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Health Monitoring System

A Project Report of Project - 2

Submitted by

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(1713104033)

in partial fulfilment for the award of the degree

of

BACHELOR OF COMPUTER APPLICATION(BCA)

SCHOOL OF COMPUTING SCIENCE AND ENGINEERING

Under the Supervision of

MR. S Prakash
Professor

APRIL / MAY- 2020

SCHOOL OF COMPUTING AND SCIENCE AND ENGINEERING

BONAFIDE CERTIFICATE

This is to certify that **Anurag Khaiwal** student of BCA Final Semester enrolment number **1713104033**, January 2020 – June 2020 session of this institute has completed her final semester project entitled "Health Monitoring System".

She has submitted satisfactory project report for the award of degree of Bachelor Of Computer Applications (BCA) of G.U.

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Professor
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ACKNOWLEDGEMENT

"No task is a single man's effort"

This project is a culmination of task undertaken by me. Acknowledgement is not mere formality or ritual but a genuine opportunity to express the indebtedness to all those without whose active support and encouragement this project wouldn't have been possible. One of most pleasing aspects in collecting the necessary information and compiling it is the opportunity to thank those who have actively contributed to it.

I am extremely grateful to Mr. S. Prakash for her reversed guidance and encouragement, which led to the completion of this project till now. Without his constant appraisal and efforts, this task would have been a mere dream. He was always there to help us throughout this project. He provided us with all the necessary resources and guidance during the project which helped us to complete the project successfully. My special thank to all faculty members for their active support, affectionate guidance and constant encouragement.

Anurag Khaiwal

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ABSTRACT

In today's world of automation, the field of biomedical is no longer aloof. Application of engineering and technology has proved its significance in the field of biomedical. It not only made things easier for the patients but also helped to take care of their health. The basic idea behind this project is, it implies that a person sitting at home can check his/her temperature, pulse rate and ECG without the need of visiting a clinic/hospital. There are people who live at places where it is not convenient to visit a clinic/hospital for their regular checkup, therefore, this project aims to provide the basic checkups which a person can carry out at home itself.

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ABBREVIATIONS

HMS	Health Monitoring System
ECG	Electrocardiography

LED	Light Emitting Diode
DFD	Data Flow Diagram
DB	Database
PWM	Pulse With Modulation
IC	Integrated Circuit
PC	Personnel Computer
LCD	Liquid Crystal Display
USB	Universal Serial Bus
IoT	Internet of Things

CHAPTER 1

INTRODUCTION

1.1 INTERNET OF THINGS

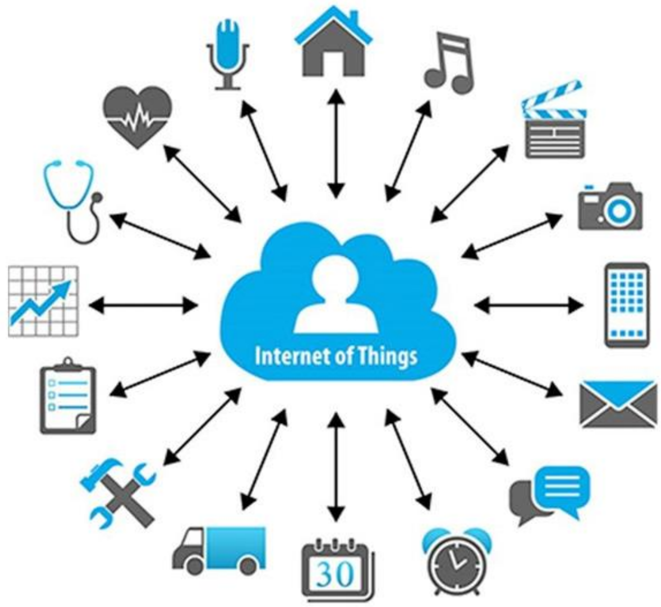


Fig.1 Internet of Things

We are living in Internet age where every physical object may be connected to each other for sharing information purpose. Due to enhanced wireless technologies like 6LoWPAN, Wi-Fi, Bluetooth & ZigBee, many things or objects around us have the ability to exchange information automatically. This network of things or objects that are connected to each other via Internet, local area network or Wireless Sensor Networks is called Internet of Things (IoT). IoT is made of two words one is Internet and second is Things. Internet is network of networks that are connected world widely via some standard protocols. Things refers to any Physical Object that may be involved in connectivity. IoT uses many technologies like Radio Frequency Identification (RFID) tag, Sensors, Actuators and Smart phone and cloud computing support etc. By using IoT, we can connect anything, can access any service and useful information of any object from anywhere and anytime.

1.2 INTERNET OF THINGS APPLICATION AREAS

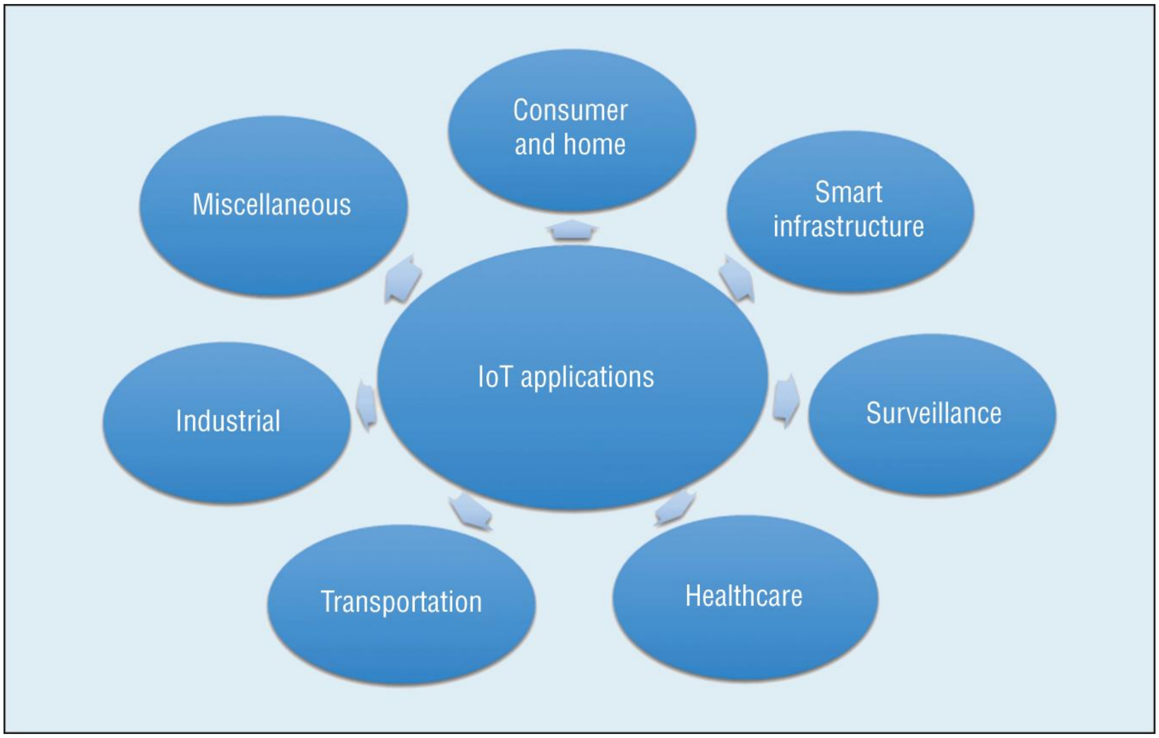


Fig.2 Applications of Internet of Things

Near Field Communication (NFC), Radio frequency Identification (RFID), Machine-to-Machine Communication (M2M) & Vehicle-to-Vehicle Communication (V2V) are the technologies by which IoT is being implemented exponentially. It is assumed that more than 50 billion IoT devices will be connected through internet by 2020. It is going to change human life, working style, entertaining ways and many more. IoT have many Applications Areas and domain of these application are increasing day by day.

1.3 INTERNET OF THINGS AND HEALTH MONITORING

Health is one of the global challenges for humanity. In the last decade the healthcare has drawn considerable amount of attention. The prime goal was to develop a reliable health monitoring system so that the healthcare professionals can monitor the patients, who are either hospitalized or executing their normal daily life activities.

1.4 INTERNET OF THINGS APPLICATIONS IN HEALTH MONITORING

IoT could have various applications in medical industry for improving the quality of life, saving lives and reduce treatment cost. By using IoT based technologies, medical industry can improve the ability of the healthcare system in minimizing human error, simplifying the treatment process and quality of life for caregiver as well patient. IoT based monitoring system can help doctors in treatments and predict a symptom before starting diagnosis. Monitoring system can also alarm in medical emergency situations like falling of old age patient ,patient has abnormal behavior as in the intensive care unit (ICU).There are many IoT based healthcare use cases/application area as follows:

- Health Monitoring
- Personal Fitness Monitoring
- Chronic Disease Monitoring
- Safety Monitoring
- Medication Monitoring
- Home Rehabilitation
- Real Time Location Tracking

1.5 ABOUT PROJECT

The **"HEALTH MONITORING SYSTEM"** is one of the major advancements because of its improved technology. Currently, there is need for a modernized approach. In the traditional approach the healthcare professionals play the major role. They need to visit the patient's ward for necessary diagnosis and advising. There are two basic problems associated with this approach. Firstly, the healthcare professionals must be present on site of the patient all the time and secondly, the patient remains admitted in a hospital, bedside biomedical instruments, for a period of time. In order to solve these two problems, the patients are given knowledge and information about disease diagnosis and prevention. Secondly, a reliable and readily available HMS is required.

In order to improve the above condition, we can make use of technology in a smarter way. In recent years, health care sensors along with raspberry pi play a vital role. Wearable sensors are in contact with the human body and monitor his or her physiological parameters. We can buy variety of sensors in the market today such as ECG sensors, temperature sensors, pulse monitors etc. The cost of the sensors varies according to their size, flexibility and accuracy. The Raspberry Pi which is a cheap, flexible, fully customizable and programmable small computer board brings the advantages of a PC to the domain of sensor network.

The project HMSis a monitoring system that checks the pulse rate, temperature and ECG of a patient. In the present era people need to visit the clinic or hospital on a daily basis as the workload is more in the developing world. In some cases people live in areas where there are no nearby clinics or hospitals, therefore, our project will help the people to check their pulse rate, temperature and ECG at their homes itself without any need to visit the clinic or hospital.

In our system we are using different available sensors for checking temperature, pulse rate and ECG of an individual. This sensor collected data i.e. biometric information is given to raspberry pi and then it is transferred to server. The data stored in a database and can be displayed in a website that can be accessed only by authorized personnel. The doctors, RMOs, patient or his family members can be given authorization. The system even facilitates the doctor to view the patient's previous history from the data in memory.

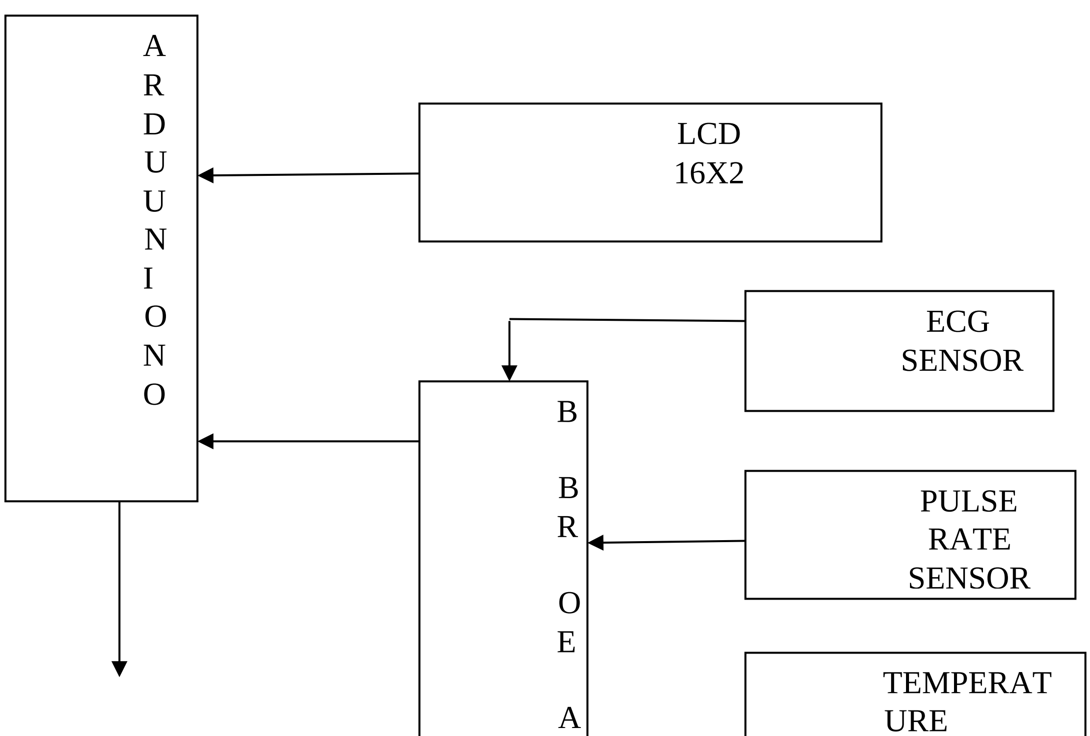
CHAPTER 2

SYSTEM ANALYSIS

The Merriam Webster dictionary defines system analysis as “the process of studying a procedure or business in order to identify its goal and purposes and create systems and procedures that will achieve them in an efficient way”. Another view sees system analysis as a problem solving technique that decomposes a system into its component pieces for the purpose of the studying how well those component parts work and interact to accomplish their purpose.

2.1 EXISTING SYSTEM

In the existing system, we use active network technology to network various sensors to a single HMS. User’scritical parameters are continuously monitored via single HMS and are reported to the user. In this HMS we monitor the important physical parameters like temperature, pulse rate and ECG using the sensors which are readily available. Thus, the analog values that are sensed by the different sensors are given to the microcontroller attached to it. The microcontroller processes these analog signal values of health parameters separately and converts it to digital values.



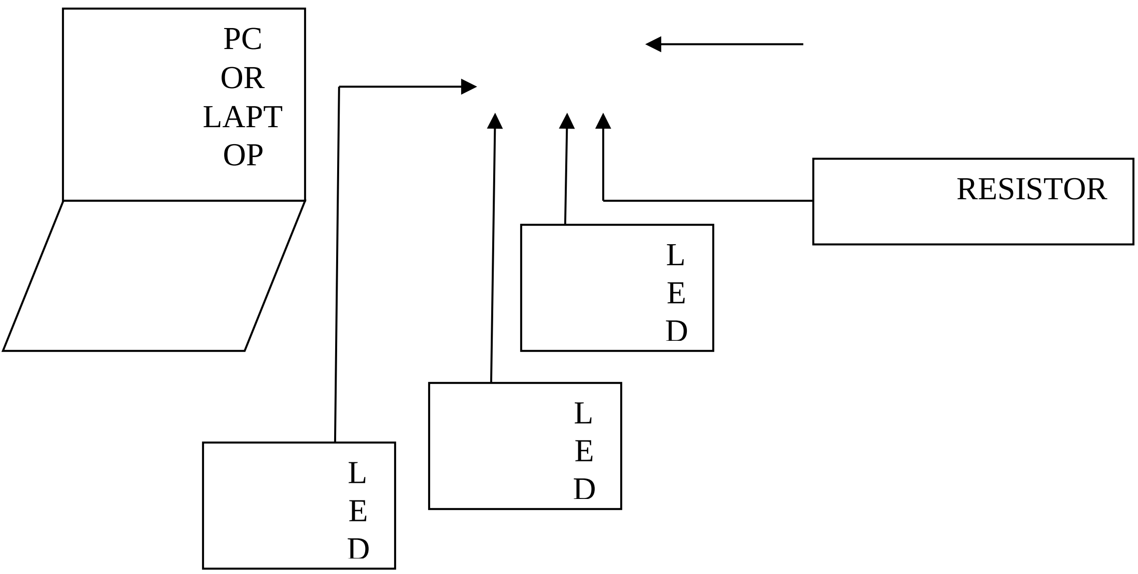


Fig.3 Block Diagram of existing system

According to the above block diagram we are using Arduino Uno which is used to create an interface between the monitor, sensors and LCD. The arduino boards are used to read inputs: lights on a sensor, a finger on a button, etc. and turn it into an output, activating a motor, turning on LED, publishing something online. We can tell our board what to do by a sending a set of instructions to the microcontroller (ATmega328) on the board. To do so we use the Arduino programming language (based on wiring) and the Arduino software (IDE) based on processing.

Therefore, we have connected the Arduino board to the laptop so that we can work on the software to write the programs and give instructions to board to give the appropriate outputs. The wiring of the sensors and the LCD are done on the arduino via breadboard. We have used three LED's green for temperature sensor, red for pulse rate sensor and blue for ECG. We have used resistor to limit the current through the LED and to prevent that it burns.

LCD (16X2) screen has been used to display the output of the pulse rate and temperature sensor.

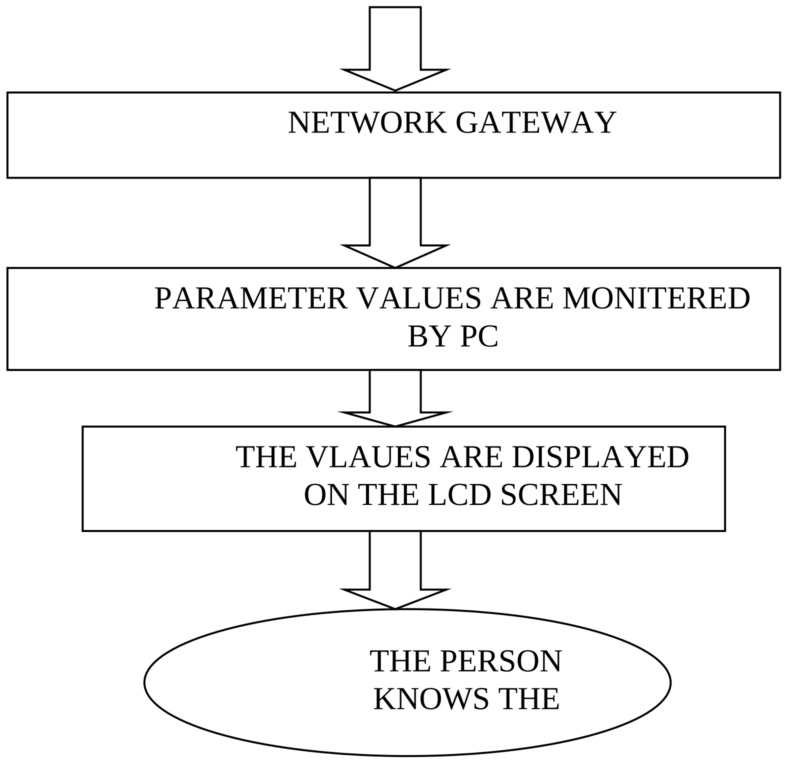


Fig.4 Flow chart of existing system

According to the flowchart of the system anyone of the sensor is attached to the body of the person. The readings that are sensed by the sensor are taken by the arduino board and displayed on the LCD screen and the results can even be displayed on the serial monitor and serial plotter of the software. And the readings are monitored by the PC/laptop.

