SenseBOT: A HEALTH MONITORING APP TO COLLECT VITAL LIFE SAVING INFORMATION THROUGH IoT

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This Report Presented in Partial Fulfillment of the Requirements for the Degree of Bachelor of Science in Computer Science and Engineering

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APRIL 2019

APPROVAL

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We hereby declare that, this project has been done by us under the supervision **of Md. Sadekur Rahman, Assistant Professor, Department of CSE** Daffodil International University. We also declare that neither this project nor any part of this project has been submitted elsewhere for award of any degree or diploma.

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ACKNOWLEDGEMENT

First we express our heartiest thanks and gratefulness to almighty God for His divine blessing makes us possible to complete the final year project successfully.

We really grateful and wish our profound our indebtedness to **Md. Sadekur Rahman, Assistant Professor,** Department of CSE Daffodil International University, Dhaka. Deep Knowledge & keen interest of our supervisor in the field of "Embedded Systems Circuits and Programming" motivated us to carry out this project. His endless patience, scholarly guidance, continual encouragement, constant and energetic supervision, constructive criticism, valuable advice, reading many inferior draft and correcting them at all stage have made it possible to complete this project.

We would like to express our heartiest gratitude to The Almighty Allah and **Prof. Dr. Syed Akhter Hossain, Head, Department of CSE**, for his kind help to finish our project and also to other faculty member and the staff of CSE department of Daffodil International University.

We would like to thank our entire course mate in Daffodil International University, who took part in this discuss while completing the course work.

Finally, we must acknowledge with due respect the constant support and patience of our parents.

ABSTRACT

“SenseBOT: A Health Monitoring App to Collect Vital Life Saving Information Through IoT”is a research based project that aims to create awareness about primary healthcare condition among the mass people of Bangladesh.This project is a combination of hardware and software. There is a device including 3 sensors which are LM35, Pulse sensor and BMP180. There isalsoa mobile application. The device collects three things. Pulse Rate, Body Temperature and Barometric Pressure. All the information is sent to the mobile application via bluetooth and is displayed in the screen. Thus, the user is able to know about his/her health condition in those sectors. There is a database where the health record of the user can be recorded for 30 days. This will reduce the accidental health failure rate in our country.

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CHAPTER 1

Introduction

1.1Overview

Within modern world, people's life changes day by day with the aid of science. However, people usually are not serious about their health condition until something is happened. Most important health indicators of any person are blood pressure, temperature and pulse. Knowing these information helps us to detect early warning about one person's health condition. Right information about health are vital for quick action and speed recovery.

So, we came out with a plan to detect this three vital information through a device. We call it "**SenseBot**"

1.2 Motivation

The main motivation behind our project is the lack of consciousness about health care among the people of Bangladesh. This is the major cause of many accidents. This problem is more severe among rural people. The focus of our project is to avoid such problems.

1.3 Objectives

The foremost purposes of our project are:

- Developing a mobile application which will be implemented on a device to monitor the user's health condition.
- To warn the user through the app, if some of the conditions are not satisfactory.
- To check various condition of users when they want to check.

1.4 Expected outcome

Will be able to measure/monitor/perform:

- Wearer's heart rate
- Barometric pressure
- Body Temperature

1.5 Report Layout

- In chapter 1 we have introduced our project
- In chapter 2 we have discussed the background work
- In chapter 3 we have described the hardware part
- In chapter 4 we have described the hardware connections
- In chapter 5 we have discussed the implementation and testing
- In chapter 6 we have discussed the conclusion and future scopes

CHAPTER 2

Background

2.1 Introduction

We've created SenseBot for the greater contribution towards the healthcare of the mass people of the country. It is based on both hardware and software. Any user can easily check his/her condition anytime they want. For that, they do not even need high quality smartphones. People can easily use the application on any normal smartphone that at least supports android 4.4 (KitKat).

2.2 Related Works

There are many organizations which created more less same kind of devices. For instance, Xiaomi created MI Band, Samsung created Samsung Gear Fit, Apple created Apple Watch etc. However, all the devices have different functionalities with different features. The price range is also higher for those devices.

2.3 Comparative Studies

Many medical centers and health organizations all over the world are doing research and implementing devices with sensors for monitoring health issues of a human being. Not only health related organizations but also the technology based institutions and organizations are doing research for that. Individual researchers are also taking part. The main aim is to provide better solutions to all the health monitoring related problems and to ensure the accuracy of the measuring, as a result people can reliably use those devices for their own betterment.

2.4 Comparison with related devices

A comparative analysis of some related devices is shown in table 2.1

Table 2.1: Comparative Analysis Table

Company	**Device Name**	**Features**	**Limitations**
Apple	Apple Watch	Can collect pulse rate and temperature Can collect humidity also	Very High Price (35000 BDT) Only works with iPhones
Samsung	Samsung Gear Fit	Pedometer is implemented Can collect Humidity Can predict sleeping schedule	High Price (17000 BDT) Unable to measure barometric pressure and temperature
Xiaomi	MI Band	Price is cheap Able to measure pulse rate Can find out step numbers while walking	Unable to measure temperature and barometric pressure
SenseBOT	SenseBOT	Price is cheap Able to measure pulse rate, temperature and barometric pressure	Unable to measure blood pressure and sleeping schedule

2.5Scope of the Problem

So far we have seen that, the price of those existing devices is very high which is difficult for the people of Bangladesh to buy. The device we have built will not be that much costly if we compare this with other devices in the market. Moreover, we have seen that, many devices from other companies do not have the feature like measuring Barometric Pressure, which we have implemented. Barometric Pressure is an important thing for human health as it plays a vital role in the human body, especially for the older people.

2.6Challenges

The most challenging thing was to collect good quality sensors for making SenseBot more efficient and accurate. It was very difficult to find out the best sensors in Bangladesh. We have seen some good sensors outside the country and we wanted to purchase those but we could not because of the extreme high price. Owing to this problem, we faced serious difficulties regarding the accuracy issues.

