ISSN No:-2456-2165

Old Age People Health Monitoring System using IoT and ML

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Abstract:- Health is very important for human life, especially of old age people. In this modern generation occurrence of diseases became more compared to earlier so it became necessary to take care of health. In these days heart attack cases are increasing and also other diseases, so as to prevent these, real time health monitoring is needed. In current health care system the patient needs frequent visit to hospital to know their health condition, which is not an easy task to do for patient. Our project will provide a health model which help to monitor patient by 24*7 which avoids the need to visit hospital frequently. This helps to know the health condition of patient using wearable sensors and internet of things technology. In our project, few parameters has been chosen Electrocardiogram (ECG), Pulse rate, Temperature and Position detection by using wearable sensors. These sensors are connected to Raspberry pi. Once the Raspberry Pi is connected to internet, it acts as a server and sends data on a specific URL. The parameters can be monitored on any mobile device including laptops or smart phones which are connected under same network. By this sensed data ML helps in taking care of old age people by analysis and providing status of health condition as normal and abnormal.

Keywords:- *Old Age Health Monitor, Monitoring Health IoT and Machine Learning, Old Age Health.*

I. INTRODUCTION

Internet of things is the one where things are connected to internet, connecting the unconnected. IoT (Internet of Things) is one of the trending technology, used in every field such as agriculture, business, retail industry and so on in these days. Internet of Things can be applied in health sector. Health monitoring can be done continuously using IoT technology. Wearable sensors can be used to monitor health of patient, where as IoT helps to access sensor values in real time.

Sensor values can be sent remotely via internet with help IoT. As there is a high need for efficient real time health monitoring system especially for old age people, IoT is the best choice. The proposed work demonstrates the health monitoring of an elderly person based on IoT, by collecting values from sensors, processing the data through microcontrollers. The doctor and family member can access the patient's health parameter values through the web page.

Machine learning in health monitoring system plays important role. IoT and Machine learning both when integrated in health monitoring system provides better health of human being, here machine learning helps by analyzing the sensor data using IoT can predict the future disease that may occur and also can give suggestions to prevent that disease. In machine learning supervised machine learning is the one where the input is already known which is fed to machine learning algorithm and which provides output. Machine learning in health monitoring system, classifying normal and abnormal conditions of health parameters using scikit learning package of python. Identify normal and abnormal condition of patient based on sensors data .Sensors data used to analyze health condition of patient .

II. LITERATURE SURVEY

Ovidiu Apostu, Bogdan Hagiu, Sever Pașca,[1] Wireless ECG Monitoring and Alarm System Using ZigBee, in this project, author developed ECG monitoring and alarm using Zigbee. Patient whose health is not critical can monitor their ECG at home in real time via internet. This is to provide health monitoring for ECG and can detect abnormalities so that needed action can be taken immediately.

Warsuzarina Mat Jubadi, Siti Faridatul Aisyah Mohd Sahak,[2]"Heartbeat Monitoring Alert via SMS", in this project, author developed heart beat monitoring and alert through SMS. Patient those suffered from mild level heart attack needs to be monitored, this system monitors their heart beat continuously and alert if any abnormal behavior is found while monitoring. and alert is sent to doctor or family member through SMS.PPG technique is used to monitor heart beat.

Goutam Motika, Abinash Prusty,[3]" Wireless Fetal Heartbeat Monitoring System Using ZigBee & IEEE 802.15.4 Standard", in this project author developed fetal heart beat monitoring system with Zigbee and IEEE 802.15.4 standard. Fetal mortality is important measure in health care. This is for fetus heart beat monitoring. The developed system is mainly for pregnant woman who can't visit hospital for

frequent checkup and want health care at home. The project is intended to decrease fetal mortality rate.

S. M. Mahalle, P. V. Ingole,[4]"Design and Implementation of Wireless Body Area Sensor Network Based Health Monitoring System", the project here is health monitoring system using ATmega8.In this author developed health monitoring system based on wireless body area sensor network, where patient health data extracted using sensors sent to physicians server and suggestions are sent to patient by physician using GSM technology.LCD display is done for results of health monitoring.

"Healthcare Monitoring System Using Wireless Sensor Network"[5], D. Mahesh Kumar, in this project author developed the smart gateway which provides health monitor and faster response time about health state of patient. It is low power and low cost embedded system. Ethernet, wi-fi, GSM/GPRS are integrated to smart gateway to provide faster results of health. Smart gateway is platform for Wireless sensor network health monitor system.

