VIRTUAL HEARTBEAT MONITORING SYSTEM USING INTERNET OF THINGS

A MINI PROJECT REPORT

Submitted by

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in partial fulfilment for the award of the degree of

BACHELOR OF TECHNOLOGY

in

INFORMATION TECHNOLOGY

KONGUNADU COLLEGE OF ENGINEERING AND TECHNOLOGY

(AUTONOMOUS)

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KONGUNADU COLLEGE OF ENGINEERING AND TECHNOLOGY

(AUTONOMOUS)

NAMAKKAL- TRICHY MAIN ROAD, THOTTIAM, TRICHY.

COLLEGE VISION & MISSION STATEMENT

VISION

"To become an Internationally Renowned Institution in Technical Education, Research and Development by Transforming the Students into Competent Professionals with Leadership Skills and Ethical Values."

MISSION

- Providing the Best Resources and Infrastructure.
- Creating Learner-Centric Environment and continuous Learning.
- Promoting Effective Links with Intellectuals and Industries.
- Enriching Employability and Entrepreneurial Skills.
- Adapting to Changes for Sustainable Development.

INFORMATION TECHNOLOGY

VISION:

To produce competent IT and software professionals with entrepreneurial attitudes for successful software organizations/ventures.

MISSION:

- Enrich the students' programming and computing skills through best teaching learning processes, laboratory practices and through project-based learning.
- Inculcate real world challenges, emerging technologies and endeavor the students to become entrepreneurs or make them employable.
- Inculcating moral and ethical values to serve the society and focus on students' overall development.

PROGRAM EDUCATIONAL OBJECTIVES (PEOs)

- **PEO I:** Graduates shall become IT professionals with specialization in Software Engineering, Networking, Data Mining and Cloud computing.
- **PEO II:** Graduates shall build IT solutions through analyzing, designing and developing software and firmware solutions for real-world problems and social issues.
- **PEO III:** Graduates shall have professional ethics, team spirit, life-long learning, good oral and written communication skills and adopt corporate culture, core values and leadership skills.

PROGRAM SPECIFIC OUTCOMES (PSOs)

- **PSO1: Professional skills:** Students shall understand, analyze and develop IT applications in the field of Data Mining/Analytics, Cloud Computing, Networking etc., to meet the requirements of industry and society.
- **PSO2: Competency:** Students shall qualify at the State, National and International level competitive examination for employment, higher studies and research.

PROGRAM OUTCOMES (POs)

Engineering Graduates will be able to:

1. **Engineering knowledge**: Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.
2. **Problem analysis**: Identify, formulate, review research literature, and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.
3. **Design/development of solutions**: Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmental considerations.
4. **Conduct investigations of complex problems**: Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions.
5. **Modern tool usage**: Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modeling to complex engineering activities with an understanding of the limitations.
6. **The engineer and society**: Apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal and cultural issues and the consequent responsibilities relevant to the professional engineering practice.
7. **Environment and sustainability**: Understand the impact of the professional engineering solutions in societal and environmental contexts, and demonstrate the knowledge of, and need for sustainable development.
8. **Ethics**: Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice.
9. **Individual and team work**: Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.
10. **Communication**: Communicate effectively on complex engineering activities with the engineering community and with society at large, such as, being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions.
11. **Project management and finance**: Demonstrate knowledge and understanding of the engineering and management principles and apply these to one’s own work, as a member and leader in a team, to manage projects and in multidisciplinary environments.
12. **Life-long learning**: Recognize the need for, and have the preparation and ability to engage in independent and life-long learning in the broadest context of technological change.

KONGUNADU COLLEGE OF ENGINEERING AND TECHNOLOGY (AUTONOMOUS)

BONAFIDE CERTIFICATE

Certified that this project report "**VIRTUAL HEARTBEAT MONITORING SYSTEM USING INTERNET OF THINGS"** is the bonafide work of **"GOKUL E (621320205017), PREMKUMAR S (621320205305),ANISH K (621320205007)"** who carried out the project work under my supervision.

SIGNATURE	**SIGNATURE**
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Submitted for the project work and viva-voce held on ....

INTERNAL EXAMINER **EXTERNAL EXAMINER**

ABSTRACT

The purpose of the project entitled as "**VIRTUAL HEARTBEAT MONITORING SYSTEM USING INTERNET OF THINGS**" is based on spatial features. The heartbeat sensor was initially designed to measure heartbeat rate of human body which is highly related to Bradycardia and Tachycardia. This system detects the Heartbeat of the person when the module is positioned on an appropriate location on human body and it generates a result of the heartbeat signal that to be represented by Graph format on Thinks Speak.com. Another method we used is Monitoring heart rate using an Android application and easy pulse plug-in sensor. The easy pulse plug-in sensor is placed on the user's fingertips to record heart rate data using photoplethysmography (ppg) signals. In this project, an IoT based system has been implemented which can monitoring Heart beat using ESP32 with Wi-Fi (Node MCU) which is connected to ECG module to track Heartbeat of the Human being. Programming code to be loaded to ESP32 by Arduino IDE. Using mobile hotspot to setup IP address for ESP32 with Wi-Fi. Data are sent to database from ESP32 by ISP-Routing Thus, the importance of this device evaluated through lecturers, Peoples perspectives was 90% respectively.

ACKNOWEDGEMENT

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LIST OF ABBREVIATION

ECG	Electrocardiography
ISP	Internet Service Provider
HRM	Heart Rate Monitoring
ADC	Analog to Digital Communication
BP	Blood Pressure
API	Application Programable Interface
PPG	Photoplethysmography

CHAPTER 1

INTRODUCTION

Cardiac diseases such as coronary heart disease (CAD) are increasing worldwide due to lifestyle changes, unhealthy diet, and lack of exercise. Early detection or diagnosis of such diseases is therefore important to monitor or control the overall health of a person. According to an estimate by the World Health Organization (WHO), cardiovascular diseases kill nearly seventeen million people worldwide each year, with approximately twenty million people at risk of sudden heart failure. In Singapore, around fifteen people die from cardiovascular disease every day, accounting for one in three deaths in the country. Some of these lives could be saved if an affordable healthcare system was provided at home. Therefore, at-risk patients require frequent monitoring of their cardiac health so that immediate treatment can be initiated in case of problems. Recently, it is becoming more popular for monitoring patients outside of hospitals, as patients will have lower costs, travel, and waiting time for basic health services. With advances in telecommunications technologies, sensors, and signal processing equipment, it is easier to design a home heart rate telemonitoring system to acquire, display, record, and transmit physiological data such as the electrocardiogram (ECG) and heart rate anywhere in the world. For the heart rate telemonitoring system, telemedicine has recently been used by medical personnel in hospitals to remotely monitor a patient or patients on a bicycle at home. So remote monitoring consists of all these combined components. Remote healthcare monitoring the system is a new idea that enables doctors or medical professionals. Specialists monitor patient health parameters Anytime, Anywhere, on Internet-based Medical Care devices. The heart functions as a machine that pumps blood, Below the ribcage between the two lungs. the heart is divided in two that he has two sides (left and right) with two chambers on two pages. The lower chamber is called the ventricle and the upper chamber is called the ventricle. One is the atrium. Blood is discharged through a one-way valve from the atrium to the ventricle. blood is the heart by the cooperation of the atria and ventricles. right, the ventricles contract to push blood into the lungs. get blood Oxygenated in the lungs and returns through the left atrium 4 pulmonary veins. The atrium pushes blood to the left Ventricles that pump all blood back into the body. or A full cardiac cycle lasts approximately 0.8 seconds and occurs between 60 and 100 seconds. times per minute in a normal heart. The beating of the heart Rhythmic pathways powered by electrical impulses It is responsible for the heart's guidance system. or Sinus node or SA node, also known as the natural one Pacemakers produce electrical impulses It passes through the heart in defined rhythmic patterns. Electrical impulses pass from the atria to the ventricle’s Atrioventricular node or atrioventricular node. So, the AV node is denoted as the heart's natural gatekeeper. The impulse is transmitted. The electrical impulse is then transmitted to the Purkinje fibers. Via the HIS bundles that form the ventricles Agreement. The heart is a complex organ of the body. electrical equipment Pulse, as well as heart rate, are important parameters. work of the mind. Heart rate monitoring is therefore very important for a healthy life. What is a modern heart monitoring system? Always monitor your heart and notify your doctor when an abnormal condition is detected.

The IoT Healthcare system is very popular these days and features a real-time monitoring system. heart Recently, the disease has become very common. people can have Heart failure and instant death. ECG module, global system for mobile communication (GSM) technology, using Integrated Wi-Fi module in real-time monitoring to implement the system and, pulse sensor Operational amplifiers (operational amplifiers) are used to take various data from the human body. It was a different system than theirs Presented to meet different requirements. For this reason, mainly based on how the surveillance system is designed for Application conditions.

1.1 Problem Introduction

1.1.1 Causes of weak pulse

The most common causes for a weak or absent pulse are cardiac arrest and shock. Cardiac arrest occurs when someone's heart stops beating. Shock happens when blood flow is reduced to vital organs. This causes a weak pulse, rapid heartbeat, shallow breathing, and unconsciousness. Shock can be caused by anything from dehydration, infection, or severe allergy attack to a heart attack.

1.1.2 Problem-related to Heartbeat

Most people with heart attacks experience some sort of chest pain or discomfort. But it's important to understand that chest pains don't occur in every heart attack. Chest pain is a common sign of a heart attack. People have described this sensation as feeling like an elephant is standing on its chest.