CHAPTER 3

Description of Hardware and Software

3.1 Name of tools and materials

Tools and materials used in our project are listed below followed by their description:

1. Arduino Nano
2. Rechargeable Battery
3. Pulse Sensor
4. Temperature Sensor LM35
5. Pressure Sensor BMP180
6. Breadboard
7. Jumper Wires
8. Bluetooth Module HC-05
9. Switch
10. Battery Holder
11. Wristband

3.2Arduino Nano

The Arduino Nano is a compact board like the UNO. It is a little, total, and breadboard-accommodating board dependent on the ATmega328P. It has pretty much a similar value of the Arduino Duemilanove, yet in an alternate bundle. It needs only a DC control jack, and works with a Mini-B USB interface as opposed to a standard one [1]:

- Power USB: It's essentially used to supply control from PC to Arduino board. This is provided by a USB cable. This board doesn't utilize standard USB for connection with a PC, rather, it accompanies Mini USB support.
    - Arduino Reset: It Resets Arduino and start the program from the beginning.
    - Pins: It contains 14 digital pins, 8 analog Pins, 2 Reset Pins & 6 Power Pins.
    - Every one of these Digital and Analog Pins are allotted with different capacities yet their fundamental capacity is to be designed as information or yield.

- Vin: It is input control supply voltage to the board when utilizing an outer power wellspring of 7 to 12 V.
- 5V: It is a directed power supply voltage of the board that is utilized to control the controller and different segments put on the board.
- GND: These are the ground sticks on the board. There are various ground sticks on the board that can interfaced in like manner when more than one ground stick is required.
- Reset: Reset stick is included the board that resets the board. It is useful when running project goes excessively perplexing and hangs up the board.
- Analog Pins: There are 8 simple sticks on the board set apart as A0 – A7. These pins are utilized to quantify the simple voltage going between 0 to 5V.
- Rx, Tx: These pins are utilized for sequential correspondence where Tx speaks to the transmission of information while Rx speaks to the information recipient.
- PWM:Six pins 3,5,6,9,10, 11 can be utilized for giving 8-pit PWM (Pulse Width Modulation) yield.

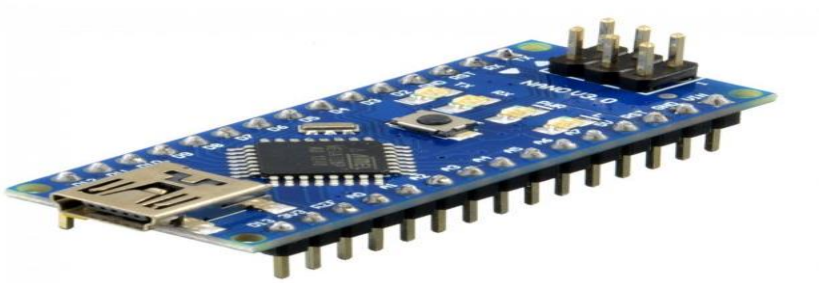

Fig 3.1: Arduino Nano

3.3Jumper Wires

Jumper wires is an electrical wire with a solid tip at each end, which is normally used to interconnect the components in a breadboard. They are used to transfer electrical signals on the breadboard to Arduino board.

3.4Types of Jumper Wires

Variation of jump wires with insulated terminals as per male-female combinations:

- Male – Male
- Male – Female
- Female – Female

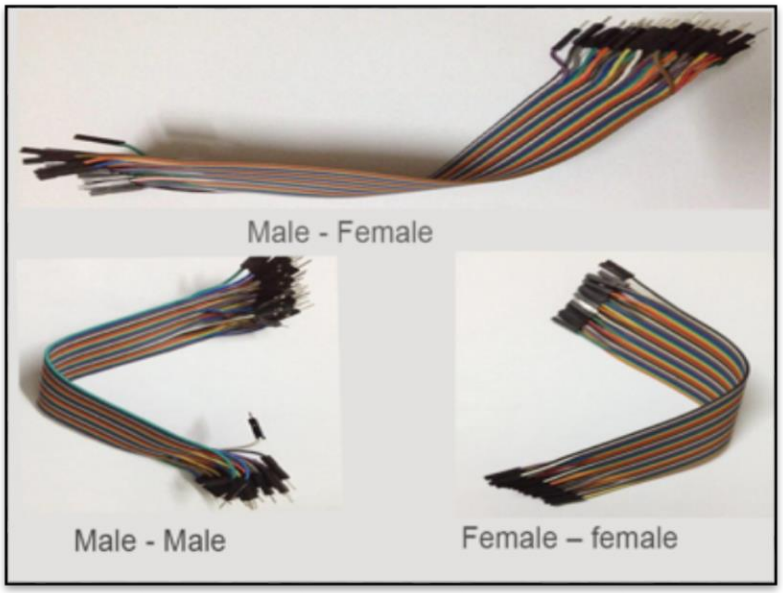

Fig 3.2: Types of Wires

3.5 Battery – Lithium-ion Battery

Lithium battery, rechargeable lithium ion battery technology. This battery is more easy to use and long lasting.

Fig 3.3: Battery – Lithium-ion battery

3.6 Temperature Sensor

A temperature sensor is a gadget which is planned explicitly to quantify the hotness or frigidity of an item. LM35 is an accuracy IC temperature sensor with its yield corresponding to the temperature (in °C). With LM35, the temperature can be estimated more precisely than with a thermistor. It additionally has low self-warming and does not cause more than 0.1 °C temperature ascend in still air. The working temperature extend is from - 55°C to 150°C [2]:

Fig 3.4: Temperature Sensor – LM35

3.7Pulse Sensor

Heartbeat Sensor is a fitting and play pulse sensor for Arduino. It can be utilized by pupils, creators and developers who need live pulse information into their tasks [4]:

The Pulse Sensor Kit incorporates:

1) Soft twisted wire strip cable.

2) Crystal Vinyl Dots, which make electrical insulation simple.

3) The Pulse Sensor likewise has 3 sewing-gaps, for "Wearable's People".