III. PROPOSED METHODOLOGY

The proposed methodology consists of input unit, processing unit and output unit.

Input unit consists of Sensors which are heart rate, temperature, position and ECG. These sensors are wearable and connected to human body which senses health parameters of patient and sends sensed data to microcontroller for processing.

Processing unit consists of microcontroller Raspberry pi used for processing the data extracted from the sensors. These sensors code is executed in microcontroller. The sensor extracted results can be monitored 24*7 on web page which informs health condition of patient. This information can be accessed through any mobile device like laptop, smart phones, tablet via internet. The sensor extracted data can be stored in the database which can be used in future for analysis of health of patient. In machine learning data from database is used to identify normal and abnormal state of patient.

Output unit provides 24*7 health parameter values of patient on webpage. The web page is developed using PHP. The health parameter values sent on the web page where doctor and family members can monitor health of old age people. Using machine learning the values of health parameters stored in database is used and provide the health condition of patient as normal or abnormal. If the condition is abnormal the patient needs to visit hospital.

Classification is done based on health parameter values of patient. Normal and abnormal condition are identified based on threshold values according to the range of health parameter values.

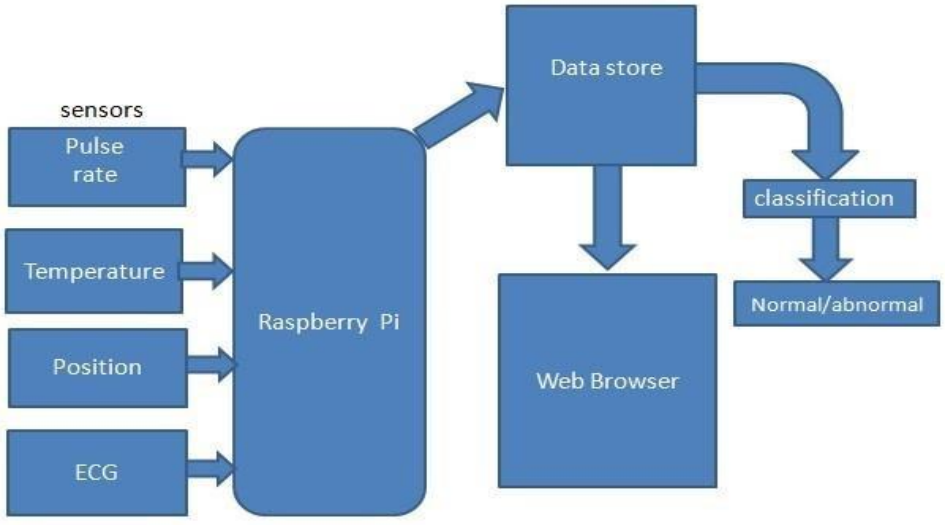

Fig 1:- System Architecture

ECG and Position sensors uses analog pin for sensor data so they are connected to Arduino, and Arduino data is sent to Raspberry pi. Heart rate sensor and temperature sensors are directly connected to Raspberry pi.

In Arduino IDE code is written for ECG and Position sensor, the values of sensor are transferred to Raspberry Pi. Python programming is used in Python IDLE of Raspberry pi. And web page is developed using PHP where user can access health parameter values 24*7. The sensors data is

stored in database. This data is used in machine learning to provide normal and abnormal health condition of patient.

➢ *Raspberry Pi:*

The proposed system works with Raspberry Pi 3 Model B that is a third generation Raspberry Pi. This powerful credit-card sized single board computer can be powered by a micro USB socket with 5 Volts, 2.5Amperes. Raspberry Pi 3 Specifications, SoC **is** Broadcom BCM2837**,** CPU is 4× ARM Cortex-A53, 1.2GHz**,** GPU is Broadcom Video Core IV**,** RAM is 1GB LPDDR2 (900 MHz), Networking is 10/100 Ethernet, 2.4GHz 802.11n wireless, Bluetooth 4.1 Classic, Bluetooth Low Energy and micro SD, GPIO 40-pin header, populated, Ports are HDMI, 3.5mm analogue audio-video jack, 4× USB 2.0, Ethernet, Camera Serial Interface (CSI), Display Serial Interface (DSI).

