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Automated Water Treatment Plant

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ABSTRACT

The project is basically based on smart solutions to every major problem occurring in any metropolitan village areas to use water availability, and various accessing techniques for water demanding services. The main processor which handles the controlled parameter and commands for executions of data is Arduino module to operate various Analog & Digital information from source to destination which is desired output. Input is sensed by level sensor, which is further transmitted by the level transmitter to the processor module for obtaining desired output. Heart of the system is Arduino minicomputer. Arduino model B has dedicated general purpose input outputs pins. These GPIO pins can be accessed for controlling hardware such as LEDs, motors, and relays, which are all examples of outputs. As for inputs, arduino can read the status of buttons, switches, or it can read sensors like temperature, light, motion, or proximity sensors.

Keywords **:** *Arduino, Automation, water treatment plant, process control*

I. Introduction

Water is one of the most important natural resources and is of vital importance for all living things on the earth. Up to 70% of human body is water. Therefore quality of water we drink is very important. The drinking water should be clean, pure and free of microorganisms and it should be treated and disinfected before consuming it. Water treatment plants treat the raw water from river, lake, reservoirs or other underground sources and provide safe and reliable drinking water to mankind. Automation is a key to water treatment plant management since. It has various tangible and intangible.

Conventionally, Programmable Logic Controllers (PLCs) have been used for the automation of water treatment plants.

This paper focuses on an innovative and intelligent control and monitoring system for Water Treatment Plant by using "Arduino" as an effective alternative to PLCs for the automation of small water treatment plants. It is a minicomputer which has an ability to control the system comes with advantages like low cost and compact size. Automation of operations involves monitoring and control of various sensors, actuators and motors. These sensors, actuators and motors can be skillfully controlled using Arduino.

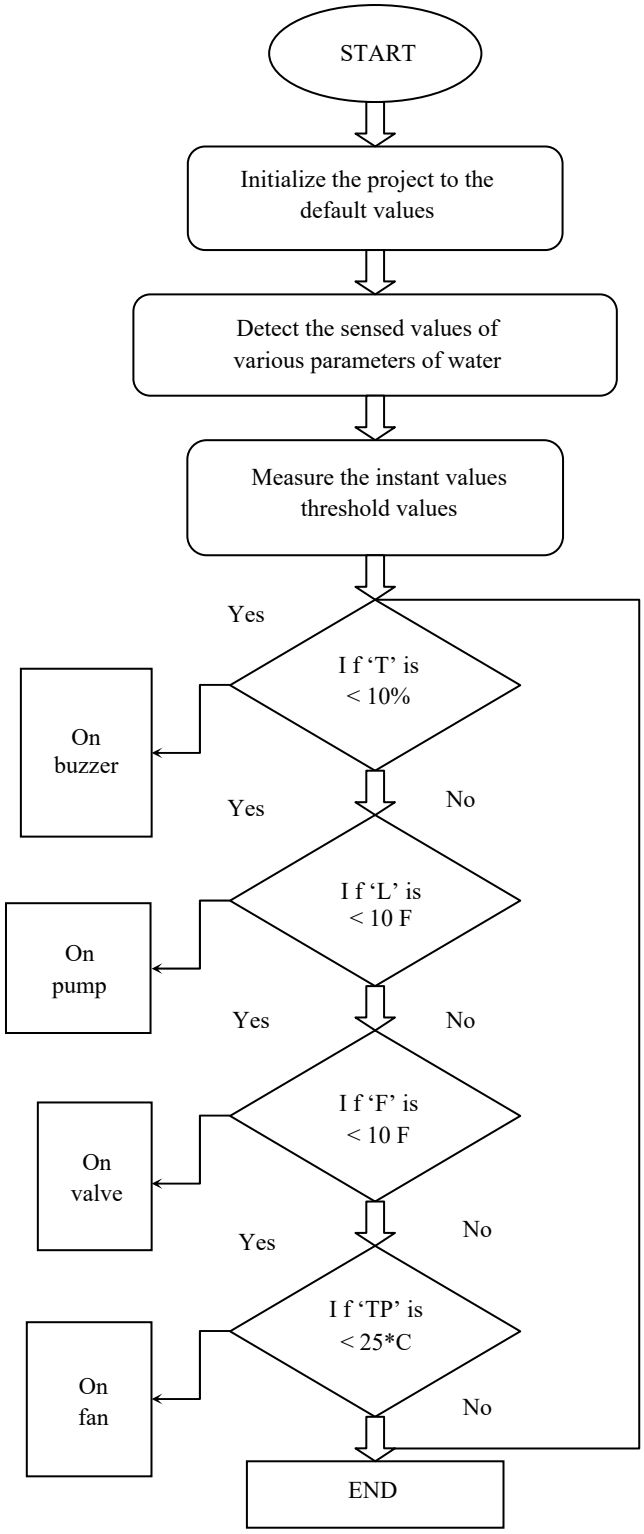
II. Overview of Water Treatment Plant

In the first stage of water treatment plant, the raw water flows through the normal flow from the water turbidity sensor which detects the quality of incoming water to the plant by sensing its muddy or clean transparent nature.

In the second stage, water undergoes flow sensor which is sensing the amount of flow of water in terms of water flowing per milliseconds. As the threshold is set to a certain limit to activate the respective output of flow control to minimize the quantum of flow of the water.

In the third stage, water is stored in the tank and the level of water is measured by using the level sensor which is basically a potentiometer that varies the resistance with respect to the rotation of ball. Flow ball is freely moving in the water storage tank and as when water level increases or decreases the movement of the ball changes its direction from upwards to downwards side. This rotation results in variation of resistance which is supplied to the arduino for the further action of starting the water pumping motor or stop the water motor.

Final stage of water treatment detects the temperature of the water to be supplied to the respective applications of goods or product manufacturing in various industries and different water dependent application that uses water as source to generate output result of water based product.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Detect the sensed values of various parameters of water
Measure the instant values threshold values
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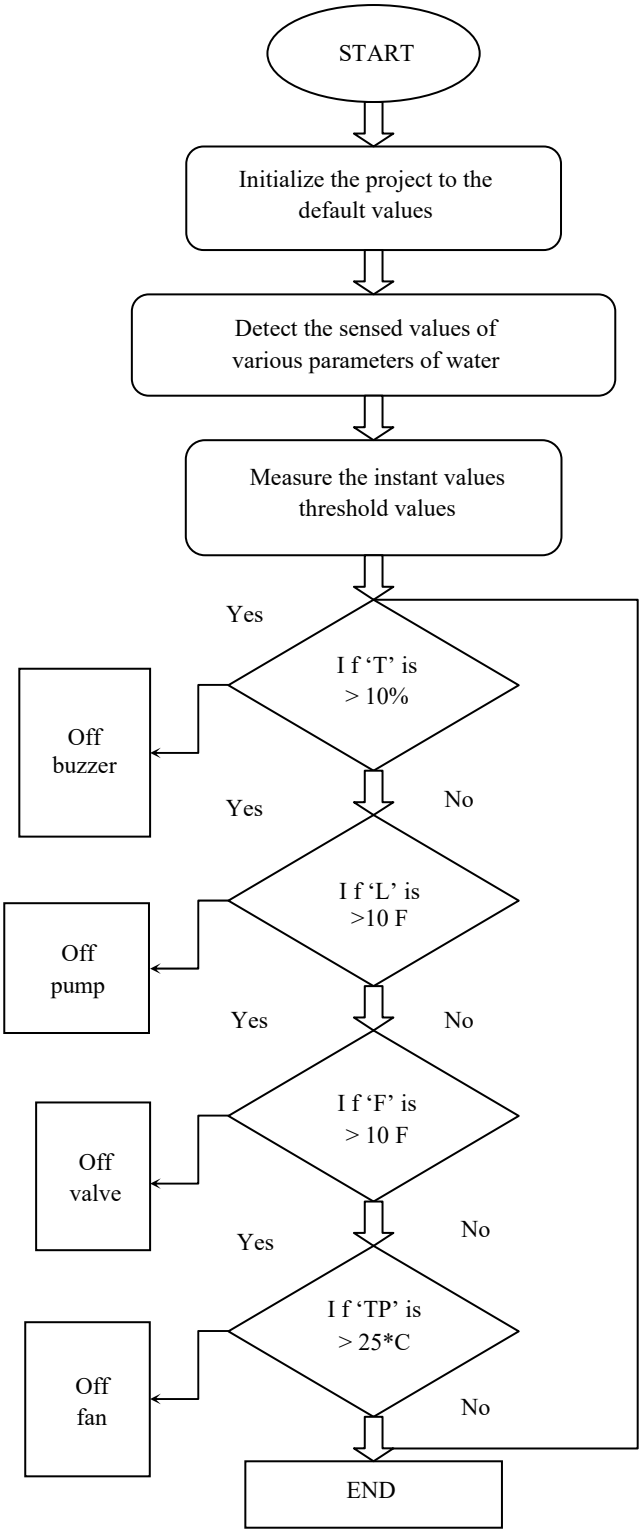
Yes
On buzzer
No
I f 'L' is < 10 F
Yes
On pump
No
I f 'F' is < 10 F
Yes
On valve
No
I f 'TP' is < 25*C
Yes
On fan
No
END


START
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Detect the sensed values of various parameters of water
Measure the instant values threshold values
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Yes
Off buzzer
No
I f 'L' is >10 F
Yes
Off pump
No
I f 'F' is > 10 F
Yes
Off valve
No
I f 'TP' is > 25*C
Yes
Off fan
No
END

III. Methodology

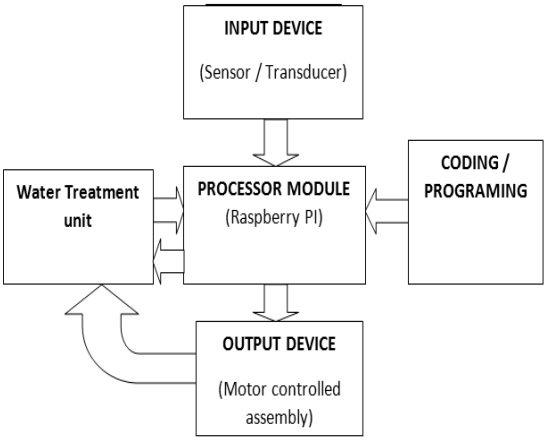

Fig.3. Block diagram

The main processor which handles the controlled parameter and commands for executions of data is Raspberry pi module to operate various Analog & Digital information from source to destination which is desired output. Input is sensed by level sensor, which is further transmitted by the level transmitter to the processor module for obtaining desired output. Appropriate coding is used to obtain desired output by means of programming. Water handling unit provides the mechanism to control the flow of water by using motor control assembly. The photo depicts the schematics for an infrared sensor which allows you to detect an object's distance from the robot. The big picture problem is attaching this infrared sensor on both wings of the aerial robot. Attaching these sensors on the wing tips will help the robot navigate through the halls of any building. This tutorial shows you how to construct and test one infrared sensor and takes approximately 3 hours to complete.

A Photodiode is a p-n junction or p-i-n structure. When an infrared photon of sufficient energy strikes the diode, it excites an electron thereby creating a mobile electron and a positively charged electron hole. If the absorption occurs in the junction's depletion region, or one diffusion length away from it, these carriers are swept from the junction by the built-in field of the depletion region, producing a photocurrent. A potentiometer colloquially known as a pot is a three-terminal resistor with a sliding contact that forms an adjustable voltage divider. If only two terminals are used (one side and the wiper), it acts as a variable resistor or rheostat. Potentiometers are commonly used to control electrical devices such as volume controls on audio equipment. Potentiometers operated by a mechanism can be used as position transducers, for example, in a joystick.

Photodiodes can be used under either zero bias (photovoltaic mode) or reverse bias (photoconductive mode). Reverse bias induces only little current (known as saturation or back current) along its direction. But a more important effect of reverse bias is widening of the depletion layer.

IV. Output and Result

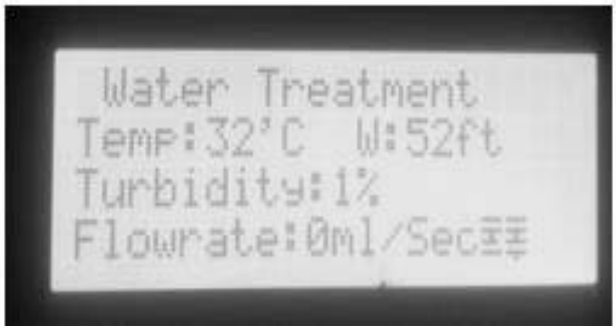

Fig.4. Output Display

Output display unit consists of four parameters as like temperature of the water by using temperature sensor at the input which provides the necessary output values that determines the proper temperature of the water which has threshold up to 25 degree Celsius. Second parameter is the level indicator which determines the level of the water in the storage tank which has threshold up to 10 feet. Third parameter is the most important parameter that is the turbidity sensing parameter which detects the clean or muddy nature of the water and provides the transparency of water in terms of the turbidity values which has threshold up to 10% of clean water. Last and final parameter is the flow sensing parameter which determines the quantum of flow of the water through the pipe which has threshold up to 10 ml per second of the flow of water.

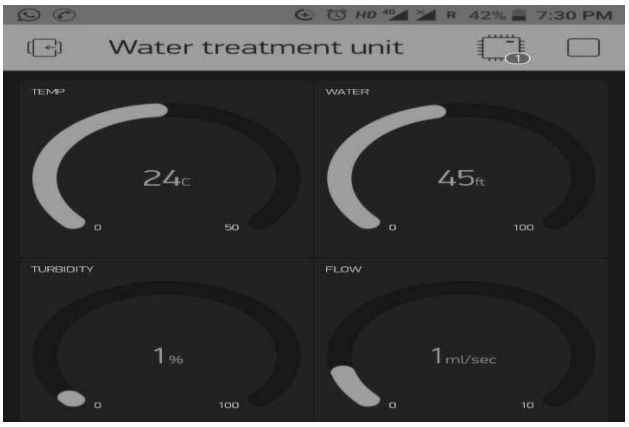

Fig.5. Display on Blynk Application

Blynk was designed for the Internet of Things. It can control hardware remotely, it can display sensor data, and it can store data, visualize it and do many other cool things. There are three major components in the platform: Blynk App - allows to you create amazing interfaces for your projects using various widgets we provide.Blynk Server - responsible for all the communications between the Smartphone and hardware. You can use our Blynk Cloud or run your private Blynk server locally. Its open-source could easily handle thousands of devices and can even be launched on an Arduino.

Blynk Libraries - for all the popular hardware platforms - enable communication with the server and process all the incoming and out coming commands.

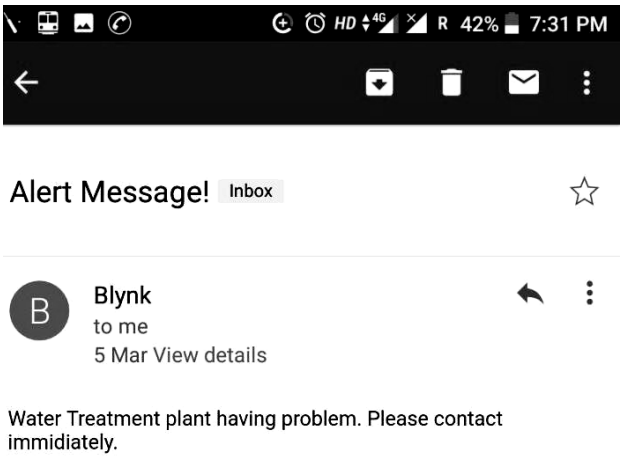

Fig.5. Working of Blynk Application

V. Future Scope

The scope of the project is, it can be used for further transmission of saved water to agricultural field and farming sector to reuse it for needful application. And the other basic needs of washing of vehicles can be performed by using saved water. Also for compact water usage mechanism and restoring the system. Common accessing terminal for the usage and recycling of water.

VI. Conclusion

This system is highly effective and it is efficient in segregation and proper management of water.

Due to its on-cloud capabilities it greatly reduces the use of dynamic man-power**.** Various fail-safe sensors give it redundant get-always since each sensor working is independent of one another.

The circuit being small can efficiently replace PLC in small scale water management based projects**.**

VII. Acknowledgement

We would like to express heartfelt gratitude towards our project guide, Prof. Prachi Mujawar madam of electronics Department.

We would like to thanks to our HOD Dr. Anjali Deshpande. We are greatly thanked to other prof. for their help and guidance. We are also greatly thanked our collage and lab assistant for proving us lab facilities, which shows their support. And last but not the least; we want to thanks all those important people who have directly and indirectly given their special time and attention towards making project successful.

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Egg Candling Through Image Processing

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ABSTRACT

An egg Candler is a device used for testing eggs. Candling eggs is a method of testing eggs while they are incubating to determine if they are viable or not. "Viable" means that the egg is fertilized and an embryo is able to develop and hatch. Candling is a method used in embryology to study the growth and development of an embryo inside an egg. The method uses a bright light source behind the egg to show details through the shell, and is so called because the original sources of light used were candles. The technique of using light to examine eggs is used in the egg industry to assess the quality of edible eggs. After passing with the help of conveyer belt these eggs passes through a process called candling.This candling process can be executed by image processing by taking different samples of different types of eggs. After passing from the screening if the egg found is to be fertilizing or rotten, these eggs can be removed so that only infertile eggs and which are good for consumption can passthrough conveyer.

Keywords **:** *Egg candling, Raspberry pi, Illumination, Image processing.*

1. Introduction

In manufacturing, quality control is very important in developing systems to ensure products or services are designed and produced to meet or exceed customer requirements. Egg is one of the most important products because it's nutritional value and egg grading is important in controlling its quality. A high quality egg will have a smooth, well-shaped shell free of blemishes and cracks. Occasionally an egg may contain a small blood spot. This may be due to the breed of the hen or it may occur if the hen is upset during the formation of the egg. Such faults are generally detected during candling. The classification of defective eggs from qualified ones constitutes a fundamental issue of the poultry industry for both economical and sanitary reasons. The processing of poultry eggs for human consumption has three steps: collecting, grading and packaging. The eggs grading step, in which eggs are inspected for defects detection such as blood spots, cracks and dirt stains, is still done manually. The early separation of defective and cracked eggs is a fundamental issue to be accomplished as stains and leaks degrade all the mechanical parts while progressing on the mechanized conveyor belts either at the farm or at the grader/packer sites. Poultry industry has to deal with much more defective eggs due to the lack of the washing stage and eggshell defects appear in a great variety of combination of the more common defects such as: blood spots, dirt stains and cracks.

At present in industries, conventional candling method is used to inspect eggs' abnormalities for instance blood spot. Egg candling is a technique of using light to examine eggs by using naked eye to assess the potency of edible eggs. During candling each egg rotates over a strong light source which enables the inspector, who is a human being, to see inside the egg and look for any internal imperfections. The inspection and sorting process is currently performed by expert graders. The automation of the grading stage at the poultry farm constitutes a promising and innovative field to alleviate both the manual inspection and the early stage rejection of dirt and cracked eggs.

2. Methodology and Block Diagram

The research of the problem was done when it was observed that the eggs were collected from the chicken coop and were directly transported for the sale. After consuming multiple eggs over the years, there were many eggs which were having blood spots in the Yolk which is relatively not advised to consume. The process named candling has been used to differentiate the defective eggs. Candling is the only method of testing eggs for quality, internally and externally, without breaking them. It consists of inspecting an egg with a beam of light that makes the interior quality visible. A very simple form of candling is placing a candle in a dark room and positioning an egg in front of the flame and looking at the interior quality. Here, to make this process smart and automatic the following components are used, the light source used is LED bulb for better energy efficiency, the observation of eggs will be carried out by the camera interfaced with a processor and the eggs will be rolled to the turn table to the Black Box which is a setup including light beam and camera. The eggs are to be placed sideways facing on the turn table and motor starts rotating because of which eggs are moved to Black

Box. As the name suggests the light intensity inside the box is completely dark. Inside the box after the arrival of the egg sample the light beam will lit illuminating the egg and the camera will take the images of the illuminated egg sample which will be stored in the database of the system. The processor will extract the image from the database and begin the image processing operation which will provide values for predefined parameters of the egg. These values will be compared with values obtained during training the system according to which the defected egg will be pushed out of the system and the remaining eggs will be segregated according to the class standards.

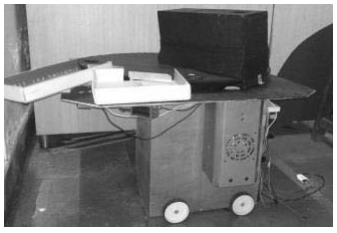

Fig. 1 Actual Hardware system

In our system we are classifying eggs in 3 grades viz,
A, B, C A: Consumable eggs with normal size
B: Consumable eggs with small size
C: Bad eggs (not consumable)
So we made different algorithms to segregate this grades

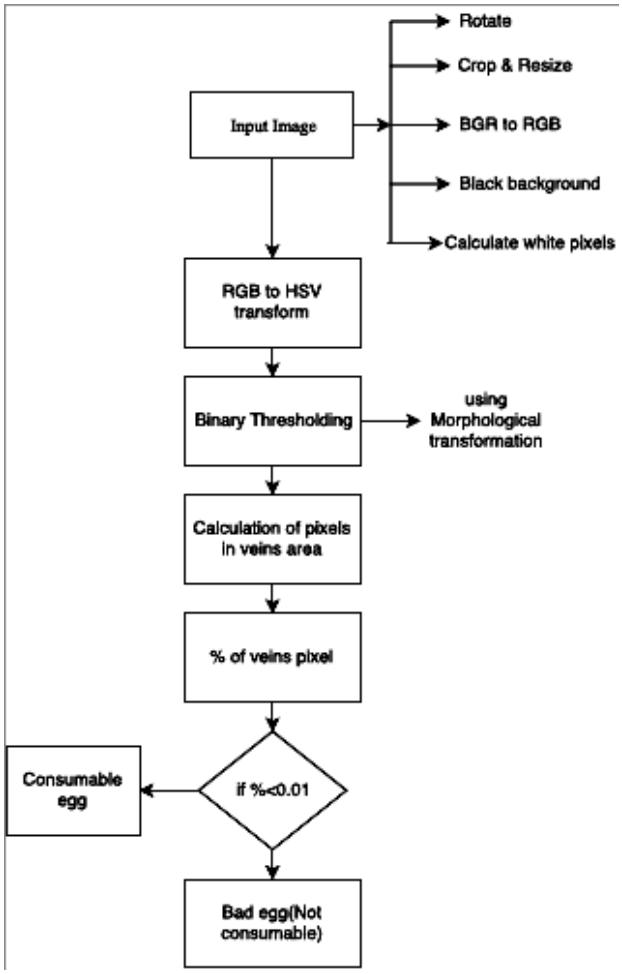

Fig. 2 Veins detection

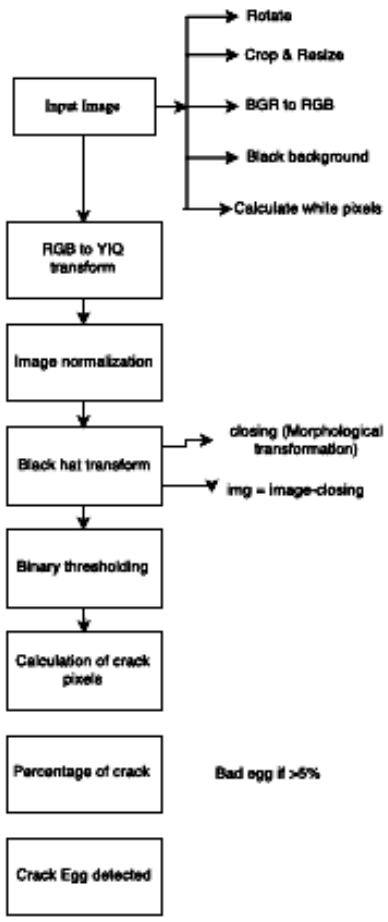

Fig. 3 Crack Detection

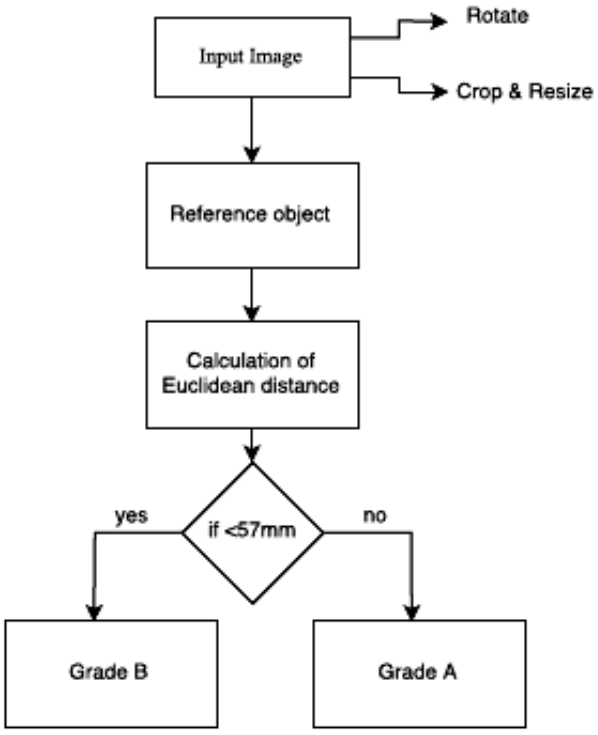

Fig. 4 Height Detection

2.1 Blood Spots

Since the making-decision about being blood spots in eggs is crisp and even some blood in egg is sufficient for removing egg from production cycle, thus defect severity measurement is not necessary in this section. Also because of a good color distinction between bloody egg and other parts of image, it is not necessary separating the egg from background. Therefore, the development of algorithm becomes easier and the time of image processing reduces. Although here we can do segmentation operation by proposed method in next section and separate egg from background. The blood in egg changes colors of materials inside the egg. Depending on the amount of blood, these changes may be large or small. With observation of these eggs by halogen lamp, yellow light can display blood spots. **Figure 5** shows two samples of defected case and one intact egg.

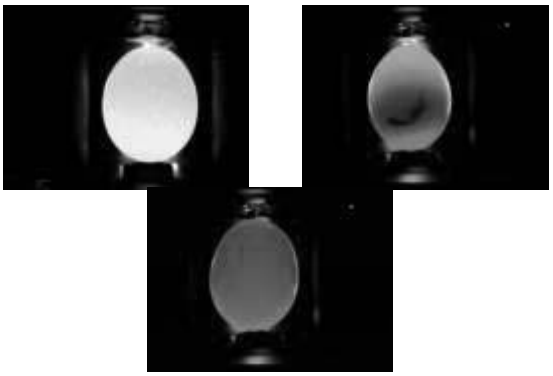

Fig. 5 Egg Samples

2.2 Size

When image is processed algorithm of height detection will give us the size of the egg using the reference size of the object (in this case coin) and it will classify it in A and B grade. Here A grade is shown if egg is greater the 57 mm and if less than that then it is B grade. **Figure 6** shows the size calculation using reference object.

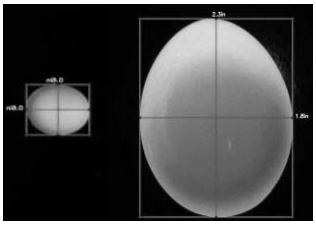

Fig. 6 Size detection

2.3 Crack

When system processes the algorithm and if crack is detected then the egg will be directly classified as class C. Here the threshold percentage of crack is set to 5 percent.

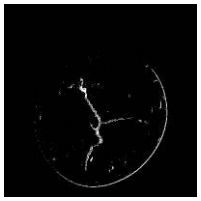

Fig. 7 Crack detection

3. Conclusion

In this study, image processing techniques were used to detect eggs defects. According to defect detection performance of trained operator, the accuracy of algorithm is acceptable. After evaluating the samples that the algorithm has done incorrect detection on them, was determined in some cases, detection has been difficulty also by operators. This problem has happened more for intact eggs with more yellow yolks. Because of yolk seems a little reddish after directing the yellow light through it. Also in crack detection, the lowest correct detection was on the eggs with less crack on their eggshells. The clean eggs and eggs with high crack were detected easier that it is more probable in eye inspection by human workers.

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Space Vector Modulation

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ABSTRACT

In most of the Industrial Drive Systems, Variable Frequency Drives (VFD) are widely used. The main objective is to provide inverter output voltage and frequency control in an efficient manner. This prompts the need for a modulation technique with less total harmonic distortion, fewer switching losses, greater power factor and wider linear modulation range. Space vector pulse width modulation (SVPWM) provides a better technique compared to the more commonly used PWM or SPWM techniques because of its increased efficiency, easier digital realization and better DC bus utilization. In Space Vector Modulation (SVM) we consider a rotating phase which is obtained by adding all the three voltages. Modulation is accomplished by switching state of an inverter. SimPowerSystems toolbox of MATLAB will be used for Simulation studies. This will then be coded in MATLAB and VHDL/Verilog and implemented on FPGA. It will provide a basis for Application Specific Integrated Circuitry (ASIC). Simple UART functionality can be introduced at FPGA level which will in turn exchange data with PC based software (like Visual Basic) over UART port of PC (or using USB to RS232, TTL level converter).This handshaking will help us to set various parameters of SVPWM like modulation index, carrier & amplitude Modulating frequencies.

I. Introduction

Pulse Width Modulation, PWM techniques are invariably used in inverter control used for high performance drive applications. In Space Vector Modulation (SVPWM) we consider a rotating space vector which is obtained by adding all the three voltages. Inverter control, in most of the applications is obtained using DSP processors, which are less flexible due to their non-reconfigurable nature. In this project, we have planned to replace DSP processors with Field Programmable Gate Arrays, FPGA. In addition to the compact size, FPGA also provides very high processing speed, thus making it suitable for high frequency switching circuits.

With SVM the performance of Induction Motor is improved because it eliminates all the lower order harmonics in the output voltage of the inverter (stator voltage of the IM) when compared to the conventional SPWM technique.

II. Theory Behind Project

To provide variable voltage, variable frequency output, PWM inverters are used. An inverter is an electric apparatus that changes direct current (DC) to alternating current (AC) that is DC Power to AC Power.

However, the output of inverter is always full of harmonics that reduces the efficiency of conversion. The most common and popular technique for generating True Sine Wave is Pulse Width Modulation (PWM). Space Vector Pulse Width Modulation is the best technique for this. This PWM technique involves generation of a digital waveform, for which the duty cycle can be modulated in such a way so that the average voltage waveform corresponds to a pure sine wave. This technique produces a much more similar AC waveform than that of others.

III. Problem Definition

To generate control signals for implementing SVPWM in a three phase Voltage Source Inverter using FPGA. To develop a set up using available resources preferably in the institute that provides SVPWM control pulses for three phase Voltage Source Inverter (VSI).

IV. Space Vector Modulation

Space Vector Pulse Width Modulation is the best technique for PWM generation. This PWM technique involves generation of a digital waveform, for which the duty cycle can be modulated in such a way so that the average voltage waveform corresponds to a pure sine wave. Space Vector modulation calculates duty cycles of switches to synthesize a desired output voltage on average, without the use of a carrier waveform. SVM represents the three phase voltages as voltage space vector rotates in (d-q) plane. It approximates the reference voltage V_{ref} by a combination of eight switching patterns (V_0 to V_7). The switching sequence between vectors is designed so that only a single switch position has to be changed at a time, thus reducing the switching losses and increasing utilization.

SVM algorithm has four switching rules: (a) the trajectory of V_{ref} should be a circle, (b) only one switching per state transition, (c) not more than three switching in one sampling period, and (d) The final state of one sample must be the initial state of the next sample. These rules help in limiting the number of switching actions, and therefore, there is a decrease in the switching losses. In addition, they maintain symmetry in switching waveforms at the VSI output to achieve the lower THD [4].

SVPWM implementation involves sector identification, switching time calculation, switching vector determination, and optimum-switching-sequence selection for the inverter voltage vectors.

V. Existing Techniques

Described below are three existing techniques used for implementation of Space Vector modulation. The aim of these techniques is to thoroughly study the steps and method involved in them and select the best possible implementation for Space Vector Modulation.

A. Conventional Implementation :

Space Vector modulation is a PWM control algorithm for 3 phase AC generation. Algorithm for generating space vector PWM using Conventional method.

1. Here from three 120^0 phase shifted sine waves we directly calculate V_d and V_q using the formula

$$V_d = \frac{2}{3}\left(V_a + \frac{1}{2}V_b - \frac{1}{2}V_c\right)$$

$$V_q = \frac{2}{3}\left(\frac{1}{\sqrt{3}}V_b - \frac{1}{\sqrt{3}}V_c\right)$$

2. V_d and V_q are basically the projections of the V_a, V_b and V_c on two dimensional reference axis dq.
3. V_d and V_q are Cartesian co-ordinates which are then converted to their corresponding polar form.

$$V_r = \sqrt{V_d^2 + V_q^2}$$

$$\theta = \tan^{-1}\frac{V_q}{V_d}$$

4. From this polar form we get the angle theta which helps us determine the sector in which the vector is present. Here before finding the sector we convert the angle into degrees.
5. If 0<theta<=60; Sector 1,
   60<theta<=120; Sector 2,
   120<theta<=180; Sector 3,
   180<theta<=240; Sector 4,
   240<theta<=300; Sector 5,
   300<theta<=360; Sector 6
6. This reference vector is rotated through different sectors and sinusoidal voltage at the output is obtained.
7. Determining switching time duration for vectors, from magnitude of reference vector, angle of reference vector, sampling time and input DC voltage we can find T_1 and T_2 for which each vectors are active in corresponding sector.

$$T_1 = \frac{|V_r| \, T_s \sin(60-\theta)}{V_{dc} \sin 60}$$

$|V_r|$ = Length of Reference Vector.

θ is measured from the start of the vector.

$$T_2 = \frac{|V_r| \, T_s \sin(\theta)}{V_{dc} \sin 60}$$

$$T_s = \text{Sampling Time} = T_1 + T_2 + T_0$$

B. Digital Implementation of Space Vector Modulation

The Digital Implementation Algorithm for SVM is as given below:

1. Generation of 3 sine waves using look up table approach.
2. Calculation of V_d and V_q.

$$\begin{bmatrix} V_d \\ V_q \end{bmatrix} = \frac{2}{3}\begin{bmatrix} 1 & -\frac{1}{2} & \frac{-1}{2} \\ 0 & \frac{\sqrt{3}}{2} & -\frac{\sqrt{3}}{2} \end{bmatrix}\begin{bmatrix} V_{an} \\ V_{bn} \\ V_{cn} \end{bmatrix}$$

$$V_d = \frac{1}{3}\left[2V_a - V_b - V_c\right]$$

$$V_q = \frac{1}{\sqrt{3}}\left[V_b - V_c\right]$$

This transformation requires value of $\sqrt{3}$ to be calculated and it is difficult to implement floating point numbers using FPGA. Hence instead of d-q transformation, intermediate transformation vectors are used as follows

$$X_d = \left[2V_a - V_b - V_c\right]$$

$$X_q = \left[V_b - V_c\right]$$

For implementing $2V_a$ a barrel shifter is designed. The whole equation is implemented using subtractor and barrel shifter.

3. Sector identification

   For sector identification 3 conditions are used,

   a. Condition 1: sign of Xd
   b. Condition 2: sign of Xq
   c. Condition 3: |Xd | > |Xq|

   First condition 1 is checked, then 2 and finally by using abs() function 3rd condition is checked.

   The rules for identifying sectors can be easily written from **Fig1** are given as follows:

   a. **Rule 1:** if (Xd>0 &Xq>0 & |Xd|>|Xq|), then Sector-1
   b. **Rule 2:** if (Xd>0 &Xq>0 & |Xd|<|Xq|) Sector-2 OR if (Xd<0 &Xq>0 & |Xd|<|Xq|) Sector-2
   c. **Rule 3:** if (Xd<0 &Xq>0 & |Xd|>|Xq|) Sector3
   d. **Rule 4:** if (Xd<0 &Xq<0 & |Xd|>|Xq|) Sector-4
   e. **Rule 5:** if (Xd>0 &Xq<0 & |Xd|<|Xq|) Sector-5 OR if(Xd<0 &Xq<0 & |Xd|<|Xq|) Sector-5
   f. **Rule 6:** if (Xd>0 &Xq<0 & |Xd|>|Xq|) Sector-6

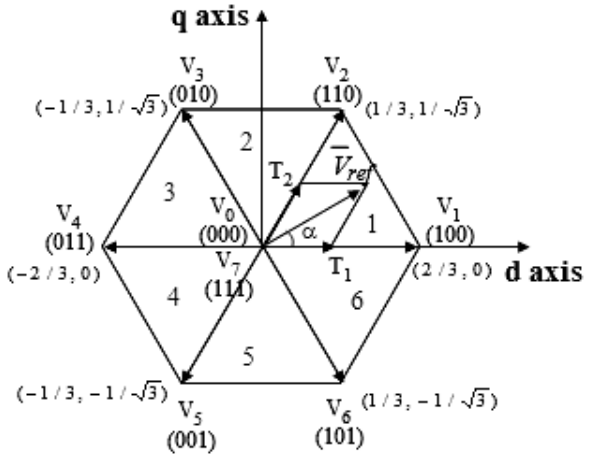

Fig. 1: Sector Identification

The above rules are implemented by using simple and low power logic circuits based on combinational logic circuits, thus reducing the power consumption and increasing performance. For computing Xq a signed shifter can be used.

4. The output voltage i.e. Xd and Xq can be in any of the sector 1 to sector 6 for symmetric PWM and it is given by the equation,

$$V_{ref} = \frac{T_n}{T_z} V_n + \frac{T_{n+1}}{T_z} V_{n+1}$$

5. The T_n and T_{n+1} matrix is given by

$$\begin{bmatrix} T_n \\ T_{n+1} \end{bmatrix} = T_{PWM} M_o \begin{bmatrix} X_d \\ X_q \end{bmatrix}$$

where, the sum of T_n and T_{n+1} should be less than or equal to T_{PWM} and rest of period the switching time should be T_0. Here T_{PWM} is the total PWM time.

The M_0 is called as decomposition matrix, given as

$$\begin{bmatrix} M_{00} & M_{01} \\ M_{10} & M_{10} \end{bmatrix} = \begin{bmatrix} \frac{2}{\sqrt{3}} \sin(\frac{\pi}{3} n) & \cos(\frac{\pi}{3} n) \\ -\frac{2}{\sqrt{3}} \sin\left(\frac{\pi}{3}(n-1)\right) & \cos\left(\frac{\pi}{3}(n-1)\right) \end{bmatrix}$$

6. Altering some values the coefficients of the decomposition matrix can be written as

Sector n	1	2	3	4	5	6
M00	½	1/2	0	-1/2	-1/2	0
M01	-1/2	1/2	1	1/2	-1/2	-1
M10	0	-1/2	-1/2	0	1/2	1/2
M11	1	1/2	-1/2	-1	-1/2	1/2

Table 1: Coefficients of Decomposition Matrix

7. Hence T'_0, T'_n and T'_{n+1} matrices can be obtained as,

$$T_n' = \begin{bmatrix} M_{00} & M_{01} \end{bmatrix} \begin{bmatrix} X_d \\ X_q \end{bmatrix}$$

$$T_{n+1}' = \begin{bmatrix} M_{10} & M_{11} \end{bmatrix} \begin{bmatrix} X_d \\ X_q \end{bmatrix}$$

$$T_0' = \sqrt{3} - T_n' - T_{n+1}'$$

8. Their values can thus be stated by,

If (sector=1): Tn= Xd - $\frac{1}{2}$ (Xq), Tn+1= Xq,

T0 = (√3) - Tn -Tn+1

If (sector=2): Tn= Xd + $\frac{1}{2}$ (Xq), Tn+1= $\frac{1}{2}$ (Xq) - Xd,

T0 = √3-Tn-Tn+1

If (sector=3): Tn=Xq, Tn+1= - Xd - $\frac{1}{2}$ (Xq),

T_0 = √3-Tn-Tn+1

If (sector=4):Tn= - Xd + $\frac{1}{2}$ (Xq),Tn+1= - Xq,

T_0= √3-Tn-Tn+1

If (sector=5):Tn= - Xd - $\frac{1}{2}$ (Xq),Tn+1=Xd - $\frac{1}{2}$ (Xq),T_0= √3-Tn-Tn+1

If (sector=6): Tn= - Xq, Tn+1= Xd + $\frac{1}{2}$ (Xq),

T0= √3 –Tn-Tn+1

9. Time duration of any PWM pulse is dependent on number of sector and switching times T0, T1 and T2.
10. The PWM Generation is implemented using a counter. Range of counter is 1 to (T0/2 + T2 + T1 + T0/2 + T0/2 + T1 + T2 + T0/2 = 2*T0 + 2*T1 + 2*T2).
11. For sector 1 the implementation conditions are as shown in Fig 2, in case of all sectors the conditions are modified accordingly.(for sector 1 and 2 range of counter is 1 to (2*T0 + 2*T1 + 2*T2))

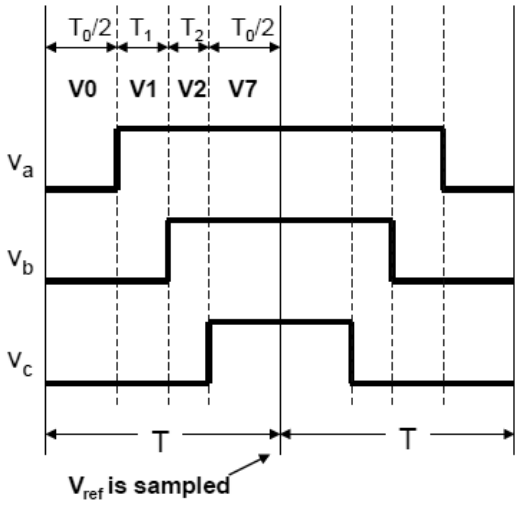

Figure 2: Sector 1 Timings

T = T0 + T1 + T2

From Fig 2, If (Sector=1):

If(counter< (T0/2): PWM_A='0', PWM_B='0', PWM_C='0';

If (T0/2 ≤ counter <(T0/2)+T1) : PWM_A='1', PWM_B='0', PWM_C='0';

If (T0/2+T1 ≤ counter <(T0/2)+T1+T2) : PWM_A='1', PWM_B='1', PWM_C='0';

If (T0/2+T1+T2 ≤ counter <T0+T1+T2): PWM_A='1', PWM_B='1', PWM_C='1';

If (T ≤ counter < T + T0/2): PWM_A='1', PWM_B='1', PWM_C='1';

If (T + T0/2 ≤ counter <T + T0/2 + T2): PWM_A='1', PWM_B='1', PWM_C='0';

If (T + T0/2 + T2 ≤ counter < T + T0/2 + T2 + T1): PWM_A='1', PWM_B='0', PWM_C='0';

If (T + T0/2 + T2 + T1 ≤ counter <2*T): PWM_A='0', PWM_B='0', PWM_C='0';

C. Reduced Computation :

Reduced Computation method is very similar to sine pwm. algorithm for generation of space vector PWM using Reduced Computation method

1. Generate three 120° phase shifted sine waves.
2. Find out maximum and minimum value among three amplitudes at each instant.
3. Calculate value of common mode voltage. Refer equation.
4. Add the value of common mode voltage to amplitude of sine wave.
5. Comparing the resultant wave and triangular wave(carrier wave), we get a three phase pwm wave.

$$\overline{V_{aN}} = \overline{V_{com}} + \overline{V_{an}} = d_a V_d$$

$$\overline{V_{cN}} = \overline{V_{com}} + \overline{V_{cn}} = d_c V_d$$

$$d_a = 1 - \Delta d$$

$$d_c = 0 + \Delta d$$

$$\overline{V_{com}} = \frac{V_d}{2} - \frac{\overline{V_{an}} + \overline{V_{cn}}}{2}$$

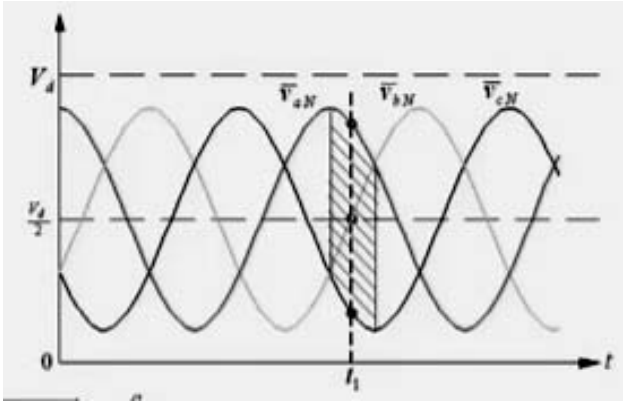

Figure 3 : Common Mode voltage in SVPWM

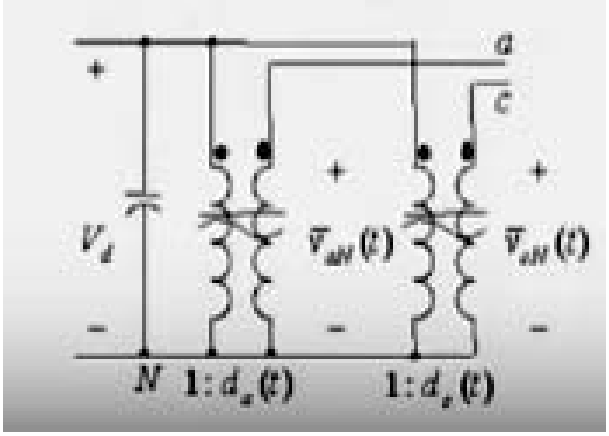

Fig 4. Equivalent Circuit for Pole Voltages

$$V_{com} = \frac{V_d}{2} + (-\frac{1}{2})(\max(\overline{V_{an}}, \overline{V_{bn}}, \overline{V_{cn}}) + \min(\overline{V_{an}}, \overline{V_{bn}}, \overline{V_{cn}})$$

VI. Our Approach

The basic block diagram for generation of PWM pulses using the approach is as follows

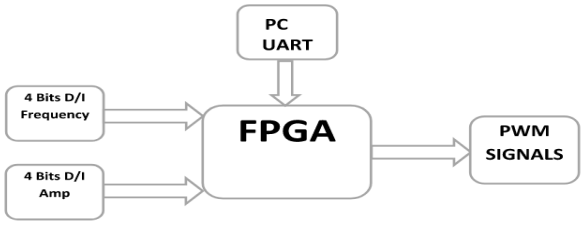

Fig 5. Basic Block Diagram

Expanding the diagram for space vector modulation:

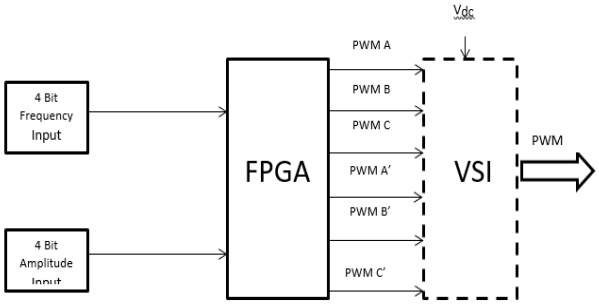

Fig 6. Block Diagram Representation 1

The above block diagram has components Lookup table (which is stored in form of array in main program), FPGA board and VSI. Lookup table contains instantaneous values of voltages V_a, V_b, V_c. These voltage values are stored as ROM in form of an array in the man code itself. The block diagram shown in Fig.7 will be implemented with the help of FPGA. (n: acts as input to switching time generation module)

The internal processes leading to generation of the 6 PWM pulses are shown in Fig. 7.