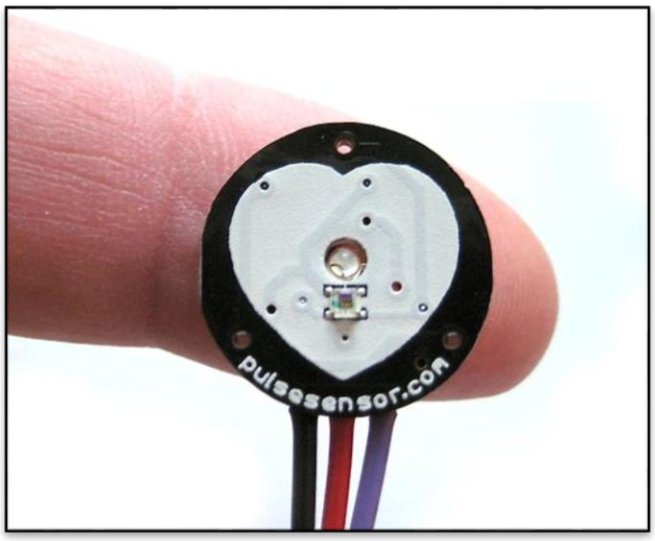

Fig 3.5: Pulse Sensor [5]

3.8 Pressure Sensor – BMP180

The BMP180 is the new computerized barometric weight sensor of Bosch Sensor Tec, with an extremely superior, which empowers applications in cutting edge cell phones, for example, cell phones, tablet PCs and sports gadgets. The ultra-low powerutilization down to 3 μA makes the BMP180 the pioneer in power putting something aside for our cell phones [6].

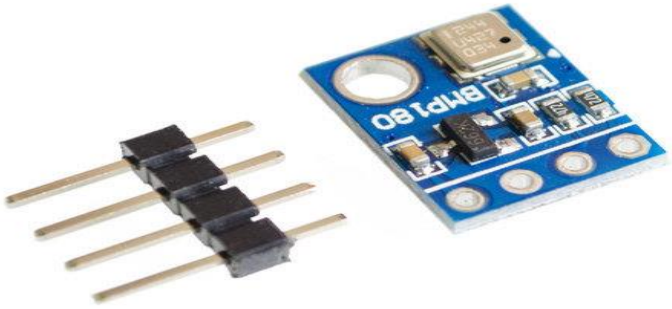

Fig 3.6: Pressure Sensor

3.9 Bluetooth Module HC-05

HC-05 Bluetooth Module is a wireless device that connected our smartphone via an apps and control our project appliance like as fan, light, AC, projector etc. HC-05 works on serial communication [3].

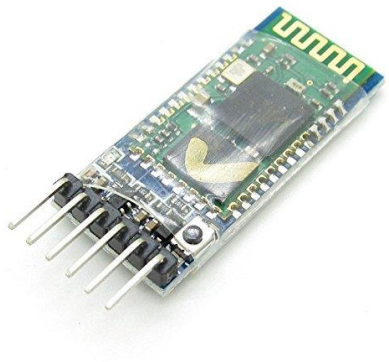

Fig 3.7: Bluetooth Module

3.10 Rocker Switch

Rocker switches are generally used to legitimately control a gadget. They are accessible in numerous shapes, sizes and hues, with both standard and custom images accessible on the actuator. Rocker switch light might be controlled on a different circuit, or be subject to switch position, in view of what arrangement is picked. Accessible end choices incorporate SMT, PCB pins, weld hauls, screw terminals, and brisk associate tabs [7].

Fig 3.8: Rocker Switch

3.11 Battery Holder

The 1S2P 18650 battery holder gives space to two lithium-particle 18650 batteries. The printed circuit board (PCB) introduced on the front surface shields the batteries from shortcircuits, cheating, over depleting, and over release [8].

Fig 3.9: Battery Holder

3.12 Introduce to IDE

IDE is a software application that provides computer programmers with an integrated facility for developing any software. Here for our Smartphone app we have to work on different IDE.
We used –

1. Android studio

3.13 Android Studio

In our project, for the software side for developing our first mobile application on android platform, we have used android studio. Though we want to develop it in IOS platform also in future after accomplishing it successfully on android devices.

3.14 GUI for this Project

User Interfaces

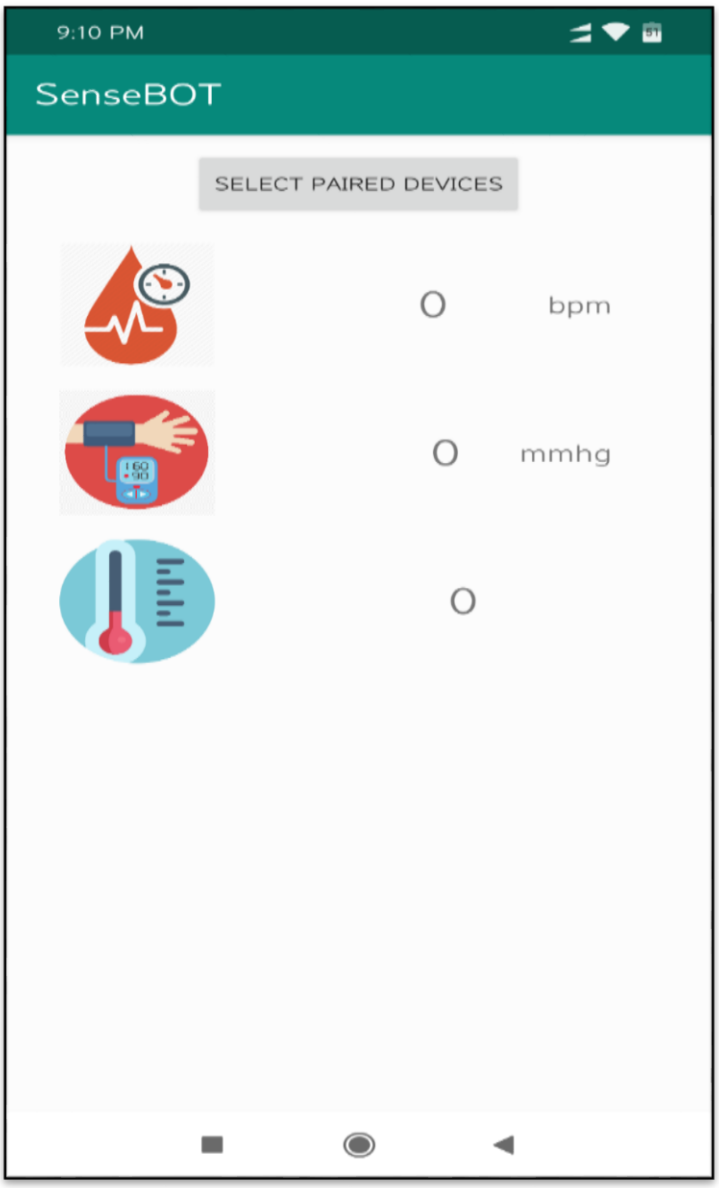

Fig 3.10: Starting UI

This is the starting home user interface of our application where the values of the sensors before the Bluetooth connection to the device.

