

# PROTECTION OF ETHERNET FACILITIES IN HARSH ENVIRONMENTS

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## ABSTRACT

*Ethernet is the most prevalent LAN application worldwide, offering the benefits of standardization, low-cost components, and high-performance switching technology. It's easy to configure and install. Ethernet has steadily migrated from the office environment onto the factory floor for automation and industrial control, in industries as wide ranging as food processing, mining and automotive and heavy-equipment manufacturing. As the technology becomes increasingly efficient and affordable, even small manufacturers are now transitioning to Ethernet. The shift from only legacy field-bus communication systems to new protocols on an Ethernet backbone not only improves the ease of process control and automation, but also gives management visibility to streamline operations and improve productivity of the industry.*

## I. INTRODUCTION

### 1.1 The Network

The biggest mistake plants make in installing an industrial network is thinking that the office network can be the same network used for the production floor. The variable traffic and address schemes of the corporate network interfere with the consistent, structured, and less variable nature of the production network. A VLAN (virtual local area network) is one way to segment network traffic. Industrial environments require industrial-rated switches; they are designed to stand up to the rigors of the industrial world, and help the network run more efficiently. In production, it's critical to get information from point A to point B reliably. The end result of poor network performance in an office may only be users' PCs running slowly. On the production floor, the difference between a communication being sent in four versus six seconds could be the difference between a high-speed bottling line working or not. Or, in a sheet metal plant, it might determine whether or not the material is cut in the correct lengths. The proper flow of information keeps the belt moving at exactly the right speed, and keeps the temperature consistent over a 140-foot span.

### 1.2 Electrical Signalling

The devices on the network such as switches can be impacted by many of the same issues that affect cabling. Harsh electrical environments can cause transients, disturbances, and static discharge. Extreme humidity and temperature changes, vibration, and inconsistent or inefficient power delivery can all disrupt signaling. Appropriately IP rated devices can mitigate many of these problems.

### 1.3 Cabling Infrastructure

In a typical data center, a server with unshielded twisted-pair cables hanging from the back and running unprotected to the ceiling can be found; and that is perfectly fine. In an industrial environment, cables need to be protected with plastic or metal conduit. It is acceptable to run Ethernet along the ceiling in open trays. But when those cables reach any place where they might be sprayed with water, made hot, or hit by a lift truck, it is necessary to put it in conduit.

Also there is a need to reconsider EMI shielding. For example, one machine might be filling bottles and another machine loading them into the boxes. The Ethernet line needs to be separated and shielded from the EMI field that machines, cables, motors, and transformers generate. Excessive electronic noise will interfere with signals. It usually manifests itself as particular types of easily recognizable network errors, and indicates that the transmitted frame has been corrupted somewhere along the path.

What can be done about it? UTP (unshielded twisted pair) cabling is by nature fairly immune to lower levels of EMI. An opposite signal is transmitted on each leg of pair, and because the pair is located in the same place, any interference is the same on both legs, effectively canceling out EMI. For higher levels of EMI, a cabling type called shielded twisted pair (STP, also known as CAT 5 cable) is used. Or for even greater protection, a fiber optic cable, which is immune to EMI is used. Using enhanced, higher-rated cabling is not the only means of dealing with harsh environments. Consider using a combination of separation, isolation, and enhancement strategies. For example, when there is a risk of liquids, separation can be achieved by running cabling in cable trays at ceiling height as opposed to on floor pathways. Isolation can be achieved by using appropriate conduits or raceway, such as properly grounded metal conduit that helps isolate some EMI noise.

When operating under harsher conditions, preventative measures such as regularly replacing patch cords and connectors well before their rated life to help avoid downtime should be done.

## II. ETHERNET IN INDUSTRY

The biggest issues in industrial Ethernet stem from the hazards to which networks are exposed. Two major factors contribute to these hazards: lack of climate control and the presence of other electrical equipment. While the network in an office or data center is protected from nature's elements by air conditioning and shade, most industrial environments lack such climate control. Excessive heat and humidity, for example, can impact the transmission media.

Unshielded twisted pair cable, commonly used in office networks, can be damaged by prolonged exposure to sunlight. The electromagnetic interference (EMI) generated by electrical equipment causes noise that impedes network traffic. RJ-45 connectors, a mainstay of corporate networks are not designed for long-term performance in excessive heat or stress and their contacts can corrode and locking tabs easily break off.

### 2.1 Here are some of the factors that can impact your network

|  |   |
|--|---|
| Ambient Humidity and direct moisture                 | Cable Corrosion                         |
| Vibration to Cable wear                              | Disconnects                             |
| Extreme Temperature                                  | Cable Wear and Tear, Failures           |
| Chemical Exposure                                    | Cable Corrosion                         |
| Dust/Poor Outlet/Plug/Connector Contact particularly | EMI Electro Magnetic Interface Degraded |

|                        |              |
|------------------------|--------------|
| with optic fiber cable | Transmission |
|------------------------|--------------|

**Fig.1 Impact of Industrial environment on network**

The distances over which signal must be transmitted is another key difference. Industrial Ethernet cable may need to run ¼ of a mile or more as it is routed through a large plant, around hazards, and from machine to machine and switch to switch. Unshielded twisted pair cable, typically used in offices, has a 100-meter maximum distance. While this specification originated to separate user transmissions and prevent collisions, today the distance limitation is the result of power transmission. Network Interface cards (NICs) are designed for 100 meters. Beyond this distance, extra power is required and it generates noise that interferes with data transmission. Multimode fiber is sufficient for up to two kilometers.

For distances over 2-3 kilometers, singlemode fiber optic cable may be required. Yet fiber optic cable brings its own set of requirements. The diameter of a single mode fiber is smaller than a red blood cell. Fingerprints, or even dust in the air can sit on the fiber optic end-face, causing reflectance and inhibiting signal transmission. Finally, something as basic as power can affect an Ethernet installation. Office-grade Ethernet components may not function in an industrial environment powered by 24 or even 48 volts, with AC and DC sources. Industrial grade components will probably be required.

### III. ETHERNET STANDARDS AND RATINGS

Knowledge of some of the Ethernet standards and ratings that have evolved over the years can help design a more robust and resilient network.

### IV. MICE TABLES

To describe possible environmental conditions within industrial sites, the Telecommunications Infrastructure Association(TIA) has created Mechanical, Ingress, Climatic/Chemical, and Electromagnetic (MICE) tables. MICE Level 1 describes a typical office environment. MICE 2 describes a slightly harsher setting. MICE 3 describes a heavy industrial environment.

Approximately 80% of environments are addressed by the tables, excepting only the most extreme or specialized environments. The Mechanical section of each table provides values for shock/bump, vibration, tensile force, crush, impact, and bending/flexing. Ingress specifies the size of particulates (dust). The Climatic/Chemical section provides values for temperature, humidity, radiation, and liquid and gaseous pollution from common industrial contaminants.

Finally, the Electromagnetic section provides specific values for electrostatic discharge, radiated and conducted radiofrequency (RF), surge (transient ground potential difference) and magnetic field.

The MICE tables do not constitute a set of requirements for cabling, but they do provide a helpful context for evaluating a specific environment and selecting cabling systems that are compatible. Also cabling may run through multiple MICE environments. By establishing environmental boundaries, need for the highest-rated cabling can be minimized throughout the entire facility.

### V. PROTECTION RATINGS

An IP (Index of Protection) rating indicates the degree of protection offered by equipment. The rating is always specified with the letters IP followed by two numbers. The first number indicates the degree of protection

against solid foreign bodies. The second number is the degree of water protection. A lower rating of IP 55, for example, indicates that a device provides enough protection from dust particles and water spray that operation won't be disrupted. A higher rating of IP 68 indicates the device is dust-proof and can be immersed in water over time without adverse effects.

The commonly used RJ-45 connector in a typical patch cable is not IP rated. It is not designed to provide any protection from dust or to be at all waterproof. Ethernet cable in harsh environments will either require specially designed RJ45

connectors with protective sealed boots, or another type of connector altogether such as the M-12. With an IP-68 rating, the M-12 connector offers some of the highest levels of physical protection against solids and liquids. A pharmaceutical wash-down room is a good example of an application that requires not only connectors with high IP ratings, but also specially designed equipment enclosures that carry high IP ratings.

## **VI. USABILITY MODELS**

A few methods that help in the Ethernet cables not being damaged by the surroundings are:

Cold bend, Abrasion, Cold Impact, Crushing, Cut through, High Temperature, Oil Resistance, UV-Exposure, Water Immersion

## **VII. CONCLUSION**

Most industrial organizations invest significantly to protect the safety and security of their production processes, and to provide workers with safety and protective gear, such as hard hats, safety glasses, gloves and footwear. Doesn't it make good business sense to invest wisely to preserve, protect and defend the data network infrastructure that supports all of the facility's mission critical information, automation and control functions?

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# IDENTIFICATION AND CLASSIFICATION OF PLANT LEAF DISEASE

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## ABSTRACT

*This paper presents a method for identifying plant leaf disease based on color. Agrarians are suffering from the issue rising from different types of plant diseases. Sometimes biologists are also unable to identify the disease that leads to lack of identification of right type of disease. The goal of proposed work to diagnose the disease using image processing and artificial intelligence techniques on image of plant leaves disease. The input image of leaves is converted RGB to HIS. Then leaf disease segmentation is done using K-means clustering. After segmentation the mostly green color pixels are masked based on specific threshold values that are computed using Otsu's method. Neural network is trained for classification.*

**Keywords:** HIS, Image processing, K-means, Leaf disease, Neural Networks.

## I. INTRODUCTION

India is an agricultural country. Farmers have wide range of diversity to select suitable fruit and vegetable crop. Research work develops the advance computing system to identify the diseases using infected images of various leaf spots. Images are captured by digital camera mobile and processed using image growing, then the part of the leaf sport has been used for the classification purpose of the train and test. The technique evolved into the system is both Image processing techniques and advance computing techniques.

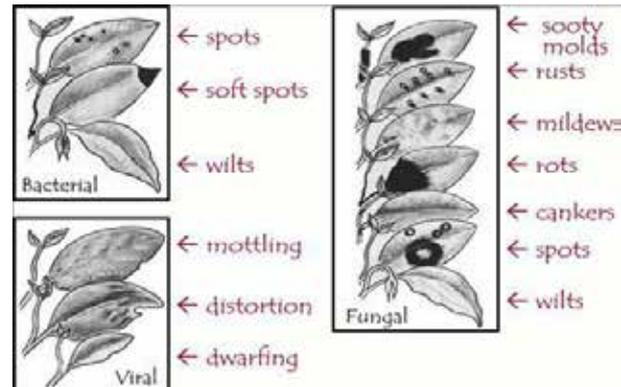
Image Analysis Can Be Applied For The Following Purposes:

1. To detect diseased leaf, stem, fruit.
2. To quantify affected area by disease.
3. To find the boundaries of the affected area.
4. To determine the color of the affected area.
5. To determine size & shape of leaf.
6. To identify the Object correctly.

Disease management is a challenging task. Mostly diseases are seen on the leaves or stems of the plant. Precise quantification of these visually observed diseases, pests, traits has not studied yet because of the complexity of visual patterns. Hence there has been increasing demand for more specific and sophisticated image pattern understanding.

Various Types of Leaf Spot Diseases:

- Bacterial
- Fungal
- Viral



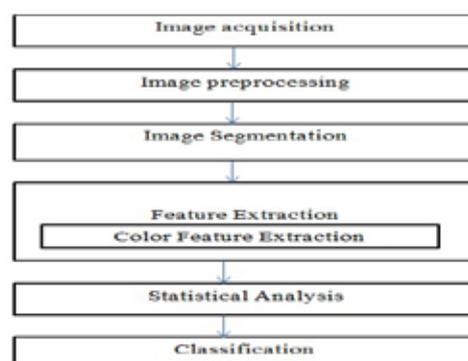
**Figure 1: Various types of diseases**

Most leaf diseases are caused by fungi, bacteria and viruses. Fungi are identified primarily from their morphology, with emphasis placed on their reproductive structures. Bacteria are considered more primitive than fungi and generally have simpler life cycles. With few exceptions, bacteria exist as single cells and increase in numbers by dividing into two cells during a process called binary fission viruses are extremely tiny particles consisting of protein and genetic material with no associated protein. In biological science, sometimes thousands of images are generated in a single experiment. These images can be required for further studies like classifying lesion, scoring quantitative traits, calculating area eaten by insects, etc. Almost all of these tasks are processed manually or with distinct software packages. It is not only tremendous amount of work but also suffers from two major issues: excessive processing time and subjectiveness rising from different individuals. Hence to conduct high throughput experiments, plant biologist need efficient computer software to automatically extract and analyze significant content. Here image processing plays important role [1].

In this project, we develop software for the automatic identification & classification of plant leaf diseases. Here the end-user is the farmer. This project classifies the plant leaves diseases hand into infected and non-infected classes. The developing software provides a fast and accurate method in which the leaf diseases are detected and classified using k-means based segmentation and neural networks based classification.

## II. METHODOLOGY

The Methodology for diagnosing leaf diseases involves several tasks, such as Image acquisition, image enhancement, segmentation, feature extraction and leaf disease classification based on neural network.



**Figure 2: Stages for classification of plant leaf diseases**

**Algorithm 1.** Basic steps describing the proposed algorithm:

1. RGB image acquisition
2. Create the color transformation structure
3. Convert the color values in RGB to the space specified in the color transformation structure
4. Apply K-means clustering
5. Masking green-pixels
6. Remove the masked cells inside the boundaries of the infected clusters
7. Convert the infected (cluster / clusters) from RGB to HSI Translation
8. SGDM Matrix Generation for H and S. (Another name for gray-level co-occurrence matrix is gray-level spatial dependence matrix.)
9. Calling the GLCM function to calculate the features
10. Texture Statistics Computation
11. Configuring Neural Networks for Recognition

## 2.1 Image Acquisition

The different types of commercial crops, food grain, fruits and cereals samples both healthy and unaffected agriculture/horticulture produce used in the present work are collected.

## 2.2 Pre-Processing

Usually the images that are obtained during image acquisition may not be suitable straight for identification and classification purposes because of certain factors, such as noise, lighting variations, climatic conditions, poor resolutions of an images, unwanted background etc.

## 2.3 Color Transformation Structure

First, the RGB images of leaves are converted into Hue Saturation Intensity (HSI) color space representation. The purpose of the color space is to facilitate the specification of colors in some standard, generally accepted way. HSI (hue, saturation, intensity) color model is a popular color model because it is based on human perception. Hue is a color attribute that refers to the dominant color as perceived by an observer. Saturation refers to the relative purity or the amount of white light added to hue and intensity refers to the amplitude of the light. Color spaces can be converted from one space to another easily. After the transformation process, the H component is taken into account for further analysis. S and I are dropped since it does not give extra information.

## 2.4 Masking Green Pixels

In this step, we identify the mostly green colored pixels. After that, based on specified threshold value that is computed for these pixels, the mostly green pixels are masked as follows: if the green component of the pixel intensity is less than the pre-computed threshold value, the red, green and blue components of the this pixel is assigned to a value of zero. This is done in sense that the green colored pixels mostly represent the healthy areas of the leaf and they do not add any valuable weight to disease identification and furthermore this significantly reduces the processing time [2].

## 2.5 Removing The Masked Cells

The pixels with zeros red, green, blue components were completely removed. This is helpful as it gives more accurate disease classification and significantly reduces the processing time.

## 2.6 Segmentation

K-means clustering is used to partition the leaf into four clusters in which one or more clusters contain the disease in case when the leaf is infected by more than one disease. The K means clustering algorithms tries to classify objects (pixels in our case) based on a set of features into K number of classes. The classification is done by minimizing the sum of squares of distances between the objects and the corresponding cluster or class centroid [3].

## 2.7 Feature Extraction

The method followed for extracting the feature set is called the color co-occurrence method or CCM method. It is a method, in which both the color and texture of an image are taken into account, to arrive at unique features, which represent that image.

## 2.8 Color Co-Occurrence Method For Texture Analysis

The image analysis technique selecting for this study is the CCM method. The use of color image features in the visible light spectrum provides additional image characteristics features over the traditional grey scale representation.

The CCM methodology consists of three major mathematical processes. First, the RGB images of leaves are converted into HSI color space representation. Once this process is completed, each pixel map is used to generate a color co-occurrence matrix, resulting in three CCM matrices, one for each H, S and I pixel maps. Hue Saturation Intensity (HSI) space is also a popular color space because it is based on human color perception. Hue is generally related to the wavelength of a light and intensity shows the amplitude of the light. And saturation measures the colourfulness in HSI space.

Color spaces can easily be transformed from one to another. Following equations can be used to transform the images from RGB to HSI.

$$\text{Intensity } (I) = \frac{R+G+B}{3}$$

$$\text{Saturation } (S) = 1 - \frac{3 \min(R,G,B)}{(R+G+B)}$$

$$\text{Hue } (H) = 2 - \text{ACOS} \left\{ \frac{[(R-G)+(R-B)]}{\sqrt{(R-G)^2 + (R-G)(G-B)}} \right\}, B > G$$

$$\text{Hue } (H) = \text{ACOS} \left\{ \frac{[(R-G)+(R-B)]}{\sqrt{(R-G)^2 + (R-G)(G-B)}} \right\}, B \leq G$$

## 2.9 Neural Networks For Recognition

In this paper, neural networks are used in the automatic detection of leaves diseases. Neural network is chosen as a classification tool due to its well-known technique as a successful classifier for many real applications. The training and validation processes are among the important steps in developing an accurate process model using

NNs. The dataset for training and validation processes consists of two parts; the training feature set which are used to train the NN model; while a testing features sets are used to verify the accuracy of the trained NN model. Before the data can be fed to the ANN model, the proper network design must be set up, including type of the network and method of training. This was followed by the optimal parameter selection phase. However, this phase was carried out simultaneously with the network training phase, in which the network was trained using the feed-forward back propagation network. In the training phase, connection weights were always updated until they reached the defined iteration number or acceptable error. Hence, the capability of ANN model to respond accurately was assured using the Mean Square Error (MSE) criterion to emphasis the model validity between the target and the network output [2].