➢ *ECG Sensor(AD8232):*

ECG scan be extremely noisy, the AD8232 Single Lead Heart Rate Monitor acts as an op-amp to help obtain a clear signal from the PR and QT Intervals easily. The ECG module AD8232heart ECG monitoring sensor module is an integrated signal conditioning block for ECG and other bio-potential measurement applications. The ECG Module AD8232 Heart ECG Monitoring Sensor Module Kit for Arduino is designed to extract, amplify, and filter small biopotential signals in the presence of noisy conditions; such as those created by motion or remote electrode placement. The AD8232 breaks out nine connections from the IC that you can solder pins, wires, or other connectors too. SDN, LO+, LO-, OUTPUT, 3.3V, GND provide essential pins for operating this monitor with an Arduino or other development board.

➢ *Position Sensor(ADXL335):*

The ADXL335 gives complete 3-axis acceleration measurement. This module measures acceleration within range ±3 g in the x, y and z axis. The output signals of this module are analog voltages that are proportional to the acceleration. It contains a poly silicon surface-micro machined sensor and signal conditioning circuitry. It is a small, thin, low power, complete 3-axis accelerometer with signal conditioned voltage outputs and consumes low power.

➢ *Temperature Sensor(DS18B20):*

The DS18B20 Digital Thermometer provides 9 to 12-bit (configurable) temperature readings which indicate the temperature. The core functionality of the DS18B20 is its direct-to-digital temperature sensor. The resolution of the temperature sensor is user-configurable to 9, 10, 11, or 12 bits, corresponding to increments of 0.5°C, 0.25°C, 0.125°C, and 0.0625°C, respectively. The default resolution at power-up is 12-bit. The DS18B20 powers up in a low power idle state.

➢ *Heart Beat Sensor with probe:*

This sensor gives digital output. The sensor is connected to human body which senses heart rate and provide result heart beats per 60 seconds. It functions on the principle of light modulation by blood flow through the nerves of the finger at every pulse. The module output mode, Digital output mode is simple, Serial Output is with exact readings.

IV. RESULTS

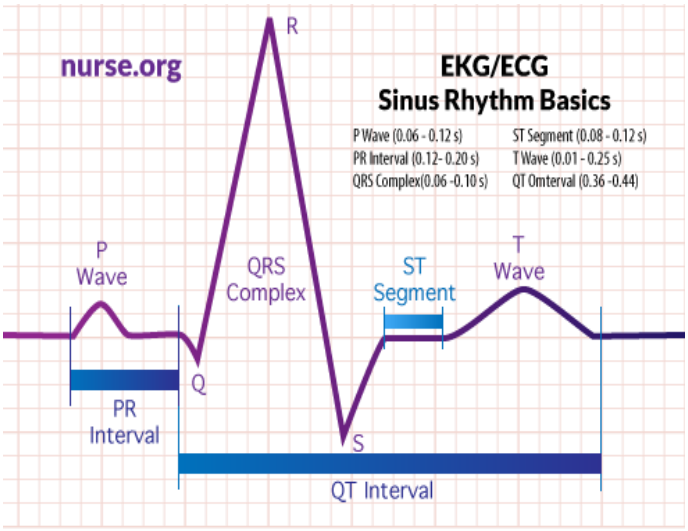

Fig 2:- ECG SIGNS

➢ *Table Normal ECG Parameters*

P Wave 0.06-0.12s ,PR Interval 0.12-0.20s,QRS Complex 0.06-0.10s, ST Segment 0.08-0.12s ,QT Interval 0.36-0.44s,T Wave 0.01-0.25s

Fig 3:- OUTPUT ECG SERIAL PLOTTER

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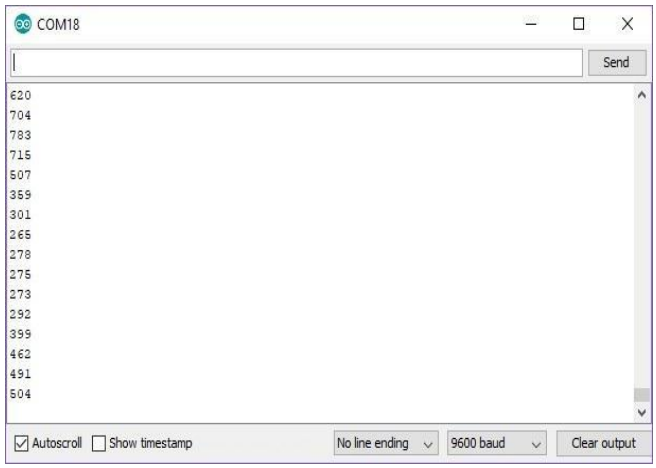

