DATA ANALYTICS APPROACH FOR HEALTH MONITORING USING WEARABLE SENSOR

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Abstract: In this age of technological advancement, individuals are becoming less involved incompletion their physical work. Tele medicine plays an important role in the new trend, promoting the transition of health care services from clinic-centered to patient-centered with the aid of omnipresent social connectivity. One of the applications facilitated by data analysis is the continuous health management frame work. Wearable sensor devices used in Data Analytics have continuously produced an enormous amount of data for the health monitoring system. The speed of data generation for data analytics equipment is very high, so the amount of data generated from it is also high. In order to track critical parameters such as blood pressure, body temperature, pulse rate, the sensor is integrated with humans. The approach of data analytics compares the health parameter of the person and, if necessary, makes a decision. This approach provides the healthcare provider with a quick but powerful and reliable communication tool to have the solution in hand before the situation gets worse. Proteus professional software has been used to execute the concept.

Keywords: Data analytics, Wearable sensor, Health monitoring, Proteus professional.

Introduction

Happiness is commensurate with the wellbeing of the person. Without well being, no happiness can be achieved. In order to live more comfortably, health is important. But health-related illnesses, on the other hand, the grow than advance mention science and technology is rising day by day [1]. Science and technology are in search of Health-relate disuses control. The increased use of health-related mobile

technology and smart devices have a huge impact on people. A health monitoring system using IOT is proposed where the authorized personal can access these data stored using any IOT platform and based on the values received, diseases are diagnosed by the doctors for much distance [2].

Through the design of Data analytics approach for health Monitoring system, we can monitor heartbeat rate, temperature and pressure of people with different age groups. This paper is designed to monitor the heart beat of a person by using heart beat sensor, monitor the temperature of the body by using temperature sensor LM35 and blood pressure using MPX4115. For people far away from cities and living in villages, the health monitoring system may prove more useful. Such individuals are unable to enter the hospital in good time to save their life. By planning such, together with E-mail warning and storing data in cloud which can easily save the patient's life by attaching the health monitoring system to the patient's body, and they can easily be diagnosed online through the internet. So, we introduced a method which continuously monitors the patient's condition and automatically transmit the data to server, so the doctor can access the data continuously and we can intimate caretaker when patient is in critical situation [3].

When a person's health problem has progressed to the point that his or her life is in jeopardy, they seek medical help, which may result in an unnecessary waste of money. By offering online medication according to the health condition, a doctor may diagnose the patient in order to hospitalize the patient on time if necessary, so that the risk of losing patient life can be reduced.

PROPOSEDWORK:

The main aim of our project is to make the frame work for health monitoring simple and precise. Health monitoring system include the collection and processing of data obtained from smart phones, smart watches, smart bracelets, as well as from various age groups of people with different sensors. Using a data analytics approach, a health monitoring device can measure the pulse rate, temperature, and blood pressure of patients of any age group, and these data can then be translated into a patient's qualified data collection. These data can also be sent to health care centers which will also have the knowledge about patient's health. By this when our health condition varies health care center will contact us to take preventive measures. All of these parameters can be transmitted to the Blynk Cloud wirelessly .Test values can be transmitted wirelessly to physicians in emergency situations and the patient will also be alert using IOT via E-mail and blynk app. In our design we have integrated all three parameters in a single system to make it cost-effective. All the data which

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have been stored in cloud can be accessed or extracted at any time to understand the health status of the patient.

BLOCKDIAGRAM

Fig.3.1shows the block diagram of health monitoring system and its working.

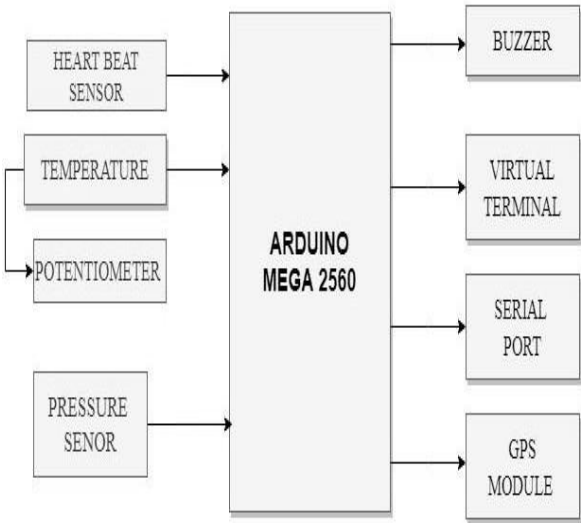

Fig3.1.Block diagram of health monitoring system

The values of temperature, blood pressure and heart beat sensors of the patient are input. The age of the patient is determined using potentiometer. These sensors are connected to Arduino mega 2560.All these values are then sent to Arduino mega to check with threshold values in simulation mode using proteus professional suite. Tested values will be displayed in virtual terminal. If the values are abnormal, E-mail will be sent to respective patient and the doctor.