Fatigue

A heart attack can cause exhaustion due to the extra stress on your heart to try to pump while an area of blood flow is blocked. If you often feel tired or exhausted for no reason, it could be a sign that something is wrong.

1.1.3 Heart palpitations

Heart palpitations due to heart attack can create a sense of unease or anxiety, especially in women. Some people may describe heart palpitations as a sensation their heart is pounding in their neck, not just their chest.

1.2 Objective

The main objective of this work is to ensure a heartbeat monitoring (HRM) is a personal monitoring device that allows one to measure/display heart rate in real time or record the heart rate for later study. It is largely used to gather heart rate data while performing various types of physical exercise.

1) Collect the heartbeat from the human body by using of ECG module.
2) Esp32 is used to get and process the heartbeat from the ECG module.
3) Esp32 should be programmed by using of Arduino IDE.
4) The processed output data must be displayed the processed data must be displayed.

1.3 Scope of the Project

1) Recently many diseases are related to the heartbeat of the human body.
2) But all the normal people could not be able to check their heartbeat.
3) Because of this condition a new heartbeat monitoring system to be introduced to check the heartbeat in their daily life.
4) This new device makes it easier to measure the heart rate in a way.
5) It is easier to predict heart-related diseases such as Bradycardia, Tachycardia, and so on.
6) Because of predicting earlier diseases makes easier to prevent it

CHAPTER 2
LITERATURE SURVEY

2.1 Introduction

There are some papers which are based on various work carried out in literature on heartbeat monitoring using internet of things are reviewed. In this project various techniques used for Opinion mining and sentiment classification is investigated. Subsequently feature selection techniques which are critical for unstructured data classification is reviewed. The following are the some of the works on Student feedback using sentiment Analysis.

2.2 Existing Methods

1. A microcontroller based automatic heart rate counting system from fingertip Mamun AL, Ahmed N, AL Qahtani (JATIT)Journal OF Theory and Applied technology ISSN 1992-8645: In this research paper heartrate signals were collected from finger or ears using IR TX-RX (Infrared Transmitter and Receiver pair) module which was amplified in order to convert them to an observable scale. A low pass filter was used to filter inherent noise. These signals were counted by a microcontroller module (ATmega8L) and displayed on the LCD. Microcontroller is programmed with an algorithm to run the proposed heart rate counting system. The results obtained using this process when compared to those obtained from the manual test involving counting of heart rate was found satisfactory. The proposed system is applicable for family, hospital, community medical treatment, sports healthcare and other medical purposes. Also, fit for the adults and the pediatrics. However, this method in the developed system needs further investigation and need more functionality, which may be useful to consider advance in future research.

2. Heart beat Sensing and Heart Attack Detection Using internet of things: IoT Aboobacker sidheeque, Arith Kumar, K. Sathish, (IJESCE) International Journal Of Engineering Science and Computing, April 2007: In this research paper implementation of heartbeat monitoring and Heart attack detection system using Internet of things is shown. These days we saw increased number of heart disease and heart attack. The sensor is interfaced to a microcontroller that allows checking heart rate readings ad transmitting them over internet. The user may Set the level of heart beat limit. After setting these limits, the system starts monitoring and as soon as patient heart beat goes above a certain limit, the system sends an alert to the controller which then transmits this over the internet and alerts the doctors as well as concerned users. Also, the system alerts for lower heartbeats. Whenever the user logs on for monitoring, the system also displays the live heart rate of the patient. Thus, concerned patients may monitor heart rate as well get an alert of heart attack to the patient immediately from anywhere and the person can be saved on time.

3. A Heartbeat and Temperature Measuring System for Remote Health Monitoring using Wireless Body Area Network Mohammad Wajih Alam , Tanin Sultana and Mohammad Sami Alam International Journal of Bioscience and Bio-Technology Vol.8, No.1 (2016) : In this research paper, the design and development of a microcontroller based heartbeat and body temperature monitor using fingertip and temperature sensor is shown. The device involves use of optical technology to detect the flow of blood through the finger and offers the advantage of portability over conventional recording systems. Wireless body area network based remote patient monitoring systems have been presented with numerous problems including efficient data extraction and dynamic tuning of data to preserve the quality of data transmission. Evaluation of the device on real signals shows accuracy in heartbeat measurement, even under intense physical activity. This paper presents these challenges as well as solution to these problems by proposing an architecture which allows a network to be formed between the patient and doctor in order to enable remote monitoring of

patient by analyzing the data of patient. The device consists of sensors which are used to measure heartbeat as well as body temperature of a patient and it is controlled by a central unit. The readings from these sensors are further processed and sent via GSM module to a remote location where it is displayed on cell phone. The optical heartbeat sensor counts the heartbeat per minute and Temperature sensor measures the temperature from the body and both the measured data are sent to a receiving end utilizing wireless technology where the data is displayed in a cell phone for further processing and patient care. This device is shown superior in comparison to traditional systems.

4. Heartbeat Monitoring Alert via SMS 2009 IEEE Symposium on Industrial Electronics and Applications October 4-6, 2009, Kuala Lumpur, Malaysia. Warsuzarina Mat Jubadi, Siti Faridatul Aisyah Mohd Sahak Dept. of Electronics Engineering University Tun Hussein Onn Malaysia Batu Pahat, Johor, Malaysia : In this research paper, it is shown that the heart rate can be measured by monitoring one's pulse using specialized medical devices such as an electrocardiograph (ECG), portable wrist strap watch, or any other commercial heart rate monitors. Despite of its accuracy, somehow it is costly, involve many clinical settings and patient must be attended by medical experts for continuous monitoring. For a patient whom already diagnosed with fatal heart disease, their heart rate condition has to be monitored continuously. This paper proposed an alert system that able to monitor the heart beat rate condition of patient. The heart beat rate is detected using photo plethysmograph (PPG) technique. This signal is processed using PIC16F87 microcontroller to determine the heart beat rate per minute. Then, it sends SMS alert to the mobile phone of medical experts or patient’s family members, or their relatives via SMS. This will also alert the family members to quickly attend the patients.

CHAPTER 3
ANALYSIS

3.1 Existing system

Electrocardiogram (ECG), a non-stationary signal, is extensively used to measure the rate and regularity of heartbeats. Comparison of overall ECG waveform pattern and shape enables doctors to diagnose possible diseases. Currently there is computer-based analysis which employs certain signal processing to diagnose a patient based on ECG recording. Noise severely limits the utility of the recorded ECG and thus needs to be removed for better clinical evaluation. ECG feature extraction is also required because it plays a significant role in diagnosing most of the cardiac diseases. One cardiac cycle in an ECG signal consists of the P-QRS-T waves. The feature extraction scheme determines the amplitudes and intervals in the ECG signal or any other features of it for subsequent analysis. Recently, numerous research and techniques have been developed for analyzing the ECG signal. This proposed paper discusses various techniques and transformations proposed earlier in literature for feature extraction and analysis of ECG signals and makes comparison among them.

3.2 Proposed system

The Heart Rate Monitoring system is developed using IOT technology with an objective of detecting the heartbeat of the patient in order to monitor the risk of heart attack and also the regular checkup. Body health monitoring is very important to us to make sure our health is in excellent condition. In this project we describe the design of low-cost heart rate monitoring device from fingertips based on the Bluetooth technology. The entire system is comprised of several parts such as the

Heart Rate module, Android application, ESP32 and Thinkspeak.com. The Heart Rate (HR) module picks up the heart rate signal by a noninvasive technique (Photoplethysmography) from the subject (patients) and sends it (signal) wirelessly to computer or android application using Bluetooth module. This system can be embraced and combined as a part of the telemedicine constituent. The data received from heart rate module can be saved and viewed for further medical usage. The result from this device prototype can be utilized for various clinical investigations, indeed these Bluetooth's signal can be transmitted to Android devices.

3.3 Feasibility study

The feasibility of the project is analyzed in this phase and business proposal is put forth with a very general plan for the project and some cost estimates. During system analysis the feasibility study of the proposed system is to be carried out. This is to ensure that the proposed system is not a burden to the company. For feasibility analysis, some understanding of the major requirements for the system is essential.

3.3.1 Economic Feasibility

This study is carried out to check the economic impact will have on the system will haveon the organization. The amount of fund that the company can pour into the research and development of the system is limited. The expenditures must be justified. Thus, the developed system as well within the budget and this was achieved because most of the technologies used are freely available. Only the customized products have to be purchased.

3.3.2 Technical Feasibility

This study is carried out to check the technical feasibility, that is, the technical requirements of the system. Any system developed must not have a high demand on the available technical resources. This will lead to high demands being placed on the client. The developed system must have a modest requirement, as only minimal or null changes for the implementing this system.

3.3.3 Operational Feasibility

The aspect of study is to check the level of acceptance of the system by the user. This includesthe process of training the user to use the system efficiently. The user must not feel threatened by the system, instead must accept it as a necessity. The level of acceptance by the users solely depends on themethods that are employed to educate the user about the system and to make him familiar with it. His level of confidence must be raised so that he is also able to make some constructive criticism, which is welcomed, as he is the final user of the system.

CHAPTER 4
REQUIREMENTS

4.1 Functional Requirements

The functional requirements of the system are to the implement the solution for finding the train details and route information in the large existing rail system.

- **Input / Output**

The user selects the train type and enters the source and destination codes, which finds the train details and route information.

- **Processing**

The information regarding train details is retrieved from the database.

- **Storage Requirements**

The information will be retrieved from the database.