### III. CONCLUSION

This work consists of identifying the affected part of the plant leaf disease. Most affected part was segmented efficiently according to color classification tasks. Initially Image often more complex structures are needed in order to segmentation is done, and finally image analysis and make an optimal separation, i.e., correctly classify important features are extracted and classification performed using Neural network. An extension of this work will focus on developing hybrid algorithms such as genetic algorithms and NNs in order to increase the recognition rate of the final classification process underscoring the advantages of hybrid algorithms; also, we will dedicate our future works on automatically estimating the severity of the detected disease.

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# MALICIOUS PACKET FILTERING USING HC-CBF METHOD: A CONCEPT IN CLOUD

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## ABSTRACT

Cloud computing is a distinct environment that is designed for sharing computing resources and services. It allows costumers and organizations to use its services without installing any software. It allows them to use cloud resources without investing in infrastructure and training personnel. But this technology suffers from the problem of different kinds of attacks. DDoS attacks are a major threat to the cloud environment. Various traditional methods had been applied to mitigate them but due to their low efficiency and low storage capacity made these traditional approaches less useful and popular. So, in this paper we propose a dual mechanism in which packets are first filtered using their hop counts and then packets those are filtered are passed through the second phase of the mechanism in which packets are discarded on the basis of score calculated using the confidence based filtering method. The method is deployed using two periods, i.e. attack and non attack period.

**Keywords:** Confidence Based Filtering (CBF), Hop Count Filtering (HCF), Packet Filtering, Denial of Service (DoS), Time-To-Live (TTL)

## I INTRODUCTION

DDos attacker is one of the most common attack in cloud computing. Services become unavailable to the legitimate users for some interval of time by sending connection requests to the server. It was reported that 94 % of data center operators security attacks, 76 % had suffered distributed denial of service. Many researchers had founded many measures to prevent such attack such as Intrusion detection, Hop Count method, CBF etc. These all methods have some advantages over others.

In recent years, many researches on DDoS defense have been carried out and many successful schemes have been put forward. There are approximately three major branches of the research: attack detection [4] [5] [6], attack filtering[7] [8] [9] [10] [11] [12], and attack traceback [13] [14] [15]. As mentioned in [7], the branch of attack filtering can be roughly categorized into three areas based on the point of protection: source-initiated, path-based and victim-initiated. The method proposed in this paper is in victim-initiated area, which filters incoming attack packets from victim side. In this area of research, a number of brilliant approaches have already been proposed.

## II. RELATED WORK

PacketScore [7] generates value distributions of some attributes in the TCP and IP headers, and then uses Bayes' Theorem to score packets. PacketScore has a pretty high filtering accuracy and it is also easy to be deployed.

But since its scoring and discarding are related to attack intensity, it is not suitable for handling large amount of attack traffic. Also it has some costly operations in scoring, which leads to low process efficiency in real-time filtering.

ALPi [8] is an improvement of PacketScore. Two schemes LB and AV which uses leaky buckets and value variances of attributes respectively are proposed and are evaluated by comparison with PacketScore. Hop-Count Filtering (HCF) [9] uses the relationship of source IP address and TTL value to carry out filtering. After building an IP to hop-count mapping, it can detect and discard spoofed IP packets with about 90% accuracy. It is effective and easy to be deployed but it is vulnerable to distributed attacks because of its assumption about spoofed IP traffic. Our method aims at mining the correlation patterns, which refer to some simultaneously-appeared characteristics in the legitimate packets. [16] [17] use the document popularity and user browsing behaviors to detect attack packets, which reflect some correlation patterns between packets in a flow. But these patterns are mainly in application layer, making these methods mostly effective for application layer DDoS.

Ayman Mukaddam et al. has proposed for victim side and conventional method of HCF has been used which is time consuming and not effective. Xia Wang et al. are not trying to improve the packet filtering technique which is needed for elimination of random IP spoofing. The algorithm of Krishna Kumar et al. requires a shared key between every pair of adjacent routers which requires lot of computational time and more than usual memory space [18].

### **III HC-CBF PACKET FILTERING TECHNIQUE**

Cloud computing is a distinct environment that is designed for sharing computing resources and services. It allows costumers and organizations to use its services without installing any software. It allows them to use cloud resources without investing in infrastructure and training personnel. But this technology suffers from the problem of different kinds of attacks. One of such attack is DDOS attack. Attack in which attacker continuously sends bogus packets to the cloud servers. Cloud will waste its bandwidth in serving these requests. As a result legitimate users will not get any services of the cloud provider. So, to handle these attacks we need methods that are effective enough and can be proved to a great use. So, in this paper the above problem is being handled and HC-CBF technique is proposed.

Packet filtering is a process of controlling access to a network by analyzing the incoming and outgoing packets and letting them pass or halting them based on the IP address of the source and destination. Packet filtering is both a tool and a technique that is basic building block of network security. In Hop Count Filtering, hop count is the number of hops a packet traverses when it moves from the sender to the receiver destination that can be used to check the authenticity of packet.

The main goal of HC-CBF is to filter the packets received from various source on the basis of the IP spoofing by using TTL field in the packet and then allowing these filtered packets to go through CBF method. CBF is based upon the correlation pattern stored in the packets. These patterns are mainly in network and transport layer. DDOS attack is accompanied by IP spoofing. Attackers conceal their identity by changing the Source IP address field of the packet to make it as packet is coming from the legitimate user. But attacker cannot forge the Hop Count of the packet i.e. numbers of hops it require to reach destination from the source. This idea is used in here to filter the packets.

Hop count and SYN flag of the packets detects whether the packet is spoofed one or legitimate. If the source IP address is not in the table then SYN flag is checked. If it is set then hop count is calculated and entry is added in the table else discard the packet. The case when the source IP address is in the table already. We extract the value of SYN flag from the incoming packet. If it is set then computed hop count is compared with the saved Hop count. The packet will be allowed if both have same values else the entry in the table for that IP address is updated. But if the SYN flag is not set in the packet, we again compare hop counts values. If same we allow the packet but instead of updating entry in table, here packet is dropped. Hence the spoofed packet is rejected and rest the packets which passed this test are collected under filtered list for further test. This filtering has reduced the numbers of packets on which further tests will be applied. Hence it reduced the overhead of applying CBF on all the packets.

CBF consist of two concepts- Confidence and Score. Each packet from the filtered list is collected and the frequency of appearance of single attribute is calculated. This is the confidence of that attribute value. More the confidence value, more will be legitimacy of the packet. If the confidence of single attribute is greater than the minconf which is decided earlier are selected to generate attribute value pairs. This step is essential because if the confidence of one attribute value in an attribute value pair is not greater than minconf, the confidence of the combination of this value pair will still not be greater than minconf. All the packets in the filtered list are again scanned to count the frequency of appearances of attribute value pairs and count their confidence. Attribute values pairs whose confidence is greater than minconf will update the nominal profile.

Nominal profile is a 3 dimensional array. The first dimension is for first attribute pair and the second dimension is for second attribute pair. The third dimension is the confidence value dimension. There is no need to update nominal profile if the confidence of attribute pairs less than predefined confidence value. This step again reduces overhead of updating profile for each attribute pair. This is all done in non attack phase. Attack and non attack phase can be distinguished either on timing basis or on the number of packet basis or any other function. In attack phase we calculate score of packets. Score is the weighted average of the confidence of the attribute value pairs in it.

$$\text{score} = \frac{\sum_{i=0}^n (\text{weight} * \text{confidence} [\text{attribute value pairs}])}{\sum_{i=0}^n (\text{weight})}$$

where , n= number of packets

Weights of the attributes are adjusted on the basis of operating system, network structure and other elements. The patterns which are less copied by attackers are generally are given higher weight. Weight of the protocol type is usually given less weightage because it could be easily guessed by the attacker. Score calculation requires looking in the nominal profile for the confidence of the attribute pairs and applying some arithmetic operations. Attributes pairs whose confidence is not on the nominal profile, minconf value is used instead when confidence values are used in calculating score. Score of the packets is generated by the above method. After calculating CBF scores of the packets, attack packets are distinguished from the legitimate ones. Method will only accept the packets with scores greater than discarding threshold. Discarding Threshold can be fixed depending upon the score distribution or dynamic like load shedding algorithm. Fixed discarding threshold is used in this approach. So, in this proposed methodology every incoming packet is passing through the two stages and thus is more confident and we can have more trust on the packet.

## IV CONCLUSION

The most serious threat to cloud computing is DDOS attack. It caused a lot of damage to many organizations. Attacker shut down the servers for a period of time. The site became non functional for some time. Dual mechanism approach is used to prevent attack. This method is about to improve the existed CBF method which is based on the correlation patterns. So HC-CBF technique may be provided as a tool to prevent from attack by using IP Spoofing and correlation pattern among attributes of packet in cloud environment. DDOS attack is mainly associated with spoofed packets. The spoofed packets are dropped in the initial phase so reducing the overhead in calculating confidence and score of the all packets.

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# TRENDCASTING FMCG SECTOR IN INDIA

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## ABSTRACT

*With the increase in literacy level, rising per capita income , rapid urbanization, Indian economy is moving ahead with leaps and bounds at both national and international level. An upsurge in no of Multinational Corporations (MNC's) has been witnessed that had led to the great proliferation of wide variety of products and brands available for customers. Fast moving consumer goods (FMCG) are recognized by almost everyone because of its stronger presence in almost every retail outlet both organized and unorganized, advertisements on television, print media, and so on. Big giants dealing in fast moving consumer goods are growing and posting stellar top line growth, coming up with innovative plans so as to meet and satisfy the needs of the customers. This paper focuses on the trends of FMCG , the key potential drivers that will accelerate the existing trend and future growth. The paper will also discuss the future implications of FMCG.*

**Keywords:** Consumers, FMCG, Trends, Drivers, Implications,

## I. BACKGROUND

In the 1990s era to get rid of economic problems of poverty, inflation, and unemployment decision of reforming India was taken by introducing economic reforms – liberalization and privatization. These evolutionary economic reforms became an important part of economic development and opened the closed doors of Indian economy to the world trade eliminating the trade barriers for the easy entry of foreign companies that resulted in the spurt of large number of multinational corporations (MNC's) entering India , giving tough competition to the local and regional players

With the advent Globalization of Indian economy every sector witnessed an evolutionary change. Procurement of raw materials from agriculture, manufacturing and distribution all have gained momentum. On a wider scenario it also had its effects on micro level elements such as occupation level, income level, education level, demographic lifestyles., and psychographic profiles of consumers. A change in social and cultural environment gave new outlook to the individuals, new values, customs and traditions, new means of employment, and a much wider exposure.

Consumers are the primary focus of concern for almost every firm. Having wide diversity and heterogeneity in the billion plus population. of India, India became an attractive destination for plethora of global and local players who are eyeing upon the vast untapped potential areas . Marketers are playing their own gimmicks to target the segment of their potential customers and capture the major chunk of the market. In a study by McKinsey Global Institute (MGI) it suggests that if India continues to grow with such pace “average household

income will triple over the next two decades and it will become the world's 5<sup>th</sup> largest consumer economy by 2025 up from 12<sup>th</sup> now"<sup>1</sup>

## II. FMCG SECTOR IN INDIA

FMCG industry has tripled its size over the past ten years and it happens to be the fourth largest sector in India. Despite the economic downturn in the recent past it is growing at a rapid rate of nearly 60 percent and the market currently stands for 85000 crore<sup>2</sup>. According to a market research firm India's FMCG sector after witnessing a muted growth in 2014 is now all ready for a healthy recovery due to drop in inflation<sup>3</sup>

Fast moving consumer goods are also known as consumer packaged goods are generally bought frequently by the customers as they are small in value but together form a major part of consumer's wallet. FMCG are called 'fast moving' simply because they are the quickest items to leave the retailer's shelves. It has been observed that the level of involvement of consumer is low while making purchase decision as most of the consumers do not give much importance in going into deep of technical specification of the product. This sector provides with the product range from necessities to comforts to luxury serving through the entire cross section of the population. FMCG, broadly consist of consumer non durables such as personal care, household care, food and beverages. FMCG may also include pharmaceuticals, consumer electronics, packaged food products, chocolate bars and tissue paper. It is characterized by the strong presence of organized and unorganized retail and an established distribution network.

It is the 4<sup>th</sup> largest sector in Indian economy and is an important contributor to India's GDP growth. A study observed that the overall fast moving consumer goods (FMCG) market is expected to touch US\$ 110.4 billion by 2020, it has also been forecasted that rural FMCG market is expected to reach US\$ 100 billion by 2025<sup>4</sup>. Major FMCG players include ITC, HUL, Nestle, Dabur, Godrej Consumer Products, Marico, Glaxo Smithkline Consumer Healthcare.

## III. CURRENT TRENDS SHAPING FUTURE

FMCG sector was marked with high inflation, low salary hikes, slow economic growth in 2012 which directly affected the budget of urban consumers. The sector again saw a slowdown in 2013 due to deceleration in GDP growth and high inflation but on the contrary it saw a positive direction where rural consumers were willing to spend more on FMCG products due to their rise in income, direct cash transfer scheme and other supportive government policies whereas urban middle class continued to be affected by the slowdown. The sector accounted for 2.4 percent of the country's GDP in 2013. However an optimistic trend is anticipated in 2020 as GDP growth is projected to be around 7-8 percent<sup>5</sup>.



**Fig.1: Growth in FMCG Revenue**

This sector is all set to move with positive waves of change. Some of the biggest and important trends came from this sector which are also shaping the future growth<sup>6</sup>. The above Fig.1 showed that the sector generated revenue \$36.8 billion in 2012 and is expected to reach \$103.7bn in 2016 thus depicting a positive trend. Neilson Indian region president said that FMCG sector will encounter volume growth in the coming years and it will be around 16 percent in 2016<sup>3</sup>. The trends is studied under 4 headings-

**Fig. 2: Trends in FMCG sector**

### 3.1 Consumer Related Trends

#### 3.1.1 Premiumisation

On account of increasing disposable income and more choices available in the market, Rich wants to spend for their emotional and exclusive feel and so they are upgrading from premium to super premium products whereas upper middle income class tries to emulate the rich and upgrade to high price products for better functional experience from mass products. According to a report by booz&co. their no will double to 7 percent of the total population and the two income groups will be the ladder for growth in future<sup>7</sup>

#### 3.1.2 Evolving Categories

When the consumers need change they start demanding more sophisticated products in a category. Rich may demand a higher price product in a category that satisfies his need. Consumers may also start demanding customized product which is according to their lifestyle, taste and preferences. Cosmetic producing companies are launching male grooming products such as Emami Ltd launched fair and handsome for men. Many other product like jams, toothpaste, skin care, hair care are still untapped. Such trends are primarily observed among upper middle and lower middle class. Their size is expected to increase in future

#### 3.1.3 Value at the Bottom of the Pyramid

These are the consumers that earn INR 200 per annum per household. Large part of the Economic pyramid of Indian economy largely consist of rural dwellers which are underserved and less aware of the products, have unmet aspirations. Many companies are meeting up their needs by launching low priced value for money

products. With their rising income they are contributing to FMCG more than their urban counterparts. With 34 percent of the total FMCG market rural contribution is expected to increase to 45-50 percent by 2020<sup>8</sup>. Rural consumers are also moving towards customized branded products from unbranded ones. With 70 percent of the population residing in rural areas it surely can be looked up as an untapped potential

#### **3.1.4. Purchase Pattern Shift**

Consumers are evolving their purchase pattern by demanding from need based product to want based product. Consumers are demanding more of customized products for example shampoos are launched with various variants. The new Indian consumer is ready to spend on brand ,quality and convenience. A want of a better life especially with lower strata, increase in income all these are reshaping Indian consumer behavior.

#### **3.1.5. Need of Speed**

In the era of digital marketing everything goes faster and smarter. There is an emerging need in the consumers and that is of speed here the speed is referred in context of making quick decision while purchasing a product that is recognition of a distinctive factor that will facilitate the purchase decision process. This need is more prevalent in young consumers. According to a Datamonitor's Consumer Survey 2013 consumer aged 15-24 are more influenced if in a product it is written that the results are achieved quickly. But this was not the case with the people of age group of 65<sup>9</sup>. The companies need to focus on this emerging need of speed.

#### **3.1.6. Youth Factor**

The young generation is looking beyond the utility aspect of the product. They have now more say about the brand and the lifestyle associated with the product. Such trending youth of India are ready to explore different categories of the product.

### **3.2 Product Related Trends**

#### **3.2.1Packaging and Innovation**

Every now and then companies are always in search of new ways to lure their consumers. An introduction of sachet is one of such example which proved a treat to cost conscious customers. The price of such product generally range from rupees 2-10 introduced in almost all the FMCG products categories from food and beverages to home and personal care. Sachet are useful in facilitating trial consumption in case of new product launches<sup>10</sup>. This trend has fuelled growth and the larger part of the profit came from rural consumers. The new and attractive ways of packaging is done to promote and protect the product .Tetra pack for milk by many of the milk companies allow consumers to make several uses of their product thus trending up the sales volume. Marketers are experimenting with new and emerging segments with their product customized to suit their target segment. The word 'innovation' is the new buzz word having different functional aspects

#### **3.2.2Healthy and Eco-friendly**

Many products have cashed up growth in food and beverages categories such as sugar free sweet, multi grain pasta, oats maggi ,wheat cornflakes and muesli, diet coke, organic and green tea<sup>11</sup> such trends are seen as

Indian consumers have increasingly started believing in a healthier living. Health and wellness is the new mantra. Consumers are not only thinking about the affect the product is doing to their health but also the overall consequences it does to the environment and thus they are more focusing on the eco friendly products and their packaging issues. Companies need to understand the climatic changes and the scarcity of resources and act responsibly. Such trends compel brand managers to rethink on the appropriate application marketing mix elements.