FLOWCHART

The flow chart of the control system for data analytics approach of patient health monitoring is shown inFig.3.2.
Once Arduino super starts the operation, using virtual com, sensors and blynk cloud are initialized. Sensors then read the values of patient as per the potential meter variation. These values are checked with threshold values using Arduino mega. If the values surpass the threshold values, then the patient and the doctor will receive an e-mail warning. Then buzzer and GPS will be activated to check the current location to locate the nearest health care center.

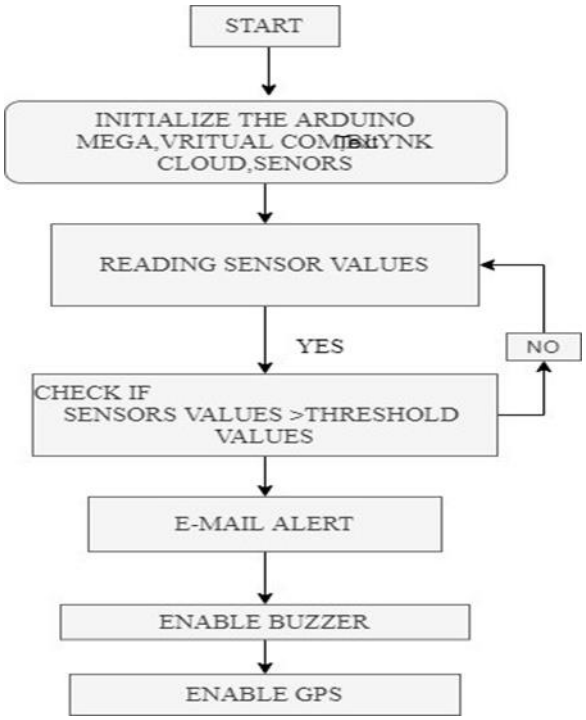

Fig3.2. Flow chart of health monitoring system.

RESULTS

The Model has been simulated by using Proteus Software to monitor the human health using different sensors with no limitations of age. After initialization of circuit all the values of temperature, blood pressure and heartbeat rate are inputted and age of the person through potentiometer. Fig 7.1 shows circuit diagram of health monitoring system and the values obtained in virtual terminal. Fig7.2 shows the tested values of sensors in blynk app. All the tested values are displayed in blynk app along with current location which is useful to locate the patient to the nearby health care center. As the health parameters are beyond the threshold Values, the person is notified through mail. At the same time buzzer also reached the ON state to make the person realize the condition.

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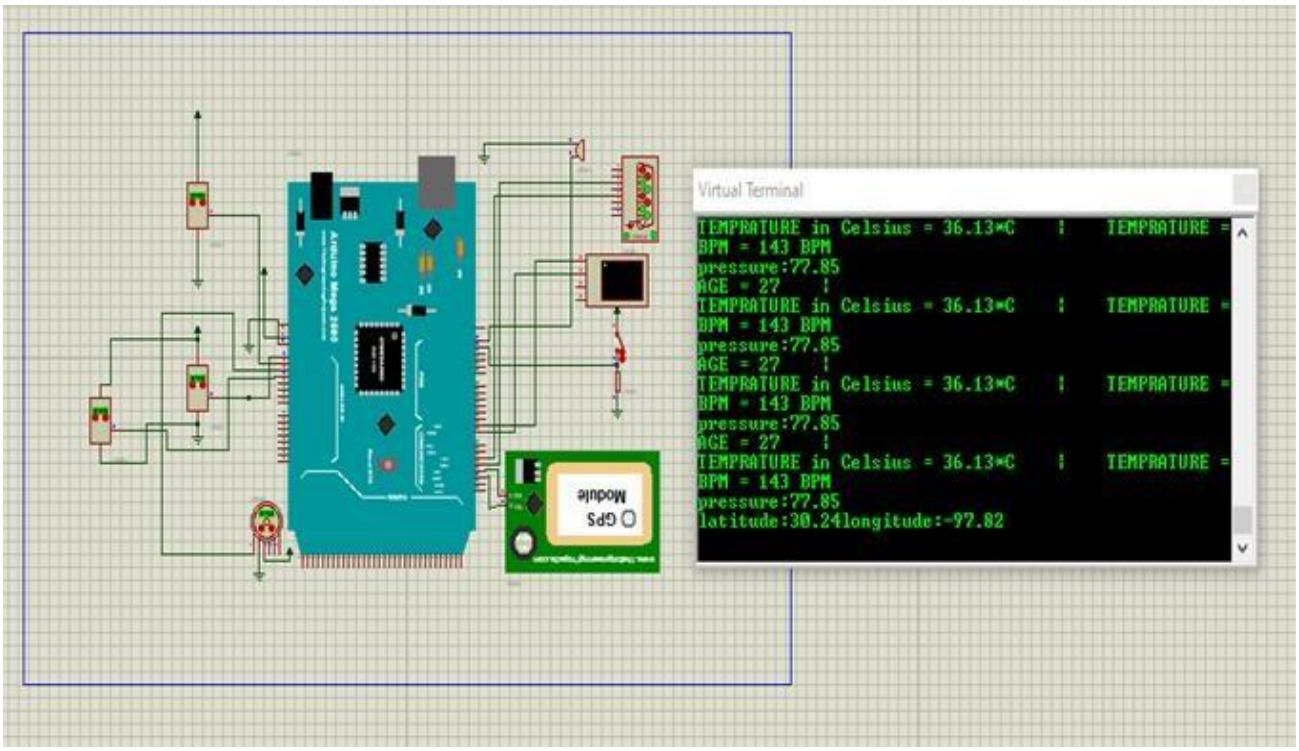

