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**Dr. K. Saravanan**

Kokula Krishna Hari Kunasekaran, Daniel James &  
Saikishore Elangovan

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**VOLUME 1**

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## **PREFACE**

I am delighted to welcome you to the Third International Conference on Information Engineering, Management and Security 2016. ICIEMS is an international interdisciplinary conference covering research and developments in the field of Engineering Technology, Industrial Engineering, Application Level Security and Management Science. The conference has been a good opportunity for participants coming from various part of the world to present and discuss cutting-edge researches in their respective research areas. One of the unique and valuable dimensions to the ICIEMS conference series is the way the series brings a healthy mixture of high standards of selectivity coupled with wide participation from academic community together from around the world to discuss ways to serve learners better.

A conference such as this requires a huge amount of work from many people. In particular, we take this opportunity to thank the organising committee as well as the researchers who supported the conference in a multitude of ways. I would like to extend our sincere gratitude to Association of Scientists, Developers and Faculties team specially the United Kingdom Team who have been the integral part of carving this book into an wonderful structure. I would like to take this opportunity to express our gratitude and appreciation to you all for making this conference a great success.

I congratulate all the organizers and wish the function a great success.

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# Balance, Kinetics, Isotherm and Thermodynamic Modeling of Adsorption of Reactive Yellow 107 on to *Balsamodendroncaudatum* Wood Squander Activated Carbon Material

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**Abstract:** *Balsamodendron caudatum* wood waste activated carbon (BACM) has the potential to take up the dyes from aqueous solution. The inappropriate discarding of dyes in waste water constitutes an environmental problem and can cause harm to the flora and fauna. Present examination deals with the exploitation of (BACM) waste as adsorbent for the elimination of Reactive Yellow 107 dye from its aqueous solutions. The treated (BACM) using sodium sulphate was evaluated through SEM and XRD. The analysis indicates that adsorption is inclined by initial dye concentration, contact time, dye solution pH, thermodynamic parameters such as the free energy, enthalpy, entropy and adsorption temperature have been investigated in the present study. A Kinetic study of dye followed the pseudo-first-order, pseudo second-order and Elovich models correspondingly. Conclusions show that the pseudo first order kinetic model was found to compare the investigational data fit.

**Keywords:** BACM, Adsorption, Reactive Yellow 107, kinetics, isotherm; low-priced sorbents; aqueous solution.

## INTRODUCTION

Water is the most essential requirement in daily life that has been contaminated by the disposal of domestic, municipal, and industrial wastes. Anything, which is not needed, finds its way to the nearest watercourse or land, which further pollutes the ground water. So, there is a need to utilize the available resources effectively without polluting the water. Textile effluents are known toxicants, which inflict acute disorders in aquatic organisms. Uptake of textile effluents through food chain in aquatic organisms may cause various physiological disorders like hyper tension, sporadic fever, renal damage, and cramps etc., which are hazardous to human as well as animal health. Dyes are the most common water pollutants. Various sources of dye effluents are from pickling industries, paper and pulp industries, dye stuff industries, tanning, and textile industries. So, there is a need to utilize the available resources effectively without polluting the water (Prasad and Kumar 2010). Textile industries have shown a significant increase in the use of synthetic complex organic dyes as coloring materials (Talarposhti et al. 2001). A dye is carcinogenic, affects reproductive organs and develops toxicity and neurotoxicity (Lakshmi 1987). Therefore, the dyes are to be necessarily removed from water and wastewater. Different processes for color removal typically include physical, chemical, and biological schemes. Some processes such as electrochemical techniques and ion-pair extractions are relatively new for textile waste treatment, while others have been used in the industry for a long time. Adsorption has been found to be superior to other techniques for water reuse in terms of initial cost, simplicity of design, use of operation, and insensitivity to toxic substances (Meshko et al. 2001). The lower generation of residues, easy metal recovery, and the possibility to reuse adsorbent are the greatest advantages of this method (Gurnani et al. 2003). One of the major challenges associated with adsorption by activated carbon is its cost effectiveness. Hence research of recent past mainly focused on utilizing waste materials as alternatives to activated carbon. Bamboo (Ahmad et al., 2009), sugar cane bagasse ash (Kanawade et al., 2011), bone

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char (Alvin et al., 2010), fly ash (Sell et al., 1994), peat moss (Allen and McKay 2001; Chen et al., 2001), ipomoea carnia stem waste (Karthikeyan et al., 2007), jujuba seeds (Somasekhara Reddy et al., 2012) and potatoes, egg Husk (Hila et al., 2012) and solid coal (Katarzyna Czerw et al., 2016) are some of the waste materials which have been fruitfully tried for this purpose.

## 1 Experimental

### 1.1 Adsorbent

*Balsamodendron caudatum* wood waste was obtained from various regions of Erode & Tirupur Districts, Tamil Nadu, and India. The study of *Balsamodendron caudatum* wood waste material is used as adsorbent is expected to be economical, environmentally safe and it has practical importance. To develop adsorbents, the material was first ground and washed with doubly distilled water and then dried. The dried material thus obtained was treated with hydrogen peroxide (30%W/V) at room temperature for about 24 hrs to oxidize the adhering organic matter. The resulting material was thoroughly washed with doubly distilled water and then subjected to the temperature of 120°C for the moisture removal.

One portion of the above material was soaked well with Na<sub>2</sub>SO<sub>4</sub> solution for a period of 24 hours. At the end of 24 hrs the excess of Na<sub>2</sub>SO<sub>4</sub> solution were decanted off and air-dried. Then the materials were placed in the muffle furnace carbonized at 120-130°C. The dried materials were powdered and activated in a muffle furnace kept at 800°C for a period of 60 minutes. After activation, the carbon of obtained were washed sufficiently with large volume of water to remove free acid, Then the obtained material was washed with plenty of water to remove excess of acid, dried then to desired particle size and named as BACM.

### 1.2 Preparation of Aqueous dye Solution

The stock solutions of the dye (1000 mg/L) were prepared by dissolving 1 g of respective dye in one litre of water without any further treatment, which were kept in dark coloured glass bottles. For batch study, an aqueous solution of this dye was prepared from stock solutions in deionized water. NaOH and HCl solutions were used as buffers for pH studies.

### 1.3 Amount of dye Adsorbed

The formula used to find the Amount of dye adsorbed,  $Q_e$ , was as shown below:

$$Q_e = \frac{C_0 - C}{M} \times V \quad (1)$$

$Q_e$  (mg/g) is the amount of dye adsorbed at equilibrium,  $V$  (L), is the volume of the solution dye,  $C_0$  (mg/L) is the initial dye concentration,  $C$  (mg/L) is the dye concentration at any time and  $M$  (g) is the adsorbent dosage.

The percentage of removed anionic dye (R %) in solution was calculated using eqn. (2)

$$\% \text{ Removal} = \frac{C_0 - C_t}{C_0} \times 100 \quad (2)$$

The initial concentration of Reactive Yellow 107pH and temperature was investigated by varying any one parameters and keeping the other parameters constant

### 1.4 The Pseudo First – Order Equation

The pseudo first - order equation (Lagergren 1898) is generally expressed as follows.

$$\frac{dq_t}{dt} = k_1(q_e - q_t) \quad (3)$$

Where,

$q_e$  and  $q_t$  are the adsorption capacity at equilibrium and at time  $t$ , respectively (mg g<sup>-1</sup>),  $k_1$  is the rate constant of pseudo first –order adsorption (l min<sup>-1</sup>).

After integration and applying boundary conditions  $t = 0$  to  $t = t$  and  $q_t = 0$  to  $q_t = q_t$ , the integration form of equation (3) becomes.

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$$\log(q_e - q_t) = \frac{\log(q_e) - k_1}{2.303} \times t \quad (4)$$

The value of  $\log(q_e - q_t)$  were linearly correlated with  $t$ . The plot of  $\log(q_e - q_t)$  Vs  $t$  should give a linear relationship from which  $k_1$  and  $q_e$  can be determined from the slope and intercept of the plot, respectively.

### 1.5 The Pseudo Second – Order Equation

The pseudo second – order adsorption kinetic rate equation is expressed as (Ho et al. 2000)

$$\frac{dq_t}{dt} = k_2(q_e - q_t)^2 \quad (5)$$

Where,  $k_2$  is the rate constant of pseudo second order adsorption ( $\text{g} \cdot \text{mg}^{-1} \cdot \text{min}^{-1}$ ). For the boundary conditions  $t = 0$  to  $t = t$  and  $q_t = 0$  to  $q_t = q_t$ , the integrated form of equation (5) becomes.

$$\frac{1}{q_e - q_t} = \frac{1}{q_e} + k_2 t \quad (6)$$

Which is the integrated rate law for pseudo second – order reaction. Equation (6) can be rearranged to obtain equation (7), which has a linear form.

$$\frac{t}{q_t} = \frac{1}{k_2 q_e^2} + \frac{1}{q_e} t \quad (7)$$

If the initial adsorption rate  $h$  ( $\text{mg} \cdot \text{g}^{-1} \cdot \text{min}^{-1}$ ) is

$$h = k_2 q_e^2 \quad (8)$$

Then Equations. (7) And (8) become:

$$\left( \frac{t}{q_t} \right) = \frac{1}{h} + \frac{1}{q_e} t \quad (9)$$

The plot of  $(t/q_t)$  and  $t$  of equation (7) should give a linear relationship from which  $q_e$  and  $k_2$  can be determined from the slope and intercept of the plot, respectively.

### 1.6 The Elovich Equation

The Elovich model equation is generally expressed (Chien and Clayton 1980) as

$$\frac{dq_t}{dt} = \alpha \exp(-\beta q_t) \quad (10)$$

Where,  $\alpha$  is the initial adsorption rate ( $\text{mg} \cdot \text{g}^{-1} \cdot \text{min}^{-1}$ ),  $\beta$  is the adsorption constant ( $\text{g} \cdot \text{mg}^{-1}$ ) during any one experiment.

To simplify the Elovich equation, assumed  $\alpha\beta t \gg 1$  and by applying the boundary conditions  $q_t = 0$  at  $t = 0$  and  $q_t = q_t$  at  $t = t$  Eq (10) becomes;

$$q_t = \frac{1}{\beta} \ln(\alpha\beta) + \frac{1}{\beta} \ln t \quad (11)$$

If Reactive Yellow 107 adsorption fits the Elovich model a plot of  $q_t$  vs  $\ln t$  should yield a linear relationship with slope of  $(1/\beta)$  and an intercept of  $(1/\beta) \ln(\alpha\beta)$

## 2 Results and Discussions

### 2.1 Characterization of Adsorbent

Physico-chemical characterizations of the adsorbents are presented in Table 1.

Table 1 Characteristics of the Activated Carbon BACM

Parameter	BACM
pH	6.5
Surface area (m <sup>2</sup> /g)	339.64
pH <sub>zpc</sub>	4.5

The surface area of the BACM was measured through N<sub>2</sub> adsorption at 77K using a NOVA1000, Quanta chrome Corporation. The pH of BACM was measured by a PHS-3C pH meter. pH of zero charge (pH<sub>zpc</sub>) of the samples was determined using pH drift method (Fariaa et al., 2004). The surface area of the BACM obtained from the N<sub>2</sub> equilibrium adsorption isotherms was found to be 339.64 m<sup>2</sup>/g. The results of "pH drift" experiment, from which the pH<sub>zpc</sub> of BACM studied in this test was found to be 4.5.

### 2.2 Effect of pH

From the set of experiments conducted to find the effect of pH on adsorption phenomenon, it was observed that pH influences BACM surface dye binding sites and the dye chemistry in water. Figure 1 shows the amount of dye adsorbed,  $q_e$  using acid activated adsorbent at initial pH value. In this experiment, the initial dye concentration was fixed at 20 mg/L. From the shake flask experiments, better colour removal of the dye, Reactive Yellow 37, was observed at pH of 6.5. The uptake of Reactive Yellow 37 was found to be optimal at pH 6.5 with the maximum dye uptake of 81.6 mg/g.

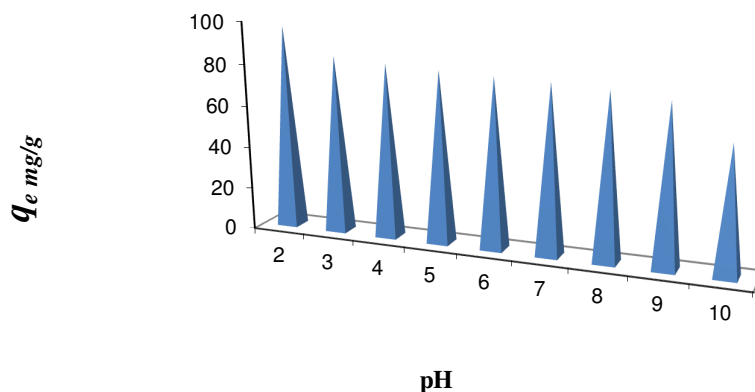


Figure.1 Influence of pH on stability uptake of Reactive Yellow 107 adsorption onto BACM. 100 mg; V, 50 ml; C<sub>0</sub> 20 mg/L; temperature, 30°C).

### 2.3 Effect of Adsorbent Dosage

The effect of quantity of acid treated BACM on the amount of color adsorbed was studied by agitating 50 ml of 20 mg/L dye solution with amount of sorbent addition was 100 mg. All these studies were conducted at room temperature and at a constant speed of 200 rpm. An increase in % colour removal was observed with an increase in adsorbent dosage.

### 2.4 Effect of Initial dye Concentration and Contact Time

For conducting the kinetic studies, the dye is agitating at equal time intervals were used. Contact time experiments were carried out by agitating with 50 ml of dye solutions whose concentrations viz. 20 mg/L, 40 mg/L and 60 mg/L at an optimum pH of 6.5 with 100 mg of BACM at room temperature. The rate of agitation was maintained constant at 250 rpm. The colour reduction profiles were obtained using the absorbance capacity.

### 2.5 Influence of Temperature on Kinetic Rate Constant and Rate Parameters

Sorption experiment was established out with preset initial dye concentration (20mg/L) at pH 6.5 and at different temperature viz. 30 °C, 45 °C and 60 °C. The study of the data in (Table 2) reveals that the effect of temperature of the dye has very little influence on the pseudo second order rate constants. The table 2 also reveals that the effect of the temperature of dye on Elovich and pseudo first

order rate constant is neither considerable nor little. It is evident that the adsorption of dye on the BACM waste activated carbon is best described by first order rate equation with regression coefficient value is greater than 0.98.

Table 2. The adsorption kinetic model rate constants for BACM at different Temperature

Adsorbent	Initial Temperature	Pseudo first order		Pseudo Second order			Elorich Model		
		$k_1$ $l\text{min}^{-1}$	$r^2$	$k_2$ $g\text{mg}^{-1}\text{min}^{-1}$	$h$ $\text{mg}\text{g}^{-1}\text{min}^{-1}$	$r^2$	$\beta$ $\frac{g}{\text{min}^{-1}}$	$\alpha$ $\frac{\text{mg}\text{g}^{-1}}{\text{min}^{-1}}$	$r^2$
BACM	30°C	0.0234	0.9986	0.0017	0.4572	0.8521	0.1438	0.8547	0.9356
	45°C	0.0128	0.9767	0.0670	4.3547	0.4016	0.1578	0.4689	0.9093
	60°C	0.03467	0.7096	0.0056	0.1435	0.6458	0.1345	0.4345	0.8654

## 2.6. Morphology

The study by SEM of the adsorbent shown in the fig. 1 exposed that, it is highly permeable in nature. From the SEM results, it was found that there are uniform holes and cave type openings on the surface of the specimen that would definitely have increased the surface area (Khattri et al. 2000)

## 2.7. XRD Analysis

Fig. 2 shows the wide angle XRD pattern for porous carbon sample. The XRD analysis of permeable carbon proved that the carbon prepared by acid treatment shows the X-ray diffraction angle  $2\theta = 23$  it is similar to the reported graphitization wood waste (Syed 2011).

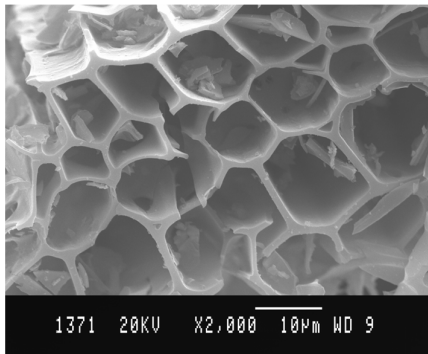


Figure. 2 SEM analysis for BACM

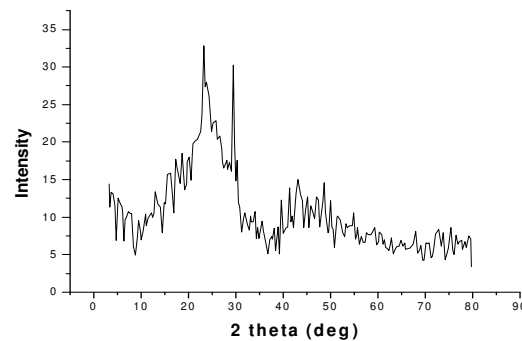


Figure. 3 XRD pattern for BACM

## 3.0 Adsorption Thermodynamics

The rate of a reaction or the reaction rate can be calculated from the knowledge of kinetic studies. But the changes in reaction that can be expected during sorption process require the brief idea of thermodynamic parameters. The three main thermodynamic parameters include, enthalpy of adsorption ( $\Delta H$ ), free energy change ( $\Delta G$ ) due to transfer of unit mole of solute from solution to the solid liquid interface and entropy ( $\Delta S$ ) of adsorption.

The thermodynamic parameters obtained for the adsorption systems were calculated using the following equation (Inbaraj and Sulochana 2002).

$$K_c = \frac{C_{Ae}}{C_e} \quad (16)$$

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$$\Delta G = -RT \ln K_c \quad (17)$$

$$\log K_c = \frac{\Delta S}{2.303R} - \frac{\Delta H}{2.303RT} \quad (18)$$

$K_c$  is equilibrium constant,  $C_{Ac}$  is the solid phase concentration at equilibrium,  $C_c$  is residual concentration at equilibrium,  $R$  is gas constant (J/mole) and  $T$  is the temperature in Kelvin.  $\Delta H$  and  $\Delta S$  was obtained from the slope and intercept of Vant Hoff plot ( $1/T$  Vs  $\ln K_c$ ). Table 5 gives the value of  $\Delta G$ ,  $\Delta S$  and  $\Delta H$  for the adsorption of BACM. The negative values of free energy change ( $\Delta G$ ) indicate the feasibility and spontaneous nature of adsorption of BACM. The positive value of  $\Delta S$  is due to the increased randomness during the adsorption of adsorbents.

Table 3 Thermodynamic parameters for Reactive Yellow 37, BACM adsorption.

Adsorbent	$\Delta G$ (J mol <sup>-1</sup> )			$\Delta$ (J mol <sup>-1</sup> K <sup>-1</sup> )	$\Delta S$ (J mol <sup>-1</sup> K <sup>-1</sup> )
	30°C	45°C	60°C		
BACM	-3245.84	-5652.28	-7569.07	79.77	256.79

### 3. Conclusions

The sorption of reactive dye on the BACM was originate to be reliant on the pH, (The most favourable pH of Reactive Yellow 107 was 6.5), temperature and concentration for adsorbent. Thermodynamic parameters obtained for the adsorbent accounts for feasibility of the process at each concentration. Adsorption equilibriums were reached within 105 min contact time for reactive dye used in this test. Thermodynamic parameters obtained for the adsorbent accounts for feasibility of the process at each concentration. The kinetics of Reactive Yellow 107 sorption on adsorbent was found to follow a pseudo first-order rate equation. An equilibrium isotherm for the adsorption of Reactive Yellow 107 on BACM was analysed by the Langmuir isotherm equations. Result showed that the Langmuir isotherm best-fit the Reactive Yellow 107 adsorption.

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# Beyond Bag of Features: Adaptive Hilbert Scan Based Tree for Image Retrieval

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**Abstract-** One fundamental problem in large scale image retrieval with the bag-of-features is its lack of spatial information, which affects accuracy of image retrieval. Depending on distribution of local features in an image, we propose a novel adaptive Hilbert-scan strategy which computes weight of each path at increasingly fine resolutions. Owing to merits of this strategy, spatial information of object will be preserved more precisely at Hilbert order. Extensive experiments on Caltech-256 show that our method obtains higher accuracy.

**Keywords :** Hilbert-Scan; image retrieval; bag-of-features; feature representation

## I. INTRODUCTION

In last decade, the bag-of-features (BOF) [1] model has become very popular in image retrieval and object classification because of its simplicity and good performance. However, the BOF model loses sight of spatial order of local descriptors, which severely limits the descriptive ability of image representation. Hence, it is incapable of capturing shapes or locating an object in image. To overcome this drawback, many extensions of BOF model were proposed such as SPM [2], Spatial BOF [3], Spatial Weighting BOF [4] and HS-BOF [5].

In our research, we focus on the Hilbert-Scan based tree (HSBT) [5] approach which can do retrieval quickly yet still loss some spatial information of interest points. We aim to construct a mechanism to select scanning path for each image automatically. Generally, two factors are considered in our proposed method. One is the total number of interest points in two adjacent blocks in an image. Another one focuses on comparing the amount of interest points between these two blocks. In order to combine these two factors effectively, a weighing coefficient is proposed to control the relative significance of them. Furthermore, inspired by the generative method of Hilbert-Scan, a hierarchical strategy is performed from global geometric distribution of interest points from the local geometric distribution of them. Since the mass of interest points are closer in linear sequence after mapping, the appearance of key objects can be captured more quickly. The merging error and the number of layers in HSBT will be reduced.

## II. Related Works

### A. Hilbert-Scan

A Hilbert curve is a continuous fractal space-filling curve first described by the German mathematician David Hilbert in 1891 [6]. Hilbert space filling curve has the property to preserve the locality between objects of multidimensional space in the linear space. If the distance between two points in the 2-D image is small, the distance between the same pair of points in the 1-D sequence is also small in

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most cases. In the application of data analysis, it is used for scanning data in two dimensional spaces. This scanning way is called Hilbert-scan. Original Hilbert-Scan requires square-sized image. To solve this problem, Reference [7] proposed Pseudo Hilbert-Scan which can be applied for arbitrarily-sized image. Fig. 1 and Fig. 2 show the Hilbert-Scan and Pseudo Hilbert-Scan.

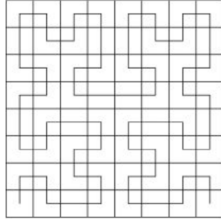


Figure 1. 8 × 8 Hilbert curve in 2-D space

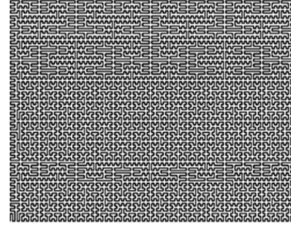


Figure 2. Pseudo Hilbert-Scan for arbitrarily-sized rectangle

### B. Hilbert-Scan Based Tree (HSBT)

We set  $r$  as the resolution of an image. After detecting the interest points, we use Pseudo Hilbert-Scan [7] to map all this interest points from 2-D space to 1-D space. Then this linear sequence is divided into many segments averagely which called sub regions. The  $j$ -th region in  $i$ -th grouping is labeled by  $R_{ij}$  and it is made of four data: the number of local features in this region ( $N_{ij}$ ), the region's gravity center ( $C_{ij}$ ), the set of descriptors ( $D_{ij}$ ), the clustering center of this region ( $K_{ij}$ ). Regions in  $i$ -th grouping are denoted as  $R_i$ . There exist three steps in grouping stage: initialization, region selection and region merging.

- 1) **Initialization:** Linear sequence  $S$  is firstly divided into  $N$  segments by a factor  $k$ .
- 2) **Region selection:** Firstly, we sort regions depended on the number of interest point. After sorting,  $R_i$  can be changed as  $R'_i$ . For sorted set,  $R'_i = \{R'_{i1}, R'_{i2}, \dots, R'_{in}\}$ . Finally,  $R'_i = \{R'_{i1}, R'_{i2}, \dots, R'_{in}\}$ .
- 3) **Merging step:** For example, there exist three adjacent regions in the  $i$ -th grouping:  $R'_{i1}, R'_{i2}$  are main regions and  $R'_{i3}$  is the rest region,  $R'_{i3}$ . There comes a question that which main region  $R'_{i1}$  should be merged into. The merging rule [5] is :

$$\frac{N_{i1} + N_{i3}}{C_{i1} + C_{i3}} < \frac{N_{i2} + N_{i3}}{C_{i2} + C_{i3}} \quad (1)$$

### III. Adaptive Hilbert-Scan

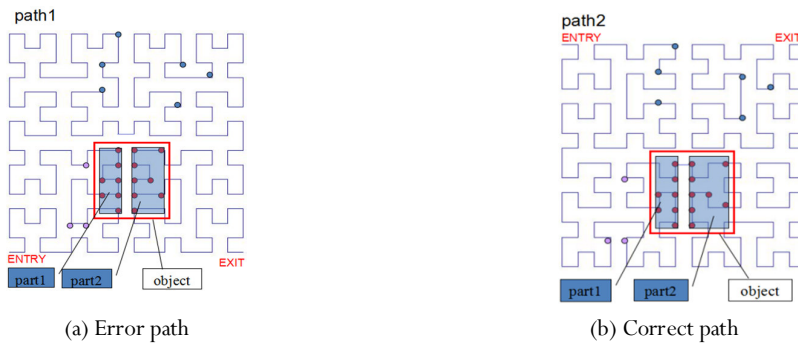


Figure 3. Drawback of Hilbert-scan based tree structure

HSBT can add the spatial information of interest points into nodes without any labeling and manual handing. However, four different kinds of paths can be utilized for image scan. When choosing different scanning path, the order of each block in an image is different in 1-D sequence. For example, see Fig. 3, the region containing object will be separated into two parts in liner sequence by using path1. Thus, many uncorrelated interest points (blue and purple dots in Fig. 3) will be mistakenly merged into this region when building HSBT. So our target is to make sure that those interest points extracted from local appearance of object are as close as possible after

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mapping them from 2-D space to 1-D space. Hence, a novel hierarchical path selection strategy is proposed to choose correct path for each image.

### C. Path selection

As we mentioned in the last part, the region which contains the majority of interest points should be treated as the main region, for example, sub-block 2 and sub-block 3 in Fig. 4. So the first factor focuses on the number of interest points in sub-blocks on the both sides of split edge (see Fig. 4 the yellow lines represent the split edge). The formula is given as follow,

$$(2)$$

In this formula,  $n_1$  and  $n_2$  denote the number of interest points in sub-blocks on the both sides of split edge respectively,  $n$  denotes the total number of interest points in this image,  $s$  denotes the  $s$ -th scanning path. If  $n_1 > n_2$ , sub-block 1 and sub-block 2 shouldn't be separated because they contain more interest points.

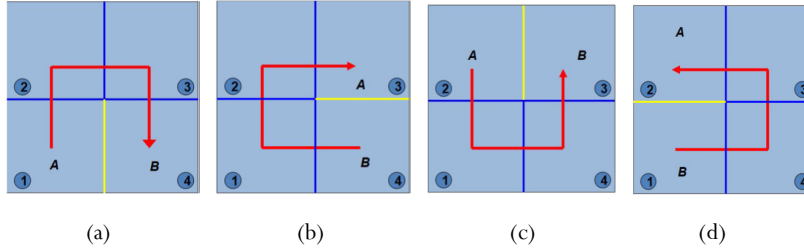


Figure 4. Illustration of four kinds of scanning path in an image

At this time, there comes a problem that if most of interest points in split region distribute in one sub block (e.g. sub-block 1 or sub-block 2 in Fig 4 (a)), then these interest points are still close after mapping them to 1-D space. To solve this problem, another factor is proposed as follow,

$$(3)$$

To combine these two factors effectively, we set a weighting coefficient  $\lambda$  to control the relative importance of them. And the final formula is as follow:

$$(4)$$

Inspiring by the generative method of Hilbert Curve [7], we proposed to perform this strategy at increasingly fine resolutions. Thus, this hierarchical strategy can be represented as follow, where  $i$  denotes the  $i$ -th division,  $k$  is the total number of division,  $j$  denotes the  $j$ -th sub-block at  $i$ -th division,  $c$  denotes the total number of interest points in image,  $n_j$  denotes the number of interest points in  $j$ -th sub block at  $i$ -th division,  $w_j$  represents the weight of  $j$ -th block at  $i$ -th division relative to the whole image. Because this novel strategy can help select correct scanning path for each image automatically, we call this method Adaptive Hilbert-Scan (AHS).

$$(5)$$

After choosing path and constructing HSBT for each image, the BOF model will be combined with adaptive Hilbert-Scan based tree (AHSBT) to form the final model Adaptive Hilbert-Scan based Bag-of-Features (AHS-BOF). Finally, we are able to obtain a descriptive histogram representation for each image by AHS-BOF.

## IV. Experiments

In our experiments, we evaluate this approach on a challenging object dataset -- Caltech-256. Mean average precision (mAP) is used to evaluate our proposed method. We select SIFT [8] to extract local features. To train the vocabulary, we randomly choose 50 images from each category (totally 12800 images) as the training set. Then, K-means is used to generate the vocabulary. For testing, 5 images per category are randomly selected from the rest images in each category. We choose the same vocabulary size as the previous work [5]. We set  $K=500$  and  $Th=0.8$ . In Fig. 5, it can be clearly seen that our method outperforms than other methods. Table I compares AHS-BOF with previous work HS-BOF under different vocabulary sizes (10k, 20k, 50k, and 100k) in terms of mAP. When vocabulary size is 100k, the number of visual words is almost equal to the numbers of local descriptors. Hence, the histogram representations become less discriminative, which affect the retrieval precision. So no matter which kind of scanning path we select,

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the retrieval result is nearly the same. The result of level 3 in Table II has a little degeneration which indicates paying more attention on local details of interest points will lose the appearance of objects in building AHSBT

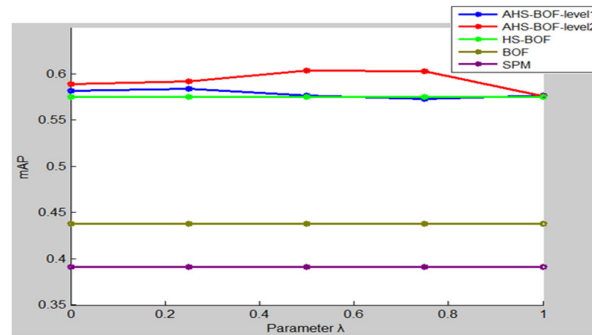


Figure 5. Illustration of performance under different  $\lambda$

Table I Comparison of mAP on Caltech-256 with different vocabulary size

Word size	BOF[11]	SPM[11]	HS-BOF	AHS-BOF
10k	0.438	0.391	0.576	0.604
20k	0.541	0.437	0.625	0.653
50k	0.573	0.472	0.635	0.657
100k	0.604	0.499	0.595	0.596

Table II Results under different level

L (level of split)	AHS-BOF ( $\lambda=0.5$ )	HS-BOF
1	0.576	0.575
2	0.604	
3	0.592	

## V. Conclusions

In our study, we propose a novel AHS method depended on the distribution of interest points in image. The AHS can choose correct path for each image automatically. There are two main contributions in our method: a) it can reduce the merging error and recover the shape of objects more quickly; b) The computing time of constructing tree is reduced because of fewer layers. Evaluations on public database Caltech-256 have demonstrated the effectiveness of this method.

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# Optimum Reliability Analysis of Mobile Adhoc Networks using Universal Generating Function under Limited Delivery Time and Cost

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**Abstract:** *The emphasis in this paper is on executing the optimum MANET reliability subject to the constraints delivery time and cost. This work is devoted to assess the MANET reliability in a Universal Generating Function (UGF) paradigm. By introducing different composition operators over UGF, the physical happening of the network can be predicted. An algorithm has been proposed to execute the system reliability.*

**Keywords:** *MANET, Network Reliability, Universal Generating Function, Group Communication Application, Multicasting, delivery time, transmission cost*

## 1. Summary and Motivation

Network reliability is an important part of planning, designing and controlling network. Designing, developing and testing real applications for ad hoc network environments still deserves particular attention by the MANET research community. A MANET is a dynamic multi-hop wireless network that is established by a group of mobile nodes on a shared wireless channel. Mobile ad hoc networks can be in military use, rescue operations, remote site construction, and communication among a group of islands or ships. The efficiency of the MANET is executed with the parameters reliability, transmission time and cost. This work instantiates an algorithm to obtain the optimum MANET reliability achieved by any of the sub MANET in a dynamic environment. The proposed Algorithm is validated using a numerical example in a battlefield environment.

This work concentrates on calculating the MANET reliability subject to the constraints time and cost using UGFT. The first UGFT was proposed by Ref [1] and was improved by Ref [2] using some simplified techniques. Ref [3,4] extended the UGFT further for general multistate network reliability, which is more practical and reasonable than acyclic multistate networks. UGFT is applied to obtain MANET reliability by Ref [5,6]. The goal of this paper is to find which combination of the sub MANET provides the optimum reliability with minimum cost and delivery time.

## 2. Mathematical Modeling

The Universal Generating Function Technique is considered as an important tool to evaluate the reliability assessment of a multi-state system. Composition operators are introduced to composite different universal generating functions.

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**Definition 2.1** The individual UGF for the source node (S) is denoted by  $u(S)$  and is defined as  $u(S) = \sum_{N \subseteq \theta_S} P_{S:N} X^N$ . Here the

exponent N represents the state and the coefficient of X denotes the event probability of the set of nodes ( $N \subseteq \theta_S$ ) that receive information directly from the source node S.

**Definition 2.2** The individual UGF for neighbouring nodes denoted by  $u(n)$  is defined as a polynomial function of X by  $u(n) = \sum_{N \subseteq \theta_n} P_{n:N,T} X^T$  where  $P_{n:N,T}$  refers to the probability of sending messages from the node n to a set of nodes N, ( $N \subseteq \theta_n$ ) where they get transmitted within the group (only one time repetition is permitted) and finally reaches the terminal T.

**Definition 2.3** The path UGF via node n, denoted by  $U(n) = U(S) \otimes u(n)$ ,  $n = 1, 2, 3, \dots$  is the composition of node UGF and its source UGF. It is defined as  $U(n) = \sum_{N \subseteq \theta_n} P_{S:n,N,T} X^T$ . Here  $P_{S:n,N,T}$  denotes the probability of transmitting the received information

by the node n from the source S, to the destination node T through the neighbours of node n. For a source node, the node UGF and path UGF are the same that is,  $U(S) = u(S)$ .

**Definition 2.4** Reliability of a sub MANET is defined as the probability of the event that the transformed message received at the sub source from the main source has been passed among the group members (nodes) and reached the sub source again.  $R_{SM}$  is obtained from  $\sum_{n \subseteq \theta_n} U(n)$ . Reliability of the MANET reliability from source node (headquarters) to the target node T is given by  $R_M = \sum R_{SM_i}$ .

The cost and time for a particular transmission is included at the subscript.  $u(S) = \sum_{N \subseteq \theta_S} P_{S:N:T} X_{(c,t)}^T$ . The first subscript denotes the cost and the latter one denotes the time constraint (sec). The cost and time factors are added consecutively for any information initiated from the source node and transmitted through any path and reached the target successfully.

### 3. Reliability Calculation Algorithm

**Step 1:** Define the UGF for each sub source (source) of the available SMs as

$$u(S) = \sum_{N \subseteq \theta_S} P_{S:N} X_{(c,t)}^N$$

**Step 2:** Define the UGF for all neighbouring nodes except the source in each SMs as  $u(n) = \sum_{N \subseteq \theta_n} P_{n:N,T} X_{(c,t)}^N$

**Step 3:** Obtain the path UGF U (n) as a polynomial in X using the composition operator  $U(n) = u(S) \otimes u(n)$ .

**Step 4:** Compute the reliability, the transmission cost and delivery time of SMs. Select the reliable sub MANET with optimum reliability.

### 4. Numerical Analysis

Forming a fixed wired network is highly impossible in a war zone. The military applications have to respect time constraint in order to update positions of wounded soldiers, get enemy map position or find medical assistance etc. Providing time constrained services can highly benefit the MANET environment. Hence this particular work considers the MANET reliability with time as one of the major constraints.

In order to validate the efficiency of the proposed algorithm an example network given in Figure 1 has been considered. An intelligent team at headquarters has decided to check the efficiency of their three platoons of soldiers. For that they design an assignment which consists of destruction of a terrorist camp with in a fixed time of 10 minutes and fixed budget of \$350. They disseminate this information to all the group leaders at a time (multi casting). After getting the information, the group leaders of three platoons will

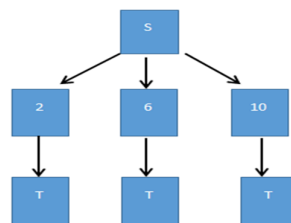


Figure 1 Message transmission in MANET

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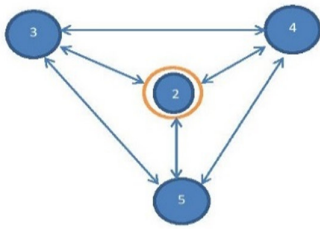


Figure. 2 Sub MANET 2

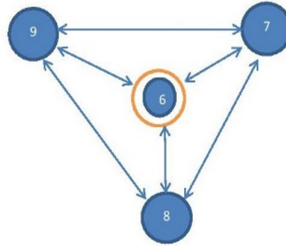


Figure 3 Sub MANET 3

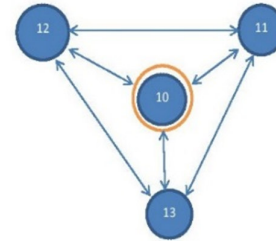


Figure 4 Sub MANET 3

pass it to their group members and destroy the target within the fixed cost and stipulated time. The MANET environment of this scenario is expounded in Figure 1. In that, S stands for the headquarters and T represents the target [terrorist camp] and the intermediate nodes 2, 6 and 10 denote the group leaders (sub sources). Each sub source together with some participating nodes can be treated as sub MANETs (Shown in Figures 2 to 4). For the numerical analysis, the working states, state dependent probabilities, delivery cost and delivery time of various sub MANETs are considered from the table 2

Table 2: Sub MANET numerical data

Groups	Working States	SDP	Delivery Cost (\$)	Delivery Time (sec)
I	2-3	0.09	0.50	1.0
	2-4	0.05	1.00	2.0
	2-5	0.20	0.75	1.0
	3-4	0.40	1.00	2.5
	3-5	0.06	0.50	1.0
	4-5	0.70	1.00	1.0
II	6-7	0.30	0.5	1.0
	6-8	0.10	0.5	0.5
	6-9	0.05	0.5	2.0
	7-8	0.04	1.0	2.0
	7-9	0.02	2.0	2.0
	8-9	0.07	0.5	1.0
III	10-11	0.20	0.25	0.5
	10-12	0.40	1.00	1.0
	10-13	0.05	0.50	1.0
	11-12	0.10	1.00	1.0
	11-13	0.06	0.25	2.5
	12-13	0.07	0.25	1.5
Source	H-2,6,10	1	0.5	0.05
Target	T-2,6,10	1	0.5	0.05

### 4.1 Reliability Calculation for Sub MANET 1

The node UGF for source node 2 of SM 1 is obtained by considering all possible member nodes that receives information directly from it. The node UGF for nodes 3,4 and 5 defined by considering all chances of transmitting messages via them to reach the target.

**Step 1:** The UGF for SM 1 is defined as  $U(i) = U(S) \otimes u(i)$  here  $S = 2; i = 3, 4, 5$

**Step 2:** The node UGF for sub source and neighbouring nodes with the corresponding time and cost can be obtained as follows:

$$\begin{aligned}
 u(2) &= U(2) = P_{2,3} X_{(0,5,1)}^3 + P_{2,4} X_{(1,2)}^4 + P_{2,5} X_{(0,75,1)}^5 + P_{2,\{3,4\}} X_{(1,5,3)}^{\{3,4\}} + P_{2,\{3,5\}} X_{(1,25,2)}^{\{3,5\}} + \\
 &\quad P_{2,\{4,5\}} X_{(1,75,3)}^{\{4,5\}} + P_{2,\{3,4,5\}} X_{(2,25,4)}^{\{3,4,5\}} \\
 u(3) &= P_{3,2} X_{(0,5,1)}^2 + P_{3,4} X_{(2,4,5)}^2 + P_{3,5} X_{(1,25,2)}^2 + P_{3,4,3} X_{(2,5,6)}^2 + P_{3,4,5,2} X_{(2,75,4,5)}^2 + P_{3,5,4,2} X_{(2,5,4)}^2 + P_{3,\{4,5\}::\{\emptyset,2\}} X_{(2,25,4,5)}^2 \\
 &\quad + P_{3,\{4,5\}::\{2,\emptyset\}} X_{(2,5,4)}^2 + P_{3,\{4,5\}::\{2,2\}} X_{(3,25,6,5)}^2 + P_{3,5,3,2} X_{(1,5,3)}^2 . \\
 u(4) &= P_{4,2} X_{(1,2)}^2 + P_{4,3,2} X_{(1,5,3,5)}^2 + P_{4,5,2} X_{(1,75,2)}^2 + P_{4,3,4,2} X_{(3,7)}^2 + P_{4,3,5,2} X_{(2,25,4,5)}^2 + P_{4,5,3,2} X_{(2,3)}^2 + \\
 &\quad P_{4,\{3,5\}::\{\emptyset,2\}} X_{(2,75,4,5)}^2 + P_{4,\{3,5\}::\{2,\emptyset\}} X_{(2,5,4,5)}^2 + P_{4,\{3,5\}::\{2,2\}} X_{(3,25,5,5)}^2 + P_{4,5,4,2} X_{(3,4)}^2 .
 \end{aligned}$$

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$$u(5) = P_{5:2} X_{(0.75,1)}^2 + P_{5:3,2} X_{(1,1)}^2 + P_{5:4,2} X_{(2,3)}^2 + P_{5:3,5,2} X_{(1.75,3)}^2 + P_{5:3,4,2} X_{(2.5,5.5)}^2 + P_{5:\{3,4\}:\{2,\emptyset\}} X_{(2,3)}^2 + P_{5:\{3,4\}:\{2,2\}} X_{(2.5,4)}^2 + P_{5:\{3,4\}:\{3,5\}} X_{(3,5)}^2 + P_{5:4,5,2} X_{(2.75,3)}^2 + P_{5:4,3,2} X_{(2.5,4.5)}^2$$

Considering all possible communications (which includes transmission of messages from 2 to 3, {3,4}, {3,5}, {3,4,5}) and reaches again 2, the path UGF for SM 1 is calculated.

