Project Documentation
on
Remote Health Monitoring with Analytics Monitoring

1. INTRODUCTION

1.1 Overview

Health is always a major concern in every growth the human race is advancing in terms of technology. Like the recent corona virus attack that has ruined the economy of China to an extent is an example how health care has become of major importance. In such areas where the epidemic is spread, it is always a better idea to monitor these patients using remote health monitoring technology. So Internet of Things (IoT) based health monitoring system is the current solution for it [1].

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.

1.2 Purpose

Health Monitoring Systems provide alternatives to the traditional management of patients reducing hospitalization and the cost of formal health care, and allowing disease prevention and related lifestyle changes.

2. LITERATURE SURVEY

2.1 Existing problem

Internet of Things (IoT) and cloud computing plays a vital role in today's Tele-monitoring health system. This system keeps track of patient's physiological parameters through collection of body sensors' data using Raspberry Pi board. The patient are able to monitor their health remotely without visiting to the hospital [1]. Using cloud computing, the data can be stored, updated and accessed from anywhere in the world. It is very suitable for rural areas where medical facilities are not available. In Remote health monitoring system using IoT, Body wireless sensor Network (BWSN) is used to transmit the patients' health parameters collected through Raspberry Pi microcontroller to the physicians and caretaker wirelessly [2]. Being long range wireless technology, emergency situation of the patient's health is quickly detected and timely intervention leads to save the life of the patient. Owing to costlier healthcare and long waiting time in hospitals, the concept of in-home patient monitoring system have been emerging in the recent years. This system collects data of various body parameters through Biosensors, wearable devices and smart textiles and it transmits the data to central node server securely through Cipher text Policy Attribute Based Encryption (CP-ABE) method. In turn, the

server shares the collected data to the hospitals for further treatment. The server rings alarm to the ambulance [3] during emergency situation. It is very beneficial for elders and chronic patients who require continuous monitoring. The specialized healthcare monitoring system for elderly people is a growing need in the aging population world. This system performs basic health checkups by measuring the body parameters regularly and report the people to whether they are ill or not. The result data are then displayed as statements in a web application where they can check their health status regularly[4]. The main challenge is to make elders equipped with for growing new International Journal of Pure and Applied Mathematics Special Issue 250 technologies and to become familiarity towards Smartphone, computer, etc. IoT based Smart healthcare with the help of smart devices and objects improves the healthcare monitoring system effectively, thus by reducing the inefficiencies of existing healthcare system. Smart devices with new and upgraded technologies enhances the data accuracy to be collected, real-time accessibility of patient's condition, intelligent integration of data collected, maintaining the integrated data smartly through cloud service, etc. [5]. IoT along with smart devices reduce complexity and complications in the healthcare system. The penetration of mobile technologies and smart devices over healthcare system cause huge impact on the world. The full-fledge utilization of M-health and E-health applications in today's world is made aware to the people for improving and maintaining the good quality of life. Apart from regular monitoring of patients condition through M-health system, the main objective is to educate them through recommendations of healthy eating habits and effective workout routines for improving their quality of healthy life [6]. In remote mobile health monitoring system, the patient health parameters are recorded by a smart phone by eliminating an additional hardware and transmit data through a web interface[7]. The real time health parameters are measured through wearable sensors and transmitted to a smart phone which shows the patient health status in graphical interface. [8]. Secondly, the major challenge is of the accuracy, validity and integrity of measurement data with other devices. Thirdly, the usability and the experiences of the user with the device and its friendly supporting software play vital role in continuing regular and long period use of wearable tracking devices. The use of Internet of Things (IoT) and its e-Health applications in the Tele-medicine health system leads to seamless flow of information between doctors and patients, thus making healthcare cost effective and improving the quality of patients' treatment.

2.2 Proposed Solution

In this proposed system develop a IoT device which can sense the temperature, pulse and BP values of the person and upload it to IBM 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. Build a dashboard which will visualize the health parameters.

