

# Smart Heart-Rate BPM Meter

**T. E. Information Technology**

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## **CERTIFICATE**

This is to certify that the project entitled “**Smart Heart-Rate BPM Meter**” is a bonafide work of “**Harshkumar Bhikadiya, Shivam Bhosale , Parth Dali , Pranav Dalvi**” Roll no-29, Roll no-30 , Roll no-31 , Roll no-32 submitted to the University of Mumbai towards completion of mini project work for the subject of **Sensor Lab (Course Code: ITL603)**.

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Examiners

1.-----

2.-----

Date:

## DECLARATION

I declare that this written submission represents my ideas in my own words and where others' ideas or words have been included, I have adequately cited and referenced the original sources. I also declare that I have adhered to all principles of academic honesty and integrity and have not misrepresented or fabricated or falsified any idea/data/fact/source in my submission. I understand that any violation of the above will be cause for disciplinary action by the Institute and can also evoke penal action from the sources which have thus not been properly cited or from whom proper permission has not been taken when needed.

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## **ABSTRACT**

Heartbeat Sensor is an electronic device that is used to measure the heart rate i.e. speed of the heartbeat. Monitoring body temperature, heart rate and blood pressure are the basic things that we do in order to keep us healthy.

In order to measure the body temperature, we use thermometers and a sphygmomanometer to monitor the Arterial Pressure or Blood Pressure. Heart Rate can be monitored in two ways: one way is to manually check the pulse either at wrists or neck and the other way is to use a Heartbeat Sensor. In this project, we have designed a Heart Rate Monitor System using Arduino and HeartbeatSensor. You can find the Principle of Heartbeat Sensor, working of the Heartbeat Sensor and Arduino based Heart Rate Monitoring System using a practical heartbeat Sensor

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# INTRODUCTION

## 1.1 Introduction to domain /area

Heart rate measurement is one of the very important parameters of the human cardiovascular system. The heart rate of a healthy adult at rest is around 72 beats per minute (bpm). Athletes normally have lower heart rates than less active people. Babies have a much higher heart rate at around 120 bpm, while older children have heart rates at around 90 bpm. The heart rate rises gradually during exercises and returns slowly to the rest value after exercise. The rate when the pulse returns to normal is an indication of the fitness of the person. Lower than normal heart rates are usually an indication of a condition known as Bradycardia, while higher than normal heart rates are known as tachycardia. Heart rate is simply and traditionally measured by placing the thumb over the subject's arterial pulsation, and feeling, timing and counting the pulses usually in a 30 second period. Heart rate (bpm) of the subject is then found by multiplying the obtained number by 2. This method, although simple, is not accurate and can give errors when the rate is high. More sophisticated methods to measure the heart rate utilize electronic techniques. Electro-cardiogram (ECG) is one of frequently used and accurate methods for measuring the heart rate. ECG is an expensive device and its use for the measurement of the heart rate only is not economical. Low-cost devices in the form of wrist watches are also available for the instantaneous measurement of the heart rate. Such devices can give accurate measurements but their cost is usually in excess of several hundred dollars, making them uneconomical. This project describes the design of a very low-cost device which measures the heart rate of the subject by clipping sensors on one of the fingers and then displaying the result on a mobile application.

## 1.2 Motivation to select area

Keeping track of your heart rate can give you insight into your fitness level, heart health and emotional health. Many people are walking around with a resting heart rate that is too high, due to factors such as too much caffeine, dehydration, inactivity and persistent stress. Those extra heart beats over time can be taking years off your life. By developing a low cost heart rate monitor, people will be able to track their heart rate everyday.

### **1.3 Proposed Solution**

To develop a wireless heart rate monitoring system using a SEN-11574 pulse sensor and display heart rate value on mobile applications using HC05 bluetooth module.

### **1.4 Organization of the Report**

The first chapter of the report introduces us to the domain of the project. The second chapter consists of literature review of technical papers. The third chapter explains the system design of the project. Implementation and results are included in the fourth chapter. The conclusion of the project is given in the fifth chapter. The final chapter consists of references used while making the project.



