

HEALTH-CARE WEARABLE 4.0

Submitted in partial fulfillment of the requirements for the award of

Bachelor of Engineering Degree in
Electrical and Electronics Engineering

By

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SCHOOL OF ELECTRICAL AND ELECTRONICS ENGINEERING**

SATHYABAMA

**INSTITUTE OF SCIENCE AND TECHNOLOGY
(DEEMED TO BE UNIVERSITY) Accredited with Grade “A” by NAAC
JEPPIAAR NAGAR, RAJIV GANDHI SALAI, CHENNAI - 600 119**

APRIL 2021



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BONAFIDE CERTIFICATE

This is to certify that this Project Report is the bonafide work of **BHARATH P** (Reg. No. 37140014) and **RAGULKAR S** (Reg. No. 37140066) who carried out the project entitled "**HEALTH-CARE WEARABLE 4.0**" under our supervision from Dec 2020 to April 2021.

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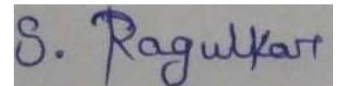
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DECLARATION

We **BHARATH P** (Reg. No. 37140014) and **RAGULKAR S** (Reg. No. 37140066) hereby declare that the Project Report entitled “**HEALTH-CARE WEARABLE 4.0**” done by us under the guidance of **DR.D.SUSITRA** is submitted in partial fulfillment of the requirements for the award of Bachelor of Engineering Degree in Electrical and Electronics Engineering.



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ABSTRACT

A great demand of modern earth is to get everything within a very short time. In the present situation, people want to realize their current health condition and also want proper care rapidly. But older and disabled people are very incapable without someone's help. Even they have to face so many difficulties to inform someone about their health condition. To solve this problem a smart and automobile system has proposed. The proposed system consists of health monitoring systems with body temperature and heartbeat measurement, respiration and glucose. This health monitoring system displayed temperature, blood glucose level, heart rate, respiration levels data on an LCD; it also sends an automatic notification to caretakers or doctors. A fall detection system is added to abstain from unintentional injury and death for old and disabled persons. When the data crosses the normal value and the fall detector detects the fall that time the system sends an automatic notification. This paper will focus on basic health monitoring and caring systems for older and disabled people.

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CHAPTER-1

INTRODUCTION

GENERAL INTRODUCTION

Health is one among the predominant challenges for humanity. Last few decades they have witnessed a sharp rise in the number of elderly people. However 65% of aged people suffer from chronic illness. The recent advances in Information and communication technology enable modern and innovative health care systems which address all kinds of solutions. Internet of Things (IoT) is one of the promising, user friendly technologies which allows effective communication between connected things. Harnessing the power of the Internet of Things for E-Health creates a lot of choices to improve the convenience and outcomes, drive wellness in the population by creating convenient facilities in the modern healthcare system. Proper manipulation and maintenance of health related data can be used to enable remote health monitoring and emergency notification systems. These health monitoring systems can range from monitoring blood pressure, heart rate and many more, where they can detect a patient's health condition.



FIG 1.1 HEALTH-CARE WEARABLE 4.0

To keep an individual healthy and effective, a readily accessible modern health care system is a prerequisite. Hence Modernized health care systems come into picture which provides better health care services to people anytime and from anywhere in an economically viable and patient friendly manner. But the communications in the health care system are mostly wireless in nature.



FIG 1.2 DIFFERENT TYPES OF WEARABLE

This leads to patient's data presumably to be vulnerable which causes more security threats to the system. Ensuring secure and privacy preserved patient's medical data is a basic necessity for its usage in IoT healthcare systems. Hence we describe various key security measures which help to verify their identity to every other. Thus we propose a secured health care system which guarantees to efficiently operate and maintain patient's health data in a more effective manner.

MARKETING STRATEGY

The global wearable healthcare devices market is projected to succeed USD 46.6 billion by 2025 from USD 18.4 billion in 2020, at a CAGR of 20.5% from 2020 to 2025. Emerging economies like India, China, and Brazil are expected to provide a good range of opportunities for players within the industry. Furthermore, the growing adoption of mobile platforms, increasing adoption of AI and 5G, and the growing awareness and preference for home healthcare will also will boost the expansion growth of this market.

The pharmacies segment to dominate the wearable healthcare devices market. In 2019, the pharmacies segment accounted for the largest market share in the wearable healthcare devices market by distribution channel. The market is mainly driven by the increasing trend of self-monitoring and non-invasive monitoring and diagnosis have resulted during a substantial increase within the supply of wearable devices in pharmacies. This is driving the uptake of wearable devices among customers, as they have quick access to varied wearable devices offered by a variety of companies. Furthermore, pharmacies are widely perceived to sell authentic and reliable products, which has greatly driven consumer preference for this distribution channel.

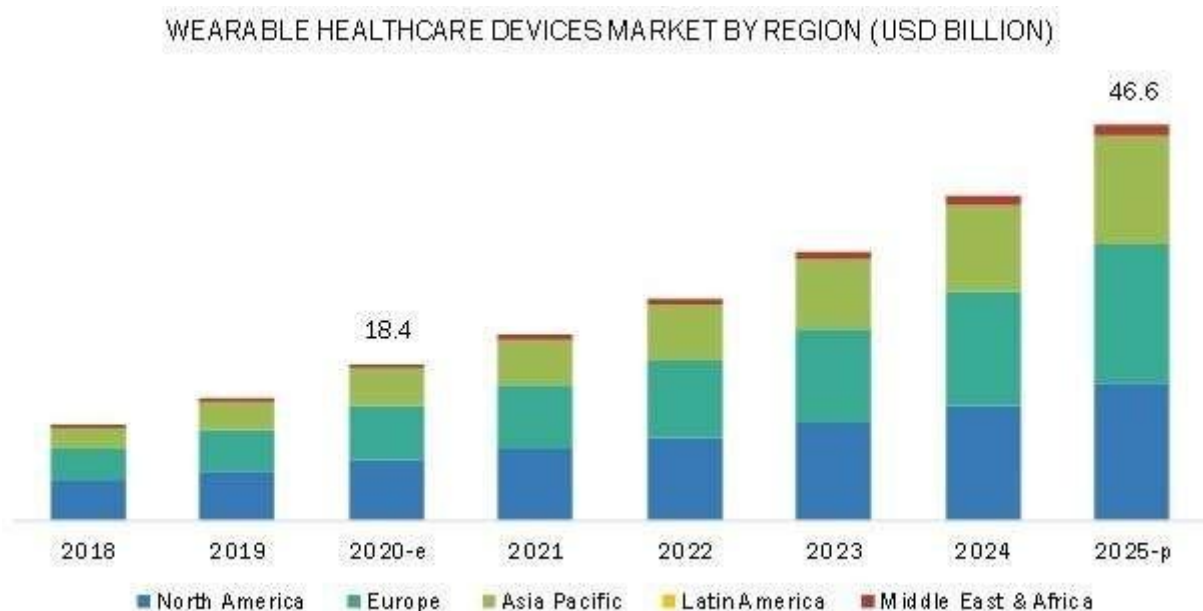


Fig 1.3 FLOW OF MARKETING STRATEGY

Asia Pacific to grow at the very best rate during the forecast period (2020–2025)

The wearable healthcare devices market in the Asia Pacific is expected to grow at a high pace in the coming years. The factors attributing to the high growth of the Asia Pacific region include the presence of a large patient population, growing penetration of smartphones, increasing disposable income, improving the quality of living & economic conditions, and the presence of several low-cost device manufacturers in the Asia Pacific.

WEARABLE HEALTHCARE DEVICES MARKET (By Products)

- Activity Monitors/Trackers
- Smartwatches
- Patches
- Smart Clothing.

RECENT DEVELOPMENT

- In 2019, Apple Watch Series 5 was launched with advanced functionalities by Apple, Inc. (US)
- In 2020, Fitbit Charge 4, activity tracker was launched by Fitbit, Inc. (US).
- In 2019, Omron (Japan) launched Heart Guide, a wearable vital sign.

ADVANTAGES

- To treat the user(patient or employee) in easy manner.
- To reduce the time and cost of regular check-up of the user (Senior Citizen).
- To monitor the user health status day by day & maintain the regular fitness of the user.
- Lightweight,Easy to handle, Simple operation and Monitors pulse rate and rhythm.

APPLICATIONS

Recommended for

- Senior Citizens,
- Heavy Industrial Engineers,
- Pilots,Biological Researchers and more....

CHAPTER - 2

LITERATURE SURVEY

2.1 LITERATURE SURVEY

- ❖ **“Analysis of Industry 4.0 Technologies Applied to the Health Sector”** Franco da Silveira, Italo Rodeghiero Neto, Filipe Molinar Machado, Marcelo Pereira da Silva and Fernando Gonçalves Amaral”. The health sector is possibly the world most in need of an adequate technological convergence of factors of the Fourth Industrial Revolution. Health 4.0 can be understood as the set of technological procedures emerging from the physical, biological and digital worlds that seeks to enhance the efficiency and effectiveness of health processes and professionals with guidelines for transforming data into useful and accessible information. Technological innovations have driven the health sector to an unprecedented level. Different medical devices, many of them portable, are being sold in the consumer market to provide a healthier lifestyle for society [Some of the technologies relate to Cloud Computing (CC) and Internet of Things (IoT). These are platforms that provide alternatives to medical support through the solution of various problems in health applications, with intelligent hospitals, drug control and remote medical services [6, 8]. In addition, with cyber-physical systems, they can interconnect with a combination of softwares, sensors, processing and communication technologies that together play an important role in decision making by providing accurate and momentous information

- ❖ **“K. Nivetha, N. Ramya et al “BLOOD GLUCOSE MEASUREMENT BY SWEAT USING ARDUINO” – IESRA – 2017”**. This existing work investigated the effect of blood glucose measurement by conductivity measurement technique. Sweat contains dissolved ions, which contribute conduction between the two copper electrodes because the concentration of ions within the sweat increases, conduction increases. The measured parameters such as voltage

- ❖ from the copper sensor is given to Arduino controller and then to the LCD display. Normal person have voltage range of 320 conductivity/sec and its corresponding glucose level is 80mg/dl. For diabetic person the voltage range is 377conductivity/sec and its corresponding glucose level is 141mg/dl. The responses are studied as salt content within the sweat is high, which ends up in high glucose level. If salt content in the sweat is low, it results in low glucose level. The correlation between salt content in sweat with its corresponding voltage and glucose level is completed interpolation equation. Non-invasive blood glucose estimation framework is utilized to quantify the blood sugar without taking the biopsy.

- ❖ **“Kola Ayanlowo et al proposed “AUTOMATION OF HEALTH RECORD MANAGEMENT” USING SOME SELECTED HOSPITALS IN SOUTH WESTERN NIGERIA AS CASE STUDY” – IJCSET**, An attempt was made to develop an automatic record management system for a typical health institution. The record systems of five hospitals in south-west Nigeria were used as case studies for evolving a strong and comprehensive design for the electronic database. Java programming language was used to develop the application while MySQL was used because the command language. The application offers numerous advantages over the traditional manual record-keeping system among which are data consistency, data integrity, ease of data retrieval, record integration and data mining.