Project Flow:

- Send the health parameters (Temperature,pulse,BP) to IBM IoT platform. Use an online simulator.
- Create a machine learning model using Watson studio and Auto AI experiment which will analyze the health status from 0-2 where 0 is that he is perfectly okay, 2 is that the person is very much ill and that he needs to consult a doctor.
- Create a Node-RED flow to get data from IBM IoT devices and which will communicate with mobile apps using HTTP requests.
- Create a mobile app through which The person can register along with their name, age, and gender.
- Store the entire data in the Cloudant DB using Node-RED
- Configure the Node-RED to give the sensor input to the ML model and predict the illness of the person.
- Configure the mobile app which will visualize the health parameters and show the suggestions according to the predicted output.

3. THEORITICAL ANALYSIS

3.1 Block Diagram

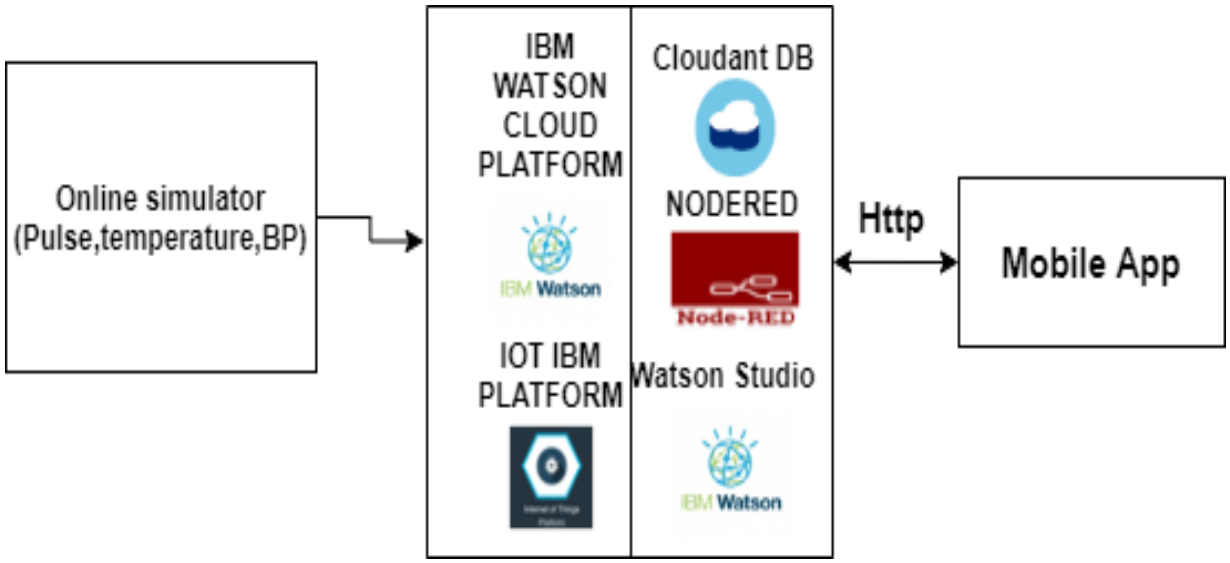


Fig 3.1 System Architecture

3.2 Hardware / Software designing

1. Temperature sensor

A 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 °C).With LM35,the temperature can be measured more accurately than with a thermistor. It also possess low self heating and does not cause more than 0.1 °C temperature rise in still air. The operating temperature range is from -55°C to 150°C.The LM35's low output impedance, linear output, and precise inherent calibration make interfacing to readout or control circuitry especially easy. It has find its applications on power supplies, battery management, appliances, etc.

2. Blood Pressure Sensor:

A pressure sensor is a device for pressure measurement of gases or liquids. Pressure is an expression of the force required to stop a fluid from expanding, and is usually stated in terms of force per unit area. A pressure sensor usually acts as a transducer; it generates a signal as a function of the pressure imposed. For the purposes of this article, such a signal is electrical.

3. Heartbeat sensor

The heartbeat sensor is based on the principle of photo phlethysmography. It measures the change in volume of blood through any organ of the body which causes a change in the light intensity through that organ (a vascular region). In case of applications where heart pulse rate is to be monitored, the timing of the pulses is more important. The flow of blood volume is decided

by the rate of heart pulses and since light is absorbed by blood, the signal pulses are equivalent to the heart beat pulses.

