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Health Diagnosis by using Machine Learning Algorithms

B.Pavitra, R.Nagaswetha, E.Sathish

Abstract: ***In the field of health care, the health monitoring contributes a wide variety of applications such as hospitals, homecare unit, sports training and emergency monitoring systems. In this project, a wireless system is designed for health monitoring. The developed integrated system is used for monitoring of patient's Pulse rate, Systolic pressure, Diastolic Pressure and Temperature by using machine learning algorithm. By taking Machine learning algorithms such as Logistic regression, SVM, k-NN, Decision Tree and Random Forest , we trained that algorithms for predict the person health condition depending on previous datasheet. Depending on accuracy choose best algorithm and push message alert to mobile app. For wiring the sensors data APIs and Model predicted output Node-Red Tool was used.***

Index Terms: ML, Logistic regression, SVM, k-NN, Decision Tree.

I. INTRODUCTION

Machine learning calculations assume on noteworthy job in software engineering research. The benefit of utilizing these calculations over manual location is that they can bolster human specialists to analyse wellbeing condition, perform examination of complex information in a more productive way.in medicinal services space, information are regularly unpredictable, setting subordinate, and the idea of information is heterogeneous which makes it trying errand for extricating sagacious data from the first information. Machine learning calculations can be joined to distinguish designs in information and the upside of such calculations is that framework can gain from the recognized information which gives more hearty and effective finding.[5] A large number of machine learning algorithms are available that can perform pattern recognition, classification and regression. Most algorithms are support vector machine (SVM), logistic regression, decision tree, random forest, k-NN etc. These algorithms are used in different domains applications and each domain uses different performances matrices. In this paper logistic regression, support vector machine (SVM) and k-NN algorithms are applied on two parameters i.e. Pulse rate and Temperature to classify the patient is normal or abnormal.[5]

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***** Correspondence Author
B. Pavitra*, Department of Electronics and Communication engineering from ANNA University Chennai(TN), India,
Naga swetha R, Department of Electronics and Communication engineering JNTUH University,
Sathish Egadhandi, Departmet of in Electronics and Communication engineering from the JNTUH University, Hyderabad, India

II. SYSTEM ARCHITECTURE

In this project a wireless system is designed for health monitoring. The developed integrated system is used for monitoring patient's Pulse rate and temperature the sensors data is transmitted via Bluetooth to Mobile app where the patient's enters their name, age gender.
The sensors data and patient details are uploaded to cloud and placed in database. The data is given for analysis for with predefined data related to pulse rate and temperature using DSX machine service of IBM Cloud. After analysis normal level of patient with respect to BP and temp is given as notification again to mobile app.[1]

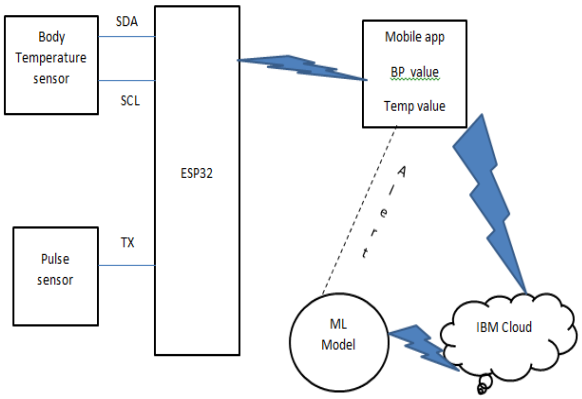

Fig1: Block diagram[3]

II. HARDWARE DESCRIPTION

ESP32:

The ESP32 fig (2) is used as embedded controller to inter face with body temperature, BP sensor and connect with mobile app and IBM Cloud.
The ESP32 has 40 pins inbuilt Wi-Fi and BLE module with 32-bit processer, two cores, CPU frequency of 160mhz, RAM of 512kb, flash of 16mb, GPIO pins of 36, 18 ADC pins, 2 DAC pins, 5 busses (SPI, I2C,UART,I2S, CAN). BP and Temperature sensors are connected to the ESP32 and sensors output values are sent cloud via Bluetooth.

Fig 2: ESP32 controller

BP SENSOR:

Blood pressure sensor module fig (3) shows systolic, Diastolic and Pulse readings. Compact design fits our wrist like a watch. Working voltage +5V, 200mA,Output format serial Data at 9600 baud rate (8 bits data, no parity, and 1 stop bits).

BP sensors have 3 pins. TX pin is connected to 16thpin of the ESP32 controller, VCC (+5V), GND.

