SMART HEALTH MONITORING SYSTEM USING IOT AND IFTTT

ABSTRACT

Internet of Things (IoT) is one of the most useful inventions that humanity has ever invented because this is an important player in any domain out there. When we take the example of the Health Care domain. It is everything in this domain because we all know that for reading any of our body parts reports. The implementation of a smart health monitoring system is one of them that can bring a major change in the field of Health Care. This replacement can help avoid medical staff contact with the patient during the dangerous disease and reduce manpower. It can also be instead used as a family doctor for a minor health check-up at home, saving money and time. This is an intelligent health monitoring system project that is a combination of the required common data sensors related to temperature, heartbeat, oxygen saturation (SpO2), etc... collect all the data of the sensor to the Arduino UNO microcontroller then this data related to all values sent to the server thing speak using Node MCU which consist of ESP8266 Wi-Fi module and then to the Android app. So, in this way, the patient receives data related to temperature, SpO2 levels, BPM, etc... on the app. If the patient's condition is normal, it gives a normal message. If there is an emergency it will send a notification to the doctor, or guardian through email and voice call

TABLE OF CONTENTS

Page

List of Figures

CHAPTER-1

INTRODUCTION

1. INTRODUCTION

The Internet of Things (IoT) represents an online concept that reaches the real world with all its uses in our daily lives. It is present in everything that we use, and observe in our daily lives. In the digital world, everything is based on IoT. A person can access all his everyday objects such as smartwatches, laptops, smartphones, etc... these devices have embedded technology which is a subset of IoT this is only possible due to IoT. IoT is also used in artificial intelligence in some of the trending technologies 2 that we all use in our daily life such as voice recognition, face recognition, and fingerprint devices embedded into mobile phones using IoT. The Self Driving System implemented in most modern cars like Tesla's where this technology is dependent on sensors like ultrasonic etc.. sending ultrasonic waves to detect the object near it and its shapes with the help of IoT and Artificial Intelligence.

IoT also plays a major role in the field of health care just imagine if there were no sensors for calculating any sort of important reading from the patient's body, especially the most common reading like temperature, SpO2, etc… These readings like temperature, heartbeat, and SpO2 may seem to be normal. But these readings are very important in the field of medical science by which the status of the affected disease can be measured or the symptoms of the many diseases can be found in the early stage of the disease which may help to prevent the disease. It would be very difficult to even imagine if there are no more sensors that can help us in health care then most of our lives would be in danger.

Most of the things possible today in the field of health care especially due to IoT. We can also observe more and more improvements that we can find day to day in the field of health care based on IoT. IoT makes our lives not only smarter but also easier with all its applications. It also helps in terms of accessibility of everything from anywhere in the world like providing remote access for everything like access the remote controlling the thing like a light in a house, the motor in an agricultural field from all over the world and helps a doctor in someplace in the world can analyze the health status related to a disease of a patient who is present in some other part of the world this type of real-time remote monitoring system the IoT will also, play a major role.

I0T helps to track the health status of patients. Using a variety of sensors max30100 which helps to read the heartbeat and SpO2 level of the patient with a scan of the patient's finger, Lm35 to read the temperature from the patient, and AD8232 for the ECG generation of the

patient a microcontroller Arduino UNO that can track the patient's health reading according to the patient's body temperature, heart rate, SpO2, and ECG, collect data from all these sensors about the condition of the respective patients send it to a cloud [Thing speak] using Node MCU which is a microcontroller integrated with Wi-Fi module which is connected to Arduino UNO, send data to mobile app and this information can also be shared with your doctor stored in google sheet with help of webhooks and IFTTT. This health monitoring system setup helps us to measure a person's body temperature, oxygen level, and heart rate.

During pandemics, people are afraid to go to the hospital to check the health status of their family members due to the uneven situation. But by using this health monitoring system they can do the same thing in their homes without any sort of worry, and this can be used in hospital wards to save manpower and avoid contact with the staff. This System can help in ICUs where every second of a patient's health status should be monitored in real-time and this system can help if there are any emergencies there could be cases where the doctor may or may not be near the patient this will help at such situation by send the phone call and email to the doctor.

This model can also help the old people because many of them are in a stage where they can't be taken to the hospital frequently for health check-ups this smart health monitoring system can help you in such a situation to make the work done at home without any stress of 3 taking them to the hospital every time. It collects all the data of one patient about his or her heart rate, oxygen level, body temperature, and ECG. If the system finds any abnormalities in his or her health inform both physician and patient by email and phone call. This present system has much future scope where the collected data on patient health status in the form of google sheets can be used in medical research.

CHAPTER-2

RATIONALE AND SCOPE OF THE STUDY

2.1. PROBLEM STATEMENT:

The major problem in the health care system is to control the death rate in hospitals when the doctor is not available in the ward or the room or any such cases. In such cases, the patient will be in critical condition, or the patient will die. And in the Old-aged homes, so many old people are facing the problems related to health, and these old, aged people are not comfortable traveling to hospitals or might take too much time to reach hospitals in cities, and the persons with disabilities, these people can face problems related to health.

2.2. PROPOSED MODEL:

To overcome these types of problems we have implemented the Smart Health Monitoring System using IoT and IFTTT. This system collects the values from the sensors like Heartbeat, Oxygen, ECG, and Temperatures sensors, and these all values from the sensors are converted into single data, and this single data is sent to Node MCU by the Serial Communication method. After this single data is sent to Node MCU and it will divide into the required format after it will be sent to the cloud. If there is an emergency for the patient it will send a message and call the required person by using the IFTTT app.

Let us take an example of the patient being in ICU and the doctor is not available in the ICU ward, at this critical situation patients may die due to not being available to the doctor on time. To overcome this problem Smart Health Monitoring System using IoT and IFTTT detects the problem whether it was decreasing Oxygen levels, BP high, or temperature high this system sends the MSG or Call to Doctor and Nurse by using the IFTTT app.

CHAPTER-3

OBJECTIVES AND HYPOTHESIS

3.1 OBJECTIVE:

The main objective of the project is to design the Smart Health Monitoring Using IOT and IFTTT. Mainly this project is useful for the diagnosis of the patient's health condition. This system has the same types of a like heartbeat sensor, temperature sensor, and ECG sensors connected to the patient body. This system is mainly used in some places like hospitals, old-age homes, and disabled persons. These sensors detect the condition of the patients and the collection by the sensors is sent to the cloud after that it is sent to the IFTTT app if there is a critical situation for the patient it sends an alert message and calls to medical staff and doctors.

As we all know that a person's life is important, and in this health care system hospitals play a crucial role. If the patient is in a hospital ward and the patient is facing problems like not having the oxygen levels and proper heartbeat the doctor is not available in your ward, in this current situation the system we proposed is useful more. As it is continuously monitoring the patient's condition and the data collected by the sensors send to the doctor and medical staff whether the staff is at any place. If the condition of the patient is not good an (At a Serious Stage), the IFTTT app will send the alert message and calo doctors and the medical staff –The patient in the Ward Number, Patient name, Oxygen levels, and Heartbeat levels, this kind of information sent to medical staff, by this alert message they will take the further actions quickly.

We can view the system in three different parts, the first one is to collect or detect the data from the sensors attached to the patient body, the second one is the data collected from the respective sensors is sent to things speak cloud, the third one is the data from the cloud send IFTTT app there we any the information regarding a patient at any place at any time and the system monitors the data time to time.

Internet of Things (IoT) is the platform that leading in the medical field and implements new technologies in health care services. These technologies are making new equipment that helps the human being like

1. Identifying the diseases at the starting stages.
2. If there are any critical conditions in patients send an alert message to medical staff in real-time.
3. And make the things so smart to operate in this field in a specific manner.
4. Data tacking and storing related to patients can be implemented by simple interfaces.

CHAPTER-4

SOFTWARE AND HARDWARE REQUIREMENTS

4.1 SOFTWARE REQUIREMENTS:

- Arduino UNO
- Proteus
- MIT App Inventor

4.1.1 Arduino IDE

Arduino is an open-source electronics configurable prototyping platform that produces their microcontroller boards which can be configurable again and again which makes the users create their interactive electronic projects. Arduino also has its community which enables the users to discuss their problems to get solved among themselves for better solutions.

To Configure the Arduino Microcontroller Boards they have a software Arduino IDE which is an Integrated Development Environment software that enables the user to reprogram the Microcontroller board again and again. Arduino IDE uses C++ as its programming language for programming the boards again and again.

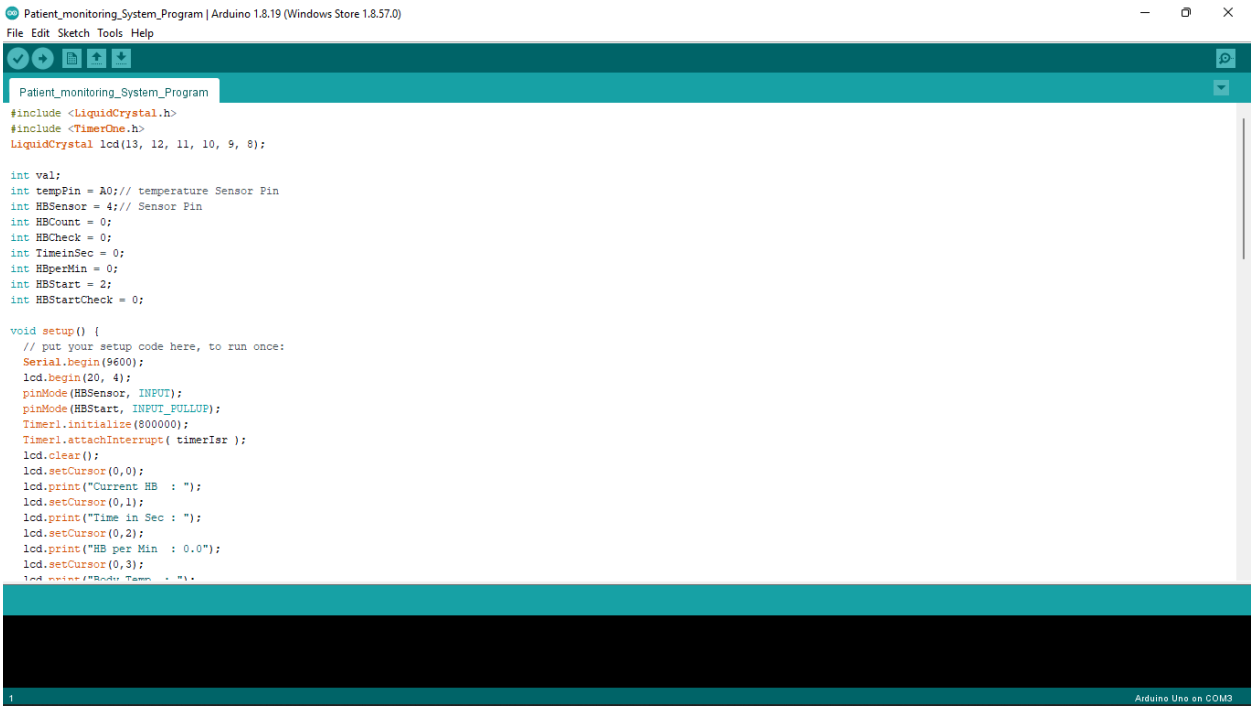


Figure. 4.1. Arduino Integrated Development Environment.

