REMOTE HEALTH MONITORING SYSTEM WITH ANALYTICS DASHBOARD

ABSTRACT:

Recent years people have moved from one place to another for various places where they are separated from their family and near ones. To bridge this gap between people , Internet of things have paved way through the cloud environment.One such solution and eye opener is IOT Watson IBM platform. This project monitors the health status of human beings based on the ir age, Body Temperature, Diastolic ,Systolic and pulse rate.Based on the there parameters the health condition of a person can be assessed and acted upon any abnormalities.Ths project also trains the collected data set using the optimized classifier algorithm and integrates the IOT platform with the AI.

SYNOPSIS:

1. Creating a Sensor Device and generate the API key.
2. Create a Simulation Environment
3. Create IOT device and Configure the events based on the Dataset.
4. Run the IBM IOT simulator
5. Deploy the scenario in the Node Red Application
6. Import the Json file corresponding with the Dataset.
7. Create project in Watson Studioand train the Health dataset
8. Infer the Health status from Node Red

STEP:1 CREATING A SENSOR DEVICE AND GENERATE THE API KEY

The creation of sensor node or a device is very important for the the IOT cloud environment by navigating to Internet of things platform Fig.1 with the unique organization id, IBM has two options for device types such as normal device and gateway device. Since the device for sensing is to be created , the deive type is selcted and the unique identifier fo the device is created by the user.The created device meatadata wil ge generated automatically, after which the API Key for the device is generated manually as shown n Fig.3.

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Fig.1. IBM IOT Platform

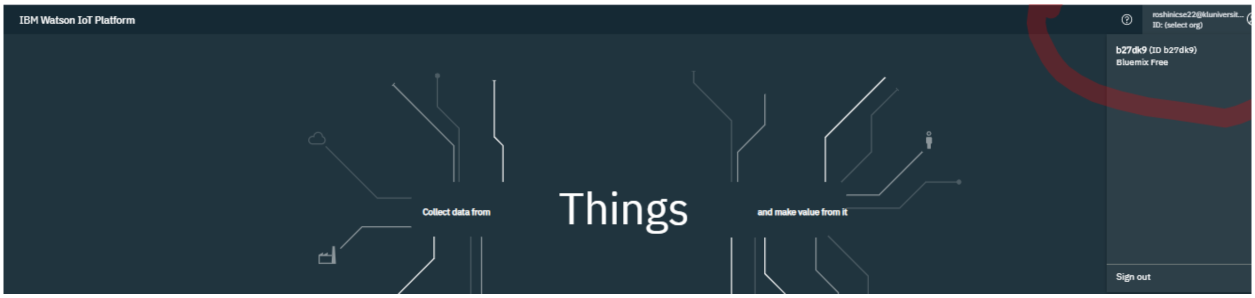
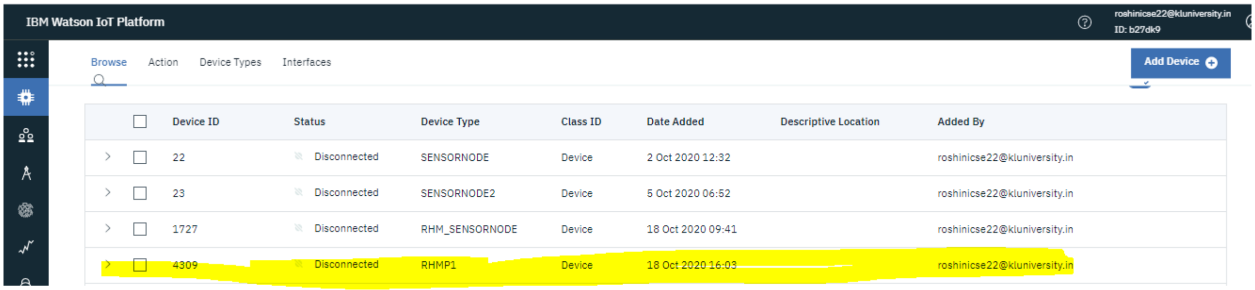
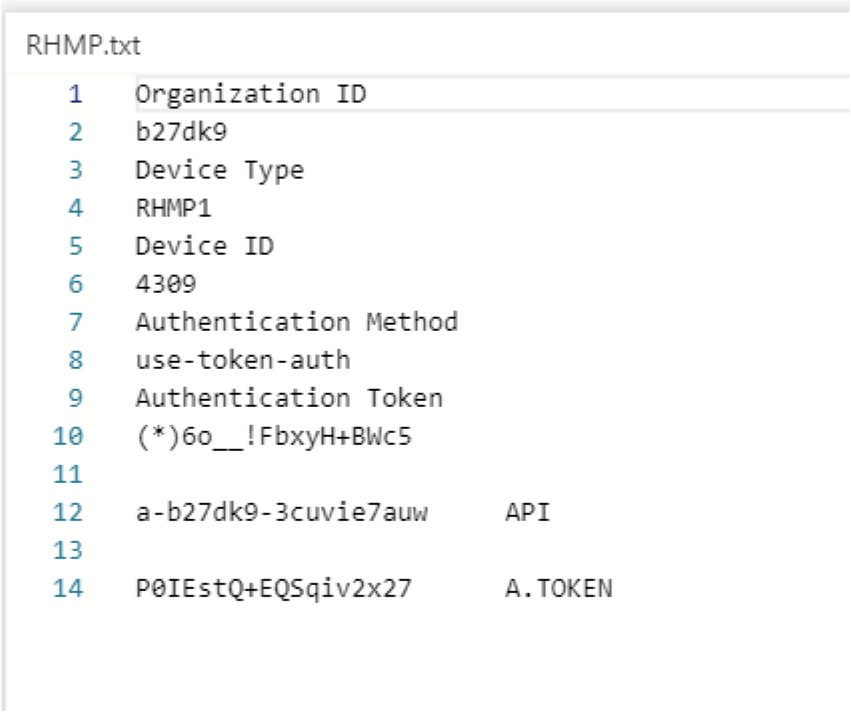


