# AN IOT-BASED PLATFORM FOR PATIENTS IN QUARANTINE DURING THE COVID-19 OUTBREAK

**A PROJECT REPORT**

***Submitted by***



| | |
|---|---|
| **HARAN MURTHI V** | **REG.NO.: 922319106008** |
| **KRISHNA VENI T** | **REG.NO.: 922319106011** |
| **VIGNESH KUMAR M** | **REG.NO.: 922319106032** |
| **RAMAN KISHORE R** | **REG.NO.: 922319106701** |



***in partial fulfillment for the award of the degree***

***of***

**BACHELOR OF ENGINEERING**

**in**

**ELECTRONICS AND COMMUNICATION ENGINEERING**


**UNIVERSITY COLLEGE OF ENGINEERING DINDIGUL**

**ANNA UNIVERSITY: CHENNAI 600 025**


**MAY 2023**

## ANNA UNIVERSITY: CHENNAI 600 025

## BONAFIDE CERTIFICATE

Certified that this project report "**AN IOT-BASED PLATFORM FOR PATIENTS IN QUARANTINE DURING THE COVID-19 OUTBREAK"** is the bonafide work of "**HARAN MURTHI V (922319106008), KRISHNA VENI T (922319106011), VIGNESH KUMAR M (922319106032) and RAMAN KISHORE R (922319106701)**" who carried out the project work under my supervision.

| | |
|---|---|
| **SIGNATURE** | **SIGNATURE** |
| **Dr. S. SUTHA, M.E.,Ph.D.,** | **Dr.R. SARAVANARAM,M.E.,Ph.D.,** |
| **HEAD OF THE DEPARTMENT,** | **PROJECT SUPERVISOR,** |
| **DEAN OF THE COLLEGE,** | **ASSISTANT PROFESSOR,** |
| Department of Electronics and communication, | Department of Electronics and communication, |
| University College of Engineering, | University College of Engineering, |
| Dindigul. | Dindigul. |

Submitted for the **Viva-Voce** Examination held on ___________________

**INTERNAL EXAMINER** **EXTERNAL EXAMINER**

# ACKNOWLEDGEMENT

We utilize this wonderful opportunity to express our sincere thanks to our Dean **Dr. S. SUTHA M.E., Ph.D., University College of Engineering, Dindigul,** who kindly and heartily permitted us to go on with this project.

We are also grateful to **Dr. S. SUTHA M.E., Ph.D., Head of the department in ECE, University College of Engineering, Dindigul** for her constructive suggestion and encouragement during our project.

We express our deep sense of gratitude to our Project Supervisor **Dr.R. SARAVANA RAM M.E., MBA., Ph.D., Assistant Professor in ECE, University College of Engineering, Dindigul** for his valuable guidance, suggestions and encouragement in the completion of this project.

We also express our sincere thanks to our Project Coordinator **Dr.R. SARAVANA RAM M.E., MBA., Ph.D., Assistant Professor, Department of ECE, University College of Engineering, Dindigul** for giving the valuable guidance and encouragement during our project.

We also thank all our **Faculty Members** and all **Non -Teaching Staff Members** who have helped us directly and indirectly in this project.

We also humbly extend our sincere gratitude to our loving **Family** and **Friends** for their constant support during this Project Work

# ABSTRACT

The COVID-19 outbreak has forced governments to impose quarantine measures to control the spread of the virus. However, quarantine can be a challenging experience, especially for patients who are isolated from their loved ones and healthcare providers. To address this issue, this paper proposes an IoT-based platform for patients in quarantine. The platform enables patients to monitor their vital signs such as body temperature, blood pressure, and oxygen levels remotely using IoT sensors. The platform also provides real-time communication between patients and healthcare providers through video conferencing, chat, and voice calls.

In addition, the platform includes a dashboard that displays the patient's health status and alerts healthcare providers in case of any abnormalities. The proposed platform can improve the quality of care for patients in quarantine while minimizing the risk of infection for healthcare workers. One of the key advantages of the IoT-based platform is that it can provide healthcare providers with real-time data on patients' vital signs, allowing for prompt and accurate diagnosis and treatment of any health issues that arise. This can improve the overall health outcomes for patients in quarantine, as well as potentially reduce the length of time they need to spend in isolation.

# TABLE OF CONTENTS

## LIST OF FIGURES

# LIST OF TABLES

# LIST OF ABBREVIATIONS

| | | |
|---|---|---|
| IOT | - | Internet Of Things |
| COVID | - | Corona Virus Disease |
| SARS | - | Severe Acute Respiratory Syndrome |
| COPD | - | Chronic Obstructive Pulmonary Disease |
| LCD | - | Liquid Crystal Display |
| HTTP | - | Hypertext Transfer Protocol |
| IP | - | Internet Protocol |
| IDE | - | Integrated Development Environment |
| IC | - | Integrated Circuit |
| LED | - | Light Emitting Diode |
| EDA | - | Exploratory Data Analysis |

# CHAPTER-1

# INTRODUCTION

COVID-19 patients have several symptoms, such as fever, shortness of breath, decrease in oxygen saturation level, dry cough, diarrhea, vomiting, sore throat, headache, loss of taste and smell, body pain, and abnormal pulse rate. Among these symptoms, high fever, low oxygen saturation level, and abnormal pulse rate are considered serious. Low oxygen saturation level and shortness of breath cause hypoxemia and hypoxia, respectively. Patients who suffer from hypoxemia and problems with pulse rate have a less chance of survival. Sometimes, patients do not recognize hypoxemia and an increasing rate of pulse, and they subsequently die without receiving proper treatment. Therefore, it is important for COVID-19 patients to be regularly informed about their health conditions, especially body temperature, heart rate, and oxygen saturation (SpO2).

As a person enters old age, it becomes increasingly vital for them to undergo standard medical health checkups. Since it may be time-consuming and difficult for most people to get regular health checkup appointments, IoT-based arrangements can be beneficial to individuals for routine health checkups. IoT technology has developed into an imperative innovation with applications in numerous areas. Specifically, it refers to any system of physical devices that obtain and exchange information over wireless systems without human mediation. With a significantly large increase in active COVID-19cases during the second wave, every country (including Bangladesh) faces issues in providing proper treatment to their patients. Pulse rate and body temperature are the most basic markers of human health. The pulse rate, also known as the beat rate, is the number of pulses per minute. The normal pulse rate ranges between 60 and 100 beats per minute for typical individuals. The average resting pulse rate for adult males and females is approximately 70 and 75 bpm, respectively.

Females over the age of 12 typically have higher pulse rates than men. However, the pulse rate for COVID-19 patients is abnormal and requires aid from an emergency medical assistant. The internal heat level of an individual depends on various factors, such as surrounding temperature, gender, and dietary pattern, and the temperature ranges between 97.8°F (36.5°C) and 99°F (37.2°C) in healthy adults. Various factors, such as influenza, low-temperature hypothermia, and other diseases, may prompt a fluctuation in body temperature. In most diseases, including COVID-19, fever is a common symptom; therefore, it is essential to regularly measure the body temperature. Oxygen saturation is also an important factor inCOVID-19patients. The normal oxygen saturation (SpO2) of the human body ranges from 95 to 100%. If the SpO2 (oxygen saturation) level of a COVID-19 patient is below 95%, they require emergency medical care. SARS-COV-2 coronavirus produces silent hypoxia, that is, without shortness of breath. Silent hypoxia can be diagnosed by monitoring SpO2 using a pulse oximeter. If the oxygen saturation level of a COVID-19 patient is significantly low, the patient may die. To manage COVID-19, it is crucial to monitor early symptoms such as fever, cough, heart rate, and SpO2.

Recently, different types of devices have been used to measure these values. For example, a fingertip pulse oximeter, which is used to measure SpO2 and pulse rate, is commercially available in most countries. The deluxe handheld pulse oximeter is also commercially available, which can measure SpO2 and heart rate; although, it is priced at approximately. A wrist-worn pulse oximeter is available across the counter and can be used to measure SpO2 and heart rate. This device, like the above mentioned devices, does not include body temperature measurement features. The wrist-worn pulse oximeter costs 179 USD, rendering it expensive. Analog and digital thermometers are currently available in the market, but most of them are expensive. The devices mentioned earlier are not based on IoT. Some of them show values, but it is cumbersome to obtain measurements from different devices. There is a demand for rapid monitoring of COVID-19 patients with serious symptoms. With the help of technology, it is possible for patients to receive COVID-19 treatment from home using their mobile phones. This system helps patients with fever, low oxygen saturation, and an increasing or decreasing pulse rate. A person's pulse rate depends on their age, body size, heart health, and emotional stability. The oxygen saturation and pulse rate are related because when a patient's oxygen level falls, their pulse rate increases. The IoT-based smart healthcare system is a real-time patient monitoring system, which has significantly aided the healthcare industry. Recently, IoT-based smart healthcare devices have gained increased attention from a research perspective. The development of smart healthcare monitoring systems in an IoT environment is provided in the reviewed literature. In this study, we used an Android-based pulse-monitoring system with a temperature sensor, a SpO2 sensor, and a heart rate sensor. In, the SpO2 measurement sensor was not used, and they shared the measured data on the internet.

An IoT-based lung function monitoring system for asthma patients was proposed, in which the temperature, SpO2, and pulse rate were not involved. Arduino, Android, and microcontroller-based heart rate monitoring systems have been proposed in. The system is based on the Arduino Uno and cloud computing, in which only a hardware prototype was produced. However, there is no real-world testing data available. In, a mobile application-based heart rate monitoring device was demonstrated. The patient's pulse rate was measured using a pulse rate sensor in this system, and the data were analyzed using Arduino. The measured information was delivered to the Android application. In the investigation, the number of sensors used was limited. Different authors have presented different IoT-based wireless health-monitoring systems.

However, presumably, IoT-based smart systems for measuring temperature, heart rate,and SpO2 for COVID-19 patients in one device have not been presented so far. The main objective of this research is to develop and implement a novel IoT-based smart health monitoring system for COVID-19 patients based on human body temperature pulse, and SpO2.The system can display measured human body temperature, oxygen saturation level, and pulse rate through a mobile application, which has been developed so that the patient can seek medical attention even if the specialist is physically unavailable. To treat a COVID-19 patient, a doctor requires the patient's oxygen saturation level and pulse rate. By using our proposed system, patients can inform doctors about their health conditions.