4. Micro Controller:

Arduino is an open-source platform used for building electronics projects. Arduino consists of both a physical programmable circuit board (often referred to as a microcontroller) and a piece of software, or IDE (Integrated Development Environment) that runs on your computer, used to write and upload computer code to the physical board. The Arduino platform has become quite popular with people just starting out with electronics, and for good reason. Additionally, the Arduino IDE uses a simplified version of C++, making it easier to learn to program. Finally, Arduino provides a standard form factor that breaks out the functions of the micro-controller into a more accessible package.

5. IBM Cloud and services:

IBM Cloud and services are used for accessing machine learning model for analysis of health of the person. Watson studio is used to depoly the machine learning Model, Clod object storage, machine learning service, IBM IOT watson platform is used to access the sensor data.

4. EXPERIMENTAL INVESTIGATIONS

1. Configure and collect the sensor data from the heart rate ,BP and Temperature sensors and send to IBM IoT device.
2. Create the Watson Studio.
3. Adding the cloud object storage.
4. Create Auto AI experiment.
5. Training and Deploying the Auto AI Experiment.
6. Configure the Node Red Application to get the sensor data from IOT platform
7. Predicting the output by providing sensor data as an input to machine learning model.
8. Creating the Web UI to visualize the data

5. FLOWCHART

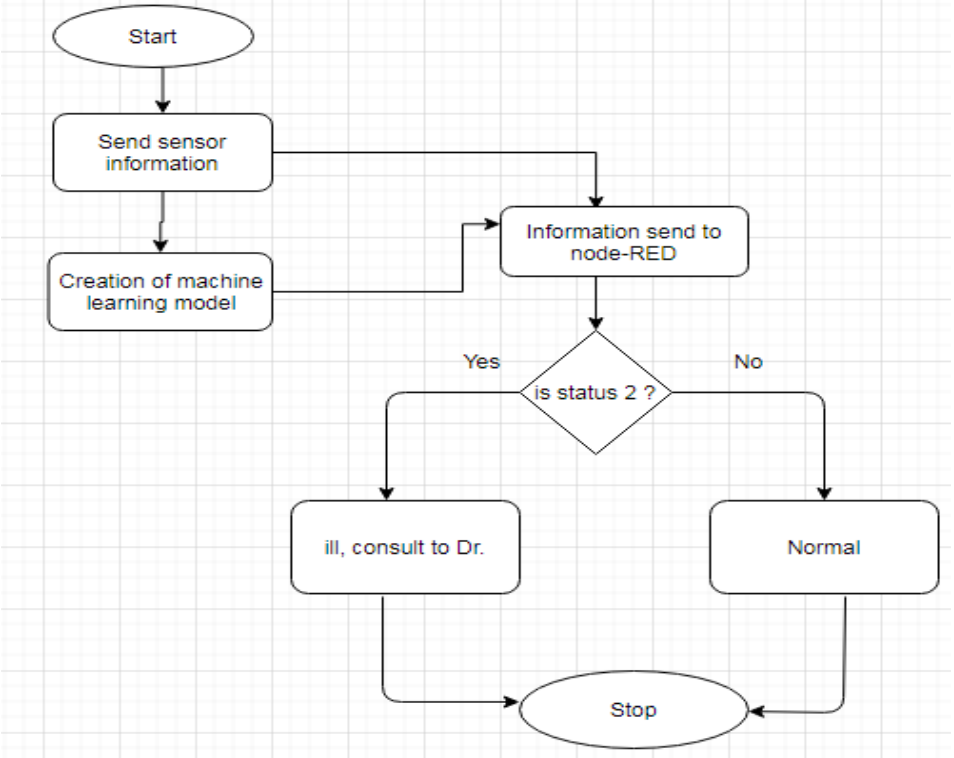
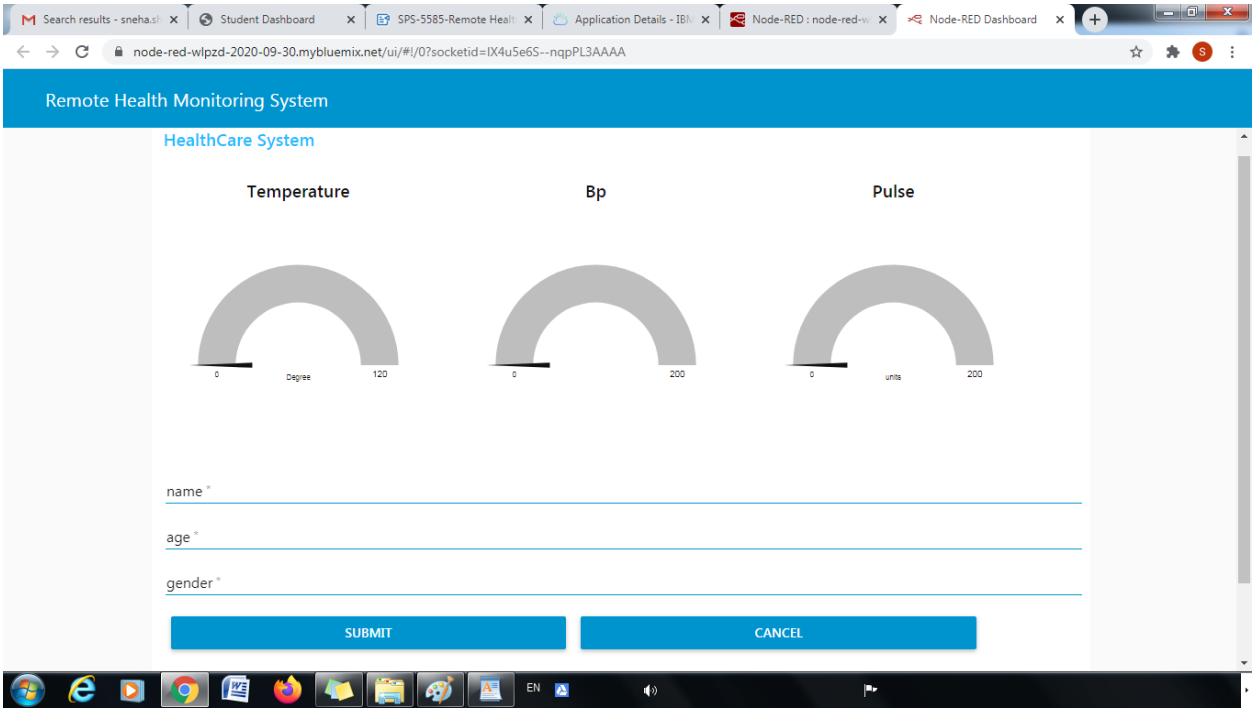


