A
Project Report
on

"IOT Based Smart Device for monitoring COVID-19 patients and alert to medical authorities"

Academic Year of 2021-2022

(Savitribai Phule Pune University)

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CERTIFICATE

This is to certify that **Ms. Sakshi Maskar, Mr. Yadnesh Kayande, Ms. Madhavi Mote** the students of BE Electronics & Telecommunication Engineering, JSCOE, Hadapsar have submitted their project report entitled **" IOT Based Smart Device for monitoring COVID-19 patients and alert to medical authorities"** under the supervision and guidance of **Prof. V.P.PATIL** for the partial fulfillment of the requirement for the award of the degree of "Bachelor of Engineering" during the academic year 2021-22 of Savitribai Phule Pune University.

Date: 20/05/2022
Place: Hadapsar, Pune.

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We take this opportunity to present our project report on "**IOT Based Smart Device for monitoring COVID-19 patients and alert to medical authorities**". We express our sincere thanks to our project guide **Prof. V. P. PATIL** for her valuable help, guidance and the confidence, which she gave us at all stages of the project work.

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ABSTRACT

With an improvement in technology and miniaturization of sensors, there have been attempts to utilize the new technology in various areas to improve the quality of human life. One main area of research that has seen an adoption of the technology is the healthcare sector. The people in need of healthcare services find it very expensive this is particularly true in developing countries.

As a result, this project is an attempt to solve a healthcare problem currently society is facing. The main objective of the project was to design a remote healthcare system. It's comprised of three main parts. The first part being, detection of patient's vitals using sensors, second for sending data to cloud storage and the last part was providing the detected data for remote viewing. Remote viewing of the data enables a doctor or guardian to monitor a patient's health progress away from hospital premises.

The Internet of Things (IoT) concepts have been widely used to interconnect the available medical resources and offer smart, reliable, and effective healthcare service to the patients. Health monitoring for active and assisted living is one of the paradigms that can use the IoT advantages to improve the patient's lifestyle. In this project, We have presented an IoT architecture customized for healthcare applications. The aim of the project was to come up with a Remote Health Monitoring System that can be made with locally available sensors with a view to making it affordable if it were to be mass produced.

Hence the proposed architecture collects the sensor data through Arduino microcontroller and relays it to the cloud where it is processed and analyzed for remote viewing. Feedback actions based on the analyzed data can be sent back to the doctor or guardian through Email and/or SMS alerts in case of any emergencies.

Keywords: Health monitoring system, pulse sensor, temperature sensor, , IOT

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CHAPTER 1

INTRODUCTION

1.1 BACKGROUND INFORMATION

In the recent years wireless technology has increasing for the need of upholding various sectors .In these recent years IoT graped the most of industrial area specially automation and control. Biomedical is one of recent trend to provide better health care. Not only in hospitals but also the personal health caring facilities are opened by the IoT technology. So having a smart system various parameters are observed that consumes power, cost and increase efficiency .In according to this smart system , this paper is reviewed.

In traditional method, doctors play an important role in health check up. For this process requires a lot of time for registration, appointment and then check up. Also reports are generated later. Due to this lengthy process working people tend to ignore the checkups or postpone it. This modern approach reduces time consumption in the process.

In the recent years use of wireless technology is increasing for the need of upholding various sectors .In these recent years IoT groped the most of industrial area specially automation and control. Biomedical is one of recent trends to provide better health care. Not only in hospitals but also the personal health care facilities are opened by the IoT technology. So having a smart system, various parameters are observed that consume power, cost and increase efficiency .In accordance with this smart system, this paper is reviewed.[3]

Medical scientists are trying in the field of innovation and research since many decades to get better health services and happiness in human lives.

Their contribution in medical area is very important to us and cannot be neglected. Today's automotive structures have the root ideas coming from yesterday's basics. Also

Early detection of chronic diseases can be easy with these technology.[4]

The body temperature, heart rate, blood pressure, respiration rate are prime parameters to diagnose the disease. This project gives temperature and heart rate values using IoT

1.2 OVERVIEW OF PROPOSED SYSTEM

Modern health care system introduces new technologies like wearable devices or cloud of things. It provides flexibility in terms of recording patients monitored data and send it remotely via IOT. For this connection, there is need of secure data transmission .To transmit the data with privacy is the Moto of this project. The proposed system introduces security of health care and cloud of things .System works in two major parts viz. storage stage and data retrieving stage. In storage stage, data is stored, updated for future use. In data retrieving stage, retrieve data from cloud. The cloud server can share with authenticated user as per request. A patient with wearable devices continually updates his record every 5 or 10 min. In emergency mode, it updates for every 1min. This can able to give to cloud server using GSM and 3G.

At cloud server, each patient is defines with unique address. So data at cloud can authenticate the right patient and provide the required request.[1]

1.3 MOTIVATION AND SCOPE

In rural hospitals, the facilities for health caring are limited. The poor quality of health management enables issues in health care system Everyone should get the knowledge of own health as easy and early as possible. Also it should be worth for each .Latest report of The India Spend analysis of data says that the 500,000 doctors shortage in India. WHO defines the doctor patient ratio will be 1:1000 which has been failed in India.

In developing countries there is lack of resources and management to reach out the problems of individuals. A common man cannot afford the expensive and daily check up for his health. For this purpose various systems which give easy and assured caring unit has been developed. Theses system reduces time with safely handled equipment.

1.4. PROBLEM DEFINITION

In this proposed work the vital parameters such as temperature, heart beat readings which are monitored using Arduino Uno. These sensors signals are send to Arduino Uno via amplifier circuit and signal conditioning unit (SCU), because the signals level are low (gain), so amplifier circuit is used to gain up the signals and transmit the signals to the Arduino Uno. Here patients body temperature , heart rate is measured using respective sensors and it can be monitored in the screen of computer using Arduino Uno connected to a cloud database system as well as monitored anywhere in the world using internet source.

The proposed method of patient monitoring system monitors patient's health parameters using Arduino Uno. After connecting internet to the Arduino uno, it is connected to cloud database system which acts as a server. Then the server automatically sends data to the receiver system. Hence, it enables continuous monitoring of the patient's health parameters by the doctor. Any abrupt increase or decrease in these parameter values can be detected at the earliest and hence necessary medications can be implemented by the doctor immediately.

1.5. OBJECTIVES

To develop health monitoring system i.e. it measures body temperature and heart rate.

 To design a system to store the patient data over a period of time using database management.

 To do analysis of collected data of sensors

CHAPTER 2

LITERATURE SURVEY

2.1 Review of literature survey

At cloud server, each patient is defines with unique address. So data at cloud can authenticate the right patient and provide the required request.[1]

Telemonitoring system via WBAN is evolving for the need for home based mobile health and personalized medicine. WBAN can able to collect the data acquired from sensor and record the output. This output results sent to controller wirelessly to health monitoring system. In this paper, Zigbee is used to in WBAN technology due to its guaranteed delay requirement for health telemonitoring system. Zigbee used in the communication.[2]

Afef Mdhaffar, Tarak Chaari, Kaouthar Larbi, Mohamed Jmaiel and Bernd Freisleben has explained low power WAN network to perform analysis of monitored data in health caring system. They have established WAN network for communication upto the range of 33m2 at around 12 m altitude. Also they have demonstrated that power consumed by LoRaWAN network is ten times less than the GPRS/3G/4G.The IOT architecture has been given for step wise working for understanding of IOT .The main purpose of LoRaWAN is the energy consumption. The power consumption in idle mode for LoRaWAN is 2.8mA while in GPRS is 20mA.Hardware cost in LoRaWAN is 10doller while in GPRS is 50 dollar. Maximum data rate in LoRaWAN is 50kbps (uplink), 50 kbps downlink while in GPRS is 86.5 kbps(uplink ,14kbps(downlink).These results gives the overall efficiency of LoRaWAN in the demonstration of IOT for health monitoring system. [5]

Mohammad M. Masud, Mohamed Adel Serhani, and Alramzana Nujum Navaz had given the measurement of ECG signals at various intervals and at different situations. They have considered energy aware, limited computing resources and lose network continuity challenges .For these challenges; mathematical model has been developed to execute each task sequentially. There are three approaches designed to work out the process .One is mobile based monitoring approach, data mining and third is machine learning approach [6]

Ayush Bansal , Sunil Kumar, Anurag Bajpai, Vijay N. Tiwari, Mithun Nayak, Shankar Venkatesan, Rangavittal Narayanan focuses on development of a system which is capable of detecting critical cardiac events. Using an advanced remote monitoring system to detect

symptoms which lead to fatal cardiac events [7]

Hamid Al-Hamadi and Ing-Ray Chen gives trust based health IOT protocol that considers risk classification, reliability trust, and loss of health probability as design dimensions for decision making. Comparative analysis of trust based protocol and baseline protocols te check feasibility.[8]

Muthuraman Thangaraj Pichaiah Punitha Ponmalar Subramanian Anuradha .”Digital hospital” term is introduced for hospital management. It enables automatic electronic medical records in standard. Also discusses with the implemented real world scenario of smart autonomous hospital management with IOT.[9]

2.2 Advantages over existing systems

Design a health monitoring system which has heart beat detection system, temperature detection system ,humidity detection system, heart beat detection system and GPS receiver system. A doctor or health specialist can use the system to monitor remotely of all vital health parameters of the patient or a person of interest. An attempt at designing a remote health care system made with locally available components

1) The temperature humidity and heart beat modules interfaced with microcontroller. The data collected was transmitted wirelessly to a receiver module.

2) A simple cloud server where hosted with data base for all the vital data to be accessed remotely whenever required.