This device can benefit COVID-19 patients as well as those suffering from other diseases, such as chronic obstructive pulmonary disease (COPD) and asthma. In 2005, COPD caused 5% of total deaths worldwide and could be a worldwide open health concern in the future. Therefore, this system could be beneficial for such patients. If a patient's oxygen saturation and pulse rate is abnormal, the system immediately produces a buzz to alert the patient. Therefore, through a mobile application, patients can analyze the measured oxygen saturation level, pulse rate, and body temperature to avoid critical health conditions. This system was tested on five human test subjects. The patient and doctor can read the data throughout the day by using the mobile application. This system also has the ability to measure body temperature, which has not been included in any other research.

## 1.1 IOT MODULE

IoT stands for the Internet of Things, which refers to the interconnected network of physical devices, vehicles, home appliances, and other items embedded with sensors, software, and network connectivity that allows them to collect and exchange data. IoT technology enables these devices to communicate with each other and with other systems over the internet, creating a vast network of connected devices that can work together to perform various tasks.

IoT has numerous applications across various industries, including healthcare, agriculture, transportation, and manufacturing. In healthcare, for example, IoT devices can be used to remotely monitor patient health, track medication adherence, and manage medical equipment.

Overall, the potential of IoT is vast, as it can enable new efficiencies and services, improve productivity, and even lead to new business models. However, there are also concerns around data privacy and security, as well as the potential impact of widespread automation on jobs and society.

Big Analog Data, representing the physical world, is challenging because it has more than two values that digital data has, so it needs to be treated differently. Perpetual Connectivity, or always being connected, allows organizations to monitor, maintain, and motivate products and consumers.

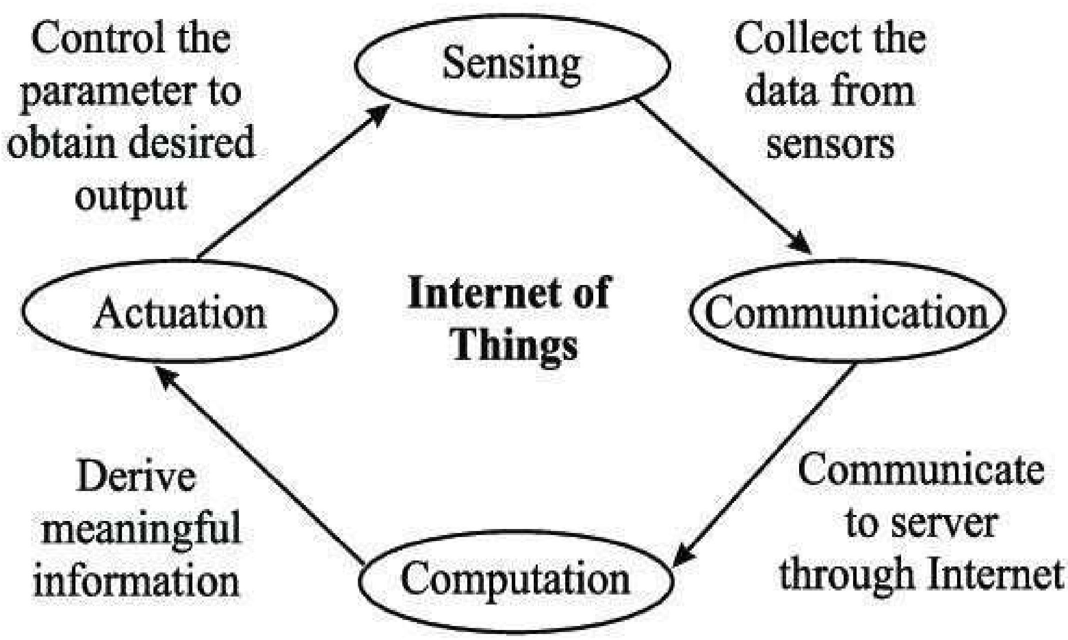


**Fig 1.1 Representation of IOT Module**

## 1.2 IOT PRINCIPLES

Real-time in IoT begins at the sensor, with an alarm going off even before the data goes to the cloud or data center. The Spectrum of Insight relates to the place of IoT data in a five-phase flow of real time, in motion, early life, at rest, and archive. Immediacy Versus Depth in traditional computer and IoT solutions causes a trade-off between speed and depth, but engineers are aiming to resolve this. Shift Left refers to sophisticated high-end compute and data analytics moving closer to the point of data acquisition and accumulation, resulting in more immediate and deep insights. Visibility, the fifth V, refers to having access to data and apps independent of time, place, and device.

## 1.3 ADVANTAGES

1. **Increased Efficiency**: IoT devices can streamline processes, automate routine tasks, and reduce the time and effort required for manual work, resulting in increased productivity and efficiency.
2. **Cost Savings**: IoT devices can help reduce costs by optimizing energy usage, reducing waste, and minimizing the need for human intervention.
3. **Improved Customer Experience**: IoT devices can provide real-time information about customers, allowing businesses to personalize products and services, enhance customer satisfaction, and improve customer loyalty.

## 1.4 DISADVANTAGES

1. **Security Risks**: IoT devices are vulnerable to hacking and cyber-attacks, and data breaches can compromise sensitive information, such as personal and financial data.
2. **Interoperability**: IoT devices from different manufacturers may not be compatible with each other, leading to interoperability issues and challenges in creating a cohesive and integrated system.

3. **Privacy Concerns**: IoT devices collect vast amounts of data about users, which can raise privacy concerns and ethical issues related to data ownership, consent, and sharing.

# CHAPTER - 2
# LITERATURE REVIEW

## 2.1 INTRODUCTION

In this literature review, we will explore the latest research on IoT-based COVID-19 patient health monitoring in quarantine. We will examine the various types of IoT devices being used to monitor patient health, the data they can collect, and the ways in which this information can be used to improve patient outcomes. We will also discuss the challenges and limitations of this technology and suggest potential areas for future research.

## 2.2 LITERATURE SURVEY

### 2.2.1 SURVEY NO:1

**Title :** IoT-Based Smart Health Monitoring System for COVID-19 Patients

**Authors :**Mohammad Monirujjaman Khan, Safia Mehnaz,
Antu Shaha, Mohammed Nayem , Sami Bourouis

During the ongoing COVID-19 pandemic, Internet of Things- (IoT-) based health monitoring systems are potentially immensely beneficial for COVID-19 patients. This study presents an IoT-based system that is a real-time health monitoring system utilizing the measured values of body temperature, pulse rate, and oxygen saturation of the patients, which are the most important measurements required for critical care. This system has a liquid crystal display (LCD) that shows the measured temperature, pulse rate, and oxygen saturation level and can be easily synchronized with a mobile application for instant access. The proposed IoT-based method uses an Arduino Uno-based system, and it was tested and verified for five human test subjects. The results obtained from the system were promising: the data acquired from the system are stored very quickly. The results obtained from the system were found to be accurate when compared to other commercially available devices. IoT-based tools may potentially be valuable during the COVID-19 pandemic for saving people’s lives.

### 2.2.2 SURVEY NO:2

**Title :** An IoT Based Patient Health Monitoring

**Authors :**D. Shiva Rama Krishnan; Subhash Chand Gupta; Tanupriya Choudhury

Nowadays the Health-care Environment has developed science and knowledge based on Wireless-Sensing node Technology oriented. Patients are facing a problematic situation of unforeseen demise due to the specific reason of heart problems and attack which is because of nonexistence of good medical maintenance to patients at the needed time. This is for specially monitoring old age patients and informing doctors and loved ones. So we are proposing an innovative project to dodge such sudden death rates by using Patient Health Monitoring that uses sensor technology and uses the internet to communicate to the loved ones in case of problems. This system uses Temperature and heartbeat sensors for tracking patients' health. Both the sensors are connected to the Arduino-uno. To track the patient's health , the microcontroller is in turn interfaced to a LCD display and wi-fi connection to send the data to the web-server(wireless sensing node). In case of any abrupt changes in patient heart-rate or body temperature alert is sent about the patient using IoT. This system also shows patients temperature and heartbeat tracked live data with timestamps over the Internetwork. Thus Patient health monitoring systems based on IoT use the internet to effectively monitor patient health and help the user monitor their loved ones from work and save lives.

### 2.2.3 SURVEY NO : 3

**Title :** Leveraging data science to combat **COVID-19**: A comprehensivereview

**Authors :** S Latif, M Usman, S Manzoor, W Iqbal

The paper explores various aspects of data science in combating COVID-19, including the role of machine learning in predicting the virus's spread and identifying high-risk areas. Data visualization techniques are discussed for effective communication. The use of data science in contact tracing, understanding intervention effectiveness, and accelerating research is examined. Ethical considerations of data collection are addressed. In conclusion, data science is highlighted as a critical tool in understanding the virus, implementing interventions, and shaping future pandemic strategies.

### 2.2.4 SURVEY NO : 4

**Title :** Cloud-based COVID-19 Patient Monitoring using Arduino

**Authors :**Ibrahim Kareem Hanoon;Mohammed I. Aal-Nouman

The paper highlights the advantages of using Arduino for patient monitoring, such as its affordability, versatility, and ease of integration with various sensors. The authors discuss the selection and integration of sensors to measure crucial health parameters, including body temperature, heart rate, blood oxygen levels, and respiratory rate.

Furthermore, the authors describe the architecture of the proposed system, which involves connecting the Arduino-based monitoring device to the cloud infrastructure. They explain the data transmission process from the sensors to the cloud server, where the collected data is securely stored and processed. The cloud-based approach allows healthcare professionals to remotely access and monitor patients' health status, facilitating timely interventions when necessary.

### 2.2.5 SURVEY NO : 5

**Title :** COVID-19 Zero-Interaction School Attendance System

**Authors :**EmilySawall; Amber Honnef

The paper presents a zero-interaction school attendance system by Emily Sawall and Amber Honnef . It addresses the need for contactless attendance tracking in schools during the COVID-19 pandemic. The proposed system utilize facial recognition technology, IoT infrastructure, cloud-based data storage and analysis, and mobile applications. It eliminates physical contact and allows for automated attendance recording. The system enables real-time data collection, secure storage, and analysis while prioritizing the health and safety of students and staff. The findings contribute to the research on adapting educational systems to pandemic challenges.

