# IOT Based Smart Health Monitoring System

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July 30, 2021

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# 1 Introduction

Healthcare is given the extreme importance nowadays by each country with the advent of the novel corona virus.So in this aspect, an IoT based health monitoring system is the best solution for such an epidemic.Internet of Things (IoT) is the new revolution of internet which is the growing research area especially in the health care.With the increase in use of wearable sensors, the smart phones and laptops, these remote health care monitoring has evolved in such a pace.IoT monitoring of health helps in preventing the spread of disease as well as to get a proper diagnosis of the state of health, even if the doctor is at far distance.

# 2 Project Description

In this project, we have implemented a microcontroller-based health monitoring system. It can continuously monitor patients' health conditions such as body temperature, pulse, basic parameters of the room and send this information to doctors and patient's relatives' phones. It will also automatically upload all information on the cloud through the wifi module. Besides, the user can also observe data on the lcd display. The LCD constantly screens the patient's heartbeat, temperature and environment info. So, We proposed a nonstop checking and control instrument to screen the patient condition and store the patient information's in server utilizing Wi-Fi Module based remote correspondence. A remote health monitoring system using IoT is implemented where the authorized personal can access these data stored using any IoT platform and based on these values received, the diseases can be diagnosed by the doctors from a distance.

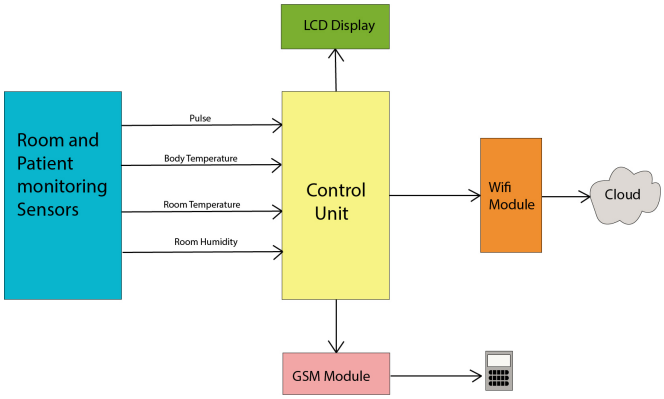


Figure 1: Circuit Diagram

# 3 Components

## 3.1 ATmega32

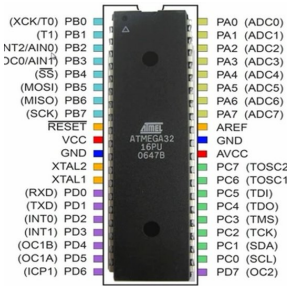


Figure 2: ATmega32

- The AVR microController is based on the advanced Reduced Instruction Set Computer (RISC) architecture. ATmega32 microController is a low power CMOS technology based controller.
- We used ATmega32 to convert AC values to DC (ADC conversion) from the sensors and to create USART serial communication.

## 3.2 Arduino Uno


Figure 3: Arduino Uno

- Arduino Uno is a microcontroller board based on the ATmega328P. It has 14 digital input/output pins (of which 6 can be used as PWM outputs), 6 analog inputs, a 16 MHz ceramic resonator (CSTCE16M0V53-R0), a USB connection, a power jack, an ICSP header and a reset button. It contains everything needed to support the microcontroller.

- We used Arduino as the center of all data. We used Arduino to get Analog to digital data from pulse sensor and send data to the ESP8286 and GSM module.

## 3.3 GSM Module (SIM800L)

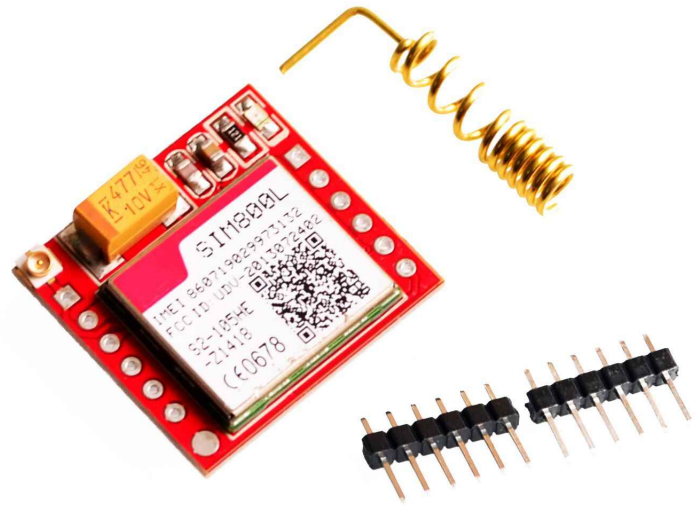


Figure 4: SIM800L

- Sim800l is a miniature cellular module which allows for gprs transmission, sending and receiving sms and making and receiving voice calls. Low cost and small footprint and quad-band frequency support make this module a perfect solution for any project that requires long-range connectivity.