CHAPTER 3

BLOCK DIAGRAM AND EXPLAINATION

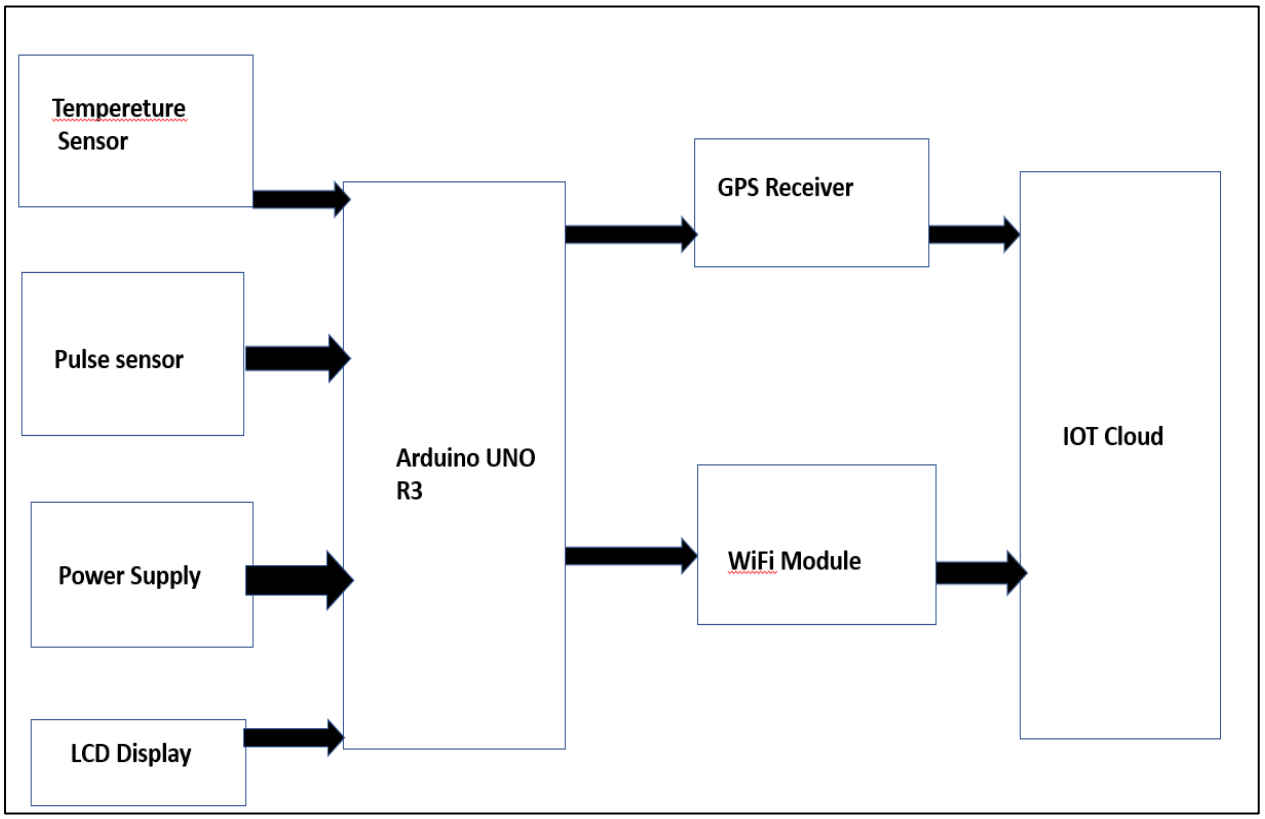

Figure 3.1 System Block Diagram

Fig 3.1 shows the proposed system .The health monitoring sensors are used to collect health related data i.e. for data acquisition. Communication can be done by controller for sending data on internet wirelessly. Data processing has been done at server. All data collected and aggregated at server point. To get health related information in understandable format it can be shown on web page i.e. data management. The main objective is to design a Patient Monitoring System with two-way communication i.e. not only the patient's data will be sent to the doctor through SMS and email on emergencies, but also the doctor can send required suggestions to the patient or guardians through SMS or Call or Emails. And Patient or guardian can able to track patient's location at any point in time through Google Maps which would enable to send medical services in case of an emergency for non-bed ridden patients.

Fig 3.2 shows the working flow of system. The results collected from sensor are

analyzed i.e. if abnormal behavior has been detected , then emergency plan activated to inform the Doctor about patient's health .So it reduces critical conditions in Hospital.

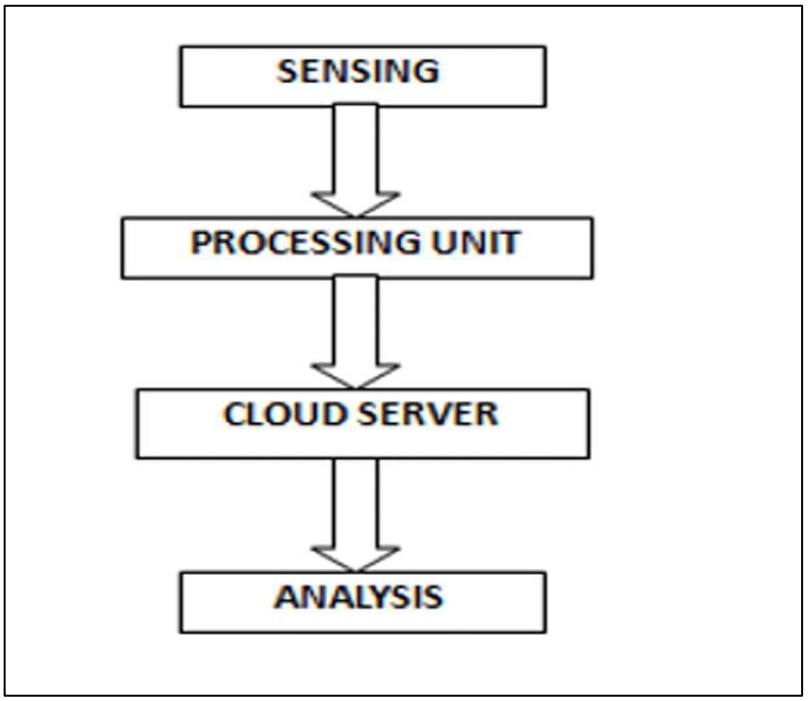

Fig 3.2

Above is the block diagram of "IOT based health monitoring system" which consists the following blocks.

HARDWARE SPECIFICATIONS

a) Arduino UNO R3
b) NodeMcu esp8266
c) Pulse sensor
d) GPS Receiver
e) Power Supply

SOFTWARE SPECIFICATIONS

1) Arduino – Nightly : The open-source Arduino Software (IDE) makes it easy to write code and upload it to the board. It runs on Windows, Mac OS X, and Linux. The environment is written in Java and based on Processing and other open-source software. This software can be used with any Arduino board.
2) ISIS Proteus Design Suite
3) Thingspeak: ThingSpeak is an IoT analytics platform service that allows you to

aggregate, visualize and analyze live data streams in the cloud. ThingSpeak provides instant visualizations of data posted by your devices to ThingSpeak. With the ability to execute MATLAB code in ThingSpeak you can perform online analysis and processing of the data as it comes in. ThingSpeak is often used for prototyping and proof of concept IoT systems that require analytics.

4) Thing Speak allows you to aggregate, visualize and analyze live data streams in the cloud. Some
of the key capabilities of Thing Speak include the ability to:
Easily configure devices to send data to Thing Speak using popular IoT protocols.
· Visualize your sensor data in real-time.
· Aggregate data on-demand from third-party sources
. · Use the power of MATLAB to make sense of your IoT data.
· Run your IoT analytics automatically based on schedules or events
. · Prototype and build IoT systems without setting up servers or developing web software.
· Automatically act on your data and communicate using third-party services like Twilio® or Twitter®.

3.3 Arduino UNO

3.3.1. Introduction

Arduino is an open-source electronics platform based on easy-to-use hardware and software. Arduino boards are able to read inputs - light on a sensor, a finger on a button, or a Twitter message - and turn it into an output - activating a motor, turning on an LED, publishing something online. You can tell your board what to do by sending a set of instructions to the microcontroller on the board. To do so you use the Arduino programming language (based on Wiring), based on Processing. Over the years Arduino has been the brain of thousands of projects, from everyday objects to complex scientific instruments. A worldwide community of makers - students, hobbyists, artists, programmers, and professionals - has gathered around this open-source platform, their contributions have added up to an incredible amount of accessible knowledge that can be of great help to novices and experts alike.

The possibilities of the Arduino are almost limitless. As such, there is no way that one single tutorial can cover everything you might ever need to know. That said, I've done my best to give a basic overview of the fundamental skills and knowledge that you need to get your Arduino up and running. If nothing more, this should function as a springboard into further experiment.

3.3.2. Architecture

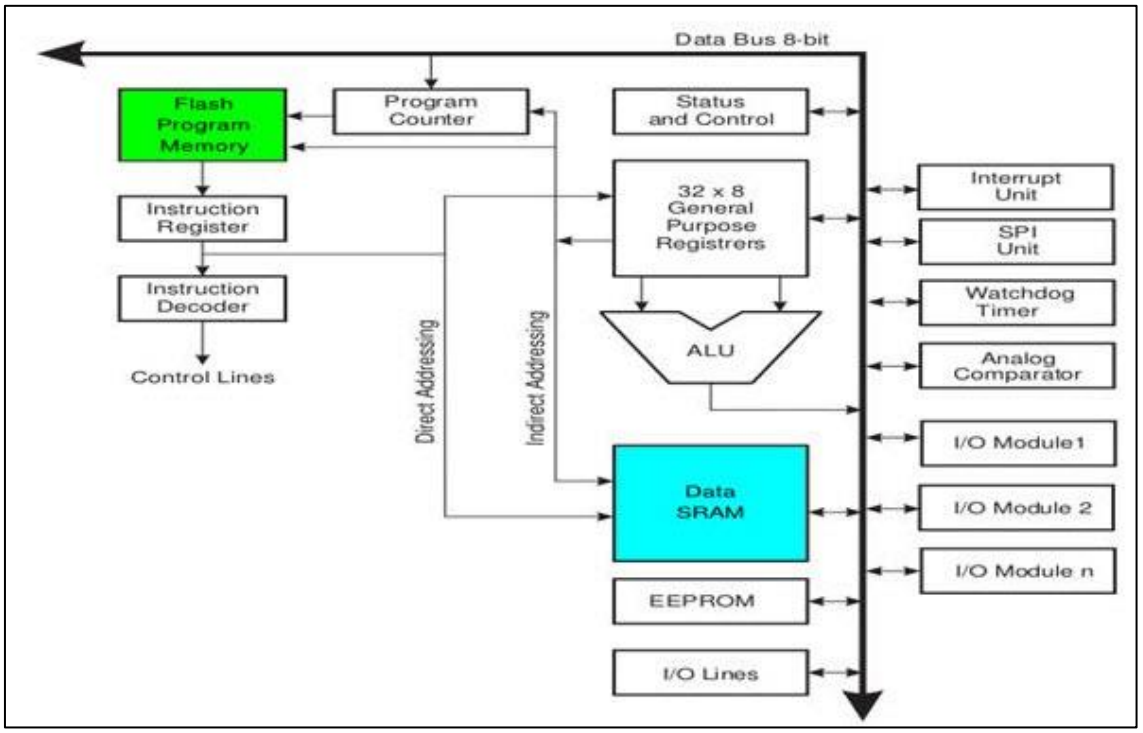

Figure 3.3 Arduino Architecture

Arduino's processor basically uses the Harvard architecture where the program code and program data have separate memory. It consists of two memories- Program memory and the data memory. The code is stored in the flash program memory, whereas the data is stored in the data memory. The Atmega328 has 32 KB of flash memory for storing code (of which 0.5 KB is used for the bootloader), 2 KB of SRAM and 1 KB of EEPROM and operates with a clock speed of 16MHz.

Basically, the processor of the Arduino board uses the Harvard architecture where the program code and program data have separate memory. It consists of two memories such as program memory and data memory. Wherein the data is stored in data memory and the code is stored in the flash program memory. The Atmega328 microcontroller has 32kb of flash memory, 2kb of SRAM 1kb of EPROM and operates with a 16MHz clock speed.

3.3.3. Criteria for Selection

It's simple and accessible user experience, Arduino has been used in thousands of different projects and applications. The Arduino software is easy-

to-use for beginners, yet flexible enough for advanced users. It runs on Mac, Windows, and Linux. Teachers and students use it to build low-cost scientific instruments, to prove chemistry and physics principles, or to get started with programming and robotics. Designers and architects build interactive prototypes, musicians and artists use it for installations and to experiment with new musical instruments. Makers, of course, use it to build many of the projects exhibited at the Maker Faire, for example. Arduino is a key tool to learn new things. Anyone - children, hobbyists, artists, programmers - can start tinkering just following the step-by-step instructions of a kit, or sharing ideas online with other members of the Arduino community.

