical units in standby redundancy and these units are connected by a perfect switch. The system can fail completely on failure of either of two sub-systems and due to environmental failure. Each unit of the system has three modes namely *good*, *degraded* and *failed*. All the repairs follow general time distributions while all failures follow exponential time distributions

*Keywords*—System, degraded stste, Mean time to Failure, Laplace transform , relaiability, availability and Markov process

## 1. INTRODUCTION

The importance of obtaining highly reliable systems and components has been recognized in recent years. Thus high degree of reliability is usually achieved by introducing redundancy and service facility. The choice of redundancy depends on the systems configuration. If the failure detection and switching over devices are extremely reliable, the standby redundancy technique must be used in the design stage as it provides theoretically much higher reliability than parallel redundancy. In standby arrangements, when the main unit in action fails, the identical standby unit is put into operation through switch.

In reliability analysis, it has been mostly assumed that the system has an immediate repair facility and after detection of failure, the unit goes under repair. But in many cases it is not advisable to always have a repair facility. Gopalan and Naidu (1982) and A. Kumar (1988) have discussed reliability systems in which the repair facility exists at random interval of time.

Keeping these facts in view, in this chapter, the author has considered a complex system consisting of two sub-systems connected in series. The sub-system *A* consists of two identical units in series while sub-system *B* consists of two identical units in standby redundancy. The whole system can fail, if one the subsystems, *A* or *B* fail and the whole system can also fail due to environmental failure or critical human error. Each of the units of the system has three modes mainly normal, degraded and failed. The two standby units of subsystem *B* are connected by a perfect switch with general switching rate. All the repair follows general time distribution while all the failure follows exponential time distribution Reliability parameters; viz; mean time to failure (M.T.T.F.) and availability in such system

have also been obtained using Markov process and Supplementary variable process. These equations are solved with the help of Laplace transform technique. Certain particular cases are analysed. Also, numerical illustrations with various graphs have been given at the end to connect the model with physical situations of the model.

## 2. ASSUMPTIONS

1. Initially the system is in good state of normal efficiency.
2. Each unit has three modes namely –normal, degraded and failed.
3. In one step only one change can take place.
4. The system can fail on the failure of either sub-systems and due to environmental failure.
5. Repair is given only when the unit is either in degraded state or in failed state.
6. After repair, the system works like a new one and never damages anything.
7. Switching over device is perfect and switching rate is general.

## 3. NOTATIONS

$P_0(t)$  : The probability that at time  $t$ , the system is in good state.

$P_1(t) \Delta$  : The probability that, the system, in time  $t$ , is in failed state due to failure of one unit of subsystem *B* and elapsed repair time lies in the interval time  $(x, x + \Delta)$

$P_2(t)$  : The probability that the system is in operable state.

$P_3(y,t) \Delta$  : The probability that the system is in failed state at time  $t$ , due to the failure of both units of subsystem *B* and elapsed repair time lies in the interval  $(y, y + \Delta)$

$P_4(x,t) \Delta$  : The probability that the system at time  $t$ , is in failed

state due to failure of one unit of sub-system A and the elapsed repair time lies in the interval  $(x, x + \Delta)$

$P_5(z,t) \Delta$  : The probability that the system at time  $t$ , is in failed state due to environmental failure and elapsed repair time lies in the interval  $(z, z + \Delta)$

- $\lambda_1$  : The constant failure rate from state  $S_0$  to  $S_4$ .
- $\lambda_2$  : The constant failure rate from state  $S_0$  to  $S_1$  and  $S_2$  to  $S_3$ .
- $\beta(x)$  : The general switching rate from state  $S_1$  to  $S_2$ .
- $\lambda_{c1}$  : The constant failure rate from state  $S_0$  to  $S_5$  i.e. environmental failure rate.
- $\lambda_{c2}$  : The constant failure rate from state  $S_2$  to  $S_5$ .
- $\mu(x)$  : General repair rate from state  $S_4$  to  $S_0$ .
- $\eta(y)$  : General repair rate from state  $S_3$  to  $S_0$ .
- $\alpha(z)$  : General repair rate from state  $S_5$  to  $S_0$ .

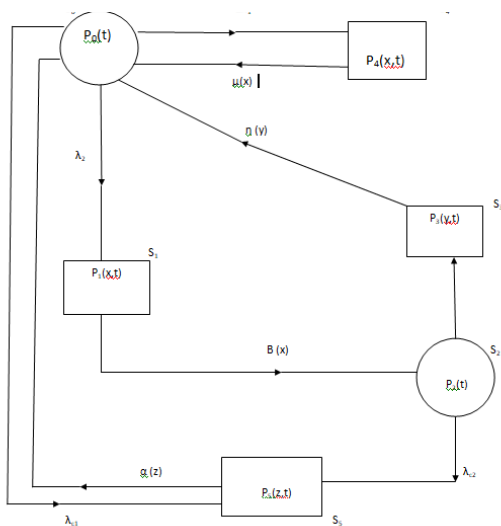


Fig 4.1

4. FORMULATION OF MATHEMATICAL MODEL

Viewing the nature of this system, we obtain the following set of difference differential equations by connecting the state probabilities at time  $t + \Delta$  with those at time  $t$ , and taking limit as  $\Delta t \rightarrow 0$

$$\left[ \frac{\partial}{\partial t} + 2\lambda_1 + \lambda_2 + \lambda_{c1} \right] P_0(t) = \int_0^\infty P_3(y,t)\eta(y)dy + \int_0^\infty P_4(x,t)\mu(x)dx + \int_0^\infty P_5(z,t)\alpha(z)dz \dots (4.1)$$

$$\left[ \frac{\partial}{\partial x} + \frac{\partial}{\partial t} + \beta(x) \right] P_1(x,t) = 0 \dots (4.2)$$

$$\left[ \frac{\partial}{\partial t} + \lambda_2 + \lambda_{c2} \right] P_2(t) = \int_0^\infty P(x,t)\beta(x)dx \dots (4.3)$$

$$\left[ \frac{\partial}{\partial y} + \frac{\partial}{\partial t} + \eta(y) \right] P_3(y,t) = 0 \dots (4.4)$$

$$\left[ \frac{\partial}{\partial x} + \frac{\partial}{\partial t} + \mu(x) \right] P_4(x,t) = 0 \dots (4.5)$$

$$\left[ \frac{\partial}{\partial z} + \frac{\partial}{\partial t} + \alpha(z) \right] P_5(z,t) = 0 \dots (4.6)$$

These equations are to be solved under following boundary and initial conditions:

BOUNDARY CONDITIONS

$$P_1(0,t) = \lambda_2 P_0(t) \dots (4.7)$$

$$P_3(0,t) = \lambda_2 P_2(t) \dots (4.8)$$

$$P_4(0,t) = 2\lambda_1 P_0(t) \dots (4.9)$$

$$P_5(0,t) = \lambda_{c1} P_0(t) + \lambda_{c2} P_2(t) \dots (4.10)$$

5. INITIAL CONDITIONS

$$P_0(0) = 1, \text{ otherwise zero.} \dots (4.11)$$

6. SOLUTION OF THE MODEL

Taking Laplace transforms of equations (4.1) through (4.10) and solving them one by one by using initial conditions, one can obtain :

$$\begin{aligned} [s + 2\lambda_1 + \lambda_2 + \lambda_{c1}] \bar{P}_0(s) &= 1 \\ + \int_0^\infty \bar{P}_3(y,s)\eta(y)dy + \int_0^\infty \bar{P}_4(x,s)\mu(x)dx \\ + \int_0^\infty \bar{P}_5(z,s)\alpha(z)dz &= dz \dots \end{aligned} \dots (4.12)$$

$$\left[ \frac{\partial}{\partial x} + s + \beta(x) \right] \bar{P}_1(x, s) = 0 \quad \dots (4.13)$$

$$[s + \lambda_2 + \lambda_{c2}] \bar{P}_2(s) = \int_0^\infty \bar{P}_1(x, s) \beta(x) dx \quad \dots (4.14)$$

$$\left[ \frac{\partial}{\partial y} + s + \eta(y) \right] \bar{P}_3(y, s) = 0 \quad \dots (4.15)$$

$$\left[ \frac{\partial}{\partial x} + s + \mu(x) \right] \bar{P}_4(x, s) = 0 \quad \dots (4.16)$$

$$\left[ \frac{\partial}{\partial z} + s + \alpha(z) \right] \bar{P}_5(z, s) = 0 \quad \dots (4.17)$$

$$\bar{P}_1(0, s) = \lambda_2 \bar{P}_0(s) \quad \dots (4.18)$$

$$\bar{P}_3(0, s) = \lambda_2 \bar{P}_2(s) \quad \dots (4.19)$$

$$\bar{P}_4(0, s) = 2\lambda_1 \bar{P}_0(s) \quad \dots (4.20)$$

$$\bar{P}_5(0, s) = \lambda_{c1} \bar{P}_0(s) + \lambda_{c2} \bar{P}_2(s) \quad \dots (4.21)$$

On integrating (4.13) and by using (4.18), we obtained

$$\begin{aligned} \bar{P}_1(x, s) &= \lambda_2 \bar{P}_0(s) e^{-sx - \int_0^x \beta(x) dx} \\ \Rightarrow \bar{P}_1(s) &= \lambda_2 \bar{P}_0(s) D_\beta(s) \end{aligned} \quad \dots (4.22)$$

from (4.14) by using (4.22), we get

$$\begin{aligned} [s + \lambda_2 + \lambda_{c2}] \bar{P}_2(s) &= \lambda_2 \bar{P}_0(s) \bar{S}_\beta(s) \\ \Rightarrow \bar{P}_2(s) &= \frac{\lambda_2 \bar{P}_0(s) \bar{S}_\beta(s)}{s + \lambda_2 + \lambda_{c2}} \end{aligned} \quad \dots (4.23)$$

Integrating (4.15) and by using (4.19) & (4.23), we have

$$\begin{aligned} \bar{P}_3(y, s) &= \lambda_2 \bar{P}_2(s) e^{-sy - \int_0^y \eta(y) dy} \\ \Rightarrow \bar{P}_3(s) &= \lambda_2 \bar{P}_2(s) D_\eta(s) \end{aligned}$$

$$= \frac{\lambda_2^2 \bar{P}_0(s) \bar{S}_\beta(s)}{s + \lambda_2 + \lambda_{c2}} D_\eta(s) \quad \dots (4.24)$$

Integrating (4.16), by using (4.20), we get

$$\begin{aligned} \bar{P}_4(x, s) &= 2\lambda_1 \bar{P}_0(s) e^{-sx - \int_0^x \mu(x) dx} \\ \Rightarrow \bar{P}_4(s) &= 2\lambda_1 \bar{P}_0(s) D_\mu(s) \end{aligned} \quad \dots (4.25)$$

Integrating (4.17) by using (4.21) & (4.23) and relevant relations, we get

$$\begin{aligned} \bar{P}_5(z, s) &= [\lambda_{c1} \bar{P}_0(s) + \lambda_{c2} \bar{P}_2(s)] e^{-sz - \int_0^z \alpha(z) dz} \\ \Rightarrow \bar{P}_5(s) &= [\lambda_{c1} \bar{P}_0(s) + \lambda_{c2} \bar{P}_2(s)] D_\alpha(s) \\ &= \bar{P}_0(s) \left[ \lambda_{c1} + \frac{\lambda_{c2} \lambda_2 \bar{S}_\beta(s)}{s + \lambda_2 + \lambda_{c2}} \right] D_\alpha(s) \end{aligned} \quad \dots (4.26)$$

Finally (4.12) gives on simplification by using relevant relations,

$$\bar{P}_0(s) = \frac{1}{A(s)}$$

where

$$\begin{aligned} A(s) &= s + 2\lambda_1 + \lambda_2 + \lambda_{c1} - \frac{\lambda_2^2 \bar{S}_\beta(s)}{s + \lambda_2 + \lambda_{c2}} \bar{S}_\eta(s) \\ &\quad - 2\lambda_1 \bar{S}_\mu(s) - \left[ \lambda_{c1} + \frac{\lambda_{c2} \lambda_2 \bar{S}_\beta(s)}{s + \lambda_2 + \lambda_{c2}} \right] \bar{S}_\alpha(s) \end{aligned} \quad \dots (4.27)$$

It is interesting to note that sum of all the probabilities

$$\bar{P}_0(s) + \bar{P}_1(s) + \bar{P}_2(s) + \bar{P}_3(s) + \bar{P}_4(s) + \bar{P}_5(s) = 1/s$$

Thus, finally we have

$$\bar{P}_0(s) = \frac{1}{A(s)} \quad \dots (4.28)$$

$$\bar{P}_1(s) = \frac{1}{A(s)} \lambda_2 D_\beta(s) \quad \dots (4.29)$$

$$\bar{P}_2(s) = \frac{1}{A(s)} \frac{\lambda_2 \bar{S}_\beta(s)}{(s + \lambda_2 + \lambda_{c2})} \quad \dots (4.30)$$

$$\bar{P}_3(s) = \frac{1}{A(s)} \frac{\lambda_2^2 \bar{S}_\beta(s)}{(s + \lambda_2 + \lambda_{c2})} D_\eta(s) \dots (4.31)$$

$$\bar{P}_4(s) = \frac{1}{A(s)} 2\lambda_1 D_\mu(s) \dots (4.32)$$

$$\bar{P}_5(s) = \frac{1}{A(s)} \left[ \lambda_{c1} + \frac{\lambda_{c2} \bar{S}_\beta(s)}{s + \lambda_2 + \lambda_{c2}} \right] D_\alpha(s) \dots (4.33)$$

7. ERGODIC BEHAVIOUR OF THE SYSTEM

$$\lim_{s \rightarrow 0} s \bar{F}(s) = \lim_{t \rightarrow \infty} F(t) = F$$

Using Abel's Lemma viz; (say);

provided the limit on R.H.S. exists; the following time independent probabilities have been obtained from equations (4.28) through (4.33)

$$P_0 = \frac{1}{A'(0)} \dots (4.34)$$

$$P_1 = \frac{1}{A'(0)} \lambda_2 M_\beta \dots (4.35)$$

$$P_2 = \frac{1}{A'(0)} \frac{\lambda_2}{(\lambda_2 + \lambda_{c2})} \dots (4.36)$$

$$P_3 = \frac{1}{A'(0)} \frac{\lambda_2^2}{(\lambda_2 + \lambda_{c2})} M_\eta \dots (4.37)$$

$$P_4 = \frac{1}{A'(0)} 2\lambda_1 M_\mu \dots (4.38)$$

$$P_5 = \left[ \lambda_{c1} + \frac{\lambda_{c2} \lambda_2}{\lambda_2 + \lambda_{c2}} \right] \dots (4.39)$$

8. PARTICULAR CASES

By setting  $\bar{S}_\beta(s) = \frac{\beta}{s + \beta}$   $\bar{S}_\eta(s) = \frac{\eta}{s + \eta}$ ,

$$\bar{S}_\mu(s) = \frac{\mu}{s + \mu}$$

$$\bar{S}_\alpha(s) = \frac{\alpha}{s + \alpha},$$

in the equations (4.28) through (4.33), one may obtain

$$\bar{P}_0(s) = \frac{1}{E(s)} \dots (4.40)$$

$$\bar{P}_1(s) = \frac{1}{E(s)} \frac{\lambda_2}{s + \beta} \dots (4.41)$$

$$\bar{P}_2(s) = \frac{1}{E(s)} \frac{\lambda_2}{s + \lambda_2 + \lambda_{c2}} \cdot \frac{\beta}{s + \beta} \dots (4.42)$$

$$\bar{P}_3(s) = \frac{1}{E(s)} \frac{\lambda_2^2}{s + \lambda_2 + \lambda_{c2}} \cdot \frac{\beta}{s + \beta} \cdot \frac{1}{s + \eta} \dots (4.43)$$

$$\bar{P}_4(s) = \frac{1}{E(s)} \frac{2\lambda_1}{s + \mu} \dots (4.44)$$

$$\bar{P}_5(s) = \frac{1}{E(s)} \left[ \lambda_{c1} + \frac{\lambda_{c2} \lambda_2 \beta}{(s + \lambda_2 + \lambda_{c2})(s + \beta)} \right] \frac{1}{s + \alpha} \dots (4.45)$$

where

$$E(s) = s + 2\lambda_1 + \lambda_2 + \lambda_{c1} - \frac{\lambda_2^2 \beta \eta}{(s + \lambda_2 + \lambda_{c2})(s + \beta)(s + \eta)} - \frac{2\lambda_1 \mu}{s + \mu}$$

$$\left[ \lambda_{c1} + \frac{\lambda_{c2} \lambda_2 \beta}{(s + \lambda_2 + \lambda_{c2})(s + \beta)} \right] \frac{1}{s + \alpha} \dots (4.46)$$

9. EVALUATION OF PROBABILITIES OF UP AND DOWN STATES.

We have

$$\bar{P}_{up}(s) = \bar{P}_0(s) + \bar{P}_2(s)$$

$$= \frac{1}{s + 2\lambda_1 + \lambda_2 + \lambda_{c1}} \left[ 1 + \frac{\lambda_2}{(s+1)(s + \lambda_2 + \lambda_{c2})} \right] \dots (4.47)$$

$$\Rightarrow P_{up}(t) = \left[ 1 + \frac{\lambda_2}{(1-2\lambda_1 - \lambda_2 - \lambda_{c1})(\lambda_{c2} - 2\lambda_1 - \lambda_{c1})} \right] e^{-(2\lambda_1 + \lambda_2 + \lambda_{c2})t}$$

$$+ \frac{\lambda_2 e^{-(\lambda_2 - \lambda_{c2})t}}{(2\lambda_1 + \lambda_{c1} - \lambda_{c2})(1 - \lambda_2 - \lambda_{c2})}$$

$$+ \frac{\lambda_2}{(2\lambda_1 + \lambda_{c1} - \lambda_{c2})(\lambda_2 + \lambda_{c2} - 1)} e^{-t} \dots (4.48)$$

Also,

$$P_{down}(t) = 1 - P_{up}(t) \dots (4.49)$$

10. RELIABILITY AND M.T.T.F. EVALUATION

$$\bar{R}(s) = \frac{1}{s + 2\lambda_1 + \lambda_2 + \lambda_{c1}}$$

$$\Rightarrow R(t) = e^{-(2\lambda_1 + \lambda_2 + \lambda_{c1})t} \dots (4.50)$$

and M.T.T.F. =  $\frac{1}{2\lambda_1 + \lambda_2 + \lambda_{c1}}$   $\dots (4.51)$

11. INTERPRETATION OF RESULTS

Availability Analysis:

According to equation (4.48), we plot a graph for Availability Vs time, shown in the fig (4.6 ). We observe that availability of the system decreases with increase in time 't'.

t	R(t)
0	1
1	0.852144
2	0.726149
3	0.618783
4	0.527292
5	0.449329
6	0.382893
7	0.32628
8	0.278037
9	0.236928
10	0.201897

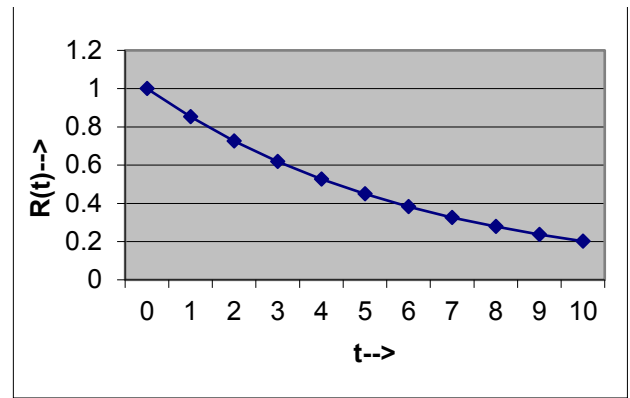


Fig 4.2

Reliability and M.T.T.F. analysis :

We plot various graphs according to equations (4.50) and (4.51), shown in fig (4.2), (4.3), (4.4) and (4.5)

We observe that reliability decreases as time t, increases, also M.T.T.F. of the system decreases with respect to increase in  $\lambda_1, \lambda_2$  and  $\lambda_{c1}$  respectively.