### 3.2.3 Expansion and New Launches

Firms are diversifying their product lines and also launching their new product category. Many giants are expanding into new geographies and segments. Couple of years back Hindustan lever has launched dove hair oil<sup>11</sup> usually a segment which is dominated by Marico known for its parachute oil<sup>11</sup>. With increase in number of MNC's varieties of new product are available in the market. Expansion has been seen not only in urban markets but they are also making their way into still untapped potential in rural market.

### 3.2.4 Penetrated and Underpenetrated categories

According to NEILSON the penetrated growth categories in market is shampoos at 79 % followed by biscuits at 78%. Utensils cleansers and edible oils penetration has increased to 36 % from 33% and 21% to 17 % from 2012 and 2014. People are moving from unbranded to branded product categories. On the other hand penetration level of detergent has decreased from 60% to 59% in 2012 and 2014. Skin creams have seen a change most people are buying face wash , anti aging and so on . The future growth lies with the branded foods. New food categories such as bread spreads ,peanut butter and spices. Because of affluence level rural consumer will spend more on grocery items<sup>12</sup>. Under penetrated categories such as chocolates, baby food , breakfast cereals, soft drinks currently have low penetration but have huge growth potential. Most of the products like jams, toothpaste, skin care and shampoos have low per capita consumption but are expected to rise in future.

## 3.3 Market Related Trends

### 3.3.1 Modern Trade

Modern trade is still at its nascent stage in India . Being an urban phenomena it is gaining momentum and with increase in investment in multi brand retail it has taken growth in form of supermarket , hypermarket and specialty store. On the other hand General trade that is kirana store accounts for 95% of the overall retail sales .Ease of browsing, one stop destination, opportunity to compare, access to wide variety, comfortable environment such features come with the modern trade generally called as organized retail. With the facility of credit card this retail is cashing up the trend. The modern trade will increase and may account for 30% of the total trade by 2020<sup>8</sup> On the other hand the traditional retail will also increase but at a diminishing rate and will occupy a larger space.

### 3.3.2 Adapting to local Taste and Flavors

Indians are usually very much addicted to the local taste of the product. Many companies are launching their product with the local taste of their targeted segment. Such products are high in demand and if followed will give immense growth to the product. A Nestle product Maggi is being marketed by the name ' masala maggi'

and oats are also being launched with different taste and flavors. This trend will help marketers to grapple huge profit in future.

### **3.3.3 Interactive Media**

According to a study by TMW and Marketing sciences that surveyed 2000 people ranging across different age groups it was observed that shoppers aged 18 to 24 are 174 per cent more likely to use recommendations on social media as compared to the shopper that are more than 25 years of age<sup>9</sup>. Social media is facilitating the interaction between buyer and seller and every seller is making an effort to involve and connect the buyer with their product and brands emotionally. Creative advertisements, interactive campaign are helping in bucking up this trend.

### **3.3.4 E-trend**

E-commerce previously was supposed to be the source of information but now it has emerged as a source of buying. Fueled by factors like need for convenience, paucity of time consumers are shifting from traditional brick and mortar to a virtual store. This trend has induced frequent buying and selling with an ease and comfort. With an increasing internet penetration in both rural and urban areas online buying is set to rise

### **3.3.5 Globalization**

With the advent of globalization large no of MNC's are entering into Indian market and offering wide varieties of product, generating employment, raising standard of living and increasing the purchasing power of consumer. Thereby bringing boom to the Indian FMCG industry

### **3.3.6 Demographic Profile**

India has a favorable demographic profile and its long term growth primarily depends upon two factors demographics and rising wealth. India has a huge and burgeoning population, its workforce between 15-62 is expected to rise from almost 64 % of its population in 2009 to 67 Percent in 2020<sup>12</sup> The country is also marked with great diversity in culture, language regions having different need and preferences. Increase in GDP , Increase in per capita income all contribute to be the increasing spending power by consumers in the near forcible future.

## **3.4 Environment Related Trends**

### **3.4.1 Corporate Social Responsibility**

A trend is observed that many firms are connecting themselves with a social cause thus trengthening their image in the minds of consumers and in turn the consumers are also gaining faith and trust for their brands and the company. To encounter domestic violence ponds have tied up with the United Nations Development Fund for women<sup>13</sup> Companies are also focusing in reduction of the carbon in the product development process and are following Green strategies, green messages in their products.

### 3.4.2 Government Initiated Policies

Government is tailoring policies for the inclusive growth of Indian economy by protecting the interest of weaker sections of society. They have also enacted several policies that are aimed at protecting interest of Indian industry. Food adulteration guidelines, regulation on MRP are some of the policies meant for protecting the interest of consumers.

### 3.4.3 Technology

With the advancement of technology companies are able to increase their sales by carrying out market research in order to gain insights about the changing consumer behavior, a good supply chain management, data base management system, efficient sales and distribution network. Are some of the examples of modern technology. Investments in evolutionary technology will bring efficiency and economy in FMCG industry

## IV KEY POTENTIAL DRIVERS

The key drivers that are accelerating FMCG trends are as follows



Fig. 3: Drivers fuelling FMCG growth

## 4.1 Demand Related Drivers

### 4.1.1 Increasing Affluence

With the increase in wealth among consumers and their rising income . Rich and upper middle class consumers are up trading to premium products and have become more brand conscious.

### 4.1.2 Changing Lifestyle

Consumer lifestyle is continuously evolving. Companies are tailoring their product with features that suit the lifestyle of their target segment. On the other hand consumers are buying products which matches up with their living standard, class and which are acceptable in the culture. This sector is witnessing an immense growth as consumer is ready to spend more for their beauty and healthy well being. Middle income women have become more conscious of their looks and they are they are happily willing to spend more on their lifestyle

### **4.1.3 Rising Urbanization**

Major part of rural population shifts to urban in search of job, and education this results in the change in outlook of migrating population as they adapt themselves in the local environment. Indian FMCG sector is changing due to increasing urbanization. The migrating population is getting aware of plethora of brands available in the market and thus results in increase in consumption.

### **4.1.4 Increase in Discretionary Spending**

It was observed that both rural and urban consumers have lessened up their spending on basic items and they have started spending on other FMCG categories. These consumers are buying products that they want and have reduced their purchases of need based products. Consumers are increasingly spending on luxury items. Such trends are driving the sectors growth. A recent survey conducted by Neilson Co -luxury brand survey India was ranked third after Greece and Hong Kong in the list of most brand conscious countries in the world .More than 35% of Indians said that they spent on luxury items<sup>6</sup>

### **4.1.5 Increase in Income**

Increase in rural non agricultural income, government spending for the rural welfare all have resulted in increase in disposable income of rural consumers and this is playing as a major driver in FMCG sector. With the trend of perks in corporate sector it had led to the increase in the spending power of urban consumers. Such things have induced the pattern of shift from unbranded to branded products. Phenomenal growth has been seen in tier II and III cities due to increase income and standard of living <sup>2</sup>

### **4.1.6 High Private Consumption**

India has a very high rate of private consumption. And most of it comes from retail spends that is goods and services than that of public spending on items like on rent and education <sup>6</sup>

### **4.1.7 Growing Awareness**

Rural demand is set to rise with rising awareness. Growing television sets in rural areas have paved the way for marketers to reach to them although the impact of such televisions are smaller but such increasing no of television sets are driving the companies to target them with customized advertisements

### **4.1.8 Variety Seeking Behavior**

Consumers have started the liking of varieties in a product as they get bored of the same product using on a continuous bases. This is a driving force for the companies to come up with new products in their categories

## **4.2. Market Related Drivers**

### **4.2.1 Competition heating up**

Competition among companies to win over consumers is getting severe and companies are leaving no stone unturned in making products that not only satisfies consumers but also retains them for future.

#### **4.2.2 Growth in Retail**

With opening up of retail outlet products have become easier to access. At present it has 8.8 million retail outlets however this is expected to increase with the spurt in organized retail. Supermarket has the highest share in terms of no of stores in 2009. It accounted for more than 85 % of modern trade. Transport services are improving with urbanization. GCMMF Amul ( the Gujarat Cooperative Milk Marketing Federation) it deals in the milk and milk products and perishable segments is the largest food marketing company in India . it has a vital access to rural market.

#### **4.2.3 Availability and Accessibility**

It is the biggest driver of FMCG sales. Availability of products and their brands in the shelves of retail shop are inducing customers to add those products into their consideration set and then make a purchase decision Although the distribution dropped in 2013 to 1.1% from a healthy 2.3% in 2010 <sup>14</sup> Still companies are making their best efforts to make their product widely available.

#### **4.2.4 Low Labor Cost**

India acts like an edge giving a strong manufacture base for national and international companies. Cheap labor is available in the market driving up the speed of MNC's establishment in India

### **4.3 Environment Related Drivers**

#### **4.3.1 Infrastructure Development**

Investment in infrastructure is picking up speed, Railway projects are increasingly being taken up by the government, power and water facility, air transport, communication services by which individuals are able to connect themselves with the global world are also gearing up and it is acting as a catalyst in the demand for FMCG goods not only by urban consumers but also rural consumers as they are being connected with the urban areas and have easier accessibility of the market.

#### **4.3.2 Population Growth**

In 2013 india accounted for 17.5% of the world's population and has a tendency to reach to 1.53 billion by 2030. It was observed that 50 % of the Indian population are below age 25 and by 2020 young working population will account for 64 % of the Indian population. Such increase will undoubtedly generate tremendous revenue from FMCG sales <sup>15</sup>

#### **4.3.3 Gross Domestic Product**

At present GDP growth rate is at 7.5% gained from 6.4% in 2014. Rising GDP is a strong indicator of economy growth. Services like electricity, gas, water supply and other utility services like trade, hotels, transport, communication and services related to broadcasting financial, real estate and professional and public administration, defense and other services all have recorded growth. Thus directly or indirectly they contribute to the purchasing power of consumers

#### **4.3.4 Government Policies**

Government initiatives in the form of tax holidays, reduced custom duties and so on are an important motivating factor for the establishment of FMCG industries. Many states are offering incentives to different sectors wooing them by giving land at concessional rates and subsidies so as to encourage economic development.

### **V FUTURE IMPLICATIONS**

The wider picture of such trends will be incomplete without discussing its future implications on different sectors, industries, stakeholders and environment.

#### **5.1 Economic contribution**

##### **5.1.1 FMCG is an important contributor to economic growth**

Indian FMCG industry is expected to be in the range of INR 3700 billion-5200 billion by 2020 and is anticipated that it will contribute close to 3% of the GDP <sup>8</sup>

##### **5.1.2 Employment generation**

Retail stores approximately accounts for 12-13 million retail stores in India, out of which 9 million are FMCG kirana stores. Thus it can be well said that the sector provides livelihood of almost 13 million people <sup>16</sup>

##### **5.1.3 Social contribution**

Apart from creating employment it also contributes in raising the standard of living, creating awareness in rural areas, providing them with the education, working for a social cause, one of such efforts is made by Dabur company which conducts education programmes and provides training programmes facilitating employability.

#### **5.2 Digital Evolution**

There is an increasing trend of online buying. FMCG marketers are capitalizing into media strategies by opening up a virtual store thus moving from traditional to brick and mortar medium of buying and selling. This revolution has increased the penetration of digital gadgets and penetration of internet in both rural and urban areas.

#### **5.3 Evolving Consumer**

Wide variety of products available in the market, consumers are getting aware of those products and their behaviors decision making process are evolving

#### **5.4 Implications on Investors**

Many investors are investing in Indian FMCG industry and in future they will find this sector as an attractive destination for investment.

#### **5.5 Implication on Retailers**

Both organized and unorganized retailers will collaborate with FMCG players so as to accelerate the growth and bring economy and efficiency in Indian economy

## 5.6 Contribution to other Sectors and Industries

Procurement of raw materials from agriculture has increased as more and more MNC's are entering into FMCG sector. Ancillary sectors such as Manufacturing and distributions saw a whooping growth. Packaging industry is expected to grow faster due to growth in private labels, to make product more attractive in order to promote the product. Media industry too had gain immense profit from this sector as large part of the revenue comes from advertising the products and their brands.

## 5.7 Environmental Concern

An increasing pressure from government, NGO's and consumers companies are required to act in the best interest of environment.

## VI CONCLUSION

Apparently, the above listed drivers and trends are acting in the best interest of FMCG industry growth. But looking to the overall dynamic nature of business environment there is a need to make relentless effort to survive within the ambit of rivals and playing every game right while complying with their responsibilities towards their customers.

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# COOLING OF BIKER'S HELMET USING PELTIER MODULE

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## **ABSTRACT**

*Human life is so precious and valuable, that it should not be compromised under any cost. The concern over the safety of vehicle drivers has pushed for invention of new equipment that can save lives. According to Statistics from the Insurance Institute for Highway Safety (2010), it is mentioned that nearly 70% of mortality in road accidents occur due to head injury, where the rider has not worn a helmet. It is not that people are very negligent about their lives on road, but that they experience dozens of discomforts by wearing helmets. The most common discomfort is that, heavy sweat occurs due to excessive heat formation. This paper deals with the development of cooling system for biker's helmet using thermoelectric technology. The system consists mainly of a heat sink, aluminum passageway and Peltier module. The prototype is fabricated and mounted onto biker's head. Experiments are conducted on the prototype to analyze the performance of the cooling system.*

**Keywords:** *Biker's helmet, coolant, Peltier module*

## **I. INTRODUCTION**

The helmet is a critical piece of safety equipment for bike rider. Although there are many varieties of helmet designs available in the market, the product must essentially protect the head against injuries, maintain user comfort, and appeal to the user in terms of cost and aesthetics. It is imperative that the rider is comfortable with wearing the helmet. The conventional biker's helmet has two principle protective components: a thin, hard, outer shell typically made from polycarbonate plastic, fiber glass, and a soft, thick, inner liner usually made of expanded polystyrene or polypropylene "EPS" foam. The poly-foam liner serves as the shock absorber to support the head during collision. The purpose of the foam liner is to crush during an impact, thereby increasing the distance and period of time over which the head stops and reducing its deceleration. Unfortunately, since the equipment has been made compulsory to be worn, the user must endure uncomfortable causes by the device. Indeed, the liner has high heat insulation properties which results in low heat transfer between the head and the outside air. This creates an uncomfortable and dangerous environment to the head, especially for long distance travel. Carpenter (1987) [1] projected that temperature in the helmet during such conditions reaches 38°C. In this temperature, it is very hazardous to travel due to a reduction in the ability to concentrate. Therefore, keeping a bike rider cool during transit has been at the forefront of helmet design considerations. This project is using the famous concept of Peltier discovered in 1834. According to the Peltier Effect, at the junction of two dissimilar metals the energy level of conducting electrons is forced to increase or decrease. A decrease in the energy level emits thermal energy, while an increase will absorb thermal energy from its surroundings. In other words, when current is made to flow through a junction between two conductors A and B, heat may be generated (or removed) at the junction. The Peltier heat generated at the junction per unit time,  $\bar{Q}$ , is equal to

$$\bar{Q} = (\mu_a - \mu_b) * I$$

Where  $\mu_a$  and  $\mu_b$  are the Peltier coefficient of conductor A and B respectively and I is the electric current from A to B. The reasons which made me to use Peltier effect (Thermo-couple module) are of interest. The very important reason is that they possess no moving parts, along with this; they not only have zero maintenance but also have long service life time. A typical Peltier heat pump device involves multiple junctions in series, through which a current is driven. Some of the junctions lose heat due to the Peltier effect, while others gain heat. There are several attempts made in order to enhance the comfort level of the biker's helmet by improved ventilations. But it seems to be non-impressive as most of the solutions revolve around forced convection of the air but unfortunately the respective system does not provide proper circulation of the air to the head of the rider [2]. The phase change material (PCM) cooling helmet utilizes the principles of heat transfer via conduction to cool the rider's head. Tan and Fok [3] have taken a simplified approach to their design with a solution that requires no power supply for operation. What they needed is the PCM which is to be placed in the bag in between head and the inner boundary of the helmet. When the surface temperature of the rider's head is greater than the melting temperature of the PCM, the absorption of heat from the head causes the PCM to melt. The stored heat in the PCM is discharged by immersion in water for a time period ranging from 13-25 minutes which re-solidifies the PCM for further use. As a result they have designed a solution which would be ineffective for riding applications such as touring and would prove difficult to adapt to applications in other areas where a longer operation time is required. The pro remote intake cooler is designed for desert dune buggy racing but with minor adaptations could easily be designed for operation on a motorcycle. Its operation is quite simple. A motor draws large amounts of air in from the environment. The air is filtered and blown at relatively high pressure into the motorcycle helmet. In the case of motorcycle helmet operation, a considerably smaller filter system could be used and a smaller motor with lower compression could also be utilized. The over-riding limitation of this package is the control offered to the rider. If the Ambient temperature is considerably high the cooling effect will be greatly limited. Since the designs suggested above fail to give the satisfactory solution, this paper aims to provide a better solution for the cooling of the helmet.