- ❖ **Haoran Ren, et al proposed “A Novel Cardiac Auscultation Monitoring System Based on Wireless Sensing for Healthcare” IEEE of Translational Engineering in Health and Medicine – 2018**. In this existing paper, a novel wireless sensing system to watch and analyze cardiac condition is proposed, which sends the knowledge to the caregiver as also as a medical practitioner with an application of the Internet of Things (IoT). An integrated system for heart sound acquisition, storage, asynchronous analysis has been developed, from scratch to information uploading through IoT and signal analysis. Cardiac auscultation sensing unit has been designed to watch cardiovascular health of an private. Bluetooth protocol is used to offer power efficiency and moderate data transmission rate. The Hilbert-Huang transform is used to eliminate interference signals and to assist to extract the guts sound signal features. Subsequence segmentation algorithm based on double-threshold has been

developed to extract physiological parameters.

- ❖ **Malcolm Clarke et al proposed “Interoperable End-to-End Remote Patient Monitoring Platform supported IEEE 11073 PHD and ZigBee Health Care Profile” - IEEE Transactions on Biomedical Engineering – 2018.** This existing paper described the implementation of an end-to-end remote monitoring platform supported the IEEE 11073 standards for Private Health Devices (PHD). It provides an overview of the concepts and approaches and describes how the quality has been optimized for small devices with limited resources of processor, memory and power which use short range wireless technology. It explains aspects of IEEE 11073, including the Domain Information Model, state model and nomenclature, and how these support its plug-and-play architecture.
- ❖ **“Miss Priyanka Mayapur1A Literature Survey on pulse Variability and its Various Processing and Analyzing Techniques”** .Measurement of HRV helps in evaluating cardiac autonomic regulation and thus provides significant information regarding cardiac irregularities or injuries. It also provides quantitative information about the modulation of cardiac vagal and sympathetic nerve activities and information about the sympathetic parasympathetic autonomic balance. It is one of the most crucial markers proven to be beneficial in obtaining reliable stress diagnosis and its related disorders. Current research suggests that each individual has a resonant frequency at which heart rate variability is the greatest, and this resonant frequency can be measured by biofeedback instruments. While there is no uniform ideal value for all persons, this resonant frequency is most often produced by persons during a relaxed psychological state, with a positive emotional tone, breathing diaphragmatically at a rate of about 5-7 breaths per minute. Psychophysiological research suggests that these frequency ranges reflect different biological influences. The high frequency range is associated with parasympathetic pathways, the influences of respiration in normal frequencies on vagal tone. The low frequency range is associated with the influence of blood pressure (baroreceptors) on heart rhythms, and meditative/slow breathing augments this range. The very low frequency range is associated with sympathetic activation, or more probably the withdrawal of parasympathetic braking, and also the influences of visceral and thermal regulation. Studies have also shown that depressive disorder lowers pulse.

- ❖ **“Syed Tauhid Ullah Shah, Faizan Badshah, Faheem Dad, Nouman Anjum and Mian Ahmad Jan”** Cloud-Assisted IoT-Based Smart Respiratory Monitoring System for Asthma Patients. A cloud-assisted IoT-driven healthcare monitoring framework for asthma patients. First of all, using different devices and sensors, patient respiration rate can be recorded at home or outdoors. On the client side, using a desktop-based or mobile application will take out the undesirable noise from the collected signal. As patient data safety is very important in Healthcare IoT. Therefore, data must be protected from unauthorized access. A gap within the patient data security may cause mental disorder, social embarrassment, heart attack, or any other physical damage. Therefore the signal is embedded with watermarking for Cloud-Assisted IoT-Based Smart Respiratory Monitoring System for Asthma Patients.

- ❖ **Mohammed H Iqbal, Abdullatif Aydin, Oliver Brunckhorst, Prokar Dasgupta and Kamran Ahmed** MRC Centre for Transplantation, Guy's Hospital, King's College London, London, UK. Continuous vital signs monitoring is a significant part of basic care of patients admitted to hospital. ViSi Mobile System (Sotera Wireless Inc., USA)¹⁵ can continuously measure heart rate, respiratory rate, oxygen saturation level and blood pressure. Welch et al.¹⁵ report that such devices have the ability to reduce alarm fatigue, often a result of constant monitoring of patient vital signs. The device has also been used in assessment and risk stratification for pressure ulcers. However, there are limited data available in the literature to support its accuracy or clinical benefit. It was developed to constantly monitor vital signs and alert medical professionals of abnormalities, instead of nurse-led intermittent measurements of vital signs. However, it may not be suitable for daily patient use outside a hospital setting due to positioning of the sensors on the chest, wrist, shoulder and abdomen.

- ❖ **From Wearable Sensors to Smart Implants – Towards Pervasive and Personalised Healthcare** Javier Andreu-Perez, Daniel R. Leff, H.M.D. Ip, and Guang-Zhong Yang*, Fellow, IEEE. The developed world is experiencing a major demographic shift. Age-related diseases, such as cardiovascular disease, cerebrovascular accidents and cancer are set to become more

prevalent [112]. Emerging evidence suggests rising ill-health in the elderly population with an increasing incidence of chronic conditions such as osteoarthritis, chronic airways disease and diabetes [113]. Similarly, the global burden of disease is leading to an increase in interventional procedures, especially surgery [114]. Whilst techniques have become increasingly minimally invasive, post-operative complications such as surgical site infection, inadequate tissue healing and gastrointestinal anastomotic failure persist.

- ❖ **A STUDY OF INTERNET OF THINGS ENABLED HEALTHCARE ACCEPTANCE IN MALAYSIA YAP SY YUAN¹, DR. TAN CHYE CHEA.** In the health and healthcare industries, Health Information Technology (HIT), the current major information technology used in health information management, supports health information exchange in secure manner among the consumers, patients, caregivers and service providers across the computerised system. Market Research.com report [10] has estimated that by 2020, the amount of USD 117 billion will be contributed by the IoT enabled development in healthcare sector.

CHAPTER-3

STATEMENT ,CONDITION & SCOPE OF THE PROJECT

PROBLEM STATEMENT

A company XYZ has 100 employees working where it has provided each and every employee with an android support wearable technology to monitor each and every one's health. The company's major concern is the priority of the employees' health. Now that the company has executed the first half of their target by providing the employees with wearables. Now they have to fulfil the second half of their target which would be creating an application to monitor individually and to govern them as a group.

GUDIELINESS

TABLE 3.1 GUDIELINESS FOR PROTOTYPE

Have an IoT device or Open API deployed on server to gather the datasets for the health impacting parameters like Body Temperature, Blood Pressure, Respiration, Glucose, Heart Rate, Oxygen Saturation, Electro Cardiogram etc.
Any critical values in any one of the parameters is considered to be putting that particular person is not health conscious. So, for monitoring purposes applications are needed.
Have a prediction model to find diseases from parameters so that precautions can be taken beforehand.

APPLICATION CONDITION

TABLE 3.2 INTERFACE CONDITION FOR APPLICATION

Mobile Application (Single user)	Web Application(Multiple users)
Screen 1: UI to show the health parameters value as mentioned above. After getting the values from wearable to smartphone upload the values in your personal cloud like firebase for every 30 seconds.	Page 1: Now from the database that contains all users records with their health information. Visualize their health information based on critical and normal values for each and every parameter mentioned above.
Screen 2: Option to add manual data with body text or document like medical records and view them whenever needed.	Page 2: View the medical records of all the users based the username search criteria and list them wisely.

PROTOTYPE CONDITION

TABLE 3.3 CONDITION FOR PARAMETERS

A average human body temperature is 98.6 F. The reality is that a "normal" body temperature can fall within a good range, from 97 F to 99 F.
A blood sugar level less than 140 mg/dL (7.8 mmol/L) is normal. A reading of more than 200 mg/dL (11.1 mmol/L) after two hours indicates diabetes. A reading between 140 and 199 mg/dL (7.8 mmol/L and 11.0 mmol/L) indicates prediabetes.
Normal oxygen saturation is usually between 96% and 98%. Any level below this is considered dangerous and leads to hypoxemia.

A pulse of 100 to 125 beats per minute.
A rate of respiratory 20 to 30 breaths per minute.

SCOPE OF THE PROJECT

This model was proposed under successfully implemented in this paper for providing safety for heavy machinery engineers, senior citizen of India. This system detects Temperature, Sugar level, Respiration, Heartbeat, SpO2 in the body. this detector parameters are monitored by an organization 24 *7 by using IoT Technology. end of the everyday parameter results will share to user through SMS. this is used to maintain a user health in a correct workflow. The cloud storage data are used at time of treatment for the user. LCD display is integrated in this model for checking the live health status of the user. This project is implemented using the pic micro-controller(PIC 16F877A).

CHAPTER - 4

PROPOSED SYSTEM & COMPONENTS DESCRIPTION

BLOCK DIAGRAM

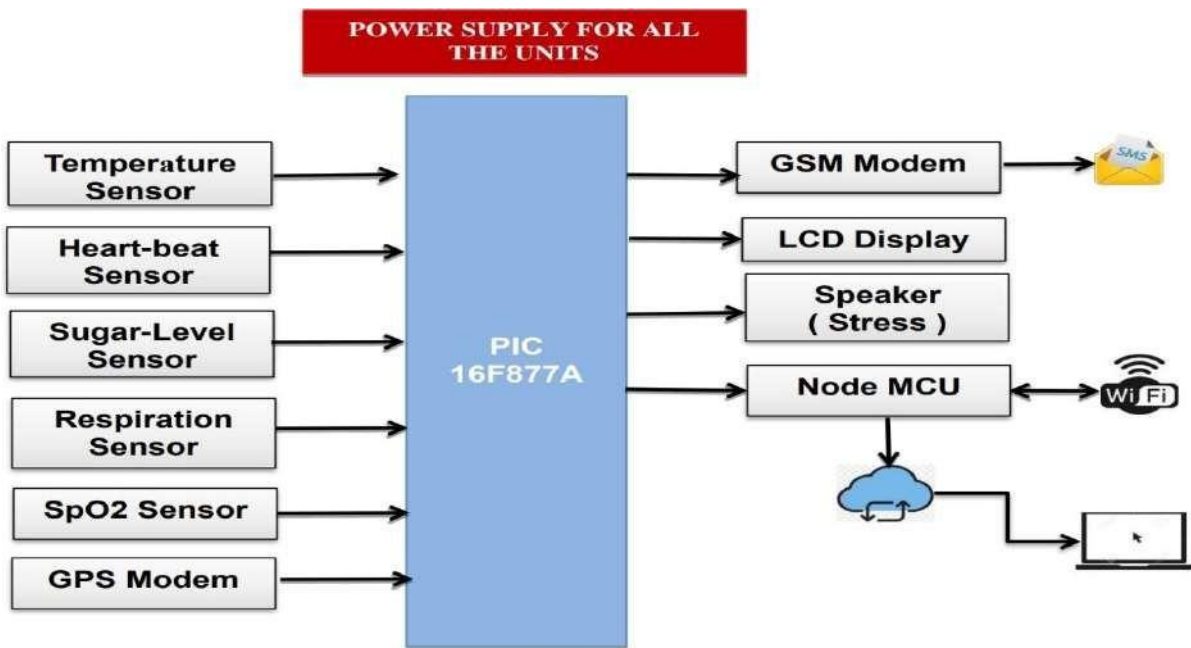


FIG 4.1 BLOCK DIAGRAM OF PROPOSED MODEL

This system uses Temperature, Heartbeat, Sugar-level, Respiration and SpO2 sensor for tracking patients health. These sensors are connected to the PIC controller(16F877A) . Laser light is used across the finger hose to measure glucose. Laser transmittance involves a light source and a light detector positioned on either side of the finger hose. The amount of light passing through the finger hose depends on the amount of blood glucose in that region. The finger hose was chosen due to the absence of bone tissues and also because of its relatively small thickness. Provides increased protection against severe low blood glucose - even when patients are asleep. To track the user health, micro-controller is in turn interfaced to a LCD display and internet connection to send the data to the

web-server (wireless sensing node). In case of any abrupt changes, in patient heart-rate or some other parameters alert is sent about the user using IoT.