$\lambda_1$	M.T.T.F
0.01	12.5
0.02	10
0.03	8.333333
0.04	7.142857
0.05	6.25
0.06	5.555556
0.07	5
0.08	4.545455
0.09	4.166667
0.1	3.846154

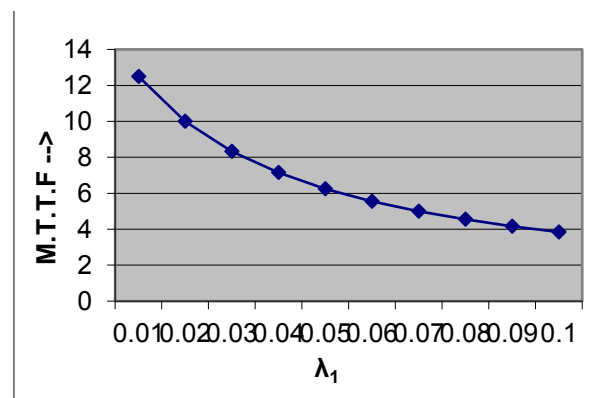
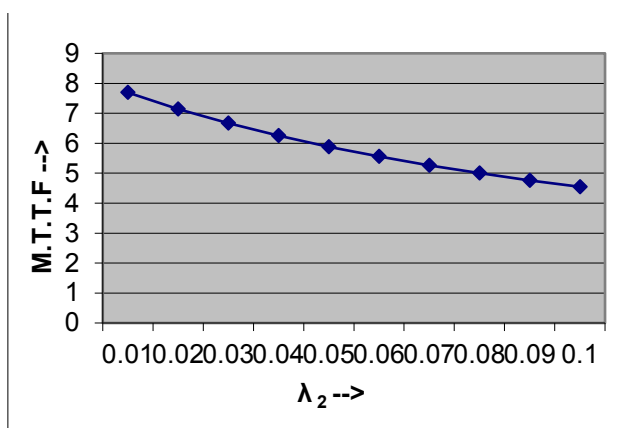


Fig 4.3

$\lambda_2$	M.T.T.F
0.01	7.692308
0.02	7.142857
0.03	6.666667
0.04	6.25
0.05	5.882353
0.06	5.555556
0.07	5.263158
0.08	5
0.09	4.761905
0.1	4.545455



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# AN INEQUALITY BASED PROOF OF THE FIXED POINT THEOREM IN C\*-ALGEBRA VALUED MODULAR SPACES

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**ABSTRACT:** Complex-values Modular spaces extend several interesting spaces like Lebesgue, Lorentz, Orlicz etc. Recently, Shateri introduced a fixed point theorem in a C\*-algebra-valued modular space. We obtain a fundamental inequality for a contraction with respect to a C\*-algebra-valued modular space. Using this inequality we simplify Shateri's proof. **AMS 2010 Subject Classification:** 47H10; 46L05.

**Keywords:** Banach contraction principle; fixed point; C\*-algebras; modular spaces.

## 1 Introduction

In [10], Ma, Jiang, and Sun defined C\*-algebra-valued metric spaces and proved a fixed point theorem for the corresponding contractions. The short proofs of this theorem appeared in [1, 5, 4]. Along this line of research, Shateri [13] introduced recently the terminology of a C\*-algebra-valued modular space and generalized the notion of contraction in this space. We first recall both these definitions:

**Definition 1.1.** Let  $X$  be a vector space over  $F = (R \text{ or } C)$  and let  $A$  be a unital C\*-algebra. Then the function  $\rho : X \rightarrow A$  is called a C\*-algebra-valued modular on  $X$  if the following conditions hold for each  $x, y \in X$ ; and for each  $\alpha, \beta \in F$ :

- (a)  $\rho(x) \geq \theta$ . In addition,  $\rho(x) = \theta \Leftrightarrow x = 0$ ;
- (b)  $\rho(\alpha x) = \rho(x)$  whenever  $|\alpha| = 1$ ;

$$(c) \quad \rho(\alpha x + \beta y) = \alpha \rho(x) + \beta \rho(y) \quad \text{whenever} \\ \alpha, \beta \geq 0 \text{ and } \alpha + \beta = 1.$$

In this case, we get a C\*-algebra-valued modular space  $X_\rho$ ; which is a vector space, defined by  $X_\rho = \{x \in X : \rho(\lambda x) \rightarrow \theta \text{ when } \lambda \rightarrow 0\}$ .

**Remark 1.2.** When  $0 < \alpha < \beta$  and  $y = 0$ ; it implies from Definition 1.1(c) that

$$\rho(\alpha x) = \rho\left(\frac{\alpha}{\beta}(\beta x)\right) \leq \rho(\beta x).$$

It is easy to observe that a C\*-algebra-valued modular space extends the classical notion of modular space, when we replace the set of positive real numbers by the set of positive elements of the C\*-algebra.

**Definition 1.3.** Assume  $X_\rho$  to be a C\*-algebra-valued modular space. A function  $T : X_\rho \rightarrow X_\rho$  is called C\*-algebra-valued contraction in  $X_\rho$ , if there exist an  $a \in A$  such that  $\|a\| < 1$  and positive real numbers  $\alpha, \beta$ ; with  $\alpha > \beta$  satisfying

$$\rho(\alpha(Tx - Ty)) \leq a * \rho(\beta(x - y))a \\ \text{for every } x, y \in X_\rho.$$

In [12], Palais mentioned a fundamental inequality for contractions and gave elementary proof of the classical Banach contraction principle (BCP) [2]. Inspired from this new theme, in the next section we give an easy proof of [13, Theorem 2.2]. In particular, our approach

also gives a short proof for the BCP in classical modular spaces if we consider trivial C\*-algebra(cf. [8, 7]).

## 2 Banach contraction principle

The following definition is from [13].

**Definition 2.1.** Let  $(x_n)$  be a sequence in a C\*-algebra-valued modular space  $X_\rho$ .

Then

(a)  $(x_n)$  is called  $\rho$ -Cauchy if

$$\rho(x_n - x_m) \rightarrow 0 \text{ as } n, m \rightarrow \infty;$$

(b)  $(x_n)$  is called  $\rho$ -convergent if there

exists  $x \in X_\rho$  such that

$$\rho(x_n - x) \rightarrow 0 \text{ as } n \rightarrow \infty.$$

The space  $X_\rho$  is called  $\rho$ -complete if every  $\rho$ -Cauchy sequence  $(x_n)$  is always  $\rho$ -convergent. The modular  $\rho$  is said to satisfy  $\Delta_2^*$ -condition if  $\rho(2x_n) \rightarrow 0 \text{ as } n \rightarrow \infty$ .

Let  $X_\rho$  to be a C\*-algebra-valued modular space and let  $T : X_\rho \rightarrow X_\rho$  be a C\*- algebra-valued contraction in  $X_\rho$ .

Since  $\alpha > \beta$ ; there exists  $\gamma > 0$  such that

$$\frac{\beta}{\alpha} + \frac{1}{\gamma} = 1. \text{ Then for each } x_1, x_2 \in X_\rho \text{ using}$$

$$\frac{\beta}{\alpha} + \frac{1}{\gamma} = 1 \text{ in Definition 1.1(c), we have}$$

$$\begin{aligned} & \rho(\beta(x_2 - x_1)) \\ &= \rho(\beta(Tx_1 - Tx_2) + \beta(x_1 - Tx_1) + \beta(Tx_2 - x_2)) \end{aligned}$$

$$= \rho \left( \begin{aligned} & \frac{\beta}{\alpha} (\alpha(Tx_1 - Tx_2)) + \frac{1}{\gamma} (\beta\gamma(x_1 - Tx_1)) \\ & + \beta\gamma(Tx_2 - x_2) \end{aligned} \right)$$

$$\leq \rho(\alpha(Tx_1 - Tx_2))$$

$$+ \rho \left( \frac{1}{2} (2\beta\gamma(x_1 - Tx_1)) + \frac{1}{2} (2\beta\gamma(Tx_2 - x_2)) \right) \leq \frac{\|a\|^{2n} + \|a\|^{2m}}{1 - \|a\|^2} \rho(2\beta\gamma(x - T(x))) \quad (2.2)$$

$$\begin{aligned} & \leq \rho(\alpha(Tx_1 - Tx_2)) + \rho(2\beta\gamma(x_1 - Tx_1)) \\ & \quad + \rho(2\beta\gamma(Tx_2 - x_2)). \end{aligned}$$

Taking the C\*-norm on both the sides and since  $T$  is a C\*-algebra-valued contraction in  $X_\rho$ ; we get the following inequality:

**Fundamental inequality for contractions:**

If  $T$  is a C\*- algebra-valued contraction in a C\*- algebra-valued modular space  $X_\rho$ ; then

$$\begin{aligned} & \|\rho(\beta(x_1 - x_2))\| \\ & \leq \frac{1}{1 - \|a\|^2} \|\rho(2\beta\gamma(x_1 - Tx_1)) + \rho(2\beta\gamma(Tx_2 - x_2))\|. \end{aligned} \quad (2.1)$$

**Corollary 2.2.** The C\*-algebra-valued contraction  $T$  in  $X_\rho$  cannot have more than one fixed point.

**Proposition 2.3.** Suppose  $X_\rho$  is a C\*-algebra-valued modular space and  $T : X_\rho \rightarrow X_\rho$  is a C\*-algebra-valued contraction in  $X_\rho$ . Then for each  $x \in X_\rho$ ; the sequence  $\{\beta(T^n(x))\}$  is  $\rho$ -Cauchy.

**Proof.** Substitute  $x_1 = T^n(x)$  and  $x_2 = T^m(x)$  in the inequality 2.1, and using  $\alpha > \beta$  (see Remark 1.2) combined with the definition of the contraction  $T$  we obtain

$$\begin{aligned} & \|\rho(\beta(T^n(x) - T^m(x)))\| \\ & \leq \frac{1}{1 - \|a\|^2} \|\rho(2\beta\gamma(T^n(x) - T^{n+1}(x))) \\ & \quad + \rho(2\beta\gamma(T^{m+1}(x) - T^m(x)))\| \\ & \leq \frac{1}{1 - \|a\|^2} \|a^{*n} \rho(2\beta\gamma(x - T(x)))a^n \\ & \quad + a^{*m} \rho(2\beta\gamma(T(x) - x))a^m\| \end{aligned}$$

$$(2.2)$$

Hence  $\|a\| < 1$  along with the preceding inequality gives  $\|\rho(\beta(T^n(x) - T^m(x)))\| \rightarrow \theta$  as  $n, m \rightarrow \infty$ .

When  $X_\rho$  is  $\rho$ -complete with  $\Delta_2^*$ -condition, the fact that  $\{\beta(T^n(x))\}$  is  $\rho$ -Cauchy sequence, implies that the sequence  $\{T^n(x)\}$  is also  $\rho$ -Cauchy. Therefore it is  $\rho$ -convergent to a point  $p \in X_\rho$ . It is trivial that  $p$  is a fixed point of  $T$ . Hence we have the following version of Banach contraction principle (see [13, Theorem 2.2]):

**Theorem 2.4.** Suppose  $X_\rho$  is a  $C^*$ -algebra-valued  $\rho$ -complete modular space with  $\Delta_2^*$ -condition and  $T : X_\rho \rightarrow X_\rho$  is a  $C^*$ -algebra-valued contraction in  $X_\rho$ . Then  $T$  has a unique fixed point  $p \in X_\rho$ .

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# *Untapped Potential of Multilevel Car Parking*

## *(A case study on Kankaria Multilevel Car Parking, Ahmedabad)*

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**Abstract**—Vehicle ownership in India is increasing at fast rate and by year 2030 it will cross 2 billion mark. With such huge influx of vehicles, parking problems will also rise. Parking lots and underground parking facilities are crowded and due to lack of space available, new solutions were suggested. Among all solutions multilevel car parking system was implemented in many cities of India, but the end results were disappointing due to lukewarm response from majority of car users. Lack of proper enforcement and minimal awareness are one of the major reasons. It is therefore necessary to study these reasons and make suitable changes in existing facility. This paper discusses untapped potential of multilevel car parking facility in a developing city like Ahmedabad along with various reasons and suggestions.

**Keywords**— *Enforcement, Implementation, Retrieval Time*

### I. INTRODUCTION

India, the second most populated country in the world houses more than 40 million vehicles. Since it has strong domestic market, the growth is expected to be sustainable and increase over the next few years. However infrastructure available for vehicles like roads and parking spaces have been a challenge in most of the Indian cities. Country faces severe problem of congestion due to growth of personalized vehicles. The traffic management in the many cities is marked by introduction of a series of one-way traffic system. The one-way traffic system has, however, implications on pedestrian safety and fuel consumption. One-way traffic is generally desirable when there are complementary roads and the additional traveling distance is not more than 300m. Hence, whenever such systems are introduced, the interests of public transport modes and pedestrians are duly addressed. Demand for parking in the CBD areas of Indian cities is twice the supply. Acute shortage of parking supply is witnessed in commercial areas and indiscriminate parking impedes free flow of traffic and cause accidents.

### CONCEPT OF MULTI LEVEL CAR PARKING

Multi-level car parking system is to maximize car parking capacity by utilizing vertical space, rather than expand horizontally. However, with land in metros and 'A' grade cities becoming scarce and dearer, and plots getting smaller, conventional parking is proving infeasible. Sometimes it is found that the ramp or car lifts eat up much parking area that no increase in parking capacity is possible. In such case, mechanized car parking systems make creation of extra parking capacity feasible. In multi-level car parking system cars are driven at only one level for parking or retrieval. Cars are parked in steel pallets and a target pallet comes up or down to the driveway level at the press of a button, for parking or retrieval.

Technologies used for automated parking systems are of the following types:

1. Puzzle Type or Modular
2. Elevated Type or Tower
3. Multi-Level Floor Parking
4. Multi-Level Circulation Automated Parking System
5. Rotary type
6. TD (Stacker) System

Automatic multi-story car parks provide lower building cost per parking slot, as they typically require less building volume and less ground area than a conventional facility with the same capacity. However, the cost of the mechanical equipment within the building that is needed to transport cars internally needs to be added to the lower building cost to determine the total costs. Other costs are usually lower too, for example there is no need for an energy intensive ventilating system, since cars are not driven inside and human cashiers or security personnel may not be needed. The driver leaves the car in an entrance module. It is then transported to a parking lot by a robot trolley. For the driver, the process of parking is reduced to leaving the car inside an entrance module.

At peak periods a wait may be involved before entering or leaving. The wait is due to the fact that loading passengers and

luggage occurs at the entrance and exit location rather than at the parked stall. This loading blocks the entrance or exit from being available to others. Whether the retrieval of vehicles is faster in an automatic car park or a self-park car park depends on the layout and number of exits.

## II. NEED OF STUDY

### PROBLEM STATEMENT

Many Indian cities are opting for multi-level structured car parks to meet the insatiable demand of parking. Parking deficit is cited as a reason to argue for more multilevel parking structures. At national level the Union Ministry of Urban Development has charted infrastructure development plans under the Jawaharlal Nehru National Urban Renewal Mission (JNNURM) and included multi-level car parks in its menu of action. In the conventional planning process, it is accepted that parking demand will continue to grow as vehicles grow in numbers and therefore more parking spaces are needed. Most city governments are finding it difficult to make the multi-level cars parks work and deliver benefits. The parking facility near Gate 6 of the lakefront can accommodate 250 cars and 450 two wheelers, it has no takers due to the high parking fee. While public ignores the parking facility, corporation shells out more than Rs 70,000 a month to keep the parking lot running. Abundant and cheap parking outside reduces its utilization. There are several smaller parking lots near the lakefront which charge lesser fee. Meanwhile, commuters say that there are several parking area around the lakefront which are much more affordable.

## III. OBJECTIVE OF STUDY

Kankaria multi-level car parking is in working condition from past two years yet it is not utilized to its full capacity. It is necessary to study the reason for its failure and underutilization.