## 2.3 SUMMARY

The literature review has shown that IoT-based COVID-19 patient health monitoring in quarantine can provide valuable real-time data on a patient's condition, including vital signs and other health paramete

# CHAPTER - 3

# PROPOSED METHODOLOGY

## 3.1 EXISTING METHOD

1. In a hospital, either the nurse or the doctor has to move physically from one person to another for a health check, which may not be possible to monitor their conditions continuously.
2. Thus, any critical situation cannot be found easily unless the nurse or doctor checks the person's health at that moment. This may be a strain for the doctors who have to take care of a lot of people in the hospital.
3. Also, when medical emergencies happen to the patient, they are often unconscious and unable to press an Emergency Alert Button. One of the application protocols that are being used to transfer data is HyperText Transfer Protocol for general communication over the Internet.
4. When HTTP is applied to communication in IOT, protocol overhead and resulting performance degradation is a serious problem.
5. Moreover ,Ip addressing depends on physical location, which causes the problem of complexity of network control.

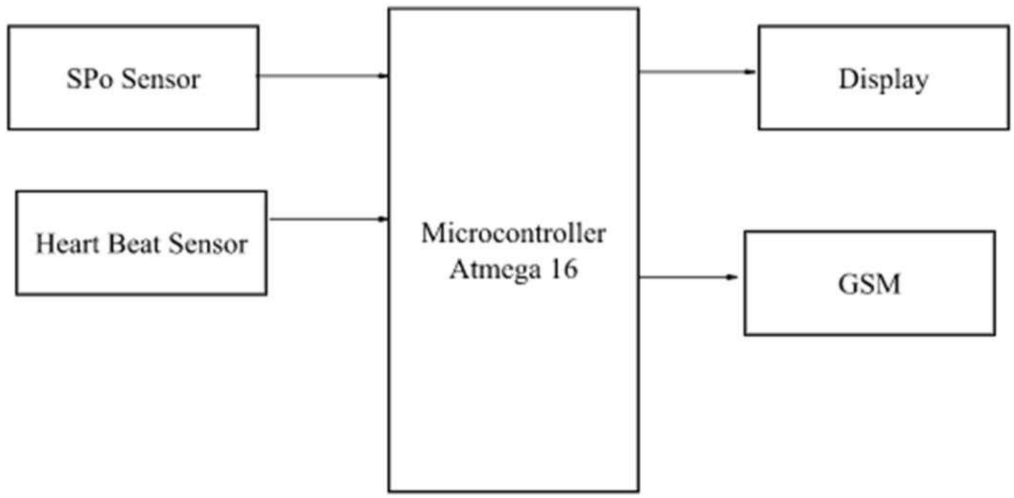


**Fig : 3.1 Existing Method Block Diagram**

## 3.2 DISADVANTAGES

1. **Security Risks**: With the increasing use of IoT devices in hospitals, there is a growing concern about the security of patient data. These devices can be vulnerable to cyber-attacks and hacking, which can lead to the compromise of sensitive patient information.
2. **Reliability Issues**: IoT devices are dependent on internet connectivity to function properly. In a hospital, network connectivity can be unstable, which can lead to reliability issues with IoT devices.
3. **Cost**: The implementation of IoT devices in a hospital can be expensive. Hospitals need to invest in not only the devices themselves but also the infrastructure required to support them. This can be a financial strain for many hospitals.
4. **Technical Expertise**: The installation and maintenance of IoT devices require technical expertise. Hospitals may need to hire additional staff or train existing staff to manage these devices, which can be time-consuming and expensive.

## 3.3 PROPOSED METHOD

1. The core objective of this project is the design and implementation of a smart

patient health tracking system.

2. The sensors are embedded on the patient body to sense the temperature and SPO2 , pulse rate of the patient.
3. Two more sensors are placed at home to sense the Heart Sensor and the Temperature of the room where the patient is staying.
4. These sensors are connected to a control unit, which calculates the values of all the four sensors.
5. These calculated values are then transmitted through an IoT cloud to the base station.
6. From the base station the values are then accessed by the doctor at any other location.
7. Thus based on the temperature and heart beat values and the room sensor values, the doctor can decide the state of the patient and appropriate measures can be taken.

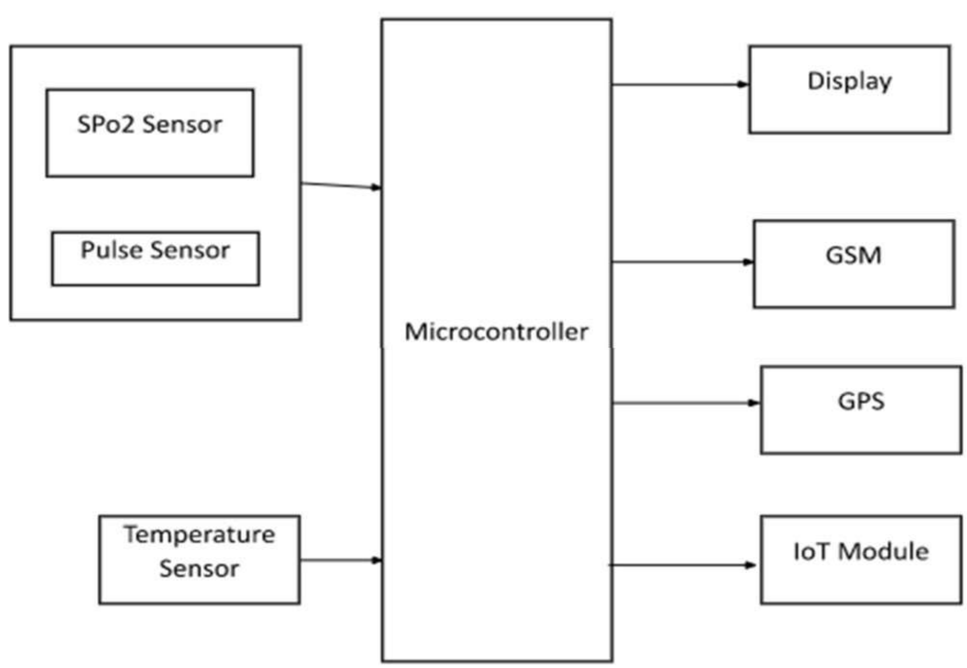


**Fig: 3.2 Proposed Method Block Diagram**

### 3.4 ADVANTAGES

1. **Continuous Monitoring**: The system allows for continuous monitoring of a patient's health status, which enables early detection and intervention of any potential health issues. This reduces the risk of complications and improves the chances of successful treatment.
2. **Improved Accuracy**: The use of sensors in the system provides accurate and reliable measurements of the patient's vital signs. This reduces the possibility of human error and ensures that the doctor has access to precise information about the patient's condition.
3. **Remote Access**: The system allows doctors to access patient data from any location, which facilitates faster decision-making and better communication among healthcare providers. This is particularly useful in emergency situations where immediate action is required.
4. **Better Patient Outcomes**: With continuous monitoring and timely intervention, the system can improve patient outcomes and reduce the length of hospital stays.

# CHAPTER - 4

# SOFTWARE IMPLEMENTATIONS

## 4.1 SOFTWARE TOOLS

The software used in this project is given below

1. IDE
2. Proteus
3. IC Program
4. KEIL Development Tool

### 4.1.1 IDE

Integrated Development Environment (IDE) is a comprehensive editor, project manager and design desktop for application development of embedded designs

#### 4.1.1.1 IDE Features

IDE provides the ability to:

1. Create and edit source code using the built-in editor.
2. Assemble, compile and link source code.
3. Debug the executable logic by watching program flow with the built-in simulator or in real time with in-circuit emulators or in-circuit debuggers.
4. Make timing measurements with the simulator or emulator.
5. View variables in Watch windows.

### 4.1.2 Proteus

Traditionally, circuit simulation has been a non-interactive affair. In the early days, net lists were prepared by hand, and output consisted of reams of numbers. A pseudo -graphical output plotted with asterisks to show the voltage and current waveforms. More recently, schematic capture and on screen graphing have become the norm, but the simulation process is still non-interactive - you draw the circuit, press go, and then study the results in some kind of post processor. This is fine if the circuit you are testing is essentially static in its behavior e.g. an oscillator which sits there and oscillates at 1MHz. However, if you are designing a burglar alarm, and want to find out what happens when a would-be burglar keys the wrong PIN into the keypad, the setting up required becomes quite impractical and one must resort to a physical prototype.

Only in educational circles has an attempt been made to present circuit simulation like real life electronics where it is possible to interact with the circuit whilst it is being simulated. The problem here has been that the animated component models have been hard coded into the program. In addition, the quality of circuit simulation has often left much to be desired. For example, one major product of this type has no timing information within its digital models. Proteus Vsm brings you the best of both worlds. It combines a superb mixed mode circuit simulator based on the industry standard SPICE3F5 with animated component models. And it provides an architecture in which additional animated models may be created by anyone, including end users. Indeed, many types of animated models can be produced without resorting to coding. Consequently PROTEUS VSM allows professional engineers to run interactive simulations of real designs, and to reap the rewards of this approach to circuit simulation.

And then, if that were not enough, we have created a range of simulator models for popular microcontrollers and a set of animated models for related peripheral devices such as LED and LCD displays, keypads, an RS232 terminal and more. Suddenly it is possible to simulate complete micro-controller systems and thus to develop the software for them without access to a physical prototype.

### 4.1.3 IC Program

This software is used for downloading the program into the PIC controller. IC programming is the process of transferring a computer program into an integrated computer circuit. The modern ICs are typically programmed in circuit through a serial protocol. Some even load the data serially from a separate flash or prom chip on every startup.

### 4.1.4 Keil Development Tool

Keil software provides the ease of writing the code in either C or ASSEMBLY. UVISION2, the new IDE from Keil Software combines Project management, Source Code Editing and Program debugging in one powerful environment. It acts as a CROSS-COMPILER. Keil software offers development tools for ARM.

## 4.2 MULTISIM DETAILS

Multisim is the schematic capture and simulation application of National Instruments Circuit Design Suite, a suite of EDA (Electronic Design Automation) tools that assists you in carrying out the major steps in the circuit design flow. Multisim is designed for schematic entry, simulation, and feeding to downstage steps, such as PCB layout.

Ultiboard is the PCB layout application of National Instruments Circuit Design Suite, a suite of EDA (Electronic Design Automation) tools that assists you in carrying out the major steps in the circuit design flow. Ultiboard is used to lay out and route printed circuit boards, perform certain basic mechanical CAD operations, and prepare them for manufacturing. It also provides automated parts placement and layout. Schematic capture is the first stage in developing your circuit.

In this stage you choose the components you want to use, place them on the circuit window in the desired position and orientation, wire them together, and otherwise prepare your design. Multisim lets you modify component properties, orient your circuit on a grid, add text and a title block, add sub circuits and buses, and control the colour of the circuit window background, components and wires.

