**Remote Health Monitoring System with analytics dashboard and Mobile App**

**INTRODUCTION**

**Project Description:** This project helps doctor to monitor the health measurements of a patient present at remote place and doctors can suggest early treatment to them to save the treatment time when it gets admitted in to the hospital

* 1. **Overview**

**Project Idea:**

The aim of this project is to take health measurements of the patient sitting at remote place and share them with the physician/doctor so that he/ she can monitor them from anywhere at any time. If anyone's health measures shows abnormal - out of range or higher than a critical value - the doctor can notify the health care workers(or pharmacists in that area) to provide precautionary medicines so that the treatment time will be saved when they admitted in hospital.

This system will be beneficial to the people living in rural areas and where they don’t have medical also be used in particular areas or remote village OPD facility. Doctors can remotely monitor and suggest some preliminary medicine. Health monitoring systems play a vital role which will help in early detection of the diseases which can reduce the suffering and medical costs. In this Health monitoring system we will be detecting the level of ill health of the person and would recommend few medications that can be taken by him by which he can recover a bit than before using Machine learning and Internet of things.

**Purpose:** purpose to build the system is to get immediate preliminary prescription of the doctor to avoid the critical situation related to health of a patient. This saves the treatment time also. Hospitals can be notified about the emergency cases in advance which may leads to save a life.

**2 LITERATURE SURVEY**

**2.1 Existing problem :** Patients who are admitted in the hospitals, Patients health is monitored by the nurses and ward boys in the hospital and report is sent to doctors time to time. For critical cases it is necessary to get the report in no time so that further treatment can be started. Now a days in most of the areas specifically in rural areas medical facility is not present and people don’t understand the symptoms of the disease. Generally they go to pharmacist and takes the medicine without proper prescription which may lead to critical health issues. Some times the patients with diseases like heart issues need to get admitted in emergency and it takes time get the heath parameters of the patient and preadmit treatment.

**2.2 Proposed solution :** In this proposed system doctors can monitor the patient’s health parameters like BP, pulse, temperature etc and take the decision based on that data, He/She can also suggest some precautionary measures and can give prescription also. To achieve this we develop a IoT device which can sense the temperature, pulse and BP values of the person and upload it to cloud IoT platform. In the cloud the data will be sent to a Machine learning algorithm to predict his health status and alerting the persons if their health condition is abnormal. Doctors will be notified and can suggest the early treatment to the patient. Build a dashboard which will visualize the health parameters. Mobile application is also developed for the doctors to monitor the health of the patient.

**3.THEORITICAL ANALYSIS:**

We collected some data related to normal and abnormal values of Temerature,BP and pulse.

**Temperature:**

The average normal body temperature is generally accepted as 98.6°F (37°C). Some studies have shown that the "normal" body temperature can have a wide range, from 97°F (36.1°C) to 99°F (37.2°C). A temperature over 100.4°F (38°C) most often means you have a fever caused by an infection or illness.[2]

**Blood pressure** is a measurement of the force exerted against the walls of your arteries as your heart pumps blood to your body. Hypertension is the term used to describe high blood pressure.Untreated high blood pressure can lead to many medical problems. These include heart disease, stroke, kidney failure, eye problems, and other health issues.Blood pressure readings are given as two numbers. The top number is called systolic blood pressure. The bottom number is called diastolic blood pressure. For example, 120 over 80 (written as 120/80 mm Hg).One or both of these numbers can be too high. (Note: These numbers apply to people who are not taking medicines for blood pressure and who are not ill.)

Normal blood pressure is when your blood pressure is lower than 120/80 mm Hg most of the time.

High blood pressure (hypertension) is when one or both of your blood pressure readings are higher than 130/80 mm Hg most of the time.

If the top blood pressure number is between 120 and 130 mm Hg, and the bottom blood pressure number is less than 80 mm Hg, it is called elevated blood pressure.

**Systolic blood pressure number:**

* Normal: Below 120
* Elevated: 120-129
* Stage 1 [high blood pressure](https://www.webmd.com/hypertension-high-blood-pressure/default.htm) (also called hypertension): 130-139
* Stage 2 hypertension: 140 or more
* Hypertensive crisis: 180 or more.