This Arduino IDE has an inbuilt compiler, debugger, and uploader which helps in writing the code and uploading it to the Arduino Microcontroller through select the board using IDE. Which also has a serial plotter as well as the serial monitor helps us to observe the output from the Arduino to the serial monitor, Whereas the serial plotter helps us in plotting the waveform from the Arduino.

4.1.2 PROTEUS

Proteus is a circuit simulation software that helps the students as well as working professionals to work on electronic circuits like Arduino projects etc.. where we can do most of the things that we can do with the real hardware this simulation software can help the user by saving lots of money as well as the time because the hardware components can be quite expensive. But one can observe the working of the Model just by the simulation.

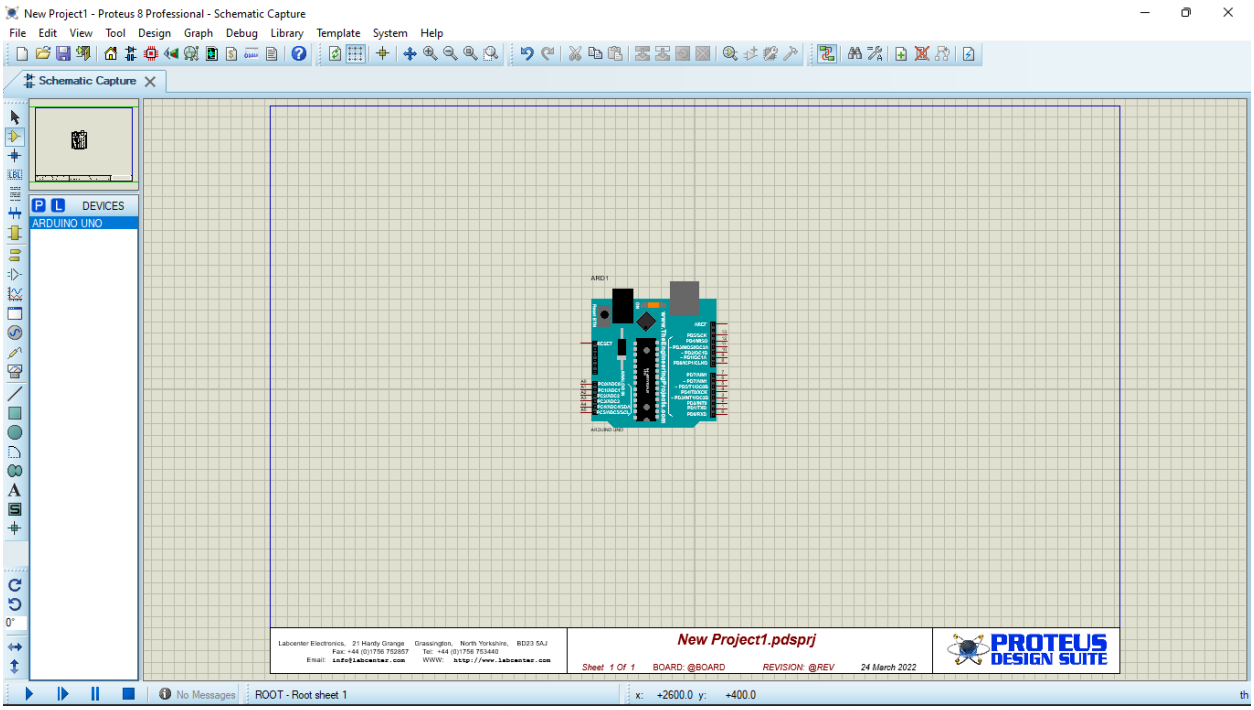


Figure. 4.2. Proteus Design Suite Simulation Software.

4.1.3 MIT APP INVENTOR:

In this modern world where the technologies are improving day today, we can observe a major change that has been improving in the field of technology. Creating a mobile application is not that easy as there are many technologies out there to create one such application if need to

create one for an IOS device we can use shift, for an Android we can use either Java or Kotlin to create one such app additional to that we also add flutter for the UI design, etc…

But Massachusetts Institute of Technology has come up with a great idea that the programming which these new technologies are not that easy, especially for those who have not even had an idea of the programming. So they have built an online platform called MIT App Inventor which helps in creating the app without the need for any such complex programming with such technologies.MIT App Inventor has two parts one for the UI design part known as the Designer part where the operations are performed by just drag and drop the components at the same time editing the component's properties like height, width, color, text, text size, etc… with help of the property window on the right. For making this application interactable we also have a Block part when we need to design the logic with help of the logic blocks.

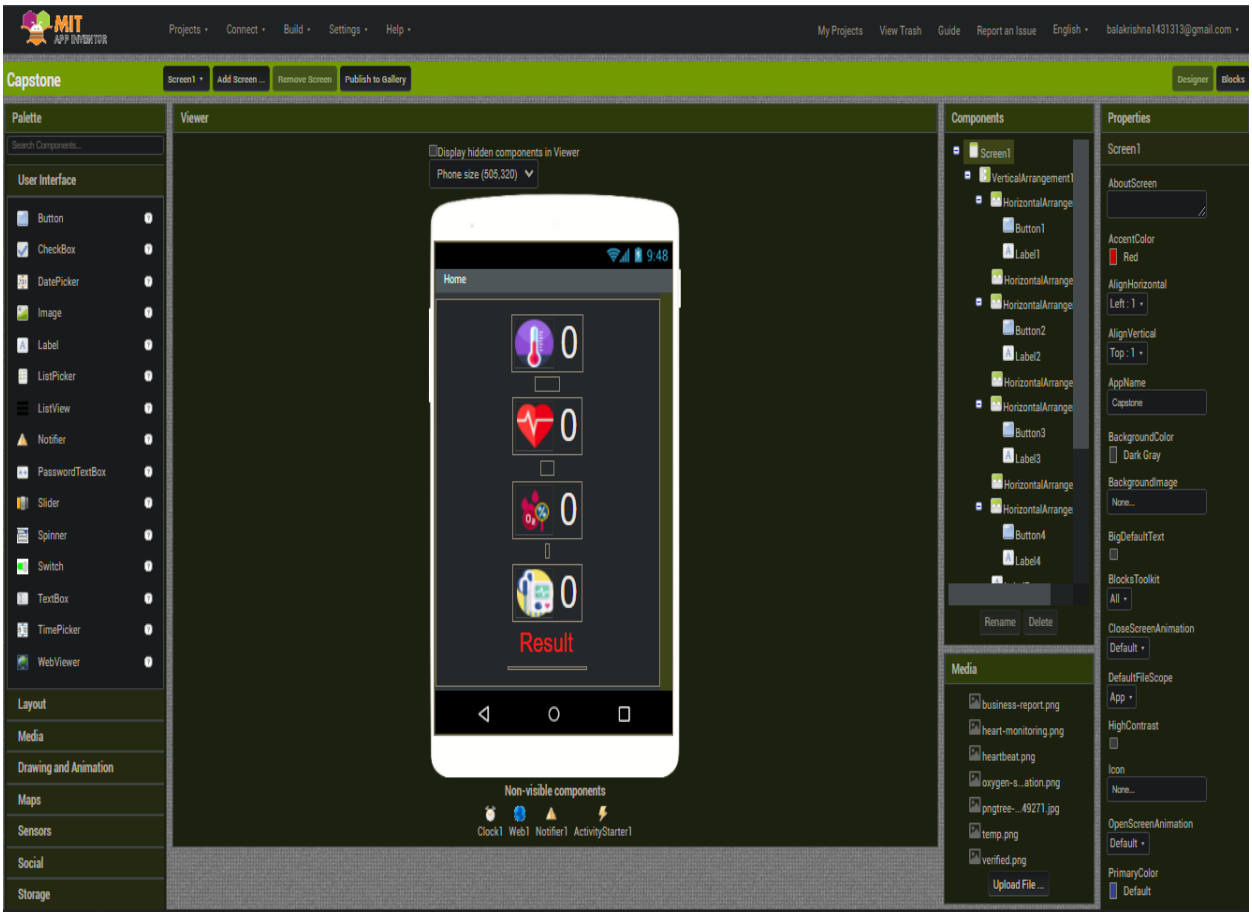


Figure. 3. Designer part of MIT App Inventor.

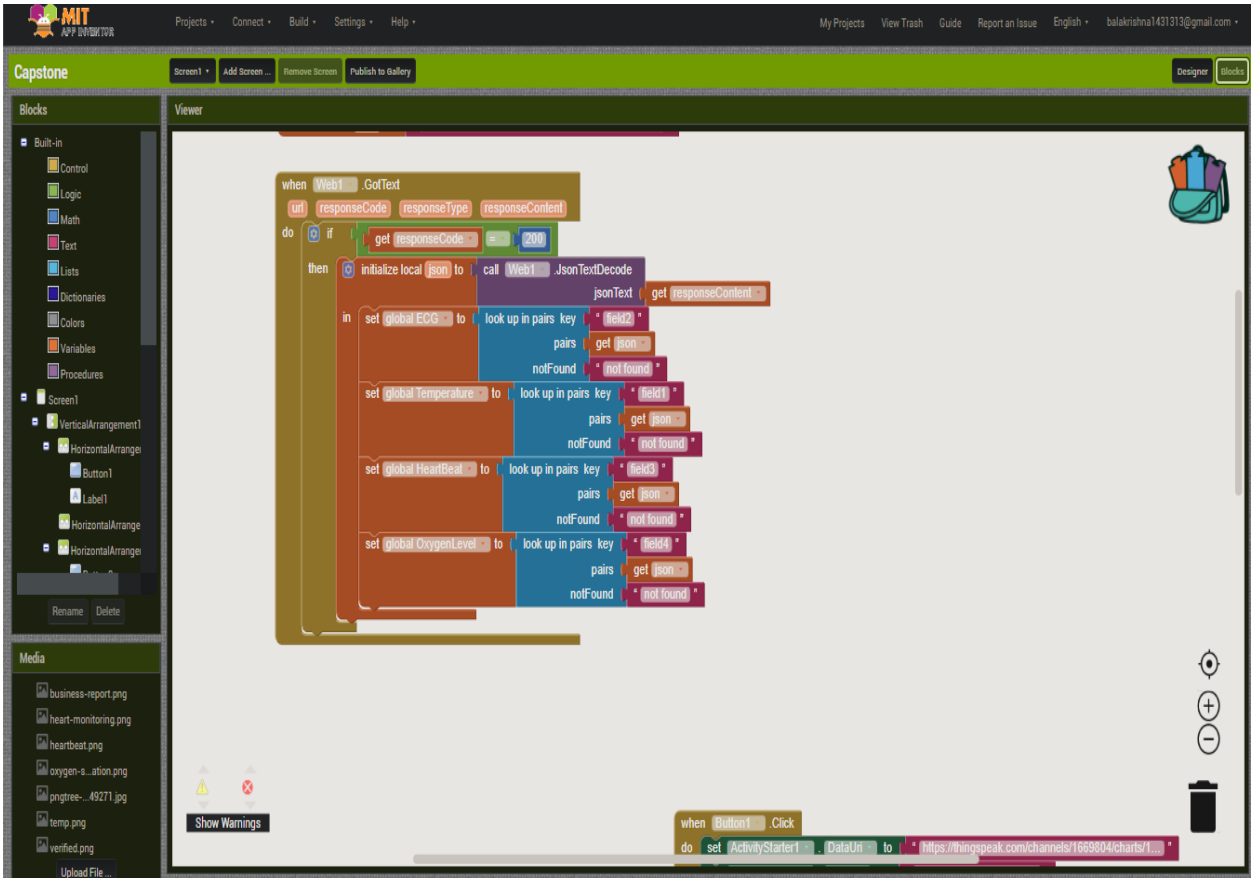


Figure. 3. Block part of MIT App Inventor.