Fig.2. Device list



		Device ID	Status	Device Type	Class ID	Date Added	Descriptive Location	Added By
›	□	22	Disconnected	SENSORNODE	Device	2 Oct 2020 12:32		roshinicse22@kluniversity.in
›	□	23	Disconnected	SENSORNODE2	Device	5 Oct 2020 06:52		roshinicse22@kluniversity.in
›	□	1727	Disconnected	RHM_SENSORNODE	Device	18 Oct 2020 09:41		roshinicse22@kluniversity.in
›	□	4309	Disconnected	RHMP1	Device	18 Oct 2020 16:03		roshinicse22@kluniversity.in

Fig.3. Device data and API key



```
Organization ID
b27dk9
Device Type
RHMP1
Device ID
4309
Authentication Method
use-token-auth
Authentication Token
(*)6o__!FbxyH+BWc5

a-b27dk9-3cuvie7auw     API

P0IEstQ+EQSqiv2x27      A.TOKEN
```

STEP:2 CREATE A SIMULATION ENVIRONMENT

Now with the created device the simulation environment must be initiate, hence turn on the simulator and click on the simulation environment.The new simulation environment is configured for the device created with the input values we consider in the dataset, here in the datasetthe following physiological signals are considered for monitoring the health status based on the Age parameter:

1. **Body Temperature**
2. **Systolic**
3. **Diastolic**
4. **Pulse rate**

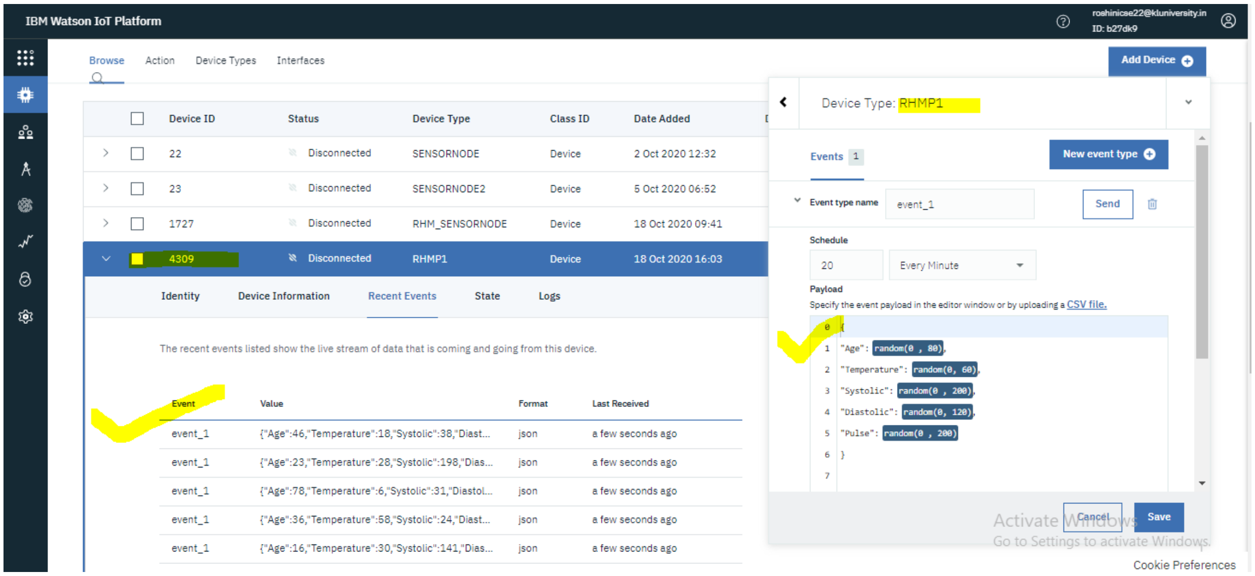
The following code snippet**10/28/2020** must be initiated in the simulation environment :

```
{
"Age": random(0 , 80),
"Temperature": random(0, 60),
"Systolic": random(0 , 200),
"Diastolic": random(0, 120),
"Pulse": random(0 , 200)
}
```