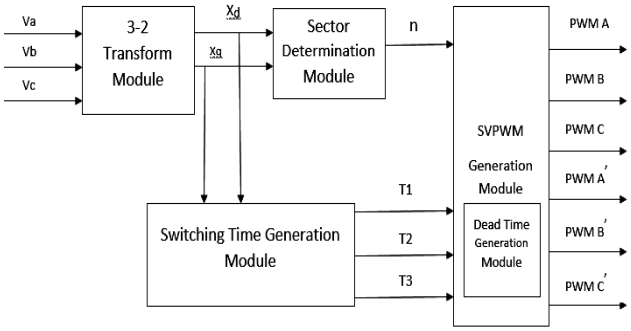

Figure 7. Block Diagram Representation 2

The first block converts its input V_a, V_b, V_c to equivalent 2 phase signals X_d and X_q using equations 1 & 2. X_d and X_q are used for sector identification by using table 1. X_d and X_q are also used for calculating T_0, T_1 and T_2 in the time generation module using equations (3), (4) and (5). Further the Sector determination module is used for calculating the correct sector. The PWM Generation module then generates the 3 PWM i.e. A, B , C and A', B', C'.

VII. System Designed

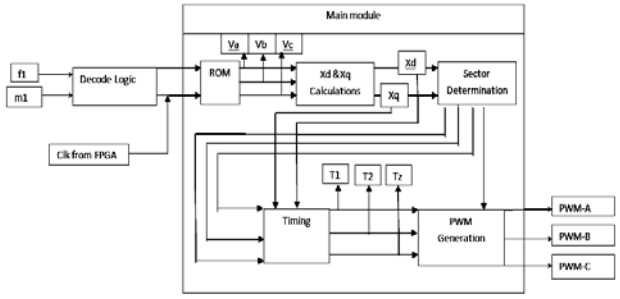

Fig. 8 System Designed

Description :

f_{in} and m_{in} are two four bit inputs applied to the system for frequency and amplitude selection.

Decode Logic : Its input consists of f1 (frequency step size) and m1 (modulation Index) which is of 4 bits each. Depending on input applied by the user, corresponding value of modulation index (m_{out} which is 16 bit signed fixed point number) and frequency step size (f_{out} which is an integer) is passed to the next module.

Main Code Blocks:

ROM: ROM is designed such that it has 1023 values. The outputs of ROM are values of Va, Vb, Vc which are 16 bit fixed point signed numbers (sfixed) .They are further passed to the Xd and Xq calculation block.

Xd and Xq calculation block: Values of Xd and Xq are calculated using Equation 1 and 2. Outputs of this block are Xd and Xq which are 16 bit fixed point signed numbers.

Sector Determination: The input to sector determination module is Xd and Xq (sfixed).The output of this module is sector number and it is of type std_logic_vector (2 downto 0) The sector determination block uses the conditions specified below to calculate the appropriate sector number.

Condition 1: Sign of Xd
Condition 2: Sign of Xq
Condition 3: |Xd | > |Xq|
The output of this module is further given to timing module and PWM generation module

Timing :

The timing module calculates T1, T2 and Tz using modulation index(m) given by user as well as sampling time(Ts) obtained from the sampling frequency depending upon the sector identified. This T1, T2 and Tz are 16 bit fixed point values(sfixed).These values are then passed to the PWM generation module.

$$T_1 = \frac{|V_{ref}| * T_s * \sin(\frac{\pi}{3} - \alpha)}{V_{dc} \sin\frac{\pi}{3}}$$

$$T_2 = \frac{|V_{ref}| * T_s * \sin(\alpha)}{V_{dc} \sin\frac{\pi}{3}}$$

PWM Generation:

The timings T1, T2 and Tz are used to determine the time for which a particular PWM signal i.e. PWM_A, PWM_B, PWM_C has a logic '1' or logic '0' state. Switching sequence of PWM_A, PWM_B, PWM_C are determined according to respective sectors. The outputs PWM_A ,PWM_B, PWM_C are std_logic. The output of this module is the final output which is observed on according device.

Working

The frequency step size and modulation index are inputs to the system. The ROM created in main code contains instantaneous values of Va, Vb and Vc. Initially we check the rising edge of the FPGA clock having frequency value of 1 MHz. The en signal is used to ensure that the FPGA will not scan next set of Va, Vb and Vc until the PWM signal for current output is generated. The initial value of en signal is set as '1'.The first set of Va, Vb and Vc values is scanned, from which Xd and Xq are calculated using formula given below (Eqn (9) & Eqn (10)).These Xd and Xq values are used for sector determination and timing calculation using formula in Eqn (19) and Eqn (20).

$$X_d = [2V_a - V_b - V_c]$$

$$X_q = [V_b - V_c]$$

These Xd and Xq values along with the identified sector are used to calculate timings T1 and T2.

Sector n	1	2	3	4	5	6
M00	1/3	1/3	0	-1/3	-1/3	0
M01	-1/3	1/3	2/3	1/3	-1/3	-2/3
M10	0	-1/3	-1/3	0	1/3	1/3
M11	2/3	1/3	-1/3	-2/3	-1/3	1/3

Table 2: Timing Coefficients

$$T_1 = M_{00} * X_d + M_{01} * X_q$$
$$T_2 = M_{10} * X_d + M_{11} * X_q$$
$$T_z = T_s - T_1 - T_2$$

T1, T2, Tz values and sector number identified before is given as input as shown below to PWM generation module. These T1, T2, Tz determine the value of count1, count2, count0 respectively which is as follows

$$count\ 0 = \frac{T_0}{T_{clk}} = T_0 * f_{clk}$$

$$count\ 1 = \frac{T_1}{T_{clk}} = T_1 * f_{clk}$$

$$count\ 2 = \frac{T_2}{T_{clk}} = T_2 * f_{clk}$$

These count values are used to count number of rising edges of FPGA clock input. When calculated values of T1, T2 and T0 are divided by time period of FPGA clock, we get number of rising edges of clock i.e. count0.count1 and count2. These count values determine the time for which switching vectors are active. This method has been used since FPGA does not have inbuilt timer. Thus PWM A, PWM B, PWM C are obtained.

The sector wise switching sequence for PWM A, PWM B and PWM C is as shown in table given below.

Sector Number	Active vectors							
1	000	100	110	111	111	110	100	000
Time (for remaining active)	$T_{z/2}$	T_1	T_2	$T_{z/2}$	$T_{z/2}$	T_2	T_1	$T_{z/2}$
2	000	010	110	111	111	110	010	000
Time (for remaining active)	$T_{z/2}$	T_2	T_1	$T_{z/2}$	$T_{z/2}$	T_1	T_2	$T_{z/2}$
3	000	010	011	111	111	011	010	000
Time (for remaining active)	$T_{z/2}$	T_1	T_2	$T_{z/2}$	$T_{z/2}$	T_2	T_1	$T_{z/2}$
4	000	001	011	111	111	011	001	000
Time (for remaining active)	$T_{z/2}$	T_2	T_1	$T_{z/2}$	$T_{z/2}$	T_1	T_2	$T_{z/2}$
5	000	001	101	111	111	101	001	000
Time (for remaining active)	$T_{z/2}$	T_1	T_2	$T_{z/2}$	$T_{z/2}$	T_2	T_1	$T_{z/2}$
6	000	100	101	111	111	101	100	000
Time (for remaining active)	$T_{z/2}$	T_2	T_1	$T_{z/2}$	$T_{z/2}$	T_1	T_2	$T_{z/2}$

Table 3: Sector wise switching sequence for PWM A, PWM B and PWM C

IX. Implementation And Output Results

Main code PWM Output: Entire lookup table is scanned and PWM output is generated. PWM outputs for two sets of m and f inputs are given below. By changing value of m magnitude of reference vector changes. Similarly when f changes step size is varied which in turn provides variation in sine wave frequency at the output VSI.

Case 1 : For m = 1110 and f = 0100

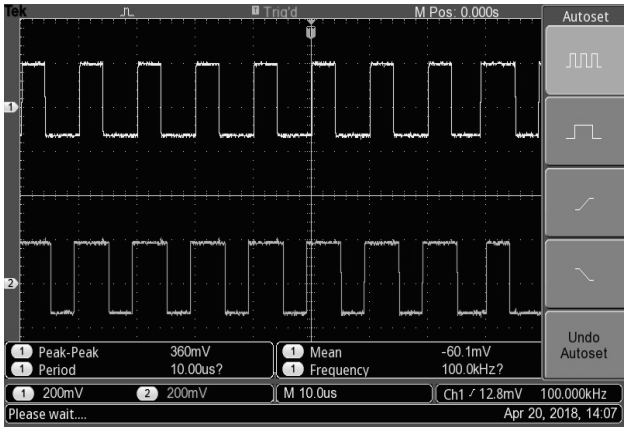

Fig. 9 : Main code PWM Output for phase A and B for m=1110, f=0100

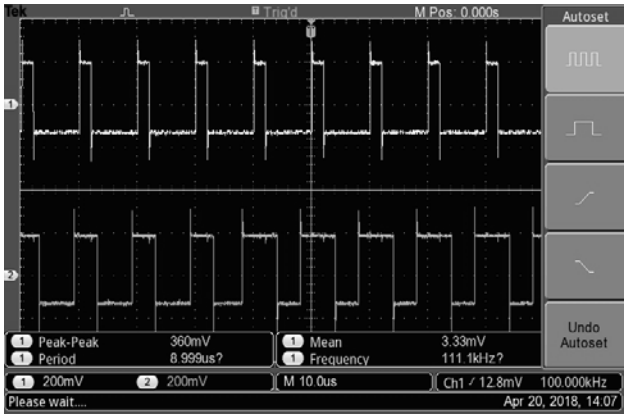

Fig. 10 : Main code PWM Output for phase B and C for m = 1110, f = 0100

Case 2: For m = 0010 and f = 1100

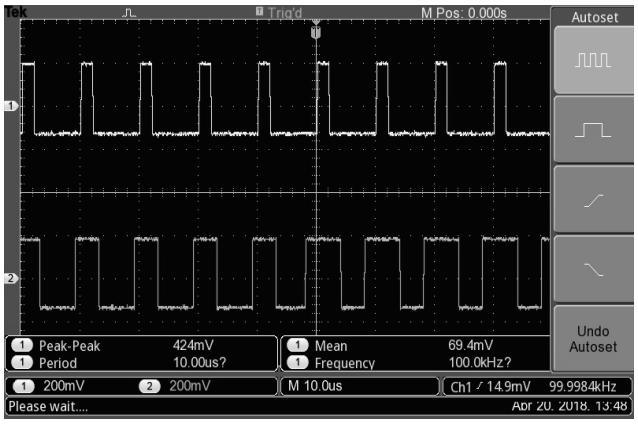

Fig. 11 : Main code PWM Output for phase A and B for m = 0010, f = 1100

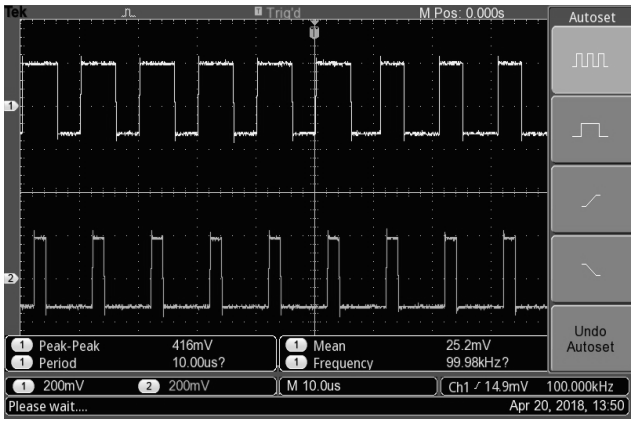

Fig. 12 : Main code PWM Output for phase B and C for m = 0010, f = 1100

X. Conclusion

In this paper, we have implemented the algorithm for SVPWM used three phase voltage source Inverter Control. To understand the complex algorithm, MATLAB/Simulink models were first analyzed. Effect of modulation on THD was also observed. In SVPWM, Amplitude and frequency control of 3 phase sine waves is obtained by changing magnitude and rotating frequency of reference vector. We generated a three-phase sine-wave by storing a lookup table in the FPGA. Here we stored a set of 1023 values and read these values by indexing them to generate Va, Vb, Vc for a three-phase. We have also tested and verified various cases for timing calculation and PWM generation for different sectors. By changing the four bit input code, frequency can be varied and by keeping the amplitude constant, we get sine waves of different frequency. Variations in amplitude input changes the time interval for which particular vector is active. We have generated corresponding PWM control signals, which can be used for control. So by varying the frequency we get 16 PWM signals. Further, the system was designed using VHDL and was implemented on the FPGA. Simple method has been presented to change complicated equations in simple form which further reduces run time of instructions. A 4-bit value was given as an input to the system for selecting the frequency of sine wave and accordingly PWM signal was generated. The frequency of PWM signal depended on clock frequency, the 4-bit input value and the sampling time(Ts). This method provides minimum switching losses.

XI. Future Scope

Hardware implementation of Three Phase Bridge inverter. To design filter for PWM. Speed of induction motor can be controlled using v/f method. Closed loop control can be introduced in the system. Multilevel PWM generation for reduction in lower order harmonics. Implementation of Space Vector Modulation for more than 6 sectors.

XII. Acknowledgement

The authors are thankful to their project guide, Dr. Anjali Deshpande and Prof. Geetha Narayanan for their patient support and timely advice. They are also thankful to Mr. Shirish Joshi and Mr. Anand Paralkar Sir for imparting their immense knowledge about FPGA and solving the doubts whenever they approached them.

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Reference: Video Lecture of Ned Mohan, Oscar A.Schott Professor, University of Minnesota

Efficient Farm

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ABSTRACT

Compact power meter attached with farmer's appliances. It will smartly give information to the farmer about status of power consumption and availability through wireless link. Also, it will keep an eye on load shedding effect, excess current being drawn, etc. i.e. It will inform the farmer about the same and he will be able to decide if he wants some process to take place or some appliance to start or no using wireless communication which will link the farmer's appliances to a portable device. This will help the farmer in cases when he is away from the farm and wants to do some activity. Health of the motor can also be monitored to some extent.

Keywords **:** *Arduino uno, GSM 900A, I2C converter, LM35, LCD (16X4), etc.*

I. Introduction

Farmers face many problems in their fields. Their workload increases cause of these strenuous reasons which require them to be available at the farmlands all the time. Motor's and appliances reduce their workload by drawing water for their fieldwork. But at the same time the health of this motor is a major issue which further adds to the farmer's problems. Timely availability of power at the fields increases efforts of the farmer when the field is away from his home. The idea of the project is to provide the farmer a wireless access to his farm appliance and at the same time monitor and maintain the health of his motor. It majorly focusses on the availability of the power and usage of the same. Power in areas of farmland is not available all the time or at specific hours of the day. It's availability is a major problem. The farmer needs to travel back to his field to turn on the motor when the power is available. Meanwhile the problem arises if the house is away from the field. Under those conditions the power has gone by the time the farmer reaches the field and further as water won't be drawn under such circumstances, the further work of the farmer gets stuck. If the farmer is away from his field land he should be provided access for the above stated reasons so that when he returns he can continue with his work. At times, the farmer faces problems with the working of his motor. The health of his motor is of great importance to the farmer in today's time. There should be ways to work help him with the same.

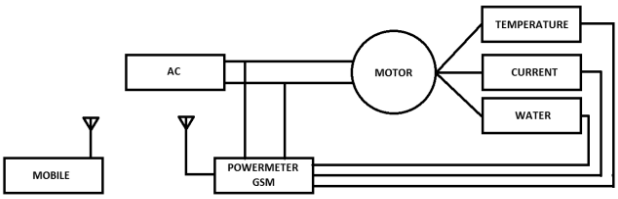
II. Literature Survey

Many researches are being carried out on power measurement and ease of availability and usage of available power to the maximum gains. Also, wireless communication is being used to develop many modern systems, and is the need of the hour. We referred several technical papers on similar projects to get more detailed information about our project. Following the papers helped us understand the drawbacks of some similar existing products and the changes to be made in order to make the product low cost and reliable; most importantly easy to use and less maintenance demanding.

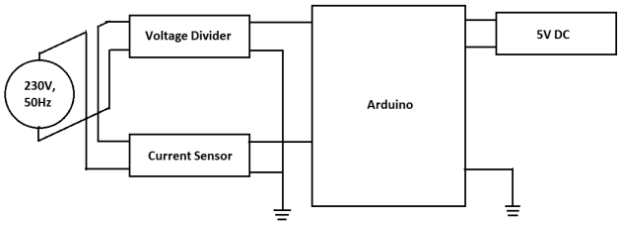
1. In Advanced metering and billing system [1], we studied the availability and operation of existing powermeter systems with metering system and bill generator.
2. In Smart GSM based home automation system [2], we studied how a GSM can be used for remote access and monitor and control systems.

III. Proposed Model

A. Block Diagram



B. Powermeter



IV. Working

The goal is not only of creating more awareness about energy consumption would be optimization and reduction in energy usage by the user but also to notice the farmer about the availability and state of the same. This would reduce their energy costs, as well as conserve energy and save the farmer's time and resources.As the health of the motor is also taken into consideration, severe issues and fears of the farmer are taken into consideration. Temperature of the motor (problems of over-heating), current drawn (in case the motor draws large amounts of current) and in case of problems like single phasing; the motor will be turned off immediately and a message will be sent to the farmer about the same.

This will increase the motor's life and reduce the effort of it's maintenance. The farmer will be notified with a wireless connection when the power is available at the field, about the availability of water (water level at the source), about the immediate switching off of the motor due to above stated conditions and at the same time he will have a control over switching on and off of the motor by sending the command from home via the same wireless connection.

The power meter will keep a check as and when the power is available at the mains. It will keep a check by monitoring the supply at frequent intervals of time. Once a stable power supply will be available, the farmer will be notified about the same. GSM module will then send a message to the farmer to notify him. The farmer will now decide if he wants to turn the motor on or no by sending a message. He will thus be able to access his farm appliance remotely. When the farmer will respond to turn on the motor, the motor starts. Meanwhile, when the motor will be turned on, the water level at the source is checked to find about the availability of water. If the water level will be low, the motor will be turned off. When the motor will be running, it's temperature will be monitored using a thermistor. Any sudden and drastic change in the temperature of the motor will result in turning off, of the motor. Between the power meter and the motor, another circuit will also be connected, to check the phases of the supply. This way the problem of single phasing will also be eliminated. If any such problem occurs, the supply to the motor will be turned off immediately. Whenever the motor will be turned off by the system, the farmer will be notified about the same.

Acknowledgement

We are extremely grateful to our project guide, Prof. Javed Patel (Assistant Professor, Electronics Department., VIT) for insightful suggestions on the project work and for guiding us during the entire project with his encouragement, support and cooperation. We are also grateful to Prof. (Dr.) Anjali Deshpande (HOD, Electronics Department., VIT), Prof. Shrikant Velankar (Professor, Project Coordinator, Electronics Department., VIT) for allowing us to proceed with the project and providing us with the opportunity to embark on the subject, which has given us invaluable knowledge and experience. We would also like to deeply thank Prof. Prathamesh Mestry (Assistant Professor, Electronics and Telecommunication Department., VIT) for his inputs in the project by sharing his immense knowledge about microcontrollers with us and helping us in every step of the implementation of the project. We would also like to extend our heart-felt thanks to our family and friends for their expenditure moral support, love and affection which was inevitable for the success of this project.

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Vertical Gardening

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ABSTRACT

The purpose of this project is to cultivate good quality of plants at home without using any excess chemical, fertilizers, medicines, etc. This system allows a layman to produce good quality of plants without taking much effort. Seed pots are mounted vertically on the wall which takes very less space. Use of IOT technology allows the user to continuously monitor the plant. A customized mobile application is provided to user which gives him access to continuous monitoring plant parameters and also allows manually turning on and turning off the valves. The mobile application may also provide users with tips and guide lines related to farming, recipes, decorations, etc.

Keywords **:**
Fertilizers, IOT technology, mobile application, valves

I. Introduction

Smart agriculture is an often overlooked business case for the Internet of Things because it does not really fits into the well known categories such as health, mobility or industrial design. But the process of farming can be revolutionized by using the technology Internet of Things. The uncertain change of weather cycle is resulting in tremendous loss for agriculture industry. Prediction of atmosphere has become difficult for a farmer which compels him to add extra supplements, medicines and pesticides for growth of plant. However this pesticides increases the plant growth but are very dangerous for people consuming it. Indoor vertical farming is the urban farming of fruits, vegetables, and flowers inside a building in a city or urban centre, in which small pots are designed to accommodate certain crops. The objective of this project was to provide fresh and clean non contaminated fruits, vegetables and flowers to people which they can grow in their house without taking much trouble. Its virtues, relative to conventional agriculture, have long been clear. Indoors, the climate can be controlled year-round. Pests can be minimized, and with them pesticides. Water and nutrients can be applied in precise quantities. Also a continuous monitoring system is provided which allows the user to continuously keep a watch on the parameters of plant (eg. moisture of soil, humidity) continuously. This system also provides automation in controlling the parameters (e.g. automatic controlling of motor).

II. Proposed System

(A) Excess use of pesticides and medicines for the growth of edible plants and corps is a severe problem today. This excess use of chemical and fertilizers are leading to growth of various diseases in mankind. It is very difficult to find out pure chemical free vegetables and fruits. Thus a technology has to be proposed where user can cultivate his own plants and use them. The proposed technology should simplify the process of cultivating plants and a continuous monitoring should be done. Results of this monitoring should be easily accessible by the user to make necessary improvements.

(B) The proposed system has a vertical panel which can fit on any wall of house or office. The only condition to be satisfied is that wall should be facing towards sunlight. Seed pots are provided to the user. A variety of seed pots can be made which may consists seeds of various vegetables, flowers etc. User has to just plug the pot on the panel. A water tank is to be connected to the panel. The panel consists of sensors which are located near to every seed inside the pot. This sensor helps to gather information of the plant parameters which can be accessed by the user on a custom designed android mobile application.

The panel also consists of a microcontroller /microprocessor which helps to control the flow of water towards the seed. A particular set point will be set for the moisture of the soil according to which the water pump will be turned on or turned off. System also has a lamp located near every pot which will be turned on in absence of sunlight.

III. Analysis

This system consists of three controllers, 1 master and 2 slaves. Three different types of sensors are used here i.e. temperature sensor, soil moisture sensor and light detection sensor. Output of all these three sensors is analogue which is converted into digital one using a 10 bit inbuilt ADC within the slave controller. Slave controller stores the data into its own memory and transmits it to the master whenever asked. Master then receives the data and uploads it on the server. The data can be accessed by the user using the android mobile application. A power supply of 12 V regulated down to 5V and 3.3V which can be used by the microcontrollers, Sensors and WiFi Module.

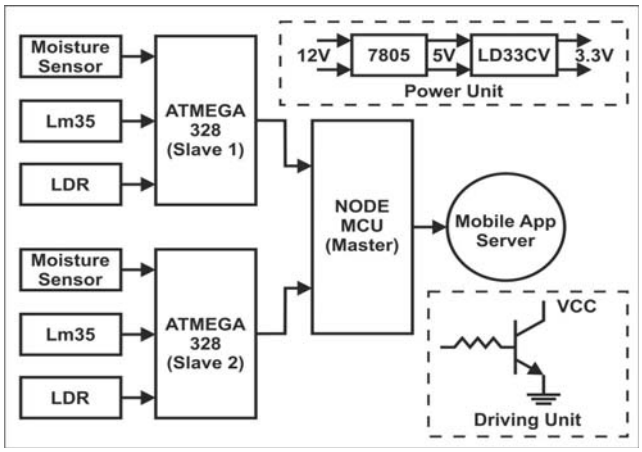


Fig. 1 : Basic block diagram

IV. Design

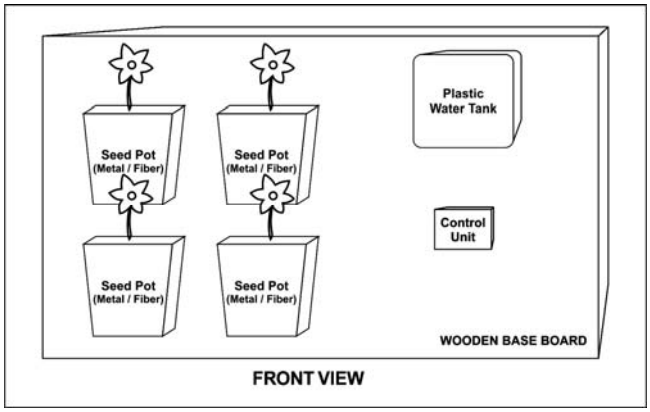


Fig. 2 : Front view of panel

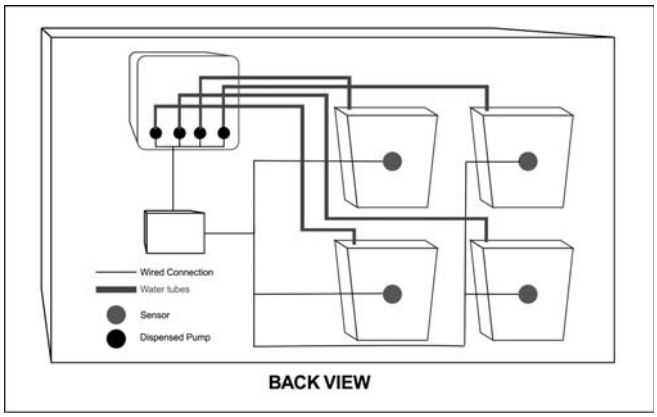
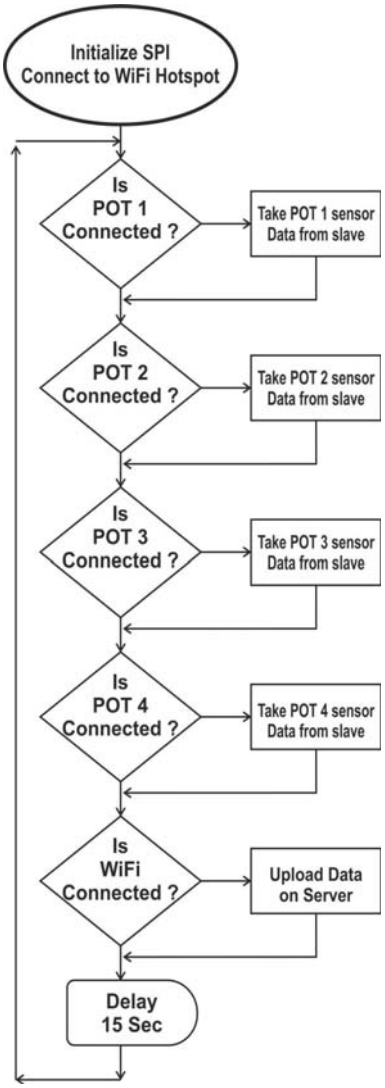
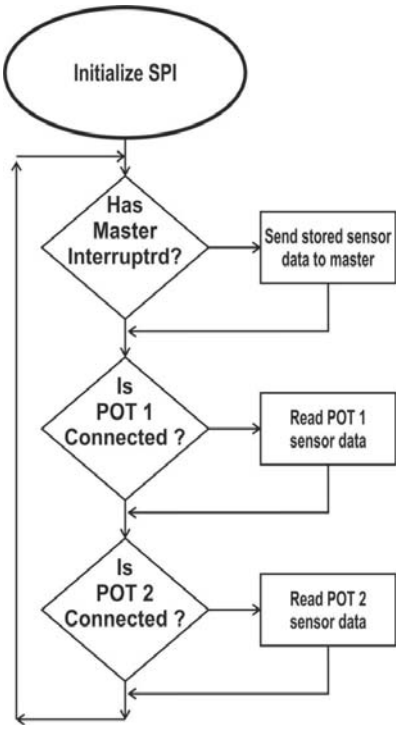


Fig. 3 : Back view of panel

Flow Chart: Master



Flow Chart: Slave



V. Methodology

This project can be explained in following phases

Phase 1 : Collection of data from sensors

In this phase the sensors such as temperature, humidity and light are used to sensor the parameters and send them to ADC for converting them into digital values to be processed by the microcontroller.

(1) Temperature :

A LM35 is used to sense the room temperature and continuously monitor the real time data using the following formulas.

Vout=10mV / ºC

Vout=0.01 / ºC

ºC = Vout / 0.01

ºC = Vout × (1 / 0.01)

ºC = Vout × 100

Thus,

Temperature = (VCC × Vout X 100) / (ADC Resolution)

Temperature = (VCC × Vout X 100) / (1024)

(2) Light :

A light dependent resistor (LDR) is used as a light sensor to sense the light around the plant. Resistance of this resistor decreases with the increase in the light. This means that output of this sensor is in form of Voltage. Thus calibration has to be done with respect to lux(Light).

(3) Moisture :

A conventional soil moisture module is used for sensing the moisture in the soil. This module has a analog output pin as well as digital output pin which gives us analog and digital values of moisture around the soil.

Phase 2: Serial communication between slaves and master

Once the data is gathered by the slave, it has to send to the master for uploading it on sever. Thus serial communication is used by slave for sharing of data. Four major pins are used for this purpose.

(1) Master In Slave Out (MISO) :

On this pin master receives data from the slave controller. This data can be any sensor value asked by the master.

(2) Master Out Slave In (MOSI):

This pin helps master to ask the sensor data to slave controller so that it can be uploaded on cloud. Master uses certain codes to ask for a specific data.

00: Moisture sensor 1
01: Temperature sensor 1
02: Light sensor 1
03: Moisture sensor 2
04: Temperature sensor 2
05: Light sensor 2
06: Motor 1
07: Motor 2
08: Connect Pot 1
09: Connect Pot 2

(3) Clock (Clk) :

1 Mhz Clock frequency is used for synchronization between masters and slaves during serial communication.

(4) Slave Select (SS):

As master is having to it, SS pin helps to select the slave which is connected. If SS=0 interrupt is executed or else it is considered that slave is not connected.

Phase 3: Uploading data on server

After the data is received by the master it has to be uploaded on the server. For this a free server (thingspeaks.com) is used. Private channels are created on the server which helps to store the data on the server and display it on the mobile application. Each channel provides with 8 fields. Such four channels are used to store and display the data.

Channel 1 : Slave 1

Field 1: Moisture sensor 1
Field 2: Temperature sensor 1
Field 3: Light sensor 1
Field 4: Moisture sensor 2
Field 5: Temperature sensor 2
Field 6: Light sensor 2
Field 7: Connect Pot 1
Field 8: Connect Pot 2

Channel 2 : Slave 2

Field 1: Moisture sensor 1
Field 2: Temperature sensor 1
Field 3: Light sensor 1
Field 4: Moisture sensor 2
Field 5: Temperature sensor 2
Field 6: Light sensor 2
Field 7: Connect Pot 1
Field 8: Connect Pot 2

Channel 3 : Motors

Field 1: Moisture Motor 1 automation ON or OFF field (1=ON, 0=OFF)
Field 2: Motor 2 automation ON or OFF field (1=ON, 0=OFF)
Field 3: Motor 3 automation ON or OFF field (1=ON, 0=OFF)
Field 4: Motor 4 automation ON or OFF field(1=ON, 0=OFF)
Field 5: Motor 1 Threshold Value
Field 6: Motor 2 Threshold Value
Field 7: Motor 3 Threshold Value
Field 8: Motor 4 Threshold Value

Channel 4 : LED

Field 1: LED 1 ON or OFF Field (1=ON, 0=OFF)
Field 2: LED 2 ON or OFF field (1=ON, 0=OFF)
Field 3: LED3 ON or OFF field (1=ON, 0=OFF)
Field 4: LED 4 ON or OFF field(1=ON, 0=OFF)

An API Key is provided by the server for every channel which helps the mobile application to access every channel. Also ESP266WiFi.h library is used for the connection protocol between the NODE MCU and server. ESP 8266HTTP Client.h is the library used for uploading and receiving the data from the server.

VI. Scope

There is always a chance to improve any system as research and development is an endless process. Our system is no exception to this phenomenon. Also the future scope of this project is it can also be designed to detect the particular disease on the plant and suggest the proper curative measures on it.

(1) Further implementation of sensors and features
Many more sensors, particularly, the gas, and pH sensor can be interfaced in the project to provide the results about the soil.

(2) Can be used in commercial areas
This project also allows you to create living walls in any shape or size in any room in the house or office.
Thus by incorporating these changes a "Market Ready Product" can be made out of our project.

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Mathematical Modelling of Temperature under Various Parameters & Validation through Sensor Array

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ABSTRACT

High precision temperature control applications can be developed with proper knowledge of the temperature dynamics inside the required system along with an accurate mathematical model of its temperature profile. Hence in this project we are developing a mathematical model for the temperature profile of an actual physical system and validate it by measurement of temperature inside the system using a sensor array.

It is observed that the major factors that affect temperature in any system are heat sources, cooling sources, air circulation inside the system, thermal properties of the structure material, humidity, composition of air inside the system, local temperature disturbances and level of thermal isolation. We will be finding the relations between these parameters and temperature, and subsequently generating mathematical expressions to define these relations in an accurate and quantifiable manner. Using these relations the mathematical model of temperature profile of the system has been designed.

An actual physical system has been constructed with all the necessary hardware to validate our mathematical model. A cubic box of plywood will be made. A heating coil, a Peltier module, air inlet, door, a metallic wall and a fan will be included inside it. An array of sensors will be placed inside the box to measure the temperature in each part of the box. Controlled perturbations are induced in the system using the components mentioned above and we will track the temperature changes in the box in response to these perturbations.

Finally, we have tried to validate our mathematical model by comparing the predicted temperature values obtained from the model and the actual values obtained from sensor array inside the system.

Keywords **:**
Mathematical modelling, Temperature Profile, Sensor Array, Control Systems, Parameter tracking.

I. Introduction

The main motivation behind this project is to learn about the development and the practical implementation of a mathematical model by developing a real-time application for temperature profiling. We want to capture the dynamics of real life changes at physical layer through the mathematical model and examine how the variables which will be found inside the system will be affecting the change and the rate of change of temperature inside the system.

The knowledge of the controlling parameter dynamics is essential to design an efficient and precise control algorithm. Hence mathematical modelling is a pre-requisite step in any critical control application. It can be considered as the preliminary step to development of any high accuracy control system design.

Temperature control is required in a variety of application. Temperature profiling of a system is an important step required before achieving temperature control and high precision temperature control applications are possible only due to accurate modelling of the required system. Temperature variation is a relatively slow process and thus we can track it in a fairly accurate manner and create a reliable temperature profile. Consequently it becomes possible to study transient behaviour of temperature. Hence development and validation of the mathematical model of a temperature profile of a system is more feasible than other physical quantities or parameter.

The final objective is to create an accurate mathematical model of the temperature of a system considering different parameters and perturbations, which can be used for various applications, which will later be validated by the hardware system designed to obtain the desired results.

II. Problem Statement

1. Create a theoretical model using fractional order differential equations. In the recent years fractional order calculus has been proved to be a useful tool to model systems with much better accuracy.
2. Designing a physical system as shown and will track the temperature inside it in real-time. Monitor the temperature dynamics in response to various perturbations.
3. Validate our model with the actual readings obtained from the system.

III. Proposed System Design

The system is designed in order to validate our mathematical model. Practically, it is going to be used to develop the model as well. It contains hardware to create conditions required to produce temperature disturbances in the system and an array of sensors that will continuously monitor the temperature at various nodes in the system. The system in itself is a fully functional data acquisition system and can be used in temperature monitoring applications.

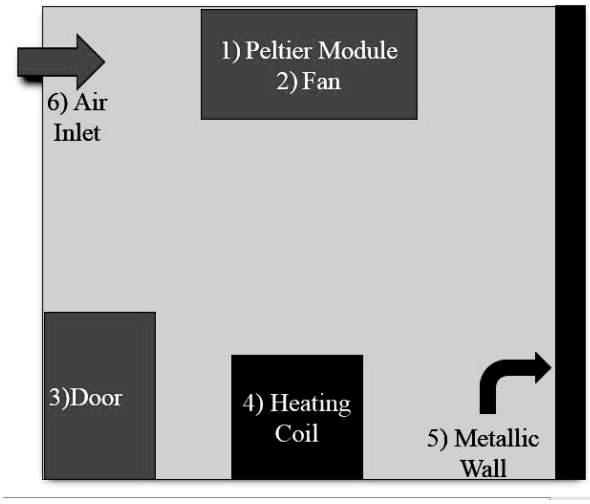

Fig. 1 Proposed System Design

The proposed system diagram, consists of six factors that can cause perturbations in temperature in the system inside a cubic box. There is a Peltier cooler unit situated at central position on the top surface of the system which will be one of the parameters affecting the temperature. It will act as a heat sink inside the system. Along with the Peltier cooler a fan is situated to internally circulate air in the system. A door is located at a lower position on a sidewall of the system with a mechanism to make sure that the system will remain thermally insulated. Opening of the door induces a sudden temperature bias in the system. This causes the system to undergo a transient before regaining temperature stability. At the bottom surface of the system a heating coil is placed. It acts as a heat source to system. A sidewall of the system will be made of metal. This eliminates the thermal isolation of the system creating a bias near that side proportional to the temperature difference inside and outside the system. Also, we will be able to observe the changes and effects of changes that will take place due to change in structure material and how it will affect the overall temperature profile of a system. The last component is a cavity on a sidewall through which air will be pumped into the system. It will create a localized disturbance in the system.

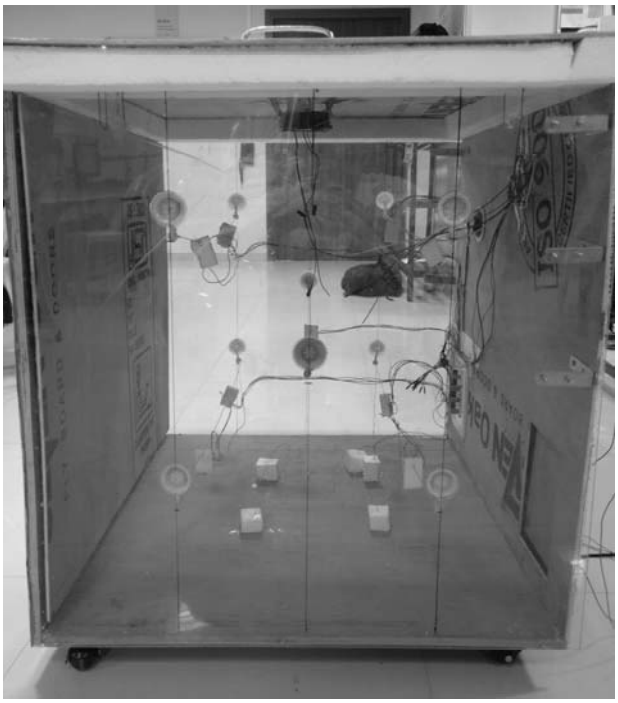

Fig. 4 Actual System Implementation

IV. Mathematical Modelling

The sensor placement geometry decides where the sensors are going to be placed at different locations inside the systems so that optimal temperature measurement will be done and even minute changes in the temperature of the air circulating inside the system will be captured with the help of the sensor We have worked out on two sensor array geometries that can monitor the temperature in the most suitable manner.

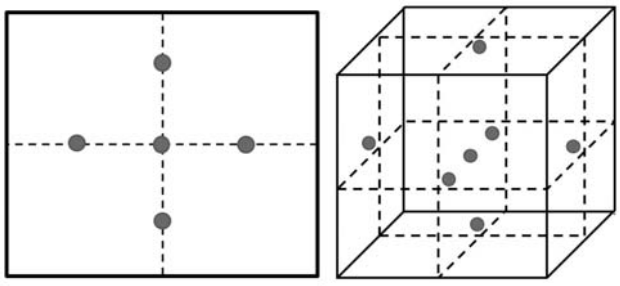

Fig. 2 Front view and Isometric View of the system using (6+1) sensor placement geometry

In the above figure, the front view of the system with sensor placement geometry of 7 sensors is shown. Here the number of visible sensors are 5 and the remaining 2 sensors are hidden behind the central sensor which are not visible in the front view. Those sensors can be seen in the isometric view of the system which are not visible in the front view of the system. The disadvantage of using this geometry is that as our system is cubic in shape the corners of the system remain comparatively isolated and faithful temperature monitoring is not possible

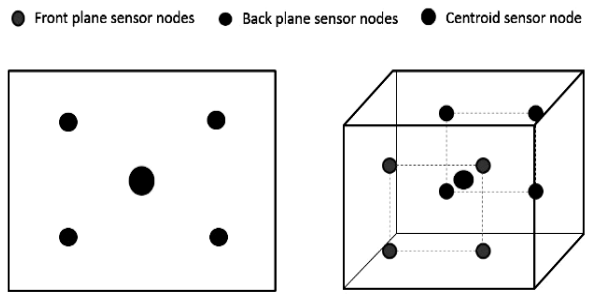

Fig. 3 Front view and Isometric View of the system using (8+1) sensor placement geometry

In the above figure, the front view of the system with sensor placement geometry of 9 sensors is shown. Here the number of visible sensors are 5 and the remaining 4 sensors in the back plane are hidden behind the 4 front plane sensors which are not visible in the front view. Those sensors can be seen in the isometric view. This geometry is more suitable for our application and has been implemented in this project.

V. Mathematical Modelling

(A) Peltier Module

The heat taken away from the system by the Peltier module is given by Q = -P*I*t; where P is the Peltier Constant, I is the current passing through the module and t is the time for which the Peltier module absorbs heat.

(B) Heating Coil

The heat generated by the coil in the system is given by $Q = (V^2 / R)*t$; where V is the voltage across the heating coil, R is the resistance of the coil and t is the time for which the heating coil radiates heat.

(C) Metallic Wall

The heat induced in the system due to this wall is directly proportional to the area of the sheet and the temperature difference between the two sides of the wall and inversely proportional to its thickness.

Q = kA(Tout - Tin)/(d); k is the thermal conductivity of the sheet, A is its area, Tout is outside temperature, Tin is the inside temperature, d is the thickness of the sheet.

(D) Door

The opening and closing of the door is a sudden action, not a gradual change of position. Also when the door is closed there is proper thermal insulation in the gap. Hence the only factor that can induce change in temperature is the number of times the door is opened or closed.

(E) Air inlet

The temperature difference produced due to the inlet depends upon the velocity with which the air is pumped and the temperature difference between the air inside and outside.

(F) Fan

Fan provide thermal stability to the overall system. The transient response time due to introduction of thermal disturbances is reduced significantly when the fan is on

VI. Conclusion

The system implementation was completed successfully and data obtained from the system is stored properly. Modifications are required in the mathematical model for successfully validation.

In the future, the number of parameters affecting the conditions inside the system can be varied so that it can be used at different places in different situations and will display different outputs for the same. More parameters affecting the temperature can be added such as humidity, composition of air in system etc. In addition we can implement fractional order differential equations based mathematical model in the future so as to improve the accuracy of the predicted outputs. It will also help to model the dynamics of the temperature in a better way. With the help of the available mathematical model we will be able to design a control algorithm to control the temperature of the system. Such control algorithm can control the temperature smoothly with great precision even with the presence of strong perturbations inducing parameters in the system

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Design of 16T Full Adder Circuit Using 6T XNOR Gates

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ABSTRACT

Adders are most useful circuits for processor and microcontroller designs such as multipliers, shifters and other complex VLSI applications. This paper proposes design of 16T–one bit full adder circuit comprising of XNOR gates, pass transistors and transmission gate logic. The design includes two 6T XNOR gates and one 2:1 MUX. Functionality of the design is faithfully verified using Cadence Virtuoso Simulation tool using GPDK 180nm technology. The W/L ratio of 2µm/180 nm is considered for all the transistors. The performance of 16T single bit Full Adder has been investigated and evaluated by the simulation results obtained from the improved design of XNOR gate and has resulted in improvement of power dissipation and output voltage.

Keywords **:**
6T XNOR gate, 16T Single bit Full Adder, Transmission gate logic (TG), Pass Transistor Logic (PTL), GPDK 180nm, Cadence Virtuoso.

I. Introduction

Multi-bit Adders are most useful circuits for processor and microcontroller designs. Also adders are mostly used in cascade configuration to drive the next logic in the digital circuit. All the basic arithmetic operations in a circuit is done using Full Adder (FA). So the overall logic and performance of the circuit is mainly dependent on the full adder output. Adders must provide Good driving capability and accuracy in output logic. Therefore, the driving capability of a full adder is very important. If the full adders lack driving capabilities then it requires additional buffer, which consequently increases the power dissipation.

It is well known that the Exclusive-NOR (EX-NOR) gates plays significant role as a basic building block in the design of complex digital circuits. Many researchers have suggested novel designs of Adder circuits using XNOR as basic building block [1-5]. We have first implemented 2T XNOR gate and 6T single bit adder as proposed by Krishna Chandra et al. [1]. However, performance of basic 2T XNOR gate and 6T single bit adder was not satisfactory. Therefore, in our paper, we have made an attempt to improve the performance of the basic 2T XNOR gate by proposing modified 3T and 6T XNOR gate designs W/L ratio of 2µm/180nm is retained same to make the design compatible with GPDK 180nm technology. Finally, a design of 16T single bit Full Adder circuit is proposed using two cascaded 6T XNOR gates and a 2:1 MUX using transmission gates.

Modified design of 6T XNOR is built using pass transistor and transmission gate logic which facilitates to enhance the driving capability for all input conditions. This in turn helped to improve the Adder performance.

The paper is organized as follows - In section II overview of pass transistor logic, transmission gate logic, single bit FA along with its disadvantages is presented. In section III, basic 2T XNOR gate and design of modified 3T and 6T XNOR gates are described along with its improved performance. In section IV simulation results of our proposed design i.e. 16T single bit Full adder discussed. In section V comparative study is done. Conclusion and future scope is given in section VI.

II. Overview

(A) Pass Transistor Logic and Transmission Gate logic

In VLSI technology Pass Transistor Logic (PTL) is used to reduce the transistor count and simplify the complex logic. But the major disadvantage of PTL is that when the data ‘0’ is passed through the NMOS pass transistor, it is received accurately at the output and when a voltage of 5V is applied as data input to NMOS pass transistor, the output received is 5V-Vth (threshold voltage).Similarly PMOS pass transistor passes logic ‘1’ effectively whereas logic 0 is received as 0V+Vth. In brief, NMOS in PTL passes strong ‘0’s and weak ‘1’s whereas PMOS in PTL passes weak ‘0’s and strong ‘1’s. To overcome this disadvantage of PTL the Transmission Gate Logic is used [3]. It uses both the NMOS PT and PMOS PT

together in order to send both the data '0' and '1' effectively. In this logic drain of PMOS transistor is connected to source of NMOS transistor and source of PMOS is connected to the drain of NMOS. Whereas the gate terminals of both the transistors are driven by control signal and its complement. When PMOS is off, NMOS is on and it will pass data of logic '0' effectively and reversely when NMOS is off and PMOS is on, it will pass data of logic '1' effectively.

III. Design and Development of XNOR gate

(A) The Basic 2T XNOR Gate[1]

Basic 2T XNOR gate structure as proposed by Krishna Chandra et al. [1] is shown in Fig.2. Gate is implemented using Pass transistor and is simulated using GPDK 180nm technology in Cadence Virtuoso environment. The W/L ratio of both PMOS and NMOS is same i.e. 2um/180nm.