## REVIEW LITERATURE

### 2.1 Review of literature in tabular format

**Table 2.1.1:** Literature survey

Ref.No	Title	Advantages	Future Scope
[1]	Heart Rate Monitoring System Using Labview	Device is economical and user friendly and uses optical technology to detect the flow of blood through the index finger.	Can extend and implement our project to find out the heart rate and store it in a memory to find out the variations in it.
[2]	Beats-Per-Minute (BPM): A Microservice based platform for the monitoring of Health Related Data via Activity Trackers.	The efficacy, reliability and integrity of BPM when utilized as a monitoring solution for health conditions, such as Cardiovascular Disease.	Develop analysis services for the onset detection of conditions such as Atrial Fibrillation to evaluate BPM's utility
[3]	Heart Rate Monitoring Using GSM Technology	In this system, heart beat sensor continuously monitors the patient's heart beat and in case of any abnormalities the system will send message to the doctor or relatives of the concerned person	The system can be miniaturized into a small wearable device like a glove or a ring that can monitor the heart rate continuously.
[4]	Heart Rate Monitoring System using Pulse Sensor with Data Stored on Server	Small device which can be fixed to any atmosphere. It is less bulky and a portable WiFi module and the person can be connected to their android mobile using Wifi hotspot settings.	Can connect this module to the emergency alert to the nearby hospital ambulance. This can be later upgraded to other modules like microcontroller, vlsi and advanced types of integrated boards.

## **2.2 Problem definition**

- To develop a heart rate monitoring system using a SEN-11574 pulse sensor. And then generate details of the same using an HC05 bluetooth module on the user's device.
- To check the heart rate and display a detailed analysis of the result on a mobile application/website.