STEP:3 CREATE IOT DEVICE AND CONFIGURE THE EVENTS BASED ON THE DATASET.

Now the simulation environment is triggered and returns the sensing values in the recent events, by gathering the physiological signals.

Fig.4.Simuator Initiate



	Device ID	Status	Device Type	Class ID	Date Added
□	22	Disconnected	SENSORNODE	Device	2 Oct 2020 12:32
□	23	Disconnected	SENSORNODE2	Device	5 Oct 2020 06:52
□	1727	Disconnected	RHM_SENSORNODE	Device	18 Oct 2020 09:41
□	4309	Disconnected	RHMP1	Device	18 Oct 2020 16:03

The recent events listed show the live stream of data that is coming and going from this device.

Event	Value	Format	Last Received
event_1	{"Age":46,"Temperature":18,"Systolic":38,"Diast...	json	a few seconds ago
event_1	{"Age":23,"Temperature":28,"Systolic":198,"Dias...	json	a few seconds ago
event_1	{"Age":78,"Temperature":6,"Systolic":31,"Diastol...	json	a few seconds ago
event_1	{"Age":36,"Temperature":58,"Systolic":24,"Diast...	json	a few seconds ago
event_1	{"Age":16,"Temperature":30,"Systolic":141,"Dias...	json	a few seconds ago

Device Type: RHMP1

Event type name: event_1

Schedule: 20 Every Minute

Payload

Specify the event payload in the editor window or by uploading a CSV file.

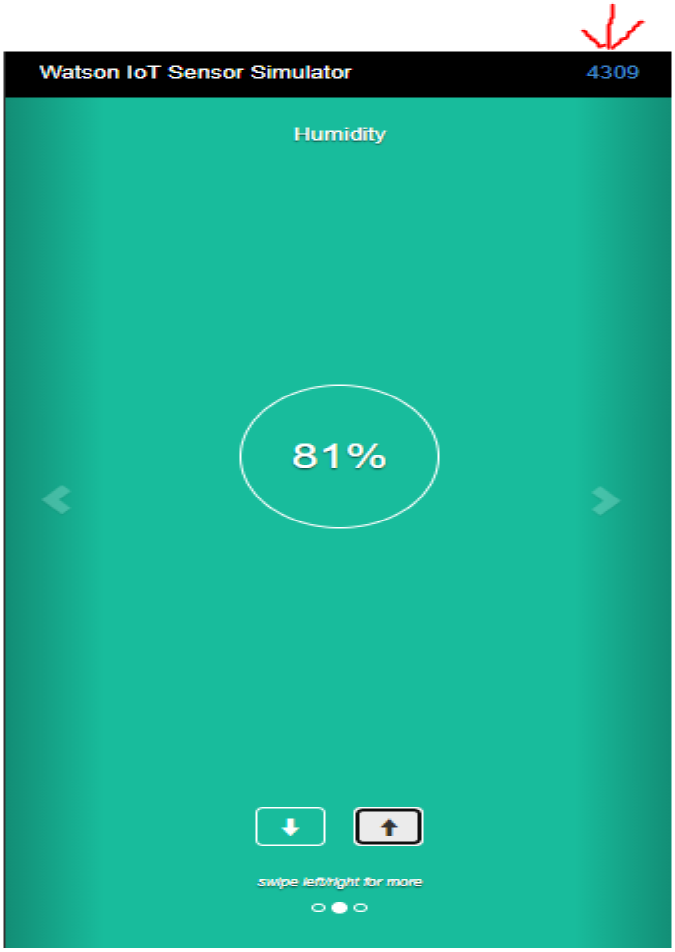
```
{
"Age": random(0 , 80),
"Temperature": random(0, 60),
"Systolic": random(0 , 200),
"Diastolic": random(0, 120),
"Pulse": random(0 , 200)
}
```

It is necessary that other simulators are turned off since the output status will not be clearly visible if multiple simuations are running in parallel.