- We used sim800l to send sms containing the health details.

## 3.4 Wifi Module (ESP8286 NodeMCU)

Figure 5: ESP8286 NodeMCU

- NodeMCU is an open-source Lua based firmware and development board specially targeted for IoT based Applications. It includes firmware that runs on the ESP8266 Wi-Fi SoC from Espressif Systems, and hardware which is based on the ESP-12 module.
- We used esp8286 wifi module to send data to the cloud of ThingSpeak which is an IoT analytics platform.

## 3.5 Pulse Sensor (SEN - 11574)

Figure 6: Pulse Sensor

- The Pulse Sensor Amped is a plug-and-play heart-rate sensor for Arduino. It essentially combines a simple optical heart rate sensor with amplification and noise cancellation circuitry making it fast and easy to get reliable pulse readings.

- We used the pulse sensor to get the heart beat per minute(BPM) to monitor health.

## 3.6 Body Temperature Sensor (LM35)

Figure 7: LM35 Temperature Sensor

- 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. It is rated for Full 55°C to 150°C Range and assure 0.5°C accuracy.
- We used LM35 to measure body temperature to monitor health.

## 3.7 Room Temperature and Humidity (DHT11)

- DHT11 is a basic, ultra low-cost digital temperature and humidity sensor. It uses a capacitive humidity sensor and a thermistor to measure the surrounding air, and spits out a digital signal on the data pin (no analog input pins needed).

Figure 8: DHT11

- We used DHT11 to measure room temperature and humidity to monitor the environment for proper health analysis. Because the standard health conditions change relative to the environment.

## 3.8 LCD Display (16×2)

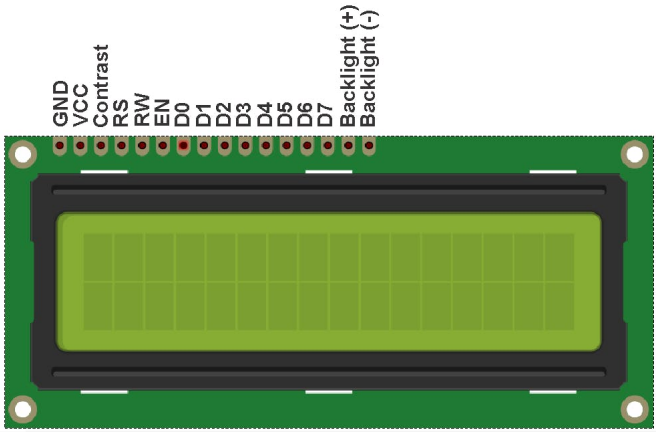


Figure 9: LCD Display

- The term LCD stands for liquid crystal display. It is one kind of electronic display module used in an extensive range of applications. It is a kind of dot matrix module to show letters, numbers, and characters and so on. The $16 \times 2$ means on the display, 2 rows can be showed and 16 characters in each.

- We used lcd $16 \times 2$ display to show the data we calculated from the sensors.

### 3.9 Other Components

- USBasp Programmer
- Breadboards
- Battery
- Capacitor
- Resistor
- Potentiometer
- Jumper Wires
- LED