- To evaluate different aspects of multi-level car parking system,
- To identify reasons of failure,
- To provide solutions and increase efficiency,
- To bring awareness about the facility in citizens.

## IV. SCOPE OF STUDY

- Review literature for different existing multi-level car parking system in different cities.
- Studying different aspect of multi-level car parking.
- Enumerate different reasons of underutilization.
- Analyse study area location and existing problems.

## V. STUDY AREA

Kankaria Lake is one of the most popular recreational spot in city of Ahmedabad. Every day approximately 30,000 people come to Kankaria lake while on Sundays more than 60,000 people throng it. A seven story multilevel parking for two-wheelers and four-wheelers was inaugurated on 10th June 2013

near the lake to eradicate parking woes. The building is replete with traffic barriers, ticketing machine, screen displays and signage showing available parking space on each floor. A swipe card facility is also available. The parking facility initiated by Ahmedabad Municipal Corporation can accommodate about 250 four-wheelers on one to seven floors, while 250 two-wheelers can be parked in the basement and ground floor. The parking complex is standing over 3900 sq.m. plot with 6650 sq.m built-up area. There are two lifts for vertical movement and 4 shuttles for horizontal movements. A parked car is brought to the exit gate in 3-4 minutes. Traffic barriers, ticketing machine, display of vacant slots, automatic parking system, and swipe Card, reader etc. are used as technology support mechanism. The facility is being maintained by Gannon Dunkerley and Company.

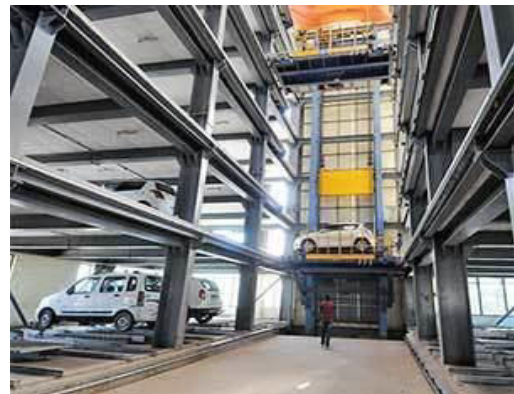


Figure 1. Multi-level car parking, Kankaria

## VI. EXISTING PROBLEMS

The multi-level parking facility created at a cost of Rs. 28 crore near Kankaria lakefront has failed to serve its purpose due to lack of enforcement of its own notification by the traffic police.

**Badly underutilized:** It is unacceptable that a 28 crore structure remains grossly underutilised. While the structured parking remains nearly empty, the surrounding surface parking are choc-a-block with cars, two wheelers and auto-rickshaws. It has not helped in reducing parking congestion in Kankaria area.

**Approach to the structured parking is narrow:** The approach road to the multi-level car park is very narrow and has little navigation space. As the multi-level parking is located very close to the lake front, people visiting the lake front mostly prefer to park their vehicles along the road. The perception is that parking inside will be chaotic and they may get stuck finding a parking space.

**Delays due to long retrieval time:** It takes more time to park and retrieve the car from the multilevel car park. People report that inside the structure it takes 10 to 20 minutes to park. Retrieval is another 10 minutes. The users who are still not used

to the system get impatient about waiting for the retrieval of the cars and avoid parking in it. Thus under-utilisation of the multi-level car park continues.

**Technical Hurdles and delays:** Sometimes due to technical fault the system stops working, due to which people are unable to retrieve their vehicles. Such hurdles spread negativity and thus people avoid parking in multi-level building.

**Lack of enforcement:** People who park their vehicles on road say the traffic cops who have a picket just about 60 yards away never stop them from doing so and they don't even know if the multi-level parking facility is functional.

Figure 2. Empty Multi level car parking



Figure 3. Roadside encroachments & Illegal Parking

## VII. RECOMMENDATIONS

Kankaria lake front is a hotspot among tourists as well as citizens. Every year in December it hosts carnival which attracts people from all over the state yet the multi-level car parking is not utilised to its full capacity. The main problem is lack of enforcement and awareness. Following are some recommendations which can ease out existing problems.

- Clear roadside encroachments and introduce "No Parking Zone" on alternate days.
- Make changes in parking charges and implement smart card system
- Bring awareness about multi-level car parking system through social media or banners.

- Traffic cops should strictly follow rules and insist visitors to use the facility.
- Discourage on-street car parking and list out benefits of multi-level car parking.
- Introduce attractive schemes for two wheelers.
- Educate users about the multi-level car parking mechanism and its key concept.
- Regular monitoring of the system.

## VIII. CONCLUSION

Multi-level car parking system is suitable for the Indian environment as the number of cars is increasing day by day. Hence it is adoptable as this system provides maximum density by storing large number of cars in the particular area. With the rising population and the number of cars, more intelligent ways need to be devised to combat the present problems. Such parking systems are seen as the best solution in the present day scenario for multi-storied buildings due to their unique feature of increasing the parking space by almost 17 times. Some of the problems in this system is the absence of a regular body for monitoring the quality of such systems, lack of skilled labour to assemble them or factors like poor after-sales services and technical snags that limit market growth. Kankaria multi-level car parking can ease out parking problems in the area if the facility is fully utilised after considering different recommendations.

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# Rooftop rainwater harvesting: A case study at Silver Oak Campus, Ahmedabad

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## Abstract:-

Due to inadequate awareness or planning, excess rain water has been getting discharged into the oceans after passing through the drains and rivers. In fact, it is possible to prevent this wastage of water by storing it during the rainy season — to use it as drinking water during the dry seasons. Or for allowing it to seep underground in the dry areas as a measure of maintaining adequate levels of ground water. This water can subsequently be ‘recharged’ or pumped up for irrigation or drinking water purposes. And this is what rainwater harvesting is all about.

There are different ways in which rainwater can be harvested. There is a method of what is known as ‘rooftop harvesting’ in which the rainwater is allowed to get collected in built-up tanks. This water can be used for direct consumption and also for recharging groundwater through simple filtration devices. Water can also be collected in tanks that have cement slabs built at their base to prevent the water from seeping underground. Project campus consists of four major buildings i.e. Block-A,B,C,D having roof top area 900.0 m<sup>2</sup>,1742.0 m<sup>2</sup>, 586.5 m<sup>2</sup>,1108.0 m<sup>2</sup> respectively. Conservation of water for the coming generation is the main point in our agenda. However, clean water is scarce because of a high demand, pollution and a relatively low supply in arid Ahmedabad.

Rooftop rainwater harvesting is a technique through which rainwater is captured from roof catchments and stored in reservoirs. The main Objective of rooftop rainwater harvesting is to make water available for later use. Capturing and storing rainwater for later use is particularly important in dry land, hilly, urban and coastal areas. Water scarcity is one of the issues of the

North-Western states of India, such as Gujarat. In this context, people have developed over the time, techniques to meet their water requirements. Rain Water Harvesting was functioning in the old city of Ahmedabad before the extension of the modern water supply system to the entire town till the middle of the 20<sup>th</sup> century. The continuous increase of the population in the following decades as well as the financial, administrative and technical deficiencies of the new supply system have lead to the deterioration of the water service in the city. In the meantime, the water demand has considerably increased due to the improvement of standards of living. This has resulted in an increasing pressure on underground water resources, which has lead to an alarming depletion of aquifers.

The growing water demand in both rural and urban areas have prompted the successive governments of Gujarat to bring water from far away which is economically, socially and environmentally unsustainable on the long term. From this overall situation arises the question that the use of alternative sources of water in Ahmedabad are required.

## 1. About case study

The objectives of this mini project will be:

- Improve water availability during the year by collecting rainwater and storing the collected water. In order to reduce consumption of water from other sources as ground water.
- Come up with a strategy so that SOCET can be a front runner in the field of rainwater harvesting in Ahmedabad.
- Let students be the leader for the development of rainwater harvesting at the campus.
- Student involvement is very important for rainwater harvesting at the SOCET. Students will be involved in, maintenance, tours and awareness sessions at the campus as well as to

other parties that may be interested in rainwater harvesting in the Ahmedabad. The facilities should be made easily accessible in order to provide a good network of the system.

- To finance this project, SOCET could request the alumni association and the local government for financial support. SOCET has a large network of trustees that can be able to provide enough financial support to install the installation for rainwater harvesting.
- To create more water awareness a water meter will be installed on SOCET. This meter will measure and display the used amount of water for all blocks each day. Thus it is possible to compare the current use of water with the average of each block (52 m<sup>3</sup> for block A, 68 m<sup>3</sup> for B, 32 m<sup>3</sup> for C and 45 m<sup>3</sup> for D).

## 2. Data Collection

At Silver oak campus at present, there are 5 academic departments with more than 4000 students. The campus consist of four buildings named alphabetically (A,B,C,D).

The roof top areas of each are as follows:

Name of Building	Dimension	Area of rooftop
Building A	30m x 30m	900.0 m <sup>2</sup>
Building B	52m x 35m	1742.0 m <sup>2</sup>
Building C	12.75m x 46m	586.5 m <sup>2</sup>
Building D	52m x 22m	1108.0 m <sup>2</sup>

Table (1) Dimension of buildings

## 3. Use Of Roof Top Rainwater

As silver Oak College is having very vast campus, stored rain water can be utilized in following effective ways.

- Under Ground Water storage tank with capacity of storing huge amount of water will be constructed below Amphitheatre
- Recharging of existing tube wells
- Domestic utilization e.g. Canteens, toilet flush, etc.
- Laboratories
- Gardening

Except recharging tube wells all the usages will require prior treatment.

## 4. Analysis

Rainwater is to be collected from roofs available on SOCET by using the current system of gutters and drainpipes. Extra pipes to connect the different buildings with the collection point need to be installed. The potential for rainwater harvesting is calculated by using both the average and maximum precipitation over the monsoon season. Average precipitation information was derived from the Indian Meteorological Department average is (0.7 m) and maximum precipitation from Sky-metweather (0.845 m).

Building	Surface area(m <sup>2</sup> )	Volume-average precipitation (m <sup>3</sup> )	Volume-maximum precipitation (m <sup>3</sup> )
Block A	900	630	761
Block B	1742	1219	1471
Block C	586	410	495
Block D	1108	776	936
Hostel	860	602	727
Total	5196	3596	4391

Table (2) Surface of building at SOCET and potential rain volume

Another option to collect rainwater is through using vegetation on the roof by installing a green roof. Figure-1 present a green roof and its structure. Extra costs are involved for installation but there are many benefits. Drainage towards the collection point is slowed, rainwater is pre-filtered and there are more benefits concerning the building on which a green roof is installed and its surroundings. Also living walls, vegetation growing on the front or sides of a building have benefits for the building and its surroundings.[4]

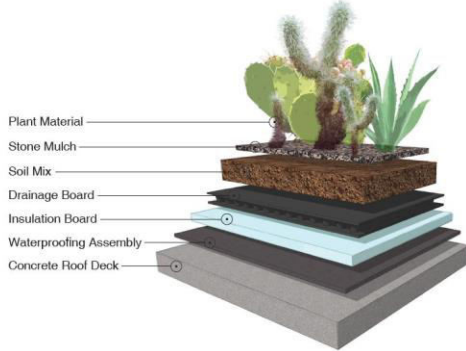


Fig-1 Structure of a green roof

**5. Beneficial Prospects**

**5.1 Green Roof**

A green roof is an installation used all over the world, there are many benefits of using a green roof and few possible dangers. The benefits are reduced energy consumption for cooling or heating a building, increased durability of the roof itself, fire retardation due to lower heat load, improved storm water discharge and possible noise reduction. Possible dangers are faulty installation of the green roof and mistakes made in calculation of discharge quantity. A green roof comprises the vegetation layer and several layers beneath to ensure protection of the roof itself and to ensure good drainage of water. The design of a green roof is presented in image.

The plant *Dracaena marginata* is selected to plant on the green roof. These plants are suitable for a green roof in Ahmedabad and this plant filters the air (Admynn, 16-2-2008). A soil depth of 15 cm is sufficient and the plant requires water every 3 to 4 days and they can stand bright light. A maintenance of about every month to remove weeds and to remove excess of plants. The cost of planting the green roof is presented in table-2.

This area can be used for reading space, library, cafeteria, etc and students could refresh their minds in a cool atmosphere which would help in nourishing their minds.



	Cost per item	Amount items	Total cost
<i>Dracaena marginata</i>	338 Rs	1720	581,360 Rs
Drainage cell	28 Rs		259,000 Rs
Water resistant foil	150 Rs		129,000 Rs
Root foil	995 Rs	36	35,840 Rs
Average cost estimate	1511 Rs each square feet	(Length=171 feet Breadth=110 feet)	1005200 Rs

**5.2 Green Walls**

Living walls are vertical placed vegetation that cover the front, side or back of a building. The benefits of a living wall are comparable with a green roof, reduction of heat island effect, reduced energy consumption as well as that sounds in the local area are reduced (Heffernan, 5-6-2013).[3]

The living wall plants are (table-3) and they have a maintenance of trimming once every year and a water need of every 2 weeks.[2]

Table (3) Cost of green roof (source of foils is India Mart on 5-1-2017)[1]



Fig-2(a)Outer look of living walls

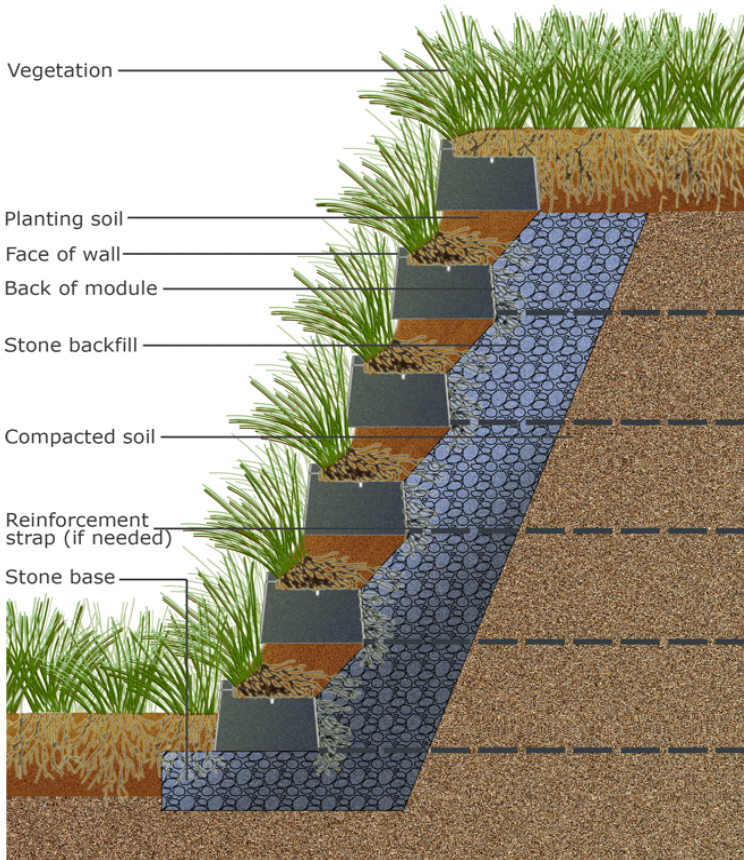
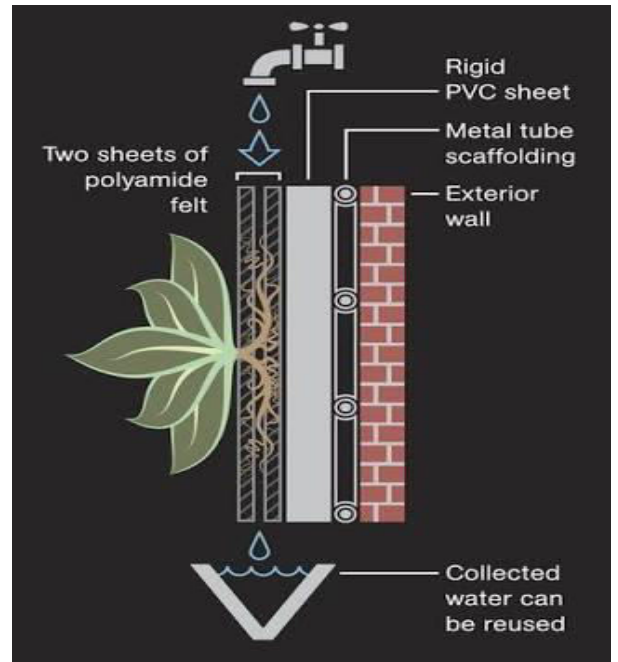


Fig-2(c) Structure of living walls

### 5.3 Amphitheatre



Fig (3) Amphitheatre

An **amphitheatre** or **amphitheatre** is an open-air venue used for entertainment, performances, and sports. The term derives from the **ancient Greek** amphitheatron, from *amphi*, meaning "on both sides" or "around" and "theatron" meaning "place for viewing".[5]

**Ancient Roman amphitheatres** were oval or circular in plan, with seating tiers that surrounds the central performance area, like a modern open-air **stadium**. In contrast both **ancient Greek** and **ancient Roman** theatres were built in a semicircle, with tiered seating rising on one side of the performance area. In modern usage, "amphitheatre" is sometimes used to describe **theatre-style** stages with spectator sitting on only one side, **theatres in the round**, and stadiums. Natural formations of similar shape are sometimes known as natural amphitheatres.

These amphitheatre can be used for reading area including open library with cafe and garden area and also can be used for sports activities.

New Under Ground tank will be constructed below the amphitheater which will be capable of storing huge amount of collected water which can be further utilized for other activities going on in campus.

### 6. Outcomes:-

On implication of this project, Silver Oak College of Engineering & Technology would be a trend setter for near by premises and institutes as it would be a pilot project of Rain Water Harvesting and its usage.