STEP: 4 RUN THE IBM IOT SIMULATOR

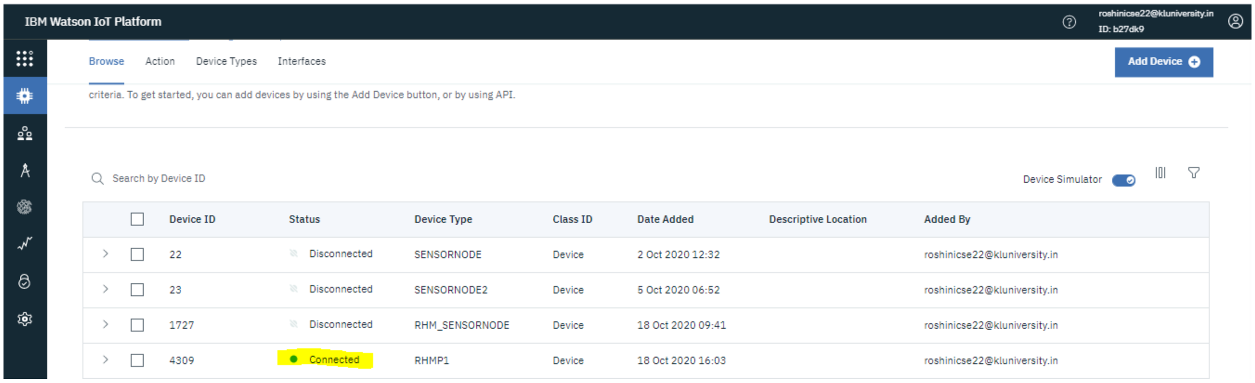
To check if the device connection could be enabled, online IBM IOT simulator is opened in the google search engine, and the device details saved are enetered in the simulator which will access temperature, humidity and object temperature when the device is enabled the IOT device in the IOT platform Fig.5. will be in connected status.

Fig.5.IBM IOT Simulator



The coneection status of the device is shown in Fig.6. which represents that the device is connected and it is active in status.

Fig.6. Connection status



criteria. To get started, you can add devices by using the Add Device button, or by using API.

	□	Device ID	Status	Device Type	Class ID	Date Added	Descriptive Location	Added By
>	□	22	Disconnected	SENSORNODE	Device	2 Oct 2020 12:32		roshinicse22@kluniversity.in
>	□	23	Disconnected	SENSORNODE2	Device	5 Oct 2020 06:52		roshinicse22@kluniversity.in
>	□	1727	Disconnected	RHM_SENSORNODE	Device	18 Oct 2020 09:41		roshinicse22@kluniversity.in
>	□	4309	● Connected	RHMP1	Device	18 Oct 2020 16:03		roshinicse22@kluniversity.in

STPE:5 DEPLOY THE SCENARIO IN THE NODE RED APPLICATION

Node Red is a platforms to integrate the hardware devices through programming language. It s a flow based programming interface and is used to connect the IOT device and the corresponding values with the nodes. Here in remote health monitoring project, the IBM IOTin node and the device API key along with the authentication token is mapped and connected with the gauge nodes to return the meter reading of the signals as shown in Fig.7.

After deploying all nodes , check for if the IOT node is connected and each modifications must be deployed for succesful update.To check the functioning of the flow,click on the dashboard icon and navigate to a new tab, the working of the gaugemeter will be observed as Fig.8.