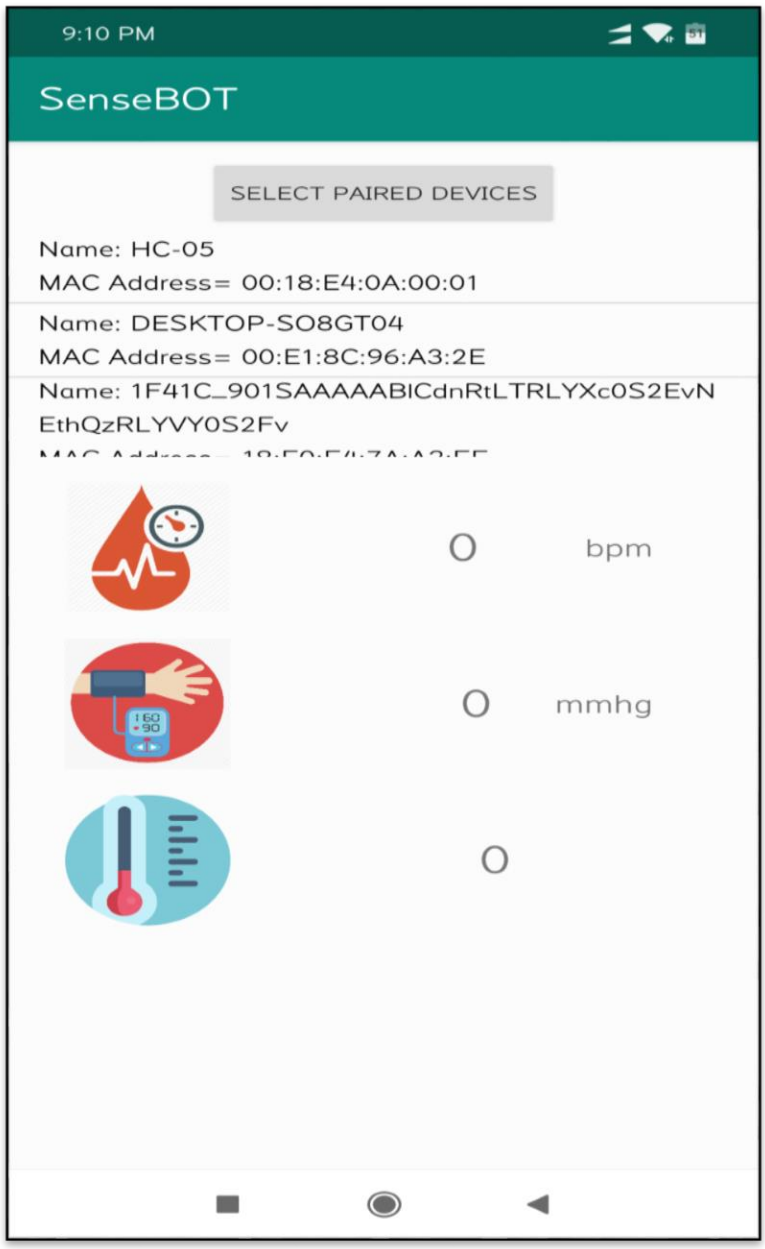

Fig 3.11: Getting the available Bluetooth devices

After running the device this app will get the availability of the device's Bluetooth connection. Here the available Bluetooth connection will be shown in the app.

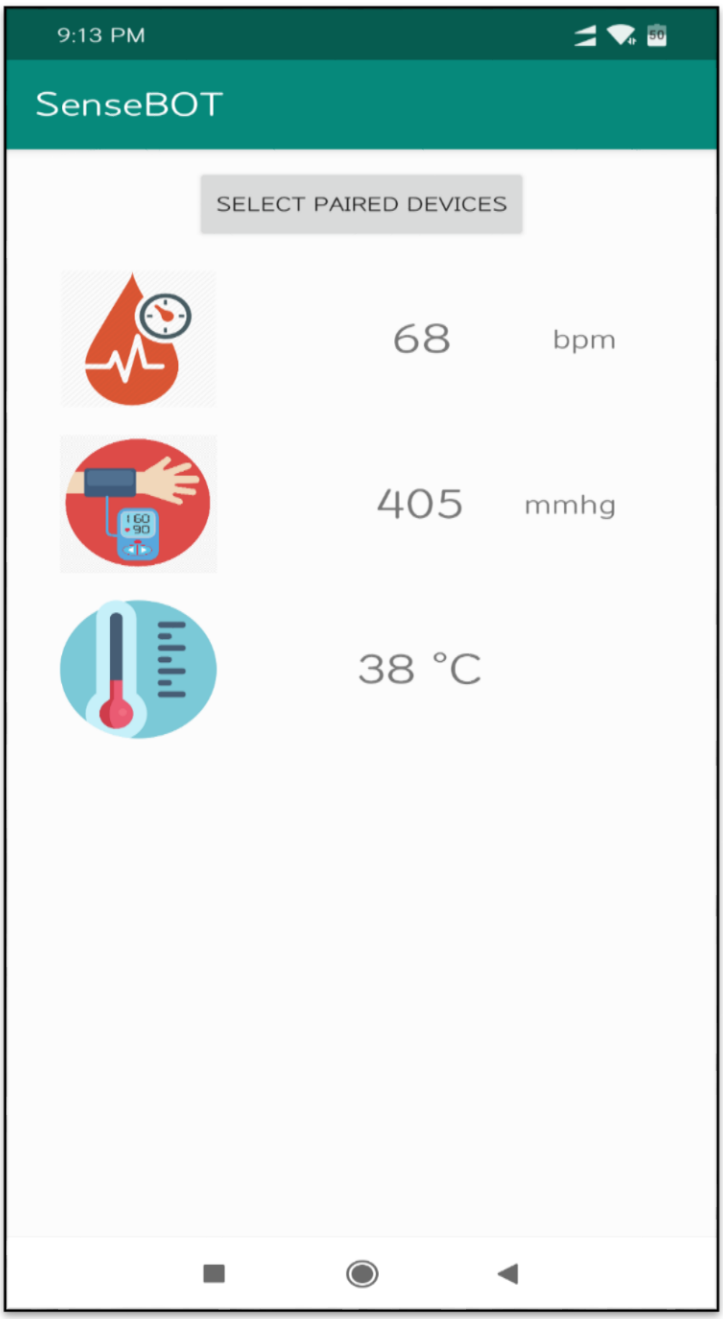

Fig 3.12: Display of the values

After selecting the device Bluetooth network, our app will be connected to our device. And it will get the values from the device and will display those here.