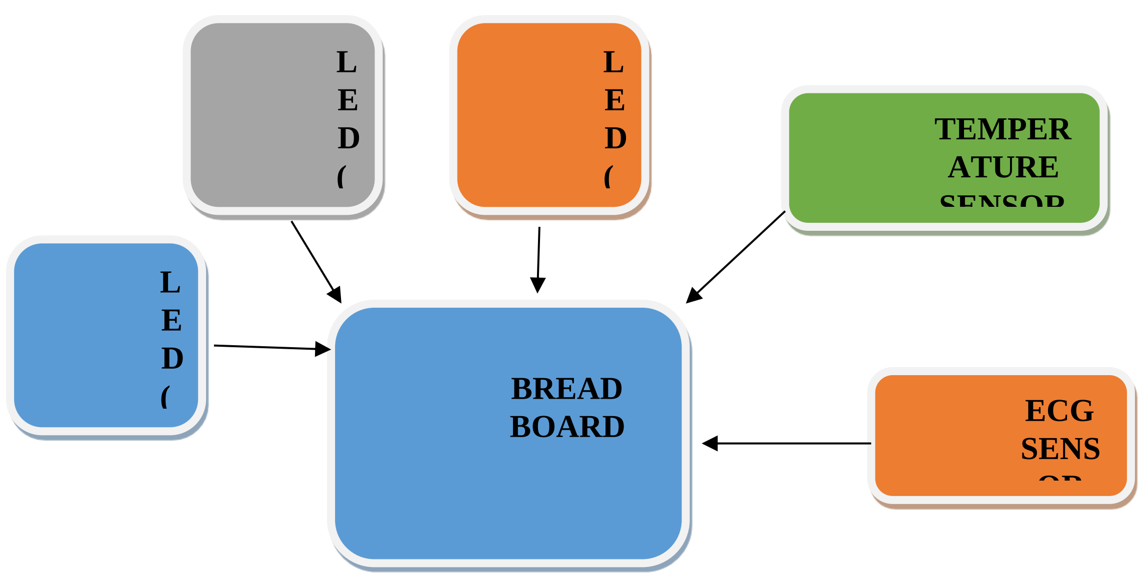
2.2 PROPOSED SYSTEM

Proposed system is a HMS, through our system the user check his/her temperature, pulse rate and ECG. Our module has the following advantages.

- User friendly interface

- No need to visit the clinic/hospital for checkups
- Less error
- Wireless

All the manual difficulties in managing the HMS have been rectified by implementing computerization.



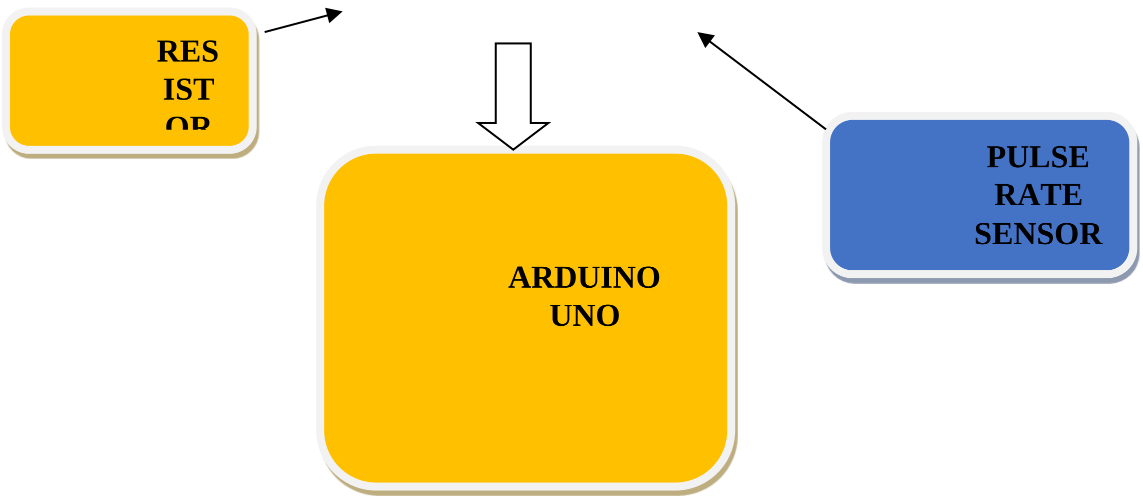


Fig.5 Proposed System

2.3 LIMITATIONS OF EXISTING SYSTEM

The existing system uses only three sensors i.e. temperature, pulse rate and ECG sensor. The system works on arduino uno. An interface was created to upload the data on server and send it to the person’s mobile phone via SMS, mail, etc. The data is now displayed on the LCD because the raspberry pi crashed while running the code for multiple sensors altogether.

CHAPTER 3

FEASIBILITY STUDY

Whatever we think need not be feasible. It is wise to think about the feasibility of any problem undertaken. Feasibility is the study of impact, what happens in the organization by the development of a system. The impact can be either positive or negative. When the positive nominate the negatives, then the system is considered feasible. Here the feasibility study can be performed in two ways such as financial, technical and resource and time feasibility.

3.1 FINANCIAL FEASIBILITY

Development of this system is highly financially feasible. The organization need not spend much money for the development of the system which is already available. The only thing to be done is to make an environment for the development of the system with an effective supervision. If this is done then we can attain maximum usability of the corresponding resources. Even after the development the organization need not to spend much money for its maintenance. Therefore, the system is economically feasible.

3.2 TECHNICAL FEASIBILITY

We can say that it is technically feasible, since there will not be much difficulty in getting the required resources for the development and maintenance of the system. All the resources needed for the development and maintenance of the system will be easily available in the organization.

3.3 RESOURCE AND TIME FEASIBILITY

Resources that are required for the hospital management system are programming device (Laptop), hosting space (freely available), arduino uno (easily available), breadboard (easily available) and LCD display (easily available). Therefore the HMS has required resource feasibility.

CHAPTER 4

HARDWARE AND SENSORS

4.1 ARDUINO UNO

Arduino Uno is a microcontroller board based on the ATmega328P. It has 14 digital input/output pins (of which 6 can be used as PWM outputs), 6 analog inputs, a 16MHz quartz crystal, a USB connection, a power jack, an ICSP header and a reset button. It connects everything needed to support the microcontroller, simply connect it to computer but here in the HMS we are connecting it to the raspberry pi.

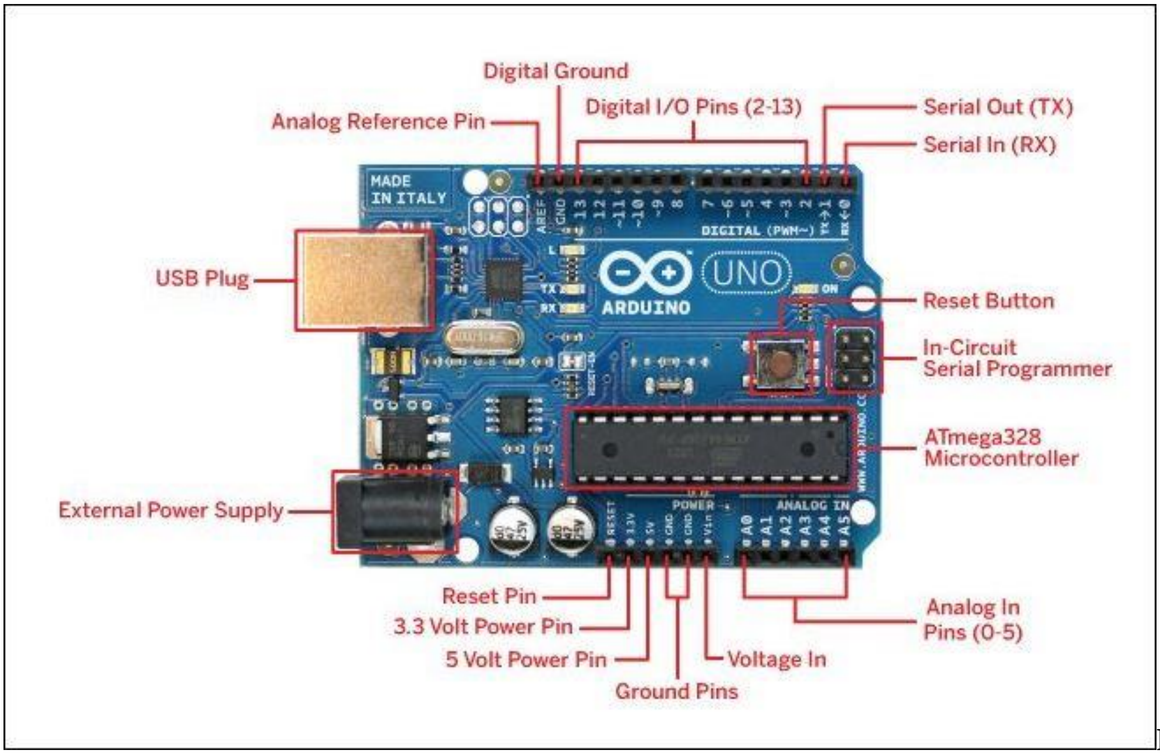


Fig.6

Arduino Uno

Starting clockwise from the top center:

1. Analog Reference pin
2. Digital Ground
3. Digital Pins 2-13
4. Digital Pins 0-1/Serial In/Out – TX/XR (dark green) –These pins cannot be used for digital input/output (digitalRead and digitalWrite) if you are also using serial communication (e.g. Serial.begin).
5. Reset Button – S1
6. In-circuit Serial Programmer
7. Analog In Pins 0-5
8. Power and Ground Pins
9. External Power Supply In (9-12VDC)-X1
10. Toggles External Power and USB Power (place jumper on two pins closest to desired supply) – SV1

11. USB (used for uploading sketches to the board and for serial communication between the board and the computer, can be used to power the board)

4.2 RASPBERRY PI

In the simplest form the Raspberry Pi is a credit card sized computer developed by the raspberry foundation in UK. With its huge flexibility and simplicity, Raspberry Pi has gained its importance among tech geeks and enthusiasts alike.

What can you do with Raspberry Pi?

There are endless possibilities for what you can do with this credit card sized computer. You can interface all those sensors, motors, LEDs, LCD screens, etc. to your Raspberry Pi. Or you can plug in a USB keyboard and mouse to it to replace the huge CPU of your PC with a credit card sized PC and perform almost all functions that you can with a Linux PC. You can even make your own dream computer that has no keyboard or mouse. Instead, you can use just a bunch of sensors to sense your motion and move the cursor on your screen.

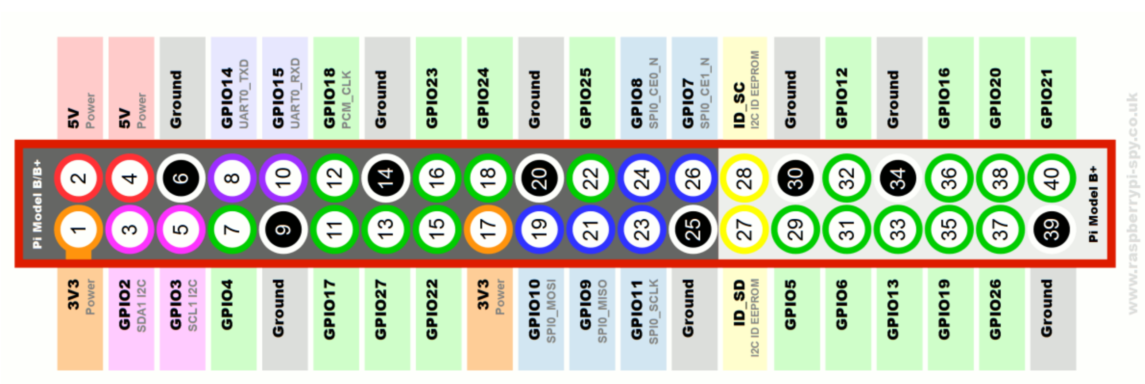


Fig. 7 GPIO module raspberry pi

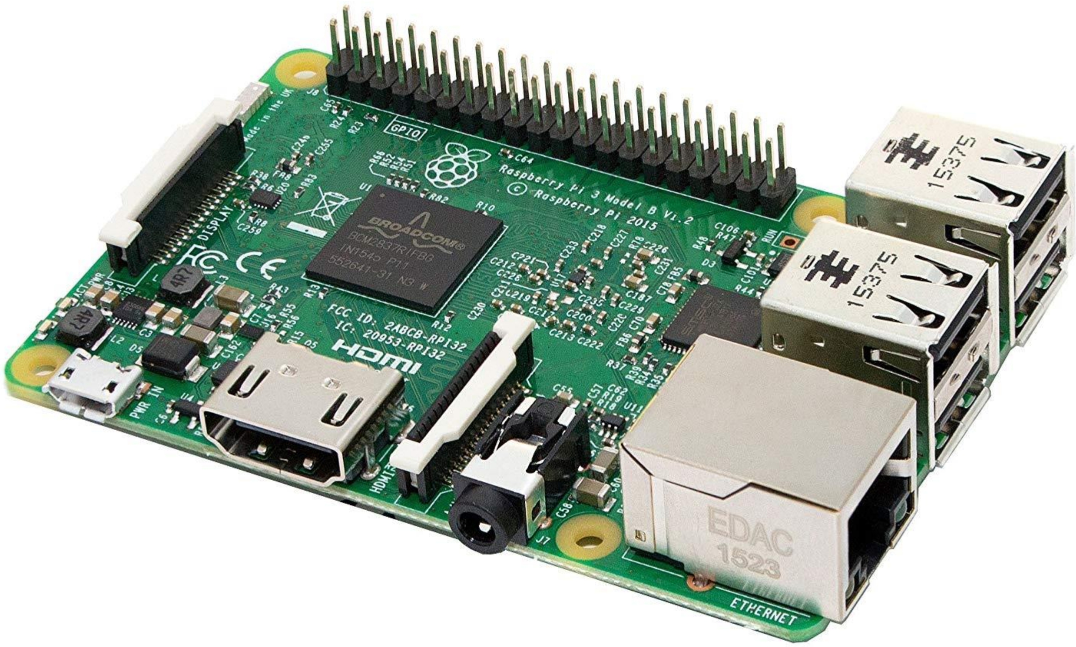


Fig. 8 Raspberry Pi

COMPONENTS OF RASPBERY PI

- **ARM CPU/GPU:** This is a Broadcom BCM2835 System on a Chip (SoC) that's made up of an ARM central processing unit (CPU) and a Videocore 4 graphics processing unit (GPU). The CPU handles all the computations that make a computer work (taking input, doing calculations and producing output), and the GPU handles graphics output.
- **GPIO:** These are exposed general-purpose input/output connection points that will allow the real hardware hobbyists the opportunity to tinker.
- **RCA:** An RCA jack allows connection of analog TVs and other similar output devices.
- **Audio out:** This is a standard 3.55-millimeter jack for connection of audio output devices such as headphones or speakers. There is no audio in.
- **LEDs:** Light-emitting diodes, for all of your indicator light needs.

- **USB:** This is a common connection port for peripheral devices of all types (including your mouse and keyboard). Model A has one, and Model B has two. You can use a USB hub to expand the number of ports or plug your mouse into your keyboard if it has its own USB port.
- **HDMI:** This connector allows you to hook up a high-definition television or other compatible device using an HDMI cable.
- **Power:** This is a 5v Micro USB power connector into which you can plug your compatible power supply.
- **SD card slot:** This is a full-sized SD card slot. An SD card with an operating system (OS) installed is required for booting the device. They are available for purchase from the manufacturers, but you can also download an OS and save it to the card yourself if you have a Linux machine and the wherewithal.
  - **Ethernet:** This connector allows for wired network access and is only available on the Model B.

4.3 ECG SENSOR

ECG records the electrical activity generated by heart muscles depolarization, which propagates in pulsating electrical waves towards the skin. Although the electricity amount is in fact very small, it can be picked up reliably with ECG electrodes attached to the skin. The full ECG setup comprises at least four electrodes which are placed on the chest or at the four extremities according to standard nomenclature (RA = right arm; LL = left leg). Of course, variations of this setup exist to allow more flexible and less intrusive recordings, for example, by attaching the electrodes to the forearms and legs. ECG electrodes are typically wet sensors, requiring the use of conductive gel to increase connectivity between skin and electrodes.