3.2 HARDWARE REQUIREMENTS:

3.2.1 NODE MCU:

In the Hardware proposal, we are trying to achieve a model which can overcome some of the problems facing these days in health care related to check-ups, an alert system to notify through the mail and a voice when emergencies and collect data for the research. The sensors and hardware used in the model are, Node MCU. We have used the Node MCU ESP8266 node for this system. The MCU node is an asynchronous receiver-transmitter communication module and enables connection to another module. The node MCU is a wireless microcontroller with WIFI capability and is used to send data to a large server. The MCU node capable of operating with a power supply is an operating voltage of 3.3V and an input voltage of 4.5V to 10V. The MCU node has SRAM of 64KB, and Flash Memory is 4MB. It has 11 digital input PINs and 1 Analog anchor. The node of the MCU ADC Range is 0 to 3.3V. It has built-in WIFI is 802.11 b / g / n. PCB note. The MCU node sends the pulse rate measurement, and body temperature to a large server. MCU node can send this data because these sensors are connected by an IP address to the MCU node to measure data. MCU node is an IOT-based application.

Figure.5. Node MCU ESP 8266.

3.2.2 Arduino UNO:

Arduino is one of the open-source electronics prototyping platforms which provides its services like the software Arduino IDE which helps to configure and reprogram hardware boards like Arduino UNO, Mega, Nano, Due, Portenta X8, etc... where are their signature products. In our system, we are using the Arduino UNO which is a microcontroller board based on the ATmega328p microcontroller. Which has 16 digital in/output pins, 6 analog inputs, a 16 MHz quartz crystal, a USB connection, a power jack, an ICSP header, an Operating voltage of 5V, and the input voltage of 6V to 20V. Flash memory of 16 KB, and a reset button which helps us to reset the microcontroller before reprogramming or when we need to reset the board.

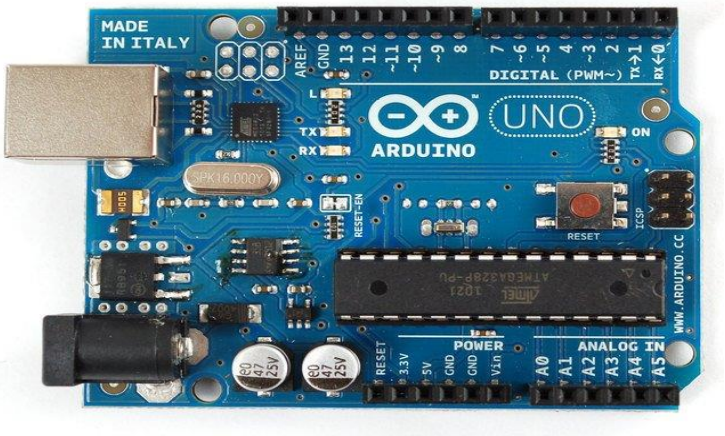


Figure. 6. Arduino UNO.

3.2.3 LM35:

LM35 is one of the members of the precision integrated-circuit temperature sensors family whose output voltage varies based on the temperature around it. It is a resistance temperature detector that collects the information from a source and converts the information collected into an understandable format like degrees Celsius or Fahrenheit. It is small and less expensive that can be used to measure temperatures ranging between -55°c and 150°C. It can easily be interfaced with any Microcontroller interfaced that has an ADC. Lm35 pin configuration,

(i) The first pin is a ground pin that is connected to the ground of the power supply.
(ii) The second pin is an output pin there will be increased by 10 millivolts change in every one degree Celsius.
(iii) The third pin is Vcc which is connected to typical 5 volts power supply.

Figure. 7. LM35 temperature sensor.

3.2.4 MAX30100:

MAX30100 is a pulse oximeter integrated with the heart rate monitor sensor. It is an I2C-based low-power biometric sensor that can be used in most projects where a live heart rate can be visualized. It is a visual aid It will learn how to extract two wavelengths of light from two LEDs and then with the suction unit a simple image scanner can draw blood. It is a combination of two LEDs, a photodetector, optimized optics, and a low-noise analog signal processing to detect SpO2 and heart rate. It works by shining both lights onto the finger or earlobe and measuring the amount of reflecting light using a photodetector this method is also known as "Photoplethysmogram". This sensor operates from 1.8 V with a power supply. The TMAX 2000 we use most on portable devices. as Assistant and Qualified Assistant devices, 1 and medical

monitoring device. These are some of the pins 1. VIN -3.3Volts, VCC of the power supply,2. GND of the power supply, 3. SCL,4.SDA which can be used to send the analog data collected, 5. INT.

Heartbeat reading: The heartbeat reading which we get in the form of an analog signal from the MAX30100 sensor is calculated with the help of a photodetector which captures the reflected light changes in the form of the waveform this is possible because our arterial blood contains oxygenated hemoglobin (HbO2) which has a peculiar of absorbing IR light in our case it is produced by MAX30100 when the blood is pumped through the finger the IR light produced gets reflected the photodetector for each heartbeat which forms a waveform as output which we can read as heartbeat reading.

Figure. 8. MAX30100 sensor.

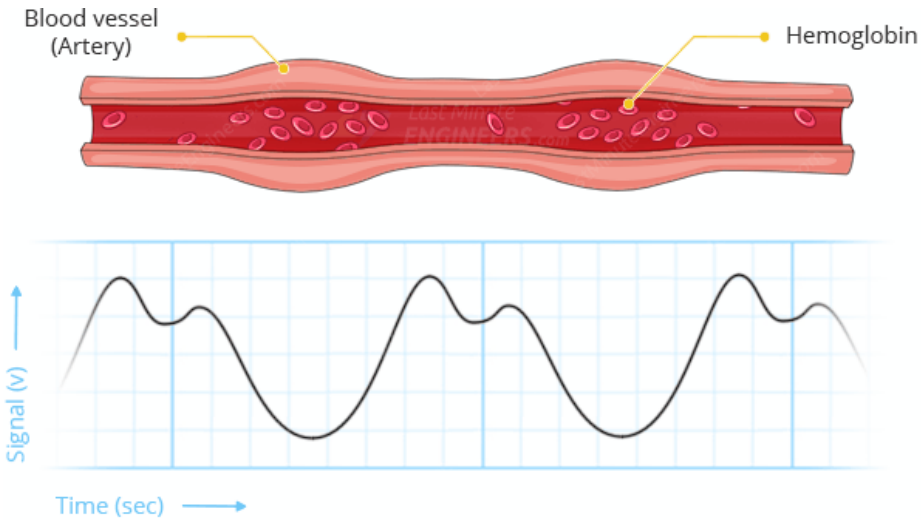


Figure.9. Heartbeat reading from the blood vessel.

SpO2 reading Pulse oximetry SpO2 levels that are calculated are based on the variation of the amount of red and IR light absorbed with the amount of oxygen in our blood.

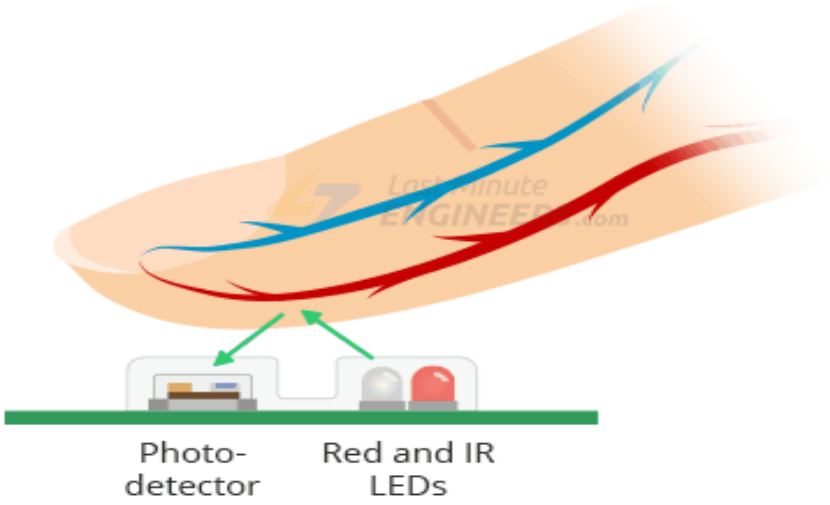


Figure. 10. SpO2 reading from the Max3100 when finger placed.

3.2.5 ADA8232:

The ECG electrocardiography is a process by which we collect the electrical signals generated by the heart of the human. The AD8232 ECG sensor is a Commercial board that is used to calculate the electrical moment of the human heart. The AD8232 supplies the ECG signal to the controller section. This is an ARM 7 controller-based sensor that is used to acquire the ECG signals. The result can be charted like 9 an electrocardiogram and the output of this is an analog reading [20]. This reading is connected to the human using electric lead wires then this electrical activity of the heart is then measured, interpreted, and sent as an analog signal. The electrocardiogram can be very noisy, to reduce the noise AD8232 Chip can be used. The heart rate monitoring Sensor like AD8232 includes the like SDN Pin, Lo- pin, Lo+ pin, electrocardiogram pins Output pin, Output pin, 3.3 vaping, and GND Pin. The principle of the ECG sensor is like an operational amplifier that helps to get a clear signal from the internal simply just by collecting the data from the three electrodes RA lead wire the red electrode which is placed under the clavicle near the right should within the rib cage fame, LA electrode which is yellow should be placed under the left clavicle near left shoulder within the rib cage frame, LL electrode which is the final green electrode which is placed on the left side of the below pectoral muscles lower edges of the rib cage the. AD8232 sensor is used for signal conditions ECG.