There are many other microcontrollers and microcontroller platforms available for physical computing. Parallax Basic Stamp, Net media's BX-24, Phidgets, MIT's Handy board, and many others offer similar functionality. All of these tools take the messy details of microcontroller programming and wrap it up in an easy-to-use package. Arduino also simplifies the process of working with microcontrollers, but it offers some advantage for teachers, students, and interested amateurs over other systems:

- **Inexpensive** - Arduino boards are relatively inexpensive compared to other microcontroller platforms. The least expensive version of the Arduino module can be assembled by hand, and even the pre-assembled Arduino modules cost less than $50

- **Cross-platform** - The Arduino Software (IDE) runs on Windows, Macintosh OSX, and Linux operating systems. Most microcontroller systems are limited to Windows.

- **Simple, clear programming environment** - The Arduino Software (IDE) is easy-to-use for beginners, yet flexible enough for advanced users to take advantage of as well. For teachers, it's conveniently based on the Processing programming environment, so students learning to program in that environment will be familiar with how the Arduino IDE works.

- **Open source and extensible software** - The Arduino software is published as open-source tools, available for extension by experienced programmers. The language can be expanded through C++ libraries, and people wanting to understand the technical details can make the leap from Arduino to the AVR C programming language on which it's based. Similarly, you can add AVR-C code directly into your Arduino programs if you want to.

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- **Open source and extensible hardware** - The plans of the Arduino boards are published under a Creative Commons license, so experienced circuit designers can make their own version of the module, extending it and improving it. Even relatively inexperienced users can build the breadboard version of the module in order to understand how it works and save money.

3.3.4. Pin Configuration of Arduino Uno

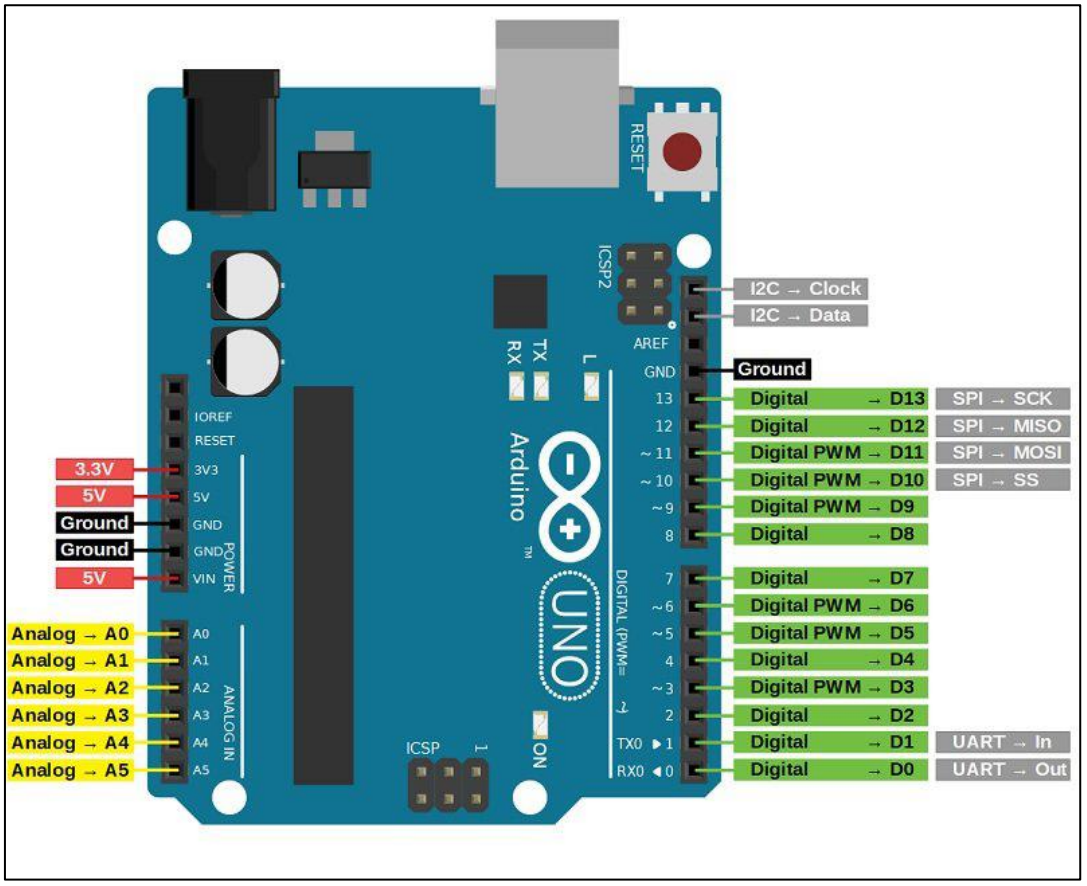


Figure 3.4 Pin Diagram of Arduino Uno

3.3.5 Pin Functions

Vin: This is the input voltage pin of the Arduino board used to provide input supply from an external power source.

5V: This pin of the Arduino board is used as a regulated power supply voltage and it is used to give supply to the board as well as onboard components.

3.3V: This pin of the board is used to provide a supply of 3.3V which is generated from a voltage regulator on the board

GND: This pin of the board is used to ground the Arduino board.

Reset: This pin of the board is used to reset the microcontroller. It is used to Resets the microcontroller.

Analog Pins: The pins A0 to A5 are used as an analog input and it is in the range of 0-5V.

Digital Pins: The pins 0 to 13 are used as a digital input or output for the Arduino board.

Serial Pins: These pins are also known as a UART pin. It is used for communication between the Arduino board and a computer or other devices. The transmitter pin number 1 and receiver pin number 0 are used to transmit and receive the data resp.

External Interrupt Pins: This pin of the Arduino board is used to produce the External interrupt and it is done by pin numbers 2 and 3.

PWM Pins: This pin of the board is used to convert the digital signal into an analog by varying the width of the Pulse. The pin numbers 3,5,6,9,10 and 11 are used as a PWM pin.

SPI Pins: This is the Serial Peripheral Interface pin; it is used to maintain SPI communication with the help of the SPI library. SPI pins include:

SS: Pin number 10 is used as a Slave Select

MOSI: Pin number 11 is used as a Master Out Slave In

MISO: Pin number 12 is used as a Master in Slave Out

SCK: Pin number 13 is used as a Serial Clock

LED Pin: The board has an inbuilt LED using digital pin-13. The LED glows only when the digital pin becomes high.

AREF Pin: This is an analog reference pin of the Arduino board. It is used to provide a reference voltage from an external power supply.

3.3.6. Specifications of Arduino

Microcontroller	ATmega328P – 8-bit AVR family microcontroller
Operating Voltage	5V
Recommended Input Voltage	7-12V
Input Voltage Limits	6-20V
Analog Input Pins	6 (A0 – A5)
Digital I/O Pins	14 (Out of which 6 provide PWM output)
DC Current on I/O Pins	40 mA
DC Current on 3.3V Pin	50 mA
Flash Memory	32 KB (0.5 KB is used for Bootloader)
SRAM	2 KB
EEPROM	1 KB
Frequency (Clock Speed)	16 MHz

3.4 Node MCU ESP8266 Wi-Fi Module

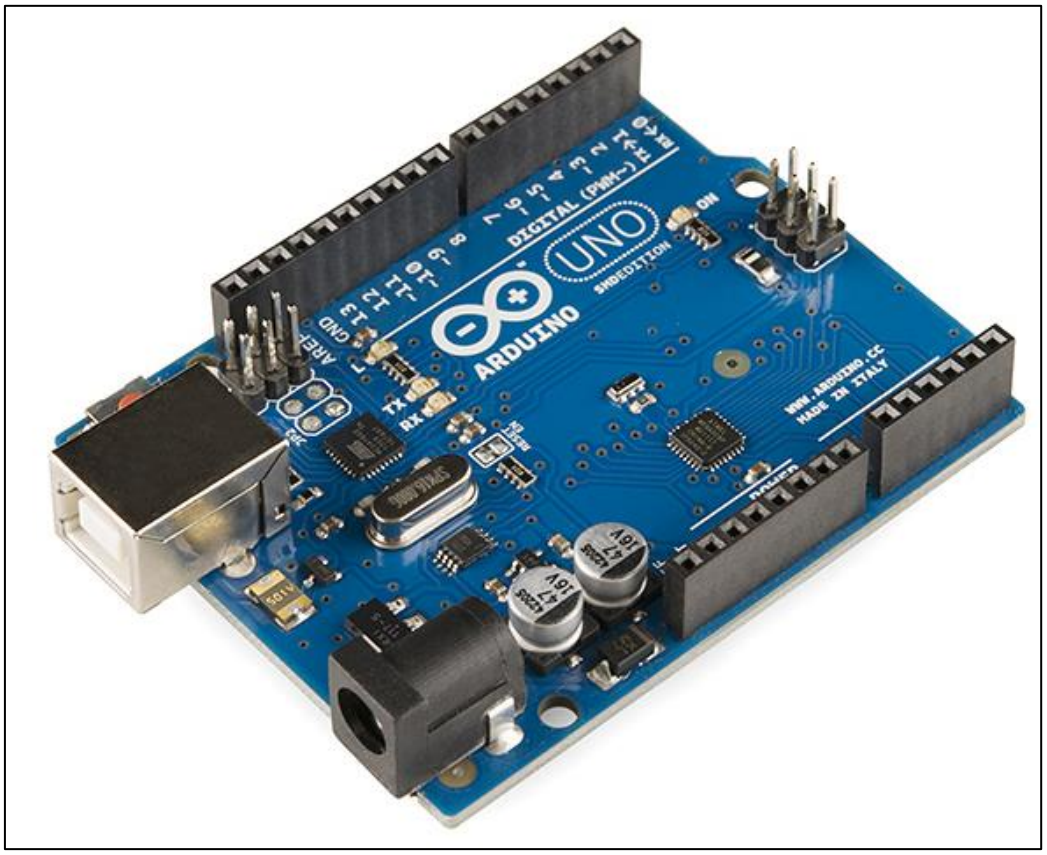
	Pin Name	Pin Category	Description
1	Micro-USB, 3.3V, GND, Vin	Power	**Micro-USB:** NodeMCU can be powered through the USB port **3.3V:** Regulated 3.3V can be supplied to this pin to power the board **GND:** Ground pins **Vin:** External Power Supply
2	**EN, RST**	Control Pins	The pin and the button resets the microcontroller

3	GPIO1 to GPIO16	GPIO Pins	NodeMCU has 16 general purpose input-output pins on its board
4	SD1, CMD, SD0, CLK	SPI Pins	NodeMCU has four pins available for SPI communication
5	PD3 (INT1/OC2B)	Pin3 of PORTD	External Interrupt source1 OC2B(PWM - Timer/Counter2 Output Compare Match B Output)
6	TXD0, RXD0, TXD2, RXD2	UART Pins	NodeMCU has two UART interfaces, UART0 (RXD0 & TXD0) and UART1 (RXD1 & TXD1). UART1 is used to upload the firmware/program.
7		I2C Pins	NodeMCU has I2C functionality support but due to the internal functionality of these pins, you have to find which pin is I2C.