Fig 4:- OUTPUT ECG SERIAL MONITOR

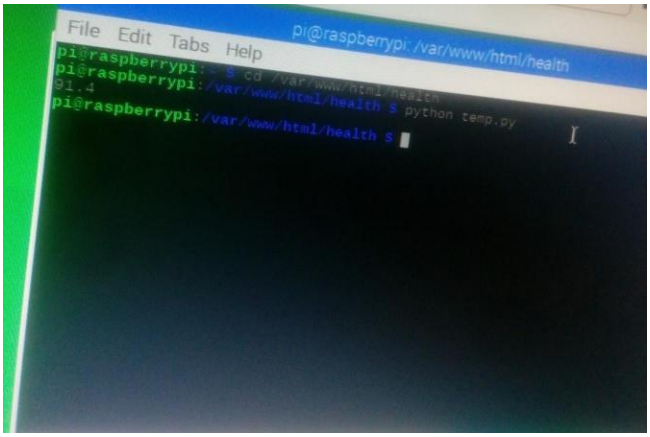

Fig 5:-Temperature sensor output

Age	Centigrade	Fahrenheit
Newborn to 1 year	37.5-37.7° C	99.4-99.7°
3 to 5 years	37.0-37.2° C	98.6-99.0°
7 to 9 years	36.7-36.8° C	98.1-98.3°
10 years and older	36.6° C	97.8°

Table 1:- Normal temperature values

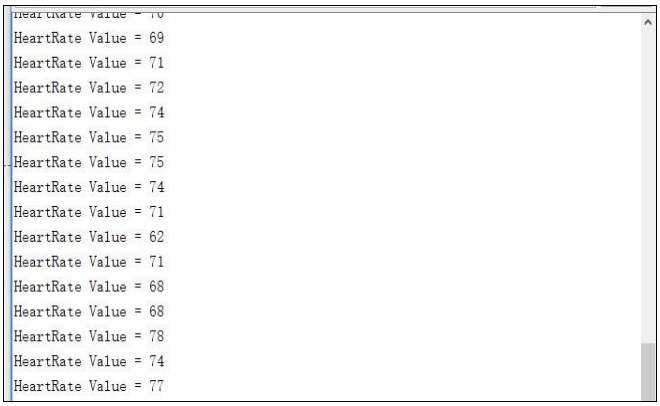

Fig 6:- Heart rate sensor output

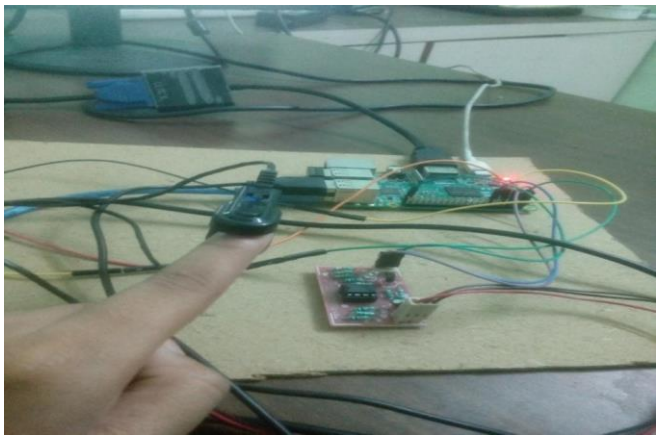
Fig 7:- Heart rate sensor test

Acceptable Ranges of Heart Rate	
Age	**Heart Rate (Beats per Minute)**
Infant (6 months)	120-160
Toddler (2 years)	90-140
Preschooler	80-110
School-age	75-100
Adolescent	60-90
Adult	60-100