## 4.3 ATMEL STUDIO 7

Atmel Studio is an Integrated Development Environment (IDE) for writing and debugging applications for AVR/ARM platforms. Currently as a code writing environment, it supports the included AVR Assembler and any external AVR

GCC/ARM C compiler in a complete IDE environment.

Using Atmel Studio as an IDE gives you several advantages:

1. Editing and debugging in the same application window allows for faster error tracking.
2. Breakpoints are saved and restored between sessions, even if the code was edited in the meantime.
3. Project item management is made convenient and portable.

## 4.4 PROGRAMMING FOR 328P

1. Go to the ATMEL website and download ATMEL studio 7. The download link is below and it can be downloaded and installed either the web installer or the offline installer.
2. The second step to program Arduino using ATMEL Studio 7 is to add AVR dude as an external tool. To do this, open ATMEL studio and go to Tool > External Tools. There you will see a form for specifying external tools. Here we have to set up the AVRdude.exe that Arduino uses as our external tool so that ATMEL studio can use it.
3. The final step to program Arduino using ATMEL Studio 7 is to write, compile and upload the program into the Microcontroller via USB. As we said we will use a C program to write the code. Start a new GCC C Executable Project, provide some name and finally select the Atmega328P as your device. This also works if you want to use C++ programming language.
4. The External Tool Arduino UNO Programmer that we created in the earlier step. But before that you have to connect the Arduino to your PC.
5. To do this, go to Tools menu in the toolbar and select/click Arduino UNO Programmer. The hex code will be burned into the microcontroller and you should see a message “avrdude.exe done. Thank you.” in the output window.

## 4.5 C++ PROGRAM

```
#include <LiquidCrystal.h>
LiquidCrystal lcd(7, 6, 5, 4, 3, 2);
#include <SoftwareSerial.h>
SoftwareSerial GPS_SoftSerial(11, 12); // rx , tx

#include <TinyGPS++.h>
TinyGPSPlus gps;

#include "gsmfile.h"

#include <OneWire.h>
#include <DallasTemperature.h>
#define ONE_WIRE_BUS 9
OneWire oneWire(ONE_WIRE_BUS);
DallasTemperature sensors(&oneWire);

String temp,mess;
String spob,bpmb,locate;
String lat_val="10.41",lng_val="77.91",Str_data;
String inputstring;
boolean input_stringcomplete =false;
int spo=0;
int bpm=0;
int wtemc=0;
int ecg;
int x=0,y=0;
/*****************************************************************************************
*******************/

void getplace()
{
 if (GPS_SoftSerial.available() > 0)
  {
   gps.encode(GPS_SoftSerial.read());
   if (gps.location.isUpdated())
   {
```

**Fig: 4.1 C++ Program**

The data is then sent via serial communication to another device, likely a computer or a smartphone, and also displayed on an LCD screen.It appears that the code is for an Arduino project that includes reading data from various sensors, including a GPS module, a temperature sensor, and an ECG sensor.Additionally, the code includes functionality for sending SMS messages to a specific phone number using a GSM module, likely in response to certain sensor readings exceeding a certain threshold.The code is organized into several functions that perform different tasks,

1. **including:getplace()**: Reads the latitude and longitude values from the GPS module and stores them in variables
2. **lat_val and lng_val.water temp()**: Reads the temperature from the temperature sensor and stores it in the wtmc variable, which is then converted to a string and stored in the temp variable.If the temperature exceeds 100 degrees Fahrenheit, an SMS message is sent with the text "BODY TEMP HIGH".
3. **Serialstringsep()**: Parses incoming serial data and extracts the BPM, SpO2, and location values, which are then stored in the bpm, spo, and

locate variables, respectively.

4. **recvWithEndMarker() & showNewData()**: Work together to read and parse incoming serial data.recvWithEndMarker() reads incoming serial data until it reaches a newline character and stores it in the inputstring variable.

# CHAPTER - 5
# HARDWARE IMPLEMENTATIONS

## 5.1 ESP 8266 IOT

ESP8266 offers a complete and self-contained Wi-Fi networking solution, allowing it to either host the application or to offload all Wi-Fi networking functions from another application processor. When ESP8266 hosts the application, and when it is the only application processor in the device, it is able to boot up directly from an external flash. It has an integrated cache to improve the performance of the system in such applications, and to minimize the memory requirements. It is easy to connect the Internet through WIFI Router and update the content of the data on the internet.

## 5.2 WIFI ROUTER

The WIFI router is used to connect the IOT module of the hardware with the local area network. The router is used to format the data and send over the LN with IP address and data.. The user can type the IP address in their browser. This will connect the web browser with hardware and display the content of the board in their browser section.

## 5.3 WEB BROWSER

The web browser is used to display the content of the data posted by the microcontroller. The data is formatted in terms of HTML in C language. This HTML code will be accepted in the browser and display data in the browser.

## 5.4 LCD DISPLAY

Liquid Crystal Cell Display or used in similar applications where LEDs are used. These applications are display of numeric and alphanumeric characters in dot matrix and segment display. Display unit with larger size of 16x2 with columns and rows to show user details update from Database.

The most commonly used Character based LCDs are based on Hitachi's

HD44780 controller or other which are compatible with HD44580. In this project document, we will discuss character based LCDs, their interfacing with various microcontrollers, various interfaces (8-bit/4-bit), programming, special stuff and tricks you can do with these simple looking LCDs which can give a new look to your application. LCD (Liquid Crystal Display) screen is an electronic display module and finds a wide range of applications. A 16x2 LCD display is a very basic module and is very commonly used in various devices and circuits. These modules are preferred over seven segments and other multi segment LEDs. The reasons being: LCDs are economical; easily programmable; have no limitation of displaying special & even custom characters (unlike in seven segments), animations and so on.

A 16x2 LCD means it can display 16 characters per line and there are 2 such lines. In this LCD each character is displayed in a 5x7 pixel matrix. This LCD has two registers, namely, Command and Data.

The command register stores the command instructions given to the LCD. A command is an instruction given to LCD to do a predefined task like initializing it, clearing its screen, setting the cursor position, controlling display etc. The data register stores the data to be displayed on the LCD. The data is the ASCII value of the character to be displayed on the LCD.

These modules are preferred over seven segments and other multi segment LEDs. The reasons being: LCDs are economical; easily programmable; have no limitation of displaying special & even custom characters (unlike in seven segments), animations and so on.

## 5.4.1 LCD INTERFACE CIRCUIT

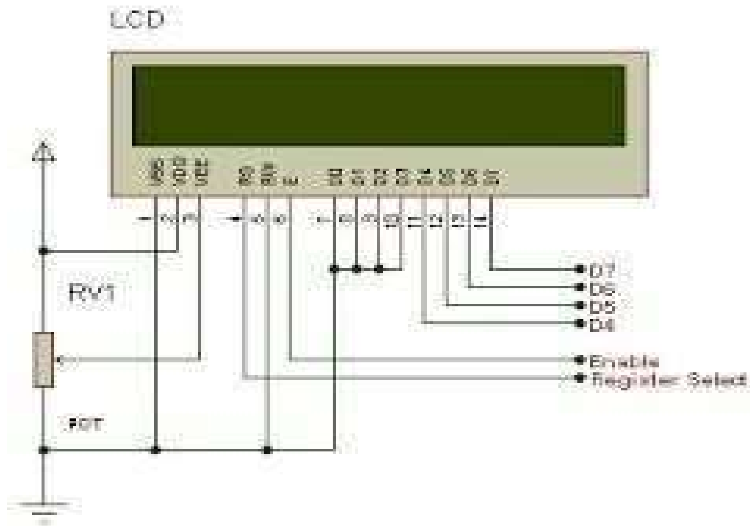


**Fig : 5.1 LCD interface circuit**

## 5.4.2PIN CONFIGURATION OF LCD

| PIN NUMBER | SYMBOL | FUNCTION |
|---|---|---|
| 1 | Vss | GND |
| 2 | Vdd | + 3V or + 5V |
| 3 | Vo | Contrast Adjustment |
| 4 | RS | H/L Register Select Signal |
| 5 | R/$\overline{W}$ | H/L Read/Write Signal |
| 6 | E | H →L Enable Signal |
| 7 | DB0 | H/L Data Bus Line |
| 8 | DB1 | H/L Data Bus Line |
| 9 | DB2 | H/L Data Bus Line |
| 10 | DB3 | H/L Data Bus Line |
| 11 | DB4 | H/L Data Bus Line |
| 12 | DB5 | H/L Data Bus Line |
| 13 | DB6 | H/L Data Bus Line |
| 14 | DB7 | H/L Data Bus Line |
| 15 | A/Vee | + 4.2V for LED/Negative Voltage Output |
| 16 | K | Power Supply for B/L (OV) |

**Table5.1 Pin Configuration**

The LCD standard requires 3 control lines and 8 I/O lines for the data bus. Liquid Crystal Display is very important device in embedded system. It offers higher flexibility as the user can display any data on it. Copy and paste technique may not work when an embedded system engineer wants to apply LCD interfacing in real world projects. First thing to begin with is to know what LCD driver/controller is used LCD.

LCD driver provides a link between microcontroller and LCD. In LCD initialization user has to send command bytes to LCD. Here the user sets the interface mode, display mode, address counter increment direction, set contrast of LCD, horizontal or vertical addressing mode, color format. The command register stores the command instructions given to the LCD.

A command is an instruction given to LCD to do a predefined task like initializing it, clearing its screen, setting the cursor position, controlling display etc.

The registers store the data to be displayed on the LCD.

1. 16 characters *2 lines display
2. 4-bit or 8-bit MPU interfaces
3. Display mode and back light variations

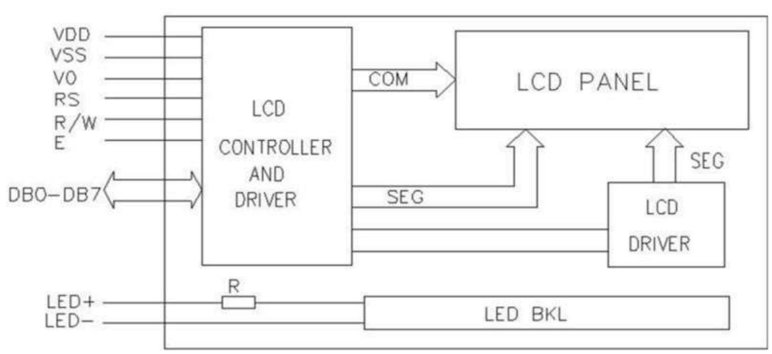


**Fig:5.2 Register in LCD**

## 5.5 MICROCONTROLLER ATMEGA 328 P

Microcontroller is used to process the sensor value and send it to the receiver unit. In the transmitter unit, it sends the various parameters of the monitoring system. These two analog values are processed and compared with the threshold value of the predefined environment.