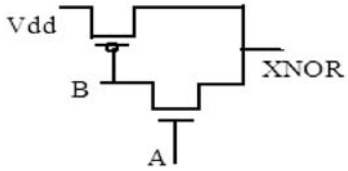

Fig.1 Existing 2T XNOR circuit diagram

Table 1 : Truth Table for Xnor

A	B	OUT
0	0	1
0	1	0
1	0	0
1	1	1

The given circuit should work ideally as XNOR gate and give output values as TABLE I .The practically obtained output is deviating for some conditions. For input conditions, AB=00, AB=10, AB=11 the outputs are satisfactory. When A= 0, B=1, i.e. when both transistors are in OFF state, the logic "0" output is expected. However, it is observed that the voltage level of 3.13 V which is interpreted logic "1" appears at the output. This situation arises because both the transistors are in cut off state and it results in high impedance state at the output node. The analyzed voltage output for different combinations of AB are given in the TABLE 2.

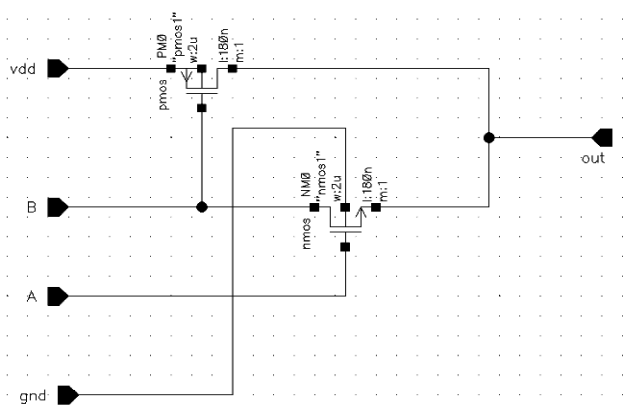

Fig. 2 Existing 2T XNOR schematic diagram

Table 2 : Analysis of Basic 2t Xnor

A	B	Voltage level (v)	Output
0	0	3.3	1
0	1	3.13	0 (HIGH IMPEDANCE)
1	0	358mV	0 (WEAK)
1	1	2.546	1

(B) Intermediate 3T XNOR gate

To avoid high impedance state obtained in previous 2T XNOR at output node for condition AB=01, NMOS transistor is added. Gate, drain and source terminals of NMOS are connected to B, out, A respectively. The main purpose of added NMOS is to force output to logic level '0' when other two transistors in the circuit are in cut-off state.

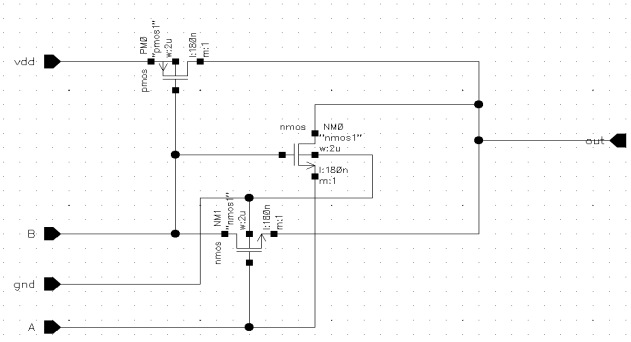

Fig. 3 : Intermediate 3T XNOR schematic diagram

The output obtained from the schematic is shown in Fig.7. It is evident from output waveform of modified XNOR gate that the drawbacks of basic 2T XNOR are successfully overcome such that for condition AB = 01, high impedance state at output node is avoided. But from waveform it can be also observed that output voltage level is poor. To overcome this problem we have modified 3T XNOR to 6T XNOR using transmission gate logic.

(C)Improved 6T XNOR gate

As a solution to problem of poor output voltage level, modified 6T XNOR gate structure is shown in Fig 4.In modified 6T XNOR combination of PTL and TG is used [3]. PTL is used to reduce transistor count by using only one PMOS, when TG always has to transmit logic level '1'. Similarly NMOS is used to transmit logic level '0'.From the output waveform of the modified 6T XNOR in Fig 4. it is evident that all the drawbacks of 2T and 3T XNOR are overcome with improved output voltage level.

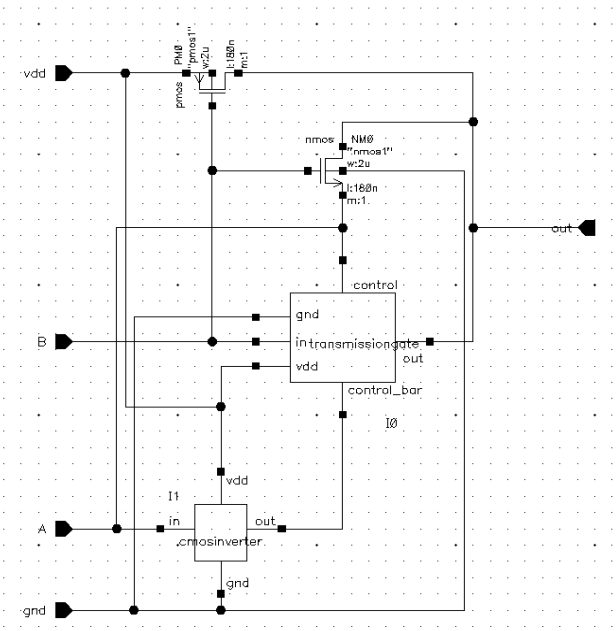

Fig. 4 Improved 6T XNOR schematic diagram

(D) 16T single bit full adder using 6T XNOR gates

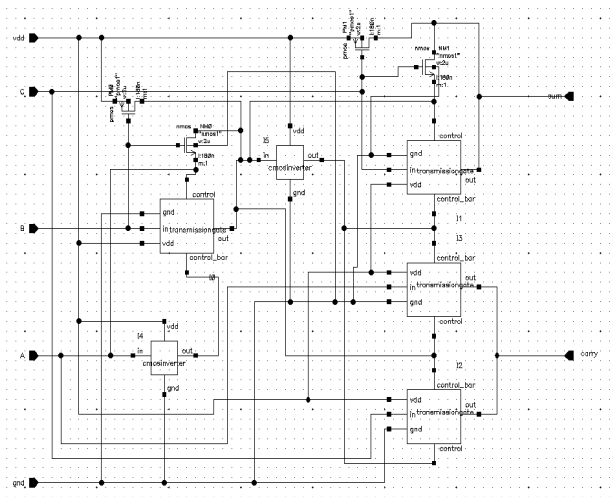

Fig.5 : 16T Single bit FA using 6T XNOR schematic diagram

The proposed 16T single bit FA using modified 6T XNOR gates and a 2:1 multiplexer is shown in the Fig.5. The output voltage levels of the proposed 16T single bit FA design is shown in TABLE III. From the output waveform in Fig. 9 good driving capability and low power consumption is obtained.

Table 3 : Analysis of Basic 16t Full Adder

A	B	C	SUM	SUM	CARRY	CARRY
0	0	0	358 mV	0	-678.26 nV	0
0	0	1	3.3 V	1	-409.99 nV	0
0	1	0	3.3 V	1	-4.4038 µV	0
0	1	1	2.267	0	3.3 V	1
1	0	0	3.3 V	1	140.96 µV	0
1	0	1	358 mV	0	3.3 V	1
1	1	0	358 mV	0	3.3 V	1
1	1	1	3.3 V	1	3.3 V	1

IV. Simulation Results

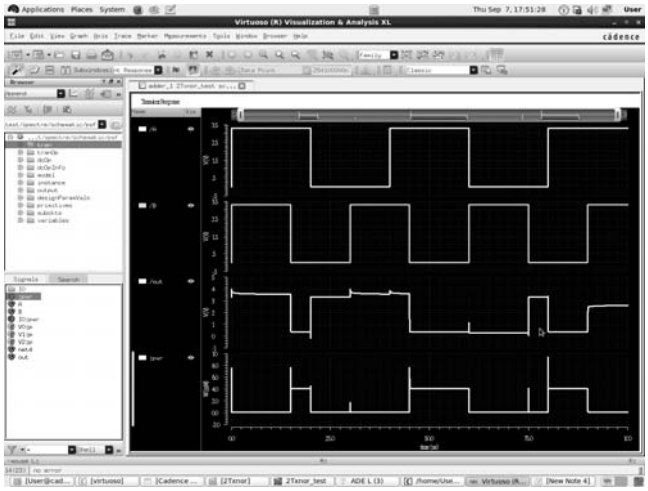

Fig. 6 : Existing 2T XNOR output waveform

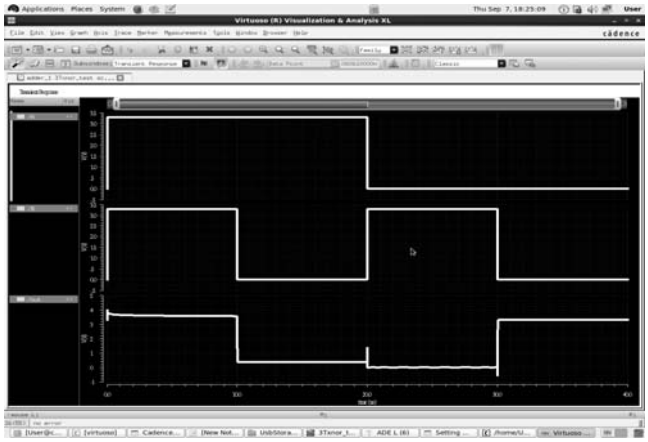

Fig. 7 : Intermediate 3T XNOR output waveform

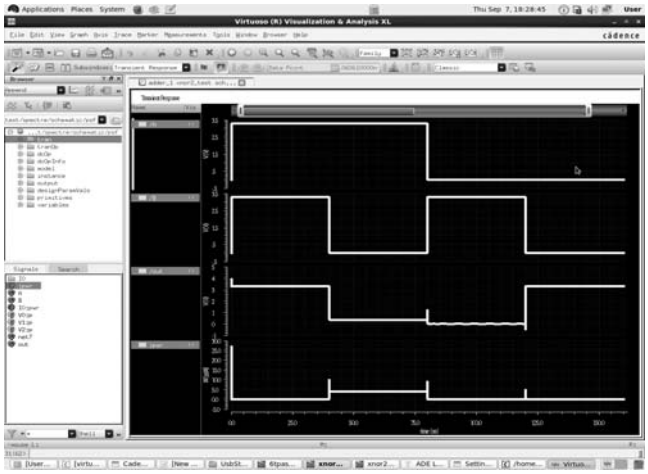

Fig. 8 : Improved 6T XNOR output waveform

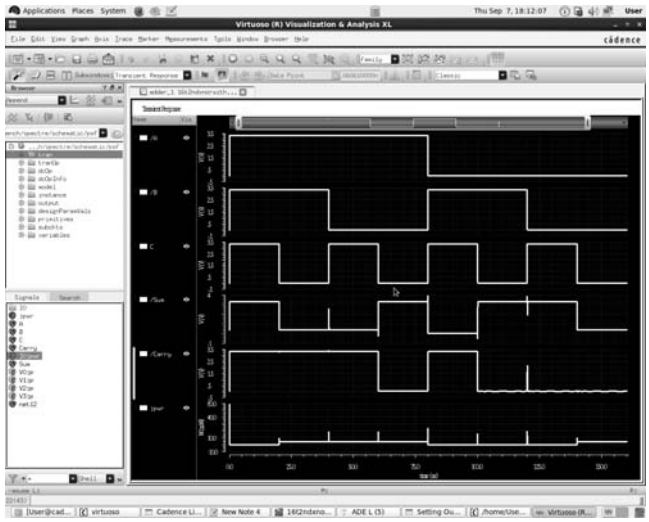

Fig. 9 : 16T single bit FA using 6T XNOR output waveform

V. Comparative Study

Average Power and delay of the proposed 6T XNOR gate and basic 2T XNOR gate proposed by Krishna Chandra [1] is compared in the table IV. Average power is improved by 16.58% at the cost of increase in delay. Decrease in average power is attributed to the fact that transmission gate has low ON time resistance compared to the pass transistor logic. Average Power and delay (sum and carry) of the proposed 16T single bit full adder and 6T single bit full adder proposed by Krishna Chandra [1] is compared in the table V. Average power is improved by 68.34% at the cost of increase in delay.

Table 4 : Comparison Of Improved 6t Xnor Gate With Basic 2t Xnor Gate [1]

Parameter	2t Xnor	6t Xnor	% change
Average power	1.218mW	1.016mW	16.58% (DECREASE)
Delay	15ns	40ns	166.66% (INCREASE)

Table 5 : Comparison Of Proposed 16t Single Bit Full Adder With 6t Adder [1]

Parameter	6t Full Adder	16t Full Adder	% Change
Average Power	6.462mW	2.04mW	68.34% (Decrease)
Delay (i/p to sum)	1.58psec	9.35psec	488.36% (Increase)
Delay (i/p to carry)	7.418psec	13.61psec	83.67% (Increase)

VI. Conclusion And Future Scope

In this paper, we have proposed a single bit 16T full adder using two modified 6T XNOR gates and a 2:1 multiplexer. Design of XNOR gate is proposed which is used as a basic building block in the adder circuit. This proposed design gives satisfactory functionality in respect of output logic level for all possible input combinations. The performance of 6T XNOR gate and 16T single bit FA has been investigated and evaluated using GPDK 180nm technology of Cadence Virtuoso Tools. Average power is significantly improved for 6T XNOR gates as well as 16T single bit FA at the cost of increase in delay.

The proposed single bit FA can be used in complex circuits such as ALU's, multipliers where good driving capability and accuracy in output logic is desired. The delay of improved 6T XNOR gate and subsequently of 16T one bit Full Adder can be enhanced by further modifying the design of the circuit with reduced transistor count.

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Smart Refrigerator

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ABSTRACT

Intelligent appliances with multimedia capability have been emerging into our daily life. Thanks to the fast advance of computing technology and the wide use of the Internet, smart city is one of the most prominent areas of intelligent appliances. The Smart Refrigerator module is designed to convert any existing mini refrigerator in a hotel room into an intelligent refrigerator. The smart refrigerator is capable of sensing and monitoring its products which are been consumed by the consumer. This will be done by using breakable RFID tag to keep a check on the products. With smart sensing technology, this refrigerator will keep a check on the products which a consumer may have consumed while residing in the hotel room. It gives a readymade bill at the reception counter during the time of checkout.

Index Terms : *Billing systems; breakable RFID tags; RFID reader module; smart refrigerator***.**

I. Introduction

Smart environment with smart technologies" is the new concept which every industry and research is focusing on. Research is already underway for making our environment elderly-friendly and hence on similar grounds, smart environment with technology enabled appliances are the need for professional workers as well. In recent time, rapid growth of IOT devices in smart home environment envisioned a wide range of novel services and applications. The focus of our project is on the smart fridge in high end hotels for keeping a check on the amount of products used from the fridge which helps in the billing at the checkout of the user. Many efforts in the development of the smart refrigerator have been made, none of which has been energy efficient or cost effective.

II. Conceptual Smart Fridge Models

In this section, we describe some of the emerging smart fridge concepts and features contributed by different manufacturers. 2.1. Siemens Cool Media Fridge Freezer Siemens Cool Media Fridge Freezer KG39MT90 has built in 15" LCD TV and comes with remote control and cable or DVD sockets. The difference between this LCD TV and other TV is that the screen can be swiveled out. So you can cook and watch Siemens Cool Media TV from practically anywhere in the kitchen. The fridge aims to encourage eating and watching TV in the kitchen areas rather than in the living room.

2.1 LG TV Refrigerator

2008 International Symposium on Ubiquitous Multimedia Computing 978-0-7695-3427-5/08 $25.00 © 2008 IEEE DOI 10.1109/UMC.2008.17 39 The newest LG TV Refrigerator LSC27990TT [11] has remote-controlled, cable-ready 15" LCD TV with DVD connection and FM radio, also has 4" Weather Plus LCD display with forecasts based on users' area, date/time, calendar with alarm, eight-category recipe bank with 100 preloaded recipes and personal digital photo album. Other features include child lock function, room temperature display, digital user manual and product controls.

2.2 Electrolux Screen Fridge

The Electrolux Screen Fridge has the function of broadband connection and TV via wireless connection. As if Internet, email, phone, radio and MP3 player are not enough, not only comes with the 15" touch screen and pop-up keyboard, but also Electrolux adds highly advanced calendar and video messaging system so the kitchen truly becomes the center hub in the house. Every morning, users can check weather and traffic conditions, business appointments with Screen Fridge personal organizer, before you leave, and also easily print out updatable electronic shopping list. The refrigerator is also accessible by remote access feature.

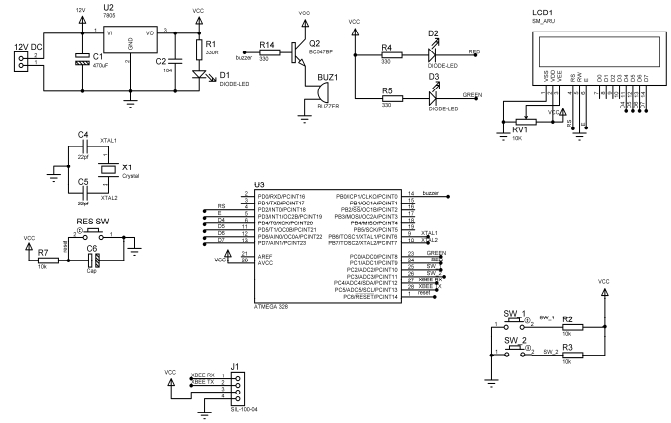
2.3 Samsung Smart Zipel Refrigerator

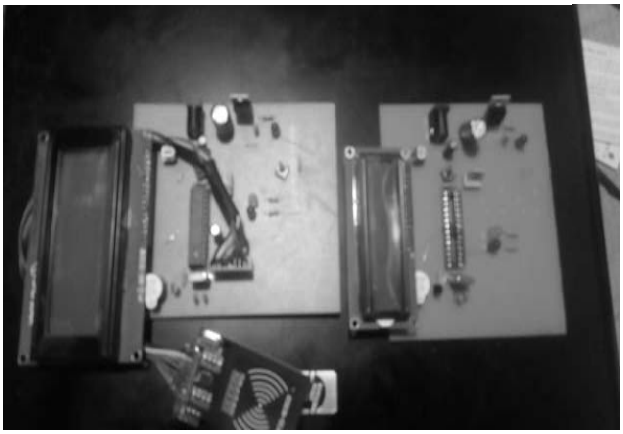
If you're the one who can't be without TV or connectivity to the net even for a second, Samsung has its Smart Zipel refrigerator for you that wears a 10.4-inch wireless LCD screen on its chest like a badge of honour. The 4x3 flat panel display lets you connect to anything remotely multimedia such as video or the Web. The Internet access might be convenient if you need to display a recipe you've found on the Web while you're busy preparing it in the kitchen. Details are sketchy at this point with no pricing or availability information forthcoming, but the refrigerator looks like a fairly highend unit, capable of holding 26.6 cubic feet of groceries.

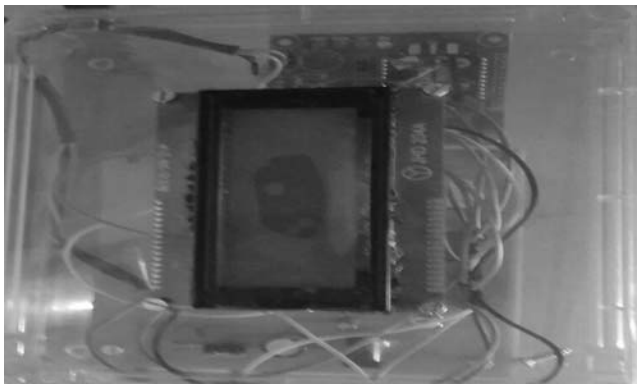
III. Comparison with the Existing System

In today's world time is our most precious resource. The luxury hotels have to keep themselves updated. With growing technology, there should continuous increment in the billing system. Currently when a consumer checks out of the hotel room manual help is needed to keep a check on what items are consumed from the refrigerator. This process requires extended time as it starts after the consumer checks out of the hotel room. Once the manual help provides with the information of the items consumed the billing takes place which again consumes extended time.

IV. Design







V. System Operations

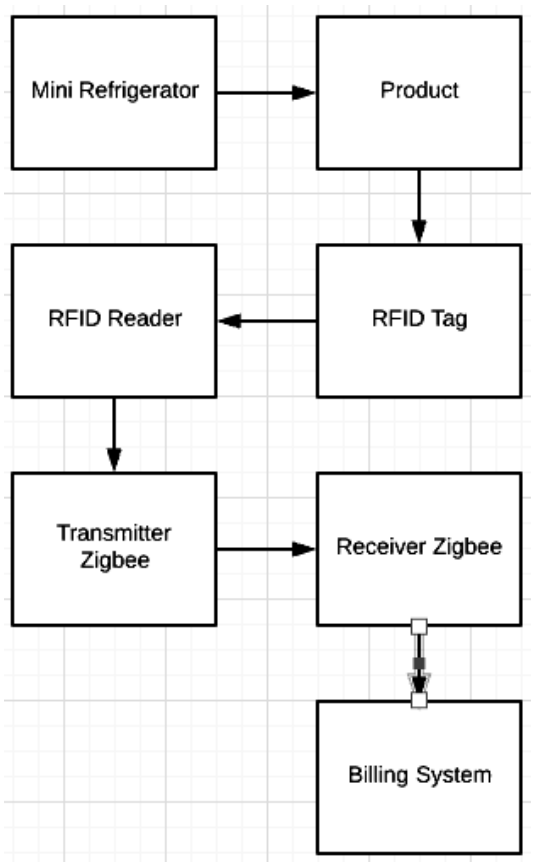


Fig.1 Block Diagram

Here we observe in the block diagram, assuming a consumers checking into a high end hotel having the smart refrigerator facility. The smart refrigerator is stocked up with different products considering it to be drinks, food items, etc. which is charged when consumed.

Each product in the smart refrigerator has a breakable paper RFID tag attached at the seal of the product. An RFID reader is attached on the ceiling of the mini smart refrigerator. This RFID reader has a range which covers the whole refrigerator. When a consumer utilizes any of the products fom thr refrigerator he is bound to break the seal of what so ever product he might aim to consume. As the RFID tags are breakable and are made out of paper they can be broken easily with the seal itself of the product. Sp even if the consumer breaks the seal of the product he or she will have to pay for whatever tag of the product has been broken.

When the consumer takes out a product out of the smart refrigerator the RFID reader scans the products and sends it to the transmitting module. The transmitter and the receiver are connected using Zigbee as the range of Bluetooth isn't that large as of Zigbee. A receiver zigbee and a transmitter zigbee is been interfaced using the XCTU application. So when the RFID reader sends the data of the product utilized from the smart refrigerator to the zigbee transmitter module it automatically transfers the data as the door of the refrigerator closes.

Now the receiver zigbee is at the reception lobby of the high end hotels where the check outs takes place. As the the data of the products used by the consumer is send it adds up all the products which are been utilized and creates a bill at the reception itself. This reduces wastage of time of the consumer a the reception lobby during the check out period and secondly it it reduces the human labor which is been needed when you check out of your hotel room. A person is sent to your room to check what all products are been utilized which will not be needed using smart refrigerator.

VI. Limitations

Although many RFID implementation cases have been reported, the widespread diffusion of the technology and the maximum exploitation of its potential still require technical, process and security issues to be solved ahead of time. Today's limitations of the technology are foreseen to be overcome and specialists are already working on several of these issues.

VII. Conclusion

- The concept of smart refrigerator updates with the consumed items in the billing system at the billing counter.
- The receptionist doesn't need to proceed with any calculations.
- The system proposed is highly time saving.
- The system proposed reduces manual labor.

VIII. Future Scope

Proposed smart refrigerator intends to keep a check on the items consumed per room which minimizes manual labor and accurate billing system during the time of checkout. An Android application or a website can be made where the consumer could login to check the bill of that particular room number. As the consumer utilizes items from the refrigerator it will be update on the room login on the application or the website. This will help the consumer to make online payments which will save more time than it is been currently saved.

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Gesture Controlled Gadget

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ABSTRACT

The man–machine interface (MMI) is one of the most exciting areas of contemporary research. To make the MMI as convenient for a human as possible, it is desirable that efficient algorithms for recognizing body language are developed. This effortless connection required by humans to control computer and various devices is exploited by our project. The gadget can be used as a mouse to navigate on the screen by mapping the movements of our hand as well as give easy access to shortcuts in the form of hand gestures. These gestures are not restricted to static gestures and involve movement of hand in 3-dimensional space. This gadget represents a system for quick and effective recognition of gestures of hand body language, based on data from a specialized gadget equipped with 3-axis gyroscope and other sensors to map the movement of the user's fingers. The collected data would be pre-processed in multiple ways and classification algorithms belonging to Machine Learning would help in recognizing the Gestures.

I. Introduction

Our Gesture Control Gadget will provide gesture and mouse control wirelessly. It can be easily wearable device. Gestures allow individuals to communicate a variety of thoughts and feelings. Gestures are inherent in human and hence our gadget can be adoptable by anyone. The goal of this product is to capture gesture by gadget and take gesture as input and send it to computer wirelessly for further processing. The recognition of gesture is done by machine learning algorithm.

Using hand motions, finger position, and orientations user can control using HC-12 enabled electronic devices. A touch of the thumb, a jiggle of the finger, or a tilting of the hand all act as control inputs. By utilizing the gestures that most make out of simple practice, the hope is that users will forget the control glove is there at all. The device seems to do what the user wants, as though a direct line of communication exists between the user and the hardware to be controlled.

Literature Review :

Machine learning is Research from Pune University [1], The magic glove is an ordinary glove which has multitude of sensors fitted on it like the 2D gyroscope, flex sensors, force sensor. There are no classifiers or classification algorithms used. The RC car is used as a controlled device here, with the help of different gestures the various parameters like speed, steering, lights and sound are controlled RC CAR.

Miada et al. [2], Maestro Gesture Glove is a wearable technology glove used to control Bluetooth and Wi-Fi enabled electronic devices and machines with the help of hand motion, finger position, and orientation. It lets user control Applications, Games, Drones right out of the box. There total 1000 control gestures it let user assign its own gesture to the particular function. The only downside of this product is that it's expensive.

Pawel Plawiak et al. [3], it was observed that the gestures use data from a specialized glove (with ten sensors), pre-process analyzed using the machine learning algorithms. The results confirm that efficient and quick recognition of the hand body Language is possible.

The classifiers used were probabilistic neural network, k-nearest neighbors (kNN), support vector machine (SVM) from which the best classifier achieved the sensitivity equal to 98.32%.

Materials and Methods :

(A) Materials

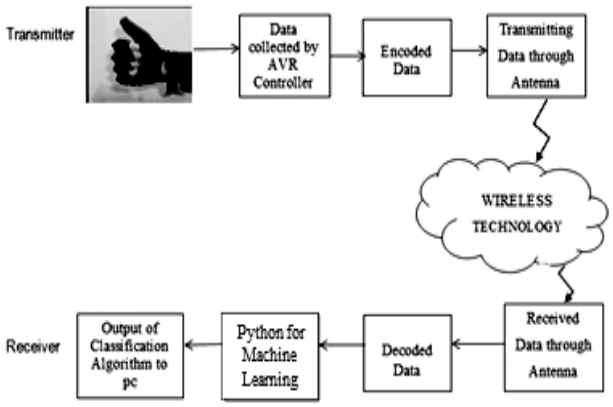
MPU 6050:

The MPU-6050 devices combine a 3-axis gyroscope and a 3-axis accelerometer on the same silicon die, together with an onboard Digital Motion Processor (DMP), which processes complex 6-axis Motion Fusion algorithms. It provides a 3-axis angular velocity which can be used to detect movement of hands. The MPU-60X0 features three 16-bit analog-to-digital converters (ADCs) for digitizing the gyroscope outputs and three 16-bit ADCs for digitizing the accelerometer outputs. For precision tracking of both fast and slow motions, the parts feature a user-programmable gyroscope full-scale range of ±250, ±500, ±1000, and ±2000°/sec (dps) and a user-programmable accelerometer full-scale range of ±2g, ±4g, ±8g, and±16g.

HC-12 :

The HC-12 is a half-duplex wireless serial communication module with 100 channels in the 433.4-473.0 MHz range that is capable of transmitting up to 1km. Serial port transparent transmission.

Block Diagram :



Working:

Movements of the user's hand are tracked using the gyroscope and various sensors. Here, we measure the angular velocity which in turn gives the path followed by the hand in 3- dimensional space. All the sensor data is normalized and processed to remove noise. This ensures success of further stages which is crucial for the accuracy and preciseness in detecting gestures.

Touch switches using MOSFETs are used to start tracking the movements of user's hand when they are touched. This eliminates the need of good support that a conventional switch requires. Also, the MOSFETs are power efficient than BJTs that is essential for the battery life of a portable device like our gadget.

```
COM3
Gesture captured
Train set: 104
Test set: 1
> predicted='O'
ZOOM OUT
Gesture captured
Train set: 104
Test set: 1
> predicted='I'
ZOOM IN
Gesture captured
Train set: 104
Test set: 1
> predicted='N'
NEXT
Gesture captured
Train set: 104
Test set: 1
> predicted='P'
PREVIOUS
Gesture captured
Train set: 104
Test set: 1
> predicted='S'
MINIMIZE
Gesture captured
Train set: 104
Test set: 1
> predicted='A'
ANNOTATIONS
```

Using a secure connection based on HC-12 protocol to transmit data reliably to the control unit. The FTDI cable is connected to the computer via USB port which sends the required data to manipulate the position of mouse pointer and keyboard by emulating a mouse-keyboard pair using pynput library.

This is used to train a machine learning classification algorithm with the predefined data set which is trained in the initial development of the product.

Classification is executed in the target computer. This helps the user in quick and effortless control over the computer. The gyroscope in the gadget also allows you to use your hand as a mouse by simply measuring the relative movement in the air. Consider the x-axis; rotation along this axis will move the mouse pointer vertically. Similarly, the rotation along Z-axis will move the mouse pointer horizontally.
Mouse button clicks can be emulated by the touch switches and the classifier determines which gesture is re-enacted by the user and the corresponding keyboard shortcuts are emulated.

Results:

Accuracy obtained using kNN(K-Nearest)
Algorithm = 100%
Sampling time = 0.1second
Gesture detection time = 0.03second
Total Predefined Gestures = 7

15 Examples of each Gesture

With each training example having 60 features, 6 features sampled every 0.1 second (3 of each axis of accelerometer and 3 of gyroscope) for 10 samples, a dataset was made with the final product. For 7 gestures and 15 training examples per gesture, we got 105 examples in our training set. These gestures were made with error introduced during the training period so that imperfections encountered when any human uses the gadget are taken into account.

Similar gestures when classified using the gadget resulted in false positives at many times and thereby reducing the accuracy of the prediction.

Conclusion :

The aim of the study was to analyze the gestures of a hand body language in order to identify them. The experiment uses data from a specialized Gadget (with Gyroscope and Accelerometer sensors), preprocessed and analyzed using the machine learning algorithms. The results confirm that efficient and quick recognition of the hand body language is possible. The best classifier achieved the sensitivity equal to 99%. The future research within the recognition of body language should proceed along two directions: implementation of the system for body language recognition based on video record-ings, and implementation of systems recognizing body language of unknown persons based on data collected for representative group of individuals.

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Intelligent Electric Bicycle

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ABSTRACT

This work presents the development of an associate degree 'Electric Bicycle System' with an innovative approach. This work shows that the normal bicycle can be upgraded to electric by some means– that includes the use of DC motor. It also uses real-time sensing; so get more people riding bikes. There are several challenges that are related to electric bike design: electric-assisted range, recharging protocol, and bike and battery checkout procedures. The proposed work outlines system requirements to successfully develop and deploy an electric bike, focusing on system architecture, operational concepts, control system algorithm and battery management. Although there is little empirical evidence, electric bike could be feasible, depending on demand and battery management, and can potentially improve the utility of existing bike systems.

Index Terms **:** *Electric bicycle, dual sprocket, motors, battery operated, smart.*

I. Introduction

The idea of a motorized bicycle isn't a recent conception and has been around for over a century. Until 1895, the electrical bicycle created its place in history. That year, Ogden-Bolton was granted U.S. Patent 552,271 for a powered bicycle with a six-pole brush-and-commutator DC hub motor mounted within the rear wheel.

The bike itself had no gears and therefore the motor may draw up to 100A with a 10V battery. Since then, the conception of the electrical bike became possible and sensible. As the years progressed, additional electrical bikes were made with varied driving mechanisms.

The electrical bicycle offers a cleaner various to travel short-to-moderate distances instead of driving a petrol/diesel-powered automotive. The value of crude has multiplied consider over the past few years and it looks to be no turning back.

The electrical bicycle could be a project which will promote each cleaner technology also as a lesser dependence on oil. It will run on clean power with the flexibility to recharge the battery three separate ways: through the AC wall supply, by generating power through the pedals of the bicycle – dynamo and by solar-cell generative power. Fashionable electrical bicycles integrate many inventions from technology and style, significantly within the past year.

II. Literature Survey

Mr. James R Turner in his work has proposed that an electric motor assembly comprises a housing and a spindle disposed to rotate in the housing. A motor is provided which comprises a stator coupled to the housing, and a rotor rotatable disposed within the stator such that the rotor is disposed about the spindle.

The assembly further includes an output driver, and a gear system operably coupled to the rotor and the output driver to rotate the output driver upon operation of the motor [3]. Similarly, T.F.Chan et al. in their work presented the design of an axial-field PM brushless DC motor drive for use on an electric bicycle. Details of the motor and the electronic converter were obtained. Performance analysis using the finite element method was briefly discussed. A prototype motor was constructed for verifying the actual performance. Good correlation between the theoretical and experimental results had been obtained which confirmed the feasibility of the proposed motor design [4].

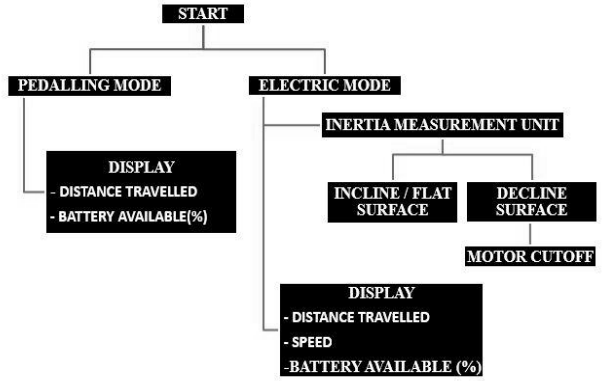
On the similar lines, Ronald W. Whittaker proposed an electric bicycle assembly with a lightweight, high performance DC electric motor and a tuned centrifugal slip clutch assembly in combination therewith. This bicycle assembly includes a two-stage start-run electric control circuitry which prevents high motor zero rpm in-rush currents which may damage the motor. Another embodiment of his invention utilizes a variable ratio V-belt drive assembly having a centrifugal clutch capability so as to engage and disengage at a predetermined RPM. Another embodiment of his invention is provided with a front wheel mounted regenerating wheel rotor assembly which is adapted to recharge batteries as needed. Final embodiment of this invention utilizes a mechanically actuated multi-stage power control switch so as to selectively provide a start circuit and two or more power control levels in the operational use thereof [5].

III. Proposed System

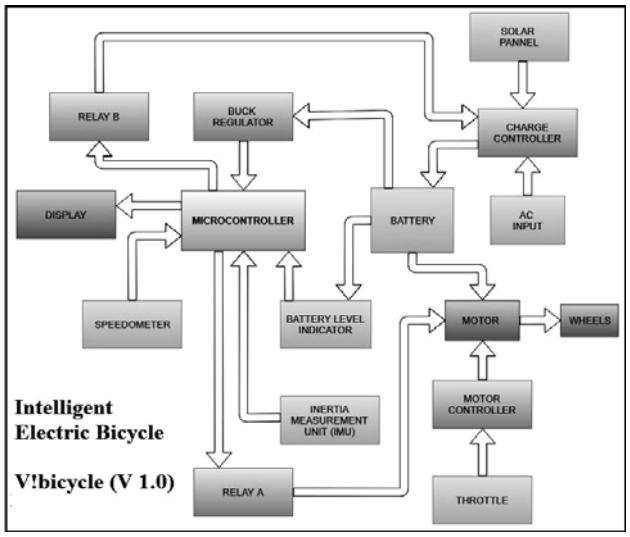
When you buy a cycle, it allows you to traverse only by pedaling. When you buy an electric bike, it allows you to ride only till the battery is charged up. So, this project basically combines these two features. It allows the rider to either use it in the electric mode by using the motor and battery or drive it in manual mode through pedaling. Also, the batteries can be charged using two methods: Solar charging and DC charging using plugin adapter. The system also includes smart features like distance and speed calibrator, battery level indicator, mode selection switches for riding and charging the system, auto charging cutoff, speed variation using a throttle as well down slope detection for switching off the motor to save

on some battery. Leave your bicycle out in the parking and switch on the charging button and return back to a fully charged vehicle for your next ride. The entire electric bicycle was built within a budget amount of Rs. 12,000. It focuses on eradication of fuel usage for travelling. A one-time investment product which can be used by a 15-year-old kid and also a 50-year-old man.

(A) System Flow Chart



(B) System Block Diagram



IV. Hardware Design

(A) Dual Sprocket Mechanism

This mechanism was installed to allow the rider to run on both pedaling mode as well as electric mode. On sprocket chain was used for the motor while the other for pedals.

(B) DC ELECTRIC BIKE MOTOR – MY1016Z2-250W

E-bike MY1016 250W 24V 2650RPM DC motor Comes with an 9-tooth, #25 chain sprocket as well as a 4-bolt mounting bracket (threaded M6) on the base. As this is DC motor it is capable of rotation in either the clockwise or counterclockwise direction by just reversing the battery polarity to the motor and can be speed controlled.

(C) Solar System

Solar Panels –

To charge the battery bank the apart from mains supply we also installed a solar system. The main part of a solar electric system is the solar panel. There are various types of solar panel available in the market. Solar panels are also known as photovoltaic solar panels. Solar panel or solar module is basically an array of series and parallel connected solar cells.

Solar Charge Controller :

Solar panels may make power at very high voltage and current. If all that is fed directly to the battery then it may get overcharged or blast (in extreme cases). This is done using Buck Converter Circuit. It controls the battery charging through the micro-controller.

(D) Microcontroller and Sensor Design

Arduino Mega 2560

The MEGA 2560 is designed for more complex projects. With 54 digital I/O pins, 16 analog inputs and a larger space for your sketch it is the recommended board for 3D printers and robotics projects. The Mega 2560 is a microcontroller board based on the Atmega2560. It has 54 digital input/output pins (of which 15 can be used as PWM outputs), 16 analog inputs, 4 UARTs (hardware serial ports), a 16 MHz crystal oscillator, a USB connection, a power jack, an ICSP header, and a reset button. It contains everything needed to support the microcontroller; simply connect it to a computer with a USB cable or power it with a AC-to DC adapter or battery to get started. The Mega 2560 board is compatible with most shields designed for the Uno and the former boards Duemilanove or Diecimila.

MPU 6050

In this project, we shall be focusing on the Accelerometer readings to map the slope angle of the system. This shall be used to control the motor on down slopes.

Magnetic Switch

The switches of magnet reed switches tend to sticking, when the specified maximum current intensity is exceeded. Contact sticking can also occur when very long connecting cables are used. To avoid this phenomenon, compensation coils can be used. In the event of magnetic reed switches being fitted too close to one another, mutual interference can occur – this can be avoided by means of shielded plates.

(E) Power Unit

Battery Pack

SMF VRLA battery pack is used. A valve-regulated lead-acid battery (VRLA battery) sometimes called sealed lead-acid (SLA), gel cell, or maintenance free battery. Due to their construction, the Gel and Absorbent Glass Mat (AGM) types of VRLA can be mounted in any orientation, and do not require constant maintenance. The system runs on 24V. Hence, two batteries of 12V/7.2 Ahr each have been used.

High Power Circuit

The motor and motor controller run on 24V. The batteries are directly connected to them. High quality industrial grade connectors have been used to assure secure connections.

Low Power Circuit

The micro-controller as well as other sensors work at 5V. The system battery voltage needs to be stepped down from 24V to 5V. This can be done using a buck converter circuit.

V. Results

The system was successfully built on a Hercules 26-inch diameter bicycle. The dual sprocket mechanism was built and the system could switch between manual and electric mode successfully.

- **Electric Mode**: Allow the rider to make use of the motor to drive the cycle and also control its speed using a throttle.
- **Charging Mode:** The system can be charged up using two techniques – Solar charging and Manual charging.

Features :

- It allows you to keep a track on the available battery charge which can be used for driving the bike.
- Auto charging cut-off.
- Auto motor power cut-off while riding down slope.
- Distance measurement unit indicating the distance travelled.
- Easy manual charging plugin option for emergency charging of the cycle.
- Solar charging for cheaper travel option.

Advantages :

- Free mode of transport
- Greener alternative for transport
- Low maintenance
- Low build up cost

VI. Conclusion and Future Scope

The design of the cycle can be improved to accommodate all the circuitry, solar panels and the battery.

- Efficiency of the system can be improved by using Li-On batteries which will also reduce the system weight.
- Better power solar panels can be used to reduce the charging time of the system
- It can be converted into an exercising machine which can display certain health parameters.
- GPS system can be installed to track the system.

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Memristor : Fabrication & Process Optimization of 22nm MIM ReRAM Device & its Performance Analysis

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ABSTRACT

The revolutionary concept of Memristor as forth missing element which links between charge and flux was first put forth by Prof. Leon Chua in 1971. This paper describes the fabrication of memristor devices based on Titanium Oxide as insulator and Gold and Aluminum as metals. Various combinations of metals are used and the effect on the IV characteristics has been studied. The oxygen flow during the deposition of Titanium Oxide in fabrication process was varied and the effect of same on the IV characteristics has been discussed.

Keywords **:**
Memristor, Fabrication, Titanium oxide

I. Introduction

For nearly 180 years, it has been accepted that there are three fundamental passive circuit elements, the resistor (1827), the capacitor (1745), and the inductor (1831). In 1971 Dr. Leon Chua theorized that mathematically there should be a fourth fundamental circuit element based on the symmetry of the equations that govern passive circuit theory. Dr. Chua called this device the memristor (short for memory-resistor), and in 2008 Hewlett Packard Labs published results of the device in physical form. MEMRISTORS are passive two-port elements with variable resistance (also known as a memristance). Changes in the memristance depend upon the history of the device. Memristive devices can be used for a variety of applications such as memory, neuromorphic systems, analog circuits, and logic design. Different characteristics are important for the effective use of memristive devices in each of these applications.

In this paper three combinations are used. 1)Au/TiO2/Au, 2) Au/TiO2/Al, 3)Al/TiO2/Al. Fabrication technique used for the deposition is sputtering. The oxygen flow during the deposition of TiO2 was varied from 0% to 30%.

II. Working of Memristor

(A) Basic working of Memristor

As Prof Leon Chua in 1971, describe that memristor can be the fourth missing element which links between charge and flux. First Memristor ever made was by HP in 2008. R. Stanley Williams and his group made the first memristor. They made MIM structure with metal as Platinum and insulator as TiO_2. The most research in fabrication of memristor is done using TiO_2. This is because the TiO_2 has the property to form TiO_2 and TiO_2-x as you can see in the figure. This the reason for the resistive switching.

Consider width of TiO_2-x as 'w' and 'l' of the TiO_2 as shown in the figure. TiO_2-x has oxygen vacancies, which means that it has high number of positive ions making it as a doped region, whereas TiO_2 is an insulator, hence acts as undoped region. When positive is applied at TiO_2-x the 'w' increases and this is called as Ron state and the device is conductive state. Similarly, when the negative voltage is applied the 'l' increases and 'w' decreases and this is Roff state and device is in resistive state.

(B) Fabrication of Memristor

The Memristor can be made as MIM or MIS structure. In this paper we have made a MIM structure with metal as Aluminium or Gold and insulator as TiO_2.

Three combinations are made:
1) $Au/TiO_2/Au$
2) $Al/TiO_2/Al$
3) $Au/TiO_2/Al$

The technique used for the deposition of gold is DC sputtering and that of TiO_2 and aluminium is RF sputtering. The deposition of metals was done under Argon environment and for TiO_2 Argon + Oxygen environment was used. Metal deposited was 100nm and TiO_2 was 22nm.

III. Requirements Of Memristive Device Characteristics

Different applications require different characteristics from the building blocks. Logic and memory applications, for example, require elements for computation and control, as well as the ability to store data after computation. These elements require sufficiently fast read and write times. The read mechanism needs to be non-destructive, i.e., the reading mechanism should not change the stored data while reading. To store a known digital state and maintain low sensitivity to variations in parameters and operating conditions, it is crucial that the stored data be distinct, i.e., the difference between different data must be sufficiently large. The transient power consumption while reading and writing, as well as static power consumption, are also critical issues.

Although the definition of a memristive system is quite broad, all memristive systems exhibit a variable resistance, which is related to an internal state variable. Memristive devices employed in practice exhibit a non volatile behavior. To provide a non-destructive read mechanism, the internal state variable needs to exhibit a nonlinear dependence on charge, i.e., changes in the state variable due to high currents should be significant, while changes due to low currents should be negligible. Other mechanisms where the state variables return to the original position after completing the read process may also require the nondestructive read mechanism. For certain applications such as analog counters, however, a linear dependence on charge is preferable, since the current is integrated during the counting process.

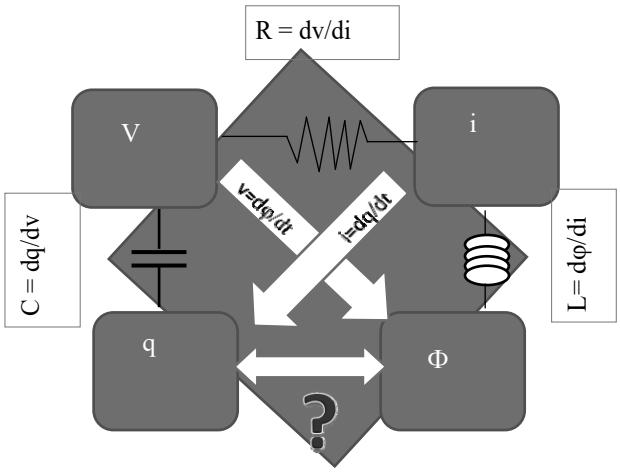


Fig. 3.1: Fundamental circuit elements and their physical relationship. Only the device relating charge and magnetic flux is missing.

(A) Mathematical Equation of Memristor

Chua predicted that, another fundamental circuit element existed and it related the magnetic flux to the charge with a simple equation. Here, M would be the value of the memresistance, a property of the memristor such like resistance is a property of resistors. In his publication, Chua defined the charge-controlled memristor as follow:

By using Faraday ‘s Law and the current definition, magnetic flux in the memristor can be re-written as
Now, the magnetic flux at any given time, t t_0, can be calculated by

The result, Equation 9, shows that the magnetic flux at a given time will depend on the history of the charge. In other words, the current behavior of this device is affected by the amount of charge that previously passed through it; this can be seen as a memory effect. Unfortunately, this idealization of a memristor was purely mathematical and not physical realization was made to demonstrate this new fundamental circuit element until recently.

(B) Fabrication Process

During this process, we will fabricate a device like the one shown in Figure 5.3.5.1. This fabrication process was developed by using standard fabrication techniques in order to ensure that current fabrication technology can be used to fabricate these memristor devices. However, some fabrication steps were not yet optimized for mass production but for research purposes.

(C) Selection of the Substrate and Substrate Cleaning

The process begins by selecting the appropriate substrate; in this case, the substrate will serve as structural support only. Since, silicon wafer is the standard substrate used in CMOS fabrication, a blank silicon wafer was selected in this case; however other materials could also be explored. The silicon wafers used during this process had a diameter of 50mm and a thickness of 525µm.These wafers were scribed and labeled for identification purposes. These wafers were cleaned by deep submersion in a solution of TCE, Acetone and Methanol respectively for 10 seconds each followed by two minutes of DI water rinsing, in order to ensure that these substrates were free of any contaminant that could affect the fabrication results.