Fig 3:BP Sensor

MAX30205 TEMPERATURE SENSOR:

The max30205 temperature sensor fig (4) accurately measures temperature and provide an over temperature shutdown output. Communication is through an I2C-compatatible, 2-wire serial interface. The I2C serial interface accepts standard write byte, read byte, send byte and receive byte commands to read the temperature data and configure the behaviour of the open drainover temperatureshutdown output

In this project this sensor's SCL pin is connected to 22nd pin of the ESP32 controller and SDA pin is connected to 21st pin. GND and VCC connected.

The sensor has a2.7V to 3.3 V supply voltagerange, lockup-protected I2C compatible interface that make it ideal for wearable fitness and medical Applications.

Fig 4: MAX30205 Temperature sensor

IV. SOFTWARE

ARDUINO IDE: The Arduino IDE is an open source software where we can write, execute and upload to the board it can install for windows, Linux, etc., here different languages like C, C++, embedded C are used. I have written the program in embedded C and uploaded to hardware board by connecting USB. The functions of IDE are setup () are used to execute or reset the program, loop () are used to repeat a specific block of code in the program.

ANDROID STUDIO: The Android studio is a software development tool to create a mobile app, were there are many other mobile app development tools I prefer android studio because it has inbuilt firebase cloud which is useful for my project. Here the code is written in Java and xml language. This studio can install for windows, Linux, etc., the text page is to write the code and design page is to design the app as per our convenient

PYTHON:

Python is an interpreted, object –oriented, high –level programming language with dynamic semantics. It is high level built in data structures, combined with dynamic typing and dynamic binding make it very attractive for Application development.

Python is simple, easy to learn syntax. Debugging python programs is easy; the edit-test-debug cycle is fast.

IBM CLOUD:

Cloud storage enables applications to upload data to network of remote, connected servers. Applications can maintain that data and access it from any ware,applications access data

using a web based API that works with client applications.

V. SYSTEM IMPLEMENTATION

The experimental works of this project conducted on three different Machine learning Algorithms i.e. logistic regression, Support vector machine (SVM), k-NN to find out the best method for predicting Patient's Health situation.

Independent parameters Systolic Blood pressure, Diastolic BP, pulse rate, temperature is used to classify whether if Patient condition is Normal or Abnormal. There are 250 cases taken from sensors. From those values we create a csv file, that file is uploaded to IBM cloud via Bluetooth for analysis. For each parameters data, each of the of this independent data is randomly divided into two datasheets i.e. Training and Testing datasheets. The Training dataset consists of 190 and testing dataset consists of 60 cases.

Table 1: Data set (.csv file)

SBP	DBP	Pulse rate	Temperature	level
110	84	86	96	0
128	120	85	101	1
130	110	89	100	1
145	130	88	101	2
105	89	86	100	1
120	85	75	98	0
142	125	86	105	2

With the above data sets we are creating a ML model that can predict the patient's health situation. The Classification Accuracy rate of Logistic regression, SVM, k-NN algorithms using sensors variables are given below table 2 Depending on the accuracy percentage we can finalize which ML algorithm is predicting better patient's health condition. After that predicted message will send to Mobile app if with patient condition is Normal or Abnormal. We will write the code in python language in jupyter note book, and create the machine learning model token. Then we go to NODE-RED service in that service we create a flow chart for sensors data and ML model predicted message .from that we push a notification alert to the Mobile App again with respect to sensors data the Patient is Mild condition or Severe condition. The below fig(5) shows the flowchart for output by using Node Red .

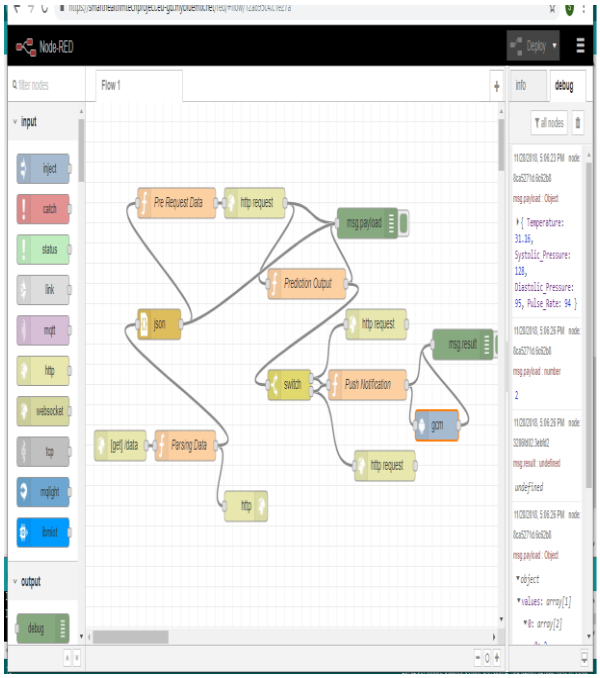

Fig (5): Node-RED output

VI . RESULTS

The below table 2 shows that accuracy for different ML algorithms when excuted the python code in jupitor notebook. From that I have taken SVM algorithm as better predicted algorithm for this project.