- **Control Requirements**

Alerts when any errors are there and when any of the field is not selected. The IoT Healthcare system is very popular these days and features a real-time monitoring system. heart Recently, the disease has become very common. people can have Heart failure and instant death. ECG module, global system for mobile communication (GSM) technology, using Integrated Wi-Fi module in real-time monitoring to implement the system and, pulse sensor Operational amplifiers (operational amplifiers) are used to take various data from the human body. It was a different system than theirs Presented to meet different requirements. For this reason, mainly based on how the surveillance system is designed Application conditions.

4.2 Hardware requirements

- Android Device
- ESP32
- Bread Board
- Jumper Wires
- Pulse oximeter or ECG

Android Device

Android is a mobile operating system based on a modified version of the Linux kernel and other open-source software, designed primarily for touchscreen mobile devices such as smartphones and tablets.

ESP32

ESP32 is a highly-integrated solution for Wi-Fi-and-Bluetooth IoT applications, with around 20 external components. ESP32 integrates an antenna switch, RF balun, power amplifier, low-noise receive amplifier, filters, and power management modules.

Breadboard

A breadboard is a solderless device for temporary prototype with electronics and test circuit designs. Most electronic components in electronic circuits can be interconnected by inserting their leads or terminals into the holes and then making connections through wires where appropriate.

Jumper Wires

Jumper wires are used to connect two points in a circuit. All Electronics stocks jumper wire in a variety of lengths and assortments. Frequently used with breadboards and other prototyping tools in order to make it easy to change a circuit as needed.

Pulse oximeter

A pulse oximeter is a device that is usually placed on a fingertip. It uses light beams to estimate the oxygen saturation of the blood and the pulse rate. Oxygen saturation gives information about the amount of oxygen carried in the blood.

ECG module

The AD8232 ECG Module is a cost-effective board used to measure the electrical activity of the heart. This electrical activity can be charted as an ECG or Electrocardiogram and output as an analog reading.

4.3 Software requirements

Software: Arduino IDE

Front end: Embedded C Language

Back end: Thinkspeak.com

Software specification

Arduino IDE

Arduino IDE is a software tool in an open-source environment where we can write a program code and upload it on to UNO board such as Arduino and ESP32 and so. It runs on platforms like windows, Mac OS and Linux OS. Is the required software environment to program the Arduino by writing a code and upload it to microcontroller board. It also outputs the results for analysis using both serial monitor and serial plotter.

Embedded C Language

Embedded C is an extension of C language and it is used for developing micro-controller-based applications. The extensions in the Embedded C language from normal C Programming Language are the I/O Hardware Addressing, fixed-point arithmetic operations, accessing address spaces, etc.

Thinkspeak.com

Think Speak is an IoT analytics cloud platform service that allows you to aggregate, visualize and analyze live data streams in the cloud.

CHAPTER 5

WORKING PRINCIPLE

In this system we use the ECG module or pulse oximeter with ESP32 and bread board, the pulse sensor is placed on the finger and it measures the heart rate and then sends the heart rate to android mobile application via Bluetooth. Early recognition of the disease is very vital in preventing more complications in the future.

A person's heartbeat is the sound of the valves in his/her heart contracting or expanding as they force blood from one region to another. The number of times the heart beats per minute (BPM), is the heartbeat rate and the beat of the heart that can be felt in any artery that lies close to the skin is the pulse. Heart Beat can be measured based on optical power variation as light is scattered or absorbed during its path through the blood as the heartbeat changes.

The heartbeat sensor is based on the principle of photoplethysmography. It measures the change in volume of blood through any organ of the body which causes a change in the light intensity through that organ (avascular region). In the case of applications where the heart pulse rate is to be monitored, the timing of the pulses is more important. The flow of blood volume is decided by the rate of heart pulses and since light is absorbed by the blood, the signal pulses are equivalent to the heartbeat pulses.

There are two types of photoplethysmography:

Transmission: Light emitted from the light-emitting device is transmitted through any vascular region of the body like earlobe and received by the detector.

Reflection: Light emitted from the light-emitting device is reflected by the regions.

The basic heartbeat sensor consists of a light-emitting diode and a detector like a light detecting resistor or a photodiode. The heartbeat pulses cause a variation in the flow of blood to different regions of the body. When tissue is illuminated with the light source, i.e., light emitted by the led, it either reflects (a finger tissue) or transmits the light (earlobe). Some of the light is absorbed by the blood and the transmitted or the reflected light is received by the light detector. The amount of light absorbed depends on the blood volume in that tissue. The detector output is in the form of an electrical signal and is proportional to the heartbeat rate. This signal is a DC signal relating to the tissues and the blood volume and the AC component synchronous with the heartbeat and caused by pulsatile changes in arterial blood volume is superimposed on the DC signal. Thus, the major requirement is to isolate that AC component as it is of prime importance.

To achieve the task of getting the AC signal, the output from the detector is first filtered using a 2-stage HP-LP circuit and is then converted to digital pulses using a comparator circuit or using simple ADC. The digital pulses are given to a microcontroller for calculating the heartbeat rate, given by the formula BPM (Beats per minute) = 60*. where F is Pulse frequency.

There are three cases in which the heart rate is displayed in Figure 6.3:

Low Pulse Rate:

The low pulse rate is displayed when the heart rate per BPM (Beats per minute) is >40 and <60. The low pulse rate may lead to medical complications this indicates that the patient needs the doctor’s help (ex: Low BP)

Normal Pulse Rate:

The normal pulse rate range is between >60 and <100 which indicates that the patient has the normal range pulse rate with no complications.

High Pulse Rate:

The high pulse rate is between >100 and <150 which indicates the patient has a high pulse range that could result in the heart-related diseases (ex: High Blood Pressure).

CHAPTER 6

DESIGN

6.1 Introduction to prototype

Proposed model

Here are the Figure 6.1 block diagrams and Figure 6.2 Circuit diagram related to the proposed model of the system.

Architecture diagram

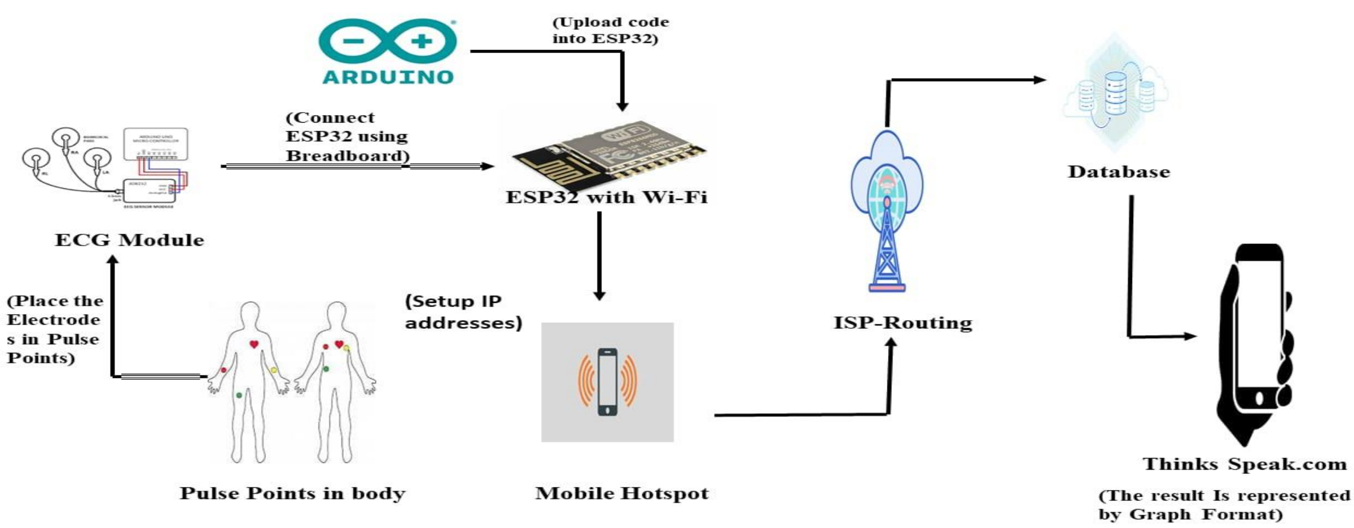


Figure 6.1

ECG module sends the data to the ESP32 and routes to the mobile devices. In this workflow is represented in the Figure 6.1