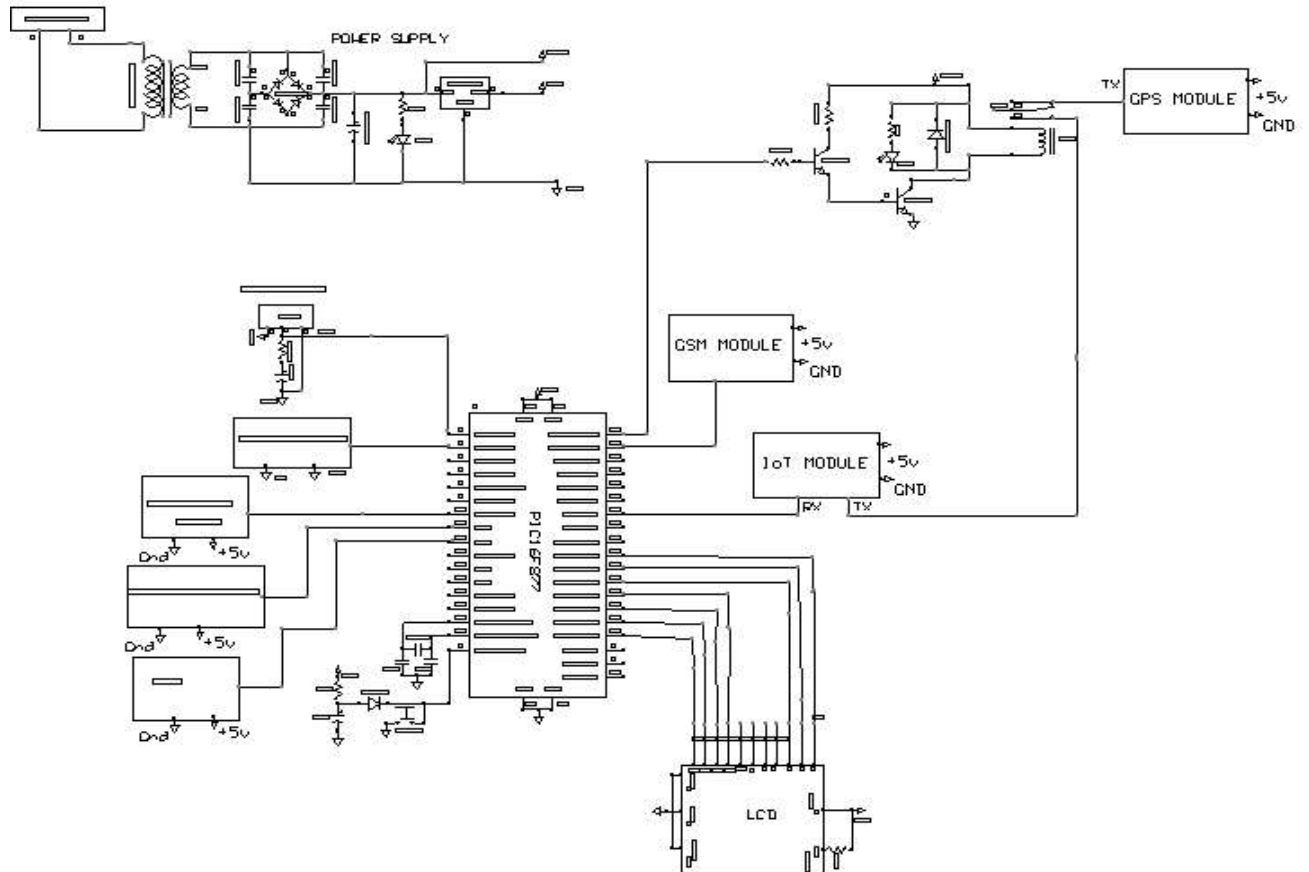


FIG 4.2 CIRCUIT DIAGRAM OF PROPOSED MODEL

Health-care Wearable 4.0 which records the patient Health parameters and also send an SMS alert by the end of day. Android application also integrated with the proposed model. All the parameters values are recorded over cayenne (web page) so that user health can be monitored from anywhere and anytime in the world over internet.

ALGORITHM

- Input supply is given to all the units.
- The GPS detects the Latitude & Longitude Position for every 10sec.
- Those values are stored in web Application(Cloud) for further purpose.
then,
- Checks all the Prototype parameters value according to the Program.
- Whether the values are increased or decreased from Programmed value it show the Alert in Android Application.
- All the output parameter Data (value) are stores in a web application in a format of Numerical & Graphical form.

Extra Case,

- We Extra integrated in this prototype is “Stress Management in work Environment”. For this case we calculated the stress value by using Temperature value and Heart-beat value.(ie. $\text{Present Stress} = \text{Present Temperature rise} + \text{Present Heartbeat rise}$).
- At the end of the day user will receive the SMS based on the parameter values.
- The process and program will continues in loop form till the end of day.

FLOWCHART

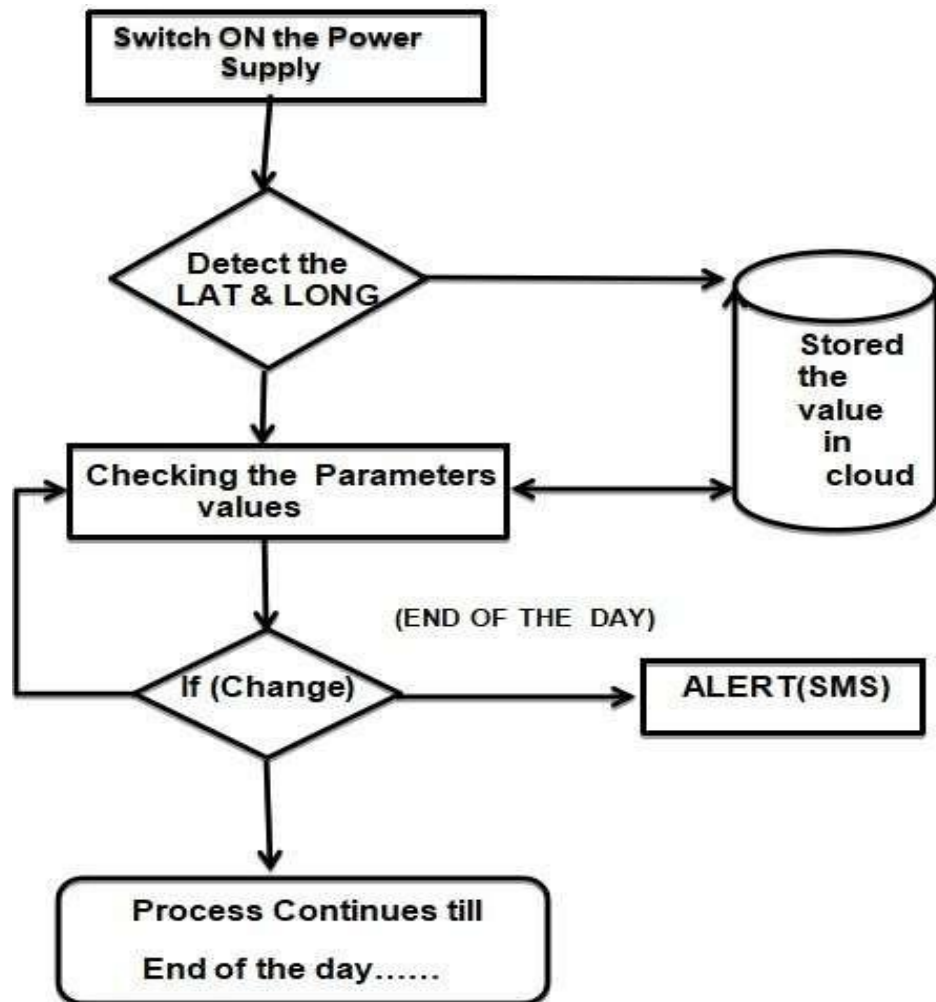


FIG 4.2 (A) FLOWCHART OF THE PROTOTYPE

HARDWARE REQUIREMENT

For making the required set up we require following components. A list of components has been described in the following section.

TABLE 4.1 HARDWARE REQUIREMENT

S.NO	COMPOUND USED	SPECIFICATION
1	PIC Micro-Controller	16F877A
2	Temperature Sensor	LM 35
3	Heart-Beat Sensor	LM-358 with transmitter and Receiver
4	Respiration Sensor	-----
5	Sugar-level Sensor	-----
6	SpO2 Pulse Sensor	HBT-V2
7	GPS	GY-GPS6MV2
8	GSM	SIM800C
9	Node-MCU	ESP8266MOD
10	LCD Display	JHD162A
11	Transformers	12V
12	Relay	12V DC
13	LED Lights	-----
14	Speaker	-----
15	Speaker Buffer	ISD1820
16	Analog to Digital Unit	-----
17	Connecting Wires	-----
18	Wi-Fi	2MB/Sec

PIC Micro-controller

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

PIC 16F877A

Various micro-controllers offer different kinds of memories. EEPROM, EPROM, FLASH etc.... are a number of the memories of which FLASH is that the last developed.

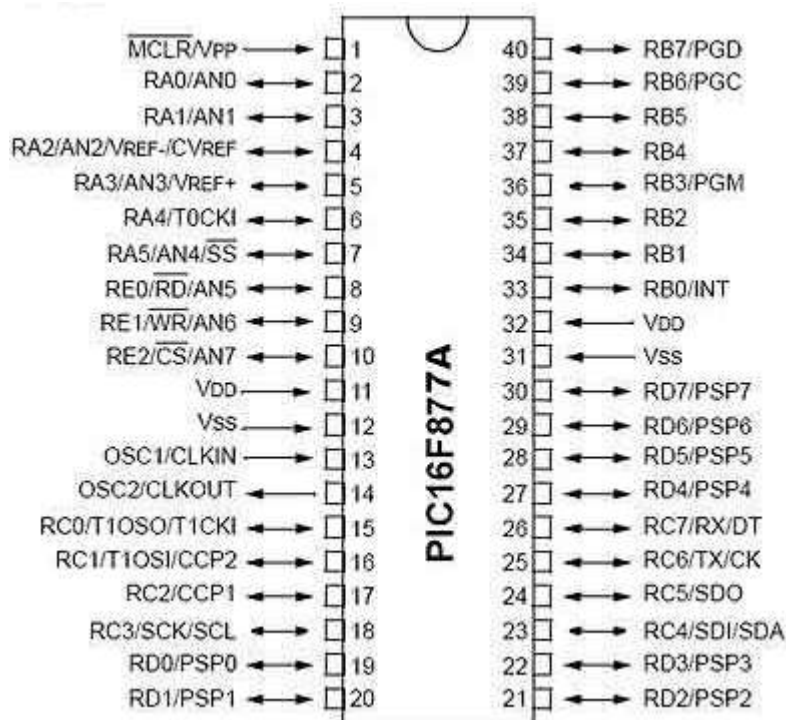


FIG 4.3 PIN DIAGRAM OF PIC16F877A

Technology that's utilized in PIC 16F877A is flash technology, in order that data is retained even when the facility is transitioned. Easy programming and erasing are other features of PIC 16F877. PIC16F877A micro-controller is employed within the project.