**Step 3:** The path UGF is obtained by introducing the composition operator over the node UGF. For example  $U(3) = U(S) \otimes u(3) =$

$$U(2) \otimes u(3) = \sum_{N \subseteq \theta_3} P_{2:3,N,2} X_{(c,t)}^2$$

$$= [P_{2:3} X_{(0.5,1)}^3 + P_{2:4} X_{(1,2)}^4 + P_{2:5} X_{(0.75,1)}^5 + P_{2:\{3,4\}} X_{(1.5,3)}^{\{3,4\}} + P_{2:\{3,5\}} X_{(1.25,2)}^{\{3,5\}} + P_{2:\{4,5\}} X_{(1.75,3)}^{\{4,5\}} + P_{2:\{3,4,5\}} X_{(2.25,4)}^{\{3,4,5\}}] \otimes [P_{3:2} X_{(0.5,1)}^2 + P_{3:4,2} X_{(2,4.5)}^2 + P_{3:5,2} X_{(1.25,2)}^2 + P_{3:4,3,2} X_{(2.5,6)}^2 + P_{3:4,5,2} X_{(2.75,4.5)}^2 + P_{3:5,4,2} X_{(2.5,4)}^2 + P_{3:\{4,5\}:\{\emptyset,2\}} X_{(2.25,4.5)}^2 + P_{3:\{4,5\}:\{2,\emptyset\}} X_{(2.5,4)}^2 + P_{3:\{4,5\}:\{2,2\}} X_{(3.25,6.5)}^2 + P_{3:5,3,2} X_{(1.5,3)}^2]$$

$$U(3) = 4[P_{2:3,2} + P_{2:3,4,2} + P_{2:3,5,2} + P_{2:3,4,3,2} + P_{2:3,4,5,2} + P_{2:3,5,4,2} + P_{2:3,\{4,5\}:\{\emptyset,2\}} + P_{2:3,\{4,5\}:\{2,\emptyset\}} + P_{2:3,\{4,5\}:\{2,2\}} + P_{2:3,5,3,2}] X_{(98,192)}^2$$

By continuing the same procedure,  $U(4)$  and  $U(5)$  are given by  $U(4) = U(2) \otimes u(4)$  and  $U(5) = U(2) \otimes u(5)$ ,

$$U(4) = 4[P_{2:4,2} + P_{2:4,3,2} + P_{2:4,5,2} + P_{2:4,3,4,2} + P_{2:4,3,5,2} + P_{2:4,5,3,2} + P_{2:4,\{3,5\}:\{\emptyset,2\}} + P_{2:4,\{3,5\}:\{2,\emptyset\}} + P_{2:4,\{3,5\}:\{2,2\}} + P_{2:4,5,4,2}] X_{(128,226)}^2$$

$$U(5) = 4[P_{2:5,2} + P_{2:5,4,2} + P_{2:5,3,2} + P_{2:5,4,5,2} + P_{2:5,4,3,2} + P_{2:5,3,4,2} + P_{2:5,\{4,3\}:\{\emptyset,2\}} + P_{2:5,\{4,3\}:\{2,\emptyset\}} + P_{2:5,\{4,3\}:\{2,2\}} + P_{2:5,3,5,2}] X_{(147,168)}^2$$

The probability, transmission cost and time for the successful transition of message via nodes 3, 4 and 5 of SM 1 are calculated as follows:

- Via node 3,** TP =  $4[0.0206982] = 0.0827928$  Cost = 98\$ Time =  $4[48] = 192$  sec
- Via node 4,** the TP = **0.089624**, Cost = 128\$, Time = 226 sec
- Via node 5,** the TP = 0.3248872, Cost =  $4[36.75] = 147$  \$, Time = 168 sec.

Considering all the possible TP's via nodes 3,4 and 5, the reliability of SM 1 is obtained as 0.497304, with a transmission cost of 373 \$ and transmission time of 9.7 mins.

### 4.2 Reliability Calculation for Sub MANET 2

For sub MANET 2, the path UGF is defined as  $U(i) = U(S) \otimes u(i)$  here  $S = 6, i = 7, 8, 9$

$$u(6) = U(6) = P_{6:7} X_{(0.5,1)}^7 + P_{6:8} X_{(0.5,0.5)}^8 + P_{6:9} X_{(0.5,2)}^9 + P_{6:\{7,8\}} X_{(1,1.5)}^{7,8} + P_{6:\{7,9\}} X_{(1,3)}^{7,9} + P_{6:\{8,9\}} X_{(1,2.5)}^{8,9} + P_{6:\{7,8,9\}} X_{(1.5,3.5)}^{7,8,9}$$

$$U(7) = U(6) \otimes u(7) = 4[P_{6:7,6} + P_{6:7,8,6} + P_{6:7,9,6} + P_{6:7,8,7,6} + P_{6:7,8,9,6} + P_{6:7,9,8,6} + P_{6:7,\{8,9\}:\{\emptyset,6\}} + P_{6:7,\{8,9\}:\{6,\emptyset\}} + P_{6:7,\{8,9\}:\{6,6\}} + P_{6:7,\{8,9\}:\{6,6\}}] X_{(106,196)}^6$$

$$U(8) = 4[P_{6:8,6} + P_{6:8,7,6} + P_{6:8,9,6} + P_{6:8,7,8} + P_{6:8,7,9,6} + P_{6:8,9,7,6} + P_{6:8,\{7,9\}:\{\emptyset,6\}} + P_{6:8,\{7,9\}:\{6,\emptyset\}} + P_{6:8,\{7,9\}:\{6,6\}} + P_{6:8,9,8,6}] X_{(72,162)}^6$$

$$U(9) = 4[P_{6:9,6} + P_{6:9,8,6} + P_{6:9,7,6} + P_{6:9,8,9,6} + P_{6:9,8,7,6} + P_{6:9,7,8,6} + P_{6:9,\{8,7\}:\{\emptyset,6\}} + P_{6:9,\{8,7\}:\{6,\emptyset\}} + P_{6:9,\{8,7\}:\{6,6\}} + P_{6:9,7,9,6}] X_{(104,216)}^6$$

### 4.3 Reliability Calculation for Sub MANET 3

The path UGF for sub MANET 3 is defined as  $U(i) = U(S) \otimes u(i)$  here  $S = 10, i = 11, 12, 13$

$$u(10) = U(10) = P_{10:11} X_{(0.25,1)}^{11} + P_{10:12} X_{(1,1)}^{12} + P_{10:13} X_{(0.5,1)}^{13} + P_{10:\{11,12\}} X_{(1.25,2)}^{11,12} + P_{10:\{11,13\}} X_{(0.75,2)}^{11,13} + P_{10:\{12,13\}} X_{(1.5,2)}^{12,13} + P_{10:\{11,12,13\}} X_{(1.75,3)}^{11,12,13}$$

$$U(11) = U(10) \otimes u(11) = 4[P_{10:11,10} + P_{10:11,12,10} + P_{10:11,13,10} + P_{10:11,12,11,10} + P_{10:11,12,13,10} + P_{10:11,13,12,10} + P_{10:11,\{12,13\}:\{\emptyset,10\}} + P_{10:11,\{12,13\}:\{10,\emptyset\}} + P_{10:11,\{12,13\}:\{10,10\}} + P_{10:11,13,11,10}] X_{(69,154)}^{10}$$

$$U(12) = 4[P_{10:12,10} + P_{10:12,11,10} + P_{10:12,13,10} + P_{10:11,12,11,10} + P_{10:12,11,13,10} + P_{10:12,13,11,10} + P_{10:12,\{11,13\}:\{\emptyset,10\}} + P_{10:12,\{11,13\}:\{10,\emptyset\}} + P_{10:12,\{11,13\}:\{10,10\}} + P_{10:12,13,12,10}] X_{(88,154)}^{10}$$

$$U(13) = 4[P_{10:13,10} + P_{10:13,12,10} + P_{10:13,11,10} + P_{10:13,12,13,10} + P_{10:13,12,11,10} + P_{10:13,11,12,10} +$$

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$$P_{10:13:\{12,11\}::\{\emptyset,10\}} + P_{10:13:\{12,11\}::\{10,\emptyset\}} + P_{10:13:\{12,11\}::\{10,10\}} + P_{10:13,11,13,10} X^{10}_{(66,180)}$$

The reliability of nodes and Sub MANETs are listed in table 3.

Table 3: Reliability for nodes and sub MANETs

Node	Reliability	Cost(\$)	Time (sec)
3	0.0827928	98	192
4	0.089624	128	226
5	0.3248872	147	168
$R_{SM1} = P_{s:2:T} X^2_{(0.5,0.05)}$	0.497304	373	586 = 9.7 mins
7	0.38736	106	196
8	0.05367	72	162
9	0.14385	104	216
$R_{SM2} = P_{s:6:T} X^6_{(0.5,0.05)}$	0.455415	282	574 = 9.6 mins
11	0.2302	69	154
12	0.726	88	154
13	0.0264	66	180
$R_{SM3} = P_{s:10:T} X^{10}_{(0.5,0.05)}$	0.9826	223	488 = 8 mins

The UGF for the source node in terms of the heads of the SMs are given by

$$u(S)=U(S) = P_{s:2:T} X^T_{(0.1,0.01)}, \quad u(S)=U(S) = P_{s:6:T} X^T_{(0.1,0.01)} \quad \text{and} \quad u(S)=U(S) = P_{s:10:T} X^T_{(0.1,0.01)}$$

By assuming the SDP of transferring message from source node S to heads of SMs and from SM's heads to target (T) as 1, the performance measure of the system through the SM's are given by  $P_{s:2,T}$ ,  $P_{s:6,T}$  and  $P_{s:10,T}$  respectively and the obtained values are given in table 4.

Table 4: Performance via sub MANETs

Sub MANETS	Reliability	Cost	Time (min)
1	0.497304	374	9.8
2	0.455415	283	9.7
3	0.9826	224	8.1

From the table 3.4, it is clear that out of the three platoons; the third one is highly reliable compared with the other two. Also the time and cost factor is advantageous for third one. For the first group, the total cost has crossed the limit. Hence the optimum reliability of the MANET is 0.9826. This reliability is achieved with in the budget of \$224 and the delivery time of 8.1 mins.

### 5 Discussions and Conclusion

Reliability is used as the performance measure for various networks. Due to the dynamic nature of nodes, MANETs do not have any fixed infrastructure. Hence the traditional methods will not be successful to obtain the reliability of MANETs. To overcome these kinds of situations, UGFT has been considered to achieve the reliability of a MANET. The suggested technique allows one to obtain the probability that the information gathered at the source node of a MANET reaches the target node though any of the sub MANETS within a fixed cost and stipulated time. As a future focus, this UGFT may be applied to a heterogeneous sensor networks.

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## Effect of Jump Circuit Training and On Court Volleyball Conditioning On Explosive Power among Volleyball Players

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**Abstract:** The purpose of the study was to find out the effect of jump circuit training and on court volleyball conditioning on explosive power among volleyball players. To achieve the purpose thirty volleyball players were randomly selected as subjects from the department of physical education, Annamalai University. The subject were divided into three groups each comprising of ten each as experimental-I (court volleyball conditioning), experimental-II (jump circuit training) and control groups. The average age, height, and weight of the experimental group were 17 to 24 years. The experimental group-I and experimental-II had undergone 60 minutes of court volleyball conditioning and jump circuit training three alternate days in a week for eight weeks whereas control group did not participate any type of specific training. The criterion variables confined to this study were explosive power measured by sergeant jump before and after the training programme. The collected data were statistically analysed by using analysis of co variance (ANCOVA). On the basis of the result, it was found that there was significant improvement on explosive power due to the above said training among volleyball players.

**Keywords:** Explosive Power, Volleyball Conditioning, Circuit Training.

### INTRODUCTION

Circuit training is an excellent way to simultaneously improve mobility, strength and stamina. Scientific studies have linked resistance training with a reduced rate of injury in athletes. Ref.[3].It fortifies leg muscles and strengthens 'weak links' in athletes' bodies, including the often-injured hamstrings and shin muscles, as well as abdominal and low-back muscles. Circuit training is an efficient and challenging form of conditioning. It works well for developing strength, power, flexibility and coordination. Plyometric is the term now applied to exercises that have their roots in Europe, Ref.[1].Where they were first known simply as jump training. Interest in this jump training increased during the early 1970s as East European athletes emerged as powers on the world sport scene.

Volleyball conditioning methods allows skill development and fitness. This type of conditioning is technique specific and could have complex game like drills with more efficient type of conditioning combining physical development along with technical and mental skills. Athletes can enjoy conditioning drills that are more specific to game situations. Ref.[4]. Greater the general quality of speed, strength, power, endurance, flexibility and agility the more quickly will be the specific skill he learned and once learned the better will be the performance. The coaches structure the practice differently to allow the skill and physical abilities of the players to develop concurrently.

Warm-ups in team training environments should be used to prepare the players for the activities to follow. If the sport requires

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jumping, then jumps should be included, sprinting requires sprint drills, contact sports require contact etc. Where possible, a ball should be involved for ball sports, and game- related drills performed so that the players can then get warm physically, technically and mentally. If balance training has little impact on speed and power, or on anaerobic conditioning, then can skill-based conditioning games have such an impact Good coaches can integrate skills training into small games and drills that require a game-related physical effort, making them fun and hard work.

## Methodology

### Selection of Subjects and Variables

The purpose of the study was to find out the effect of jump circuit training and on court volleyball conditioning on explosive power among volleyball players. To achieve the purpose thirty volleyball players were randomly selected as subjects from the department of physical education, Annamalai University. The subject were divided into three groups each comprising of ten each as experimental-I (court volleyball conditioning), experimental-II (jump circuit training) and control groups. The average age, height, and weight of the experimental group were 17 to 24 years. The criterion variables confined to this study were explosive power measured by sergeant jump.

### Training Protocol

The experimental group-I undergone volleyball court conditioning such as shuttle runs, block jumps, short sprints, tuck jumps, astride jumps for 30 minutes and experimental-II undergone jump circuit training such as burpees, skipping, squat jumps, jump and jogs, tuck jumps for three alternate days in a week for eight weeks respectively whereas control group did not participate any type of specific training.

### Statistical Technique

The collected data were statistically analysed by using analysis of co variance (ANCOVA). On the basis of the result, it was found that there was significant improvement on explosive power due to the above said training among volleyball players.

### Analysis of the Data

#### Explosive Power in Terms of Vertical

The analysis of covariance on explosive power in terms of vertical of the pre and post test scores of on court volleyball conditioning, jump circuit training and control groups on explosive power among volleyball players have been analyzed and presented in Table -I.

Table –I Ancova of on court volleyball conditioning jump circuit training and control groups on explosive power

Test	Volleyball conditioning Group	Jump circuit group	Control Group	Source of Variance	Sum of Squares	df	Mean Squares	Obtained 'F' Ratio
<b>Pre Test</b>								
Mean	49.40	53.30	50.60	Between	79.80	2	39.90	1.482
S.D.	5.18	6.21	3.89	Within	726.90	27	26.92	
<b>Post Test</b>								
Mean	61.90	58.00	51.60	Between	540.86	2	270.43	10.26
S.D.	4.81	6.32	3.97	Within	711.30	27	26.34	
<b>Adjusted Post Test</b>								
Mean	63.43	56.01	52.05	Between	653.440	2	326.72	69.94
				Within	121.449	26	4.67	

\* Significant at 0.05 level of confidence.

(The table values required for significance at .05 level of confidence for 2 and 42 and 2 and 41 are 3.222 and 3.226 respectively).

The table- I show that the pre-test mean values on explosive power in terms of vertical of on court volleyball conditioning, jump circuit training and control groups are 49.40, 53.30 and 50.60 respectively. The obtained "F" ratio of 1.482 for pre-test scores is less than the table value of 3.222 for df 2 and 27 required for significance at .05 level of confidence on explosive power in terms of

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vertical. The post-test mean values on explosive power in terms of vertical of skill based training, plyometric training and control groups are 61.90, 58.00 and 51.60 respectively. The obtained "F" ratio of 10.26 for post test scores is greater than the table value of 3.222 for df 2 and 27 required for significance at .05 level of confidence on explosive power in terms of vertical.

The adjusted post-test means of on court volleyball conditioning, jump circuit training and control groups on explosive power among volleyball players are 63.43, 56.01 and 52.05 respectively. The obtained "F" ratio of 69.94 for adjusted post test scores is greater than the table value of 3.226 for df 2 and 26 required for significance at .05 level of confidence on explosive power in terms of vertical. The results of the study indicated that there was a significant difference among the adjusted post-test means of on court volleyball conditioning, jump circuit training and control groups on explosive power among volleyball players.

To determine the significance difference among the three paired means, the Scheffe's test was applied as post-hoc test and the results are presented in Table -II.

Table -II the scheffe's test for the differences between paired means on explosive power in terms of vertical

Volleyball conditioning Group	Jump circuit group	Control Group	Mean Differences	Confidence Interval Value
63.43	56.01	-	7.42*	2.29
63.43	-	52.05	11.38*	2.29
-	56.01	52.05	3.96*	2.29

\* Significant at .05 level of confidence.

The table -II shows that the mean difference values between volleyball conditioning and jump circuit training, volleyball conditioning and control groups, jump circuit training and control groups 7.42\*, 11.38\* and 3.96\* respectively on explosive power in terms of vertical which were greater than the required confidence interval value 2.29 at .05 level of confidence. Hence the above comparisons were significant.

### Discussion on Findings

The below literature thoroughly supports the evidence of the present study, Studies have shown improvement in aerobic capacity from participation in circuit training. ef. [5]. An enhancement of motor performance associated with circuit training combined with court conditioning drills or the superiority of jump circuits, compared to their method soft training. Ref.[6]. Skill-based conditioning games improved 10-m, 20-m, and 40-m speed, muscular power (vertical jump), and aerobic power. The combination of circuit training with plyometric care thought to be useful for developing athletic power.

### Conclusions

Hence, it was concluded from the results that both on court volleyball court conditioning and jump circuit training were better method to improve explosive power in terms of vertical. Among the training, on court volleyball court conditioning improved much better than jump circuit training programme.

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## Development of Bioactive Non-Implantable Products using Brown Seaweed for Hygienic Textiles

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**Abstract:** The aim of the investigation was to evaluate the anti-bacterial, bioactive compounds and anti-oxidant property of fibrous brown marine algae *Sargassum wightii*. Antimicrobial finish has been imparted to the cotton fabric using extracts of seaweed by microencapsulation using pad-dry-cure method. Both in vitro and in vivo studies have demonstrated, how this *Sargassum wightii* acts as antioxidant, and antibacterial properties and it also shows good antiviral and anti-carcinogenic activities. Bioactive compounds are inhibited the growth of microorganisms present in human body. Bioactive compounds were confirmed by means of the spectrum in the GC-MS spectroscopy. Antioxidant activities were evaluated using the DPPH method. The total phenolic content was determined with the folin-ciocalteu method. The methanol fraction of treated fabric had the highest antioxidant activity ( $42.5 \pm 1.21\%$ ), because of the phenolic content trap the reactive oxygen species and develops the cells present in the skin. Parallel streak method was to evaluate the antibacterial activity of seaweed treated fabric. The results showed that higher inhibition zone of 40 mm. The treated fabrics are most widely used in a wide range of health care, pharmaceutical and hygienic textiles.

**Keywords:** Antibacterial textiles, Microencapsulation, Bioactive compounds, Cotton fabric.

### INTRODUCTION

The development of natural based antimicrobial finishes is directly applied to the cotton fabric to produce value added textile product [1]. Many natural based herbal products have antimicrobial properties. In recent years particularly chitosan a natural occurring biopolymer act as an antimicrobial agent in the field of textiles [2]. Many of the plants contain bioactive compounds like phenol, terpenoids, flavonoids, alkaloids, polypeptide and polyacetylenes etc. which are acting as antibacterial properties. Some of these bioactive compounds are act as bactericides and some of them act as bacteriostatic [3]. In order to maintain good hygienic environment, seaweed extracts act as an antimicrobial agent for curing most of the degenerative diseases.

*Sargassum wightii* is one of the species of brown seaweed and it is a nature's power of herbal plant, used in folkloric medicine for the treatment of various diseases, widely cultivated in the gulf of manner region. Seaweeds are rich in antioxidants such as carotenoids, pigments, polyphenols, enzymes and diverse functional polysaccharides [4]. Beneficial effects from the use of seaweed extracts as natural regulators have induced increased crop yield and plant vigor to withstand adverse environmental effects [5]. Seaweeds are one of the important marine living organisms could be termed as the futuristically promising plants and it is a major source of food and medicine [6]. Bioactive natural products are commonly distributed in the plant kingdom, and extract derived from different plants and also from red, green and brown macro and micro algae can be used as biological products [7]. A marine alga represents an infinite resource of raw materials used in pharmaceutical, medicine, food industries and cosmetics [8]. Marine algae act as an important source of bioactive natural substances [9, 10]. The extracts and active bio components of various marine algae have an excellent antibacterial

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activity against Gram-positive and Gram-negative bacteria [11]. The functions of these secondary metabolites are protecting against fouling organisms and pathogens and also play a key role in UV protection and act as allopathic agents [12]. Seaweeds collected from diverse regions have been evaluated for a broad variety of biological activities like anti-bacterial, anti-viral, anti-fungal, anti-algal, anti-tumour, anti-inflammatory, anticoagulant and anti-oxidant activities [13]. Anti-bacterial and anti-oxidant activities are most commonly investigating properties in seaweeds in all over the world [14].

*Sargassum wightii* has strong antioxidant and antimicrobial properties, recent studies have demonstrated that the carotenoids are an important group of natural pigment with specific applications as colourants, feed supplements, and nutritious medicine, cosmetic and biotechnological purposes. [15]. In addition, *sargassum wightii* extract with an abundance of flavonoids and tannins has been shown to have a highest antioxidant activity. Phenolic compounds are important components of many medicinal applications [16].

## Materials and Methods

### Materials

Bio-scoured and Bio-bleached 100% cotton socks fabric (60 Course/inch, 40 Wales/inch) was used for the application of antimicrobial finish. The plant of *Sargassum wightii* of edible brown seaweed was used for anti-microbial finish. They were freshly collected from thonidurai coast of mandapam and were rinsed in seawater and packed in aseptic bags and brought to the laboratory for further processing.

### Methods

#### Extraction Process

In this method, 20g of powdered algal sample contained in a what man No.1 filter paper thimble was placed into an extraction chamber. The extraction chamber was then connected to a flask containing 200ml organic solvent with increasing polarity; hexane, ethyl acetate, chloroform and methanol, subsequently (1:10,w/v). Constant heat source was supplied for this procedure (40-50°C). All the extracts were concentrated under reduced pressure using a rotary evaporator and left air dried in a fume cupboard to obtain paste extract. The dried paste extracts were then stored at 4°C for further bioassay.

#### Microencapsulation by Ionic Gelatin Process

Microcapsules containing extract were prepared employing sodium alginate. Then 30 ml of extract and 10 ml of Tween 20 were added to the polymer solution and mixed thoroughly to form smooth viscous dispersion. This was sprayed into calcium chloride solution by means of a sprayer. The droplets were retained in calcium chloride for 15 minutes. The microcapsules were obtained by decantation and repeated washing with isopropyl alcohol followed by drying at 45°C for 12 hours. The cotton socks was immersed in the microcapsule solution using three bowl padding mangle, squeezed and then dried at 90-100°C in an oven. The microcapsules were also applied on the fabric by using a binder (8% citric acid).

#### Quantitative Determination of Total Polyphenols

In this procedure, 100 µl aliquot of stock sample (extract concentration 1000 µg/ml of water) was mixed with 2.0 ml of 2% Na<sub>2</sub>CO<sub>3</sub> and allowed to stand for 2 min at room temperature. Then 100 µl of 50% Folin-Ciocalteu phenol reagent was added. After incubation for 30 min at room temperature in darkness, the absorbance was read at 720nm using spectrophotometer (Milton Roy Spectronic 1201). The total phenolic contents of the samples were expressed as mg Gallic acid equivalent per gram (mg GAE/g). Gallic acid was used as a positive control.

#### Gas Chromatography-Mass Spectrometry (GC-MS)

*Sargassum wightii* was shade dried at room temperature and 5 g of the powdered sample was soaked in 98% methanol for 16 hr. Then the extract was filtered through Whatman No 1 filter paper along with 0.5 g of sodium sulfate solution to remove the sediments present in the solution filtrate. The solution filtrate was then concentrated by bubbling nitrogen gas into the solution. The extract contained both polar and non-polar components of the brown seaweed. An aliquot of 2 µl of this solution was used for GC-MS analysis [17, 18].

#### Assessment of the Antioxidant Activity

##### DPPH Radical Scavenging Activity

Free radical scavenging activity was measured by 2, 2-Diphenyl-1-picrylhydrazyl (DPPH) according to the method of Yen and Chen (1995). Briefly, a 2.0 ml aliquot of test sample was added to 2.0 ml of 0.16 ml DPPH methanolic solution. The mixture was shaken

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vigorously then left to stand at room temperature for 30 min in darkness. Changes in the absorbance of the samples were measured at 517nm using a spectrophotometer (Milton Roy Spectronic 1201).

### Antibacterial Analysis

The AATCC plates were prepared by pouring 15ml of AATCC media into sterile Petri plates. The plates were allowed to solidify for 5min and the bacterial culture was inoculated as single line followed by the four lines without refilling the inoculation loop. The fabric was cut into  $5 \times 2.5$  size and immersed in treatment bath containing herbal and antimicrobial agents with the M:L ratio of 1:1:1 for 15 minutes and air dried at room temperature. The finished fabric with the diameter of 2.5 cm was placed over the inoculated bacterial species. And the plates were kept for incubation at 37°C for 24 hours. At the end of incubation, zone of incubation formed around the fabric was measured in millimeter and recorded.

### Scanning Electronic Microscope (SEM)

The surface morphology of treated and untreated fabrics was investigated by the JEOL JSM-6490 Scanning electron microscope (SEM) at the magnifications of  $\times 1000$ .

### Fabric Characteristics

The mechanical and comfort properties of treated fabric were performed according to the respective ASTM standards, ISO standards, IS standards and AATCC test methods. All the tests were carried out at standard atmospheric condition (27°C,  $65 \pm 2\%$  RH). The bursting strength of knitted fabric was measured as per standard ASTM D3786 (2009). The stiffness in terms of bending length was measured as per standard ASTM D1388 (2008). The rate of air flow passing perpendicularly through a known area of fabric is adjusted to obtain a prescribed air pressure difference between the two fabric surfaces was measured according to standard ASTM D737(1996). The ability of vertically aligned treated fabric specimens to transport liquid through them was measured according to standard AATCC TM 197(2011)

## Results and Discussion

### Qualitative Assessment of Bio-Active Components of dyes using GC-MS Spectroscopy

The qualitative GC-MS fingerprint profile methanol extract of *Sargassum wightii* (Fig.1) was picked a wavelength from 100 to 700 nm due to the sharpness of the peaks and proper baseline. The profile showed the peaks at the mm of 670, 610 and 416 with the absorption 0.347, 0.118 and 1.841 respectively. The GC-MS spectrum of the purified compound was recorded and its absorption maximum ( $\lambda_{max}$ ) was compared with the fucoxanthin standard, the results confirmed that the standard and purified compounds exhibited the same spectroscopic profile with similar  $\lambda_{max}$  (331, 446, and 468 nm). Fucoxanthin, flavonoids, phenols, tannin and saponins shows a characteristic bioactive absorption pattern ( $\lambda_{max}$ ) in this region of spectrum present in treated fabric.

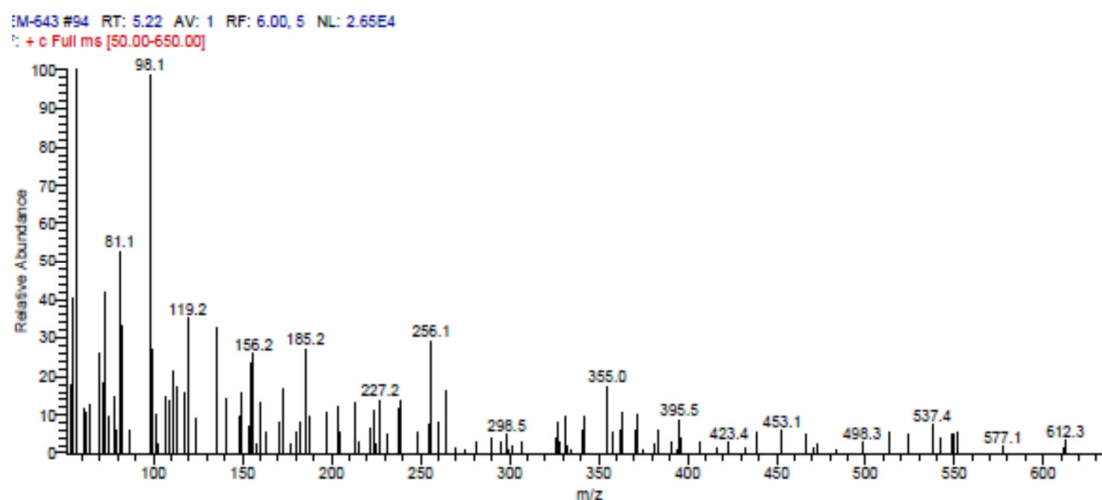


Figure.1. Analyze of bioactive compounds using GC-MS spectroscopy for Treated fabric

### Total Phenolic Content

The Phenolic content was determined using folin-ciocalteu reagent and was expressed as Gallic acid equivalents as shown in Table 1. The extraction of antioxidant substances of different chemical structure was achieved using solvents of different polarity. Numerous investigations of qualitative composition of plant extracts revealed the presence of high concentrations of phenols obtained in the treated fabric.

Table.1. Total Phenolic content (mg Gallic acid equivalents (GAE/g extract) of treated fabric

Concentration of the Methanol Extract (ml)	mg/g of Gallic acid
1.5	20.45
2.0	30.70
2.5	40.20
5.0	52.10
12.5	61.78
25.0	103.28

### DPPH Radial Scavenging Activity

The radial scavenging activity of treated fabric was analysed by DPPH method. The method helps to assess the percentage of scavenging activity present in the treated fabric. The test results are shown below in Table 2.

Table.2. Antioxidant activity of the different solvent extract of the *Sargassum wightii*

S. No	Seaweeds Name	Concentration ( $\mu\text{g/ml}$ )	DPPH Free Radial Scavenging Activity % Inhibition			
			Methanol	Aqueous Extract	Petroleum Ether	Ethyl Acetate
1.	<i>Sargassum wightii</i>	50	42.5 $\pm$ 1.21	40.11 $\pm$ 1.65	38.65 $\pm$ 1.42	39.23 $\pm$ 1.12

The test results showed that the pressure of antioxidant scavenging activity was same for seaweed Extraction and treated fabric. The antioxidant activities were more important for medical fabric, because of trapping the free radical of oxygen species and inhibit the cell damage and develop the cell growth present in the skin.

### Analysis of Antibacterial Activity

The antibacterial activities are tested on the standard of AATCC 147. It was determined mainly by two bacterial species i.e. *Staphylococcus aureus* and *E.Coli*. Both samples are cut in the size of 1.5x10<sup>8</sup>cfc/ml. In this two bacterial species *Staphylococcus aureus* has an excellent antibacterial activity when compared to *E.Coli*. This shows that an excellent antibacterial property is achieved in evenly coated fabric.

Table.3. Zone of Inhibition of coated fabrics

S.No	Fabric Sample	Seaweed Sample	Zone of inhibition (mm)			
			S.aureus		E.Coli	
			Before washing	After washing	Before washing	After washing
1	100% cotton	Brown seaweed	40	38	35	32



The graph shows that the antimicrobial properties of the selected sample of Sargassum wightii. Treated fabrics had maximum zone of inhibition of around 40 mm for Staphylococcus aureus than E.Coli.



Figure.3. Zone of Inhibition of two bacteria

The above figure 3 clearly shows the better zone of inhibition against Staphylococcus aureus, than E.Coli.

### Scanning Electronic Microscope (SEM) Test

The surface of microencapsulated seaweed coated cotton fabric was morphologically observed by scanning electron microscope. The surface of the seaweed coated material had long and narrow line. From the SEM analysis, it is clear that the seaweed coated cotton fabric surface had some morphological form which is different from the untreated cotton fabric that showed smooth surface.

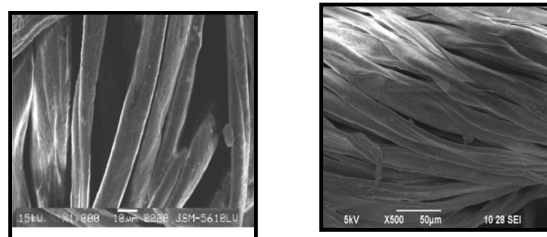


Figure.4.SEMPhotographs of Microcapsules treated fabric

The scanning electronic microscope (SEM) of fabric was tested for the untreated fabric. The result shows that the absence of coated particle on the surface of the fabric. In the case of treated cotton fabric, the result clearly indicates that the microencapsulated seaweed extract is evenly coated to the surface of the fabric.

### Effect of Air Permeability for Treated and Untreated Fabric

Air permeability is an important factor in the performance of textile materials which provide an indication of the breathability of fabrics. Socks fabric basically open loop structure weaves, so the air can easily pass through the fabric to the surrounding and the amount of air passes through sq/cm of fabric would result in permeable characteristics of the fabric.

Table.4. Air permeability test for treated and untreated fabric

S.No	Untreated fabric (Cm <sup>3</sup> /sec)	Treated fabric (Cm <sup>3</sup> /sec)
1	1.463	0.937
2	1.482	1.101
3	1.511	1.112
4	1.499	0.999
5	1.501	1.105

The above table shows that if the cover factor of the fabric increases the air permeability get increased for the untreated fabric, but in case of treated fabric due to the microcapsules coated on the interstices between the yarns then the air permeability is slightly decreased.

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### Effect of Wick Ability Characteristics for Treated and Untreated Fabric

The table.5 shows that the amount of water absorbed by the treated fabric will be slightly less than the untreated sample, because the seaweed microcapsules coated on the interstices will allow some amount of water from surface to the intermolecular structure and it will spread evenly like untreated fabric and therefore the coated particles was not affect the water wickable characteristics of the treated fabric.

Table.5. Wicking test for treated and untreated fabric

S.No	Time in sec	Untreated fabric (Cm)	Treated fabric (Cm)
1	5	2	1.8
2	10	2.1	1.9
3	15	2.5	2.1
4	20	3.0	2.8
5	25	3.2	3.0

### Effect of Bending Length for Treated and Untreated Fabric

Fabric bending indicates the resistance of the fabric to bending and it is a key factor for the study of handle and drape. This test works on the principle called cantilever. This method is used to determine the bending length, flexural rigidity and bending modulus of the treated and untreated fabrics.

Table.6. Bending length test for treated and untreated fabric

S.No	Untreated fabric (Cm)	Treated fabric (Cm)
1	2	1.8
2	2.5	2.1
3	2.8	2.3
4	2.9	2.5
5	2.5	2.3

The above table shows that the bending length will not have much difference in both treated and untreated material. The bending modulus of the treated fabric increases due to coating on the fabric s and the flexural rigidity decrease for the treated fabric. Therefore it would decrease the bending length to a minimum level for the treated fabric compared with untreated fabric. The fabric stiffness of the treated material will not be affected due to seaweed coated on the fabric.

### Effect of Treatment on Bursting Strength in Fabric

The bursting strength was more important for knitted fabric, because of unstable dimensional stability and it extended in width and lengthwise direction. The test results are given below in Table.6

Table.6 Bursting strength of untreated and treated fabric.

S.No	Untreated Fabric (Kg/Cm <sup>2</sup> )	Treated Fabric (Kg/Cm <sup>2</sup> )
1	5.5	5.9
2	5.6	6.0
3	5.9	6.5
4	5.8	6.3
5	6.0	6.2

The test result shows that microcapsules covers the fabric surface evenly and it gives better results in the treated fabric compared to untreated fabric. This is mainly due to absorption of microcapsules on the fabric surface excreted more pressure during application of liquid to the material. Further, in terms of bursting strength, the results from Table 6 also suggest that much significant difference ( $P < 0.05$ ) in bursting strength value was recorded for the untreated and treated fabrics.

### Conclusion

The *Sargassum wightii* extracted with methanol solvent in a soxhlet apparatus had functional bioactive compounds such as flavonoids, fucoidan, tannin, saponin, and polyphenols. The confirmation of bioactive compounds in the treated fabric was confirmed by using GC-MS spectrum. The micro-capsulated treated fabric has an excellent antioxidant property that has been proved by DPPH radical scavenging activity test for trapping the free radicals present in the skin for avoiding cell damage and fast growth of cell tissue present in humans. This analysis proved that higher level of bioactive compounds present in the seaweed extract and treated fabric helps to improve the antioxidant activity. The treated fabric has no significant difference in water absorbency and bending properties but it has a significance difference in the air permeability, washing fastness and rubbing fastness. Future scope of this treated fabric is most widely used for wound dressing, bandage, health and hygienic textiles.

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## An Overview on the Influence of Fabric Structural Parameters in Sports Intimate Apparels

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**Abstract:** Sports intimate apparels are worn next to the skin, which are the key aspect to physiological comfort of sports persons and help to increase their performances. Natural and synthetic fibers are mostly used in sports apparels. Natural fibers have excellent comfort, except wicking, which can be overcome by modifying the fiber profile of synthetic materials, and also imparting finishes in the fabric. It is evident that type of fibre, properties of yarn, structure of fabric, finishing treatment and features of clothing were the factors affecting clothing comfort of sports intimate apparels. Among these the economical way of fetching comfort in the sports intimate apparels can be done through the selection of right raw material, and fabric structure with right structural parameters.

**Keywords:** Comfort properties, Knitted fabrics, Plaiting, Loop length, GSM.

### INTRODUCTION

Sportswear should perform or function for some purpose, by means of moisture management and other techniques sportswear can be made to help people to be active, cool, comfortable and dry. Ref.[6]. In a normal situation, human beings restore a correct balance of heat exchange, modifying the environment. However, outdoor activities are more demanding in terms of thermal balance, the ability of recovering the thermal balance and moisture management is more challenging to achieve. For that reason, Ref.[2]. Active sportswear should provide sufficient heat; air and moisture transfer there by the skin temperature remains within comfortable range and wearer doesn't feel dampness.

Thermal and moisture management properties of fabric are essential factors for deciding not only the comfort but also the performance of wearer. Ref.[8]. Most important purpose of clothing is to provide a stable micro climate next to the skin by maximizing the rate of heat and moisture loss from the body.

Sportswear is typically designed to be light weight so as not to encumber the wearer. On the other hand, sportswear should be loose enough so as not to restrict movement and should possess good sew ability; retain its appearance during wear. It should be durable and have easy-care properties. The sportswear has specific style requirements;

Ref.[3].Functional requirements of sportswear:-



Fig.1. Sports intimate apparels

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- Optimum heat and moisture regulation
- Good water vapour and air permeability
- Rapid moisture absorption and wicking capacity
- Rapid dryness
- Dampness should be avoided
- Dimensional stability even in wet condition
- Durable
- Breathability and Comfort
- Easy-care properties
- Light weight
- Soft and pleasant touch
- Smart and Functional design
- UV resistance

Textile structures can be engineered to deliver desired properties with respect to heat and moisture transport from the body by manipulating the fibre, yarn and fabric structural features.

Ref [6]. Textile fibres in sports intimate apparel:-

The latest sports textile materials are well-designed in fulfilling specific needs in different sports activities. Sportswear fabrics and apparel that are made for high performance have become an inevitable. Ref.[6]. Advances in fibre science, yarn, fabric production technologies, and finishing techniques are the contributing factors for developing active sportswear fabrics and successful marketing of functional sportswear. Due to the recent inventions in the design and production, today's sports textiles use both manmade and natural fibres.

### **Cotton is Comfortable Soft Hand, Good Absorbency**

The slow drying rate and cold-when-wet, these characteristics of cotton make this material unsuitable fibre for use alongside the skin during strenuous activity.