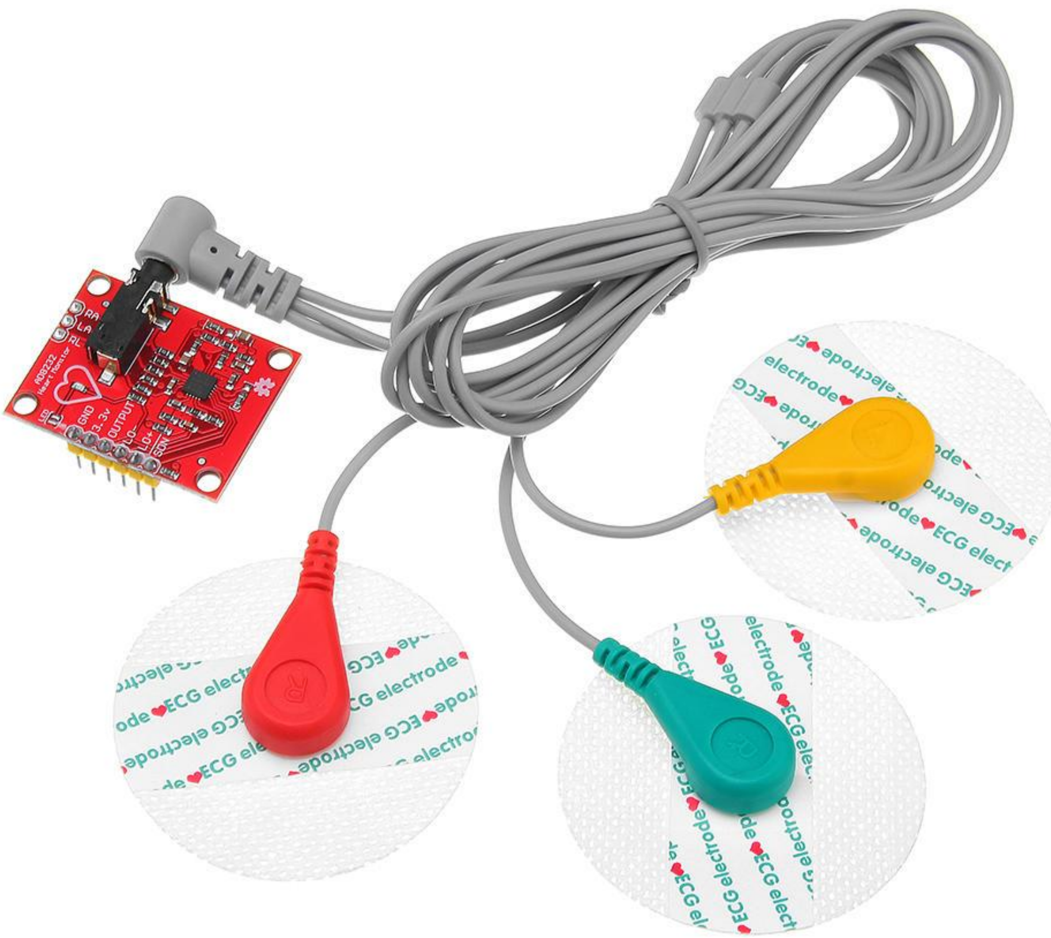


Fig.9 ECG sensor

4.4 LM35 TEMPERATURE SENSOR

Temperature sensor is a device which is designed specifically to measure the hotness or coldness of an object. LM35 is a precision IC temperature sensor with its output proportional to the temperature (in degree Celsius). With LM35,the temperature can be measured more accurately then with a thermistor. It also possesses low self-heating and does not cause more than 0.1 degree Celsius temperature rise in still air. The operating temperature range is from -55 to 150 degree Celsius. The LM35's low output impedance, linear output, and precise inherent calibration make interfacing to readout or control circuitry especially easy.

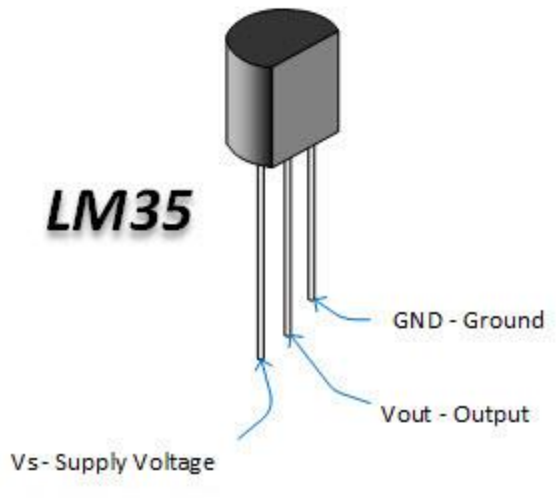


Fig.10 LM35 temperature sensor

4.5 PULSE RATE SENSOR

Pulse rate sensor is designed to give digital output of heat beat when a finger is placed on it. When the heart beat detector is working, the beat LED flashes in unison with each heart beat. This digital output can be connected to microcontroller directly to measure the Beats PerMinute (BPM) rate. It works on the principle of light modulation by blood flow through finger at each pulse.

Fig.11 pulse rate sensor

4.6 LCD

Fig.12 LCD (16X2)

The LiquidCrystal library allows you to control LCD displays that are compatible with the Hitachi HD44780 driver. There are many of them out there, and you can usually tell them by the 16-pin interface.

The LCDs have a parallel interface, meaning that the microcontroller has to manipulate several interface pins at once to control the display. The interface consists of the following pins:

A register select (RS) pin that controls where in the LCD's memory you're writing data to. You can select either the data register, which holds what goes on the screen, or an instruction register, which is where the LCD's controller looks for instructions on what to do next.

A Read/Write (R/W) pin that selects reading mode or writing mode

An Enable pin that enables writing to the registers

8 data pins (D0 -D7). The states of these pins (high or low) are the bits that you're writing to a register when you write, or the values you're reading when you read.

There's also a display contrast pin (Vo), power supply pins (+5V and Gnd) and LED Backlight (Bklt+ and BKlt-) pins that you can use to power the LCD, control the display contrast, and turn on and off the LED backlight, respectively.

The process of controlling the display involves putting the data that form the image of what you want to display into the data registers, then putting instructions in the instruction register.
The LiquidCrystal Library simplifies this for you so you don't need to know the low-level instructions.

The Hitachi-compatible LCDs can be controlled in two modes: 4-bit or 8-bit. The 4-bit mode requires seven I/O pins from the Arduino, while the 8-bit mode requires 11 pins. For displaying text on the screen, you can do most everything in 4-bit mode, so example shows how to control a 16x2 LCD in 4-bit mode.

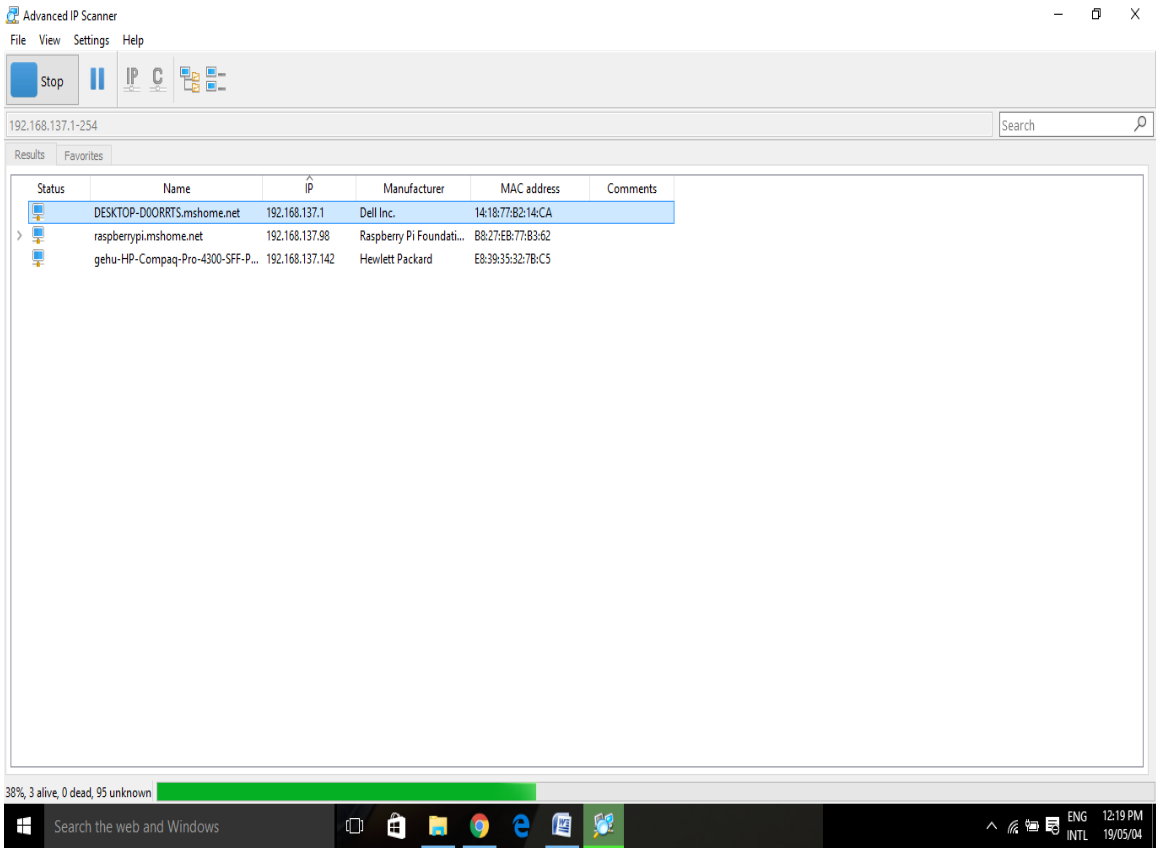
CHAPTER 5

MODULES

5.1 CONNECTION OF RASPBERRY PI TO PC

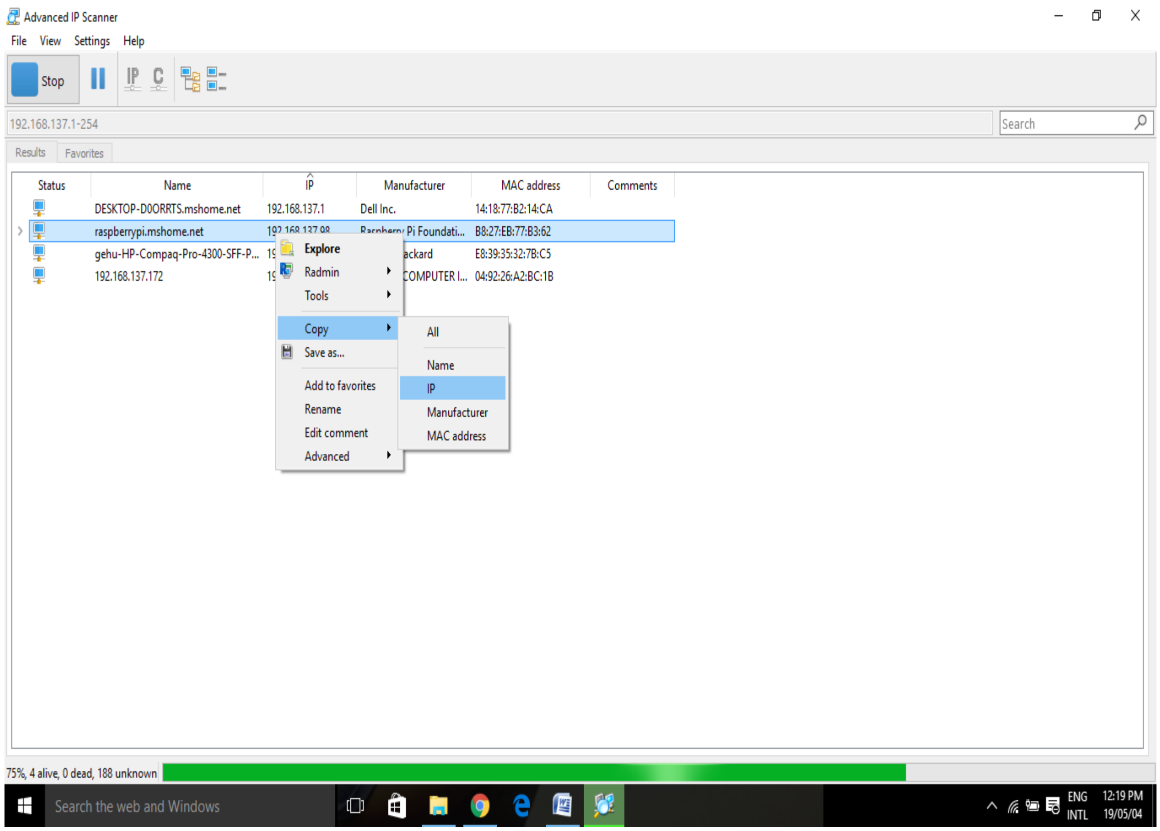
Fig.13 Connecting Raspberry Pi to Laptop

In the above screenshot we have connected the raspberry pi to the laptop by supplying it power through the power jack. Then we have used Ethernet cable for connecting the monitor and raspberry pi to the Wi-Fi.



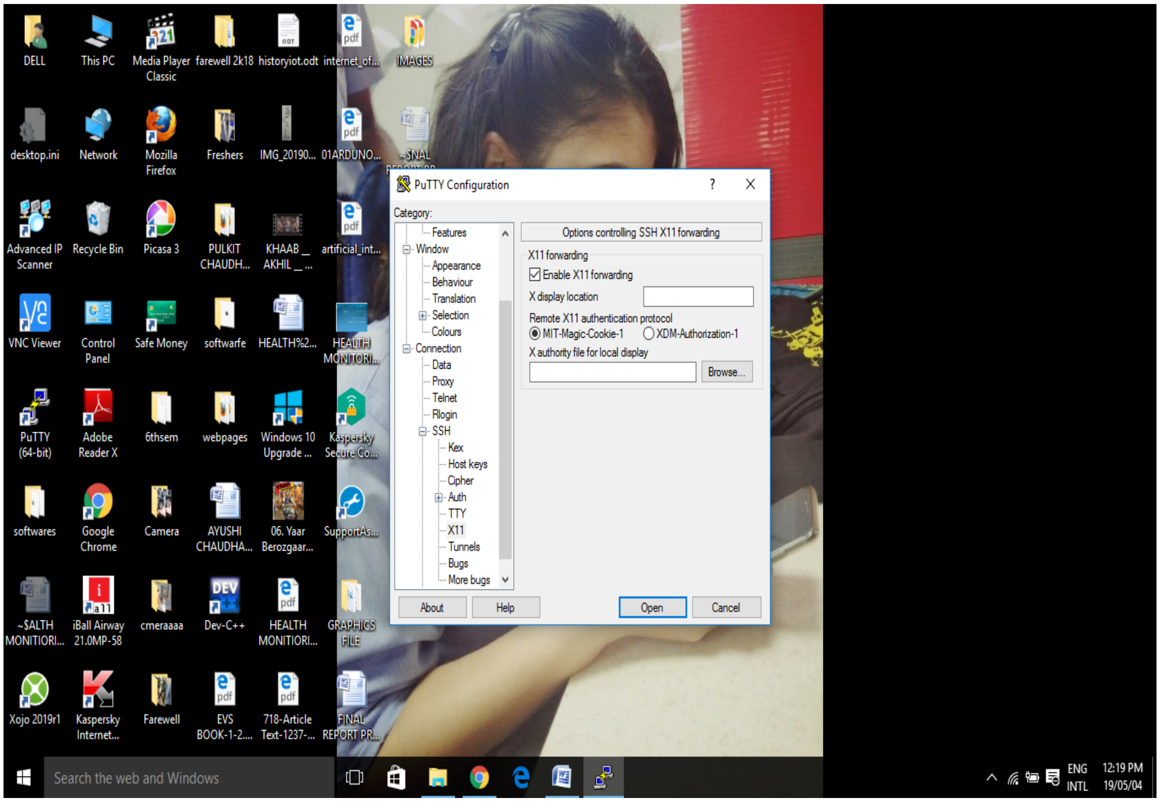
SS.1 AdvanceIP Scanner

In the above screenshot we have used the AdvancedIP Scanner software to scan the IP of raspberry pi.



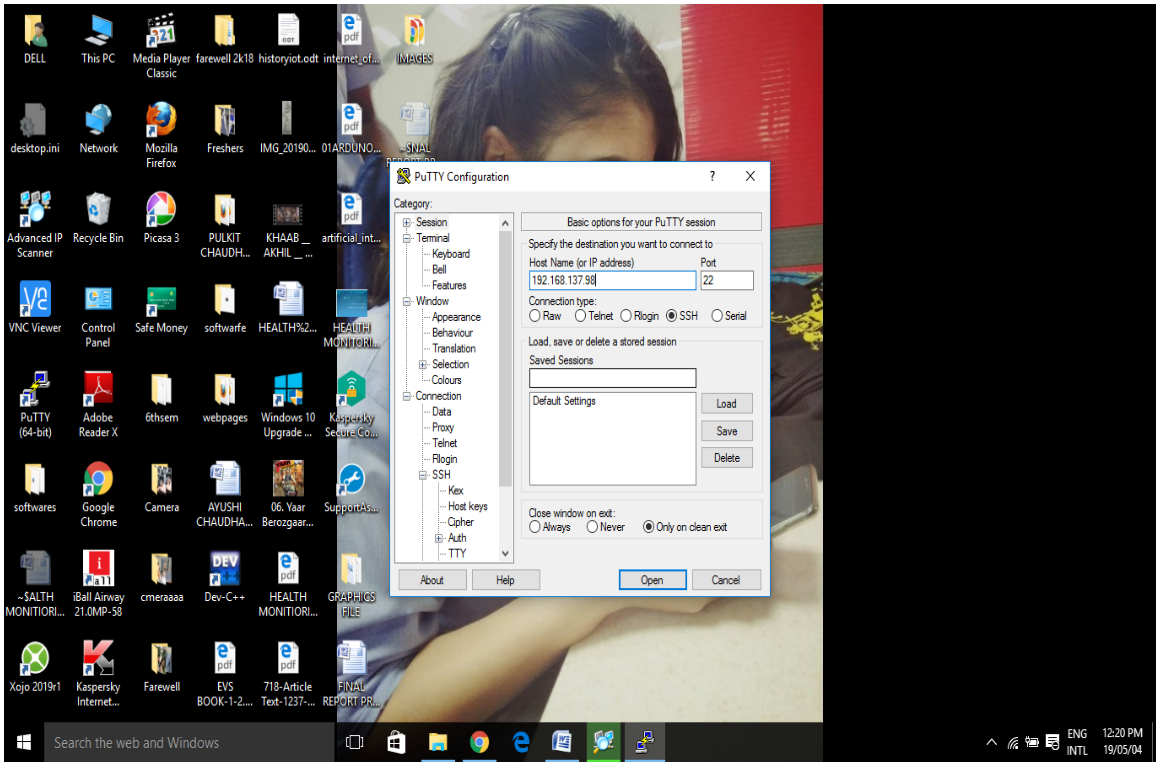
SS.2 Copying the IP of Raspberry pi

In this screenshot we are copying the IP of the raspberry pi and we are made assure by the software that the raspberry pi and the monitor are not dead i.e. they are alive in the network.