The diastolic reading, or the bottom number, is the pressure in the arteries when the [heart](https://www.webmd.com/heart-disease/rm-quiz-know-heart) rests between beats. This is the time when the heart fills with blood and gets oxygen.

This is what your diastolic blood pressure number means:

* Normal: Lower than 80
* Stage 1 hypertension: 80-89
* Stage 2 hypertension: 90 or more
* Hypertensive crisis: 120 or more.

**Pulse**

The pulse is the number of heartbeats per minute.A normal resting heart rate for adults ranges from 60 to 100 beats per minute. Generally, a lower heart rate at rest implies more efficient heart function and better cardiovascular fitness. For example, a well-trained athlete might have a normal resting heart rate closer to 40 beats per minute.

**3.1 Block diagram**

Diagram

Description automatically generated

Fig1:Block diagram

**3.2 Hardware / Software designing :**

HW:PC,IBM cloud account (can have Arduino and sensors connected to it)

To get the health data of the patient, we used simulation values generated by build in IBM IoT platform simulator .We can have a wearable device which send the health parameters of a patient such as pulse,temperature systolic/diastolic blood pressure values to IBM IoT node on cloud (through Arduino)and then to Nodered.

**4 EXPERIMENTAL INVESTIGATIONS:**

We collected data form IBM IoT simulator to train the ML model using Watson studio(Auto AI experiment).dataset used contains labelled data and categorised as multiclass classification problem to predict the severity of the patients health. for analysing the health condition target variable has multiple classes such as Critical, hypertension, Normal etc. Experiment shows that when all the algorithms are compared based on accuracy ,decision tree classification algorithm gives the best results Accuracy (95.9 %).

Graphical user interface, chart

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Fig 2: Metric chart / Pipeline comparison for performance of the algorithms used by Machine Learning auto AI experiment

Graphical user interface, application

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Fig:3 Accuracy results of the Algorithms used by Auto AI experiment

**5 FLOWCHART**

Labelled Health dataset

Get data from IoT Simulator

Train ML model using IBM Auto AI experiment

(IBM Watson studio)

Design NodeRed App to get data from IoT device and provide that data as validation data to ML model to obtain output

http request

http response

Design a Mobile application for doctors to view patients data and provide prescription

Fig:4 Flow chart

**6 RESULT :**

Configured the IBM IoT platform to generate random values for Temperature, Pulse, Systolic, Diastolic and BP. Shown in the figure below.

A screenshot of a computer screen

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Graphical user interface, application

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**Fig:5 Data collected from the IBM IoT platform**

Graphical user interface, application, Word

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**Fig 6: Data collected (ID and Health condition of a patient) by issuing http request and displayed on browser**

Graphical user interface

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A screenshot of a computer

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**Fig 7 : Mobile application development for doctors to view the health condition of a patient**

A map of a computer

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Fig 8: Node RED App for interfacing between Mobile Application IoT and ML Model

**7 ADVANTAGES & DISADVANTAGES**

**Advantages:**

1. Doctors can Monitor the health condition of a patient sitting at remote

Place

1. Saves the treatment time of the Doctors.
2. Prior decisions can be taken by the doctors for handling the emergency cases

Disadvantages:

1. Delays in the data transmission may lead to prblems

8 APPLICATIONS :Medical healthcare

9 CONCLUSION

We developed a Project using IBM IoT cloud platform for Machine learning and Internet of Things to take health measurements of the patient sitting at remote place and share them with the physician/doctor so that he/ she can monitor them from anywhere at any time.

**10 FUTURE SCOPE ` :**

* This system can be further modified to send the prescriptions to the patients on the mobile.
* If anyone's health measures shows abnormal - out of range or higher than a critical value - the doctor can notify the health care workers(or pharmacists in that area) to provide precautionary medicines so that the treatment time will be saved when they admitted in hospital..
* Pharmacists can be added to the system to provide the medical support.

**11 BIBILOGRAPHY**

[1] <https://cloud.ibm.com>

[2] https://medlineplus.gov

APPENDIX

1. Source code