ATmega328 is an eight (8) bit micro-controller. It can handle the data sized of up to eight (8) bits. It is an AVR based micro-controller. Its builtin internal memory is around 32KB. It operates ranging from 3.3V to 5V. It has an ability to store the data even when the electrical supply is removed from its biasing terminals. Its excellent features include the cost efficiency, low power dissipation, programming lock for security purposes, real timer counter with separate oscillator. ATmega-328 is an AVR micro-controller having twenty eight (28) pins in total.

All of the pins in chronological order are listed in the table shown in the figure given below.

Microcontroller is used to process the sensor value and send to the receiver unit. In transmitter unit, it sends the various parameter of monitoring system. These two analog values is process and compare with threshold value of the predefined environment.

The microcontroller compares these parameters with their preset minimum and maximum values stored in the system's memory and analyzes them to find any abnormalities and periodically upload them to the cloud platform, through Wi-Fi module. in the event of abnormality, it sounds a local alarm to alert the people around and a text SMS containing location and values of all bio parameters is sent to a Hospital's/Doctor's mobile.

| ATmega328 Pins | | | |
|---|---|---|---|
| Pin Number | Pin Name | Pin Number | Pin Name |
| 1 | PC6 | 15 | PB1 |
| 2 | PD0 | 16 | PB2 |
| 3 | PD1 | 17 | PB3 |
| 4 | PD2 | 18 | PB4 |
| 5 | PD3 | 19 | PB5 |
| 6 | PD4 | 20 | AVCC |
| 7 | Vcc | 21 | AREF |
| 8 | GND | 22 | GND |
| 9 | PB6 | 23 | PC0 |
| 10 | PB7 | 24 | PC1 |
| 11 | PD5 | 25 | PC2 |
| 12 | PD6 | 26 | PC3 |
| 13 | PD7 | 27 | PC4 |
| 14 | PB0 | 28 | PC5 |

**Table5.2 ATmega 328 Pins**

1. VCC is a digital voltage supply.
2. AVCC is a supply voltage pin for analog to digital converter.
3. GND denotes Ground and it has a 0V.
4. Port A consists of the pins from PA0 to PA7. These pins serve as analog input to analog to digital converters. If analog to digital converter is not used, port A acts as an eight (8) bit bidirectional input/output port.
5. Port B consists of the pins from PB0 to PB7. This port is an 8 bit bidirectional port having an internal pull-up resistor.
6. Port C consists of the pins from PC0 to PC7. The output buffers of port

C has symmetrical drive characteristics with source capability as well high sink.

7. Port D consists of the pins from PD0 to PD7. It is also an 8 bit input/output port having an internal pull-up resistor.

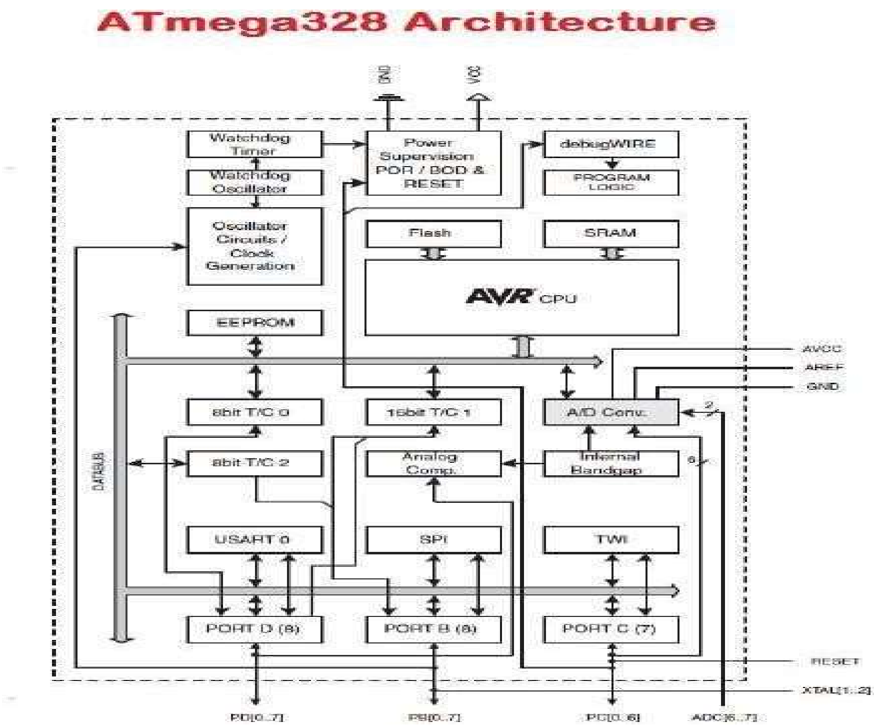


**Fig:5.3 Architecture of Atmega 328**

1. AT mega 328 has three types of memories e.g. EEPROM, SRAM etc.
2. The capacity of each memory is explained in detail below.
3. Flash Memory has 32KB capacity. It has an address of 15 bits. It is a Programmable Read Only Memory (ROM). It is non volatile memory.
4. SRAM stands for Static Random Access Memory. It is a volatile memory i.e. data will be removed after removing the power supply.
5. EEPROM stands for Electrically Erasable Programmable Read Only Memory. It has a long term data.

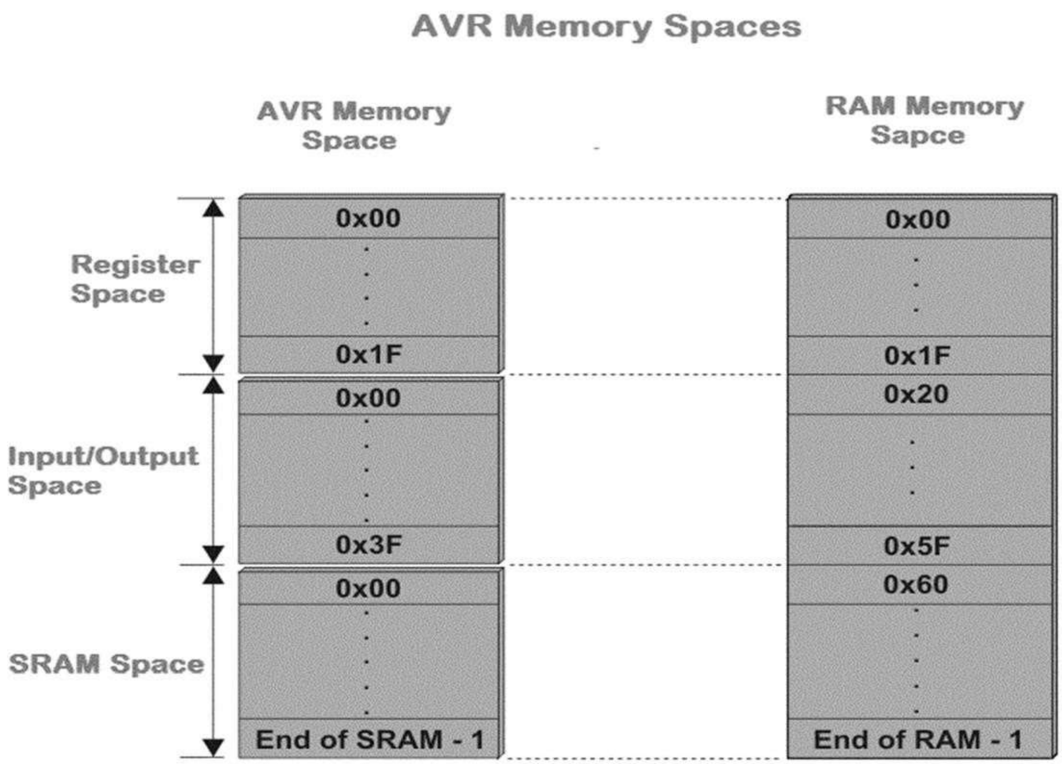


**Fig:5.4 Memory Space**

1. ATmega-328 has thirty two (32) General Purpose (GP) registers.
2. These all of the registers are the part of Static Random Access Memory (SRAM).All the registers are given in the figure shown below.

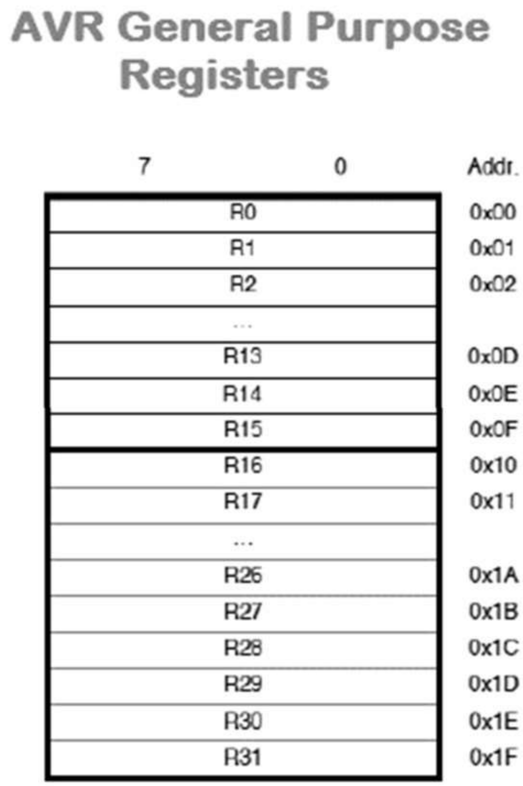


**Fig5.5: AVR General Purpose Registers**

1. The different versions of the same device are denoted by the different packages of that device.
2. Each package has different dimensions, in order to differentiate easily.
3. AT mega 328 packages are given in the table shown in the figure given below.
4. A complete package including AT mega 328 and Adriano can be used in several different real life applications.
5. It can be used in embedded systems projects.
6. It can also be used in robotics.
7. Quad-copter and even small aeroplanes can also be designed through it.
8. Power monitoring and management systems can also be prepared using this device.