Fig.7. IOT node Deployment in Node Red

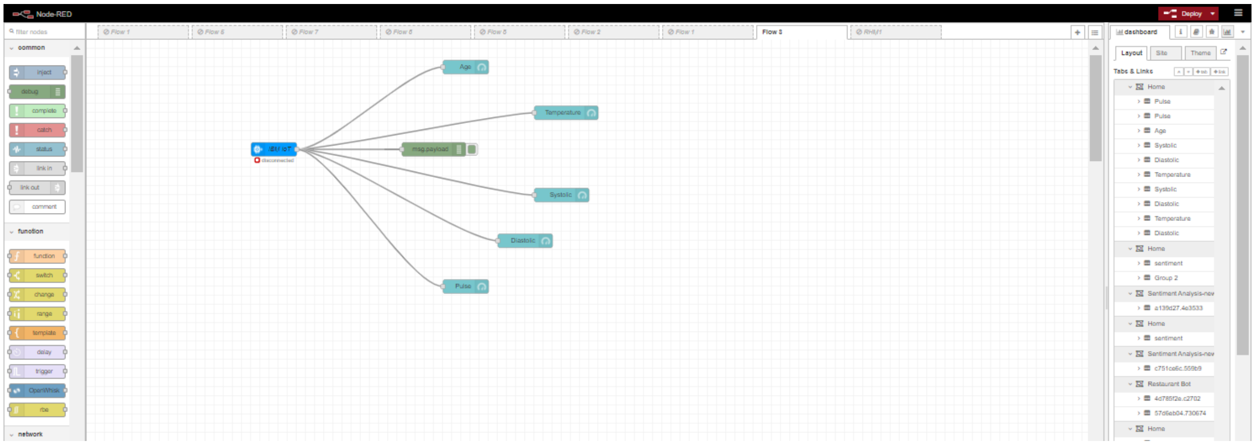
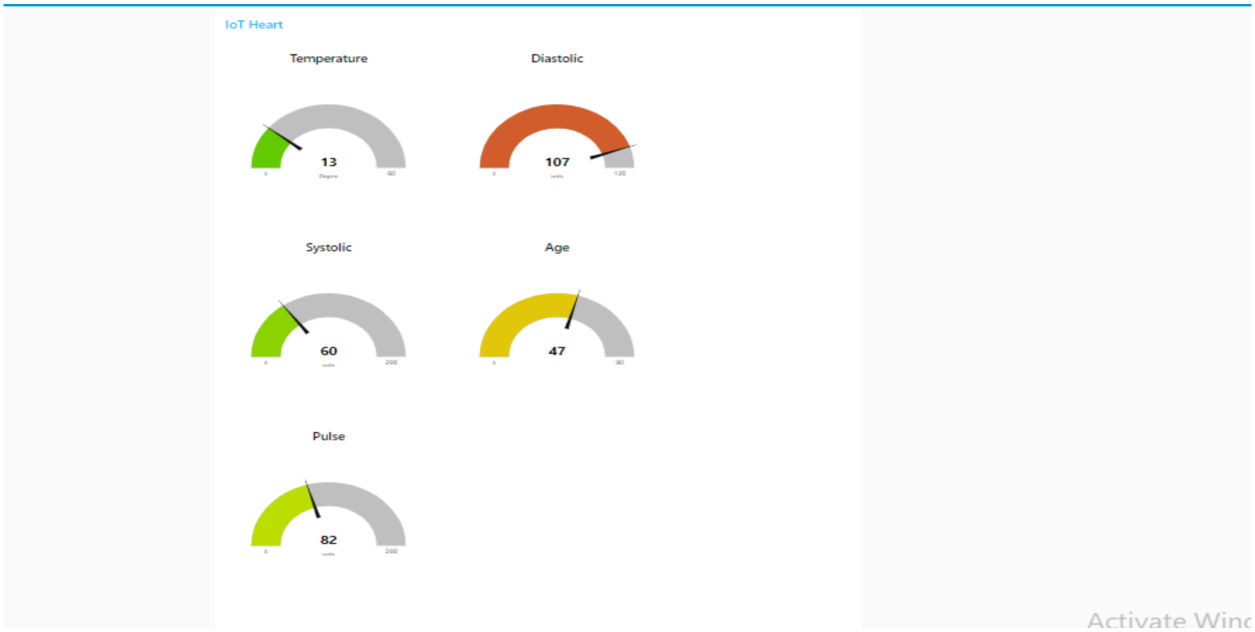