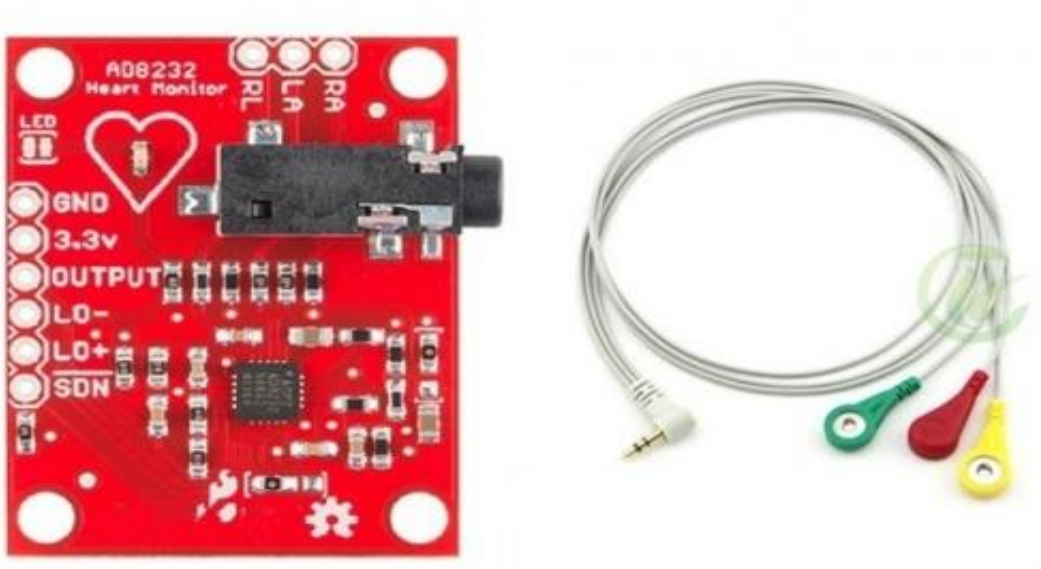


Figure.11. ADA8232 with Electrodes.

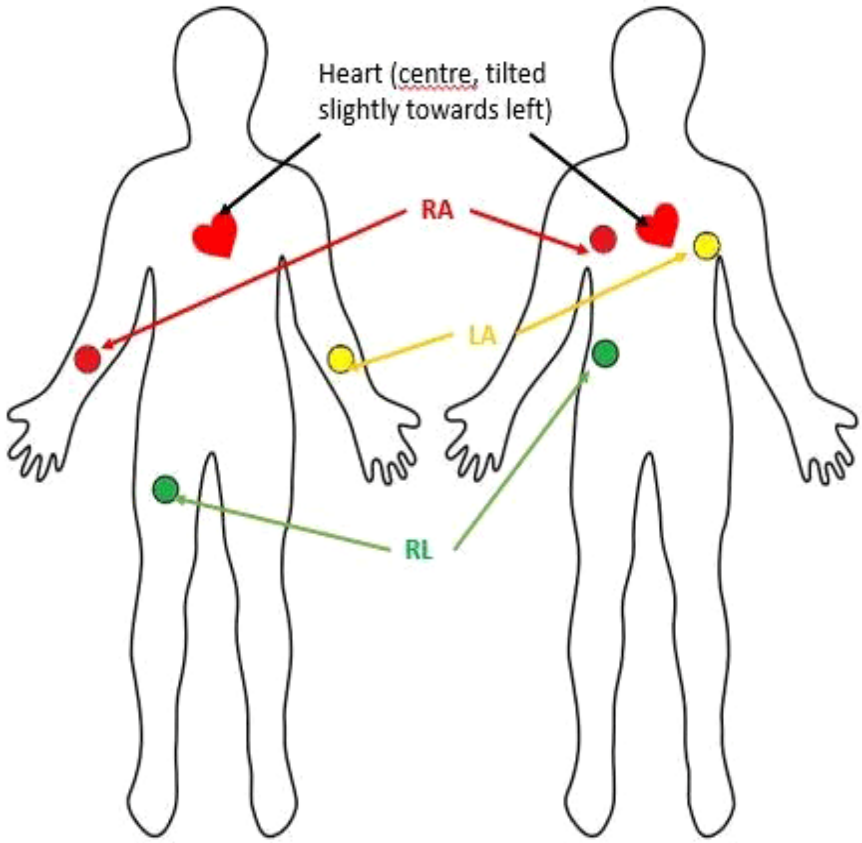


Figure.12. ADA8232 with Electrodes.

CHAPTER-5

METHODOLOGY AND WORKING

5.1 CIRCUIT

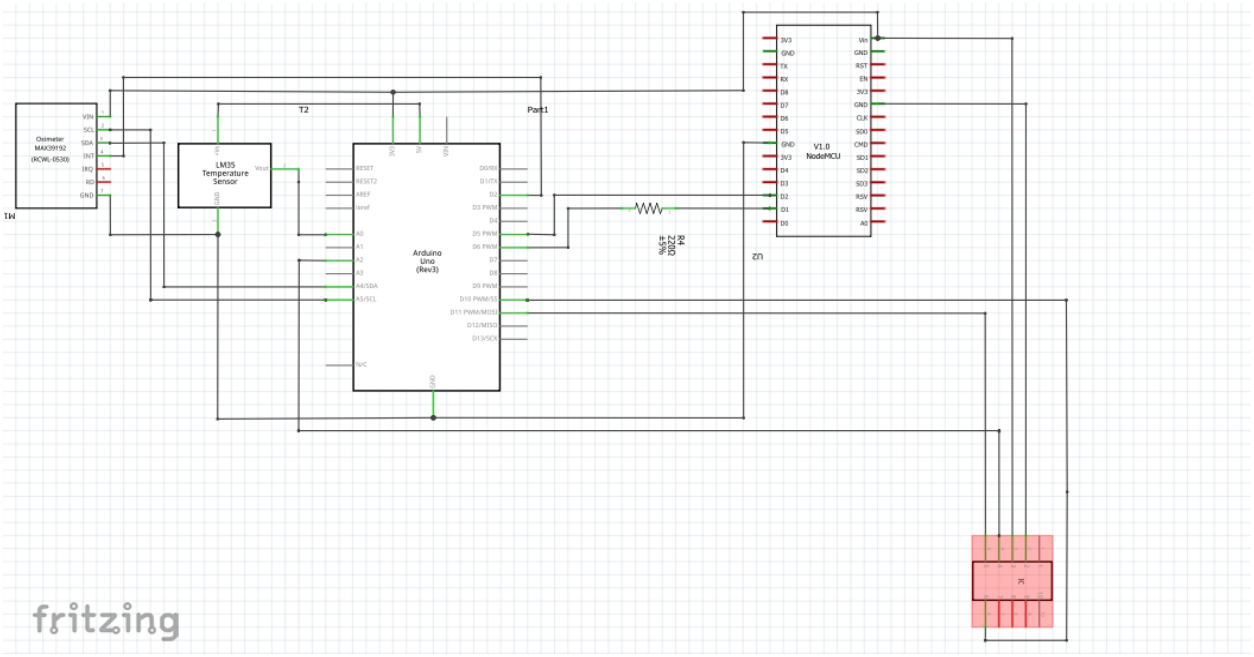


Figure. 13. Schematic Diagram of the Model.

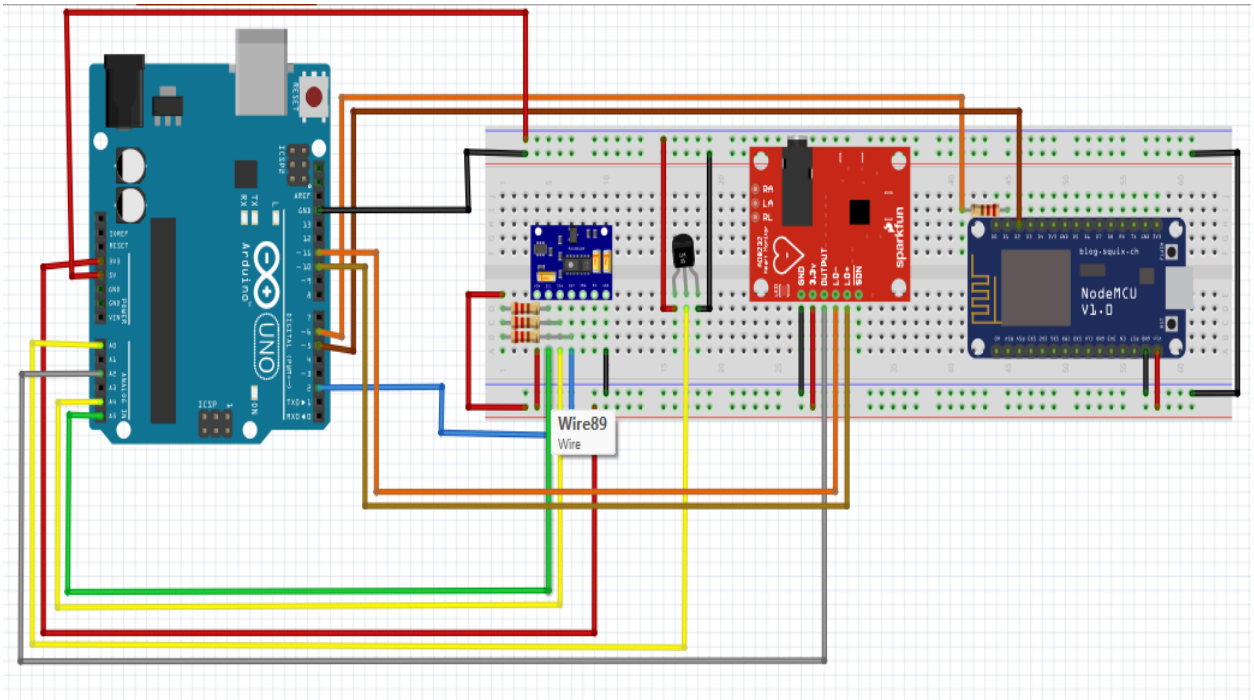


Figure. 14. Circuit Diagram of the Model.

5.2 SOFTWARE MODEL WORKING

First, we used the most used IoT software simulator tool Proteus where we get access to many IoT sensors, microcontroller boards, etc... with the help the Proteus we build our software model with components required by our system, which are available on proteus. The most important thing that we need for our model is a Microcontroller board which helps in collecting data from the different sensors like lm35, heartbeat in the proteus which helps us for providing the reading of both temperature and heartbeat the power and ground of each sensor are connected to the general power supply to provide the power for the sensors then the data signal of the both are connected lm34 data pin to the A0 analog input pin of Arduino UNO because we get an analog reading from the lm35 in terms of millivolts later we use some formulae to convert this analog value into our required format of temperature it could be Celsius or Fahrenheit. Similarly in the case of the heartbeat sensor to we would take the help of a push-button and timer from 1 to 10, then multiply the heartbeat count from the sensor by 60 which is counted when the button is pushed, and the timer is started from 1 and ends the count when the timer reaches the 10.