CHAPTER 4

4.DESCRIPTION OF INDIVIDUAL BLOCK

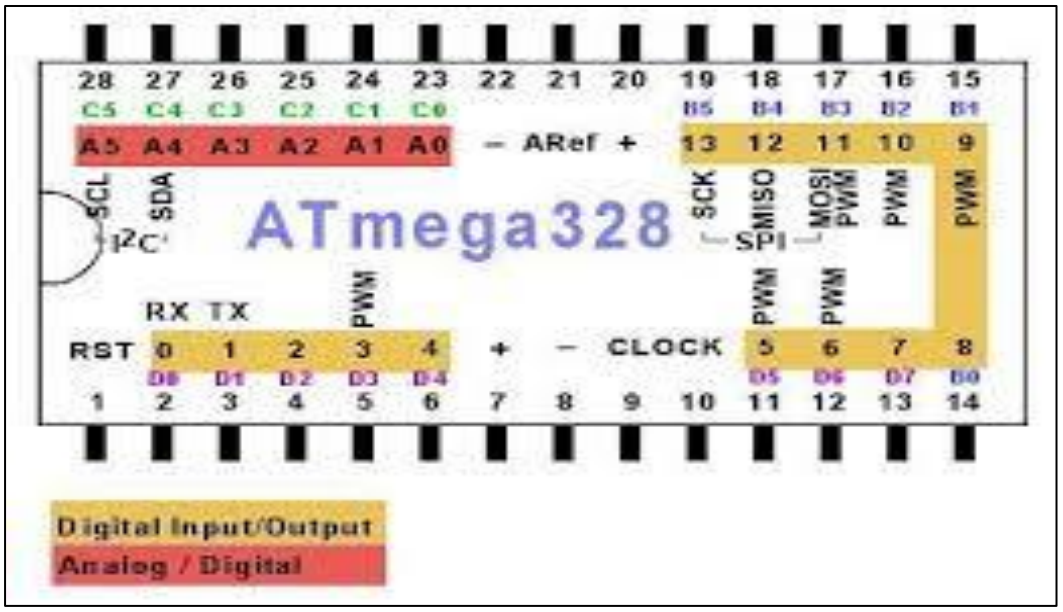
4.1.



ARDUINO UNO:

Arduino Uno microcontroller is the main command center of the robot. It is programmed to detect human beings with the help of PIR sensor which are mounted on top of the robot. The Arduino Uno R3 is a microcontroller board based on a removable, dual-inline-package (DIP) ATmega328 AVR microcontroller. It has 20 digital input/output pins (of which 6 can be used as PWM outputs and 6 can be used as analog inputs). Programs can be loaded on to it from the easy-to-use Arduino computer program. The Arduino has an extensive support community, which makes it a very easy way to get started working with embedded electronics. The R3 is the third, and latest, revision of the Arduino Uno.

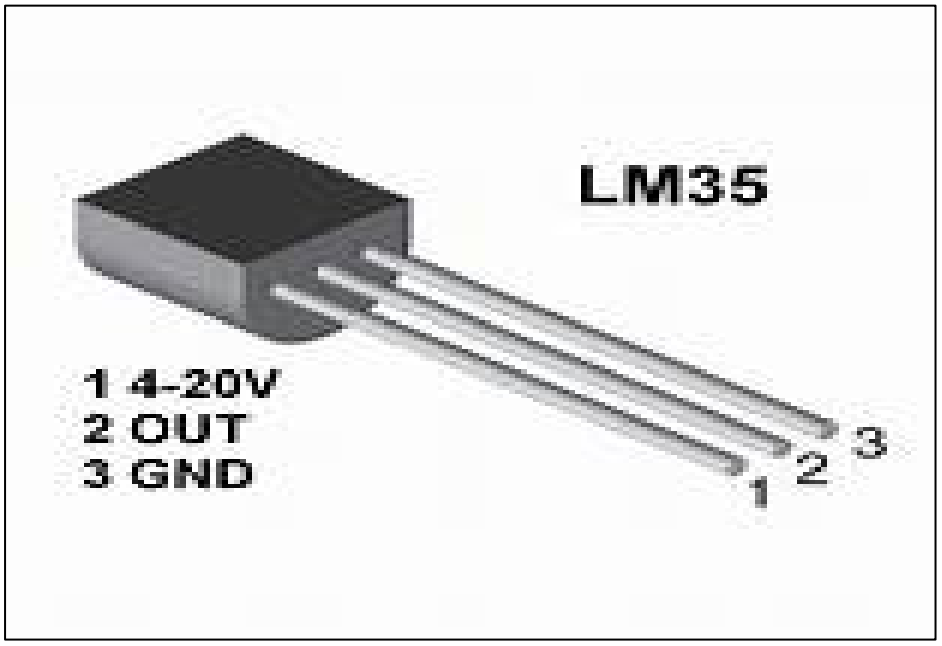
4.2. ATmega 328P Microcontroller



The arduino Uno is a microcontroller board based on the ATmega328. It has a USB connection, a power jack, an ICSP header, and a reset button. The Uno differ from all preceding boards it does not use the FTDI USB to serial driver chip.”UNO” means one in Italian and is named to mark the upcoming release of arduino 1.0. The Uno is the latest in a series of USB Arduino boards and reference model for Arduino platform. The Arduino Uno can power via the USB connection or with external power supply. External power can come either from an AC to DC adapter or battery. If supply is less than 7v the 5v pin may supply less than five volts and the board may be unstable. The Arduino software includes a serial monitor which allows simple textual data to be send to and from the Arduino board, The RX and TX LEDs on the board will flash when data is being transmitted via the USB to serial chip and USB connection to the computer. A Software Serial library allows for serial communication on any of the UNO’s digital pins, the arduino software includes a wire library to simplify use of the I2C bus. Arduino is open source hardware and software, which are license under the GNU lesser General public license, which is permitting the manufacture of Arduino board and software distribution by anyone. Specification: ¬ 32K Bytes of In-System Self-Programmable Flash program memory ¬ 1K Bytes EEPROM ¬ 2K Bytes Internal SRAM ¬ I/O: · Digital:14 pins · Analog: 6 pins ¬ Crystal oscillator: 16MHZ
¬Operating voltage: 1.8 - 5.5V ¬ External supply: 6 to 20 V ¬ Temperature range: -40°C to 85°C

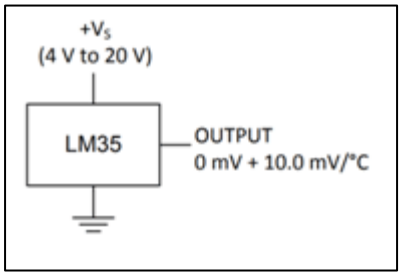
PIN NO	PIN NAME	DESCRIPTION	SECONDARY FUNCTION
1	PC6 (RESET)	Pin6 of PORTC	Pin by default is used as RESET pin. PC6 can only be used as I/O pin when RSTDISBL Fuse is programmed.
2	PD0 (RXD)	Pin0 of PORTD	RXD (Data Input Pin for USART) USART Serial Communication Interface [Can be used for programming]
3	PD1 (TXD)	Pin1 of PORTD	TXD (Data Output Pin for USART) USART Serial Communication Interface [Can be used for programming] INT2(External Interrupt 2 Input)
4	PD2 (INT0)	Pin2 of PORTD	External Interrupt source 0
5	PD3 (INT1/OC2B)	Pin3 of PORTD	External Interrupt source1 OC2B (PWM - Timer/Counter2 Output Compare Match B Output)
6	PD4 (XCK/T0)	Pin4 of PORTD	0T0(Timer0 External Counter Input) XCK (USART External Clock I/O)
7	VCC		Connected to positive voltage
8	GND		Connected to ground

4.3. TEMPRETURE SENSOR LM35



LM35 is a temperature sensor that outputs an analog signal which is proportional to the instantaneous temperature. The output voltage can easily be interpreted to obtain a temperature reading in Celsius. The advantage of lm35 over thermistor is it does not require any external calibration. The coating also protects it from self-heating.

Power the IC by applying a regulated voltage like +5V (V_S) to the input pin and connected the ground pin to the ground of the circuit. Now, you can measure the temperature in form of voltage as shown below.



If the temperature is 0°C, then the output voltage will also be 0V. There will be rise of 0.01V (10mV) for every degree Celsius rise in temperature. The voltage can converted into temperature using the below formulae.

(1) Accuracy is defined as the error between the output voltage and 10 mv/°C times the case temperature of the device, at specified conditions of voltage, current, and temperature (expressed in °C).

(2) Tested Limits are ensured and 100% tested in production.

(3) Design Limits are ensured (but not 100% production tested) over the indicated temperature and supply voltage ranges. These limits are not used to calculate outgoing quality levels.

(4) Non-linearity is defined as the deviation of the output-voltage-versus-temperature curve from the best-fit straight line, over the rated temperature range of the device.

(5) Regulation is measured at constant junction temperature, using pulse testing with a low duty cycle. Changes in output due to heating effects can be computed by multiplying the internal dissipation by the thermal resistance.

4.4 PULSE SENSOR

IR sensors are used to follow the predefined path while robot is working in automatic mode.Pulse sensors using the photoelectric pulse wave method are classified into 2 types depending on the measurement method: transmission and reflection.
Transmission types measure pulse waves by emitting red or infrared light from the body surface and detecting the change in blood flow during heart beats as a change in the amount of light transmitted through the body.
This method is limited to areas where light can easily penetrate, such as the fingertip or earlobe.
ROHM is currently developing a reflection-type pulse sensor (Optical Sensor for Heart Rate Monitor).
The reflection-type pulse sensor (Optical Sensor for Heart Rate Monitor) is explained below.
The pulse sensor includes a 24 inches color code cable, ear clip, Velcro Dots-2, transparent stickers-3, etc.

· A color code cable is connected to header connectors. So this sensor is easily connected to an Arduino into the project without soldering.

· An ear clip size is the same as a heart rate sensor and it can be connected using hot glue at the backside of the sensor to wear on the earlobe.

· Two Velcro dots are completely sized toward the sensor at the hook side. These are extremely useful while making a Velcro strap to cover approximately a fingertip. This is used to cover the Sensor around the finger.

· Transparent strikers are protection layers used to protect the sensor from sweaty earlobes and fingers. This sensor includes three holes in the region of the external edge so that one can easily connect anything to it.
Pulse Sensor Specifications The main specifications of this sensor mainly include the following

· This is a hear beat detecting and biometric pulse rate sensor
· Its diameter is 0.625

· Its thickness is 0.125

· The operating voltage is ranges +5V otherwise +3.3V

· This is a plug and play type sensor

· The current utilization is 4Ma

· Includes the circuits like Amplification & Noise cancellation

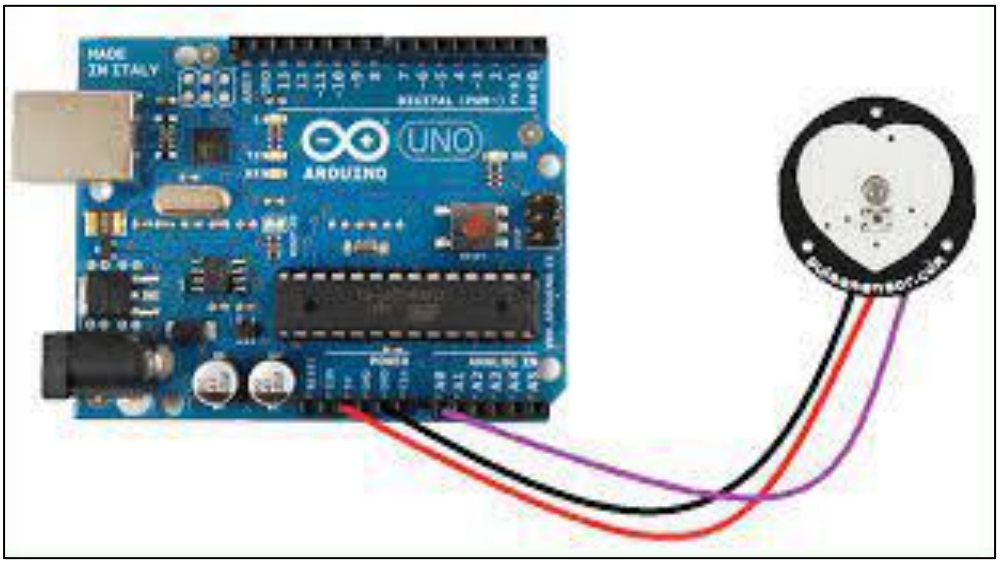
· This pulse sensor is not approved by the FDA or medical. So it is used in student level projects, not for the commercial purpose in health issues applications.