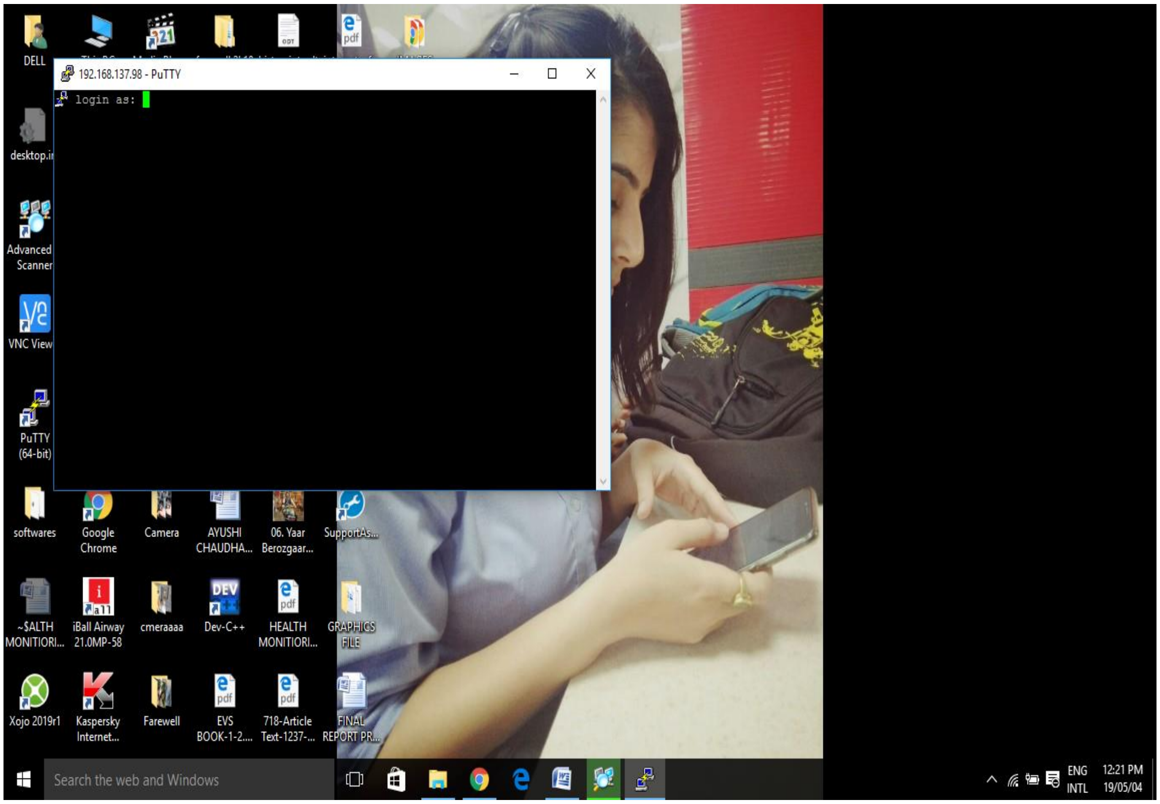
SS.3 Putty configuration

In this screenshot we are using the software Putty which provides user control over the SSH encryption key and protocol version and it allows the dynamic port forwarding with SSH (including X11 forwarding). It is used to connect the local serial ports.



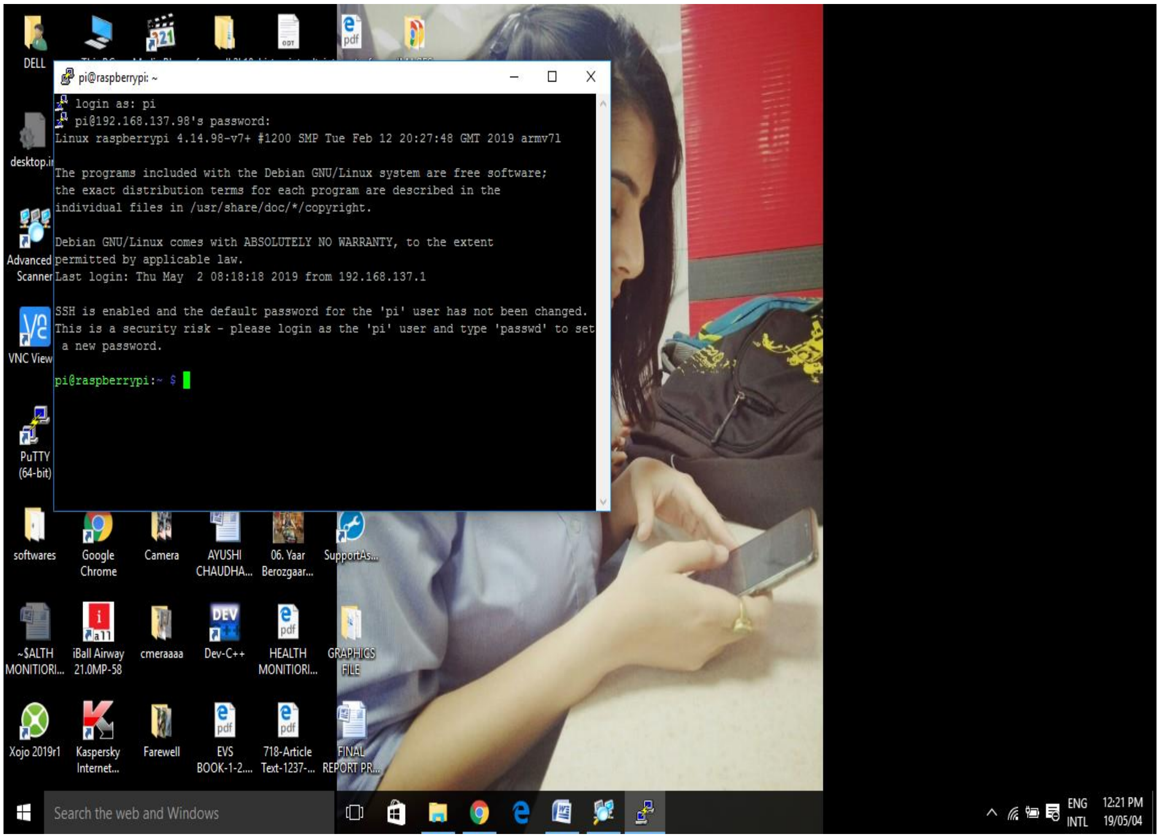
SS.4 Creating port configuration for raspberry pi

In this screenshot we are copying the IP of raspberry pi to port no 22.



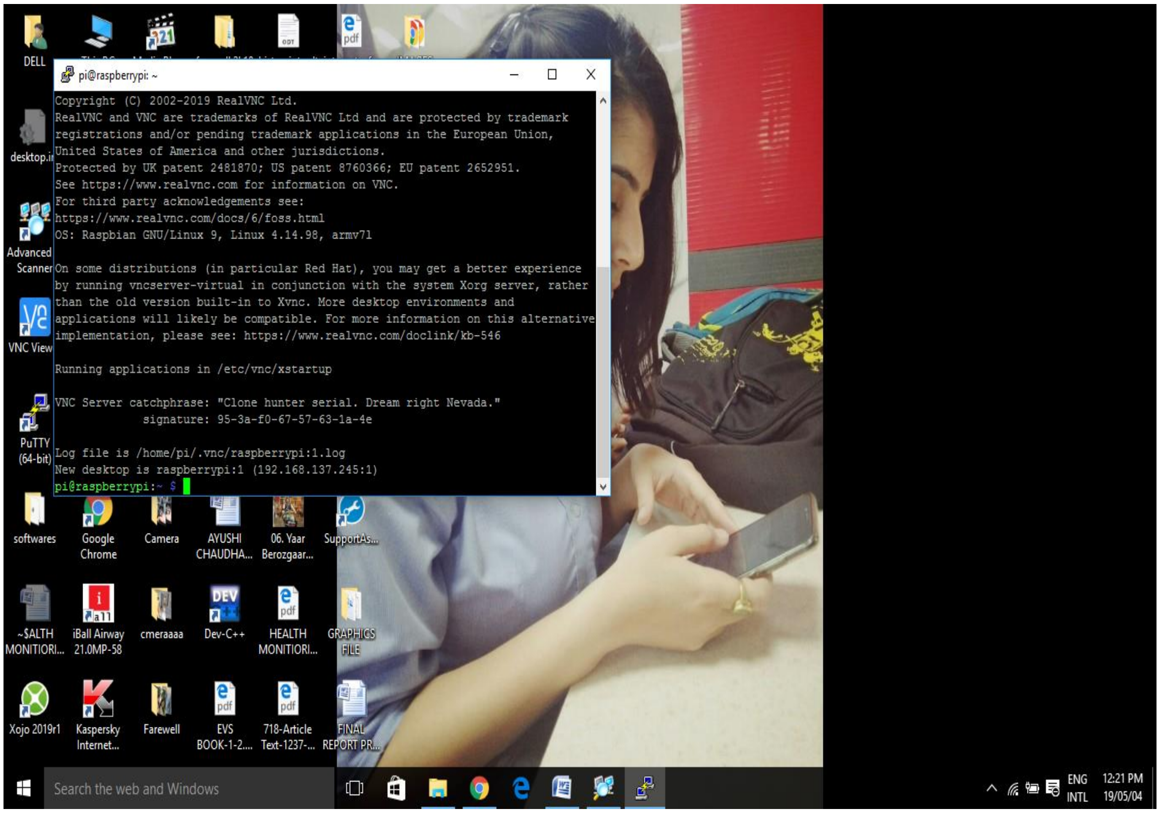
SS.5 Raspberry pi terminal window

When the connection is created between the raspberry pi and the monitor the terminal window fir raspberry pi is created via the software Putty as shown in the above screenshot.



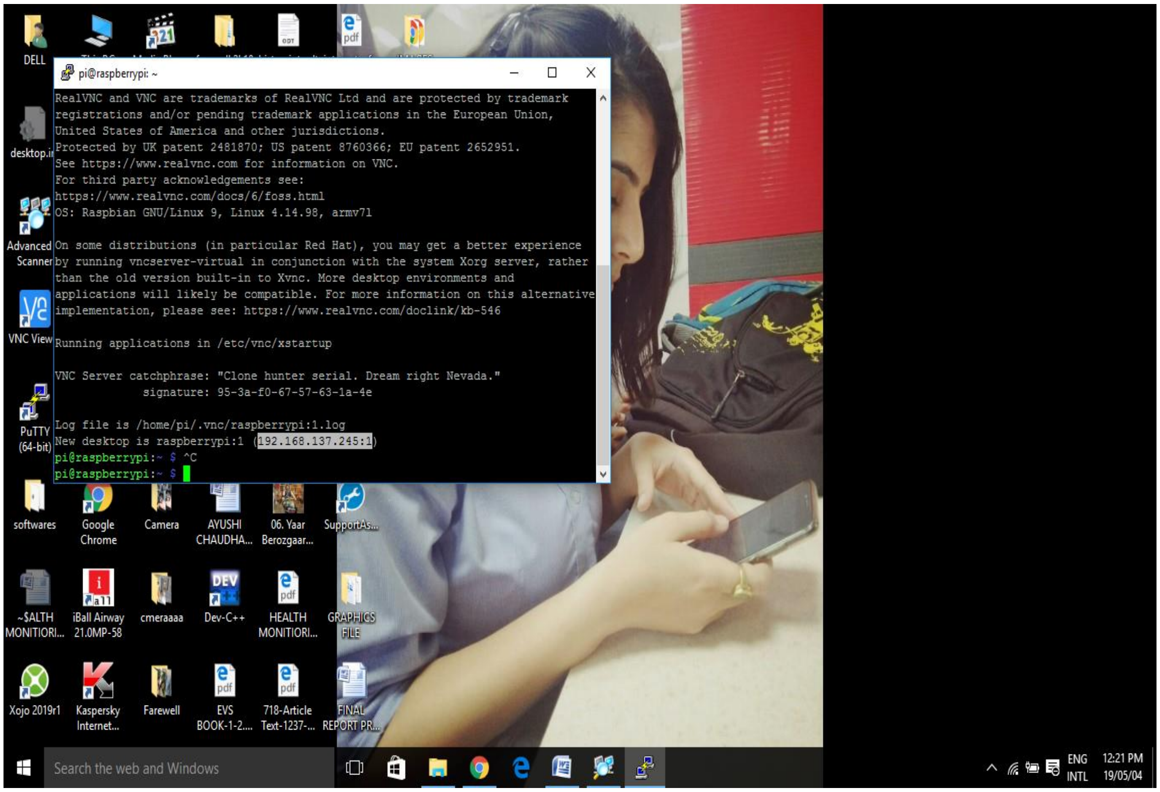
SS.6 Logged in the raspberry pi

In this screenshot we have logged into the raspberry pi by entering the user name and password as set by us for the usage of raspberry pi.



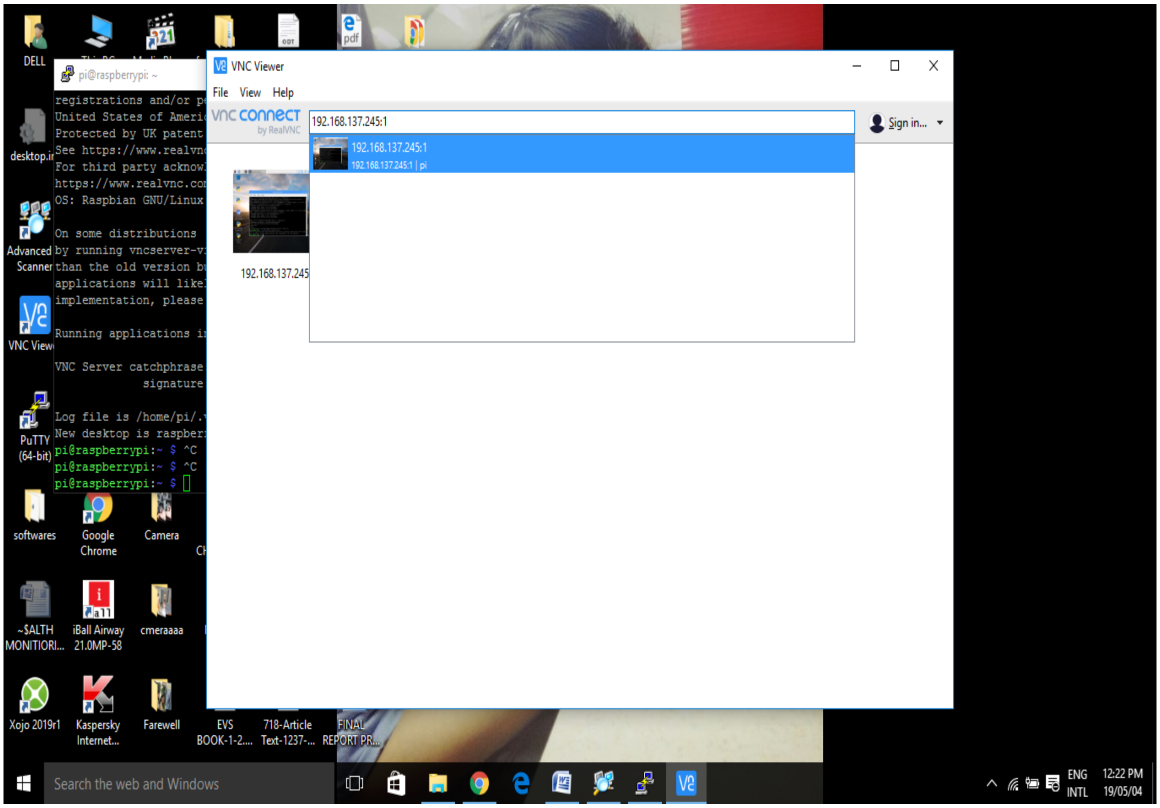
SS.7 Extracting IP of VNC server

In the above screenshot we have requested for the IP of the VNC server via the command: vncserver, in order to create the virtual window to run the raspberry pi.



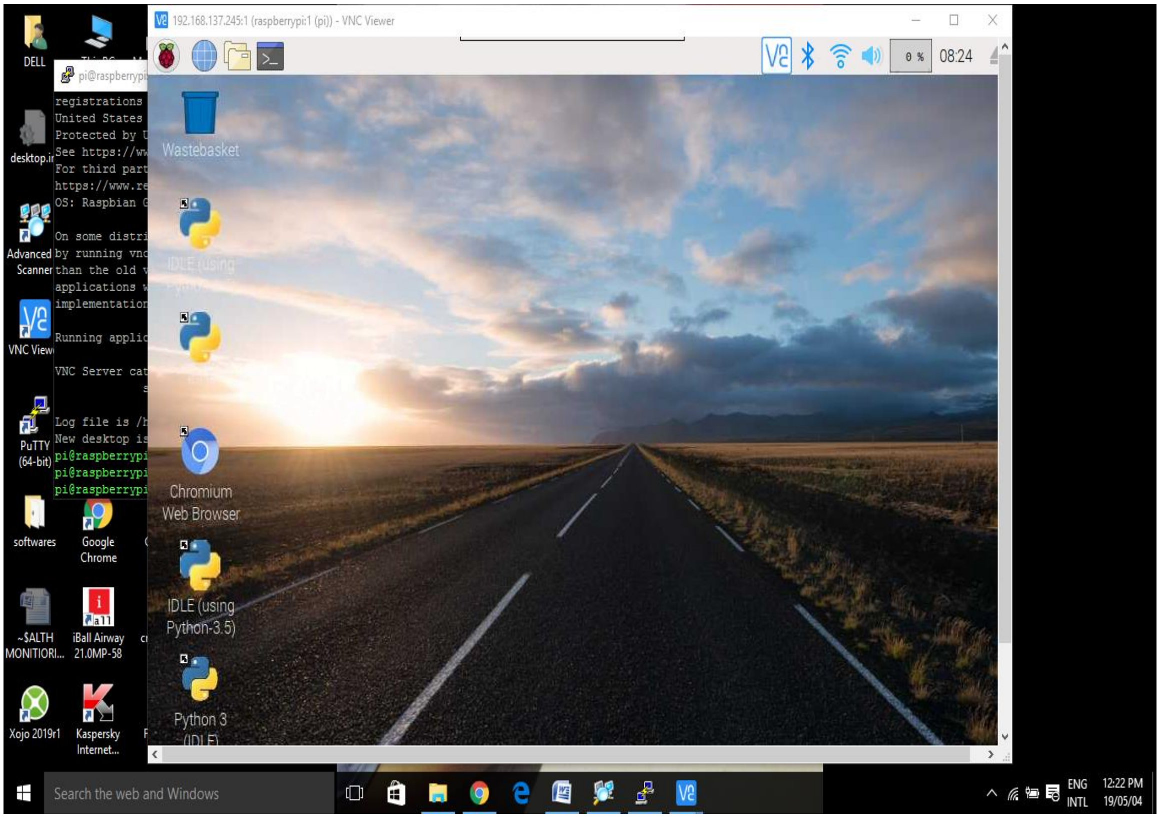
SS.8 Copied IP of VNC server

In the above screenshot we are copying the IP of the VNC server in order to open the virtual window via the VNC Viewer software.