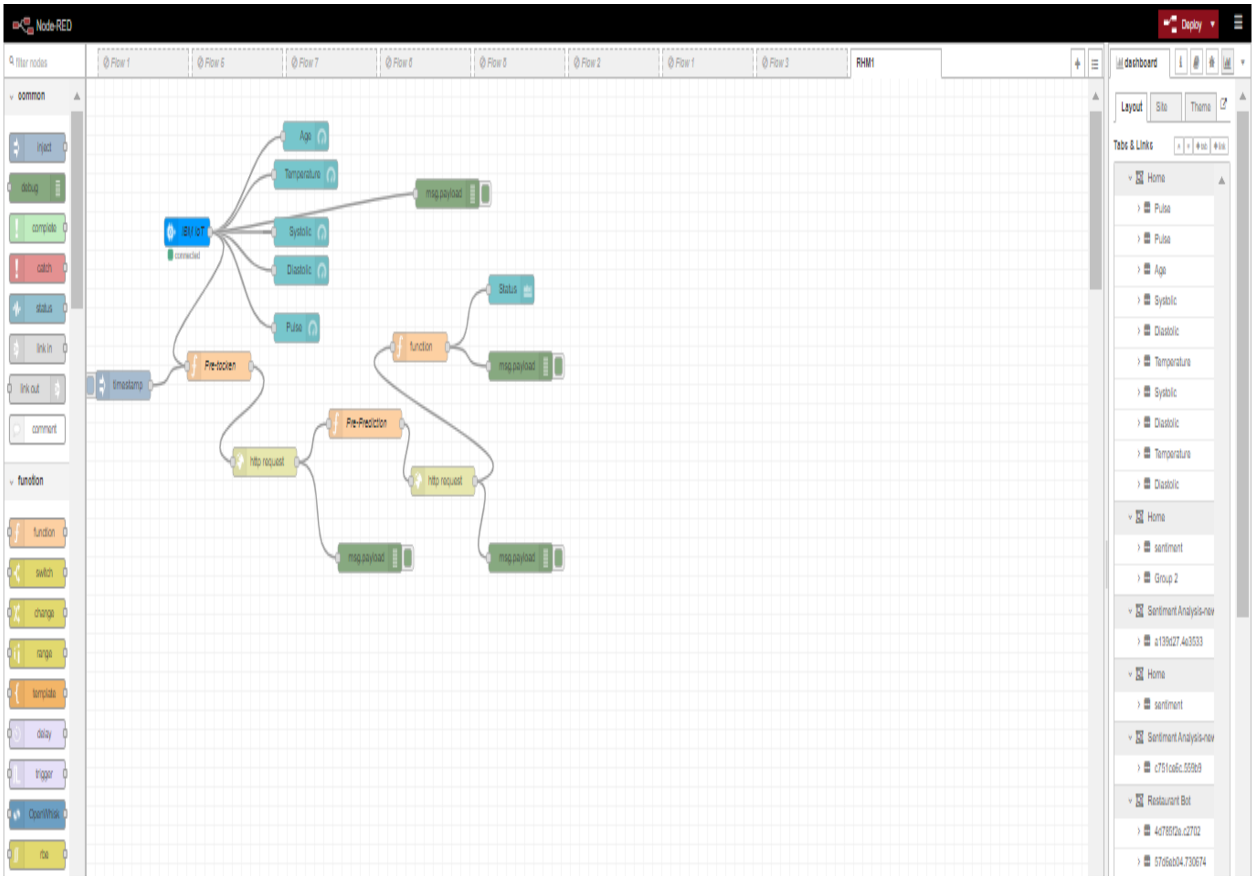
Fig.8. Gauge Readings



STEP:6 IMPORT THE JSON FILE CORRESPONDING WITH THE DATASET.

The JSON file is now imported in the Node Red application and the input values to return the status of health based on the physiological signals are also extracted Fig.9.The main two nodes that will depict the output of the monitoring system are Pretocken and http request nodes.These nodes have the output API and the service URL to moitor the status of health.