*Wool* has good wicking property, highest moisture regain and is a good insulator even when wet. On the other hand, wool is slow to dry.

**Regenerated Fibers**, are derived from natural sources, and be likely to be absorbent. Tencel is the registered trade name for a type of lyocell by Lenzing, made from wood pulp cellulose. It has a good absorption capability. Usually blend well with other fibers, both natural and synthetic. They are very soft and comfortable making them a good choice for base layers in active wear.

Ref. [4]. Bamboo has excellent UV protection, anti-bacterial and bio degradable characteristics. High moisture absorption capacity, breathability and fast drying behaviour ensure excellent comfort.

Ref.6. *Viloft* is an engineered viscose thermal fibre by Acordis. There is Viloft active, Viloft thermal, Viloft micro and Viloft spirit; the fabrics made from them have a natural look and soft feel and they manage moisture and temperature well.

**Synthetic fibers** are frequently chosen for sportswear. Polyester has outstanding dimensional stability and offer excellent resistance to dirt, alkalis, and has a comfortable smooth feel. Ref.[6]. It is the fibre used most commonly in base fabrics for active wear because of its low moisture absorption, easy care properties and low cost. Polyester is essentially hydrophobic and does not absorb moisture. However, most polyester yarns used in base layer clothing are chemically treated so that they can able to wick moisture.

Field sensor by Toray Industries Inc. is made from a polyester filament yarn which has the grooves that help the fabric to absorb sweat quickly and disperse perspiration throughout the outer surface for rapid evaporation.

**Coolmax** by DuPont is manufactured in either tetra-channel or hex channel polyester, which "wicks" moisture away from the skin to the outer layer of the fabric. This fibre grooved sections allow moisture to escape by capillary action and it dries fast, these properties helps the wearer to feel comfort.

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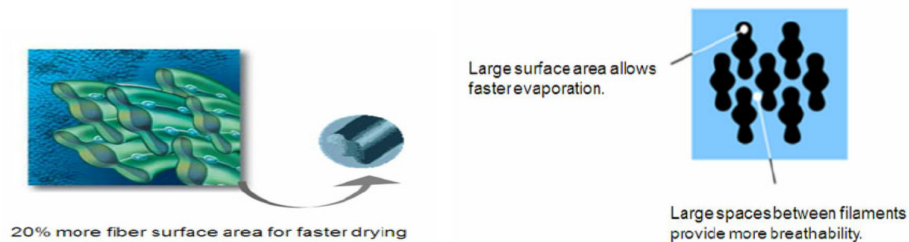


Fig. 2. Coolmax fibre cross section

Cool Pass® by Hengligroup is an eternal high functional polyester fibre designed with slots conduct to siphon effect. Ref.[7]. It pulls moisture away from the skin, transfers it to the outer layers. It helps to regulate body temperature and keeps the wearer dry and comfortable.

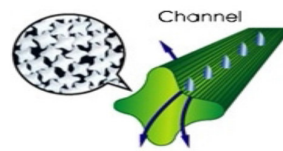


Fig. 3. Cool Pass fibre cross section

**Thermolite** by DuPont is a very fine hollow core fibre for use in the cold weather. The presence of air in the fibre core significantly improves the thermal resistance of the fabric and also convoluted surface of the fibers and the increase in surface air generated by using a fine fibre improve the wicking capacity

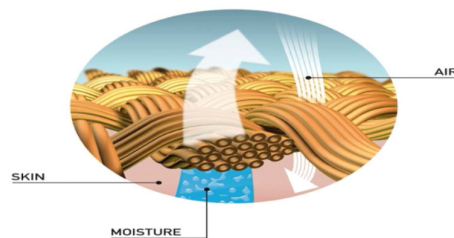


Fig. 4. Thermolite fibre cross section

**Polypropylene** fibers are increasingly being used in sportswear market although its market share is still small. The fibers have very low moisture absorbency but excellent moisture vapor permeability and wicking capabilities. Polypropylene has the advantage of providing insulation when wet. Insensible and liquid perspiration are transported away from the skin without being absorbed making it an ideal fibre for sportswear. Polypropylene is claimed to be a proved performer in moisture management due to its hydrophobic nature and has very good thermal characteristics, keeping the wearer warm in cold weather and cold in warm weather.

### Yarn used in Sports Intimate Apparel

Fabrics made from staple-fibre yarns are more absorbent than the fabrics made from filament yarns of the same content and yarn size, due to the looser packing of the yarn. A looser packing in the yarn increases the fibre surface area for absorption and by increasing the gaps between the yarns, increases moisture vapor permeability. Ref.[6]. Staple- fibre yarns also provide better thermal insulation due to the increased volume of air contained in the yarn. They may also improve the sensorial comfort through a warmer feeling to the touch; the yarns have slightly lower areas of contact to the skin.

### Fabric Structure used in Sports Intimate Apparel

Over the last few years, there has been growing interest in knitted fabrics due to its simple production technique, low cost, high levels of clothing comfort and wide product range. Knitting technology meets the rapidly-changing demands of fashion and usage. Knitted

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fabrics don't encumber there by it provide freedom of movement, but they also have good handle and easily transmit vapor from the body. That's the reason knitted fabrics are commonly preferred for sportswear, casual wear and underwear.

**Single jersey** fabric has remarkably lower thermal resistance and thermal conductivity and higher water vapor permeability and air permeability. It gives warmer feeling at first touch due to their lower thermal absorptivity values. Ref.[5]. This structure is suitable for active sportswear summer garments for better moisture management properties.

**Interlock structure** have higher thermal conductivity and less water vapor permeability values due its heavier fabric thickness Thermal conductivity values will be higher. Ref.[5]. Air permeability is lower for fabric with larger specific surface area. Ref.[5]. This garment is suitable for winter garments.

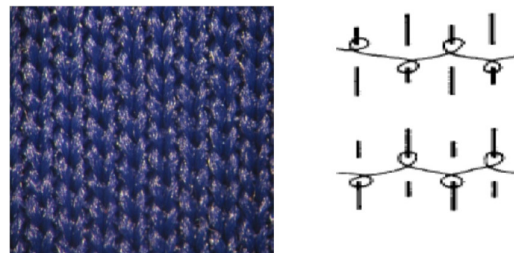


Fig. 5. Interlock fabric structure

**Rib** fabric absorbs more water but the longest time to drying. Slow release of moisture gives buffering effect.

Ref. [5]. This fabric has higher thermal insulation and higher thermal resistivity due to its thickness.

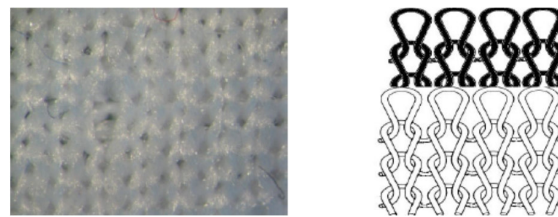


Fig.6. 2 layer fabric structure

*Plated fabric* have distinct face and back side which may be made from two different yarns Thus allowing the possibilities to have different properties such as hydrophilic/hydrophobic, finer/coarser on the two faces. These plated fabrics allow rapid transport of sweat, more permeable to air compare to the interlock and double jersey. Air permeability is higher than the interlock fabric. Water absorbency is relatively higher than the interlock structure.

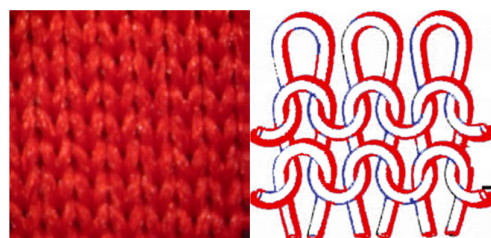


Fig.7.plated fabric structure

## Conclusion

This review concludes that, superior comfort can be achieved by plated knitted fabric structure, with the inner layer - hydrophilic material and the outer layer - hydrophobic material with high wicking rate, helps to increase in moisture management properties. Air permeability can be achieved by reducing the fabric thickness and increase in loop length of the fabric. Thermal properties can be achieved by providing sufficient heat transfer through coarser and finer yarn linear density in the inner and outer layer of fabric so the

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wearer feels comfortable. Comfort properties in active sportswear can be achieved by selection of right raw material, yarn linear density and fabric parameters (fabric thickness, tightness factor, and weight and fabric structure).

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# Exploratory Analysis of Feature Selection Techniques in Medical Image Processing

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**Abstract**— This paper analyses features selection method used in medical image processing. How image is selected by using diverse sort of method similarly: screening, scanning and selecting. We discussed on feature selection procedure which is extensively used for data mining and knowledge discovery and it carryout elimination of redundant features, concomitantly retaining the fundamental bigoted information, feature selection implies less data transmission and efficient data mining. It accentuates the need for further research in the field of pattern recognition that can effectively determine the situation with captured portion of human body.

**Keywords**—feature selection, CBIR, medical image, screening, scanning, selecting.

## I. INTRODUCTION

Medical imaging modalities are used to probe the human body. Interpretation of the resulting images requires sophisticated image processing methods that enhance visual interpretation, and image analysis methods that provide automated or semi-automated tissue detection, measurement and characterization, multiple transformations will be needed in order to extract the data of interest from an image, and a hierarchy in the processing steps will be evident, e.g. enhancement will precede restoration, which will precede analysis [1].

## II. Medical Image Processing

Image processing in medical diagnosis involve stages such as image capture, image enhancement, image segmentation and feature extraction [2, 3] Figure 1 shows a general description of lung cancer detection system that contains four basic stages. As depicted in fig 1, medical image processing contains different stages. The first stage starts with taking a collection of image (normal and abnormal) from the available patient. The second stage applies several techniques of image enhancement, to get best level of quality and clearness. The third stage implies image segmentation algorithms which play an effective rule in image processing stages, and the fourth stage obtain the general features from enhanced segmented image which gives indicators of normality or abnormality of images.

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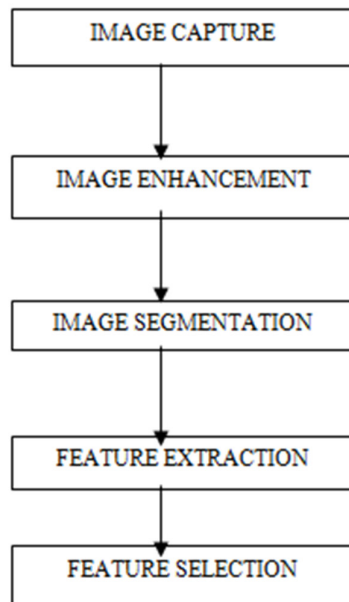


Fig 1. Process Flow in Medical Image processing

### III. Feature Selection in Medical Image Processing

Feature selection is a dimensionality reduction technique widely used for data mining and knowledge discovery and it allows exclusion of redundant features, concomitantly retaining the underlying hidden information, feature selection entails less data transmission and efficient data mining. It also brings potential communication advantages in terms of packet collisions, data rate, and storage [4]. Feature selection is one of the key topics in machine learning and other related fields. It can eliminate the irrelevant noisy features and thus improve the quality of the data set and the performance of learning systems [5]. Expeditious growth of digital image databases motivated Content Based Image Retrieval (CBIR) which in turn requires efficient search schemes. Low level visual features including color, texture and shape, are automatically selected to represent images [6].

#### A. Fundamental Feature Selection Techniques in Medical Image Processing

The feature selection method discussed on three steps when selecting image which are: screening, ranking and selecting. In screening, it removes insignificant and problematic predictors and records or cases, such as predictors with too many missing values or predictors with too much or too little variation to be useful. Ranking, Sorts remaining predictors and assigns ranks based on importance. Selecting: It identifies the subset of features by preserving only the most significant predictors and filtering or excluding all others [7]. The Feature Selection screens, ranks, and selects are the predictors that are most significant.

#### B. Survey on Feature Selection Techniques

Haleh and Kenneth describes part of a larger attempt to apply machine learning techniques to such problems in an effort to automatically generate and progress the classification rules needed for various recognition tasks, image recognition presents a diversity of difficult classification problems involving the identification of significant scene components in the presence of noise, adopting lighting conditions, and shifting viewpoints [8]. Since each feature used as part of a classification procedure can increase the cost and running time of a recognition system, there is strong motivation within the image processing community to design and implement systems with small feature sets. At the same time there is a potentially opposing need to include a sufficient set of features to achieve high recognition rates under difficult conditions. This has led to the development of a variety of techniques within the image processing community for finding an "optimal" subset of features from a larger set of possible features. Sérgio et al., described the advantage of a single-valued functions that evaluate rankings to develop a family of feature selection methods based on the genetic algorithm, it improve the accuracy of content-based image retrieval systems and it also evaluate the ranking quality allows improving retrieval performance [9]. Medical images play a central role in patient diagnosis, therapy, surgical planning, medical reference, and training. With the recent boom in the availability of filmless radiology equipment, the management of digital medical mages is receiving more and more attention. Picture Archiving and Communication Systems (PACS) have been successfully introduced in many hospitals and specialized clinics, providing quick access to screening exams and integrating the actors involved in the enterprise's workflow. The

radiological databases originally built for storing digital images have evolved from simple storage servers of past exams, kept for legal reasons, to active and easily accessible repositories for research and decision support. Jaba and Shanthi reviewed previously on continuous feature discretization and identified defining characteristics of the methods. Then suggest a new supervised approach which merges discretization and feature selection to select the most relevant features which can be used for classification purpose. The classification method to be used is Associative Classifiers [10]. Medical images are a primary part of medical diagnosis and treatment. These images are unlike from typical photographic images primarily as they disclose internal anatomy as contrasting to an image of surfaces. Sasi and Kumaraswamy, said with various techniques proposed in literature for feature extraction, classification and retrieval, Content-based image retrieval (CBIR) is a widely researched area. Also discussed that Information Gain is used to achieve the structure of a feature sets to find a subset of the original feature vector for efficient computation and features are optimized using Particle Swarm Optimization (PSO) [11]. Yong Fan, et al., presented a framework for brain classification based on multi-parametric medical images, and described the method advantage of multi-parametric imaging to provide a set of discriminative features for classifier construction by using a regional feature extraction method which takes into account joint correlations among different image parameters [12]. Ling-Chen et al., discussed a feature selection algorithm rooted on ant colony optimization (ACO), and said Image feature selection (FS) is a significant task which can affect the presentation of image classification and recognition [13]. Ant colony optimization (ACO) is an evolution simulation algorithm proposed by Dorigo et al., It has been successfully used for system fault detecting, job-shop scheduling, network load balancing, graph coloring, robotics and other combinatorial optimization problems. Pushpalata and Jyoti, described feature selection technique and an ensemble model proposed to improve classification accuracy. Feature selection technique is used for selecting subset of relevant features from the data set to build robust learning models and discussed furthermore that Classification accuracy is improved by removing most irrelevant and redundant features from the dataset and stated that Ensemble model is proposed for improving classification accuracy by combining the prediction of multiple classifiers, Three decision tree data mining classifiers were considered for classification which are CART, CHAID and QUEST [7]. Jin Yu et al., presented an approach that involves the analysis of Co focal Scanning Laser Tomography (CSLT) images using moment techniques to obtain abstract image defining features, and then the use of these features to train classifiers for automatically differentiating CSLT images of healthy and diseased optic nerves, and exploration in feature subset selection methods for reducing the comparatively large input space produced by the moment methods [14].

Vasanth et al., discussed that Breast cancer is the most common type of cancer found in women, and they proposes a image classifier to classify the mammogram images, mammogram image is classified into normal image, benign image and malignant image. A hybrid approach of feature selection was proposed in reduction of about 75% of the features [15]. Saravana et al., discussed about feature selection and an efficient method for feature extraction was proposed for image retrieval process and described Content-Based Image Retrieval as a technique that utilizes the visual content of an image to search for similar images in large scale image databases. Feature selection and feature extraction method were the significant tasks that were considered in image retrieval process [16].

Huanzhang et al. discussed about Feature subset selection as a significant subject when training classifiers in Machine Learning (ML) problems and illustrated the information that the complexity of the classifier parameters adjustment during training swells exponentially with the number of features. So they introduced a novel embedded feature selection method, called ESFS, which was simulated from the wrapper method SFS as it relies on the simple standard to add incrementally most relevant features [17]. Georgia et al., discussed the study of investigated information theoretic approach to feature selection for computer-aided diagnosis, the approach was based on the mutual information (MI) concept. MI measures the general dependence of random variables without making any assumptions about the nature of their underlying relationships. They described MI that it can potentially offer some advantages over feature selection techniques that focus only on the linear relationships of variables [18]. Mohamed et al., discussed an approach which was proposed to develop a computer-aided diagnosis (CAD) system that can be very helpful for radiologist in diagnosing microcalcifications' patterns in digitized mammograms earlier and faster than typical screening programs and showed the efficiency of feature selection on the CAD system, and implemented the proposed method in four stages which are [19]:

- a) The region of interest (ROI) selection of 32x32 pixels size which identifies clusters of microcalcifications,
- b) The feature extraction stage based on the wavelet decomposition of locally processed image (region of interest) to compute the significant features of each cluster,
- c) The feature selection stage, which select the most significant features to be used in next stage, and
- d) The classification stage, which classify between normal and microcalcifications' patterns and then classify between benign and malignant microcalcifications.

Guo-Zheng et al. discussed the feature selection methods with support vector machines which contains obtained satisfactory results, and propose a prediction risk based on feature selection method with multiple classification support vector machines. The performance of the projected method is compared with the earlier methods of optimal brain damage rooted feature selection methods with binary support vector machines [4]. Shuqin et al., said feature selection techniques has been widely used in various fields and discussed a new refined feature selection module which utilizes two-step selection method in computer-aided diagnosis (CAD) system for liver disease, the method used was filter and wrapper method, Support Vector Machine (SVM) and Genetic Algorithm (GA) And stated that the advantage was to show the ability of accommodating multi feature selection search strategies and combining filter and wrapper method, especially in identifying optimal and minimal feature subsets for building the classifier [20]. Yong and Ding-gang described

feature extraction and selection are of great importance in neuro image classification for identifying informative features and reducing feature dimensionality, which are generally implemented as two separate steps and presented an integrated feature extraction and selection algorithm with two iterative steps: constrained subspace learning based feature extraction and support vector machine (SVM) based feature selection [21]. Haleh and Kenneht discussed an approach being explored to develop the usefulness of machine learning techniques for generating classification rules for complex, real world data. An approach has been implemented and tested on difficult texture classification problems.

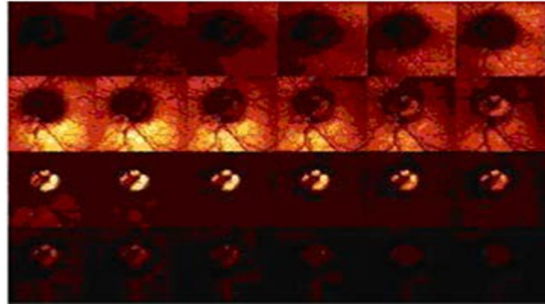


Fig2. CSLT Image of optic disc.

The approach involves the use of genetic algorithms as a "front end" to traditional rule induction systems in order to identify and select the best subset of features to be used by the rule induction system [8]. Feature Selection (FS) algorithms aim at choosing a reduced number of features that preserves the most relevant information of the dataset. FS is usually applied as a preprocessing step in data mining tasks by removing irrelevant or redundant features (dealing with the dimensionality issue), therefore leading to more efficient (reducing the computational cost and the amount of memory required) and accurate classification, clustering and similarity searching processes. Since each feature used as part of a classification procedure can increase the cost and running time of a recognition system, there is strong motivation within the image processing community to design and implement systems with small feature sets. At the same time there is a potentially opposing need to include a sufficient set of features to achieve high recognition rates under difficult conditions. This has led to the development of a variety of techniques within the image processing community for finding an "optimal" subset of features from a larger set of possible features. Images have a large number of features. It is significant to identify and extract interesting features for a particular task in order to reduce the complexness of processing. These are attributes or portion of the image being analyzed that is most likely to give interesting rules for that problem. Not all the attributes of an image are useful for knowledge extraction. An image can be adequately represented using the attributes of its features.

The extraction of the features from an image can be done using a variety of image processing techniques. We localize the extraction process to very small regions in order to ensure that we capture all areas. Feature selection helps to reduce the feature space which improves the prediction accuracy and minimizes the computation time. This is achieved by removing irrelevant, redundant and noisy features .i.e., it selects the subset of features that can achieve the best performance in terms of accuracy and computation time. It performs the Dimensionality reduction. Features are generally selected by search procedures.

A number of search procedures have been proposed. Popularly used feature selection algorithms are Sequential Forward Selection (SFS), Sequential Backward selection (SBS), Genetic Algorithm (GA) and Particle Swarm Optimization. In this work a combined approach of Greedy stepwise method and Genetic Algorithm is proposed to select the optimal features. The selected optimal features are considered for classification.

#### IV. Conclusion

From this survey, it is discovered that selection algorithm determines the authenticity of a medical image process decisions. The selection algorithms are primarily used for the screening, ranking, and selection of the images, which are the predictors that are most significant in removing insignificant and problematic predictors and records or cases, such as predictors with too many missing values or predictors with too much or too little variation to be useful. In medical image processing, a robust and sophisticated method will be necessary such that two or three of the existing selection methods can be hybridized for better performance in real time.

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## Performance (COP) Analysis of a Vapour Compression Refrigeration System component with Nano Coating

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**Abstract-** *The COP of the refrigeration increasing the performance and to get high efficiency of the refrigeration system. By using nano coating over the evaporator of the refrigeration component the objective can be achieved. The improper heat dissipation occurred in the heat exchanger components causes' effect in performance. The vapour compression refrigeration system consuming the high power. Though the energy taken for the refrigeration process has increased and leads to more power consumption. In order to increase the performance, Nano coating Copper Oxide has been applied over the evaporator. By applying the Nano coating Copper Oxide over the evaporator the COP increased. In result the energy required for the refrigeration process and global warming problems has been reduced. By addition of nanoparticles to the refrigeration results in improvements in the COP of the refrigeration, thereby improving the performance of the refrigeration system. In this experiment the effect of using CuO-R134a in the vapour compression system expected COP will be increased by 5% with nano coating.*

### I. INTRODUCTION

Vapour-compression refrigeration, in which the refrigerant undergoes phase changes, is one of the many refrigeration cycles and is the most widely used method for air-conditioning of buildings and automobiles. It is also used in domestic and commercial refrigerators, large-scale warehouses for chilled or frozen storage of foods and meats, refrigerated trucks and railroad cars, and a host of other commercial services.

Oil refineries, petrochemical and chemical processing plants, and natural gas processing plants are among the many types of industrial plants that often utilize large vapour-compression refrigeration systems. Refrigeration may be defined as lowering the temperature of an enclosed space by removing heat from that space and transferring it elsewhere. A device that performs this function may also be called an air conditioner, refrigerator, air source heat pump, geothermal heat pump.

#### A. Working

The vapour-compression uses a circulating liquid refrigerant as the medium which absorbs and removes heat from the space to be cooled and subsequently rejects that heat elsewhere. Fig. 1 depicts a typical, singlestage vapour-compression system. All such systems have four components: a compressor, a condenser, a thermal expansion valve (also called throttle valve or metering device), and an evaporator. Circulating refrigerant enters the compressor in the thermodynamic state known as a saturated vapour and is compressed to a higher pressure, resulting in a higher temperature as well. The hot, compressed vapour is then in the thermodynamic state known as a superheated vapour and it is at a temperature and pressure at which it can be condensed with either cooling water or cooling air. That hot vapour is routed through a condenser where it is cooled and condensed into a liquid by flowing through a coil or tubes with cool water or cool air flowing across the coil or tubes. This is where the circulating refrigerant rejects heat from the system and the

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rejected heat is carried away by either the water or the air (whichever may be the case).

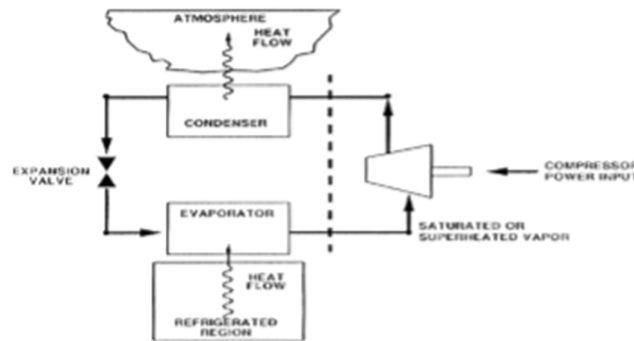


Fig. 1. Vapour Compression refrigeration

The condensed liquid refrigerant, in the thermodynamic state known as a saturated liquid, is next routed through an expansion valve where it undergoes an abrupt reduction in pressure. That pressure reduction results in the adiabatic flash evaporation of a part of the liquid refrigerant. The autorefrigeration effect of the adiabatic flash evaporation lowers the temperature of the liquid and vapour refrigerant mixture to where it is colder than the temperature of the enclosed space to be refrigerated. The cold mixture is then routed through the coil or tubes in the evaporator. A fan circulates the warm air in the enclosed space across the coil or tubes carrying the cold refrigerant liquid and vapour mixture.

That warm air evaporates the liquid part of the cold refrigerant mixture. At the same time, the circulating air is cooled and thus lowers the temperature of the enclosed space to the desired temperature. The evaporator is where the circulating refrigerant absorbs and removes heat which is subsequently rejected in the condenser and transferred elsewhere by the water or air used in the condenser. To complete the refrigeration cycle, the refrigerant vapour from the evaporator is again a saturated vapour and is routed back into the compressor.

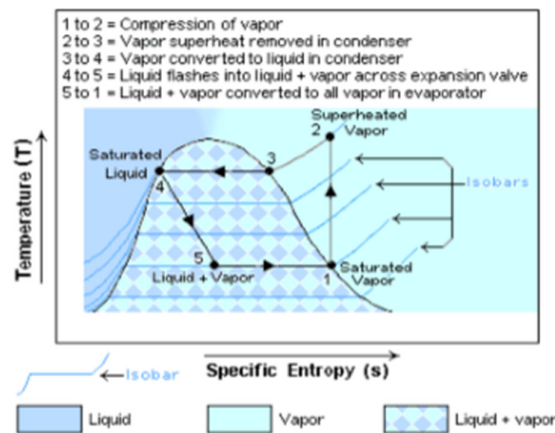


Fig.2. Temperature – Entropy Diagram

The thermodynamics of the vapour compression cycle can be analyzed on a temperature versus entropy diagram as depicted in Fig.2. At point 1 in the diagram, the circulating refrigerant enters the compressor as a saturated vapour. From point 1 to point 2, the vapour is isentropically compressed (i.e., compressed at constant entropy) and exits the compressor as a superheated vapour. From point 2 to point 3, the vapour travels through part of the condenser which removes the superheat by cooling the vapour. Between point 3 and point 4, the vapour travels through the remainder of the condenser and is condensed into a saturated liquid.

The condensation process occurs at essentially constant pressure. Between points 4 and 5, the saturated liquid refrigerant passes through the expansion valve and undergoes an abrupt decrease of pressure. That process results in the adiabatic flash evaporation and auto-refrigeration of a portion of the liquid (typically, less than half of the liquid flashes). The adiabatic flash evaporation process (i.e., occurs at constant enthalpy).

Between points 5 and 1, the cold and partially vapourized refrigerant travels through the coil or tubes in the evaporator where it is totally vapourized by the warm air (from the space being refrigerated) that a fan circulates across the coil or tubes in the evaporator.

The evaporator operates at essentially constant pressure and boils off all available liquid there after adding 4-8 deg kelvin of super heat to the refrigerant as a safeguard for the compressor as it cannot pump liquid. The resulting refrigerant vapour returns to the compressor inlet at point 1 to complete the thermodynamic cycle.

It should be noted that the above discussion is based on the ideal vapour-compression refrigeration cycle which does not take into account real world items like frictional pressure drop in the system, slight internal irreversibility during the compression of the refrigerant vapour, or non-ideal gas behavior.

## II. Description of the Refrigeration System

A refrigerator consists of a compressor connected by pipe line to the condenser, a capillary tube and an evaporator. Refrigerant in vapour state from an evaporator is compressed in the compressor and sent to the condenser. Here, it condenses into liquid and it is then throttled. Due to throttling, Temperature of the refrigerant drops and cold refrigerant passes through the evaporator absorbing the heat from the object to be cooled. The refrigerant is then return to the compressor and then cycle is completed. The test rig consists of a hermetically sealed compressor. The compressed from the compressor is send to an air cooled condenser and the condensate in the liquid form is send to the expansion valve and capillary tube for throttling. Due to throttling, the temperature to the refrigerant falls and the cold refrigerants absorb heat from the water in the evaporator tank. The refrigerant is then returned to the compressor.

A suitable filter is fitted in the refrigerant line from condenser to evaporator. A thermo couple is provide to measure the temperature of the water in the evaporator tank. An Energy meter is provided to measure the energy input to the compressor. Suitable pressure gauges are provided at the compressor inlet – low pressure (evaporator outlet), Condenser inlet (Compressor outlet), Condenser outlet- high pressure (Before throttling) and evaporator outlet (after throttling) to study the refrigeration cycle operating between two pressures. A thermostat is provided for cutting of the power to compressor when the water temperature reaches to set value. A voltmeter and an ammeter provided to monitor the inlet power supply. A voltage stabilizer is provided for the protection of the compressor. Additional four no's thermocouple is fitted at the condenser and evaporator inlet and outlet for studying the temperature at four points in the refrigeration cycle.

## III. Procedure

Start the compressor and let it run until the evaporator. The evaporator temperature is controlled by controlling the power input to heater. When the evaporator temperature is steady, note the low temperatures at evaporator inlet and outlet and condenser inlet and outlet. Also note down the Temperatures and Pressures at Evaporator inlet and outlet temperature, Condenser inlet and outlet temperature. Calculate the COP.

## IV. Result and Discussion

The results that were obtained after the nano coating has applied is tabulated below. Co-efficient of performance COP and power consumption were two parameters, which were changed during the process. Fig. 3. Shows the COP of the refrigeration with and without coating in the compressor are 1.79 and 1.52 respectively. This shows that the COP of the refrigeration makes better performance with nano coating in the compressor. Fig. 4. Shows the power input of the refrigeration with and without coating in the compressor are 60.228 Kw and 77.43 Kw respectively. From the graph which is shown in the fig. 4. Represents that the power input is reduced in the refrigeration after nano coated in its compressor.

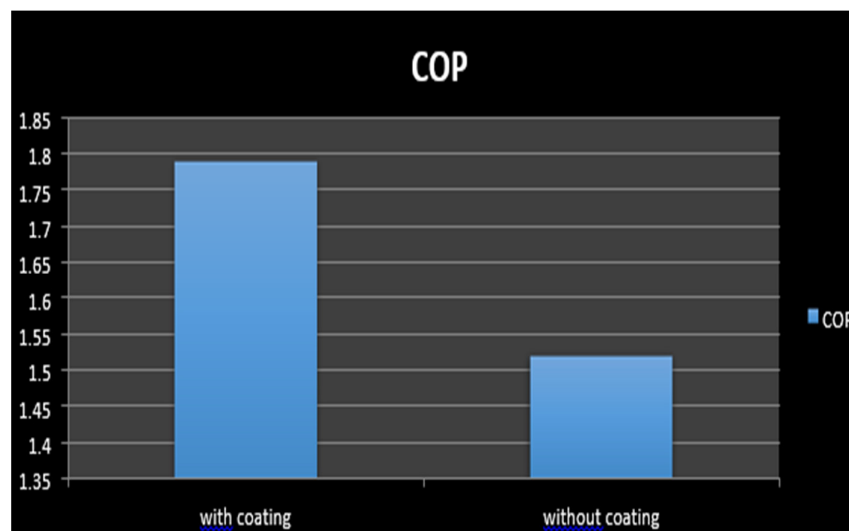


Fig. 3. COP with and without nano coting in Comparison

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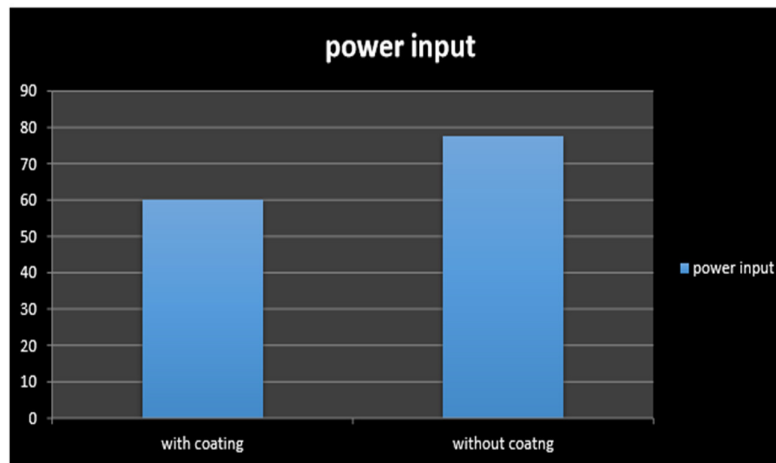


Fig. 4. Power input with and without nano coating in Comparison

## V. Conclusion

CuO nanoparticle can be to improve the COP in a refrigeration system. It leads to less usage of power during the refrigeration process. By applying the Nano coating over the evaporator, the required temperature can be easily attained in minimum time. So that the running time of compressor is reduced. Automatically the power required for the running of refrigerator also reduced. In this case, it makes a COP change in the house hold uses of refrigerator. It is very useful for the people who are using refrigerators in the house hold and in industries. In normal the refrigerator would not give efficient refrigeration after some years. By using this Nano coated refrigerator one can use refrigerator for many years. The cost of this refrigerator is also same as that of the previous refrigerator. A successful model has been designed and increase to the COP of the refrigeration system has been done.

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# Novel Tracking System to Enhance Child Prudent Using Face Recognition

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**Abstract:** An enormous number of understudies are leaving from home to class and school to home each day. For folks, basic issue is getting a sheltered transport for their youngsters. Numerous youngsters get themselves secured a school transport, nodding off or leave at the wrong station with no strategy to track them. This examination tried the materialness of radio recurrence ID (RFID) innovation with GSM in following and checking youngsters amid their excursion to and from school on school transports. The aloof RFID following innovation is utilized for kid security framework because of its following capacities, ease. Be that as it may, the disadvantage of this current framework is negligence. The proposed frameworks give FACE RECOGNITION SYSTEM GSM. Face acknowledgment is a proficient technique to recognize a face in a picture and it is anything but difficult to keep up.

**Keyword:** School Bus, Rfid (Radio Frequency Identification), Gsm Modem, Face Recognition System.

## 1. INTRODUCTION

Presently a-days the World countenances with number of transport related problems, some of them are illuminated by utilizing RFID innovation. The issues that require prompt consideration are mishap hazard administration, environment ready, movement guideline infringement control, vehicle burglary recognizable proof and activity signal administration. RFID labels are put out and about giving zone data and environment alarms, (for example, school zone, industry, market, span and so on.). One RFID is set in vehicle with proprietor data, RC book, protection points of interest, administration subtle elements etc. To send vehicle ID to activity data database. RFID per user will be put with inserted controller in vehicle, Toll Gates, Parking regions furthermore in activity signal zones.

To transmit mishap data to various focuses we utilized GSM module with installed unit in the moving vehicle. At whatever point vehicle meets with a mischance, the framework peruses region data from RFID labels put out and about and exchanges this data to installed module. The subtle elements are transmitted to the particular numbers put away in database (Police station, Owner and Hospital). Additionally, vibration sensor enacts air sacks such that serious mischance to the driver driving the vehicle can be maintained a strategic distance from and transmits this crisis circumstance to proprietor, police control office and doctor's facility through SMS.

At whatever point the vehicle crosses the specific street region, the information from Vehicle tag is perused and in light of the area, a SMS with respect to area of the vehicle will be sent to the proprietor. Social zone data can be customized in dynamic tag and this data is transmitted to RFID per user associated with vehicle inserted pack, it alerts driver about the zone.

Face Recognition is a standout amongst the most critical biometric which is by all accounts a decent trade off in the middle of reality and social gathering and adjusted security and protection well. Face Recognition fall into two classifications: Verification and Identification. Face confirmation is a 1:1 match that analyzes a face picture against a layout face pictures, whose character is being asserted.

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Unexpectedly, confront distinguishing proof is 1: Nissue that thinks about an inquiry face picture against all picture formats in a face database.

Some facial acknowledgment calculations distinguish facial elements by separating milestones, or elements, from a picture of the subject's face. For instance, a calculation might examine the relative position, size, and/or state of the eyes, nose, cheekbones, and jaw. These elements are then used to hunt down different pictures with coordinating elements.

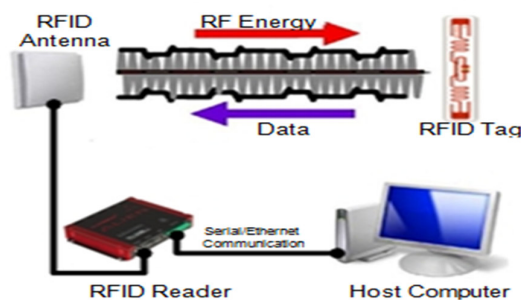
Different calculations standardize an exhibition of face pictures and afterward pack the face information, just sparing the information in the picture that is helpful for face acknowledgment. A test picture is then contrasted and the face information. One of the most punctual fruitful frameworks depends on layout coordinating systems connected to an arrangement of notable facial elements, giving a sort of compressed face representation.

## 2. Existing Method

### A. RFID Technology

RFID innovation depends on correspondence between a connected tag and a peruser. Two sorts of RFID labels are in like manner use: latent labels and dynamic tags. The aloof labels, which have no inner power supply and radiate a radio recurrence flag just because of a question from a transponder, and dynamic labels which are inside fueled and which constantly emanate a radio recurrence signal. While inactive labels are less costly, dynamic labels have higher unwavering quality and transmission power. Dynamic labels can be perused from separations of a few many meters, while uninvolvement labels have an extent between several centimeters and a couple meters. Besides, dynamic labels contain more memory and can be incorporated with extra sensors, for instance, for checking temperature or dampness, and are able to store the historical backdrop of sensor information. Inactive labels, then again, have longer life time, and its expense is fundamentally lower. The data contained in the sign of either sort of tag can be an interesting identifier that is then connected to a database (like standardized identification innovation), or can incorporate specimen information that is modified into the tag and after that telecast in the sign.

The innovation comprises of two fundamental components: RFID labels (or transponder) and RFID per users (or cross examiner). The label trades information with the per user utilizing radio waves that are tuned to the same recurrence as the peruser and inside of the perusing scope of the peruser. Figure 1 demonstrates a common aloof RFID system configuration and cases of the RFID labels.



RFID system configuration

The RFID per user comprises of a reception apparatus, handset, processor, control supply, and an interface for associating it to a host PC (i.e. by means of serial port, or Ethernet). The RFID tag has a reception apparatus, a handset, and an Integrated Circuit (IC) with memory. The execution of the RFID tag is dictated by components, for example, IC innovation utilized, the read/compose capacity, the radio recurrence, the read extent, and outside elements, for example, nature and bundling.

Taking into account the usefulness gave by every innovation, dynamic and uninvolvement RFID address diverse, yet frequently corresponding, parts of advantage/individuals deceivability. As of not long ago, the consideration was centered on individuals following taking into account dynamic gadgets transmitting reference point like signs. In the current tyke wellbeing framework, aloof RFID labels will be utilized for the kids to convey. Since aloof RFID labels are latent unless fueled by the vitality emanated by the peruser when they are close, the labels represent no mischief to the kids. Despite the fact that the working separation is restricted to the per user's reach, this will be favorable position of this framework is to know who are installed the school transport, and consequently channels the identified exception labels effectively. In addition, detached labels are minimal effort and needn't bother with battery substitution. The Ultra High Frequency (UHF) RFID perusers (868-870 MHz) were for the most part chose because of having a more extended perused range (>3 meter). In addition, UHF RFID perusers have a speedier perusing speed and a bigger memory size. There are three primary sorts of RFID labels, which are:

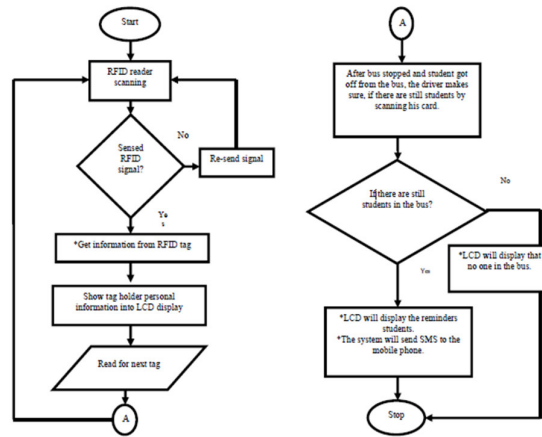
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**Inactive Tags**-There is no inward power supply in the tag; along these lines the microchip is in rest mode, until the tag is in the scope of the peruser, where the peruser send selector magnetic waves, these waves "wake up" the microchip where it changes over the waves into advanced information utilizing modulators and send it to the peruser.

**Dynamic Tags** - The tag can control the incorporated circuits and transmit the information to the peruser in the event that it have their own particular inner power supply.