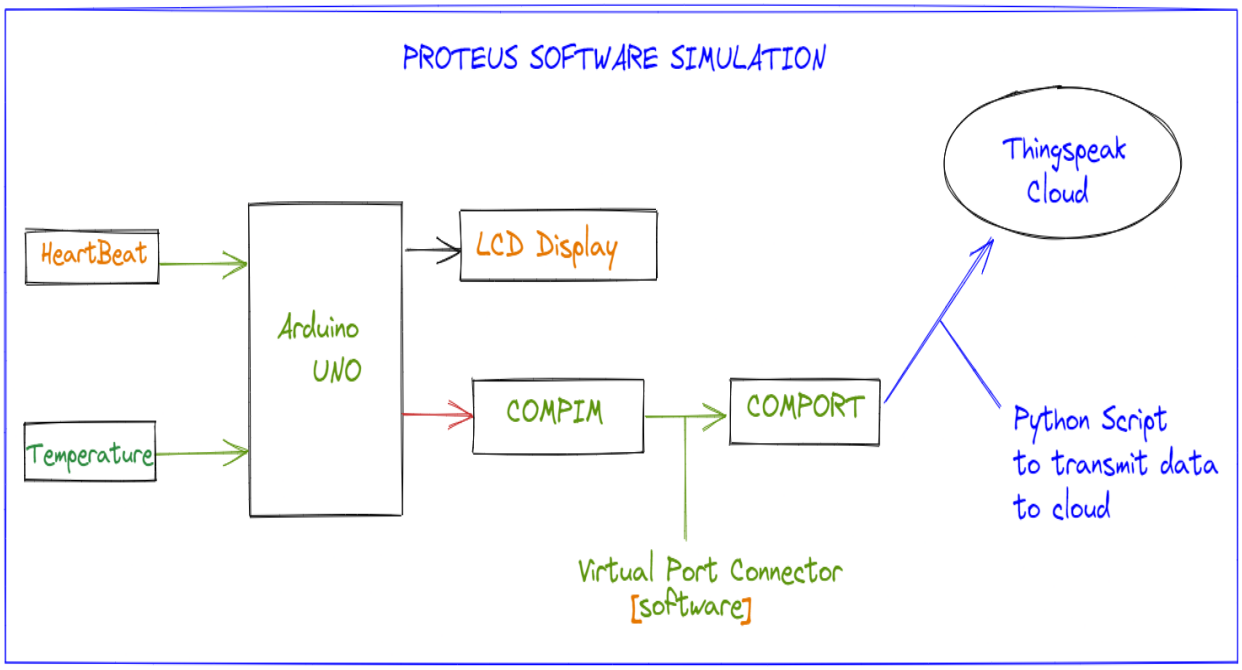


Figure. 15. The architecture of the software model.

This data from the sensor can be viewed in the proteus with the help of the LCD 20X4 display which is connected to the Arduino UNO with pins from 8 to 13 in it to the LCD required data pins (D7, D6, D5, D4), enable to 12, reset to the 13 and remaining pins to the power supply so

we can observe the reading on the LCD when we provide readings to the sensor. Later to provide this data we the cloud in the hardware model we take the help of Node MCU. But in the proteus, we have no such Wi-Fi-related libraries or modules to send the data from the proteus. So, we took the help of comp in proteus which helps us to access the comport later we will use a virtual port connector software that helps us to create a virtual port that is connected to the comport created using the comp. Then we use a Python script in the background by using its URL, timer libraries, etc…we can access the data from the virtual port COM3 with the baud rate (9600). Then divide the single data into pieces and update these values to the cloud using the writing API Keys of the thing speak cloud later we will call this function every 5 seconds for the value update to the cloud. Later we can send this data to the Android App that we have built which works in real-time and collects the data to Google Sheets etc...

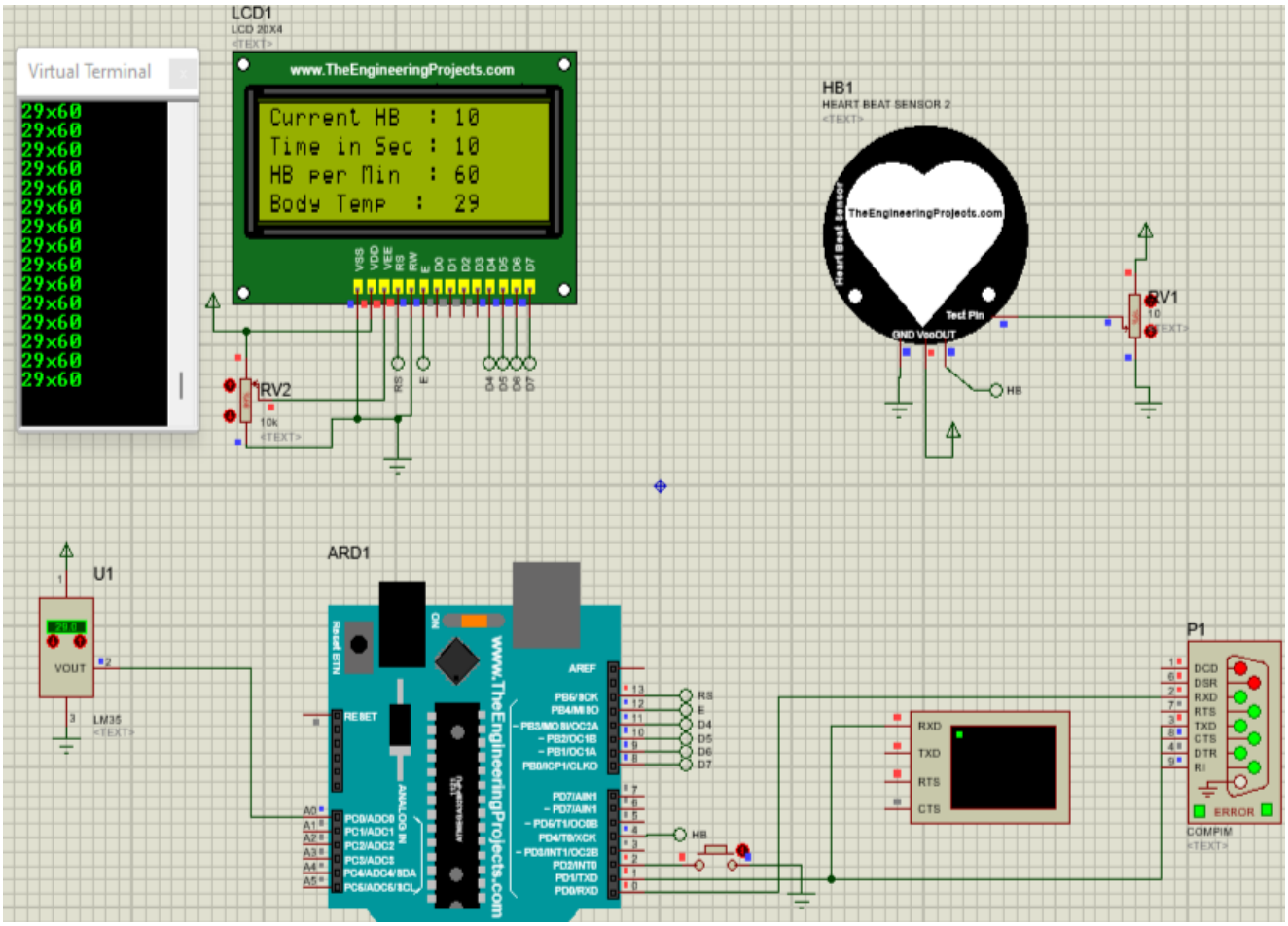


Figure. 16. Proteus software simulation model.

5.3 HARDWARE MODEL WORKING

We are using the most common sensors for collecting the data from the patient for the readings like temperature, heartbeat, SpO2, and ECG. We used LM35 to collect the temperature readings, Max30100 for collecting the data related to the heartbeat and SpO2, and then finally ECG for collecting the Electrocardiography. We have connected all the VCC and ground of each sensor to the power supply then the data pins of the sensors to the Analog input of the Microcontroller Board Arduino UNO LM35 to the A0, ADA8232 ECG sensor output data to the A2, and two output pins form the MAX30100 named SDA, SCL with A4 and A5 of Arduino UNO to collect the data from all the sensors and then form one single string which is a sentence in the programming languages where is the values are separated using the Alphabets from 'A' to 'D' [19]. Because we are sending this data to the cloud using Node MCU which is a microcontroller integrated with a Wi-Fi module that helps in sending the data to the cloud [17]. We connect the Arduino UNO to Node MCU using serial communication.

5.3.1 SERIAL COMMUNICATION

This is a process by which any two microcontroller boards can connect with the help of the Rx(receiver) and Tx(transmitter) pins of both the board in simple words. Where the Rx pin of one board is connected to the Tx pin of another board and similarly, the Tx pin of the first board is connected to the Rx pin of the second board. So that they can communicate with each other using this way. We are trying to do this same Serial communication between the Arduino UNO and Node MCU because Node MCU is a microcontroller integrated with the Wi-Fi module ESP8266, but it has a major issue of having only one Analog pin. But in our system, we need more analog pins for different sensors, so we are using an Arduino UNO which has more analog pins compared with Node MCU [7].

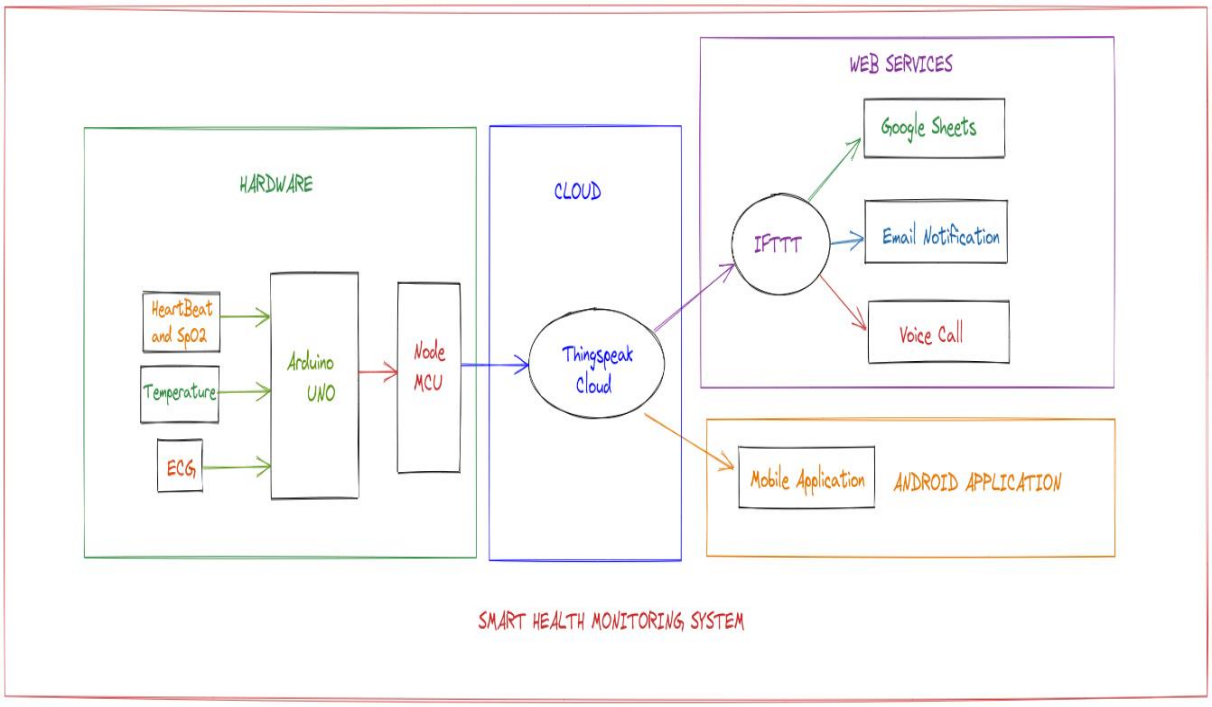


Figure. 17.Block diagram of working hardware model.