6.2 CIRCUIT DIAGRAM

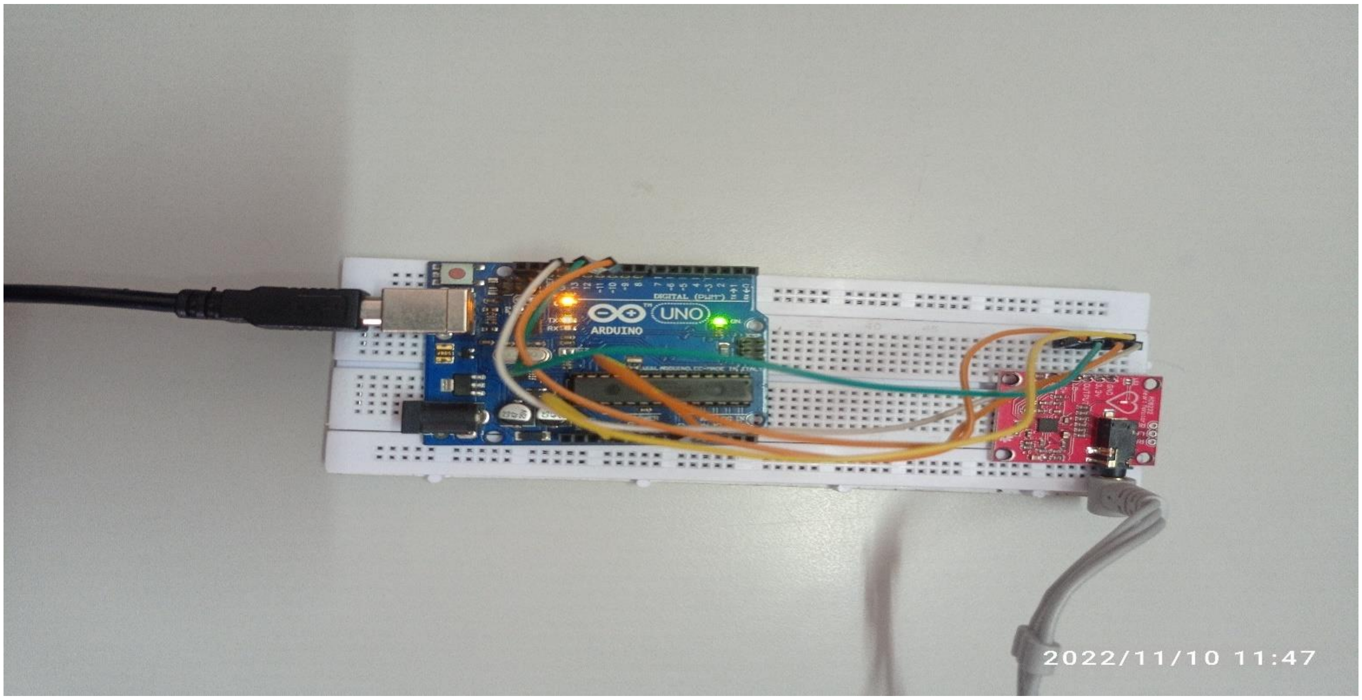


Figure 6.2

6.3 CONNECTIONS

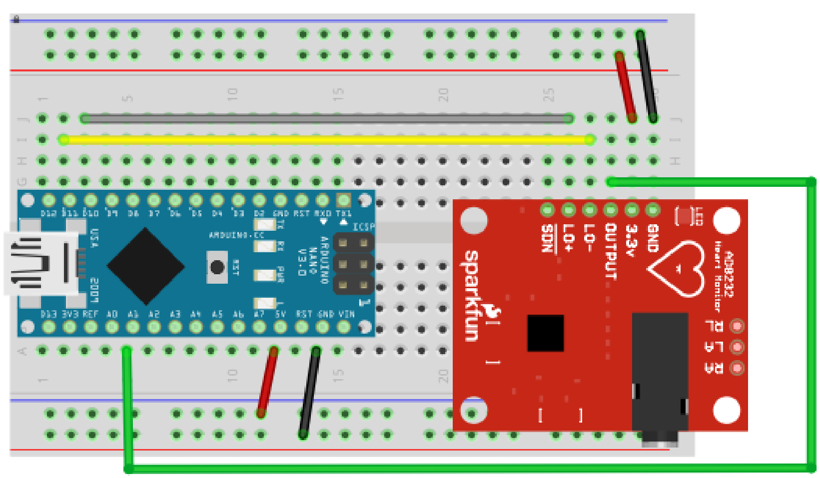


Figure 6.3

Connection among the components is shown in the Figure 6.2 and Figure 6.3. It represent the Realtime and imaginary circuit connection.

7.1 SYSTEM FLOW

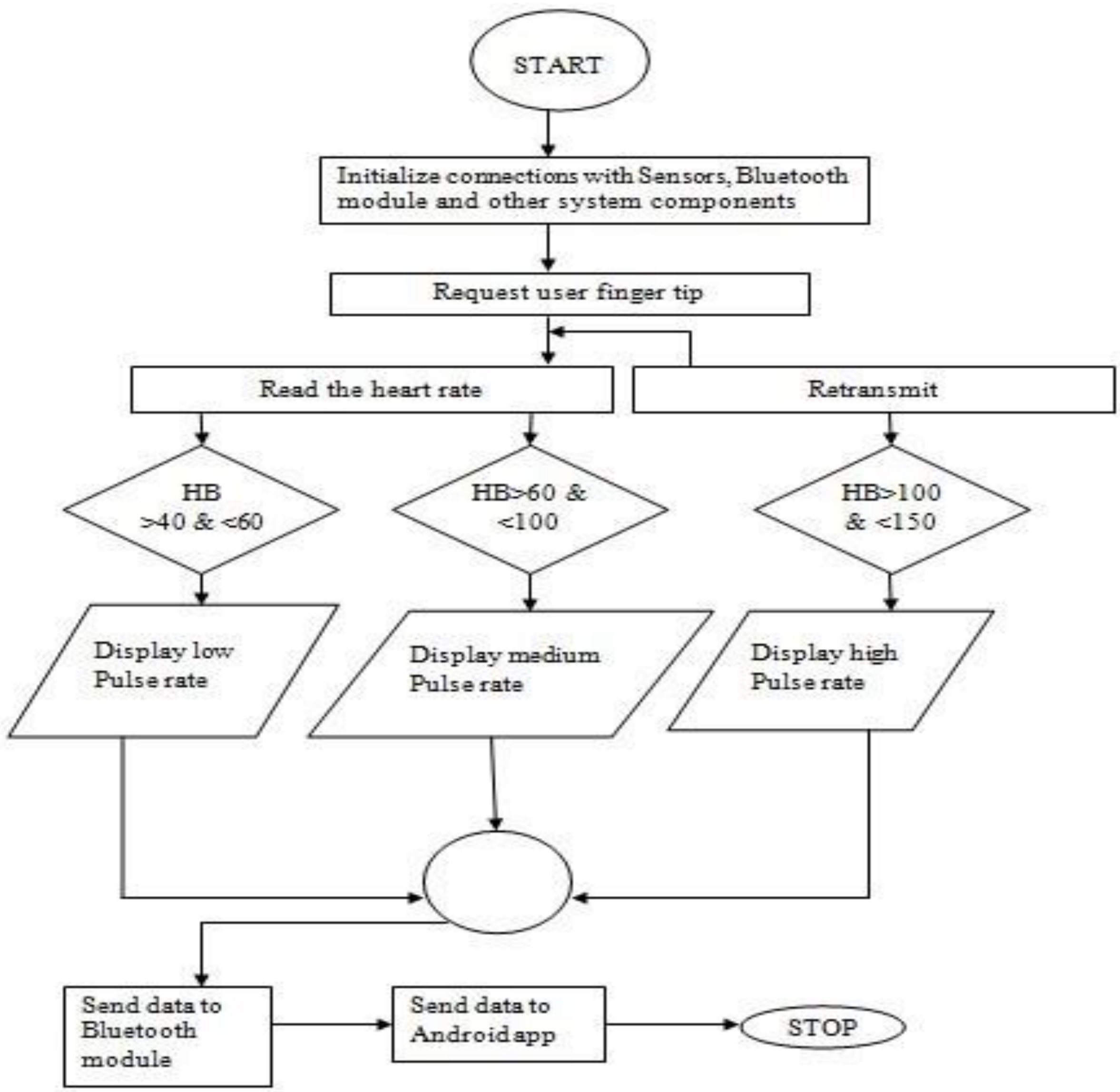
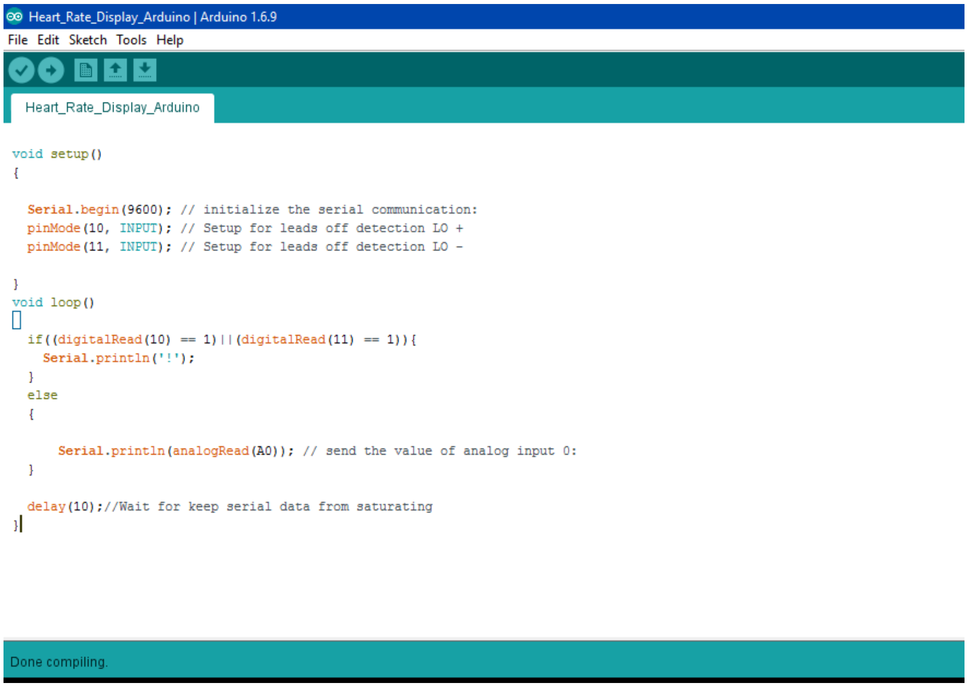