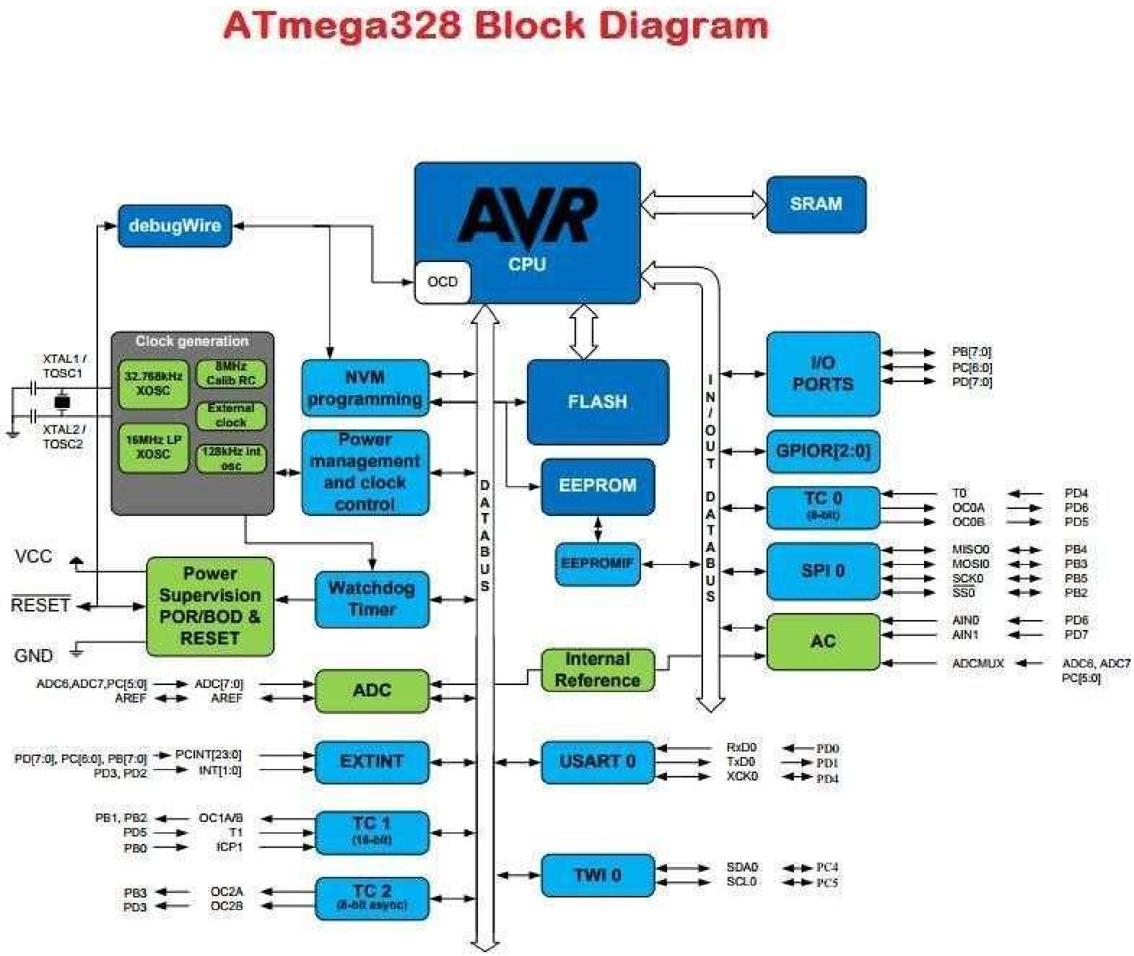


**Fig:5.6 ATmega 328 block diagram**

## 5.6 PULSE OXIMETER SENSOR

This sensor is useful in making Pulse oximetry, which is a test that measures what proportion of the oxygen-carrying molecules in the blood (called hemoglobin) are actually carrying oxygen. This is known as oxygen saturation or SpO2. One hundred percent oxygen saturation is attained when all hemoglobin in the blood is completely saturated with oxygen. This simple test does not require a blood sample and is called non-invasive.

A pulse oximeter is a medical device that indirectly measures the oxygen saturation of a patient's blood (as opposed to measuring oxygen saturation directly through a blood sample) and changes in blood volume in the skin, producing a photoplethysmograph. It is often attached to a medical monitor so staff can see a patient's oxygenation at all times. Portable battery-operated pulse oximeters are also available for home blood-oxygen monitoring.

MAX30100 is a sensor that can measure blood oxygen saturation level and pulse rate. Figure 5 shows the prototype of the SpO2 Pulse Sensor (MAX30100). Saturation of peripheral oxygen (SpO2) is a calculation of blood vessel oxygen saturation, which refers to the amount of oxygenated hemoglobin in the blood. In a human body, ordinary SpO2 values range from 90to 100%. In this system, a MAX 30100 pulse oximeter was suitable. It is a coordinated beat oximeter and heart rate sensor arrangement, which provides precise values. This sensor combines two LEDs, a photo detector, optimized optics, and low-noise analog flag handling to identify beat oximetry and heart rate signals; hence, it is suitable for this system.

On the right, the MAX30100 has two LEDs – a RED and an IR LED. And on the left is a very sensitive photodetector. The idea is that you shine a single LED at a time, detecting the amount of light shining back at the detector, and, based on the signature, you can measure blood oxygen level and heart rate. The MAX30100 chip requires two different supply voltages: 1.8V for the IC and 3.3V for the RED and IR LEDs. So the module comes with 3.3V and 1.8V regulators. This allows you to connect the module to any microcontroller with 5V, 3.3V, even 1.8V level I/O. One of the most important features of the MAX30100 is its low power consumption: the MAX30100 consumes less than 600µA during measurement. Also it is possible to put the MAX30100 in standby mode, where it consumes only 0.7µA. This low power consumption allows implementation in battery powered devices such as handsets, wearables or smart watches. The MAX30100 has an on-chip temperature sensor that can be used to compensate for the changes in the environment and to calibrate the measurements. This is a reasonably precise temperature sensor that measures the 'die temperature' in the range of -40˚C to +85˚C with an accuracy of ±1˚C. The module uses a simple two-wire I2C interface for communication with the microcontroller. It has a fixed I2C address: $0xAE_{HEX}$ (for write operation) and $0xAF_{HEX}$ (for read operation). The MAX30100 embeds a FIFO buffer for storing data samples. The FIFO has a 16-sample memory bank, which means it can hold up to 16 SpO2 and heart rate samples. The FIFO buffer can offload the microcontroller from reading each new data sample from the sensor, thereby saving system power. The MAX30100 can be programmed to generate an interrupt, allowing the host microcontroller to perform other tasks while the data is collected by the sensor. The INT line is an open-drain, so it is pulled HIGH by the onboard resistor. When an interrupt occurs the INT pin goes LOW and stays LOW until the interrupt is cleared.

SpO2 Subsystem The SpO2 subsystem in the MAX30100 is composed of ambient light cancellation (ALC), 16-bit sigma delta ADC, and proprietary discrete time filter. The SpO2 ADC is a continuous time oversampling sigma delta converter with up to 16-bit resolution. The ADC output data rate can be programmed from 50Hz to 1kHz. The MAX30100 includes a proprietary discrete time filter to reject 50Hz/60Hz interference and low-frequency residual ambient noise.

Temperature Sensor The MAX30100 has an on-chip temperature sensor for (optionally) calibrating the temperature dependence of the SpO2 subsystem. The SpO2 algorithm is relatively insensitive to the wavelength of the IR LED, but the red LED's wavelength is critical to correct interpretation of the data. The temperature sensor data can be used to compensate the SpO2 error with ambient temperature changes. LED Driver The MAX30100 integrates red and IR LED drivers to drive LED pulses for SpO2 and HR measurements. The LED current can be programmed from 0mA to 50mA (typical only) with proper supply voltage. The

LED pulse width can be programmed from 200µs to 1.6ms to optimize measurement accuracy and power consumption based on use cases.

### 5.7 TEMPERATURE SENSOR DS18B20

The DS18B20 digital thermometer provides 9-bit to 12-bit Celsius temperature measurements and has an alarm function with nonvolatile user-programmable upper and lower trigger points. The DS18B20 communicates over a 1-Wire bus that by definition requires only one data line (and ground) for communication with a central microprocessor. In addition, the DS18B20 can derive power directly from the data line ("parasite power"), eliminating the need for an external power supply.

### 5.8 APPLICATION AND PROCESS EXTENSION

These applications extend the reach of existing systems and software to allow a wider, more effective system. They integrate predefined devices for specific purposes such as allowing certain mobile devices or engineering instruments access. It supports improved productivity and more accurate data collection.

### 5.9 IOT − KEY FEATURES

The most important features of IoT include artificial intelligence, connectivity, sensors, active engagement, and small device use. A brief review of these features is given below

**AI -** IoT essentially makes virtually anything “smart”, meaning it enhances every aspect of life with the power of data collection, artificial intelligence algorithms, and networks. This can mean something as simple as enhancing your refrigerator and cabinets to detect when milk and your favorite cereal run low, and to then place an order with your preferred grocer.

**Connectivity** − New enabling technologies for networking, and specifically IoT networking, mean networks are no longer exclusively tied to major providers. Networks can exist on a much smaller and cheaper scale while still being practical. IoT creates these small networks between its system devices.

**Sensors** − IoT loses its distinction without sensors. They act as defining instruments which transform IoT from a standard passive network of devices into an active system capable of real-world integration.

**Active Engagement** − Much of today's interaction with connected technology happens through passive engagement. IoT introduces a new paradigm for active content, product, or service engagement.

**Small Devices** − Devices, as predicted, have become smaller, cheaper, and more powerful over time. IoT exploits purpose-built small devices to deliver its precision, scalability, and versatility.

## 5.10 IOT − ADVANTAGES

The advantages of IoT span across every area of lifestyle and business. Here is a list of some of the advantages that IoT has to offer

**Improved Customer Engagement** − Current analytics suffer from blind-spots and significant flaws in accuracy; and as noted, engagement remains passive. IoT completely transforms this to achieve richer and more effective engagement with audiences.

**Technology Optimization** − The same technologies and data which improve the customer experience also improve device use, and aid in more potent improvements to technology. IoT unlocks a world of critical functional & field data.

**Reduced Waste** − IoT makes areas of improvement clear. Current analytics give us superficial insight, but IoT provides real-world information leading to more effective management of resources.

**Enhanced Data Collection** − Modern data collection suffers from its limitations and its design for passive use. IoT breaks it out of those spaces, and places it exactly where humans really want to go to analyze our world. It allows an accurate picture of everything.