SS.9 Copied IP to create virtual window

We now copy the IP of the VNC server in the software VNC viewer so that we can create the virtual window and work on it.



SS.10 VNC viewer (virtual window)

The virtual window has been logged in via the software VNC Viewer. This window works similar to the linux operating system. We can now work on the Arduino board here. We can even run, download, upload various things by working on the terminal window and executing the commands.

Example: the command for updating and upgrading the raspberry pi is

- sudo get-apt upgrade
- sudo get-apt update

5.2 CONNECTING ARDUINO UNO TO RASPBERRY PI

Fig.14 Connecting Arduino board to raspberry pi

Now as we have made raspberry pi as our operating system therefore we connect the arduino uno to raspberry pi. The software Arduino(IDE) has been installed in the rasbian OS therefore we can work on the different sensors. Rasbian is the operating system for raspberry pi which has already been created by the VNC Viewer.

NOTE:

We were working on the raspberry pi and had created the interface with the mobile phone to send the output of the sensors to the user through mail, SMS on his/her respective mobile phone but due to the problem of compatibility our raspberry pi crashed, therefore, we then worked only on Arduino Uno and displayed the result on the LCD(16X2) screen.

5.3 CURRENT CONNECTION OF ARDUINO UNO TO LAPTOP/PC

Fig.15 Connecting Arduino board to laptop

In the above screenshot we have connected the Arduino board directly to the laptop through the power jack via USB2.0 cable.

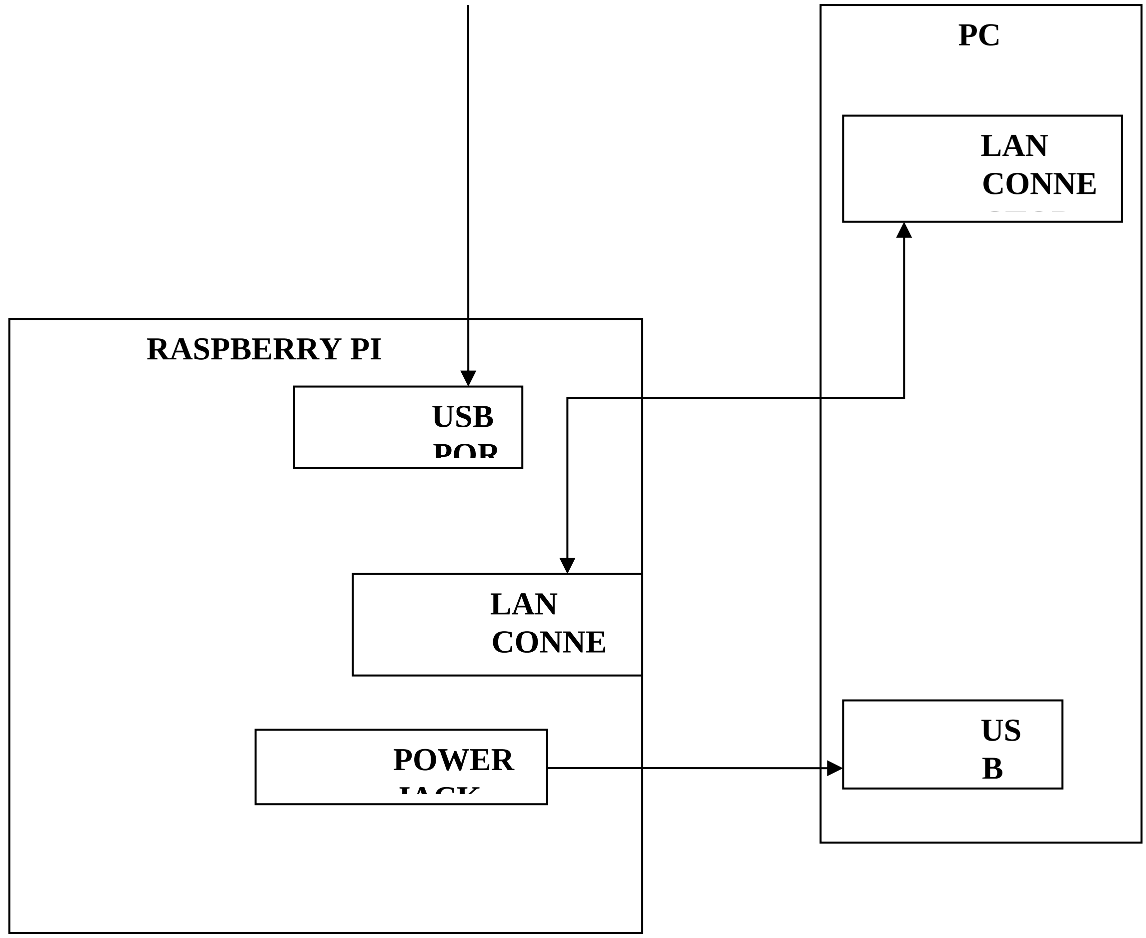


Fig. 16 Block diagram of connection of arduino uno and raspberry pi to PC (previous)

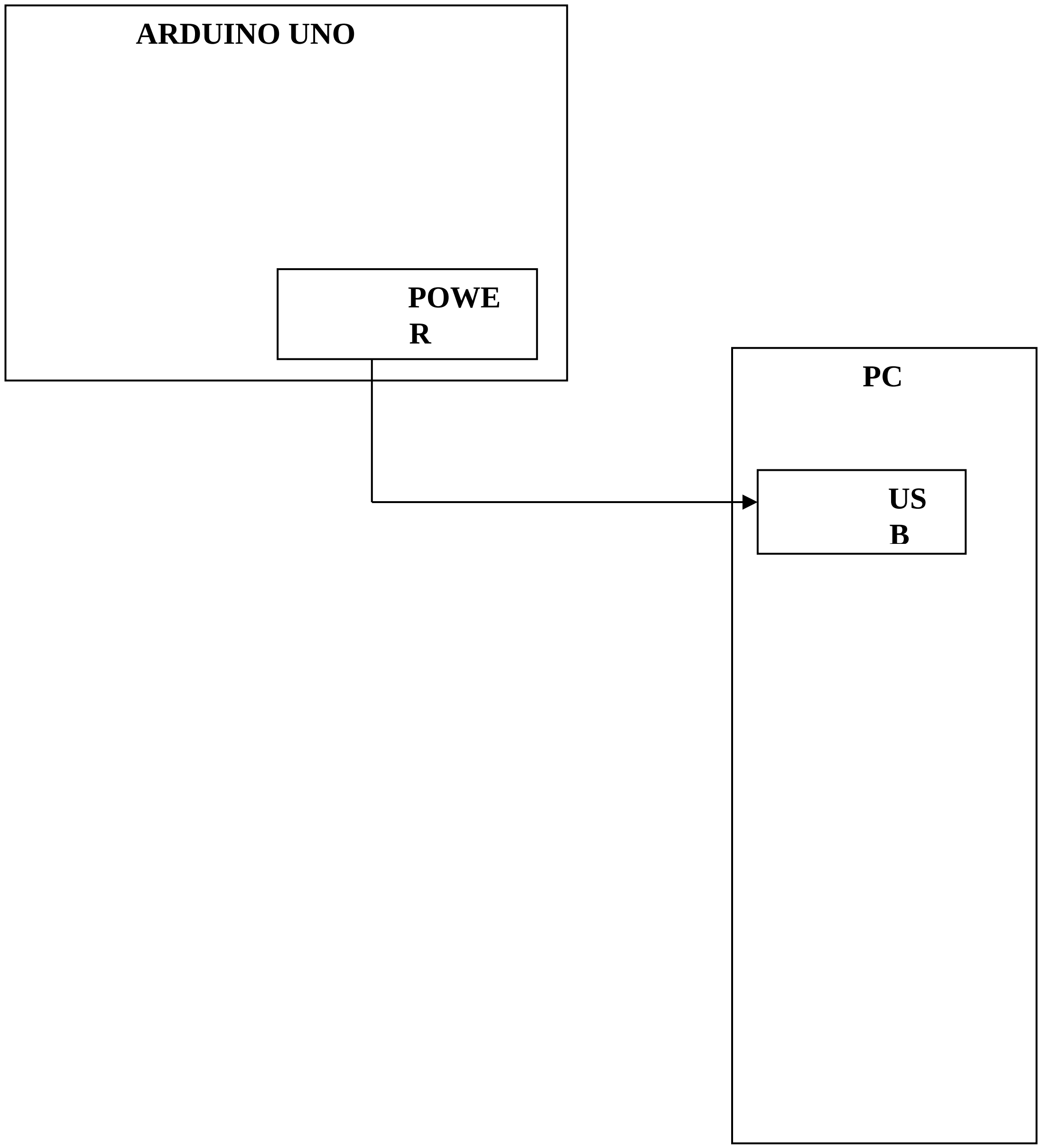


Fig.17 Block diagram of current connection of arduino uno to PC

The above block diagram shows that the arduino uno is connected to the PC via its power jack to the USB port of the PC.

5.4 PULSE RATE SENSOR

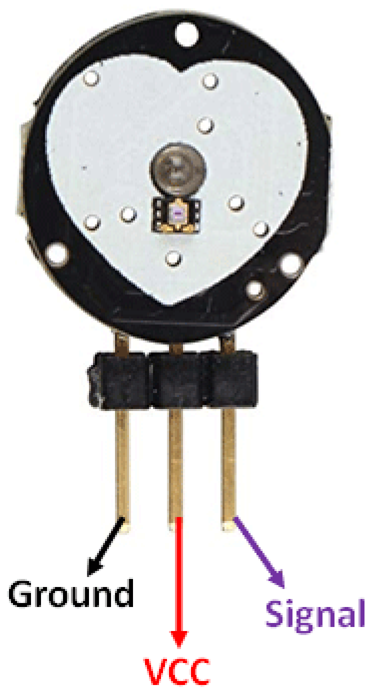


Fig.18 Pulse Rate Sensor pins

The figure shows that the pulse rate sensor has three pins i.e. ground, VCC, signal. The color of the wires can be different in different sensors but these three pins identify the pin configuration of the sensor which has been described in the table below.

Table.1 Pulse Rate Sensor Pin Configuration

PIN NUMBER	PIN NAME	WIRE COLOR	DESCRIPTION

1	Ground	Purple	Connected to the ground of the system
2	VCC	Grey	Connected to +5V supply voltage
3	Signal	White	Pulsating output signal

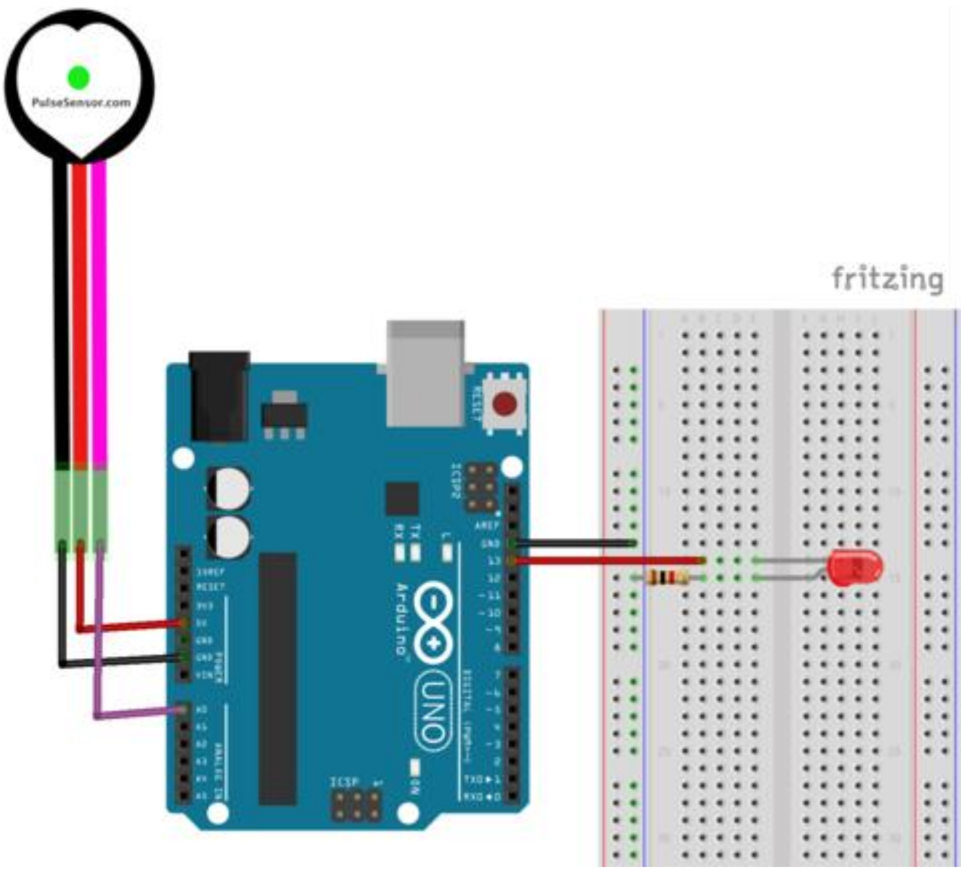


Fig.19 Pulse rate sensor circuit diagram

The above figure shows the connection of the pulse rate sensor to the arduino uno and the LED connected to arduino via breadboard. The LED flows as soon as the pulse sensor starts measuring the pulse rate of the person. Here the resistor is used to limit the current through the LED and to prevent that it burns.

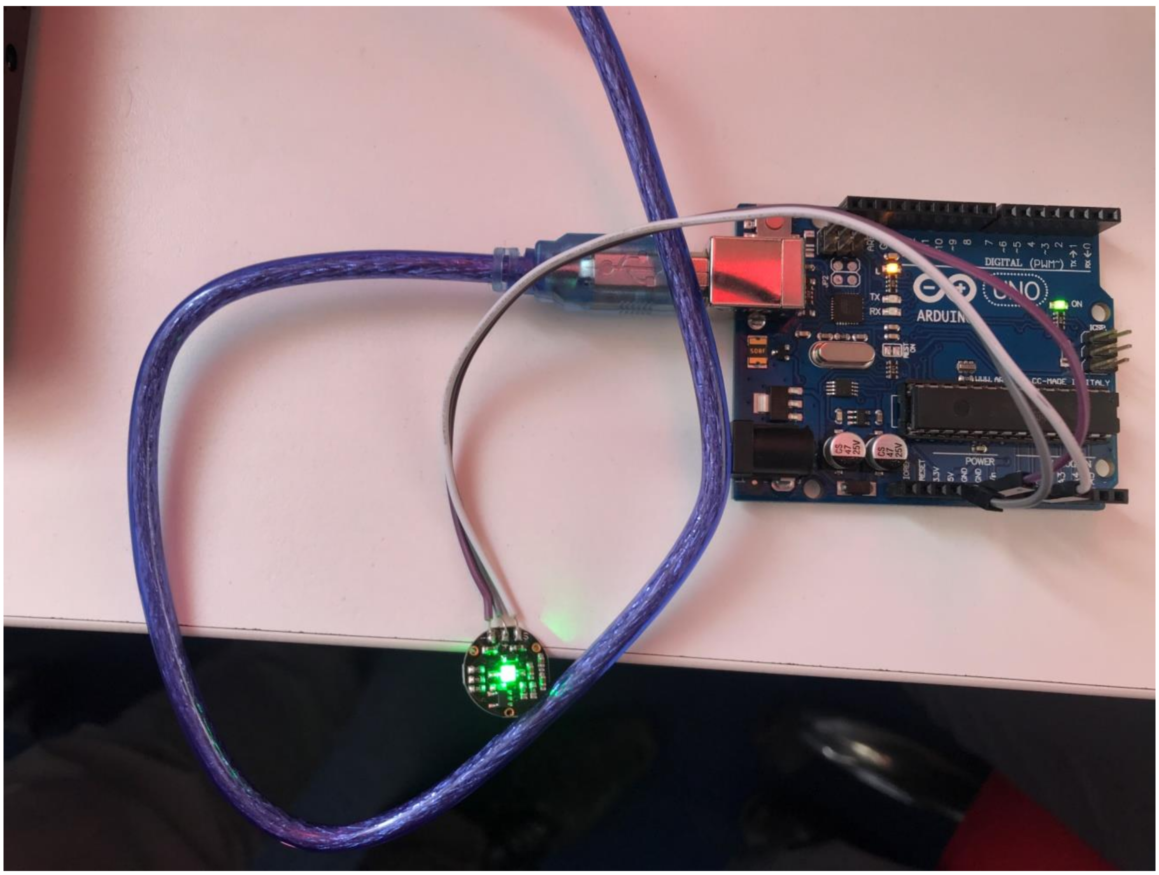


Fig.20 Connection of pulse rate sensor to arduino uno

In the above picture the pulse rate sensor has been connected to the arduino board as per the pin configuration explained in Table 1.