# SYSTEM DESIGN

## 3.1 Circuit Diagram

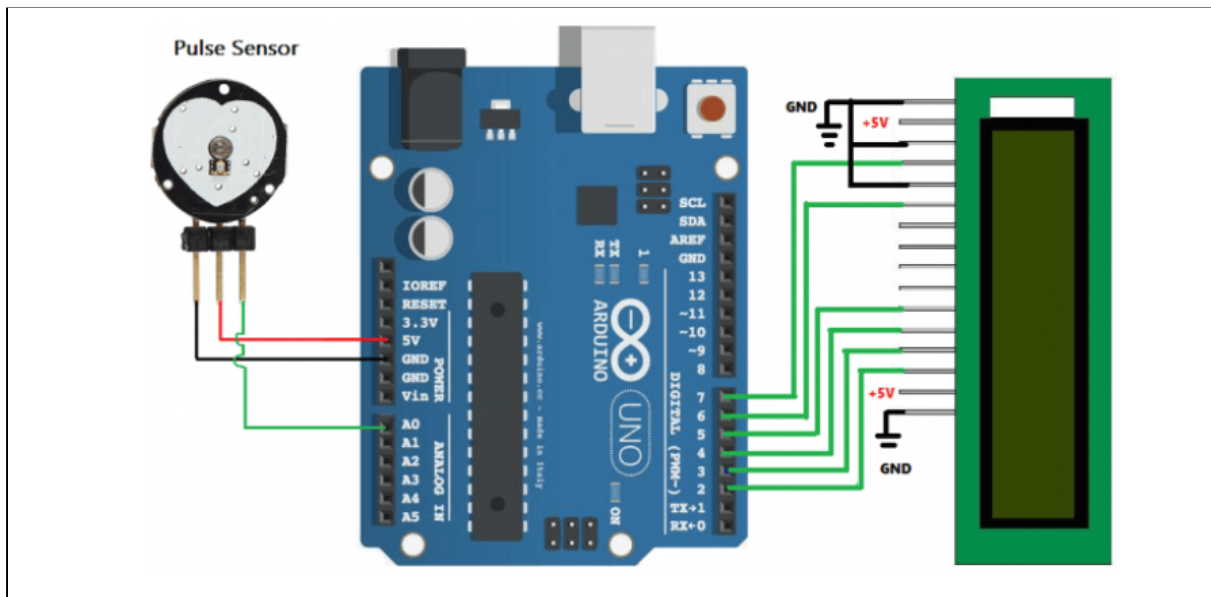


Fig 3.1.1:Circuit Diagram

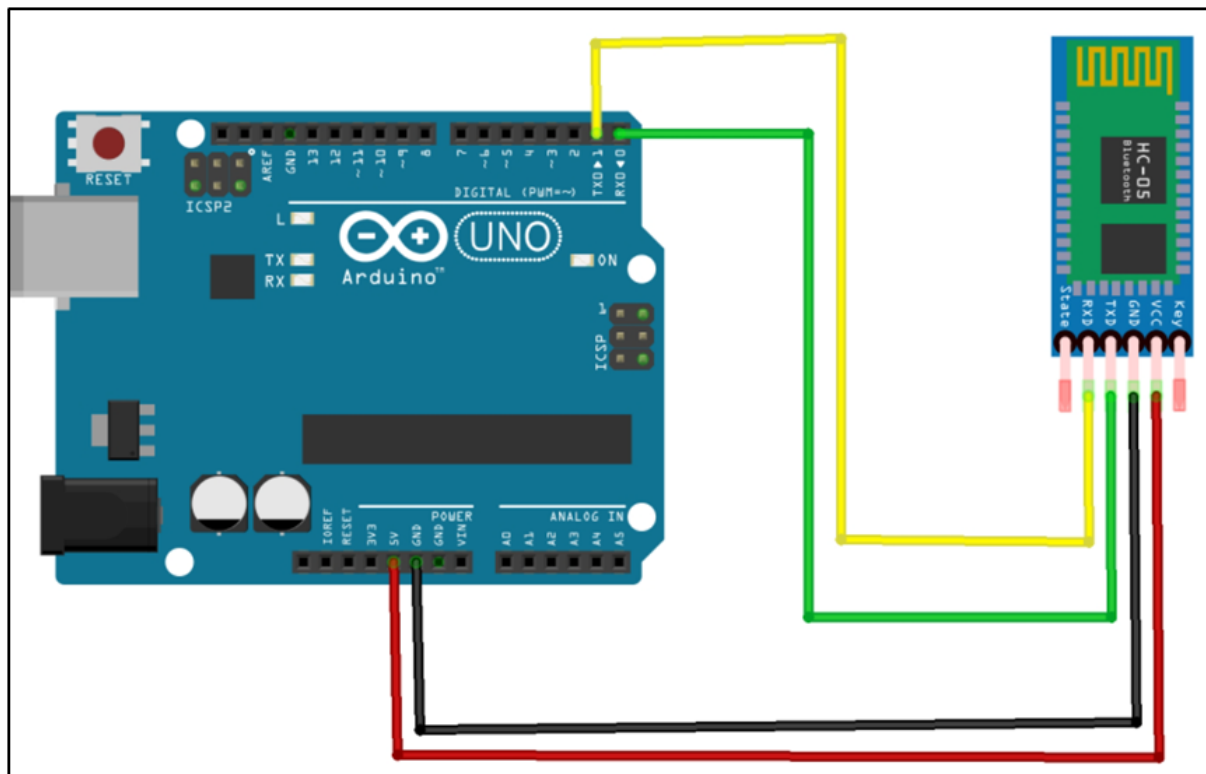


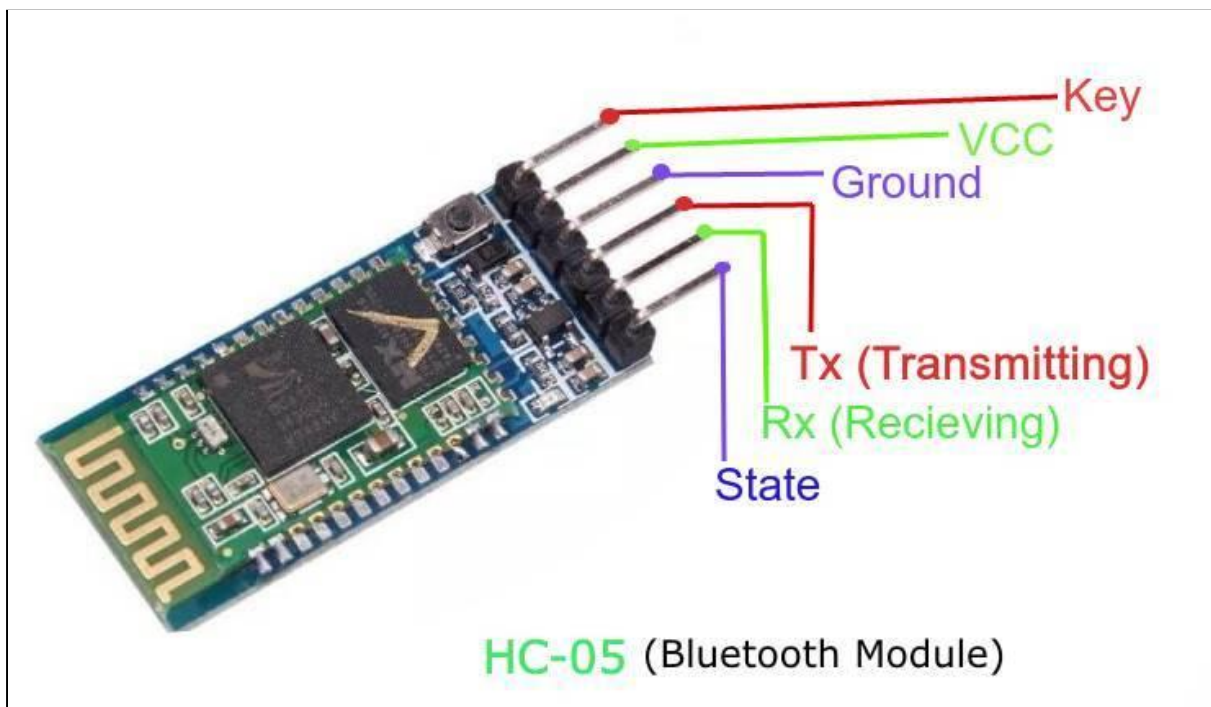
Fig 3.1.2:HC-05 Circuit Diagram

### 3.2 Explanation of block diagram:



**Fig 3.2.1:** SEN-11574 Pulse Sensor

SEN-11574 Pulse sensor is a simple sensor which is used in many places. The basic sensor has 3 pins namely ground, vcc, input signal(which is also known as A0 signal). When it is connected with the arduino, the LED is in ON condition. It works either in 3V or 5V power supply.



**Fig 3.2.2:** HC-05 Bluetooth Module Pin Definition

### 3.3 Hardware and software requirements

**Table 3.3.1:** Hardware requirements

<b>Sr.No</b>	<b>Components</b>	<b>Quantity</b>	<b>Cost</b>
1.	Arduino Uno	1	450
2.	HC05 Bluetooth Module	1	300
3.	SEN-11574 Pulse Sensor	1	150
4.	Breadboard	1	60
5.	Power Supply	1	50
6.	Lcd Display	1	150
7.	Connecting wires	20	80
<b>TOTAL</b>			<b>1240</b>