How Does Pulse Sensor Work?

The pulse sensor working principle is very simple. This sensor has two surfaces, on the first surface, the light-emitting diode & ambient light sensor is connected. Similarly, on the second surface, the circuit is connected which is accountable for the noise cancellation& amplification. The LED is located above a vein in a human body like ear tip or fingertip, however, it must be located on top of a layer directly. Once the LED is located on the vein, then the LED starts emitting light. Once the heart is pumping, then there will be a flow of blood within the veins. So if we check the blood flow, then we can check the heart rates also. If the blood flow is sensed then the ambient light sensor will receive more light as they will be reproduced by the flow of blood. This small change within obtained light can be examined over time to decide our pulse rates.

How to use Pulse Sensor Arduino?

This sensor used in straight forward, however connecting it in the correct way matters. Because all types of electronic components are directly exposed to the sensor. So, it is mandatory to envelop this sensor by using hot glue, vinyl strip otherwise other types of non-conductive materials. These sensors cannot be operated with wet hands. The sensor's smooth side must be located on the pinnacle of the vein & press it. Generally, Velcro tapes or clips are utilized to get this force.



This sensor can be used by connecting it to the Arduino board. Once it is connected, then give the power supply with the help of VCC pin and GND pins. The operating voltage of this sensor is +5V or 3.3V. Once the sensor is connected to the development board such as Arduino, then we can use the readily accessible Arduino code to make things easier. Please refer to Arduino site for interfacing of Arduino with pulse sensor and its coding.

Applications of Pulse Sensor

The applications of pulse rate sensor include the following
· This sensor is used for Sleep Tracking

· This sensor is used for Anxiety monitoring

· This sensor is used in remote patient monitoring or alarm system

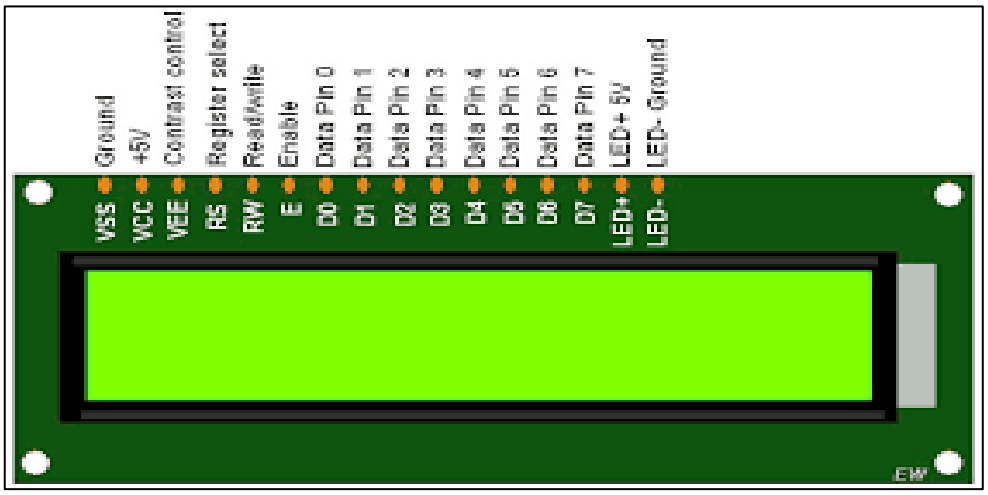
· This sensor is used in Health bands

· This sensor is used in complex gaming consoles Thus, this is all about Pulse Sensor (Heartbeat / Heartrate Sensor). it is open-source and plug-and-play hardware. This sensor can easily include live heartbeat information into their projects. This sensor includes two circuits like an optical amplifying & a noise eliminating. The connection of this sensor on earlobe otherwise fingertip can be done using a Clip, and connect it to Arduino board. So that heart rate can be easily measured.

4.5. GPS RECEIVER

The NEO-6M GPS module is a well-performing complete GPS receiver with a built-in 25 x 25 x 4mm ceramic antenna, which provides a strong satellite search capability. With the power and signal indicators, you can monitor the status of the module. Thanks to the data backup battery, the module can save the data when the main power is shut down accidentally. Its 3mm mounting holes can ensure easy assembly on your aircraft, which thus can fly steadily at a fixed position, return to Home automatically, and automatic waypoint flying, etc. Or you can apply it on your smart robot car for automatic returning or heading to a certain destination, making it a real "smart" bot!

4.6. LCD DISPLAY



The term LCD stands for liquid crystal display. It is one kind of electronic display module used in an extensive range of applications like various circuits & devices like mobile phones, calculators, computers, TV sets, etc. These displays are mainly preferred for multisegment light-emitting diodes and seven segments. The main benefits of using this module are inexpensive; simply programmable, animations, and there are no limitations for displaying custom characters, special and even animations, etc

The 16×2 LCD pinout is shown below.
· Pin1 (Ground/Source Pin): This is a GND pin of display, used to connect the GND terminal of the microcontroller unit or power source.
· Pin2 (VCC/Source Pin): This is the voltage supply pin of the display, used to connect the supply pin of the power source.
· Pin3 (V0/VEE/Control Pin): This pin regulates the difference of the display, used to connect a changeable POT that can supply 0 to 5V.
· Pin4 (Register Select/Control Pin): This pin toggles among command or data register, used to connect a microcontroller unit pin and obtains either 0 or 1(0 = data mode, and 1 = command mode).
· Pin5 (Read/Write/Control Pin): This pin toggles the display among the read or writes operation, and it is connected to a microcontroller unit pin to get either 0 or 1 (0 = Write Operation, and 1 = Read Operation).
· Pin 6 (Enable/Control Pin): This pin should be held high to execute Read/Write process, and it is connected to the microcontroller unit & constantly held high
. · Pins 7-14 (Data Pins): These pins are used to send data to the display. These pins are connected in two-wire modes like 4-wire mode and 8-wire mode.
In 4-wire mode, only four pins are connected to the microcontroller unit like 0 to 3, whereas in 8-wire mode, 8-pins are connected to microcontroller unit like 0 to 7.
· Pin15 (+ve pin of the LED): This pin is connected to +5V
· Pin 16 (-ve pin of the LED): This pin is connected to GND.
Features of LCD16x2 The features of this LCD mainly include the following.
· The operating voltage of this LCD is 4.7V-5.3V
· It includes two rows where each row can produce 16-characters.

· The utilization of current is 1mA with no backlight
· Every character can be built with a 5×8 pixel box
· The alphanumeric LCDs alphabets & numbers
· Is display can work on two modes like 4-bit & 8-bit

· These are obtainable in Blue & Green Backlight

· It displays a few custom generated characters

Registers of LCD A 16×2 LCD has two registers like data register and command register. The RS (register select) is mainly used to change from one register to another. When the register set is '0', then it is known as command register. Similarly, when the register set is '1', then it is known as data register.
1) Command Register The main function of the command register is to store the instructions of command which are given to the display. So that predefined tasks can be performed such as clearing the display, initializing, set the cursor place, and display control. Here commands processing can occur within the register.

2) Data Register The main function of the data register is to store the information which is to be exhibited on the LCD screen. Here, the ASCII value of the character is the information which is to be exhibited on the screen of LCD. Whenever we send the information to LCD, it transmits to the data register, and then the process will be starting there. When register set =1, then the data register will be selected.

16×2 LCD Commands The commands of LCD 16X2 include the following.
· For Hex Code-01, the LCD command will be the clear LCD screen

· For Hex Code-02, the LCD command will be returning home

· For Hex Code-04, the LCD command will be decrement cursor

· For Hex Code-06, the LCD command will be Increment cursor

· For Hex Code-05, the LCD command will be Shift display right

· For Hex Code-07, the LCD command will be Shift display left

· For Hex Code-08, the LCD command will be Display off, cursor off
· For Hex Code-0A, the LCD command will be cursor on and display off

· For Hex Code-0C, the LCD command will be cursor off, display on
For Hex Code-0E, the LCD command will be cursor blinking, Display on

· For Hex Code-0F, the LCD command will be cursor blinking, Display on

· For Hex Code-10, the LCD command will be Shift cursor position to left

· For Hex Code-14, the LCD command will be Shift cursor position to the right

· For Hex Code-18, the LCD command will be Shift the entire display to the left

· For Hex Code-1C, the LCD command will be Shift the entire display to the right

· For Hex Code-80, the LCD command will be Force cursor to the beginning (1st line)

· For Hex Code-C0, the LCD command will be Force cursor to the beginning (2nd line)

· For Hex Code-38, the LCD command will be 2 lines and 5×7 matrix LCD 16×2 Arduino

Thus, this is all about LCD 16×2 datasheet, which includes what is a 16X2 LCD, pin configuration, working principle, and its applications. The main advantages of this LCD device include power consumption is less and low cost. The main disadvantages of this LCD device include it occupies a large area, slow devices and also lifespan of these devices will be reduced due to direct current. So these LCDs use AC supply with less than 500Hz frequency.

4.7. Power Supply

The major blocks of power supply are given below Transformer, Rectifier, Filter, 7805 voltage regulator .These will provide the regulated power supply to the unit which is first converted into 12V AC. 12V AC is converted into DC using rectifier circuit .Finally the 7805 voltage regulator provides constant 5V DC supply which will be given to circuit.

Specification:

¬ For 230V to 12 V unregulated Power supply
· Input voltage : 230 V 50 Hz
· Output voltage: 12 V
· Output current : 2 A
· Maximum ripple : 5%
· Capacitor : 0.033 F
· Transformer: ♣ Max Vo : 13.7 V ♣ V primary : 230 VAC ♣ V secondary : 10 VAC ♣ Frequency : 50 Hz ♣ Power : 27.4 VA.
· Diode Bridge : ♣ V_reverse : 60 V ♣ Idiode : 4 A · Fuse : 0.2 A ¬ For 12 V to 5 V regulated section: · Voltage regulator chip : LM 7805
· Capacitive filter : ♣ I/P capacitor : 0.33x10^6 F ♣ O/P capacitor : 0.1x10^6 F ¬ For 12 V to 5 V unregulated section :
· Vomin : 8 V
· Capacitor : 1000x10^6 F
· Vdc FL : 10.5 V
· Vdc NL: 18.5 V
· PIV(peak inverse voltage) : 25 V
· Diode : 1A @ 25 V
· Transformer : 230/15 VAC @ 2A Calculations of 5 V and 3.3v power supply

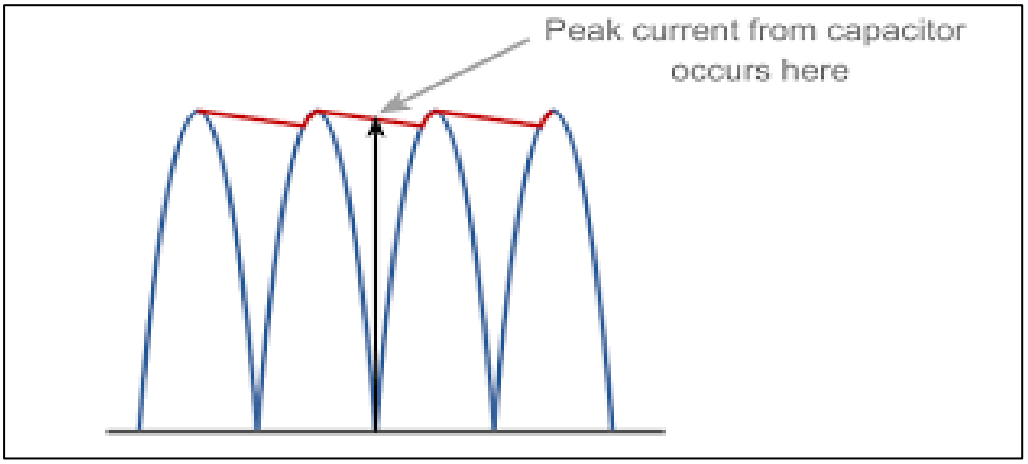
BRIDGE RECTIFIER.