Table 2:-Heart rate normal values

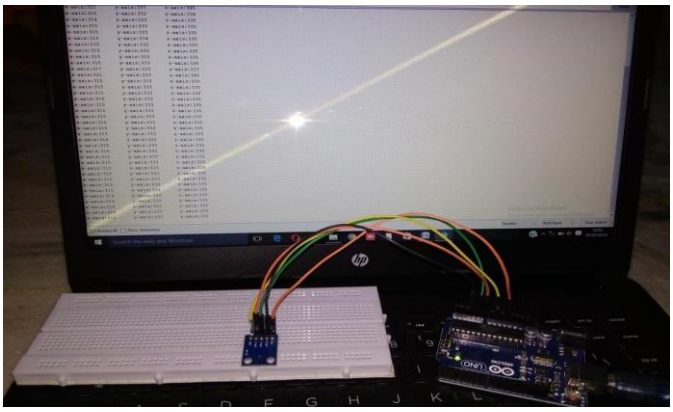
Fig 8:- Position sensor output

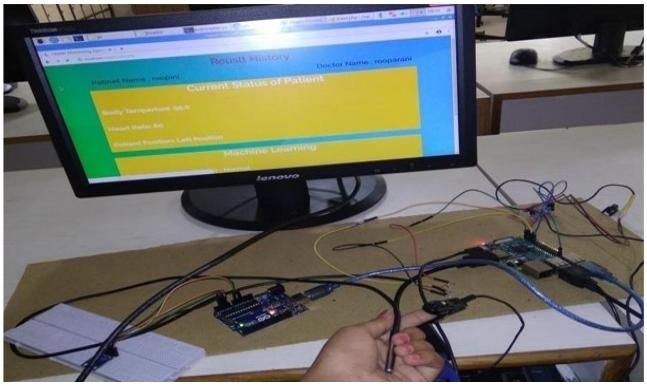

Fig 9:- Results on webpage

ISSN No:-2456-2165

V. CLASSIFICATION

PATIENT	TEMPREATURE in centigrade	HEART RATE	ECG	POSITION	CONDITION
1.	36.6	96	460	LEFT/YES	NORMAL
2.	37.7	98	461	RIGHT/YES	NORMAL
3.	36.7	99	458	RIGHT/YES	NORMAL
4.	37.0	65	436	RIGHT/YES	NORMAL
5.	36.8	75	437	LEFT/YES	NORMAL
6.	37.2	85	460	LEFT/YES	NORMAL
7.	36.9	95	461	RIGHT/YES	NORMAL
8.	37.3	115	458	RIGHT/YES	NORMAL
9.	37.1	125	437	RIGHT/YES	NORMAL
10.	37.3	135	438	LEFT/YES	NORMAL
11.	37.5	145	456	LEFT/YES	NORMAL
12.	37.4	160	429	RIGHT/YES	NORMAL
13.	37.6	120	460	LEFT/YES	NORMAL
14.	38.2	110	0	RIGHT/YES	ABNORMAL
15.	35.2	99	40	RIGHT/YES	ABNORMAL

Table 3

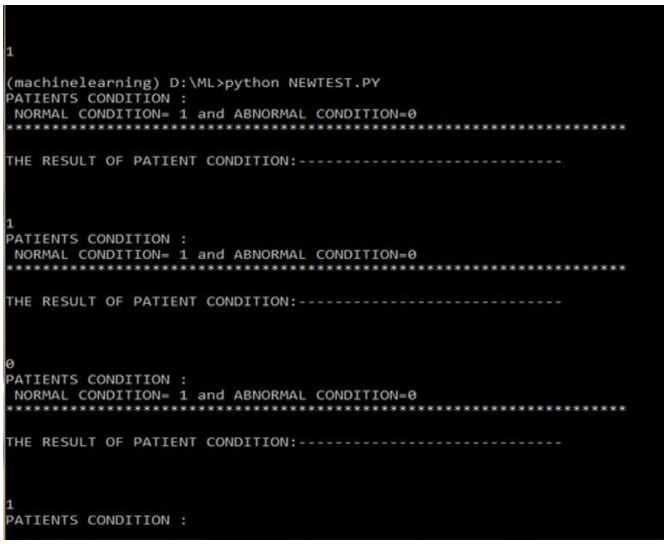

Fig 10:- health condition detection

Miniconda software is installed , scikit learn package for machine learning in python is imported. In this supervised machine learning is used ,where stored sensor data from database is collected based on that condition as normal and abnormal is specified as health condition of patient.

If the condition is abnormal patient should meet doctor and visit hospital. Using matplotlib package graphs are plotted. Below are sensor data presented with normal and abnormal condition.