Fig7.1 Circuit diagram of health monitoring system

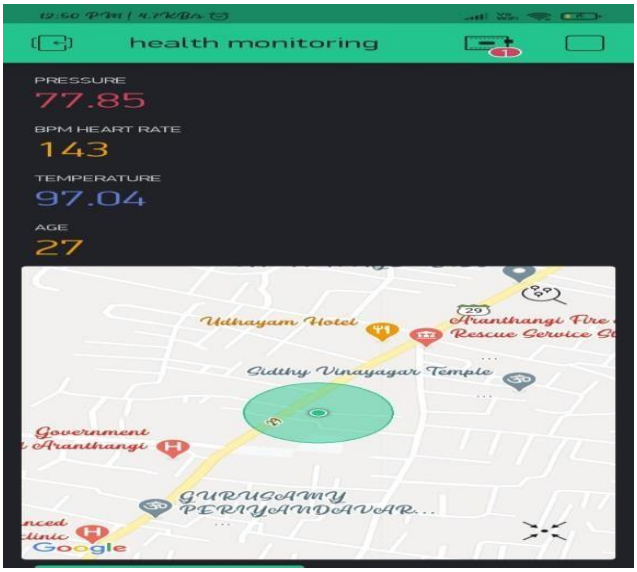

Fig7.2Tested values in blynk app.

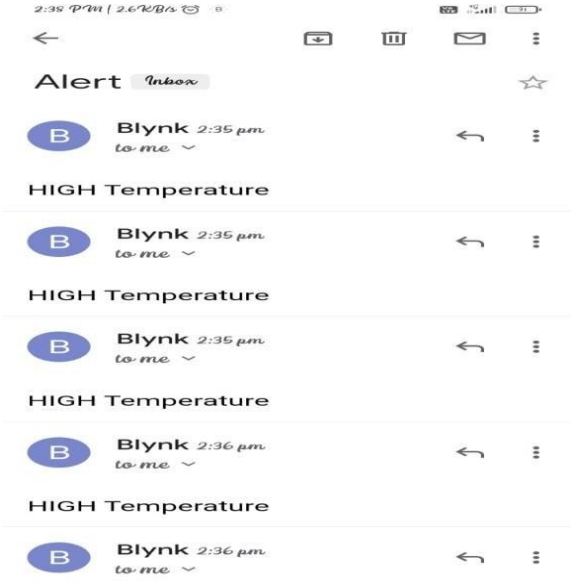

Fig7.3E-mail received by patient.

Fig7.3 shows the E-mail received by the patient. As the sensor values have crossed the threshold values an alert has been sent to patient as E-mail along with the parameter store at it accordingly.

By making data analytics approach for patient's data with different age groups using weka tool the followings graphs are obtained along with the errors in pressure and threshold values. Fig 7.4 shows the blood pressure prediction graph.