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# *Effect of Pollution on City Environment: A Discussion on Gujarat Scenario*

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## **Abstract**

*In India the environmental conditions of cities have progressively deteriorated due to urbanization, industrial development, lack of awareness, poor maintenance of motor vehicles and poor road conditions. Various cities of Gujarat are also underwent this industrialization and urbanization. As a result of which the environment in city and around it has started to affect human health, plants and animals. Through this paper, I have discussed the scenarios and different survey studies conducted in various cities of Gujarat. Among these cities Vapi and Ankleshwar are facing alarming environment problems. The amount of particulate matter and harmful suspended solids in city environment has already crossed their permissible limits in few cities. In a survey by CPCB around our country, these two cities of Gujarat are found in ten most polluted cities. GIDC should take some serious step regarding these critical problems otherwise it will be too late. Other cities like Ahmedabad, Vadodara, Surat are also on the verge of these adverse effects of pollution. It is certain that these alarming values will have adverse effects on climate, environment and health, and both personal and social wealth of the dwellers of the cities. So, a strict implementation of adequate abatement measures and environmental regulations are needed urgently to stop our cities to convert into pollution jar.*

**Keywords:** *Pollution, Environment, Industrialization, Urbanization, Effects of Pollution, Gujarat Pollution*

## **INTRODUCTION**

Gujarat has experienced impressive industrial development since its formation as a state in India 1960. As per Annual Survey of Industry (ASI), carried out by the Central Statistical Organization (CSO), under Ministry of Statistics, The industrial sector at present comprises of over 1200 large industries and over 3, 12,000 micro, small and medium industries. It has more than 90,000 industries. About 8,000 are involved in polluting environment. In Gujarat major industries creating pollution are located in the Vadodra Petrochemical Complex, Nandesari, Ankleshwar, Vapi, Vatava and Hazira near Surat. Apart from these there are few other places also.

India has been ranked among the top ten worst climate polluters in our world. While India holds 7th position, US and China hold the 2nd and 3rd positions respectively. It should be noted that the hazardous impacts from environmental pollution are regularly reported and monitored. Out of the different kinds of pollution, the air pollution is most dangerous in respect of environmental regulations since the environmental damage due to air pollution mostly affects human well-being directly by way of adverse health effects on the population exposed to it. In this paper, I have discussed the scenarios of various pollutions in different places in Gujarat due to industrialization & Urbanization.

## Types of Pollution Prevalent In Gujarat

### a) Air Pollution

The air we breathe is an essential ingredient for our survival and a healthy life. Industrialization and urbanization have resulted in a major cause of deterioration of Gujarat's Environmental Air quality. Apart from rapid industrialization, there is a lack in urbanization which has resulted in the emergence of industrial centers without a corresponding growth in civic amenities and pollution control mechanisms. Polluted air in our environment contains one, or more, hazardous substance, pollutant, or contaminant that is responsible for hazard to general health. The main constituents of pollution found in the air we breathe include, particulate matter, PAHs, lead, ground-level ozone, heavy metals, sulphur dioxide, benzene, carbon monoxide and nitrogen dioxide. Air pollution in cities causes shorter lifespan for city dwellers and animals. Air pollution is caused of ill health and death by natural and man-made sources, major man-made sources of ambient air pollution includes tobacco smoke, combustion of solid fuels for heating, cooking cleaning agents, insecticides, pesticides, automobiles, power generation, and poor environmental regulation, less efficient technology of production, congested roads. The natural sources include incinerators and waste disposals, forest and agricultural fires.

### b) Waste and Water Pollution

The water we drink is one of the important ingredients for our wellbeing and a healthy life. Water pollution has many sources. Effluent consists of Industrial discharged effluents, sewage water, and rain water pollution and polluted by agricultural or households/domestic activities cause damage to human health or the environment. The most poisonous of them are the city sewage and industrial waste effluent into the rivers. The treatments used to treat waste water are not adequate in any city all over India. Currently, only about 10% of the waste water generated is treated; and the remaining is discharged into our water bodies. Due to this, pollutants infiltrate groundwater, rivers, and other water bodies. Such water, which ultimately ends up in our domestic use, is often highly contaminated and carries disease-causing microbes.

### c) Noise Pollution

Mainly the noise pollution has two sources, i.e. industrial and non- industrial. The industrial sources include the noise from various industries and big machines working at a very high momentum and high noise intensity. Source of noise excluding industrial include the noise produced by transport/vehicular traffic and the neighborhood noise generated by various noise pollution activities. Most of the noise pollution sources will fall into the following categories: roads traffic, aircraft, railroads, construction, industry, noise in buildings, and consumer productize Pollution.

### d) Land/ Solid waste Pollution

Improper management of solid waste is one of the major factor which is responsible for environmental pollution. Land/Soil pollution is one of the major forms of environmental issues our world is facing today. Heavy metal industries have generated wastes that are disposed into landfills without special precautions.

## Effect of Pollution on Citizens

Over exploitation of the country's resources be it land or water and the industrialization/urbanization process has resulted in environmental degradation. Environmental pollution is one of the most serious problems faced by humanity and other life forms on our earth today. With India's population at 1.3 billion people and counting, plus other internal economic migration to urban areas from the countryside, the cities are bursting at the seams.

A Comprehensive environmental assessment of industrial clusters in India, undertaken by IIT Delhi and the CPCB, found that the environmental pollution levels in 10 major industrial areas had reached a "very alarmingly high" level. This list includes Ankleshwar and Vapi from Gujarat.

The air above us is looking empty without any birds; almost all the land is dead now. The air pollution has led to the empty/dead air above us, soil/water pollution has led to the dead land/soil without living creatures, there are unwanted sound everywhere due to noise pollution, plastics (wastes) are seen even in the

National Parks and Wild Life Sanctuaries. Emissions of CO, CO<sub>2</sub>, SO<sub>x</sub>, NO<sub>x</sub> etc. are polluting agents from the vehicular/industrial emission are leading various human health problems like eye irritation, lung cancer, health related disease etc. and also creating disturbance in ecosystem. The high the increase the cholesterol level in blood, high blood a pressure and problems in listening abilities. Plastic, paper excreta of animal and organic-inorganic wastes and other wastes contaminate the water and causes water borne diseases.

Simultaneously, with environmental pollution, it is important to be worry about human insensitivity of nature, polluted psychology and responsibility less society. This has led to physical and psychological diseases as well as pulling down interpersonal relationship in society.

### Scenario in Gujarat

#### Vapi

Vapi is one of the largest industrial complexes in Gujarat, developed by Gujarat Industrial Development Corporation (GIDC). Spread over 11.4 km<sup>2</sup>, it is home to over 1500 industries. About 70% of the industries in Vapi are engaged in the manufacturing of chemicals, dyes & dye intermediates, pigments, pesticides, and pharmaceuticals. Out of these, 600 units are manufacturing a wide range of chemicals for industrial and agriculture sectors. It represents an investment of Rs 2000 crore and exports goods worth Rs 200 crore per annum. Vapi together with Daman, Sarigam and Silvassa form the largest cluster of SMEs in Asia.

Vapi GIDC was established in 1967, and other chemical/pulp-paper mills in the district. There are about 832 industries out of which around 759 are the polluting ones. Of these 653 are in the red-category list of Central Pollution Control Board (CPCB). The Vapi chemical cluster manufactures a variety of chemical products like pesticides, dyes, dye intermediaries, paints, organic & inorganic pigments and textile chemicals. Now the district is well known for its industrial development, heavy pollution and diminishing agricultural produce. The air pollution wakes up people from their sleep at night and the trains

are routinely delayed during the evenings/nights due to low visibility.

Due to the pollution activities in Kolak and Daman Ganga rivers, the riverine and estuarine fish have been vanished severely affecting the income of the poorest of the fishing community. These fishing communities mainly reside in Kolak and Daman villages. The officials of Vapi and Valsad chapter of Indian Medical Association also had a meeting with the expert's panel. They concluded that over half of all patients coming to the doctors in Vapi were there for respiratory diseases and incidence of other illnesses like skin diseases, etc. were very high.

Recent knowledge about air pollution depicts that there are no real safe limits for air pollution. The air in Vapi city and around many industries in Valsad is so polluted that productivity of fruits has gone down by over 50%. Some of the measures suggested to mitigate the situation include:

- Involving affected populations (farmers, fishing community) in monitoring and regulation.
- Moratorium on expansion of these estates/industries.
- Modernization in technologies to achieve zero effluent and solid waste.
- Assessment should be done for regional environmental impacts instead of individual industrial impacts.
- Pollution cess and banning of certain products/chemicals are required.

Physico-chemical analysis of industrial effluents has shown that EC, TDS, Chlorides, Sulphates, BOD, COD, Sodium and Calcium are in very high concentration as compared to the standards prescribed by WHO. Such effluent should not be permitted to be discharged in the nearby water bodies or soil without treatment. They are unfit for agriculture/irrigation. The high level of pollution of the industrial effluents causes environmental problems which will affect whole ecosystem.

### **Ankaleshwar**

Ankaleshwar the city also known as “Golden Corridor” has hundreds of small and medium factories manufacturing chemicals, dyes, paints, fertilizer, plastics, pulp and paper; spew untreated waste into the air and waters. Ankaleshwar town has a population around 78,000 whereas the slum-like colonies here sprouted on the periphery of the industrial estate. Around 25,000 people living without basic amenities such as water, sanitation, health set-up etc. Around 60,000-70,000 people get their daily bread by working in the estate. A cursory look at Ankaleshwar would leave one in doubt whether any environmental regulations exist in this state or not. Industries here generate over 40,000 tonnes of hazardous waste and discharge more than 32 million liters of toxic effluent through open channels into river Narmada. Not only the surface water is highly polluted but the contamination of ground water is even more serious problem. A preliminary survey of a part of the slum colonies showed that 55 out of 65 hand pumps and bore wells had yellow to red coloured water and some of which were either acidic or smelt of unknown chemicals.

Hazardous solid waste has been dumped on open spaces, around water bodies without any treatment or any concern about their impact on the local water soil or living organisms. There has been no known investigation for traces of toxic residues in agricultural produce or in the milk of cattle grazing in the area.

The solutions given by industries, such as Common Effluent Treatment Plant (CETP) or hazardous waste landfill either hide or transfer the problem but didn't eliminate it. In any case they are not effective solutions, e.g. CETPs only deal with only the barest basic parameters whereas the chemical composition of effluents is highly complex. Or the landfills' stated life is at the most a couple of decades whereas the toxicity of chemicals can persist much longer.

Suggested measures-

- There should be a moratorium on new hazardous industries and further expansion.

- The regulatory board should be strong enough and better equipped to deal with the myriad problems created by such industries.

- There should greater transparency in the working of the regulatory bodies, information made available to public and forming of citizens' watchdog committees.

- Immediate steps to stop degradation of environment including punitive action should be taken.

- Detailed surveys & studies on the impacts of environmental pollution on land, water, air, flora and fauna need to be initiated immediately.

### **Vadodara**

Vadodara formerly known as (Baroda) is the 3rd largest city in the Western Indian State of Gujarat, after Ahmedabad and Surat. It is located on the bank of the Vishwamitri River. The river frequently dries up in the summer season, leaving only a small stream of water. Over the period of years, there has been a continuous increase in human population, road transportation, vehicular traffic and industrial growth in Vadodara which has resulted in rapid increase in the concentration of gaseous and particulate.

In Vadodara various large-scale industries such as Indian Oil Corporation (IOCL), Gujarat State Fertilizers & Chemicals (GSFC), Indian Petrochemicals Corporation Limited (IPCL, now owned by Reliance Industries Limited) and Gujarat Alkalis and Chemicals Limited (GACL) have emerged in the vicinity of Gujarat Refinery and all of them are dependent on it for their fuel and feedstock. Other large-scale public sector units are Heavy Water Project, Gujarat Industries Power Company Limited (GIPCL), Oil and Natural Gas Corporation (ONGC) & Gas Authority of India Limited (GAIL). In our environment, Plants exhibit many physiological changes in response to pollution. Plants can be used effectively by planners/engineers and green belt developers in controlling the urban air pollution.

A study has been conducted for identifying tolerance level of plants by calculating the Air pollution tolerance index (APTI) based on 4 parameters. The 4 parameters are: Chlorophyll, Ascorbic acid, pH, and Relative water content (RWC). The aim of this study

is therefore to calculating the seasonal APTI values of commonly growing plant species in the heavily trafficked area of Vadodara city, Gujarat. And recommend most suitable plants for afforestation.

GIDC area and Nandesari are dominated with industrial activities in city while, other sites like Alkapuri, Dandia Bazaar Nyay Mandir, Mandvi, Railway Station, Fatehgunj, Raopura are mainly commercial areas and are exposed to heavy traffic. Leaf samples of selected plant species were collected from all the sites around city.

Since bio monitoring is a crucial tool to evaluate the effect of air pollution on plants, *Peltophorum pterocarpum*, *Acacia arabica* is a solution as bio monitors of vehicular pollution stress. Among the other plant species, *Polyalthia longifolia*, *Azadirachta indica*, *Mangifera indica* have shown high APTI value compare to other species, hence these species work as sink of air pollutants.

### **Anand**

Anand popularly known as the “Milk Capital” of India. It has become famous for Amul dairy and its milk revolution in our country. It hosts the Head Office of Gujarat Cooperative Milk Marketing Federation Ltd (AMUL), National Dairy Development Board of India. It lies between Ahmedabad and Vadodara on the Western Railways. Economy of the city is very vibrant which ranges from agriculture, farming to big scale industries. Many famous big industries including Elecon Engineering, Vulcan Industrial Engineering Co. Ltd, Warm Steam, The Charotar Iron Factory (est.1938), Milcent and Atlanta Electrics are located in this industrial belt.

During last few years this city had gone through rapid urbanization as well as industrialization. As a result of which both private and mass transportation vehicles are also increasing day by day. It also APTI values are calculated for plants. Its calculation is based on four parameters viz. chlorophyll, Ascorbic acid, pH, Relative water content.

Apart from the survey site 10 sampling locations were chosen on the basis that the sampling stations were in the vicinity of free atmosphere that is without interferences from stagnant spaces and large buildings.

For APTI different leaf samples were collected from three common plant species existing in all the sampling sites viz. *Polyalthia longifolia*, *Peltophorum pterocarpum*, and *Azadirachta indica*. The calculated APTI for the 3 species studied was found comparatively higher in most of the studied sites than standards. High value of APTI was observed in *Polyalthia longifolia* (6.57-10.22), which was followed by *Peltophorum pterocarpum* (6.81-8.43) and *Azadirachta indica* (6.01-7.59).

SPM values were found high in all the sites approx. value of 100  $\mu\text{g}/\text{m}^3$ . Low relative humidity and semiarid climate is also another reason for high SPM load. All the plant species behaved as sensitive towards air pollution.

### **Conclusion**

Anything when it crosses its tolerance limits it causes a negative impact. If we do not wakeup today, it would be very late tomorrow. As a result it will be very much difficult to sustain against the pollution. High values of Sulphate indicate increased decomposing of plant and animal material done by autotrophic plants and incorporated into amino acids. During summer season temperature was very high so, DO values were low in summer because oxygen holding capacity of plants was decreased at high temperature. But, alkalinity was found high that was generally due to the presence of carbonate, bicarbonate and hydroxide. It is certain that these increasing values will make adverse effects on climate, environment and health, and both personal and social wealth of the citizens. So, it can be concluded that a strict implementation of adequate abatement measures and environmental regulations is urgently necessary.

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# Comparison of Structural Systems for Composite Construction in High Rise Building

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*Abstract*—In the present study, analysis and design of three structural systems i.e. RCC frame tube, steel frame tube and composite megaframe with supercolumn is presented. For comparison of structural performance of these systems, 30 storey building with plan dimensions 60.96m 36.576m and height 118.8m is considered. In addition to gravity loading, lateral loading due to earthquake and wind are considered. Wind forces are calculated using Gust factor method as per IS875-III and earthquake forces are estimated as per dynamic method of IS1893. ETABS software is used for modelling and design of structural elements. Analysis results in terms of natural time period, storey shear, overturning moment, lateral drift, storey displacement, forces in critical members are compared for all the three structural systems. For the design of composite structure, specifications of Euro Code 4 are followed. Based on the design of structural systems, consumption of basic materials like concrete and steel is compared for all the three structural systems. Cost of the building with three structural systems is also presented. Gravity load intensity per unit floor area is also calculated to understand variation in dead load

*Keywords*— *Structural Systems ,highrise building  
Megaframe with super column*

## I-Introduction

steel-concrete composite systems have become quite popular in recent times because of their advantages against conventional construction. Composite construction combines the better properties of the both i.e. concrete in compression and steel in tension, they have almost the same thermal expansion and results in speedy construction. The use of Steel in construction industry is very low in India compared to many developing countries. Experiences of other countries indicate that this is not due to the lack of economy of Steel as a construction material. There is a great potential for increasing the volume of Steel in construction, especially the current development needs in India. Engineers are familiar with the problems involved in constructing either steel or concrete building, as each of these materials has its own peculiarity. Steel structural members are generally fabricated as component consisting of thin plate elements, so they are prone to local and lateral buckling. Therefore, they are checked for the failure due to buckling and instability, while concrete structural members are generally thick and unlikely to buckle; but they are inclined to creep and shrinkage with time. Therefore, a system comprising steel-concrete-composite structure was developed to take benefit of both the material. For building systems, steel-concrete composite structures are known as the most economical solution to the diverse engineering design requirements of stiffness and strength. The strength and behavior of composite slabs are

governed by the shear interaction between the concrete and the steel deck. By the composite action between the two, one can utilize their respective advantages to the fullest extent. Structurally robust and aesthetically pleasing buildings are being constructed now-a-days by composite steel concrete construction meeting the specific requirements of large span, building height, soil condition, time, flexibility and economy. The main benefits from the use of composite steel concrete construction are in terms of construction time and cost. The use of rolled steel section and prefabricated component makes the composite construction fast track construction compared to the cast in situ concrete

## II. OBJECTIVE

Steel-concrete composite systems have become quite popular in recent times because of their advantages against conventional construction. Composite construction combines the better properties of the both i.e. concrete in compression and steel in tension, they have almost the same thermal expansion and results in speedy construction. The objectives of the study are

1) To provide a brief description to various components of steel concrete framing system for buildings.