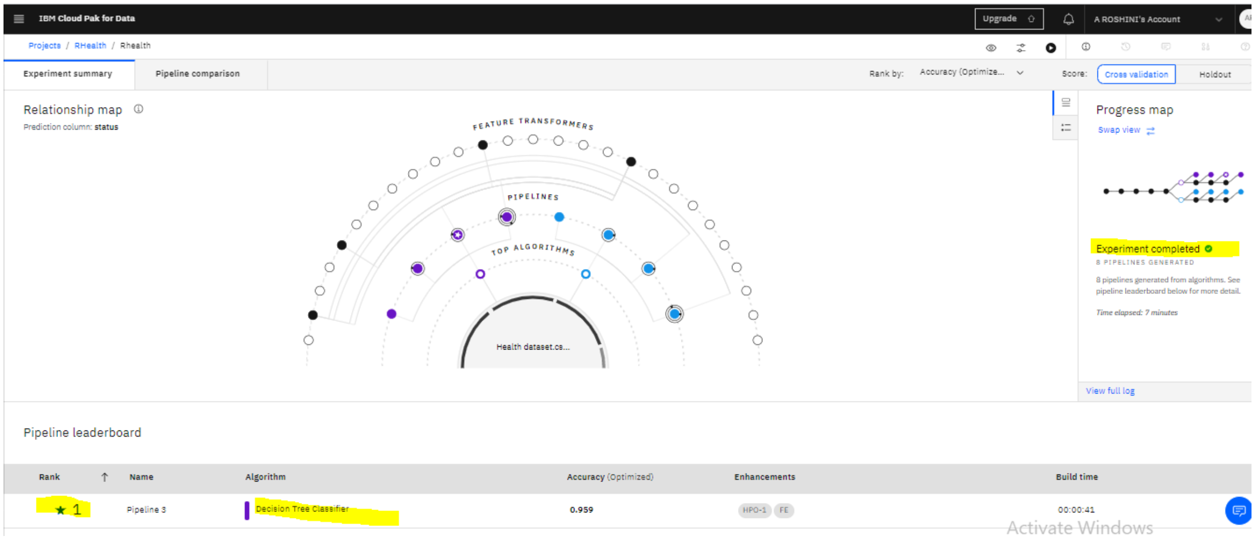
Fig.9. Json import for Health Monitoring



STEP: 7 CREATE PROJECT IN WATSON STUDIO AND TRAIN DATASET

A new project is created in watson studio to train the health dataset and the most optimum algorithm is used to train the dataset.The Auto AI eperoiment is selected to start the machine learning instance, if the instance is already available then associate the eisting machine learning service.Select the dataset to predit the health status of the subject and run the eperimernt to train the dataset. The machine learning instance will select the optimum machine learning algorithm and train the dataset as Fig.10.

Fig.10. Health dataset train



Prediction column: status

Experiment completed

8 PIPELINES GENERATED

8 pipelines generated from algorithms. See pipeline leaderboard below for more detail.

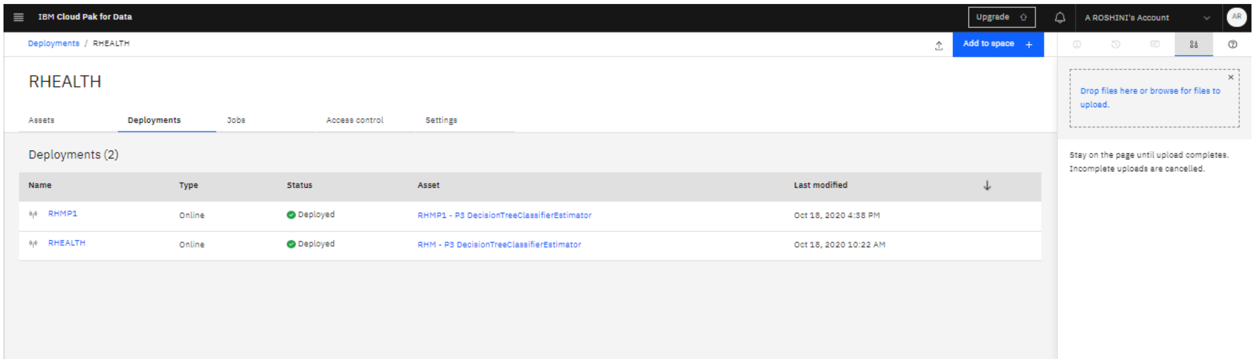
Time elapsed: 7 minutes

Pipeline leaderboard

Rank	Name	Algorithm	Accuracy (Optimized)	Enhancements	Build time
★ 1	Pipeline 3	Decision Tree Classifier	0.959	HPO-1 FE	00:00:41

Save the trained dataset as a model followed by view the model as a project and promote it to the deployment space and create a new space for deployment and deploy the created project.Generate the AP key manually and the service URL.

Fig.11. Deployed Poject



Stay on the page until upload completes. Incomplete uploads are cancelled.

Deployments (2)

Name	Type	Status	Asset	Last modified
RHMP1	Online	Deployed	RHMP1 - P3 DecisionTreeClassifierEstimator	Oct 18, 2020 4:38 PM
RHEALTH	Online	Deployed	RHM - P3 DecisionTreeClassifierEstimator	Oct 18, 2020 10:22 AM

STEP :8 INFER THE HEALTH STATUS FROM NODE RED

The pre tocken node is configured in such a way that the api key is associated with the project and the IOT node,along with the Http request.