Sl. No	Classifier	Accuracy
1	Logistic regression	47
2	SVM	98
3	k-NN	67
4	Decision tree	67

Table 2 Accuracy for different ML algorithms

When Mobile app will open the below fig 6 will appears

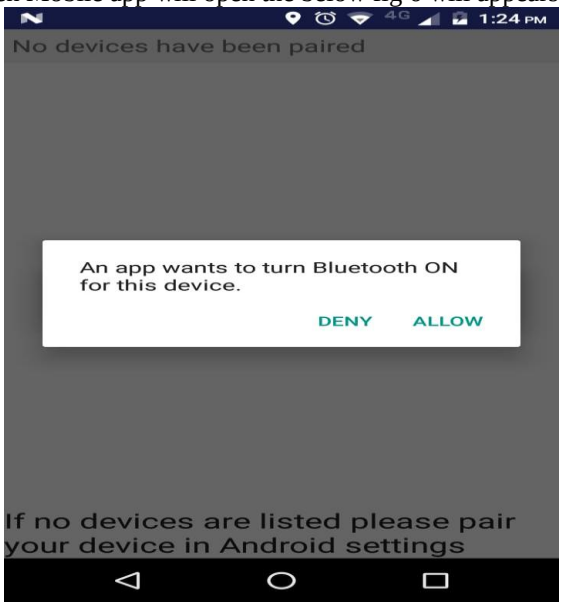

Fig 6: Mobile app not pairing ESP32

After turn on the Blutooth of Mobile thr ESP32 module inbuilt blutooth will Paired with mobile shown as fig 7

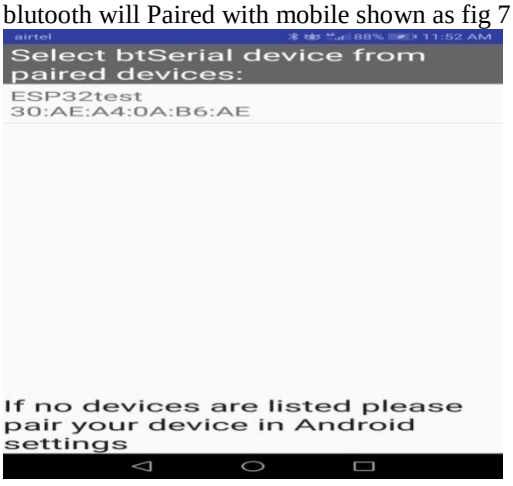

Fig 7: Mobile paired with ESP32

After pairing with ESP32 the Mobile App screen will appear as below fig

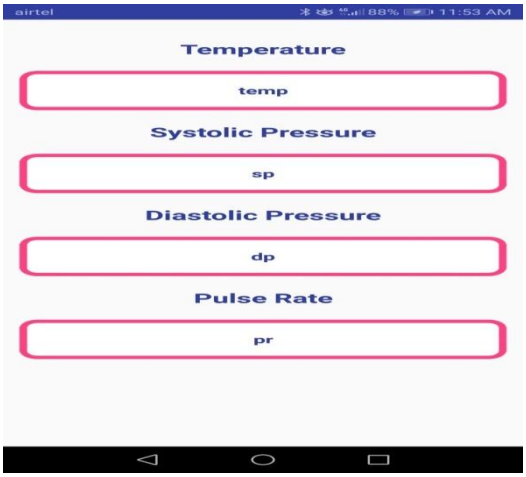

Fig 8 :Mobile app screen

After connecting the sensors to ESP32 , the values are sent Mobile App via inbuilt Bluetooth that Bp sensor and Temp values will appear in Mobile as shown in below figure