2) To investigate major parameters like cost, time, seismic response of steel-concrete composite frames over traditional reinforced concrete frames and steel frames for building structures

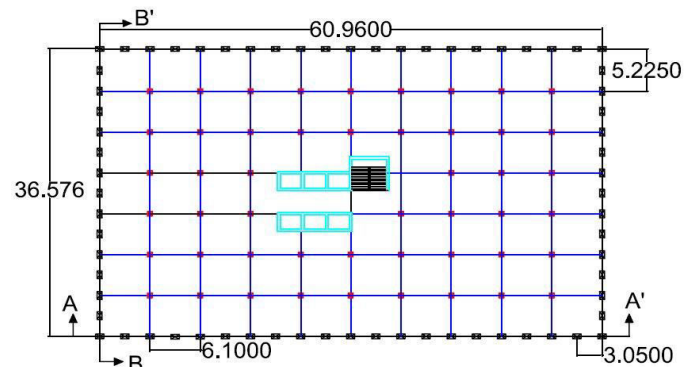
## III. COMPOSITE CONSTRUCTION

Steel-concrete composite construction means steel section encased in concrete for columns & the concrete slab or profiled deck slab is connected to the steel beam with the help of mechanical shear connectors so that they act as a single unit. In India, many consulting engineers are reluctant to accept the use of composite steel-concrete structure because of its unfamiliarity and complexity in its analysis and design. But literature says that if properly configured, then composite steel-concrete system can provide extremely economical structural systems with high durability, rapid erection and superior seismic performance characteristics.

## IV. BUILDING DETAILS

The plan of the building is 60.96 X 36.57. Height of building is 118.8m .Bay in X direction 10 bay in Y

direction 7. The centre to centre distance between two grids is 6.1m and 5.25m respectively



TYPICAL STORY PLAN (All dimensions are in meter)

Fig.1 Plan showing typical floor

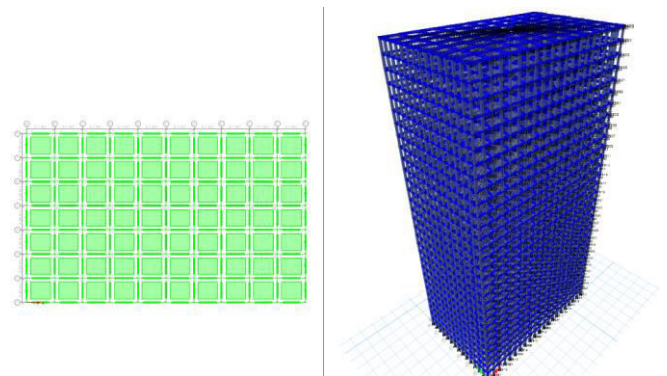


Fig.2 3-D and plan ground level view from E-TABS

Table 1: Data for Analysis of RCC Structure

Table 1: Data for Analysis of RCC Structure

Particulars	Dimension/Value
Plan Dimension	60.96 X 36.57
Total height of the building	118.8m
Height of each storey	3.96m
Height of parapet	1 m

Depth of foundation	4 m
Size of beams 6.0m span	450x600
Size of beams 4.0m span	300x450
Size of outer columns	450x1000
Size of internal columns	450x850
Thickness of slab	140mm
Thickness of walls	230mm
Seismic zone	IV
Wind speed	50 m/s
Importance factor	1.0
Zone factor	0.16
Damping ratio	5%
Floor finish	4.0kN/m <sup>2</sup>
Live load at all floors	1.0 kN/m <sup>2</sup>
Density of concrete	25 kN/m <sup>3</sup>
Density of brick	20 kN/m <sup>3</sup>
Grade of concrete	M30
Grade of reinforcing steel	Fe500
Soil condition	hard soil

Table 2: Data for Analysis of Steel Structure

Particulars	Dimension/Val
Plan Dimension	60.96 X 36.57
Total height of the building	118.8 m
Height of each storey	3.96 m
Height of parapet	1 m
Depth of foundation	4 m
Size of beams 6.0m span	ISMB 450
Size of beams 4.0m span	ISMB 300
Size of columns	ISMB 450
Thickness of slab	140mm
Thickness of walls	230mm
Thickness of bracing	
Seismic zone	IV
Wind speed	50 m/s
Importance factor	1.0
Zone factor	0.16
Damping ratio	5%
Floor finish	1.0 kN/m <sup>2</sup>
Live load at all floors	4.0 kN/m <sup>2</sup>
Density of steel	7850 kg/m <sup>3</sup>
Density of brick	20 kN/m <sup>3</sup>
Grade of concrete	M20
Grade of reinforcing steel	Fe415
Soil condition	hard soil

Zone factor	0.16
Damping ratio	5%
Floor finish	1.0 kN/m <sup>2</sup>
Live load at all floors	4.0 kN/m <sup>2</sup>
Density of steel	7850 kg/m <sup>3</sup>
Density of brick	20 kN/m <sup>3</sup>
Grade of concrete	M20
Grade of reinforcing steel	Fe415
Soil condition	hard soil

Table 3: Data for Analysis of Composite Structure

particular	Dimension/Value
Plan Dimension	60.96 X 36.57
Total height of the building	118.8 m
Height of each storey	3.96 m
Height of parapet	1 m
Depth of foundation	4 m
Size of beams 6.0m span	ISMB 450
Size of beams 4.0m span	ISMB 300
Cold form Deformed bars	Based on requirement
Size of columns	ISMB 450
Thickness of slab	140mm
Thickness of walls	230mm
Thickness of bracing	
Seismic zone	IV
Wind speed	50 m/s
Importance factor	1.0
Zone factor	0.16
Damping ratio	5%
Floor finish	1.0 kN/m <sup>2</sup>
Live load at all floors	4.0 kN/m <sup>2</sup>
Density of steel	7850 kg/m <sup>3</sup>
Density of brick	20 kN/m <sup>3</sup>
Grade of concrete	M20
Grade of reinforcing steel	Fe415

## V. MODELING & ANALYSIS

The explained 3D building model is analyzed using Equivalent Static Method. The buildings models are analyzed by using ETABS software. In composite structure the beam is modeled as composite beam element and column is modeled as RCC beam element and shear wall is modeled as RCC plate element. In RCC structure the beam and column is modeled as RCC beam element and shear wall is modeled as RCC Plate element. The different parameters such as maximum shear force, axial force, maximum bending moment and time period

## VI. RESULTS

### Storey Maximum Drift

Structural System	Max. drift	
	X direction	Y direction
RCC frame tube	0.000009	0.00043
Steel frame tube	0.000468	0.00075
Megaframe with Supercolumn	0.00043	0.00034

**Storey Maximum Displacement**

Structural System	Max. displacement(m)		
	X direction	Y direction	Permissible
RCC frame tube	0.0492	0.132	0.237
Steel frame tube	0.119	0.217	0.237
Megaframe with Supercolumn	0.134	0.096	0.237

**Weight of Structure**

Weight of Structure in KN		
RCC	144388	
STEEL	128591	10.94 % reduced
Composite	136718	5.31 % reduced

**Base Shear Due Earthquake and Wind**

Structural System	Direction	Base shear due to static EQ(kN)	Base shear due to Dynamic EQ (kN)	Base Shear due to wind(kN)
RCC Frame Tube	X direction	6998	555.31	6271.25
	Y direction	6998	541.031	9256.25
Steel Frame Tube	X direction	3703	283.4	6171
	Y direction	3703	296.7	9012

Megaframe with super column	X direction	4664	3600	5565
	Y direction	11850	3608	8451

**Modes and Time Periods**

Mode	RCC frame tube	Steel frame tube	Megaframe with supercolumn
Mode 1	3.66 (UY)	3.29 (UY)	2.83 (UX)
Mode 2	2.80 (UX)	3.01 (UX)	2.6 (UY)
Mode 3	2.06 (RZ)	2.24 (RZ)	0.95 (RZ)
Mode 4	1.11 (UY)	1.00 (UY)	0.82 (UX)
IS1893(Part III):2002	2.01	2.28	2.28

**VII CONCLUSION**

Composite structural system gives lesser displacement and drift providing more human comfort for higher stories

Axial forces in column have been reduced by 14.25% in steel structure and reduced by 24.66 % in Composite structure as compared to R.C.C.framed structure

Megaframe with supercolumn has minimum base shear due to wind and steel frame tube has minimum base shear due to earthquake as its lighter structure than other two systems

It is clear that the weight of Composite structure is reduced by 5.31% as compared with RCC structure. Hence cost of foundation is also reduced

Steel and composite structure gives more ductility to the structure as compared to the R.C.C. which is best suited under the effect of lateral forces

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# *Traffic Management in Urban Area.*

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**Abstract-** In recent years the ownership of private vehicles has increased many folds, which is causing difficulty in management of Traffic. Traffic management is the focus area for most urban dwellers and planners. Some of the main concerns for traffic management of big cities is traffic congestion and avoidance which mainly occurs near & at working zone, as these issues cause huge damages on both personal and environmental level. In India Traffic Management is rarely conducted during construction. It should be one to reduce numerous problems related to traffic and safety at working site. There are various methods available for traffic management such as video data analysis, infrared sensors, inductive loop detection, wireless sensor network, etc. All these methods are effective methods of smart traffic management. For that study of traffic volume, topography, accident study, time delay study & the study of safety provided at working area is mandatory to do. Implementation of metro rail projects paves way to the construction activities and in this process long term construction work zones are inevitable. Long term work zones on urban roads lead to many problems such as reduction in capacity, increase the travel time delays, queue length, fuel consumption, number of forced merges, and roadway accidents which lead to unaccounted economic losses.

**Keywords—** *Traffic Management, Traffic control, Route Diversion, Road safety at work zone, Traffic distribution, Traffic diversion.*

So it becomes necessary to study and quantify the impact of mass rapid transit system construction work zones on traffic environment which will further help in estimating the economic loss due to metro rail construction work zone. Through Route Diversion at the stretch of work zone with considering all the factors and its methodology, safety of human and environment can be achieved which enhance the level of comfort and convenience of road users. To achieve the objective of the topic very less fund is required as it requires only the analytical studies and some traffic diversion sign boards which direct the road users to their alternate path to reach at destination.

## INTRODUCTION

Traffic management is the arrangement, guidance and control of both stationary and moving traffic, including pedestrians, bicyclists and all types of vehicles. Its aim is to provide for the safe, orderly

and efficient movement of persons and goods, and to protect and, where possible, enhance the quality of the local environment on and adjacent to traffic facilities. Generally in India Traffic Management is not carried out near or at work zone, but near work zone traffic management is mandatory to do to maintain the level of service of existing road, road safety & to provide comfort and convenience to the road user. Traffic refers to the movement of people, ships, trains, or aircraft between one place to another. Traffic also refers to the people and goods that are being transported. All these movements need appropriate management, to work effectively. Speed, Traffic Flow & Density is basic three parameters of Traffic which essential factor affecting traffic management.

Traffic on roads consists of road users including pedestrians, ridden or herded animals, vehicles, streetcars, buses & other conveyances, either singly or together, while using the public way for purposes

of travel. Traffic laws are the laws which govern traffic and regulate vehicles, while rules of the road are both the laws and the informal rules that may have developed over time to facilitate the orderly and timely flow of traffic. Organized traffic generally has well-established priorities, lanes, right-of-way, and traffic

control at intersections. Traffic is formally organized in many jurisdictions, with marked lanes, junctions, intersections, interchanges, traffic signals,

or signs. Traffic is often classified by type: heavy motor vehicle (e.g., car, truck), other vehicle (e.g., moped, bicycle), and pedestrian. Different classes may share speed limits and easement, or may be segregated. Some jurisdictions may have very detailed and complex rules of the road while others rely more on drivers' common sense and willingness to cooperate. Organization typically produces a better combination of travel safety and efficiency. Events which disrupt the flow and may cause traffic to degenerate into a disorganized mess include road construction, collisions, and debris in the roadway. On particularly busy freeways, a minor disruption may persist in a phenomenon known as traffic waves. A complete breakdown of organization may result in traffic congestion and gridlock. Simulations of organized traffic often involve queuing theory, stochastic processes and

equations of mathematical physics applied to traffic flow. Construction always has some impact on the users of the facility. The various activities required during construction normally cause some disruption to existing pedestrian, bicycle, and motor vehicle patterns. In all but a few instances, the public must have some form of access through or around the work site. The planning, design, and preparation of contract documents for modification of the normal traffic and pedestrian patterns during construction is commonly known as work zone traffic control. The frequency of crashes in work zones is disproportionately higher than at other locations. Therefore, the primary consideration in work zone traffic control is safety for pedestrians, bicyclists, motorists, and personnel on the worksite. Maintaining the full carrying capacity and accommodation for all users is usually not possible during construction. Existing walkways, bicycle accommodation, and motor vehicle travel lanes are narrowed, closed, or rerouted. Even when reductions, closures, and rerouting are not necessary, construction activity often reduces quality of service for roadway. Users because it can be distracting and cause temporary disruptions. Improving alternative routes of travel, providing temporary facilities, staging work to occur in off-peak hours, and providing police officer control are ways to reduce the impact of construction on roadway operations. These strategies need to be used in such a way as to maintain the safety of facility users and work crews.

#### LITERATURE REVIEW

B.H. Heutinck , M. van den Berg , J. Hellendoorn , L.H. Immers [2006] have performed a detailed case study on Dynamic Route Guidance During Road Maintenance Work. In this article we propose a dynamic traffic management measure which makes use of two different traffic management measures. The first measure is a ramp metering installation, in this case located at an off-ramp. By metering the flow leaving the freeway with a traffic signal, the traffic operation on the freeway is influenced. The result of the measure can be predicted very well, because of the obligated character of the traffic signal. The second measure is dynamic route guidance. Dependent on the traffic situation on the freeway, the traffic will be given a route advice. This measure is less obligating than the ramp metering installation, because the road user can decide whether to comply to the advice or not. Currently ramp metering installations are used on on-ramps of the freeway network. In this configuration the flow entering the freeway is controlled via the metering rate. This metering rate is determined depending on the flow characteristics on the freeway. All in all in this research paper the effect of the use of dynamic route guidance during maintenance works is investigated. Dynamic route guidance can improve the traffic operation during maintenance works. A reconfiguration project which will be executed in the upcoming years in The Netherlands is used as a case study. A microscopic traffic simulation model is made of the area and two different possibilities of dynamic route guidance are compared.

Perco Paolo & Dean Sara [2012] did a research on Driving Speed Behavior Approaching Road Work Zone On Two Lane Rural Road. In this study analyses of the speed of vehicles approaching work zones aiming to understand the drivers' speed behaviour. This work shows that drivers do not obey the temporary speed limit and that they reduce speeds only when the lane width is reduced, resulting in high deceleration rates. These results should be taken into careful consideration when designing work zone sites. In this paper speed is one of the most significant factors in road accidents, this study analyzed the speed behaviour of drivers approaching eleven work zones on two-lane rural roads in the attempt to provide useful information for the design process of work zones, ultimately trying to improve the safety of motorists and workers. The results show that the actual speed at the beginning of the work zone is always higher than the temporary posted speed limit and that the difference usually exceeds 20 km/h. However, this difference is reduced if the work zone has a physical reduction of the carriageway width and a redirection of the normal path of travelling vehicles. On the other hand, the results also show that in this case the deceleration rate in the proximity of the work zone can be high. Therefore, both these aspects should be considered in the design process of the work zone. The results of this study seem to confirm that the presence of a physical reduction of the carriageway width can be useful in reducing speed, but consequences on accident occurrence should be studied in the near future. Essam Radwan, Zaier Zaidi, and Rami Harb [2011] had evaluated behavior of variable speed limits in work zone while merging the dynamic lane. The main objective of Operational Evaluation of Dynamic Lane Merging in Work Zones with Variable Speed Limits is to evaluate the operational effectiveness of the proposed Dynamic Early Lane Merge (DLM) systems. In this research found, through the simulation of the above mentioned scenarios, that for low and medium volume levels (V500, V1000 and V1500) there is no significant difference between the MOT (Maintenance of Traffic) plans. For higher volume levels (V2000 and V2500), late SDLMS (Simplified Dynamic Lane Merge System) with and without VSL (Variable Speed Limit) produced higher mean throughputs for all compliance rates and truck percentages except when demand volume was 2500 vph and compliance of 60%, where it produced significantly lower mean throughputs. It can be inferred from the simulation results that integrated SDLMS and VSL systems have better performance in terms of traffic mobility than existing individual controls and also shows that this integration has more potential than each individual systems.

Spiliopoulou, M. kontorinaki, I. Papamichail, M. Papageorghiou [2014] did a research on Real Time Route Diversion Control At Congested Off-Ramp Areas. In which they used dynamic route diversion concept in order to avoid recurrent motorway congestion which is triggered by a saturated off-ramp. The analytical results shows that both proposed route succeed in maintaining the off-ramp queue length within the off-ramp bounds, thus improving the traffic conditions on the motorway mainstream substantially,

compared to the case that no route diversion is required for off-ramp network.

Ravi Bhutani, Dr.Sewa Ram & Dr.Kayitha Ravinder [2016] have found out the Impact of Metro Rail Construction Work Zones on Traffic Environment and quantify the unaccounted direct and indirect economic loss. Systematic work zone scheduling and traffic management techniques are required to be implemented to reduce these impacts of work zone. Development of shockwaves should be checked and can be controlled by altering the traffic signal timings. Since the maximum percentage of economic losses is due to loss in time by bus passengers in the work zone therefore public transport should be given priority in the work zones. Restricting one or more types of vehicle in peak hours in the work zone area could be one of the traffic management schemes which can be adopted in work zones.