CHAPTER 4

Hardware Connections

4.1 Introduction

As the main part of our project depends on our device so it was very important for us to implement the device properly first. So hardware connection is most important for our project as well as any Arduino based project.

We will divide into two parts in our connection of our project:

One is **Initial system module connections.**

Another is **Upgraded system module connections.**

4.2 Initial System Module Connections

Initial system module connections mainly used to test purpose connections in our project.

4.2.1 Arduino Nano Connection

Hardware Required

1. Arduino Nano
2. Pulse sensor
3. LM35 (temperature sensor)
4. BMP180
5. Bluetooth module HC-05

Arduino Nano got 36 pins in total.

Digital I/O, PWM - 14 Pins, For Analog Functions - 9 Pins, Power - 7 Pins, SPI (Apart from Digital I/O Section) - 3 Pins, Reset - 3 Pins, total - 36 Pins.

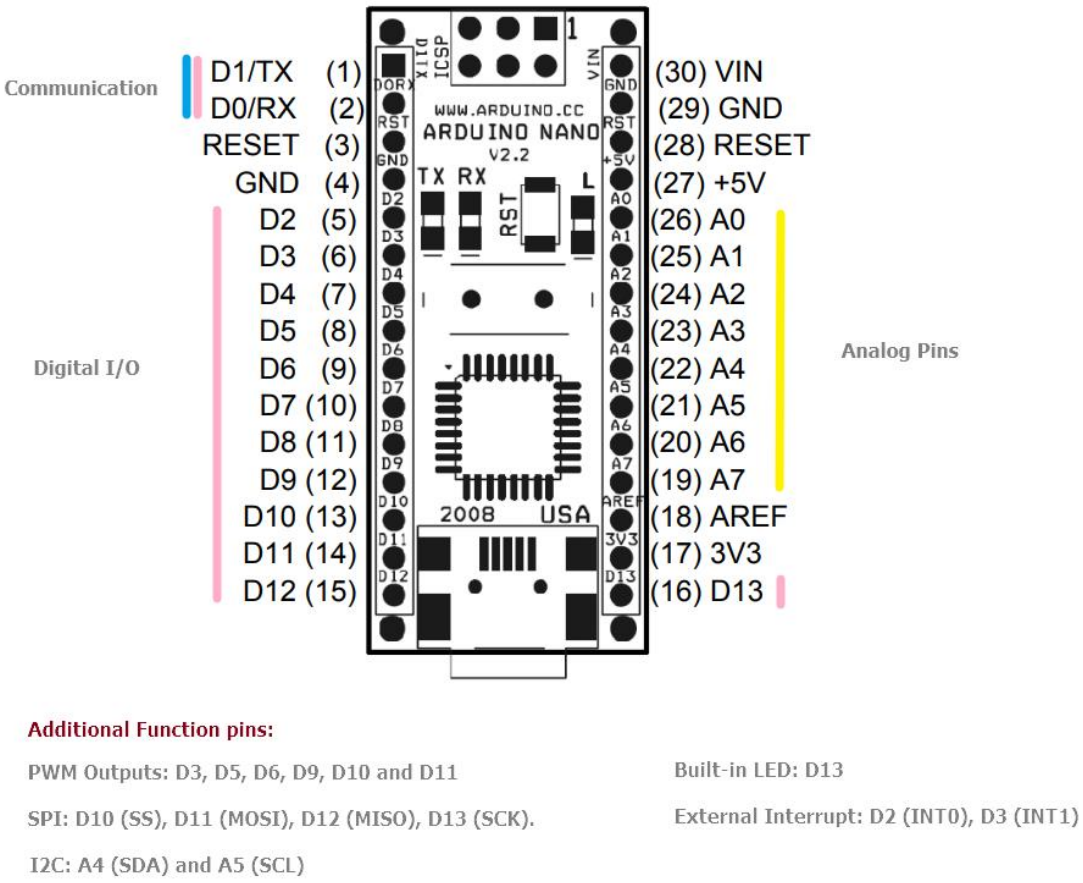

Fig 4.1: Arduino Nano

4.3 Diagram of Hardware Connections

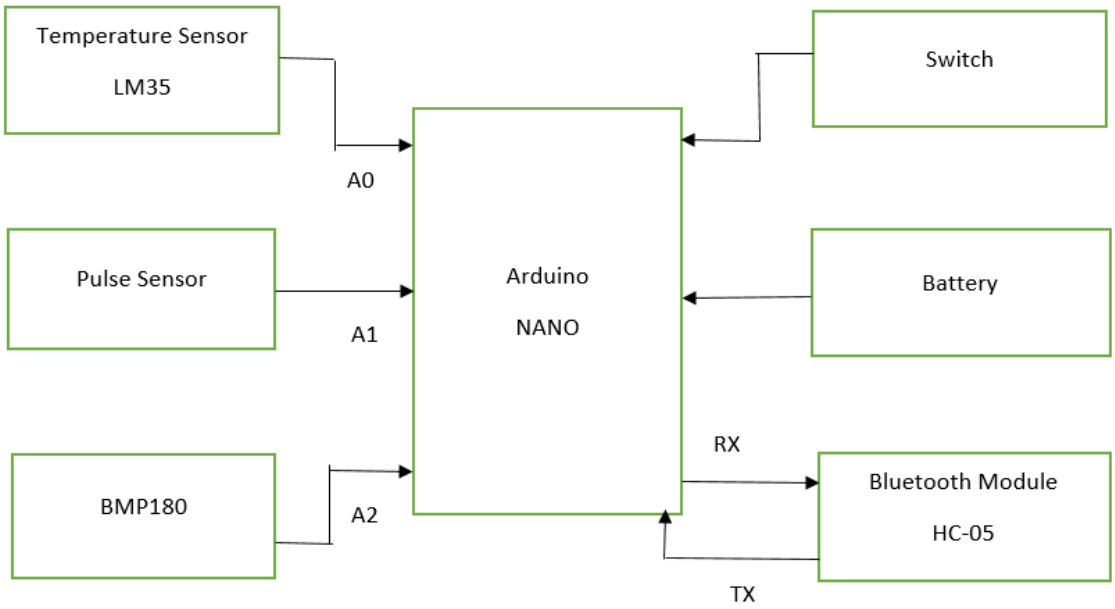

Fig 4.2: Hardware connection setup of the device

- Our device is based on Arduino Nano.
- There are three sensors working with this device called Pulse sensor, Temperature sensor - LM35 and Pressure sensor - BMP180.
- Three sensors are connected to the analog pins of the Arduino board.
- To pass the values we have used Bluetooth module HC-05 which is connected to the pin named RX and TX of the Arduino board.
- Battery for power supply and a switch for turning on the device are connected to the digital pins of the Arduino board.