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```
BP
  N                                71
  Mean absolute error              5.4873
  Root relative squared error      2491.4003
  Direction accuracy               40
  Relative absolute error          2904.9529
  Mean absolute percentage error   6.2838
  Root mean squared error          6.9467
  Mean squared error               48.2568
```

```
THRESHOLD VALUES
  N                                71
  Mean absolute error              1.5669
  Root relative squared error      302.8956
  Direction accuracy               0
  Relative absolute error          1083.712
  Mean absolute percentage error   1.2392
  Root mean squared error          2.1837
  Mean squared error               4.7685

Total number of instances: 83
```

```
Hot Spot
========
Total population: 118 instances
Target attribute: THRESHOLD VALUES
Target average in total population: 127.364
Minimum segment size: 39 instances (33% of total population)
Maximum branching factor: 2
Maximum rule length: unbounded
Minimum improvement in target: 1%

THRESHOLD VALUES (127.3644)
  BP > 93.265 (132.4615 [39])
  AGE > 30 (128.8974 [39])
```

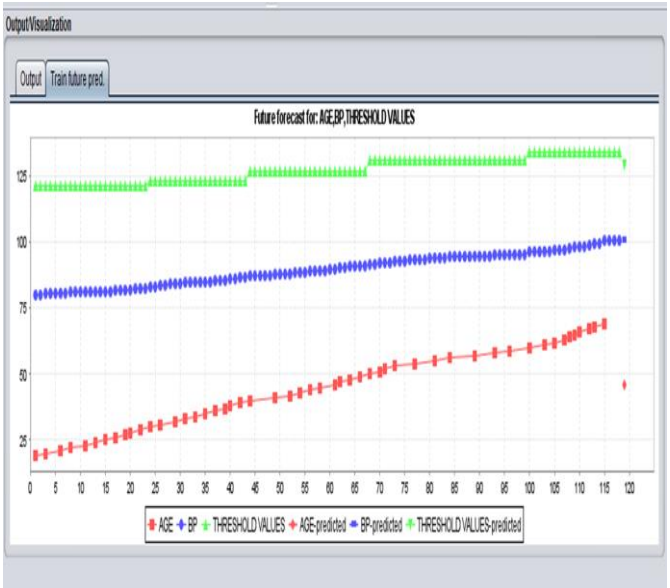

Fig7.4Blood pressure predictiongraph

Although low blood pressure (also known as "hypotension") is a less common issue than hypertension, it can also have a major effect on blood flow to the brain. Shock, stroke, heart attack, and kidney failure are all possibilities.

Fig 7.6 shows the heart rate prediction graph using weka tool with no limitations of age. Errors are also occurred while predicting the heart rate with its threshold values with respect to its concerned age.

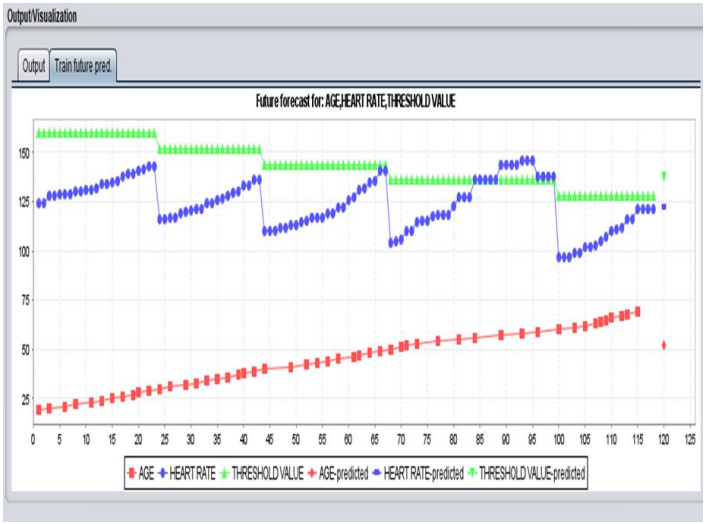

Fig7.6Heartrate prediction graph

The condition of the graph when the heart rate reaches the threshold values is shown in Fig 7.7. When your heart rate rises, you can experience the following symptoms: Shoulder, arm, and/or leg pain, numbness, and/or tingling Back, jaw, or back pain Shortness of breath can occur while you are active, at rest, or lying flat. You can feel chest pain during physical activity that subsides when you rest. I'm experiencing dizziness.

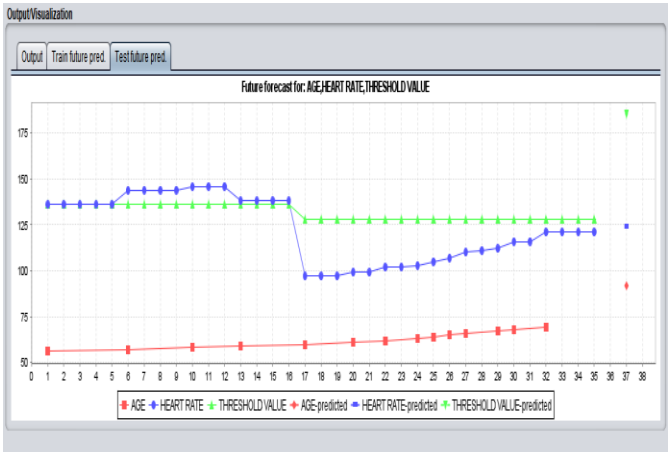

Fig7.7Heartrateexceededgraph

Fig 7.8 shows the temperature prediction graph of patient's

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temperature with no limitations of age Using weka tool. Certain error will also occur during the visualization.

HEART RATE	
N	71
Mean absolute error	3.1754
Root relative squared error	94.659
Direction accuracy	70
Relative absolute error	127.9107
Mean absolute percentage error	2.6476
Root mean squared error	6.1957
Mean squared error	38.3868

AGE	
N	32
Mean absolute error	8.928
Root relative squared error	463.5778
Direction accuracy	75
Relative absolute error	443.8976
Mean absolute percentage error	25.0173
Root mean squared error	12.2015
Mean squared error	148.8765