Ninad Lanke & Sheetal Koul [2013] have proposed A Radio Frequency Identification (RFID) system consists of RFID controller and RFID tag for Smart Traffic Management System. The RFID controller consists of RFID interrogator. This interrogator is used for the communication with the RFID tag. RFID tags are wireless devices which make use of radio frequency electromagnetic fields to transfer data, which is used for identifying and tracking of the objects. Tags information can be stored in a non-volatile memory. Tag consists of a Radio Frequency transmitter and receiver. Each tag can be assigned a unique serial number. They suggested a speed detector device, Automatic detection of speed limit Violation & automatic billing toll charges system to detect those vehicles that travel beyond the design speed and get punished them by fining them. The proposed system aims at effective management of traffic congestion. It is also cost effective than the existing system.

Robert L. Bertini & Ahmed M. El Geneidy [2006] have research on Advanced Traffic Management System, in which initially they went through the implementation of Intelligent Transportation System for system management purpose. For that they kept data which is collected for ITS and elaborate those data for Advanced Traffic Management System (ATMS). Ten ITS systems will be introduced with some examples of how archived data have been used to provide evidence for the effectiveness of these systems & those are as follows: Freeway management, Incident management, Transit management, Arterial management, Emergency management, Electronic payment, Traveller information, Crash prevention and safety, Operations and maintenance, Road weather management. After studying all the ten system it was concluded that each system is not capable to stand alone to manage whole transportation system.

Wendy Weijermars & Henk Spittje [2008] did a detailed investigation on Analysis Of Traffic Safety At Road works. It is cleared from the investigation that more crashes occurred at road works in due to heavy traffic of heavy vehicles. Especially on rural roads, road works crashes are relatively often rear-end crashes, crashes with parked vehicles and crashes with objects. To improve traffic safety at work zones in the Netherlands, measures are recommended to stimulate

and improve the application of the CROW guidelines for safe road works. To be able to do this effectively, it should be investigated why the guidelines are not applied correctly. Possible measures include informing and educating road workers and other involved parties, and increasing the enforcement of the application of the guidelines. Also, it is recommended to pay more attention to cyclists. To prevent unsafe behaviour as much as possible, cyclists should be guided past work zones as much as possible.

#### RECOMMENDATION

In urban area, there are many factors need to be considered for regulating the traffic i.e. speed of vehicle, lane driving, coordination of signals, traffic flow, traffic concentration & behavior of traffic flow. When Traffic management is carried out for urban area, safety of travelers is also an important thing to be considered and for that some of traffic controlling devices and safety precaution should be kept during trip.

#### ACKNOWLEDGEMENT

The work reported in this review paper is the part of the detailed research work on “Traffic Management in Urban area” and the executive of the research is under process. I have to express my gratitude towards Silver Oak Group of Institute (SOGI) for supporting me at each and every phase of my research work.

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# A Review on Desalination of Sea Water

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**Abstract** Desalination is the process that removes minerals from saline water. The existing water resources both surface & subsurface are depleting due to increase in demand of water for irrigation, industrialization, population growth and improving standard of life. Sea water is desalinated to produce water suitable for human consumption or irrigation purpose and many more. The most critical issue now a day is scarcity of water. Many areas in Gujarat are facing this problem and it is high time to solve the issue as it is affecting our society and our country. The aim is to solve this problem from the root level at economic and simple way. Desalination of sea water by implementing Evaporation concept- is the main object of our project.

**Keywords**—Desalination, saline, resources, scarcity, sea, Evaporation

## INTRODUCTION

Desalination is a process that removes minerals from saline water. Generally, desalination refers to the removal of salts and minerals from a target substance, as in soil desalination, which is an issue for agriculture. Seawater is desalinated to produce water suitable for human consumption or irrigation. In Gujarat, region like Kutch, water is available but in the form of saline sea water. Hence, it can't be used for basic necessities by the communities living there. From the past studies, it is observed that desalination of sea water is too expensive and not easy to implement by common society of villagers. Evaporation is the nature's rule of producing clean water and the same concept we want to opt for our case study.

## OBJECTIVES OF STUDY

The main objective of our project is to provide additional drinking water and water that can be used for different purposes like agriculture, industrial and other purposes.

The objectives are as summarised as follows:

- 1) To provide fresh water supplies specially in dry regions.
- 2) All the salts are removed from sea water and minerals are added to make it drinkable.
- 3) It will come up with the future problems of drinking water. As 95% of earth's surface is covered by water and it is saline, as a result it cannot be used for drinking or any other purposes.
- 4) The desalination of sea water provides an opportunity to obtain additional drinking water at low cost. Ensuring fresh water supplies at dry and arid regions and especially at coastal areas.

## LITERATURE REVIEW

The literature review is carried out of previous Desalination projects and on desalination researches on Evaporation concepts. This review consists of both desalination papers and papers which give information about sea water clarification.

**A. Hunter, A. Ridett, B. Denness, G.S. Virk and M.G. Ford (2001)** This paper presents that the results of a feasibility study to assessment of the potential of ambient energy in producing low-cost desalinated water. The proposed method uses conventional off-the-shelf desalination equipment linked up to an innovative energy harvesting system made of extruded aluminum planks which are formed part of the building and which is able to provide low-cost energy for the desalination process of the system. The most common energy collection system forms an engineered roof of a building. Water is pumped through this roof for the collection of solar and ambient energy that can then be used for a variety of applications. Results from an EC-funded feasibility study to assessment of the potential of using ambient energy to produce fresh potable water from seawater are presented here. It is felt that the technology offers a good potential for water desalination in arid and semi-arid regions of the world where there is an abundance of solar and ambient energy are in recent use.

**Corinne Cabassud and David Wirth (2002)** This work focuses on the vacuum membrane distillation (purification method) (VMD) for seawater desalination. The aim of the work was to compare two hollow fiber module configurations (inside/out and outside/in). Experiments were carried out to with pure water and with 15 g/L up to 300 g/L NaCl solutions and for two different materials and structure of fibers. Pure water permeability and global heat transfer coefficient were compared for the two configurations. The influence of hydrodynamics on global heat and mass transfer coefficients is discussed in that.

**Soteris A. Kalogirou (2005)** This paper studies on addressing the water-shortage problem with seawater desalination; however, the separation of salts from seawater requires large amounts of energy which, when produced from fossil fuels, can cause harm to the environment.

Therefore, there is a need to employ environmentally-friendly energy sources in order to desalinate seawater. This paper covers a large variety of systems used to convert seawater into fresh water suitable for human use. It also covers a variety of systems, which can be used to harness

renewable energy sources; these include solar collectors, photovoltaic, solar ponds and geothermal energy.

Both direct and indirect collection systems are included. The representative example of direct collection systems is the solar still. Indirect collection systems employ two sub-systems; one for the collection of renewable energy and one for desalination. Only industrially-tested desalination systems are included in this paper. The paper also includes a review of various systems that use renewable energy sources for desalination.

**M.A. Darwish, N. Lior and N.M. Al-Najem (2009)** Gulf countries have very limited natural water resources to meet this growth, and as the result of this, desalted seawater in Kuwait became the main source of drinkable water, about to 93% in 2002.

It works essentially to look for energy efficient ways to produce power and desalted water so as to save the country's total income of these non-renewable fuel resources, to save the environment and indeed life itself in Kuwait, and this is the objective of this paper. It reviews that the presently used desalting methods of sea water and their energy requirement, and the correctness of fuel allotment formulas for CPDP, to determine the most efficient methods to apply in real world and the less efficient methods to avoid.

Fourteen desalting cases are analysed by utilizing the recent practice, with and without combination of the power generation plants (using steam or gas or combined gas/steam turbines cycles). The results shows that operating thermally driven desalting systems by steam directly supplied from fuel-fired boilers is the most inefficient practice, and should be avoidable. The consumption of the gas/steam turbine combined cycle, which is also the most efficient power generation cycle, to drive seawater reverse osmosis (SWRO) desalination plants is the most efficient combination.

**Trivedi Hetal K., Prof. Dr. D.V. Bhatt (2011)** All over the world, access to potable water to the people are narrowing down day by day. Most of the human diseases are due to polluted or non-purified water resources. Even today, under developed countries and developing countries face a huge water scarcity. The groundwater quality problems present today are caused by contamination and by overexploitation, or by combination of both. The only nearly inexhaustible sources of water are the oceans, which, however, are of high salinity. It would be feasible to address the water-shortage problem with seawater desalination; however, the separation of salts from seawater requires large amounts of energy. Conventional and non-conventional methods are used to distil the water. Both direct and indirect collection systems are included. The representative example of direct collection systems is the solar still. Indirect collection systems employ two subsystems; one for the collection of renewable energy and one for desalination.

For this purpose, standard renewable energy and desalination systems are most often employed.

Only industrially-tested desalination systems are included in this paper and they comprise the phase change processes, which include the multistage flash, multiple effect boiling and vapour compression and membrane processes, which

include reverse osmosis and electrodialysis. The paper also includes a review of various systems that use renewable energy sources for desalination. The paper also includes a review of various systems, characteristics of the major desalination system and REDS Technology Implementation.

## CONCLUSION

It is clear from the feasibility to study that ambient energy can be used for water desalination in severe temperate climates. In hotter countries where there is more solar energy available, the potential for using the technology to produce low-cost desalination systems is even more significant.

The application of ambient energy for water desalination is continuing, and it is intended to explore commercial-scale water desalination process using MSF/MED evaporation techniques in arid and semi-arid parts of the world where there are shortages of water.

There is a strong need for a versatile solution that has flexibility so that small-scale and large-scale units are equally feasible so that systems that are readily applicable to individual users or for isolated small communities can be realized.

Other applications of the ambient technology include domestic houses, hospitals, nursing homes, hotels, schools, industrial processes, cloth mills, industrial and commercial buildings, swimming pools, horticultural applications, agriculture, irrigation and sewage treatment. Some of these applications are being actively pursued by the University of Portsmouth/Ambient Energy Systems of the and progress will be reported in the future papers.

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# REHABILITATION OF UNLINED CANAL TO LINED CANAL A CASE STUDY @ “BAVLA CANAL

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In India canal irrigation is a major source of artificial irrigation. Many canals are unlined and due to that major seepage is found in unlined canal. 50 to 60 % seepage is found in unlined canal. Concrete, shortcrete, stones are the general materials used for lining of canal. Concrete can reduce seepage losses upto 70 % as well as shortcrete is efficiently reduce losses upto 90 %. these materials also required a maintenance due to expansion and contraction cracks Lining of Canals is considered an effective solution to this problem. But lining of canals in BAWLA is a great issue as canals will need to be closed long enough to deprive the farmers at least one crop season and the farmers are unable to pay this price for canal. The main factors to be considered in the selection of a lining type include durability, seepage loss, construction cost and time, and maintenance cost. For irrigation canals, the use of concrete (cast in place or precast) with or without reinforcement is the most common practice of canal lining.

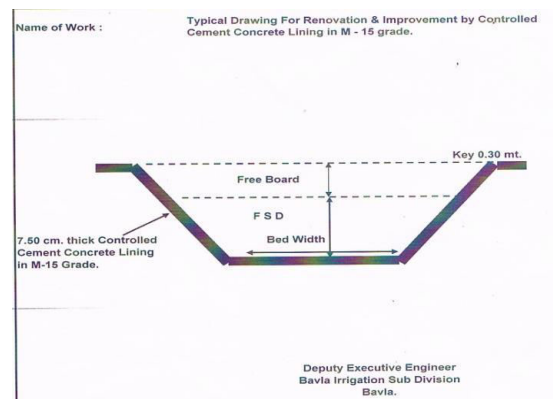
Keywords—*Irrigation, Canal, Alignment, Design, Maintenance*

## I. INTRODUCTION

A canal is defined as an artificial channel constructed on the ground to carry water from a river or other canal or a reservoir to the fields.



(FIG.1 VISIT AT BAVLA CANAL)



(FIG.2 RECENT DESIGN FOR LINE CANAL OF MOTI FATEHWADI)

Canal lining is the process of reducing seepage loss of irrigation water by adding an impermeable layer to the edges of the trench. Seepage can result in losses of 30 to 50 percent of irrigation water from canals. Canal linings are also used to prevent weed growth, which can spread throughout an irrigation system and reduce water flow. Lining a canal can also prevent waterlogging around low-lying areas of the canal.

By making a canal less permeable, the water velocity increases resulting in a greater overall discharge. Increased velocity also reduces the amount of evaporation and silting that occurs, making the canal more efficient.

The oldest known paved canal was discovered in 1995 near the pyramids of Giza, and is estimated to be around 4,500 years old.

An irrigation canal system consists of canals of different sizes and capacities accordingly, the canal are also classified (1)main canal (2) branch canal (3)major distributor, (4)minor distributor, and (5) watercourse. The canals are designed so that water may flow in them under gravitational force only. With respect to design there are three different designs (1)Canal running in full cutting, (2)Canal running in full embankment, (3)Canal running in partly in filling and in cutting.

With respect to Materials (1)concrete (2)concrete blocks, bricks (3)sand cement (4)plastic(5)compacted clay

**II. Site:**

We visited two sites in Ahmedabad and gandhinagar.

- (1) Moti fatehwadi near Bawla
- (2) GH0 to sarghasan road near gandhingar

One main site is “Moti-fatehwadi” section near bawla. His canal transfer water from vasna barrage to bawla threw changodar. 80%part of this canal is lined concrete canal but 20% part of moti fatehwadi section is unlined clay base canal. 80%part of this canal is lined concrete canal but 20% part of moti fatehwadi section is unlined clay base canal.

This canal is for irrigation purpose only. But some farmers are using it for fishing also.

We talked with some of the farmers who have farms right beside the canal. They are not happy with it because it **concludes** the water of factory so the polluted waste by company mixed in this canal threw under water.

We talked with Mr. Ramesh “Farmer”. He talked with us and said about how they go to the irrigation section bawla and how they get help on this topic.

We visited other site near the gandhinagar that canal is seasonal canal which have water during monsoon and winter only. This canal is under renovation we visited for getting detailed about how they held this work and which machinery, which theorem helps to create to good dimensioned and clean canal making process.



(FIG.3 ONE SIDE IS CLEANED/SHAPED AND OTHER IS UNDER MAINTANENCE)

**III. Data:**

We collected data from Bahumadi Building near Vastrapur and got the plans, discharge, H.F.L and all data for make this process real on our canal.

During visiting the site we get knowledge of how much is important. We get details of the canal water way, lining, Route, Water discharge.

Grade of Concrete	M-15	
Characteristic strength	15 N/sq.mm	
Specification	IS 456:2000	
Type of Cement	OPC-53	
Name of Factory	J.K.Laxmi	
Storage condition	Fresh(Not older then 3 month)	
Fine Aggregate Source	Sayala	
	4.75mm:100%	2.36mm :90%
	1.18mm:70%	600micron:30%
	300micron:20%	150micron:5%
Type of Course aggregate	Black Trap (Sayala)	
Type of Work	Canal lining	
Water	Local well	

MATERIAL	REQUIRED QUANTITY	SUPPLIED QUANTITY
Cement	3	3.5
Fine Aggregate	5	6
Course Aggregate	20mm MSA	
	40 to 20 mm	
	20 to 10 mm	10
	10 to 4.75 mm	6
Plastic Container	50 litre	50 litre

**IV. Problems:**

Less Discharge because of Seepage, Evaporation and Garbage.

Slope or alignment of the canal is not proper for an irrigation purpose.

Weed Problems which make cracks in lined canal.

These canals don't have walkway on it so they use tree a walkway. Canal concludes the water of factory so the polluted waste by company mixed in this canal threw under water.

Garbage can't pass through gate and they need to clean it weakly for regular water discharge.

**V. Solution:**

AquaLastic is a state-of-the-art, high performance, sprayed, plural component pure polyuria elastomer. This system is based on amine-terminated polyether resins, amine chain extenders and MDI pre polymers. It provides a flexible, resilient, tough, monolithic membrane with good water and chemical

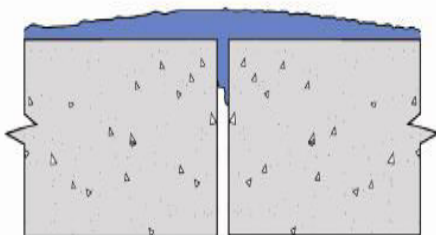
resistance. It is applied using high pressure application equipment. 100% solids. No solvents, No VOC's

Fast set: Handle in two minutes or less, Hydrophobic, therefore unaffected by damp, cool surfaces during application, Proprietary adhesion enhancing additives ensuring excellent bond strength to concrete, Extended tack time to allow deep surface penetration

There are many factors affecting in it like, Age of Canal, Length and width of canal, Type of canal, Base soil type, Material quality, Viscosity and Salinity of water, Chemical mixed in water And design of canal but these all problems will solve by using such changes.

We use aqualastic for protecting it from cracks. By using of aqualastic we can decrease the volume of concrete that is used in construction, because of when we use aqualastic we have to spread a thin layer of concrete that can capable for providing protection from cracks. Aqualastic sheet is like a plastic square it is made from polythin For use aqualastic sheet first we have to place aqualastic sheet on surface then we can apply thin layer of concrete. Aqualastic sheet cannot bear the high temp. sun light so for the purpose of protecting it from sunlight we are using solar panel.

The collection of eight planets and their moons in orbit round the sun, together with smaller bodies in the form of asteroids, meteoroids, and comets. Sardar Sarovar Narmada Nigam Limited(SSNNL) is all set to start building a 10 Mega Watt (MW) solar power generation plant over Narmada canal in Vadodara. Sources said the plant will be completed in six months and will produce 16.2 million units in the first year. Since it is coming up over the canal, the wastage of water through evaporation will help save a lot of water.



(FIG.4 APPLYING AQUALASTIC ON FIELD)  
(FIG.5 IMAGE OF CRACK REPAIRING BY AQUALASTIC)



(FIG.6 SOLAR SYSTEM ON NARMDA CANAL, GUJRAT)

A. Some herbicides can kill submerged or emergent aquatic weed species that produce oxygen in the water. In addition, degradation of plant materials will also consume oxygen within the water column. As a result, dissolved oxygen levels can fall below levels that are needed to sustain fish populations. Aquatic Herbicides, Copper Products, Diquat, Diuron, Endothall, Fluridone, Glyphosate, Imazapyr.