## 4 Circuit Diagram

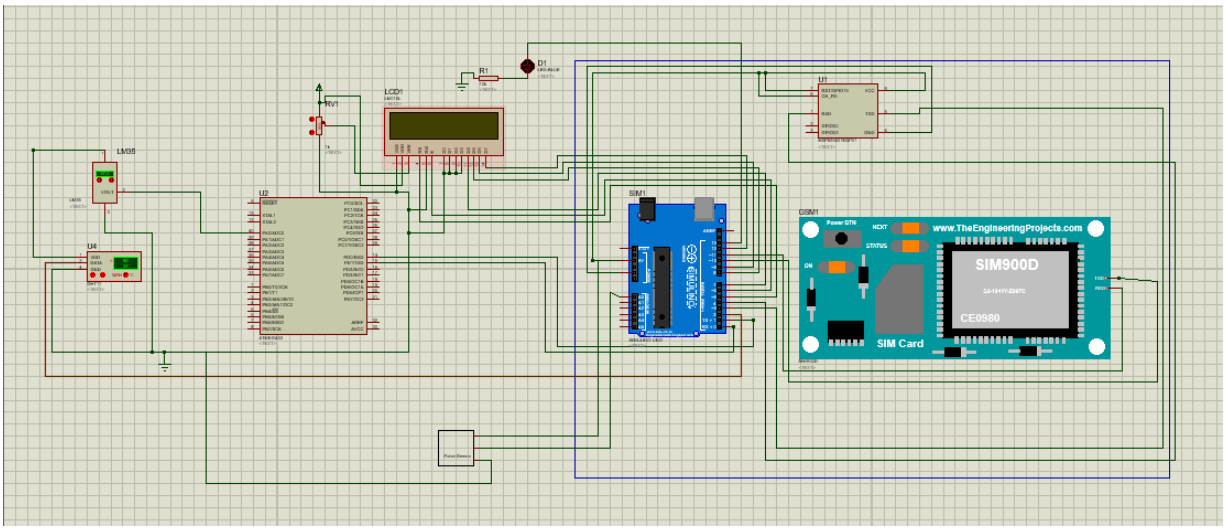


Figure 10: Circuit Diagram

# 5 Difficulties Faced and Solution

- **Buying Components:**
  - **Problem:** We had to buy components frequently, but it was time consuming.
  - **Solution:** Plan the project properly and buy extra components. Buy debugging components and LEDs.
- **Uploading Codes to ATmega32:**
  - **Problem:** We faced problems burning our code through extreme burner and also khazama programmer.
  - **Solution:** Observe the programmer properly and connect the pins according to written labels or default labels(if not written). Check wires properly whether they are damaged. Check if the programmer is getting powered properly and if the clock frequency is set right.
- **Displaying to LCD:**
  - **Problem:** We faced problem displaying data to the lcd display.
  - **Solution:** Check if lcd is powered properly. Use potentiometer to set proper contrast and connect grounds properly.
- **Using Sensors:**
  - **Problem:** We faced problem getting data from sensors.
  - **Solution:** Check if the sensors are powered properly. Connect the pins according to written labels on the sensors or default labels if not written. Don't give too much power to the sensors as it has a possibility to burn.
- **Sending SMS through GSM:**
  - **Problem:** We faced problem sending messages through gsm module. The gsm module took a long time to connect to the network and sometimes it was sending blank messages.
  - **Solution:** Sim800l didn't send messages while using other sims than Grameenphone Sim. So, trial sims while using sim800l module. And send message to the same sim operator. Connect capacitors to ensure network. Don't use special characters of C language in the message text to avoid blank messages.

- **Uploading Codes to Wifi Module:**
  - **Problem:** We faced problems uploading code to esp8286 module.
  - **Solution:** Trial using different baud rates to burn the code. Our wifi module was written to work at 9600 baud rate, but it caused "espmem failed error".Then we used 115200 baud rate and it worked. Setup the driver properly and while uploading code, disconnect rx tx pins.
- **Sending Data to Cloud Using Wifi Module:**
  - **Problem:** We faced problems to send data to the cloud because the website has a latency while writing in the cloud. It caused imbalance of time between receiving and sending data in wifi module.
  - **Solution:** Go through the library for the cloud and use proper delay according to the cloud used.

# 6 Conclusion

The Internet of Things is considered now as one of the feasible solutions for any remote value tracking especially in the field of health monitoring. It facilitates that the individual prosperity parameter data is secured inside the cloud, stays in the hospital are reduced for conventional routine examinations and most important that the health can be monitored and disease diagnosed by any doctor at any distance. In this paper, an IoT based health monitoring system was developed. The system monitored body temperature, pulse rate and room humidity and temperature using sensors, which are also displayed on a LCD. These sensor values are then sent to a medical server using wireless communication. These data are then received in an authorized personals smart phone with IoT platform. With the values received the doctor then diagnose the disease and the state of health of the patient. This project can be a really cheap medium to monitor a patient continuously and efficiently.

# 7 Video

*YouTube Link*

# 8 GitHub Link

*Health-Monitoring-System*