Rectifier: A single silicon rectifier diode in forward conduction develops a voltage of around 0.7V (but can be up to 2V). In general we allow about 2V -3V drop for the bridge rectifier configuration. The voltage at different points in the circuit, based on a 240:12V transformer. Here you can see the output from the transformer. The output is a sine wave centered around 0 volts. The peak voltage Vpk is 1.414 times the RMS output - the transformers quoted value.

Thus Bridge rectifier output is Vdc= (Vac X 1.414)-1.4.
Here, Vac=12V
Therefore Vdc= (12 * 1.414)-1.4 =16.968-1.4 =15.568

SMOOTHING CAPACITOR

If we assume that your step down transformer reduces the amplitude of 60 Hz sine wave from 220 V to 15 V, and if we assume that your 5 V power supply will need to output at most I_max = 1 A current, then we can start making some calculations. Your smoothing capacitor, which you will place after the bridge rectifier, will have V_max = 15 V on it, which is the amplitude of your sine wave.



You see that capacitor discharges during almost the whole period of half-wave rectified wave (in our case this discharge is caused by the Imax = 1 A load current going into LM7805). The discharge time of reservoir capacitor in the case of half-wave rectifier is T discharge = T = (1/f) = (1/60 Hz) = 16.6 m s, however, notice that, in our case we have a more sophisticated rectifier (Diode bridge) which gives a full-wave rectified output. So, the discharge time will be T discharge = T/2 = (1/2*f) = 8.3 m s. Now, at the beginning of each discharge period our capacitor is charged up to Vmax = 15 V. In order to prevent our capacitor voltage going below V min = 7 V (which is the lowest input operating point for LM7805 voltage regulator) in the end of the discharge period, our capacitor value should be chosen with the equation:
C >= (Imax*T discharge)/(V before discharge -V after discharge)
Using the values; V before discharge = Vmax = 15 V.
V after discharge = V min = 7 V. Imax = 1 A
T discharge = 8.3 m s,
We can calculate that: C min = (1 A)*(8.3 m s)/ (15 V - 7 V) = 1 mF=1000uF.

Calculation of 3.3 V using LM317 The output voltage is selected using two resistors. Normally R1 is chosen to be around 220Ω or 240Ω. The formula for calculating the value of R2 is V out = V ref*(1+ (R2/R1)) Or to put it another way

R2=R1 ((V/1.25)-1) Setting R2 to zero (ground the adjusting pin) will cause the output voltage to drop to 1.25V. R2 may be replaced by a pot to give an adjustable output voltage range. Here Vout=3.3V, Vref=1.25 and Assuming R1=330E Then R2=330((3.3/1.25)-1) =330(1.64) =541E. So the R2 is replaced with POT to adjust the output voltage.