Bottom Electrode Deposition

The bottom and top electrodes of these devices were made using Gold and Aluminium rather than Platinum (Pt) like the devices fabricated by HP. The decision was taken upon the fact that gold is a super conductor and has a comparable work function with Platinum, 4.32-5.22 and 5.12-5.93 respectively. Aluminium was chosen due to its property of forming oxide layer on its surface which can assist the formation of TiO_{2-X} layer. The bottom electrode consisted in a Gold layer with a thickness of 100nm. This layer was deposited over the entire glass substrate by using DC magnetron sputtering. The thickness of this layer was controlled by calculating the deposition time with a previous characterization of the deposition rate of this material under a pressure of $8*E^{-3}$ mbar, DC magnetron voltage of 0.42KV and current of 0.11A.

Bottom Electrode Hard Mask

In order to reach the bottom electrode of these sample memristor devices, it was needed to hard-mask a section of the bottom electrode with the intention that no other material could cover it in further fabrication steps allowing us to make electrical contact to this electrode. As it was mentioned before, this step was not intended for mass production but as an easy way to prototype the sample device and serve as a proof of concept. The hard masking of the device was done by covering a section of the substrate and its bottom electrode with a smaller piece of a silicon wafer, as shown in Figure 18. This piece of wafer was mechanically attached to the substrate before beginning the next fabrication steps.

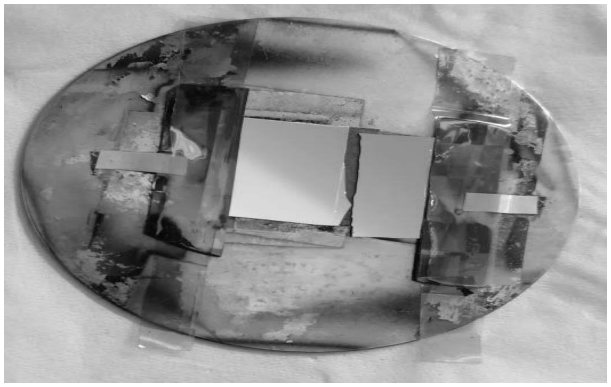
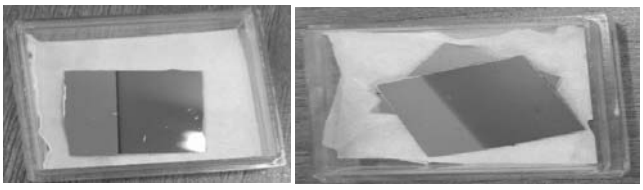


Fig. 5.3.3.1: A piece of silicon wafer was used to hard mask part of the tungsten bottom contact in order to avoid any other material to deposit in one section of the back contact allowing us to reach the back electrode for future electrical characterization.



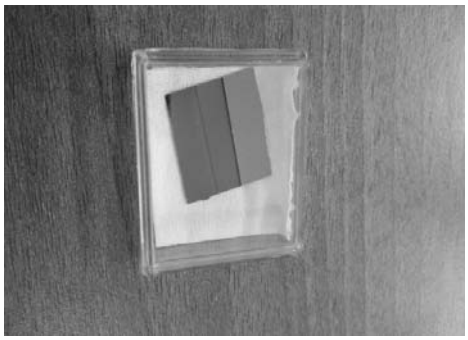


Fig. 5.3.4.2: The TiO2 and TiO2-x layers can be observed as the bluish section of the wafer, while the hard-masked tungsten remained accessible without any material deposited in top. Marks of the claps used to attach the hard mask.

Top Electrode Deposition

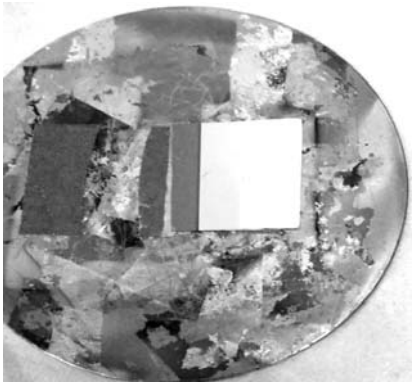


Fig **5.3.5.1:** a) Al/TiO_2/Au

(C) Physical Characterization

Thickness of Au (100nm)

AFM results

Deposition for 1min 32 sec of Gold by DC sputtering by keeping Voltage-0.42KV, Current-0.11A, Ar flow 25sccm, Pressure-8*E^{-3} mbar the AFM thickness we got is:

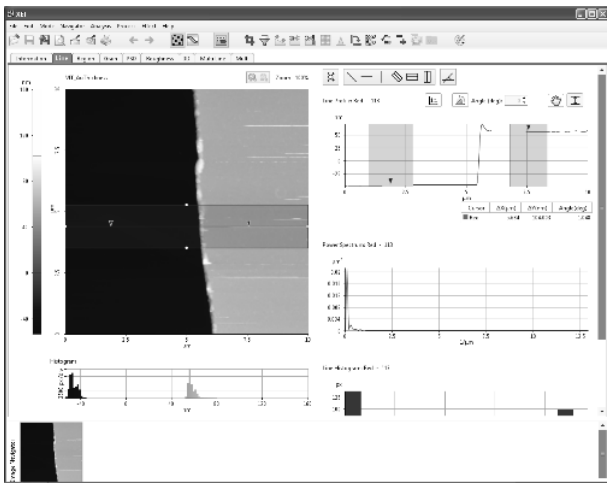


Fig 6.3.1.1: AFM result of Gold(Au) thickness of 104nm for 1min 32 sec deposition

Thickness of TiO2

SEM Results

- **TiO_2 Thickness Measurements**

Deposition for 30 mins of TiO2 by RF sputtering with Power-100W, Ar flow-40sccm, Pressure-8*E^{-3} mbar the SEM image we got is:

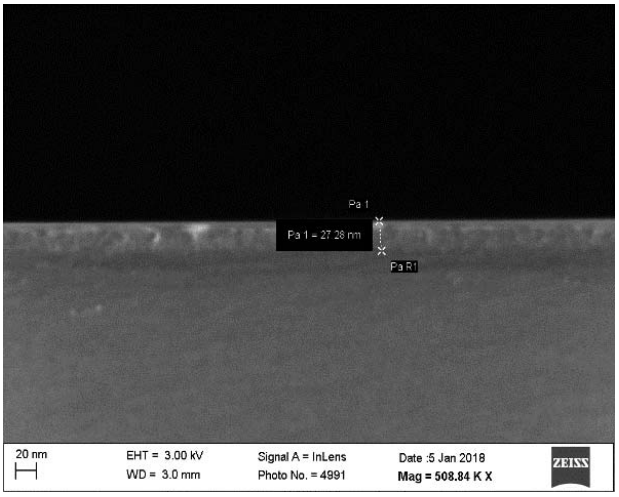


Fig. 6.4.1.1: SEM image for TiO2 thickness of 27nm for 30 min deposition

- **Aluminum Thickness Measurements**
  Deposition for 20 mins 20 sec of Al by RF sputtering with Power-100W, Ar flow-30sccm, Pressure-8*E^{-3} mbar the SEM image we got is:

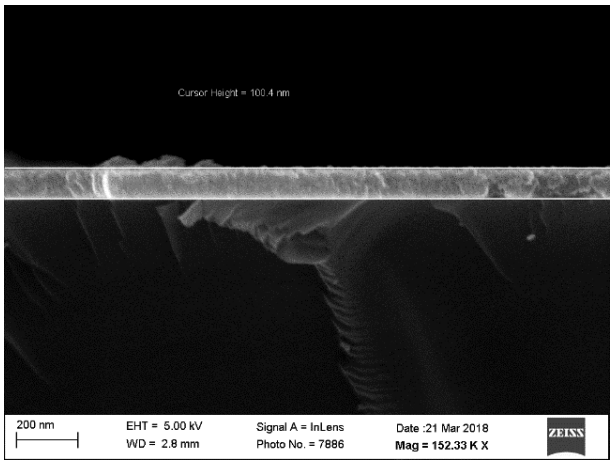


Fig. 6.4.1.3: SEM image of Al thickness of 100nm for 20min 20sec deposition

Conclusion of Physical Characterization

From the physical characterization we concluded that:

- For gold the deposition rate is 55.2 nm /min.
- For TiO2 the deposition rate is 1nm/min.
- For Al the deposition rate is 4.9 nm/min.

(D) Electrical Characterization

The fabricated device was then characterized by using 2 probe method by the Kethley's I-V machine. The characterization was done by applying voltage from 0-1 V on the top and the bottom electrode and is I-V was characterized using Lab view software. For all samples I-V was done and the results are as shown below:

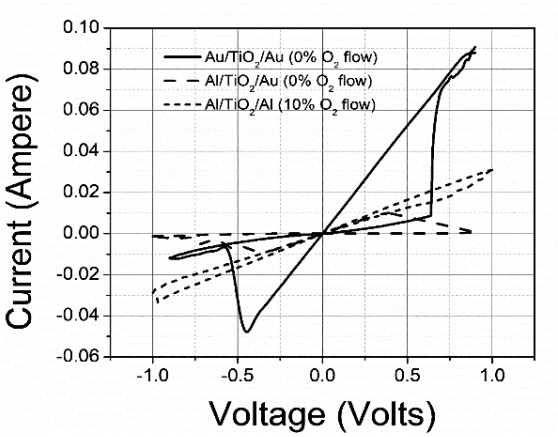


Fig. 7.1: I-V curve for the memristor
(a) Au/TiO_2/Au (0% O_2)
(b) Al/TiO_2/Au (0% O_2) c) Al/TiO_2/Al (10% O_2)

(E) Analysis Table :

MIM Device	Vth	Roff/Ron
Al/TiO2/Au (0% O2)	0.9V	40
Al/TiO2/Au (10% O2)	0.7V	6.24
Au/TiO2/Au (0% O2)	0.63V	7.35

Table 7.1: Analysis of Graphs

(F) Conclusion of Electrical Characterization

- We conclude that Au/TiO_2/Au has better I-V characteristics as compared to Al/TiO2/Au and Al/TiO2/Al.
- From the I-V characteristics we conclude that:
  - The Roff/Ron ratio of Au/TiO_2/Au is greater than that of Al/TiO_2/Au and Al/TiO_2/Al.
  - The threshold voltage of Au/TiO_2/Au is less than Al/TiO_2/Au and Al/TiO_2/Al.
- For Au/TiO_2/Au deposition of TiO2 with 0%O_2 shows lesser threshold voltage (Vth=0.63V) as compared to other process parameters.
- For 0%O_2 we get a better hysteresis loop at lower threshold which is good for memristor device.

(G) Conclusion

Current Non-Volatile Flash Memory technology has served us well allowing many applications to be developed especially in portable devices. Flash memory technology has become the de facto standard for data storage in mobile devices. However, the increasing demand for higher capacity and lower prices in memory devices have driven flash technology close to its limits of densification. Current flash memory manufactures are facing many fabrication problems such as the increased difficulty of producing a good quality tunnel oxide at such scale of shrinking. At each scale shrink, flash memory devices become more prone to reliability issues and are harder to fabricate. These limitations will eventually prohibit a further scalability of the flash technology forcing semiconductor companies to look for alternatives. Thankfully, recent studies have

demonstrated memristor devices to be a promising alternative to current flash memory devices. It ability to remember its conduction state without requiring power for data retention, a operation free of the tunnel oxide limitations, a simpler device structure with only two terminal are only few of the quality that make this rising memory technology very attractive. During this research, the current flash memory technology was studied inorder to identify its limitations and to establish the need for a new non-volatile memory technology. Furthermore, the memristor devices was studied and the physics principles behind it operation were explored in order to gain a better understanding of this new technology. After gaining sufficient background information and understanding of memristor devices, a fabrication process was developed and carried in order to create basic titanium oxide memristor devices by making use of fabrication techniques.

Acknowledgment

We would like to take the opportunity to thank everyone who helped us during our project work. Without them, this research could not have been completed. First, we would like to thank our advisor, Dr. Sangeeta Joshi for all the guidance and motivation that she offered us along the way of this research. In addition, we want to extend special thanks to. Dr. Venu Gopal Achanta, who provided the necessary equipment for fabrication and characterizing the devices and for giving us the opportunity to acquire knowledge in semiconductor fabrication while making use of his installations at Tata Institute of Fundamental Research, also members of his lab for their valuable suggestions. We would also like to express our appreciation to Abhishek Gupta, Faraz Inam, Gajendra Mulay, Shilpa S Samdhani and Aman Agrawal who helped us while fabricating and characterizing the devices in these experiments, and taught us to use the equipments in the lab.

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Artist Recommendation System using Hybrid Method : A Novel Approach

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ABSTRACT

Recommendation systems have a wide range of applications today in the digital world. The recommender system must be able to accurately predict the users' tastes as well as broaden their horizon about the available products. There are various dimensions on which recommendation systems are created and evaluated. Accuracy and diversity play an important role in the recommendation systems and a trade-off must be identified between the two parameters to suit the business requirements. The proposed system makes use of a various recommendation approaches to give a wide range of recommendations to users. The recommendations are provided based on similarity of the selected artist, top artists in a genre, using a hybrid model and artists listened by users' friends. Some recommendations would include the most popular ones, and some would be randomly picked for a diverse range of recommendations.

Keywords : *Collaborative Filtering; Diversity; Hybrid Model; R; Recommender Systems*

I. Introduction:

In today's world of Internet and large-scale growth of e-commerce business, recommender systems play an important role for the growth of the business. This is because if the website provides products as per the users' requirements, the customer is bound to be loyal to that company for a long period of time. Hence effective recommendations play an important role [1, 2]. The main objective of a recommender system from the customer point of view is to provide suggestions to online users to make better decisions from a variety of options available. The main goal from the business point is to increase the sales and profit [3]. Recommending popular items involves lower risk in terms of accuracy. However, it is not always advisable to recommend only the popular ones. Increasing the diversity of recommendations is essential in businesses. Increasing the diversity and accuracy is not in the same direction, thus making it important to make ideal decisions between the two parameters [4]. Appropriate recommendation model must be chosen so as to maximize the benefits and maintain customer loyalty by creating value-added relationships. The user contentment plays an important parameter in measuring the success of the recommendations provided [5]. A recommender system must consider diverse factors while providing recommendations. Some of them include vendor's target market, data sources, data availability, scalability, algorithms to be used, interfaces to manage the recommendations and data access.

Recommender systems are broadly classified as- Content based filtering, Collaborative Filtering (CF), Hybrid approach and Knowledge-based recommender systems.

1.1 Content based filtering: The content-based filtering method [Fig 1.1] makes use of content and features of the item already purchased by the user to recommend items. Content based filtering considers how do the items ia and ib relate to each other [6]. The similarity between two items can be calculated using various methods like Pearson, Jaccard similarity and Cosine similarity. The problem with content-based filtering is overspecialization. Overspecialization is taking into account only those items that are very similar to each other and giving least importance to the interests of the users. Also, it offers only partial information, generally text information, and the visual and semantic information is a challenging task [7].

1.2 Collaborative Filtering: The collaborative filtering (CF) [Fig 1.2] approach makes recommendations for a user with the help of collective preferences of other users [3, 6]. Collaborative filtering models are grouped into 2 types- Neighborhood-based and model-based methods. Neighborhood-based methods include User based collaborative filtering (UBCF) and Item based collaborative filtering (IBCF). The UBCF recommends to a user those items that are most preferred by similar users [1]. The IBCF recommends to a user the items that are most similar to the users' purchases. Model based approaches include Bayesian Clustering, Adaptive learning, Linear classification and Neural networks [8]. The user feedback can either be explicit indications or implicit indications. Implicit feedback gathering does not require active user requirement. Feedback can be derived from monitoring users' activities and click-throughs. Explicit feedback can be gathered by letting users rate the items. Knowing whether user like/disliked a particular

item and text comments can be analyzed. CF, however, suffers from data sparsity problems, particularly when dealing with large datasets. The cold start problem occurs when a new user or item has just entered the system. Unless some information becomes available from reliable sources, it is difficult to find similar ones. New items cannot be recommended until some users' rate it. To alleviate the data sparsity problem, many approaches have been proposed. Some of them are Dimensionality reduction techniques, such as Singular Value Decomposition (SVD), removing unrepresentative or insignificant users (users who have not given much ratings/reviews) or items to reduce the dimensionalities of the user-item matrix directly [9].

1.3 Hybrid: The Hybrid system [Fig 1.3] uses information from previous user-item interactions and contents of purchased items. There are 7 types of hybrid methods-Weighted, Switching, Mixed, Feature Combination, Cascade, Feature augmentation and Meta-level [10].

1.4 Knowledge Based: There might arise some conditions when collaborative and content-based filtering don't work. The knowledge-based filtering uses explicit knowledge about the users and the products [11]. Such systems require knowledge about the group of items and knowledge about the users [7].

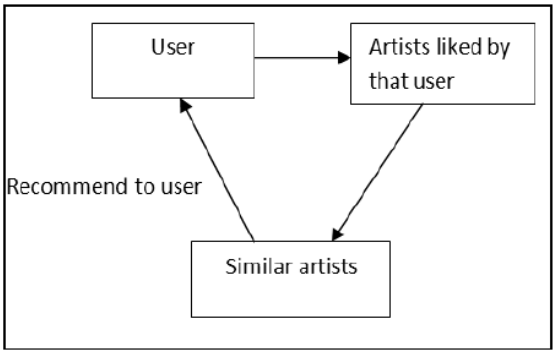

Fig. 1. Content based filtering

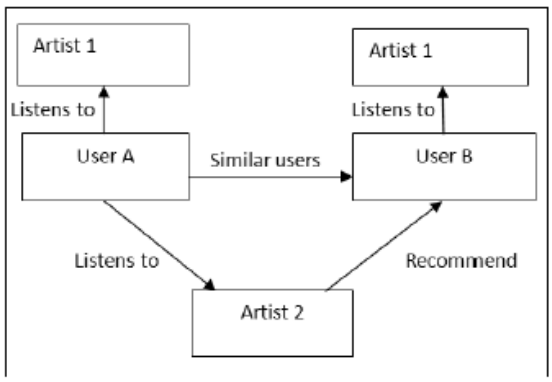

Fig. 2. Collaborative filtering

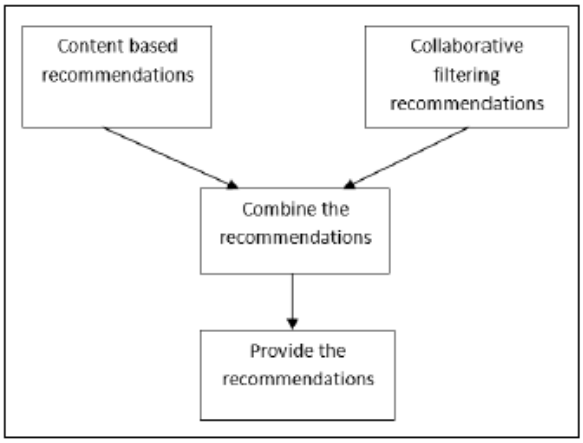

Fig. 3. Hybrid model

II. Investigating Related Work:

The table below shows the comparative study of the existing recommender systems.

Ref No	Title of Paper	Technology Used	Advantages
[2]	Building a Sporting Goods Recommendation System	SVD(Single Value Decomposition), with matrix factorization ALS-WR algorithm	1. Predicts next purchase of user. 2. Considers the purchase frequency of items. 3.Uses Item-based recommendation to solve cold-start problem
[3]	Recommender System for News using Supervised Learning	SVD algorithm	1.The system considered various parameters like relevancy, read-ability, novelty and time-on-page to recommend articles. 2.Category of articles is considered to Improve recommendations.
[4]	Research Paper Recommendation with Topic Analysis	Collaborative filtering algorithm	1. Generate satisfactory recommendations with few ratings. 2.Alleviates cold start problem

[5]	Development of a Tourism recommender system	Artificial Intelligence mechanism	1. The system plans and combines itineraries with other cultural and leisure activities according to users preferences. 2. Considers factors like place of origin of user, travel group, date of trip and activities to recommend places of interest.
[6]	A Personalized Electronic Movie Recommendation System Based on Support Vector Machine and Improved Particle Swarm Optimization		
[7]	A New Recommender System for the Interactive Radio Network Fmhost	Collaborative filtering algorithm	1.Matrix factorization tech to increase scalability
[8]	An innovative tour recommendation system for tourists in Japan	Collaborative filtering, greedy algorithm	1.Suggests optimal touring plans composed of various points of interest.

III. Proposed System:

The proposed system aims to implement a multi-featured approach to musical artist recommendation through the use of UBCF algorithm, similarity matrices, content-based filtering and hybrid filtering. The proposed system will address the diversity and accuracy problems of recommender system which was missing in the earlier systems. Accuracy and diversity are not in the same direction, hence the proposed system will implement a trade-off between these two quantities.

The block diagram of the proposed system is as shown in the figure:

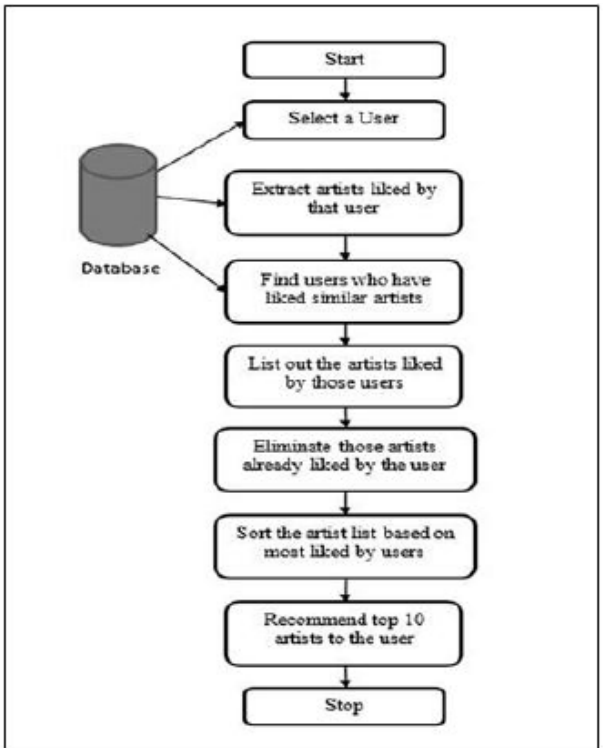

Fig. 4. Flowchart of the proposed system

IV. Implementation:

The system was implemented using the R language. The 'Last.fm' dataset was used for implementation.

Step 1: Data acquisition and cleaning

The artist dataset has been taken for research. The dataset has information about the artists, users, friends of users, artists tagged by the users along with its timestamp. Additional attributes like age and frequency of user listening to a particular artist was added to improve the quality of the recommendations. The data cleaning is the process of filling missing values, smoothing the data, removing any outliers and resolving any inconsistencies [15]. Thus, the dataset was cleaned and made suitable for analysis.

Step 2: Loading the data

The data was loaded to RStudio to build a recommender model.

Step 3: Developing Recommender Engine

The RStudio aids development of recommender systems. It supports various algorithms like UBCF, IBCF, SVD, POPULAR, RANDOM and Hybrid recommendations [16]. The dataset was tested using various methods on similarity. Analysis using different models was also performed.

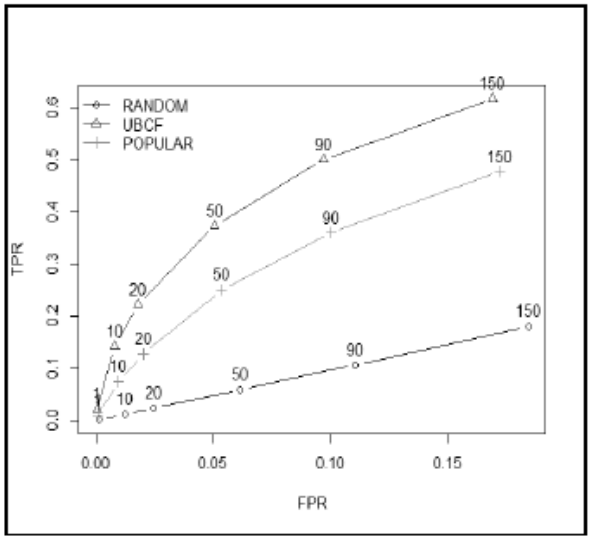

Fig. 5. Comparison of various models

The above figure [Fig 4.1] shows comparison of ROC curves using three models-UBCF, RANDOM and POPULAR. ROC analysis helps to pick the best model. The greater the area under the ROC curve, the better is the model performance. As seen in the graph, the UBCF outperforms the other models. Though UBCF performs better, due weightage has been given to RANDOM and POPULAR methods to include a diverse range of recommendations.

The recommender model provides recommendations by implementing various algorithms. Many factors are considered for recommendation. A user can get top 10 similar artists by selecting a particular artist [Fig 4.2]. The similarity was calculated using similarity() function and cosine distance was used for measuring similarity [Fig 4.3]. The greater the value of the cosine distance, greater is the similarity between two artists. The rows and columns represent the unique artists and the cell value corresponds to the degree of similarity. The characteristics of the artist are considered to recommend to the user [17].

The recommender model considers many factors for recommendation. A user can get top 5 similar artists by selecting a particular artist. Similarity is calculated using similarity() function and cosine distance is used for measuring similarity. The greater the value of the cosine distance, greater is the similarity between two artists. The rows and columns represent the unique artists and the cell value corresponds to the degree of similarity.

	7	9	12	15	25	30	32
77	0.200	0.070	0.000	0.000	0.000	0.277	0.206
81	0.247	0.115	0.000	0.000	0.058	0.325	0.169
84	0.131	0.275	0.000	0.000	0.000	0.207	0.269
85	0.057	0.000	0.000	0.000	0.120	0.337	0.263
86	0.082	0.000	0.000	0.000	0.087	0.049	0.064
88	0.230	0.207	0.000	0.082	0.069	0.195	0.152
89	0.299	0.157	0.000	0.062	0.052	0.237	0.231
93	0.149	0.314	0.000	0.000	0.000	0.355	0.385
96	0.144	0.000	0.000	0.000	0.101	0.057	0.074

Fig. 6. Artist similarity matrix

Fig. 7. Similar Artists to a selected artist

The user can get the top 5 recommendations on a particular genre. The user tagged data is used to classify an artist in a particular genre. The rows represent artist IDs and the columns represent the tag ID. The cell value shows the frequency of artist tagged to a particular genre. As the data is sparse in the matrix, we binarize the matrix to give recommendations.

	1	2	4	5	6	7	13
7	25	3	NA	NA	15	1	NA
9	NA	NA	NA	NA	NA	NA	NA
12	NA	NA	4	7	NA	NA	NA
15	1	NA	12	2	NA	NA	NA
25	7	NA	7	3	NA	7	NA
30	1	NA	NA	NA	NA	NA	NA
32	NA	NA	1	NA	NA	NA	NA
45	1	NA	NA	NA	NA	NA	NA
51	NA	NA	NA	NA	NA	NA	1
52	NA	NA	NA	NA	NA	NA	10
53	NA	NA	NA	NA	NA	NA	16
54	NA	NA	NA	NA	NA	NA	8
55	NA	NA	NA	NA	NA	NA	1
56	NA	NA	NA	NA	NA	NA	3

Fig. 8. Artist-genre matrix

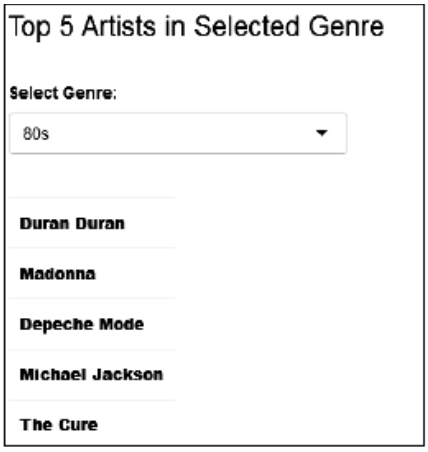

Fig. 9. Top artists in a selected genre

The UBCF (User Based Collaborative Filtering) model provides recommendations based on users who have liked similar artists.

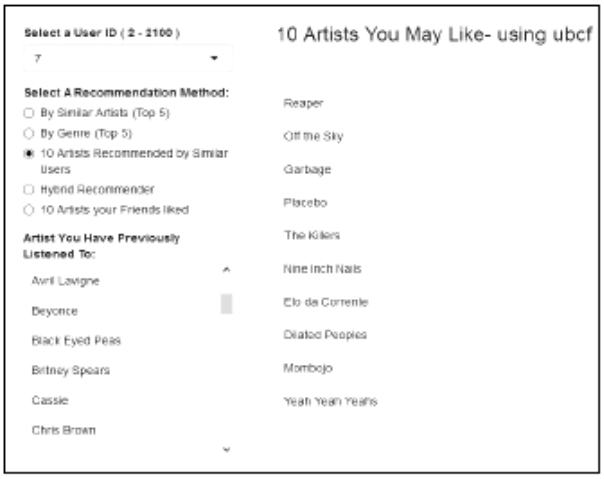

Fig. 10. Artists recommendation using UBCF

The Hybrid model uses the linear-weighted method of recommendation. A linear-weighted hybrid is composed of recommendation components $\kappa 1$ through κk, whose output is combined by computing a weighted sum. A linear-weighted hybrid of this style has a number of advantages like; the recommendations are specialized in a particular dimension of the data. Thus, the linear-weighted hybrid offers a way to construct algorithms that take all dimensions of a system into account without requiring mathematically-complex and computationally-intensive dimensionality-reduction techniques, which are less extensible and flexible. [11]

The weights are assigned to POPULAR, RANDOM and RERECOMMEND methods to provide recommendations. The POPULAR method recommends the trending artists. The RANDOM method selects a random list of artists. It is used to improve diversity of the recommender system. The RERECOMMEND method recommends artists from the user's history.

Fig. 11. Artists recommendation usng Hybrid model

Recommendations are also given considering artists tagged by friends of the users. Factors like age and frequency of tagging the artists are considered.

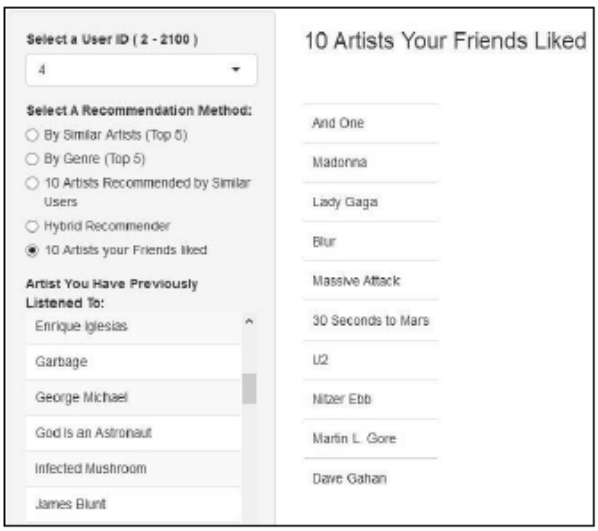

Fig. 12. Artist recommendation from friends' tags

Step 4: Evaluation of the model

The most popular measure of effectiveness is accuracy metrics, which is used to evaluate the ratings a particular user would give to a particular item [3]. The True Positives (TP) are the recommendations provided to the user and liked by the user. False Positives (FP) are the recommendations provided but not liked by the user. The False Negatives (FN) are those which the system fails to recommend, though the user would like them. The True Negatives (TN) are those which the user does not like and are not recommended [19].

The Top-*N* recommendation lists are typically evaluated in terms of their precision and recall. Precision measures the percentage of recommended products that are relevant, whereas recall measures the percentage of relevant products that are recommended [18, 20].

Table 4.1
Performance of the system using the UBCF method

TP	FP	FN	TN	Precision	Recall	TPR	FPR
1.29144385	1 8.70855615	1 5.55080214	7 78.44919786	0.06457219	0.08461227	0.0846 1227	0.02345738

Table 4.2
Performance of the system using the Hybrid method

TP	FP	FN	TN	Precision	Recall	TPR	FPR
1.1149733	8.885026 7	2 4.991978 6	77 0.0080214	0.1114973	0.0428570	0.0428570	0.0113972

The accuracy of the recommender system is calculated as [8]:

$$\text{Accuracy} = \frac{\text{The correctly classified samples}}{\text{The total number of samples}} \quad (1)$$

The performance of the UBCF model is shown in table 4.1 and that of the hybrid model is shown in table 4.2. From formula (1), the accuracy of the system is calculated. The accuracy of the system using the UBCF method is 95% and using the hybrid model is 69%.

V. Conclusion :

In this paper, a recommender system is implemented using various recommendation approaches. The system also gives recommendations based on artist similarity, top artists in a genre and artists listened by users' friends. An interactive user interface is developed to display the recommendations. It is observed that the accuracy of the system decreases on increasing the randomness of the recommendations. An attempt has been made to provide a list of accurate and diverse range of recommendations to the user, using various algorithms.

VI. Future Work:

Possible future work with the recommender model could include assessing in an online environment whether or not the suggested 'Artists You Might Enjoy' lists lead users to explore artists they have not listened to previously. Such an assessment could be done by tracking click-through rates for those lists. The system could include URLs of the artists which, upon clicking on the artist recommended, will directly lead the users on their respective websites. The system could be made dynamic by including user feedback for the recommendations provided and replacing those recommendations which the user did not like with new ones. The recommendations liked by the user could be used for recommending further items.

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News Source Analysis using Modelling and Classification of Tweets

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ABSTRACT

Man continuously feeds on information and evolves using that information. In recent times, the source of information is not limited to newspapers or news channels. Online social networks play a key role in dispersing information on touch of a button, in a cost effective manner. Twitter, is one such OSN platform, where user posts and interact with messages, known as "Tweets", with a character restrictions of 280 characters. The grace of Twitter is its customised and structured responses according to user's topic of interests. Therefore, analysing and verification of information over Twitter has become an indispensable task. A considerable amount information posted over platform prove to be wide of the mark and at times, such information can prove to be hazardous. Our project aims to reduce the spread of such information by devising an ingenious method where people can look for themselves, how credible the information is. The proposed system consists of: a user reliability-based component and a tweet classifier and credibility engine.

Keywords *: Twitter, Tweet Credibility, Multinomial logistic regression, Machine learning*

I. Introduction

Online Social Network have grown enormously in the 21st century. Information dispersion through Twitter as a platform has attracted over 100 million daily users as of January,2017. The momentum, accessibility (330 million users as of January 2018) and cost effective makes it an excellent News and Social Networking Website. The user is allowed to express, their emotions and knowledge, and interact with the masses with almost null control, is yet another fascinating aspect of this platform. When such liberty and right to publish with none to supervise, the credibility of Information on such

Social Network becomes a major concern. A set of malevolent user on such platform can spread information for rationale, which may not be in align with the compassion of society. Spread of hoax through online social networks can have adverse and destructive effects. Thus, a study on credibility of information is best solution how to judge the reliability of information and in turn cushion the impact of misinformation.

One major difference between dissemination of news or information through traditional media and Twitter is that, Twitter is a crowd-sourced medium. In contrast to television or print or news websites where the source of information are few and known (i.e. credible), users on Twitter act like its sensors, and all in the information gap about an event. Due to the anonymous and unmonitored nature of the Internet, a lot of content generated on Twitter maybe incredible. When a user types a query on the Twitter search or clicks on a related trending topic, all tweets matching the query words are displayed to the user. Though a large volume of content is posted on Twitter, not all information is trustworthy or useful in providing information about the event. The credibility and quality of information often plays a critical role during high impact events. Fake news and rumors also propagate along with genuine news. Researchers have shown that role of Twitter during mass convergence and emergency events considerably than more general Twitter activity. They showed that tweets during such events led to more information broadcasting and brokerage. This was the motivation for us to specially consider some major events for our analysis. The main contributions of this paper are:

- We performed multinomial linear logistic regression analysis on various Twitter based (content and user) features. Prominent content based features were number of words or phrases on Twitter. characters, swear words, pronouns and emoticons in a tweet; and user based features like the number of followers and length of username.

- We showed that automated algorithms using supervised machine learning and relevance feedback approach based on Twitter features can be electively used in assessing credibility of information in tweets.

The rest of the paper is organized as follows: Section 2, describes the closely related work to this paper. Section 3 explains the proposed system and methodology that we used in collecting data used for analysis of the tweets. Section 4 describes the analysis performed. Section 5 discusses the credibility based relevance ranking performed on the tweets. Section 6 summarizes the results from our analysis and highlights the implications of our results.

II. Problem Formulation

This project will focus on the social media outlet Twitter. The intention of this project is to investigate factors that can be used to determine the credibility of a tweet. To provide this service is the ambition of this project. Machine learning software will be used to analyse a large set of tweets and create an algorithm for determining the credibility of tweets. The algorithm will only require the tweet ID of a single tweet to determine its credibility and will not require human perception of the credibility of the tweet or the user. The result will then be tested and compared to the findings of projects that have studied Twitter credibility under different circumstances.

Given a news or fact based tweet, identify whether the user who posted the tweet is a bot or a normal human user and assign a credibility index to each user based on their history of twitter activity. Classify the tweets based on their content into five groups: Highly credible, likely credible, highly not credible, likely not credible, cannot decide. Any new incoming tweet by a user will be given a credibility value based on the credibility of user as well as credibility of the content.

In our proposed system, a tweeter visits the Web Application where the trending Hash Tags are feed into Search Box as input. The search operation triggers our tweet fetch mechanism where a code snippet extracts data via Twitter API based on Hash Tags. This fetched data is stored in our Database. The Knowledge Base and Trained Machine work upon the rendered result and define its credibility. The credibility of a particular tweet is recorded and appended to the fetch data. The result (Tweet + Credibility) is displayed on the Web Application as output. People also review on credibility of the tweets.

The steps to be followed are mentioned:

1. Search for a trending Hash Tag.
2. System will search Tweets matching Hash Tags.
3. The tweets are stored in Databases
4. The Knowledge base is applied
5. Credibility is calculated
6. The results are displayed as output

III. Credibility Measuring System

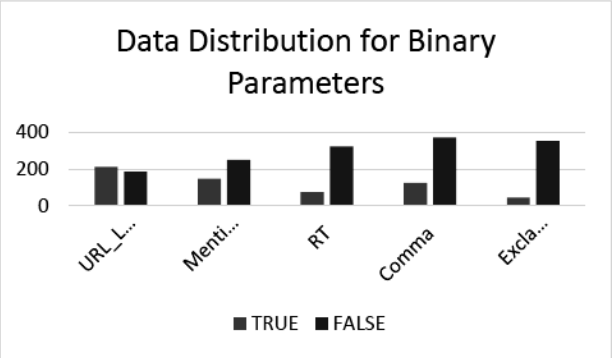
1. Credibility Analysis of Tweet:

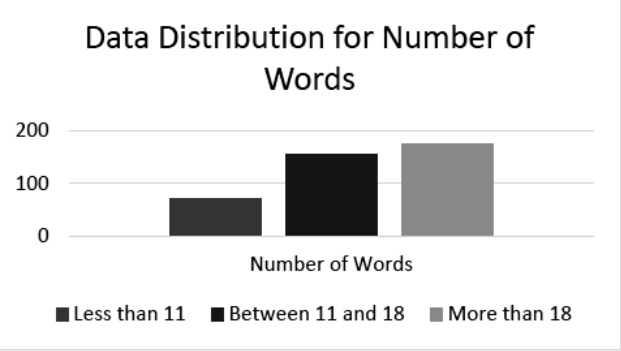
The Twitter API enables us to gather 42 parameters for a tweet. However, all parameters cannot be used for classification of tweets into categories as:

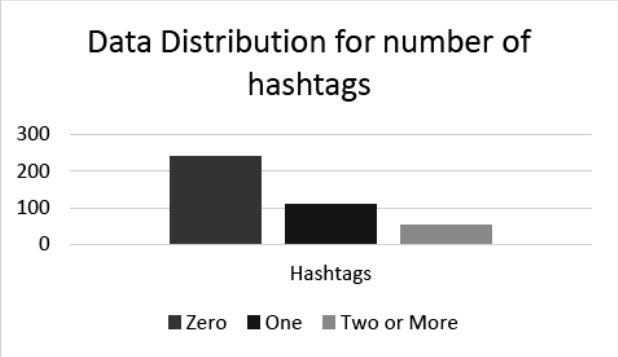
i) The classes may be imbalanced or
ii) The parameters may not give any information

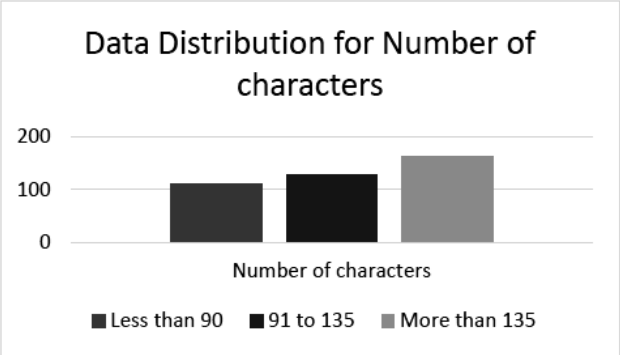
Therefore, we selected features based on past papers and our experience on Twitter as users. We chose these parameters for tweets:

Parameter	Value Type	What Does the Parameter Indicate	Used for Classification
Tweet_ID	String	Unique ID string of the tweet	No
URL_Linked	Binary	Does the tweet contain a hyperlink	Yes
RT	Binary	If a user is choosing to retweet someone else's tweet and quoting it	Yes
Comma	Binary	If a tweet contains a comma or not	Yes
Exclamation	Binary	If a tweet contains an exclamation mark or not	Yes
Mentions	Binary	If that tweet contains a reference to another Twitter user	Yes
Number of words	Categorical	Number of words in the tweet	Yes
Number of characters	Categorical	Number of characters in the tweet	Yes
Number of hashtags	Categorical	No. of hashtags a tweet contains	Yes









We scraped data from Twitter under the following topics: death of actress Sridevi, IPL, Syria, Modi and mixed trending tweets. In addition to this, we used the health dataset from Arizona State University and tweets from the US 2016 Presidential election from Open Dataset. Out of these tweets, we used reservoir sampling to generate a 400 tweet dataset, and manually categorized the tweets as follows:

Topic	Credibility Level				
	VLC	LC	NC	HC	VHC
2016-US Presidential Election	24	30	19	25	5
Health	2	8	20	23	17
Death of actress Sridevi	1	2	3	3	2
IPL	11	2	2	3	11
Syria	9	13	12	0	1
PM Modi	9	1	0	2	10

VLC: Very Low Credibility, LC: Low Credibility, NC: Neutral Credibility, HC: High Credibility, VHC: Very High Credibility

MLR: Multinomial Logistical Regression, SMO: Sequential Minimal Optimization, RF: Random Forest, CV: Cross Validation

Then, for this multiclass classification problem, we chose 3 algorithms: Multinomial Logistical Regression, Random Forest and SMO and executed them under 3 conditions: complete training set, 10-fold cross validation and 70-30 train-test split.

Based on this table, we chose to use Multinomial Logistical Regression for categorization of tweets.

Algorithm	Mode	Correctly Classified Instances	Incorrectly Classified Instances	Kappa Statistic	Root Relative Squared Error
MLR	Training Data	190	210	0.1272	0.98
MLR	10-fold CV	171	229	0.0497	1.01
MLR	70–30 split	55	65	0.0636	1.01
SMO	Training Data	186	214	0.0943	1.05
SMO	10-fold CV	187	213	0.117	1.05
SMO	70-30 split	53	67	0.059	1.06
RF	Training Data	279	121	0.530	0.79
RF	10-fold CV	164	236	0.069	1.10
RF	70-30 Split	52	68	0.077	1.08

2. User Reputation based Component

With 42 parameters from the Twitter API, there are numerous parameters describing the user and its account. Based on the previous research and the related work, we selected the following parameters for classifying the user's credibility.

- Source: The source from where the tweet was published.
- Listed count: The number of public lists that a user is a part of.
- Verified: Indicates if a user has been verified by Twitter.
- Followers to friends ratio: The number of followers to friends for a Twitter user
- Account age: The age of an account in years
- Statuses count: The number of statuses posted by a user For user categorization, we assigned each user a score as follows:

Score 1: Source
- 1 if the source contained Twitter
- 0 otherwise

Score 2: Listed Count
- High: if value between median and upper whisker of boxplot of all values or value within upper hinge of boxplot of outliers
- Moderate: if value between lower hinge to median of boxplot
- Low: too high or too low(outliers)

Score 3:
A combined score of Verified and Followers to Friends ratio

Score 4: Age
- New if the account was made after 2014
- Middle if between 2008 and 2013
- Old otherwise

Score 5: Statuses count:

- High: if value between median and upper whisker of boxplot of all values or value within upper hinge of boxplot of outliers
- Moderate: if value between lower hinge to median of boxplot
- Low: too high or too low(outliers)

Score 6: Followers/Friends Ratio:

- High: if value between median and upper whisker of boxplot of all values or value within upper hinge of boxplot of outliers
- Moderate: if value between lower hinge to median of boxplot
- Low: too high or too low(outliers)

We fetched tweets from the Twitter API on various trending topics such as Death of Indian actress Sridevi, Syria attack, Indian political party BJP's historic win in Tripura state. Datasets of approximately 500 tweets was generated and they were pre-processed, cleaned and stored. To check the user's credibility, we had initially thought of analysing and manually rating around 15-20 tweets of each user fetched. But to technical issues and time-constraints we had to automate that process and analyse the user credibility based on conditions and then assigning a score to each variable. On the basis of those scores, a model was trained using multinomial logistic regression with 5-fold cross validation.

On using MLR, the model trained gave an impressive result of 96% accuracy and thus this model is used for categorization of users into three categories: Highly credible, Neutral credible and Low credible.

IV. Results And Discussion

Fig: Output of Tweet credibility

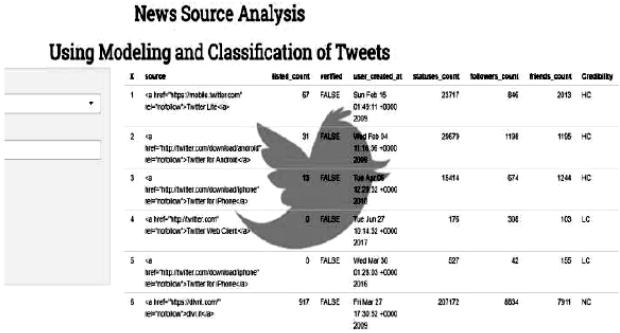


Fig: Output of User Credibility

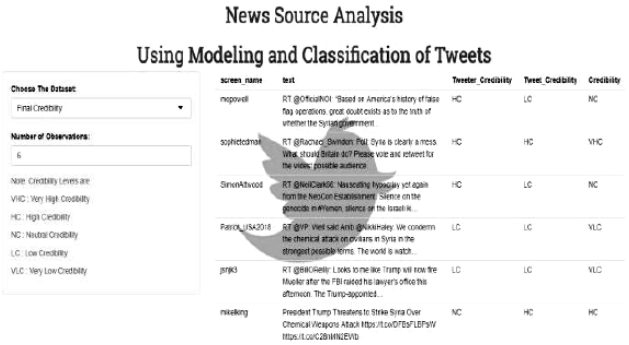


Fig: Output of Final Credibility

We chose 200 tweets and sent a set of 10 tweets 20 users each to ask their opinions on our system.