When possible, selectively control species that shade out or crowd other native species. Avoid treatments on cloudy days when dissolved oxygen will naturally be lower. If a large portion of a water body is extensively covered with plants, treat no more than 1/3 to 1/2 of the area at one time. This will allow time between applications for oxygen recovery. During the winter months, optimal performance of the herbicide will be achieved when water temperatures are relatively warmer.

Also we are planning to design a new harvester for cut the recent weed and which will apply chemical to the canal for stop to weed in canal.

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## ***Determining the possibility of reusing exhaust air from spray dryer for energy conservation***

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**Abstract**— Spray dryer requires a large amount of energy for drying feed with low solid concentration. Thus in order to save energy exhaust air stream is recycled to recover the heat inside it. That is done by mixing recycled stream with the fresh air stream. This mixed stream is now heated at the required temperature to be able to evaporate the water. Only recycling of exhaust air is sufficient for the slurry feed with high solid content. But for the low solid content slurry feed, the exhaust air is containing high moisture content in it. Thus the absorption capacity of the mixed stream decreases by recycling exhaust air. This leads to high energy consumption in order to reach the required inlet drying air temperature thereby decreasing the efficiency. To overcome this problem of high moisture content in the exhaust air, it can be dehumidified. In dehumidification the temperature of the air raises thus requiring less energy for heating. Also Low moisture in the inlet drying air will provide greater driving force for drying.

**Keywords**— *Spray dryer, cyclic process, Energy conservation*

### I. INTRODUCTION

Spray drying is a highly heat consuming technique. But also it is an unavoidable method to be used for obtaining powder form products. It is carried out by contacting drying air with the fine droplets of the feed to evaporate the water. This contact takes place only for few seconds only. Thus the absorption capacity of the drying air must be very high in order to remove the required moisture during the contact time. Otherwise problems like wall deposition and agglomeration takes place there by reducing the product quality.

Product quality and energy efficiency are like the two sides of the coins. Quality of the product depends on the parameters like feed flowrate, inlet air flowrate and inlet moisture content of the air. Thus if we want to dry the feed with the air of higher moisture content than the inlet air flowrate has to be high and feed flowrate has to be low to achieve the desired product quality. This high inlet air flowrate will consume higher amount of energy to heat it up to the required drying temperature. On the other side if inlet air with lesser moisture content is used and if the feed flowrate is kept constant, then to achieve the product of same quality the amount of inlet drying air required will be lower. Therefore energy will be saved if we will decrease the inlet moisture content of the drying air. Thus in this way both high quality and high efficiency can be achieved.

While recycling the exhaust air in the spray dryer, no doubt efficiency increases but the inlet moisture content of drying air is also high, this compels to keep the feed flowrate lower. Thus production rate of dry powder is slowed down. Now in order to faster the rate by using drying air with low moisture content keeping constant inlet flowrate OR to save heating energy by decreasing the amount of drying air used by keeping the feed flowrate constant, the recycled air can be dehumidified before mixing with fresh air and heating. Dehumidifying will certainly decrease the moisture content by removing water vapor in form of condensed water by cooling. After cooling, heating can be done using the vent air stream, thus raising the temperature.

In this work possibility of saving energy has been explored by comparing the energy requirement of the conventional process and the proposed idea.

### II. INLET AND OUTLET PARAMETERS

Inlet temperature of drying air ( $T_{da}$ )	170°C
Inlet flowrate of drying air ( $m_{da}$ )	2500Kg/hr
Inlet temperature of atomizing and fresh air ( $T_{aa} = T_{fa}$ )	30°C
Inlet flowrate of atomizing air ( $m_{aa}$ )	90Kg/hr
Inlet flowrate of feed	90kg/hr
Inlet temperature of feed ( $T_{sl}$ )	50°C
Relative humidity of fresh and atomizing air	70%
Water content	60%
Moisture in the final product ( $X_p$ )	3%
Reference temperature	0°C

Nomenclature			
$C_p$	specific heat capacity ( $\text{J kg}^{-1} \text{K}^{-1}$ )	<i>dew</i>	dew point
<i>ES</i>	energy saving (%)	<i>ea</i>	exhaust air
$h$	specific enthalpy ( $\text{J kg}^{-1}$ )	<i>fa</i>	feed air
$m$	mass flow rate ( $\text{kg s}^{-1}$ )	<i>h</i>	wet base
$Q$	amount of heat in unit time ( $\text{J s}^{-1}$ )	<i>i</i>	<i>i</i> th stream
<i>RR</i>	recirculation ratio (%)	<i>in</i>	inlet
$T$	temperature (K)	<i>j</i>	<i>j</i> th phase
$W$	weight percentage of water on wet basis (%)	<i>l</i>	liquid
$X$	mass fraction of water on dry basis ( $\text{kg kg}^{-1}$ )	<i>loss</i>	loss
$Y$	humidity on dry basis ( $\text{kg kg}^{-1}$ )	<i>ma</i>	mixed air
<i>Greek symbols</i>		<i>oa</i>	ambient air
$\eta_R$	energy efficiency (%)	<i>out</i>	outlet
$\lambda$	latent heat of water ( $\text{J kg}^{-1}$ )	<i>p</i>	solid product
<i>Subscripts</i>		<i>ra</i>	recirculated air
<i>a</i>	dry air	<i>rec</i>	recovered
<i>aa</i>	atomizing air	<i>ref</i>	reference
<i>crit</i>	critical	<i>req</i>	required
<i>d</i>	dry base	<i>s</i>	solid
<i>da</i>	drying air	<i>sl</i>	slurry
		<i>v</i>	vapor
		<i>va</i>	vent air

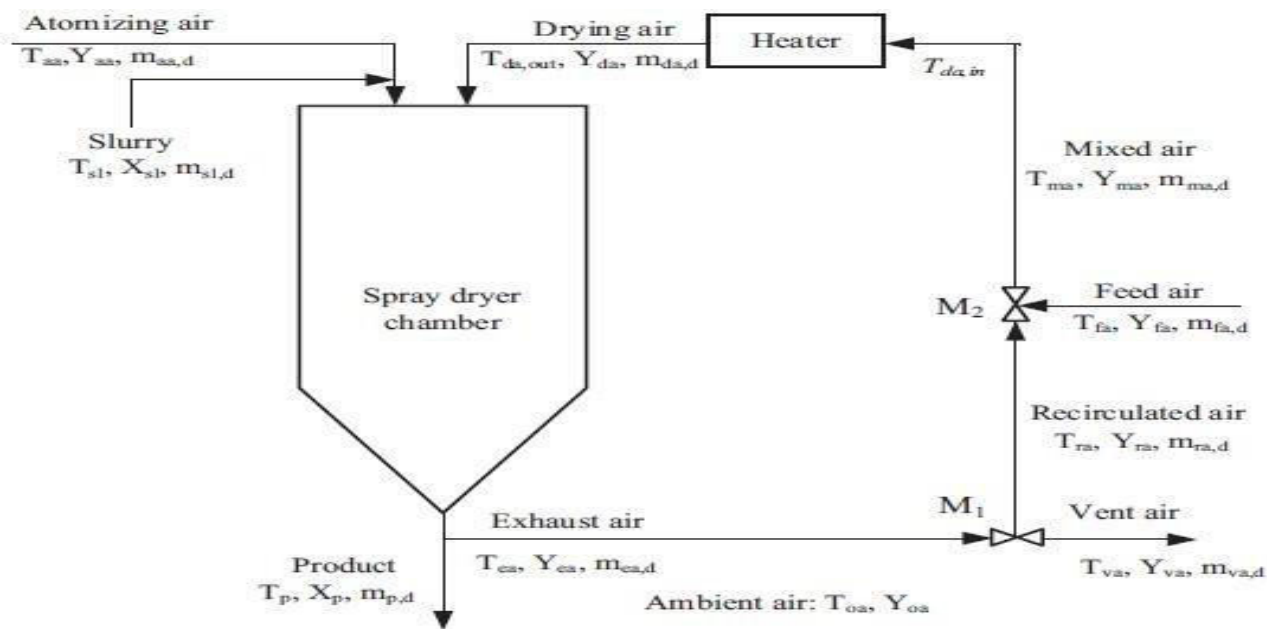


Fig. 1. Schematic diagram of the spray drying system with exhaust air recirculation.

III. ENERGY BALANCE CALCULATION WITHOUT USING DEHUMIDIFICATION

Energy balance for the flow diagram as shown in the figure (1) was carried out. The drying of alumina-based ceramic composite slurry is investigated. The mathematical model developed by Boris Golman was used for reference. Hence according to his model here also recirculation ratio 70% is used as it was found to be the optimum.

$$\begin{aligned}
 T_{va} &= T_{ra} = T_{ea} = T_p \\
 Y_{va} &= Y_{ra} = Y_{ea} \\
 Y_{fa} &= Y_{aa} = Y_{oa} \\
 m_{sl,d} &= m_{p,d} \\
 T_{fa} &= T_{aa}
 \end{aligned}
 \tag{1}$$

A. Inlet energy calculation

$$\begin{aligned}
 Q_{sl} &= m_{sl,d}(C_{ps} + X_{sl}C_{pl})(T_{sl} - T_{ref}) = \underline{3542.5125 \text{ J/s}} \\
 m_{sl,d} &= 40/100 * 90 = 36 \text{ Kg/hr}
 \end{aligned}
 \tag{2}$$

$$\begin{aligned}
 Q_{fa} &= m_{fa,d}[(C_{pa} + Y_{fa}C_{pv})(T_{fa} - T_{ref}) + Y_{fa}\lambda_{ref}] \\
 m_{ra} &= 70/100 * 2590 = 1813 \text{ Kg/hr} \\
 m_{fa} &= 2500 - 1813 = 687 \text{ Kg/hr}
 \end{aligned}
 \tag{3}$$

At 70% relative humidity and  $T_{fa} = 30^\circ\text{C}$ ,

$$\begin{aligned}
 Y_{fa} &= 0.0213 \\
 Q_{fa} &= \underline{15130.8315 \text{ J/s}}
 \end{aligned}$$

$$\begin{aligned}
 Q_{aa} &= m_{aa,d}[(C_{pa} + Y_{aa}C_{pv})(T_{aa} - T_{ref}) + Y_{aa}\lambda_{ref}] \\
 Q_{aa} &= \underline{1982.205 \text{ J/s}}
 \end{aligned}
 \tag{4}$$

$$\begin{aligned}
 Q_{da} &= m_{da,d}(C_{pa} + Y_{da}C_{pv})(T_{da} - T_{ma}) \\
 Y_{da} &= 0.0707 \\
 T_{ma} &= (687*303 + 1813*T_{ra}) / 2500 \\
 Q_{da} &= \underline{281608.0066 - 567.7006T_{ma}}
 \end{aligned}
 \tag{5}$$

B. Outlet energy calculation

$$\begin{aligned}
 Q_p &= m_{p,d}(C_{ps} + X_pC_{pl})(T_p - T_{ref}) = 9.1103(T_{ra} - 273) \\
 Q_p &= \underline{9.1103T_{ra} - 2487.1119 \text{ J/s}}
 \end{aligned}
 \tag{6}$$

$$\begin{aligned}
 Q_{va} &= m_{va,d}[(C_{pa} + Y_{va}C_{pv})(T_{va} - T_{ref}) + Y_{va}\lambda_{ref}] \\
 Y_{va} &= 0.0894
 \end{aligned}
 \tag{7}$$

$$Q_{va} = \underline{250.5652T_{ra} - 268404.3087 + 44607.83 \text{ J/s}}$$

C. From (2)+(3)+(4)+(5)=(6)+(7)

$$\begin{aligned}
 827.3761T_{ra} &= 328547.1462 \\
 T_{ea} = T_{ra} &= \underline{397.0952 \text{ K}} = \underline{124.1^\circ\text{C}}
 \end{aligned}
 \tag{8}$$

$$\begin{aligned}
 T_{ma} &= 98.24^\circ\text{C} \\
 Q_{da} &= \underline{56175.1201 \text{ J/s}}
 \end{aligned}$$

IV. ENERGY BALANCE USING DEHUMIDIFICATION OF EXHAUST AIR

The part of exhaust temperature at  $124.1^\circ\text{C}$  is dehumidified in order to increase its absorption capacity.

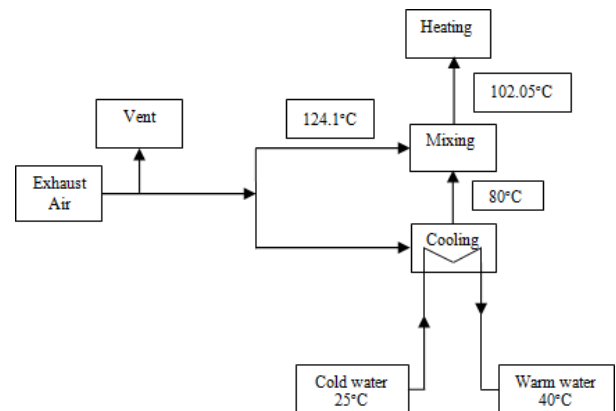
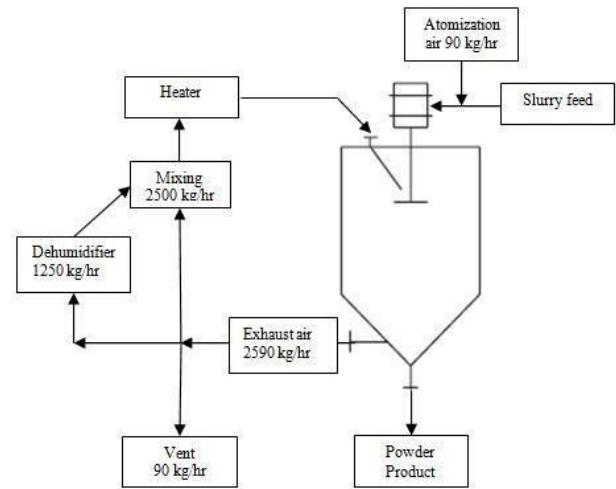


Fig. 2. Schematic diagram of spray drying system using dehumidification of exhaust air

In this proposed work the use of fresh air stream has been completely eliminated. By doing so the inlet temperature at the air heater will remain higher compared to the process where fresh air is used. This can be done if and only if we can reduce the humidity of the exhaust air and then recycle it.

Here after venting 90 Kg/hr exhaust gas, 50% of the remaining exhaust gas i.e. 1250 Kg/hr of air will be sent to a condenser for dehumidification. Here in this condenser the exhaust air at  $124.1^\circ\text{C}$  will be cooled to  $80^\circ\text{C}$  by using cold water at  $25^\circ\text{C}$ . Thus by dropping the temperature of hot gas

below 100°C will condense the water vapor in it leading to decrease in the humidity. This dehumidified air is then mixed with the remaining 50% of the exhaust air at 124.1°C forming a mixed stream of air  $T_{ma}$  at 102.05°C.

$$Q_{\text{rejected}} = m_{\text{water p,water}} C_p (40 - 25) \quad (9)$$

$$m_{\text{water}} = 1 \text{ kg/s}$$

$$Q_{\text{rejected}} = \underline{62790 \text{ J/s}}$$

$$Q_{\text{rejected}} = m_{\text{cold air}} (h_{c1} - h_{c2}) \quad (10)$$

$$h_i = 10^3(T_i - 273) + Y_i (2260 \cdot 10^3 + 1.8 \cdot 10^3(T_i - 273)) \quad (11)$$

$h_{c1}$  = enthalpy of air before cooling at  $T_{ea} = 124.1^\circ\text{C}$  and

$$Y_{ea} = 0.0894$$

$$h_{c1} = \underline{346114.172 \text{ J/Kg}}$$

$$m_{\text{cold air}} = 1000 \text{ g/s}$$

$$h_{c2} = \text{enthalpy of air after cooling} \quad (12)$$

$$h_{c2} = \underline{165278.972 \text{ J/Kg}}$$

From equation (11) at  $T_{c2} = 80^\circ\text{C}$

$$Y_{c2} = \underline{0.0355}$$

$$Y_{ma} = (0.0894 \cdot 1250 + 0.0355 \cdot 1250) / 2500 \quad (13)$$

$$Y_{ma} = \underline{0.0625}$$

$$T_{ma} = (124.1 \cdot 1250 + 80 \cdot 1250) / 2500$$

$$T_{ma} = \underline{102.05^\circ\text{C}}$$

$$\text{From equation (5)} \quad Q_{da} = \underline{52496.0938 \text{ J/s}}$$

## V. RESULTS AND DISCUSSION

From the above energy balance it is clear that the majority amount of the heat is consumed in heating the drying air. Thus efficiency of the spray dryer largely depends on the energy input done at inlet air heating. Thus in order to reduce the energy consumption the inlet air temperature at the air heater must be high.

In the case of 70% recycling exhaust air and 30% fresh air, the mixed air temperature at the inlet of heater was 98.24°C with the humidity of 0.0707.

$$Q_{da} = \underline{56175.1201 \text{ J/s}}$$

In the present investigation purging of 90 kg/hr of exhaust gas in the vent and dehumidifying 50% of 2500 kg/hr of exhaust air to reduce its temperature to be 80°C and humidity to 0.0355 is done. Thus mixed air temperature at the inlet of heater was 102.05°C with 0.0625 humidity.

$$Q_{da} = \underline{52496.0938 \text{ J/s}}$$

## VI. CONCLUSIONS

$$\underline{\Delta Q = 3679.0263 \text{ J/s}}$$

Thus every second above amount of energy can be saved by using dehumidification method with spray dryer.

Also after dehumidification the absorption capacity of the air is increased by reducing humidity from 0.0707 to 0.0625. This means that we can reduce the flowrate of inlet drying air for same inlet flowrate of feed and final product specification.

Reducing amount of inlet drying air into the heater will again save energy.