5.5 LM35 TEMPERATURE SENSOR

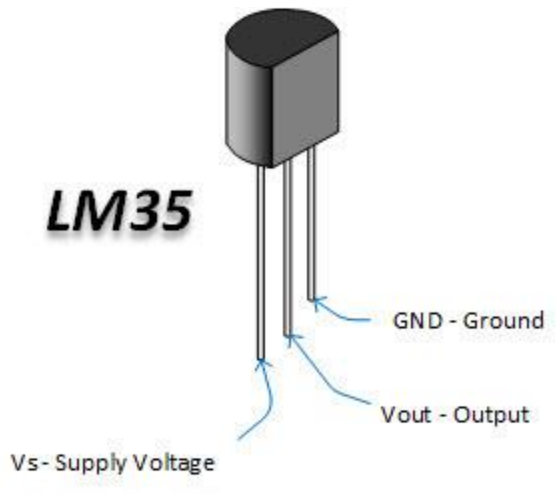


Fig.21 LM35 temperature sensor pins

The figure shows that the LM35 temperature sensor when held in hand, looking at the flat side where LM35 is written has left pin as VCC, the middle one for the output and the right pin for ground.

Table.2 LM35 Temperature Sensor Pin Configuration

PIN NUMBER	PIN NAME	DESCRIPTION
1	VCC	Input voltage is +5V.
2	Analog out	There will be the increase in 10mV for raise of every 1°C. Can range from -1V(-55°C) to 6V(150°C).
3	Ground	Connected to ground terminal of the circuit.

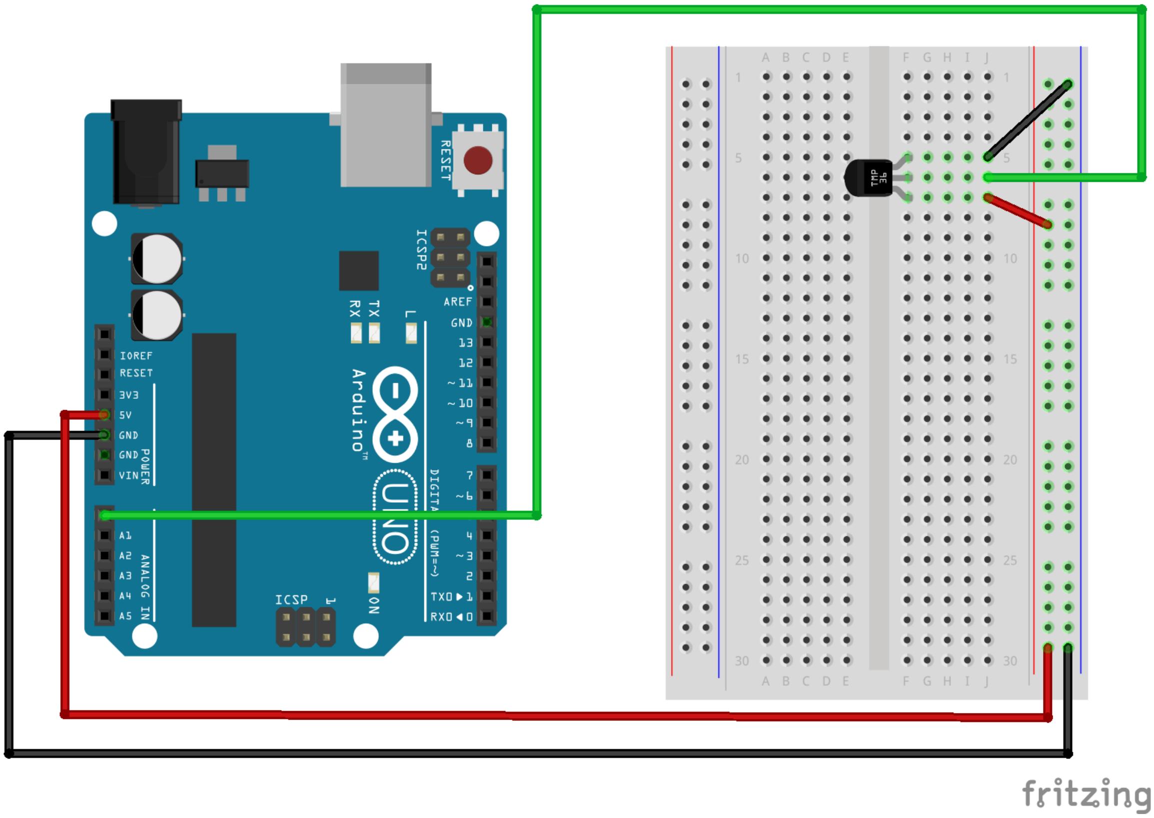


Fig.22 Temperature sensor circuit diagram

The above figure shows the LM35 temperature sensor connected to the arduino uno via breadboard

5.6 ECG SENSOR

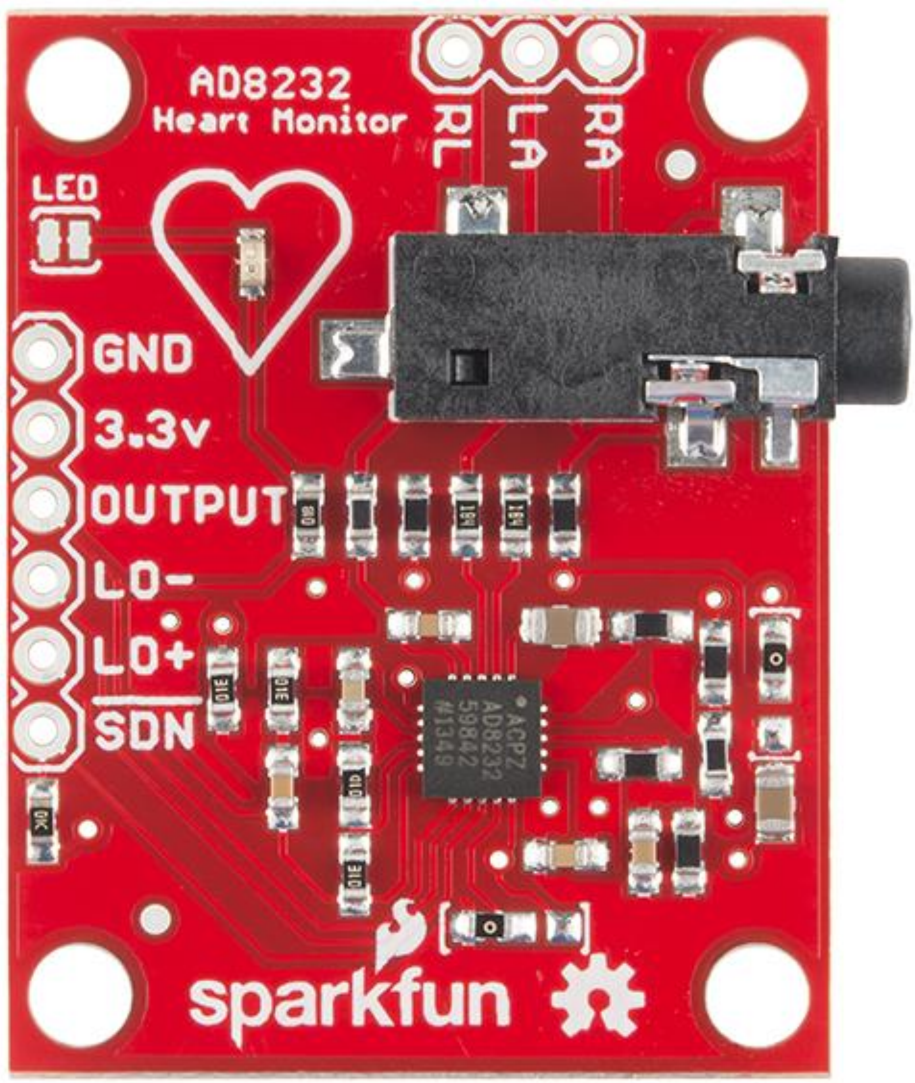


Fig.23 AD8232 Board

The board in the figure is used to connect the ECG sensor to the Arduino board.

Table3. AD8232 Board Pin Configuration

BOARD LABEL	PIN FUNCTION	ARDUINO CONNECTION
GND	Ground	GROUND
3.3V	3.3V power supply	3.3V
OUTPUT	Output signal	A0
LO-	Leads-off detect-	11
LO+	Leads-off detect +	10
SDN	Shutdown	NOT USED

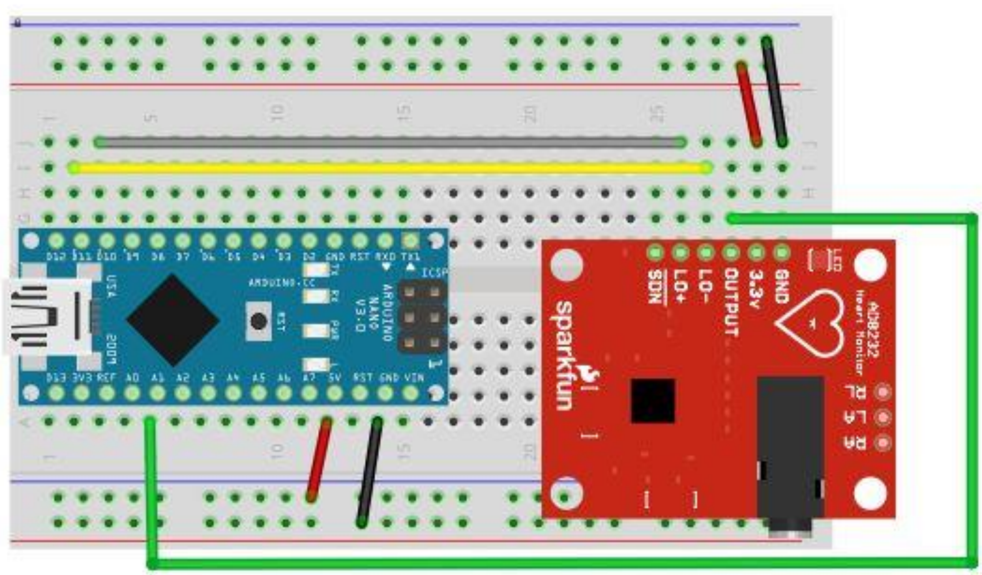


Fig.24 ECG sensor circuit diagram

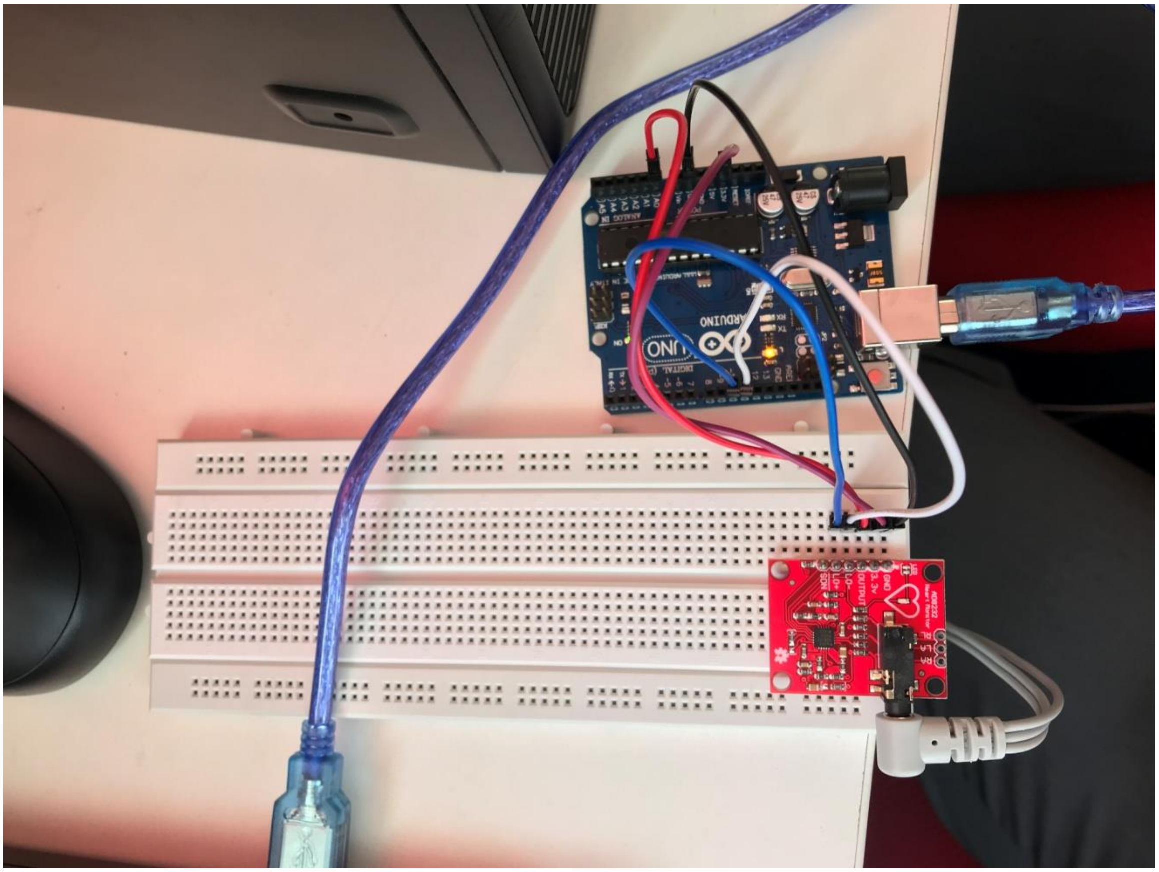


Fig.25 Circuit of ECG sensor connected to arduino uno via bread board.

In the figure the ECG sensor has been connected to the arduino board via the AD8232 board whose pin configuration has been given in table.3 with the help of bread board.

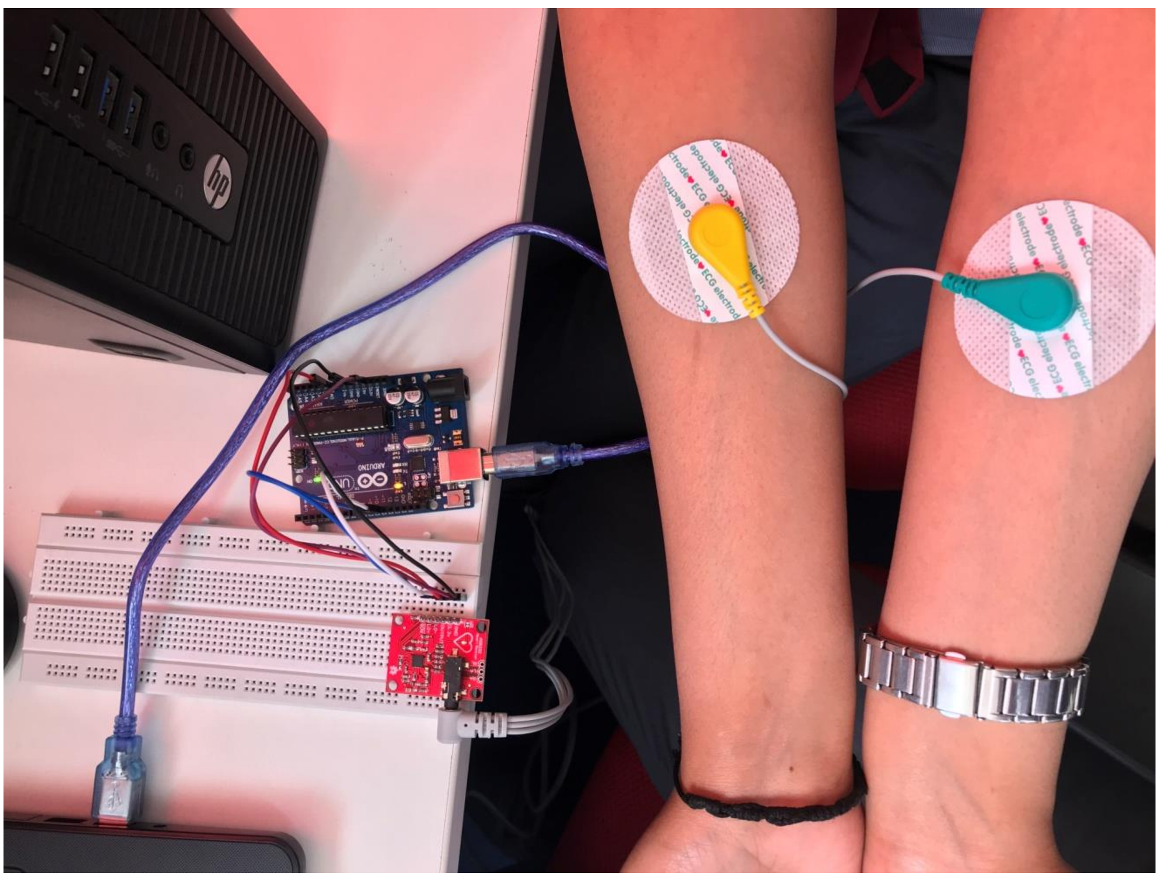


Fig.26 Checking the ECG of a perso.

In the figure the ECG sensor has been attached to the body of a person in order to check the ECG of this person.