Figure 7.1

Arduino IDE code

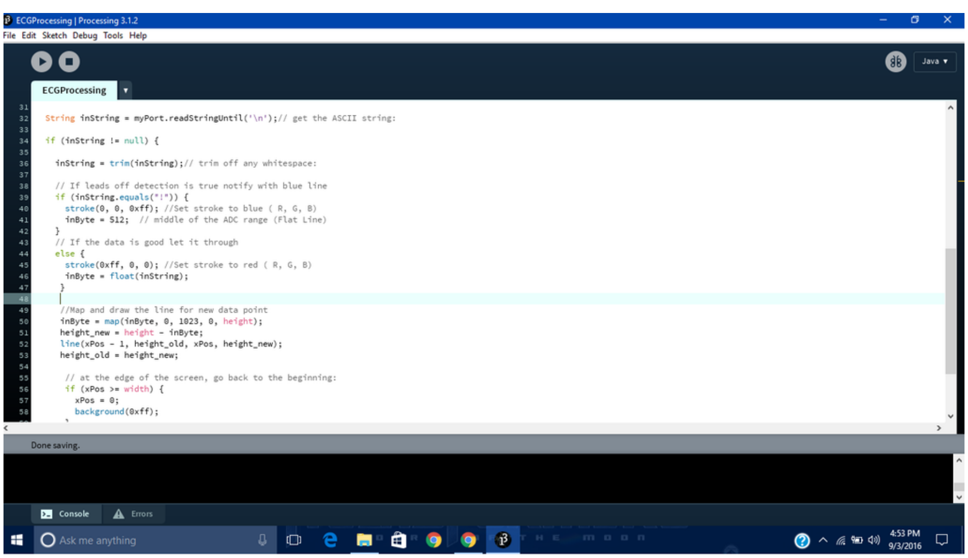


```
void setup()
{

  Serial.begin(9600); // initialize the serial communication:
  pinMode(10, INPUT); // Setup for leads off detection LO +
  pinMode(11, INPUT); // Setup for leads off detection LO -

}
void loop()
{
  if((digitalRead(10) == 1)||(digitalRead(11) == 1)){
    Serial.println('!');
  }
  else
  {

      Serial.println(analogRead(A0)); // send the value of analog input 0:
  }

  delay(10);//Wait for keep serial data from saturating
}
```

Figure 7.2

In the above Figure 7.2 represents the code for

PROCESSING PROGRAM



```
String inString = myPort.readStringUntil('\n');// get the ASCII string:

if (inString != null) {

  inString = trim(inString);// trim off any whitespace:

  // If leads off detection is true notify with blue line
  if (inString.equals("!")) {
    stroke(0, 0, 0xff); //Set stroke to blue ( R, G, B)
    inByte = 512;  // middle of the ADC range (Flat Line)
  }
  // If the data is good let it through
  else {
    stroke(0xff, 0, 0); //Set stroke to red ( R, G, B)
    inByte = float(inString);
   }

   //Map and draw the line for new data point
   inByte = map(inByte, 0, 1023, 0, height);
   height_new = height - inByte;
   line(xPos - 1, height_old, xPos, height_new);
   height_old = height_new;

    // at the edge of the screen, go back to the beginning:
    if (xPos >= width) {
      xPos = 0;
      background(0xff);
```

Figure 7.3

PROCESSED OUTPUT

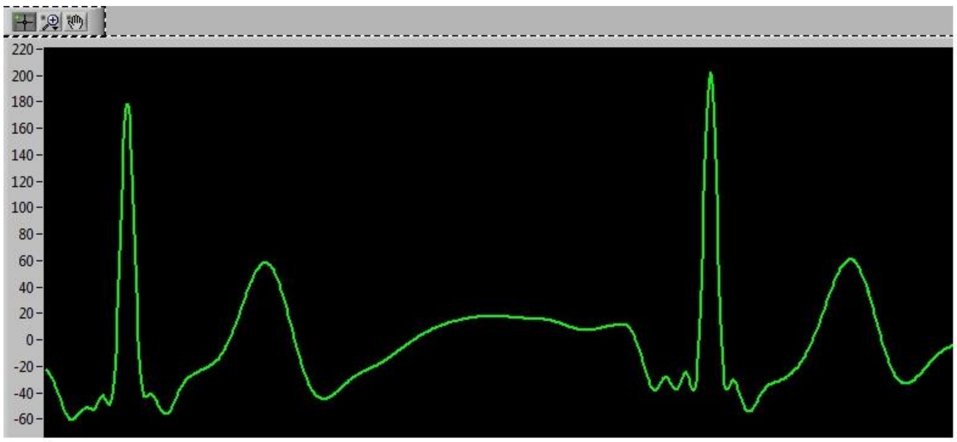


Figure 7.4

How to Set Up Thing Speak for Remote Monitoring

Setting up the Thing Speak IoT platform is very easy. First, you have to create a free account on Thinkspeak.com website. Like Figure 7.5, Figure 7.6

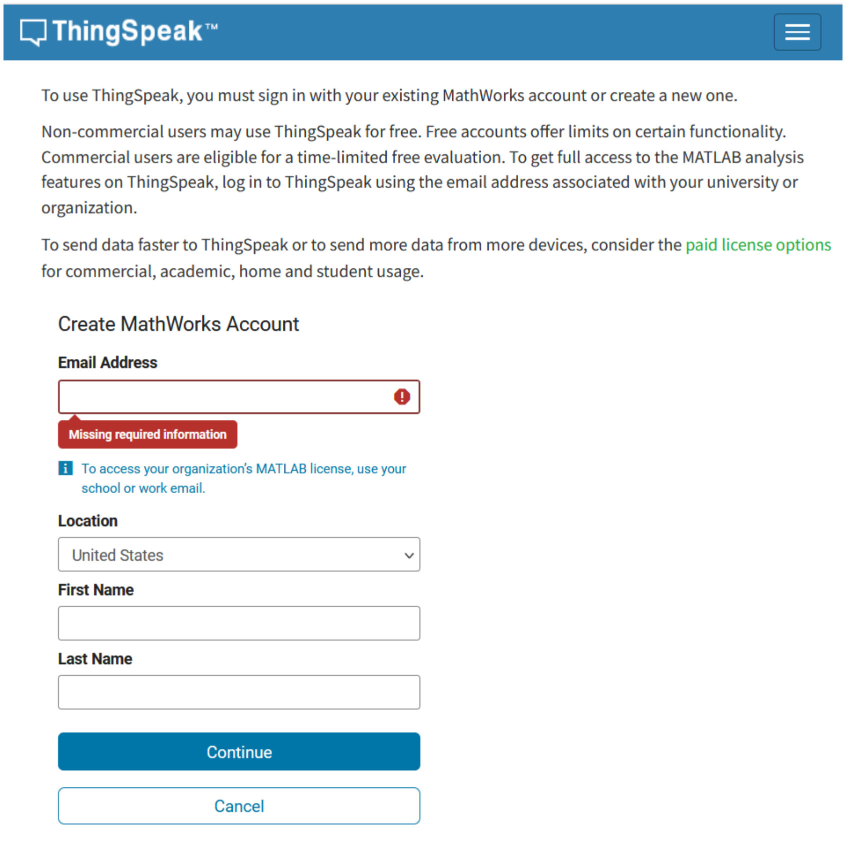


Figure 7.5

Once you have signed up, create a new channel. shown in the Figure 7.5

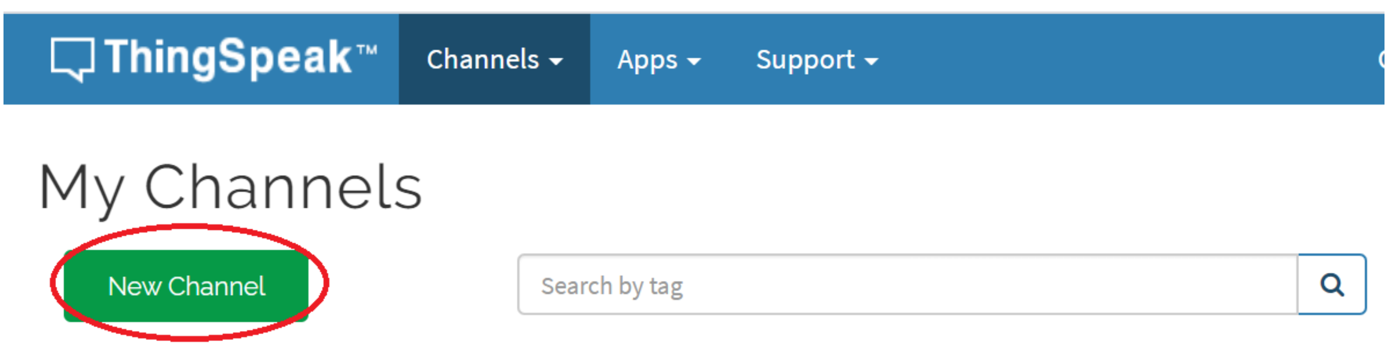


Figure 7.6

Then, create a field to save the beats per minute (BPM) value of the heart rate.