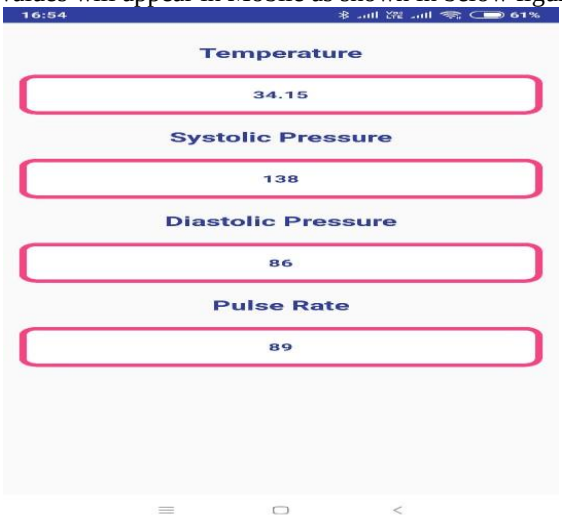

Fig 9: Mobile app with sensor readings

The below figure shows that prototype of the project.Temperature and BP sensors are connected to the ESP32

Fig 10 :Project prototype Output

When connecting the sencors to ESP32 that values we can seen Arduino IDE shoen in below fig.

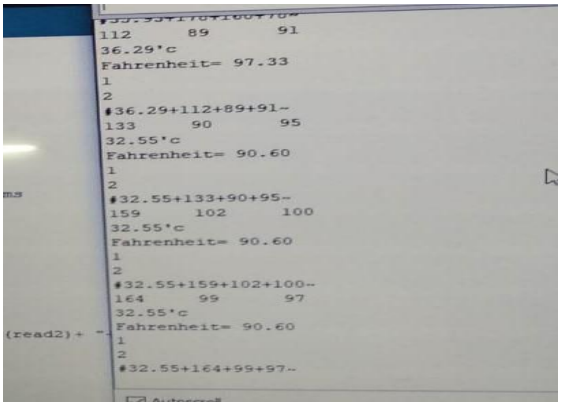

Fig 11: Arduino ESP32 serial monitor output

The sencors values are sent Machine learning model .

That ML model will predict the person parameters and wiill sent the predicted message to mobile that figure shown below

Fig 12:Predicted message from ML model

VII. CONCLUSION AND SCOPE

Advances of technology lead to complex and heterogeneous data in Healthcare system .for medical treatments doctors and researchers can use machine learning algorithms for diagnosis and prognosis of Patients. However there is a large variety of machine learning methods from that we have to choose appropriate method for selected domain. This paper provides a method that works based on the sensors data and provides best classification accuracy. In this paper the goal is to diagnose patients BP and body Temperature whether patient is Normal condition or Abnormal, that is observed by using SVM algorithm as better predicted ML algorithm.The increasing data scale and complex challenges for diagnosis of some variety of diseases we can detect that problems. Here is Machine learning algorithms can provide wide range of techniques, tools and frame works that can address hybrid challenges .so that we can use combination of different algorithms in future for developments in healthcare and big data solutions.

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AUTHORS PROFILE

B. Pavitra was born in Nellore, Andhra Pradesh, India, in 1986. She received the B.Tech degree with distinction in Electronics and Communication engineering from ANNA University Chennai(TN), India, in 2007, and the M.Tech.in Embedded Systems with Distinction from JNTUH University, Hyderabad, India in 2014. Registered for Ph.D. at JNU, Jaipur in the year 2019, worked as **Lecturer** at AVS College of Engineering from July 2007 to March 2009. Worked as **Assistant professor** at Avanthi College of Engineering from July 2009 to March 2010. Since 2010 Working as **Assistant professor** at ANURAG GROUP OF INSTITUTIONS from Till Date. Her current research interests include Embedded Systems, Embedded & IOT, Machine Learning, and Deep Learning. She is a Member of the ISTE. She has Published Papers in various National Journals by Supervising M.Tech students and also Published 4 papers in Presented a paper in 2 (two) International Conferences.

Naga swetha R was born in Hyderabad, India, in 1987. She received the B.Tech degree in Electronics and Communication engineering from the JNTUH University, Hyderabad, India, in 2008, and the M.Tech.in Embedded Systems from JNTUH University, Hyderabad, India in 2013. Registered for Ph.D. at KIIT university, Bhubaneswar in 2018. Since July 2011, she has been with the Department of Electronics and Communication, as a Assistant Professo. His current research interests include Embedded Systems, Embedded & IOT, Machine Learning, Deep Learning. She is a Member of the ISTE. She has Published Papers in various National Journals by Supervising M.Tech students and also Published 2 papers in International Conferences.

Sathish Egadhandi was born in Hyderabad, India, in 1989. He received the B.Tech degree in Electronics and Communication engineering from the JNTUH University, Hyderabad, India, in 2011, and the M.Tech.in Embedded Systems is pursuing JNTUH University, Hyderabad, India.