## II. DESIGN

The major components of the air conditioned thermoelectric helmet include: circular cavity as outside/inside air channel, Electric fan as a heat extracting device, the peltier module, cooling chamber, heat sink and water as coolant. The electrical power is supplied by means of a 12 V DC battery. On the very front side of the helmet two circular ducts are facilitated to introduce the atmospheric air in to the helmet. This air is collected in to the cooling chamber above which the assembly of peltier module and heat sink is placed while in between the riders head and the cooling chamber a pouch filled with water is fixed. The pouch of water not only works as coolant but also does service as spreading media for the cooled air on to the head. The heat sink is used to enhance the rate of heat transfer from the hot surface of the thermoelectric module so that the heat will be discarded outside the helmet. In order to maintain the efficiency of the thermal module, a cooling fan is used to reject the heat from the hot side of the module to ambient surroundings.

## III. PELTIER MODULE

A thermoelectric cooling (TEC) module is a semiconductor-based electronic component that functions as a small heat pump. When DC power is applied to a TEC, heat gets transferred from one side of the module to the

other. There are 127 couples in single module; 40mm x 40mm x 3.8mm size module is a single stage module which is designed for cooling and heating up to 90°C applications.



**Fig. 1: A typical single stage thermoelectric module.**

#### **IV. HEAT SINK**

The rectangular fin type heat sink is deemed most suitable to be used on the prototype helmet. The external sink is the focus of preliminary design as it is understood that the effective operation of the cooling system would depend on the ability of the external sink to remove heat energy.

#### **V. AIR CHANNEL**

The hollow circular air channel is made in inner foam of helmet for forcing the air in and out of the chamber directly. The passage is able to supply considerable amount of flowing air from outside the helmet during high speed travel. Basically, the air from the outside will push the air in the chamber into the helmet. Thus, a higher cooling rate will be achieved.

#### **VI. COOLING CHAMBER**

The chamber is built with a built-in internal fan thermoelectric cooler for cooling purpose. It acts as medium of heat transfer where outside air will be cooled and then directly transferred into the helmet. The chamber is built to provide enough space for air to be cooled and pumped-in using small electric fan. The fan will be installed on the open space of the chamber thus extracted cooled air from the chamber, right into the helmet.

#### **VII. ELECTRIC FAN AS AN AIR PUMP**

The use of the fan is very important in this design. The fan works as the pump for transferring cooled air from the cooling chamber into the helmet.



Fig.2 Air passage and cooling chamber



Fig.3 Electric fan

**VIII. OVERVIEW OF THE NEWLY DESIGNED HELMET:** The design of prototype is shown.



Fig.4 Front view of prototype of helmet



Fig.5. Back view of helmet

**IX. RESULTS:** The observations for moving conditions recorded by digital temperature display are as follows.

**Table1**

| Reading no. | Time in (min : sec)       | Temperature in <sup>0</sup> c |
|-------------|---------------------------|-------------------------------|
| 1.          | Initial condition (00:00) | 33.80                         |
| 2.          | 00:15                     | 33.80                         |
| 3.          | 00:30                     | 33.08                         |
| 4.          | 00:45                     | 33.08                         |
| 5.          | 01:00                     | 32.80                         |
| 6.          | 01:15                     | 32.80                         |
| 7.          | 01:30                     | 32.80                         |
| 8.          | 01:45                     | 32.50                         |
| 9.          | 02:00                     | 32.50                         |
| 10.         | 02:15                     | 31.80                         |
| 11.         | 02:30                     | 31.30                         |

|     |       |       |
|-----|-------|-------|
| 12. | 02:45 | 30.10 |
| 13. | 03:00 | 30.90 |
| 14. | 03:15 | 29.90 |
| 15. | 03:30 | 29.70 |
| 16. | 03:45 | 29.50 |
| 17. | 04:00 | 29.10 |

Thus during 4 minutes of trial, it is found that cooling of 4.7 degrees is achieved when tested on the field.

## **X. CONCLUSION**

The prototyping of a cooling system based on thermoelectricity for a motorcyclist helmet has been done. The targeted cooling performance is achieved and future improvements will be carried out to enhance the cooling performance of the design. This will include the use of higher power thermoelectric. This can be a very effective solution mainly for the people living in high temperature zones like Nagpur and Jaipur.

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# EXPERIMENTAL INVESTIGATION OF COMPARISON OF NORMAL COOLING TOWER AND EVAPORATIVE COOLING TOWER IN VCRS SYSTEM

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## ABSTRACT

Beginning from a early time period of refrigeration and air conditioning system. Improving COP is one of the important parameter and major aspect in the field of RAC system. Air cooled condenser give satisfactory performance and less costly than water cooled condenser. The COP is mainly affected in air cooled condenser by the temperature of ambient air, which is used as a cooling medium in condenser. In order to solve this problem we can use water cooled condenser. But water cooled condenser increase the overall cost of VCRS system. By attaching the cooling tower to water cooled condenser the performance of overall system increase. The main motive of this experimental study is to concentrated toward the improving the COP of VCRS system by using evaporative cooling tower as compared normal cooling tower.

A VCRS with water cooled condenser has been built .Initially it's attached with simple cooling tower and further it is attached to evaporative cooling tower. We have taken evaporative cooling concepts from evaporative cooled condenser. We have taken two different ambient temperatures 25°C and 30°C and calculate the COP. In starting case when simple cooling tower is used at 25°C and 30°C the COP change from 4.5 to 4.48. Similarly in next case when we take evaporative cooling tower at 25°C and 30°C, the COP rises and change as compared to normal cooling tower which changed from 4.72 to 4.61.

**Keywords:** Refrigeration And Air Conditioning, Water Cooled Condenser, Cooling Tower, Vapour Compression Refrigeration System, Evaporative Cooling Pad

## I. INTRODUCTION

Refrigeration is the process of removing heat from that place where it is not required. In order to maintain quality and flavor of food, heat is removed from air. There is innumerable application in industry in which heat is taken out from the particular place or material to achieve a desired effect. In 1834 the first mechanical producing cooling system was developed later it become vapour compressor. Refrigeration or air conditioning is a kind of heat pump whose function is to remove heat from a lower temperature source to high temperature sink. Evaporative cooling tower concept was developed by evaporative condenser. In our experimental setup we have focus over the cooling tower. Initially we use normal cooling tower at two different ambient temperature 25°C and 30°C. In normal cooling tower hot water from water cooled condenser is pumped at the top of the tower, from the bottom of cooling tower circulated air drawn into the tower by using draught fan. Similarly in second case evaporative cooling tower is used. In evaporative cooling tower we use evaporative pad in front of draught fan at a same time another pump is used to circulate normal water over a cellulose pad .When air is draw

through fan ,first it enter in cellulose pad taken some moisture from it and then it enter into cooling tower. Experimental performance at ambient temperature 25°C and 30°C respectively.COP of system decrease from 4.5 to 4.48 as we move from 25°C to30°C .Similarly again it decrease from 4.72 to 4.61 respectively as move from 25°C to30°C

Fouda and Melikyan et al. [1] A simplified mathematical model was used to discuss the heat and mass transfer between the air and water in a direct evaporative cooler. A comparison between the model results and the experimental results was presented. The results indicate that during a steady state condition, the cooling efficiency is decreased by increasing the inlet frontal air velocity, and increased by increasing the pad thickness. This is because the contact surface between water and air is increased.

Kulkarni and Rajput et al. [2] theoretically analyzed the performance of indirect-direct two stage cooler with cellulose and aspen media in direct stage. They selected the most frequently occurring inlet condition of 39.9 0C DBT and 32.8 % RH for the analysis. The saturation efficiency ranged from 121.5 to 106.7 % for two stages cooler.

Jain et al. [3] developed and tested a two stage evaporative cooler with wooden shave as packing material. The effectiveness ranged from 1.1 to 1.2 and could achieve favorable temperature and relative humidity for storage of tomatoes for 14 days.

S.S. Hu, B.J. Huang et al. [4] conducted an experimental investigation on a split air conditioner having water cooled condenser. They developed a simple water-cooled air conditioner utilizing a cooling tower with cellulose pad filling material to cool the water for condensing operation. The experimental investigation verified that the water-cooled condenser and cooling tower results in decreasing the power consumption of the compressor.

Sreejith K et al. [5] Heat can be recovered by using the water-cooled condenser and the system can work as a waste heat recovery unit. The recovered heat from the condenser can be used for bathing, cleaning, laundry, dish washing etc. The modified system can be used both as a refrigerator and also as a water heater. Therefore by retrofitting a water cooled condenser it produce hot water and even reduce the utility bill of a small family. In this system the water-cooled condenser is designed as a tube in tube heat exchanger of overall length of 1m. It consists of an inlet for the cooling water and an exit for collecting the hot water. The hot water can be used instantly or it can be stored in a thermal storage tank for later use.

## II.EXPERIMENTAL SETUP

Our experimental setup contain different part of VCRS system i.e. expansion device, compressor, evaporator and water cooled condenser. A large tank is built and we placed condenser into it. From this tank a cooling tower is to be connected. With the help of pump hot water from condenser is circulated at the top of cooling tower. At a same time draught fan at the lower side of tower circulated air into the cooling tower. The compressor of volume (cc) 4.5 are used to increase the pressure and temperature of refrigerant (R134a).Here the capillary tube is used, made up of a copper tube of very small diameter 0.36mm.Capillary tube used as expansion device. The evaporator is used to reduce the pressure, dissipating heat and making liquid refrigerant to much cooler. Evaporator used in this experiment setup is tube and fin type. Flowing of water continuously circulate over the cellulose pad while performing the experiment. Different measuring devices are used in this experiment setup such as Digital Thermometer TPM-10, which gives the temperature at various points within the system. Pressure gauge is also used; first pressure gauge measures the suction pressure before the

compressor and second pressure gauge measure the discharge pressure after the compressor. Similarly ammeter and voltmeter are used to measure the current and voltage to input to the system.



**Fig. 1: VCRS System Attached With Normal Cooling Tower.**

The above figure represent normal cooling tower which attached to simple vapour compression system. Hot water is circulated over cooling tower with the help of pump at a same time air is circulated from the lower position side of cooling tower with the help of fan. Due to gravity action water fallen down in the downward direction and when it comes in contact of circulated air it goes to cool down. At the bottom of cooling tower cooled water is present and again it circulated in condenser as cooling medium.



**Figure 2: Cellulose Pad Kept In Front of Fan**



**Figure 3: Aerodynamic Fan**

From the figure 2 and figure 3 it represents the cellulose pad kept in front of draught fan and at a same time water is circulated over the cellulose pad with the help of another pump. Initially air enters into cellulose pad taken some moisture from it and then it enters into the cooling tower. When we use cellulose pad overall performance of VCRS system increase.

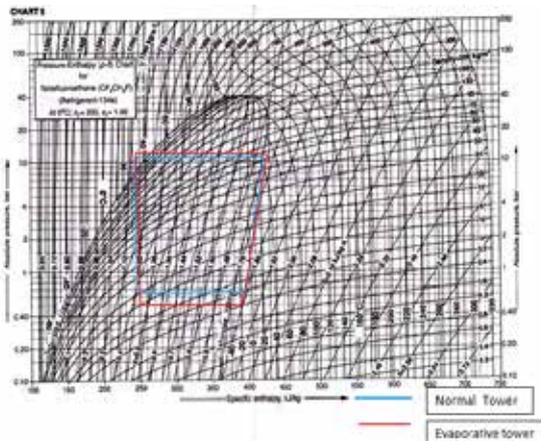
### III. EXPERIMENT RESULT AND DISCUSSION

**Table 1: Result obtained at two different ambient temperature 25°C and 30°C**

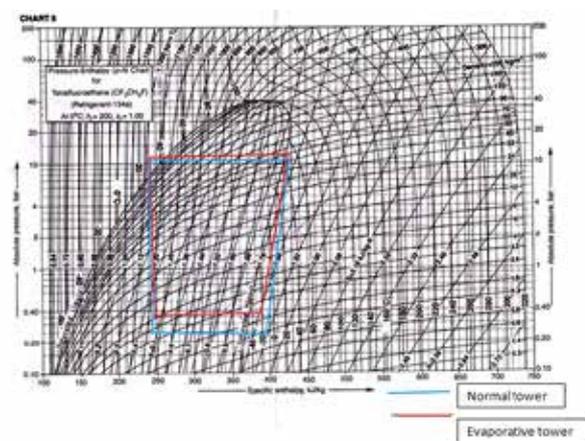
| Parameter                    | Symbol    | Unit | Normal cooling tower         |                              | Evaporative cooling tower    |                              |
|------------------------------|-----------|------|------------------------------|------------------------------|------------------------------|------------------------------|
|                              |           |      | Ambient air temperature 25°C | Ambient air temperature 30°C | Ambient air temperature 25°C | Ambient air temperature 30°C |
| Evaporator Absolute pressure | $P_{esa}$ | bar  | 0.55                         | 0.35                         | 0.45                         | 0.40                         |
| Condenser Absolute pressure  | $P_{con}$ | bar  | 10.34                        | 11.14                        | 11.44                        | 11.32                        |
| Evaporator exit temperature  | $T_1$     | °C   | -17.4                        | -16.9                        | -19.1                        | -20.5                        |

|                             |       |        |      |      |      |      |
|-----------------------------|-------|--------|------|------|------|------|
| Compressor exit temperature | $T_2$ | °C     | 41.3 | 42.4 | 44.5 | 45   |
| Condenser exit temperature  | $T_3$ | °C     | 28.8 | 31.4 | 33.5 | 32.4 |
| Total electric current      | I     | Ampere | 0.72 | 0.77 | 0.67 | 0.72 |
| Total electric voltage      | V     | Volts  | 210  | 210  | 210  | 210  |

In order to check the performance of vapour compression system which have normal cooling tower and evaporative cooling tower, experimental test are performed in two consequent stages. In first stage, normal cooling tower is attached we calculate COP at 25°C and 30°C. Similarly in second stage we use evaporative cooling and calculate following different property at 25°C and 30°C. The properties of refrigerant (R134a) and air remained constant (after 20min) throughout the process in order to maintain the steady state condition and data are recorded.



**Fig. 4: Pressure-Enthalpy diagram for normal tower and Evaporative cooling tower at an ambient temperature 25°C.**



**Fig. 5: Pressure-Enthalpy diagram for normal tower and evaporative cooling tower at an ambient temperature 30°C.**

#### IV. CALCULATION AND RESULTS

While performing the experiment, the result obtained. Based on this result thermodynamic properties of refrigerant R134a are obtained at the different point of the system. In order to calculate the enthalpy, using the P-h chart of the refrigerant R134a. Such parameter are compressor work, COP of the system are calculate from the required following equation.

A. Compressor Work  $W_c = V * I = m_{ref} * (h_2 - h_1)$

B. Mass flow rate of refrigerant  $m_{ref} = \frac{W_c}{(h_2 - h_1)}$

C. Cooling effect produced  $Q_r = m_{ref} * (h_1 - h_4)$

D. COP =  $\frac{Q_r}{W_c}$

Where,

$h_1$  = enthalpy of refrigerant at inlet of compressor in kJ/kg (1)

$h_2$  = enthalpy of refrigerant at exit of compressor in kJ/kg (2)

$h_3$  = enthalpy of refrigerant at exit of the condenser kj/kg (3)

$h_4$  = enthalpy of refrigerant at entry of evaporator in kj/kg (4)

The compressor work done is obtained by the input power given to the experimental setup. The voltage and current of the input power is obtained by using the voltmeter and ammeter that attached to the setup.

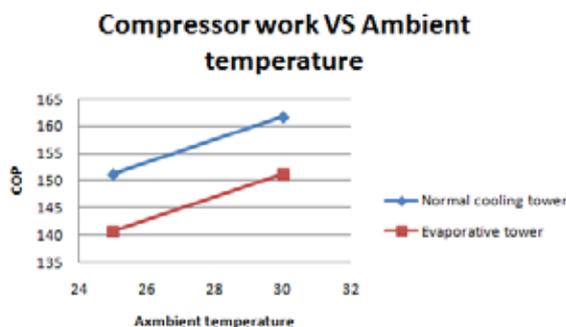
Table 2 and 3 given the result from the observation table at an ambient temperature 25°C and 30°C.

| Performance result of Air Conditioner ( $T_{amb}$ -25°C) |            |                      |                           |
|--|------------|----------------------|---------------------------|
| Parameter  | Unit       | Normal cooling tower | Evaporative cooling tower |
| Compressor work $W_c$                                    | Watt       | 151.2                | 140.7                     |
| COP  | -----<br>- | 4.5                  | 4.72                      |

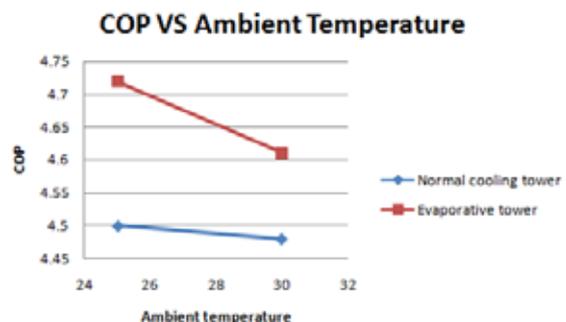
| Performance result of Air Conditioner ( $T_{amb}$ -30°C) |       |                      |                           |
|--|-------|----------------------|---------------------------|
| Parameter  | Unit  | Normal cooling tower | Evaporative cooling tower |
| Compressor work $W_c$                                    | Watt  | 161.7                | 151.2                     |
| COP  | ----- | 4.48                 | 4.61                      |

**Table 2: Result of the experiment at ambient air temperature 25°C**

**Table 3: Result of the experiment at ambient air temperature 30°C**



**Graph 1: Compressor work variation ambient temperature**



**Graph 2: COP variation with ambient with temperature**

## V. CONCLUSION

This evaporative cooling tower design is very simple and we can easily applied to normal VCRS system. This can be done by employing cellulose pad in front of draught fan within cooling tower and circulate water over the cellulose pad. Due to which when incoming air pass through cellulose pad take some moisture content and then it enter into cooling tower at the same time hot water from condenser is pumped to cooling tower , which is cooled down by this circulated air. VCRS system requires certain economical modification with no extra skill require. So we can easily installed evaporative cooling tower in VCRS system.