**Table 3.3.2:** Software requirements

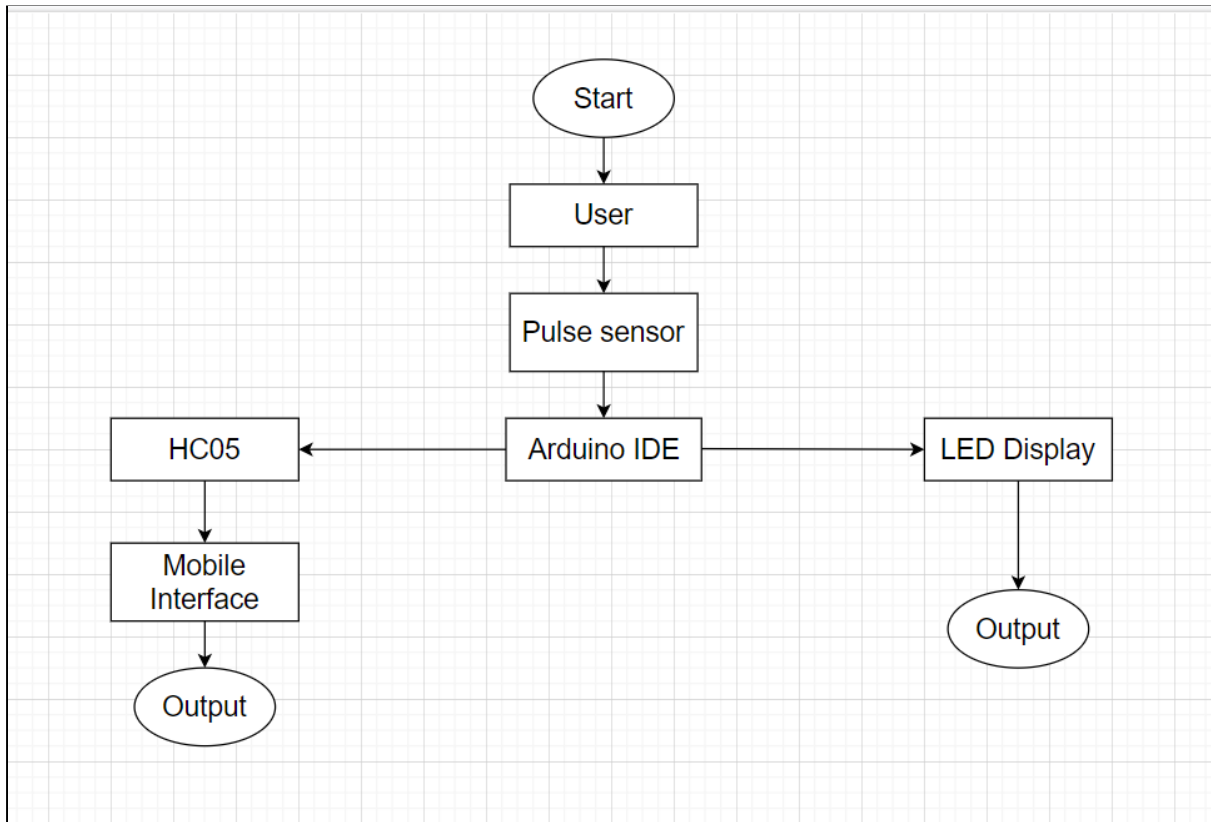
<b>Sr.No</b>	<b>Components</b>	<b>Quantity</b>	<b>Cost</b>
1.	Arduino IDE	1	0
2.	Arduino Serial Monitor	1	0
<b>TOTAL</b>			<b>0</b>

### 3.4 Application areas of project

- To help the user exercise at the right intensity.
- To timely monitor the patient's heart rate after he/she has undergone a heart surgery.
- To detect irregularities in the heartbeat of a person.
- To detect/prevent overtraining.