LCD Module

The Liquid Crystal library allows you to regulate LCD displays that are compatible with the Hitachi HD44780 driver. There are many of them out there, and you can usually tell them by the 16-pin interface. The LCD's have a parallel port, meaning that the micro-controller has got to manipulate several interface pins directly to regulate display. The interface consists of the subsequent pins: A register select (RS) pin that controls within the LCD's memory you're writing data to. You can select either the data register, which holds what goes on the screen, or an instruction register, which is where the LCD's controller looks for instructions on what to try to next. A Read/Write (R/W) pin that selects reading mode or writing mode. An Enable pin that permits writing to the registers. 8 data pins (D0 -D7). The states of those pins (high or low) are the bits that you're writing to a register once you write, or the values you're reading once you read. There's also a display contrast pin (Vo), power supply pins (+5V and Gnd) and LED Backlight (Bkl+ and Bkl-) pins that you simply can use to power the LCD, control the display contrast, and turn on and off the LED backlight, respectively. The method of controlling the display involves putting the data that form the image of what you would like to display into the data registers, then putting instructions in the instruction register. The Liquid Crystal Library simplifies this for you so you do not got to know the low-level instructions. The Hitachi-compatible LCDs are often controlled in two modes: 4-bit or 8-bit. The 4-bit mode requires seven I/O pins from the Arduino, while the 8-bit mode requires 11 pins. For displaying text on the screen, you can do most everything in 4-bit mode, so example shows the way to control a 2x16 LCD in 4-bit mode.

i. Features of LCD module

Before wiring the LCD screen to your Arduino or Genuine board we propose to solder a pin header strip to the 14 (or 16) pin count connector of the LCD screen

To wire your LCD screen to your board, connect the subsequent pins:

- LCD RS pin to digital pin 12
- LCD Enable pin to digital pin 11
- LCD D4 pin to digital pin 5
- LCD D5 pin to digital pin 4

- LCD D6 pin to digital pin 3
- LCD D7 pin to digital pin 2

Additionally, wire a 10k pot to +5V and GND, with it's wiper (output) to LCD screens VO pin (pin3). A 220 ohm resistor is employed power the backlight of the display, usually on pin 15 and 16 of the LCD connector

II. LCD PIN CONFIGURATION

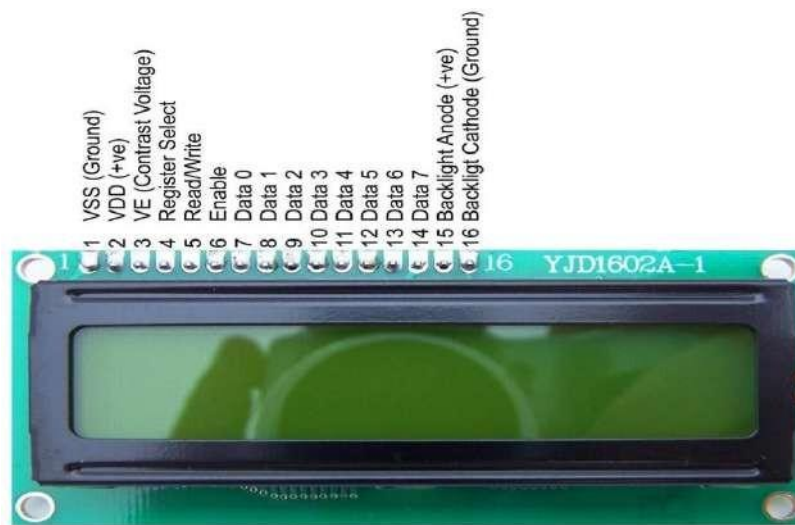


Fig 4.4 LCD PIN CONFIGURATION

iii. DATA PINS (D7:DO)

Bi-directional data/command pins. Alphanumeric characters are sent in ASCII format.

Register Select ,

RS = 0 -> Command Register is chosen RS = 1 -> Data Register is chosen.

R/W: Read or Write

0 -> Write, 1 -> Read

E: Enable (Latch data)

Used to latch the data present on the data pins. A high-to-low edge is needed to latch the data. The 8 data lines are connected to PORT 1 of 8051 microcontroller. The three control lines (RS, RW and EN) are connected to PORT 3.5, 3.6 and 3.7 respectively.

PIN DIAGRAM OF LCD DISPLAY

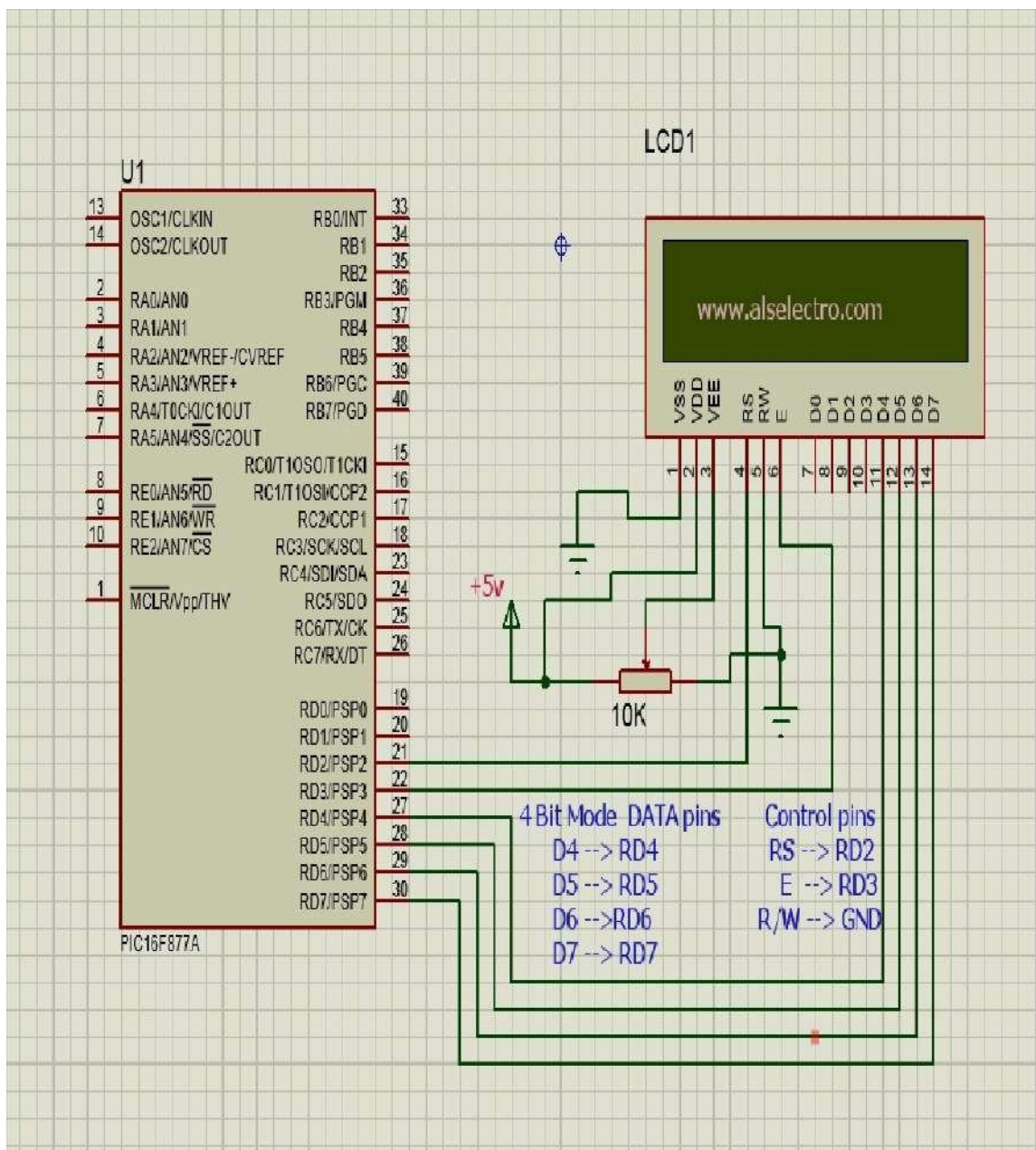


FIG 4.5 Pin Diagram of LCD Display

GSM MODERM

A GSM modem may be a wireless modem that works with a GSM wireless network. A wireless modem behaves like a dial-up modem. The main difference between them is that a dial-up modem sends and receives data through a hard and fast telephone line while a wireless modem sends and receives data through radio waves. The working of GSM modem is predicated on commands, the commands always start with AT (which means Attention) and finish with a <CR> character. For example, the dialing command is ATD<number>; ATD3314629080; here the dialing command ends with semicolon.



FIG 4.6 GSM MODERM

The AT commands are given to the GSM modem with the help of PC or controller. The GSM modem is serially interfaced with the controller with the assistance of MAX 232. Here max 232 acts as driver which converts TTL levels to the RS 232 levels. For serial interface GSM modem requires the signal based on RS 232 levels. The T1_OUT and R1_IN pin of MAX 232 is connected to the TX and RX pin of GSM.

PIN DIAGARAM OF GSM MODULE

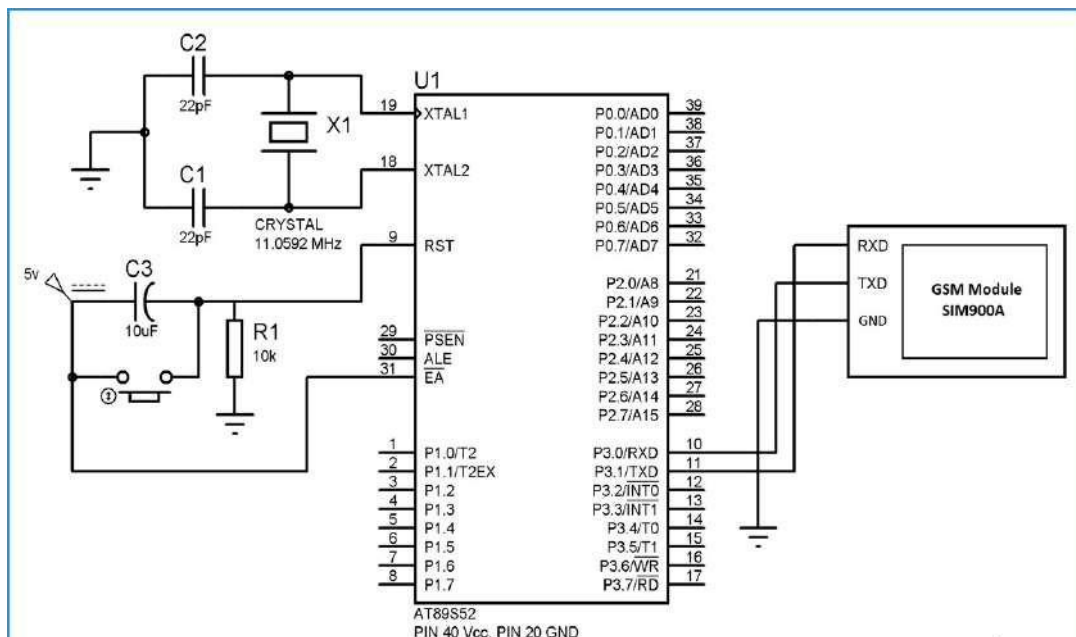


Fig 4.7 Pin Diagram of GSM Module

TABLE 4.2 COMMENTS FOR GSM MODILE

Command	Description
AT+CMGD	DELETE SMS MESSAGE
AT+CMGF	SELECT SMS MESSAGE FORMAT
AT+CMGL	LIST SMS MESSAGES FROM PREFERRED STORE
AT+CMGR	READ SMS MESSAGE
AT+CMGS	SEND SMS MESSAGE
AT+CMGW	WRITE SMS MESSAGE TO MEMORY
AT+CMSS	SEND SMS MESSAGE FROM STORAGE
AT+CMGC	SEND SMS COMMAND

GPS MODULE

The Global Positioning System (GPS) is a satellite-based navigation system that consists of 24 orbiting satellites, each of which makes two circuits round the Earth every 24 hours. These satellites transmit three bits of data – the satellite's number, its position in space, and therefore the time the information is shipped. These signals are picked up by the GPS receiver, which uses this information to calculate the distance between it and the GPS satellites.