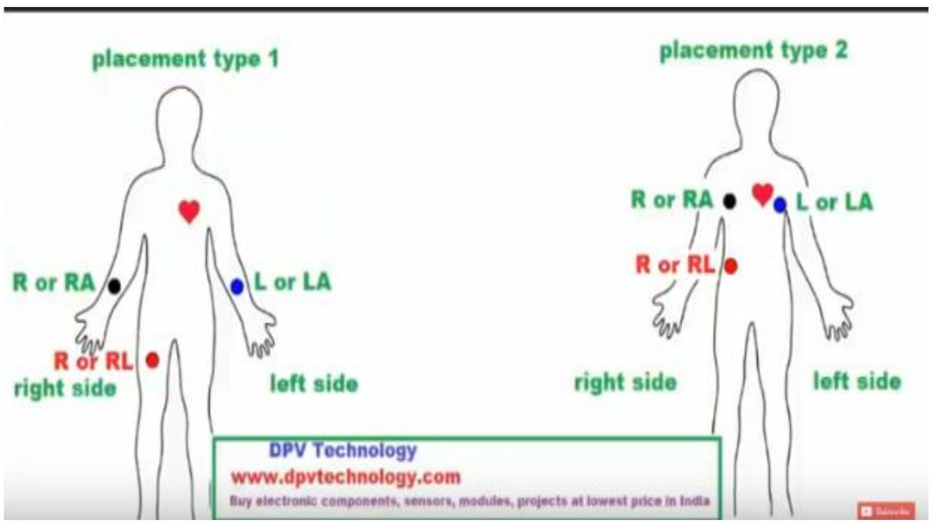


Fig.27 Placement of ECG sensor on a person's body

We have placed the red electrode on the

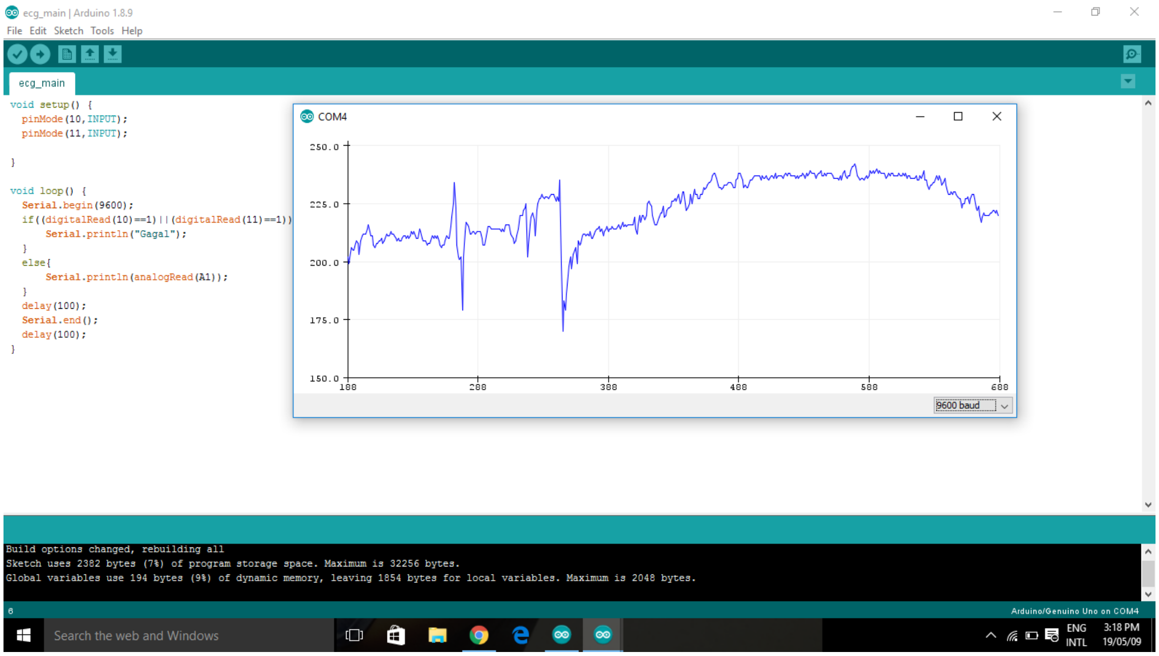


Fig.28 ECG graph of a person

In the figure the graph has been displayed via the serial plotter which plots the readings of a person when the ECG is being checked by the ECG sensor.

5.7 LCD CONNECTION TO ARDUINO UNO

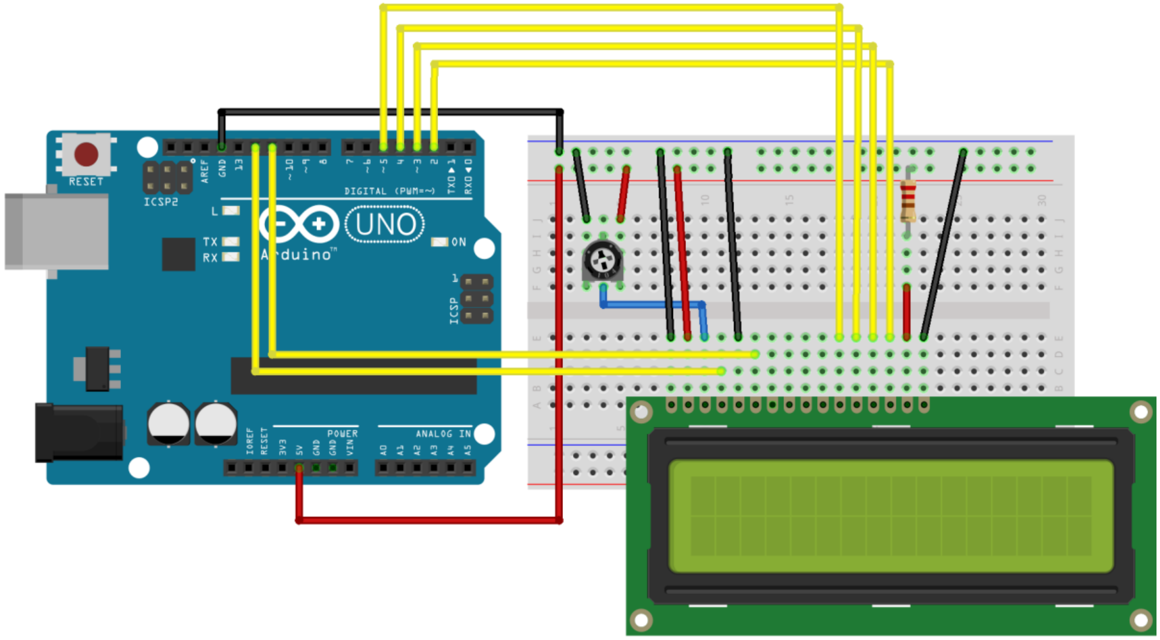


Fig.29 Circuit diagram of LCD connection with arduino board

The above figure shows how the LCD is being connected to the arduino board in order to display the desired output. The pin configuration has been explained in Table.4.

Table.4 LCD pin configuration

PIN NO.	PIN NAME	FUNCTION
1	Ground	Ground (0V)
2	VCC	Supply voltage (5V)
3	Vo/VEE	Contrast adjustment; the best way is to use a variable resistor such as a potentiometer. The output of the potentiometer is connected to this pin. Rotate the potentiometer knob forward and backwards to adjust the LCD contrast.
4	RS	Selects command register when low, and data register when high.
5	Read/Write	Low to write to the register, High to read from the register.
6	Enable	Sends data to data pins when a high to low pulse is given; extra voltage push is required to execute the instruction and EN(enable) signal is used for this purpose. Usually we make it en=0, and when we want to execute the instruction we make it high en=1 for some milliseconds. After this we again make it ground i.e. en=0.

7	DB0	
8	DB1	
9	DB2	
10	DB3	8 bit data pins
11	DB4	
12	DB5	
13	DB6	
14	DB7	
15	Led +	Backlight VCC (5V)
16	Led -	Backlight Ground (0V)

CHAPTER 6

S.OFTWARE AND HARDWARE REQUIREMENT SPECIFICATION

6.1 HARDWARE REQUIRED

- Arduino Uno
- Breadboard
- LED
- Temperature Sensor
- Pulse Rate Sensor
- ECG Sensor
- Resistor
- LCD (16X2)

6.2 SOFTWARE REQUIRED

- Arduino (IDE)
- AadvancedIP Scanner
- Putty
- VNC Viewer

CHAPTER 7

SYSTEM DESIGN

7.1 DATA FLOW DIAGRAM

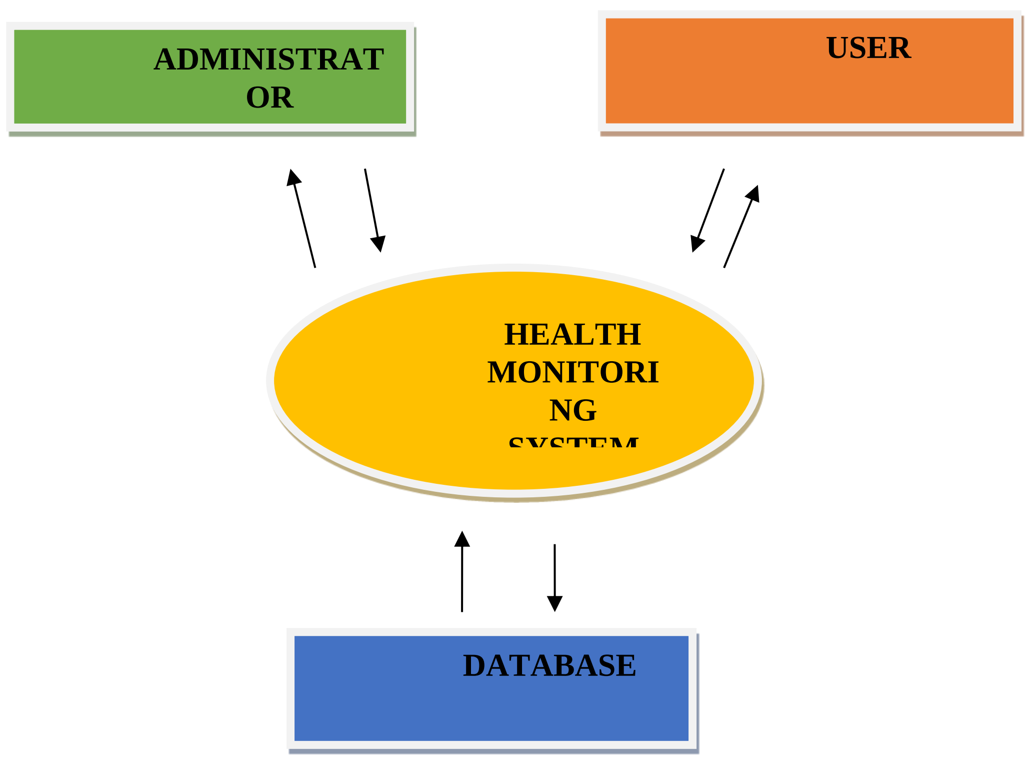
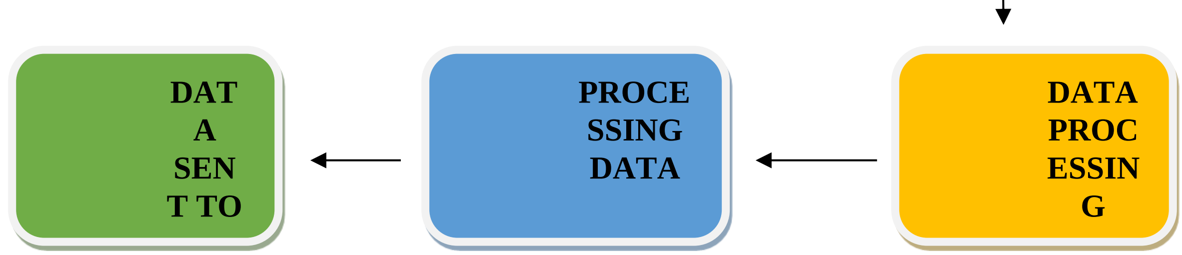
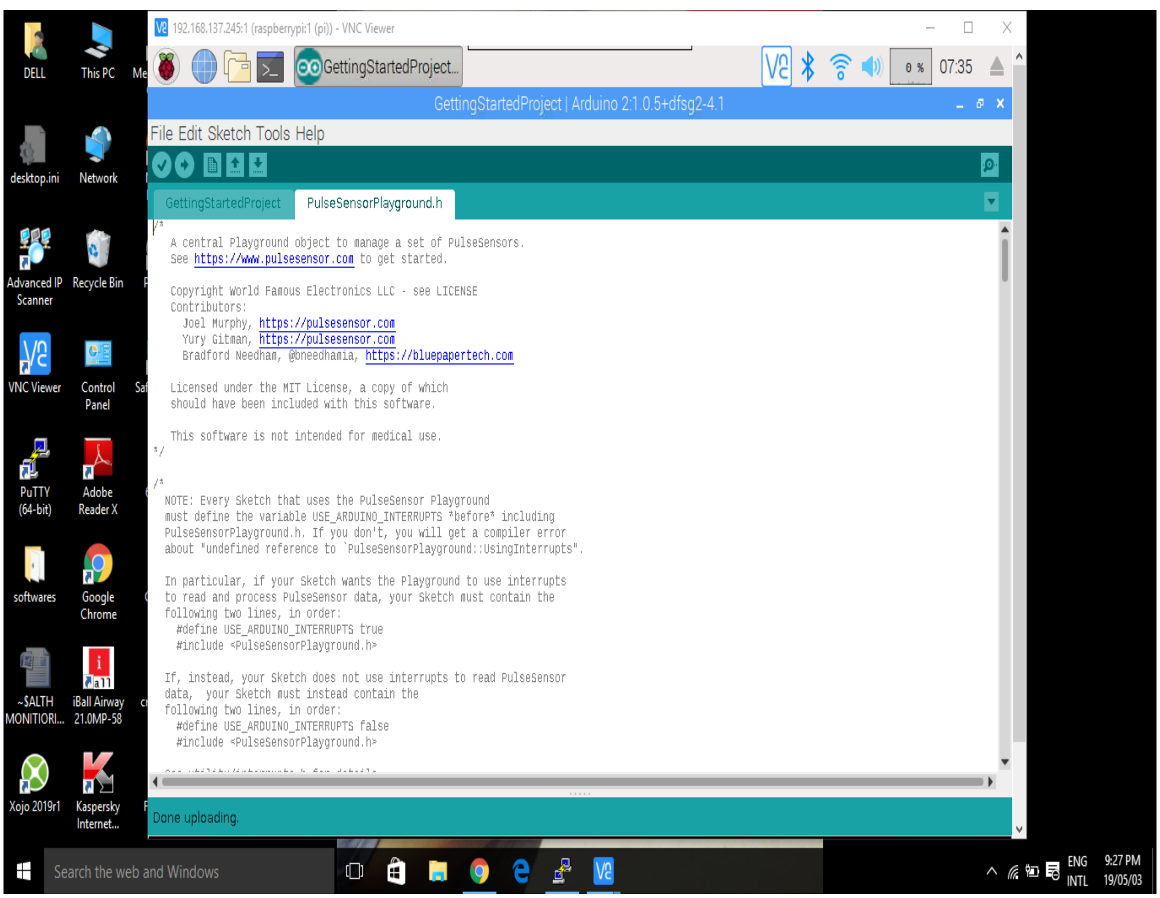


Fig.30 Context diagram of the existing system

Fig.31 0 level DFD

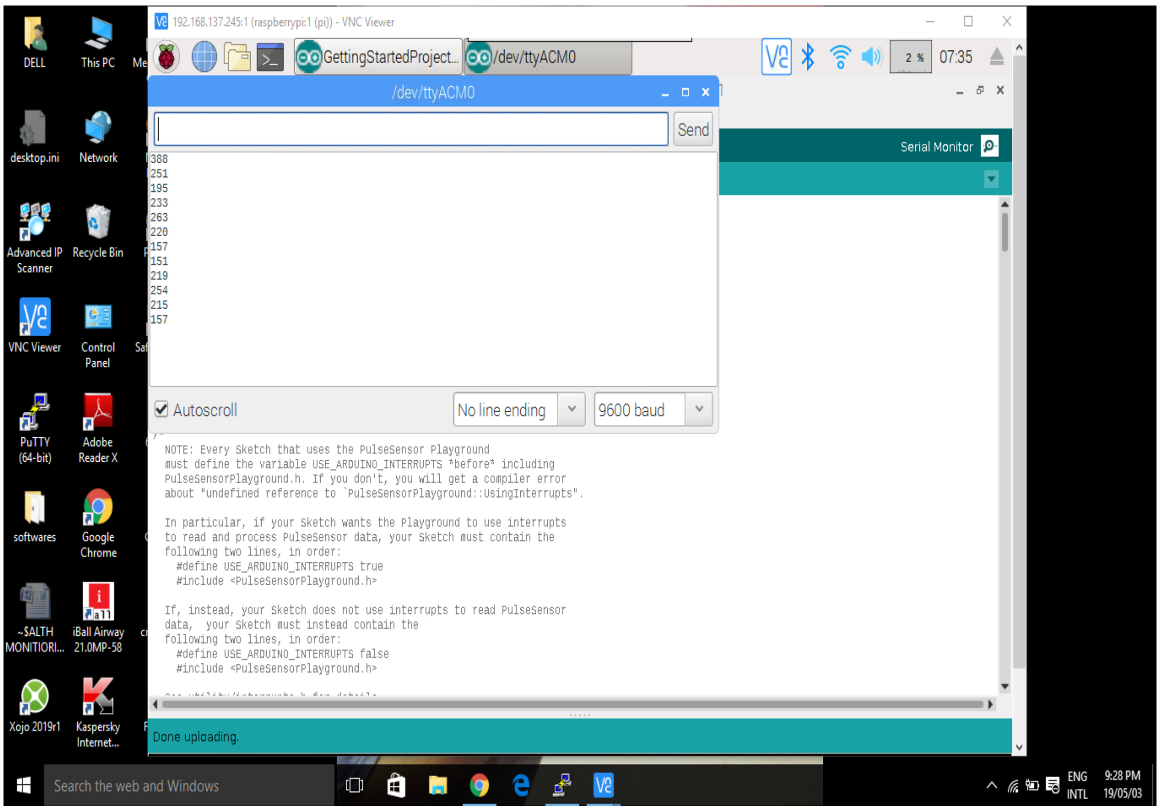
7.2 SCREENSHOTS





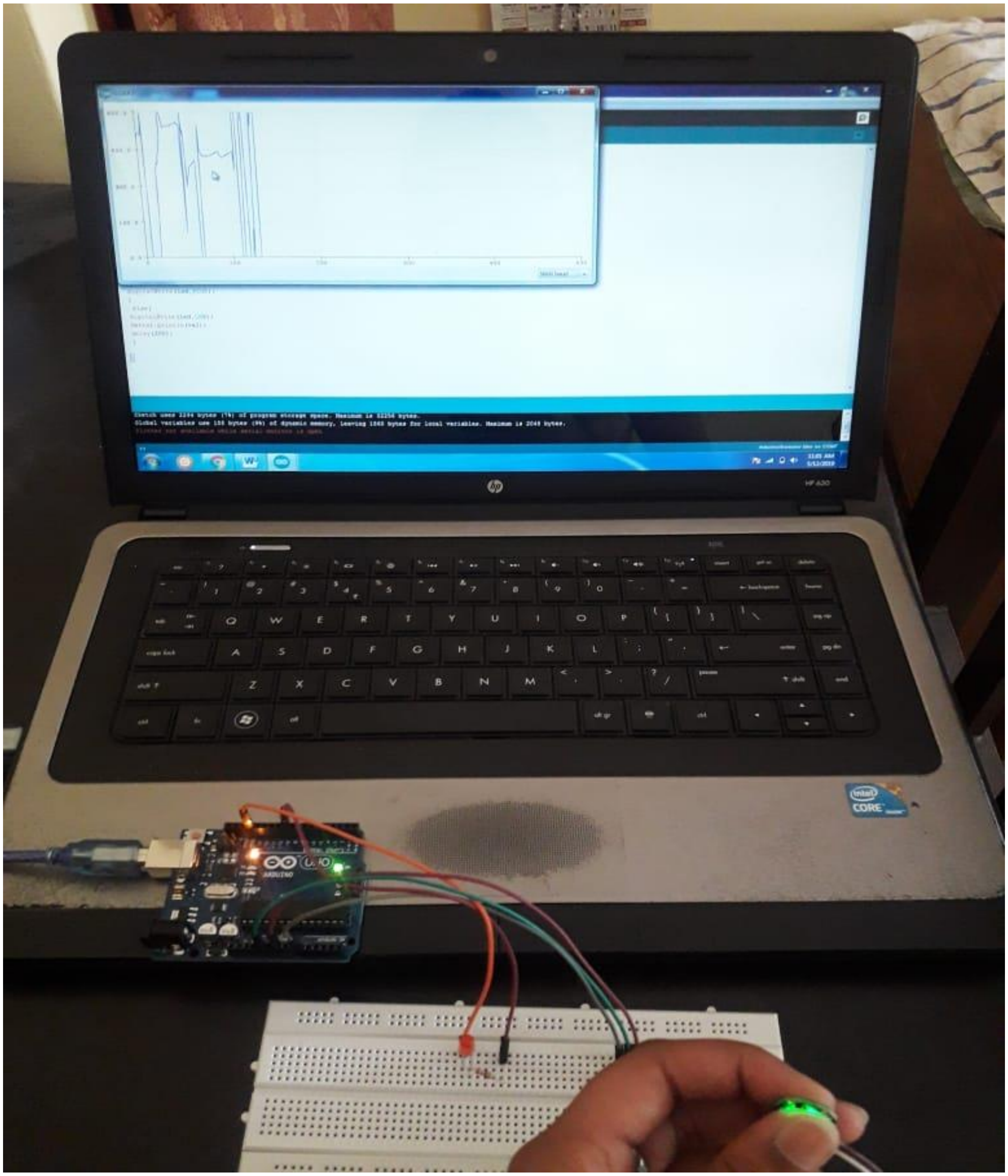
SS.11 The code for pulse rate sensor written in Arduino (IDE)

The above screenshot is the code for pulse rate sensor that has been implemented on the rasbian.