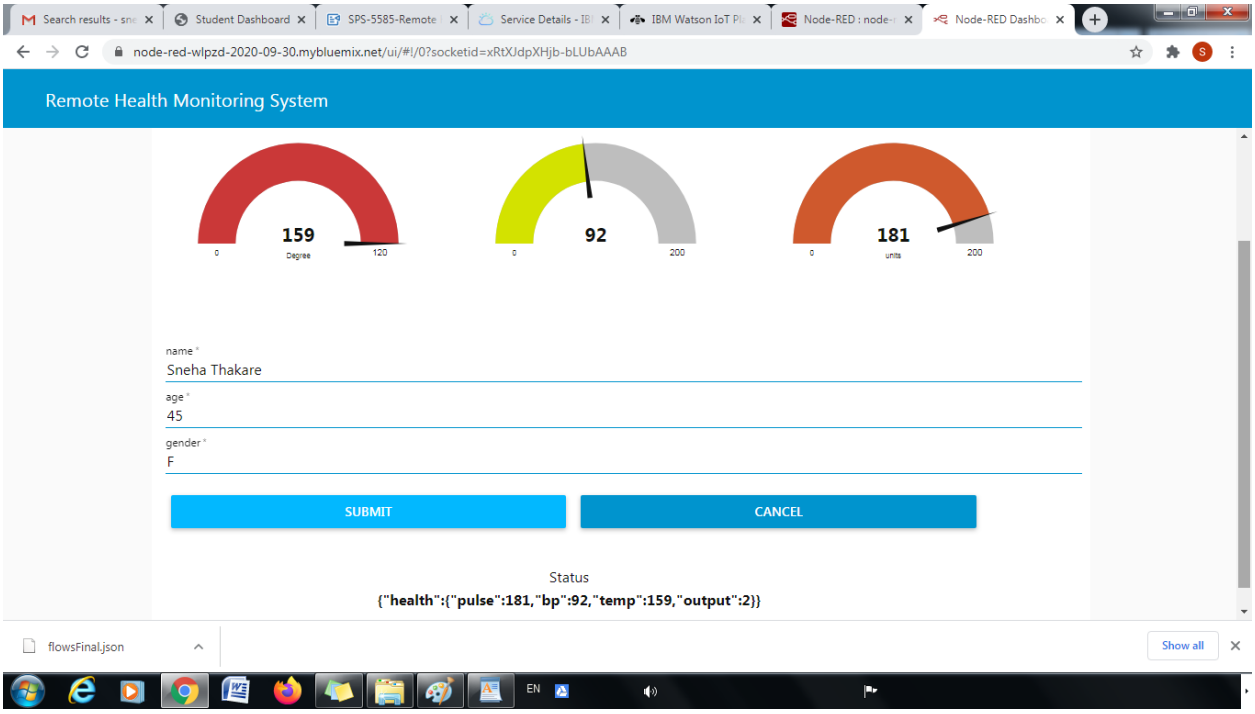
fig. 5.1 Flowchart of system

6. RESULT

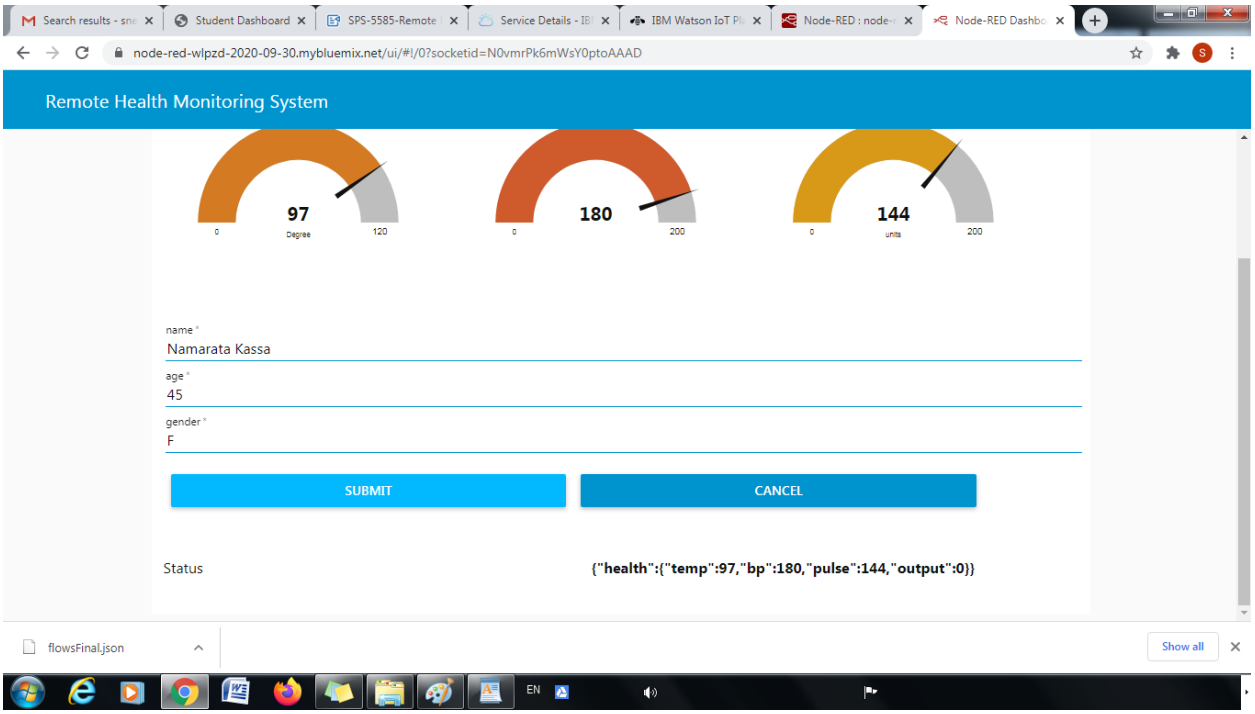
GUI of Health Monitoring System



Output for ill person



Output for Normal Person



7. ADVANTAGES

1. Remote monitoring
2. Real-time identification and actions
3. Context identification
4. Save money and time

8. APPLICATIONS

1. Day-to-day activity monitoring applications
2. Fall and movement detection applications
3. Medication intake monitoring applications

9. CONCLUSION

The system proposes a health monitoring application that can be provides information directly to person who is ill or normal. An application for health systems provides health monitoring service. By using this application, person can monitor alteration in body temperature, heart rate, blood pressure as soon as possible accurately, so they can analyse the physical characteristics by their own and get decisions properly.

10. FUTURE SCOPE

The system can be helpful for hopsital. Remote health monitoring used to be a costly venture for healthcare providers. COVID-19 forced healthcare to go virtual. Remote Health monitoring services and telehealth became vital in care delivery efforts. It is easier now than ever for providers to implement and use these virtual care services without previous restrictions.

Remote Health Monitoring is going to be ubiquitous technology and a standard for patient care because of the expansion of virtual care services, the increase in chronic conditions, and the growth in the consumerization of healthcare. Healthcare providers who implement Remote Health Monitoring technology ensure that their patients benefit from early intervention by catching blood glucose or blood pressure changes and adjusting treatment plans in real-time.