We present a novel design of evaporative cooling tower concept in which cellulose pad is to be installed in front of draught fan. From( graph1) which shows that as increase in ambient temperature compressor work

increase. But compressor work of evaporative cooling tower is less as compared to normal cooling tower. Similarly from (graph 2) COP of system decrease as the ambient temperature goes on increase. But COP of system with evaporative cooling tower is more as compared to normal cooling tower. The test result shows that evaporative cooling tower has high COP for both ambient temperature 25°C and 30°C. 4.8% change in COP as we move from normal cooling tower to evaporative cooling tower at ambient temperature 25°C. Similarly 2.9% change in COP when temperature changes from 25°C to 30°C. The test result explain that it have high cooling capacity as compared to normal cooling tower.

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# A SMART METHOD FOR AUTOMATIC TEMPERATURE CONTROL

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## ABSTRACT

*The main challenge and aim of the present work is to monitor and control the temperature in a limited environment i.e, to maintain the living room temperature at a predefined specific level with the use of the present method. A ON/OFF controller is designed to measure temperature and the LABVIEW virtual instrument is used to control the temperature and ensure that the temperature does not go beyond a certain set point. Feedback control is used by industry to regulate a variety of processes and systems. This paper describes the design and development of a feedback control system that maintains the temperature of a process at a desired set point given by user. The present system consists of a PC-based data acquisition unit using NI LABVIEW software that provides input and output interfaces between the PC and the sensor circuit and hardware. The paper consists of the sensor module, detail signal conditioning, the data acquisition unit, shows the implementation of the controller and the result of the on-off controller.*

**Keywords :** *Data Acquisition, NI -LABVIEW, Resistance Temperature Detector, Temperature-Monitoring, Temperature -Control, , Temperature Control Loop.*

## I INTRODUCTION

In the recent time, several work has been done on temperature control. Temperature monitoring and control is an important part in home automation. A various technique has already been established for temperature monitoring and controlling. In the present work a modern technique has been adopted for this purpose. There are several temperature sensors used in temperature measurement. They are RTD, Thermocouple, Thermistors etc. For the present temperature monitoring purpose Resistance Temperature Detector has been used due to some advantageous features such as its linearity, ease to assemble, high range etc.

The operating range of the RTD'S is from -250<sup>0</sup>C to 1000<sup>0</sup>C [1], and their accuracy is very high. Thermistors have the negative temperature coefficient. Their sensitivity is very high. The resistance versus temperature characteristics of the thermistors is highly non-linear. Resistance of the Thermistor is very high as compared to the RTD's, so error due to lead resistance in Thermistors is small. Thermocouple is a temperature measuring device, which is based on the principle of Seebeck effect. According to the Seebeck effect “ when the two dissimilar metals are joined together, an emf will exist between the two points A and B which is a function of the junction temperature,” Thermocouples are typically used up to a temperature of about 1400<sup>0</sup>C.

Order of sensitivity: Thermistors > RTDs > Thermocouple

Order of linearity: RTDs > Thermocouples > Thermistors

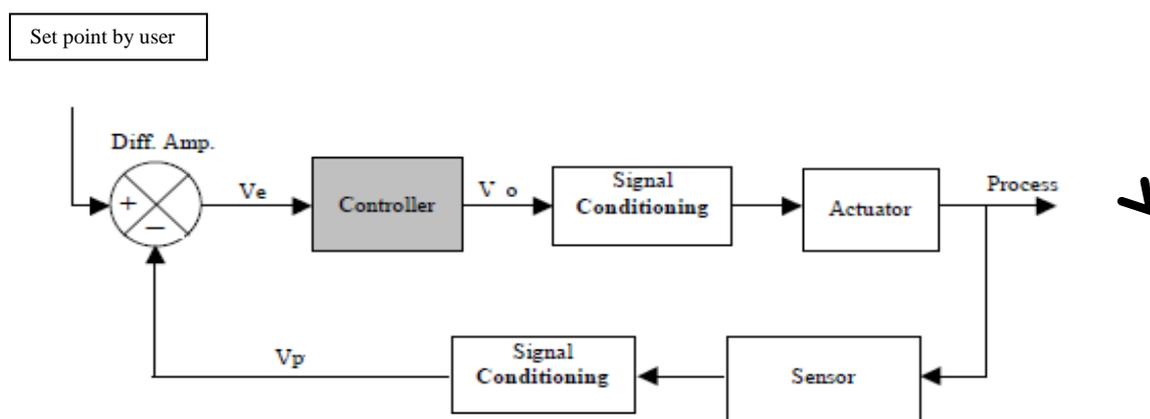
For the present work platinum RTD has been chosen because of its good linearity, resistivity, chemically inertness, accuracy. Here for controlling and monitoring purpose NI LABVIEW has been used which is more advantageous than others. By using NI LABVIEW it is very much easier to implement the comparator circuit, display circuit in place of electronic circuitry. A ON/OFF controller has been designed to measure temperature and the NI LABVIEW has been used to control the temperature and ensure that the temperature does not go beyond a certain set point.

## II DETAIL OF NI LABVIEW AND DATA ACQUISITION

NI LabVIEW™ (Laboratory Virtual Instrument Engineering Workbench), a product of National Instruments™, is a versatile powerful software system that accommodates data acquisition, instrument control, data processing and data presentation. LabVIEW graphical programs, called Virtual Instruments, contains a Front Panel and a Block Diagram. Front Panel has various controls and indicators while the Block Diagram consists of a variety of functions. It manages data acquisition, analysis and presentation into one system. Data acquisition is the process of acquiring an electrical or physical phenomenon such as voltage, current, temperature, Acoustic energy, pressure with a computer. A DAQ system consists of a DAQ card or sensor module, hardware from which data is to be acquired and a computer with associated software. NI USB-6363 DAQ can be used to get data related to impulse voltage which require very high accuracy. Sampling rate of this card is 2MS/s [ 2 ]

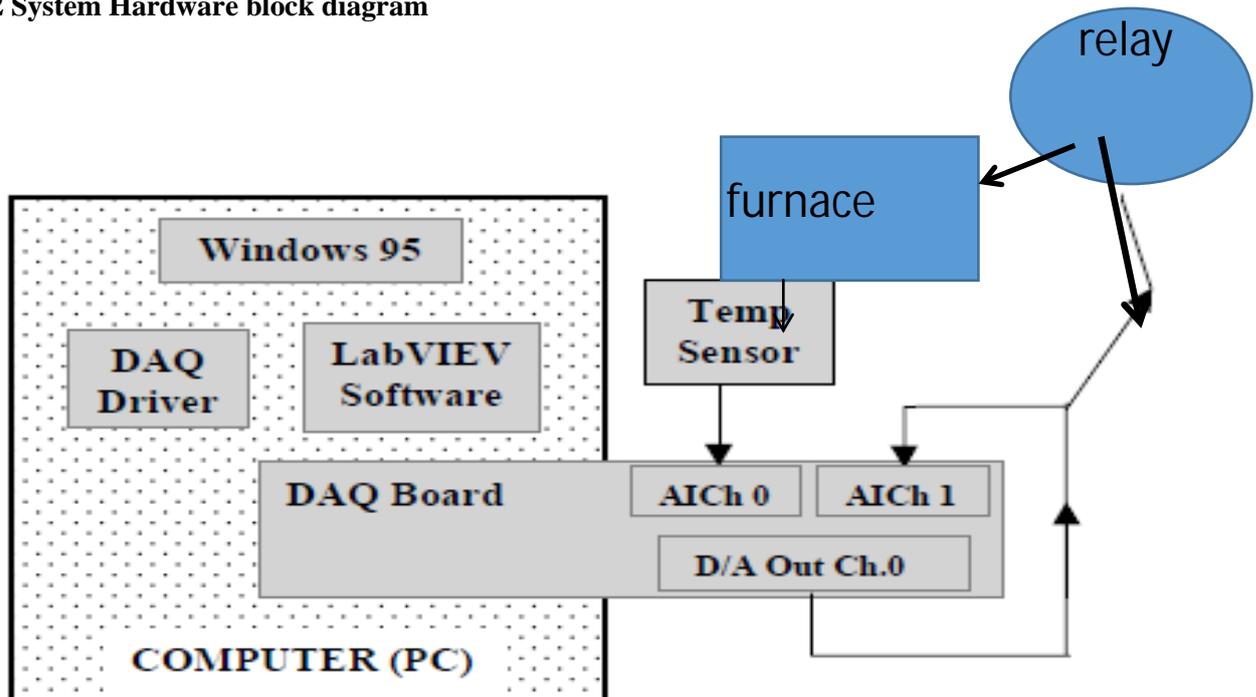
## III BLOCK DIAGRAM

### 3.1 Temperature control loop (closed loop control)



**Fig.1. Simplified Block Diagram of The Temperature Control Loop**

### 3.2 System Hardware block diagram



**Fig2. System Hardware Block Diagram**

The blocks of the above figure is described below

Process:-Furnace Temperature is being controlled and monitored here, so furnace is the process of our project.

RTD:-Resistance Temperature Detector or RTD is used as a temperature sensor. It senses the temperature according to that gives the output voltage.

DAQ:-DAQ acts as a media between the physical circuit and virtual circuit. It has several input and output ports through which it communicates between physical circuit and virtual circuit (NI LABVIEW software)

NI LABVIEW Software:- It is a software which acts like a virtual instrument. With the help of this software we can make a circuit virtually and also apply it physically. In our project we will make our comparator ON-OFF controller with help of this software.

Relay:- Here relay acts as a final control element

LED:- We use LED as a indicator.

RTD:Resistance temperature detector is one of the most accurate temperature sensors. Where precise temperature control and small temperature differences are needed, RTDs are the only solutions. Generally, three/four types of RTDs are generally used in terms of choosing materials. They are nickel, platinum, copper, tungsten. Among them platinum RTDs are mostly used because of its good linearity and inertness. Material of RTD should be pure otherwise it will deviate the conventional temperature graph. The variation of resistance of a metal with temperature can be represented by the following relationship.

$$R_t = R_0(1 + At + Bt^2 + Ct^3 + \dots) \quad (1)$$

$R_0$  = Resistance at  $0^\circ\text{C}$ ,  $R_t$  = Resistance at  $t^\circ\text{C}$ , A, B, C are the constants.

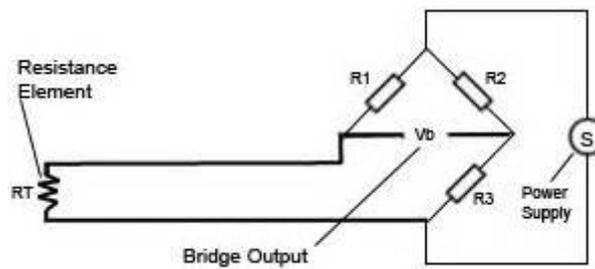
The significant characteristic of metals used as resistive elements is the linear approximation of the resistance versus temperature relationship between 0 and  $100^\circ\text{C}$ . This temperature coefficient of resistance is called alpha,  $\alpha$ . The equation below defines  $\alpha$ ; its units are ohm/ohm/ $^\circ\text{C}$ .

$$\alpha = \frac{R_{100} - R_0}{100R_0}$$

$R_0$  = the resistance of the sensor at  $0^\circ\text{C}$

$R_{100}$  = the resistance of the sensor at  $100^\circ\text{C}$

In RTD circuits resistance changes with the change of temperature. Resistance is calibrated in terms of temperature. Here, some bridge balance circuits are used for measurement. Simple Wheatstone bridge circuit can't be used as RTD is a very sensitive element. So contact resistance of POT, temperature variations, heating effect have to be taken care of and some modifications are needed. Basically we use 3 wire RTD.

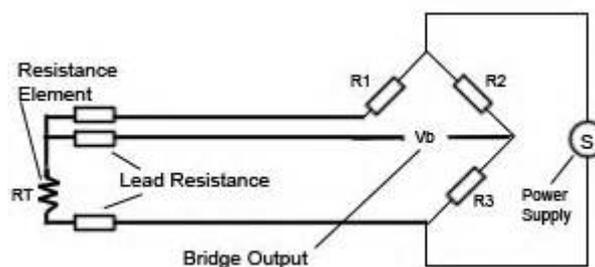


At balance condition,  $R_t = (R_1/R_2) * R_3$

If  $R_2 = R_1$ , then  $R_t = R_3$

$R_3$  is an adjustable Potentiometer. All resistors are made of manganin in order to avoid any effect due to ambient temperature change as manganin has the lowest temperature co-efficient. Disadvantages of 2-wire RTD:

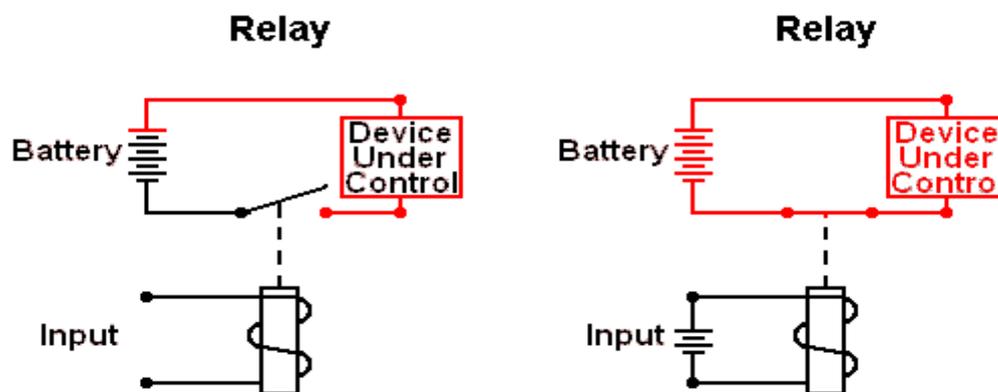
1. There is an  $I^2R$  heat loss in the RTD.
2. It's self-heating effect makes the reading erroneous. Current through RTD must be low to avoid 3-wire RTD



Three wire method is used to compensate for variable lead wire resistance. Balance bridge is obtained by adjusting the POT resistance which is calibrated in terms of temperature. The effect of contact resistance is

avoided here. Each lead wire made of copper wire of the same diameter and length so that each has equal resistance.

**RELAY:-** Electromechanical Relay is a simple device that use magnetic field to control a switch. When a input voltage applied to the input coil, the resulting current creates a magnetic field. The magnetic field pulls a metal switch (or reed) towards it and the contacts touch closing the switch. The contact that closes when the coil is energized is called normally open(NO). The normally closed (NC) contacts close when the coil is not energized and open when input coil is energized. Normally open contacts are shown as two lines and will be open (non-conducting) when the input is not energized. Normally closed contacts are shown with two lines with a diagonal line through them. When the input coil is not energized, the normally closed contacts will be closed (conducting). Relay is used in DC source. Now days many other type of relay is used in industry like solid state relay, digital control protective relay etc. In case of solid state relay Thyristors, Transistors are used as a switch controller and in case of digital protective relay microcontroller programming is use.



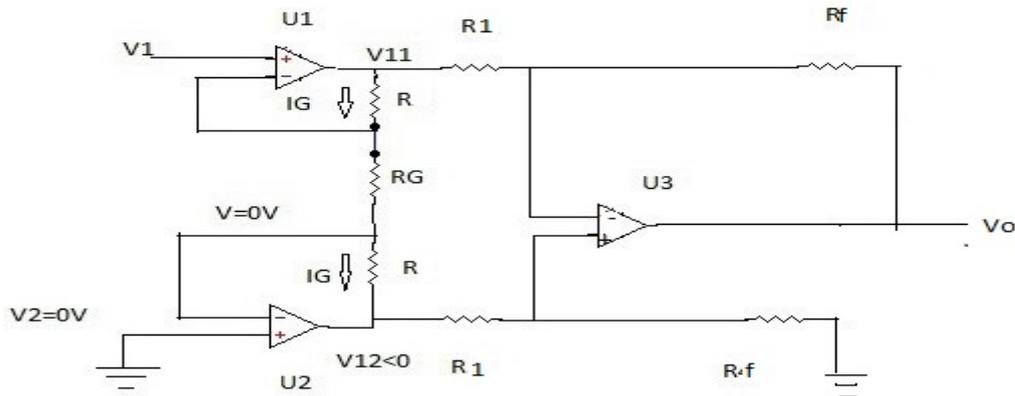
**Fig.4. Relay Circuits**

**Instrumentation Amplifier:** Instrumentation amplifiers are commonly used in environment with high common-mode noise such as in data acquisition systems where remote sensing of input variables are required. An instrumentation amplifier is a differential voltage-gain device that amplifiers the difference between voltages existing at its two input terminals . The main purpose of an instrumentation amplifier is to amplify small signals that are riding on large common-mode voltages. The key characteristics are high input impedance, high common-mode rejection , low output offset , and low output impedance . A basic instrumentation amplifier is made up of three operational amplifiers and several resistors. The voltage gain is set with an external resistor. Amplifier  $A_1$  and amplifier  $A_2$  are non-inverting configurations that provide high input impedance and voltage gain.  $A_3$  is used as a unity gain differential amplifier.

$$V_0 = R_f / R_1 ( V_2 - V_1 ) ( 1 + 2R/R_g )$$

$$Ad = V_0 / ( V_2 - V_1 ) = R_f / R_1 ( 1 + 2R/R_g )$$

For gain 10,  $R_g = 220$  ohm , considering all other resistances are of equal values.