4.4 Upgraded System Module Connections

At last, we are able to put our completed project here (SenseBot) with Bluetooth module, 3 different sensors, lithium-ion battery, switch, wristband, Arduino Nano, jumper wires etc.

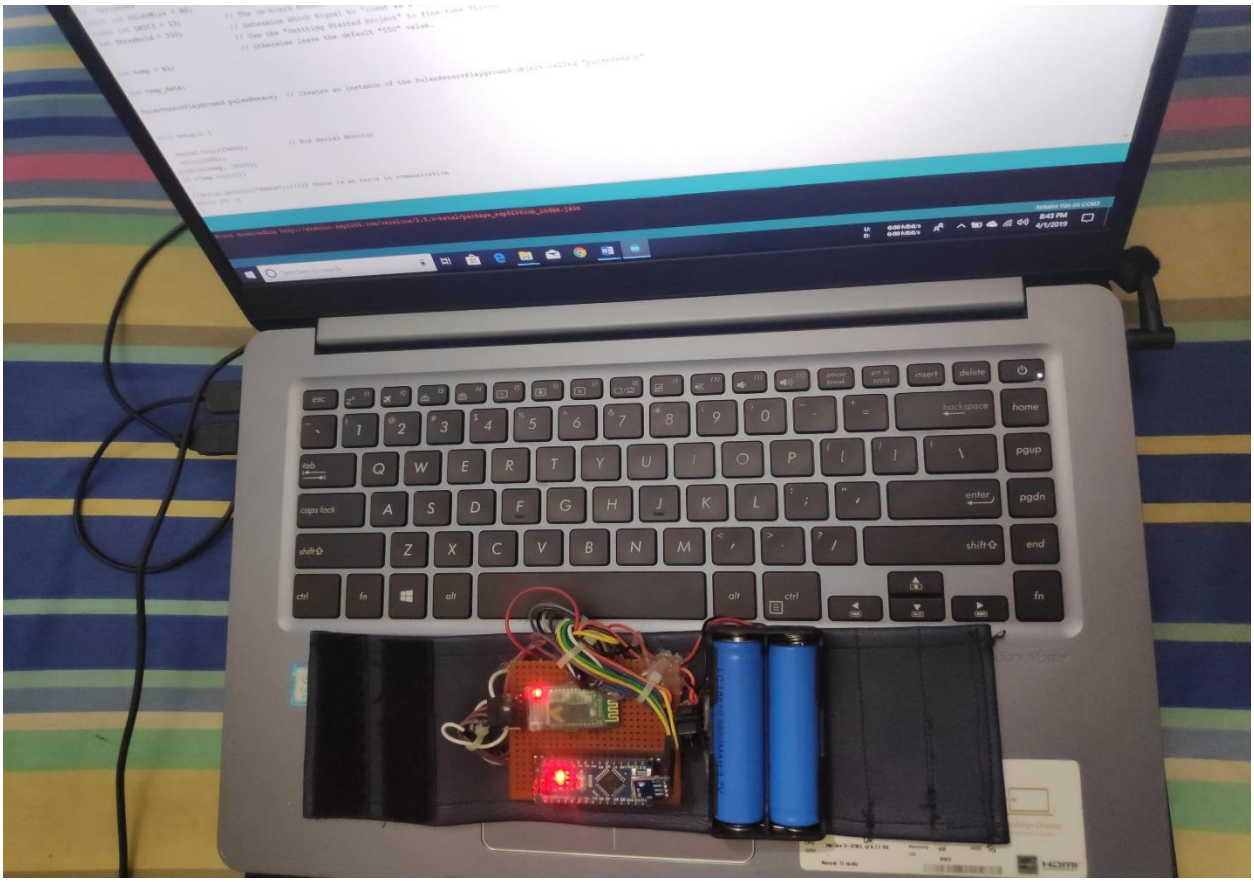

Fig 4.2: Completed Hardware System

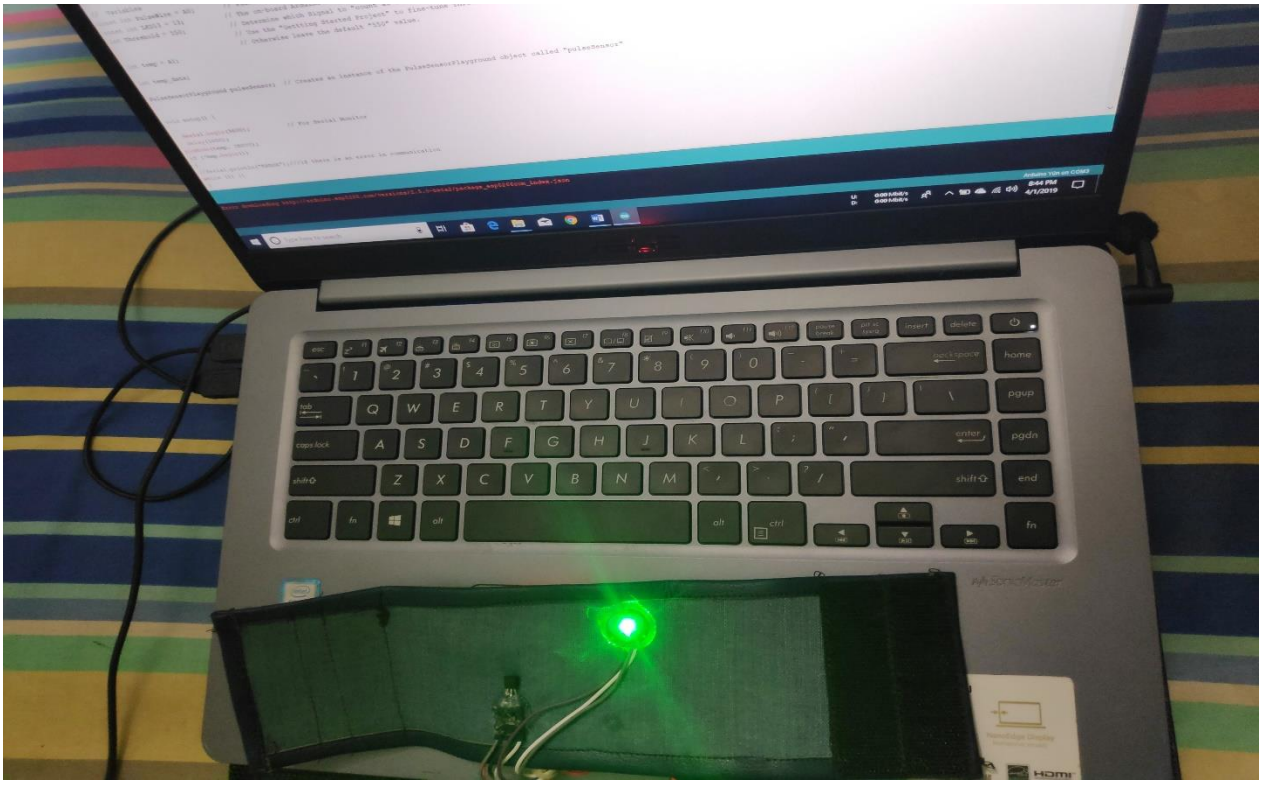

Fig 4.3: Completed Hardware System

CHAPTER 5

Implementation and Testing

In this chapter, we will discuss the final output of our project SenseBot. We will also show different types of outcome from different human beings.