Correspondence is a great deal more solid from dynamic labels to perusers than the uninvolved labels. Notwithstanding the force supply the dynamic tag can have on-board hardware, for example, sensors, I/O ports among others that are controlled by the on-board control supply. With this element the dynamic labels can be utilized as a part of a great deal a larger number of uses than the latent labels. The read scope of the tag can achieve 100m.

**Semi Passive Tags** - The labels layer between the aloof and the dynamic labels, since they have a battery to control the coordinated circuit anyway they utilize the force from the electromagnetic waves that the peruser sends to recover the information present on the tag.



System flowchart

This stream diagram clarifies the operation of the framework. The framework begins once the Students check their card into the RFID peruser. The RFID peruser will sense the medium, in the event that it caught any information from the RFID label (card), the framework will demonstrate the information into LCD show. On the off chance that it is not, the RFID peruser will re-sense the medium to peruse the following tag. After the transport halted, the driver ensures if there are still understudies inside the bus by filtering his card. On the off chance that there are still understudies on the transport, the LCD will show the update understudies and the GSM will send a SMS message to the school administration. On the off chance that there is not, the LCD will appear, there is no one on the transport.

### 3. GSM

Computerized cell correspondence utilizes Global System for Mobile Communication (GSM), which is an all-around acknowledged standard. The regular European cellular phone standard GSM for a versatile cell radio framework working at 900MHz. The SIM300 module is a Triband GSM/GPRS arrangement in a reduced module including an industry-standard interface.

It conveys voice, information and fax in a little frame element with low power consumption. SIM900 GSM modem is utilized as a part of this execution as it permits sending SMS to the administration of the school furthermore to the guardian's by means of internet. This modem acknowledges SIM card, and works through a membership to a mobile operator. The fundamental point of interest of this modem is thin and conservative. It likewise has low power utilization. This modem has GPRS highlight that permits transmitting the information by means of the web in various strategies, for example, SMS, GPRS, or CSD.

### 4. Face Recognition System

Very nearly 50 years, Face acknowledgment frameworks have been led from now. Face acknowledgment is one of the looks into in range design acknowledgment and PC vision because of its various common sense applications in the territory of biometrics, Information security, access control, law authorization, brilliant cards and observation framework. The primary vast scale use of face acknowledgment was done in Florida.

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Biometric-based systems have risen as the most encouraging choice for perceiving people as of late since, rather than confirming individuals and permitting them access to physical and virtual areas.

Keeping in mind the end goal to build up a valuable and relevant face acknowledgment framework a few variables should be take close by.

1. The satisfactory scope of rate from location to acknowledgment ought to be utilized.
2. The exactness ought to be high.
3. The framework ought to be effectively overhauled and broadened, that is anything but difficult to build the quantity of subjects that can be perceived.



Face recognition system

Before all else of the 1970's, face acknowledgment was dealt with as a 2D design acknowledgment issue. The separations between vital focuses where used to perceive known countenances, e.g. measuring the separation between the eyes or other essential focuses. In any case, it is important that the face acknowledgment frameworks to be completely automatic. The most difficult yet fascinating issue that has pulled in analysts is face acknowledgment who have diverse foundations: brain science, design acknowledgment, neural systems, PC vision, and PC illustrations.

### Mixture Method

The all-encompassing and highlight extraction techniques are utilized as a part of cross breed face acknowledgment. In half breed techniques, by and large 3D pictures are utilized. The picture of a man's face is discovered in 3D, permitting the framework to take note of the bends of the eye sockets. For sample, the states of the button or brow. Indeed, even a face in profile would serve on the grounds that the framework utilizes profundity, and a pivot of estimation, which gives it enough data to build a full face. The 3D framework generally continues in this way: Detection, Position, Measurement, Representation and Matching.

**Recognition** - Capturing a face either a filtering a photo or shooting a man's face continuously.

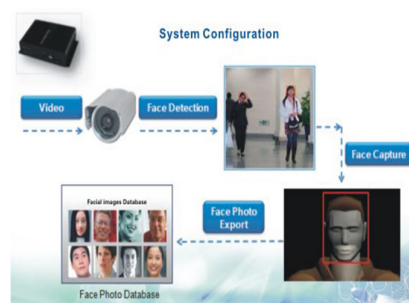
**Position** - Determining the area, size and point of the head.

**Estimation** - Assigning estimations to every bend of the face to make a format with particular spotlight on the outside of the eye, within the eye and the point of the nose.

**Representation** - Converting the format into a code - a numerical representation of the face

**Coordinating** - Comparing the got information with countenances in the current database.

In Case the 3D picture is to be contrasted and a current 3D picture, it needs no modifications. Commonly, be that as it may, photographs that are placed in 2D, and all things considered, the 3D picture require a couple changes. This is one of the greatest difficulties in the field today.

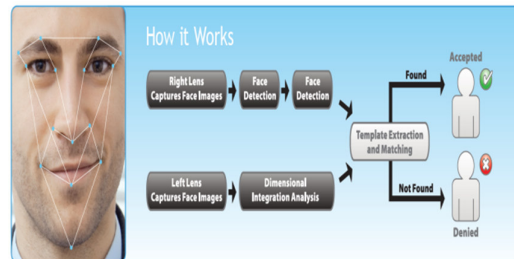


System configuration

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## 5. Result

The face pictures are additionally gotten under normal conditions, for example, frontal countenances and indoor enlightenment. The face acknowledgment arrangement of this application can accomplish high exactness without much co-operation from client. The Face acknowledgment innovation is utilized to screen the client persistently who is before a camera. At the point when the client leaves for a foreordained time, it cripples the work of catching. Again when the other client returns and is perceived, the photo of a client shows up. Some other client separated from the database format who tries to show up before camera, the approval is denied as shown in figure.



Output figure

## 6. Conclusion

The coordination of FACE RECOGNITION SYSTEM and GSM advances helps the transport driver to distinguish that the customary understudies are getting inside the transport furthermore their area by folks are known. Using this framework, concerned powers, transport driver can be cautioned as it's proficient perceivability through FACE RECOGNITION SYSTEM. The GSM innovation send a sms to folks about the area of an understudy at the season of travel, in case if there was an understudy stay inside after the destination of bus, the framework will likewise send a SMS message to the administration of the school to take the right choice. The paper demonstrates that the FACE RECOGNITION SYSTEM is still goes about as one of the best answer for improve distinguishing proof of a man precisely and proficiently, which will denied the wrong understudies inside the transport.

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## A Survey on Energy Efficient and Key Based Approach for Data Aggregation in WSN

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**Abstract:** A Wireless Sensor Network is a multiple collection of large number of sensor nodes. These sensor nodes are used to collect the information from the surroundings and pass it to the base station. Data Aggregation is an important technique to achieve power resource effectively in the sensor network. Because sensor node has limited battery power so data aggregation techniques have been proposed for WSN. The data from the multiple sensor nodes are aggregated is usually performed by averaging method. The aggregated data are stored into header aggregator node and it is highly susceptible to attacks. To address this security issue, Iterative Filtering algorithms are used to monitor sensor nodes and provide great promise by detecting vulnerable errors. For transferring aggregator data from aggregated node to base station, this paper introduces Cryptography and Random Key Generation technique. We use encryption technique for original message and simultaneously create a key for that encrypted message. That generated key and encrypted message will be sent to the receiver through the possible paths where the hackers cannot hack the original message.

**Keywords:** Data Aggregation, Sensor Networks, Network level Security, Collision Attacks.

### I. INTRODUCTION

A Wireless Sensor Network (WSN) are widely distributed autonomous sensors to monitor physical or surrounding conditions such as temperature, noise etc., and to cooperatively pass their data through the network to a main location. WSNs are widely used in several applications, such as wild habitat observation, forest fire exposure, and military surveillance. Individual sensor nodes transmit the data to the base station continuously; therefore power consumption is increased [2]. In order to reduce the power consumption of WSNs, several approaches are proposed such as radio scheduling, control packet elimination, topology control, and data aggregation [1].

An example data aggregation scheme is presented in Fig. 1 where a collection of multiple sensor nodes gather information from a target boundary. When the base station queries the network, rather than sending each and every sensor node's data to base station, any one sensor node from the network is called as data aggregator. It will gather the information from its nearby nodes aggregates them and transmit the aggregated data to the base station through a multi hop path. WSN are influenced by many types of security attacks including false data injection and data forgery. Sensor nodes can be mutually concession by intruders and the compromised nodes can distort data integrity by injecting false data [9]. In [9] the first of its kind to integrate the detection of false data with data aggregation and confidentiality.

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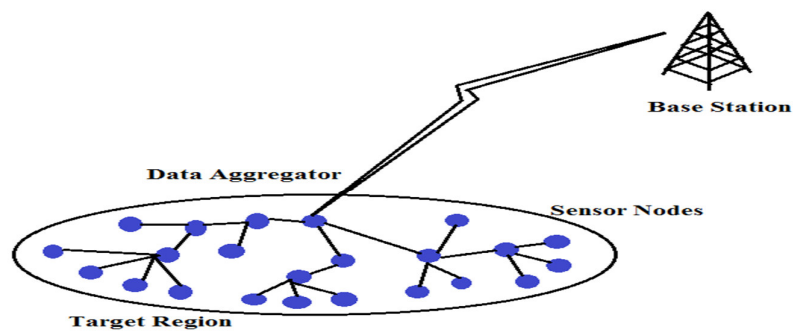


Fig. 1. Data aggregation in a wireless sensor network.

Data aggregation is implemented in WSN to eliminate data redundancy, reduce data transmission, and improve data validity. Data aggregation results in better bandwidth and battery utilization [9]. To detect false data injected by a data aggregator, some neighboring nodes of the data aggregator also perform data aggregation and evaluate MACs for the aggregated data to activate their pair mates to verify the data later. DAA also provides data secrecy and the data are forwarded between data aggregators [9]. In this scheme, they use a ring topology in which a node may have multiple parents in the aggregation hierarchy and every sensed value or sub aggregate is denoted by a duplicate-insensitive bitmap called synopsis [10]. Reputation and trust play an essential role in such applications by enabling multiple parties to establish relationships that achieve mutual profit. Reputation allows parties to build trust, or the degree to which one party has confidence in another within the framework of a given purpose or decision [4]. Trust management systems for WSN could be very useful for detecting malicious nodes and for assisting the decision-making process [5].

The rest of this paper is organized as follows. The associated work is presented in Section II, Section III describes the problem statement and the assumptions, Section IV starts with a brief summary of security requirements of wireless sensor networks and show how they narrate with data aggregation process, Section V describes a Message Digest (MD5) algorithm and Section VI concludes this paper.

## II. Related Work

Several researchers have studied problems related to data aggregation in WSNs. Header aggregator nodes can be easily compromised by attackers. The hackers may inject false data into the node and it is highly vulnerable. To address this problem they used Iterative Filtering algorithm [1]. For example, In the Page Rank algorithm, they accept that a random walk over the network is a good model of real navigation for web surfer. In trust propagation over networks, we accept the transitivity of trust if node A trusts node B and B trusts node C, then A will trust C [7]. Compromised nodes might attempt to frustrate the aggregate computation process in multiple ways; they are violating data privacy, Falsifying the local value and Falsifying the sub aggregate.

Several key establishment protocols are developed for sensor networks which propose “direct key establishment” for neighboring nodes and “path key establishment” for sensor nodes [9]. Our work is also closely related to provide security for transmitting the data from aggregator node to base station.

## III. Problem Statement and Assumption

Our goal is to transfer the encrypted message and its key to the base station through the multi hop path. In [10] technique, the mutually concession node can inject a large amount of error in the final estimate of BS (inflation attack). Although sensor nodes are considered to have limited computational capabilities, there are in fact different types of nodes with different levels of constraints are Weak nodes, Normal nodes and Heavy-Duty nodes. Weak nodes are extremely constrained, Heavy-Duty nodes have PDA-like capabilities and Normal nodes are the most common type of sensor node device with enough resources to create a fully functional sensor network [5].

We assume that the sensor nodes for a multi hop network with BS as the central point of control. A compromised node can corrupt the aggregate estimate of the base station, keeping their focus on the ring-based hierarchical aggregation algorithms. To address this issue, they presented a lightweight verification algorithm which would activate the base station to verify whether the computed aggregate was valid [10].



## IV. Security Requirement

Due to unfriendly environments and unique properties of WSN, it is a challenging task to defend sensitive information transmitted by WSN [2]. Therefore, security is a main concern for WSN and there are many security requirements that should be investigated. In this section, we present the necessary security requirements that are raised in a WSN atmosphere and make clear how these requirements relate with data aggregation and transmission process. Trust and Reputation Systems (TRS) represent a significant class of decision support tools that can help to reduce risk when engaging in transactions and interactions on the Internet [3].

Data aggregation protocols must decrypt the sensor data to carry out data aggregation and encrypt the aggregated data before transmitting it. Data aggregation protocols can be classified into two parts: tree-based data aggregation and cluster-based data aggregation protocols [2]. The protocol called EADAT (Energy-Aware Distributed Aggregation Tree) is based on an energy-aware distributed heuristic. Security requirements of WSN can be satisfied using any symmetric key or asymmetric key cryptography. Due to resource limitations of sensor nodes, symmetric key cryptography is preferable more than asymmetric key cryptography. Secure DAV protocol is very similar except that elliptic curve cryptography is used for encryption purposes and provides data confidentiality, data security and source authentication [2].

## V. Message Digest (MD5) Algorithm

This section presents about Message Digest (MD5) algorithm and its operations. A MD5 algorithm is also known as cryptographic hash function. It receives a message as input and creates a fixed-length output, which is generally lower than the length of the input message. The output is known as hash value, a fingerprint or a message digest. In [9] elaborate the protocol DAA and its algorithms, namely MNS and SDFC. The limitations of DAA due to the value depends strictly on several circumstances such as geographical area situation, modes of deployment, transmission range of sensor nodes and power management. The Bipartite method has two major drawbacks are the statistical ranking methods are very hard to be used to detect the users who give random rating scores and some important rating scores given by some users can be possibly removed by the statistical methods applied [8]. The properties of MD5 includes: one-way, collision-resistant and satisfy pseudo-randomness.

When the above properties are satisfied, we describe the algorithm a collision-resistant message-digest algorithm. Message-digest algorithms are mainly used in implementing digital signature. On account of its property of pseudo-randomness, MDA is also used to be an element of the mechanism for random number generation. There are three kinds of operations in MD5 are Bitwise Boolean Operation, Modular Addition, Cyclic Shift Operation. All these three operations are very rapid on a 32-bit machine. So MD5 is quite fast. The mechanism of MD5 as well as MD2 and MD4, follows a design principle planned by Merkle and Damagard. Its basic idea in block-wise mode to do hash. In a word, MD5 consists of two phases: padding phase and compression phase. In the padding stage, some extra bits (1 to 512bits) are appended to the input message. In the compression stage, a compression function is used on each 512-bit block and generates a 128-bit output. The output is always involved in the calculation of next round.

## VI. Conclusion

This paper provides a detailed review of secure data aggregation and security concept in wireless sensor networks. We discussed how to prevent the encrypted message from the hackers while transmitting to the base station. To address this problem, we used Message Digest (MD5) algorithm that provides security by compressing the data. This algorithm would guarantee the successful protection of the encrypted data even in the presence of an attack. As for the future work, we will investigate that our approach can protect against compromised attackers.

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## Identification of Brain Regions Related to Alzheimers' Diseases using MRI Images Based on Eigenbrain and K-means Clustering

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**Abstract:** Early identification of Alzheimer's disease (AD) from the Ageing Movement Control (AC) is very important. However, the computer aided diagnosis (CAD) was not widely used, and the classification performance did not reach into practical use. Existing System has a novel CAD system for MRI brain images based on eigenbrains and machine learning with focus on two things: accurate detection of both AD subjects and AD related brain regions. The eigenbrain method was effective in AD subject prediction and discriminated brain region detection in MRI scanning. But, the results showed that existing method achieved 92.36% accuracy, which was competitive with state-of-the-art methods. We, Propose a system to improve the accuracy and easy computation of identification through MRI images based on K-Means Clustering.

**Keywords:** K-means Clustering, Region Detection, Support Vector Machine (SVM), Machine learning.

### INTRODUCTION

Alzheimer's disease (AD) is not a normal part of aging. It is a type of dementia that causes problems with memory, thinking, and behavior. Symptoms usually develop slowly and worsen over time. Symptoms may become severe enough to interfere with daily life, and lead to death (Hahn et al., 2013). There is no cure for this disease. In 2006, 26.6 million people worldwide suffered from this disease.

AD is predicted to affect 1 in 85 people globally by 2050, and at least 43% of prevalent cases need high level of care (Brookmeyer et al., 2007). as the world is evolving into an aging society, the burdens and impacts caused by AD on families and the society has also increased significantly. In the US, healthcare on people with AD currently costs roughly \$100 billion per year and is predicted to cost \$1 trillion per year by 2050 (Miller et al., 2012).

Early and accurate detection of AD is beneficial for the management of the disease (Han et al., 2011). Presently, a multitude of neurologists and medical researchers have been dedicating considerable time and energy toward this goal, and promising results have been continually springing up (Xinyun et al., 2011). Magnetic resonance imaging (MRI) is an imaging technique that produces high quality images of the anatomical structures of the human body, especially in the brain, and provides rich information for clinical diagnosis and biomedical research (Shamonin et al., 2014). The diagnostic values of MRI are greatly enhanced by the automated and accurate classification of the MR images (Goh et al., 2014; Zhang et al., 2015a,b). It already plays an important role in detecting AD subjects from normal elder controls (NC) (Angelini et al., 2012; Smal et al., 2012; Nambakhsh et al., 2013; Hamy et al., 2014; Jeurissen et al., 2014).

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The Eigenbrain was an excellent multivariate approach that solves both the curse of dimensionality and the problems in small sample size. It was proposed by Alvarez et al. (2009a) and Lopez et al. (2009), and was applied on Single Photon Emission Computed Tomography (SPECT) images. In their research, the eigenbrain approach was shown to efficiently reduce the feature space from  $\sim 5 \times 10$  to only  $\sim 10$ , and therefore, was able to achieve excellent classification accuracy. In this study, we make a tentative test of applying eigenbrains in MRI scans for AD detection.

Support vector machine (SVM) has been arguably regarded as one of the most excellent classification methods in machine learning (Zhang and Wu, 2012a). Original SVMs are linear classifiers, and do not perform well on nonlinear data. Hence, we introduced in the kernel SVMs (KSVMs), which extends original linear SVMs to nonlinear SVM classifiers by applying the kernel function to replace the dot product form in the original SVMs (Gomes et al., 2012).

Compared with the original plain SVM, the K-means Clustering allows one to fit the maximum-margin hyperplane in a transformed feature space (Garcia et al., 2010). The transformation may be nonlinear and the transformed space is high dimensional; Thus although the classifier is a hyperplane in the high-dimensional feature space, it may be nonlinear in the original input space (Hable, 2012).

The aim of our study was to develop a novel classification system based on eigenbrain and K-means Clustering, in order to grow a computer aided diagnosis (CAD) system for the early detection of AD subjects and AD related brain regions. Our goal was not to replace clinicians, but to provide an assisting tool. The rest of the paper was organized as follows: the next section reviewed related literatures from two aspects: the extracted features and the classification methods. Section the Existing Method describes methodology of Classification of MRI images based on SVM. Section The Proposed Method describes the methodology of the proposed CAD. Section Experiments and Results contain the experiments and results. Finally, Section Conclusion and Future Research are devoted to conclusion and future research. For ease in reading, the acronyms and their meanings of this study are listed in Table 12 in the appendix.

**Literature Review:** In common convention, the automatic classification consisted of two stages: feature extraction and classifier construction. We reviewed over ten literatures, and analyzed them through the two stages.

### Feature of MR Image

Scholars have proposed numerous methods to extract various features. Chaplot et al. (2006) used the approximation coefficients obtained by discrete wavelet transform (DWT). Maitra and Chatterjee (2006) employed the Slantlet transform, which is an improved version of DWT. Their feature vector of each image was created by considering the magnitudes of Slantlet transform outputs corresponding to six spatial positions that were chosen according to a specific logic. From the literature used, the DWT based features were proven to be efficient. In this study, we suggested using a novel feature of eigenbrain, which was used for SPECT images but was never been used in MR images.

### Classification Model in MRI

There are numerous classification models, but only a few of them are suitable for MR images. Chaplot et al. (2006) employed the self-organizing map (SOM) neural network, K-means Clustering and SVM. Maitra and Chatterjee (2006) used the common artificial neural network (ANN). ElDahshan et al. (2010) used ANN and K-nearest neighbor (KNN) classifiers. Plant et al. (2010) used SVM, Bayes statistics, and voting feature intervals (VFI) to derive the quantitative index of pattern matching. Zhang et al. (2011) suggested using ANN. Yang et al. (2015) used SVM as the classifier, and employed biogeography-based optimization (BBO) to train the classifier. Zhang et al. (2015) used SVM as the classifier based on eigenbrain. Suman Tatiraju proposed K-means clustering used for Image segmentation.

After reviewing the latest literatures that were related to classifiers, we found that SVM and K-means Clustering had significant advantages of high accuracy, elegant mathematical tractability, and direct geometric interpretation, compared with other classification methods (Collins and Pape, 2011). Here, we take K-means Clustering to classify the AD along with severity. In addition, it did not need a large number of training samples to avoid overfitting (Li et al., 2010).

### The Existing Method

#### Eigenbrain

AD has different physical structures from NC. Revisit Figure 1 which indicated the AD subjects had severe atrophy of the cerebral cortex (region i), severely enlarged ventricles (region ii), and extreme shrinkage of hippocampus (region iii). Therefore, eigenbrain tried to capture those different characteristic changes of anatomical structures between AD and NC.

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Eigenbrain is carried out by PCA, which is a statistical procedure that uses an orthogonal transformation to convert a set of observations of possibly correlated variables into a set of values of linearly uncorrelated variables called principal components (PC). For 2D images the PCs are extended naturally to the 2D eigenbrains.

Suppose  $X$  is a given data matrix with size of  $N \times A$ , where  $N$  represents the number of samples and  $A$  number of attributes (For a  $256 \times 256$  image, we need to vectorize it to a  $1 \times 65536$  vector, hence  $A = 65536$ ). First, we normalized the dataset matrix  $X$ , so that each sample in the normalized matrix  $Z$  was mean-centered and unit-variance scaled, by subtracting its mean value and dividing the difference by its standard deviation.

$$Z \leftarrow \frac{X - \mu(X)}{\sigma(X)} \quad (2)$$

Next, we estimated the covariance matrix  $C$  with size of  $A \times A$  by

$$C \leftarrow \frac{1}{N-1} Z^T Z \quad (3)$$

Here we used  $N - 1$  instead of  $N$  in order to produce an unbiased estimator of the variance (See Bessel's correction (Russell and Cohn, 2012) for details).

Third, we perform the eigendecomposition of  $C$ :

$$C = U \Lambda U^{-1} \quad (4)$$

Where  $U$  is an  $A \times (N - 1)$  matrix, whose columns are the eigenvectors of covariance matrix  $C$ , matrix  $\Lambda$  is an  $(N - 1) \times (N - 1)$  diagonal matrix whose diagonal elements are eigenvalues of  $C$ , each corresponding to an eigenvector of  $A$ . It is common to sort the eigenvalue matrix  $\Lambda$  and eigenvector matrix  $U$  in order of decreasing eigenvalue  $u_1 > u_2 > \dots > u_N$ . To view the  $i^{\text{th}}$  eigenbrain  $u(i)$ , the  $i^{\text{th}}$  column of  $U$  was reshaped to an image.

The flowchart of calculating eigenbrain is shown in Figure 2.

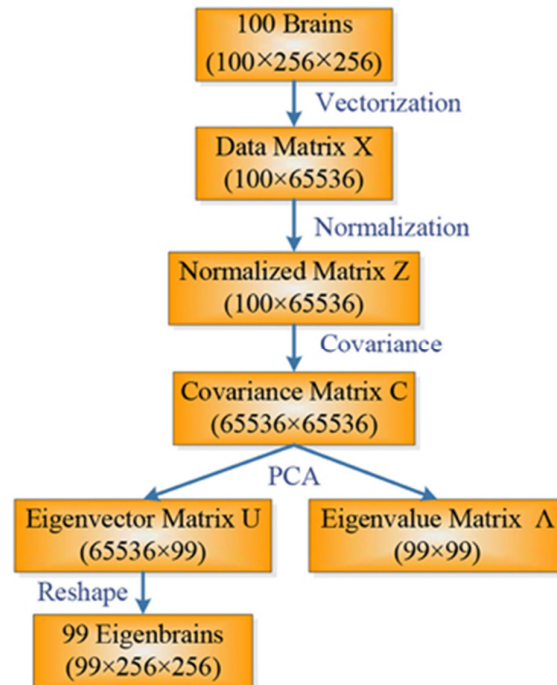


Figure 2: Flowchart of Calculating Eigenbrain

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## Region Detection

In existing method, a visual interpretation method of Eigenbrain to detect regions that can distinguish AD and NC, which is not reported in literatures of Alvarez et al. (2009a) and Lopez et al. (2009). The interpretation in a four-stage process is listed in Table 1.

Measure	Definition
Accuracy	$(TP + TN) / (TP + TN + FP + FN)$
Sensitivity (Recall)	$TP / (TP + FN)$
Specificity	$TN / (TN + FP)$
Precision	$TP / (TP + FP)$

Table 1: Four Stage region detection Method

### Classifier

SVM was used as the classifier. In addition, sequential minimal optimization (SMO) is chosen to train SVM due to simple and fast speed (Zhang and Wu, 2012b). Traditional linear SVMs cannot separate intricately distributed data. In order to generalize SVMs to create nonlinear hyperplane, the kernel trick is applied. The KSVMs allows us to fit the maximum-margin hyper-plane in a transformed feature space (Liu et al., 2014). The transformation may be nonlinear and the transformed space is a higher dimensional space. Though the classifier is a hyper-plane in the higher-dimensional feature space, it may be nonlinear in the original input space.

## The Proposed Method

### Pre-processing on Volumetric Data

For each individual, all available 3 or 4 volumetric 3D MR brain images were motion-corrected, and co-registered to form an averaged 3D image. Then, those 3D images were spatially normalized to the Talairach coordinate space and brain-masked. CDR was interpreted as the target (label). It is a numeric scale quantifying the severity of symptoms of dementia (Williams et al., 2013). The patient's cognitive and functional performances were assessed in six areas: memory, orientation, judgment and problem solving, community affairs, home and hobbies, and personal care. In this study, we chose two types of CDR, i.e., the subjects with CDR of 0 were considered as NC and subjects with CDR of 1 were considered as AD (Marcus et al., 2007). Calculating eigenbrains on the entire brain was difficult. Instead, we proposed a simplified method that selected several key slices that capture structures indicative of AD from NC. The procedure was as follows: we established the ICV  $v$  as

$$v(k) = \|\mu_{AD}(Slice = k) - \mu_{NC}(Slice = k)\|^2 \quad (1)$$

Where  $k$  was the index of key slice,  $\mu_{AD}$  and  $\mu_{AC}$  represented the mean of gray-level values of the  $k^{\text{th}}$  slice of AD subjects and NC subjects, respectively,  $\|\cdot\|^2$  represented the  $l_2$  norm. Then, we selected the key-slices of ICV larger than 50% of maximum ICV, with  $10\times$  under-sampling factor (i.e., every 10 slices).

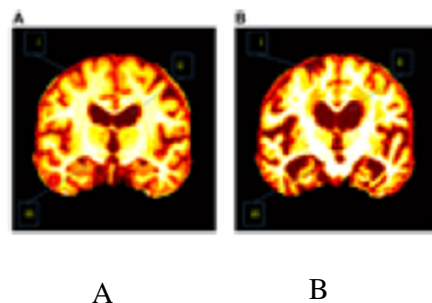
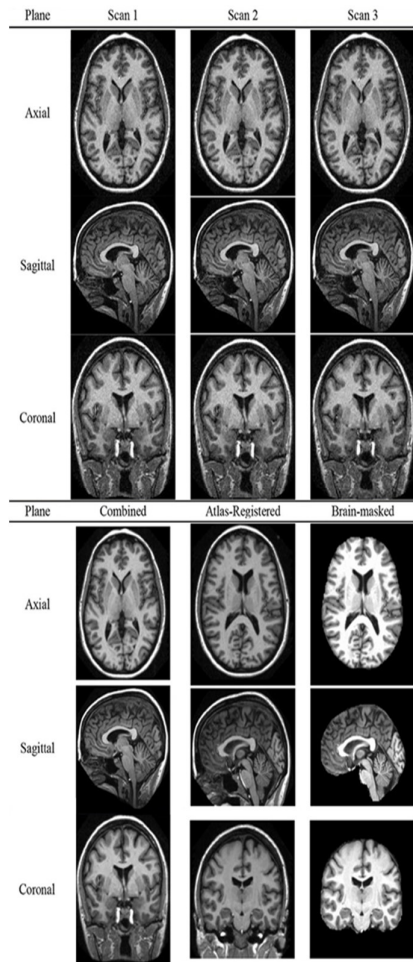


Figure 1: Difference between healthy brain (A) and AD brain (B)

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Table 2 shows an example of the combination of 3 individual scans of a subject. The resolution is  $1 \times 1 \times 1.25$  mm. The preprocessing performed motion-correction on the 3D MR images, registered them to form a combined image in the native acquisition space, and re-sampled to  $1 \times 1 \times 1$  mm. afterwards, the combined image was spatially normalized to the Talairach coordinate space, and brain-extracted (Table 2).



The null hypothesis is that the eigenvalues of AD and NC have equal means, without assuming they have equal variances. The alternative hypothesis is they have unequal means. WTT was carried out at the 95% confidence interval. The eigenvalues of the selected most important eigenbrain (MIE) were used as input features for following classification.

### Classification by K-means Clustering

K-Means algorithm is an unsupervised clustering algorithm that classifies the input data points into multiple classes based on their inherent distance from each other. The algorithm assumes that the data features form a vector space and tries to find natural clustering in them. The points are clustered around centroids  $\mu_j$  for  $j = 1, 2, \dots, k$  which are obtained by minimizing the objective

$$V = \sum_{i=1}^k \sum_{x_j \in S_i} (x_j - \mu_i)^2 \tag{5}$$

Where there are  $k$  clusters  $S_i$ ,  $i = 1, 2, \dots, k$  and  $\mu_i$  is the centroid or mean point of all the points  $x_j \in S_i$

As a part of this project, an iterative version of the algorithm was implemented. The algorithm takes a 2 dimensional image as input. Various steps in the algorithm are as follows:

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1. Compute the intensity distribution (also called the histogram) of the intensities.
2. Initialize the centroids with k random intensities.
3. Repeat the following steps until the cluster a label of the image does not change anymore.
4. Cluster the points based on distance of their intensities from the centroid intensities.

$$c^{(i)} := \arg \min_j \|x^{(i)} - \mu_j\|^2 \tag{6}$$

5. Compute the new centroid for each of the clusters.

$$\mu_i := \frac{\sum_{i=1}^m 1\{c^{(i)} = j\}x^{(i)}}{\sum_{i=1}^m 1\{c^{(i)} = j\}} \tag{7}$$

Where k is a parameter of the algorithm (the number of clusters to be found), i iterates over the all the intensities, j iterates over all the centroids and  $\mu_i$  are the centroid intensities.

Table 3 shows the ranges for AD and classification as follows:

Slice	$\lambda_1$		p
	NC	AD	
60	-3.36 ± 20.01	11.75 ± 27.91	<b>0.01</b>
70	-6.84 ± 25.60	23.92 ± 28.33	<b>0.00</b>
80	-7.48 ± 29.05	26.18 ± 27.04	<b>0.00</b>
90	6.79 ± 32.04	-23.75 ± 24.86	<b>0.00</b>
100	-6.93 ± 34.25	24.27 ± 30.89	<b>0.00</b>
110	-6.95 ± 31.89	24.31 ± 24.10	<b>0.00</b>
120	-5.93 ± 31.60	20.74 ± 23.14	<b>0.00</b>
130	5.02 ± 28.13	-17.56 ± 28.09	<b>0.00</b>
140	4.27 ± 25.02	-14.94 ± 22.06	<b>0.00</b>
150	5.51 ± 18.50	-19.30 ± 30.21	<b>0.00</b>

*P-values less than 0.05 are in bold.*

From the ranges the K-means clustering happens for each slice.

### Experimental Result

The contributions of the paper fall within the following five aspects: (i) we generalize the Eigenbrain to MR images, and prove its effectiveness; (ii) We propose a hybrid eigenbrain based CAD system that can not only detect AD from NC, but also detect brain regions that related to AD. (iii) We prove the proposed method has classification accuracy comparable to SVM methods, and the detected brain regions are in line with 17 existing literatures. (iv) We use ICV and WTT to reduce redundant data; (v) we find POL kernel is better than linear and RBF kernel for this study.

### Conclusion

We presented an automated and accurate classification method that was based on eigenbrains and K-means Clustering, in order to detect AD subjects and AD related brain regions using 3D MR images. The results showed the proposed K-means Clustering method achieved 96% accuracy, which was competitive with SVM methods.

In the future, we will focus our research in the Eigenbrain can be used in combination with DWT based features and others, and an increase in classification accuracy is expected.

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## Characterization of Copper Matrix Composite Reinforced with Aluminium Nitrate using Friction Stir Processing Techniques

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**Abstract-** The main objective of this project is to produce copper reinforced metal matrix composite (MMC) layers using micron sized AlN particles via friction stir processing (FSP) in order to enhance surface mechanical properties. Micro structural evaluation using Optical Microscopy (OM) and Scanning Electron Microscopy (SEM) indicated that an increase in traverse speed and a decrease in rotational speed cause a reduction in the grain size of different groove width (0, 0.4, 0.8, 1.2 mm) of stir zone (SZ) for the specimens friction stir processed (FSPed) without AlN particles. It was found that upon addition of AlN particles, wear properties were improved. This behavior was further supported by SEM images of wear surfaces. Results demonstrated that the micro composite produced by FSP exhibited enhanced wear resistance and higher average friction coefficient in comparison with pure copper. Tensile properties and fracture characteristics of the specimens FSPed with and without AlN particles and pure copper were also evaluated. According to the results, the MMC layer produced by FSP showed higher strength and lower elongation than pure copper while a remarkable elongation was observed for FSPed specimen without AlN particles and been greatly developed by the use of AlN.

### I. INTRODUCTION

Copper is an excellent electrical conductor. Most of its uses are based on this property or the fact that it is also a good thermal conductor. However, many of its applications also really on one or more of its other properties. For example, it wouldn't make very good water and gas pipes if it were highly reactive. We look at these other properties as a good electrical conductor, a good thermal conductor, corrosion, resistant, easily joined, ductile, tough, non-magnetic, attractive, color, easy to alloy, recyclable, catalytic. Copper is low in the reactivity series. This means that it doesn't tend to corrode. Copper can be joined easily by soldering or brazing. This is useful for pipe work and for making sealed copper vessels. Copper exhibits high formability good resistance to oxidation and corrosion and a special position between all metals because of its electrical and thermal conductivity, so the most general application of copper is where high thermal and electrical conductivity are needed, low strength and poor wear resistance are the major limitation of copper and its alloy. The physical and mechanical properties of pure copper were shown in Table No. 1.1.

PROPERTIES	VALUES
Melting point	1083°C
Density	8.95 g/cm <sup>3</sup>
Thermal conductivity	391 W/mK

Table 1.1 Physical and Mechanical Properties of Pure Copper

The reinforcement of different ceramics i.e Boron Carbide (B<sub>4</sub>C), Silicon Carbide (SiC), Aluminium Oxide (Al<sub>2</sub>O<sub>3</sub>), Titanium Carbide

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(TiC), Tungsten Carbide (WC) and Aluminium Nitrate (ALN) were selected and the various mechanical properties of those reinforcements were shown in Table No. 1.2. Thermal conductivity of the Aluminium Nitrate (ALN) was higher than the other ceramics. So Aluminium Nitrate (ALN) was selected as Reinforcement.

Property	B <sub>4</sub> C	SiC	Al <sub>2</sub> O <sub>3</sub>	TiC	WC	ALN
Density (g/cc)	2.52	3.21	3.92	4.93	14.95	3.260
Melting Point (°C)	2763	2050	2700	3160	2870	2200
Coefficient of thermal expansion (10 <sup>-6</sup> /°C)	5	4.8	7.5	8.3	5	-
Hardness (VHN)	2900	1937	1800	2850	2481	-
Thermal conductivity (W/mK)	29	132	33	20	42	285
Elastic modulus (GPa)	450	430	350	345	620	-
Compressive strength (MPa)	3000	2800	2500	2500	2700	-

Table 1.2 Comparisons of Various Mechanical Properties of Reinforcements

## II. Surface Metal Matrix Composites

A composite material is a material consisting of two or more physically and/or chemically distinct phases. The composite generally has superior characteristics than those of each of the individual components. Usually the reinforcing component is distributed in the continuous or matrix component. When the matrix is a metal, the composite is termed a metal-matrix composite (SMMC). In SMMCs, the reinforcement usually takes the form of particles, whiskers, short fibers, or continuous. A metal matrix composite (SMMC) is composite material with at least two constituent parts, one being a metal necessarily, the other material may be a different metal or another material, such as a ceramic or organic compound. When at least three materials are present, it is called a hybrid composite. An MMC is complementary to a cermet.

## III. Production and Optimization of FSP Parameters

In this study, the material used was a pure copper plate (99.91% purity) with 100 mm length, 0.4, 0.8, 1.2 mm width and 10 mm thickness. ALN particles size was less than 10 micron. The specimens were clamped onto thick H13 steel and the copper plate was fixed by the bolts. In order to produce surface composite layers, ALN particles were contrived in a groove with 0.4, 0.8, 1.2 mm width and 4 mm depth in the middle of the specimens. Then, the ALN particles were compressed into the groove and the upper surface of the groove was closed with a FSP-like tool without pin to prevent outpouring of the Cr particles. A cylindrical pin tool with a concave shoulder used as FSP tool that was made of hot-working steel with the shoulder diameter, square pin diameter and length of 20, 5 and 2.7 mm, respectively. The shoulder concavity was 6° between the edge of the shoulder and the pin. Square pin profiled tool produced good quality and defect free FSP region, irrespective of irrespective of shoulder diameter and rotational speeds. After preparing specimens, FSP tool was plunged into plate for stirring the SZ and producing the Composites. FSP tool was tilted by an angle of 1.5°. Three traverse speeds of 40mm/min in constant rotational speed of 1000 mm/min were investigated. Sped surfaces were prepared by standard metallographic techniques and etched with a solution of 100 ml distilled water, 15 ml H<sub>2</sub>O<sub>2</sub> and 2.5g FeCl<sub>3</sub>. Micro structural changes from base metal to the stirred zone were examined by optical microscopy (OM) and field emission scanning electron microscopy (FESEM). Micro hardness properties of the specimens were measured on the cross-section of the specimens and perpendicular to the processing direction in depth of 1 mm from the Sped surface using an indenter with a 200 g load for 15 s. A pin-on-disc test machine was used to evaluate friction and wear performances of specimens. FSP Procedures to Fabricate Surface Composite: (a) Cutting a Groove, (b) Compacting the Groove With Ceramic Particles, (c) Processing Using a Painless Tool and (d) Processing Using a Tool With Pin, the below diagram shows the detailed diagram of the FSP process obtained from the optimized parameters taken from various concerns and from various process I with the comparisons to that the friction stir processing of copper with aluminum nitrate has been performed successfully at here is shown in figure 3.1.

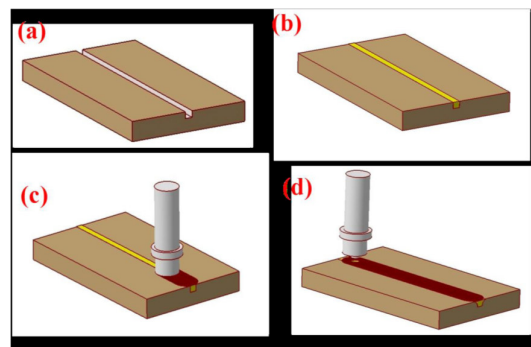


Fig. No.3.1 copper production using FSP process

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### 3.1 Identification of Process Parameters

For FSW, two parameters are very important: tool rotation rate ( $v$ , rpm) in clockwise or counterclockwise direction and tool traverse speed ( $n$ , mm/min) along the line of joint. The rotation of tool results in stirring and mixing of material around the rotating pin and the translation of tool moves the stirred material from the front to the back of the pin and finishes welding process. Higher tool rotation rates generate higher temperature because of higher friction heating and result in more intense stirring and mixing of material as will be discussed later. However, it should be noted that frictional coupling of tool surface with work piece is going to govern the heating. So, a monotonic increase in heating with increasing tool rotation rate is not expected as the coefficient of friction at interface will change with increasing tool rotation rate. In addition to the tool rotation rate and traverse speed, another important process parameter is the angle of spindle or tool tilt with respect to the work piece surface.