#### IV WORKING PROCEDURE

Step 1 : The RTD has been connected to a balanced Wheatstone bridge circuit.

Step 2: When the temperature changes there will be an unbalanced voltage from the Wheatstone bridge circuit.

Step 3 : The unbalanced voltage is amplified by using an Instrumentation amplifier.

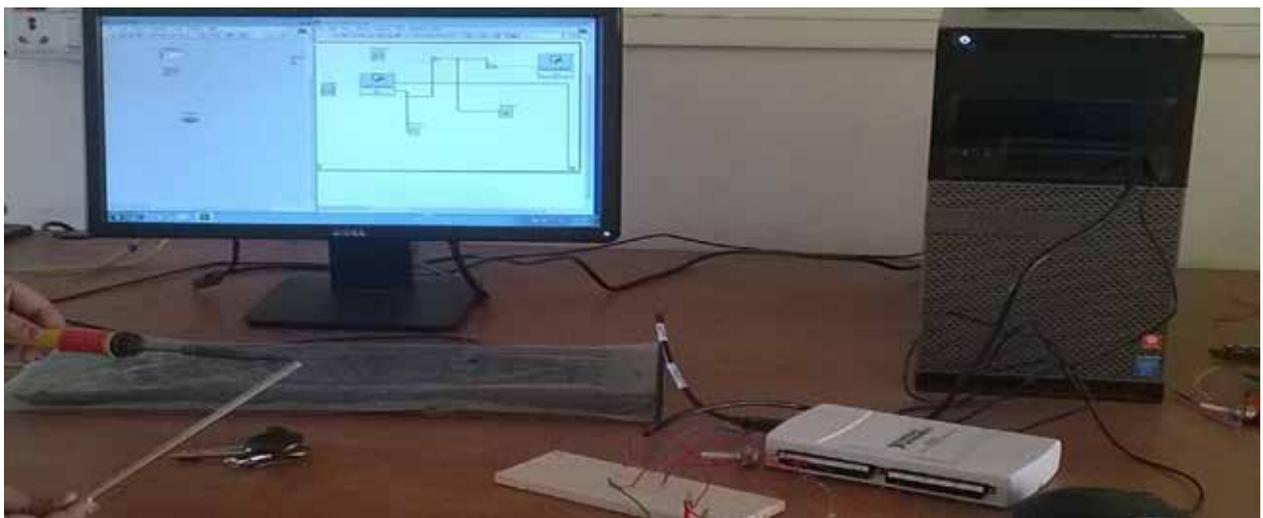
Step 4 : The output of the Instrumentation amplifier is connected to the DAQ card to the PC.

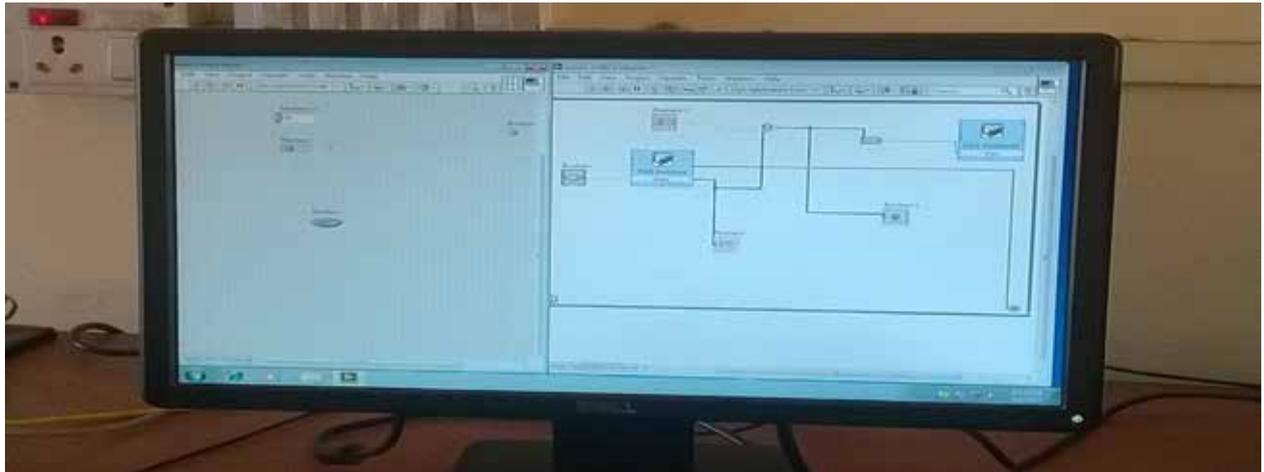
Step 5 : When the temperature was beyond the set point value then the comparator o/p in NI LABVIEW is very high.

Step 6: An LED has been connected to the o/p of the DAQ card. When comparator o/p is high , LED will be ON and when comparator o/p is low, LED will be OFF.

Step 7 : When the LED was ON, the comparator o/p has been fed back to the final control element, here an relay has been used. When relay was normally open, the power source has been cut off.

#### V SOME PHOTOGRAPHS OF THE PRESENT WORK





## VI CONCLUSION

It was a very useful one and completed successfully. By using the NI LABVIEW virtual instrumentation temperature control has been done fruitfully.

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# ANALYSIS OF CARDIAC HEALTH USING CHAOTIC THEORY

Chandra Mukherjee<sup>1</sup>, Parul Bansal<sup>2</sup>

## ABSTRACT

*The prevalent knowledge of the biological systems is based on the standard scientific perception of natural equilibrium, determination and predictability. Recently, a rethinking of concepts was presented and a new scientific perspective emerged that involves complexity theory with deterministic chaos theory, nonlinear dynamics and theory of fractals. The unpredictability of the chaotic processes probably would change our understanding of diseases and their management. The mathematical definition of chaos is defined by deterministic behavior with irregular patterns that obey mathematical equations which are critically dependent on initial conditions. The chaos theory is the branch of sciences with an interest in nonlinear dynamics, fractals, bifurcations, periodic oscillations and complexity. Recently, the biomedical interest for this scientific field made these mathematical concepts available to medical researchers and practitioners. Any biological network system is considered to have a nominal state, which is recognized as a homeostatic state. In reality, the different physiological systems are not under normal conditions in a stable state of homeostatic balance, but they are in a dynamically stable state with a chaotic behavior and complexity. Biological systems like heart rhythm and brain electrical activity are dynamical systems that can be classified as chaotic systems with sensitive dependence on initial conditions. In biological systems, the state of a disease is characterized by a loss of the complexity and chaotic behavior, and by the presence of pathological periodicity and regulatory behavior. The failure or the collapse of nonlinear dynamics is an indication of disease rather than a characteristic of health.*

## I. INTRODUCTION

Heart failure and a variety of other pathologies demonstrate a paradoxical decrease of the nonlinear variability observed in the normal sinus rhythm in healthy people. The chaos theory and the field of nonlinear dynamics are research areas that are related to basic and clinical cardiology. Important classical research fields related to cardiology are the sinus rhythm, ventricular fibrillation, cellular cardiac electrophysiology. Cardiac chaos is related to the purposeful-fluctuations in the instantaneous heart rate or interbeat interval (beat-to-beat variability) in healthy subjects, while in patients with heart failure this phenomenon of heart rate variability (HRV) seems to decrease [6]. There is substantial evidence that the deleterious progression of heart failure and its complicated clinical picture follows the philosophy of chaos theory [7]. Heart failure is a system that displays chaotic behavior and practical unpredictability of future deleterious progression as the small differences in the initial causal conditions can lead to large differences of the subsequent clinical course. The subsequent state of the disease's progression is comprehended as a system that follows a deterministic chaotic attitude in contrast to the concept of rhythm regularity as the classical behavior of a diseased state. The prevalent knowledge of the biological systems is based on the standard scientific perception of natural equilibrium, determination and predictability. Recently, a rethinking of concepts was presented and a new scientific perspective emerged that involves complexity theory with deterministic chaos theory, nonlinear dynamics and theory of fractals. The

unpredictability of the chaotic processes probably would change our understanding of diseases and their management. The mathematical definition of chaos is defined by deterministic behavior with irregular patterns that obey mathematical equations which are critically dependent on initial conditions [1]. The chaos theory is the branch of sciences with an interest in nonlinear dynamics, fractals, bifurcations, periodic oscillations and complexity. Recently, the biomedical interest for this scientific field made these mathematical concepts available to medical researchers and practitioners [2,3]. Any biological network system is considered to have a nominal state, which is recognized as a homeostatic state [4]. In reality, the different physiological systems are not under normal conditions in a stable state of homeostatic balance, but they are in a dynamically stable state with a chaotic behavior and complexity [5]. Biological systems like heart rhythm and brain electrical activity are dynamical systems that can be classified as chaotic systems with sensitive dependence on initial conditions. In biological systems, the state of a disease is characterized by a loss of the complexity and chaotic behavior, and by the presence of pathological periodicity and regulatory behavior. The failure or the collapse of nonlinear dynamics is an indication of disease rather than a characteristic of health. Heart failure and a variety of other pathologies demonstrate a paradoxical decrease of the nonlinear variability observed in the normal sinus rhythm in healthy people. The chaos theory and the field of nonlinear dynamics are research areas that are related to basic and clinical cardiology. Important classical research fields related to cardiology are the sinus rhythm, ventricular fibrillation and cellular cardiac electrophysiology. Cardiac chaos is related to the purposeful-fluctuations in the instantaneous heart rate or interbeat interval (beat-to-beat variability) in healthy subjects, while in patients with heart failure this phenomenon of heart rate variability (HRV) seems to decrease [6]. There is substantial evidence that the deleterious progression of heart failure and its complicated clinical picture follows the philosophy of chaos theory [7]. Heart failure is a system that displays chaotic behavior and practical unpredictability of future deleterious progression as the small differences in the initial causal conditions can lead to large differences of the subsequent clinical course. The subsequent state of the disease's progression is comprehended as a system that follows a deterministic chaotic attitude in contrast to the concept of rhythm regularity as the classical behavior of a diseased state.

## II. THEORETICAL ASPECT

At the present time, clinical evaluation is based on various parameters rested on clinical experience and epidemiological studies. The same clinical parameters assess progression of a disease and evaluate the underlying risk of sudden cardiac death. It is significant in clinical practice the development of sophisticated methods from nonlinear dynamics in order to advance medical diagnostics. In an early date, Mackey and Glass [13,14], suggested that irregular physiological rhythms might be associated with deterministic chaos. In the philosophy of medicine, chaos theory has limited implications for the analysis of the concept of disease and the concept of causation, because chaotic processes are fully deterministic and unpredictable due to extreme sensitivity to initial conditions. In contrast, the complexity theory has substantial implications for our knowledge and practice in medicine. Thus, the unpredictability of chaotic processes produces practical problems in diagnosis, prognosis, and treatment, but may be very important in understanding the physiological processes and disease entities.

Preliminary studies supported the hypothesis that methods from nonlinear dynamics are able to evaluate heart rate fluctuation and identify patients at high risk for sudden cardiac death. In an early publication, it was

suggested that the reduction of the HRV in a subgroup of patients with increased cardiac mortality after myocardial infarction, was due to an autonomic imbalance marked by increased sympathetic and decreased vagal nervous activity. Significant physiological information about the heart is the time between two consecutive beats, known as the interbeat interval which varies constantly.

The fluctuation of the normal heartbeat period (irregular periodicity) is not explained completely by a linear approach and it was proposed that it is a nonlinear deterministic procedure [17]. Also, Goldberger [17] discovered that heart rates show fractal patterns but it is still inconclusive why the fractal patterns break down in diseased hearts. The human heart exhibits deterministic chaotic behavior under normal circumstances, while the unhealthy heart is presented by immutability and predictability. Hence, in cardiac rhythm, the normality is represented by a chaotic inter beat interval (beat-to-beat variability) while a regular heart beat is a sign of disease and predictor of imminent cardiac arrest [18]. It appears that a regular beat follows pathological conditions like end-stage heart failure, while normal irregularities are signs of normal heart function (Figure 1). The electrocardiograms of healthy individuals demonstrate complex nonlinear dynamics and deterministic chaotic behavior, but not stochastic (non-deterministic). In healthy people, the chaotic behavior is displayed by short-term variations of beat-to-beat interval, but in patients with heart failure there are periods with non-chaotic fluctuations [19]. A decrease of the normal nonlinear variability is observed in different cardiovascular diseases and before ventricular fibrillation [20]. Stochastic analyses like standard deviation or power spectrum, display reduced sensitivity and specificity compared to the dimensional measures (attractors) [21]. Thus, a reduced standard deviation of inter beat interval may predict an increased mortality of the group, but cannot identify the individuals who will develop fatal arrhythmogenesis. In contrast, the attractor dimension of the same data can specify which patients will have sudden death. The explanation for the increased sensitivity and specificity of the dimensional measures or attractors is the fact that they are deterministic and therefore more accurate in biological systems and medicine to detect disorders [22].

In the DIAMOND study, Huikuri et al [23], reported the application of nonlinear dynamics to the study of HRV signal in patients after a myocardial infarction. They suggested that the loss of short-term correlation properties of the inter beat intervals predict arrhythmic and total mortality. Probably, a continuous sympathetic activation and a decreased vagal tone reduce the complexity of HRV and induce the inter beat interval to be less adaptable and capable to cope with a continuously changing body and cardiac environment [24,25].

The reduction of variance and the low-frequency spectral component of HRV are related to an increased mortality in heart failure [26]. Also, the chaos analyses on the HRV of fifty patients with heart failure and survival analysis showed that the chaos level is the best predictor of mortality [27]. Methods based on chaos analysis and nonlinear indices provide valuable clinical information and predict fatal cardiovascular events in post-infarction patients and in patients with heart failure. Although the concepts of chaos theory and nonlinear dynamics remain still at a distance from the current practices of clinical medicine, they cover an important scientific field that needs further interdisciplinary research [28]. In an attempt to elucidate the underlying mechanisms of cardiovascular dynamics, Wessel et al, stressed the importance of the dominant influence of respiration on heart beat dynamics. They supported the hypothesis that the observed fluctuations are explained by respiratory modulations of heart rate and blood pressure. Molon et al, in sixty heart failure patients implanted with cardiac resynchronization therapy (CRT) assessed if a HR-related complexity predicts adverse clinical and

cardiovascular events in one year. They used a set of linear indices of HRV and demonstrated that heart failure patients with lower baseline complexity-related indices, present worse clinical outcome.

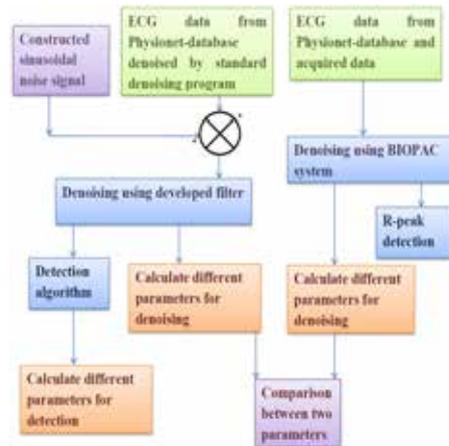
### III. A. THE PHYSIOLOGY OF HEART FAILURE PROGRESSION