The Software Serial Library in Arduino IDE with the help of which we are using Serial Communication to send the data from the Arduino UNO to Node MCU then in it we will separate the data with help of alphabets used before in Arduino UNO and Send this data to the cloud using the thing speak library with the help of writing the data with direct function using our Writing API key and Channel Id of the thing speak cloud [4].When we compare this model with the software model we have avoided part of the LCD because there could be cases where the patient can get into tension or worry about their condition if there are any emergencies they would be overthinking the situation which can lead to any other health issues like a heart attack or high Blood Pressure etc...Instead, we have used a mobile application that helps with real-time monitoring of the reading from the patient [15].

5.3.2 MOBILE APPLICATION

We have created an Android with the help MIT app inventor provided by MIT which is a no-code android development platform where any beginner can build his or her design for both the android and IOS devices. Where we can design our model for the front, we will work with the User Interface when we design home page buttons, icons, text that can be viewed by the end-user, and for the backend, we connect the blocks which will then help us to build the logic that we can build using coding instead with the help of block to connect [7]. We have created an App that is required for our system to numerically display the values of all the sensors in real-time. This app has a home page when we start the app we can observe a vertical alignment with four horizontal alignments which has two components on each alignment one is an icon of temperature, heartbeat, SpO2 level, and ECG where all these icons themselves are individual buttons which would redirect us to the graph of values which is collected in the cloud in a graphical representation which help in some case even user can analysis his reading increment as well as decrement with the values, along with this we also have the real-time updated numerical values next to each of these icons[5]. Then we can find a check-up icon downward which determines basic conditions with an alert when some uneven values are found it would provide some advice and alert [16]. Then finally a database button redirects to the data collected with the timestamp in Google Sheets.

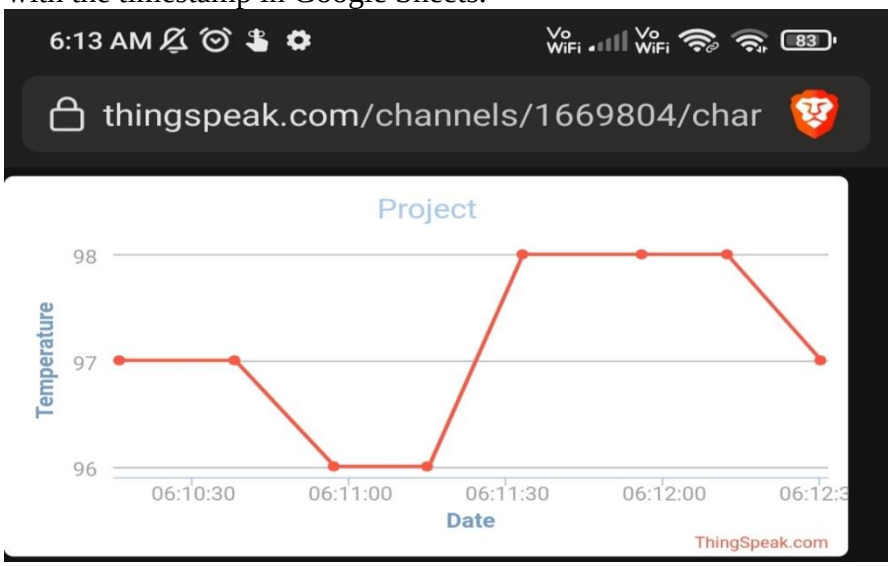


Figure. 18. Temperature Graph when tapped on the icon.

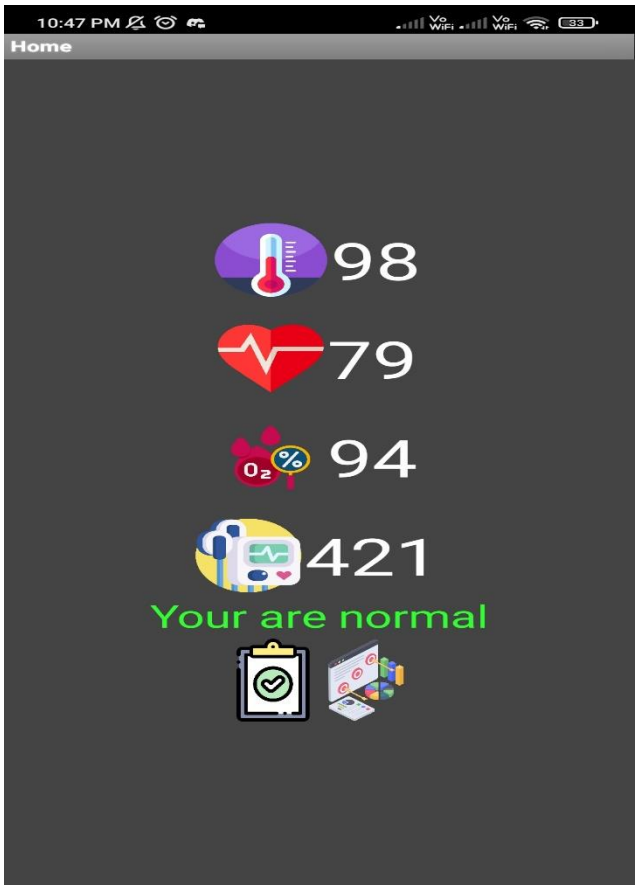


Figure. 19.Android Mobile Application.

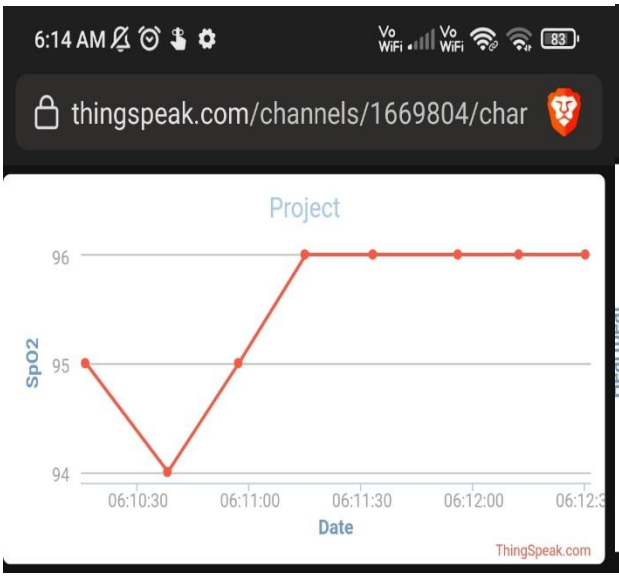


Figure. 20. SpO2 values Graph.

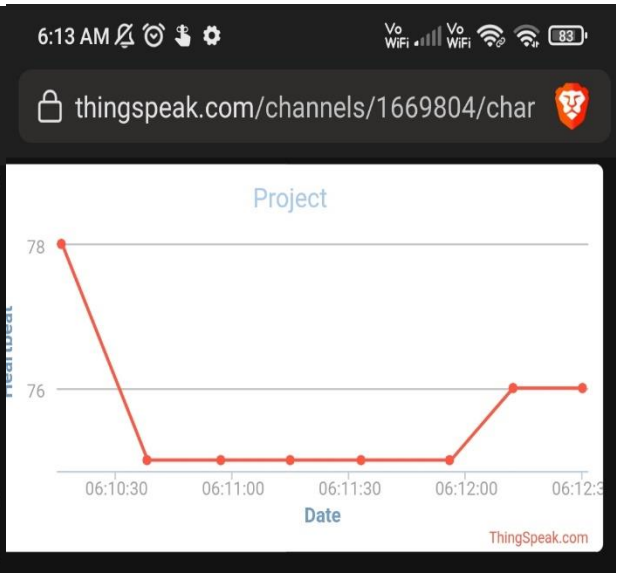


Figure. 21. Heartbeat Graph.

ECG which is Electrocardiograph a graph that indicates cardiac activity. From figure 18 we have a P wave which indicates the contraction of the atrial. Where the next part QRS Complex indicates ventricular depolarization and contraction.

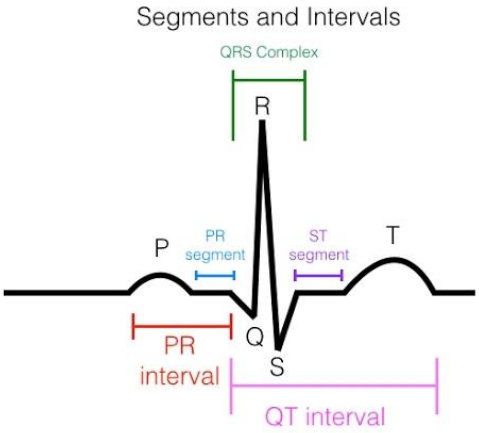


Figure. 22.ECG signal in detail.

Finally, the T wave, which is normally a little upwards waveform, represents ventricular repolarization.

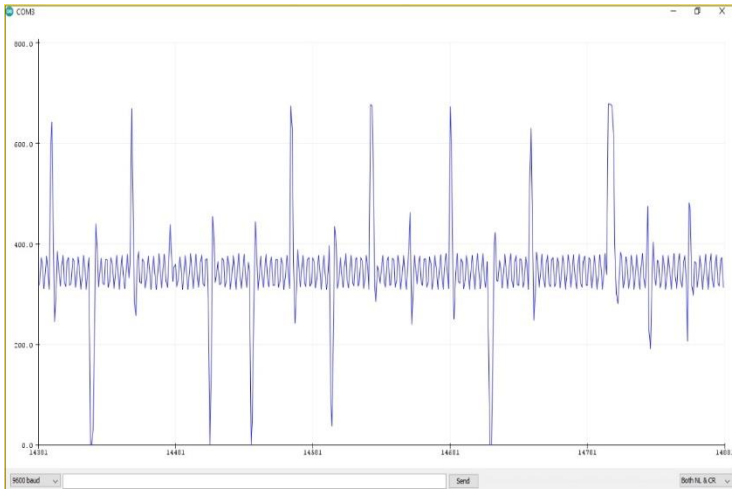


Figure. 23. ECG from the Hardware model.

5.3.3 IFTTT

IFTTT means “If This, Then That” it is a fairly trouble-free web service provider company that allows its users to trigger some of the most commonly used services like Alexa, email, phone calls, SMS, posting some content on social media sites, etc... when a response is sent to the IFTTT[24]. Which is used for webpage protocol which makes the complex process more simple and easy to use[14]. As its name indicates "If This, Then That" where the "If This" part is the response from a website or a react app or given conditions, "Then That" part is the main trigger part they are the output produced for the input response given to IFTTT[22]. It has Applets which are also known as "recipes" these are the predicates made from Triggers and Actions. It also has Ingredients that are the basic data available from a trigger.