- People who felt that all our classifications were correct: 4
- People who felt that more than 75% of our classifications were correct: 15
- People who felt that less than 50% of our classifications were correct: 1

Similarly, for users, we gave a set of 10 users to 10 users and asked for their opinion.

- People who felt that all our classifications were correct: 2
- People who felt that more than 75% of our classifications were correct: 6
- People who felt that less than 50% of our classifications were correct: 0

V. Conclusion

This paper presents the study on how to assess information on Twitter. This has been an issue especially at social networking level where people participate actively and at a large scale. Twitter and other social networking have become a major source of information and mitigation help during high impact events because they make it possible for relevant parties to obtain important sufficiently quickly to coordinate counter measures to such events.

To obtain a better understanding of how to assess information credibility on Twitter, we measured and characterized the content and sources of Twitter tweets. Based on the data, we extracted the features that can be of most help in the assessment process. Based on our extraction process, we designed an automated classification system that consists of major components: a credibility analysis of tweet, user reputation based component. The credibility analysis of tweets analyses the content of tweet and decides the credibility of tweet and user reputation based component analyses the tweeter's reputation.

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Microcontroller Based Speaking Aid

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ABSTRACT

Since man is a social being, communication is of vital importance for him. But some people are unfortunate as they lack the ability to speak and hear. It is for these people that the sign language has been developed. But common people find it difficult to understand sign language. Sign language is interpreted differently in different parts of the world. To overcome these distinctions, we present a system called microcontroller based speaking aid. This system translates gestures to their corresponding meanings in terms of speech. So, our project aims to help the hearing impaired and mute people.

Keywords **:** *American Sign Language, Gestures, Arduino, Flex Sensors, Speaking Aid, Microcontroller*

I. Introduction

Communication is a basic necessity for all human beings. It involves exchanging ideas, thoughts, feelings, information in form of verbal or non-verbal messages. Communication plays an integral role in making a person feel as a part of the society. The hearing impaired people and the mute people face this difficulty on day to day basis. Our project aims to bridge this communication gap between them and the society by allowing interaction without any barriers. Our project involves converting the sign gestures into speech. This system helps hearing and speech impaired people to effectively express their thoughts. Through this deliverable, a nearby person can clearly understand and help the impaired person. This saves the time to understand each other and eases the communication.

II. Scope

Our system would be using American Sign Language (ASL). However, other sign languages such as British Sign Language (BSL) could also be accommodated by making slight changes in the code. The speaking aid will consist of gesture detection and recognition modules :

- Embedded glove: The system will consist of two gloves to be worn on both hands. Flex sensors will be attached to each finger of the glove. Accordingly, the system will consist of 10 flex sensors for 10 fingers. The flex sensor patented technology is based on resistive carbon elements.
- Tilt recognition: It is the most important and fundamental part of the entire system. This module will detect changes in the angle while making actions. It is based on a microcontroller controlled circuitry with the help of a 3-axis accelerometer (ADXL335). The ADXL335 is a small, thin, low power, complete 3-axis accelerometer with signal conditioned voltage outputs.
- Gesture recognition: A slight bend in the finger is detected by the flex sensors. The flex sensors are very sensitive to these bends. The system is very sensitive to the bending of the finger. However, for simplicity, our system would only detect two different levels 0 representing low (no bend) and 1 representing high (bend).

III. Background

"Speech" and "gestures" are the expressions, which are mostly used in communication between human beings. Learning of their use begins with the first years of life. Research is in progress, that aims to integrate gesture as an expression in Human Computer Interaction (HCI). In human communication, the use of speech and gestures is completely coordinated. A number of hardware techniques are used for gathering information about body positioning; typically, either image-based (using cameras, moving lights etc.) or device-based (using instrumented gloves, position trackers etc.), although hybrids are becoming an upcoming technology. However, getting the data is only the first step. The second step, that of recognizing the sign or gesture once it has been captured is much more challenging, especially in a continuous stream. Gesture recognition can be seen as a way for computers to begin to understand human body language, thus building a richer bridge between machines and humans than primitive text user interfaces or even GUIs, which still limit the majority of input to keyboard and mouse. Gesture recognition enables humans to interface with the machine (HMI) and interact naturally without any mechanical devices. Using the concept of gesture recognition, it is possible to point a finger at the computer screen so that the cursor will move accordingly. This could potentially make conventional input devices such as mouse, keyboards and even touch-screens redundant. Although this technology is still in its infancy, applications are beginning to appear. Flutter, a start-up out of Palo Alto, CA, allows anyone with Mac/Windows computer and webcam to download an app that allows them to control Music & Video apps such as Spotify, iTunes, Windows Media Player, QuickTime, and VLC using gestures. Gesture recognition can be conducted with techniques from computer vision and image processing.

IV. Proposed System

We have proposed the following system for our project :

- **Hand gestures :**
  These will be sensed by both the flex sensors as well as the accelerometer sensor.
- **The flex sensors :**
  These are resistance based sensors whose resistance changes with the amount of bend.
- **Accelerometer Sensor :**
  The accelerometer readings are taken into consideration. The combination of flex sensor and accelerometer readings give rise to a particular gesture. So we note the different readings needed for a predefined gesture and map those values in our code to convert a particular gesture input to a voice output.
- **Gesture Recognition Circuit :**
  The flex sensors are interfaced with microcontroller Arduino Mega 2560. The microcontroller is programmed with Arduino software which accounts for taking in all the inputs and converting it to predefined voice. The system also contains an SD card module which is mounted on the microcontroller. All the audio files are stored in the SD card and are fetched from there whenever required.
- **Speaker :**
  The system requires a total power supply of maximum 6V. The final audio output is given out through speaker which is provided by interfacing the microcontroller with PAM8403 amplifier.

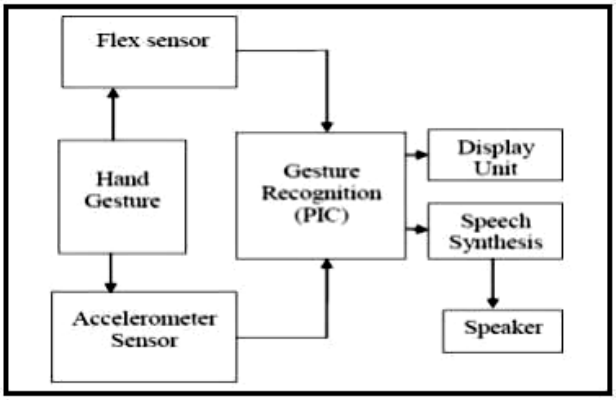


Fig.1 : Block Diagram Of Proposed System

V. Methodology

We mount the flex sensors on the glove fabric to detect the amount of bend in the fingers. Flex sensors has 2 pins. One pin is connected to a supply of 5V. The other pin is connected to the analog input pin of the microcontroller Arduino. Analog pins on the microcontroller will be declared for flex sensors. Along with the flex sensors, the gloves are also mounted with an accelerometer which acts as a tilt sensor and detects the motion of hands. SD card is formatted and set to appropriate standards. Audio files will be stored on the SD card. This SD card will be inserted into the SD card adapter. And this adapter will be attached to microcontroller module. Mapping of the acquired readings is done with the predefined gesture values in our code and the result is converted into speech. We code the microcontroller using Arduino software so as to enable it to process the flex sensor inputs and convert it into a predetermined voice.

VI. Flow Chart

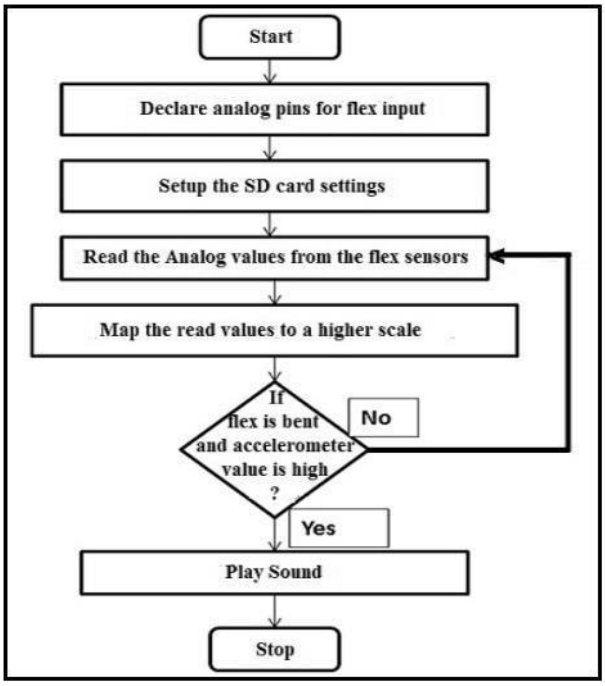


Fig 2: Flowchart of Our Proposed Implementation

VII. Algorithm

1. Start.
2. Declare analog pins for flex input.
3. Setup the SD card.
4. Read the analog values from flex 1 and assign to flex1 variable.
5. Map the read values to a higher scale.
6. Read the analog values from flex 2 and assign to flex2 variable.
7. Map the read values to a higher scale.
8. Read the analog values from flex 3.
9. Map the read values to a higher scale and assign to flex3 variable.
10. Continue to do so for remaining seven flex sensors and store their resistance value in their respective variables.
11. If flex1 is bent (th1 <flex1 <th2 && th3 <flex2 <th4 && th3 <flex3 <th4)
    And if adxl335 is set (th11 <x <th12 && th21 <y <th22 && th31 <z <th32)
    Then play sound 1.
12. Delay
13. If flex2 is bent (th1 <flex2 <th2 && th3 <flex1 <th4 && th3 <flex3 <th4)
    And if adxl335 is set (th13 <x <th14 && th23 <y <th24 && th33 <z <th34)
    Then play sound 2.
14. Delay
15. If flex3 is bent (th1 <flex3 <th2 && th3 <flex1 <th4 && th3 <flex2 <th4)
    And if adxl335 is set (th15 <x <th16 && th25 <y <th26 && th35 <z <th36)
    Then play sound 3.

16. Delay
17. If flex1 and flex2 is bent (th1 <flex1 <th2 && th1 <flex2 <th2 && th3 <flex3 <th4)
    And if adxl335 is set (th17 <x <th18 && th27 <y <th28 && th37 <z <th38)
    Then play sound 4.
18. Delay
19. If flex2 and flex3 is bent (th1 <flex2 <th2 && th1 <flex3 <th2 && th3 <flex1 <th4)
    And if adxl335 is set (th19 <x <th10 && th29 <y <th20 && th39 <z <th30)
    Then play sound 5.
20. Continue for other gestures and play corresponding recordings.
21. Stop

VIII. Pseudo Code

Pseudo Code for Reset Function:

```
void
setup() { }
void
loop() { }
```

Pseudo Code for Main Function :

```
#include < SD.h > //library for including the SDCard.
#define CS P in//Defining the Chip Select Pin
#include < TMRpcm.h > //Includes the library for playing audio f iles
#include < SP I.h > //Includes the library for other serial peripheral devices.
TMRpcm object name; //object of TMRlibrary
constintvariable = pin number; //Repeat for each flex sensor attached to the glove
voidsetup(){
tmrpcm.variable = pin number; //initializing the speaker pin 30
pinMode(pinnumber, OUT P UT); //Sets the pin as output
Serial.begin(9600); //the baud rate of Arduino microcontroller.
if(!SD.begin(cs pin)){
This If condition checks if the SDcard has been initialized or not
}
else
{
tmrpcm.setVolume(4); //Sets the volume of the Speaker
Prints a SD Pass statement
}
pinMode(pin number, INP UT); //Sets the pin as input
}
voidloop(){
int variable = analogRead(variable); //Reads the values from the input pins
intvariable = map(variable, 0, 400, 0, 1000); //mapping function maps the original values
to new values.
Serial.println(variable); //Prints the value of the variable
Repeat the same statements for all the pins of the flexsensors. if(cndt1cndt2cndt3cndt4cndt5)
{Plays the soundclip if al lthe conditions are satisf ied.
The if loop will be repeated for each gesture that needs to be included in this system.
No two if conditions can produce ambiguity due to the presence of condition.
}
delay(time)//creates time delay after every sign.
```

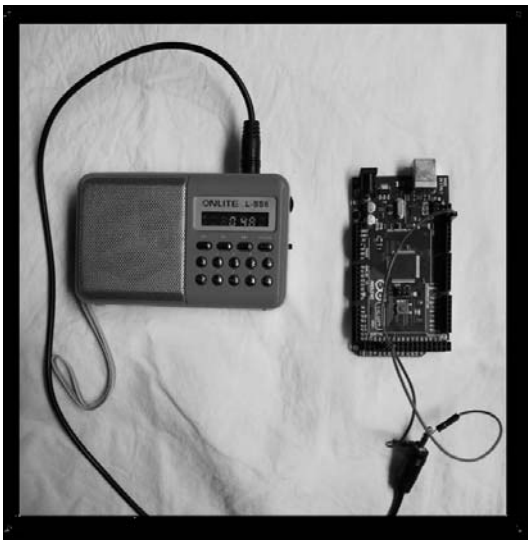
VIII. Interfacing

Glove with flex sensors :

The flex sensors are mounted on the gloves and they are connected serially with each other with one VCC and GND pin.

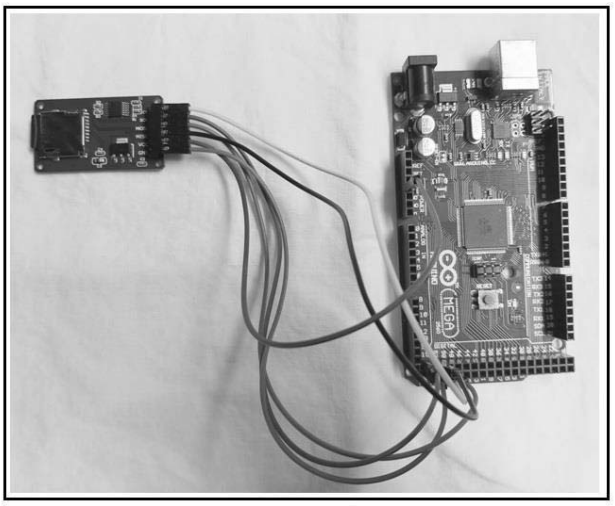
Interfacing Speaker with Arduino :

The speaker is connected with the help of an auxiliary cable to digital pin 46 of the Arduino. This device is the output source used for the final results.



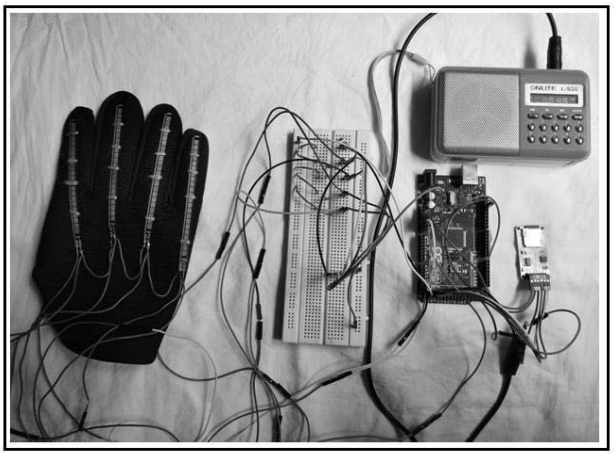
SD Card module with Arduino :

The files are stored in .wav format on the SD card which is then inserted in the SD Card module. This module is further connected to Arduino.



Entire Working Circuitry

This includes the integration of all the components included to develop a complete system that takes resistances from the flex sensors and gives audio clips as output.



IX. Conclusion

Keeping in mind the communication gap between the impaired people and the society we decided to undertake the project with the intension of minimizing it. Over the past year we have managed to achieve our set goal by developing a portable device that converts the basic American sign language gestures to audio. The portability of the device can work as a great asset for the propagation of the concept. The device can be converted to a finished product thus making it extremely cost effective when manufactured on a large scale. We have personally achieved and learnt a lot from this experience and are grateful to our department for providing us with this opportunity. Learning a new technology and choosing a project out of our comfort zone has taught us team work, persistence and dedication.

X. Areas of Improvement

There are certain improvements which can further be added that could enhance this devices finesse.

- Introducing the concept of tilting the hands while gesturing can open up a whole new variety of signs present in the ASL.
- Our current project implements the concept resulting into a raw product. This can be taken up further by converting it into a finished product thus increasing its portability and efficiency.
- The current lag present in the project can be reduced by upgrading the specifications of the components currently used.

XI. Future Scope

Including the following features can exceed the intelligence of the current device, increasing its usability and effectiveness:

- Inclusion of an LCD screen can covert the gestures to text along with the speech output already included in the project.
- It can further include the feature of reversing the current concept, i.e. converting the gestures to speech or text.

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Automated Driving Test Score Generator Using 3D Simulation

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Prof. Akshay Loke

ABSTRACT

This Driving System project allows a person to get an overview of the scenarios he may face during real time driving. So the driving system is an important way of teaching as well as making the person aware of the overall scenarios and conditions he may face while driving a vehicle through a 3D game. Thus using this project, we aim at reducing the number of accidents by testing the ability of the applicants regarding driving rules using a marking system. The user will have to go through a series of tests where he will be facing many real life traffic and road scenarios in a virtual environment and then will be evaluated based on the basis of his performance. The user will get a hands on experience on a driving kit which will comprise of steering wheel, accelerator and brake thus giving a feeling of driving real car.

Keywords *: 3D game, driving kit, marking system, virtual environment.*

I. Introduction

This project presents an idea of developing a 3D game for driving practice and interfacing it with the driving kit. Thus it will provide real-time environment to the player to face different scenarios he may face during driving. We believe in a safer world, a world with quality drivers, a world with less accidental death and for this we are implementing a virtual world or we can say virtual driving simulation.

This modular and adaptable system attaches to com-metrically-available stationary car systems and interfaces with a computer or laptop for simulation and data acquisition processes. Parameters monitored by these systems are communicated to a driver interface screen and can be amplified before entering its virtual environment. This simulation will help the people as we can simulate real life scenarios like how to get away with an accident which is not possible in traditional question answer test system. In this there will be different test cases like applicant follow the rules for example, if the speed limit is 30 km/hr. , then driver should not cross the speed limit and follow the traffic signal rules.

In recent years, the number of deaths caused by traffic accidents has been decreasing in line with advances in vehicle safety systems and emergency rescue and medical techniques. On the other hand, the number of traffic accidents still remains high. In particular, accidents involving elderly and young people have been increasing in number, not only as injured pedestrians but also as culpable drivers. It is said that one factor in this is a higher-aged society with less children.

Originally, the traffic environment was divided into two kinds of structures, such as a strong site like a vehicle driver and a vulnerable site like a pedestrian. The former needs sufficient ability to control the vehicle, and therefore they must have gained a license through an aptitude test for driving ability. On the other hand, the latter does not need the same kind of ability as drivers. However, the person in both sites in the traffic environment must understand the safety rules and manners.

II. Aims and Objectives

The objective of this project is to yield better drivers. Our project aims at educating the users about the traffics rules and regulations and also giving them a hands-on experience about driving in the Virtual world.

The driver will be facing various test cases during the course of his examination which will judge how he faces real life situations. The driver has to follow all the traffic rules and regulations of the road so that he gets used to the practical environment.

Our project will consist of a marking system where the user will be marked based on how he performs in the test. There will be an initial score to start with and as he makes progress through the test, certain marks will be deducted if he commits a mistake. At the end of the test, result will be dis-played to show whether he has passed or failed. If we commit more than three mistakes or breaks the laws then he will be failed.

The Test will help the user to get the knowledge about driving in an real environment and also make him ready to drive the car in real world.

III. Technology Used

A. Hardware Requirement:

- A 32/64 bit Computer.

Name	Quantity
Arduino UNO Wemos D1 R1	1
Foot Switches (Break and Accelerator)	2
Steering Wheel	1
Rotary Potentiometer (5k ohm)	1
Resistors (330 ohm)	5
Jumper Wires	40
USB Cables	2
Soldering Machine	1

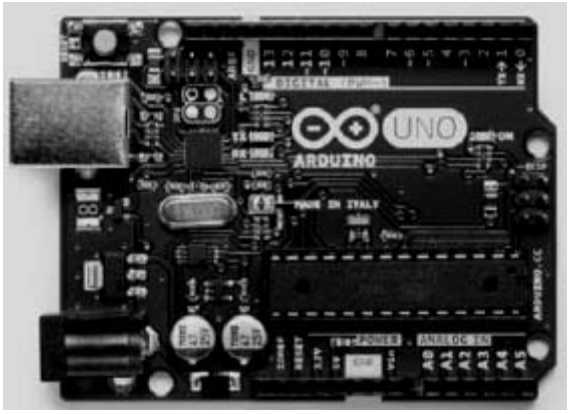
B. Software Requirement:

- Unity 3D
- MonoDevelop IDE
- Arduino IDE

IV. Implementation

A. Arduino Uno Wemos D1 R1:

It is a microcontroller board based on the AT-mega328P (datasheet). It has 14 digital in-put/output pins (of which 6 can be used as PWM outputs), 6 analog inputs, a 16 MHz quartz crys-tal, a USB connection, a power jack, an ICSP header and a reset button. It contains everything needed to support the microcontroller; simply connect it to a computer with a USB cable or power it with a AC-to-DC adapter or battery.



B. Foot switch:

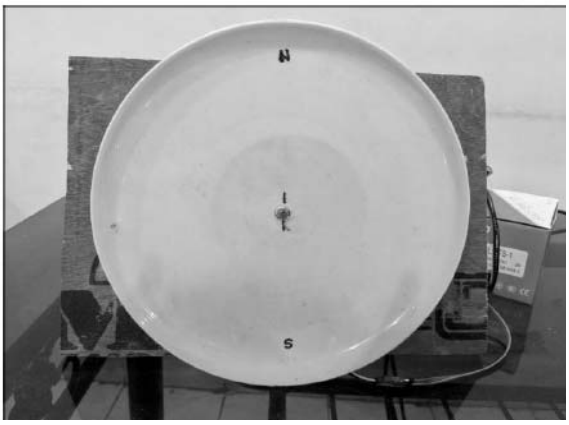
Foot switches were used for demonstrating the accelerator and the brake in our project.These switches were then connected to Pin 6(break) and 7(accelerator) on the Arduino board The speed of the car depended upon the amount of pressure applied on the switch. The non-slip pad on top and rubber bumpers on the bottom keep the pedal from slipping out of place during use.

C. Rotary Potentiometer:

This potentiometer was used to measure the angular displacement of the steering wheel. Monitoring steering wheel input is extremely useful in translating data correctly.

D. Steering Wheel:

A plastic steering wheel was used and it was thus reduced the cost.



E. Jumper Wire:

A male to female jump wires were used to inter-connect the components of the UNO board or other prototype or test circuit, internally or with other equipment or components, without soldering. Individual jump wires were fitted by inserting their end connectors i.e crocodile clips into the slots provided on the UNO board.

Design Circuit Diagram

The circuit diagram for the hardware setup was designed according to the requirements of the project and were drawn as per the industry standard symbols.

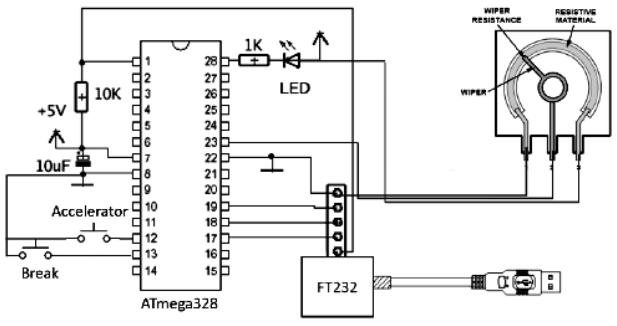


Fig.1. Circuit diagram of automated driver tester

V. Flowchart :

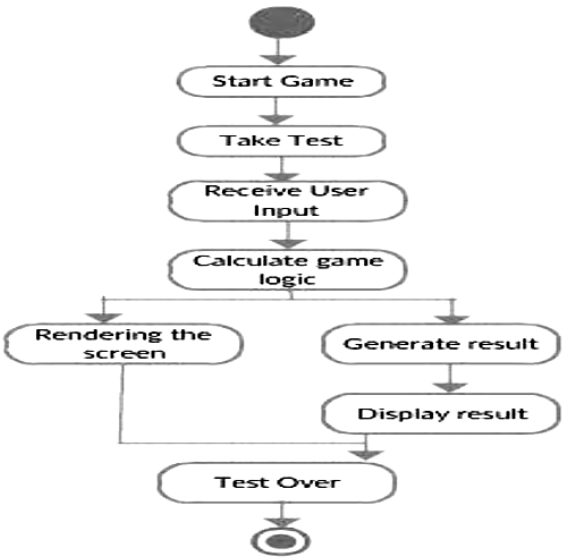


Fig.2. Block diagram of proposed application

(A) Virtual Environment

The virtual environment in the project will be created using a software called as Unity 3D. It will simulate an actual city where there will be all the sceneries and objects that present in a metropolitan city. The design will consists of two lane roads, traffic junctions, highways, bridges etc. Also effort was dedicated to increasing the degree of accuracy of objects to increase the authenticity of the display. Additionally, vehicle dashboards, traffic lights in intersections, AI physical traffic flows, climate conditions, and collisions will be added to the environment to create a more realistic and more informative driving environment simulation platform.

(B) Following steps need to be followed

Step 1: The user will get a Main menu page where he will have the option to start the test.

Step 2 : After starting the test, the user will have to follow the various instructions shown during the test and follow all the rules and regulations while playing. If he commits a mistake, then marks will be deducted depending upon the degree of the mistake he commits. After all the instructions are followed, the test will be completed.

Step 3 : After the test is completed, the result will be displayed that will show his final marks and whether he has passed or failed.

(C) Marking System

Speed Limit : The speed restriction is 30 km/h and if the driver goes beyond a limit of restriction of speed then, he will fail at that time, and 20 points will be subtracted from a total count i.e. 100 points. In this precedent the penalty of restriction of speed included, for example, if the user doesn't control vehicle speed then, then the penalty will be added and if the penalty occurs more than 3, thus, the user will be failed.

Signboards : This test case checks, on account of users to follow signs properly or does not follow i.e. during the test there may be signs to turn left or right and do not turn to the left or do not turn right. If user does not follow signs, 20 points will be subtracted.

On Curbs : In this test case if the users who steers the car out of vision the street then, 30 points are drawn off.

Traffic signal : In this test case if then user has broken the traffic signal 30 points are drawn off. So accordingly software automatically generates the result that user will pass or fail during the test.

Modules:

Following Modules will be developed as a part of the proposed Application:

1. Rules to be followed.
2. Start test.
3. Score Calculation.
4. Display Score.
5. Display result whether the driver passed or failed the test based on his score.

VI. Results:

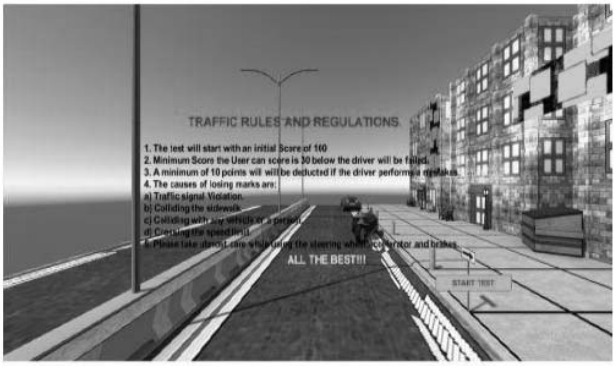


Fig.3 : Rules and regulations

Fig 4: During test

Fig 5: Result Displayed

Fig 6 : Practical hardware setup

VII. Conclusion

Thus in this paper we implemented driving kit using Arduino UNO board and interfaced it with a virtualized driving environment. It will help to improve the quality of drivers on road.

In reality the drivers face some complex situations which are not tested in driving test at RTO. This leads to increased in accidents. The simulator and the game we created comprises these situations thus improving the reflex time of the drivers as they need to respond to the situation as fast as possible.

VIII. Future Scope

- Provide different driving terrains.
- Improvise calibration of steering wheel.
- Use VR head mount display.

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Indoor Navigation for Firefighters

1st Shailaja Mishra, 2nd Sahil Mulla, 3rd Bhavana Sangare,
4th Prof. Ajitkumar Khachane

ABSTRACT

Navigation system is a system that aids in navigation. Firefighting is an alarming job to perform as there can be several unpredictable threats while rescuing victims. Since the firefighters are not aware about the internal structure of the fire ridden building, they will not be able to find the location of the EXIT door, a fact that can prove to be catastrophic. We introduce an indoor navigation system (FIREGUIDE) using RFID technology.

Keywords **:** *Indoor, Navigation System, Firefighters, RFID, Shortest Route Application, FIREGUIDE.*

I. Introduction

Firefighters put their own lives in danger to save innocent people trapped inside a building encompassed by fire. The frame of mind of firefighters during a rescue operation is not completely steady due to loss of visibility, urgent condition of victims and many other environmental factors. In such a situation, if the firefighters get puzzled about the location of the nearest exit door, then lives of both firefighters and victims are imperiled.

To address these issues, we introduce the FIREGUIDE system which provides indoor navigation using passive RFID technology implemented on an Android Smartphone. The firefighter will carry an Android Smartphone and a RFID glove. In the environment, we set up passive RFID tags on the walls and along the baseboard. The system also includes a FIREGUIDE server that stores information about the building which includes the images and the instructions to the nearest exit. It is evident that the FIREGUIDE system will save a significant number of firefighters and victims lives. We envision that FIREGUIDE can be provided as a subscription service to the fire departments. For wide deployment of such a system, each commercial building will be required to deploy the proposed infrastructure and share the building blueprints and tag deployment with such a service provider.

A. Existing Indoor Navigation System

MapsIndoors –Indoor wayfinding with Google

MapsIndoors is built on Google Maps, which makes the transition from outdoor navigation to indoor navigation completely seamless. All the known functionality and design of Google Maps is brought inside and the user can get directions from any point outside the venue and all the way inside.

- **Indoor Navigation - solutions by infsoft**

Infsoft offers the whole range of indoor positioning services: Indoor navigation, indoor analytics, indoor location tracking and indoor location-based services.

- **Indoor Navigation using SAILS Technology**

SAILS Tech.'s iMap App – Taipei Main Station is the 2015 Best Use Case Winner of InLocation Alliance competition.

The 2015 Best Use Case venue is Taipei Railway Station, also known as the Taiwan's largest maze, is so complicated that 1st timers waste at least 15 minutes trying to figure out their way

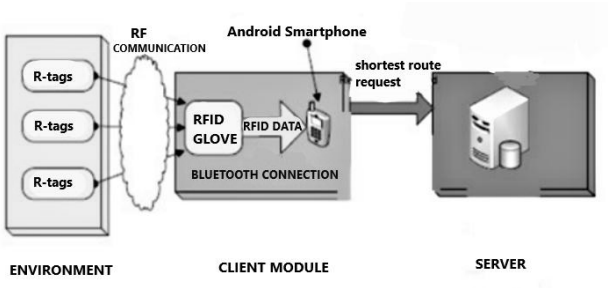
B. Field Study

Firefighting is a dangerous job to perform as there can be several unexpected hazards while rescuing victims. Since the firefighters do not have any knowledge about the internal structure of the fire ridden building, they will not be able to find the location of the EXIT door, a fact that can prove to be fatal.

During the brief interaction with a firefighter, it was figured out that the following challenges were faced by them:

- Lack of knowledge about the infrastructure of a fire ridden building.
- They are not equipped with the latest technology that will help them when disaster strikes.
- Lack of safety measures provided for the firefight operation.
- Lack of visibility due to presence of smoke and dust in environment.

II. Fireguide System Architecture



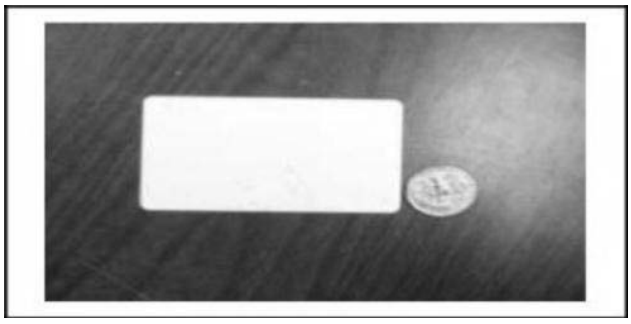
The FIREGUIDE system architecture is composed of the following components :

1. Environment- Passive RFID tags (R-tags) deployed in the building.
2. User Device– RFID glove and the Android based Smartphone.

3. FIREGUIDE Server– FIREGUIDE server stores the unique ID (of deployed R-tags), corresponding images to the exit, respective audio instructions, and communicates with the user device.

Passive RFID tag (R-tag):
R-tags are densely deployed in the building. They are located at each door of the building at a 4ft height and at the baseboard level. Granularity was the main reason behind selecting this technology for FIREGUIDE.

A proximity of 2-3 cm is required to transfer data from an RFID tag into the reader. Other reasons for selecting these R-tags were their cost and the fact that they do not need an active power source.



This section describes the which includes the RFID glove and the Android Smartphone for visual representation.

Fig. 2.0 : RFID Tag

RFID Glove :
The RFID Glove allows the user free use of his hand as well as the ability to scan an R-tag.

Fig 2.1: RFID Glove (back view) Scanning an R-Tag

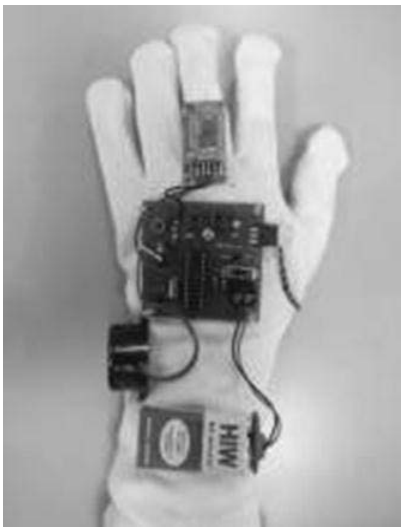


Fig 2.2 Front view of RFID Glove

Fig 2.3: Picture of surroundings of Room 312

The R-tag is scanned by placing the palm on top of R-tag. The glove communicates the unique ID represented by an R-tag using Bluetooth technology to the Android Smartphone. There are 2 buttons (Button A and B) provided on the glove. Each button has a different functionality implemented in the Android Smartphone to facilitate the navigation of the firefighter inside the building. When the firefighter scans an R-tag, the shortest route leading to the nearest Exit door is displayed on the Android Screen (see Figure 2.3). If this shortest route is infeasible to reach, then the firefighter has another option to find an alternative Exit door. The firefighter can press Button A to switch to the Alternate view which displays the shortest route path leading to the other Exit door along with the audio instruction playing in the background. With the help of the shortest route, the firefighter will know how to reach the nearest Exit door in the smoky environment (where visibility is almost zero). A picture of the surroundings of each R-tag will be stored in the Android phone. The firefighter will be presented a picture of his surrounding (with clear visibility). Figure 2.3 shows the surroundings of Room 312 assuming the firefighter is facing towards the R-tag deployed in the corridor near Room 312.The firefighter will press button B if he wants to repeat the audio instruction again.

Bluetooth Module :
FIREGUIDE system uses multiple wireless technologies such as Bluetooth module and RFID which is responsible to exchange information between the glove and smartphone. It will exchange signals with the glove at regular time intervals and if the signal is broken then a new connection will be made after discovering that the earlier connection was broken.

Microcontroller 89C51 Integrated Circuit :
The button signals (Button A, B) will be converted into appropriate instructions using microcontroller which is coded in keil using embedded C.
Button 'A' signal is converted into instruction for providing alternate nearest exit.
Button 'B' signal is converted into instruction for repeating the audio instruction.

FireGuide Server:
The fireguide server will process the request made by the client module. Server's response consist of nearest exit path images and audio instructions for the requested unique id.

Android Smartphone Applications:
Android Smartphone provides great features to build multiple applications in one single application. Android client module consists of Bluetooth module, Android basic Drawing APIs, OpenGL libraries, and shortest route applications.

The shortest route images and audio instructions will be displayed on the screen of Android Smartphone.

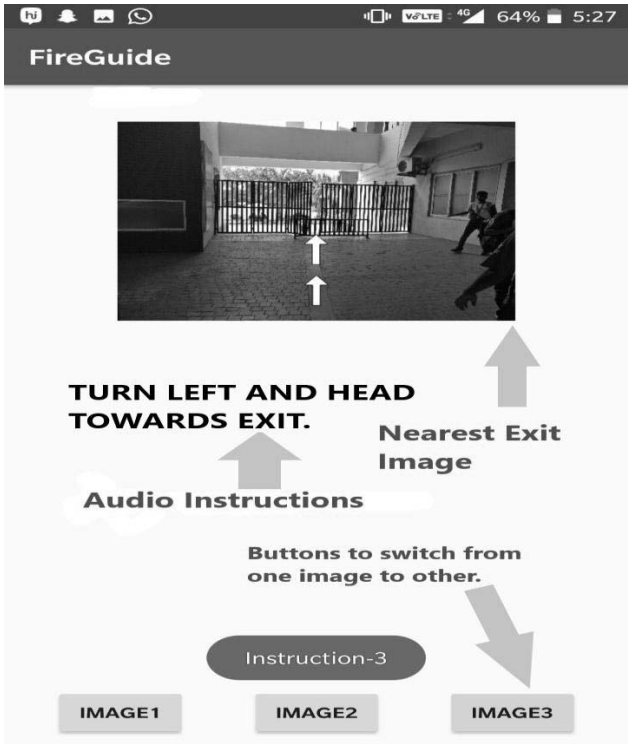


Fig 2.4: An Instance of developed FireGuide System

III. Flow of Events In Fireguide Application

1. Start
2. Firefighter scans the RFID tag using the RFID Glove.
3. Unique RFID number is read by the RFID receiver.
4. Bluetooth module transfers this ID to the Server.
5. Server accepts the ID and passes it as a parameter to the Fire guide application.
6. The fire guide application is started and then it retrieves the associated audio file and the clear images of the nearest exit from the server.
7. Audio instruction starts playing and the shortest path is displayed on the FIREGUIDE application.
8. If Firefighter presses button A, alternate shortest path will be displayed on the screen.
9. If firefighter presses button B, audio instruction is repeated.
10. Stop.

IV. Conclusion

Thus we have developed an indoor navigation system that provides assistance to fire fighters during fire hazard, where time is of utmost importance. The model will prove to be one of the quintessential aspects for life saving. The model uses technology like RFID, Bluetooth etc. which can be further optimized in future with upcoming advanced and more efficient technologies. The system can be integrated with smart cities model in future. Apart from that using spatial vectors and spatial databases will help to integrate the concept of augmented reality with the existing project which will help to get a 3-Dimensional view of the shortest exit path.

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Android Controlled Trolley

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ABSTRACT

The project is designed to develop a wirelessly controlled trolley, on which objects can be placed and which has the ability to move from one place to another without any disturbance. Any light weighted object can be placed on that trolley like structure. The Trolley controlled by android application where trolley and android application should be in the range of WiFi that is approximately 100 metres .If any obstruction comes between the trolley and android application the range may slightly decrease and we are using camera module which is used for live streaming , that is what work the trolley is doing should directly reflect back to our android application.

Keywords **:** *Wifi-module, Live Streaming, Arduino uno , Motors, Application.*

1. Introduction

The project is designed to develop android based trolley which can majorly be used for household purposes. It can safely carry things like mobile phones, laptops and other objects from one place to another safely and without human himself moving. The trolley is controlled by an android application. At the transmitting end using android application device, commands are sent to the receiver to control the movement of the trolley either to move forward, backward and left or right etc. At the receiving end, there is a Arduino uno which acts as receiver which is interfaced with Motor driver IC and Motor. The android application device transmitter acts as a remote control that has the advantage of adequate range, while the receiver end is fed to the Arduino Uno to drive DC motors. Controlling the trolley can be achieved by any smart-phone running on Android Operating system . The main advantage of this trolley is that it can be used for carrying highly reactive chemicals for one place to another in industries . Secondly, There will be a live streaming Application which will help the remote user to see if there any hurdles or objects when the trolley is moving. This gives a more convinent way to user by watching the trolley and controlling it on same place itself.

1.1 Existing System

The prior Implementation involves using a bluetooth Module which Is interfaced with microcontroller which drives the Motor driverIC.But the Problem was there wasn't much Distance covered since Bluetooth module cove less distance than Wifi-Module.

2. Proposed System

One can need an object which is placed at a different place while he/she is in the middle of an important work, or one urgently needs to send some object to other person while he himself is not able to move from his desk. In all such situations what comes to solve the problem is this proposed trolley.

We designed a trolley which is wirelessly controlled by the user with the help of his/her smartphone.
The trolley or the container will be able to hold small to medium sized object inside it. This trolley will be equipped with wheels so that it can move around the corridors easily. Moreover, Mobile phone camera on it will always capture the path ahead of it, so as to assist the user to navigate through easily and uninterrupted.

The user's smartphone will be provided with an application using which the movements of the trolley can be controlled. The user need not to worry about the visibility of the trolley to him/her, as the live stream of the way ahead of the trolley is displayed on the same mobile application simultaneously.

The communication between the smartphone and the trolley is done via the Wifi technology for an effective communication and better radius of operation. The user connected to the trolley will be the only one able to control it. Once his/her task is done the user can free the trolley i.e. disconnect from the trolley and make it available for others to connect and use.

3. System Specification

3.1 Hardware Specifications

Arduino Uno : The Arduino Uno is a microcontroller board based on the ATmega328. It has 14 digital input/output pins (of which 6 can be used as PWM outputs), 6 analog inputs, a 16 MHz crystal oscillator, a USB connection, a power jack, an ICSP header, and a reset button. This Arduino Uno will be an Intermediate between robotic trolley and Smartphone.

Wi-Fi Module : ESP8266 is an Wi-Fi transparent transmission module with ultralow power consumption. It offers a complete and self-contained Wi-Fi networking solution, allowing it to either host the application or to offload all Wi-Fi networking functions from another application processor. This wifi module is interfaced with arduino Uno so that it can accept the signals from smart phone/app.

Wheels : Standard / Fixed wheels would be more preferable for this project DC Motors: Used for converting electrical energy (signals) into mechanical energy that is to rotate wheel forward, backward, right and left.

L293D : It is a typical Motor Driver IC which allows DC motor to drive on either direction. L293D is a 16-pin IC which can control a set of two DC motors simultaneously in any direction.

Led's : There is no major role of LED's but this can be help to check whether the connection is proper and to check whether the circuit arrangement is working correctly.

Battery : depending upton the voltage battery is made available. Mostly we need to work with 12 V

Smart Phone : Smartphone in which an app which would be implemented by us is installed .Through this app we can control the trolley .

3.2 Software Specifications

Android Studio : Android Studio is the official IDE for android application development which is used to develop complex android applications. The controller app is designed using android IDE.

Arduino Ide : It consists of both a physical programmable circuit board (often referred to as a microcontroller) and a piece of software, or IDE (Integrated Development Environment) that runs on your computer, This IDE is used to burn the program on the microcontroller.

4. Working

Android controlled trolley is controlled by android application through WiFi module. Android application sends control signals (right, left, forward, backward, stop) to control the trolley. The signal is sent over WiFi as a character to the WiFi module present in the trolley and then the trolley works as per the signals received.

Moreover, to control the trolley in efficient way the user gets live view of the path ahead of trolley on the same controller app present on the smartphone. For live streaming we have used a phone with camera which is placed on the trolley, the camera preview frames captured by this phone are then converted into byte array and sent to the controller application over the wifi communication channel. The received stream of images are displayed on the controller application in a frame layout just above the buttons used for controlling.

The trolley on the receiving end is driven with the help of two dc motors which are easily controlled and instructed to rotate as per the need, with help of a motor driver IC L293D. The other components involved include ardunio board, and wi-fi module. The interfacing of these components is seen in the Fig.1

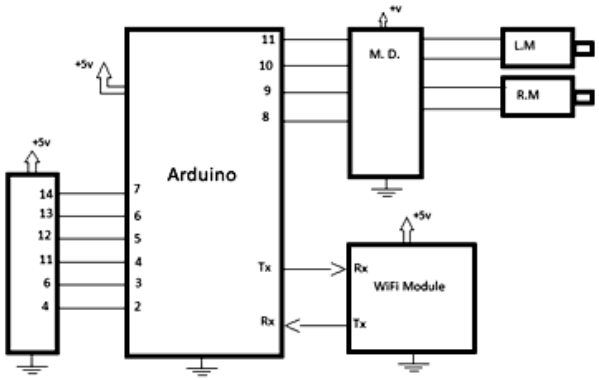

Fig. 1 : Interfacing of arduino and other components

The L293D helps in rotating the motors in both clockwise and anti-clockwise individually, when given proper signals to do so. Inorder to take a right turn, the right wheel should rotate in backwards direction and the left wheel in forward direction, similarly for every action to be performed the the logic changes. This can be understood well with the help of Fig.2 which shows the actual implementation of the circuit.

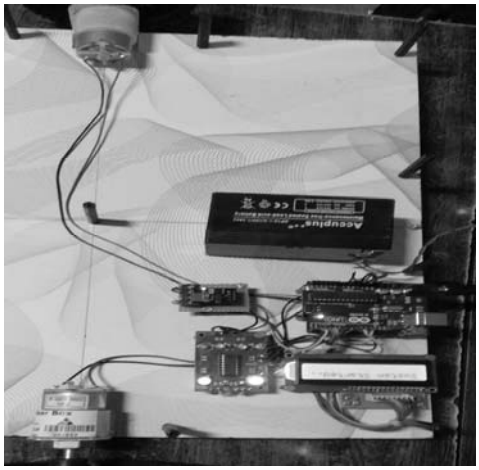

Fig. 2 : Actual implementation of the circuit

This logic of different required combinations of rotation to perform different movement is stored in the arduino-uno board. The Arduino board sends this logic of performing the action in the form of corresponding control signals to the L293D IC. The arduino board sends the corresponding control signals upon receiving the same requet from the contoller application at the wifi module connected to the arduino board. The wifi module receives the control charecter and gives it to the arduino which in turn performs the further action.

5. Result

Android Controlled Trolley is capable of lifting weight of 7-8Kg. The speed of trolley is independent of the weight which makes it efficient in terms of weight or object which needs to be moved from one place to another. Live streaming is very essential concept encapsulated in trolley which allows the user to view what's in front of trolley and helps to avoid any obstacle. The final model of the trolley can be seen in the Fig.3

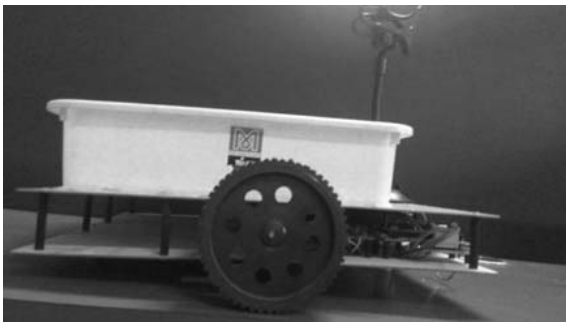

Fig. 3 : The trolley consisting of the mobile camer holder

The trolley also works properly in the regions with slope, since it has a good grip around the wheels. The speed of the trolley can be enhanced using more powerful motors and more voltage battery. The model is purely working as basic example of load carrier which can be controlled by the android application shown in Fig.4. It can further be enhanced and implemented in Industries, for Domestic purpose ,Malls and Marts on large scale.