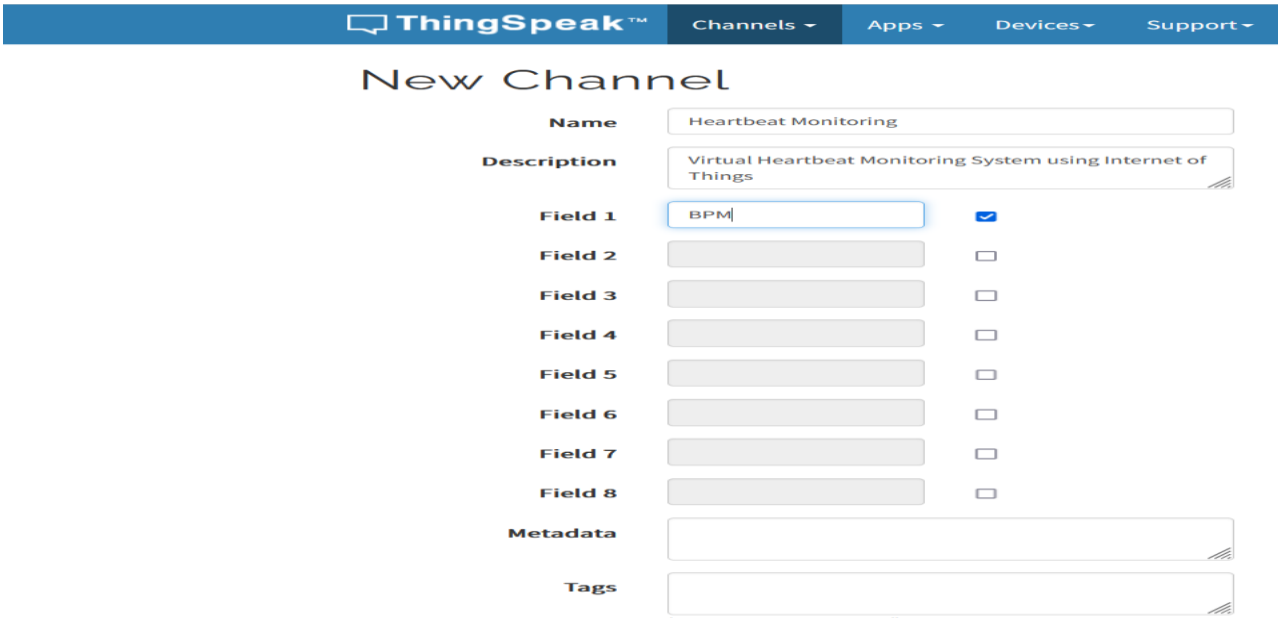


Figure 7.7

Once you create your channel, Thing Speak directs you to a webpage with a customizable graph, like the one shown in Figure 7.7.

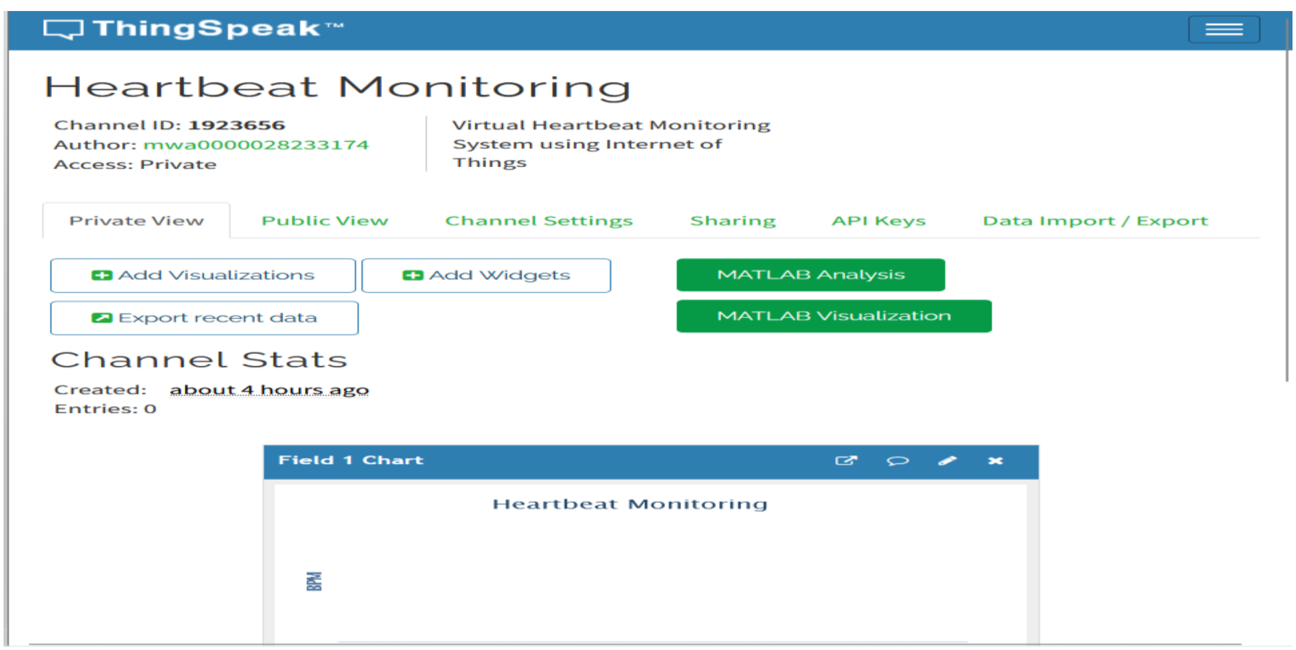


Figure 7.8

Finally, click on the API Keys tab shown in Figure 7.8.

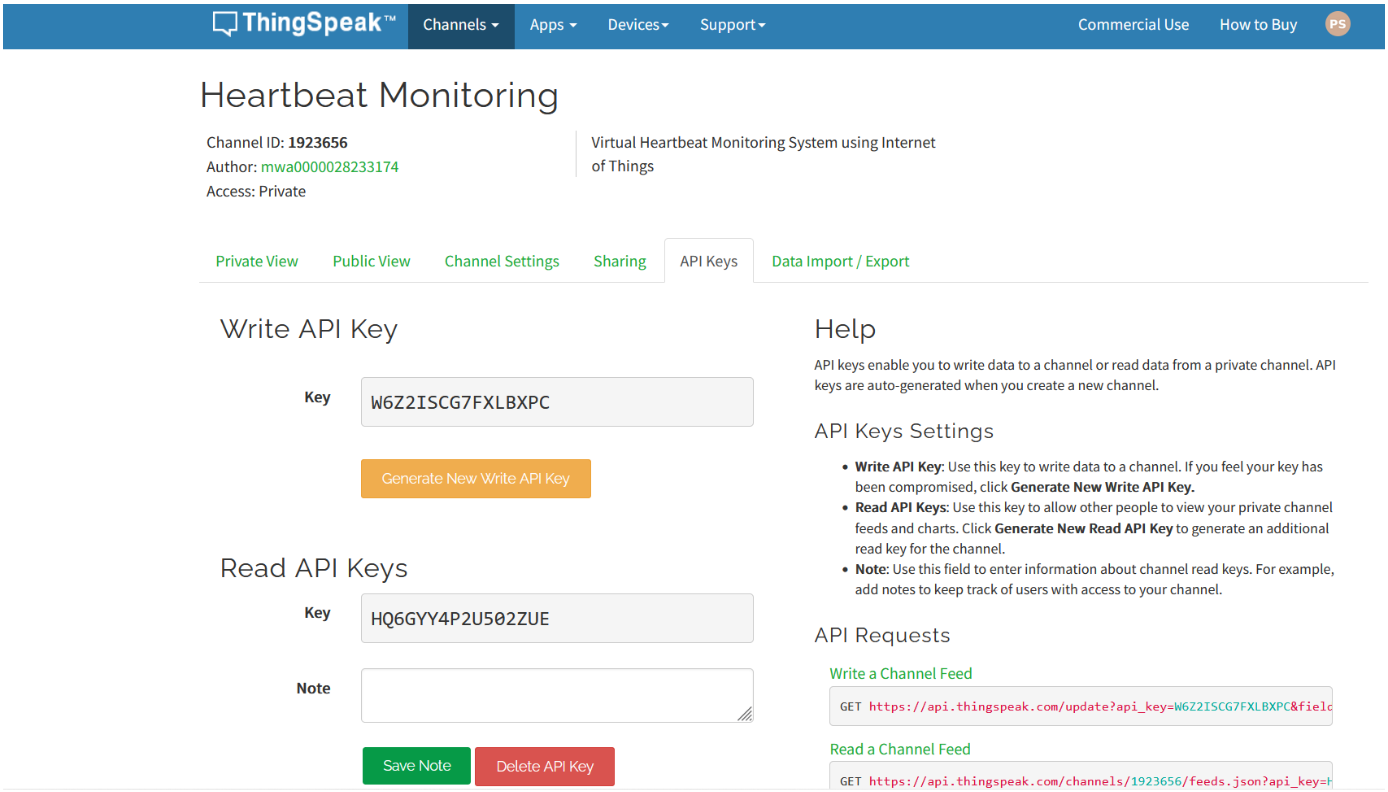


Figure 7.9

The Figure 7.9 Describes

- The Write API Key is useful when we attempt to write data or send data from the ESP32.
- The Read API Keys can be used to monitor data from a remote device.

Think to speak Output Demo

Once you successfully set up the project, you can observe the heart rate pulses from the serial plotter. The Thing Speak graph updates the BPM value every 20 seconds.