## IMPLEMENTATION AND RESULTS

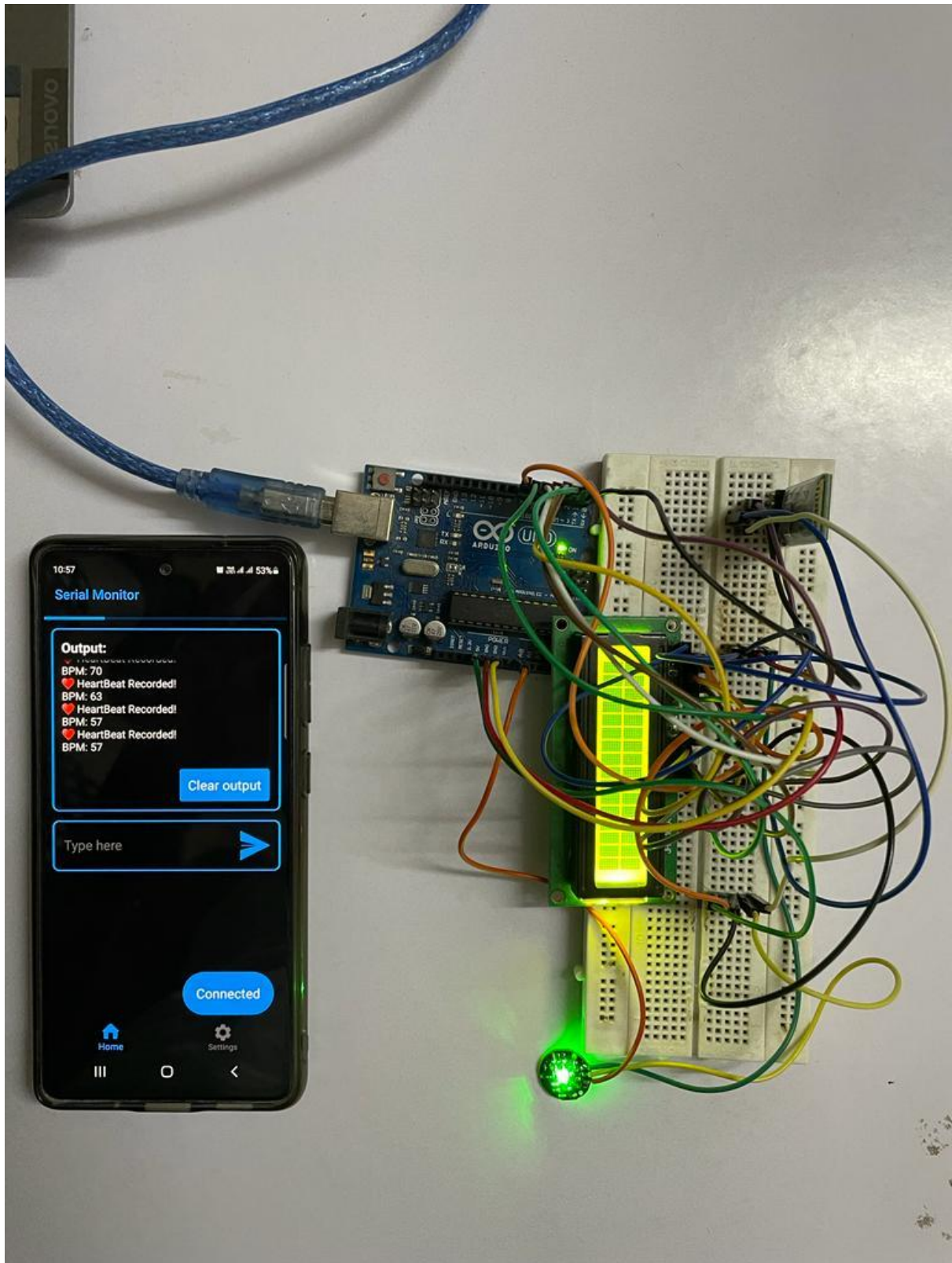
### 4.1 Flow Chart:



**Fig 4.1.1:** Flowchart

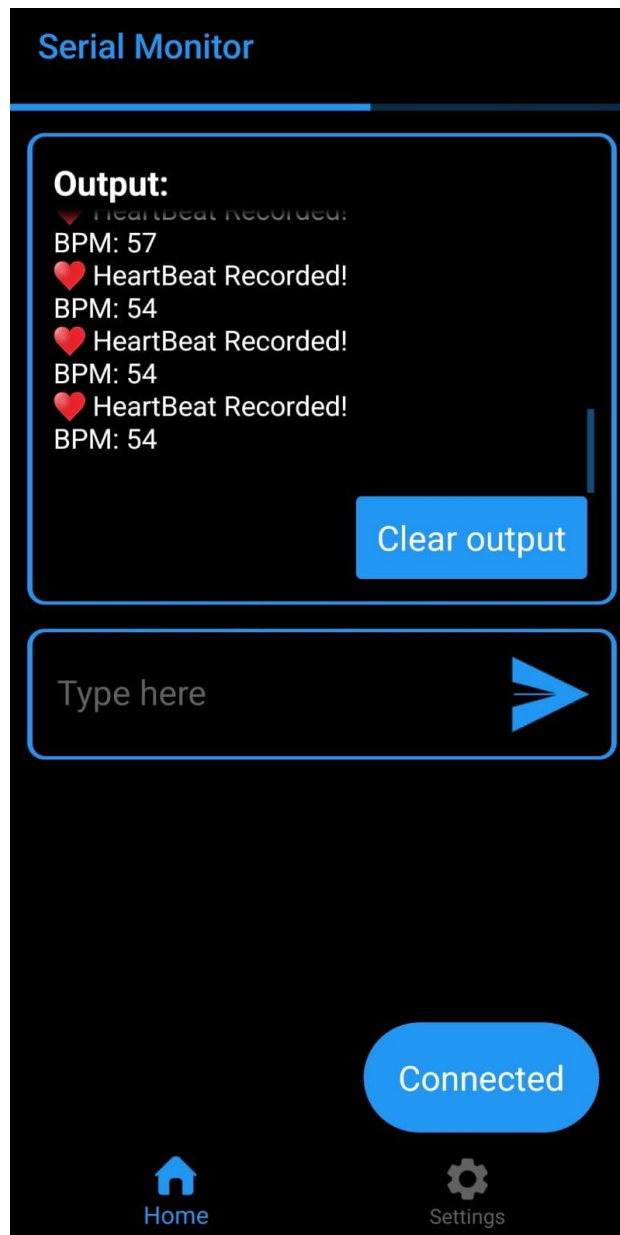
The above flowchart depicts a user who interacts with a pulse sensor, programmed on an Arduino to display the recorded heart beat(Android Application).

## 4.2 Screenshots:



**Fig 4.2.1:** SEN-11574 Pulse Sensor on Breadboard

The above figure shows a completely interfaced SEN-11574 pulse sensor with arduino uno. Also the HC05 Bluetooth module was incorporated in the circuit for wireless transmission of heart rate values to a mobile application.



**Fig 4.2.2:** Mobile Application displaying Pulse Sensor values

Figure 4.2.2 shows successful transmission of data from pulse sensor to arduino serial monitor using HC05 bluetooth module. Heart rate values are now successfully displayed on a user's device.