A suitable tilt of the spindle towards trailing direction ensures that the shoulder of the tool holds the stirred material by threaded pin and move material efficiently from the front to the back of the pin. Further, the insertion depth of pin into the work pieces (also called target depth) is important for producing sound welds with smooth tool shoulders. The insertion depth of pin is associated with the pin height. When the insertion depth is too shallow, the shoulder of tool does not contact the original work piece surface. Thus, rotating shoulder cannot move the stirred material efficiently from the front to the back of the pin, resulting in generation of welds with inner channel or surface groove. When the insertion depth is too deep, the shoulder of tool plunges into the work piece creating excessive flash. In this case, a significantly concave weld is produced, leading to local thinning of the welded plates. It should be noted that the recent development of ‘scrolled’ tool shoulder allows FSW with 08 tool tilt. Such tools are particularly preferred for curved joints. On the study of various parameters a typical process parameters have been made to concern of using and performed for our process, the parameters which we have been used are listed below in the following tables keeping values of all parameters as the same unless keep on changing the groove width for various experiments.

S.NO	PARAMETERS	NOTATION	UNIT	LEVELS			
1	Rotational Speed	N	Rpm	1000	1000	1000	1000
2	Transverse Speed	S	mm/min	40	40	40	40
3	Groove Width	W	Mm	0	0.4	0.8	1.2
4	Groove Depth	W	Mm	4	4	4	4
5	Ceramic particle	Aluminum Nitrate (AlN)					

Table No. 3.1. Selected Process Parameters

## IV. Result and Discussion

### 4.1 Analysis of Copper and Aluminium After FSP



Fig 4.1 Optical Photomicrograph of Transient Zone between Cu and AlN

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The effect of volume fraction of AlN particles on the microstructure of the transition zone is shown in Figures. The transition zone of friction stir processed monolithic alloys generally consists of heat affected zone (HAZ), thermo mechanically affected zone (TMAZ) and friction stir processed (FSPed) zone (Ma 2008). The boundary between HAZ and TMAZ is not seen clearly in Figure of FSPed copper (0 vol. %). The FSP zone spreads over TMAZ. The recrystallization during FSP occurs relatively easier in single phase copper which leads to such a wider FSP zone (Lee & Jung 2004). But the boundary between HAZ and TMAZ is clearly visible in Figures. TMAZ reveals the alignment of AlN particles along the boundary. A parallel band-like distribution of particles is observed. The boundary becomes thicker when volume fraction is increased due to increased content of AlN particles. It is further evident from Figure 4.1 that there are no discontinuities or flaws along the boundary. The AlN surface composite is properly bonded to the copper substrate.

#### 4.2 Evaluation of Microstructure

The variation of microstructures when tool rotational speed increases from 200 to 1000 r/min. The traverse speed and axial force were kept constant. It is evident from the figure that the tool rotational speed significantly influences the area of friction stir processed zone that contains the surface composite. The area of the surface composite increases as the tool rotational speed increases. The area of the surface composite was measured using an image analyzing software and the values are listed. Frictional heat is generated as a result of rubbing of the tool shoulder on the copper plate. The quantity of frictional heat generated is dependent upon the tool rotational speed. The frictional heat causes copper to plasticize. The amount of plasticized copper is dependent upon the available frictional heat. As the tool rotational speed increases, the frictional heat generated increases. The amount of plasticized copper subsequently increases. The increase in the area of the surface composite leads to a reduction in the actual volume fraction of AlN particles in the surface composite as presented because the same amount of AlN particles packed in the groove is to be distributed to more amount of plasticized copper. It is evident from that the grains are coarsened as the tool rotational speed increases. The increase in tool rotational speed produces higher frictional heat that leads to coarsening of grains.

The effect of tool rotational speed on the microstructure of Cu/AlN surface composites. The optical micrograph clearly reveals the distribution of AlN particles in the copper matrix. The distribution is not uniform at 800 r/min due to the presence of AlN clusters at several places. Each cluster consists of closely located AlN particles. The SEM images as presented in the variation of microstructures at different tool rotational speeds with higher magnification. The average spacing between AlN particles increases when the tool rotational speed increases. The tool rotational speed does two more functions apart from frictional heat generation. Tool rotation stirs the plasticized materials as well as influences material flow behaviour across the friction stir processed zone. The formation of clusters at 800 r/min can be attributed to insufficient stirring and inadequate material flow from the advancing side to the retreating side. The worn surface is observed to be uniform due to the higher content of AlN particles and it is covered with wear debris. There are no apparent cracks or subsurface deformation. The debris does not adhere to the worn surface due to the hard

#### Conclusion

Pure copper matrix reinforced with different type of ceramic particles such as AlN were successfully fabricated by using a novel technique i.e. FSP. The mechanical properties like micro hardness, FSP area and dry sliding wear behavior of copper surface composite were studied. Mathematical models were developed to predict FSP area, micro hardness and dry sliding wear behavior of CMMCs and the FSP parameters were optimized using generalized reduced gradient method. Tool rotational speed, traverse speed and groove width were independently and significantly influenced the FSP area, micro hardness and dry sliding wear behavior of surface composites. Type of ceramic particles were not significantly influenced the responses.

The effect of tool rotational speed, traverse speed, groove width and type of ceramic particles on micro hardness, FSP area and wear rate was studied. The grain size was measured using a linear intercept method. Microstructural characterizations were carried out using OM and SEM. The AlN particles refined the grains of copper. The SEM microstructures revealed the presence of clear interface between particles and copper matrix without the presence of any voids or reaction products. The distribution of AlN particles in the surface composites was influenced by tool rotational speed and traverse speed. Lower tool rotational speed ( $N = 1000$  rpm) and higher traverse speed ( $S = 40$  mm/min) resulted in poor distribution of AlN particles and vice versa. The increase in groove width from 0.4 to 1.2 mm did not affect the distribution of AlN particles in a significant manner.

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## Extensive Survey on Datamining Algorithms for Pattern Extraction

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**Abstract:** Volume of data available in the digital world is increasing every day at a greater speed. Due to enhancement of various technologies and new algorithms, extraction of essential data from huge volume of data is not a tough task nowadays but our goal is the extraction of patterns and knowledge from large amounts of data. Different sources are available for collecting the reviews about a product. To enhance the quality of the products and services these reviews provides different features of the products. Models can use one or more classifiers in trying to determine the probability of a set of data belonging to another set, say spam or 'ham'. Depending on definitional boundaries, modeling is synonymous with, the field of machine learning, as it is more commonly referred to in academic or research and development contexts. In this paper we identified and discussed about three algorithms which are efficient in identifying essential patterns in the available huge volume of data.

**Keywords:** Genetic Algorithm, Shuffled frog leap algorithm, artificial neural networks.

### 1. INTRODUCTION

Mining frequent patterns is used in actuarial science, marketing, financial services, insurance, telecommunications, retail, travel, healthcare, pharmaceuticals, capacity planning and other fields. Various algorithms are useful in mining the essential data. In this paper we discussed about the working model of three algorithms namely,

- Genetic Algorithm.
- Shuffled frog leap algorithm.
- Artificial neural networks.

### 2. Genetic Algorithm

In recent times, computer science has seen great advancements in demands, hence implementation becomes very difficult. This situation is very apt for applying genetics and obtains optimal solutions. Genetic algorithms are search and optimization technique based on the Darwin's theory of natural evolution. The genetic algorithm is applied over the problem where the outcome is unpredictable and contains complex modules. In genetic algorithm, a population of solutions to an optimization problem is evolved towards better solutions. Each solution has a set of chromosomes (properties). Solutions from one population are taken and used to form a new population. The solutions which are selected to form new solutions called offspring are selected according to the fitness value of the solutions (chromosomes).

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## 2.1 Basic Steps in the Algorithm

Step1: Random initialization populations of 'n' chromosomes are generated.

Step2: Evaluate fitness  $f(s)$  for each solution 's' in the population 'n'.

Step 3: Generate a new population. Repeat the following three process until the new population is generated.

- (i) Selection: Select two parent chromosomes from the population according to their fitness value. The chromosome which has the highest fitness value is more likely to be selected.
- (ii) Crossover: Cross over the parent chromosome to produce the new offspring. Crossover may or may not be performed. If crossover is not performed then the new offspring is same as that of the parent chromosome.
- (iii) Mutation: Mutate new offspring at each position.

Step 4: If the population in last generation is nearer to the desired solution, stop.

Step 5: Go to step 2.

## 2.2 Encoding

There are many ways of encoding the chromosome such as octal encoding, permutation encoding, value encoding, binary encoding, tree encoding and hexadecimal encoding. The most used way of encoding is the binary encoding. The chromosome should contain the information about the solution which it represents. Each chromosome (solution) present in the population contains a binary string. The binary string consists of 0's and 1's. Each bit in the string represents particular characteristic of problem.

Chromosome X – 11001000110100  
Chromosome Y – 01110100111001

## 2.3 Fitness Function

Fitness function quantifies the optimality of the chromosome (solution). A fitness value is assigned to every chromosome in the population. The value is assigned based on how close it is to solve the problem.

## 2.4 Operators and Selection

After an initial population is generated, the algorithm evolves through the three operators, selection, crossover, mutation.

Selection is the process of selection two parent chromosomes in the population for generating new population. The parent chromosomes are selected according to their fitness. The chromosome which has the highest fitness value is more likely to be selected than the chromosome with lowest fitness value. The most common methods used for selection are Roulette wheel selection, Tournament selection, Elitism, Rank selection. In Roulette wheel selection, each chromosome in the population is assigned a slot. The chromosome with higher fitness value is assigned a larger slot and the chromosome with lower fitness value is assigned a smaller slot. The algorithm for Roulette wheel selection is simple. The weighted wheel is spinned n times (where n is the total number of solutions). When the wheel stops, the chromosome corresponds to that slot is returned. When creating new population by crossover or mutation the best chromosome may be lost. Elitism was introduced in order to retain the best chromosome at each generation. Elitism is a method which copies the best chromosome in the population to the new offspring.

## 2.5 Crossover

Crossover is a process in which two parent chromosome are combined to form their genetics (bits) to form new offspring which possess characteristics of both the chromosomes. Methods: Single point crossover, two point crossover, Uniform crossover. In single point crossover, one crossover point is selected, binary string from the beginning to the crossover point is copied from one point and the rest is copied from other parent chromosome.

Chromosome X	<b>1100010110101</b>
Chromosome Y	10100 01110010
Offspring 1	<b>11000</b> 01110010
Offspring 2	10100 <b>10110101</b>

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In two point crossover, two crossover points are selected, binary string from beginning of the chromosome to the first crossover point is copied from one parent, the part from the first to the second crossover point is copied from the second parent and the rest is copied from the first parent.

Chromosome X	<b>1100010110101</b>
Chromosome Y	1010 001110010
Offspring 1	<b>1100</b> 00111 <b>0101</b>
Offspring 2	1010 <b>01011</b> 0101

In uniform crossover, bits are randomly copied from the first chromosome or from the second parent chromosome. Uniform crossover yields only one offspring.

Chromosome X	<b>1100110110101</b>
Chromosome Y	10100 01100 010
Offspring	<b>11000</b> 01110 <b>100</b>

If there is no crossover, offspring is exactly same as the parent chromosome. If there is a crossover, offspring is made from parts of parent's chromosome. If crossover probability is 100%, then all offspring is made by crossover. If it is 0%, whole new generation is made from exact copies of chromosomes from old population

## 2.6 Mutation

Mutation is a process by which a string is changed or inverted. Mutation probability says how often will be the parts of chromosome mutated. If there is no mutation, offspring is taken after crossover without any change. If mutation is performed, part of chromosome is changed. If mutation probability is 100%, whole chromosome is changed, if it is 0%, nothing is changed.

Parent chromosome	<b>1100101110010</b>
Offspring (child)	1101101 <b>100011</b>

The most important point is that genetic algorithms supports parallelism. Genetic algorithms are used in various fields of data mining to get the optimized solutions for the better performance of the data that are required in decision making and process the accurate result. Genetic algorithm requires no knowledge about the response surface. It provides comprehensive search methodology for machine learning and optimization. Genetic algorithm has a wide scope in business. It handles large, poorly understood search spaces easily. It is easy to discover global optimal solution using Genetic algorithm.

## 2.7 Limitations

In many problems, Genetic algorithms may have a tendency to converge towards local optima or even arbitrary point rather than the global optimum of the problem. Finding the optimal solution to complex high-dimensional problems often requires repeated fitness function evaluations which lead to poor performance. For specific optimization problems and problem instances, other optimization algorithms may be more efficient than genetic algorithms in terms of speed of convergence. There is no effective terminator in genetic algorithm. Operating on dynamic data sets is difficult, as chromosomes begin to converge early on towards solutions which may no longer be valid for later data.

## 3. Shuffled frog Leap Algorithm

The shuffled frog leap algorithm is a meme tic meta-heuristic approach designed to perform an informed heuristic search to seek a global optimal solution. It is based on the evolution of memes and a global exchange of information among population. The algorithm

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has been tested on several problems and found to be efficient in finding global solutions. The shuffled frog leap algorithm is a combination of random and deterministic approaches. In random approach, the search begins with a randomly selected population of frogs (solutions) covering the entire swamp. The population of solutions is partitioned into different subsets known as memplexes that are permitted to evolve independently. Within each memplex, the frogs are infected by other frog's idea, hence they experience a memetic evolution. Memetic evolution improves the quality of the meme and enhances the individual frog's performance towards a goal. During the evolution, the frogs (solutions) may change their memes using the information from the best of the entire population. After a certain number of memetic evolution time loops, the memplexes are forced to mix and new memplexes are formed through a shuffling process. This shuffling enhances the quality of the memes after being infected by frogs from different regions of the swamp. The deterministic approach allows the algorithm to use response surface information effectively to guide the heuristic search.

### 3.1 Basic Steps in the Algorithm

Step 1: Initialization. Select  $x$  and  $y$ , where  $x$  is the number of memplex and  $y$  is the number of frogs (solutions) in each memplex. The size of the swamp  $S = xy$ .

Step 2: Generate a virtual population.

Step 3: Evaluate the fitness of the frogs. Sort the frogs in the order of decreasing performance.

Step 4: Partition the total population into  $m$  memplexes.

$$X^k = f(k + m(j - 1))$$

Where  $k$  varies from 0 to  $m$ ,  $j$  varies from 0 to 1. For example, if  $m=3$ , rank 1 goes to memplex 1, rank 2 goes to memplex 2, rank 3 goes to memplex 3, rank 4 goes to memplex 1 etc.

Step 5: Evolution of memes in each memplex.

Step 6: Shuffle the memplex. If convergence criteria is satisfied then determine the best solution, stop. Otherwise, return to step 3.

### 3.2 Local Search

In step 5, the evolution of memplex continues independently  $N$  times. The steps in local search for each memplex is as follows:

Step 1: Set  $ix = 0$  where  $ix$  counts the number of memplexes and will be compared with the total number of  $x$  memplexes. Set  $it = 0$  where it counts the number of evolutionary steps.

Step 2: Set  $ix = ix + 1$ ,  $it = it + 1$ .

Step 3: Determine the position of the frog in the population.

Step 4: Improve the worst frog's position.

Change in position,

$$= \text{rand}() \cdot (P_b - P_w)$$

Where  $P_b$  is the best frog's position and  $P_w$  is the worst frog's position. If this produces a better result replace worst frog.

Step 5: If step 4 cannot produce a better result, then the new position are computed for that frog is computed.

Step 6: If the new position is not better than old position, the spread of defective meme is stopped by randomly generating a new frog  $r$  at a feasible location to replace the frog.

Step 7: Upgrade the memplex.

Step 8: If  $it < N$ , go to step 1,  $ix < X$  go to step 2. Otherwise return to shuffle memplexes.

The Shuffled frog leap algorithm is also very suitable for parallelization. It has been used as a tool to obtain the best solutions with the least total time and cost by evaluating unlimited possible options. In this algorithm, the information gained from a change in position is immediately available to be further improved upon. This instantaneous accessibility to new information separates this approach from Genetic algorithm that requires the entire population to be modified before new insights are available.

## 4. Artificial Neural Networks

Artificial neural networks are a mathematical model or computational model based on the concept of human brain. It consists of simple processing units (artificial neurons) that communicate by sending signals to one another over a large number of interconnections. The artificial neuron transfers the incoming information on their outgoing connections to other units. It changes its structure based on external or internal information that flows through the network during the learning phase. Artificial neural networks have powerful pattern classification and pattern recognition capabilities. It can identify correlated pattern between input datasets. It can also be used to predict the outcome of the new independent input data. Artificial neural network process non-linear, complex data problems even if the data are noisy and imprecise. There are many different types of neural networks. Some of the widely used applications include classification, noise reduction and prediction.

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#### 4.1 Basics of Artificial Neural Networks

The working of artificial neural network has developed from the biological model of the human brain. A neural network consists of a set of connected cells. Each cell is called a neuron. The neuron receives the information from either the input cells or from other neurons and performs some kind of transformations on the input and transfers the outcome to the other neurons or output cells.

#### 4.2 Neural Network Architectures

The two widely used artificial neural network architectures are feed forward network and recurrent networks. In feed forward network, information flows in one direction along connecting pathways, from the input layer via hidden layers to the output layer. In this network, the output of any layer does not affect that same or preceding layer.

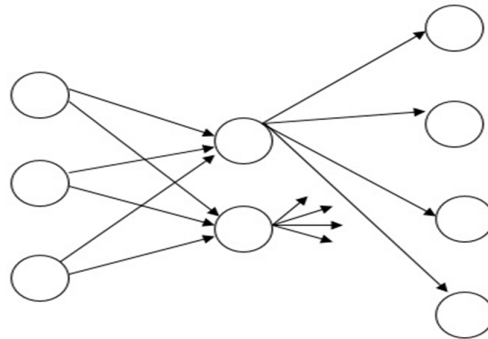


Fig: Feed forward network

In recurrent networks, there will be at least one feedback loop i.e. there could exist one layer with feedback connections. There may also be neurons with self-feedback links i.e. the output of neuron is fed back into input of itself.

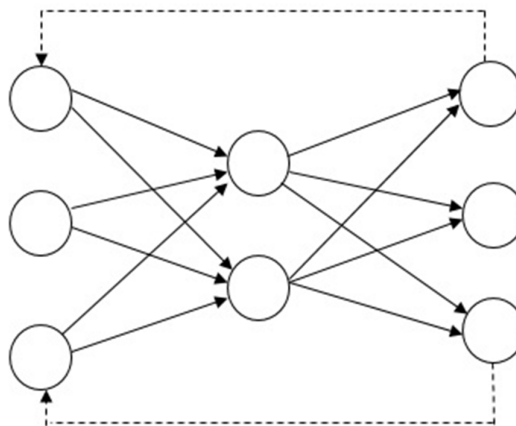


Fig: Recurrent network

#### 4.3 Construction of ANN Model

Step 1: The input variables are selected using several variable selection procedures.

Step 2: The dataset is divided into training, testing and validation datasets. The training dataset is used to learn patterns present in the data. The learned patterns are applied on the testing data. The performance of the trained data is verified by using validation dataset.

Step 3: Define the structure of the architecture including number of hidden layers, number of hidden nodes, and number of output nodes etc.

- a) Hidden layers: The hidden layer provides the network with its ability to generalize.
- b) Hidden neurons: There is no certain formula for selecting optimum neurons. Some thumb rules are available for calculating hidden neurons.
- c) Output nodes: Neural network with multiple output nodes will produce inferior results when compared to network with one output node.

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- d) Activation function: Activation functions are mathematical formula that determines the output of a processing node. Most commonly used activation functions are as follows:

The linear function,

$$y = x$$

The logistic function,

The hyperbolic tangent function,

$$(\exp(x) - \exp(-x)) / (\exp(x) + \exp(-x))$$

Step 4: Building the model.

Multilayer perceptron is very popular and is used more than other neural network type.

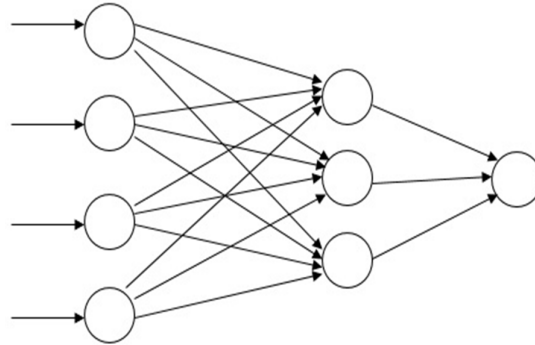


Fig: Schematic representation of neural network

#### 4.4 Learning

Learning is a procedure that consists in estimating the parameters of neurons so that the whole network can perform a specific task. The network becomes more knowledgeable about environment after each iteration of learning process. There are three types of learning namely, supervised learning, reinforced learning, and unsupervised learning. In supervised learning, every input pattern that is used to train the network is associated with an output pattern. A comparison is made between the network computer output and the expected output, to determine the error. The error can be used to change the network parameters, which results in an improvement in performance. In unsupervised learning, there is no feedback from the environment to indicate if the outputs of the networks are correct. The network must discover features, regulations, correlations, categories in the input data automatically.

Artificial neural network with Back propagation learning algorithm is widely used in solving various classifications and forecasting problems. It can be easily implemented in parallel architectures. ANN can handle large amount of datasets and has the ability to implicitly detect complex nonlinear relationships between dependent and independent variables. Its ability to learn by example makes them very flexible and powerful.

#### 5. Conclusion

Various algorithms discussed above has its own advantages based on the application with which its used. Based on parameters for extraction appropriate algorithm may be selected for getting efficient output.

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## Implementation of MAC using Modified Booth Algorithm

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**Abstract-** The proposed system is an efficient processing of 16-bit Multiplier Accumulator using Radix-8 and Radix-16 modified Booth Algorithm and other adders (SPST adder, Carry select adder, Parallel Prefix adder) using VHDL (Very High Speed Integrated Circuit Hardware Description Language). This proposed system provides low power, high speed and fewer delays. In both booth multipliers, comparison between the power consumption (mw) and estimated delay (ns) are calculated. The application of digital signal processing like fast fourier transform, finite impulse response and convolution needs high speed and low power MAC (Multiplier and Accumulator) units to construct an adder. By reducing the glitches (from 1 to 0 transition) and spikes (from 0 to 1 transition), the speed of operation is improved and dynamic power is reduced. The adder designed with SPST avoids the unwanted glitches and spikes, reduce the switching power dissipation and the dynamic power. The speed can be improved by reducing the number of partial products to half, by grouping of bits in the multiplier term. The proposed Radix-8 and Radix-16 Modified Booth Algorithm MAC with SPST reduces the delay and obtain low power consumption as compared to array MAC.

**Keywords:** Radix-8 modified booth algorithm Radix- 16 modified booth algorithm, Digital signal processing, VHDL (Very High Speed Integrated Circuit Hardware Description Language), Spurious Power Suppression Technique (SPST).

### I INTRODUCTION

Multiplication is a fundamental operation in digital signal processing application which consumes more power and area. Consequently, there is a need for designing low power Booth Algorithm. Booth algorithm is a standard technique which provides significant improvement in terms of chip area and power compared to other multiplication techniques. The implementation of the multiplier depends on the type of adder which is used in the MAC unit. By combining the multiplication with the accumulation the development of a hybrid type of adders like Parallel prefix adder and Carry save adder, the performance has improved. Several commercial processors have selected the Radix-8 multiplier architecture to increase the speed of operation, thereby reducing the number of partial products in the multiplication terms. The Radix-8 encoding reduces the digit number length in a signed digit representation as compared to Radix-2 multiplication. Its performance is bottleneck by the generation of the term 3X (Multiplicand), also referred to as hard multiple. The proposed MAC unit accumulates intermediate result in the terms of sum and carries bits instead of the output of the final adder, which optimize the pipeline system to improve the overall performance. The modified Booth's algorithm based on the Radix-8, generally called Booth-2, is the most popular approach for implementing the fast multipliers using parallel encoding. In general, multi-operand addition is the part of many complex arithmetic algorithms, such as multiplication and certain DSP algorithms. One of the most popular multi-operand adders is the carry-save adder which is capable of adding more than two operands at a time.

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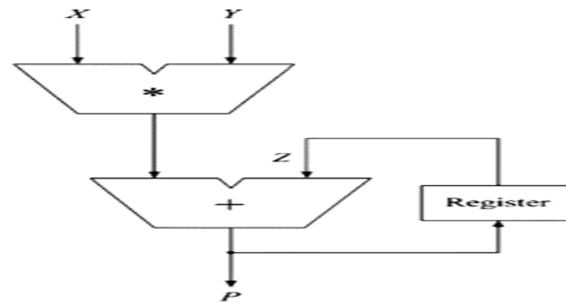


Figure 1. Hardware Architecture of General MAC Array Multiplier

The objective of this paper is to introduce the flexibility of adding three-input operands to a regular adder, thereby reducing the need of a special adder to the same process. General architecture of MAC is shown in Figure 1. The proposed approach is implemented using VHDL design with ModelSim 6.5c software. This executes the multiplication operation by multiplying the multiplier and the multiplicand. Multiplier is considered as X and multiplicand is Y which is added to the previous multiplication result Z as an accumulation step.

## II Types of Adders

### A. SPST Adder

In SPST Adder, the 16-bit adder /subtractor are divided into MSP (Most Significant Part) and LSP (Least Significant Part) between the 8th and 9th bits.

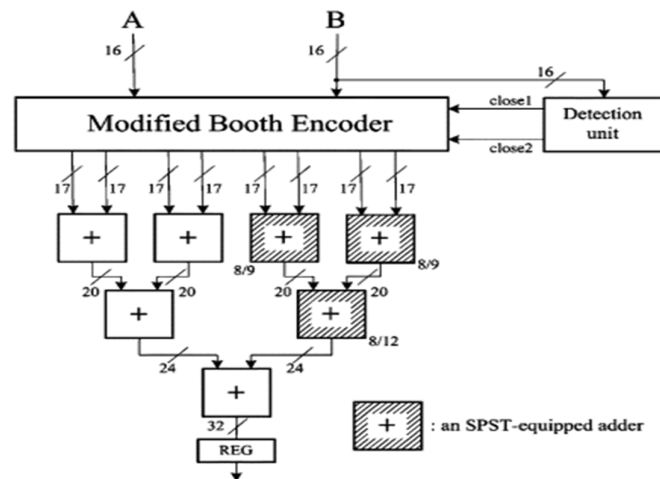


Figure 2. Proposed Low Power SPST Equipped Multiplier

The MSP of the original adder is modified to include the detection logical circuits, data controlling circuits, sign extension circuits, latch and clock circuits and logic for calculating carry-in and carry-out signals. Figure 2 shows the Proposed Low Power SPST Equipped Multiplier which consist of Latch, Detection logic and Sign extension logic.

### B. Carry Select Adder

The 16-bit carry-select adder with a uniform block size of 4 can be created with three of these blocks and a 4-bit ripple carry adder is used. Since carry-in is known at the beginning of computation, a carry select block is not needed for first four bits. The delay of this adder will be four full adder delays, plus three MUX delays. The 16-bit carry-select adder with variable size can be similarly created shown in Figure 3. Here an adder with block sizes of 2-2-3-4-5 is used. This break-up is ideal when the full-adder delay is equal to the MUX delay, which is unlikely. The total delay is of two full adder delays and four multiplexer delays.

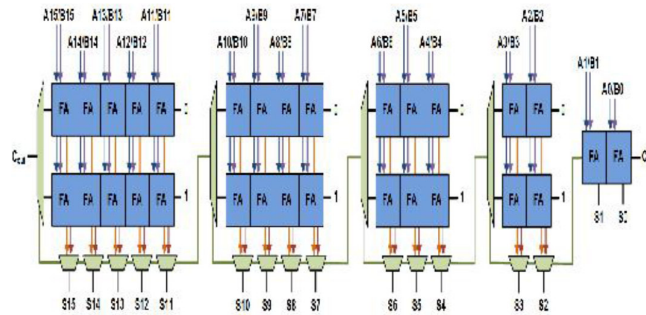


Figure 3. Variable Sized CSLA

### C. Parallel Binary Addder

The goal of this paper is to present the architectures that provide the flexibility within a regular adder to augment/decrement the sum of two numbers by a constant which is considered in the addition process. This flexibility adds to the functionality of a regular adder, which achieves a comparable performance to conventional designs, therefore eliminating the need of having a dedicated adder unit to perform the same tasks. In this adder if the third operand is a constant, a design to accomplish three-input addition is required. These designs are called Enhanced Flagged Binary Adders (EFBA), shown in Figure 4. It also examines the performance of the adder when the operand size is expanded from 16 bits to 32 and 64 bits. Detailed analysis has been provided to compare the performance of the new designs with carry-save adders in terms of delay, power dissipated and area consumes.

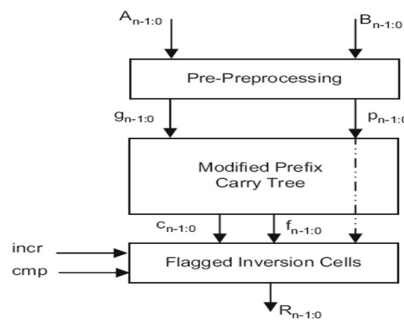


Figure 4. EFBA Block diagram

### III Implementation

The Booth multiplication is a technique that allows faster multiplication by grouping the multiplier bits. The grouping of multiplier bits and Radix-8 Booth encoding reduce the number of partial products to half. The shifting and adding is for every column of the multiplier term and multiplying by 1 or 0 is commonly used. Here every second column is taken and multiplied by  $\pm 1$ ,  $\pm 2$ , or 0. The advantage of this method is halving of the number of partial products. In Booth encoding the multiplier bits is formed in blocks of three, such that each block overlaps the previous block by only one bit. Grouping is started from the LSB side, and the first block only uses two bits of the multiplier term. Figure 5 below shows the grouping of bits from the multiplier term.

To obtain the correct partial product, each block is decoded from the grouped terms. Table 1 shows the encoding of the multiplier value Y, which uses the Modified Booth Algorithm and generates the following five signed digits, -2, -1, 0, +1, +2. Each encoded digit in the multiplier performs a certain operation on the multiplicand X.

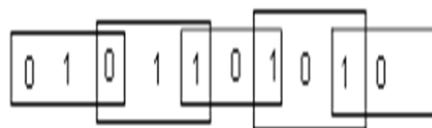


Figure 5. Grouping of bits from the multiplier term in the multiplication operation

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Table I Encoded five signed digits

<i>Block</i>	<i>Re-code digit</i>	<i>Operation on X</i>
001	0	0X
001	+1	+1X
010	+1	+1X
011	+2	+2X
100	-2	-2X
101	-1	-1X
110	-1	-1X
111	0	0X

#### IV Modified Booth Algorithm for Radix-16

The numbers of subsequent calculation stages are decreased by enhancing the parallelism operation. So one of the solutions of realizing the high speed multipliers is to enhance parallelism operation. The Radix-4 Booth multiplier is the modified version of the conventional version of the Booth algorithm (Radix-2). The generation of Radix 2 and Radix 8 multiplication generally requires some kind of carry propagate adder, which increases the latency mainly due to the long wires that are required for propagating carries from the less significant to more significant bits.

High-speed modulo multipliers using the Booth encoding for partial product generation have been proposed in the Booth encoding technique which reduces the number of partial products to be generated and accumulated. In Radix-4 Booth encoding all modulo-reduced partial products can be generated by shifting and negation. The greater savings in area and dynamic power dissipation are feasible for large word-length multipliers by increasing the radix beyond four.

In Radix-8 Booth encoding method as shown in the Figure 6, the number of partial products is reduced by two-thirds. However, this reduction in the number of partial products leads to increased complexity in their generation. Compared with many other arithmetic operations multiplication is the time consuming and power hungry. Thus enhancing the performance of the circuit and reduction the power dissipation are the most important design challenges for all applications in which multiplier unit dominate the system performance and power dissipation.

The effective way to increase the speed of the multiplier is to reduce the number of the partial products. The number of partial products can be reduced with the higher radix Booth encoder, but the numbers of hard multiples are costly to generate and increases simultaneously. To increase the speed and performance, many parallel MAC architectures are proposed.

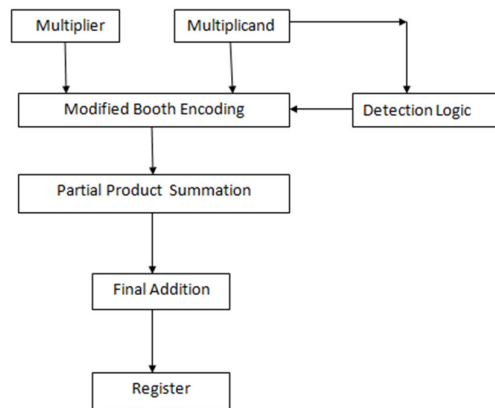


Figure 6. Block Diagram of Radix-8 MBA

There are two different common approaches that make use of parallelism to enhance the multiplication performance. The difference between the two is the latest one carries out accumulation by feeding back the final CSA (Carry Save Adder) output rather than the final adder results that are obtained. The entire process of parallel MAC is based on radix-8 booth encodings. Further the implementation result and the characteristics of parallel MAC based on both of the booth encodings is exposed.

## V Results

The simulation results for 16-bit Radix-2 and Radix-8 modified Booth algorithm with three different adders and MAC are shown below. Table II and III shows the synthesis report for array MAC, Radix-2 and Radix-8 modified Booth algorithm with adders used in MAC. The code is dumped onto the target device Spartan 3E (Xc3s500ft2564), inputs (Set frequency of asynchronous nets as 10MHz), signals (Set frequency for asynchronous nets as 10MHz) and outputs (Set capacitive load of outputs as 28000 pf).

Table II shows the comparisons of power consumption and delay estimated of the Radix-2 Modified Booth Algorithm with three different adders in MAC. Table III shows the Radix-8 using that same adders used in the Radix-2 MAC. The design summary and simulation result also shown below.

Table II Comparison of radix-2 MBA

Device parameters	Array Multiplier & accumulator	SPST adder	Parallel prefix adder	Parallel Binary adder
Number of 4 input LUTs	636 out of 29504	1093 out of 29504	1083 out of 29504	549 out of 9312
Number of gate count for design	4209	5987	7167	3768
Estimated delay(ns)	217.8	39.69	24.93	53.084
Power consumption (mw)	154	144	138.80	16.533

Table III Comparison of Radix-8 MBA

Device parameters	Array Multiplier & accumulator	SPST adder	Parallel prefix adder	Parallel Binary adder
Number of 4 input LUTs	636 out of 29504	1093 out of 29504	1083 out of 29504	1222 out of 9312
Number of gate count for design	4209	5987	7167	7155
Estimated delay(ns)	217.8	39.69	24.936	66.10
Power consumption (mw)	154	144	138.80	19.93

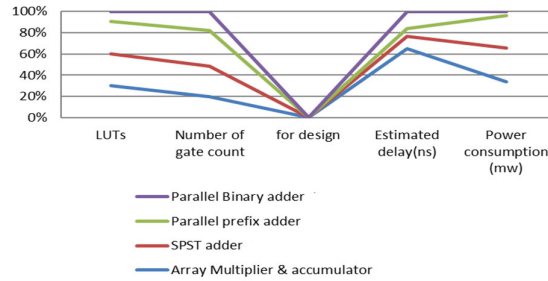


Figure 7. Graphical comparison of different parameter of the adders

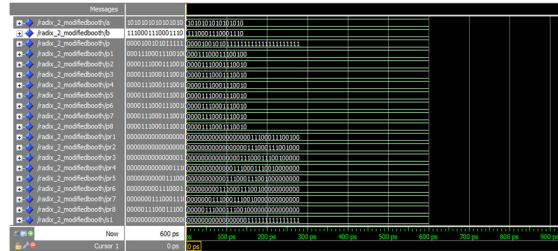


Figure 8. Simulation results for a 16-bit multiplier using radix-2 modified Booth algorithm with Parallel Prefix adder

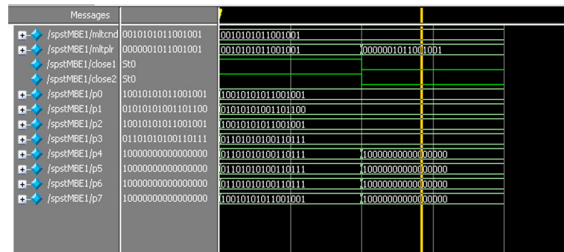


Figure 9. Simulation results for a 16-bit multiplier using radix-8 modified Booth algorithm with Parallel Prefix adder

Device Utilization Summary				
Logic Utilization	Used	Available	Utilization	Notes
Number of 4 input LUTs	1,088	29,504	3%	
<b>Logic Distribution</b>				
Number of occupied Slices	568	14,752	3%	
Number of Slices containing only related logic	568	568	100%	
Number of Slices containing unrelated logic	0	568	0%	
<b>Total Number of 4 input LUTs</b>	<b>1,088</b>	<b>29,504</b>	<b>3%</b>	
Number used as logic	1,088			
Number used as a route-thru	7			
Number of bonded IOBs	64	250	25%	
<b>Total equivalent gate count for design</b>	<b>7,167</b>			
Additional JTAG gate count for IOBs	3,072			

Figure 10. Design Summary of Radix-2 MBA for Parallel Prefix Adder

Device Utilization Summary				
Logic Utilization	Used	Available	Utilization	Notes
Number of 4 input LUTs	1,745	9,312	19%	
<b>Logic Distribution</b>				
Number of occupied Slices	902	4,656	19%	
Number of Slices containing only related logic	902	902	100%	
Number of Slices containing unrelated logic	0	902	0%	
<b>Total Number of 4 input LUTs</b>	<b>1,745</b>	<b>9,312</b>	<b>19%</b>	
Number used as logic	1,745			
Number used as a route-thru	3			
Number of bonded IOBs	83	190	43%	
<b>Total equivalent gate count for design</b>	<b>10,983</b>			
Additional JTAG gate count for IOBs	3,984			

Figure 11. Design Summary of Radix-8 MBA for Parallel Prefix Adder

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## VI Conclusion

The different adders are compared for various measures and works well either in power dissipation or in delay. So the performance of each adder is different from the other. The adder is to avoid the unwanted glitches and spikes therefore switching power dissipation is minimized. The Radix-2 modified booth algorithm reduces the number of partial products to half by grouping of bits from the multiplier term in the multiplication operation, which improves the speed.

## VII Future Scope

The modified booth algorithm which is different from the existing booth algorithm are commonly used. The Radix-2 and Radix-8 Booth Algorithm is used for all multiplication process that reduces the number of critical path, and reduces the power consumption. In this paper, 16-bit Radix-8 Modified Booth Algorithm using spurious power suppression technique and Radix-16 MBA is also implemented from the designed Radix-8 MBA. The benefits of miniaturization are high packing densities, good circuit speed and low power consumption. A fixed-width multiplier is required to maintain a fixed format and minimum accuracy loss to output data.

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## Embedded System Based Digital Fuel Gauge for Automobiles

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**ABSTRACT:** *Most of the petrol bunks today have manipulated the pumps such that it displays the amount as entered but the quantity of fuel filled in the customer's tank is much lesser than the displayed value. let the pumps are tampered for the benefit of the petrol bunks owner. This results in huge profits for the petrol bunks but at the same time the customers are cheated. All the vehicles in India consist of analog meters hence it is not possible to precisely know the amount of fuel currently in the vehicle and also it is not possible to cross check the quantity of fuel filled in the petrol bunk. To creating a digital display of the exact amount of fuel contained in the vehicles tank and also helps in cross checking the quantity of fuel filled at the petrol bunk. Finally once the fuel is filled at a bunk the device also sends an SMS to the vehicle owner indicating the amount, quantity, and date, time to find the exact location of the vehicle.*

**Index Terms** —DC power supply, PIC Microcontroller, Fuel sensor, Speedometer, Temperature Sensor, Keypad, GPS, GSM, LCD Display

### 1. INTRODUCTION

In this modern and fast running world everything is going to be digitized and easily understandable and also to give exact calculation. Considering this idea we started a project named Digital fuel gauge, which shows the exact amount of fuel remaining in the fuel gauge as compared to the previously used gauge meter in which a needle moves to give a rough estimate of the fuel left. A fuel indicator is an instrument used to indicate the level of the fuel contained in the tank. Commonly used in cars and bikes, these may also be used in any tank including underground storage tanks. As used in cars, the fuel gauge has two parts:-

- The sender unit
- The indicator

The sending unit usually uses a float connected to a variable resistor. When the tank is full, the resistor is set to its low resistance value. As the tank empties, the float drops and the slides a moving contact along the resistor, increasing its resistance, finally reaching its highest value when the tank is empty. In addition, when the resistance is at a certain point, it will also turn on a "low fuel" light on some vehicles. Meanwhile, the indicator unit (usually mounted on the instrument panel) is measuring and displaying the amount of electrical current flowing through the sending unit. When the tank level is high and maximum current is flowing, the needle points to "F" indicating a full tank. When the tank is empty and the least current is flowing, the needle points to "E" indicating an empty tank.

#### 1.1 Existing System

All the vehicles in India consist of analog meters hence it is not possible to precisely know the amount of fuel currently in the vehicle and also it is not possible to cross check the quantity of fuel filled in the petrol bunk. Most of the petrol bunks today have manipulated

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the pumps such that it displays the amount as entered but the quantity of fuel filled in the customer's tank is much lesser than the displayed value. Let the pumps are tampered for the benefit of the petrol bunks owner. Most of the petrol bunks today have manipulated the pumps such that it displays the amount as entered but the quantity of fuel filled in the customer's tank is much lesser than the displayed value. Let the pumps are tampered for the benefit of the petrol bunks owner.