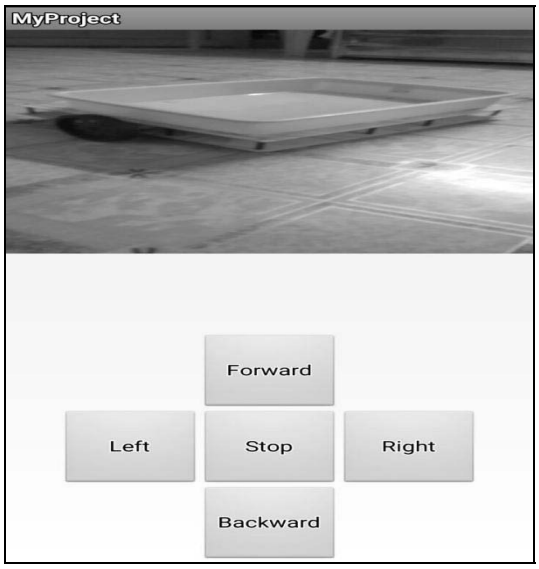

Fig 4 : Screen shot of android application

6. Conclusions

The implemented android controlled trolley has shown results as expected, with the help of successful communication between the android interface application and the ESP8266 module interfaced with arduino in the trolley. The complete project is capable of real life application such as in an office environment or even for household purposes.

The result of live stream is also satisfactorily good and gives appropriate guidance to the user so as to properly move the trolley.

The mobile vehicle is capable of moving in their environment and is not restricted to only one location. These type of projects are the main focus of a lot of research and development. They can find a wide variety of applications in industries and military applications. They can be also used widely as consumer products, in residential environment.

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CMS based Technical Research Sharing Point for Educational Institute

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ABSTRACT

Yearly, n number of research papers are uploaded on the web by the students on various topics. The procedure behind approving every research paper seems to be unorganized and becomes a hectic job. The Research Paper Forum allows students to upload their research paper on any topic, which will be organized by the admin and assigns the research paper to the respective teacher. Admin/HOD handles the system by adding teachers, students and creating a panel and assigning topics to multiple teachers. Teachers can review the paper for any corrections and remark the points if required. After successful registration of a student, he/she can upload a research paper, which will be checked and verified by the panel (Teacher).Student need to wait for the approval from the teacher and if teachers found any correction in the paper then the respective student gets notified about the corrections. Once the student sorts the corrections on the paper, then he/she may re-upload that paper. Students can view teacher's panel, which is created by the admin. System allows students to view and edit their profiles details if required.

Keywords **:** *Automation, Role based model*

I. Introduction

An internet gives various pathways that allow exchange of information, data files, audio, video files etc. Being connected to internet is a mean of getting access to these pathways. It has millions of smaller domestic, academic, business, and government networks and websites, which together carry many different information and services. In other words, an Internet is a network of networks. An Information Communication Technology (ICT) refers to technology that provides access to information through telecommunication which focuses primarily on communication technologies which include an Internet, wireless networks, cell phones and other communication media. It can be utilized to automate various daily procedures in all Education institutes.

This project is based on conference creation and knowledge sharing where in the basic & technical knowledge is imparted to the user or the staff (faculty). The primary purpose of our project is to avoid all the paper work being worked out in educational institutes and following the digital way instead.

Most of the institutes still use traditional methods for things such as technical paper presentations, conducting conferences etc. We preclude using papers which is basically a hectic work and have a simplified way for these aspects for the students as well as the faculties. This advancement would also reduce a lot of production time, increase feasibility, reduce costs and eliminate human error. Student or faculty can also access or share the recent trends in any particular fields. Some other modules that are present in our project are "Video lecture. Secondly, all of these leads to an easy Submit-Check process, that is, all the students have to do is just upload their work in their respective fields and within a span of 24 hours it will be displayed on our web portal. Only the admin will be allowed to add, edit or update the information as the work of the students is only to be informed regarding the same.

II. Literature Review

Automation refers to use of electronic or mechanical devices such as computers or other machines for the execution of tasks. It is a process of having a machine or machines to accomplish tasks which were performed wholly or partly by humans. In other words, automation is replacement of manual operations with computer procedures and other machinery. As a technology grows, automation can be applied to almost any human endeavor, manufacturing, office, teaching - learning, administrative or assessment tasks and operations[1]

Need of Automation
There are many different reasons to automate manual processes, which includes following aspects:

- Increase in productivity.
- Low operational variability.
- Presence of a complex working environment.
- High cost of human labor.
- Reduce production time.

Advantages and Disadvantages of Automation
Major advantages of automation are:

- It increases throughput and productivity.
- It improves quality of product.

Major disadvantages of automation are:

- Security Vulnerability: An automated system may have a limited level of intelligence and therefore more susceptible to committing errors outside of its immediate scope of knowledge.

- Excessive development costs: Research and development cost of automation of process may exceeds cost saved by the automation itself.

In literature review, we conducted review on technical papers, review of existing similar systems, survey of education institute.

1. Technical Paper Review

- Knowledge sharing: A review and directions for future research
- It discuss about importance of knowledge sharing points
- It elaborates importance of knowledge sharing point in academics
- Knowledge sharing is an activity through which knowledge is exchanged among people.
- In Knowledge sharing point each user either student or staff can share their research work and knowledge gain from outside resources.

2. Existing System Review

An existing System in VIT uses traditional approach

We referred in the Existing System Review :

- **EasyChair**

  Basically, EasyChair is a conference management system that is flexible, easy to use, and has many features to make it suitable for various conference models. It is currently probably the most commonly used conference management system.

  It has a number of options allowing conference organizers to choose a model suitable for their conference. These options include submission, reviewing and proceedings creation.

EasyChair Contents

- Conferences
- CFP List
- News
- EasyChair :
  - Publish With us
  - Donate to Easychair
  - News
  - My Account
  - My Conferences
  - My Recent Roles
  - Logout
- The features track combining and Sorted Emails is absent in Easychair.
- Edass

EDAS supports a range of review styles for conferences and journals, from conferences where each paper receives three reviews of the same type, to multiple levels, types or iterations of review. For example, there can be separate review forms for abstract and full paper reviews, or in-depth reviews and meta reviews.

3. Institute Survey

Major purpose of this survey is to understand scope and requirement of present Educational Institutes to provide more relevant solution in terms of proposed system. We have visited Vidyalankar Institute of Technology college to understand their way of administrations and functionality used. Below table elaborates learning from Institute survey.

Institute Name	Learning from Institute Survey
Vidyalankar Institute Of Technology (VIT)	In VIT, academic details management system is manual. All the academic processes are manual and include paper based work in terms of dairies and itisin well structure format. It includes human intervention due to which there is a lot of scope for errors. Interface of student and administrator needs a lot of involvement, which makes the system time consuming. We had spoke with Dr. Varsha Turkar mam. She had given the validate inputs. Every year RACEM (Recent Advances & Challenges in Engineering & Management) conference is conducted in our college.

III. Proposed Work

In literature survey, we have discussed review of literature. This section majorly focuses on finding from review of literature and motivation that promotes to build proposed system.

A design of a proposed automated system involves integration of various phases that mainly focuses on :

- Conversion of paper based work to paperless work using Form Oriented Model.
- Managing access control and task completion using Type Role Hierarchy based Access Control (HBAC) model to ensure the confidentiality and privacy of data
- Implementation of knowledge sharing point
- Providing Central Repository for data storage
- Ensuring data security
- To achieve automation in manual processes

Phase -1 : Conversion of Paper based documents into online documents:

In this phase, we have converted physical documents of academic details into online web based system using Form Oriented Model which is simple and gives exact natural appearance as same as that of existing paper based documents of academic details, So users will feel easy while interacting with the paperless system.

Phase 2 : Hierarchy based Access Control (HBAC) model:

Our proposed model (HBAC) follows the following steps:

i) User creation and functionality assignments as per their user role type
ii) Formation of user role hierarchy
iii) Formation of Administrative Role based Access Control

Phase 3 : Implementation knowledge sharing point :

I. Knowledge Sharing Point :

- It is a special service provided in our proposed system. Here each user either student or staff can share their research work and knowledge gain from outside resources.

During implementation we have used the concept of private user role. Each user can share their research work and knowledge gain and it is visible to all the other users present in an institution but Delete and Edit permission access control is only assigned to that individual users and not getting inherited to upper user hierarchy. Concerning about data details whether it is correct, At a department level R and D co-ordinator will be their assigned and according to his/her approval the content will be uploaded on knowledge sharing point,

Phase 4 : Providing Central Repository for data storage:

The present system involves scattered data across all the departments so integration and sharing for different purpose become difficult and time consuming. To overcome this difficulty we have proposed Central Repository for database system. With three-tier client server architecture.

Roles in the system

- Conference chair
- Program chair
- Publication chair
- Organizing secretory

Modules and their Description

The system comprises of 5 major modules with their sub-modules as follows :

1. **Program Chair**
   a. **Login :** Using valid login credentials, program chairperson need to login first.
   b. **Add/Manage Staff :** Can add new staff details and also can manage it.
   c. **Add/Manage Topic :** Can add new topic and manage its details.
   d. **Add/Manage Events :** Can add new event and manage added event details.
   e. **Add News :** Can add news with its details.
   f. **Add Video Link :** Can add a video link for reference.
   g. **View Authors :** Can view all the registered authors with their details.
   h. **View Paper :** Can view all added paper by the registered authors.

2. **Publication Chair**
   a. **Login :** Using valid login credentials, publication chairperson need to login first
   b. **Add Format :** A publication person can create and add a paper format.
   c. **View Events :** Can view list of events with details which are added by the admin.
   d. **View News :** Can view news with details which were added by the admin.

3. **Organization Secretary**
   a. **Login :** Using valid login credentials, organization secretary need to login first to access below modules
   b. **Add/View Expense :** Can add expense details with details and also can view it.
   c. **View Events :** Can view list of events with details which are added by the admin.

4. **Author**
   a. **Register :** Author need to register first with basic registration detains and need to create a valid login id and password.
   b. **Login :** Using valid login credentials, author need to login first to access below modules.
   c. **Add Paper :** Author can add a paper and request author for approval of research paper.
   d. **View Paper Status :** Can check for approval status.
   e. **View News :** Can view news with details which were added by the admin.

5. **Reviewer**
   a. **Login :** Using valid login credentials, reviewer person need to login first.
   b. **View Events :** Can view list of events with details which are added by the admin.
   c. **View News :** Can view news with details which were added by the admin.
   d. **View Authors :** Can view all the registered authors with their details.
   e. **View Paper :** Can view papers received for review. Reviewer has right to approve the research paper.

Technical Details :

1. **Track-Combining**
   In this project we use the technique of Track-combining. Basically, here we swap the papers from 1 track to another track. Suppose 1 track have 10 number of papers n another track have less papers so we can adjust those papers using track-combining.

2. **Sorted Email**
   We use the Sorted email technique.
   Here, we distribute the mails as per accepted mails and rejected mails format.

IV. Implementation and Analysis

The proposed system is implemented on three tier architecture in which the client interface is simply a web browser, XAMP 1.7.1 is configured as a web server, PHP is used as scripting language, MySQL Database connectivity.

After successful completiontion of all the mentioned in proposed technique, we are able to achieve the following aspects related to access control in any organization:

- **Online Filling of Data :** After User Creation each user will have their own authenticated login and can fill their academic details at central location and further can be utilized for automating the daily procedures.
- **Secured Access Control :** By creating different resource platform for each user type our system is preventing the resource access from unauthorized users

V. Experimental Results and Discussion

Table : Comparison between an Existing system and a Proposed system

Parameter	Existing System	Proposed System
Basic method	Paper based System	Paperless web based System
Record maintenance	Academic details are maintained in the form of Physical Diaries	Academic details are maintained in the form of E-Diaries
User Hierarchy maintenance	Manual	Automated
Division administrative actions among administrative user roles	Absent	Present
Decision making	Manual and time consuming.	Faster and error free.
Dynamicity	Time consuming	Faster
Speed of Administrative Actions	Slower	Faster
Data Access	Slower	Faster
Speed of performance evaluation	Slower	Faster
Knowledge Sharing Point	Absent	Present
Central Repository of Data	Manual	Automated Secured
Performance Evaluation	Manual	Automated

VI. Conclusion

In this paper, a suitable automated web based paperless system is designed. The principle idea of the System is used as platform in Educational Institutes to fill and manage paper details, automate major academic processes that reduce iterative manual and paper based work and helps upper user hierarchy to monitor administrative processes and evaluate the performance to take decision for improvement. System provides Central Data Repository for maintaining Institute's academic details together so no need of searching for segregated data at different places and enabling College Administrative System to make fast and informed decisions. Utilization of services (notification, performance evaluation and knowledge forum) improves overall efficiency of System and provides user satisfaction.

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Smartscanner

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ABSTRACT
Nowadays, keyboard typing remains the most common way of giving input data to computers. This is probably the most time consuming and labour intensive operation. To overcome this issue, a lot of paper documents are transformed into electronic form, which easies information processing, like searching, analysis and conversion. In this project the analysis of OCR usability for automatic data entering is presented. SmartScanner android app uses the Optical Character Recognition technology. OCR technology is the machine replication of human reading and has been the subject of intensive research for more than three decades. It converts the images into machine-encoded text that can be used in machine translation, text-to-speech and text mining. In our study we took into account the entire sequence of digitizing the print-outs: scanning, data indexation, approval, and file preparation. The tests were made on Smartphones, for which commercially available OCR engines were employed. The survey showed that the recognition of printed text is reliable and significantly accelerates data processing. On the contrary, the handwritten text appeared difficult to recognize by OCR systems. Applications of this app are to make textual versions of printed documents, to make electronic images of printed documents searchable and data entry for business documents.

Keywords: *Cuff-less, Non-invasive, Pulse Transit Time, Pulse Wave Velocity.*

I. Introduction

Nowadays, a lot of documents are produced in paper form. The document is repeatedly copied and changed during subsequent processing steps, so it exists in many different copies. This way of processing is inefficient, so we decide to digitalize theirs documents. Working with files is cheaper than processing traditional documents, because there is no space required for document storage. Moreover each document exists in one copy, and consequently all changes or notes are visible for all document users .There are three main steps of document digitalization: scanning, indexation (data entry) and presentation of digitalized documents. In this paper we focused on indexation, especially on using automatic systems in this process.

Character recognition has gained significant popularity and it has been emerged as an important research area. Character recognition is an area for research where techniques are used to classify inputs of the character according to the predefined classes. There are several algorithms that have been proposed but the choice of algorithm and classifier may result differently for different problem domains. We use three classifiers and two feature extraction techniques for the purpose of evaluation and comparison of results. We adopt 1-m approach to compare the results of Local Binary Pattern (LBP) with the Support Vector Machine (SVM) and Neural Networks (NN).

Documents generated on a high quality paper with modern printing technologies allow the systems to exceed 99% recognition accuracy. However, the recognition rate of the commercially available products depends on the age of the documents, quality of the paper and ink, which may result in significant data acquisitions noise. Documents with coloured or patterned backgrounds, marked with pens, crooked when scanned, can yield poor OCR results. Some improvement can be done by either adjusting the scanner settings and rescanning the document or manually correcting the electronic data.

The paper is organized as follows: We present the overall definition and description of OCR in Section I and present out proposed system in Section II. We present our evaluation in Section III and discuss our results in Section IV. We finally present our conclusion and future work in Section V.

II. Methodology

There is basically one traditional approach which is used for recognizing characters and its classification. In this approach we do image acquisition, prepare database of collected images, conduct pre-processing, and carry out classification. We compare our character recognition success using various techniques and classifiers and provide result to the user.

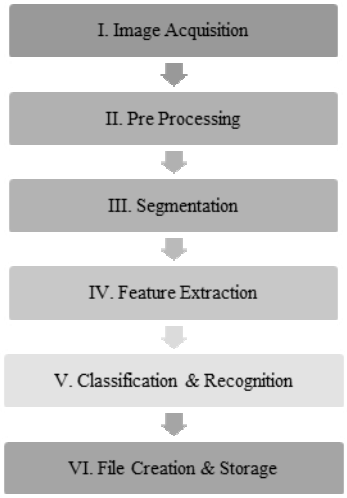


Fig: Methodology and traditional approach

The traditional approach involves five steps which are needed to carry out in order to get optimized result. They are as follows:

(A) Image Acquisition

Image acquisition is the process in which we acquire a picture or a scanned image in JPEG, PNG, or BMT formats. Initially we provided users with sheets and asked them to write a sample sentence. We collected all the sheets and convert into an image in required format through a high definition camera or by scanning the sheets through scanners. We then transfer these images to a computer such that the final image contains all characters separately.

(B) Pre Processing

Pre-processing is one of the important parts in image recognition. It applies a number of operations on grey and binary images for making them more readable for the software. The major role of the pre-processing is to filter out the impurities from the image and also to perform smoothing and normalization. We acquired image, via HD camera or scanned the sample sheet. Firstly it will resized the whole image and reduced it into 0.6 scale of the original image. In second step of the process we take its complement and convert the RGB to equivalent HSV colour space image. HSV values returned in MxNx3 image array, which controls the saturation, hue and also the value component of the image. As this is colour based segmentation. We requested users to use colour pen for their sample sheet. We then selected H channel as it helped us in segmenting characters from the sheet. In next step we binaries and applied threshold to image. In next step we take the complement of the image for box removal.

After this, morphological operation is applied to character to extract its skeleton. By performing this process we will be able to obtain neat and tidy edges of the character. We have applied thin operation we have set the value ranging from n to infinity so that operation will repeat until the image has no longer change. After extraction of the skeleton we removed unwanted components such as lines and dots, which are not key to the overall shape of the image, or small branches shorter than required for this we have applied bridge operation to the thinned image so that it will bridge previously unconnected pixels and set an value to 7. Then we have remove all the connected components or objects by using binary area open function it will remove all the pixel which are less then value of pixel set by us. As this is 2D image we have set value 8. Final result after applying all the morphological operation process is now available.

(C) Character Recognition

After extraction skeleton of character we observed that after zooming the image. Some pixel were not connected due to application of other morphological operation. Unconnected pixels are highlighted in yellow box which can be joined in later process.

After removal of all the unwanted components from the image and to join the unconnected pixels we dilate the image. So that it gradually increases the pixel at the border of the image. We have used diamond shape as a parameter for this process. Final shape of the character is obtained.

After getting the actual shape of the alphabets we segmented the letter from the assessment sheet. We created a function which will first segment the characters in rows which are separated in red colour and then by using mix max function. We have segmented characters in column as shown in green colour. Column wise segmented in highlighted in green colour.

After segmentation we reduced the picture of segmented characters to 42x24 dimensions.

(D) Post Processing

Post-processing is also one of the important parts in image recognition. In this various algorithms are used to verify detected characters. We use the following algorithm, presented as Algorithm 1, for extraction of correct letters and incorrect letters from sample sheet image file supplied as input to Algorithm 1. We use LBP for feature extraction. Every point which produces the value from LBP and allocate it with factor 2p to create the value. Different combinations of points transformed into one unique single LBP and we use “R” to define local texture approximately. We finally compute uniform and non-uniform LBP. This in return gives us feature values and we further reduce feature sets for further process.

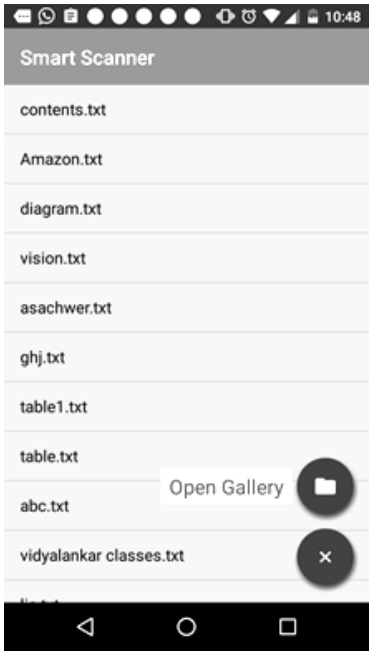
(E) Application Specific Optimization

In recent years, the major OCR technology providers began to tweak OCR systems to better deal with specific types of input. Beyond an application-specific context, better performance can be had by taking into account business rules, standard expression, or rich information contained in colour images. This strategy is called Application-Oriented OCR or Customised OCR.

III. Proposed System

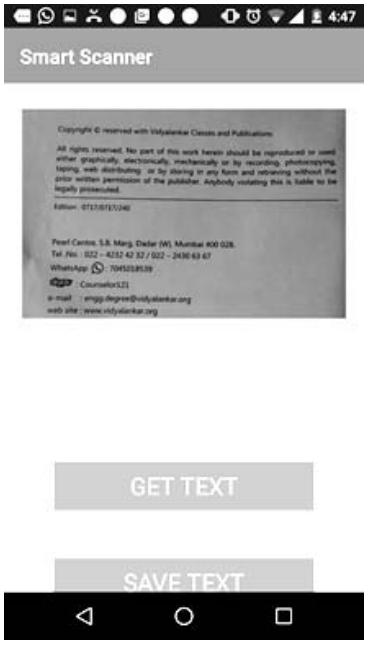
The working of our app is given as follows:

Step 1:



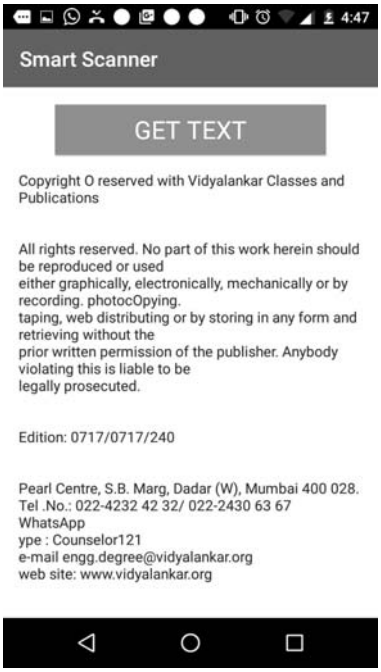
When user opens the SmartScanner, He have to choose 'Open Gallery' option for selecting an image. For that, first he have to take an image in his smartphone.

Step 2:



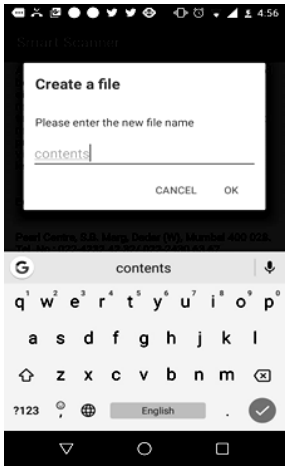
After selecting an image, user have to click on 'GET TEXT' option to extract the text.

Step 3:



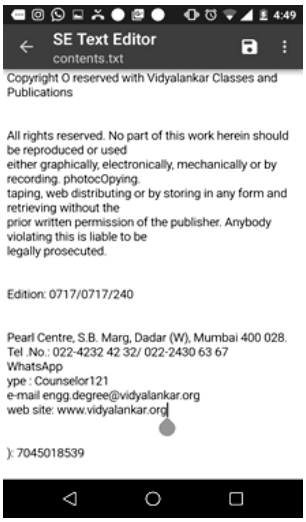
After Successful conversion of text; for saving the text, there is an 'SAVE TEXT' button.

Step 4:



User can also rename the file and Click on 'OK' to save the file.

Step 5:



User can edit the document as per his requirements.

IV. Acknowledgement

We wish to offer my profound thanks and sincere thanks to our project guide Professor Sneha Annappanavar for his significant direction, consistent support, useful remarks, thoughtful demeanour and tremendous inspiration, which has managed our endeavours at all phases of this undertaking work. Her important counsel and recommendations for the amendments, changes and change enhanced the flawlessness in playing out our activity well.

V. Conclusion

Optical character recognition is a necessary first step for all applications that consider typed as input. Recognition of printed text gives good results. Almost all the data read was correct. Only few recognized fields contained mistakes, but they have been unreadable or damaged during the scanning process. Our evaluation shows that LBP with NN gives optimal results with accuracy of 80%. Indentation issues are still there for scanning a whole document.

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Smart Infant Incubator

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Vidyalankar Institute of Technology, Wadala

ABSTRACT

In today's generation the rate of premature babies birth has increased rapidly due to thermoregulatory effect. Preterm care is a very sensitive issue in Biomedical Engineering Field. To avoid this thermoregulatory effect and provide the same environment to the preterm as present in mother's womb the medical health care has designed a rigid box like device called 'Infant Incubator 'in which the temperature and humidity can be maintained. The Arduino (ATMEGA328) based incubator consist Wi-Fi module (ESP8266) to transfer the data, DHT11 (temperature and humidity sensor), fan, bulb, load cell, phototherapy light, waterbed. It is developed at a low cost and is a sophisticated version of conventional incubator system.

Keywords: *Prematurity;ATMEGA328;ESP8266;DHT11; Load cell, Phototherapy Light, Waterbed*

I. Introduction

According to statistics around 25% of deaths are caused due to condition of prematurity Nowdays care of premature babies has become a very important issue to look after in the biomedical field[1]. It is required to provide a stabilized environment to the preterm as present in the mother's womb so the health care sector has designed a device which can be used to maintain the surrounding temperature similar to that of the mother's womb. Traditional infant incubator can only provide a relative safety environment for the new born babies. But with the change in the life style, most of the parents are so busy with the work that they have less or no time to take better care of their babies. Considering the situation, the traditional infant incubator may not provide more reliable care to the babies. In this way, a new kind of infant incubator should be researched which can self-adaptively change the environment based on a series of sensors and real-timely monitor the vital signs for the baby[3]. As the technology of Internet and network is studied by more and more scholars, the Internet of Things has been developed. In this research, an infant incubator intelligent control system has been proposed which will help in the care and monitoring of the new born baby[2].

Fig.1 Incubator Model

II. Components Analysis

1. DHT11 (Temperature and Humidity Sensor)

Low Cost digital temperature and humidity sensor. It uses a capacitive humidity sensor and a thermistor to measure the surrounding air, and gives a digital signal on the data pin

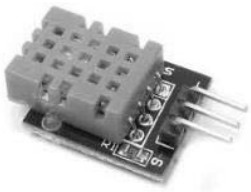

Fig.2 DHT11 Sensor

2. Arduino (Atmega328)-Microcontroller

A single chip controller developed by Atmel in the AVR family. It is 8 bit AVR.It operates between 1.8 -5.5v.

Fig.3. ATMEGA328

3. Wi-Fi Module (ESP8266)

ESP8266 is a complete and self-contained Wi-Fi network solutions that can carry software applications.It consumes less than the current 12uA.It contains multiple analog and digital interfaces

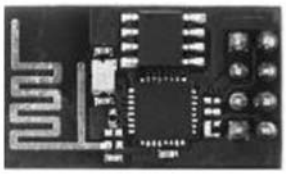

Fig.4 Wifi Module

4. Load Cell (HX711)

The purpose of load cell is to measure weight as per maturity condition of prematured neonate.

Fig.5 Image of Load Cell

5. Fan

The purpose of fan is to control the temperature. When temperature goes beyond 37 degree C fan is turned 'ON' and works in 2 speeds so as to maintain an adequate temperature for the neonate.

Fig.6 Fan

6. Bulb

The purpose of light is to increase the temperature as per need. When temperature goes below 28 degree C fan is turned 'ON' and works for increasing temperature by heating mechanism so as to maintain an adequate temperature for the neonate.

Fig.7 Light

7. Acrylic Box

It is rigid box which is used to avoid external environment to effect the neonate

8. LCD 20x4

LCD/GLCD(Graphical/Liquid Crystal Display) screen is an electronic display module and find a wide range of applications.20x4 LCD i.e. 4 rows, 20 characters. LCDs consume much less power than LED. It is able to show any character with ASCII values running from 0 to 255.

9. Blue Light

It is used for Phototherapy Purpose

10. Humidifier

Humidification by cold fog, can effectively prevent the use of air-conditioned small environment as a result of dry air caused by halogen bulb. It operates as a negative ion oxygen bar. Nourish skin and maintain elastic and smooth.

Fig.8 Humidifier

III. Block Diagram

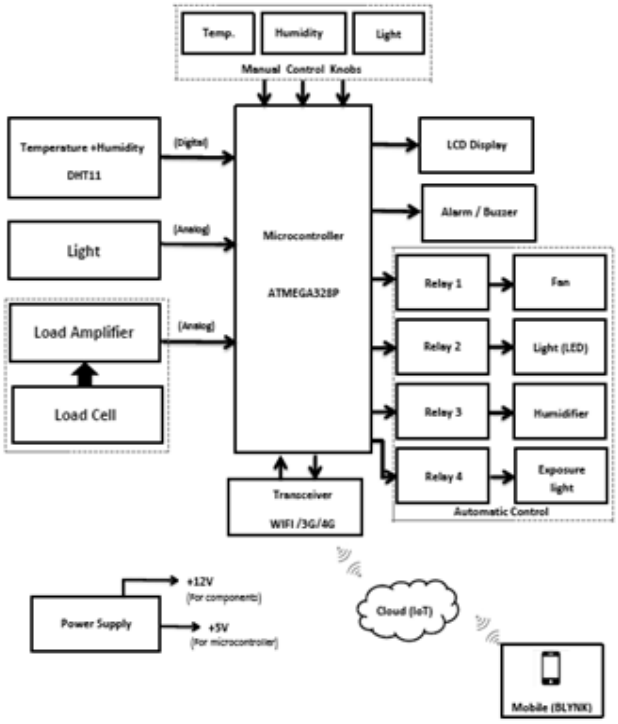

Fig.9 Block Diagram of Proposed System

IV. Flow Diagram

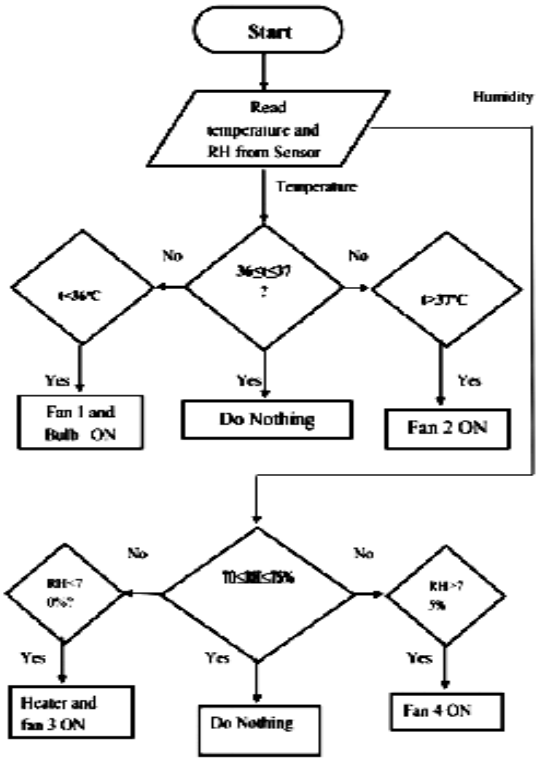

Fig.10.Flow Chart of Different Parameter Control

V. Implementation And Results

Fig.11 Proposed Model

Fig.12 Implementation of the Model

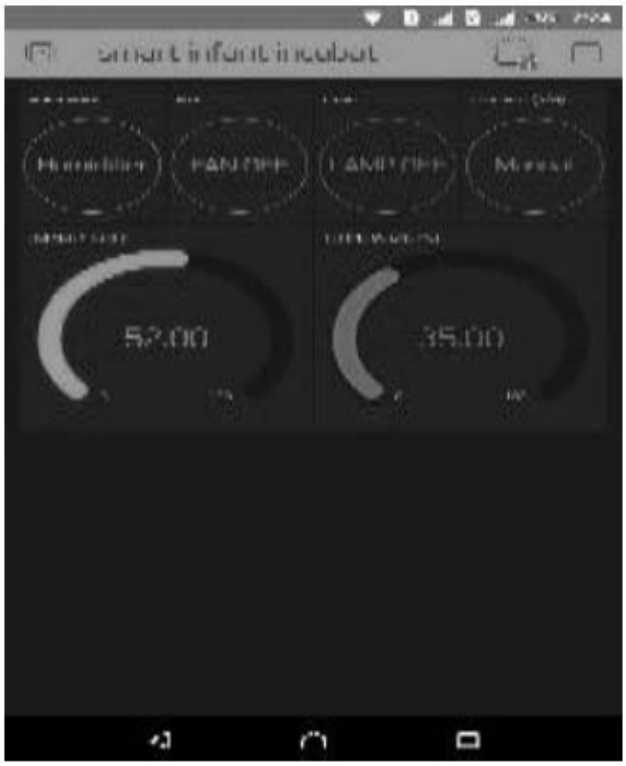

Fig.13.Parameter Control

VI. Advantages

- Cost efficient.
- Bidirectional controlling system (automatic and manual control).
- Includes Phototherapy feature.

VII. Future Work

- Battery can be used for making the model portable or ambulatory.
- A Skin Temperature Sensor can be added
- SpO2 measurement can be included

VIII. Conclusion

In this research, an smart infant incubator is proposed based on IOT to achieve the remotely monitoring of temperature, humidity, phototherapy feature and controlling of environment in the infant incubator

IX. Acknowledgment

Firstly I would like to thank our HOD for giving us opportunity and motivation to make this project. A special gratitude I give to our guide, Prof.Suvarna Udgire, whose contribution in stimulating suggestions and encouragement, helped me to coordinate my project. I would also like to thank my other group for their co-operation, understanding, support and coordination. In addition, I would also like to express my gratitude to my loving parent and friends who had helped and given me encouragement.

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Electro-oculography(EOG) Based Wheelchair

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ABSTRACT

According to study on physically disabled individuals with severe paralysis, it is found that those patients still retain the ability of eyeball movements. Various systems are being developed to assist the mobility of such patients. Electroencephalogram (EEG) based Wheel Chair systems are being developed which not only require high computational complexity but also are not cost effective. In this project, we have discussed a cost effective and reliable approach towards Human Machine Interface using Electrooculography (EOG). EOG is a physiological signal which can be recorded from temple of eyes during eyeball movements. EOG being a voluntary biomedical signal, it can be used in applications which make the desired control of a machine, a reality. In our project, we have designed a signal acquisition and conditioning unit which gives out the filtered and amplified signal used for the demonstration of Wheel Chair based on EOG. The designed system is found to showcase reliable performance in terms of obtaining EOG signal, its conditioning and its desired application.

I. Introduction

It is known that the eye behaves like a electrical cell with potential difference existing between the cornea and retina. In this representation cornea and retina behave as two electrodes of the cell with cornea being positive and retina being negative. The resting potential between cornea and retina is 10-30mV. This potential is disturbed when eye deflects from its central axis. The potential arising due to this deflection is measured by the electro-oculography measurement system.

Saccades are rapid, ballistic movements that abruptly change the point of fixation. They can be elicited voluntarily but occur reflexively whenever the eyes are open or even when fixated on a target.

The sensors are Ag/AgCl surface EOG electrodes. In the left gaze the cornea approaches the electrode near the outer canthus resulting in a negative-going change in the potential difference recorded from it. In the Right gaze the cornea approaches the electrode near the inner canthus resulting in a positive-going change in the potential difference recorded from it.

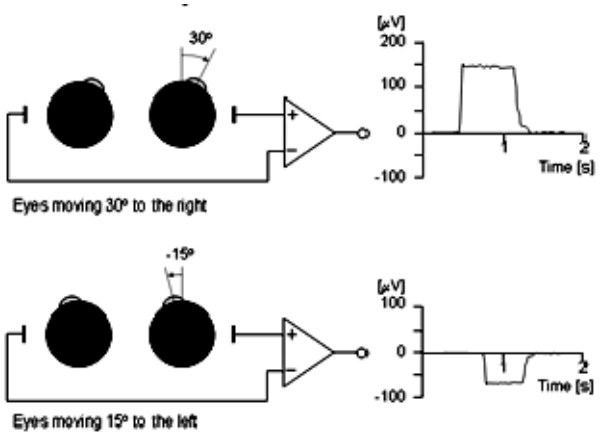

Figure 1: change in potential due to lateral eye movement

To measure eye movement, pairs of electrodes are typically placed either above and below the eye or to the left and right of the eye. If the eye moves from center position toward one of the two electrodes, this electrode "sees" the positive side of the retina and the opposite electrode "sees" the negative side of the retina. Consequently, a potential difference occurs between the electrodes. If the resting potential is constant, the recorded potential is a measure of the eye's position. The eye acts as a dipole in which the anterior pole is positive and the posterior pole is negative.

Left gaze : the cornea approaches the electrode near the outer canthus of the left eye, resulting in a negative-trending change in the recorded potential difference.

Right gaze : the cornea approaches the electrode near the inner canthus of the left eye, resulting in a positive-trending change in the recorded potential difference.

Quadriplegics is paralysis caused by illness or injury to a human that results in the partial or total loss of all their limbs and torso. Quadriplegics is highly dependent on an assistant for wheelchair movement. It is not always the case where the helper is with the patient all the time, therefore independence is encouraged among the wheelchair users. The eye movement can be considered as a significant communication tool. The signal from the eye muscles, called electrooculogram is generated due to different eye movements, directions and levels. The signal strength for various eye movements are obtained using EOG electrodes

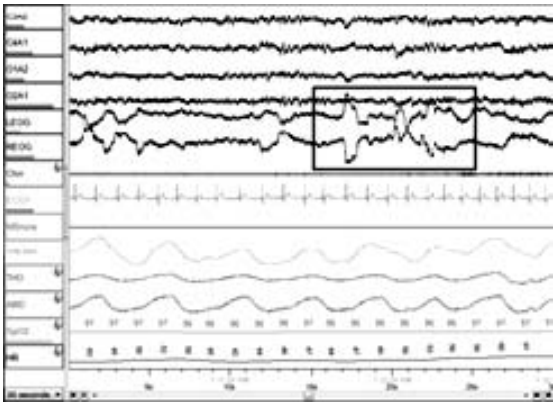

Figure.2: EOG of a normal person

II. Electrode placement

The non-polarisable electrodes are generally employed in electro-oculography. To track the horizontal movements, the electrodes are attached laterally to the sides of both the eyes and on the nose/ forehead which acts as a ground. In the same way, to track vertical motion, the electrodes are placed above and below the eye under study. Figure 3 shows the electrode placement for the procurement of the EOG signal from the patient.

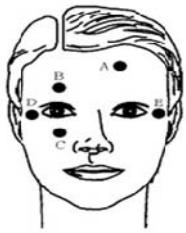

Figure 3: placement of electrodes

III. System Description

The overview of the project can be understood by using the following block diagram.

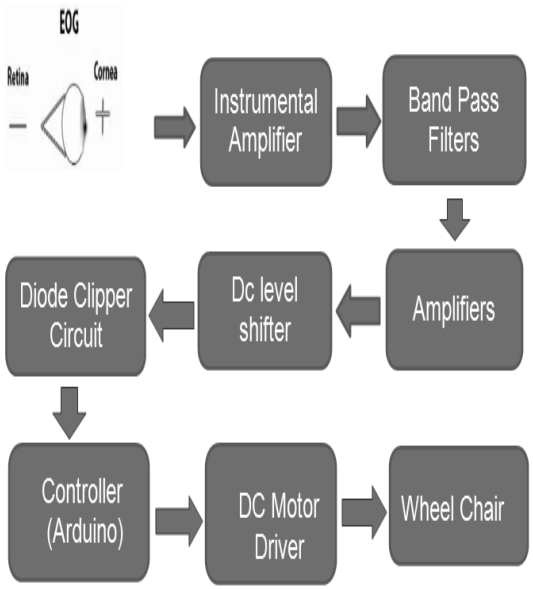

Figure 4: Block Diagram

The amplified and filtered EOG signal obtained from the designed signal conditioning circuit was sampled by using Analog to Digital Converter (ADC) which is already inbuilt in most of the available development boards. For the type of electrode placement used during our project, it was quite evident that the magnitude of the signal increases above the reference level as the subject moves his eye toward right direction.

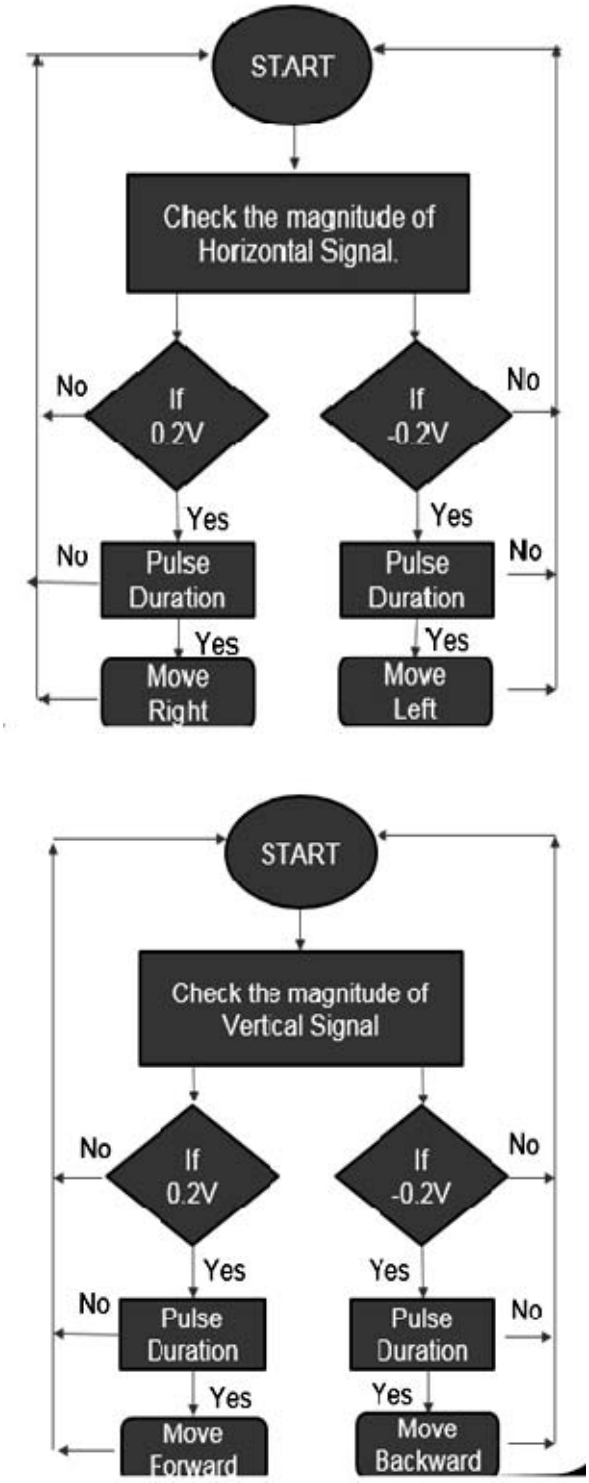

Figure 5: Flowchart

The signal reaches its positive peak when the eye is at the extreme right position. If the eye is not moving or at the Centre position the signal comes back to the reference level. Here the magnitude of reference level can be varied by making use of potentiometer available for the DC level shifter in the signal conditioning circuit. Similarly, if the eye ball moves towards the left direction, the signal drops below the reference level and reaches to minimum when the eye is at extreme left. The information about the magnitude of the EOG signal during the eyeball movement can be easily utilized to generate the necessary control signals. Thus, this demonstrates a cost effective, simple yet reliable solution for Human Machine Interface based on eye ball movement. The algorithm to extract the signal features for the eyeball location makes use of simple thresholds. Three thresholds are arbitrarily set for a Centre, extreme left and extreme right location of the eye. (Say th1, th, th2 respectively).

If signal sample>th1 this indicates eye movement towards right

If signal sample<th2 this indicates eye movement toward left

Else, this indicates eye ball is located at the center.

However, during the implementation of the crude algorithm above, care should be taken that the decision of the generation of control signals is due to the real movements. There can be sudden momentary peaks occurring in the signals that cross the above-mentioned thresholds, in such cases a concept of counter can be implemented in the algorithm, i.e. if the signal meets the threshold condition, counter for that case is increased. If both the conditions, the amplitude threshold and the counter number threshold, are met the decision is made and a control signal is generated according to that. In our case, for the idea demonstration we have used simple inexpensive LEDs (Light Emitting Diodes). Three LEDs are connected to output pin of the microcontroller used, one each for the three cases of the eye ball movement, LEFT, CENTER and RIGHT

IV. Result

We were successful in building a circuit that accurately captures the EOG signal and displayed it on the oscilloscope. The microcontroller based program was also developed.

V. Conclusion

So far we have been successful in making the individual blocks of analog and digital, work properly. We would like to add some more additional features such as , obstacle detection sensor.

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Bionic Eye-A Prototype

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ABSTRACT

Technology has created many pathways for the mankind. Now technology has improved to that extent where in the entire human body can be controlled using a single electronic chip. We have seen prosthetics that helped to overcome handicaps. Bio medical engineers play a vital role in shaping the course of these prosthetics. Now it is the turn of Artificial Vision through Bionic Eyes. Chips-designed specifically to imitate the characteristics of the damaged retina, and the cones and rods of the organ of sight are implanted with a microsurgery. Whether it is Bio medical, Computer, Electrical, Electronic or Mechanical Engineers – all of them have a role to play in the personification of Bionic Eyes. This multidisciplinary nature of the 'new technology' has inspired me to present this paper. There is hope for the blind in the form of Bionic Eyes. This technology can add life to their vision less eyes.

I. Introduction

"There is no better way to thank God for your sight than by lending a helping hand to those in dark."
There is no replacement for human sight. It is simply incomparable because of its capacity to see. Our life is full of pictures we daily see. Life without sight is dark. And blind people live dark lives. As capable human beings, we need to do something more than just helping a blind person cross the road.

Belonging to the community of engineers – there is no frontier that we cannot conquer. If scientists give birth to ideas, then it is we engineers who put life into those ideas. Today, we have every tool in our hand. The ball is in our court! It is our turn now, to return what mankind has given us. What about bestowing sight for the blind? There is no magic wand to do this in a jiffy. But yes! We certainly know the magic route to reach our goal: Science and Technology.

It is important to know few facts about the organ of sight i.e., the Eye before we proceed towards the technicalities involved.

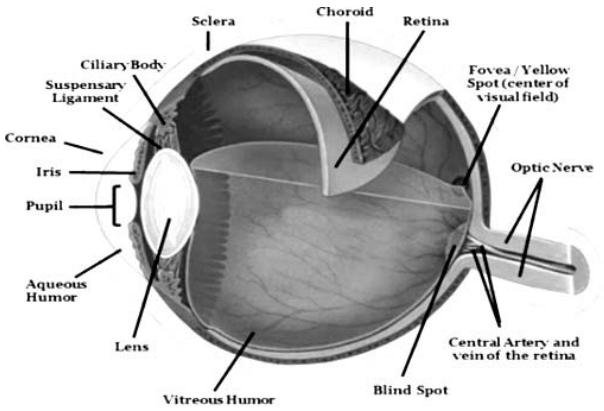
Currently there is only one proposed model of bionic eye that is Argus Retinal Implant by Boston Retinal Implant Project. There are various generations of this implant proposed by them as follows:

1. The first implant was developed in 2007-2008 and it was not suitable because the number of electrodes is too small and had biocompatibility issue.
2. The generation 2 device had a miniature design with cosmetic adaptions but was biologically incompatible.
3. Generation 3 overcomes the above issues and was surgically implanted on few people (not disclosed).
4. We at student Level cannot demonstrate the actual implant. So, we are just trying to imitate/irradiate the concept of Real time image capturing, Image Processing and wirelessly transferring the data.

II. Anatomy and Physiology of Human Eye

The eye is our organ of sight. The eye has a number of components which include but are not limited to the cornea, iris, pupil, lens, retina, macula, optic nerve, choroid and vitreous.