The syndrome of heart failure has a progressive pattern that starts with a myocardial mechanical insufficiency. The sympathetic nervous system (SNS), the renin-angiotensin-aldosterone system (RAAS) and the natriuretic peptide systems are stimulated in response to the mechanical insufficiency. These compensatory mechanisms increase myocardial contractility, peripheral vasoconstriction, fluid and sodium retention and left ventricular remodeling. The compensatory mechanisms produce an ephemeral hemodynamic stability, but subsequently become maladaptive with a myocardial deterioration and hemodynamic instability. The persistent neurohormonal stimulation of the myocardium increases left ventricular volume and mass, and changes the configuration of the left ventricle to a more spherical shape. This geometric change of the left ventricle is called cardiac remodeling and has deleterious hemodynamic effects with further deterioration of heart failure syndrome. The recurrent interchange of heart failure phases, from clinical compensation with hemodynamic stability to a decompensated state with clinical and hemodynamic instability, is detrimental to myocardium. Every episode of decompensating can induce irreversible myocardial damage, and increases inflammatory cytokines that may motivate myocardial cells apoptosis. Thus the decompensated periods followed by irreversible myocardial damage may contribute to the progression of heart failure. After an episode of decomposition and a short-lived clinical improvement the patient returns to another period of stabilization with an additional burden in myocardial function. Objectives of heart failure treatment are to reduce mortality, to relieve symptoms and signs, and to prevent progression of myocardial damage and remodeling of the myocardium. It appears that the angiotensin-converting enzyme (ACE) inhibitors and  $\beta$ -blockers delay heart failure progression and the deterioration of myocardial function. This improvement in myocardial function is based on the assumption that the compensatory mechanisms of SNS and RAAS are responsible for the activation of cardiac remodeling and heart failure progression. A sub study of the Studies of Left Ventricular Dysfunction Treatment Trial (SOLVD) demonstrated that enalapril prevented progression of left ventricular dilation and systolic dysfunction in patients with mild or moderate heart failure. Other studies showed that carvedilol decreased the left ventricular end-diastolic and end-systolic volume index, and increased left ventricular ejection fraction in patients with mild heart failure. Also, the impact of cardiac resynchronization therapy (CRT) on myocardial function has been investigated in patients with heart failure. In the randomized studies scheduled for six months of follow-up was found an up to 15% reduction in left ventricular end-diastolic diameter and an up to 6% increase in the ejection fraction. Despite the above encouraging results definite therapeutic answer to the relentless progression of heart failure needs prospective studies with a long-term follow-up. HF progression is a chaotic or a stochastic process- In heart failure, the concepts of chaos theory and nonlinear dynamics are focused mainly in the HRV analysis for its prognostic capacity. Moreover, chaos theory and systems biology methodology are important tools to understand the clinical progression of heart failure syndrome. In the present paper, a concept of chaotic behavior of cardiac function during progression of heart failure is introduced. This concept differs from the classical knowledge of chaotic behavior of the heart rhythm under normal circumstances and the appearance of rhythm regularity during heart failure. In the concept of the chaotic behavior of cardiac function deterioration, the heart failure progression in a worse clinical state has the characteristics of a complex and unstable system which in an imaginable 'phase space' is stabilized in the form

of a strange attractor of optimum size. The optimum size of the strange attractor is behaving as a kind of constraint to further increase. The progression of heart failure and the related underlying mechanisms can be linked to a chaotic behavior and explained with systems biology methodology and molecular, network and phenotype data integration [7]. The human heart failure is interpreted as a complex and unstable system with periods of molecular and clinical stabilization in the form of a strange attractor, and self-organized positive feedback stabilization mechanisms of adrenergic stimulation, left ventricular remodeling, and activation of the RAAS and natriuretic peptide systems. Thus, the stabilization mechanisms are considered compensatory processes produced by activation of various neurohormonal pathways in an endeavor to maintain cardiac function and end-organ perfusion. The stabilization period in the basins of attractors can be interrupted by a variety of minor or major deleterious causes, and then the molecular and clinical instability returns with the heart deteriorating into a decompensated situation. The above compensatory processes become maladaptive and partly are responsible for the return of the clinical instability. Natural history studies implicate the progressive left ventricular remodeling as the most probable cause of the clinical deterioration. The left ventricular remodeling involves alterations in myocardial cells' biology and myocardial loss, changes in extracellular myocardial matrix, and alterations in left ventricular chamber geometry. Heart failure progression is an open biological system and the stabilization state (attractor) is attained from different clinical and biological initial conditions (biological convergence). It is also possible, the unsteady and fluctuating initial conditions and the deteriorating clinical situation to stabilize in the basins of different attractors (biological divergence). The previously described stabilization mechanisms are recalled for a new stable clinical equilibrium state in the basins of a new strange attractor, but this is accompanied with a further progression of heart failure and a worse clinical picture. The clinical stability during the period of the strange attractor should not be confused with a rigid and stereotyped behavioral homeostasis but should be considered as part of the chaotic behavior of the whole system of heart failure progression. Thus, both clinical stabilization and formation of a strange attractor indicate that the chaotic process is rather an adaptive biological mechanism that follows the downward spiral of heart failure progression. Both constitute a temporary physiological adaptive mechanism that is activated in response to the inevitable progression of heart failure. The chaotic strange attractor maintains a maximum flexibility and stability that increases the prospects of survival. A rigid clinical situation is not adaptive and not able to react to the mechanical myocardial changes or to the deterioration of the surrounding environment. The path of the downward spiral of heart failure progression differs from patient to patient, and is determined by the initial deteriorating conditions in the beginning of each decompensated period.

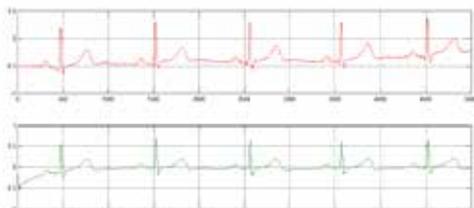
A stochastic or random process is the counterpart to a chaotic or deterministic process. In a stochastic process even if the initial conditions are known, the process can follow many possibilities. Evaluating a heart failure scenario, myocardial cells often measure their local environment through the interaction of diffusible chemical signals with membrane receptors. This process is stochastic for a single receptor, but the cell has many receptors which are reducing the variability by averaging. This explanation doesn't exclude the possibility of stochastic effects taking place in many biological signaling pathways with important implications for heart failure progression.

**IV. BLOCK DIAGRAM**

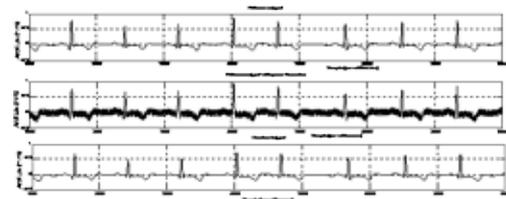


**V. TEST RESULT**

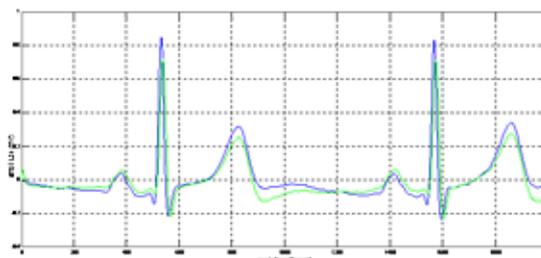
**5.1 PTB- DB Data Base**



**Fig 2: Analysis on PTB- DB Data Base**



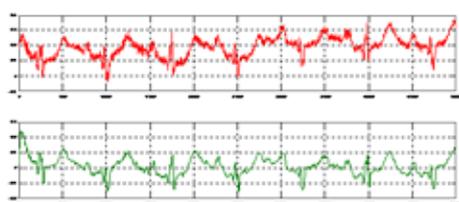
**Fig 3: Denoising of Base-Line Modulation Using IIR bandpass Filter**



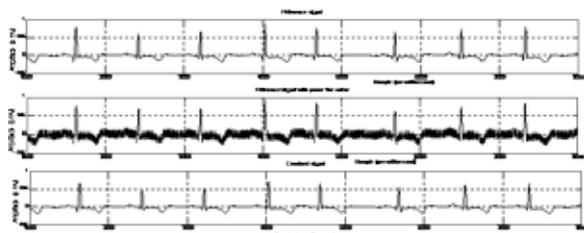
**Fig 4: Comparison between Reference and Denoised Signal**

**5.2 MIT-BIH database (100)**

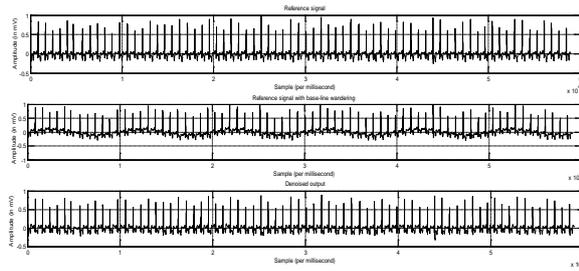
In the following figure we have shown testing result of our developed denoising algorithm for removal of power-line interference and baseline wandering on MIT-BIH database respectively-



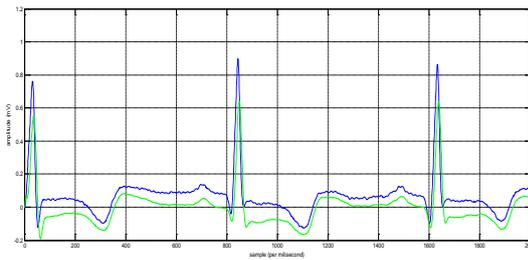
**Fig 5: Analysis on PTB- DB Data Base**



**Fig 6: Denoising of Power-line noise**



**Fig 7: Denoising Of Base-Line Modulation**



**Fig 8: Comparison between Reference and Denoised Signal**

## VI. CONCLUSION

The proposed algorithm is based on conventional digital filtering. From ECG signal we have detected QRS region and from that baseline is corrected. Using chaotic analysis we were able to extract some features of ECG signal. HRV and Cardiological diseases are detected. In human heart failure, the clinical stabilization in the form of the strange attractor, depends on its initial state and can be interrupted by dynamic minor or major causes. During the interruption period small changes of the interrupted causes can produce high clinical instability. The heart failure progression scenario gives the impression of a system that is more accurately explained by chaos theory than by a stochastic process. Probably, the stochastic effects are taking place only in the biological signaling pathways and don't explain the clinical behavior of heart failure progression that is entirely a chaotic phenomenon.

## VII. FUTURE SCOPE

There is several scope of improvement in this paper. It can be analysed by Artificial Neural Network. We have mainly analyzed HRV but Several cardiac parameters namely Arrhythmia etc. can be analysed.

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# FEATURE LEVEL FUSION BASED MULTI-BIOMETRIC CRYPTOSYSTEM USING FUZZY VAULT FOR WIRED NETWORK

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## ABSTRACT

*User authentication is necessary these days to prevent the unauthorized access by the malicious users. Multi-biometric systems accumulate evidence from more than one biometric trait (e.g., face, fingerprint and iris) in order to recognize a person. They provide higher recognition accuracy and larger population coverage. Multi-biometric systems require storage of multiple biometric templates for each user, which results in increased risk to user privacy and system security. The method to secure the individual biometric template by using the fusion method to store the data in the fuzzy vault is proposed. Now the same multi-biometric cryptosystem should be reliably used over the internet and other networks. This paper proposes a multi-biometric cryptosystem over wired network to support various applications where user authentication is necessary. The Server side encoding and client side decoding with more complex fusion module is also proposed in this paper.*

**Keywords:** *Feature Level Fusion, Fuzzy Vault, Multi-biometric Cryptosystem, Template Security, Wired Network.*

## I. INTRODUCTION

In today's modern society, all types of public and private services are dependent on computer networks supporting them. The two best examples are electronic voting and electronic commerce. The role of authentication techniques to prevent unauthorized access by malicious users becomes more significant, because crimes and incidents over networks are increasing rapidly [1].

Biometrics authentication depends on biological individuality of human characteristics such as fingerprint, iris, retina, face, and voice. A biometrics authentication technology is to extract the identification data from human characteristics automatically and to compare it with already registered and stored data to authenticate a person, but the method to implement is different according to the characteristics it focuses. Due to the disadvantages of single biometrics authentication technology, it cannot satisfy a required reliability level. Thus multi-biometrics is useful to improve reliability of biometrics authentication. For example, fingerprint authentication at the entrance of a building may be combined with iris authentication at the entrance of a secured room in that building. [1]

Multi-biometrics authentication will be more popular over networks in the future especially for wired networks. It is useful to build a network based multi-biometric cryptosystem which can be used by many applications and commonly applicable to different types of biometrics authentication technologies. This paper proposes a multi-biometric cryptosystem using network authentication to support various applications where user authentication is necessary. In particular, it provides secured services to individual biometric data and to the data to be secured.

## II. RELATED WORK

Abhishek Nagar, Karthik Nandakumar and Anil K. Jain in their paper Multibiometric Cryptosystem based on feature level fusion, explained the multi-biometric cryptosystem using both fuzzy vault and fuzzy Commitment. Also they proposed different embedding algorithms for transforming biometric representations. [2]

Umut Uludag, Sharath Pankanti, Anil K. Jain in their paper Fuzzy Vault for Fingerprints, explained the unibiometric authentication system using fingerprint minutiae as the single biometric trait. For the encoding and decoding to work they used the new cryptographic construct called Fuzzy Vault [7].

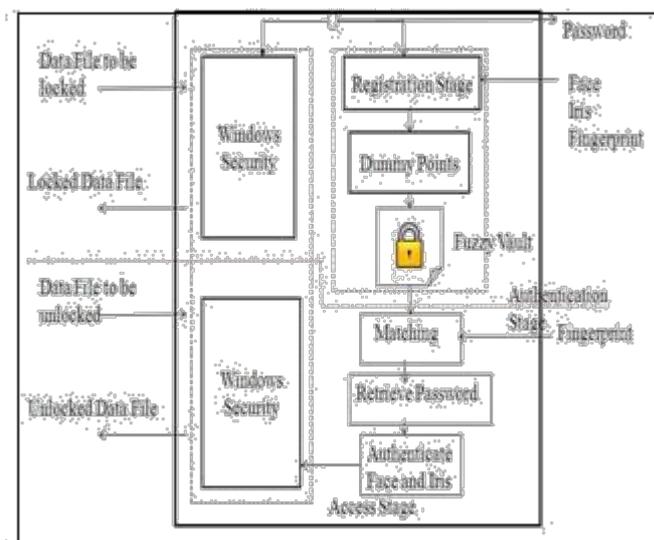
Haiping Lu, Karl Martin, Francis Bui, K. N. Plataniotis, Dimitris Hatzinakos in their paper Face Recognition with biometric encryption for privacy enhancing, explained a combination of face recognition and simple biometric encryption using helper data system. Their main objective was to address the privacy concern in a self exclusion scenario of face recognition [12].

Ae-Young Kim, Sang-Ho Lee in their paper Authentication Protocol using Fuzzy Eigenface Vault based on MOC, proposed a fuzzy vault based on the eigenfaces. For this scheme, they use a feature vector, which is called an eigenface, from a face image. The eigenface is calculated by the principle component analysis method [14].

Jules and Sudan in their paper A fuzzy vault scheme, proposed the concept of fuzzy vault. It is a logical constraint which is used to store the transformed data. It acts as the locking agent viz. whenever the fuzzy vault is created the data is considered to be locked [9].

## III. THE PROPOSED FRAMEWORK

In this section the implementation for multi-biometric cryptosystem based on feature level fusion using fuzzy vault is explained. It works in three stages. At the registration stage all the biometric templates are accepted as input. For which the real time video of user's face is captured. Then the thumb print and the iris are captured further. Edge segmentation for the face is done using Canny Edge Detection Algorithm (CED). Feature Extraction for iris is done using Independent Component Analysis (ICA) [6] and that for thumb print is done by finding the coordinates of the minutiae points. The extracted features are then quantized and mapped to binary representation for feature points matching. The produced binary features and the key entered by the user are bound using the fuzzy vault. The key will be correctly retrieved if the presented face features have substantial overlap with the enrolled ones along with matching of iris and thumb print. The details of the proposed methods are presented in this section.



**Figure 1. System Overview of Feature Level based Multibiometric Cryptosystem**

Overview of the system as shown in figure 1 consists of three stages. The first stage is the registration stage. This stage will take place at the server side of the wired network. The registration stage will accept all three biometric templates viz. iris, face and thumb print and a textual password. Then the facial features are extracted using the Canny Edge Detection Algorithm in which edge segmentation is performed. Then features from iris are extracted using ICA also the thumb print features are extracted using the angle method in which angle  $\Theta$  is found. After this step binary mapping is performed and all the data including the textual string will be converted into binary format. Using the binary format the biometric templates are fused with the entered textual string and they are stored in the Fuzzy Vault. Once the fuzzy vault is created at the server side the data is locked.

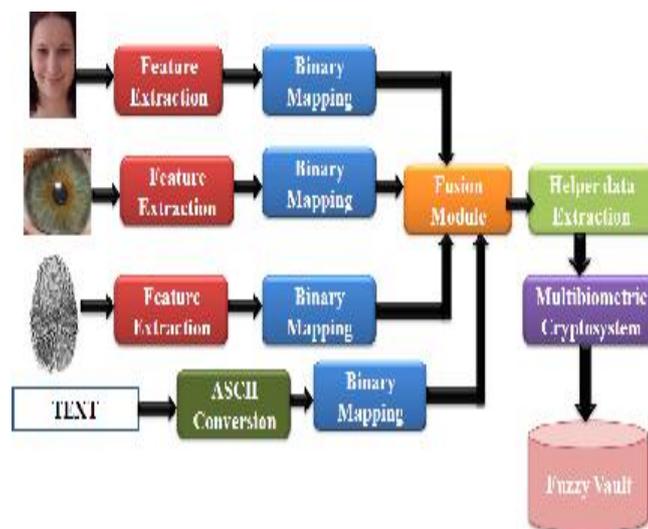
Now at the client side while accessing the same locked data authentication stage is performed. In this stage user trying to access the data is authenticated. At this stage he needs to enter only thumb print. From which the features are extracted and the password is retrieved. Using the password the other biometric templates are also retrieved and thus if they all are matched then the user is authenticated. Then the system enters the access stage. At this stage using the retrieved password and the features of the biometric templates data is accessed at the client side. For this system to work two things should be ready viz. Client Server Configuration and the Network Protocols.

### 3.1 Encoding at Server Side

On the server side, initially the user should register. For the registration purpose the user will provide his face, iris and the fingerprints. Then for each of the biometric feature the feature extraction will take place. While doing feature extraction the Canny Edge Detection algorithm will be used, the result of which is the edged map of the respected biometric feature. The same edged map is divided into subparts to go in detail with the image. Then according to the presence of the edge in the subpart, the binary value is extracted. If edge is present then 1 otherwise 0. The output is the binary valued string. The binary valued string is known as the feature vector for each biometric template. Now the feature vector for face and the feature vector for iris are concatenated. The formed biometric string is reversed and it is converted into decimal number. The value we will get will be the

coefficient of the polynomial being formed i.e.  $P(u) = C_8u^8 + C_7u^7 + C_6u^6 + \dots + Cu + C_0$  [3][4].

Now the feature vector for the fingerprint is considered. The length of the feature vector is too long to perform the calculation. So the Finite Field Arithmetic Algorithm (FFA) is used. In that algorithm the standard polynomial stated by Galois is considered. The polynomial is  $C_{16}u^{16} + C_5u^5 + C_2u^2 + 1$ . The standard value for the polynomial is 40961. Applying the FFA algorithm will reduce the normal value and make the calculations easier. This will give the variable of the polynomial. The constant of the polynomial is calculated by calculating the Cyclic Redundancy Check (CRC) of the feature vector of the fingerprint. Thus the complete value of the polynomial for one feature is obtained. In order to store all the values of the polynomials in the vault which is stored at the server side, some security measures are necessary. So we are including the chaff points here in order to confuse the hackers. The chaff will be scrambled with the original genuine points viz. is the combination of the value of the polynomial and the variable of the polynomial and hence the value will be stored on the server. The vault will be created and the user's registration is now complete. The complete process is illustrated in the following figure 2.