## 1.2 Proposed Systems

This project focuses on creating a digital display of the exact amount of fuel contained in the vehicles tank and also helps in cross checking the quantity of fuel filled at the petrol bunk so that the customers cannot be cheated as they cross check the quantity of the fuel. And subsequent additional features are added to the system to assist the drivers which enhance the compatibility of the system. A fuel quantity measuring unit is designed so that exact amount of fuel is known to the driver. This project focuses on creating a digital display of the exact amount of fuel contained in the vehicles tank and also helps in cross checking the quantity of fuel filled at the petrol bunk. Finally once the fuel is filled at a bunk the device also sends an SMS to the vehicle owner indicating the quantity, total amount, cost per kilometer, location, and date, time etc.,

## 2. System Block Diagram

Initially the microcontroller is initialized and the fuel level in the tank is measured, if the fuel level is low then it is indicated on the display and fuel is filled into the tank and if the fuel is full then the pressure is sensed and the analog value is converted into digital form and keypad using fuel cost enter by the microcontroller and displayed in numeric digital form on the LCD display.

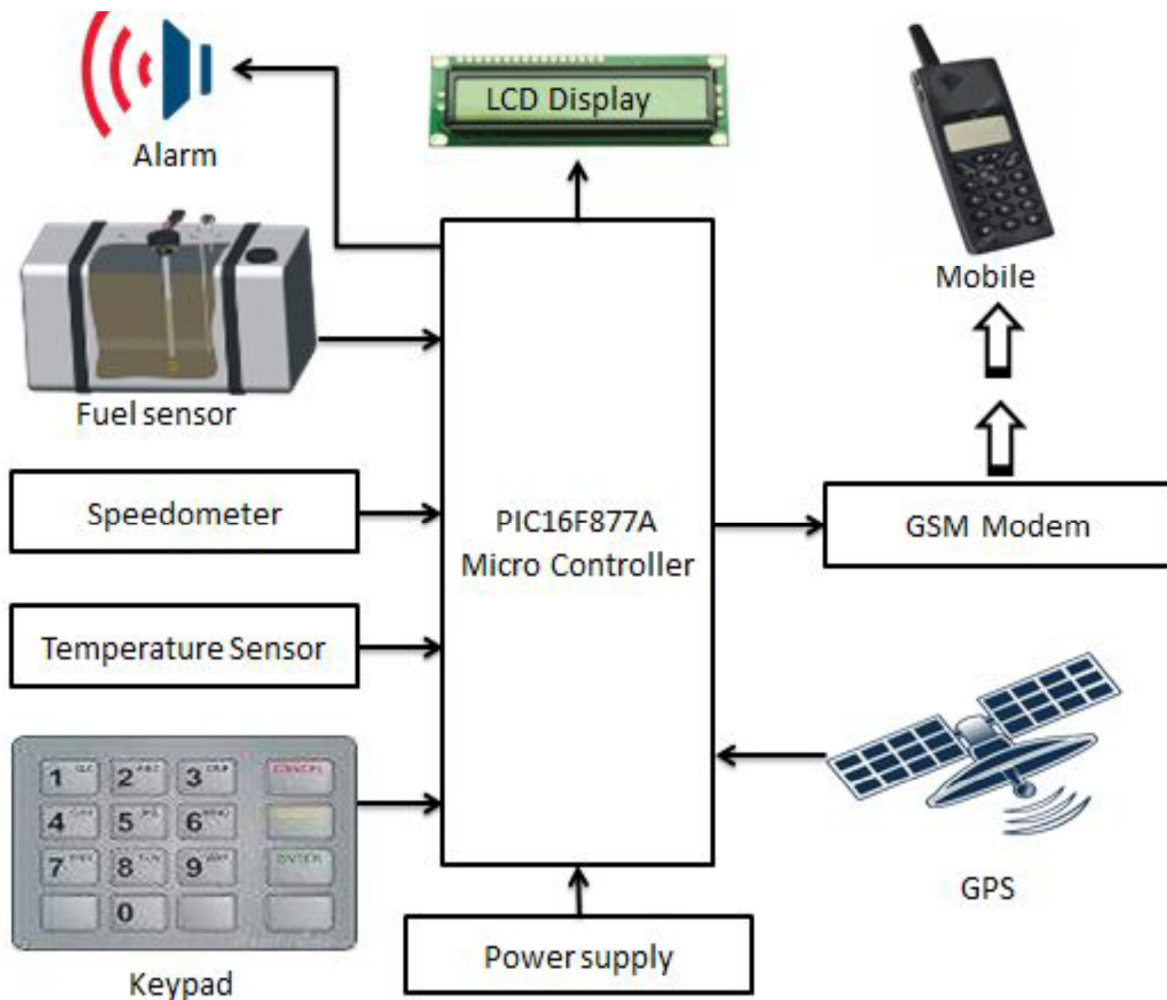


Figure 1.1 block diagram

After digitally displaying the fuel level in the tank, total cost, with the help of GPS and GSM modem the location of fuel filling place is sent to the owner's cell phone to avoid any fraud.

## 2.1 Components

The main components required for the functioning of the above proposed solution are elucidated below.

### 2.1 PIC16F877A Microcontroller

The Microcontroller used here is the PIC16F877. PIC (Peripheral Interface Controller) is a family of microcontrollers. It has attractive features and they are suitable for a wide range of application. It consists of I/O parts, 3 timers, ROM, RAM, Flash memory and inbuilt ADC. PIC channel 10bit inbuilt ADC which convert the analog value into 10 bit digital data. PIC is programmed to convert 10 bit data into an 8 bit data and to transmit the data into a transistor driver. Figure 2 shows the architecture of PIC microcontroller.

### Features of PIC16F877A

- Word instructions to learn.
- All single cycle instructions except for program Branches which are two cycle.
- Operating speed: 20MHz clock input, 200 ns instruction cycle. High performance RISC CPU
- Only 35 single
- Up to 8k x 14 words of FLASH program memory, up to 368 x 8 bytes of Data memory (RAM). Wide operating voltage range:2.0V to 5.5V
- Low-power consumption:
  - -0.6 mA typical @ 3V,4MHz
  - <1 $\mu$ A typical standby current
- Timer0: 8-bit timer/counter with 8-bit prescaler.
- Timer1: 16-bit timer/counter with prescaler, can be incremented during SLEEP mode.
- Timer2: 8-bit period register, prescaler and postscaler
- Timer0: 8-bit timer/counter with 8-bit prescaler.
- Timer1: 16-bit timer/counter with prescaler can be incremented during SLEEP mode.
- Timer2: 8-bit period register, prescaler and postscaler

## 2.2 Fuel Level Sensor

The GSlevel-1612 liquid level sensor features an SAE 5-bolt flange mount with fully-integrated electronics. The sensor is manufactured to your custom length requirement and offers a fully configurable 0-5V analogue output (typically calibrated 0.25V empty, 4.75V full).

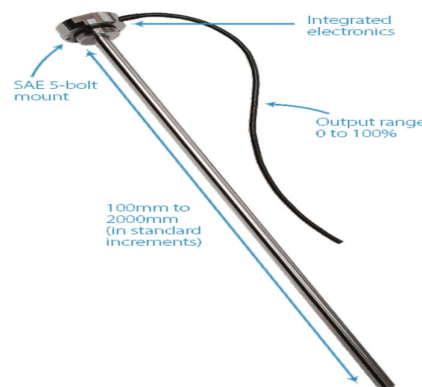


Figure 2.1 Fuel level sensors

Manufactured from aluminium, the sensor utilises capacitive technology with no moving parts to accurately detect levels of fuel. The fuel level sensor using to monitoring the fuel level of vehicle.

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sensor is placed at fuel tank to sense the fuel level and the signal from that sensor is sent to the micro controller unit to decide the exact level information.

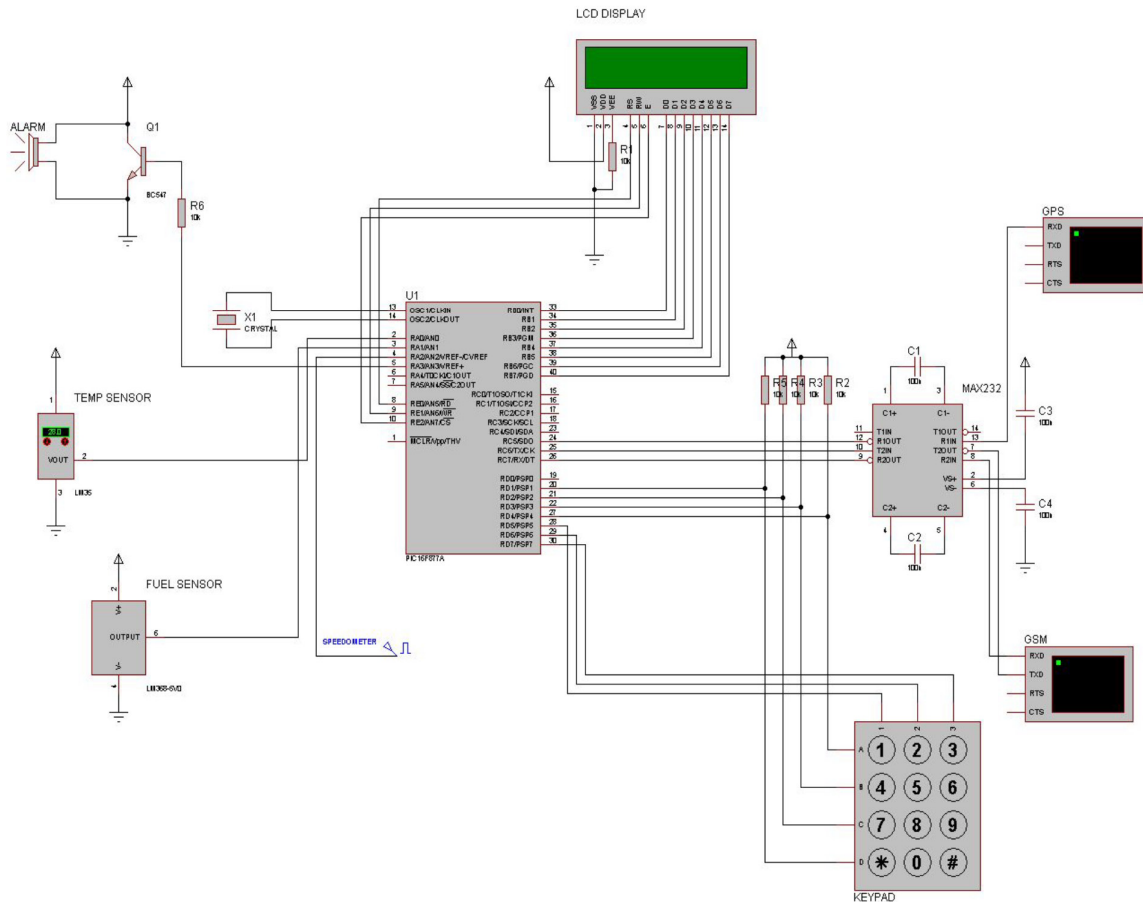


Figure 3.1 Circuit diagram

The main blocks are micro controller unit, fuel level sensor and LCD display unit. The fuel level detection circuit is used to detect the level of the fuel in the tank; here sensors are placed at certain place to find out the fuel level and the signal is sent to the micro controller unit for further operations. Temperature sensor detects vehicle body temperature to overheat alarm circuit ON. fuel sensor is placed at fuel tank to sense the fuel level and the signal from that sensor is sent to the micro controller unit to decide the exact level information. When the fuel level reaches the top level sensor which means that the tank is full and this will be indicated to the user by means of maximum tank level and the level information is indicated through LCD. With the help of GPS and GSM modem the location of fuel filling place is sent to the owner’s cell phone to avoid any fraud.

## Software Description

### 4.1. Embedded C

The embedded system market is growing rapidly and hence there is an increasing demand to write application programs in a high-level language such as C. The reasons behind this are, embedded system programming is more complex (and hence are difficult to maintain in assembly language), processors are needed to more frequent re-adaptation of applications to new instruction sets and hence the lifespan of the processor model is decreased. To address these issues, the code re-usability is needed which is achieved with the help of C-level programming. As the C language has matured over the years, various extensions for accessing basic I/O hardware (iohw) registers have been added to address deficiencies in the language. Today almost all C compilers for embedded systems support some method of direct access to iohw registers from the C source level. Specific embedded-systems deficiencies in C have been addressed to reduce application dependence on assembly code. The Embedded c specification brings back the roots of C to embedded systems as primarily a high-level language means of accessing the processor. The main advantage of embedded C is it supports in-line assembly.

## Results and Discussions

Since in today's real world the fuel level in vehicle (auto or bus) is measured analogously, by design and implementation of this project the fuel in the tank of vehicle is measured digitally and displayed on the LCD in digital numeric form. Then the GSM module sends the SMS to the owner about the location of fuel added from the received data of GPS module.

## Conclusion

The Digital fuel indicator design like that described above will most likely be more accurate, more reliable, and cheaper than other analogue meters, and will allow for added features that benefit both the customer. In the near future, the different vehicle company manufacturers will implement this kind of fuel system which also provides security for the vehicle owners.

## Future Scope

The applications in project have proved to be very important and it much required for the society. The project has the potential in it so that it gives way for future development of the project. In case of theft of vehicle, it can stopped i.e the engine can be shut down remotely using additional software enhancements. Speed of the vehicle can be limited. Location of the vehicle can be determined at any point of time.

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## Task Offloading to the Cloud by Using Cuckoo Model for Minimizing Energy Cost

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**Abstract:** *The increased usage of mobile devices caused them to face a large amount of resource, memory and processing speed scarcity. Of all other constraints, energy is the major problem for this to carry out a task. The concept of offloading gets into play for mobile devices i.e., the task or the computation which needs to be performed involving more service in the android systems will be shifted to resourceful server (for ex cloud) and getting back the results done from the cloud. The decision of whether to offload a computation or not will depend on the task accounting to the energy spent by the device while working with the application versus the amount of energy spent by the same device for uploading the task to the cloud and getting the result back from the cloud. As this concept depicts energy is the major constraint for whether to offload a task or not, there is a model called CUCKOO framework which acts as an interface between the cloud and the android environment to support for the task offloading to the cloud. Thus this framework bridges the gap between the smartphones as well as the cloud environment so that computation intensive task can be performed with less amount of energy consumed. In this work two applications are used to detect the amount of energy consumed in the cloud as well as the smartphones namely eyedentify and Photoshoot.*

**Keywords:** *Mobile Cloud Computing, Cuckoo Framework, Offloading, eyeDentify and Photoshoot.*

### 1. INTRODUCTION

The cloud computing is playing a major role in Mobile Cloud Computing. The mobile cloud computing consist of a cloud server, provided by a variety of servers. It is the responsibility of cloud servers to be able to cope up with the type of requirements of the users [1]. The mobile environment is facing a lot of constraints namely memory, speed, energy and computation. These constraints are decided by the amount of service utilised by the mobile devices [2]. The task in the android systems can be of two types as computationally intensive or ordinary task. A task can be computationally intensive if it involves multimedia processing, GUI applications etc.

Task offloading is a critical technique because in some cases it increases the energy consumption of smartphones. This is due to the fact that it involves the computation as well communication overhead to perform a task. The task can be anything depending on the amount of service (energy) consumed. This technique can be four variants depending on the task and data involved in the particular application involved [3]. In the first case, the input data is available locally on the smartphone and task execution occurs on the smartphone as well. This case seems to be normal because there is no offloading [4]. The second case is where the task execution happens on the cloud but the task data exists locally on the smartphone. In this case, the smartphone needs to upload the task data to the cloud and then download the task results. The third scenario consists of the task execution is being performed locally on the smartphone, but the task data exists on the cloud. To perform the required execution, the smartphone is allowed to download the task data and perform the task execution locally. And in this final case, the input data needs to be injected is available on the cloud and task execution occurs

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in the cloud as well. Therefore, the work needed to be performed by the smartphone is just downloading the task results which are being carried out by the cloud.

The task offloading will offer a better service when it is coupled with a framework called CUCKOO model [5]. The Cuckoo framework, which simplifies the development of smartphone applications that benefit from computation offloading and it is able to decide upon offloading [6]. It provides a dynamic runtime system that can, at runtime, decide whether a part of an application will be executed locally or remotely.

## 1.2 Objective

Providing uninterrupted service to the smartphone is evitable because of its energy consumption and low resource. To enhance the handheld device to next dimension a hybrid platform called Mobile Cloud Computing is used to minimise energy consumption is introduced. The cuckoo framework is used to analyze the energy cost consumption for task offloading to the cloud. Dynamic offloading decisions based on cuckoo model are worked out is based on the equation 1 computation. The energy consideration for each of the cases is calculated.

ECuckoo <ELocal Execution ---> (1)

ECuckoo- Energy consumed by the smartphone using Cuckoo framework (With Offloading)

ELocal Execution-Energy consumed by the smartphone (Without Offloading)

## 1.3 Scope of the Work

The aim of the work is to reduce the amount of energy consumed by the individual tasks in the smartphones, So that the smartphones battery lifetime can be enhanced. Moore's law states that the integrated circuit is accommodating number of transistors every year twice that of the previous year. In contrast, battery capacity increases only by 5% every year. Annually the gap between the energy supply and demand increases by 4%. This concept offers a better conjunction between the battery life and the task handling. For a task performed locally, it involves the energy consumption based on the application. In my consideration, two tasks are used namely eyeDentify and Photoshoot.

## 2. Related Work

Bowen Zhou et al. and Amir Vahid Dastjerdi et al. [7] stated the objective of the context sensitive offloading scheme is to derive an optimal offloading decision under the context of the mobile device and cloud resources to provide better performance and less battery consumption. The proposed framework adopts client-server communication model, in which the cloud resources (e.g. mcc cloud, public and private cloud) used will be acting as servers and the mobile device can be the client to access the services on servers. The client side framework should be consist three components, namely a context monitor, a communication manager and a decision engine. Next, the server side includes server side communication manager, a program profiler and a task manager. The cost model consists of three parts, namely the task execution time denoted by D, wireless channel energy consumption denoted by E and monetary cost denoted by M when related. Then the total cost of executing task ti is as follows:

$$P(t_i) = \alpha_1 * D(t_i) + \alpha_2 * \rho_d * E(t_i) \quad \rightarrow (2)$$

In the context of cloud computing according to Antti P. Miettinen et al. and Jukka K. Nurminen et al. [8], in energy trade-off analysis as given in equation 2, the critical aspect for mobile clients is the trade-off between energy consumed by computation and the energy consumed by communication. Bowen Zhou et el considered the energy cost for performing the local computation (ELocal) versus the cost of transferring the computation input and output data (Ecloud) as provided by K. Yang, K. Kumar, J. Liu, Y.-H. Lu, and B. Bhargava et al S. Ou, and H.-H. Chen in "A Survey of Computation Offloading for Mobile Systems," [2012] [9]. If D is the amount of data to be transferred in bytes and C is the computational requirement for the workload in CPU cycles then

$$E_{cloud} = D / D_{eff} \quad \rightarrow (3)$$

$$E_{local} = C / C_{eff} \quad \rightarrow (4)$$

Where D<sub>eff</sub> and C<sub>eff</sub> are device specific data transfer and computing efficiencies. In equation 3, D<sub>eff</sub> is a parameter meant for measuring the amount of data that can be transmitted with given energy (in bytes per joule) whereas in equation 4, C<sub>eff</sub> is a parameter used as a measure for the amount of computation that can be performed with given energy. By making use of this, he derived the relationship between computing and communication for offloading to be beneficial.

The basic idea of COSMOS given by Cong Shi et al, Karim Habak et al, Pranesh Pandurangan et al [10] is to achieve good offloading performance at low monetary cost by sharing cloud resources among mobile devices. Specifically, in this paper our goal is to minimize

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the usage cost of cloud resources under the constraint that the speedup of using COSMOS against local execution is larger than  $1-\delta$  of the maximal speedup that it can achieve using the same cloud service, where  $\delta \in (0, 1)$ . This process consists of mainly three components: a COSMOS Master running on a VM instance that manages cloud resources and exchanges information with mobile devices; a set of active COSMOS Servers each of which runs on a VM instance and executes offloaded tasks; and a COSMOS Client on each mobile device that monitors application execution and network connectivity and makes offloading decisions.

Emil Lagerspetz and Sasu Tarkoma stated the main purpose of mobile cloud computing (MCC) [11] is to enable the development of computational intensive mobile applications by leveraging the application processing services of computational clouds. Contemporary distributed application processing frameworks use runtime partitioning of elastic applications in which additional computing resources are occurred in runtime application profiling and partitioning. There are provisions for enabling computationally intensive mobile applications to have software level technique called Distributed application processing on SMDs. A number of augmentation algorithms have been proposed for alleviating the resources limitations of SMDs — energy augmentation, memory augmentation (G. Bianchi, 2005 [12]), and an application processing augmentation. The elastic applications allows for separating intensive components of the mobile applications in the current APAs.

In Graph-based application partitioning algorithms the elements of graph — vertices and edges — are used to represent the parameter or context of an application (Xinwen Zhang, Won Jeon, Simon Gibbs, and Anugeetha Kunjithapatham., 2010) [15]. The parameters can be available resources, data size, communication overhead, computation cost, and memory cost depending on the SMDs used and also the type application being used. APAs adopt the graph model for modelling execution states, cost models, internal dependency, data flow, and control flow. In graph-based APAs, obtaining the optimal partitioning decision is a Non-deterministic Polynomial-Complete (NPC) problem. Linear programming (LP) is a mathematical method for determining away to achieve the best result such as maximum profit or lowest cost with a list of requirements which are represented as a linear equation in a mathematical model. Guetal et al, Abebeand Ryan and Verbelen et al. [13] (2013) devised a hybrid partitioning algorithm. In this algorithm, a method for the allocation of components to server in the computational cloud while minimizing required bandwidth. This work is further extended by including dynamic runtime adaptation to the framework and a programming model based on annotations which aim to minimize the programmers' burden.

In the following, Majid Altamimi et al and K. Naik “A Survey of Software Based Energy Saving Methodologies for Handheld Wireless Communication Devices [2010]” [14] modelled the energy usage in two distinct cases, namely, file upload and file download. For simplicity, he assumed that the mobile device transceiver uses only two power levels, namely, PRX when it is idle, in back off mode, or receiving and PTX when it is transmitting. For File Download Case, the mobile device is mostly receiving. Here, we address first the general situation where there is no limitation on the file download rate from the cloud. Next, we address the situation where the cloud restricts the file download rate. For every MAC frame to be received, the mobile device has to send a CTS and an ACK frame. The mobile device has to send a TCP ACK for every received TCP segment. During downloading a file, a smartphone will be receiving a data frame for a time  $T + 3SIFS + TPHY + TRTS$  and it has to wait for the AP back off time  $\Theta/t$ .

### 3. Existing System

Existing system consists of two major parts, smartphones (i.e., user equipment, UE) and Cloud Computing (CC), both linked to the Internet. The smartphones are connected to the Internet through a WLAN access point or a cellular data network base station. These smartphones provide all of mobile computing functionalities to the end users via different applications. On the other hand, the CC part consists of cloud data center and cloud provider, which are accessible through the Internet. The cloud supports the end users (e.g., smartphone users) by providing all the CC functionalities that are needed for mobile computing. In the offloading technique, smartphones access the cloud via the Internet. Therefore, offloading is considered as a Network Related Application (NRA). At the beginning of studying NRA, network interfaces (i.e., 3G/4G and WLAN) should be considered because each of these interfaces has its own characteristics, such as supported data rate. As a result, each network interface consumes unequal amount of energy. In addition, the Internet protocols, namely, the Hypertext Transfer Protocol (HTTP) and the File Transfer Protocol (FTP) need to be taken into account. The network interfaces and protocols are the major factors that affect the energy costs of task offloading. They are taken into account for energy cost modelling.

#### 3.1 The Experiment

They experimentally evaluate the energy cost on smartphones when the offloading technique is used over different network interfaces and Internet protocols. They conducted experiments in four broad experimental scenarios related to the location of the task data. The first scenario corresponds to S1, where there is a local task execution and the task data exists on the smartphone. The second scenario corresponds to S2, where uploading the task data, doing the task computation (encoding) by the cloud, and downloading the task result is presented by the “Upload + CC encoding + Download”. The third scenario corresponds to S3, where there is a local task execution and the task data is downloaded from the cloud, as shown by the “Download + Local encoding”. The fourth scenario corresponds to S4, where the task data exists in the cloud and the task executed on the cloud, and the task result is simply

downloaded, as presented by the “CC encoding + Download”. For uploading and downloading files to and from the cloud, we consider the energy implications of: (i) using the HTTP and FTP protocols at the application level; and (ii) using the 3G and WLAN communications at the wireless interface level.

#### 4. Proposed System

The proposed system is defined to work in a Mobile Cloud Computing environment as briefed out earlier. The cloud environment is able to serve the variety of requests from the users based on the needs of them. Likewise the mobile device is able to serve the users by installing the applications specific to the needs of the users.

##### 4.1 The Cloud Modelling

Even though the cloud environment is able to support all kinds of users, it is based on pay as you go based service model. But we need little consideration before taking the smartphones to the cloud. The general problems of the smartphones include energy, speed and the memory. For all these considerations the cloud environment is brought into these devices to minimize the power consumed. The service provider provides provision for the cloud computing service model, giving out a very large amount of high performance computing resources and high-capacity storage devices that are shared among end users as required. There can be many kinds of cloud service models. Depending on the end users subscribing to the service may or may not have their data hosted by the service, and also computing resources allocated on demand from the pool. The service providers can also be giving service in the form of software applications offering as required by the end user. In order to be successful, the high speed network deserves a major criterion for an offloading to the cloud service model to provide connection between the end user and the service provider’s infrastructure.

The run time computational offloading involves deployment of a delegated application on the virtual machine of the cloud server node and is a challenging aspect for this process. Current COF focus on partitioning an elastic mobile application dynamically and offloading the intensive partitions at runtime. The reconfiguration of delegated applications on the virtual device instance of the machine is a critical feature of current COFs on the cloud server node. Therefore, the execution of the offloaded applications to the cloud server nodes requires the deployment of virtual phone instance(s) on the virtual machine of the cloud data center. The operating system platforms implement platform-specific application frameworks; due to the hardware architecture and operating system platform of the mobile devices are different. This interface is deployed in the ADSL layer of the android devices so that the application is coupled with this interface to make computations with regards to energy consumption.

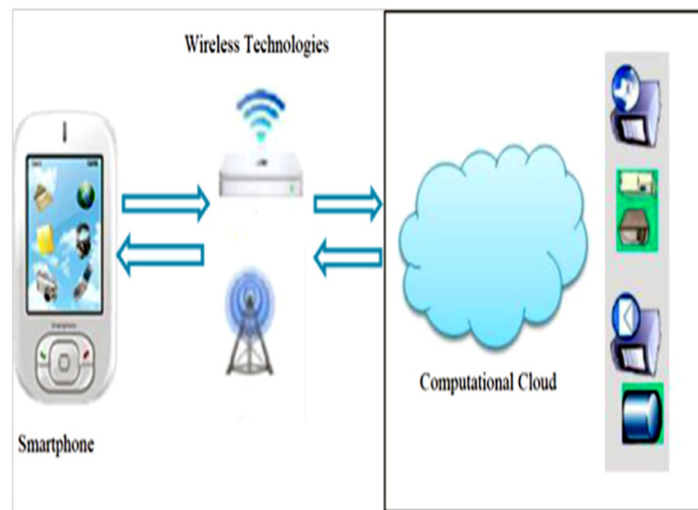


Fig. 1 Overview of task offloading

The figure1 is depicting the MCC consisting of smartphone and cloud environment with wireless communication links. The communication links can be WiFi, 3G/4G. In our proposed work, an interface is used to connect between the smartphone and the cloud environment. So the energy consumed in this case is minimized. This interface is deployed in the ADSL layer of the android devices so that the application is coupled with this interface to make computations with regards to energy consumption. Thus the amount of energy saved is

$$PC=C/M\text{-Pi}\cdot C/S\text{-Ptr}\cdot D/P \quad \text{---> (5)}$$

S: measures the speed of cloud to compute C instructions being given by the SMDs.  
 M: measures the speed of SMDs to compute C instructions  
 D: the data need to transmit  
 Pc: the energy cost per second when the mobile phone is doing computing

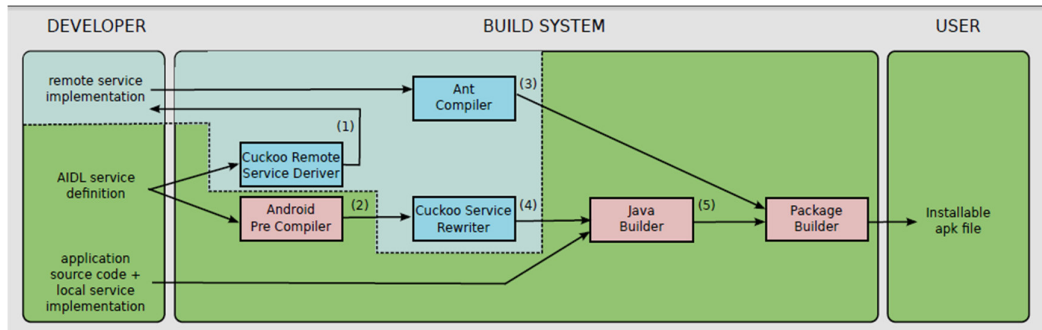


Fig. 2 Overview of Cuckoo Framework

Pi: measures the energy cost per second when the mobile phone is idle.  
 Ptr: measures the energy cost per second when the mobile is transmitting the data.

## 4.2 Cuckoo Framework

Cuckoo Framework represented in figure 2 focuses on minimizing effort to enhance the performance and reduce the battery usage of applications with heavy weight computation. The amount of energy saved by a device is given in equation 5. In connectivity drops offering a very simple programming model that supports for both local and remote execution and is able to bundle all codes in a single package. Next step is to integrate the system with existing development tools that are familiar to developers allows for automating large parts of the development process. This service offers a simple way for the application user to collect remote resources, which includes laptops, home servers and other cloud resources.

This model used the existing activity/service model in Android that makes a separation between compute intensive parts (services) and interactive parts of the application (activities), through an interface defined by the developer in an interface definition language (AIDL). If not, the code can be extracted from an interface. At the activity, the interface can be implemented as a local service when used it acts as a proxy object which is being present with it. The Cuckoo framework provides two Eclipse builders and an Ant build file that can be inserted into an Android project's build configuration in Eclipse. The Cuckoo Service Rewriter is also called first Cuckoo builder. The order of invocation can be first the Android Pre Compiler, next the cuckoo service rewriter and at the last the Java Builder. The work of Cuckoo Service Rewriter is to rewrite for each AIDL interface on the generated Stub, so that the decision of whether to execute locally or remotely is made at runtime by the Cuckoo framework. The remote implementation for the interface is called the Cuckoo Remote Service Deriver and derives a dummy implementation which acts as a second Cuckoo builder. This programmer reserves the right to implementation of the remote interface.

After the generation of the dummy remote implementation, the Cuckoo Remote Service Deriver will also generate an Ant build file, which then be used to build a Java Archive File (jar) that contains the remote implementation, which is installable on cloud resources. The order of execution of the service plays an important role. Now the Package Builder is invoked later the java builder is invoked finally the Cuckoo Remote Service Deriver and the resulting Ant file have to be invoked, so that the jar(java archive) will be part of the Android Package file that results from the build process.

## 4.3 Intelligent Offloading

Resource Manager Application is a part of the Cuckoo framework and it is able run on the smartphone. The registering process is very essential in order to make a remote resource known to a phone. The job of the remote resource is to register its address to this Resource Manager using a side channel. If a resource has a display, starting a server will result in showing a two dimensional barcode – a QR code on the resources' screen. The address of the server is fed into the QR code. Scanning the QR code is another task here. This is done by the smartphones because they are typically equipped with a camera and scan this QR code using a special resource manager application. The resource description file can be created from the resource if in case it does not have a visual output, the resource description file can be copied from the resource to the phone to register the resource. The application which uses the cuckoo computational offloading may be applied to all of its process over the long run, once the resource is known to the Resource Manager application, it can be used repeatedly for any application.

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When a method of a service is invoked by an activity, the work of the Android IPC mechanism is to direct this call through the proxy and the kernel to the stub. Normally, the invocation of the method is done by the stub which is always a local implementation of the method and then returns the result to the proxy. The Cuckoo system intercepts all method calls and evaluates whether it is beneficial to offload the method invocations or not, using heuristics, context information and history.

#### 4.3.1 eyeIdentify

Our first example application is eyeIdentify, a multimedia content analysis application that performs object recognition of images captured by the camera of a smartphone. The purpose of this application is similar to that of the Google Goggles application which can recognize contact info, places, logos, landmarks, artworks, and books. This game can be offloaded by making computation offloading which allows the speed up of the computation with a factor of 60 along with the reduction of battery consumption with a factor of 40 and increase the quality of the recognition.

#### 4.3.2 PhotoShoot

The second example that we will consider is a distributed augmented reality game, called PhotoShoot, with which we participated in the second worldwide Android Developers Challenge and finished at the 6th place in the category 'Games: Arcade & Action'. There are two players in this innovative game duel and they take part in the real world. The working mechanism for this game involves two Players each having 60 seconds and 6 virtual bullets to shoot at each other with the camera on their smartphone. The goal involves Face detection which is used to determine whether a shot is a hit or not. The duel will be recorded as the winner and he is first player that hits the other player. The face detection is the major compute intensive operation in this game. The face detection algorithm is present as an inbuilt package in the Android framework, so it is possible to create a local implementation to detect faces in an image. If we assume the process that happens without offloading, and if the processor of the smartphone is slower, the longer time it takes to analyse the shot, which causes the user of a slow smartphone a significant disappointment. However Offloading can, be used to make the game fair again over multiple times.

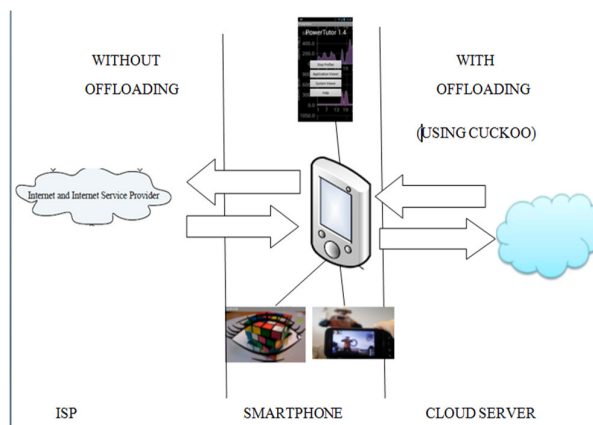


Fig. 3 Task offloading using Cuckoo framework

### 5. System Architecture

The System architecture pictured in figure 3 describes how the smartphone is connected to the internet and the cloud. While if the system is connected to the internet it will not be offloading the task rather it extracts the information needed to perform computation.

#### 5.1 No Offloading Scenario

This scenario deals with the computation of energy consumed by the application during its working over the particular task. These two tasks are computation intensive since they involve image processing. At the earliest results shows off little difference over things but improves rapidly when there are huge records that need to be processed is given in equation 6 and 7. So the energy consumed in case of no offloading scenario is that the task to be executed locally on the smartphone itself. If  $T_{task}$  is the time taken for executing the compute intensive algorithm, then time taken by the client for no-offloading scenario is:

$$T_{client} = T_{task} \quad \text{---> (6)}$$



The total energy consumption  $E_{no\_offload}$  is given by:

$$E_{no\_offload} = E_{client} = P_{client} * T_{client} \text{ ----> (7)}$$

### 5.2 Offloading Scenario

For offloading scenario, the task is executed on remote server. Hence, in this case  $T_{server} = T_{task}$  and total time returned at the client is given by.

$$T_{client} = T_{task} + T_{comm} \text{ ---->(8)}$$

Where,  $T_{comm}$  is communication time for sending the input file to server and getting the result back from server is given by equation 8. In this case, the offloading was done using Wi-Fi as well as 3G interface which is given in equation 9 and 10. For offloading, total energy consumption  $E_{offload\_wifi}$  and  $E_{offload\_3G}$  respectively are given by:

$$E_{offload\_wifi} = E_{client} + E_{internet\_wifi} + E_{datacenter} \text{ --> (9)}$$

$$E_{offload\_3G} = E_{client} + E_{base\_station} + E_{internet\_3G} + E_{datacenter} \text{ ----->(10)}$$

Where,  $E_{client}$  = Energy consumed by the client device,

$E_{datacenter}$  = Energy consumed at the datacenter.

$E_{internet}$  = Energy consumed by the internet infrastructure

Energy consumption at the datacenter is given by:

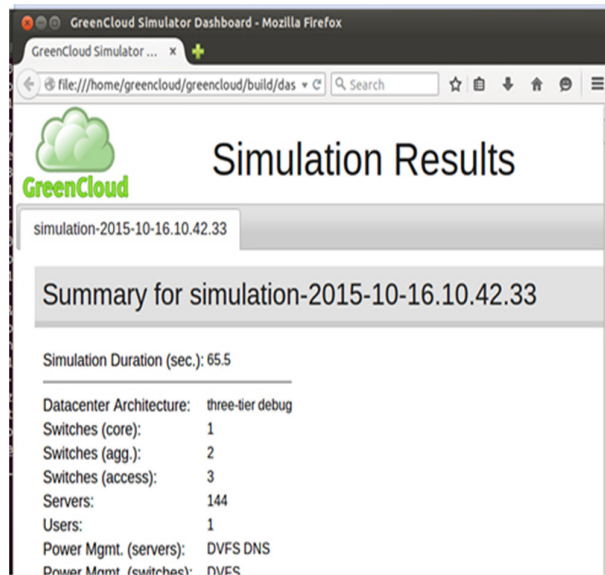
$$E_{datacenter} = E_{server} + E_{overhead} \text{ ----> (11)}$$

Where,  $E_{overhead}$  = Energy consumed by HVAC, power supply and other overheads at datacentre which provides the energy of datacentre in equation 11.

### 6. Implementation

This constitutes energy computation for both the mobile as well as the cloud environment. This can be done by installing the cloud environment using green cloud and mobile environment can be brought into the device using android SDK and eclipse with built- in java configurations.

The figure 4 represents the green cloud installs the cloud environment along with its data center. The energy consumption for the devices which are connected can also be listed. So that the task installed in the cloud will be represented the graph for parameters like performance, response time, memory access, storage access, failure rate etc., are represented. While installing the mobile environment power tutor application also needs to be installed, which is helpful for Calculating energy consumption of each of the applications.



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Fig. 4 Green cloud simulation

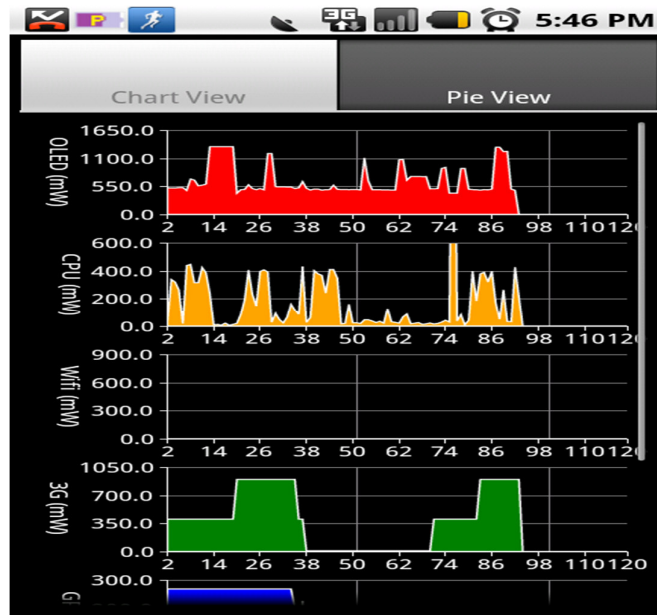


Fig. 5 Power tutor Application

The eclipse installing involves java RT environment to be installed onto the device. But the green cloud virtual disk is being coupled with the ns2, eclipse and c, c++ coding. Power tutor represents with all the parameters in the form of graphs. With all these parameters of energy responses of all the applications having graphs of all the cases are depicted. And from the results the application is decided upon whether to offload or not. In this case, both the applications needs to be offloaded since they are involving image processing. The figure 5 represents the application power tutor which allows the user to find the power consumption of individual applications.

GreenCloud simulator is an extension of NS-2 network simulator. It comes as an archived source tree, or as a pre-configured VM, which works with VirtualBox and VMWare Player. The VM also includes a pre-configured Eclipse environment, so it is the easiest way to download GreenCloud and start running simulations and/or modifying the source code.

## 7. Conclusion

Task offloading is one of the emerging topics in Mobile Cloud Computing. Task offloading serves as better job of taking the task to be done on to the cloud by creating communication link between the cloud and the mobile device. The communication links also plays a important role in task offloading. WiFi serves better offloading than 3G/4G. Because they don't deserve a physical layer communication link as wifi. Likewise offloading gives better yield when there are number of tasks to be done. This process includes the integration of three major components namely Cuckoo framework along with popular open source Android framework and at the last Eclipse development tool. The major advantage of this framework is that it provides a simple programming model, familiar to developers, and it allows for a single interface with a local and a remote implementation. The speciality of this Cuckoo model is that will decide at runtime where the computation can be local or remote. In addition to this, the Cuckoo framework adds an extra generic remote server, that allows for hosting the remote implementations of compute intensive services. A smartphone application to collect the addresses of the remote servers is also included. In this paper I evaluated the Cuckoo framework with two real world smartphone applications, an object recognition application and a distributed augmented reality smartphone game and showed that little work was required to enable computation offloading for these applications using the Cuckoo framework.