CHAPTER 5

5.1 CIRCUIT DIAGRAM

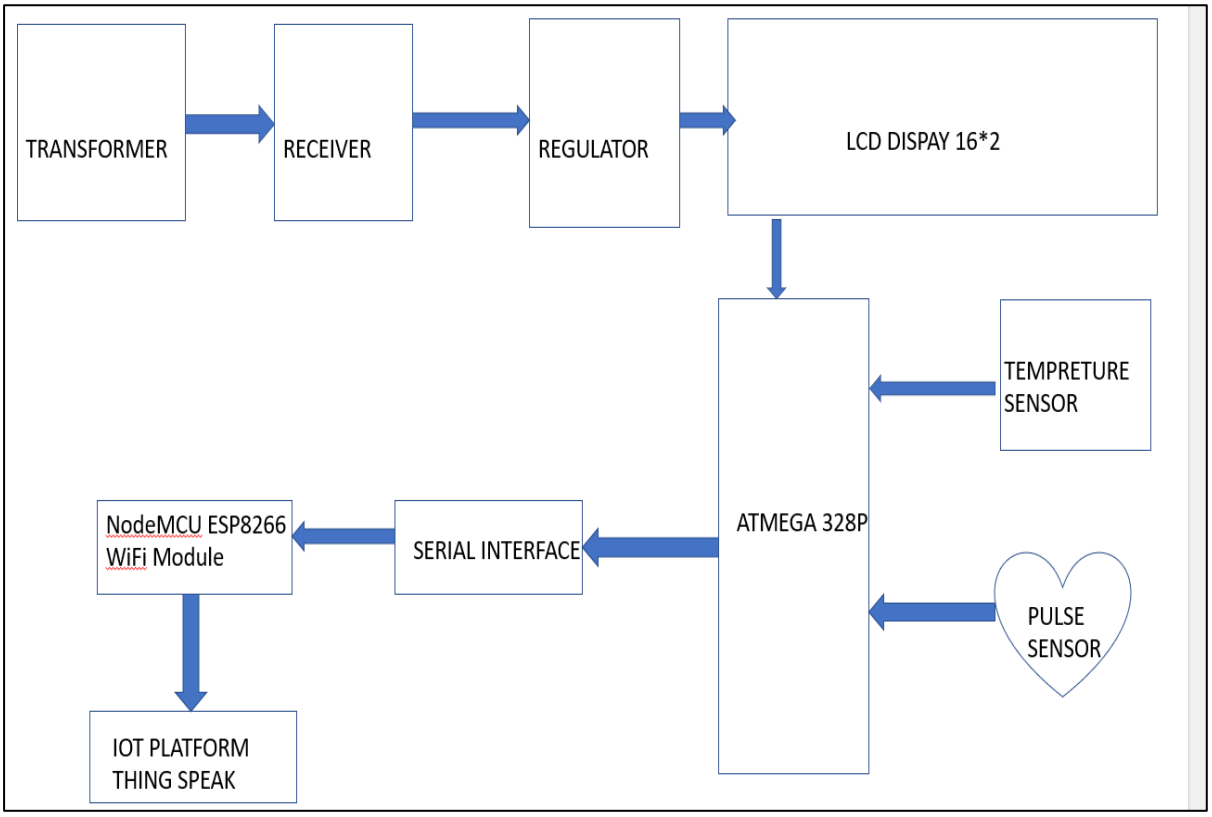


Fig 5.2

5.2 SIMULATION

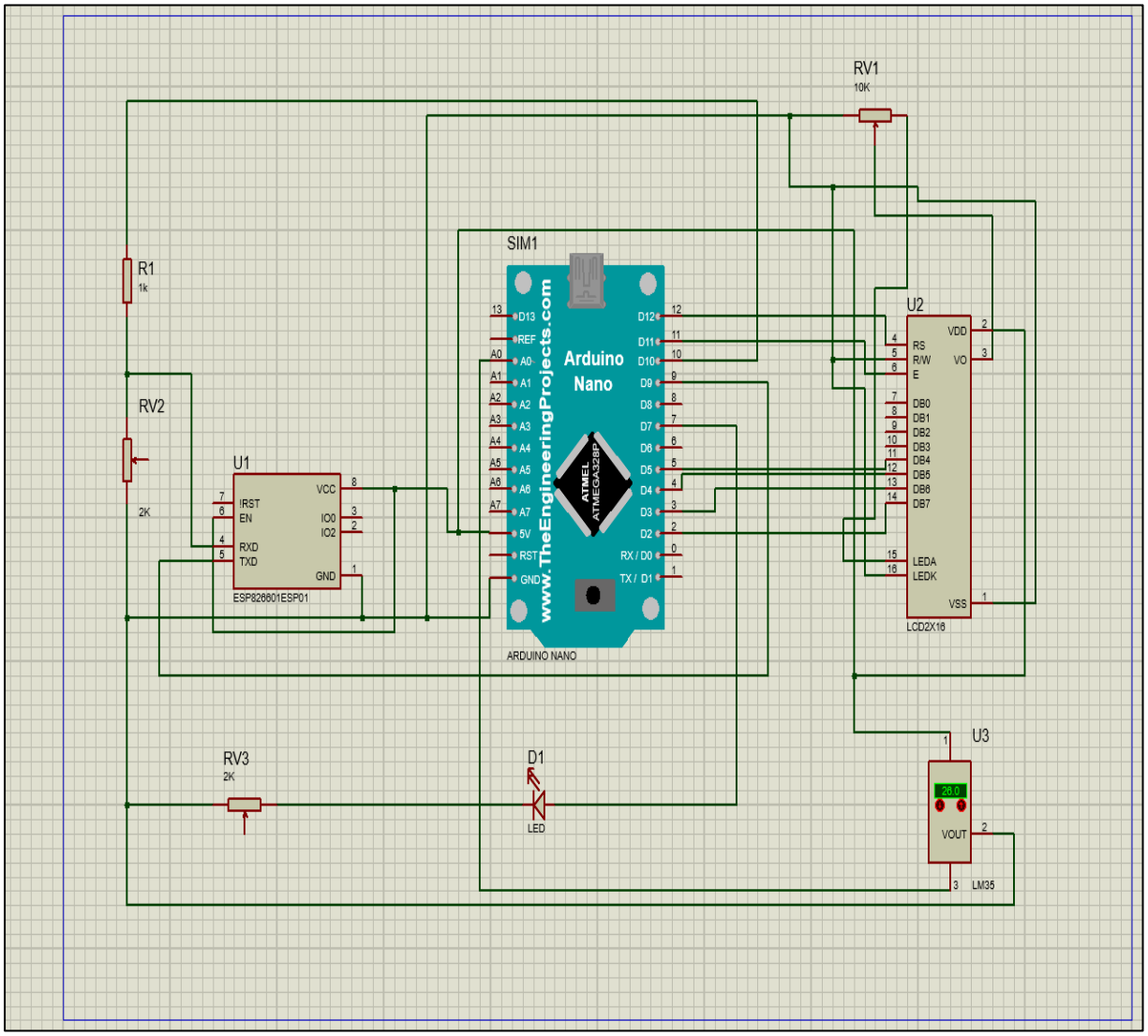


Fig 5.2 SIMULATION

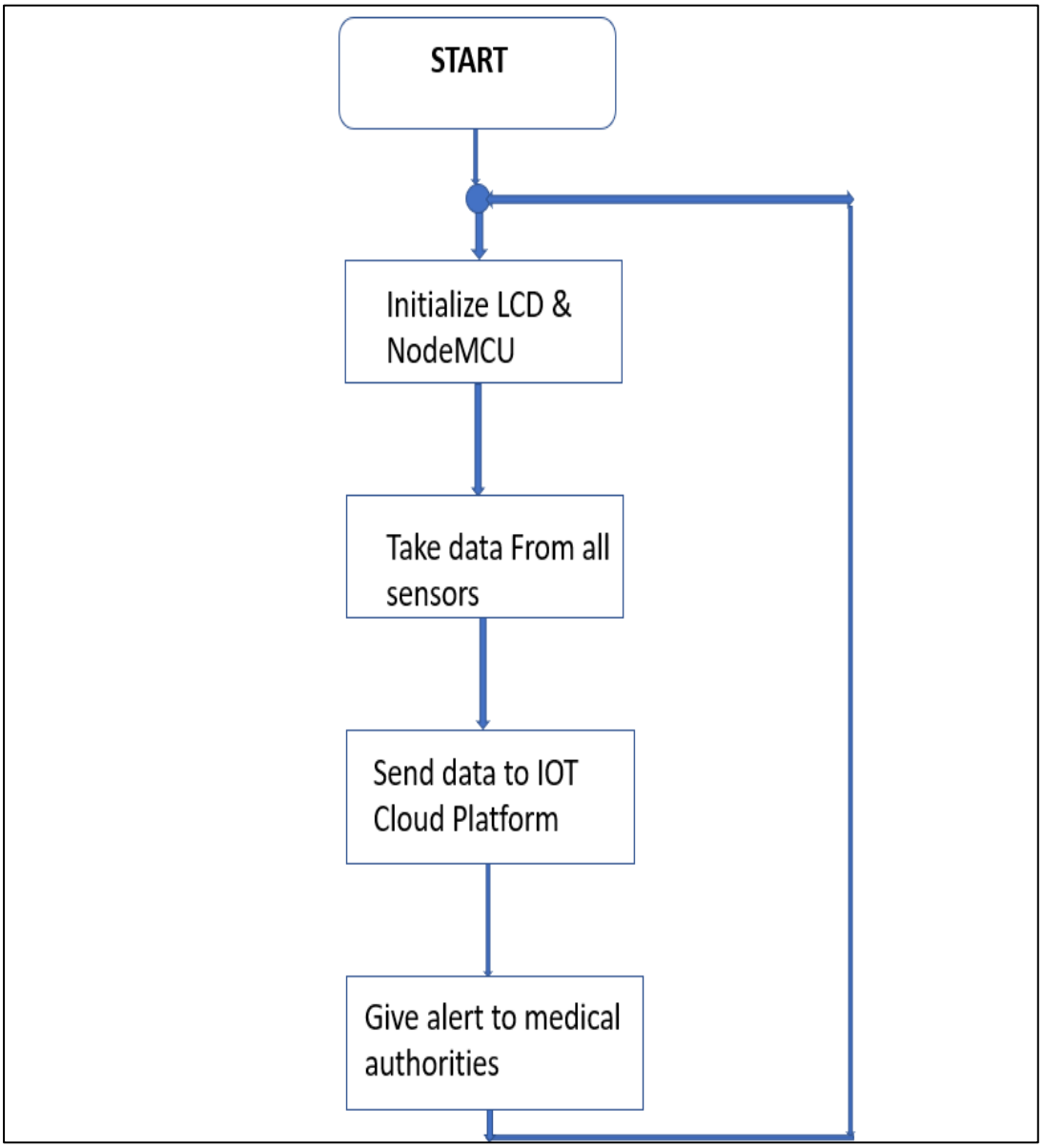
CHAPTER 6

ALGORITHM

1) Start
2) Initiate LCD and all sensors
3) Initiate Node MCU ESP8266 module and established network
4) Get all data from all sensors.
5) Displays all sensors data to LCD also sends all data to IOT Cloud platform to analyze the data.
6) Initiate alert message to any medical authority.
7) Continue again with step 2.

CHAPTER 7

FLOWCHART


START
Initialize LCD & NodeMCU
Take data From all sensors
Send data to IOT Cloud Platform
Give alert to medical authorities

HARDWARE TOOL AND COMPONENTS USED

To design this system following components are used

a) Arduino UNO R3
b) Temperature sensor LM35
c) Pulse sensor
d) GPS receiver
e) LCD 16*2
f) Node MCU ESP8266

SOFTWARE TOOL USED

a) Proteus 8
b) Arduino IDE
c) Thing speak

CHAPTER 8

Source code

```
#include <LiquidCrystal_I2C.h>

LiquidCrystal_I2C lcd(0x27,16,2);  // set the LCD address to 0x27 for a 16 chars and 2 line display
#include <SoftwareSerial.h>
#include <TinyGPS.h>
float lat = 28.5458,lon = 77.1703; // create variable for latitude and longitude object
SoftwareSerial gpsSerial(3,4);//rx,tx
TinyGPS gps; // create gps object
#include "DHT.h"
#define DHTPIN 5     // Digital pin connected to the DHT sensor
#define DHTTYPE DHT11   // DHT 11
DHT dht(DHTPIN, DHTTYPE);
int const PULSE_SENSOR_PIN = A0;   // 'S' Signal pin connected to A0

int Signal;
float h;
float t;
void setup(){
Serial.begin(9600); // connect serial
//Serial.println("The GPS Received Signal:");
gpsSerial.begin(9600); // connect gps sensor
lcd.init();
 lcd.backlight();
  dht.begin();
}
void loop(){

  Signal = analogRead(PULSE_SENSOR_PIN); // Read the sensor value
     Serial.println(Signal);
     delay(1000);

   h = dht.readHumidity();
  // Read temperature as Celsius (the default)
   t = dht.readTemperature();


  // Check if any reads failed and exit early (to try again).
  if (isnan(h) || isnan(t) ) {
    Serial.println(F("Failed to read from DHT sensor!"));
    return;
  }
Serial.print(F("Humidity: "));
  Serial.print(h);
  delay(1000);
  lcd.clear();
 lcd.setCursor(0,0);
```

```
 lcd.print("Humidity:");
 lcd.setCursor(9,0);
 lcd.print(h);
 //delay(1000);
 Serial.print(F("%  Temperature: "));
 Serial.print(t);
 delay(1000);
lcd.setCursor(0,1);
 lcd.print("Temperature:");
 lcd.setCursor(12,1);
 lcd.print(t);
 delay(1000);

 while(gpsSerial.available()){ // check for gps data
 if(gps.encode(gpsSerial.read()))// encode gps data
 {
 gps.f_get_position(&lat,&lon); // get latitude and longitude
 // display position
 lcd.clear();
 lcd.setCursor(1,0);
  lcd.print("GPS Signal");
/* Serial.print("Position: ");
 Serial.print("Latitude:");
 Serial.print(lat,6);
 Serial.print(";");
 Serial.print("Longitude:");
 Serial.println(lon,6); */
 lcd.setCursor(1,0);
 lcd.print("LAT:");
 lcd.setCursor(5,0);
 lcd.print(lat);
//  Serial.print(lat);
 // Serial.print("  ");
 lcd.setCursor(0,1);
 lcd.print(",LON:");
 lcd.setCursor(5,1);
 lcd.print(lon);
 }
 }
/*String latitude = String(lat,6);
 String longitude = String(lon,6);
//Serial.println(latitude+";"+longitude);
delay(1000);*/
}
```

CHAPTER 9

9.1 ADVANTAGES

- It helps prevent spread of diseases.
- System Is used to manage monitor covid-19 patients in hospitals remotely
- It is quite simple and easy to use For the patients In hospital
- Increased patient comfort and convenience enable better patient satisfaction and faster Recovery times

9.2 FUTURE SCOPE

IoT based Remote Patient Monitoring System can be enhanced to detect and collect data of several anomalies for monitoring purpose such as home ultrasound, Brain signal monitoring, Tumor detection etc.

a) More research on problems associated with having data online, data privacy as IoT is managed and run by multiple technologies and multiple vendors are involved in it. Security algorithms and certain precautions by the users will help avoid any sec urity related threats in IoT network.
b) The interface can be designed to control which sensors can be used by consumers according to their needs. Time
c) Web UI can be enhanced to perform several activities which include controlling the hardware, real graphs, history and analysis graphs to observe anomalies etc.
d) We can use this prototype and convert this system to wearable smart device
Also we suggest To use the wearable device as a prototype for the passengers of the airport to quarantine during their entry and exit

CHAPTER 10

COST ESTIMATION

SR.NO	COMPONENTS	QUANTITY	COST
1	Arduino UNO	**1**	**1499**
2	Temperature sensor LM35	**1**	**140**
3	Pulse sensor	**1**	**350**
4	Node MCU ESP8266	**1**	**275**
5	LCD 16*2	**1**	**150**
6	Connecting wires	**15**	**50**
7	GPS Receiver	**1**	**320**
8	Adapter	**1**	**500**
9	Power supply	**1**	**600**
	TOTAL		**3884**