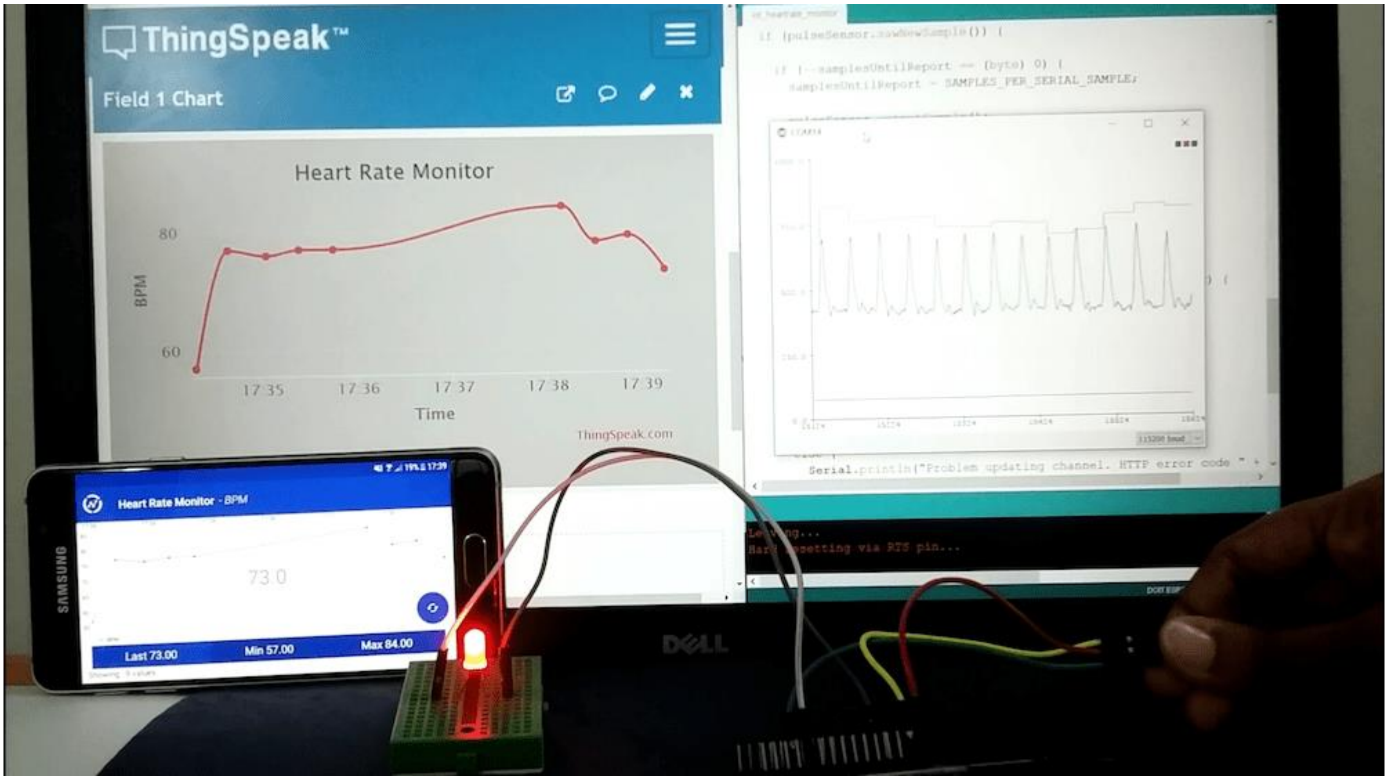


Figure 7.10

Download and install the Thinks Speak viewer App to monitor the graph from your mobile device. For a successful installation, make sure to have your channel ID and read API handy.

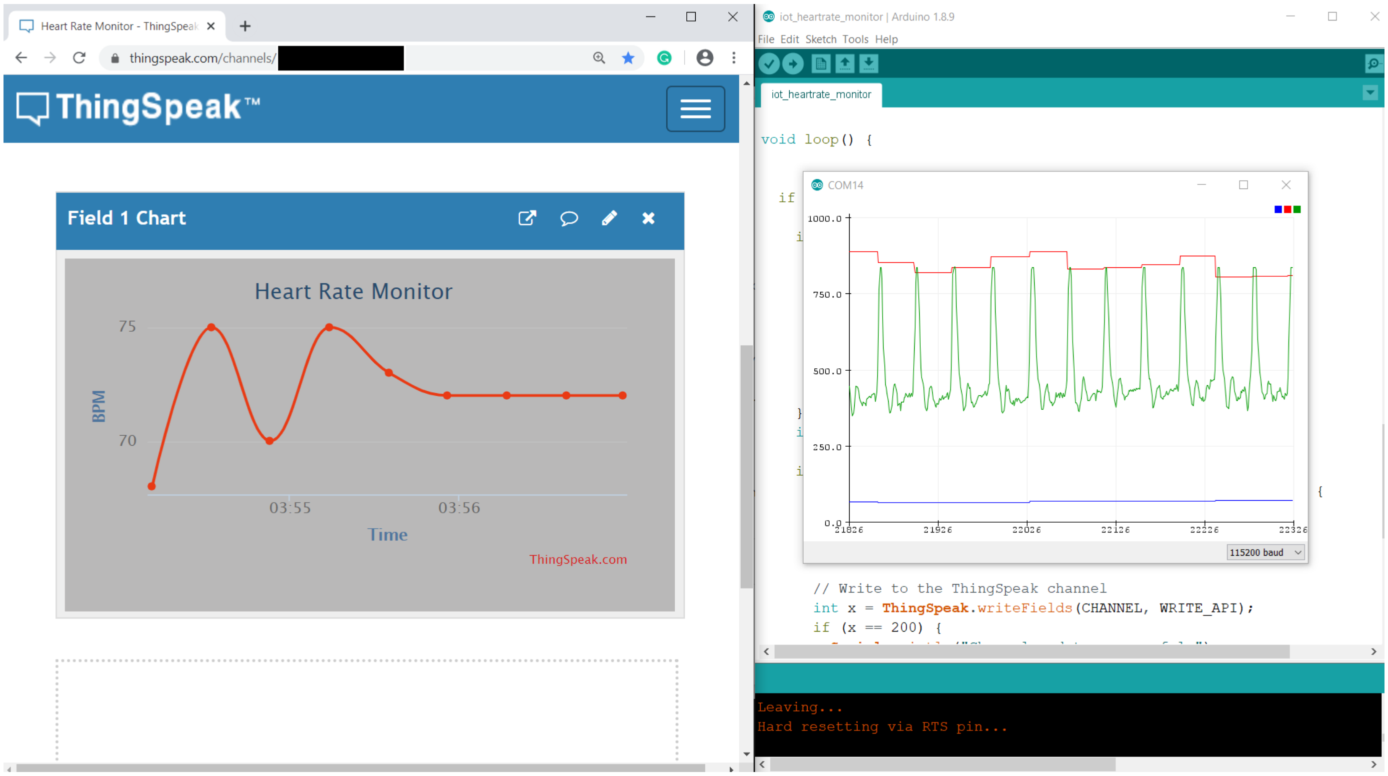


Figure 7.11

When you hold the sensor between your fingertips, the serial plotter shows your heart rate pulses in green. Once you take off your fingers from the sensor, a straight line displays on the graph. Thing Speak updates the BPM value with the date and the time.

SOURCE CODE

```
void setup() {
// initialize the serial communication:
Serial.begin(9600);
pinMode(10, INPUT); // Setup for leads off detection LO +
pinMode(11, INPUT); // Setup for leads off detection LO -

}

void loop() {

if((digitalRead(10) == 1)||(digitalRead(11) == 1)){
Serial.println('!');
}
else{
// send the value of analog input 0:
Serial.println(analogRead(A0));
}
//Wait for a bit to keep serial data from saturating
delay(1);
}
```

CHAPTER 8

MODULES

8.1 DATA EXTRACTION FROM THE HUMANS

The ECG module electrode is placed on the pulse points of the body. Our human body transmits electric pulses through the body's veins and blood vessels. The electric pulses are continuously transmitted over the human organs. Some specific points had more electric pulse conductivity. So, The ECG electrodes are placed in the body in Figures 8.1 and 8.2.

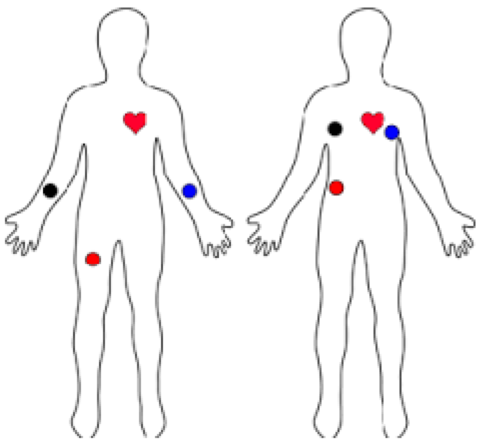


Figure 8.1

8.2 DATA PROCESSING

The electrodes are connected to an ECG machine by lead wires. The electrical activity of the heart is then measured, interpreted, and printed out. No electricity is sent into the body. Natural electrical impulses coordinate contractions of the different parts of the heart to keep blood flowing the way it should. Electric Signals Are transmitted to the IoT kit. Then the Kit process the signals and the pulse are transformed into digital values. Like Figure 7.3

8.3 DATA VISUALIZATION

The data is visualized using the thinks speak online cloud platform. The simple and easiest ways are representing output are serial monitor and plotter.