## 8. Future Enhancement

As of wireless network is concerned security breaches may occur. (1) Ensuring security for the communication link can also be taken as a next step. (2) Offloading from smartphone involves certain security violation that can also be analysed and rectified. (3) Sometimes incompatibility in both the device and cloud system may result in different results, it should be checked out and a fixed framework can also be devised. (4) 5G communication link can also be tested. (5) This offloading can also be extended as data,

application partitioning etc., in order to perform the variants of offloading. This future enhancement may allow the device to have a better scope in the Mobile Cloud Computing environment. The energy as well as memory and computation cost can also be reduced.

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## Investigation of Physical, Chemical and Structural Characterization of Eichhornia crassipes Fiber

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**ABSTRACT:** Researchers and scientists are looking forward for the new fiber sources for the sustainable processing. The ultimate goal is to produce an organic fibrous material that can be utilized in textile industry and to manufacture eco-friendly products. In this circumstance here emerges a fiber from water hyacinth (*Eichhornia crassipes*) an aquatic weed which has been attracted worldwide as a threat to biodiversity. Hence this paper highlights the physical, chemical and structural characterization of the fiber extracted from *Eichhornia crassipes*. The fiber was examined for the physical properties such as fiber length, diameter, elongation, moisture absorbency and fineness as well as mechanical properties by analyzing its tensile strength test. The structural and functional characterization of the fiber is examined using the Scanning Electron Microscope (SEM) and IR spectroscopy (FTIR). The thermal behavior of the fiber is analyzed using the Differential Scanning Calorimetry (DSC).

**Keywords:** Eichhornia crassipes, fiber properties, SEM analysis, FTIR analysis, DSC.

### I. INTRODUCTION

Now a days the textile market has the trend of manufacturing go green products. Ultimately the consumers are also aware of buying ecofriendly fabrics [1]. Specifically the present textile market is available with plenty of ecofriendly products made of emerging natural cellulosic fibers with top ranking fibers such as organic cotton, hemp and sisal. But in such cases there is a possible risk of getting a plenty of resources for bulk and continuous production. Keeping such factors in mind, the new fiber sources are identified by the researchers and scientists. But the goal is to produce an improved and sustainable products made of fibrous material which can be used in textile industry in various aspects such as garments, upholsteries and interior decorations.

Natural fibers are the class of traditional fiber materials of renewable sources which experiencing a great revival now-a-days [2]. And especially the plant fiber has the characteristics such as resistance to water, thermal insulation and related characteristics. Thus the new plant fiber has been identified to decrease the pressure of handful number of species for the small scale industry [3, 4].

Today a vast resource from water sources like pond, river, ocean and dams has given a generation to new fibrous materials called water hyacinth. Water hyacinth is a free floating aquatic herb belongs to the family *Potederiaceae*, closely related to the *Liliaceae* (lily family). It reproduces rapidly using vegetative means. The plant has the weight gain of 4.8% per day and double in every 11-15 days of field observation. Hence the water hyacinth (*Eichhornia crassipes*) leads to serious problems and considered as a threat to biodiversity, where it also affects the water transportation, canal irrigation and power generation by blocking waterways [5]. Several steps has been adapted to control the growth of *Eichhornia crassipes* and some research is also been carried out to destroy the weed completely [6].

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On the other hand, *Eichhornia crassipes* plant is considered as a valuable resource due to some of their unique properties. Several researches has been done in the last decade to utilize this weed in an economical way to produce the products of different aspects [7].

## II. Materials

The fibers can be obtained in large number from the matured stalks than in the younger ones [8]. Hence the matured *Eichhornia crassipes* plants were identified and collected from the Cauvery river of Erode district, Tamilnadu, India. The matured plants are about 15-30 inches long and 0.15-1.2 inches in diameter [9]. The stalks were separated from the leaves and roots, washed thoroughly in water and dried in shade for 2-3 days. The fibers are then extracted from the dried stalks manually using the needles [10].

## III. Methods

### A. Physical Properties of Eichhornia Crassipes Fiber

#### a) Fiber Length

The *Eichhornia crassipes* fiber is analyzed for its length manually using a calibrated metal scale. The fiber was stretched on the flat table and straighten with care to avoid elongation while measuring. The results are expressed in centimeters.

#### b) Fiber Diameter

The *Eichhornia crassipes* fiber diameter is analyzed using a Scanning Electron Microscope (SEM). The average value can be calculated by analyzing the ten different areas of an individual fiber.

#### c) Single Fiber Tensile Strength and Elongation

The tensile strength of the *Eichhornia crassipes* fiber is tested according to ASTM D 3822 using eureka single yarn strength tester. The principle of the machine is constant rate of traverse were the preconditioned fiber sample is mounted between the two jaws having the gauge length of 15 cm. The strength and elongation of the fiber is determined and noted at the point of rupture.

#### d) Moisture Regain and Moisture Content

The moisture regain and moisture content of the *Eichhornia crassipes* fiber is analyzed manually using BIS and ASTM D 629 methods. The predetermined amount of fiber (A) is conditioned in oven at 105<sup>o</sup> C and the constant mass of the fiber is obtained (B). Thus moisture properties are calculated from the measured values using (1) for moisture regain and (2) for moisture content.

$$\text{Moisture regain} = \frac{A - B}{B} \times 100 \quad (1)$$

$$\text{Moisture content} = \frac{A - B}{A} \times 100 \quad (2)$$

#### e) Fiber Fineness

The *Eichhornia crassipes* fiber fineness is analyzed according to ASTM D 1577 test method. The fibers of selected length (2 inches) were cut and bundled to the nearest weight of 0.001 mg and the number of fibers in the bundle were counted. Randomly twenty bundles are selected for testing and the average was calculated.

### B. Chemical Composition of Water Hyacinth - (FT-IR Spectroscopy)

The fresh *Eichhornia crassipes* stalks generally comprises of 90-95% of water [11]. The analysis has been made on the *Eichhornia crassipes* fiber extracted from dried stalks and the results were obtained. The fiber was examined for the structural and chemical information by analyzing under FT-IR Spectrophotometer. The fiber pellet was prepared using 2 mg of powdered specimen with KBr powder and compressed to 1 mm thickness. Then the pellet was studied under SHIMADZU 4200 type FT-IR spectrophotometer in the range of 600 – 4000 cm<sup>-1</sup> with a resolution of 2 cm<sup>-1</sup>.

### C. Structural Analysis of Eichhornia Crassipes Fiber

The surface morphology of *Eichhornia crassipes* fiber is analyzed using Scanning Electron Microscope (SEM). The surface of the fiber is coated with gold using Edward Sputter coater apparatus and then observed at an accelerating potential of 10 kV.

### D. Thermal Behavior of Eichhornia Crassipes Fiber (DSC)

The presence of transition temperature of *Eichhornia crassipes* fiber is analyzed using Differential Scanning Calorimetry (DSC) of NETZSCH STA 449F3 type instrument. The fiber sample of known weight was sealed in an aluminium pan and heated from 30<sup>o</sup> C to 500<sup>o</sup> C under nitrogen atmosphere at the heating rate of 10<sup>o</sup> C/min.

## IV. Result and Discussion

### A. Physical Properties of Eichhornia Crassipes Fiber

The length of the fibre depends upon the plant selected for extraction. *Eichhornia crassipes* fiber has the length vary from 15 cm – 20 cm and diameter of 320  $\mu\text{m}$ . The tensile strength of the *Eichhornia crassipes* fiber was determined by randomly choosing the 20 samples from a lot and the accurate results are determined. The tensile strength of the *Eichhornia crassipes* fiber range between 45.5 gf – 384 gf with the average of 212 gf. The mean elongation of the *Eichhornia crassipes* fiber is found to be 2.5 % and the standard deviation of 1.1 %. The moisture regain and moisture content of the *Eichhornia crassipes* fiber is found to be 17.64 % and 15 % respectively. *Eichhornia crassipes* fiber has the fineness of 7 tex which shows the fibre is least bulk. (See Table I)

Table I Mechanical properties of *Eichhornia Crassipes* fiber

Mechanical Properties	Values of <i>Eichhornia crassipes</i> fiber
Single fiber length	15 cm – 20 cm
Single fiber diameter	320 $\mu\text{m}$
Tensile strength	212 gf
Fiber elongation	2.5 %
Moisture regain	17.64 %
Moisture content	15 %
Fiber fineness	7 tex

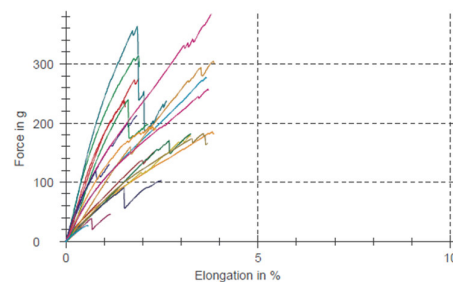


Figure 1. Tensile strength of *Eichhornia crassipes* fiber

The *Eichhornia crassipes* fiber has the water absorbency greater than that of cotton and other natural cellulosic fibers. Whereas the strength and elongation of *Eichhornia crassipes* is near to that of coir [12].

### B. Chemical Composition of Eichhornia Crassipes Fiber - (FT-IR Spectroscopy)

The analysis has been made on the *Eichhornia crassipes* fiber and analyses shows that the fibre contains  $63.75 \pm 0.24\%$  (w/w) of cellulose,  $12.33 \pm 0.08\%$  (w/w) of hemicellulose,  $20.67 \pm 0.13\%$  (w/w) of lignin,  $2.62 \pm 0.05\%$  (w/w) of ash and  $0.65 \pm 0.02\%$  (w/w) of extractives. The Spectroscopic study (FT-IR Spectroscopy) of the fiber shows the band at  $1033.85\text{ cm}^{-1}$  &  $1242.16\text{ cm}^{-1}$  of C-O stretching of strong intensity conforms the presence of cellulose, band at  $1419.61\text{ cm}^{-1}$  of C-H bend of medium intensity shows the presence of lignin contents in the fiber [13].

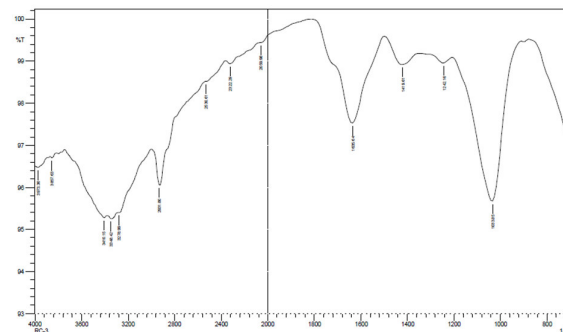


Figure 2. FT-IR Analysis of *Eichhornia crassipes* fiber

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### C. Structural Analysis of Eichhornia Crassipes Fiber

The SEM image is used to analyze the presence of lignin and hemicellulose coating over the cellulosic fibre [14]. The fibre density and composite properties are affected by the small empty spaced called voids or lumen of the fiber [15]. The figure shows the SEM analysis of *Eichhornia crassipes* fiber at the magnification of 400X (50  $\mu\text{m}$ ) and 180X (500  $\mu\text{m}$ ). The figure describes that the *Eichhornia crassipes* fiber are arranged as fibrills and has the hollow space describes that the fiber has the capacity to hold the liquid contents and also shows that the fiber has good absorbency.

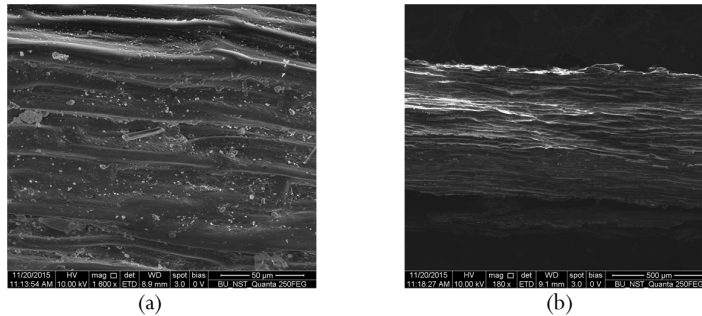


Figure 3. SEM Analysis of *Eichhornia crassipes* fiber (a) 50  $\mu\text{m}$  (b) 500  $\mu\text{m}$

### D. Thermal Behavior of Eichhornia Crassipes Fiber (DSC)

The Differential Scanning Calorimetry of the *Eichhornia crassipes* fiber was shown in the figure. The glass transition ( $T_g$ ) of the fiber begins approximately in the range of 72.7<sup>o</sup> C. The natural fibre donot melt and has lacking melting point ( $T_m$ ). The fiber withstands upto 498.3<sup>o</sup> C and left as residual mass without decomposing.

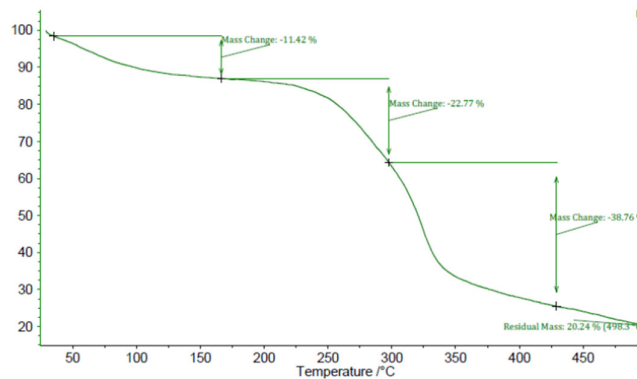


Figure 4. DSC/ $T_g$  Analysis of *Eichhornia crassipes* fiber

### V. Conclusion

The investigation of water hyacinth (*Eichhornia crassipes*) proves that the fiber obtained from its dried stalk has good amount of cellulose, hemicellulose and lignin content which meets level of other available natural fibers. The fiber has good absorbency, medium strength and elongation. Less lignin content and high density of the fiber is more suitable for making non-woven and composites. DSC curves reveal that the fiber has good thermal resistivity suitable for acoustic materials. SEM analysis of the fiber shows that the fiber has many hollow pores which can be able to hold moisture and thus suitable for high absorbency materials such as napkins and wipes. As a result it is concluded that the water hyacinth (*Eichhornia crassipes*) stalks are the possible sources of fibers and a suitable alternate for presently available textile fibers.

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## Exploration of Physical, Chemical Properties of Raw and Alkali Treated Terminalia Catappa Fruit Fibers

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**Abstract-** *The environmental sustainability level is enhanced while using natural fibers as raw material in various industries like textile, building, plastics, and automotive industries due to acquiring properties like non-hazardous, light weight, recyclable, ample and reasonably priced. Terminalia Catappa fruit fiber is one such type fiber which was extracted from Terminalia Catappa fruit. The physical and chemical properties such as density, cellulose, wax, moisture, were experimentally found out from this fiber. In this paper, the Terminalia Catappa fruit fibers were treated with 5% and 10% of NaOH and the consequence of alkali treatments on the fiber properties were investigated.*

**Keywords:** *Fibers, Physical properties, chemical properties.*

### I. INTRODUCTION

Over the past two decades, polymer-based materials reinforced with various natural fibers have been established everywhere from academic and industrial point of view. Environmental consciousness, legislation, and energy consumption have inspired academics and industrial researchers working in the area of cellulose fibers and fiber-reinforced composite. More than 1000 species of cellulose plants are being available in fibers forms and few of them are investigated to prepare the reinforced composite. The natural fiber composites have attractive features likes low cost, light-in weight, moderated strength, high specific modulus, moderate mechanical properties, easy to handle, and lack of health hazards compared to synthetics fiber composite. Structure of the fiber is framed with natural chemicals such as cellulose, lignin, and wax. The cellulose fiber-reinforced composites have been significantly used for industrial components, construction material, automobile parts, and home appliances. [1]

In practice, so far the use of okra fibres in materials has been confined to employing the mucilage as a moisture absorber [2]. Okra mucilage can be a source of polysaccharides, which can be used, with suitable chemical grafting e.g., using polyacrylonitrile, for the synthesis of biodegradable polymers [3] Various research works are being carried out with the natural fibers like bamboo, coir, jute, flax, sun hemp, ramie, kenaf, roselle, straw, rice husk, sugar cane, grass, raphia, papyrus, pineapple leaf fibers. Applying bark fibers and seed fibers as an alternative for fiber- reinforced composite was investigated in the study made by Ashori and Bahreini [4].

Edeerozey et al. [5] chemically modified the kenaf fibers and found that the alkalization treatment improved the mechanical properties. Symington and Banks [6] found that the excess treatment of natural fibers could have a negative effect on the base fiber properties. It was also ensured that less than 10 min treatment time was sufficient for removing celluloses. The natural based resins could also be used along with natural fibers for making complete biobased products. They do not induce allergic and irritation sensation to the human skin. The microstructures of the natural fibers contain cellulose, hemicellulose, lignin, moisture, wax and other impurities. But the properties of these fibers will depend on the type of the plant, the age of the plant, extraction method and the environment in

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which the plant grew. The natural fibers, in general, are available in the seeds, stems and leaves of the plants [7]. Malkapuram and Kumar [8] noticed that the chemical, mechanical, and physical properties of natural fibers vary from fiber to fiber. The mechanical properties were also lowered by the moisture content.

In the present study, the newly identified Terminalia Catappa fibers (TCFs) are extracted from Terminalia Catappa (TC) plant. The physical and chemical properties have been investigated.

### III. Materials and Experiments

#### A. Raw Fiber Extraction

The grown Terminalia Catappa fruits were collected from Terminalia Catappa fruit trees and engrossed in water for two days. The flush which was bonded with the fibers absorb water and the retting of the same started. The flush lost its bonding strength at this stage. Now the fruits were taken out of water and thoroughly washed in running water. During the washing process the fruits were gently pressed for the removal of the retted flush.

The fruits were then immersed in water for one day and the process was repeated for the removal of remaining flush. The fibers were taken out and allowed to dry in the shadow for a couple of days. The fibers were then dried in sunlight for half an hour and extracted. The raw Terminalia Catappa fruit fiber is shown in figure 1.



Figure 1. Extraction of Terminalia Catappa fruit fiber (Raw fiber)

#### B. Alkali Treatment of Terminalia Catappa Fibers

The dry Terminalia Catappa fibers were treat with 5% and 10% NaOH solution separately for about half an hour at room temperature. The fibers were then cleaned with fresh water to take away any NaOH sticking on the fiber surface. The fibers were neutralizing with 2.5% Hcl solution at room temperature. The fibers were again cleaned in distilled water and dried at room temperature for one day. The 5% and 10% NaOH alkali treated Terminalia Catappa fruit fibers are shown in figure 2



Figure 2. 5% and 10% NaOH alkali treated Terminalia Catappa fruit fibers

### C. Physical Properties

#### Fiber Density

The water displacement method was in use to find the density of the Terminalia Catappa fruit fiber. The weighed quantity of fiber was completely wrapped up in water and the volumetric displacement was observed. The weight to volume ratio yielded the density value.

### D. Chemical Properties

#### Wax Content

The wax content was deliberate with the help of Soxhlet apparatus. Petroleum benzene liquid was heated to 70°C and one gram of Terminalia Catappa fruit fiber was wrapped up in the liquid. The 60 minutes reflux time was provided and the fiber sample was dried. After aeration the fiber, it was weighed and weight difference confirmed the wax content.

#### Moisture Content

The weighed quantity of Terminalia Catappa fruit fiber was placed in an oven at the temperature range of  $105 \pm 2^\circ\text{C}$  for 4 hour. The weight of the fiber taken from the oven was measured and the difference in weight accounts for the moisture content present in the fiber.

#### Cellulose Content

The weighed quantity of Terminalia Catappa fruit fiber was wrapped up in a mixture of sodium chloride 1.72%, and three drops of sulfuric acid in water. One hour drenched time was provided. Then the excess fluid was taken away by suction process and ammonia was added. The residue was washed with distilled water, dried at room temperature and weighed. The percentage of cellulose was noted by the ratio of the residue weight to the dry sample weight.

## IV. Results & Discussion

### A. Physical Properties of Terminalia Catappa Fruit Fiber

The results are shown in Table I. It was noticed that the density values of the Terminalia Catappa fruit fibers were less than that of the synthetic fibers. These properties envisage that the Terminalia Catappa fruit fibers could be used as reinforcement in making the light weight composite structures. Moreover the biodegradability is an added feature for the use of this fiber in composites.

Table I Physical properties of terminalia catappa fruit fiber

S. NO	Type of fiber	Density value g/cc
1	Raw fiber	1.31
2	5% Alkali treated fiber	1.28
3	10% Alkali treated fiber	1.26

### B. Chemical Properties of Terminalia Catappa Fruit Fiber

The Terminalia Catappa fibers were alkali treated with 5%, 10% NaOH solution and the outcomes are presented in Table II. The change in fiber properties was pragmatic due to alkali treatment. The raw Terminalia Catappa fruit fiber consists of cellulose (66.95%), wax (0.44%) and moisture (13.5%). The alkali treatment caused the cellulosic fiber to swell and removed the cellulose and other impurities from the fiber surface. The micro fibrils of cellulose remained unaffected due to alkali treatment. The removal of the impurities led to the better mechanical properties, fiber wetting characteristics and fiber– matrix adhesiveness in composite applications.

Table II Chemical properties of raw and alkali treated terminalia catappa fruit FIBER

Fiber category	Wax content (wt%)	MOISTURE CONTENT (WT.%)	Cellulose content (wt.%)
Raw fiber	0.44	13.5	66.95
5% Alkali Treated fiber	0.24	14.8	65.49
10% Alkali Treated fiber	0.16	14.85	60.11

## V. Conclusion

The alkali treatment of the Terminalia Catappa fibers removed the wax content and other impurities from the fiber surface and made the fiber surface soft. This led to the better fiber matrix interface, fiber wetting characteristics and bonding. The density values of the Terminalia Catappa fruit fiber appear less than the synthetic fibers and it is observed that application of these fibers could be used to make less weight composite structures

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## A Comparative study on Antimicrobial Finish using Pisidium Guajava leaf Extraction on Cotton, Organic Cotton and Bamboo Fabrics

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**Abstract-** *Textiles are indispensable part of human life. Now a days; textile finishes not only enhance the feel and drape of fabrics but can also provide extraordinary hygienic properties like making it antimicrobial in nature. Nature has been a source of medicinal agents for thousands of years and an impressive number of modern drugs have been isolated from natural sources. Pisidium guajava (Guava) leaf family name is Myrtaceae. Leaf and bark extracts have in vitro antimicrobial activity mostly associated with flavonoids such as Morin glycosides, quercetin and quercetin glycosides. Antimicrobial activity of Pisidium guajava, studied from dried leaves. The chemical nature of the extract was determined and extractions of active substance from the leaves were done by using ethanol. The method of application of this herbal extract on cotton, organic cotton and bamboo fabrics using citric acid as cross-linking agent was processed in 80oC for 15 minutes with pH level 4.5. The antimicrobial activity of the finished cotton, organic cotton and bamboo fabrics based on optimized process parameters was assessed against bacteria that normally exist in the textile materials like Gram positive, Staphylococcus aureus and Gram negative, Escherichia coli by paper disc method and also fabrics evaluated objectively.*

**Keywords:** *Pisidium guajava, herbal extract, antimicrobial activity, optimized process*

### I. INTRODUCTION

Textiles are indispensable part of human life. They are mainly to cover the human body for protection against all the adversities<sup>[1]</sup>. Natural textile fibres are more susceptible to attack than synthetic fibres. At the same time human skin supports growth of bacteria, because of its metabolic side products such as acidic, basic perspirations and urine, although it is possible the most important barrier to prevent microorganisms entering the body<sup>[2]</sup>.

Textile finishing is a diversified sector due to the processed raw materials, manufacturing technique and finalized products. Trends in fashion cause continuous changes in colouring and functional finishes<sup>[3]</sup>. Natural finishes comprises of those substances that are obtained from plants and animals. Natural finishes have many advantages such as non-toxic, non-irritant, biodegradable, cost effective, easy availability<sup>[4]</sup>.

Moreover, in the present day world most of us are very conscious about our hygiene and cleanliness. Clothing and textile are a very suitable media for the growth of the micro-organisms. They can act as the carriers of some micro-organisms such as pathogenic bacteria, odour generating bacteria and mould fungi. Microbial poses danger to both living and non-living matters.

To overcome the above mentioned fact, here the study handles vital finishes with Pisidium guajava (Guava) leaf to improve antimicrobial activity, which helps in reducing the growth of microbes. Guava leaf finish is given to make the wearer feel cool and the

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finish plays significant role in anti-microbial activity. The following are the objectives of this study.

- ❖ To find out the availability of natural Herbal sources
- ❖ To optimize the parameters for finishing
- ❖ To treat cotton, organic cotton and bamboo fabric using *Pisidium guajava* (Guava) leaf extracts.
- ❖ To study the effect of natural anti-microbial finishes.
- ❖ To evaluate the finished samples

## II. Methodology

### A. Selection of Fabric Formation

The fabric forming process helps to determine the appearance and texture, the performance during use and care. The process often determines the name of the fabric. Hence, planned to select plain weave for fabrication. In view of all the facts, the selected 40's count 100% Cotton, Organic cotton and bamboo yarns were woven for the present study.

### B. Selection of Weaving Structure

Plain weave is the simplest form of weaving. It consists of interlacement of warp and weft up and down the entire width of the fabric. Plain weave fabrics are usually reversible and are stronger than the other basic weaves because each thread in each series of yarn supports the consecutive thread of other series.

### C. Pretreatment of Fabric

Pre-treatment improves wet ability of fabrics thereby facilitates uniform finishing. The aim of preparatory process is the first step towards quality, which removes the starch, natural impurities and natural yellowish grey coloring matter present in fabric and modifies the fabric for follow up process.

### D. Selection of Finishing

Natural finishing has become a part of human life since the time immemorial. India has a rich cultural heritage and the tradition of using finishes obtained from natural sources. There is an increasing realization in the textile industry as well as among the textile consumers to develop and demand eco-friendly methods of finishing textiles.

### E. Selection of Natural Source

The present investigation aims at developing an ecofriendly natural antimicrobial finish from an herbal plant of India. The guava plant is found to be present in the tropical region and it occurs along the road sides. The leaves were collected in and around the Erode. The collected leaves were shadow dried for one week, and then it was powdered. It was stored in the container box.

Plant name : *Guava*(English)  
 Family : Myrtaceae  
 Scientific name : *Pisidium guajava*

### F. Pilot Study

Pilot study is preliminary study conducted in a limited scale before the large scale are carried out in order to gain some primary information, on the basis of which the main study would be planned and formulated<sup>[5]</sup>. A pilot study was carried out in direct water soluble method and methanol extraction method in order to select material, optimize the selected herbs, binder, extraction time, temperature and application techniques.

### G. Extraction Method

Ethanol is one of the largest volume organic solvents, produced by the fermentation process all over the world. The demand for ethanol has increased in recent years as it is widely used in chemicals, potable industries, medicine and motor fuel<sup>[6]</sup>. The air dried *Pisidium guajava* leaves were made in to powder form, 100g of the powder was extracted with 500ml of ethanol (analytically grade). The mixture was allowed to stand for 24 hours. The mixtures was now filtered and evaporated carefully and the regulated water bath was maintained at the temperature of 80°C to yield to deep green semi-solid extract weighing 7.5gms. It was stored in a refrigerator at

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4°C. The extraction can be carried out from natural finishing agent by aqueous, alkaline and acidic or alcoholic method. Among these alkaline extractions shows good result.

## H. Optimization of Antimicrobial Finish

From Table -I it was clear that herbal extraction solution is mixed with water and one per cent citric acid was added. The temperature was maintained at 80°C for 15 minutes with pH level 4.5. Thus the parameters were selected for the study.

Table I Optimization of Parameters

S. NO.	CRITERIA	PILOT STUDY	SELECTED PARAMETERS
1.	Herbal solution	50, 75 and 100 per cent	100 per cent
2.	Citric acid	7:3,8:2,9:1	9:1
3.	Time	10, 15, 20 minutes	15 minutes
4.	Temperature	70 <sup>0</sup> c, 80 <sup>0</sup> c, 90 <sup>0</sup> c	80 <sup>0</sup> c
5.	pH	4-8	4.5

### I. Finishing

The durability of the finish can be enhanced when the herbal extracts of guava leaves are applied on cotton, organic cotton and bamboo fabrics. The fabrics were finished with the optimized solution for 15 minutes at 80°C by pad-dry-cure method. The treated samples were cured in room temperature and dried in shade <sup>[7]</sup>.

### J. Evaluation

Objective evaluation includes laboratory tests like mechanical property test, physical property, comfort property, absorbency and antimicrobial tests.

### K. Nomenclature

The nomenclature used for various samples are given in table II.

Table II Nomenclature

S.NO	SAMPLE	NOMENCLATURE
1.	GC	Grey Cotton
2.	FC	Finished cotton
3.	GOC	Grey Organic cotton
4.	FOC	Finished Organic cotton
5.	GB	Grey Bamboo
6.	FB	Finished Bamboo

## III. Results and Discussion

### A. Objective Evaluation Test for Physical Property: Fabric weight

The Table III reveals that the fabric weight of finished Organic cotton sample has maximum weight increased up to 13 per cent when compared with other samples. It was clearly shown that the difference between the grey and finished samples was significant at one per cent level. Thus, it was concluded that the fabric weight increased after finishing because of the fixation of the finishing agent on the fabric.

Table III Analysis of variance of fabric weight

S.No.	Samples	Mean value in (mg)	Gain or loss over original weight	Percentage of gain or loss over original weight	'f' ratio
1.	GC	122.6	2.6	2.12	784.5862 **
	FC	125.2			
2.	GOC	80.4	11	13.68	
	FOC	91.4			
3.	GB	115.2	0.4	0.3472	
	FB	115.6			

\*\*Significant at one per cent level

### B. Test for Mechanical Property Tensile Strength

From the Table IV it was that the tensile strength of the finished cotton sample was increased by 7.253 per cent along warp direction when compared with other samples. It was clear that the difference between the grey and finished samples was significant at one per cent level. Thus, it was concluded that the fabric strength increased after finishing. The tensile strength in the finished cotton sample was increased by 4.938 per cent in weft direction, when compared with other samples. From the table, it was clear that the difference between the grey and finished samples has one per cent significant level. Thus, it was concluded that the fabric strength is increased after finishing in weft side of the fabric. It shows deposit of the finishing agent.

Table IV Analysis of variance of fabric tensile strength

S.No.	Samples	Mean value in kg		Gain or loss over original		Percentage of gain or loss over original		'f' ratio	
		Warp	Weft	Warp	Weft	Warp	Weft	Warp	Weft
1	GC	38.6	48.6	2.8	2.4	7.258	4.938	29.7391**	35.6296**
	FC	41.4	51.0						
2	GOC	34.2	45.2	1.2	1	3.508	2.212		
	FOC	35.4	46.2						
3	GB	37.6	48	1.4	2	3.723	4.166		
	FB	39.0	50						

\*\*Significant at one per cent level

### C. Comfort Property FABRIC Drapability

The Table V reveals that the drapability of finished samples is 37.83 per cent gain in finished Bamboo sample, when compared with other samples. In table the original and finished sample was compared statistically. The statistical analysis showed significant at one per cent level. Thus, it can be concluded that drapability of these three materials increased after finishing, because of the evenness of finishing agent in to the fabric.



Table-V Analysis of variance of drapability

S.No.	Samples	Mean value	Gain or loss over original	Percentage of gain or loss over original	'f' ratio
1	GC	0.49	0.09	18.36	83.3801 **
	FC	0.58			
2	GOC	0.51	0.17	33.33	
	FOC	0.68			
3	GB	0.37	0.14	37.83	
	FB	0.51			

\*\*Significant at one per cent level

#### D. TEST FOR ABSORBENCY CAPILLARY TEST

The difference between the original and finished sample for capillary rise test was given in Table VI.

Table VI reveals that the capillary test of the finished cotton sample shows 42.48 when compared with other sample. Especially the finished Organic cotton was more absorbed in the length of fabric when compared with Grey Organic cotton. From the table it is clear that the difference between the original and finished sample shows significant at one per cent level. Thus it can be concluded that the capillary test of these three materials increased after finishing, because of the application of finishing.

Table-VI Analysis of variance of capillary test

S.No.	Samples	Mean value	Gain or loss over original	Percentage of gain or loss over original	'f' ratio
1.	GC	3.06	1.3	42.48	74.5175 **
	FC	4.36			
2.	GOC	4.10	1.22	29.75	
	FOC	5.32			
3.	GB	2.80	0.84	30	
	FB	3.64			

\*\*Significant at one per cent level

#### E. Antimicrobial Test

From the Table VII, it is clear that the finished Modal fabric has maximum effect when compared with other samples. Regarding these effects is minimum effect in the finished cotton fabric.

Table – VII Antimicrobial activity of cotton, organic cotton and bamboo fabrics

S.No.	Organism samples	Number of colonies x 10 <sup>5</sup> / ml		
		Finished cotton 100%	Finished Organic cotton 100%	Finished bamboo 100%
1.	E.coli	112	41	68
2.	Staphylococcus aureus	98	25	52

Inoculums size: 1 x 10<sup>6</sup> colonies / ml

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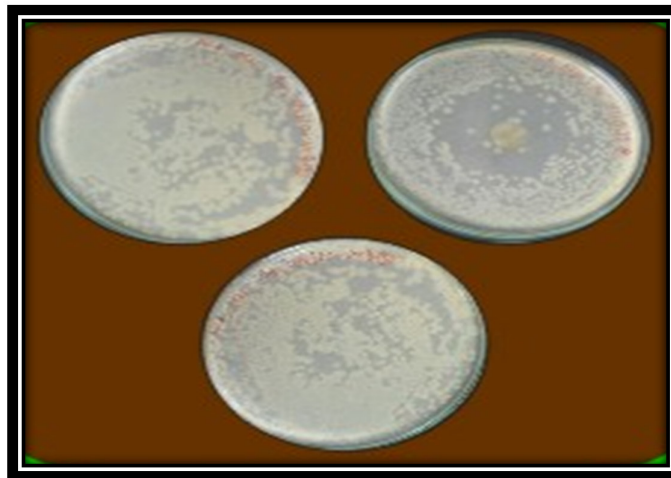


Fig 1-Antimicrobial activity of guava leaf extraction.

#### IV. Conclusion

Pisidium Guajava is a natural plant source. It is non toxic, non allergic, biodegradable, cost effective and easily available material. It will not cause any harm to humans even from infants to pregnant women. It smells pleasant and is non irritant to human beings. Guava leaf extract has been found to possess antimicrobial character due to the presence of chemical components. The active substance was extracted from the plant leaves using ethanol. The method of application of this active substance on cotton, organic cotton and bamboo fabrics using citric acid as cross linking agent by padding mangle method. The anti microbial assessment was carried out by using standard paper disc method. From the research it is be found that there is a good anti microbial property in organic cotton fabric after it has been finished, when compared to cotton and bamboo. guava leaves shows better anti microbial activity on both s.aureus and E.coli. Hence, the scope of implementation and commercialization of the herbal extract as an antimicrobial finish in textile is a novel idea. The finished samples increased in fabric weight, fabric strength, drapability and capillary test. Samples decrease in fabric elongation and abrasion resistance.

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## Diabetic Foot Wound Care Treatment Using Cleome Viscosa Herb

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**Abstract**—Herbal remedy is the traditional form of health care system recognized by mankind. Herbs had been used by all cultures throughout history. Herbs are the potential source of chemical constituents which have high therapeutic value. The present investigation was undertaken to evaluate the wound healing property of the leaves of *Cleome viscosa*. The extracts of *Cleome Viscosa* leaves have been obtained and finished on to the cotton knitted fabrics. The finished fabrics are assessed for the antibacterial activity against the selected wound pathogens which are commonly present in the human foot wounds. Phytochemical analysis showed presence of flavonoids, tannins, saponins and alkaloids. The herbal extract treated fabrics show good antibacterial activity against the pathogens.

**Keywords:** Medicinal plants, antimicrobial activity, Diabetic Wound Pathogens

### I. INTRODUCTION

Diabetic foot infection is a common cause for diabetic patients in India. Herbs have been integral to both traditional and non-traditional forms of medicine dating back at least 5000 years. Preparations from traditional medicinal plants are often used for wound healing purposes covering a broad area of different skin related diseases. Large number of medicinal and aromatic plants found growing widely and several of these plants have been in use for centuries of their medicinal properties (1). Plants act generally to stimulate and supplement the body's forces; they are the natural food for human beings (2, 3). *Cleome viscosa* Linn. is also known as Tickweed, or Spider plant. It occurs in woodland and grassland, and is a weed of fallow land, fields, roadsides and wasteland, often occurring on sandy soils, but sometimes on calcareous and rocky soils.

Vernacular name in India-

Common name- Asian spider flower, Cleome, Jakhiya, Tickweed

Hindi- Bagra

Urdu- Hulhul

Malayalam- Naivela

Tamil- Naikkaduku

Kannada- Nayibela

Gujarati- Pilitalvani

Telugu- Kukkvaminta

Botanical Name- *Cleome viscosa* (4)

Whole plant and its parts (leaves, seeds, and roots) are widely used in traditional and folkloric systems of medicine. In Asia and Africa

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the leaves and seeds used to treat infections, fever, rheumatism and headache. The whole herb is used in treatment of inflammation of the middle ear and applied on wounds and ulcers. A decoction is used as an expectorant and digestive stimulant and the vapour from a steaming decoction of the whole plant is inhaled to treat headache (5). The roots are a remedy for scurvy and rheumatism (6). The seeds and its oil have anti helminthic properties but they are ineffective in treating roundworm infections (7). Plant is also used for treatment of skin diseases, gulma (any tumor, lump or diverticulosis), asthila (prostate enlargement), krmiroga (worm infection), kandu (pruritus), and karnaroga (ear diseases) in Ayurvedic medicinal system(8). The analgesic, anti microbial, anti diarrhoeal, anti pyretic, hepato protective, anti hyper lipidemic and anti ulcer activities of the aerial parts has been reported (9). The popular use of the whole plant and leaves refers mainly to its antiseptic, anti inflammatory activity and wound healing.(10). Wound healing property of *Cleome viscosa*- The leaves and whole plant of *Cleome viscosa* are used as a folk remedy to cure the wounds, ulcers, inflammations and skin infections.(11). Hence, in this study Direct, Microencapsulation technique has been used to fix the herbal extracts on the fabrics. The extracts were applied to the cotton knitted fabric by direct application method and microencapsulation method. An extensive study was conducted to assess the efficacy against the selected human foot wounds pathogens.

## II. Materials and Methods

### A. Collection of Plant Material

The *Cleome viscosa* plant material collected from local areas of Coimbatore, Tamilnadu. Small young leaves were collected from healthy plants of *Cleome viscosa*. They were washed under continuous flashing of running tap water for 30 minutes and then with distilled water three times, shaded, dried and then powdered with the help of blender. The powdered material was kept in airtight bottles until further use.

### B. Preparation of Plant Extracts

10 grams of the herbal powder was mixed thoroughly with 100 ml of methanol and it was kept in airtight conical flask. The conical flask was incubated for 24 hours in the room temperature. The supernatant was filtered using a Whatmann no.1 filter paper and the filtrate was dried and the methanol was evaporated at room temperature. When exposed to the air.

### C. Phytochemical Screening

The phytochemical compounds are responsible for therapeutic effect are usually the secondary metabolites. The extracts of plant *cleome viscosa* were subjected to preliminary phytochemical screening by using standard procedures (Harborne, 1993; Trease and Evans, 2002) for the detection of tannins, alkaloids, flavonoids, saponins, Phenol, Fixed oil and fats

### D. GC-MS Analysis

GC-MS analysis was carried out using GC Clarus 600 Perkin Elmer system interfaced to a mass spectrometer (GC-MS) instrument employing the following conditions: column Elite-35ms fused silica capillary column (30 X 0.25 mm ID X 0.25 mm film thickness, composed of 5% Phenyl, 95% Dimethyl Polysiloxane), operating in electron impact mode at 70 eV, The carrier gas was Helium (99.99%) used at a constant flow rate of 1.51 ml/min. injector and mass transfer line temperature were set at 200°C and 240°C respectively. The oven temperature was set from 70 to 220°C at 10°C/min, held isothermal for three minutes and finally raised to 300°C at 10°C/min. Two microlitres of the sample was injected in a split mode with a scan range of 40 – 1000 m/z. The total running time of GC-MS was 30 min. The relative percentage of the extract was expressed as percentage with peak area normalization. (12&13).

### E. Selection of Fabric

Cotton fabric was selected for the application anti microbial extract of *cleome viscosa*.

### F. Selection of Human Foot Wound Pathogens

The test organisms like *Staphylococcus sp. Methicilin-resistant Staphylococcus aureus, Entrobactor colace, Pseudomonas sp. Klebsiella Pneumonia* which are present in the human foot wounds were procured from a diagnostic centre at Coimbatore, Tamilnadu, India.

### G. Finishing of Fabrics

Following two methods were used for the finishing of fabrics.

#### (i) Direct Application Method

The prepared methanol extract was directly applied on the cotton fabric using pad-dry- cure method.