Fig 4.8 GPS Module

With signals from three or more satellites, a GPS receiver can triangulate its location on the bottom (i.e., longitude and latitude) from the known position of the satellites. With four or more satellites, a GPS receiver can determine a 3D position (i.e., latitude, longitude, and elevation). In addition, a GPS receiver can provide data on your speed and direction of travel. Anyone with a GPS receiver can access the system. Because GPS provides real-time, three-dimensional positioning, navigation, and timing 24 hours every day, 7 days every week, every where the planet, it's used in numerous applications, including GIS data collection, surveying, and mapping.

PIN DIAGRAM OF GPS

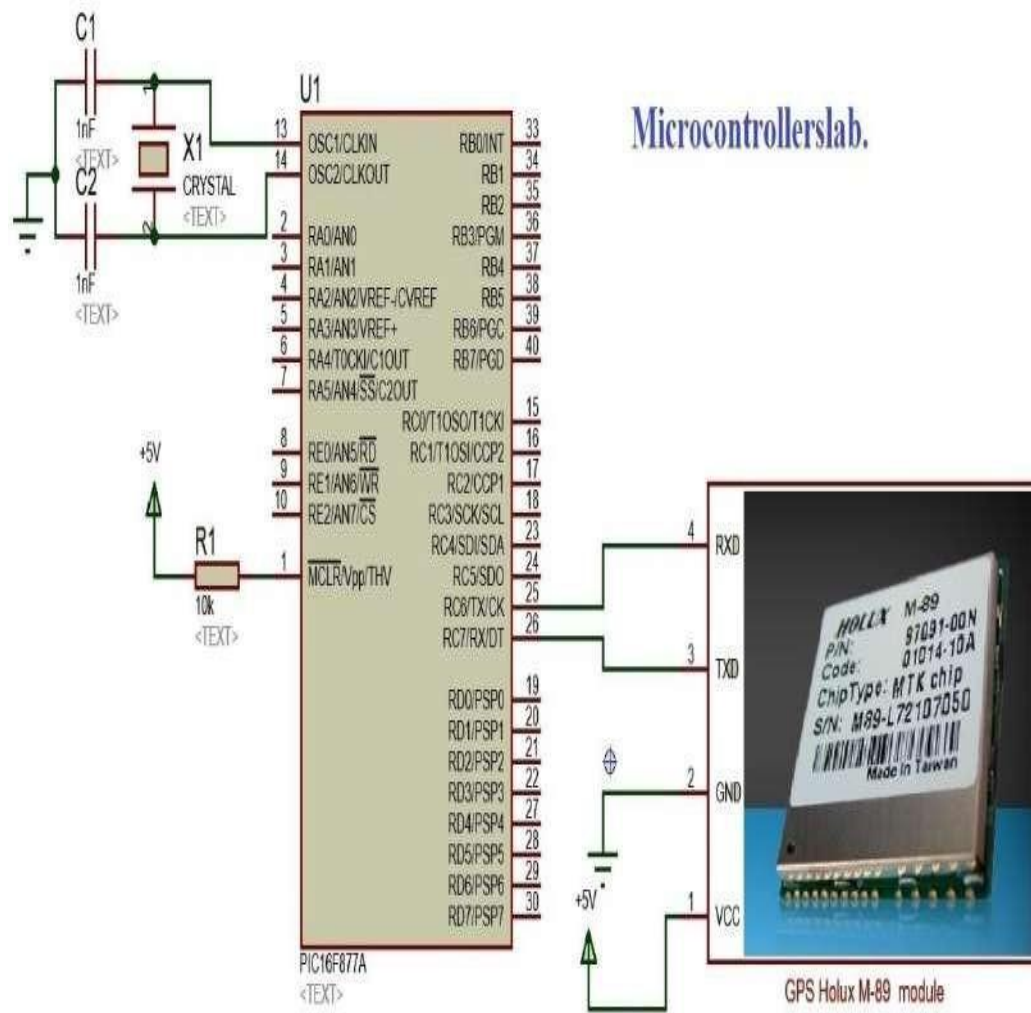


Fig 4.9 Pin diagram of GPS

TEMPERATURE SENSOR

The LM35 series are precision integrated-circuit temperature devices with an output voltage linearly proportional to the Centigrade temperature. The LM35 device has a plus over linear temperature sensors calibrated in Kelvin, because user isn't required to subtract an outsized constant voltage from the output to obtain convenient Centigrade scaling. The LM35 device does not require any external calibration or trimming to provide typical accuracies of $\pm\frac{1}{4}^{\circ}\text{C}$ at room temperature and $\pm\frac{3}{4}^{\circ}\text{C}$ over a full -55°C to 150°C temperature range.



Fig 4.10 TEMPERATURE SENSOR

Lower cost is assured by trimming and calibration at the wafer level. The low-output impedance, linear output, and precise inherent calibration of the LM35 device makes interfacing to readout or control circuitry especially easy. The device is used with single power supplies, or with plus and minus supplies. As the LM35 device draws only $60\text{ }\mu\text{A}$ from the availability, it's very low self-heating but 0.1°C in still air. The LM35 device is rated to work over a -55°C to 150°C temperature range, while the LM35C device is rated for a -40°C to 110°C range (-10° with improved accuracy).

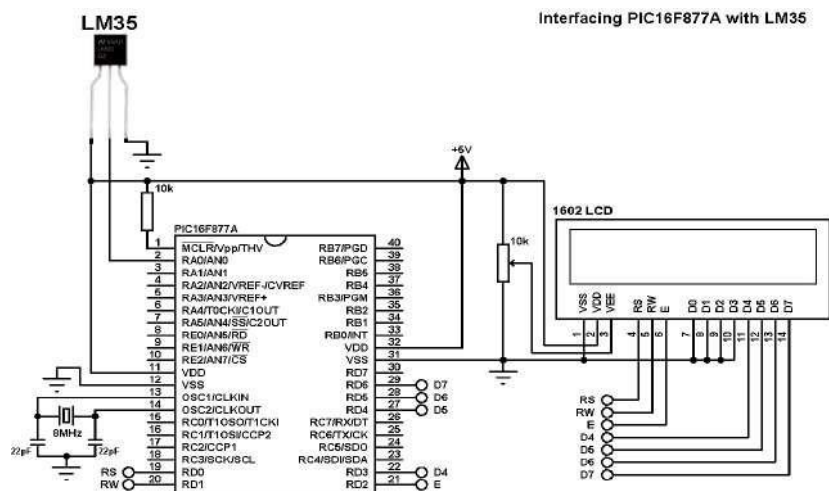


Fig 4.11 CIRCUIT CONNECTION OF LM-35

HEART- BEAT SENSOR

Heartbeat Sensor is an electronic device that's wont to measure the heart rate i.e. speed of the heartbeat. Monitoring body temperature, heart rate and blood pressure are the essential things that we neutralize order to stay us healthy.

In order to measure the body temperature, we use thermometers and a sphygmomanometer to watch the Blood Pressure or vital sign.Heart Rate can be monitored in two ways: a method is to manually check the heart beat either at wrists or neck and therefore the other way is to use a Heartbeat Sensor.In this project, we have designed a Heart Rate Monitor System using PIC and Heartbeat Sensor.

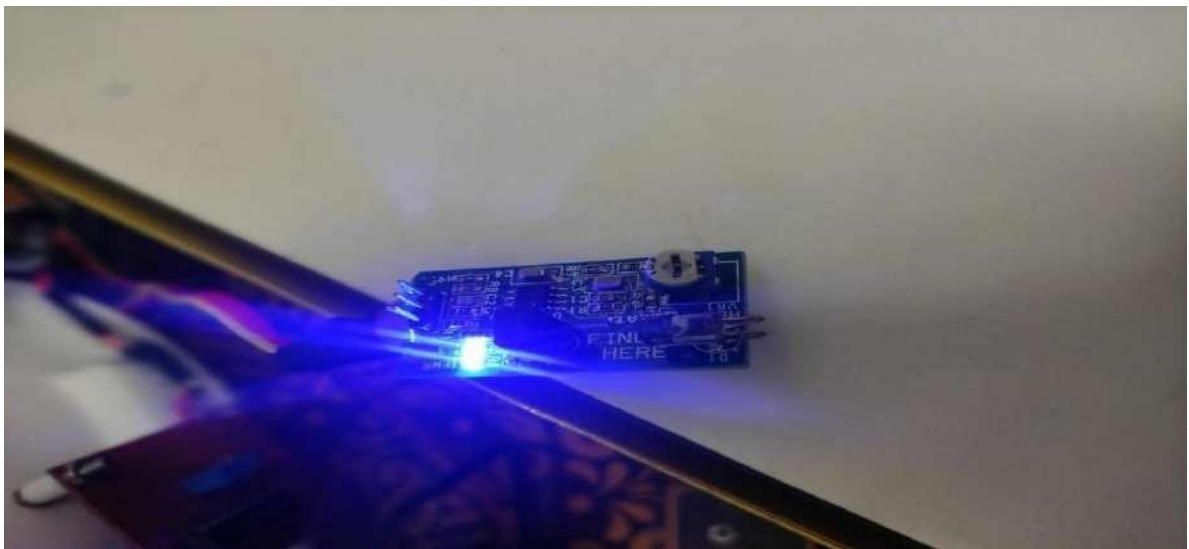


FIG 4.12 HEART-BEAT SENSOR

SUGAR-LEVEL SENSOR

The 650nm wavelength of red laser is passed to the human finger which analyze the transmitted and absorbed blood samples to determine the glucose level (mg/lit). In this proposed method, the device works by sending a laser beam through skin cells – without causing damage – to be absorbed by sugar molecules. The target is not blood glucose intrinsically as such, but the sugar content of dermal extracellular fluid, which has a strong correlation with blood sugar. The amount of absorption of the laser beam is thus an indicator of the amount of glucose in the blood.