**Figure 2. Encoding at Server Side**

### 3.2 Decoding at client side

On the client side, the client will try to access the data so it will request the server to give him the access. For the decoding purpose, user needs to provide only fingerprint. No need to provide the face and the iris. The same procedure will be implemented. Features will be extracted. The binary mapping will be carried out. Thus the feature vector will be formed. Now from this feature vector the CRC is calculated. The calculated CRC is encrypted by the symmetric key algorithm to send over the network. Then at the server side, the vault is accessed. The data read from the vault will be the combination of the chaff points and the genuine points. Genuine points are extracted. Using them the Polynomial is reconstructed. Polynomial Interpolation is performed to find out all the coefficients of the Polynomial. The polynomial interpolation is done using the LaGrange's Interpolation formula as followed [3].

$$P^*(u) = \frac{(u - v_2)(u - v_3)\dots(u - v_{D+1})}{(v_1 - v_2)(v_1 - v_3)\dots(v_1 - v_{D+1})} w_1 + \frac{(u - v_1)(u - v_3)\dots(u - v_{D+1})}{(v_2 - v_1)(v_2 - v_3)\dots(v_2 - v_{D+1})} w_2 + \dots + \frac{(u - v_1)(u - v_2)\dots(u - v_D)}{(v_{D+1} - v_2)(v_{D+1} - v_3)\dots(v_{D+1} - v_D)} w_{D+1}$$

One last coefficient among the polynomial is the constant which is the CRC. Thus the decrypted CRC and this CRC are matched. If they are matched then the access is given to the client otherwise user is stated to be invalid. The process is explained in the following figure 3.

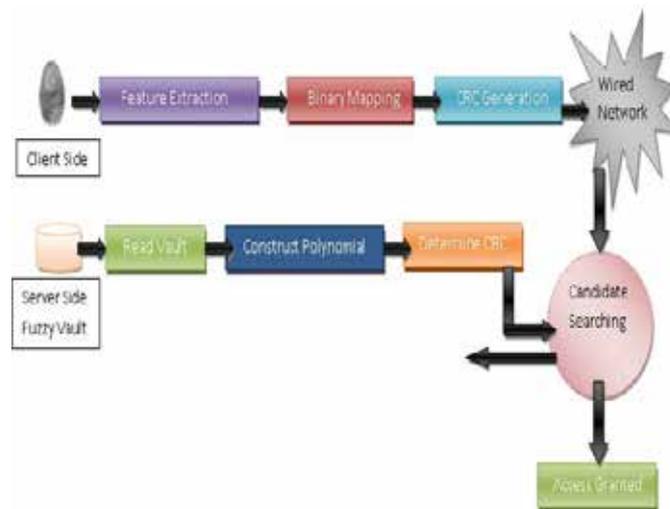


Figure 3. Decoding at client side

### 3.3 Algorithmic Approach

#### 1. Encoding Algorithm

2. Step 1: Extract facial features (A)
3. Step 2: Extract iris features (B)
4. Step 3: S = Secret key (Textual String)
5. Step 4: Extract fingerprint features (C)
6. Step 5: A|B = Coefficient of P(u)
7. Step 6: S|C = Variable of P(u)
8. Step 7: Generate 16-bit CRC
9. Step 8: P(u) = Polynomial Constructed
10. Step 9: Generate Genuine Set  $G = \{(u_1, P(u_1)), (u_2, P(u_2)), \dots, (u_n, P(u_n))\}$
11. Step 10: Generate Chaff points  $C = \{c_1, c_2, \dots, c_m\}$
12. Step 11: Generate Random points  $D = \{d_1, d_2, \dots, d_m\}$
13. Step 12: Generate constant pairs  $(c_j, d_j)$  where  $j=1,2,\dots,2m$  and its should be distinct from P(u)

14. Step 13: Generate the chaff set  $C = \{(c_1, d_1), (c_2, d_2), \dots, (c_m, d_m)\}$   
 $G \dot{\cup} C$
15. Step 14:
16. Step 15: Scramble the list generated
17. Step 16: The final vault set generated is  $VS = \{(v_1, w_1), (v_2, w_2), \dots, (v_{n+m}, w_{n+m})\}$
18. Step 17: Save vault [4].

## 2. Decoding Algorithm

Step 1: Extract fingerprint ( $GS'$ ) features

Step 2: Form Genuine Set

Step 3: Let  $V_l$  be the Vault points where  $l=1,2,3,\dots, m+n$

Step 4: Genuine Set from encoding is  $GS = \{u_1, u_2, \dots, u_n\}$

Step 5:  $u_1^*$  and  $V_l$  Genuine Set from decoding is  $GS^* = \{u_1^*, u_2^*, \dots, u_n^*\}$

Step 6: Match  $K \leq n$

Step 7: Form  $K$  such that

Step 8: Matched points  $(v_l, w_l)$  are added to the list of  $K$

Step 9:  $D =$  Degree of Polynomial and unique projections are  $D+1$

Step 10: Form set  $C = \{K, D+1\}$

Step 11: Apply LaGrange's Interpolation polynomial for each combination

$L = \{(v_1, w_1), (v_2, w_2), \dots, (v_{D+1}, w_{D+1})\}$

Step 12: Calculate CRC for  $L_1, L_2, \dots, L_D$

Step 13: Compare with CRC from encoding and if matched, key will be retrieved

## 3.4 Implementation Results

Data transfer over the client server configuration takes place securely maintaining data integrity, confidentiality and authenticity. This system secures individual biometric template data along with the data stored at specific location. It decodes with less response time.



Figure 4.1. Locking at server side

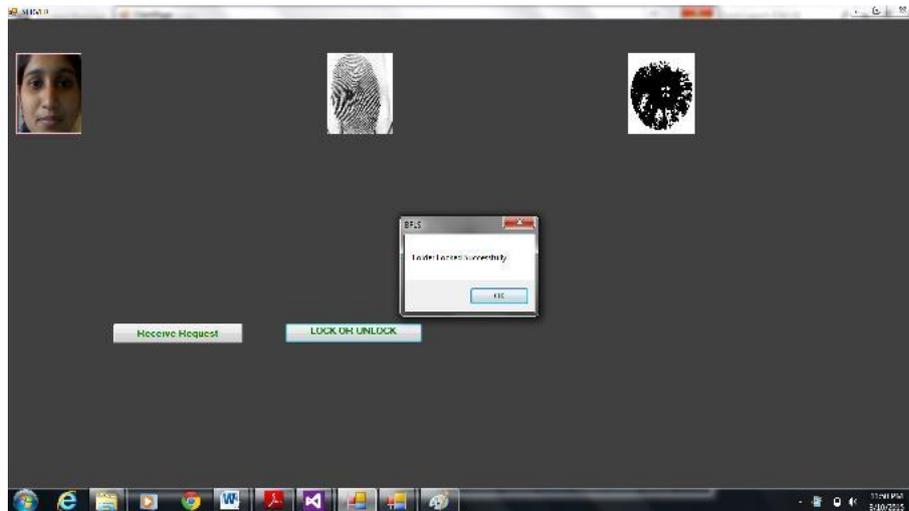


Figure 4.2. Locking at server side

### 3.5 Future Work

In future the same security system can be designed which will work for mobiles and secure mobile data on wireless mode.

## IV. CONCLUSION

Thus a feature-level fusion framework for the design of Multi-biometric cryptosystems that simultaneously protects the multiple templates of a user using a single secure sketch is proposed. The Multi-biometric cryptosystem and the feature level fusion model on wired network based on Client Server Configuration are also proposed.

## V. ACKNOWLEDGEMENT

A large measure of any credit for the “Feature Level Fusion based Multi-biometric Cryptosystem using Fuzzy Vault for Wired Network” must go to our guide Mrs. Manasi Kulkarni, Asst. Prof., and our ME coordinator Ms. Deipali Gore who with the author has assisted in the preparation of this paper. We admire their infinite patience and understanding that they guided us in field we had no previous experience. We are grateful to them for having faith in us.

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# LAND APPROVAL SYSTEM

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## ABSTRACT

*In the project implemented Approval Land searching and applying for new approval purpose it will be designed. This is designed in web oriented, the whole Tamilnadu state government approved land detail's it could be gathered ,so the public can be easily verified they are buying land is approved are not at the same time which type of approval and property owner details etc.. Available in the database .Newly applying for land approval, in this project easily done your work. New applier some important basic details gathered the approval office. The detail is could match the government civil detail and address proof, land valuation everything satisfied by the Tamilnadu government civil protocol based the land should be approved. The approval can be verify using this project and the land had been approved, the approval certificate can be showed the applier and easily download the certificate.*

**Keywords: Online, Approved.**

## I. INTRODUCTION

The Land Approval System is designed make an efficient website to the land register and the user. The main aim of this web application is to make a good web application that can make this Land approval process easy and accessible to everyone who is wanted. This system automates the manual recruitment process. In this system the user easily contact with the particular destination for requesting fort land approval. This project helps to overcome all the problems, by integrating the system that is the various jobs can be done in reduced man power. It helps to getting approval from the register, with great speed.The main objective of this process is to reduce the manual work in the register office and convenient to the user. It also developed programs to display the land approval information to the consumers. The objective of project is to provide a better management of the office and easily search the details required by the user. This process helps to the user to know about the original details of land owner which will help to the user against the malicious person.The main purpose of this system is to perform the land approval system is easy for the user and also provide the information of the original owner of the particular place. This process helps to the user to know about the original details of land owner which will help to the user against.

## 1.1 System Architecture

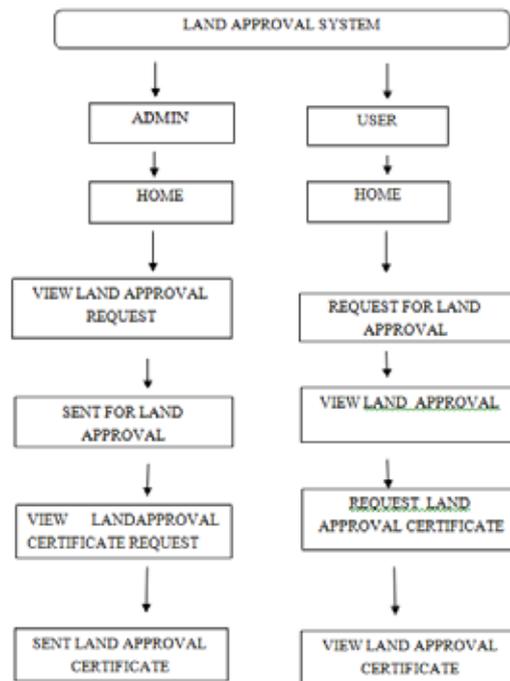


Fig. No: 1 System Architecture

## II. PROBLEM DESCRIPTION

### 2.1 Existing System

In the existing system there is a large process to getting approval from the user and verify the approval details. The existing system wanted huge number of man power and also the paper work. There may be a huge process to the administrator and the user. This existing process wants more paper work. The existing system is the manual system in which the user first visit the register office and checks availability of particular land and verify the approval floors. This process is time consuming and requires more amount of time. The land owner is not able to immediately contact with the Register because of the manual work of the reports. The main drawback of the existing system is not comfortable to comparing the details as well as getting the performance report in frequently.

#### 2.1.1 Disadvantage

1. The system consumes more manpower to store the details.
2. It is not providing the proper information about the owner and land details.
3. This is not a user friendly process.
4. There is possible to making mistakes in the man handling information.
5. The particular register must spent lot of time to maintain the details and updating the details.

### 2.2 Proposed System

The proposed system will carry out the defects in the previous systems. The main disappointments of previous systems are over come in this project. The performance are faster and easy accessible to the user for getting the report immediately. The proposed system is a web based application and maintains a centralized repository of

all related information. There is possible to view the details of the approval floor which is based on the land location. This proposed system has the mechanism to the user will get the details like approval floor, original owner details.

### 2.2.1 Advantages

1. The process is efficient to the Land Register and the user.
2. It is easy to handle and feasible to the administration.
3. The system reduces the time consuming to store the details and reduce the manpower.
4. The system uses to the user can easily find the required land owner detail and getting information about.
5. Managing the user request is easy and effective without any lose of information.
6. There is possible for cost reduction and space reduction to store the details.
7. There is a functionality to communicate with the owner which is user to find the original owner details.

## III. METHODOLOGY

1. Admin Module
2. User Module

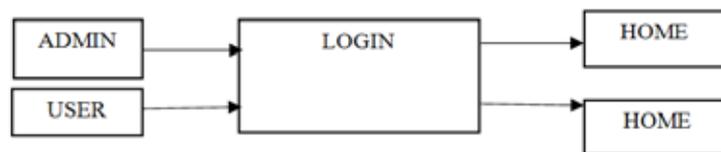


Fig.No:2 Methodology

## IV. MODULE DESCRIPTION

### 4.1 Admin Module

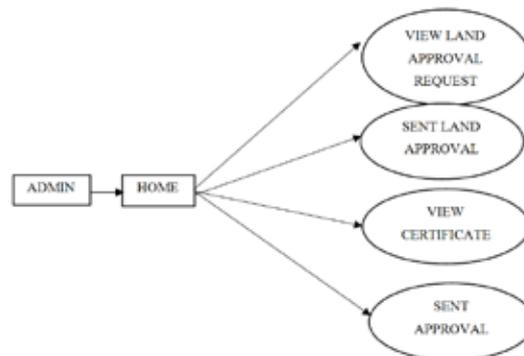


Fig.No:3 Admin Module

#### 4.1.1 Admin Initialization

This module is handling by administrator alone. Admin have a unique login and password. After that admin have to login and then only he can access the entire website.

#### 4.1.2 View Floor Approval Request

In this module used to the view all the requests from the land holder based on the approval. In this module has the functionality to view the request which helps to find the location of the land. The admin verify the details based on the user request.

#### 4.1.3 Send Floor Approval Report

In this module the admin sent the report for particular user based on the user request. This module works after the floor approval request module. The admin can find the location and verify the user request then admin posts the report to user for approvable floor in the particular place.

#### **4.1.4 View Original Owner Request**

In this module the admin can verify the request from the user for getting the information about the original owner of the particular owner. The admin can verify the details of the original land owner and according to the user request.

#### **4.1.5 Send Original Owner Report**

In this module admin can find the details about the original owner of the land. This module the admin can communicate with the land owner for getting permission for delivering the details. After the owner given the permission the admin send the details of the owner to user.

### **4.2 User Module**

#### **4.2.1 User Initialization**

In this module every user have to login into our website otherwise user have to register their details into our website after complete registration user get a unique user id and password after that only user can login in our website.

#### **4.2.2 Request for Floor Approval**

In this module the user can send the request to the admin for Floor Approval. In this module user can specify the required floor of the building and verify the approval floor in the particular land.

#### **3.2.3 View Floor Approval**

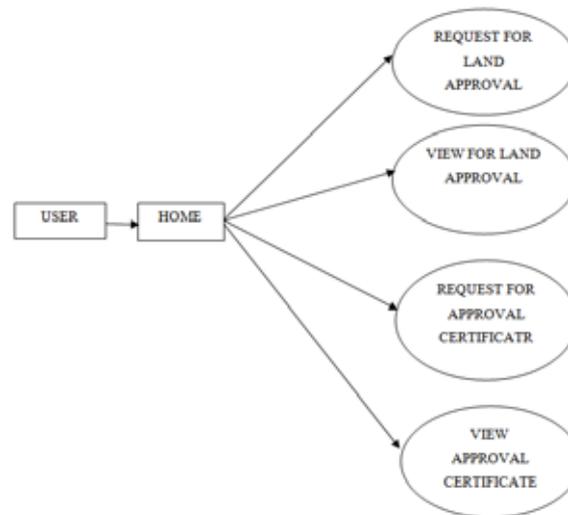
In this module used to the user for verify the approval floor in the particular area. This module used to getting report from the admin for permitted floor which is helpful to the user for rearranging the plan.

#### **4.2.4 Request for Original Owner Details.**

This module used to the user can send the request to the admin for getting details about the Original owner of the particular land. In this module user can specify the required land details which will help top the admin can verify the owner of particular land.

#### **4.2.5 View Original Owner Details**

In this module used to the user for verify the details of the owner in the particular area. This module helpful to the user views the original owner details from the admin for verify the owner details and also produce awareness of the user.



**Fig.No:4 User Module**

## **V. CONCLUSIONAND FUTURE WORK**

The main purpose of the project is to avoid the critical process of applying for land approval to the user and the register. The customer can easily request for approval floor in particular place and can easily get the report immediately. This project aims to move away from the traditional method of manual process of land approval system in which an individual has to physically record the reading. Instead the project proposes to successfully be able to contact with the register to land owner and land owner to register. The main advantage of this system is to reduce the work of the staff and reduce the time of the user while waiting for receiving the report from the register. This process has the efficient mechanism to display original owner details while the user want to get the information about the owner details after getting permission from the owner. This software package can be operational in menu driven way which will be helpful to the end user. This main usage is to verify the real owner of the land which will helps to the user to buy land from the real person without any corruption in the land document. Further extension of the system is to allow the user to getting land approval through this application then pay online. The extension of the process improves to view the details of the owner directly as well as designed to buy the land online. Maps are provided to facilitate the users.

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## BIOGRAPHICAL NOTES

|   |   |
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