IFTTT is used for collecting the all data from things speak and it will transfer the data to a google spreadsheet. It checks the data if there is any abnormal about the user and it will directly send a notification alert to the mail and it will send a voice message about the user's condition.

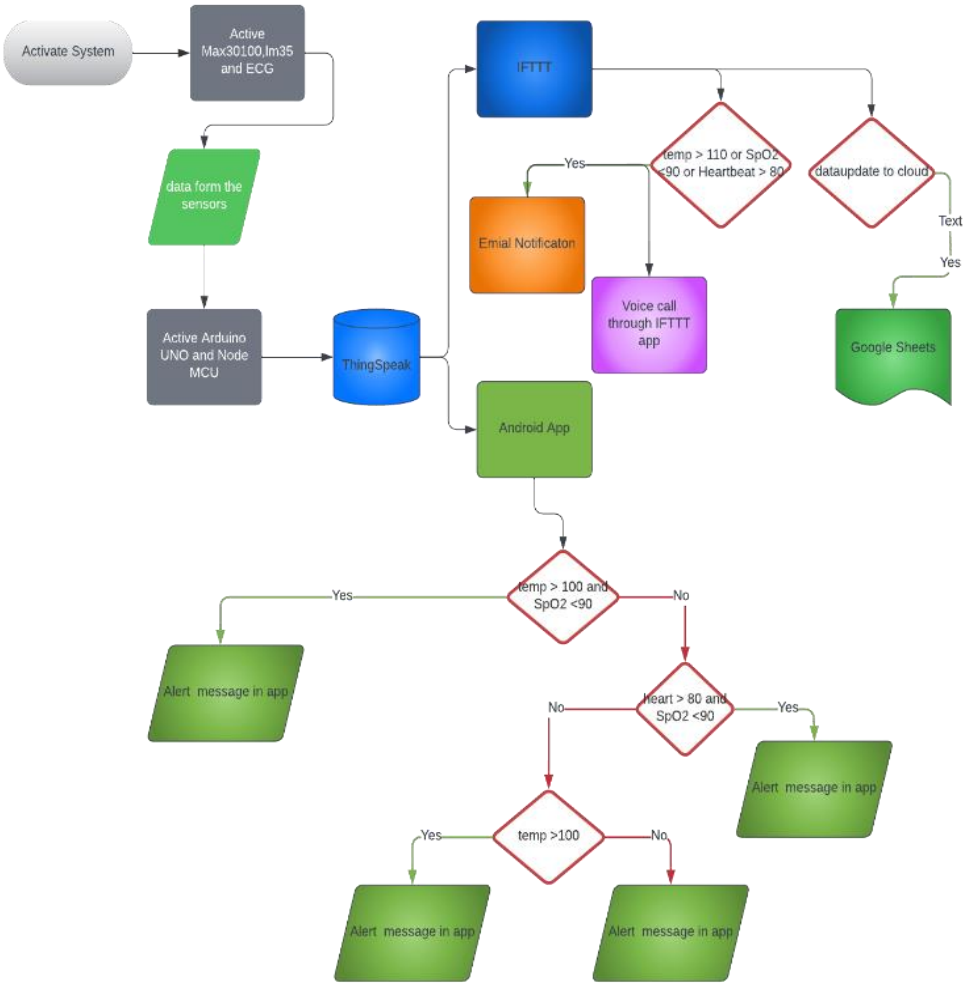


Figure. 24. Flow chart of the model

After sending the data to the thing speak cloud later using the IFTTT web services as shown in figure no we use the IFTTT for two cases from the fig-20,

Case-i

In IFTTT by using webhook with the help of web request from the think speak cloud react app by giving the conditions like temperature >100 or SpO2 <90 or Heartbeat is >80 we will consider these cases as emergencies then think HTPP in the thing speak cloud with the IFTTT webhook URL trigger with body paragraph which has values of temperature, SpO2, and heartbeat collected from the thing speak.

We also use the IFTTT for a similar sort of trigger for the voice call when the above emergency is triggered then it will send the voice call indicating a bit of advice to reach a nearby hospital along with the values of temperature, heartbeat, and SpO2.

Case-ii

We also take the help of IFTTT for collecting the new data from the think speak cloud when the new data from the hardware model from node MCU is updated to the cloud and we use a similar type of triggering a response from the thing speak cloud with the help of react app with the condition every time the data is updated to the cloud which just calls the thing HTTP Which has the body with the values then update this to the trigger which updates the data collected from the thing speak to the Google Spread Sheet[17].

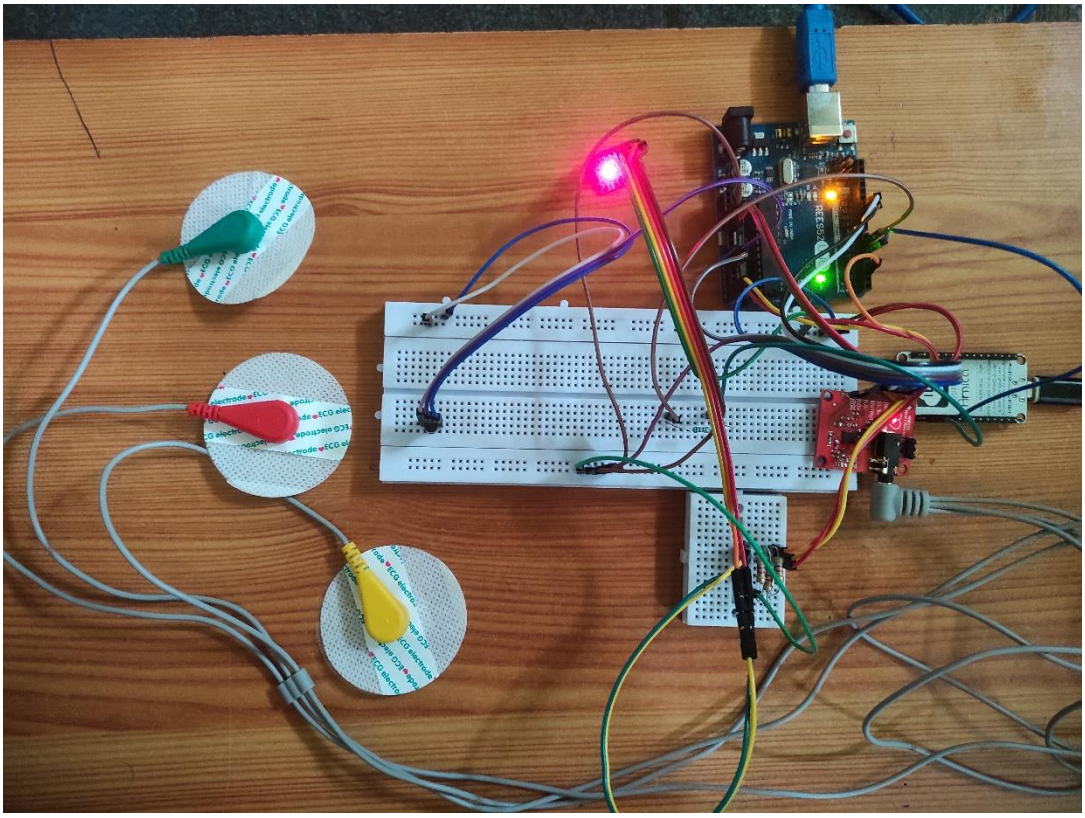


Figure. 25. Hardware Model.

Similarly, we use some of these with the android app too. In the Android app with the help of the reading API URL, we would call it to update the values of temperature, heartbeat, and SpO2 in the android application when there is an update in the values in the thing speak cloud. presenting the values below, we have the check-up button left corner these are the basic conditions.

Case(i) Temp>100 & Sp02< 90 % then in this case we update the text as “your spo2 is low, temp is high. Please consult the doctor”.

Case(ii) Heartbeat >80 bpm & Sp02< 90 % then in this case we update the text as “your Spo2 is a little low, heartbeat is fast. Please reach the hospital”.

Case(iii) Temp >100 then in this case we update the text as “your temperature is high; you have a chance to get a fever. Please reach a nearby hospital”.

Case(iv) normal then in this case we update the text as “you are normal”.

CHAPTER-6

EXPECTED OUTCOMES OF THE STUDY

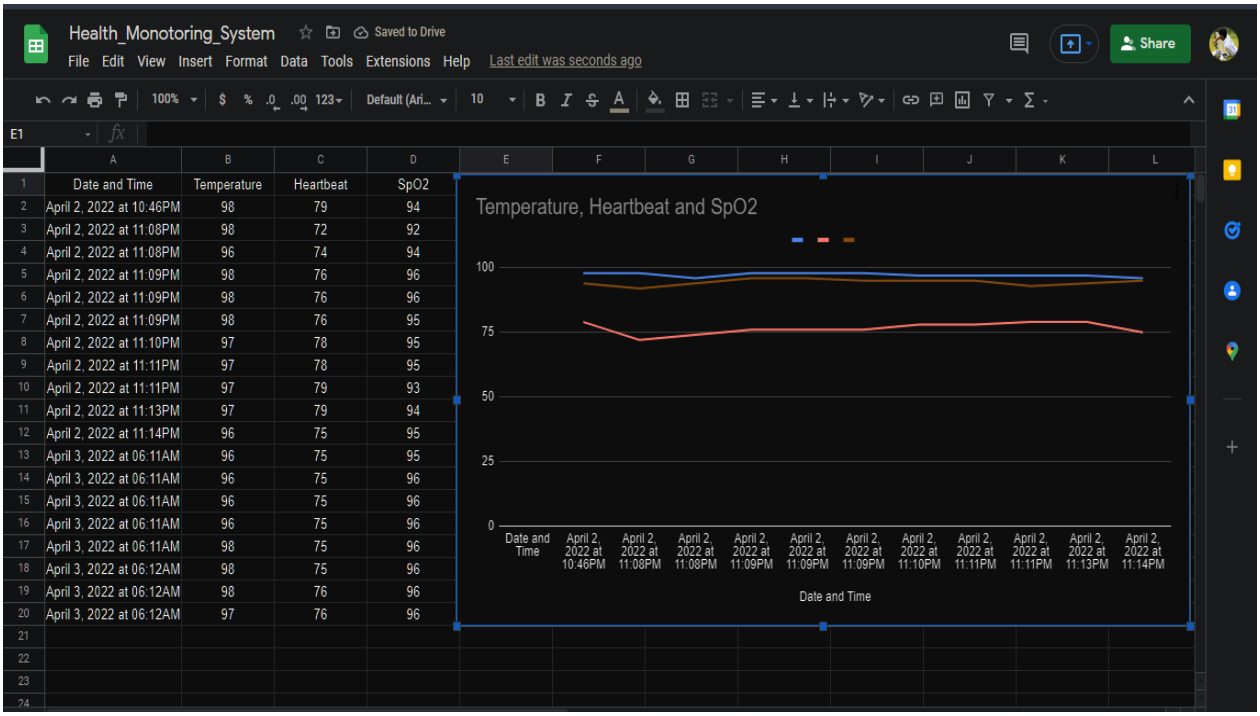
1. In this system we can easily find the symptoms by using sensors, and the situation of the patient is serious then it's sent to the cloud then to the app, and sends an alert message to medical staff.
2. The system which we can monitor remotely and the system gives the alert messages in case of any emergency.
3. By using the sensors we can easily diagnose the illness.
4. Prevent lives in case of any emergency (like change in temperature, symptoms of diseases).
5. Reduction of costs related to health care like transportation to a hospital, testing, and the doctor's charges.
6. Smart sensors which analyze the patient health conditions and data sent to the cloud.
7. If the hospital is far away from the town, this system reduces the cost.
8. This system has more value for medical purposes and medical insurance. Medical insurance companies facing more issues like cost, and costly payments to doctors.
9. We can resolve the issue at starting stage of the disease, by using the data from the cloud and the medical staff takes the measures.
10. In hospitals lack of medical staff or low no of rooms etc… at this situation system is more useful and speeds up the mediation process than the doctors.
11. By using this Smart Health Monitoring System we can easily collect regarding patient and medication in virtual mode only.
12. More overly it plays a crucial role in handicapped centers and rehabilitation centers, this will increases their comfort without traveling more distance to hospitals.
13. Like diabetes, BP patients, Asthma patients and who are facing the problems related to ECG, Oxygen levels they feel uncomfortably going to hospitals for weekly checkups, this easily check and update the persons' health into the cloud.