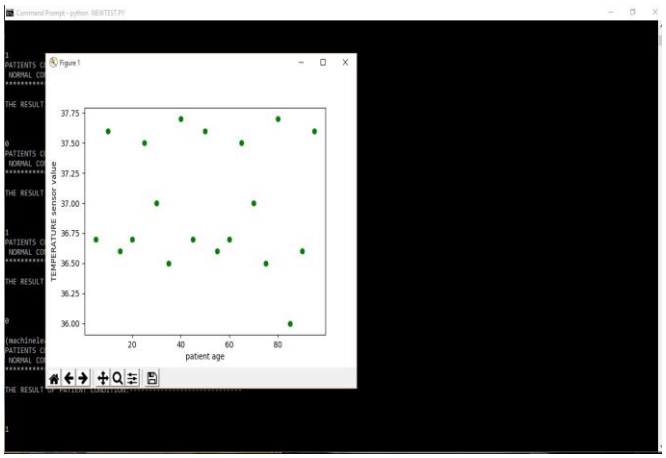

Fig 11:- Temperature normal values

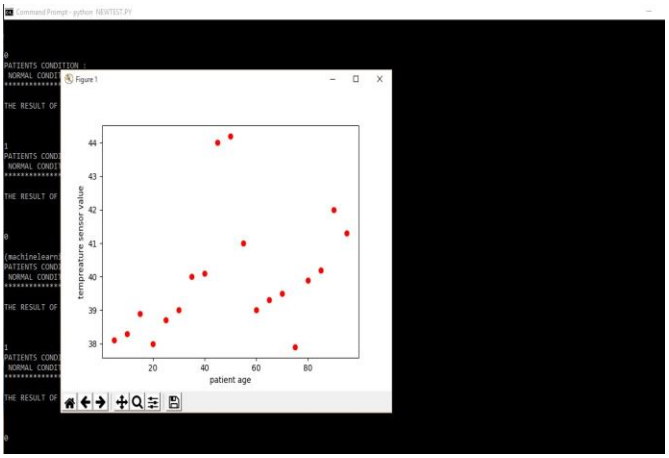

Fig 12:- Temperature abnormal values

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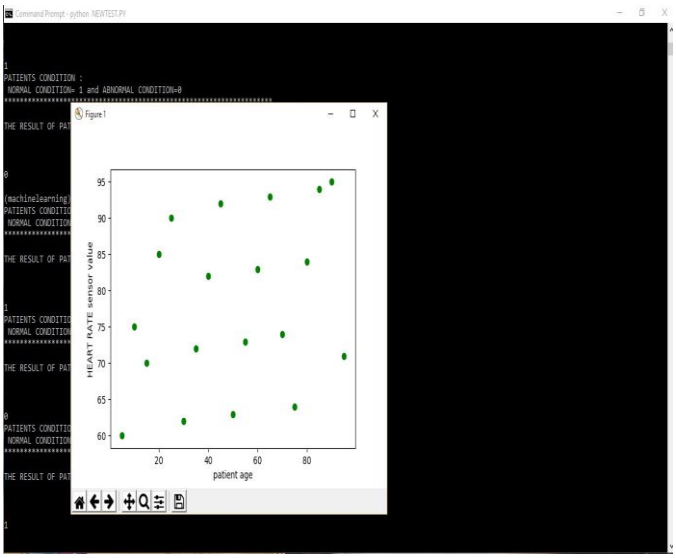