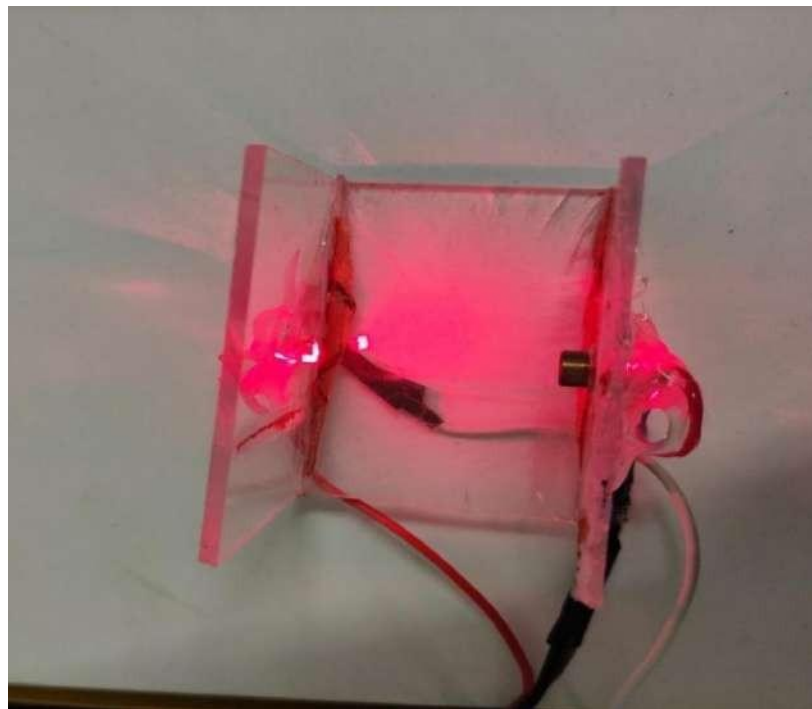


FIG 4.13 SUGAR-LEVEL SENSOR

SPO2 SENSOR

Monitoring SpO₂, the saturation percentage of oxygen in the blood, has become a standard of patient care across the globe. Almost every patient monitor has a built-in or attachable capability to monitor this crucial vital sign. SPO₂ is an indirect and noninvasive method of measuring oxygen saturation in blood. It should be tested along side all the opposite physiological parameters during preventative or corrective maintenance on a patient monitor, or stand-alone device.

SPO₂ is measured using a sensor, usually attached to the patient's finger. There are two methods of SpO₂ technology: transmissive and reflective. The transmissive method is that the more commonly used of the two(2). As shown in figure 1, transmissive technology transmits red and infrared through the finger to a photo detector.



FIG 4.14 SPO2 SENSOR

RESPIRARTION SENSOR

High-quality sensors in respiratory devices measure minute flow rates around the zero point of the respiratory flow and also detect flow rates of several hundred l/min. ... In controlled CPAP devices, pressure sensors continuously monitor the therapy pressure, thereby improving the comfort and quality of the treatment. The Respiration Sensor is employed to watch abdominal or thoracical breathing, in biofeedback applications like stress management and relaxation training. Besides measuring breathing frequency, this sensor also gives you an indication of the relative depth of breathing.

TYPES OF BREATH SOUNDS

A normal breath sound is analogous to the sound of air. However, abnormal breath sounds may include:

- Rhonchi (a low-pitched breath sound).
- Crackles (a high-pitched breath sound).
- Wheezing (a high-pitched whistling sound caused by narrowing of the bronchial tubes).
- Stridor (a harsh, vibratory sound caused by narrowing of the upper airway).