## 5.11 CONNECTED OF WIFI PORT WITH MICROCONTROLLER GENERAL LAYOUT

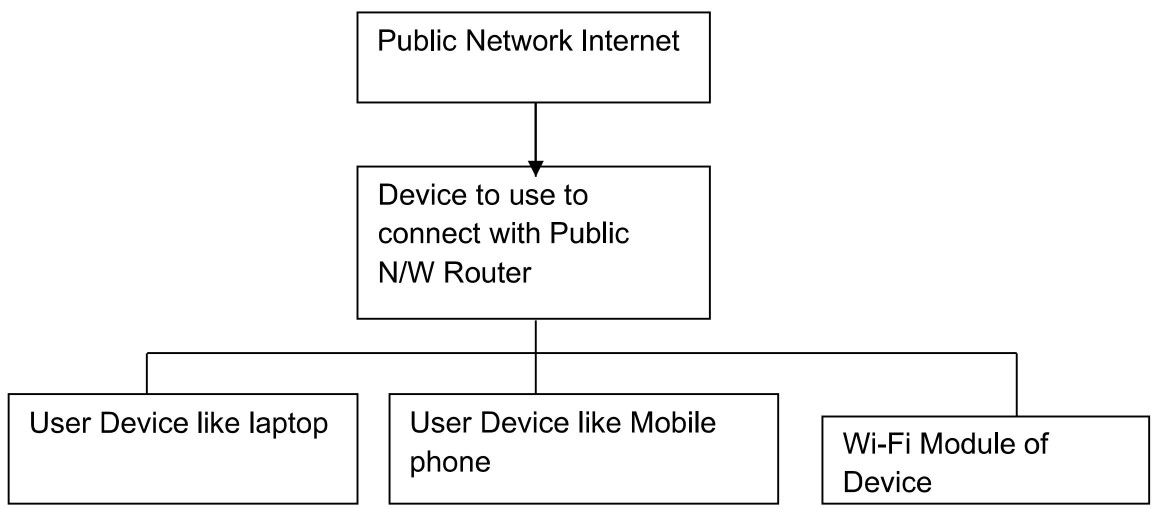


**Fig: 5.7 Connection Direction of WiFi**

## 5.12 IP ADDRESS ALLOCATION

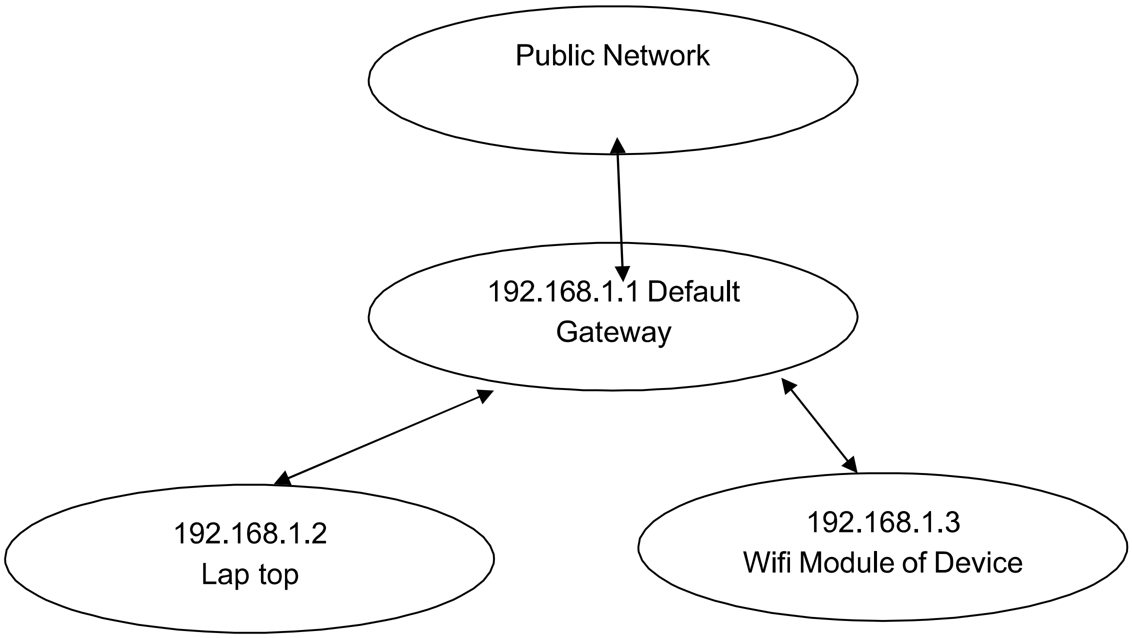


**Fig: 5.8 IP Allocation**

Wifi module used here is ESP8266 is a low-cost Wi-Fi chip with full TCP/IP stack and MCU (Micro Controller Unit). It has own modem which able to communicate with microcontroller by using AT command.

ESP-XX module then it needs to connect to the 3.3V TTL serial port during development. There are many USB to serial converter modules available which present a virtual serial connection to your host PC or laptop and connect to the chip's serial interface.

ESP8266 WiFi module is used to connect microcontroller through RX and TX in TTL logic. Directly Tx and Rx line will connect to microcontroller without any level shifter. Configure baud rate between microcontroller and WiFi module as

9600bps serial type communication. Using AT Command configures IP address to WiFi module and get its own IP address for connection with browser.

ESP8266EX has been designed for mobile, wearable electronics and Internet of Things applications with the aim of achieving the lowest power consumption with a combination of several proprietary techniques. The power saving architecture operates mainly in 3 modes: active mode, sleep mode and deep sleep mode. By using advance power management techniques and logic to power-down functions not required and to control switching between sleep and active modes, ESP8266EX consumes about than 60uA in deep sleep mode (with RTC clock still running) and less than 1.0mA (DTIM=3) or less than 0.5mA (DTIM=10) to stay connected to the access point.

## 5.13 COMMANDS

1. AT+RST - Restart module.
2. AT+GMR - View version info.
3. AT+GSLP - Enter deep-sleep mode.
4. ATE - Enable / Disable echo.
5. AT+CWMODE - WIFI mode station, AP, station + AP
6. AT+CWJAP - Connect to AP.
7. AT+CWLAP - Lists available APs.

AT Command is used to configure the Wifi Module with microcontroller through proper baud rate and serial link communication.

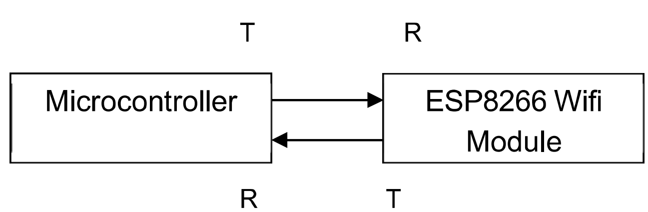


**Fig:5.9 Connection Between Wifi and Microcontroller**

## 5.14 CIRCUIT DIAGRAM

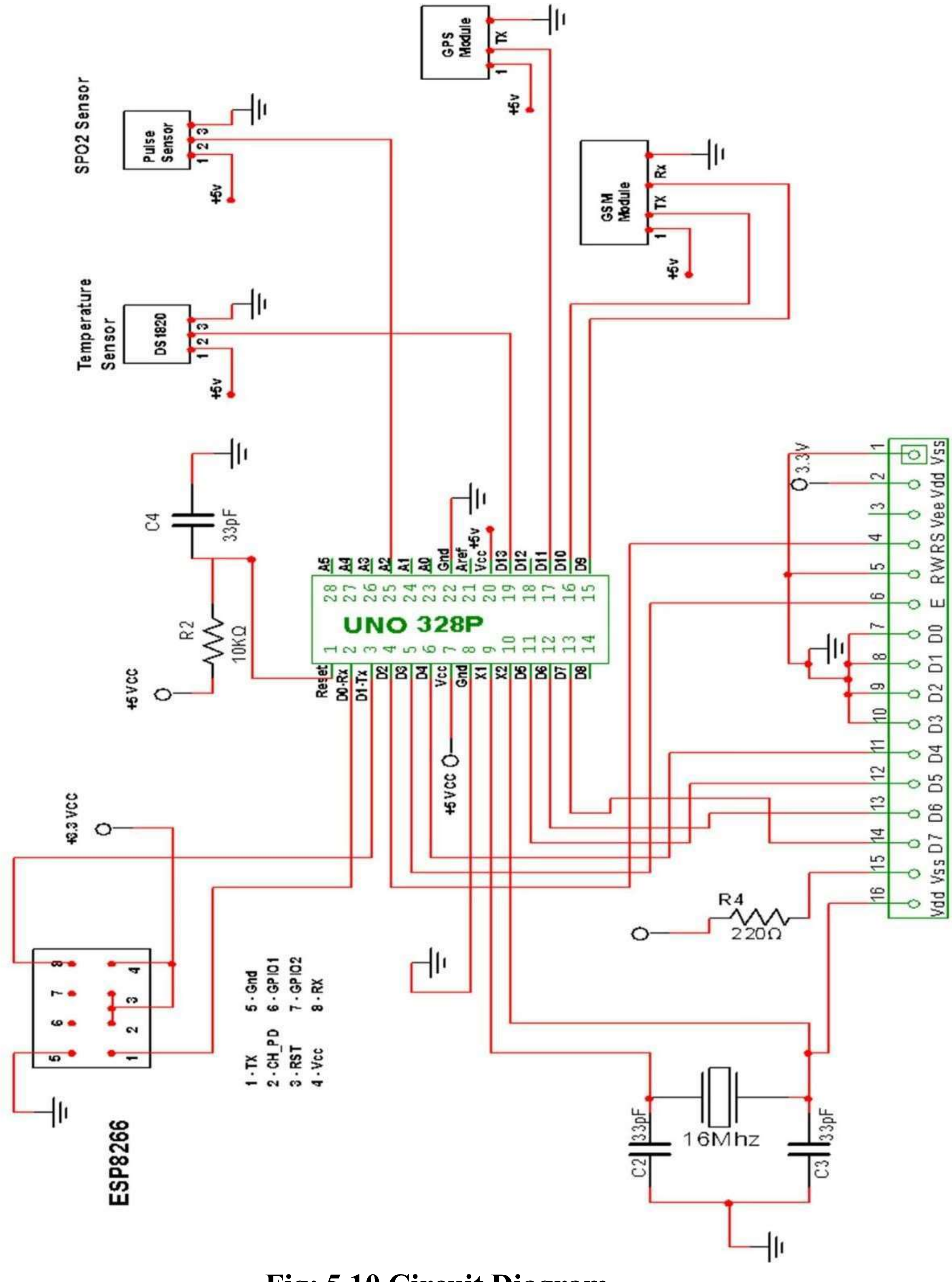


Fig: 5.10 Circuit Diagram

Here, we are designing and building a working prototype for low-power, wireless, wearable physiological monitoring system implemented using easily available components. Using proposed system we can monitor critical health parameters from anywhere on the earth with the availability of internet. The non-invasive system supports physiological monitoring of heart rate, body temperature and orientation to determine falls. The sensors are integrated that can be used to monitor the health and wellness of various patient populations.