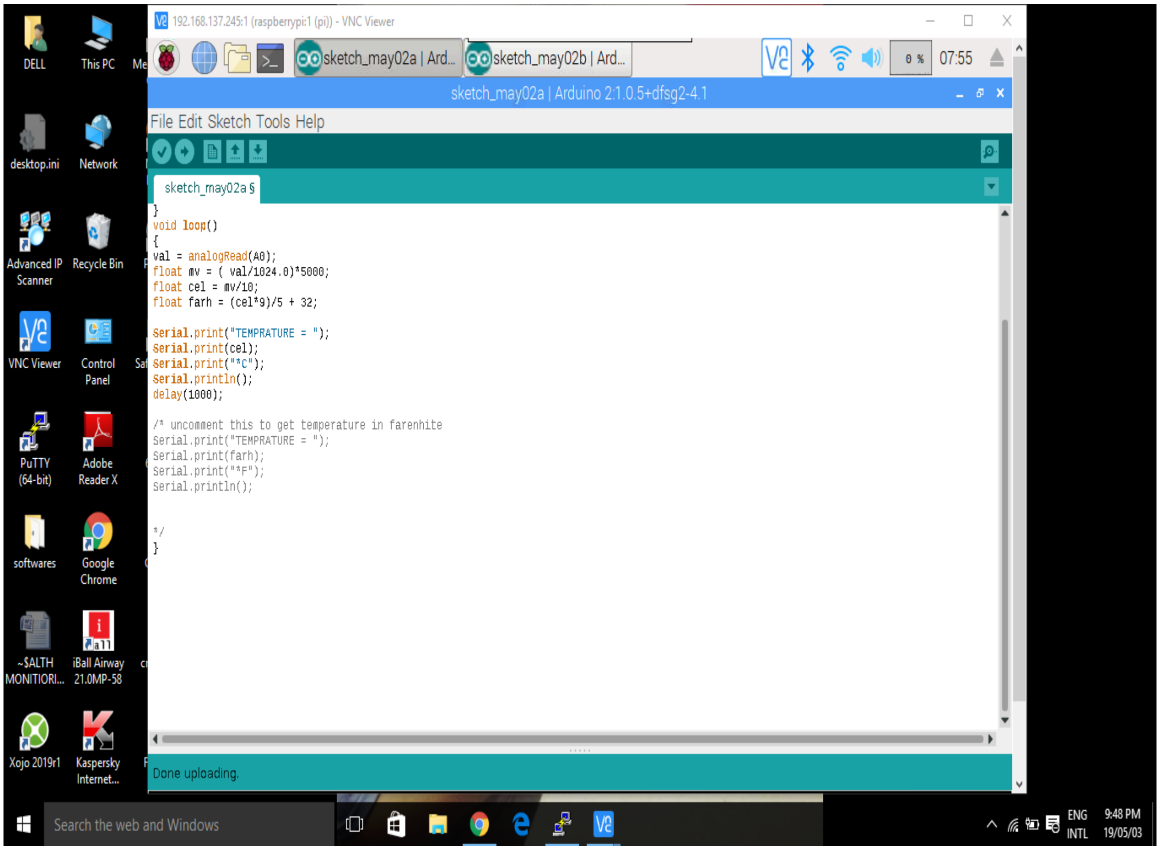


SS12. The output of the pulse rate sensor

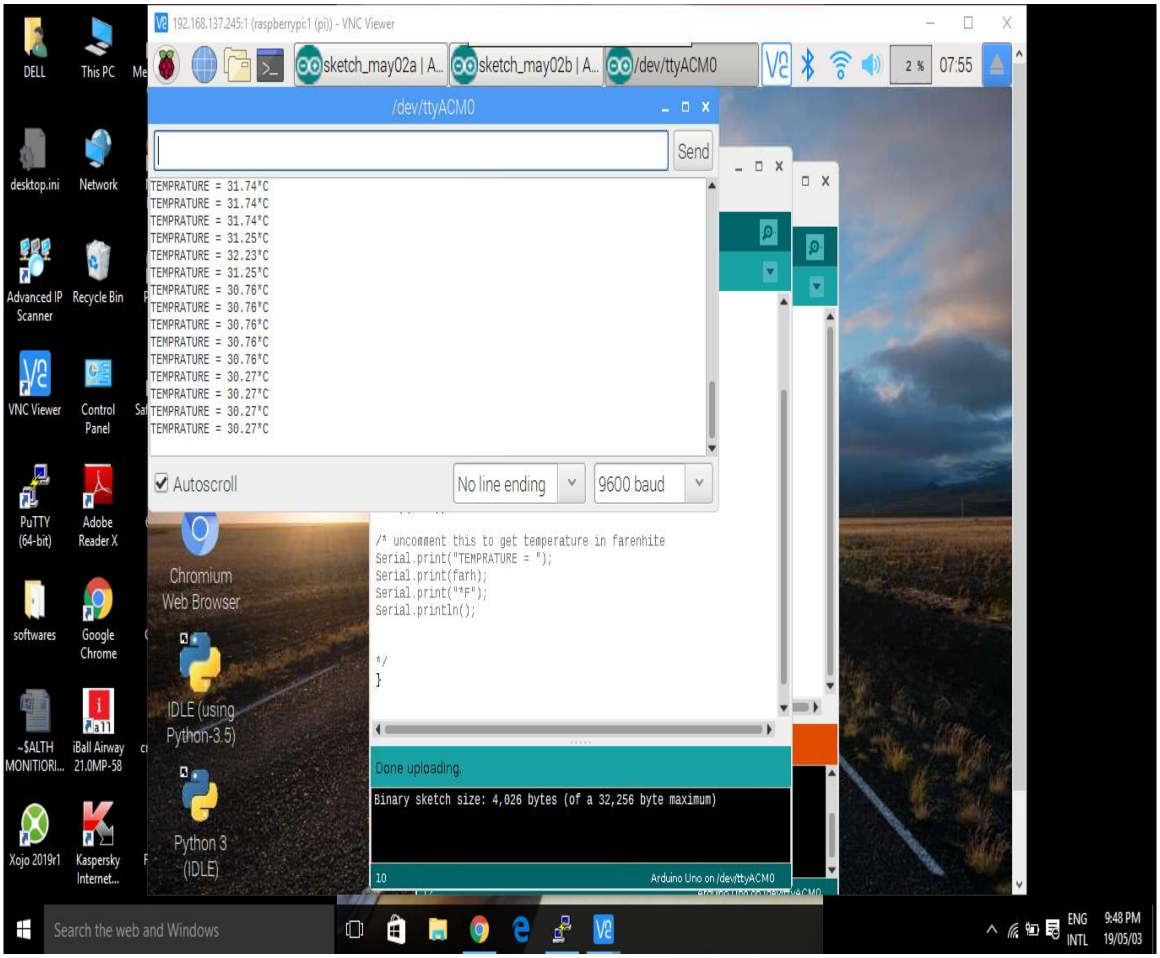
In this screenshot the output of the pulse rate sensor has been shown via the serial monitor of the Arduino (IDE).



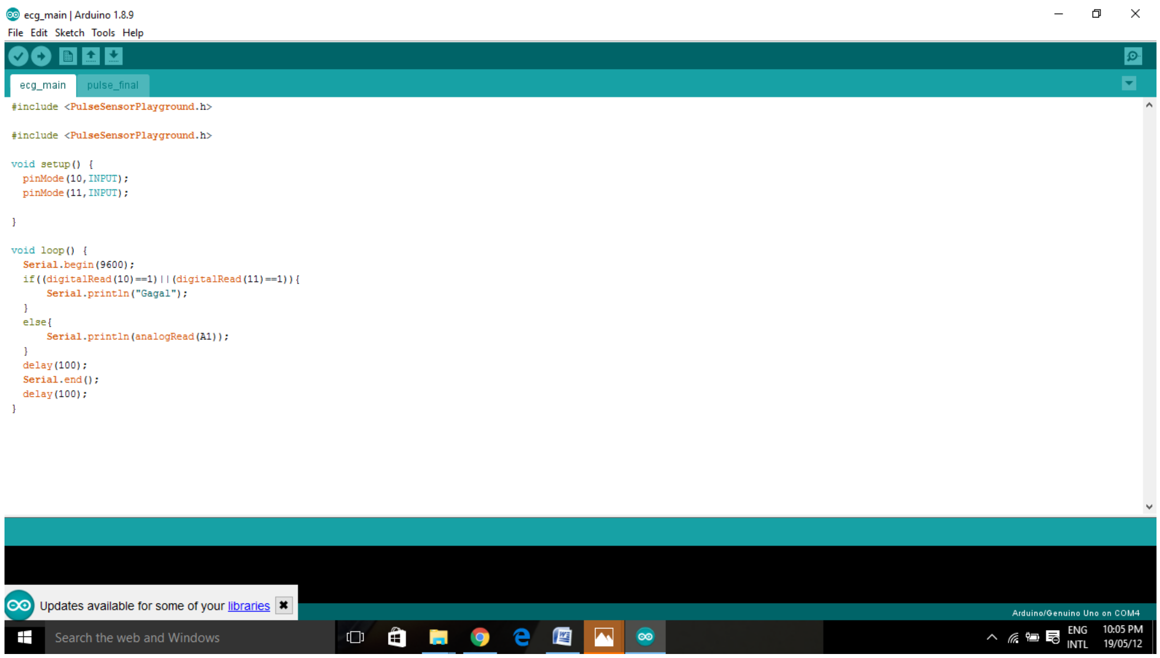
SS.13 Pulse rate graph



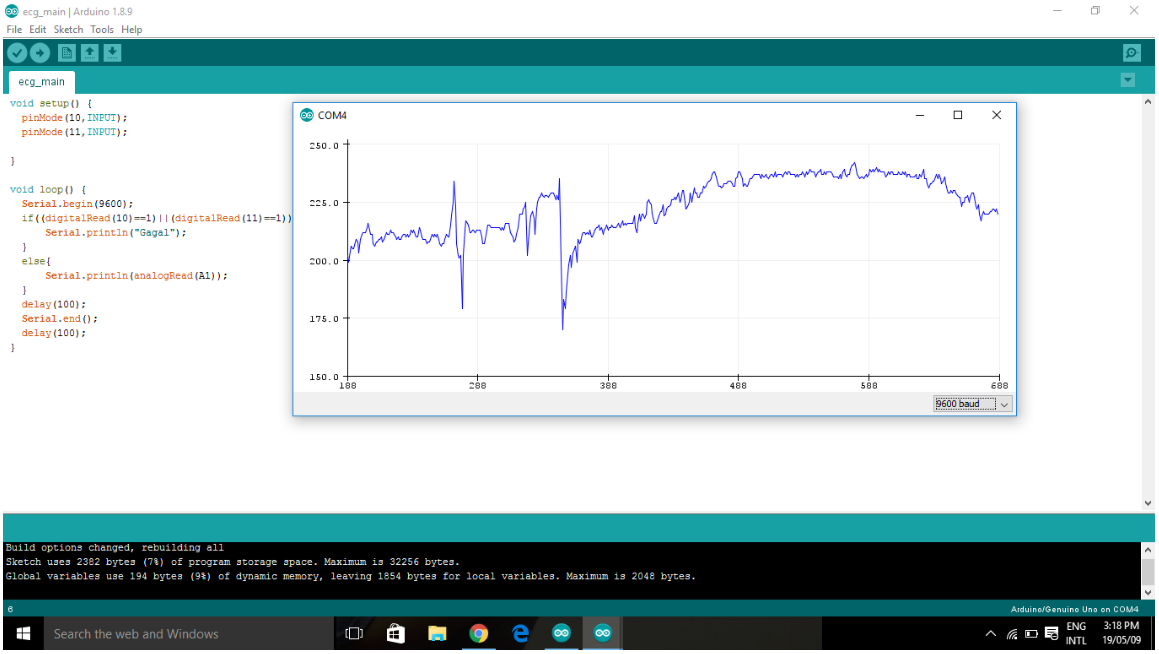
SS.14 Temperature sensor code



SS.15 Temperature sensor output



SS.16 ECG sensor code



SS.17 ECG sensor graph

CHAPTER 8

CODING

8.1 CODE FOR PULSE RATE SENSOR

```
#define USE_ARDUINO_INTERRUPTS true // Set-up low-level interrupts for most acurate 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 "Gettting 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("♥ A HeartBeat Happened ! "); // 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(20); // considered best practice in a simple sketch.
}
```

{

8.2 CODE FOR TEMPERTAURE SENSOR

```
#include<stdio.h>
LiquidCrystal lcd (7,6,5,4,3,2); //RS cont 7pin //E 6pin //D3, D4, D5, D6, pin no 5,4,3,2
float value;
int cel;
int far;
int output1=8;
int output2=9;
int output3=10;
void setup()
{
Serial.begin(9600);
```

```
lcd.begin(16,2);
pinMode(output1,OUTPUT);
pinMode(output2,OUTPUT);
pinMode(output3,OUTPUT);
digitalWrite(output1,LOW);
digitalWrite(output2,LOW);
digitalWrite(output3,LOW);
}
void loop()
{
value=analogRead(A0);
value = (value*5000)/1024;
cel=value/10;
far = (cel*9)/5;
far = far+32;
lcd.setCursor(0,0);
lcd.print("Temperat");
lcd.setCursor(0,1);
lcd.print(cel);
lcd.print(char(223));
lcd.print("C");
lcd.setCursor(4,1);
lcd.print(",");
lcd.setCursor(5,1);
lcd.print(far);
lcd.print(char(223));
lcd.print("F");
lcd.setCursor(9,0);
lcd.print("|");
```

```
}
lcd.setCursor(9,1);
lcd.print("|");
lcd.setCursor(10,0);
lcd.print("ADC is");
lcd.setCursor(10,1);
lcd.print(value);
if(cel>=28)
{
digitalWrite(output1,HIGH);
digitalWrite(output2,LOW);
digitalWrite(output3,LOW);
}
if(cel>=30)
{
digitalWrite(output2,HIGH);
digitalWrite(output1,LOW);
digitalWrite(output3,LOW);
}
if(cel>=33)
{
digitalWrite(output2,LOW);
digitalWrite(output3,HIGH);
digitalWrite(output1,LOW);
}
if(cel<=27){
digitalWrite(output2,LOW);
digitalWrite(output3,LOW);
digitalWrite(output1,LOW);
}
```

```
delay(100);
}
```

8.3 CODE FOR ECG SENSOR

```
#include <PulseSensorPlayground.h>
void setup()
 {
   pinMode(10,INPUT);
   pinMode(11,INPUT);
}

void loop()
{
   Serial.begin(9600);
   if((digitalRead(10)==1)||(digitalRead(11)==1))
{
     Serial.println("Gagal");
  }
  else
{
    Serial.println(analogRead(A1));
  }
  delay(100);
  Serial.end();
  delay(100);
  }
```

CHAPTER 9

TESTING AND VALIDATION TEST

	Condition to be tested	**Expected Result**	**Test Cycle**			
	Verified that alignment should be proper.	Alignment should be proper.				
	Verify that all Spell check are correct on Alert, error popup, error messages.	All the spelling are correct.				
	Verify that if the screen contains test	Width of textbox is				

	boxes that allow data entry, ensure that the width of data entered does not exceed the width of the table.	maintained.				

Table.5 test conditions

CHAPTER 10

COST ESTIMATISON OF PROJECT

TOTAL COST: Rs. 6,900.

CHAPTER 11

FUTURE SCOPE

IoT based HMS can be enhanced to detect and collect data of several anomalies for monitoring purposes such as home ultrasound, brain signal monitoring, tumor detection etc.

More research on problems associated with having data online, data privacy as IoT is managed and run by multiple vendors are involved in it. Security algorithms and certain precautions by the users will help avoid any security related threats in IoT network.

The interface can be designed to control which sensors can be used by consumers according to their needs.

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