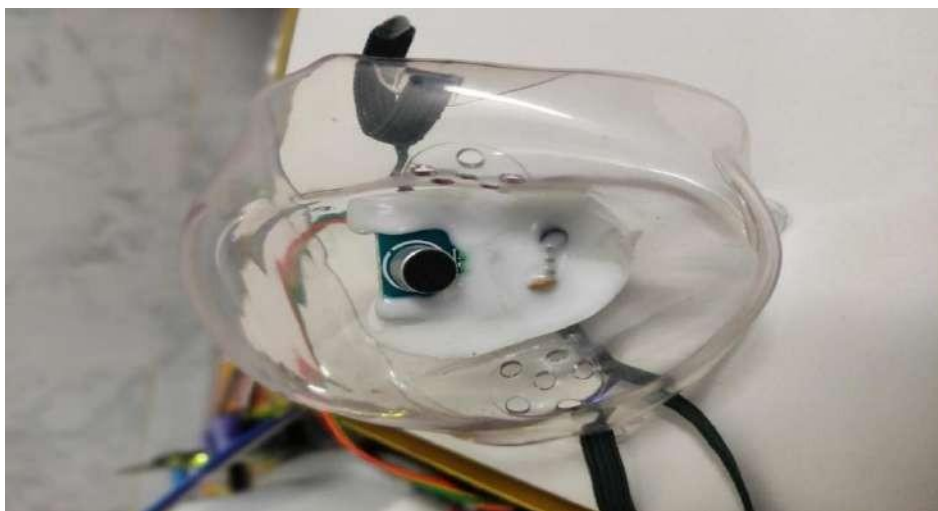


FIG 4.15 RESPIRARTION SENSOR

CHAPTER-5

CODING & OUTPUT ANALYSIS AND SAMPLES

CODING



<https://github.com/bharathp2000/DT20207188784>

OUTPUT ANALYSIS

WEB APPLICATION INTERFACE

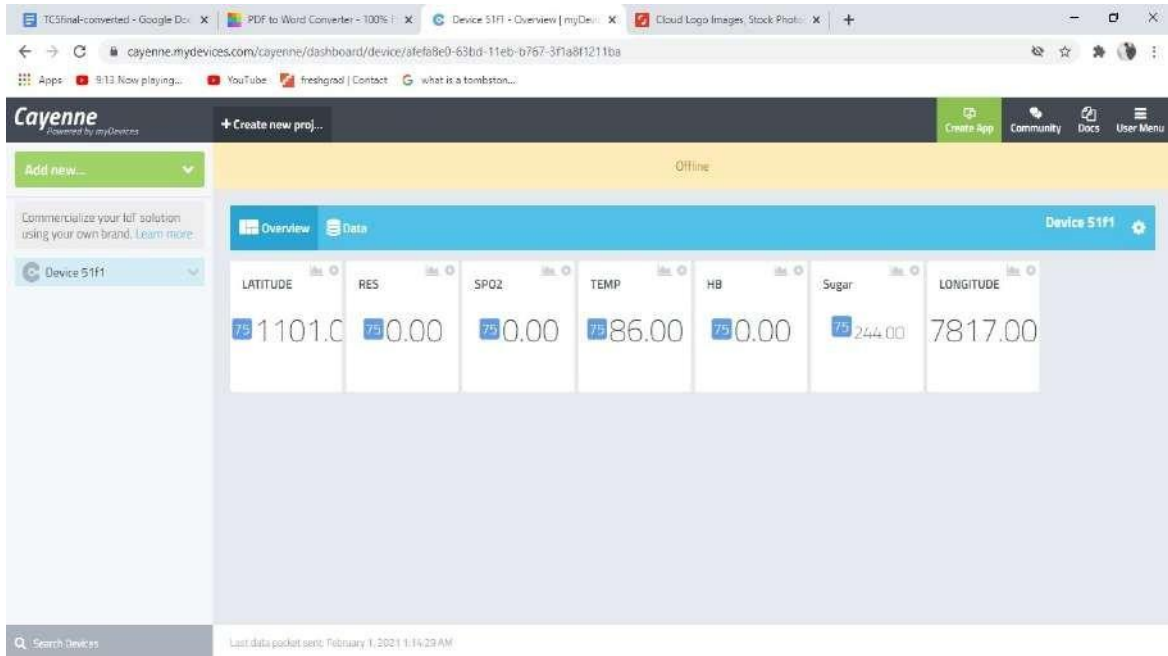


FIG 5.1 WEB APPLICATION INTETFACE

CLOUD DATA INTERFACE

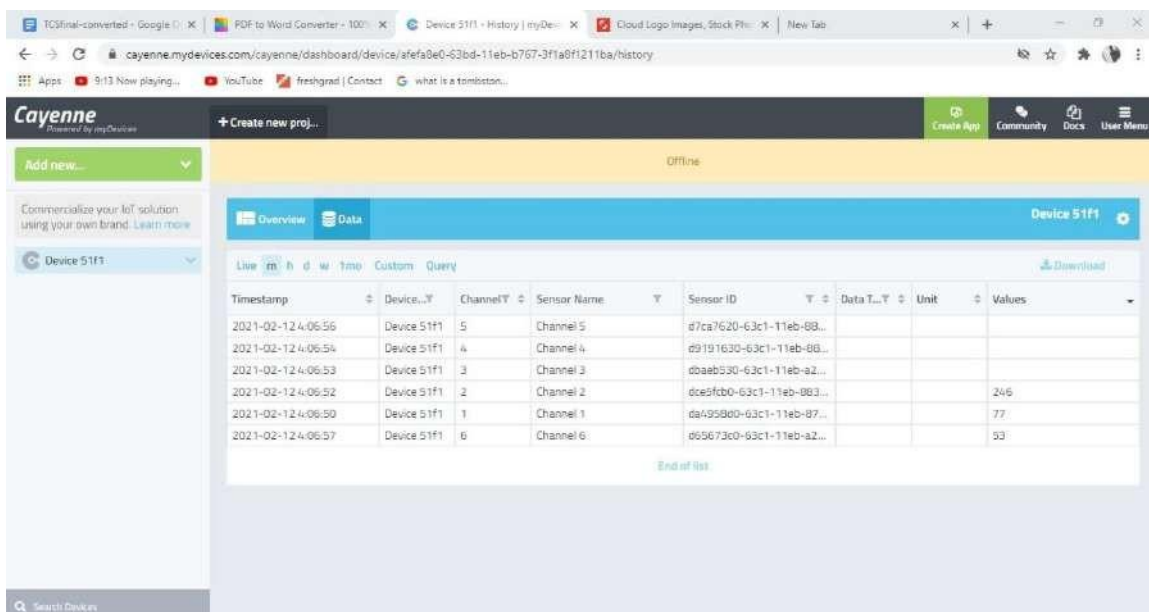


FIG 5.2 CLOUD DATA INTERFACE

REMOTE DEVICE INFO

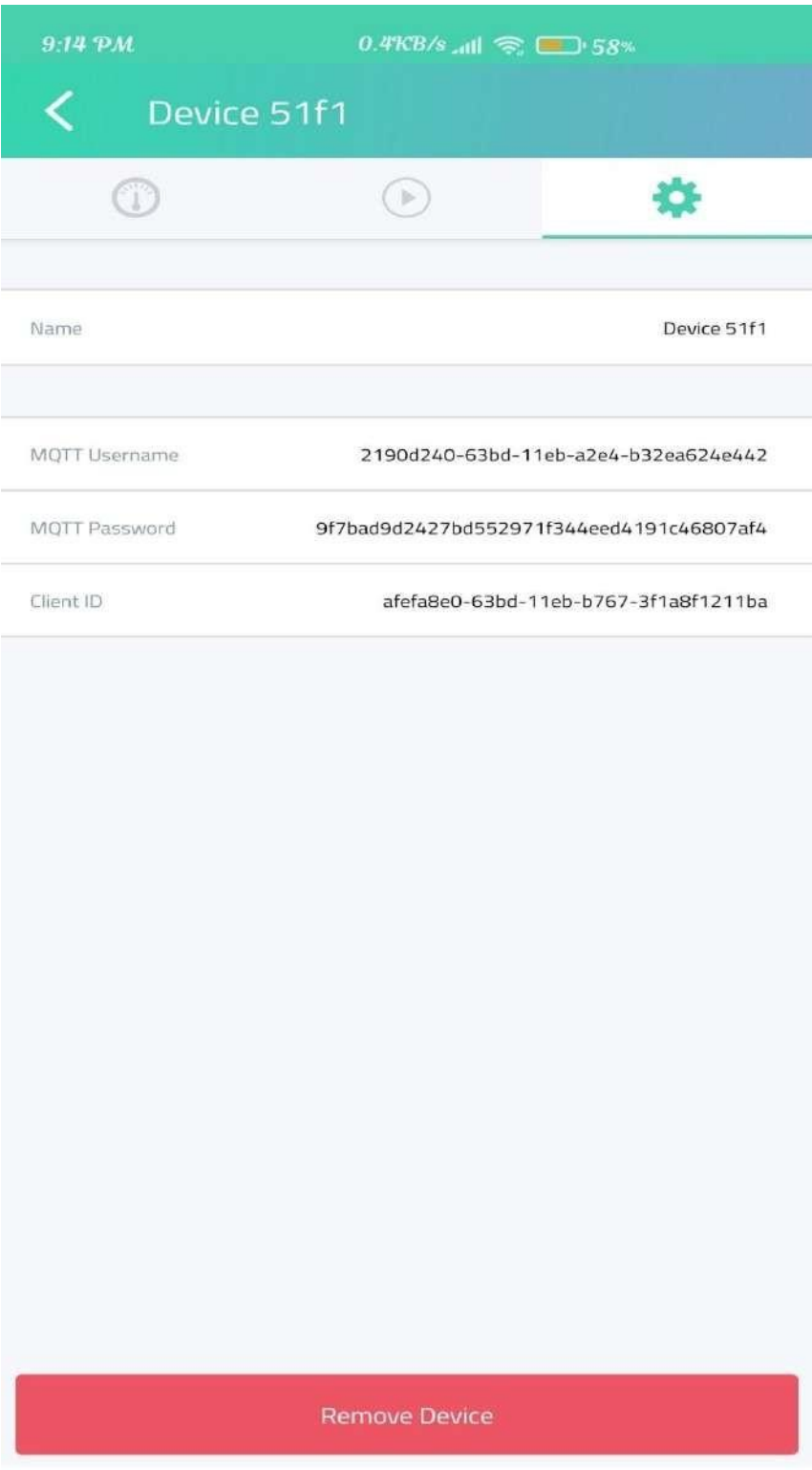


FIG 5.3 REMOTE DEVICE INFO

ANDROID APPLICATION INTERFACE

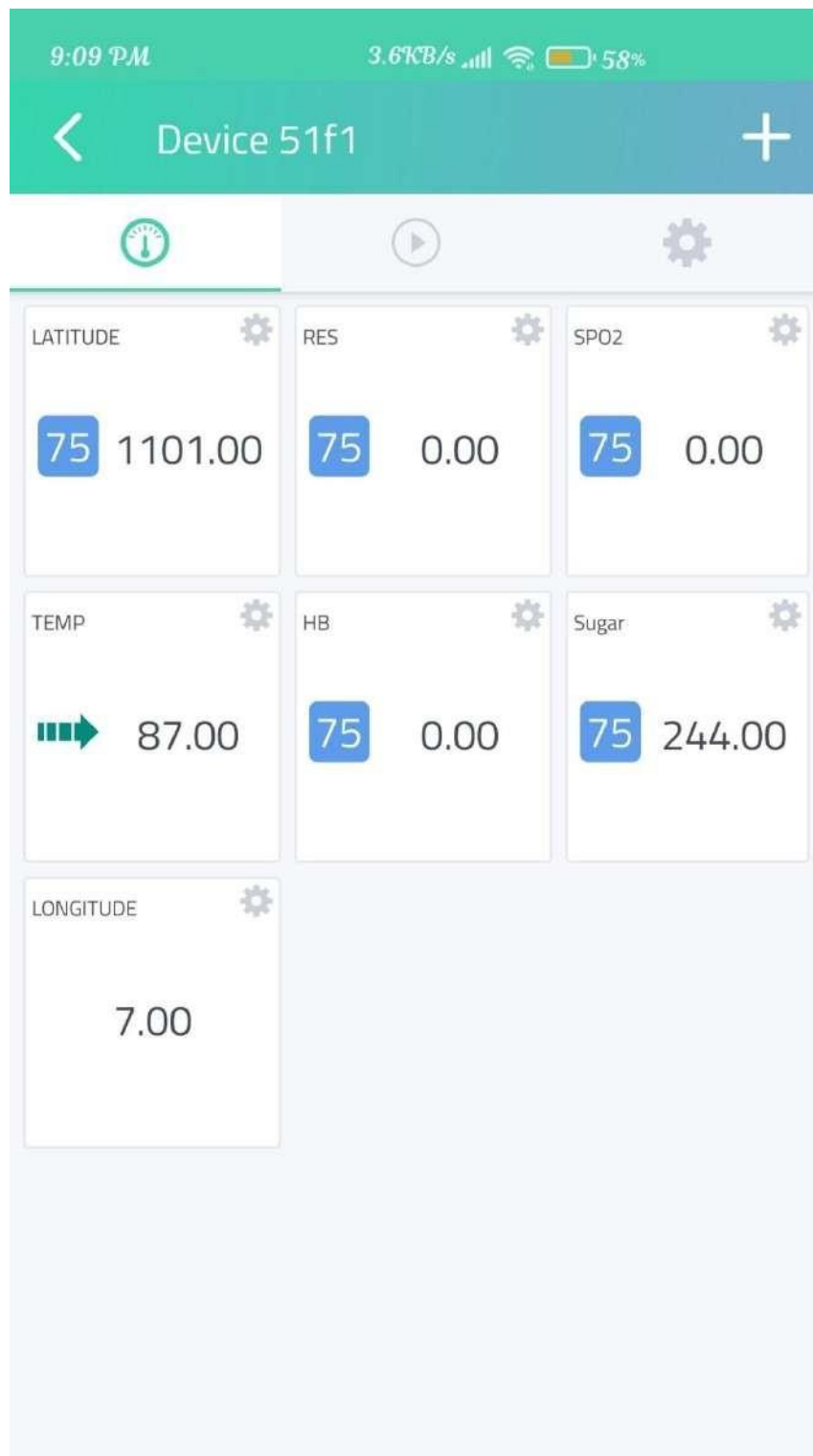


FIG 5.4 ANDROID APPLICATION INTERFACE

SMS REPORT

31-1 6:25 PM

UR HEALTH!!