Data collected by the sensors are sent wirelessly to a cloud platform for storage and visualization. The system continuously measures these parameters and displays them on a local LCD panel and also uploads them into cloud platform using a WiFi connection. It also compares these parameters with their preset minimum and maximum values stored in the system's memory. It continues to monitor the parameters periodically, unless an abnormality is found in the parameters. In the event of abnormality, it sounds a local alarm to alert the people around and a text SMS message is sent to the doctor with the patient details and authentication to cloud database.

The implemented system consists of an Atmega AVR microcontroller (ATmega328) as a main processing unit for the entire system and all the sensor and devices can be connected with the microcontroller. The sensors can be operated by the microcontroller to retrieve the data from them and it processes the analysis with the sensor data and updates it to the cloud through Wi-Fi module connected to it.

The microcontroller compares these parameters with their preset minimum and maximum values stored in the system's memory and analyzes them to find any abnormalities and periodically upload them to the cloud platform, through Wi-Fi module. in the event of abnormality, it sounds a local alarm to alert the people around and a text SMS containing location and values of all bio parameters is sent to a Hospital's/Doctor's mobile.

That SMS can intimate doctor about person's location and health condition along with the patient details and authentication to cloud database. By using the bio-parameters values, doctor can do advance preparations for treatment of the patient, hospital can prepare their staff for proper treatment of coming patient. It uses google maps to display location for displaying location by taking latitude and longitude values from SMS.

### 5.15 HARDWARE DESIGN

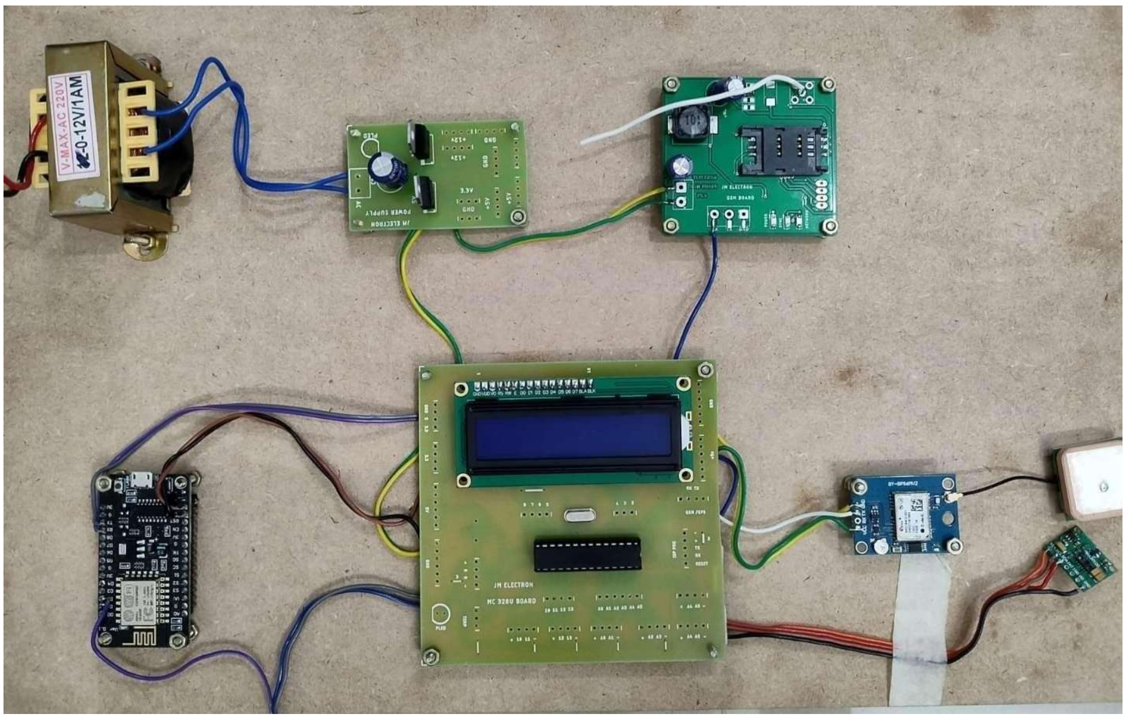

**Fig: 5.11 IoT COVID-19 Patient Monitoring Hardware Kit**

Here, we are designing and building a working prototype for a low-power, wireless, wearable physiological monitoring system implemented using easily available components. Using the proposed system we can monitor critical health parameters from anywhere on the earth with the availability of the internet. The non-invasive system supports physiological monitoring of heart rate, body temperature and orientation to determine falls. The sensors are integrated that can be used to monitor the health and wellness of various patient populations.

Data collected by the sensors are sent wirelessly to a cloud platform for storage and visualization. The system continuously measures these parameters and displays them on a local LCD panel and also uploads them into a cloud platform using a WiFi connection. It also compares these parameters with their preset minimum and maximum values stored in the system's memory. It continues to monitor the parameters periodically, unless an abnormality is found in the parameters. In the event of abnormality, it sounds a local alarm to alert the people around and a text SMS message is sent to the doctor with the patient details and authentication to the cloud database.

The implemented system consists of an Atmega AVR microcontroller (ATmega328) as a main processing unit for the entire system and all the sensors and devices can be connected with the microcontroller. The sensors can be operated by the microcontroller to retrieve the data from them.

# CHAPTER – 6

# RESULTS AND DISCUSSIONS


**Fig: 6.1 Hardware LCD Output**

It is important to note that the specific temperature, SpO2, and BPM readings for COVID-19 patients can vary depending on the individual and the severity of their illness. These readings are typically monitored by healthcare professionals to assess the patient's condition and guide treatment decisions.


**Fig: 6.2 Application Output**

Blynk app related to COVID patient monitoring. However, Blynk is a platform for building mobile applications that can control various devices, and it is possible that someone has developed a Blynk app for monitoring COVID patients.

## 6.1 DESCRIPTION

Our IoT-based platform for patients in quarantine during the COVID-19 outbreak consists of a range of hardware components that work together to provide a comprehensive solution for monitoring and assisting patients while they are in isolation. The hardware elements of the platform ensure seamless communication, real-time data collection, and efficient management of patients' health and well-being.

### 6.1.1 IOT Gateway:

The IoT gateway serves as the central hub of the system, connecting all the devices and sensors deployed within the quarantine area. It enables secure and reliable data transfer between the sensors and the cloud-based platform. The gateway acts as the bridge between the local network and the internet, facilitating continuous monitoring and control.

### 6.1.2 Smart Health Sensors:

These small, non-intrusive sensors monitor vital signs such as body temperature, heart rate, blood oxygen levels, and respiratory rate. The sensors are designed for comfort and ease of use, allowing continuous monitoring without causing discomfort to the patients.

### 6.1.3 Location Trackers:

GPS-enabled trackers are used to monitor the location of patients within the quarantine area. This ensures adherence to quarantine guidelines and provides valuable information for contact tracing, if necessary.

### 6.1.4 Activity Trackers:

Activity trackers monitor patients' physical activity levels, including steps taken, distance traveled, and calories burned. This data helps assess their overall well-being and encourages them to maintain a healthy lifestyle while in quarantine.

# CHAPTER – 7

# CONCLUSION AND FUTURE WORK

We used a cloud computing mechanism to store information, this data can be stored safely over the time and can be accessed at any moment of time. Cloud processing is additionally helpful to keep patients updated. Specialists and doctors can easily look into the patient reports at the time of emergency and can take appropriate steps accordingly. Hence giving proper guidance at the proper time to prevent a crisis. The concerned person can deal with patients without their actual physical presence. The system automatically creates the diagram of body changes and reports to the doctor about the recent change of events. The body temperature parameter is so significant that a doctor can easily predict the problem a patient is going through and also will save time. The project is very helpful for the people living in remote areas and doesn't have access to all the medical facilities. This can be signified as a small home clinic where you can just sit and get a regular check up done.

## REFERENCES


1. Asadullah, Muhammad “An overview of home automation systems” document. IEEE Accessed December 22, 2016.
2. Berger, Lars T.; Schwager, Andreas; Pagani, Pascal; Schneider, Daniel M. “Smart Grid Applications, Communications and Security.Devices, circuits and systems” ,February 2014.
3. Jin, M.; Bekiaris-Liberis, N.; Weekly, K. Spanos, C. J .; Bayen, A.M. “Occupancy detection by environmental detection”, IEEE Transactions in Engineering Science and Automation, 2016.
4. Li, Rita Yi Man; Li, HerruChing Yu; Mak, Cho Kei; Tang, Tony Beiqi. “Smart home automation and intelligent home automation”
5. Majdi soul "Design and Development of E-Health Care Monitoring System", Member, IEEE, HlaingMinn, Senior Member, IEEE.
6. M oh. Rafi khan “Android Based Body Area Network for the Evaluation of Medical Parameters", , International Conference Of The IEEE los angeles, IEEE, 2012.
7. M. V. M. Figueredo, J. S. Dias, "Internet of Things: Remote Patient Monitoring Using Web Services and Cloud Computing”. Proceedings of the 26th Annual International Conference Of The IEEE San Francisco, Ca,USA, September 1-5, 2004.
8. OvidiuApostu, BogdanHagiu, Sever Paşca, “ Mobile Telemedicine Systemfor Home Care and Patient Monitoring Using ZigBee”2011 The International Symposium on ADVANCED TOPIC IN ELECTRICAL ENGINEERING 2068-7966/AT 2011.
9. Pei-Cheng HI, Wan-Young Chung, "Health Gear: A Real-Time

Wearable System for Monitoring and Analyzing Physiological Signals", Sensors 2011.

10. Preville, Cherie (August 26, 2013) “Control your castle: the latest in homeautomation”.

11. WarsuzarinaMatJubadi, SitiFaridatulAisyahMohd, “Patient Health Management” System Using E-Health Monitoring Architecture”, 978-1-4244- 4683-4/09/25.00 ©2009 IEEE.