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# Experimental Study for Optimal Power Flow of IEEE 14 Bus System using Static VAR Compensator Device with Voltage Constraints

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**Abstract**— In power system the voltage at different buses vary with the change in load. The voltage is normally high at light load condition and low at heavy load condition. The voltage level at the consumer terminal must be maintained within permissible limits irrespective of the type & magnitude of the load. To keep bus voltage within permissible limits, it is necessary to maintain the balance of reactive power in the system. That means reactive power generation must be equal to reactive power absorbed. Any mismatch in the reactive power balance affects the bus voltage magnitude. SVS provides a fast, smooth and step less variation of compensation of reactive power injected into the line. Thus it assures an accurate voltage control of buses over a wide range of loads. This paper deals with the Simulation of optimal power flow of IEEE 14 Bus system using SVC for voltage enhancement. Power Flow is carried out, considering balanced system during peak load condition, with the voltage enhancement is the main objective. Other objectives are the reduction in power loss and improvement in power factor. The optimal power flow of IEEE 14 Bus system is carried out with the help of MATLAB software for maintaining the voltage profile of different buses. The performance of IEEE 14 bus system without and with SVC has been performed in MATLAB software and results obtained are discussed.

**Keywords**- *Optimal Power Flow Analysis; FACT; Static Var Compensator or Source (SVC/SVS); Distribution Substation; MATLAB.*

## I. INTRODUCTION

Voltage sag is one of the most common problems in heavily loaded distribution systems. In distribution systems, permissible voltage variation range is +/-5 % but due to heavy loading conditions the voltage level is not maintained up to this range. Practically it is difficult to maintain the balanced of reactive power because of the varied demand of the consumers [1]. Reactive power support at the weakest bus helps to improve voltage levels. Various compensating devices like Static capacitor banks, Synchronous Condensers, etc. can give reactive power support. FACTS Technology is one of the advanced compensating devices for reactive power support. SVC, widely used member of FACTS family, supports to maintain voltage profile when connected at the weakest bus by injection of current at the point of connection [3].

Identification of the bus where the SVC is to be installed is possible with the Load Flow Analysis.

The objective of this paper is to simulate optimal power flow of IEEE 14 Bus system using SVC for voltage enhancement considering balanced load during peak load condition. Simulation results without and with SVC are compared. The main objective of this paper is voltage enhancement, reduction in power loss and improvement in power factor with the insertion of SVC.

## II. OPTIMAL POWER FLOW AND SHUNT CONNECTED FACTS CONTROLLERS

### A. Optimal Power Flow

Optimal power flow is the most fundamental numerical algorithm approach to know the parameters of a system. The power flow study is the load flow study. The main information obtained from the load flow study consists of magnitudes, phase angles of load bus voltages, reactive power flows on transmission lines. This information is essential for the continuous monitoring of the current status of the system & for analysing the effective alternate plans for further system expansion to meet increased load demand. In a steady state condition load flow analysis gives the information regarding power generation, power delivered and losses occur in the system, current through each branch, active and reactive power, voltages at each buses, etc. [6]. Load Flow is also required to study & check the performance of existing system as well as useful in the expansion of the system.

Optimal power flow analysis is necessary for effective utilization of generators to minimize the fuel cost, reduces the system losses, improve the voltage profile. The power system which has improved voltage profile and better reactive power margin can be operated at higher load levels. The generators real and reactive power is allowed to vary within certain limit.

### B. FACTS Controllers

Compensating devices are necessary in the power systems to maintain the voltage profile and to improve the power handling capacity. Some of the traditional compensating devices like shunt capacitor shunt reactors,

synchronous condensers, and series capacitor. The drawbacks of these devices are that they are not controllable, very bulky and expensive. Flexible AC Transmission (FACTS) is one of the advanced technologies used for compensation. In shunt compensation, two types of compensation devices mainly used are Static Var Compensator (SVC) and STATCOM [8].

In this paper SVC device is used for reactive power compensation. SVC provides benefit to the transmission as well as distribution side and end users. SVC uses the combination of switching capacitors and reactors provide control over reactive power as per the requirement. Some of the advantages of SVC are cheaper, faster in operation, more reliable and higher capacity as compared to synchronous condensers. Whenever slow acting voltage regulators are used along with SVC for voltage control, and if the system voltage deviation takes place from the steady state range, SVC responds faster than the others devices. SVC is widely used in reactive power control due to which voltage enhancement, improvement in overall efficiency, hence voltage stability improvement is possible [3].

SVC is one of the major FACTS devices. This device has been used in transmission and distribution systems for reducing voltage variation. SVC is characterized by fast responses, high reliability and flexibility [5]. Whenever SVC is connected at one of the weak bus, voltage enhancement is observed in larger part of the system nearby that particular bus [4, 6]. Different types of SVC are Saturated Reactors (SR), Thyristors Controlled Reactors (TCR), Thyristor Switched Capacitor (TSC), Thyristor Switched Reactor (TSR), Fix Capacitor–Thyristor Controlled Reactor (FC-TCR) and combination of TSC-TCR are also available. In this system Thyristor Switched Capacitor (TSC) is used. Basic structure of SVC is as shown below in figure 1.

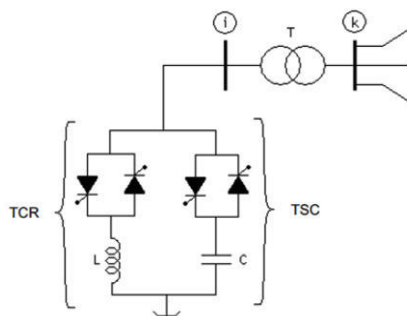


Fig. 1 One Line Diagram of SVC Device

The SVC device is a reactive power compensator, which, by absorbing or injecting reactive power (Q) controls the monitored voltage in the acceptable range around the reference voltage  $V_0$ . The typical steady-state control law of a SVC used here is depicted in Fig. 2, and may be represented by the following voltage-current characteristic: where  $V_k$  and  $I_{SVC}$  stand for controlled bus voltage and SVC device current. Typical values for the slope  $X_{sl}$  are in the range of 0.02 to 0.05 pu, depending on the SVC device rated parameters.

The slope of the SVC voltage control characteristics can be represented as  $X_{sl}$ , the equivalent slope reactance in p.u. The limiting values of the SVC inductive and

capacitive reactance are given by  $X_l$  and  $X_c$ , respectively.  $V_k$  and  $V_{ref}$  are the controlled bus and reference voltage magnitudes, respectively. Modeling the SVC as a variable VAR source, we can set the maximum and minimum limits on the reactive power output  $Q_{SVC}$  according to its available inductive and capacitive susceptance  $B_{ind}$  and  $B_{cap}$ , respectively. These limits can be given as

$$Q_{max} = B_{ind} * V_{ref}^2 \tag{1}$$

$$Q_{min} = B_{cap} * V_{ref}^2 \tag{2}$$

Where  $B_{ind} = 1/X_L$  and  $B_{cap} = 1/X_C$ .

$$V_k = V_0 + X_{SL} * I_{SVC} \tag{3}$$

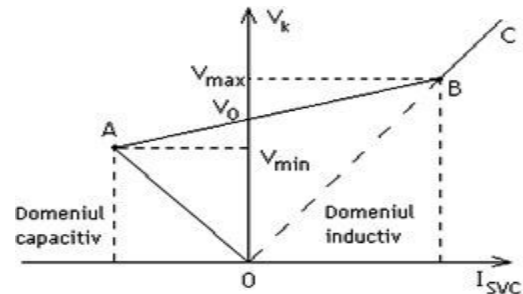


Fig. 2 SVC V- I characteristic

The control law corresponding to the SVC characteristic (Figure 2) is the following:

- If the monitored voltage is larger than the reference voltage,  $V_k > V_0$ , then the SVC device is absorbing reactive power;
- If the monitored voltage is smaller than the reference voltage,  $V_k < V_0$ , then reactive power injection into bus k is required.

### III. SYSTEM UNDER CONSIDERATION FOR IEEE 14 BUS

The IEEE 14 BUS system is taken for simulation of optimal power flow. The system consists of 14 buses, 5 generators, 5 Transformers, 20 branches, 4 SVC. Source Buses are at Bus No. 1, 2, 3, 4 and 8 and Load Buses are at Bus No. 2, 3, 4, 5, 6, 7, 9, 10, 11, 12, 13 and 14. The bus data include the bus voltage with its phase and magnitudes. Out of five generators two generators supply real power while three generators are the reactive sources i.e. synchronous condensers to provide the reactive power supply. The system consists of total real load of 5114.6 kW and reactive load of 3835.7 kVar. The five transformers data include the tap setting with the transmission data i.e. resistance, reactance and susceptance. The system branch data include resistances, reactance and capacitance.

The notations used for various components are described below on the diagram.

- X1 - X3 --- Power transformers
- B1-B4 and B8 --- Source Buses
- B2 - B7 and B9-B14 --- Load
- TL1 - TL20 --- Branches (Distribution Lines)
- P + jQ --- Static loads

#### IV. IEEE 14 BUS SYSTEM IMPLEMENTED IN MATLAB

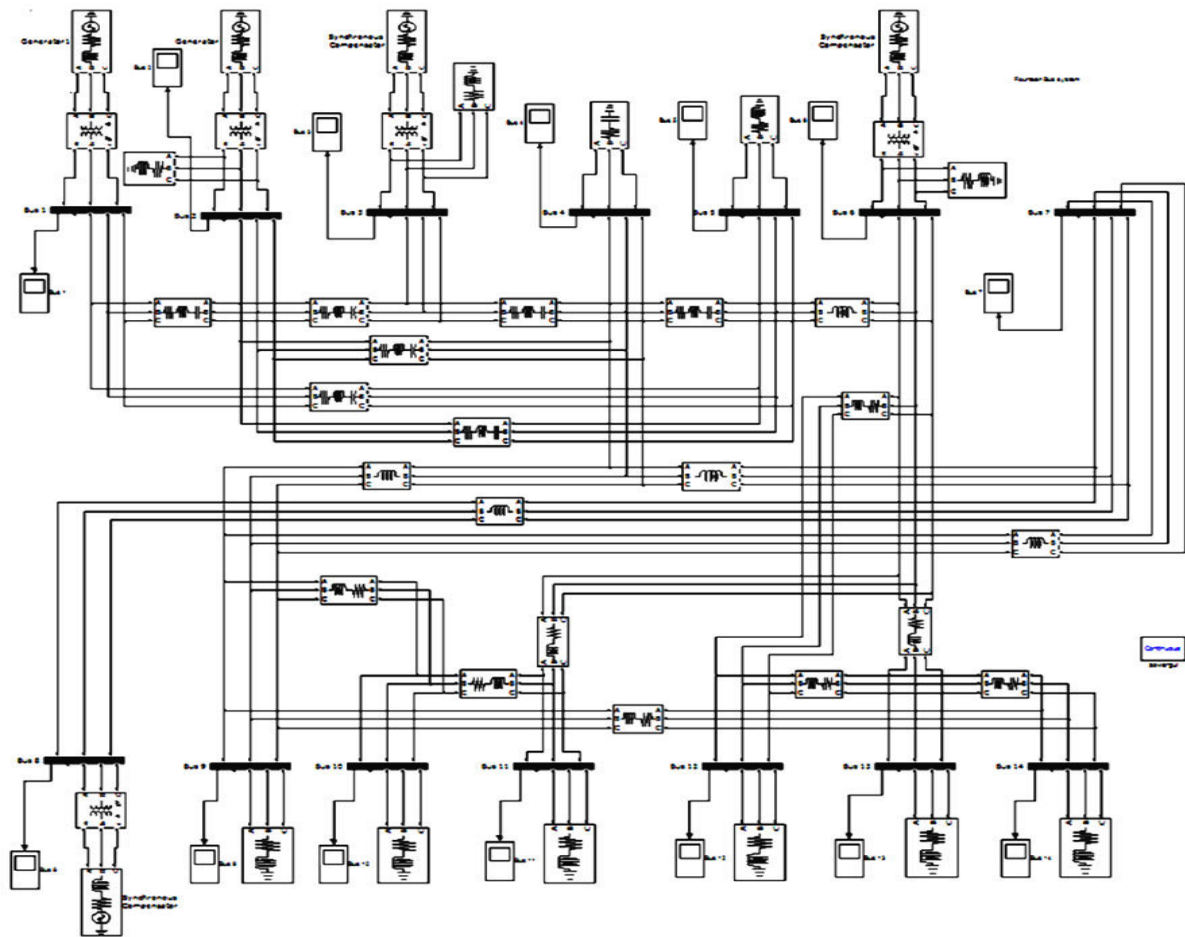


Fig. 3 IEEE 14 bus system implemented

The simulation results of IEEE 14 Bus system is shown above without implementing SVC into the system. As per the result obtained by load flow analysis the system required SVC implementation on Bus No. 5, 9, 10 and 14 because of large voltage variation on that bus. The voltage at that bus is not in the range of required limit ( $\pm 5\%$ ). It has been considered for the load flow analysis. Computer simulation of the substation has been carried out in MATLAB environment for steady state, peak load and balanced condition. SVCs are installed at Bus No 5, 9, 10 and 14 because of large voltage variation on this Bus. The simulation results without and with SVC are obtained. Simulation results are then compared in Table 4. Table 4 shown below indicates the result of system implemented IEEE 14 Bus system without SVC.

In order to investigate the impact of SVC on power systems, appropriate SVC model is very important. In this section, SVC is built up with reactors and capacitors, controlled by thyristor valves which are in parallel with a fixed capacitor bank.

The model considers SVC as shunt-connected variable susceptance,  $B_{SVC}$  which is adapted automatically to achieve the voltage control. The equivalent susceptance,  $B_{eq}$  is determined by the firing angle  $\alpha$  of the thyristors that is defined as the delay

angle measured from the peak of the capacitor voltage to the firing instant. As the reactive power demand at the bus varies, the susceptance is varied subject to the limits. However, the reactive power is a function of the square of the bus voltage. Hence the reactive power generated decreases as the voltage decreases.

The SVC can both absorb as well as supply reactive power at the bus it is connected to by control of the firing angle of the thyristor elements. By controlling the firing angle  $\alpha$  of the thyristors (i.e., the angle with respect to the zero crossing of the phase voltage), the device is able to control the bus voltage magnitude. Changes in  $\alpha$  results in changes on the current and hence, the amount of reactive power consumed by the inductor. When  $\alpha = 90^\circ$ , the inductor is fully activated but is deactivated when  $\alpha = 180^\circ$ .

Actually, the basic control strategy is typically to keep the transmission bus voltage within certain narrow limits defined by a controller droop and the firing angle  $\alpha$  limits ( $90^\circ < \alpha < 180^\circ$ ).

#### V. RESULTS AND DISCUSSION

The line diagram of IEEE 14 Bus system is shown in figure 3 and it has been considered for the load flow analysis. Computer simulation of the substation has been carried out in MATLAB environment for steady

state, peak load and balanced condition. Load flow analysis has been made without and with SVC for peak load recorded data of substation. For Load flow analysis Low rating SVC are connected at distribution transformers. SVCs are installed at Bus no B5, B9, B10 and B14 because of large voltage variation on this. The simulation results without and with SVC are obtained. Simulation results are then compared in Table 1 for the IEEE 14 Bus system.

TABLE I. COMPARISON BETWEEN THE MEASURED BUS VOLTAGE AND SIMULATION RESULTS WITH AND WITHOUT SVC AT DIFFERENT BUSES

Bus No.	Bus Voltage Without SVC [KV]	Bus Voltage With SVC [KV]
1	0.415	0.415
2	0.402	0.401
3	0.414	0.415
4	0.406	0.407
5	<b>0.372</b>	<b>0.409</b>
6	0.399	0.401
7	0.415	0.415
8	0.399	0.398
9	<b>0.376</b>	<b>0.399</b>
10	<b>0.369</b>	<b>0.403</b>
11	0.396	0.397
12	0.389	0.390
13	0.407	0.409
14	<b>0.366</b>	<b>0.404</b>

Here all values are considered in line quantity. Power factor from simulation results are recorded. Power factor without SVC is **0.85** whereas with the insertion of SVC it is **0.96**. The value of capacitor for compensation of required voltage is 44.15uF and it is calculated as per the mathematical steps shown below:

#### A. Calculation of Capacitance

Total input,  $P = 5114.6$  KW

Original p.f. =  $\cos(\theta_1) = 0.85$  lag;

Desired p.f. =  $\cos(\theta_2) = 0.98$  lag;

$\theta_1 = 31.78$ ;  $\tan \theta_1 = 0.6197$ ;

$\theta_2 = 11.47$ ;  $\tan \theta_2 = 0.2030$ ;

Assuming 100 % efficiency, Leading KVAR taken by condenser bank =  $P (\tan \theta_1 - \tan \theta_2) = 5114.6(0.6197 - 0.2030) = 2131.25$  KVAR, Rating of each capacitor connected in phase =  $2131.25/3 = 710.41$  KVAR

Phase current of each capacitor is  $I_{cp} = (V_{ph}/X_c)$

$= 2\pi \cdot 50 \cdot C \cdot (0.415/1.73) = 1260156.35C$

KVAR/Phase =  $V_{ph} \cdot I_{cp}/1000 = 1608968365C$

Now to find capacitor value, compare KVAR/phase.

So we get,  $1608968365 C = 710.41$  KVAR. The value of capacitor connected in each phase is 44.15uF.

#### VI. CONCLUSION

The objective was to improve the voltage profile of different buses of IEEE 14 Bus network. To maintain the voltage level of the bus, it is desirable to maintain the balance of reactive power in the system i.e. reactive power generation must be equal to reactive power absorbed. Any mismatch in the reactive power balance affects the bus voltage magnitude. In this paper, the

performance of IEEE 14 Bus system without and with SVC at different buses has been examined in MATLAB software. In the comparison of voltage profile without SVC, the deviations in the magnitude of voltage are found due to deficit of reactive power. By implementing SVC in particular buses the requirement for reactive power is met and hence improvement in voltage profile is observed. Also to improve the voltage performance, the use of quality transformers, proper length of distribution lines, minimum joints and jumpers are suggested.

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