REAL TIME DEMO:

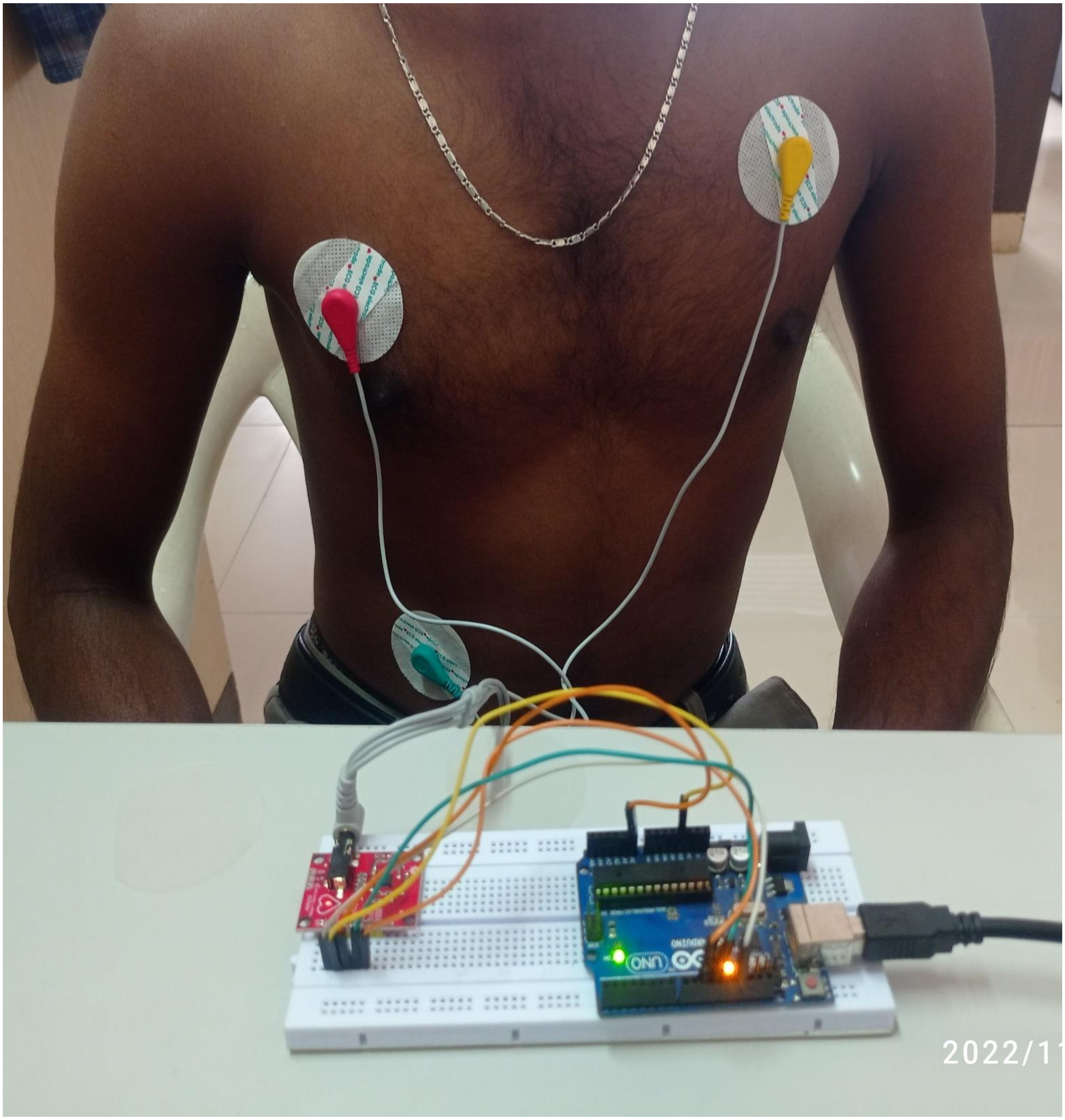


Figure 8.2

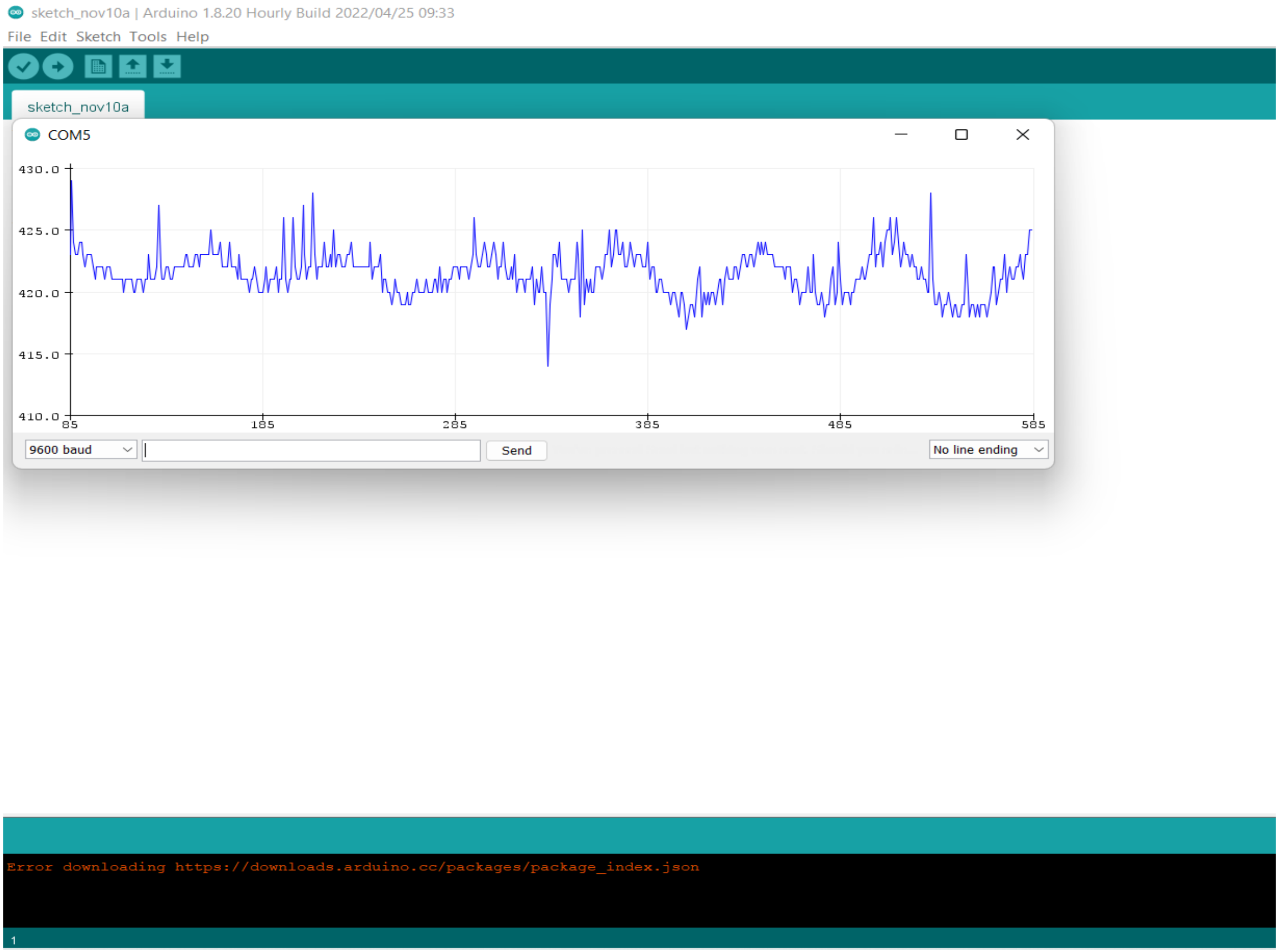


Figure 8.3

Figure 8.3 describe the functional output of the Heart beat monitoring system in serial monitor in the Arduino IDE

CHAPTER 9
TESTING

9.1 FUNCTIONAL TESTING

Functional testing is a type of testing that seeks to establish whether each application feature works as per the software requirements. Each function is compared to the corresponding requirement to ascertain whether its output is consistent with the end user's expectations. It ensures the proper working of all the functionalities of an application/software/product. It ensures that the software/product works as expected. It ensures security and safety. It improves the quality of the product.

9.2 INTEGRATION TESTING

Integration testing (sometimes called integration and testing, abbreviated I&T) is the phase in software testing in which individual software modules are combined and tested as a group. Integration testing is conducted to evaluate the compliance of a system or component with specified functional requirements. The aim of integration testing is to test the interfaces between the modules and expose any defects that may arise when these components are integrated and need to interact with each other.

9.3 PERFORMANCE TESTING

Performance testing is the practice of evaluating how a system performs in terms of responsiveness and stability under a particular workload. Performance tests are typically executed to examine speed, robustness, reliability, and application size. To determine whether the application satisfies performance requirements (for instance, the system should handle up to 1,000 concurrent users). To locate computing bottlenecks within an application. To establish whether the performance levels claimed by a software vendor are indeed true.

CHAPTER 10

CONCLUSION

Upload the code to Arduino UNO and Power on the system. The Arduino asks us to place our finger in the sensor and press the switch. Place any finger (except the Thumb) in the sensor clip and push the switch (button). Based on the data from the sensor, Arduino calculates the heart rate and displays the heartbeat in bpm. Based on the Heartbeat we conclude the disease. the heart rate is too low it’s known as bradycardia. The heartrate is too high it’s known as Tachycardia.

FUTURE ENHANCEMENT

The current version of the processing application displays the near-time PPG heart rate but does not record anything. Here is a lot of room for improvement. Logging heart rate measurements and PPG samples along with the time-stamp information available from the PC. Beeping sound alarm for heart rates below or above the threshold. Heart rate trends over time, etc.

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