CHAPTER-7

RESULTS AND DISCUSSION

7.1 RESULTS

The system that we have proposed for the smart health monitoring system has two models both software and hardware models. The software model is implemented for the basic understanding of the working of the model even possible through software simulation. we can observe how the data is sent to the cloud thing speak in our case in Figure 2. Similarly, we are sending the data to the cloud in the hardware model we can observe in Figure 12. But In this system, we are mainly focused on collecting the data of all the values of temperature, SpO2, and heartbeat to a google spreadsheet which can be later used by the doctor for analysis of a disease or this google sheet which is similar to CSV which is most commonly used format for training the machine learning model with the data that we have collected from that patients for the early disease prediction with the variation in readings of temperature, SpO2, and Heartbeat, etc... We also proposed this system to notify the doctor, or guardian with the notification system through the Email system and send a voice call of the status of readings through the IFTTT App. This is the most underrated update because this can use in ICUs where the system notifies the doctor with a voice call and email when there is a sudden emergency with the patient it will notify in seconds.



	A	B	C	D
1	Date and Time	Temperature	Heartbeat	SpO2
2	April 2, 2022 at 10:46PM	98	79	94
3	April 2, 2022 at 11:08PM	98	72	92
4	April 2, 2022 at 11:08PM	96	74	94
5	April 2, 2022 at 11:09PM	98	76	96
6	April 2, 2022 at 11:09PM	98	76	96
7	April 2, 2022 at 11:09PM	98	76	95
8	April 2, 2022 at 11:10PM	97	78	95
9	April 2, 2022 at 11:11PM	97	78	95
10	April 2, 2022 at 11:11PM	97	79	93
11	April 2, 2022 at 11:13PM	97	79	94
12	April 2, 2022 at 11:14PM	96	75	95
13	April 3, 2022 at 06:11AM	96	75	95
14	April 3, 2022 at 06:11AM	96	75	96
15	April 3, 2022 at 06:11AM	96	75	96
16	April 3, 2022 at 06:11AM	96	75	96
17	April 3, 2022 at 06:11AM	98	75	96
18	April 3, 2022 at 06:12AM	98	75	96
19	April 3, 2022 at 06:12AM	98	76	96
20	April 3, 2022 at 06:12AM	97	76	96

Figure. 26. Data Collected in Google Sheet.

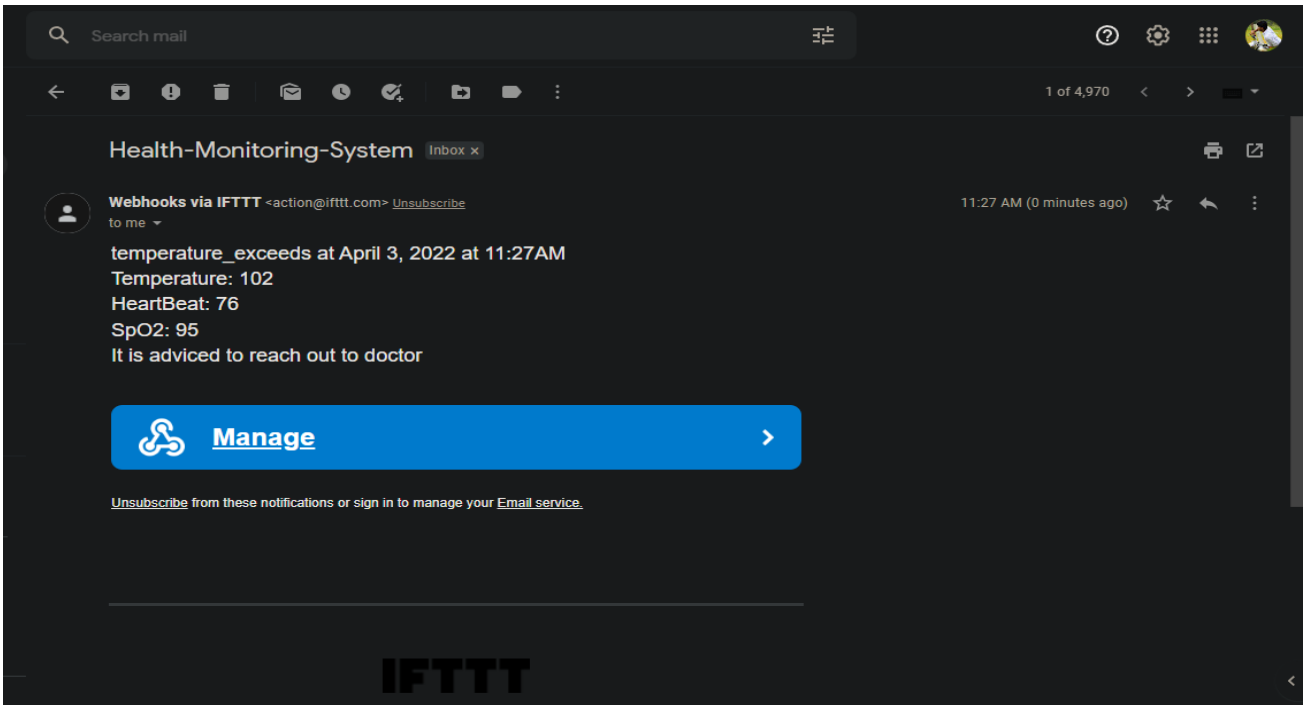


Figure. 27. Email Notification.

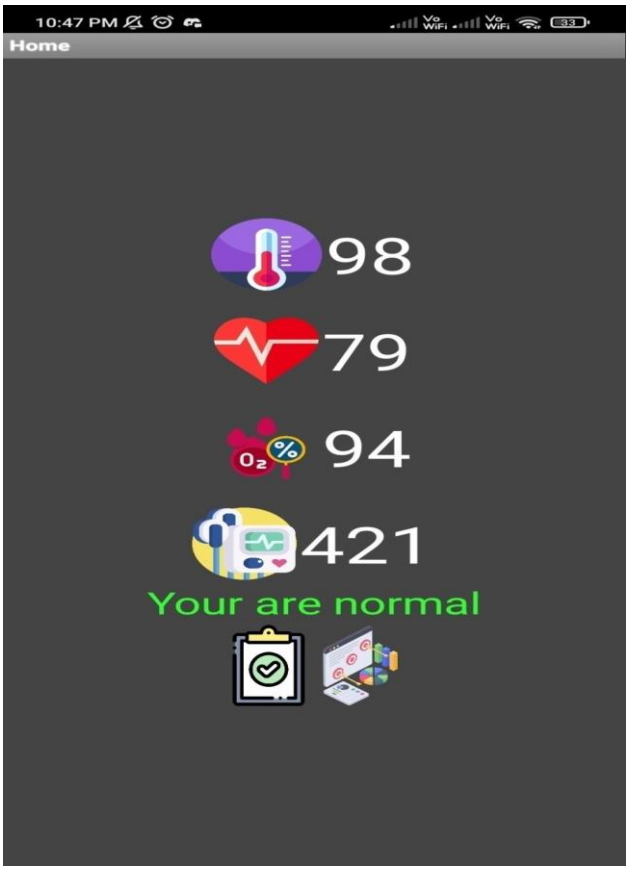


Figure. 28. Voice Call Notification.

7.2 DISCUSSION

After the implementation of the hardware system model, we have observed that the readings are updated to the Android app made with MIT App Inventor in real-time even before being displayed in the thing speak cloud sever. The notification to the IFTTT app through voice call as well as the Email is updated in real-time from the time of both the voice call from Figure 19 as well as the Email from Figure 18 at the same time. In the same instance, we have even our database google spreadsheet values updated in real-time.

As we have discussed before the model proposed can solve the majority of the problem it can help in the critical situation by helping the doctor or staff with notification as well as with a voice call with tells the doctor or the staff the reading of the patient. So in such a way, this model can be used the results can be observed from the notification sent to the email with the reported readings, through the voice call with the help of the IFTTT application, and finally sending the data to the google sheet with the timestamp which is one of the most underrated features because this feature can be very beneficial for the doctors to get the data of the particular patient at that specific time in term of google sheet which is a simple sheet that is readable by the doctors too. This can also help the professors or the students who are working in the field of healthcare for the sake of research, as well as this data, is very crucial in building some sort of machine learning models for including the Artificial Intelligence in the existing hardware models in the field of the healthcare.

CHAPTER-8

CONCLUSION AND SUMMARY OF THE REPORT

In this Project finally, we have presented both the working prototype of software simulation as well as the experimental hardware model of the smart health monitoring system in this model the components used are cost-effective which makes this accessible to all types of people who can use this in their home can save time, money, etc… this can be used in emergency purposes like recent pandemic where one can't reach the hospital at the situation for a check-up and can be used with old where we need ECG real-time monitoring with this simple setup. This can be implemented in the ICU and connect with the doctor who is in charge with the patient gets notified during immediate emergencies in real-time. In these ways, this system can save us in many situations and help us in advance with the disease. The data collected in the sheets we can mintage security because only the authorized person has the access to them. We all knew that IoT is a never-ending technology so there would always be some space in any domain for the sake of improvement. Similarly, we can make some future improvements even in this system we can take the help of trending technologies like Artificial Intelligence, Machine Learning models for predicting some diseases by training the data collected using google sheet which are the most used data sheets to train a model. we can also expand the scale of sensors with commonly used necessary reading sensors. Built the system as small size as possible that makes the system portable like the watches we carry.