11. BIBILOGRAPHY

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[8] https://smartinternz.com/

APPENDIX

A. Source Code

1. Pretoken Code

```
global.set("age",msg.payload.age)
global.set("gender",msg.payload.gender)
global.set("pulse",msg.payload.pulse)
global.set("bp",msg.payload.bp)
global.set("temp",msg.payload.temp)
var apikey="vjlxVzZqsuC_12b0ueRDIP3iSH6Rp_62OJi84nm-VXCd";
msg.headers={"content-type":"application/x-www-form-urlencoded"}
msg.payload={"grant_type":"urn:ibm:params:oauth:grant-type:apikey","apikey":apikey}
return msg;
```

2. Preprediction Code

```
var age = global.get("age")
var gender = global.get("gender")
var pulse = global.get("pulse")
var bp = global.get("bp")
var temp = global.get("temp")
var token=msg.payload.access_token
msg.headers={'Content-Type':'application/json',"Authorization":"Bearer"+token,"Accept":"appli
cation/json"}
msg.payload={"input_data":[{"fields":["age","gender","pulse","bp","temp"],"values":[[age,gend
er,pulse,bp,temp]]}]}
return msg;
```

3. Output Status checking code

```
var age = global.get('age')
var gender = global.get('gender')
var temp = global.get ('temp')
var bp = global.get ('bp')
var pulse = global.get ('pulse')
var output=msg.payload.predictions[0].values[0][0]
global.set("output",output)
msg.payload = {
 health: {
 pulse:pulse,
 bp:bp,
 temp:temp,
 output: output
  }
}
return msg;
```

4. Json file of Health Monitoring Flow


```
[{"id":"5f17b45d.37db3c","type":"tab","label":"Flow
Final","disabled":false,"info":""},{"id":"83fce837.e49d38","type":"http
request","z":"5f17b45d.37db3c","name":"","method":"POST","ret":"obj","paytoqs":"ignore","url
":"https://iam.cloud.ibm.com/identity/token","tls":"","persist":false,"proxy":"","authType":"","x"
```