CHAPTER 12

RESULTS

a) Temperature sensor output

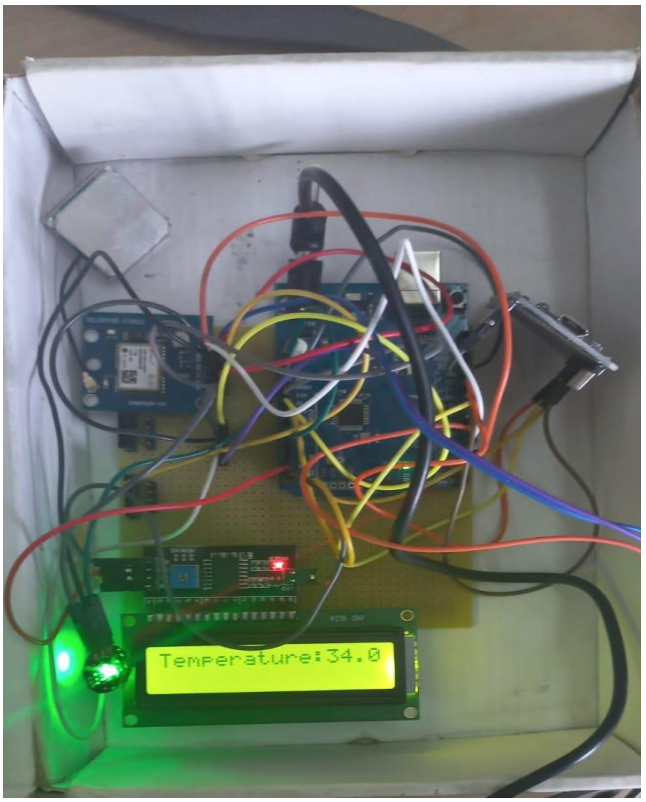


Fig 12.1

b) Pulse sensor output

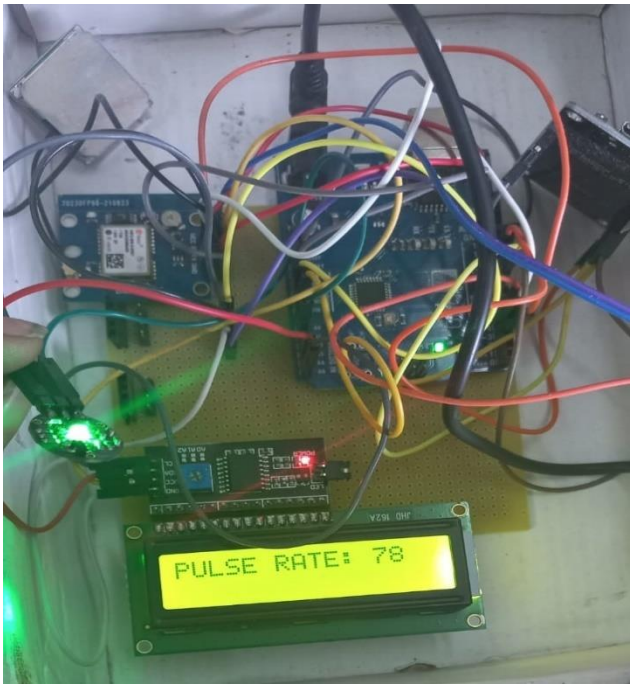


Fig 12.2

C) Latitude

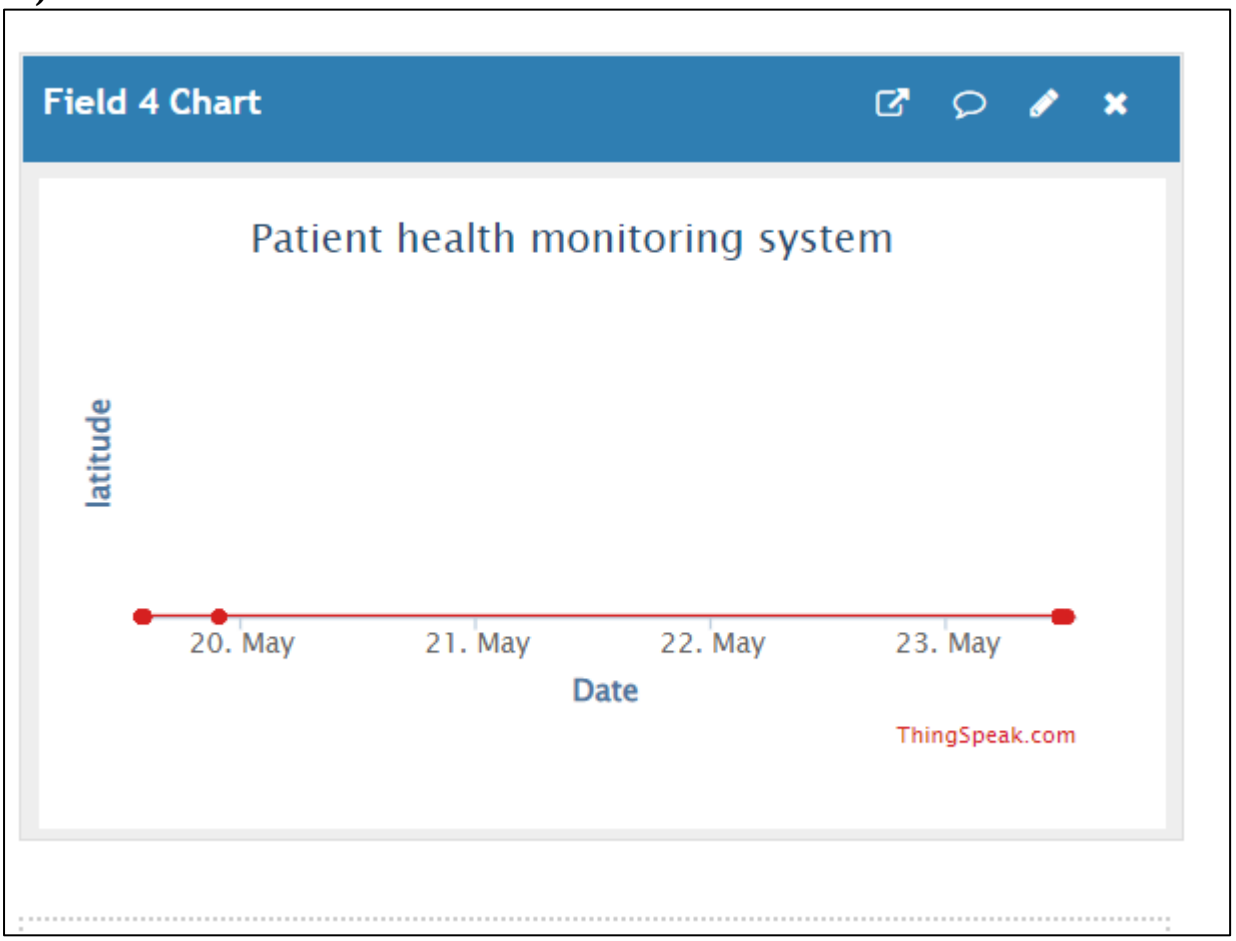


Fig 12.3

d) longitude

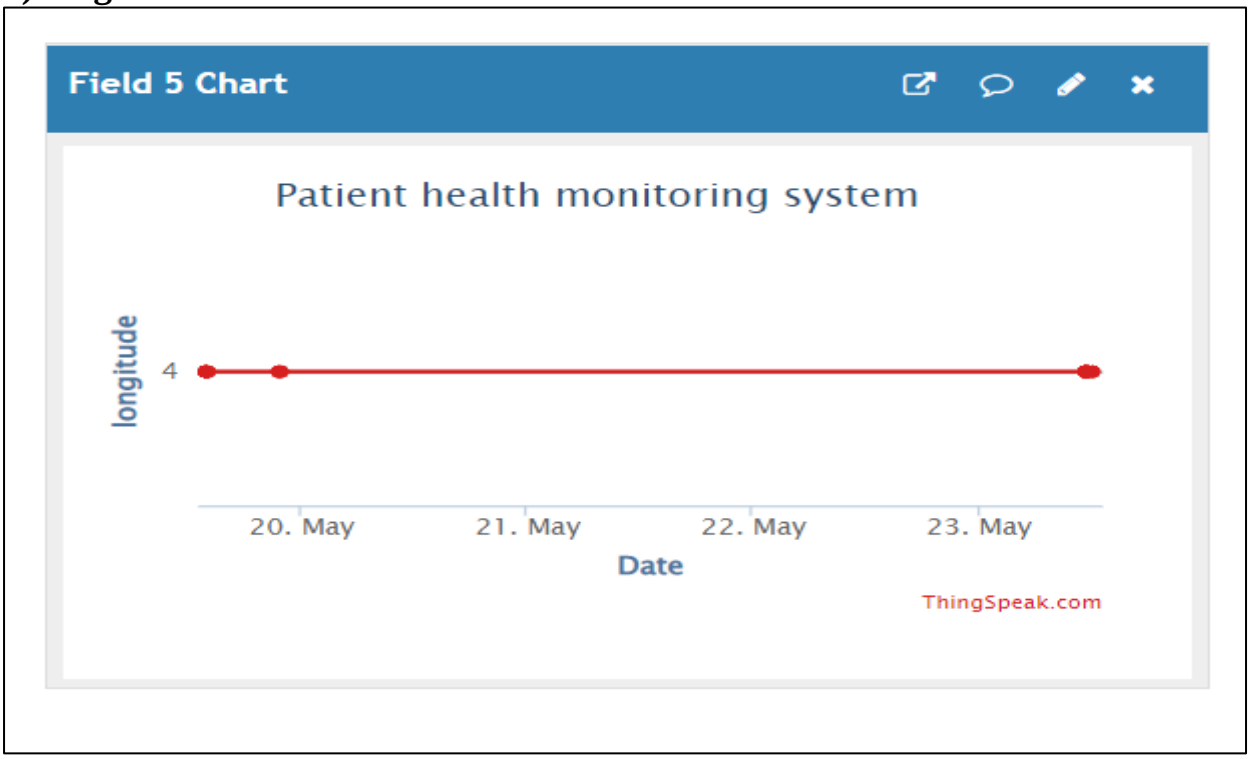
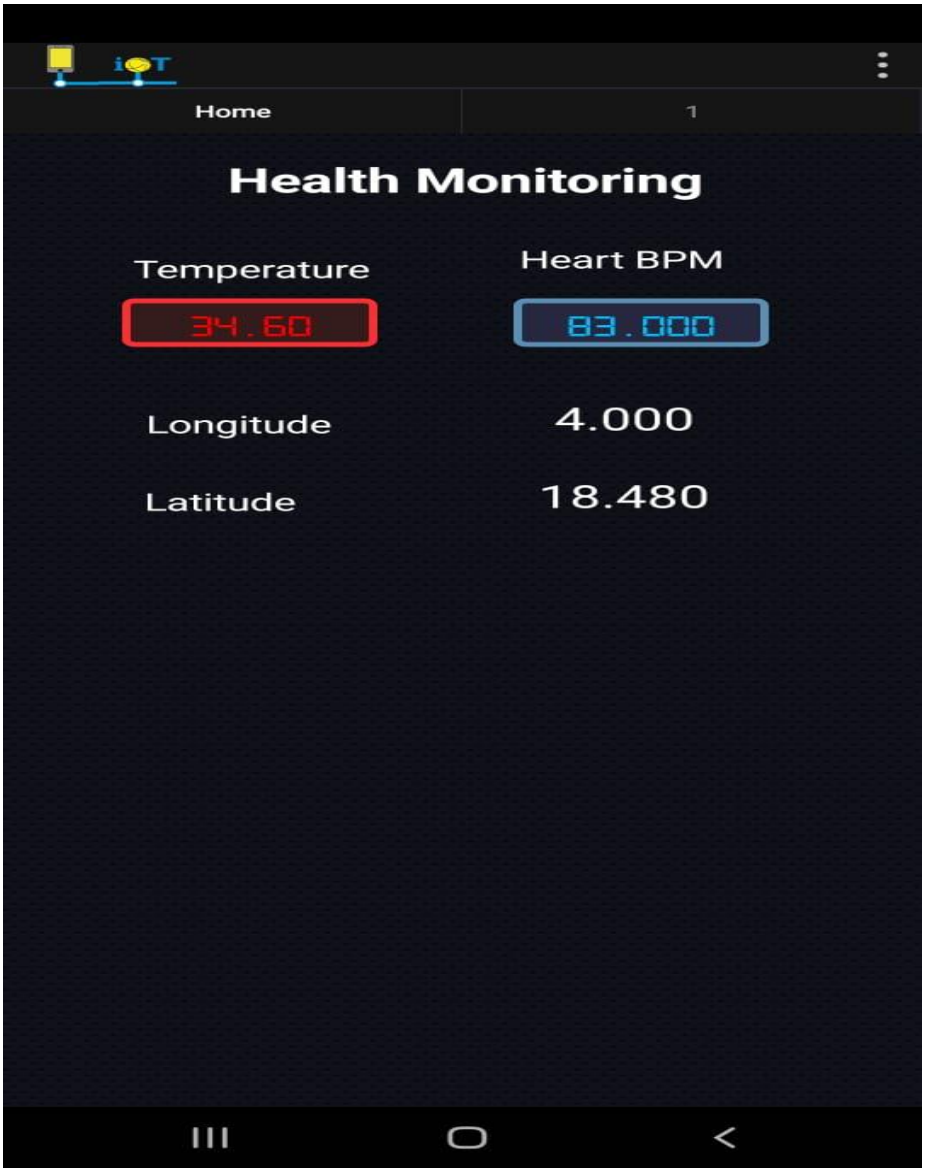


Fig 12.4

Mobile App Results



CHAPTER 13

CONCLUSION

Presently separate systems are available for monitoring patient health & sending an alert to medical authorities using a cloud data. We have proposed a combined system which will be useful to monitor all parameters in one dataset using Smart sensor, IoT & android application to provide alerts to family respondents. The system run through an IOT based mobile application, and both the doctor and the patient can receives alerts from this system during emergencies. Therefore, individuals can use this system effectively anywhere. Advanced features can be added in the future because the entire system is IOT based.

CHAPTER 11

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