Fig 13:- Heart rate normal values

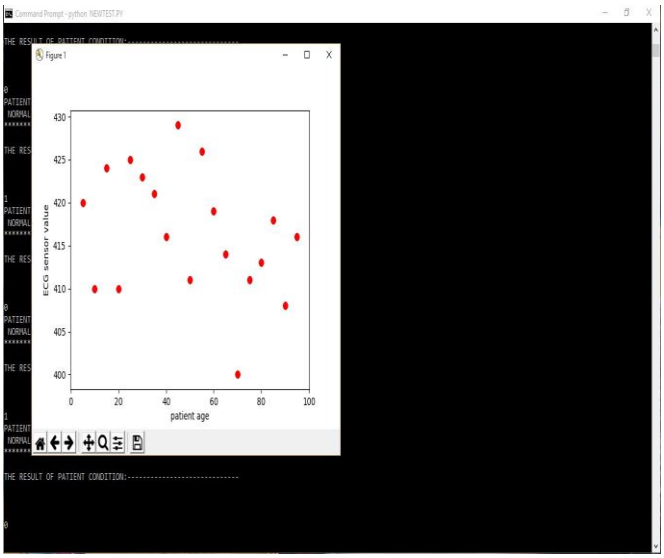

Fig 16:- ECG abnormal values

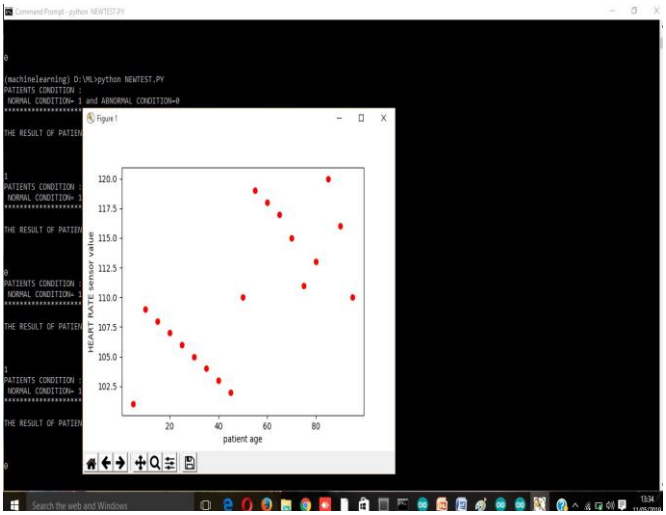

Fig 14:- Heart rate abnormal values

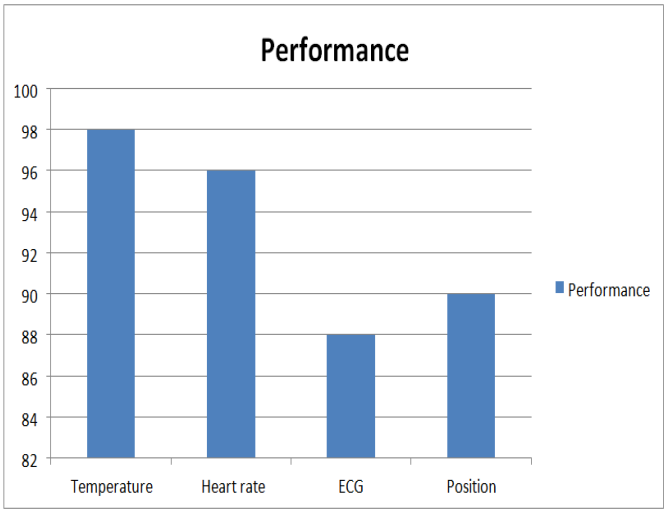

Fig 17:- performance graph

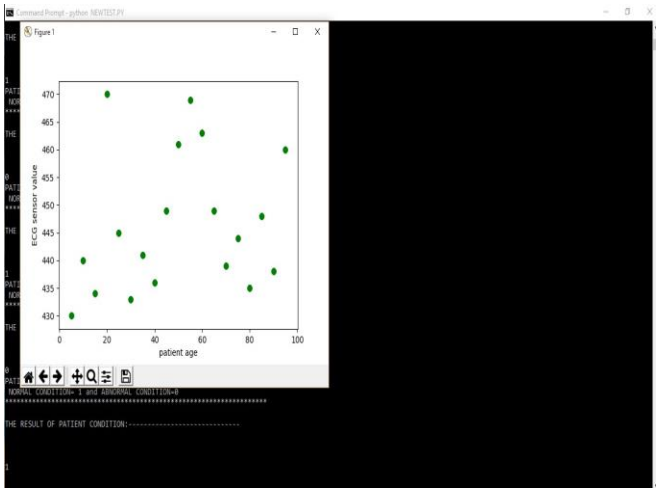

Fig 15:- ECG Normal Values

VI. CONCLUSION AND FUTURE SCOPE

The proposed IoT based smart health monitoring system for old aged patients is effective in real time system. This project can be extended with other health parameters of old age people such as blood pressure sensor, weight sensor, sweat sensor etc..,. And based on health parameters of old age people machine learning can be done ,disease that may occur can be known before. We can also add security to real time health information of patient integrating health monitoring system with encryption and decryption system.

An android application can be developed instead of webpage since android mobiles are very affordable and most commonly used these days.

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