Table-2 Antimicrobial activity of cleome viscose

Name of the micro organism	Mode of Extract	Diameter of the Zone of incubation	
		Direct application	Microencapsulation
<i>Staphylococcus aureus</i> ,	Methanol	12mm	18mm
<i>Methicilin-resistant Staphylococcus aureus</i> ,	Methanol	13mm	14mm
<i>Entrobactor colace</i> ,	Methanol	14mm	17mm
<i>Pseudomonas sp.</i>	Methanol	10mm	12mm
<i>Klebsiella Pneumonia</i>	Methanol	8mm	12mm

#### IV. Conclusion

Thus the wound healing activity of the plant can be recognized to the presence of their phytochemical which may be dynamic individually or it may be the combined activity of the constituents. Study showed that *C. viscosa* possesses the better results showed that the plant possess significant wound healing activity against the wound infecting pathogens. The great number of plants used in Indian medicine especially in wound healing which could be of considerable interest in the application of Medical Textile.

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# An Efficient Implementation and Analysis of Low Power High Performance Multipliers

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**Abstract-** Multipliers are optimized for low power which is of great interest in scientific and engineering field. There is large consumption of energy during the multiplication and addition process so an efficient implementation and analysis of different multipliers and adders are to be made to increase the performance. The multipliers used in multiplication process should involve low area, power and delay. Hence there is a need for optimization, as the performance of multiplier depends on the Multiplication process. The proposed work comprises the designing of 8-bit array multiplier and Baugh Wooley multiplier and analyzing the various parameters involved for optimizing the performance. The work has been done in a schematic editor using Tanner tool v7.00 in 20um CMOS technology. T-spice is used as simulator and W-editor is used for formal verification of the multiplier

**Keywords:** Array multiplier, Baugh Wooley multiplier, Area, Power, Delay.

## I INTRODUCTION

Multipliers play an important role in today's digital world. Multiplication is a heavily used arithmetic operation that figures prominently in scientific applications. The motive of our project is to study and develop an Efficient Fast and Low Power Multiplier. As the name suggests we had to go for faster and low power factor optimization simultaneously. We know that the basic building block of a multiplier is ADDER circuit. The basic components used in multipliers is AND gates and few full adders. Multiplication process involves three steps:

1. Partial product generation.
2. Partial product reduction.
3. Final addition.

For the multiplication of an  $n$ -bit multiplicand with an  $m$  bit multiplier,  $m$  partial products are generated and product formed is  $n + m$  bits long. Depending upon the size of the inputs multiplication operation includes the operations of shift and addition. Because of the more steps for the calculation, multiplier occupies the large area with high power consumption and low speed due to the delay. Designing of multipliers, verifying waveforms, then finally calculating area and Power consumed in the circuit. After knowing all this we also calculated delay for different multipliers which helped us to determine the best multiplier.

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## II Multipliers

### A. Array Multipliers

Array multiplier is well known due to its regular structure. Multiplier circuit is based on add and shift algorithm. Each partial product is generated by the multiplication of the multiplicand with one multiplier bit. The partial product is shifted according to their bit orders and then added. The addition can be performed with normal carry propagate adder.  $N-1$  adders are required where  $N$  is the multiplier length.

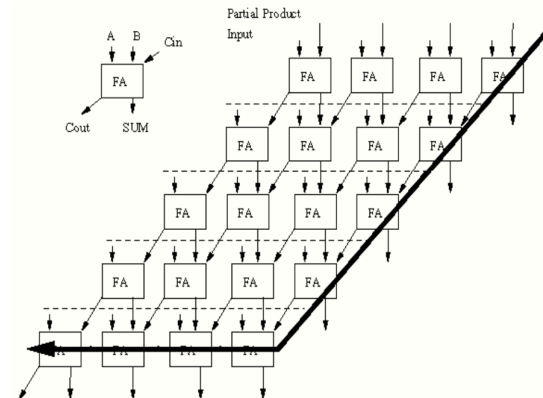


Figure 1. Array Multiplier

In Array multiplier, almost identical cells array is used for generation of the bit-products and accumulation. All bit-products are generated in parallel and collected through an array of full adders or any other type of adders and final adder. Therefore, among other multiplier structures, array multiplier takes up the least amount of area.

### B. Baugh-Wooley

Baugh-Wooley algorithm for the unsigned binary multiplication is based on the concept shown in figure. The algorithm specifies that all possible AND terms are created first, and then sent through an array of half-adders and full adders with the Carry-outs chained to the next most significant bit at each level of addition. Negative operands may be multiplied using a Baugh-Wooley multiplier. A single full adder circuit naturally lays out in a very wide (or tall) chip, which creates problems when working toward smallest form factor and efficiency of cost.

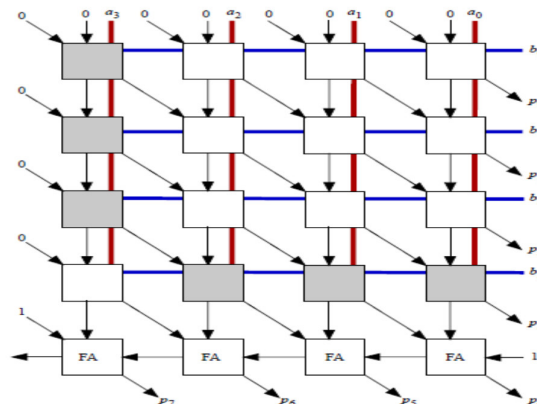


Figure 2. Baugh Wooley Multiplier

## III Result

The circuits are designed and simulated using TANNER software. The implementation of the multipliers in Tanner is used to easily understand the different designing parameters effectively. The multiplier with low power eliminates the switching activities and thus



reduces the power dissipation. The 8-bit Array and Baugh wooley multiplier have been implemented. The schematic and the simulation result for the 8-bit array multiplier is shown in the Figure 3 and Figure 4.

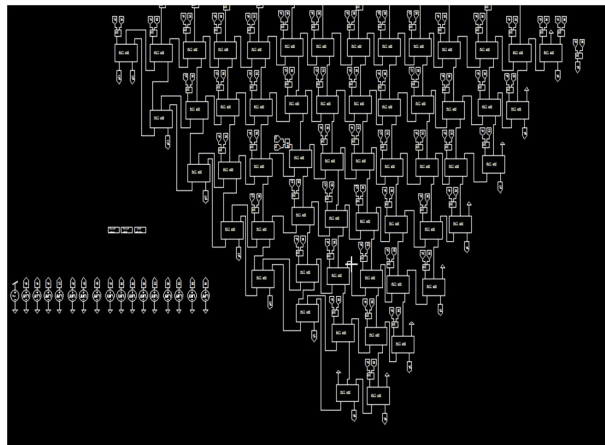


Figure 3 Schematic diagram of 8-bit Array Multiplier

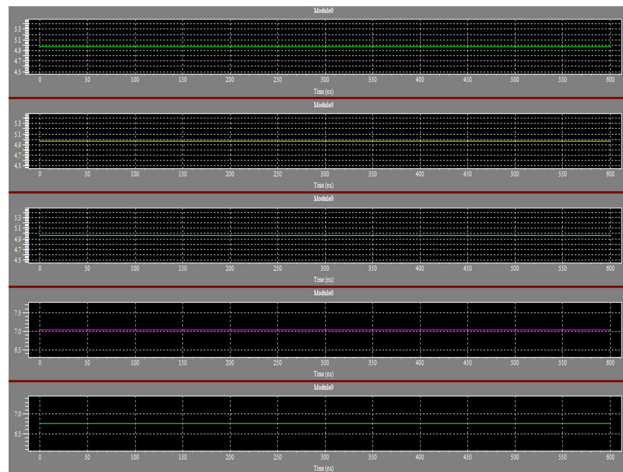


Figure 4 Simulation result of 8-bit Array Multiplier.

The schematic and the simulation result for the 8-bit Baugh Wooley multiplier is as shown.

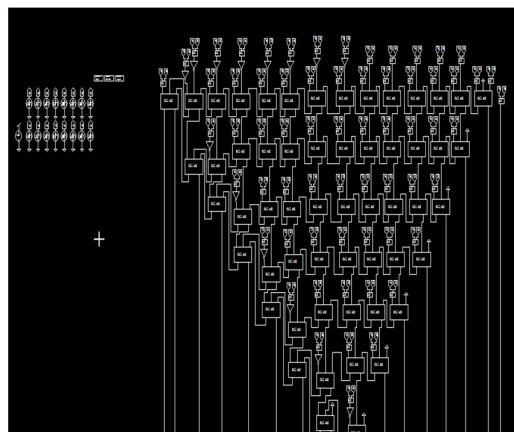


Figure 5 Schematic diagram of 8-bit Baugh Wooley Multiplier

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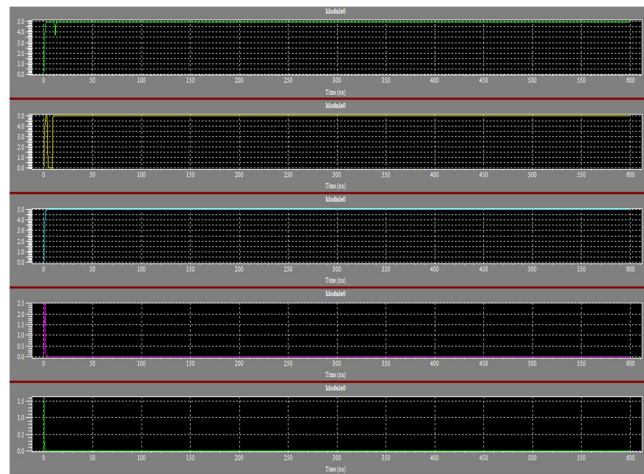


Figure 6 Simulation result of 8-bit Baugh Wooley Multiplier

Table I shows the comparison of Array multiplier and Baugh Wooley multiplier. The comparison is done on the basis of Power, Area and Delay. Array multipliers possess the best features compared to Baugh Wooley multiplier. Array multiplier has the low delay of 16.91ns. So the array multiplier has the highest speed when compared to the Baugh Wooley multipliers. Enhancement of speed always results in large area. Hence we should use Array multiplier when it comes to optimization with both Area and Time. It can be concluded that Array Multiplier is superior in all respect like speed, delay, area, Regular structure, power consumption.

Table I Comparison of Multiplier

	Power	Area	Delay	PDP
Array Multiplier	3.463151e-002	3904 um	16.91 nsec	58.561 wsec
Baugh Wooley Multiplier	3.610487e-002	3960 um	24.82 nsec	89.61 wsec

#### IV Conclusion

After going through all the hard work and facing problems, this project managed to complete its objectives that are to implement different Multipliers and learn the Power and Time trade off among them so that we can design Efficient Faster Low Power Multiplier as Low power consumption is the most important criteria for the high performance. It can be concluded that Array Multiplier is superior in all respect like speed, delay, area, Regular structure, power consumption compared to Baugh Wooley multiplier.

#### V Future Scope

As an attempt to develop multiplier algorithm and architecture level optimization techniques for low-power multiplier design, the research presented in this dissertation has achieved good results and demonstrated the efficiency of high level optimization techniques. However, there are limitations in our work and several future research directions are possible with many other multipliers.

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# Mobile Rescue Robot for Alive Human Detection in Disaster Zones

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**Abstract-** The objective of this project is to find the alive humans in destroyed building with the help of rescue robot in disaster prone and bomb blast areas. The alive human detection sensor is the special type of sensor which has two elements, the live body sensor and Amplifier Circuit. The passive infrared radiation emitting from the alive human bodies are sensed by the sensor and if there is a variation due to movement of alive human body, the difference output is generated. It will be amplified by differential amplifier and then the signal is fed to another amplifier unit in order to amplify the voltage level. Then the amplified signal is given to flash type reprogrammable microcontroller which controls the motor connected to the robot model. The robot moves according to the instructions provided by the operator. If the sensor detects the presence of alive human body, it forces the robot to stop there and microcontroller will activate the alarm. The driver circuit is constructed with transistor, which acts as a switch to turn ON and turn OFF alarm. Now the alarm makes the sound for the alive body indication.

## I. INTRODUCTION

Disaster is a serious disruption of the functioning of a community or a society involving widespread human, material, economic or environmental losses and impacts, which exceeds the ability of the affected community or society to cope using its own resources. Nowadays most of the people live in urban areas. Hazards that strike in areas with low vulnerability will never become disasters, as it is the case in uninhabited regions.

Every year, various collapse of man-made structures such as bridges, buildings and also natural catastrophes like earthquake, landslides occur in various parts of the world. The Urban Search and Rescue (USAR) say the probability of saving a victim is high only within the first 40hrs of rescue operation, and then the probability becomes zero.

In such cases, humans are being trapped in the cavities created by collapsed building either in conscious or unconscious state. One of the major natural disaster that took place in Jan 2001, at Gujarat resulted in a huge loss of human lives and property. A recent collapse of man-made multi-storied building at Moulivakkam in July 2014 claimed nearly 60 lives as per 'Hindustan times.

## II. Literature Survey

In initial days dogs were used because of their high sensitivity to any slight motion or human presence. But it was hard to totally depend on them since they can predict the presence of a living victim and dead victim and also they were not able to expose the exact situation of the human. One major drawback was dogs couldn't work independently; they need assistance of a human. It means, the need is totally or partially independent to human factor but still depends on human.

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Later techniques such as

- a. Optical devices namely Tactic Pole Utility System
- b. Acoustic devices like Microphones and Amplifiers were used but with limited applications.

Robots are now achieving good progress in many fields like Military, Industry, Medicine, etc., with proven efficiency. They are playing an important role in replacing human factor in almost all fields.

Mauricio Correa, Gabriel Hermosilla, Rodrigo Verschae, Javier Ruiz-del-Solar. (2012), "Human Detection and Identification by Robots using Thermal and Visual information in Domestic Environments", *J I tell Robot System* (2012) 66:223-243 has given the concept of enabling robots to detect and identify humans in domestic environment. This work was done with the aid of Thermal and Visual Information sources that were integrated to detect humans and further processed to verify it.

Remote Operated and Controlled Hexapod (ROACH) is a six-legged design that provides significant advantages in mobility over wheeled and tracked designs. It was equipped with predefined walking gaits, cameras, which transmit, live audio and videos of the disaster site, as well as information about locations of objects with respect to the robot's position to the interface on the laptop. Specialized robots have been designed for these types of environments such as KOHGA the snake like robot. This robot was constructed by connecting multiple crawler vehicles serially, resulting in a long and thin structure so that it can enter narrow space.

Quality work has been done in the field of robotics. They came into existence in the early 21<sup>st</sup> century but since then enormous improvements have been made in its concept, design based on purpose of use. Various rescue robots have been developed and some of these are – CRASAR (centre for robot assisted search and rescue) in university of South Florida. This robot was used for first time in real conditions on 11<sup>th</sup> September 2001 in the world trade centre disaster. Different sensors like millimetre wave radar for measuring distance. A colour CCD camera for vision and a forward-looking infrared camera for the human heat detection were used.

Shwetha. R, Dr. Chethan H K, (2014), "Automatic and Manual Controlled Alive Human Detection Robot during disaster Management", *International Journal for Technological Research in Engineering*", ISSN: 2347-4718, Volume 1, Issue 11 has done a work on designing an economical robot, which works using AVR, MCU, PIR sensor. This robot senses the human body and these messages are sent through SMS using GSM technology to enable rescue operation.

Burion presented a project that provided a sensor suitable for human detection for the USAR robots. It evaluated several types of sensors for detecting humans such as pyroelectric sensor, USB camera, microphone, and IR camera. The pyroelectric sensor was used to detect the human body radiation. The USB camera was used for motion detection. A microphone was used for long duration and high amplitude sound detection. The IR camera was used to detect humans by their heat image. The main idea was to detect a change in the image scene by checking the values of the pixels. Several images for the scene were acquired and subtracted from each other to discover if a motion has occurred. The used technique was fairly efficient in detecting the victims.

### III. Proposed System

This system proposes a mobile robot which helps in rescuing the victims of natural disaster. It helps the rescue team by identifying the alive human in disaster prone. It consumes lower power when compared to the existing system. Designing cost is also relatively low. It is easy to operate. PIR sensor is the only sensor used in this system. The proposed system does not emit any harmful radiation.

This project is very useful in the disaster and bomb blast areas for the rescue of human beings. It can also be used in military for the purpose of detecting invaders.

### IV. Block Diagram

As shown in Fig. 1, this system consists of two sections a robot and its control section.

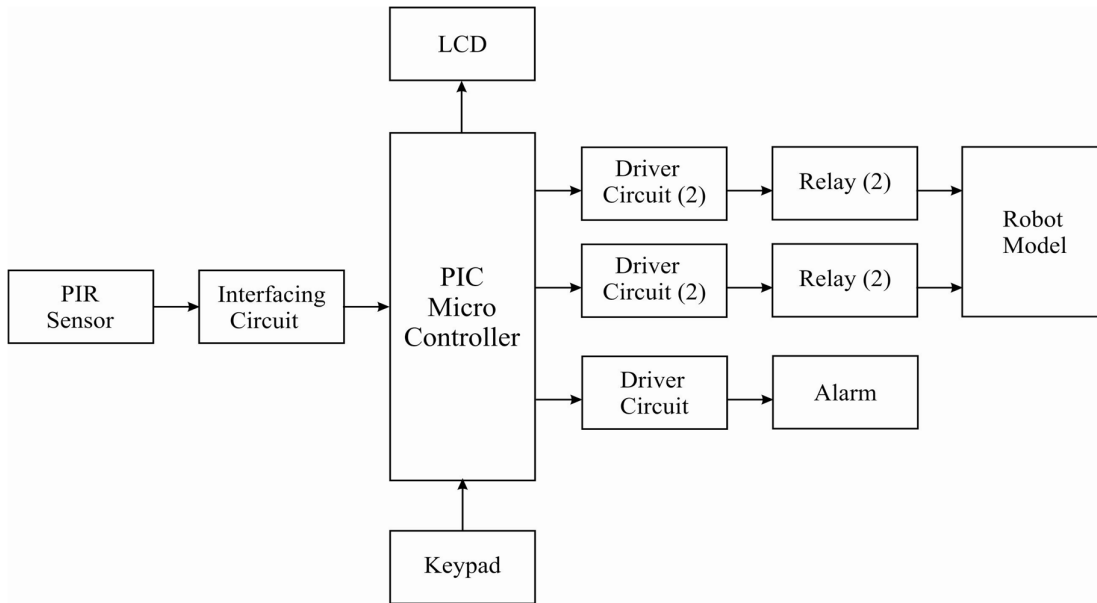


Fig.1 Alive Human Detection System

The Alive Human bodies in the destroyed building are sensed by the sensor. If the sensor detects the human body, the microcontroller forces the robot to stop. The driver circuit acts as a switch to alarm.

## V. Hardware Components

### a. Embedded Microcontroller PIC 16F877

The microcontroller that has been used for this project is from PIC series. PIC microcontroller is the first RISC based microcontroller fabricated in CMOS (complementary metal oxide semiconductor) that uses separate bus for instruction and data allowing simultaneous access of program and data memory. The main advantage of CMOS and RISC combination is low power consumption resulting in a very small chip size with a small pin count. The main advantage of CMOS is that it has immunity to noise than other fabrication techniques.

PIC (16F877): Various microcontrollers offer different kinds of memories. EEPROM, EPROM, FLASH etc. are some of the memories of which FLASH is the most recently developed. Technology that is used in pic16F877 is flash technology, so that data is retained even when the power is switched off. Easy Programming and Erasing are the other features of PIC 16F877.

Special about PIC is that, has high performance RISC CPU, fully static design, wide operating voltage range, two capture, compare and PWM modules, Synchronous Serial Port(SSP) with SPI.

Up to 8K x 14 words of Flash Program Memory, Up to 368 x 8 bytes of Data Memory (RAM), Up to 256 x 8 bytes of EEPROM data memory.

### b. PIR Sensor

The PIR sensor has two slots in it; slot is made of a special material that is sensitive to IR. The lens used here is not really doing much and so we see that the two slots can 'see' out past some distance (basically the sensitivity of the sensor) half of the PIR sensor which causes a positive differential change between the two halves. When the warm body leaves the sensing area, the reverse happens, when the sensor is idle, both slots detect the same amount of IR, the ambient amount radiated from the room or walls or outdoors. When a warm body like human passes, it first intercepts one whereby the sensor generates a negative differential change. These change pulses are what is detected. Fig.2 shows the schematic representation of PIR Sensor.

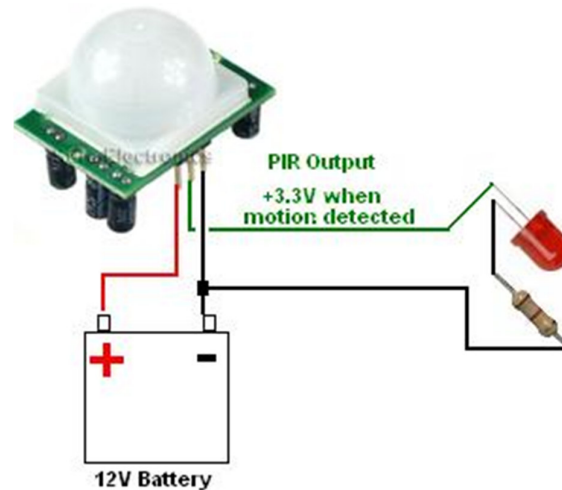


Fig.2 PIR Sensor

### c. Amplifier

An amplifier is an electronic device that can increase the power of a signal. It does this by taking energy from a power supply and controlling the output to match the input signal shape but with larger amplitude. In this sense, an amplifier modulates the output of the power supply to make the output signal stronger than the input signal.

### d. Relay

Relays are electromechanical devices that use an electromagnet to operate a pair of movable contacts from an open position to a closed position. The advantage of relay is that it takes a relatively small amount of power to operate the relay coil, but the relay itself can be used to control motors.

### e. Motor & Motor Drive

Motor causes the movement of robot which can move over disaster zones. Motor Drive is the interfacing circuit between microcontroller and robot.

### f. Alarm & Keypad

Alarm indicates the presence of alive human body. Matrix Keypads are very common input devices in embedded systems. They have simple architecture and are easy to interface.

## VI. Software Tools

MPLAB IDE

It is used for programming the PIC 16F877 microcontroller. MPLAB IDE (Integrated Development Environment) is a free, integrated tool set for the development of embedded applications employing microchip's PIC and ds PIC microcontrollers. MPLAB IDE runs as a 32-bit application on MS Windows, is easy to use and includes a host of free software components for fast application development and super-charged debugging. MPLAB IDE also serves as a single, unified graphical user interface for additional microchip and third party software and hardware development tools. Moving between tools is a snap, and upgrading from the free software simulator to hardware debug and programming tools is done in a flash because MPLAB IDE has the same user interface for all tools.

## VII. Conclusion and Future Work

The proposed system has two sections for this operation and these two sections are inter-related to each other. The first section is the control section, which makes the movement of robot into the debris. The second section is the sensor section, which searches for the alive human and send information to the rescue team. In future, automatic pick and drop of blocks and human with robot arm can be implemented which can further reduce the time consumption.

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## A Novel Approach To Dependent Demand Response Management In The Smart Grid

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**Abstract:** Now-a-days technology has developed to a large extend. At the same time the need for systems with automation and high security are preferred. To overcome new challenges, such as generation diversification, greenhouse gas emissions regulation, energy conservation, demand response and a new liberalized market system. It is clear that these cannot be resolved with the current infrastructure. Global energy generation and delivery systems are transitioning to a new computerized “smart grid”. One of the principle components of the smart grid is an advanced metering infrastructure (AMI). AMI replaces the analog meters with computerized systems that report usage over digital communication interfaces, e.g., phone lines. However, with this infrastructure comes new risk. Smart grid is the integration of advanced information, communication and networking technologies in traditional electric grid to make it smarter and faster in making decisions. The new proposed electric grid is helpful for providing uninterrupted power supply to the loads with automated demand management. The demand management was proposed with demand response management by shifting the loads to the weak bus once if the bus is loaded with its maximum capacity. To improve the performance of the power system, smart grid technology is implemented with automated metering interface that provides two way communications between the utility and supply.

**Keywords:** consumer welfare, demand response management (DRM), cost efficiency, renewable energy, smart grid, voltage frequency controller, Automated Metering Interface (AMI).

**THE GROWING DEMAND** of electricity, the aging infrastructure, and the increasing greenhouse gas emission are some of the challenges with the traditional power grid. Recent blackouts [1] have further corroborated these issues, grid into a more responsive, efficient, and reliable system. The smart grid [2], widely believed to be the future power grid, offers improved efficiency, reliability, and environmental friendliness in power generation, transmission, distribution, consumption, and management, by integration of advanced information and communication technologies. Demand response management (DRM) is the response system of end users to changes in electricity prices over time or to other forms of incentives. In the smart grid, DRM plays a key role in improving different aspects of both supply and demand sides. For instance, DRM can result in lower bills and higher utility efficiency for end users. DRM can also reduce the cost of power generation or improve the revenues to retailers or utility companies (UCs). In DSM, the pricing mechanisms and direct control strategies are employed by the energy suppliers to affect consumers’ consumption behaviors and reshape the total load [3]–[5]. The time-of-use pricing strategy sets different prices during the day to encourage consumers to shift their demand to off-peak hours [7]–[9]. Similar to the time-of-use pricing, the critical peak pricing applies a pre specified high price during the designated critical peak periods [10], [11]. Along with the DSM techniques, the integration of distributed energy resources (DERs) into the grid can also effectively increase the grid’s capacity and reduce the emission of CO<sub>2</sub> [12], [13]. Equipped with the distributed energy generation, the residential customers can also participate in the electricity market as an energy supplier. In this system we make use of two algorithms the demand response management algorithm along with v/f controls.

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### I. Related Work

Several studies on demand side management and DRM have focused on either only one utility or a number of utilities treated as one entity [5]–[10]. Mohsenian-Rad *et al.* [3] have formulated an energy consumption scheduling problem as a non-cooperative game among the consumers for increasing and strictly convex cost functions. Fan [7] has considered a distributed system where price is modeled by its dependence on the overall system load. Based on the price information, the users adapt their demands to maximize their own utility. In [9], a robust optimization problem has been formulated to maximize the utility of a user, taking into account price uncertainties at each hour. Wang and Groot [8] have exploited the awareness of the users and proposed a method to aggregate and manage end users’ preferences to maximize energy efficiency and user satisfaction. In [9], a dynamic pricing scheme has been proposed to provide incentives for customers to achieve an aggregate load profile suitable for UCs, and the demand response problem has been investigated for different levels of information sharing among the consumers. In [10], a multi resolution two-layer game is studied using mean-field game approach to incorporate inner interactions between users in the region and outer interactions between regions for dynamic distributed demand response in the smart grid. References [11] and [12] have also incorporated electric vehicles into the DRM framework. To this end, compared to relating existing literature we propose a system which can change the source when there is an increase in the threshold load, where here the measurement of load is obtained using the 1. DRM (demand response management system) and the shifting is done by using the 2.v/f controller.

### II. System Model

Fig. 1 depicts our hierarchical system model, which consists of three levels: 1) power generation units at the top level; 2) distribution algorithms and 3) residential and industrial consumers at lowest bottom with AMI (Automated Metering Interface). The framework is motivated by the hierarchy of the real power grid system. The power generation units or power plants supply power, the UCs determine the unit price and optimal amount of power to supply, and the bottom level represents the demand response to the price signal from the residential consumers. The power generation units, UCs and the consumers have bidirectional communications support to exchange price and demand information. The data communication is carried out through the communication channel using wireless technologies.

### III. Demand Side Analysis

Let  $y$  be the price per unit power. For given  $y$ , user  $n$  ( $n \in NR$ ) calculates its optimal demand response by solving the user optimization problem to maximize its welfare  $WR_n$  as follows:

$$\max_{x_{R,n}} \quad W_{R,n} := U_{R,n}(x_{R,n}) - yx_{R,n} \tag{1}$$

$$\text{s.t.} \quad x_{R,n} \geq x_{R,n,\min} \tag{2}$$

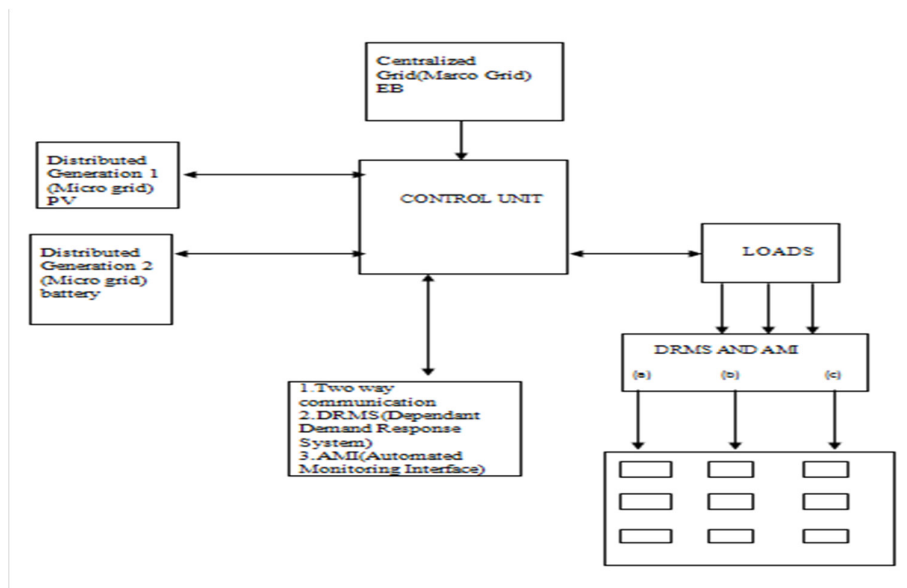


FIG.1 System model of smart grid system

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where  $x_{R,n,\min}$  is the minimum power requirement of consumer  $n$ . The above, that is, (1) and (2) characterizes a strictly convex optimization problem for given  $y$ . Hence, the stationary solution is unique and optimal. The first-order optimality condition for the optimizing residential user leads to  $(\partial WR_n / \partial x_{R,n,k}) = 0, \forall n \in NR$ , that is

$$U'_{R,n} = y, \Rightarrow x_{R,n} = (U'_{R,n})^{-1}(y). \tag{3}$$

The condition required for constraint (2) to be satisfied can be established by substituting (3) into (2), which requires  $y \leq [U_{R,n}]_{x_{R,n} = x_{R,n,\min}}, \forall n \in NR$ . This can be ensured if

$$y \leq y_{\max} := [U'_{R,n}]_{\min_{n \in \mathcal{NR}} x_{R,n} = x_{R,n,\min}}. \tag{4}$$

For the purpose of illustration and to provide function specific insights, we employ two widely adopted gain functions for residential consumers: 1) piecewise quadratic function [12]; and 2) logarithmic function [10]. We define the piecewise quadratic gain function of residential user  $n, (n \in NR)$ , as

$$U_{R,n}(x_{R,n}) = \begin{cases} v_{R,n}x_{R,n} - \frac{z_{R,n}x_{R,n}^2}{2}, & \text{if } x_{R,n} \leq \frac{v_{R,n}}{z_{R,n}} \\ \frac{z_{R,n}}{2v_{R,n}} & \text{if } x_{R,n} > \frac{v_{R,n}}{z_{R,n}} \end{cases} \tag{5}$$

where  $v_{R,n}$  and  $z_{R,n}$  are user-specific parameters  $\forall n \in NR$ . In this case, (3) and (4), respectively, take the form

$$x_{R,n} = \frac{(v_{R,n} - y)}{z_{R,n}} \tag{6}$$

And

$$y \leq y_{\max} := \min_{n \in \mathcal{NR}} (v_{R,n} - z_{R,n}x_{R,n,\min}). \tag{7}$$

The logarithmic gain function can be defined for residential user  $n, (n \in NR)$ , as

$$U_{R,n}(x_{R,n}) = \alpha_{R,n} \ln(\beta_{R,n} + x_{R,n}), \forall k \in \mathcal{K} \tag{8}$$

where  $\alpha_{R,n}$  and  $\beta_{R,n}$  are user-specific parameters. In this case, for given  $y$ , (3) and (4), respectively, take the form

$$x_{R,n} = \frac{\alpha_{R,n}}{y} - \beta_{R,n} \tag{9}$$

And

$$y \leq y_{\max} := \min_{n \in \mathcal{NR}} \frac{\alpha_{R,n}}{\beta_{R,n} + x_{R,n,\min}}. \tag{10}$$

#### IV. Supply Side Analysis

If the total power supplied by UC  $k$  is  $P_k$ , the profit of provider  $k$  is defined as

$$R_{UC,k} = yP_k - C(P_k). \tag{11}$$

Then, the optimization problem for each UC is as follows:

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$$\begin{aligned}
 & \max_{0 \leq y \leq y_{\max}, P_k \in \mathbb{R}_+} R_{UC,k} \\
 & \text{s.t. } P_I + \sum_{n \in \mathcal{N}_R} x_{R,n} \leq \sum_{k \in \mathcal{K}} P_k \\
 & P_k \leq P_{k,\max}; \forall k \in \mathcal{K}
 \end{aligned} \tag{12}$$

where  $P_{k,\max}$  is the maximum power UC  $k$  can supply. When  $P_{k,\max}$  is sufficiently large,  $P_I, P_k \ll P_{k,\max}$ . Then the second constraint can be relaxed. For a given  $y$ , (12) is a convex optimization problem. Given  $y$ , the first-order optimality condition for the UCs,  $(\partial R_{UC,k} / \partial P_k) = 0$ , gives the optimal amount of power to be supplied by UC  $k$  as

$$P_k = (C'_k)^{-1}(y); \forall k \in \mathcal{K}. \tag{13}$$

Normally, if the power supplies of different UCs are given, the unit prices would be calculated based on the given power supplies. However, we are considering here a planning level problem where both unit price and optimal power to be supplied, are the variables. Thus, the optimal power of each UC is calculated by backward induction, based on the optimal unit price, a parameter obtained as a result of the profit optimization of the UCs. With the optimal demand response of residential users (3) and UCs' power supply (13) in response to the price  $y$ , the objective of the UCs is to set the optimal price  $y$ . For supply demand equilibrium, it is required that

$$\sum_{k \in \mathcal{K}} P_k = P_I + \sum_{n \in \mathcal{N}_R} x_{R,n}. \tag{14}$$

Substituting (3) and (13) into (14) we obtain

$$\sum_{k \in \mathcal{K}} (C'_k)^{-1}(y) = P_I + \sum_{n \in \mathcal{N}_R} (U'_{R,n})^{-1}(y). \tag{15}$$

where  $G_1(y) = \sum_{k \in \mathcal{K}} (C'_k)^{-1}(y) - \sum_{n \in \mathcal{N}_R} (U'_{R,n})^{-1}(y)$ . We employ a quadratic cost function for power generation [12], [13]. Let  $a_k > 0$  and  $b_k, c_k \geq 0$  be the coefficients of the cost function  $C_k(P_k)$ . Then, if the total power supplied by UC  $k$  is  $P_k$ , then the cost incurred to the UC is

$$y = (G_1)^{-1}(P_I) \tag{16}$$

When the gain functions of the residential consumers are piecewise quadratic as given by (5), (16) takes the form

$$C_k(P_k) = a_k P_k^2 + b_k P_k + c_k. \tag{17}$$

*Proposition 1:* When the gain functions of the residential consumers are piecewise quadratic as given by (5), (18) is the unique feasible solution to the profit maximization problem (12) only if

$$y = \frac{P_I + \sum_{k \in \mathcal{K}} \frac{b_k}{2a_k} + \sum_{n \in \mathcal{N}_R} \frac{v_{R,n}}{z_{R,n}}}{\sum_{k \in \mathcal{K}} \frac{1}{2a_k} + \sum_{n \in \mathcal{N}_R} \frac{1}{z_{R,n}}}. \tag{18}$$

*Proof:* Since  $a_k > 0, b_k, c_k \geq 0, \forall k \in \mathcal{K}, v_{R,n}, z_{R,n} > 0, \forall n \in \mathcal{N}_R$ , and  $P_I \geq 0$ , (18), implies that  $y > 0$ . For given  $a_k, b_k, c_k \forall k \in \mathcal{K}$ , and  $v_{R,n}, z_{R,n} \forall n \in \mathcal{N}_R$ , substituting (18) into (7), we obtain

$$\begin{aligned}
 P_I \leq P_{I,\max} := & \left( \min_{n \in \mathcal{N}_R} (v_{R,n} - z_{R,n} x_{R,n,\min}) \right) \\
 & \times \left( \sum_{k \in \mathcal{K}} \frac{1}{2a_k} + \sum_{n \in \mathcal{N}_R} \frac{1}{z_{R,n}} \right) \\
 & - \left( \sum_{k \in \mathcal{K}} \frac{b_k}{2a_k} + \sum_{n \in \mathcal{N}_R} \frac{v_{R,n}}{z_{R,n}} \right).
 \end{aligned} \tag{19}$$

$$\frac{P_I + \sum_{k \in \mathcal{K}} \frac{b_k}{2a_k} + \sum_{n \in \mathcal{N}_R} \frac{v_{R,n}}{z_{R,n}}}{\sum_{k \in \mathcal{K}} \frac{1}{2a_k} + \sum_{n \in \mathcal{N}_R} \frac{1}{z_{R,n}}} \leq \min_{n \in \mathcal{N}_R} (v_{R,n} - z_{R,n} x_{R,n, \min}).$$

Further simplification of (20) yields (19). *Remark 1:* Note that, UCs may impose their own limits on the unit price, and usually there is a maximum limit the market imposes, i.e.,  $y_{k, \min} \leq y \leq y_{k, \max} \forall k \in K$ . Without loss of generality, we consider  $y_{\max} \leq y_{m, \max}$  and  $y \geq y_{k, \min} \forall k \in K$ . *Proposition 2:* When the gain functions of the residential consumers are logarithmic as given by (8), a unique feasible solution of (12) is

$$y = \frac{-T_1 + \sqrt{T_1^2 + 8AA_R}}{2A}, \text{ if} \tag{21}$$

$$P_I \leq \min_{n \in \mathcal{N}_R} \frac{A\alpha_{R,n}}{2(\beta_{R,n} + x_{R,n, \min})} - \frac{B_A}{2} + B_R - \frac{A_R}{\min_{n \in \mathcal{N}_R} \frac{\alpha_{R,n}}{\beta_{R,n} + x_{R,n, \min}}} \tag{22}$$

where  $T_1 = 2BR - BA - 2PI$ ,  $A = \sum_{k \in K} 1/ak$ ,  $A_R = \sum_{n \in \mathcal{N}_R} \alpha_{R,n}$ ,  $B_R = \sum_{n \in \mathcal{N}_R} \beta_{R,n}$ , and  $B_A = \sum_{k \in K} bk/ak$ . *Proof:* Substituting  $C_k, U_{R,n}$  from (17) and (8) into (15) and further simplification yields

$$\sum_{k \in \mathcal{K}} \frac{y - b_k}{2a_k} = P_I + \sum_{n \in \mathcal{N}_R} \left( \frac{\alpha_{R,n}}{y} - \beta_{R,n} \right). \tag{23}$$

The solution of (23) is  $y = (-T_1 \pm \sqrt{T_1^2 + 8AA_R})/2A$ . Since  $A > 0$  and  $\sqrt{T_1^2 + 8AA_R} > T_1$ , the root  $y = (-T_1 + \sqrt{T_1^2 + 8AA_R})/2A$  is the only real, positive one, and hence, feasible solution for  $y$ . Now, substituting (21) into (10) leads to

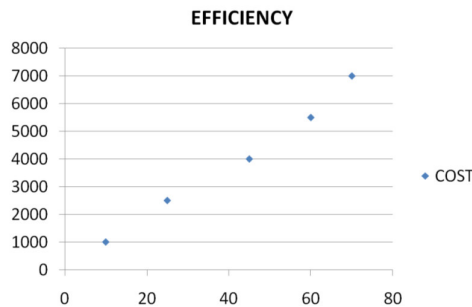
$$\frac{-T_1 + \sqrt{T_1^2 + 8AA_R}}{2A} \leq \min_{n \in \mathcal{N}_R} \left( \frac{\alpha_{R,n}}{\beta_{R,n} + x_{R,n, \min}} \right). \tag{24}$$

Squaring both sides of (25) and upon further simplification, (25) takes the form (22).

$$2A \left( \min_{n \in \mathcal{N}_R} \frac{\alpha_{R,n}}{\beta_{R,n} + x_{R,n, \min}} \right) + T_1 \geq \sqrt{T_1^2 + 8AA_R}. \tag{25}$$

*Remark 2:* If for any of the UCs,  $(C_k - 1)y > P_{k, \max}$ , then instead of using (13), UC  $k$  supplies  $P_k = P_{k, \max}$ . The power supply from UC  $k$  can, therefore, be expressed as  $P_k = \min((C_k - 1)y, P_{k, \max})$

### V. Performance Measures of Our Proposed System



### VI. Conclusion

We have proposed a system which is incorporated with dynamic demand side management with the use of smart grid using the three major systems the demand response management, v/f controller and the AMI( Automated Metered Reading) which plays a major role to send the information about power usage and storage details (i.e.,) the battery backup. With our system we can give uninterrupted

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supply to our customers even in the case of sudden surge in the load by shifting the phase automatically and again details regarding the usage is obtained via AMI.

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