### 4.3 Source Code/Program:

```
#define USE_ARDUINO_INTERRUPTS true // Set-up low-level interrupts for most accurate
BPM math.

#include <PulseSensorPlayground.h> // Includes the PulseSensorPlayground Library.
#include<LiquidCrystal.h>
LiquidCrystal lcd(7, 6, 5, 4, 3, 2);

// Variables

const int PulseWire = 0; // PulseSensor PURPLE WIRE connected to ANALOG PIN 0
const int LED13 = 13; // The on-board Arduino LED, close to PIN 13.
int Threshold = 550; // Determine which Signal to "count as a beat" and which to ignore.
// Use the "Getting Started Project" to fine-tune Threshold Value beyond default setting.
// Otherwise leave the default "550" value.

PulseSensorPlayground pulseSensor; // Creates an instance of the PulseSensorPlayground
object called "pulseSensor"
void setup() {

Serial.begin(9600); // For Serial Monitor
lcd.begin(20,4);

// Configure the PulseSensor object, by assigning our variables to it.
pulseSensor.analogInput(PulseWire);
pulseSensor.blinkOnPulse(LED13); //auto-magically blink Arduino's LED with heartbeat.
pulseSensor.setThreshold(Threshold);

// Double-check the "pulseSensor" object was created and "began" seeing a signal.
if (pulseSensor.begin()) {
Serial.println("We created a pulseSensor Object !"); //This prints one time at Arduino
power-up, or on Arduino reset.
lcd.setCursor(0,0);
lcd.print(" Heart Rate Monitor");
```

```
}  
}
```

```
void loop() {
```

```
  int myBPM = pulseSensor.getBeatsPerMinute(); // Calls function on our pulseSensor object  
  that returns BPM as an "int".
```

```
  // "myBPM" hold this BPM value now.
```

```
  if (pulseSensor.sawStartOfBeat()) { // Constantly test to see if "a beat happened".
```

```
    Serial.println("♥ HeartBeat Recorded ! "); // If test is "true", print a message "a heartbeat  
    happened".
```

```
    Serial.print("BPM: "); // Print phrase "BPM: "
```

```
    Serial.println(myBPM); // Print the value inside of myBPM.
```

```
    lcd.setCursor(0,2);
```

```
    lcd.print("HeartBeat Happened !"); // If test is "true", print a message "a heartbeat happened".
```

```
    lcd.setCursor(5,3);
```

```
    lcd.print("BPM: "); // Print phrase "BPM: "
```

```
    lcd.print(myBPM);
```

```
  }
```

```
  delay(2000); // considered best practice in a simple sketch.
```

```
}
```

## **CONCLUSION**

A heart rate monitoring device has been developed during the course of this project. Components like Breadboard, HC05 Bluetooth Module, Arduino UNO, SEN-11574 Pulse Sensor and LCD Display were used. SEN-11574 sensor is a low cost, very small size plug-and-play heart rate sensor for Arduino and Arduino compatible boards. This sensor helps to incorporate live heart rate data in our project. To display the results wirelessly on the user's device we have used the HC05 Bluetooth Module. HC05 module was used as it is easy to interface with controller or PC.

The pulse sensor SEN-11574 readings can be affected by surrounding noises as it is a relatively open sensor and not an enclosed one. The developed device is not a portable one. In future a sensor that is enclosed can be incorporated. The accuracy of the project will improve as the sensor's readings will not be affected by background noises. The user interface can also be improved and made more user friendly

By using this project, old age people and heart patients can easily find out their heart rate and its conditions while sitting in one place. As it is a low cost project and highly effective one could easily afford it. Due to absence of complex features, the designed device can also be handled by any non-medical professionals also. Thus it can also be used at home.

## REFERENCES

- [1] Manasa, S. Tony, et al. "Heart Rate Monitoring System Using LabView." International Journal of Engineering and Management Research (IJEMR) 5.2 (2015): 590-594.
- [2] Orla O'Brien. "Beats-Per-Minute (BPM): A Microservice-based Platform for the Monitoring of Health Related Data via Activity Trackers." (2017).
- [3] Vinodhini, S., et al. "Heart Rate Monitoring Using GSM Technology." (2018).
- [4] Vinodhini, R., and R. Puniarasi. "Heart rate monitoring system using pulse sensor with data stored on server." IJEAT 8.6 (2019): 2374-2377.
- [5] how2electronics. [online]. Available  
<https://how2electronics.com/pulse-rate-bpm-monitor-arduino-pulse-sensor/>  
(Accessed: Jan 23, 2022)
- [6] "How to show arduino sensor data on a web page", Russell Ramirez ,  
[online]. Available  
<https://www.circuitbasics.com/how-to-set-up-a-web-server-using-arduino-and-esp8266-01/>  
(Accessed: Jan 23, 2022)