31-1 6:53 PM

TEMP HB O2S RESP

TEMP HB O2S RESP

FIG 5.5 SMS REPORT

PROTOTYPE SAMPLES



FIG 5.6 PROTOTYPE SAMPLES-1



FIG 5.7 PROTOTYPE SAMPLES-2

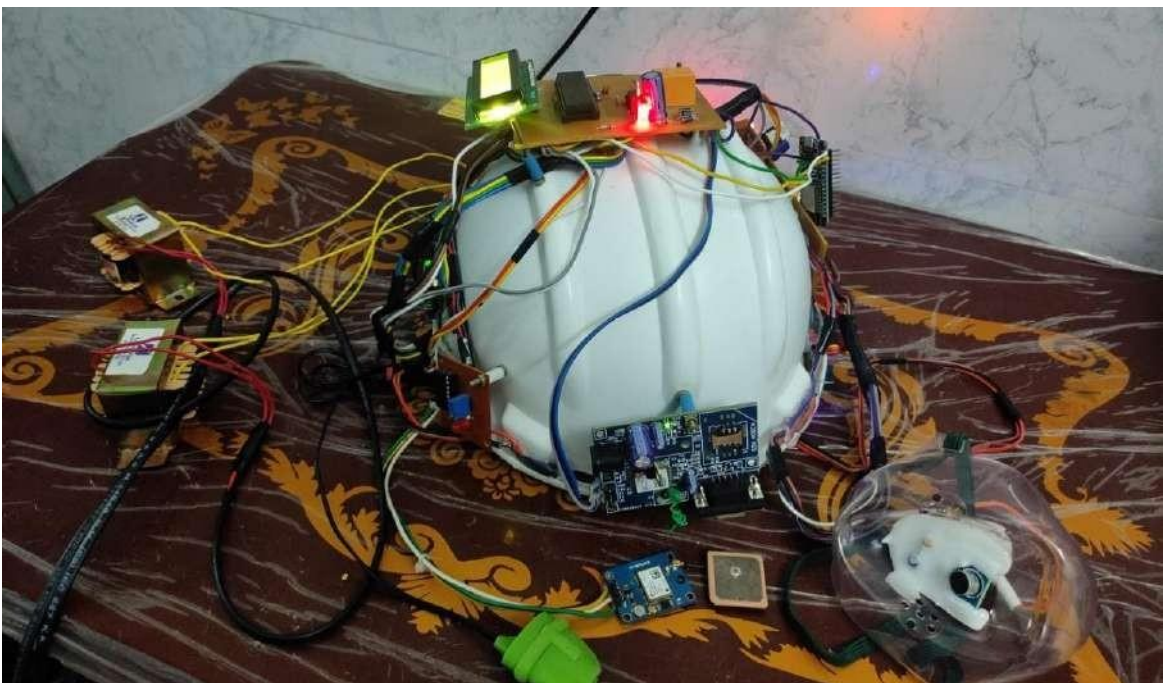


FIG 5.8 PROTOTYPE SAMPLES-3



FIG 5.9 PROTOTYPE SAMPLES - 4

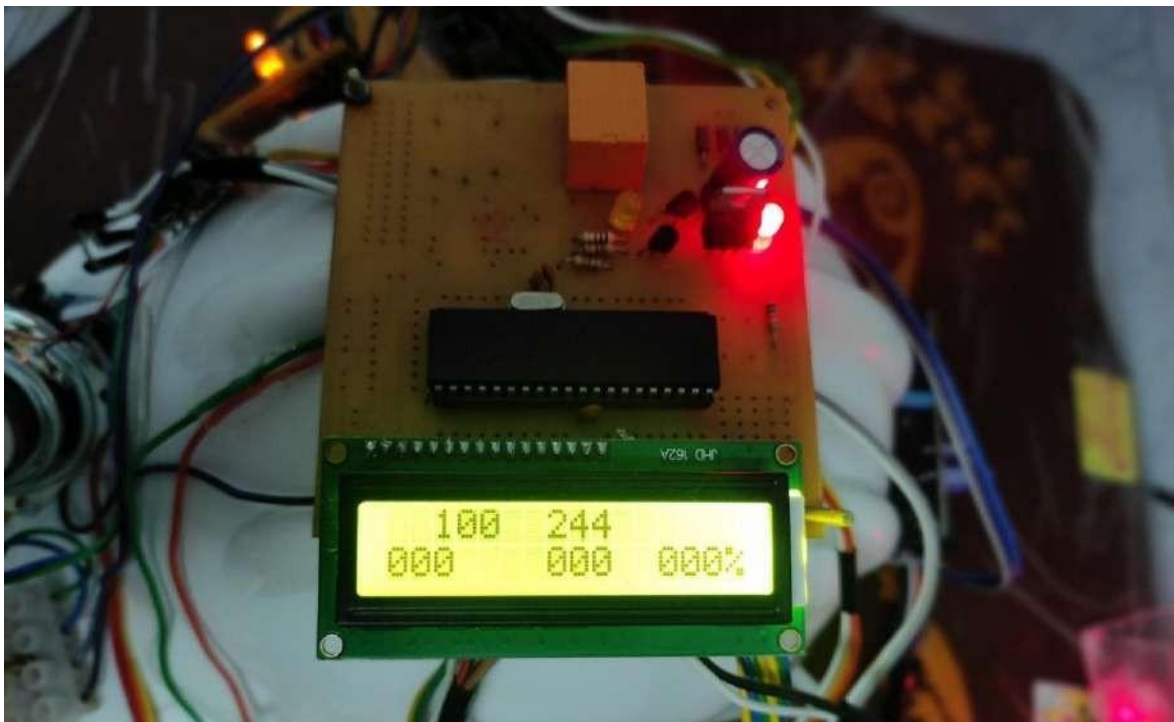


FIG 5.10 PROTOTYPE SAMPLES - 5

GEOTAGEED PHOTO

5.4 GEOTAGEED PHOTO

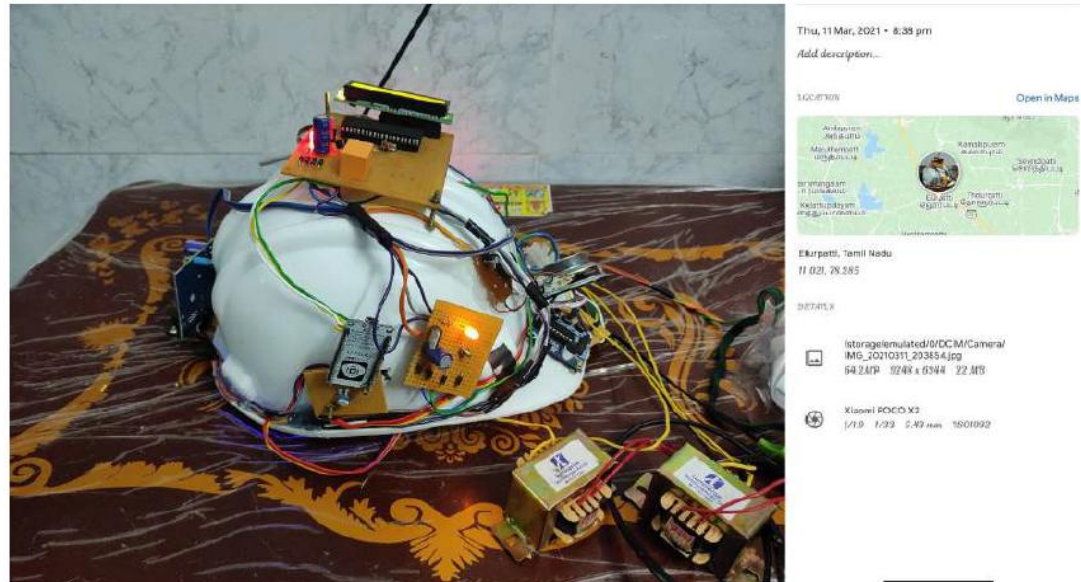


FIG 5.11 GEOTAGEED PHOTO-1

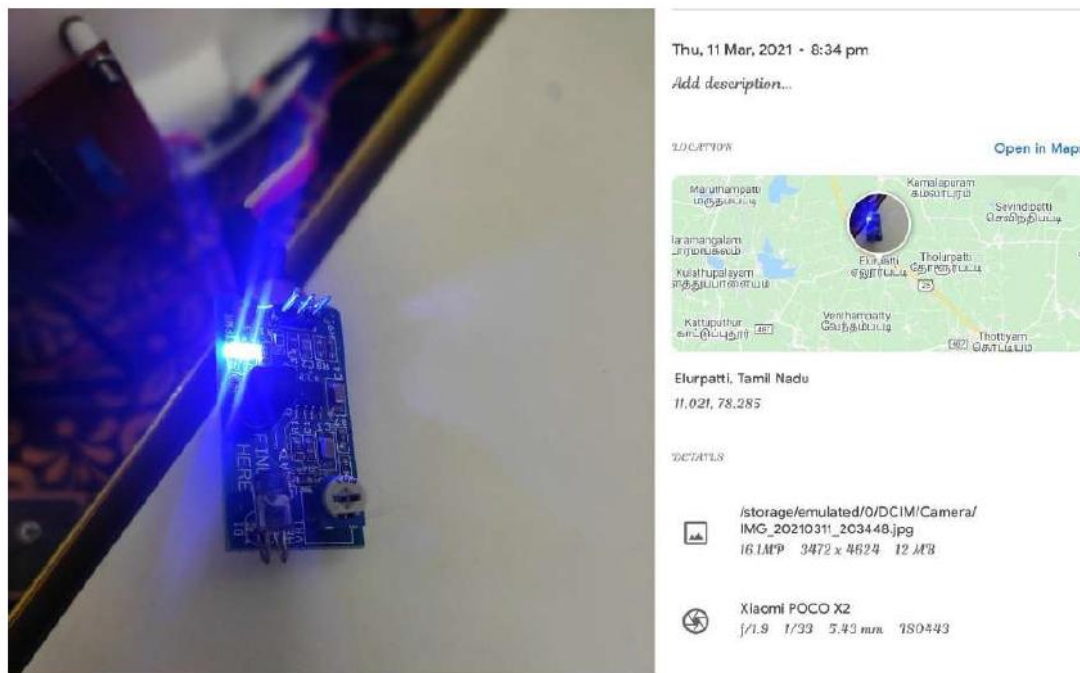


FIG 5.12 GEOTAGEED PHOTO-2

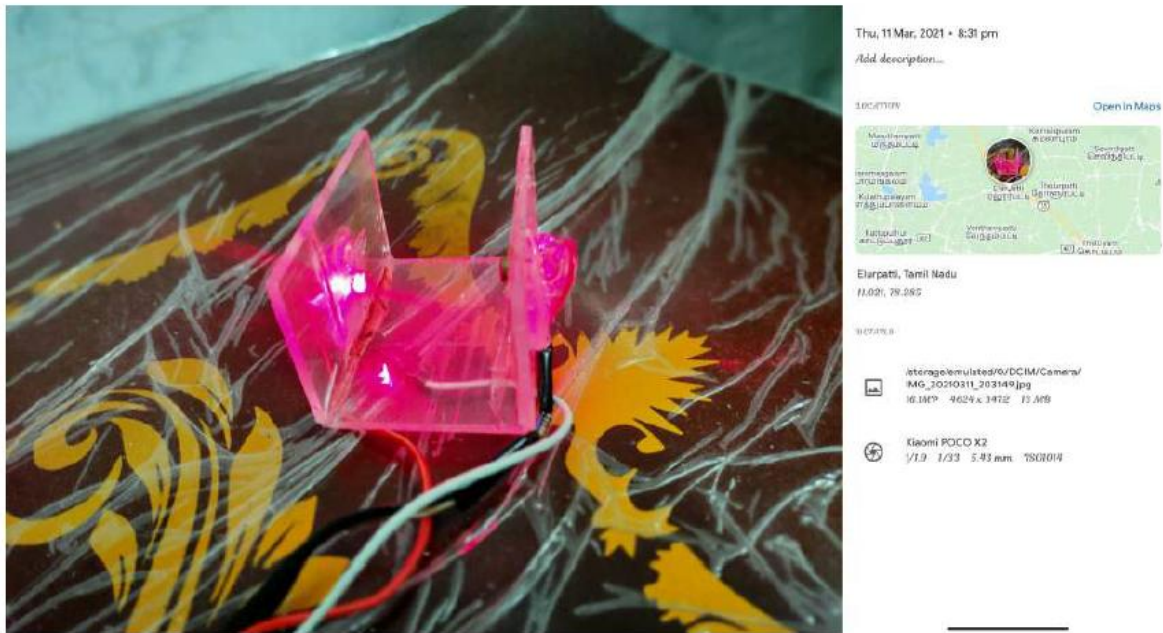


FIG 5.13 GEOTAGEED PHOTO-3

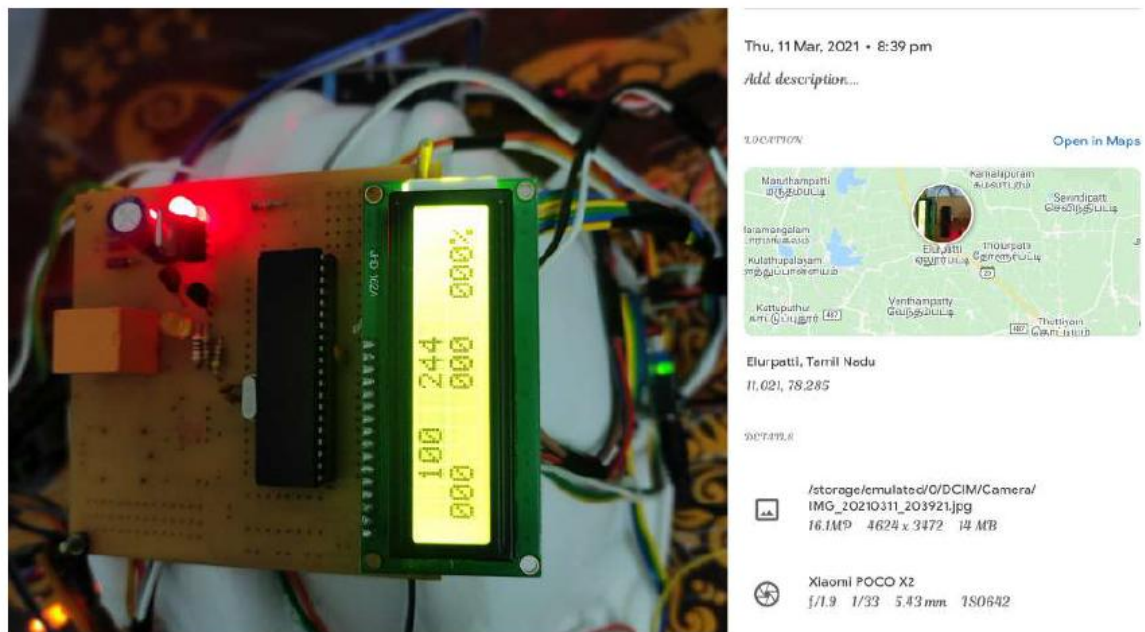


FIG 5.14 GEOTAGEED PHOTO-4

CHAPTER 6

CONCLUSION & REFERENCE

CONCLUSION

Today, many services can be reached with internet technology and the number of applications that use this technology is constantly increasing. IoT technology is expanding day by day to include different sectors with applications. Many health problems that require early diagnosis may cause vital problems because they cannot be monitored on time. Early diagnosis is unbelievably important for people with heart disease. A wireless monitoring system is developed that continuously measures the heart rate and body temperature of the patient(Employee) and provides monitoring and tracking through an android & web based interface. Many ability to gather continuous data from different origins, clinical and behavioral, will enable the event of analytical tools for a far better understanding of disease development and progression, early detection and intervention.

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