5.1 Device Wore by Person 1 and Outcome:

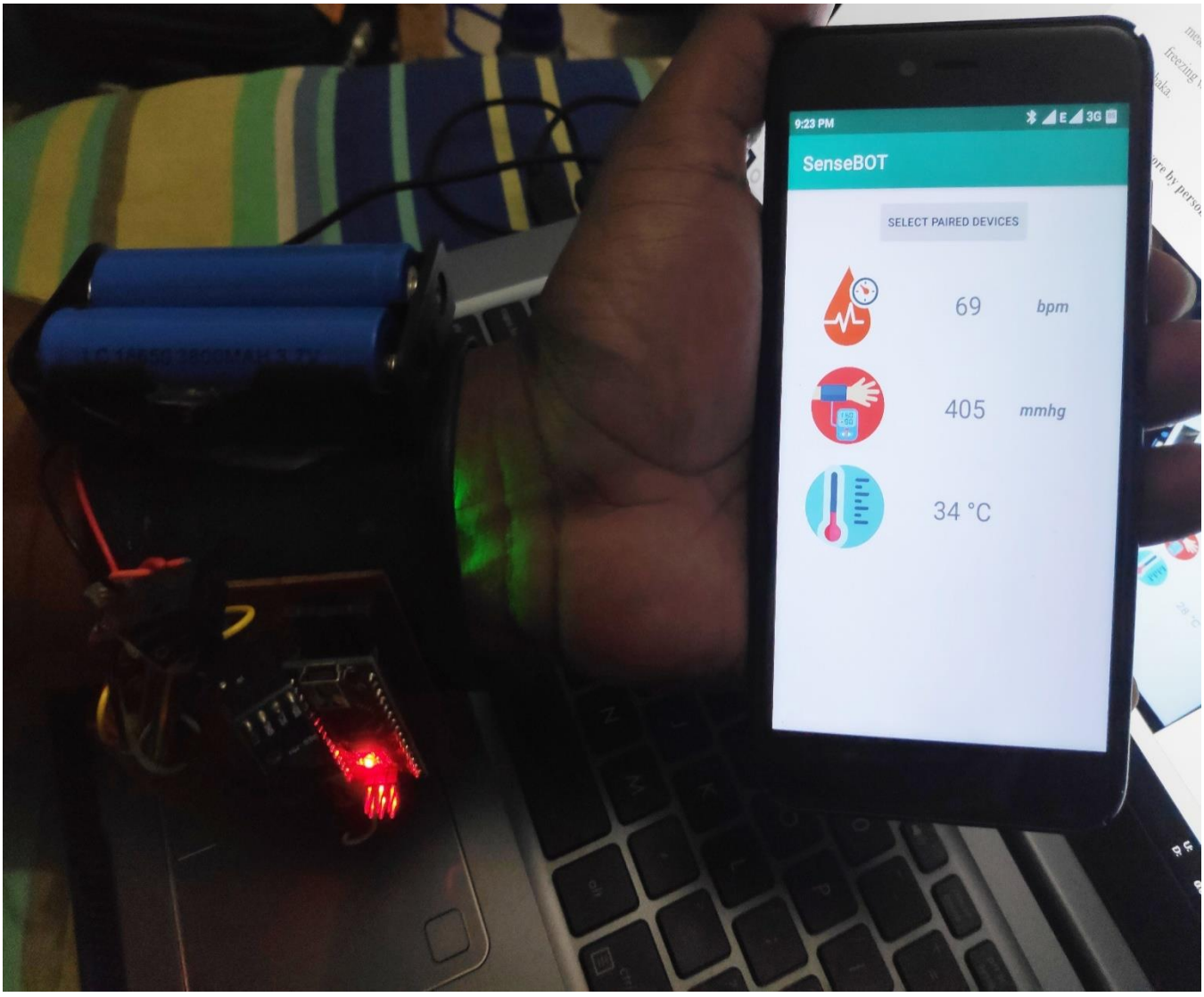

Fig 5.1: SenseBot wore by person 1

From the above picture, we can see that the first person's pulse rate is 69 beats per minute & his body temperature is 34 degrees Celsius which is equivalent to 95 degree Fahrenheit. That does mean, his health condition is normal. Also we can notice that, the barometric pressure is 405 mmgh in Dhanmondi, Dhaka.