- Cornea: clear front window of the eye that transmits and focuses light into the eye.
- Iris: coloured part of the eye that helps regulate the amount of light that enters
- Pupil: dark aperture in the iris that determines how much light is let into the eye
- Lens: transparent structure inside the eye that focuses light rays onto the retina
- Retina: nerve layer that lines the back of the eye, senses light, and creates electrical impulses that travel through the optic nerve to the brain
- Macula: small central area in the retina that contains special light-sensitive cells and allows us to see fine details clearly
- Optic nerve: connects the eye to the brain and carries the electrical impulses formed by the retina to the visual cortex of the brain
- Vitreous: clear, jelly-like substance that fills the middle of the eye



Structure of Human Eye

For vision to occur, two conditions need to be met:

1. An image must be formed on the retina to stimulate its receptors (rods and cones).
2. Resulting nerve impulses must be conducted to the visual areas of the cerebral cortex for interpretation.

Four processes focus light rays, so that they form a clear image on the retina.

1. Refraction of light rays.
2. Accommodation of the lens.
3. Constriction of the pupil.
4. Convergence of the eyes.

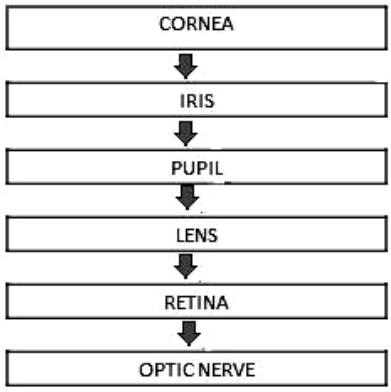
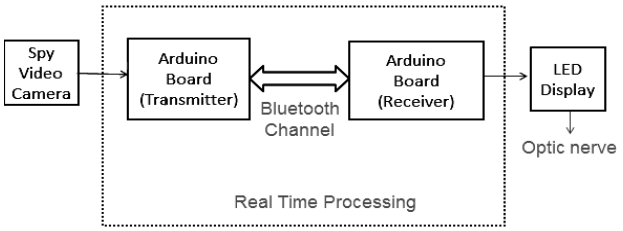


Fig. 1 : Physiology of Human Eye

III. Proposed System

- This device is useful for the people who have lost their eye sight in some accidents and to develop technology that's as effective for visual disabilities.

Block Diagram of Proposed System



Mask Used In Retinal Prosthesis :

Bi-cubic Filter Mask

$$\frac{1}{256}\begin{bmatrix}1 & 4 & 6 & 4 & 1\\ 4 & 16 & 24 & 16 & 4\\ 6 & 24 & 36 & 24 & 6\\ 4 & 16 & 24 & 16 & 4\\ 1 & 4 & 6 & 4 & 1\end{bmatrix}$$

Averaging Filter Mast

$$\frac{1}{25}\begin{bmatrix}1 & 1 & 1 & 1 & 1\\ 1 & 1 & 1 & 1 & 1\\ 1 & 1 & 1 & 1 & 1\\ 1 & 1 & 1 & 1 & 1\\ 1 & 1 & 1 & 1 & 1\end{bmatrix}$$

Sobel Mask for x and y Gradient :

Row Gradient (x)

$$\begin{bmatrix}1 & 0 & -1\\ 2 & 0 & -2\\ 1 & 0 & -1\end{bmatrix}$$

Column Gradient (y)

$$\begin{bmatrix}-1 & -2 & -1\\ 0 & 0 & 0\\ 1 & 2 & 1\end{bmatrix}$$

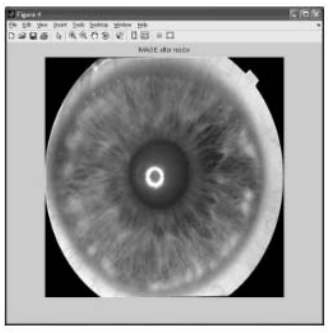
$$\begin{bmatrix}0 & -1 & 0\\ -1 & 4 & -1\\ 0 & -1 & 0\end{bmatrix}$$

Laplacian Mask

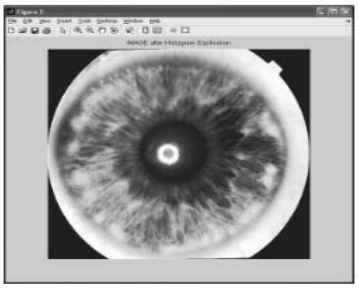
Image Filtering :

STEP 1:RGB image to grayscale conversion

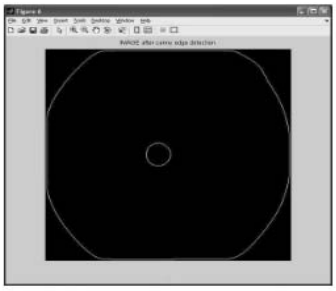
STEP 2:Image Resize



STEP 3:Histogram Equalization



STEP 4:GAUSSIAN FILTERING



STEP 5:CANNY EDGE DETECTION

Component Details

(A) SPY Video Camera :

The OV7670/OV7171 CAMERACHIPTM is a low voltage CMOS image sensor that provides the full functionality of a single-chip VGA camera and image processor in a small footprint package. The OV7670/OV7171 provides full-frame, sub-sampled or windowed 8-bit images in a wide range of formats, controlled through the Serial Camera Control Bus (SCCB) interface. This product has an image array capable of operating at up to 30 frames per second (fps) in VGA with complete user control over image quality, formatting and output data transfer.

(B) Arduino Board :

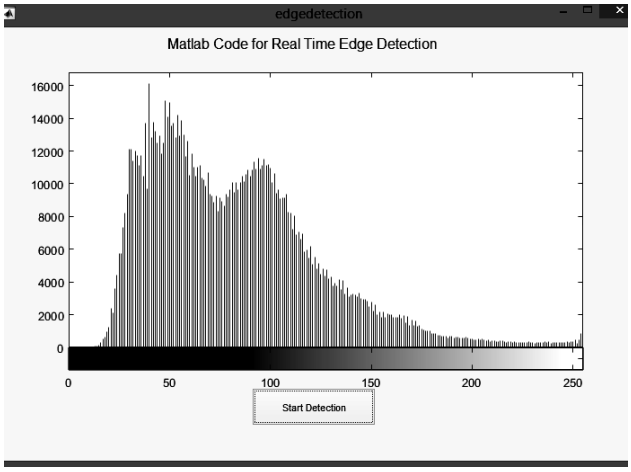
The AL422B is a First-In-First-Output (FIFO) video frame memory used to buffer audio/video/graphic data for digital processing, timing correction, or format conversion. It is manufactured with state-of the-art embedded memory technology for applications in TVs, VCRs, scan converters, and digital video systems.

(C) Led Display :

The 64 LEDs are driven by 16 output pins of the IC. The question now is how is that possible. Well the maximum number of LEDs light up at the same time is actually eight. The LEDs are arranged as 8×8 set of rows and columns. So the MAX7219 activates each column for a very short period of time and at the same time it also drives each row. So by rapidly switching through the columns and rows the human eye will only notice a continuous light.

IV. Implementation of Program

Histogram of image just after cam snapshots the image:



Histogram of image after edge detection:-

IV. Future Scope and Conclusion

In near future will be to bypass the eye and go straight to the brain. At this point, many visually impaired people aren't able to benefit from the implant, which requires a functioning retina to work. That leaves people with damaged retinas or that have lost their vision to infection, or diseases like glaucoma or diabetes, out of luck. Second Sight is "working on a new implant that bypasses even the retinal layer, and implants electrodes directly onto the visual region of the brain," Second Sight CEO Dr. Robert Greenberg told the BBC.

Conclusion:

V. Problem Statement

Biological Considerations :

- The ability to give sight to a blind person via a bionic a eye depends on the circumstances surrounding the loss of sight.
- Vision lost due to degeneration of photoreceptors is the best candidate for treatment
- Though, person born blind may lack fully developed optic nerve
- There are prototypes available which corrects vision defects, but unfortunately, they involve eye surgery whether it is Argus II Bionic Eye or any retinal implant.

Technological Considerations :

- The new artificial retina, an array of electrodes implanted on the back of the eye.
- The Boston Retinal Implant Project have been developing a Bionic Eye Implant that could restore the sight of people who suffer from age –related blindness.
- Bionic eye will only help individuals that were born with functional eye sights.

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Head/Hand Movement Controlled Switching Device for Physically Challenged People

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ABSTRACT

Accessible technology can really help disabled people live their life with full potential & always lent a helping hand for people with disabilities. With this crucial & valuable point in mind, our project can embrace people's differences and provide choice to suit everyone and empower them to achieve their goals both at work.

In the world there are many people who are physically challenged who cannot move and operate devices like switching of lights, fans, etc and they always need someone to operate switching devices for them. Even there are many people who are blind or paralyzed or a dumb that cannot speak and ask for his needs like food, medicine, water etc. So they are facing many difficulties in fulfilling of their basic needs. So in our project we have designed a "Head movement controlled device switching system for physically challenged" Now the person who is physically challenged can wear this device to head/hand and with the simple head movement's he/she can request the basic needs. This device is portable and this system operation is driven by wireless technology.

In this project in order to control the devices with head/hand movements we are using MEMS sensor. This sensor detects the tilts and gives respective output. We also used a voice circuit which speaks out the needs of the use. So the difficulty of the physically challenged person will be decreased.

I. Introduction

The term "orthopedic" refers to impairments of the skeletal system, including the spine, other bones and associated muscles. Orthopedic handicaps are conditions of the skeletal system that limit a person's abilities. Orthopedic handicaps include bone diseases such as Paget's disease and osteogenesis imperfecta, spinal cord injuries, nerve injuries such as brachial plexus palsy, and congenital conditions such as cerebral palsy and spina bifida.

People with orthopedic handicaps usually have some difficulty with walking or movement. The severity depends on the type of orthopedic handicap they have. Problems may be minor, or individuals may have difficulty moving independently at all. Some conditions cause bones to break easily. People with orthopedic handicaps may have other disabilities as well. For instance, hearing loss often occurs in people with Paget's disease.

Muscle is a special kind of tissue that enables our bodies to move. It is under the control of the nervous system, which processes messages to and from all parts of the body. Sometimes the nerve cells, or neurons, that control the muscles become diseased or injured. When that happens, a person loses the ability to move the muscles voluntarily, and we say that the person is paralyzed.

Paralysis of the muscles of the face, arm, and leg on one side of the body is called hemiplegia ("hemi" means "half") and usually results from damage to the opposite side of the brain.

The main initiative of our project to develop at least a way to make lives of such people better.

2. System description

The physically challenged people face a lot of problems to carry on with their day to day activities. One of them is their physical dependency on other person for their daily needs. By this project we aim to decrease their physical dependency on another person at least to some extent.

The user wears this device on head/hand and with simple head/hand movements he can request his basic needs like food, water, medicine or control electrical devices like fan, lights, etc. MEMS (micro electro mechanical sensor) accelerometer is a highly sensitive sensor and is capable of detecting the tilt. On the transmitting side, the MEMS accelerometer detects the head tilt and gives this as the input to the microcontroller through the ADC. The microcontroller compares this input with the pre-set values stored and depending on it, the controller judges whether the instruction is right movement or left movement operation respectively. Through RF communication this information is passed to the receiver side. On the receiver side, the RF receiver receives the signal and gives to the microcontroller, which judges the output operation to be performed based on the received instruction and thus the respective operation is performed through relays.

For example, if the tilt is to the forward then the respective device (device 1) will be 'ON' for the first time and then next time will be 'OFF'. Similarly, if the tilt is to the left or right side direction then another device will be controlled or the related need will be announced.

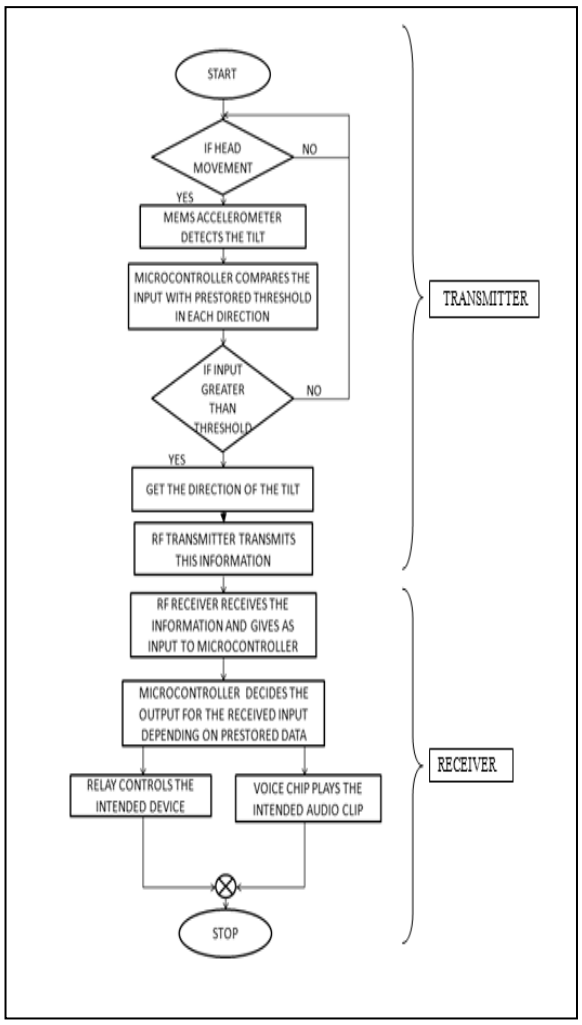

Fig. 1: Flowchart

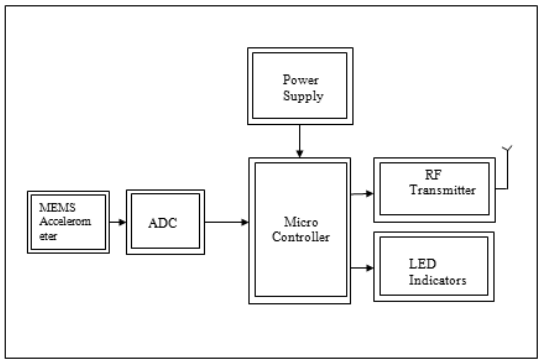

Fig. 2 : Transmitter

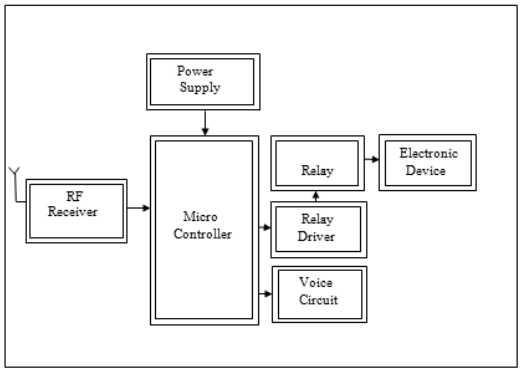

Fig. 3: Receiver

3. Result

We were successful in building a circuit that accurate works on head movement and acts a switching device. The microcontroller based program was also developed.

4. Conclusion

So far we have been successful in making the individual blocks of analog and digital, work properly. We would like to add some more additional features such as, sending the data using IOT technique for betterment of the patients.

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Multi-Patient Bedside Monitor

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ABSTRACT

Bedside monitoring technology is integral part of assessment and monitoring of patients in hospitals. It can monitor most of physiological signals including Electrocardiograph (ECG), Heart Rate (HR), Respiration Rate, Invasive and Non-Invasive Blood Pressure (NIBP), Oxygen Saturation in Human Blood (SpO2), Body Temperature and other Gases etc. Nowadays patient monitor are available as multi-parameter monitoring system. This modern day multi-parameter monitors are used in general wards to monitor different parameters of patient where sometimes patient is not that critical to monitor every parameter. This thereby increases workload on hospital staff to attend each patient's system and these individual systems also increases patient's treatment cost. Hospitals in rural areas also cannot afford many such systems for different patients. The challenge is immense, as nearly 73% of the country's population lives in rural areas and 26.1% is below poverty level1. In that case a low cost, integrated and compact monitoring device will be a boon to such hospital setups. In this project, we proposed a system called 'Multi-Patient Bedside Monitor' which not only provide multi-parameter monitoring but will also be shared by two patients simultaneously, thereby helping in cost reduction and providing compact systems. This device will monitor ECG, Heart Rate, Body Temperature and SpO2 of two patients and will display real-time data of both simultaneously on a single screen. Sensors units of two different patients will fetch signals which will be fed to the controller unit and then to the display. If any physiological parameter value exceeds the threshold value, an LED on the system will turn red from green for that parameter which will help to alert the nursing staff. Besides this, system contains a Wi-Fi module which will help to upload patient's data online at regular intervals of time. This will allow doctor to access and read patients data from remote place.

Keywords **:**

Bedside monitoring, ECG, Heart Rate, SpO2, Body Temperature, general wards, rural areas, multi-parameter, compact system, real-time data, Wi-Fi module.

I. Introduction

Patient monitoring is not a new system in health care as it was first started in the year 1625 for monitoring the body temperature and blood pressure of patients. Subsequently, this system has begun to find its usage and acceptance for monitoring different types of physiological parameters and health related aspects that are being performed until now. Multi parameter monitoring system is used for monitoring multiple physiological signals of patients by transmitting the vital information like ECG, Heart Rate, Respiration Rate, Body Temperature and Blood Pressure, etc. Due to these reasons, multi parameter patient monitoring systems play a significant role in the field of medical devices. Hospitals setup in the rural and remote areas does not have such units in large number and cannot afford them.

This project, proposes a Multi-Patient Monitoring System which not only provide multi-patient monitoring but will also reduce treatment cost and space. This device will monitor Electrocardiograph (ECG), Heart Rate (HR), Body Temperature and Oxygen Saturation (SpO2) of two patients. These several parameters can be selected as per the need of monitoring by the nursing staff. Sensors will sense the patient's body signals and these signals from these sensors after conditioning are given to the main microcontroller. Microcontroller takes sensor values and processes it. Different conditions like lead off detection, threshold values are added. Real time heart rate is calculated. This data is multiplexed and encoded in serial data and it interfaces with LabVIEW. LabVIEW is used to simultaneously display two patient's data on a single screen. This patient's data is also uploaded to ThingSpeak using a Wi-Fi module to allow doctor to access and read patients body parameters from remote places.

II. Proposed System

Multi-Patient Bedside Monitor is a monitoring system with functionality of monitoring two patient data simultaneously. Patient monitors present in the market include multi-parameter monitoring systems but none of them include multi-patient monitoring feature. Parameters including ECG, HR, SpO2 and Body Temperature of two patients will be monitored with this system. Addition to this, it includes remote online data access with the help of Wi-Fi-module present in the system.

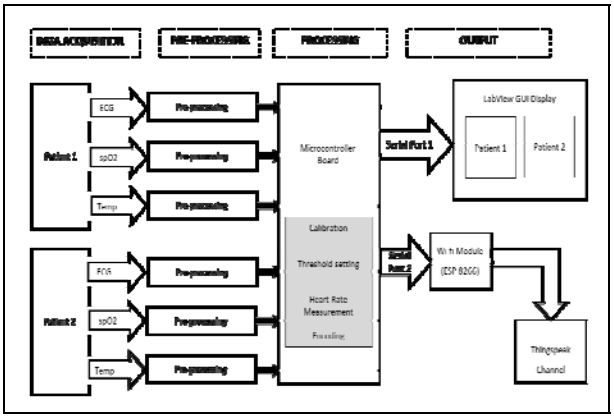

Fig.1: Proposed System

The working of this system is explained with the help of above diagram, which consists of sensor modules, a microcontroller, LabVIEW GUI display and a Wi-Fi module. Sensors are used to fetch different body signals from patients. Sensors used in the system are AD8232 for ECG, Max30100 for SpO2 and DS18B20 for Body Temperature. These signals after conditioning are given to the main microcontroller. Microcontroller in this system is Arduino Mega 2560. It takes sensor values and processes it where different conditions like lead off detection, threshold values are added. Real time heart rate is calculated. This data is multiplexed, encoded in serial data and interfaces with LabVIEW. Laboratory Virtual Instrument Engineering Workbench (LabVIEW) is a system for a visual programming language from National Instruments which will be used to simultaneously display two patient's data on a single screen. The real time data of both patients is transmitted to ThingSpeak using a Wi-Fi module ESP8266 after every 15 seconds. ThingSpeak is an open source Internet of Things (IoT) application and API to store and retrieve data from things using the HTTP protocol over the Internet or via a Local Area Network. This data will help doctor to analyze and study patient's data remotely.

III. Hardware Interfacing And Processing

A. Interfacing all the hardware modules for single set of sensors

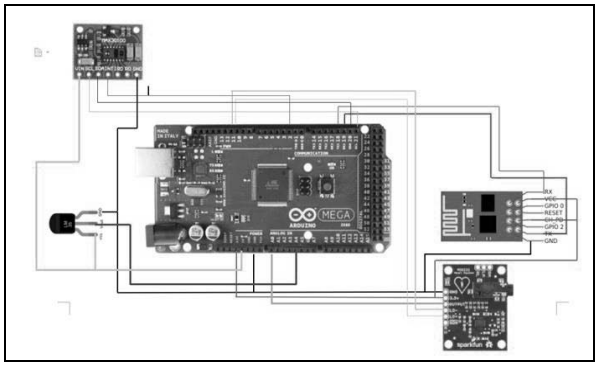

Fig. 2: Circuit Diagram

B. Processing

1) Calibration

ECG

- Values which we get is an ADC count in the range 0-1023
- ADC count value for R wave is in the range of 500-650. Thus, we consider threshold value 450 to differentiate R wave from other signals.
- To get the properly calibrated values we use the formula,
  Value in mv = (ADC count) * (Vref) /1023
- For AD8232, Vref is 3.3V

Sp02

- This project utilizes the Arduino-MAX30100 library by OXulloIntersecans for I2C and MAX interfacing.
- We get raw IR values from the sensor. After processing the raw IR values with a 1st order low-pass Butterworth (included in library) and an algorithm to remove DC components (included in library). Sampling Rate - 100 Hz, IR LED current – 50 mA, RED LED current – 27 mA
- Similarly, processed IR and Red values are used for the SPO2 calculation as follows:
  R = redACValue/irACValue
- SpO2 is calculated using the following formula,
  SPO2=110-25*R

Temperature

- Each sensor has a unique serial number assigned by the manufacturer. The sensor works by reading and converting the temperature and storing this value in scratchpad memory. The scratchpad memory is then read via the One-wire bus by the Dallas library.
- The DS18B20 output temperature data is calibrated in degrees Celsius. The temperature data is stored as a 16-bit sign-extended two's complement number in the temperature register (see Figure 2). The sign bits (S) indicate if the temperature is positive or negative: for positive numbers S = 0 and for negative numbers S = 1. The power-on value in the scratchpad memory is 85 °C. If the data being read from the scratchpad memory is corrupted in transit, then the checksum will fail, and the Dallas library will return a value of -127 °C.

TEMPERATURE (°C)	DIGITAL OUTPUT (BINARY)	DIGITAL OUTPUT (HEX)
+125	0000 0111 1101 0000	07D0h
+85*	0000 0101 0101 0000	0550h
+25.0625	0000 0001 1001 0001	0191h
+10.125	0000 0000 1010 0010	00A2h
+0.5	0000 0000 0000 1000	0008h
0	0000 0000 0000 0000	0000h
-0.5	1111 1111 1111 1000	FFF8h
-10.125	1111 1111 0101 1110	FF5Eh
-25.0625	1111 1110 0110 1111	FE6Fh
-55	1111 1100 1001 0000	FC90h

Fig. 3: Temperature Readings

2) Heart rate Measurement

Algorithm

- Set t1 = 0
- Read input ADC count
- Check if the value is greater than 450 if yes go to step 3 else come out of the loop
- Record the time in milliseconds and save in t2
- Find t = t2-t2
- If t is greater than 100 find HR using the formula
- HR = (60/t)*1000
- Print the value of HR
- Else come out of the loop

3) Flowchart of Arduino processing

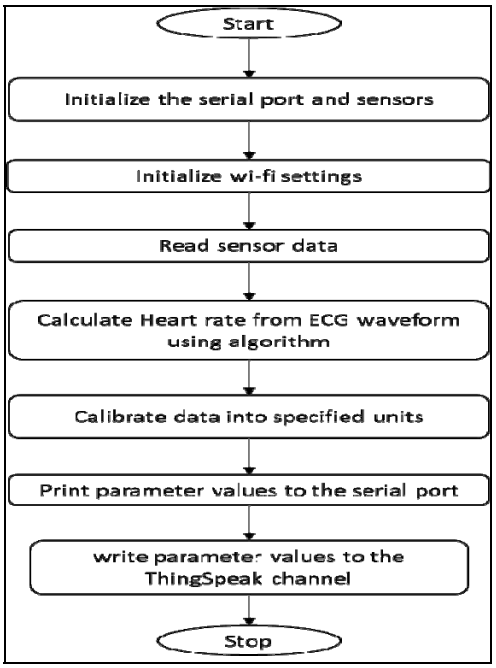

Fig. 5: Flowchart of Arduino

IV. Results and Comparison

A. Final GUI on LabView

Laboratory Virtual Instrument Engineering Workbench (LabVIEW) is a system-design platform. LabVIEW is commonly used for data acquisition, instrument control, and industrial automation on a variety of operating systems (OSs), including Microsoft Windows, various versions of Unix, Linux, and macOS. LabVIEW integrates the creation of user interfaces (termed front panels) into the development cycle. LabVIEW programs-subroutines are termed virtual instruments (VIs).

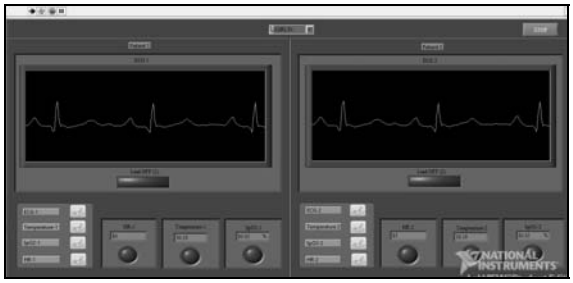

Fig. 5: Final GUI

GUI is prepared on LabVIEW to display both patient's data and modified to include switch buttons so that one can select parameters displayed on the monitor.

B. Data uploaded on ThingSpeak IOT platform

For providing remote accessing of patient's data to doctor and nurses, patient's data is sent from Arduino to ThingSpeak IOT platform using ESP8266. The data uploaded on ThingSpeak channel is as follows:

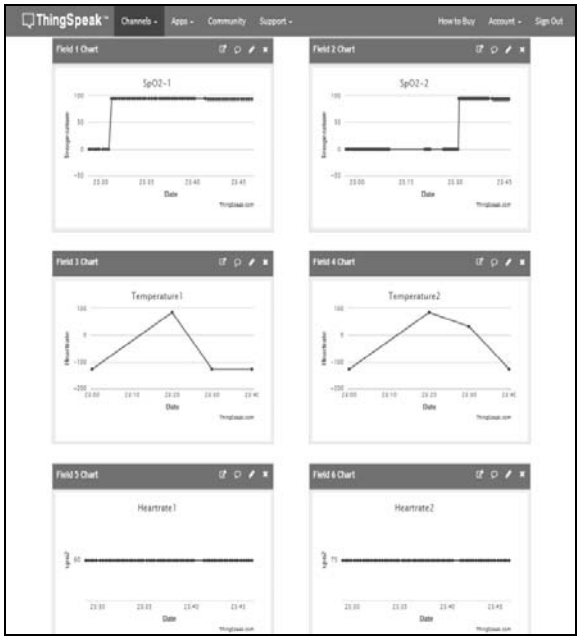

Fig. 6: ThingSpeak output

V. Conclusion

The thought of displaying multi-patient data along with their multiple parameters on a single display was successfully implemented in this project. In this, multiple physiological parameters like ECG, SpO2, Body Temperature and Heart Rate of two patients are displayed on a GUI display created using software called LabVIEW. This common use of system will save nursing staff's time and effort and will also solve space utility problems. This device is also provided with a visual alerting system where with abnormal reading of any parameter, green led will turn red. This will alert the nursing staff when patient is critical. Another advantage of this system is it allows display of specific parameter helping nursing staff monitor only the parameter of interest. This monitor is also provided with an additional feature of uploading data to Cloud. The patient's data is sent from the processor to Thing Speak channel which can be accessed by doctors or nurses from any remote place and help in critical monitoring. This system not only provides reliable measurements but is also very cost effective. This system is definitely an enhancement to the old, conventional monitors still used in hospitals.

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Gesture Control Wheelchair With Manual Stair Climbing

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ABSTRACT
Many years ago, being bedridden was the only option for physically handicapped individuals. This meant the utility of the person in the society and as a source of income for his/her family was severely hampered. Later, as technology began to progress, wheelchairs came into the picture, allowing these people to move about, albeit with the help of another person. The role of technology then was to minimize the dependency upon another individual for such people, by maximizing the functionalities present on the wheelchair. Further developments came about, with wheelchairs being able to climb stairs, overcome obstacles and negotiate with difficult terrain. While the functionalities increased, the need for another person to assist the patient stayed. To enable the handicapped individual to be accommodated back into the society functionally, it is important that the person is able to perform locomotion all by himself in any manner so desired. This has inspired us towards developing a wheelchair, which will eliminate the need of a second person, while maintaining all the functionalities offered by a regular, quality wheelchair available in the market. Our project involves developing a prototype of wheelchair primarily to be used for stair climbing, along with its regular functionalities, while providing total control of locomotion to the user by taking input from hand gestures.

Keywords **:**
gesrture control, wheelchair, stair climbing

I. Introduction

Around the world the amount of wheelchair users is estimated in 68 millions. From the wheelchair users, 90% or 1.5 million persons use manual wheelchairs. 155,000 use electrically powered wheelchairs, and 142,000 use scooters.

Other obstacle is the cost; while financing may have become more available, it remains the case that about half of people or their families pay for devices on their own. The unmet needs for devices are substantial, with the primary barrier being that people simply cannot afford to purchase them.

For wheelchair users, it is necessary to overcome natural and virtual obstacles such as stairs, which are the most known obstacles to the motion. About half of users must use steps to enter or exit their homes. Many researches have been conducted toward the design of stair climbing and obstacle traversing robots during the past decade. However, a few successful robots, which can be adapted as wheelchairs, have been built. Although they are defined as stair climbing robots, their locomotion is not restricted to stairs, they also overcome obstacles such as curbs, irregular sidewalks, etc. They can be classified in 3 groups: tracked, wheeled, and leg-robot.

The Observer is unable to climb steps higher than 14 cm and is 197 kg weight. A standard stair is 17 cm high. Kamen developed a wheelchair (iBOT 3000) that could climb stairs by rotating part of the chassis and suspension system. However, it needs assistance by another person for climbing stairs. And its cost was U$29000 in 2002. This wheelchair is no longer sold by stability problems.

The Stair Climbing Wheelchair here proposed has a hybrid mechanism called Delta-Wheel which has both walking and rolling capabilities employing only one motor.

The Stair Climbing Wheelchair is based on four wheel-leg units, containing three orbital wheels each, but only two units need traction. Different kinds of motions can be obtained by only one motor and a transmission system for each wheel-leg unit, the wheelchair passively changes its functioning mode from rolling on wheels to stepping on legs, without any command, just by blocking the wheels with an obstacle.

The locomotion unit design is based on the idea that different motions can be obtained using only one transmission system, simply locking or unlocking some degrees of freedom along the kinematic chain. While the wheelchair moves on flat, uphill, downhill or irregular surfaces, the delta-wheels can rotate freely around their shaft; Thus the robot adapts itself with respect to uneven terrain making unnecessary a suspension system.

There are two options for propelling the orbital wheels, gears or belts, in the literature in general planetary gears are referenced as star wheels, and triangular units propelled by belts are here defined as delta-wheels. Since we are focused on low cost solution, we manually control stair climbing movement, which reduces manufacturing costs.

The locomotion of wheelchair is controlled by hand gesture. Using hand gesture, we can control the direction, stair climbing movement assist by another person.

II. Proposed System

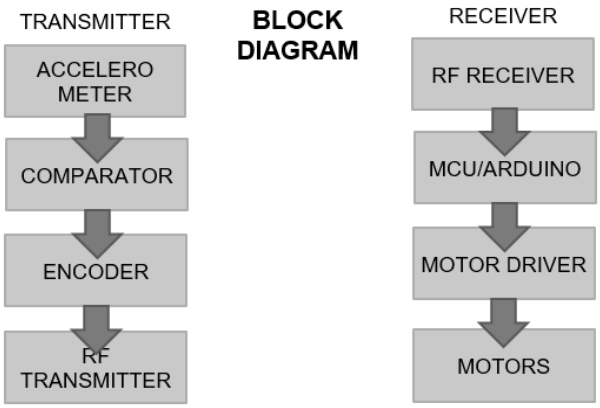

Fig 1: Block Diagram

- The position of the forehand of the in context of x, y and z coordinates is used to control the motion of the wheelchair and it will be consistently monitored
- The comparator will convert any change in position with respect to the resting state into voltage signal, which will be transmitted to the microcontroller which will process this signal and decide the voltage input of the motor driver
- When the motor driver will receive driving voltage, it will drive the motors which will bring about the desired motion

III. Methodology

A. Wheel design:

In the design of Tri-Star wheel, 5 parameters are important which are the height of the stairs(a), width of stairs(b), radius of regular wheel(r), radius of Tri-Star wheel, the distance between the centre of Tri-Star wheel and the centre of its wheel(R) and the thickness of holders that fix the wheel on its place on Tri-Star wheel(2t).

$$R = \sqrt{\frac{(a^2 + b^2)}{3}}$$

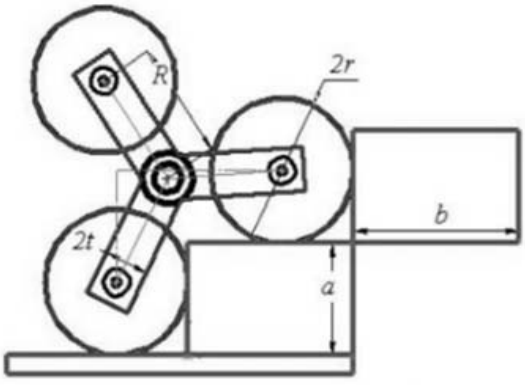

Fig 2: Parameters important for design

$E=((a*r)/\sqrt{(\Delta\text{^}2-a\text{^}2)}-(OGr*\Delta)/a-a-r)*(\sqrt{(\Delta\text{^}2-a\text{^}2)}/\Delta)$

Where : a is the step high, r is the orbital wheel radius, is the delta-side in which the delta is an equilateral triangle, and OGr is the external orbital gear radius.

Gravity = 9.8N

Required Force

= mass(weight of wheelchair with patient) × g(gravity)

Torque = Force*moment arm = m*g*r

Power × Force × Velocity = m × g × v

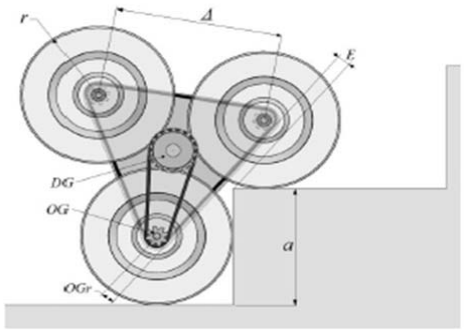

Fig 3 : Representative diagram

The condition of climbing stairs without slipping:

The situation which is shown in figure is the easiest position to slip down the stairs. The distance between the front and the back wheel is supposed to be 1m, and the distance between the gravity centre and back wheel is supposed to be x.

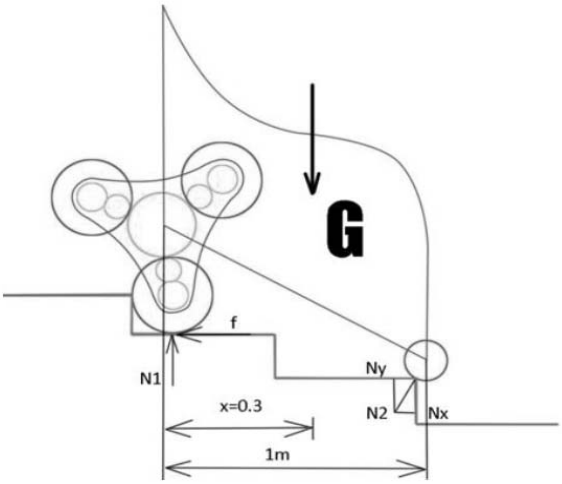

Fig 4: Condition of slip

According to the force and moment equilibrium principle the following equations are obtained.

Ny = xG

N1 = (1 – x)

Nx = Nytg30°

To make the wheelchair climb up stairs without slipping have to meet the requirement of the following condition:

$\mu N1 \geq Nx$

$\mu(1 - x)G \geq x \,.\, G \,.\, tg30$

Friction coefficient μ = 0.3 is chosen here,

$0.3(1 - x)G \geq 0.58x$

$x \leq 0.34$

In order to make sure the wheelchair is safe enough, the centre of the gravity should be close to the back of the wheelchair, because of the driving wheels as the main weight of the wheelchair, and the wheelchair leans forward when it is climbing upstairs. So the location of gravity centre is set at x = 0.3m from the rear wheel, which can realize the condition of climbing stairs without slipping.

B. Stress Analysis :

There are three motion modes for the stair-climbing wheelchair, they are: moving on a level ground, moving on a sloping ground and climbing stairs. Each of the motion modes will be stress analyzed to find out which case has the best stress condition and which case has the maximum torque.

a. Stress analysis for the wheelchair moving on a level ground

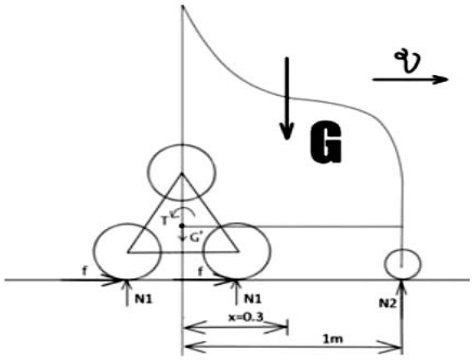

Fig. 5: Moving on level ground

When the wheelchair is moving at constant speed the following equation is obtained,

fFriction = FResistance

T = f × r

Where, r is the radius of the wheel, FResistance is the moving resistance, which is small enough and can be neglected. Therefore the force which acted on the transmission gears is very small, so the wheelchair moving on a good stress situation.

b. Stress analysis for the wheelchair moving on a slope ground

The degree of the slope is supposed to be 8 degrees as the figure below; the positive pressure can be calculated in the following equation,

f = μN1

2N1 = 1 – xG × cos8

° = 519.89 N

N1 = 259.95 N

f = μN1 = 0.3 × 259.95 = 77.98 N

T = f × r = 7.02 Nm

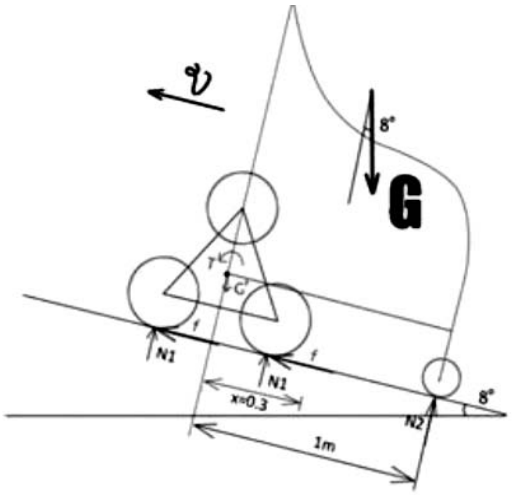

Fig. 6: Moving on a sloping ground

c. Stress analysis for climbing stairs:

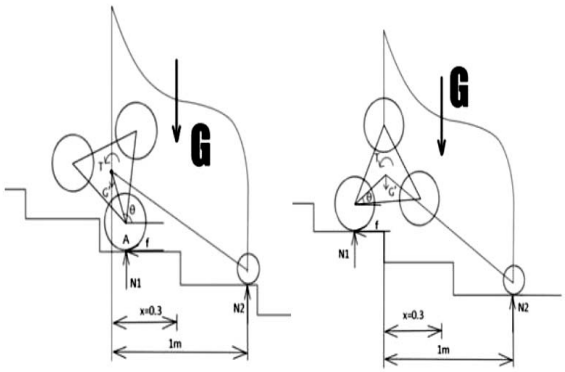

Fig. 7: Wheelchair climbing stairs

The gravity can be transferred to the planetary wheel system and marked as G′, which plays two important roles when the wheelchair climbs stairs, one helps the planetary wheel turning (left picture of the figure), the other hinders the planetary wheel turning (right picture of the figure).

And the calculation obtained is as follows,

G′ = 1 – xG = 0.7 × 750 = 525 N

The balance equation for point A :

T = G′m cos θ = 54.6 cos θ Nm

Where T is the torque, G′ is the total gravity of the wheelchair act on the planetary system. The design weight of the wheelchair is supposed to be 50kg, and the weight of user is 100kg, so the total weight is M=150kg. And the single side gravity G=75×10=750N, m is the length of the turning arm which is: m=104mm=0.104m. It is easy to see that when the rotating arm of the planetary wheel in the horizontal state, i.e. θ = 0, the distance between the barycentre of the wheelchair and the supporting point of the planetary wheels train is farthest, where it also needs the largest Motor torque,

Tmax = 54.6 N · m

The results which are calculated in above three situations are listed in table below.

Situation	Torque
Moving on ground	T1=0 N · m
Moving on slope	T2=7.02 N · m
Climbing stairs	T3=54.6 N · m

Table 1: Result of different move modes

Situation Torque
Moving on ground T1=0 N · m
Moving on slope T2=7.02 N · m
Climbing stairs T3=54.6 N · m

C. Pulling Force estimation:

The distance from fulcrum to the handle which is shown in figure 4.10 was measured, that is D=1.173m, the maximum torque is Tmax = 54.6 N · m, which we already calculated in the last section. According to the moment equilibrium theorem, the force which people use to pull the wheelchair up a stair can be calculated:

$$F1 = 54.6 \div 1.173 = 46.55 \text{ N}$$
$$Fp = 46.55 \times 2 = 93.1 \text{ N}$$

This force is the maximum critical point force during the process of climbing up and down stairs, because the driving force will be provided by the motors which will be introduced in the motor selection section. And the main role which the assistant play is supports the wheelchair and protects it from turning backward during climbing stairs.

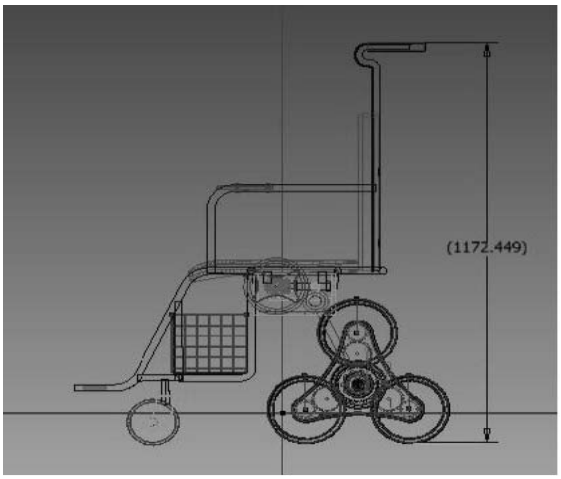

Fig. 8: Draft of the wheelchair in Inventor

D. Transmission system design:

In this section the transmission system will be designed and the principle of the transmission mechanism will be considered first; then the gears inside of the planetary wheel system will be selected and assembled; the motors selection as well as the storage battery selection will determined later.

a. Working principle for the transmission system:

Wheelchair was designed to cope with flat, inclined ground, stairs and obstacles. An epicyclic gearing was chosen as the transmission system for each locomotion unit, where the two degrees of freedom are wheels and planet carrier rotations. If we want the wheelchair to have determined locomotion, we must give two determined inputs to every locomotion unit. And the work principle for our stair-climbing wheelchair is: one input comes from two motors driver solar gears of the planetary wheels system refers to the figure 9, and the other degree of freedom is constrained by the situation of the ground. When the surface of the ground has low friction, planet carrier (i.e., the other input) can make the real-time adaptive adjustment according to the road conditions; when the wheelchair climbing stairs, one of the degrees of the freedom is restricted by the stairs, the wheels cluster can evolve into a planetary wheel system, the planet carrier drives the other two wheels around the wheel which degree of freedom is constrained to achieve the function of climbing stairs.

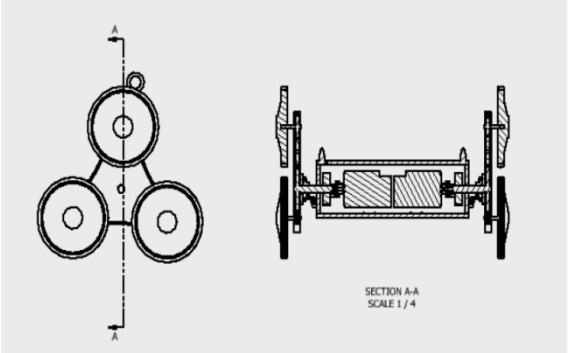

Fig. 9: Section views of planetary wheels

b. Gear Selection :

The gears inside of the planetary wheels cluster is shown in figure 10, and now the teeth and modulus for each gear will be selected.

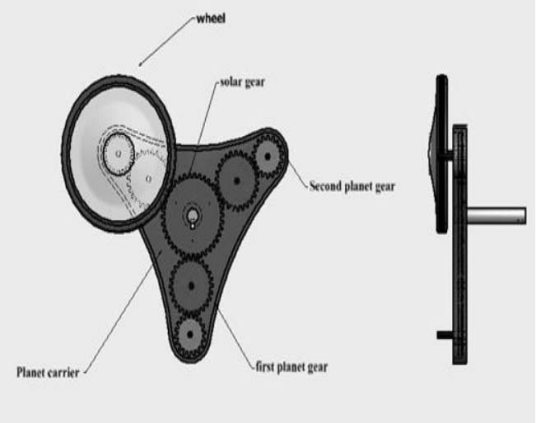

Fig. 10: Structure of wheels cluster

In the section of stress analysis, three different motion modes have already compared, and the maximum torque happened when the wheelchair climbs up and down stairs, according to the size requirements of the triangle star wheel and in order to decrease the installation accuracy, the modulus of gears is selected as m=3 and the number of every gear teeth is supposed as: z1=38, z2=26, z3=18,

and 45 steel quenched and tempered gears are chosen, the strength checking on the centre gear z1 as follows,

$$T_{max} = 54.6N \cdot m = 54600N \cdot mm$$

Where, $Y_N = 2, Y_{st} = 2, S_{Flim} = 1.5;\ \sigma_{Flim} = 270Mpa$

$$\sigma_{FP} = \frac{\sigma_{Flim}\ Y_{st}}{S_{Flim}} Y_N = \frac{270\times2}{1.5} = 720\ Mpa$$

$$\sigma_F = \frac{2KT_1}{\psi_d m^3 Z^2} Y_{Fa} Y_{Sa}$$

$$= \frac{2\times1.5\times54.6}{0.08\times3^3\times38^2} \times 2.8 \times 1.52 = 2.2351 < \sigma_{FP}$$

Where, $Y_{Fa} = 2.8, Y_{Sa} = 1.52, \psi_d = 0.08, K = 1.5.$

Obviously the gears which have been chosen can meet the requirements.

c. Motor selection:

i. Speed determination

In last section the teeth of each gear have already been calculated, the sun gear is 38, the idle gear is 26, and the planetary gear is 18, the module is 3. Design standards of wheelchairs state that the moving speed of electric wheelchairs should not exceed Vmax = 2 m s , and then transfer it to angular velocity as follows:

$$n = \frac{60\times v}{2\pi\times r} = 212\ r/min$$

So the angular velocity of central gear is:

$$\frac{Z_1}{Z_3} = \frac{n_3}{n_1} \quad \frac{38}{18} = \frac{212}{n_1}$$

$$n_1 = 100\ r/min$$

ii. Power checked

The rolling friction coefficient between tire and normal road surface is 0.02, which is decided by checking the mechanical design manual [16], and we take safety factor Ks=1.5, the total weight of a person and the wheelchair is 150kg. And the power required when the wheelchair works is,

P = Ks*fmgv = 1.5x0.02x150x9.8x2 = 90

The motor is primarily used as the engine when the wheelchair moving on the ground or climbing up and down stairs, so the rated power should be much bigger than 90W.