Code Snippet of Pre Tocken

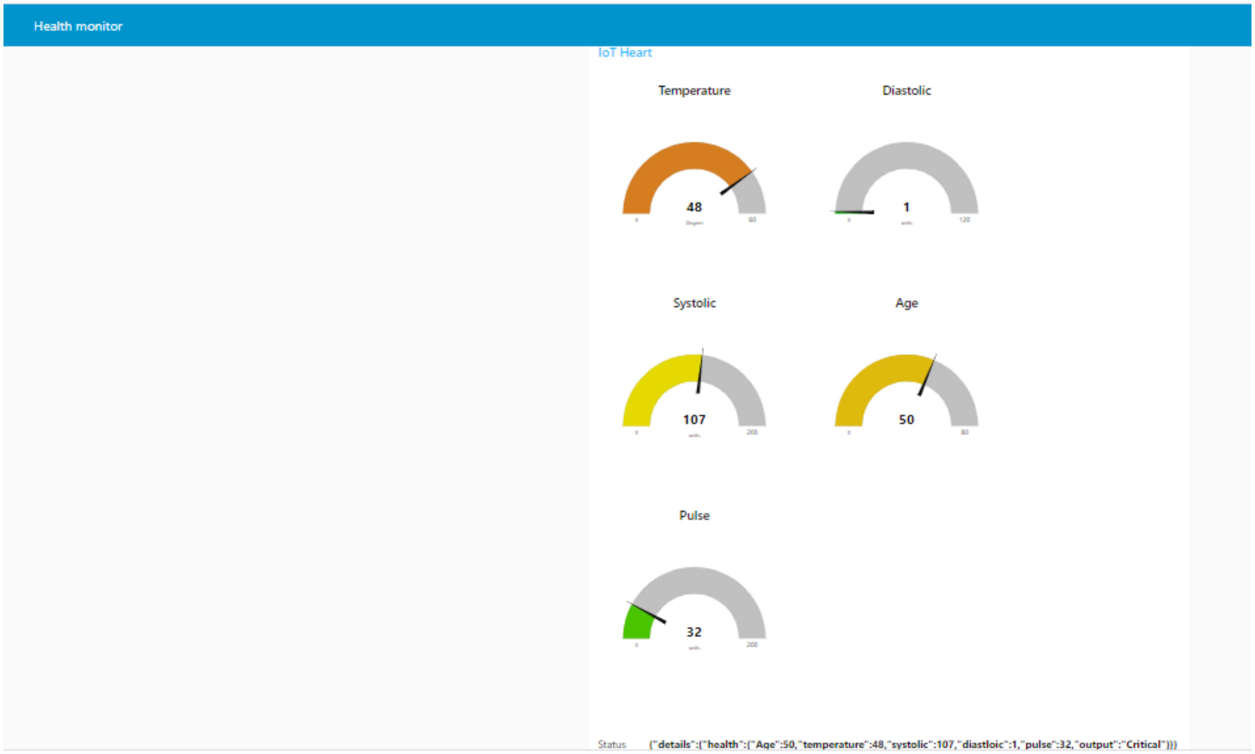
```
global.set("Age",msg.payload.Age)
global.set("Temperature",msg.payload.Temperature)
global.set("Systolic",msg.payload.Systolic)
global.set("Diastolic",msg.payload.Diastolic)
global.set("Pulse",msg.payload.Pulse)
var apikey="dGJ-AekuOFeJZW-YWdA8ByEuThAf5BKpJOQVlb4bu30B";
msg.headers={"content-type":"application/x-www-form-urlencoded"}
msg.payload={"grant_type":"urn:ibm:params:oauth:grant-type:apikey","apikey":apikey}
return msg;
```

Http Request

https://us-south.ml.cloud.ibm.com/ml/v4/deployments/3441698d-d335-40d8-893e-56f223b35e59/predictions?version=2020-10-18

Now the required health monitoring report will be generated integrating all the components.

Fig.12. Health Monitoring Status Output



Status

```
{"details":{"health":{"Age":50,"temperature":48,"systolic":107,"diastloic":1,"pulse":32,"output":"Critical"}}}
```

CONCLUSION

The health monitoring system using analytics dash board is thus deployed and the same system can be deploed with varied dataset values and a mobile application for the same could be developed as a future enhancement.