:390,"y":400,"wires":[["68f66c99.148db4","380593f0.57935c"]]},{"id":"a73454f8.179938","type":"function","z":"5f17b45d.37db3c","name":"Pre-tocken","func":"global.set(\"age\",msg.payload.age)\nglobal.set(\"gender\",msg.payload.gender)\nglobal.set(\"pulse\",msg.payload.pulse)\nglobal.set(\"bp\",msg.payload.bp)\nglobal.set(\"temp\",msg.payload.temp)\nvar apikey=\"vjlxVzZqsuC_12b0ueRDIP3iSH6Rp_62OJi84nm-VXCd\";\nmsg.headers={\"content-type\":\"application/x-www-form-urlencoded\"}\nmsg.payload={\"grant_type\":\"urn:ibm:params:oauth:grant-type:apikey\",\"apikey\":apikey}\nreturn msg;\n","outputs":1,"noerr":0,"initialize":"","finalize":"","x":330,"y":340,"wires":[["83fce837.e49d38"]]},{"id":"68f66c99.148db4","type":"function","z":"5f17b45d.37db3c","name":"Pre-Prediction","func":"var age = global.get(\"age\")\nvar gender = global.get(\"gender\")\nvar pulse = global.get(\"pulse\")\nvar bp = global.get(\"bp\")\nvar temp = global.get(\"temp\")\nvar token=msg.payload.access_token\nmsg.headers={'Content-Type': 'application/json',\"Authorization\":\"Bearer \"+token,\"Accept\":\"application/json\"}\nmsg.payload={\"input_data\":[{\"fields\":[\"age\",\"gender\",\"pulse\",\"bp\",\"temp\"],\"values\":[[age,gender,pulse,bp,temp]]}]}\nreturn msg;","outputs":1,"noerr":0,"initialize":"","finalize":"","x":610,"y":360,"wires":[["bfcc32bc.0caa9"]]},{"id":"380593f0.57935c","type":"debug","z":"5f17b45d.37db3c","name":"","active":true,"tosidebar":true,"console":false,"tostatus":false,"complete":"payload","targetType":"msg","statusVal":"","statusType":"auto","x":620,"y":500,"wires":[]},{"id":"da2feb15.de4838","type":"function","z":"5f17b45d.37db3c","name":"","func":"var age = global.get('age')\nvar gender = global.get('gender')\nvar temp = global.get ('temp')\nvar bp = global.get ('bp')\nvar pulse = global.get ('pulse')\nvar output=msg.payload.predictions[0].values[0][0]\nglobal.set(\"output\",output)\nmsg.payload = {\n \n health: {\n temp:temp,\n bp:bp,\n pulse:pulse,\n output: output\n }\n}\nreturn msg;\n","outputs":1,"noerr":0,"initialize":"","finalize":"","x":730,"y":280,"wires":[["49d2280c.118208","eee35355.a57b1"]]},{"id":"bfcc32bc.0caa9","type":"http request","z":"5f17b45d.37db3c","name":"","method":"POST","ret":"obj","paytoqs":"ignore","url":"https://us-south.ml.cloud.ibm.com/ml/v4/deployments/c9301ee0-9934-4e52-9656-95f812a038f7/predictions?version=2020-09-01","tls":"","persist":false,"proxy":"","authType":"","x":780,"y":420,"wires":[["da2feb15.de4838","43db364d.2ddf38"]]},{"id":"43db364d.2ddf38","type":"debug","z":"5f17b45d.37db3c","name":"","active":true,"tosidebar":true,"console":false,"tostatus":false,"complete":"payload","targetType":"msg","statusVal":"","statusType":"auto","x":950,"y":500,"wires":[]},{"id":"49d2280c.118208","type":"debug","z":"5f17b45d.37db3c","name":"","active":true,"tosidebar":true,"console":false,"tostatus":false,"complete":"payload","targetType":"msg","statusVal":"","statusType":"auto","x":950,"y":300,"wires":[]},{"id":"eee35355.a57b1","type":"ui_text","z":"5f17b45d.37db3c","group":"40726d6d.b058c4","order":6,"width":"17","height":"2","name":"","label":"Status (if status is 2 the person is very much ill and he needs to consult a

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