IV. Hardware requirements

Our choice of microcontroller unit is Arduino-Uno. Besides it, the circuitry consists of ADXL335 accelerometer, a motor driver and a pair of RF transmitter and receiver (nRF24L01P).

The accelerometer continuously monitors the position of the wrist, and the coordinates are transferred with Bluetooth from the nRF transmitter to the receiver. The values of the coordinates are converted into appropriate voltage values and fed to the motor driver, which in turn helps drive the motor and carry out locomotion. The motor power needs to be sufficient to carry the weight of the patient as well as the wheelchair.

V. Results

The transmitter and receiver programming was done in the C++ language. With AT commands, we successfully enabled the transmission of coordinates of the hand and continuously monitor the same. Two 12 V, 200rpm motors were able to pull a weight of 10 kilograms. Climbing stairs required the assistance from another person.

VI. Conclusion

The future enhancement of our project is we have to rectify the problems that we have encountered during descending of the wheel chair in stairs.

We had a smooth travel while ascending but while coming down from the steps, we found some vibration problem and to overcome this we have planned to install springs and braking system, so that wheel chair will be in a good control while descending also.

1. One more gear can be used near the handle for easy rotation of handle.
2. To increase the speed of the wheel chair gears and sprockets sizes can be varied.

In future, the device used by physically challenged people to enhance their personal mobility. For this reason, several wheelchairs with stair climbing ability have been developed. Some of them use tracks, as in these power wheelchairs consume a great deal of energy, compared to power wheelchairs.

In addition, they are heavy, approaching and leaving stairs are quite dangerous and slippage, when steering, is unavoidable. Some other solutions adopt a wheel-track locomotion system, as in or in the top chair these designs use a track system only for off road and stair climbing operations, using wheels on ground. Though approaching and leaving continue to be a problem, these wheelchairs are more efficient than previous solutions, in terms of energy consumption.

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IoT Based Health Monitoring and Alert System

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ABSTRACT

The purpose of the project is to design a remote, non-invasive and continuous health monitoring system. Proposed system measures vital physiological parameters, interprets the measured signals and provides an alert in case of medical emergency. Pulse rate, oxygen saturation of blood (SpO_2), temperature and galvanic skin response (GSR) biometrics that are monitored in this project. A micro-controller board is used for analyzing measured sensor data from a patient and in case of any abnormality in measured parameters causes the system to send email notifications to respective doctor or necessary personnel. Threshold for every parameter is programmed using an online wiring tool (Node-RED) and email notifications are sent via Node-RED. Node-RED has been also used to display graphical representation of parameters and to send these parameters on a cloud platform. This data is used for future analysis and review of patient's health condition for a specific interval of time, such as, for a day/week/year. The system can provide feedback to the user by means of a smartphone application which helps patient to gain a little bit of control over his emotions and helps to prevent risk of cardiac related disorders. The proposed system evaluates psychological condition of patient based on the GSR and heart rate variability. The system comprises of PSOC 4 BLE board and uses Node-RED as a programming tool for IoT application.

Keywords **:**
IoT, Pulse rate, SpO2, GSR, Node-RED

I. Introduction

People often find a need to track their personal health more efficiently. The health of a sick child at home or of a senior parent is of particular importance to people, especially when situation becomes time critical. Periodic reports and immediate alerts for any sudden changes in their health may give people an opportunity to act quickly and save the life of a person in danger. The patient's health condition depends on the status of various health parameters such as heart rate, oxygen saturation of blood, blood pressure, blood glucose level and many more. Severe changes in these parameters can lead to fatal diseases. Thus, monitoring these parameters helps to control health status within a certain limit. Advances in modern technology have allowed for the development of health monitoring systems, capable of continuous monitoring while being power efficient [2]. A need for the development of such devices exists, since they will allow for the detection of abnormalities, unforeseen situations and even provide a prognosis all based on the monitoring of physiological parameters in conjunction with possible symptoms.

Health monitoring systems can detect a medical emergency and could prevent it by reporting it to medical services or by providing the user with biofeedback as an early warning; all achievable due to the implementation of continuous monitoring. The development of such systems offers flexibility and cost saving options for both healthcare professionals and patients through the implementation of continuous health monitoring [2]. Also, the advantage of health monitoring systems is that they do not require medical professionals to operate.

This project is the design and implementation of a mobile health monitoring system capable of measuring and interpreting: (1) pulse rate, (2) saturation of oxygen (SpO2), (3) galvanic skin response (GSR) and (4) skin temperature. Measurement of oxygen saturation and pulse rate is based on photoplethysmography principle.

A. Principle of Photoplethysmography

Photo based sensing on a patient's skin, more specifically areas of the skin with perforated blood flow, is used to obtain PPG signals. This process is based on the Beer-Lambert Law which states that the intensity of a beam of monochromatic radiation in an absorbing medium decreases exponentially with penetration distance. According to Beer Lambert's law transmittance of light through the tissue can be calculated using :

$$I_{out} = I_{in} \times e^{A}$$

Where I_{out} is the light intensity transmitted through fingertip tissue, I_{in} is the intensity of the light going into the fingertip tissue and A is the absorption factor[2]. Since light is more strongly absorbed by blood than the surrounding tissues, the changes in blood flow can be detected by PPG sensors as changes in the intensity of light. The voltage signal from PPG is proportional to the quantity of blood flowing through the blood vessels. The PPG waveform has an alternating current (AC) component and a direct current (DC) component. The AC component corresponds to variations in blood volume in synchronization with the heartbeat. The DC component arises from the optical signals reflected or transmitted by the tissues and is determined by the tissue structure as well as venous and arterial blood volumes.

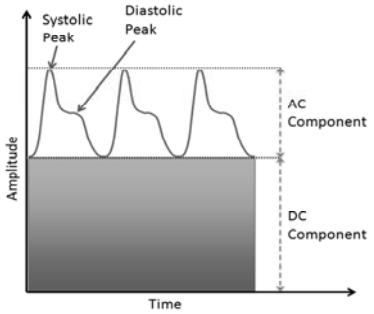

Fig.1 : Plethysmogram

B. Temperature Monitoring

Surface body temperature can be measured by using a huge number of devices such as RTD, thermocouple, thermistors and many other temperature sensor ICs. A thermistor exhibits resistance that is far more sensitive to temperature than that of other types of resistors. There are two types of thermistors: negative temperature coefficient (NTC) whose resistance decreases with increasing temperature and positive temperature coefficient (PTC) whose resistance increases with increasing temperature. NTC type thermistors are most commonly used to measure body temperature.

C. Galvanic Skin Response

Skin resistance varies with the state of sweat glands in the skin. Sweating is controlled by the sympathetic nervous system, and skin conductance is an indication of psychological or physiological arousal. Human extremities, including fingers, palms, and soles of feet display different bio-electrical phenomena. Galvanic Skin Response (GSR) device detects conductance of the skin when a person is under stress or when not. It uses just two electrodes which are placed on the fingers and act as if they were the two terminals of one resistance.

There are studies which indicate that stress increases the risk of cardiac problems. Study of GSR and heart rate variability is used to evaluate changes in autonomic nervous system of patients following myocardial infarction. Also, skin temperature rises during stress and anxiety. Thus, monitoring pulse rate and GSR along with the temperature helps to evaluate psychological condition of patient. Many studies indicate that monitoring temperature, pulse rate and GSR helps to indicate stress level of a patient. We program our proposed system such that it automatically sends email notifications when the temperature, pulse rate and galvanic skin response exceed certain threshold.

II. Proposed System

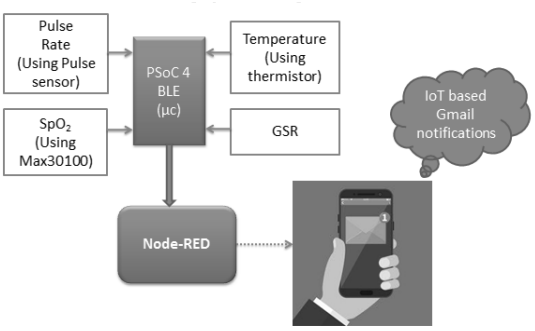

Fig. 2 : Block diagram

The system includes the sensor hardware, device hardware, PCB layout, software algorithms. These subsystems make up the core components of designed solution. Each of these subsystems performs important tasks and are integrated in a manner to optimize system performance.

First part of system consists of the sensors that measure each of the physiological parameters specified, and this is largely focused on analog front end and the acquisition of the measured signals.

The second part which consists of the processing and communication unit explains the microcontroller aspect of the system. Here focus is placed on software algorithms which extract the required information from the measured signals and then acts accordingly to prepare information used in biofeedback to the patient. This component is also responsible for the storage of data and communication with the handheld Android smartphone.

The third subsystem provides the patient with biofeedback through notifications; any abnormalities found are extracted here and sent to a medical doctor to allow for monitoring of the patient.

III. Methodology

A. Temperautre

A NTC type thermistor will be used to monitor the body temperature continuously. The reference resistor is used to create a voltage divider with the thermistor. This method reduces the nonlinearity of the output voltage. Typically, the reference resistor is the same value as the thermistor at 25 °C.

The normal human body temperature range is typically stated as 36.5–37.5 °C (97.7–99.5 °F). We decided to measure the skin temperature under the arm (axillary temperature). Temperature under the arm (axillary) is about 36.5 °C (97.7 °F).

B. Pulse Sensor

The normal resting adult human pulse rate is probably a range between 60 and 100 bpm. Tachycardia is a fast pulse rate, defined as above 100 bpm Bradycardia is a slow pulse rate, defined as below 60 bpm. During sleep a slow pulse with rates around 40–50 bpm is common and is considered normal. When the heart is not beating in a regular pattern, this is referred to as an arrhythmia.

The pulse rate is measured by counting the number of peaks appearing in the PPG signal for a specific amount of time and then scaling it to count number of pulses within a span of 60 seconds[2].

Pulses are counted by comparing obtained PPG signal with certain threshold. The value of threshold is decided according to ideal patient pulse rate reading. The main purpose of the comparators is to offer fast detection of a voltage change. It gives edge detected comparison output. Number of pulses for 10 seconds is calculated and converted to bpm by multiplying with 6, which gives the instantaneous pulse rate in bpm.

Fig. 3 : Pulse sensor

C. Oxygen Saturation

Oxygenated and non-oxygenated haemoglobin have different absorption spectra at specific wavelengths of light. Therefore, in order to measure SpO2 the haemoglobin will be bombarded with light of specific frequencies. The two light sources selected are as follows, one with a wavelength of 660 nm (red light) and the other with a wavelength of 940 nm (Infrared light). Oxygenated haemoglobin (HbO) absorbs IR light and reflect Red light while non-oxygenated haemoglobin (Hb) absorb more Red light and reflect IR light. At 660 nm the absorption of light varies greatly between the two types of haemoglobin while at 940 nm they are very similar; this allows for the use of a ratio to determine the saturation of oxygen [2].The ratio (R) of AC and DC values at infrared and red light is calculated using following formula:

$$R = \frac{R_{AC} / R_{DC}}{IR_{AC} / IR_{DC}}$$

Once the R ratio is known SpO2 can be determined through experimentation by setting up a calibration curve. The calculated R ratio and SpO_2 are related with an empirical formula which is almost linear and derived by calibration [2]. The equation is in the form of straight line which is given as

$$SpO_2 = A \times R + B$$

The MAX30100 is an integrated pulse oximetry and heartrate monitor sensor solution. It combines two LEDs, a photodetector, optimized optics, and low-noise analog signal processing to detect pulse oximetry and heart-rate signals. MAX30100 is a reflective type PPG sensor and communicates with the microcontroller using I2C protocol.

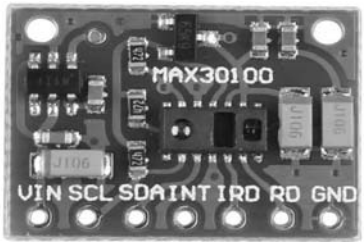

Fig. 4 : MAX30100

D. Galvanic Skin Response

For the measurement of GSR it is necessary to obtain the data from the electrodes and send it to the microcontroller unit for the signal processing and determining the stress levels using an algorithm. Generally, two electrodes are placed on the second and the third finger.

The variation of a low-voltage applied current between the two electrodes is used as measure of the Electro Dermal Activity, i.e. the changes in conductance of the skin. Human skin offers some resistance to current and voltage. This resistance changes with the emotional state of the body. The skin resistance meter circuit proposed here measures changes in your skin resistance following changes in your mental state.

In the relaxed state, the resistance offered by the skin is as high as 2 mega-ohms or more, which reduces to 500 kilo-ohms or less when the emotional stress is too high.

The reduction in skin resistance is related to increased blood flow and permeability followed by the physiological changes during high stress. This increases the electrical conductivity of the skin.

IV. Results

The system was successfully implemented, and the results were obtained for all the modules. The data could be viewed on the tera term window, it was sent to Node-RED via UART and the data was displayed there in the format of chart and gauge. The data from the Node-RED was sent to the ThingSpeak server where the entire data of each patient was saved and updated timely. The patient's data can also be viewed on a smartphone application called ThingView which can be used as biofeedback for the patient and in certain cases; the condition of stress, anxiety and anger can be brought to control using this principle. It helps in reducing the risk of the cardiac problems that may arise in the future.

Fig. 5 : Output on Node-RED Dashboard

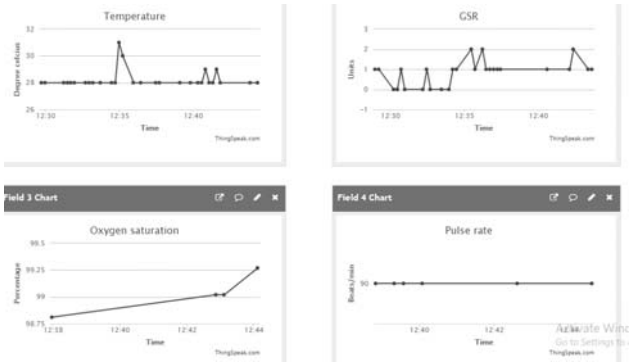

Fig. 6 : Output on Thing Speak Server

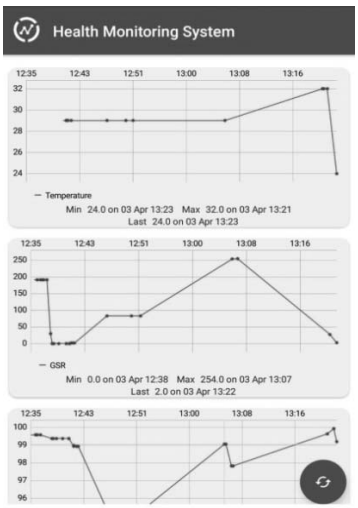

Fig. 7 : Output on Thing View Application

V. Conclusion

The overall results achieved are very closely related to what was required and expected from the design; this means that the final implementation of the system works as intended. The solution does not only focus on the specifications but also aspects to ensure that the design is practical and that the ultimate goal is to be able to deliver a working product. In our project, the hardware unit was successfully instrumented, and software algorithm was implemented to get notifications in case of abnormal measurements of biometric parameters. The purpose of creating remote, non-invasive and continuous health monitoring system is accomplished efficiently.

VI. Future Scope

There are some aspects that can be improved; as we are sending notification via IoT through WI-FI network on smartphone. The notifications can also be sent via Bluetooth through our system to smart phone. The system can also be integrated with other health related parameters like Electrocardiography (ECG), Electromyography (EMG) or Blood Pressure for obtaining a more sophisticated system. The data obtained from such sensors allows detection of possible diseases.

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Microcontroller Based Sleep Apnea Detector

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ABSTRACT

Obstructive Sleep Apnea is one of the most common respiratory disorder. During this the flow of air through the respiratory channel is stopped for greater than 10s.This condition leads to decrease in supply of oxygen to the brain. Hence it has become necessary to detect the apneic event. The purpose of this detection is to help the patient aware if they are suffering from apnea before going through expensive sleep test. The system proposed in this paper is a wireless device. Temperature Sensor (LM35) is used for measuring the exhaled air temperature and compare it with set threshold value and give an alert alarm on the GUI if the reference value is exceeded and also sends the message to the doctor through GSM. It also consist of accelerometer which helps to plot the thoracic movement graph.

Keywords **:**
Obstructive Sleep Apnea, Wireless Device, Temperature Sensor, GSM, Accelerometer

I. Introduction

Sleep plays a very important role in daily routine. It represents naturally recurring state of rest for the mind, during the central nervous system is restored. Monitoring of Sleep disorder helps in maintaining good health and lifestyle[4]. Sleep Apnea is a type of respiratory disorder. The normal breathing rate is 12-16 breaths per minute [5]. The condition wherein the supply of air to the respiratory organ is blocked for more than 10s is called sleep apnea [1]. Sleep apnea is a disorder which may lead to condition called hypoxia [3]. It may occur anytime in between the entire sleep. The earlier method for detection of apnea included Polysomnography and Actigraphy which are complicated and consumes more time [1]. The different types of sleep apnea are: Obstructive Sleep Apnea, Central Sleep Apnea, and Mixed Sleep Apnea [2]. The aim of the project proposed in this paper is to create a noninvasive and a less expensive method for detection. System designed is microcontroller based.

II. Components Required

A. Microcontroller-ARM 7(LPC 2148)

A microcontroller is a complete computer system built on a single chip.ARM7 is a 32-bit controller. It consumes low power.LPC-2148 is a widely used IC in the ARM family.LPC2148 is manufactured by Phillips and it consist of many in-built functions and peripherals. It has less number of instruction set. Provides 8 kB to 40 kB of on-chip static RAM and 32 kB to 512 kB of on-chip flash memory. It has high processing speed.

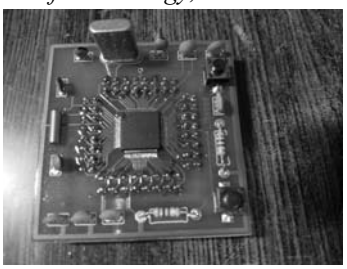

Fig. 1: ARM 7 kit

B. Temperature Sensor (LM35)

The LM35 series are precision integrated-circuit temperature devices with an output voltage linearly proportional to temperature. It has a sensitivity of 10mV/°C. Equation for conversion of output voltage to temperature is: Temp (°C) = Vout *(100°C/V).

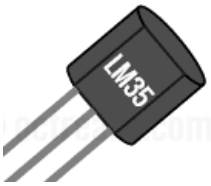

Fig. 2: Temperature Sensor – LM35

C. Accelerometer

Accelerometers have been used in biomedical applications such as human motion analysis. It is the most widely used type of motion sensor. Body positions are characterized into two types: Motion and Rest. To classify motion and rest, we need to detect the displacement of the three axes (X, Y, and Z)

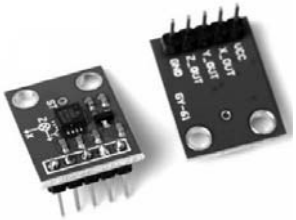

Fig. 3: Accelerometer

D. GSM Module

A GSM module is a chip or circuit that will be used to establish communication between a mobile device or a computing machine and GSM system. The system consist of a power supply circuit and a communication interface like RS232,USB 2.0.In this project GSM sim900 is been used.

Fig. 4: GSM Module – Sim900

E. Zigbee

Zigbee is a wireless networking standard that is aimed at remote control and sensor applications. It is an open global standard for wireless technology designed to use low-power digital radio signals for personal area networks. The range is 10-100meters.

Fig. 5: Zigbee Module

BLOCK DIAGRAM

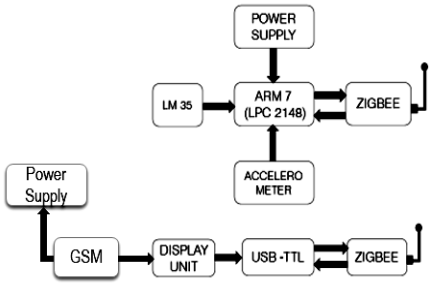

Fig. 6 : Block Diagram Of Proposed System

A. LM 35

The purpose of LM35 is to sense the temperature of the exhaled air and send the received output to the controller for further processing.

B. ARM 7

It is a microcontroller used for the processing the data obtained. It processes the data and then sends the data to the P.C through Zigbee.

C. Zigbee

It is used for the transfer of data from the controller

D. Accelerometer

Accelerometer is used to detect the thoracic movement

E. Display Unit

Display Unit is a GUI developed using a software VB.net.The GUI is used to display the graph of the temperature been detected.

The value obtained by the sensor is compared by the set value if the value is greater than the set value an alert alarm is given on the GUI.A thoracic movement graph is also plotted.

F. GSM Module

It is used to send the alert message from the P.C to the concerned person if apnea is detected for further actions.

FLOW CHART

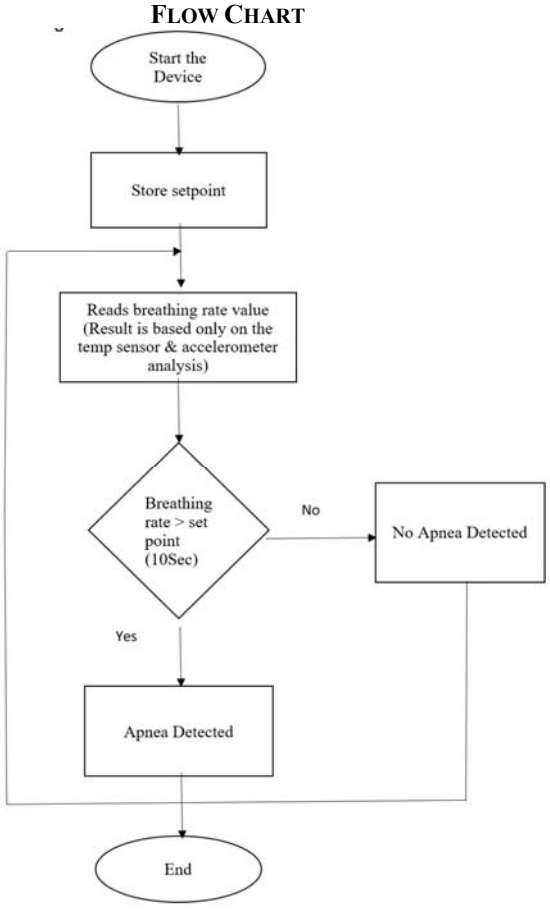

Fig. 7 : Flow Chart for Apnea Detection

V. Results

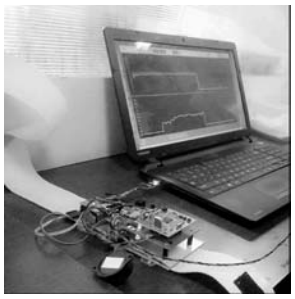

Fig. 8:Implementation of circuit

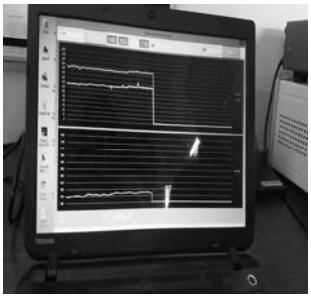

Fig. 9:Graph of temperature and thoracic movement

Fig.10:Alert message generated during apnea detection

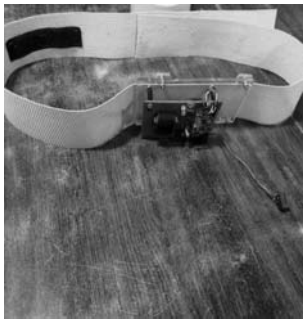

Fig.11:Designed System

VI. Conclusion

- A Wireless and Low Cost System was implemented so as to avoid complicated process of detection.
- The system is easy to use and portable.
- It consumes less power.
- Minimal space utilization.
- Noninvasive.
- It sends an alert message of patients condition on GUI and also sends an message to the doctor through GSM.
- It continuously monitors the temperature of the exhaled air.

VII. Future Work

- The device can be further mituarized.
- A CPAP machine can be attached to the device for an immediate treatment of the patient.
- A heart rate sensor can be introduced to the device.

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IX. Acknowledgement

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Cuff-less Blood Pressure Monitoring

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ABSTRACT

Blood pressure is the pressure of circulating blood on the walls of blood vessels.Blood pressure that is low due to a disease state is called hypotension, and pressure that is consistently high is hypertension.The invasive method is continuous and accurate but has increased risk, the cuff is safe but less reliable and infrequent. A reliable continuous non-invasive blood pressure measurement is highly desirable. While the possibility of using Pulse Transit Time (PTT) and Pulse Wave Velocity (PWV) were shown to have co-relation with arterial blood pressure (BP) and have been reported to be suitable for indirect BP measurement. Arterial blood pressure (BP) was estimated from Electrocardiography (ECG) and PPG waveform. This method does not require an air cuff and only a minimal inconvenience of attaching electrodes and photo detector sensors on a subject.

Keywords: *Cuff-less, Non-invasive, Pulse Transit Time, Pulse Wave Velocity.*

I. Introduction

Blood Pressure (BP) is considered to be a strong indicator of an individual's wellbeing and one of the most important physiological parameters that reflect the functional status of the cardiovascular system of human beings [1]. In our project, the non-invasive, cuffless and continuous measurement of BP can be done by obtaining a photoplethysmogram and an electrocardiogram. Arterial blood pressure is estimated from PTT. It is a time interval between an R-wave of electrocardiogram(ECG) and the peak of a photoplethysmogram (PPG) signal. PTT helps in estimation of Pulse Wave Velocity(PWV). It is the speed of the pressure pulse propagating along the arterial wall[2]. The method does not require an air cuff and only a minimal in convenience of attaching electrodes and LED/photo detector sensors on a subject[1]. The advantage of the PPG-based technique over sphygmomanometry is that the former can be done automatically without the need to inflate and deflate, enabling continuous BP measurements

II. Components Required

A. Arduino Nano

The Arduino Nano is a small, complete, and breadboard-friendly board based on the ATmega328P (Arduino Nano 3.x); offers the same connectivity and specs of the UNO board in a smaller form factor. The Arduino Nano is programmed using the Arduino Software (IDE).

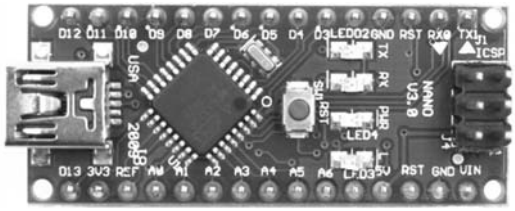


Figure 1 : Ardunio Nano

B. AD8232(ECG MODULE)

The AD8232 is a neat little chip used to measure the electrical activity of the heart. This electrical activity can be charted as an ECG or Electrocardiogram. Electrocardiography is used to help diagnose various heart conditions. The device extracts, amplifies, and filters small bio-potential signals in the presence of noisy conditions created by remote electrode placement or even patient motion. The output signal is easily acquired via an ultra-low-power analog-to-digital converter (ADC) or embedded microcontroller (MCU).

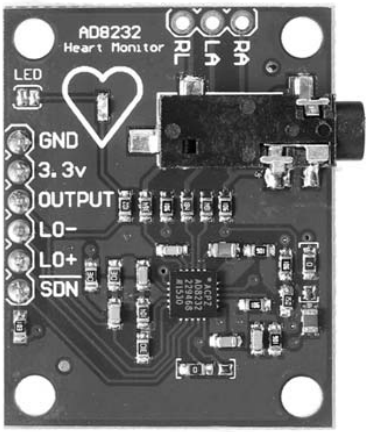


Figure 2 : AD8232(ECG Module)

C. Pulse sensor

Pulse Sensor is a well-designed plug-and-play heart-rate sensor for any microcontroller board. The sensor clips onto fingertip or earlobe. We have used fingertip for our measurement. It essentially combines a simple optical pulse rate sensor with amplification and noise cancellation circuitry making it fast and easy to get reliable pulse readings.

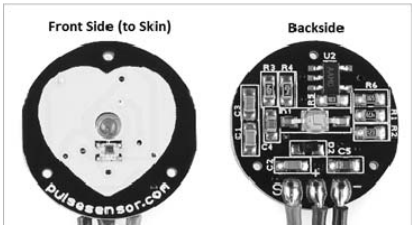
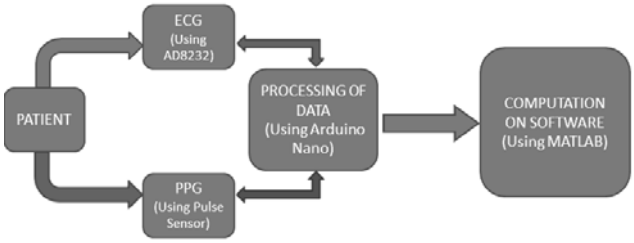


Figure 1 : Pulse Sensor

III. BLOCK DIAGRAM



A. Collection of data:

The two signals i.e. Electrocardiogram and Pulseplethysmogram are captured from the patient's body. An ECG module (AD8232) is used to detect the ECG and a Pulse sensor is used for obtaining a simultaneous PPG signal.

B. Processing using arduino:

These signals are now processed by the Arduino Nano model which is compatible with the Arduino IDE software as well as MATLAB.

C. Computation on matlab:

The MATLAB R2011 software is used for coding purpose. It includes the following steps:

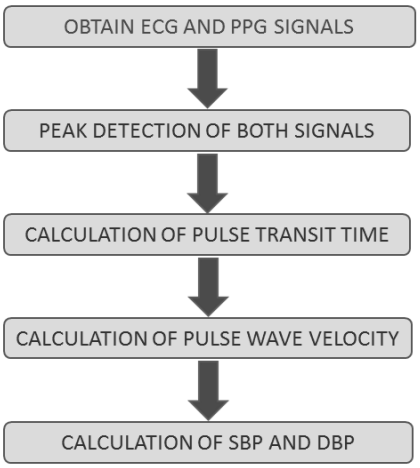
- **Peak Detection of Ecg and Ppg**
  Arduino helps in displaying both these signals on MATLAB. The peaks of both ECG and PPG are then detected using MATLAB and respective values are saved for further computation.

- **Calculation of Pulse Transit Time**
  Pulse transit time (PTT) is the time it takes for the pressure or flow wave to propagate between two arterial sites. It can be calculated by interpreting the time interval between the peaks of the two signals.

- **Finding out The Pulse Wave Velocity**
  Pulse Wave Velocity (PWV) is a measure of arterial stiffness, or the rate at which pressure waves move down the vessel. Once the PTT is calculated it is used to estimate Pulse wave velocity (PWV). Pulse Wave Velocity is calculated using the following formula:

- **Calculation of Systolic and Diastolic Bp:**
  Systolic blood pressure (SBP) and casual diastolic blood pressure (DBP) are strongly correlated with PWV. The model is linearized as BP = a*PWV+b [1]

IV. Flow Chart



V. Results

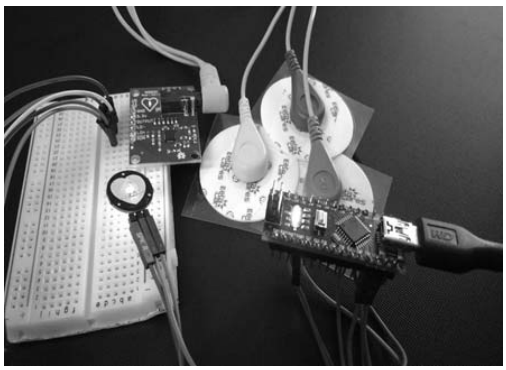


Figure 4: Setup of the project

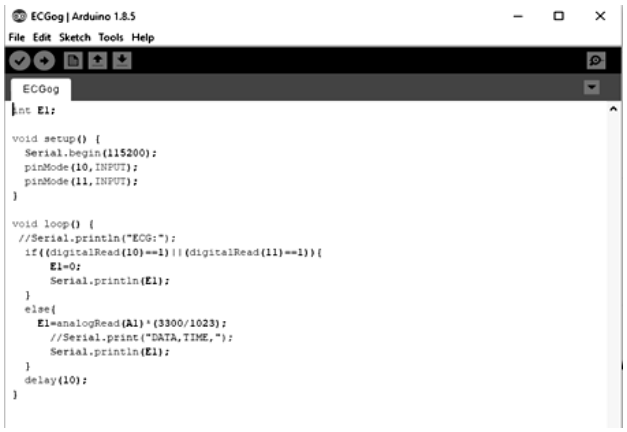


Figure 5 : Coding done in Arduino

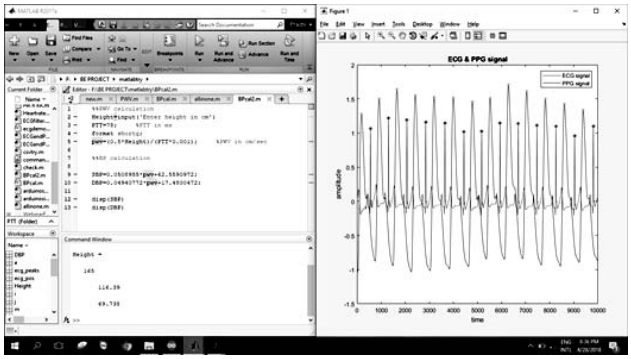


Figure 6 : Coding done in MATLAB

VI. CONCLUSION

- A non-invasive and Low Cost System was implemented so as to avoid complicated process of measurement of BP
- It is a cuff-less technique and hence avoids discomfort to the patients
- The system is easy to use and portable
- It consumes less power
- Minimal space utilization

VII. Future work

- A display hardware unit can be added for easy interpretation of ECG and PPG signals.
- An alert can be sent to compatible devices like smartphones through Bluetooth or WiFi in case of abnormal changes in the measured BP.
- An alarm system can be incorporated which can give alerts for Hypertension or Hypotension

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Smart Library

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ABSTRACT

Smart library is a self-service book borrowing and issuing system. *This project is based on library automation which consists of two systems, a depositing and issuing system enabled with a GUI system .The system also consist of a library assistant bot which manages the books. This GUI system will assist the user in selecting the correct reference book from the library. The assistant bot will pick the required book from the shelf and transfer it to the issuing end, opposite procedure will be followed while deposition of the book. This bot will also pick any book which it finds lying on the table and place it back into the shelf at its correct position. These activities are performed based on image processing and communication between the bot and the system.*

Keywords :

Barcode system, smart library management, IOT based, database management, library assistant bot, self-service, automated

I. Introduction

1.1 Need

In order to survive in the ever-evolving Internet of Things (IOT) landscape, libraries need to welcome digitalization. As we move forward into the digital age to continue the libraries must not only modernize their physical appearance but also their marketing and should take the advantage of new technologies. A smart library is constantly assessing to make the future a reality. Thus we need to implement such model which keeps the record of both users and books in the library and tracks the activities which are going on in the library such as returning and issuing of books. The library staff has to manage library containing thousands of book. The staff has to keep record of every book in the library. Also has to collect every book from the table and place them at a right place. For issuing the book from the library, sometimes we have to stand in a long queues. The library staff has to manually search the book and issue it to a student. Also if we forget to return the library book on time, we have to pay the required fine. Many times we are also confused about the exact book we want to refer and the books available currently in the library.

1.2 Main idea

Smart library solves all these problems. Smart library system consists of two parts:

1. Library book station
2. Library assistant robot.

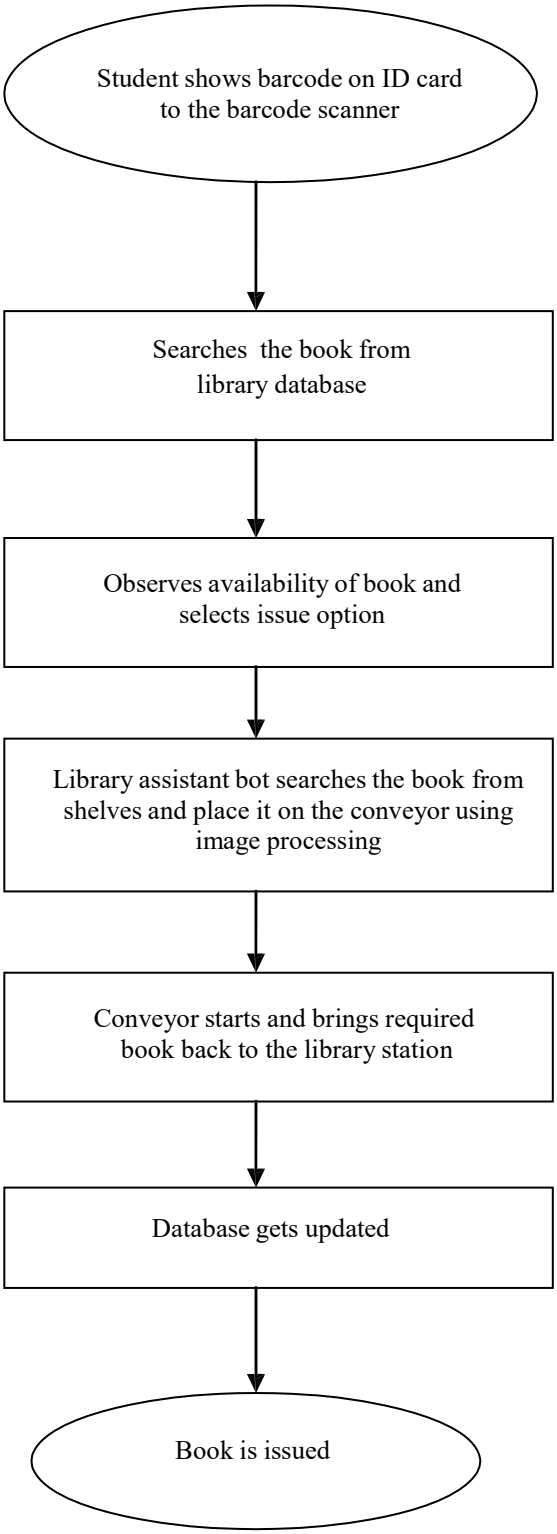
Library book station consists of an interactive GUI where a person can log in to his account by scanning Barcode based library card. After logging in to the account all records of his/her book are displayed. We can search for the book available in the library with its content displayed. We can also issue and return the book by selecting issue or return button on the screen. For returning the book, a window opens where the person has to place the book. The window then closes and checks the unique barcode id on the book through the barcode scanner. It shows warning on the screen if the book id is invalid or the person has to pay the fine. The book with valid id passes further through the conveyor belt and it gets deposited. The library assistant robot then places the book at the right place. It can also issue the selected book from the shelf and bring it to the library book station.

This system reduces the overall human intervention in managing the books from the library and hence automates the complete process through our project.

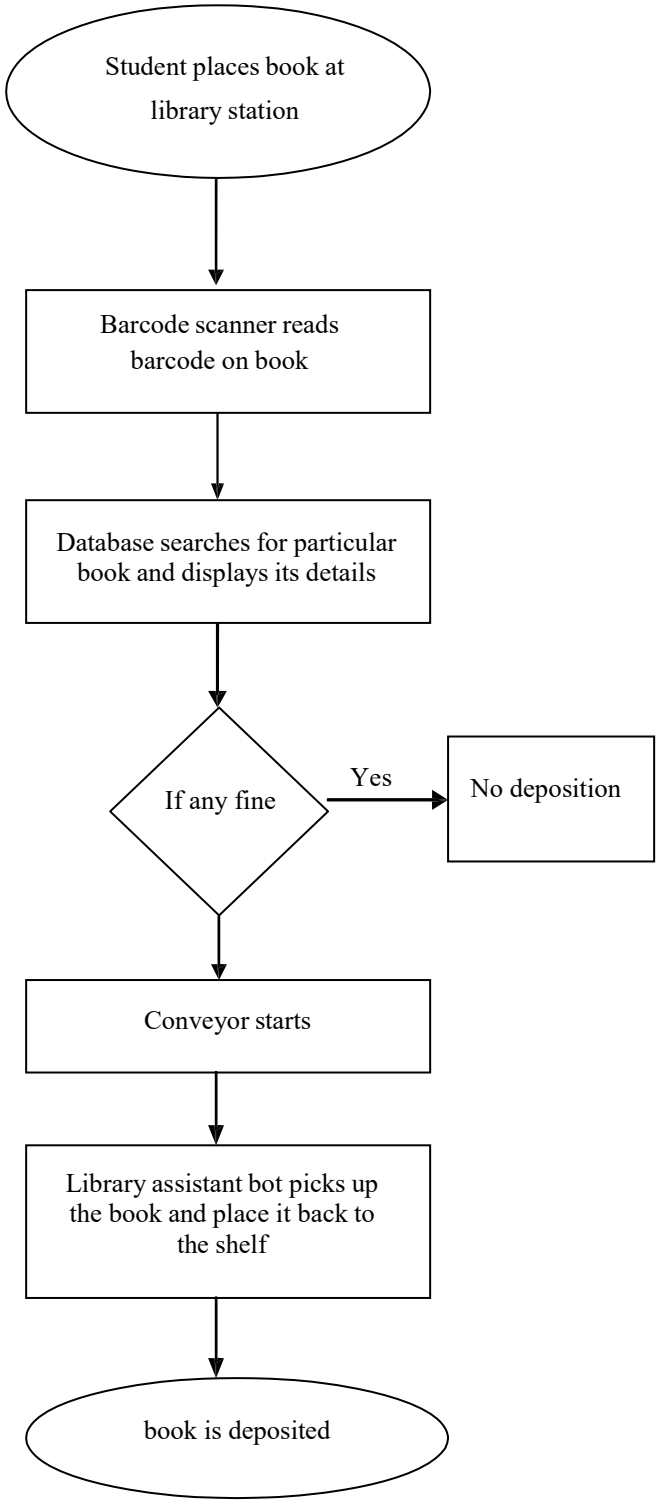
In this paper, idea of library management and its implementation is presented. The GUI is made using wamp server (PHP, MYSQL database). The next section briefly describes the process flow. Section III describes the methodology to implement idea of smart library. In Section IV, the various results of implementation are discussed. Section V and VI gives the future scope and conclusion.

II. Process Flow

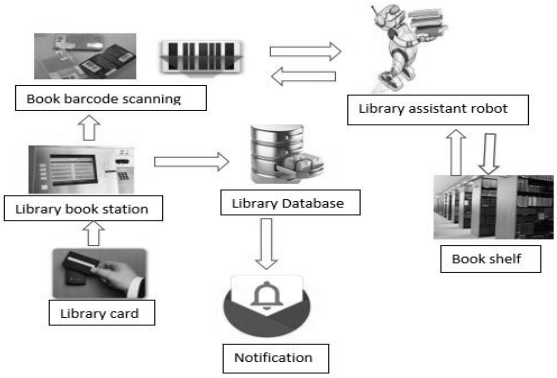
1. Book issuing system



2. Book depositing system



III. Methedology



Schematic Diagram

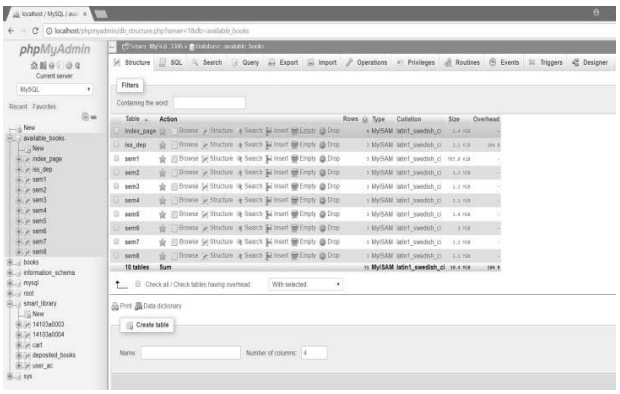
IV. Results and Discussion

I. Webpage using Wamp server :

We have made web pages (User login) using Wamp server that allows to create dynamic Web applications with Apache2, PHP, and MySQL..Welcome page have a login button which is used to connect with our database.

II. Database Using MYSQL:

When the user registers on welcome page, the data will be saved on the server as per the barcode number which will be unique of every user. The data will be updated through MySQL which is a management system for our local and sever database. Further, the data will be updated on particular select (issue, deposit). Updated database can be any time accessed by library staff, which will help library staff to analyze and track user account.



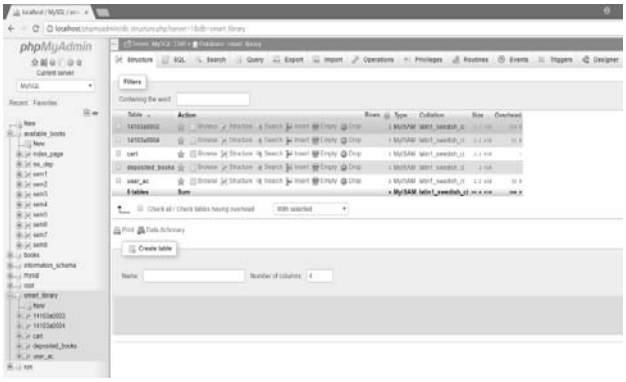


Fig.2 : Database of webpages

Fig.2 shows the database of the webpages. When data is filled in webpage and register, then all the data gets arrange in proper tables in respective database.

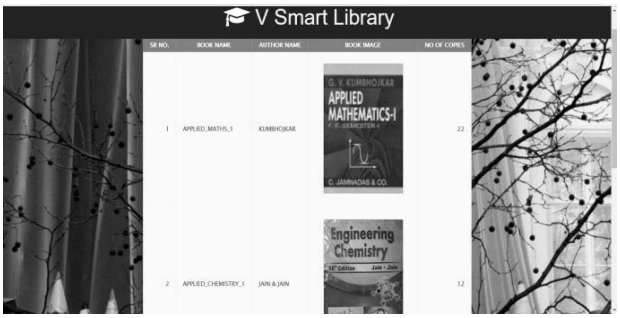


Fig 3 : Book details and no of copies

Fig.4 : User interface

Fig.4 shows user interface where user can login or register, Deposit the book.

Fig.5 : Library assistant robot

Fig.5 shows library assistant robot which picks up the books from conveyor and places to the shelves and vise versa.

V. Future Scope

In this Project we have used barcode technology for scanning books as it is cheaper and easily available in market but it has some disadvantages as listed below:-

- Very low throughput. Tags can only be read manually, one at a time.
- Line of sight is definitely required. Scanner must physically see each item directly to scan, and items must be oriented in a very specific manner.
- It has ability to only read items and nothing else.
- Durability is Low. Easily damaged or removed. Cannot be read if dirty or greasy.
- Low Security. Much easier to reproduce or counterfeit.

These drawbacks can be overcome by RFID technology as it provides:

- High throughput. Multiple (>100) tags can be read simultaneously.
- Line of sight not required. Items can be oriented in any direction, as long as it is in the read range, and direct line of sight is never required.
- It has ability to read, write, modify, and update.
- High durability. Much better protected, and can even be internally attached, so it can be read in very harsh environments.
- High security. Difficult to replicate. Data can be encrypted, password protected so information stored is much more secure.

VI. Conclusion

- This system is highly effective and it is efficient in depositing book directly into library.
- Touch screens provide user-friendly access and also saves the time.
- Library assistant robot reduces the work of library staff. The need of an operator is reduced with this project.
- This project also gives attention to the concept of self service. In future book segregation feature can also be added in this system.

VII. Acknowledgement

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