```
Hot Spot
========
Total population: 119 instances
Target attribute: THRESHOLD VALUE
Target average in total population: 143.729
Minimum segment size: 39 instances (33% of total population)
Maximum branching factor: 2
Maximum rule length: unbounded
Minimum improvement in target: 1%

THRESHOLD VALUE (143.7288)
  HEART RATE > 127 (149.28 [50])
  |   HEART RATE <= 143 (151.4419 [43])
  AGE <= 57 (148.9231 [39])
```

THRESHOLD VALUE	
N	71
Mean absolute error	4.4395
Root relative squared error	394.1974
Direction accuracy	2.8571
Relative absolute error	1312.3436
Mean absolute percentage error	3.0769
Root mean squared error	6.4825
Mean squared error	42.0222

Total number of instances: 83

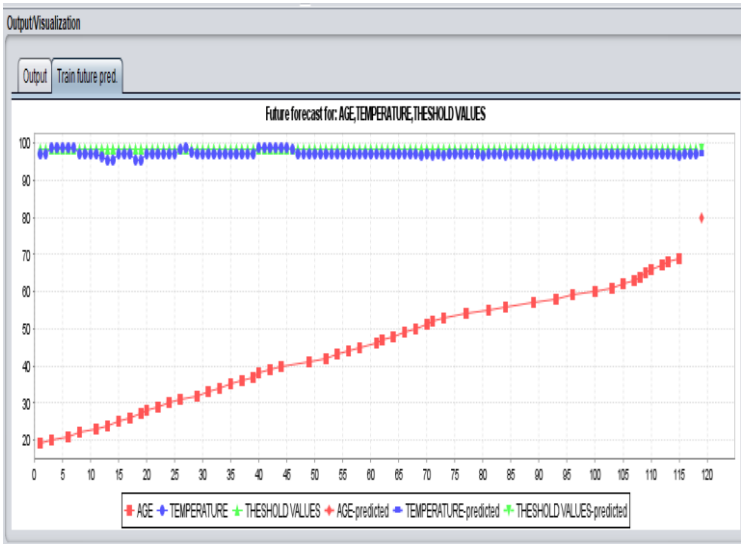

Fig7.8Temperature prediction graph

TEMPERATURE	
N	71
Mean absolute error	0.3305
Root relative squared error	97.1893
Direction accuracy	31.4286
Relative absolute error	143.5576
Mean absolute percentage error	0.3406
Root mean squared error	0.5102
Mean squared error	0.2603

THESHOLD VALUES	
N	71
Mean absolute error	0
Root relative squared error	0
Direction accuracy	100
Relative absolute error	0.0011
Mean absolute percentage error	0
Root mean squared error	0
Mean squared error	0

Total number of instances: 83

```
Hot Spot
========
Total population: 118 instances
Target attribute: THESHOLD VALUES
Target average in total population: 98.6
Minimum segment size: 39 instances (33% of total population)
Maximum branching factor: 2
Maximum rule length: unbounded
Minimum improvement in target: 1%

THESHOLD VALUES (98.6)
```


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CONCLUSION

IoT is now widely regarded as one of the most viable options for remote data collection, especially in the field of health monitoring. Body temperature, heart rate and blood pressure were calculated by the device, which are also seen in the virtual terminal of proteus software. These sensor values are then sent to the cloud via wireless communication, where doctors and patients can access the information. In an emergency, the doctor will be alerted as well. The patient will then diagnose the disease and know about their health status based on the values received. Data analytics approach enhances the system by making patient's health condition to come to health care center's knowledge. In future even life insurance Company can also take this approach to make patients ensure their policy effectively.

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