5.2 Device Wore by Person 2 and Outcome:

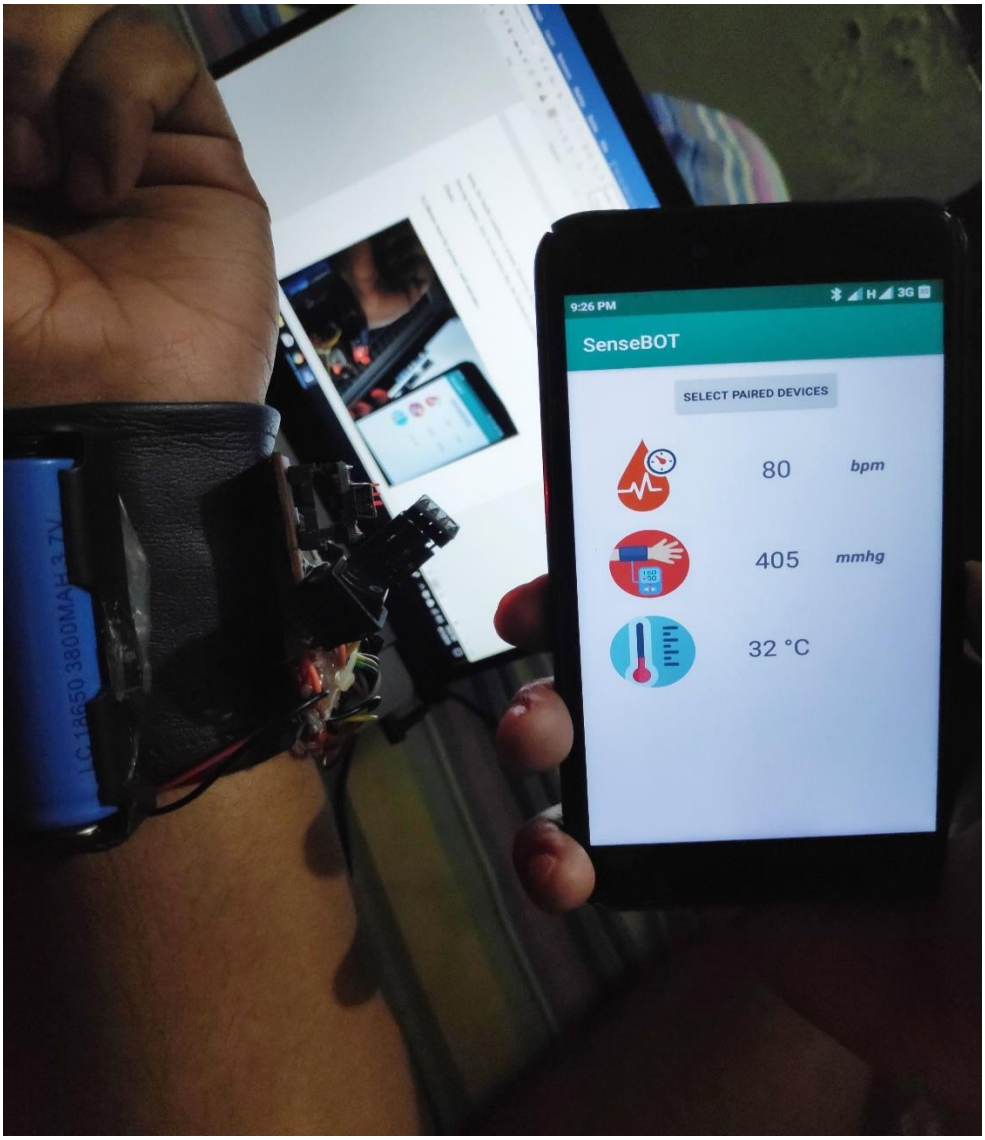

Fig 5.2: SenseBot wore by person 2

From the above picture, we can see that the second person's pulse rate is 80 beats per minute & his body temperature is 32degrees Celsius which is equivalent to 93 degree Fahrenheit. That does mean, his health condition is normal. However, his body temperature is a bit cooler because of clammy weather. Here, the barometric pressure is 405 mmgh in Dhanmondi, Dhaka.

Finally, we can see that the device is successfully measuring those three things from different human beings and the application is successfully showing the result in the cellphone display.

CHAPTER 6

Conclusion and Future Scope

6.1 Conclusion

We tried our best to develop our project but still we have some limitations and obstacles. Here, we are discussing some of those limitations which might be solved in future.

- Our mobile application is currently supported only on android platform.
- We do not have dedicated server to control our system more professionally.
- We could not provide any connection with Doctors.
- There is no alarm system if any health condition goes wrong for any patient.
- The quality of the sensors is not up to the mark.

6.2 Future Scopes

We are planning to add more services in our existing system and also want to develop the current performance as well.

- We will be able to implement ECG testing system in our current device.
- A connection with a doctor will be set up. So that, if any condition of a patient becomes abnormal, a call or SMS will be delivered to a doctor.
- Glucose measuring without the presence of blood will be made possible.
- The application will be able to predict the future health condition of patients and also will give specific suggestions to different users according their health conditions.

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APPENDIX

Appendix: Project Reflection

We have had a tremendous experience throughout the journey since last year. We are three in numbers in our group. We have had strong bonding and relationship with each other. Actually, the true bonding formed when we started to work together to make our dream successful. At first, it was hard for us to believe that we will make it. Everything seemed turbid when we had started the journey. However, day by day we became confident. After analyzing the requirement and making a proper plan, we felt even more confident. The hardship was not fade away yet. We faced several problems when we started to search the sensors. It was so difficult for us to find out good quality sensors. We bought some sensors and implemented those in the device but the accuracy was not that much good. We again went to the market to search it and tried to find out better sensors. After collecting all the equipment, we had built the device and made the application. Yes, it is true that, we had a plethora of errors at first but we solved the problems together. After a year of hard work, we've made it finally. We never felt demotivated. Throughout the journey we've learnt how to cooperate with each other, we gathered a lot of idea about hardware beside software, we now have a belief that, if we work together, we are able to solve any herculean task. After all, we are grateful to The Almighty ALLAH. We also want to thank our honorable supervisor Md. Sadekur Rahman Sir for his immense support and excellent guiding throughout the session.

Health Monitoring App Using Various Sensors To Collect Vital Life Saving Information Through IOT (SenseBOT)

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