

Remote Health Monitoring System with Analytics Dashboard

Project Report

By

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1 INTRODUCTION

1.1 Overview

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. In this project I build the above system with the help of IBM cloud services such as IBM IOT platform, IBM Cloudant, IBM Watson Studio and Node Red as follows:

- Created a device in IBM IOT platform and simulated it internally to get a person's body temperature, heart beat and blood pressure.
- Created a IBM cloudant DB where the real time data from IOT device is stored time to time periodically.
- Created a Watson Studio Service to gain the insights from the data collected in Cloudant DB using Machine learning.
- Created a Simple NodeRed UI for interacting with the users to display the gained insights on Analytical dashboard.

1.2 Purpose

The analytical Dashboard is mainly built from the insights gained from the User's health parameters using IBM services. The App demonstrates two main usecases of each for IBM IOT platform and Watson Studio as follows:

- **Continuous Monitoring:** The main health parameters such as Body temperature, Heart beat and Blood pressure are continuously collected with help of IBM IOT platform and displayed in dashboard. Even just from these parameters we can identify our health state. For example the ideal body temperature range is 97-99 °F ,Heart beat range 60-100 beats/min is and Blood Pressure range is 90/60-120/80 mmHg.
- **Alert on abnormalities:** Some times we cannot directly know about abnormalities from parameters or we may not able to monitor continuously, at that time machine learning helps us by giving alert during abnormal conditions. The machine learning model is trained with the historical data gained from our health data to detect any change in health state. It is personalized for each person so it will easily learn from person and alert them before hand so that he/she can take precautionary measures or to can consult the doctor to avoid serious problems.

2 LITERATURE SURVEY

2.1 Existing problem

The Existing health monitoring applications are more complex to create and the difficult to maintain. Even if a young researcher want to create a prototype , it is a dream for him without knowing deep knowledge on algorithm, math and coding.

The data needs to be stored periodically on DB with increases the complexity of the application and literally non cloud applicatons are mostly on-premise and gives high cost also. It is also difficult to choose the correct machine learning algorithm as it may depends on the dynamics and changing nature of incoming data.

2.2 Proposed solution

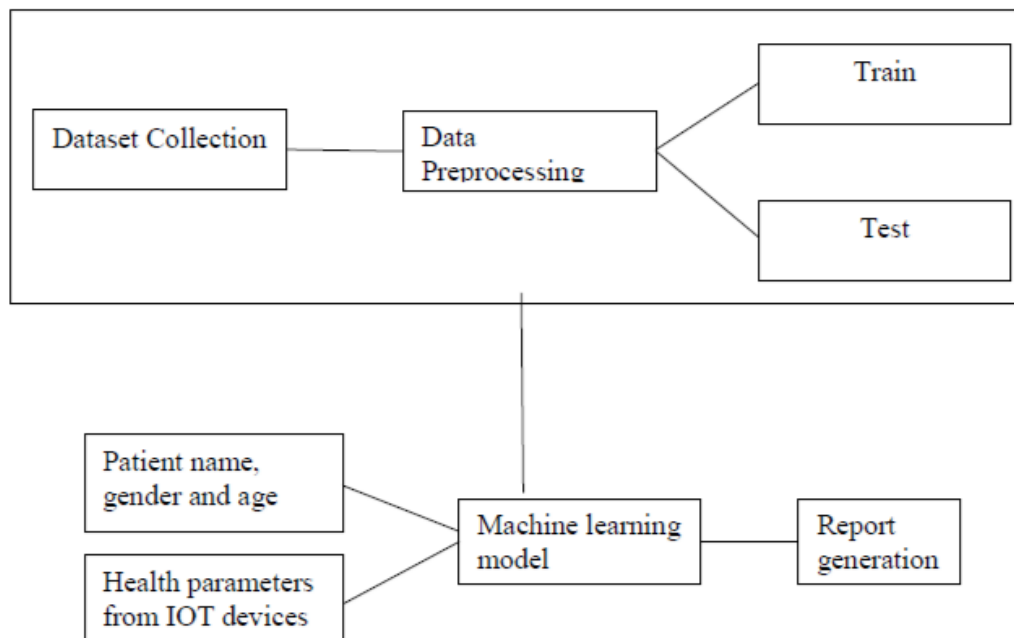
By using IBM IOT Platform, Node Red and Watson Studio it makes the application development much easy and reduces the complexity of the application. With the help of watson studio it is easy to train the machine learning model using Auto AI in which we can apply various algorithms and pick the one with high accuracy within few minutes. And also we can easily save the trained model for our future use and can use it as a service by the help of API provided by Machine learning service.

With the help of the IBM IOT platform and IBM cloudant it is easy to connect the IOT device and store the data on to the cloud. In this project instead of real IOT device , I used online simulator inside the IOT platform to give random values within specific range as a prototype to reduce cost.

With the help of Node red building Web pages for user interaction becomes very easy. Then finally all are integrated with node red to display the dashboard to the user.

3 THEORITICAL ANALYSIS

3.1 Block diagram



3.2 Hardware / Software designing

The system consists of some hardware as well as some software part. The IoT sensors which collect the user health parameters are the hardware devices. In other hand, the user interface to enter user data and the user interface to visualize the health report are webpages.

To design the whole system, we have used the web based resources of IBM. 'Internet of Things Platform' is used to simulate the IoT sensors. These sensors generate data and send to the cloudant database.

A web based health monitoring system is designed. We have used the

node-RED service of IBM to design the user interface. The user interface is compatible with computer systems as well as mobile devices which uses android operating system.

The Machine Learning service is used in Watson Studio of IBM is used to implement the machine learning model. The model is deployed in the cloud space. The model is generated with a hybrid combination of algorithms. The pipeline with higher accuracy is saved as the model, for instance Decision tree classification provides highest optimum accuracy in the pipeline. The model has to be promoted to space for instant use of the user. A deployment space is needed to promote the model in the space. We have created a deployment space namely 'Health Monitor' to deploy the model.

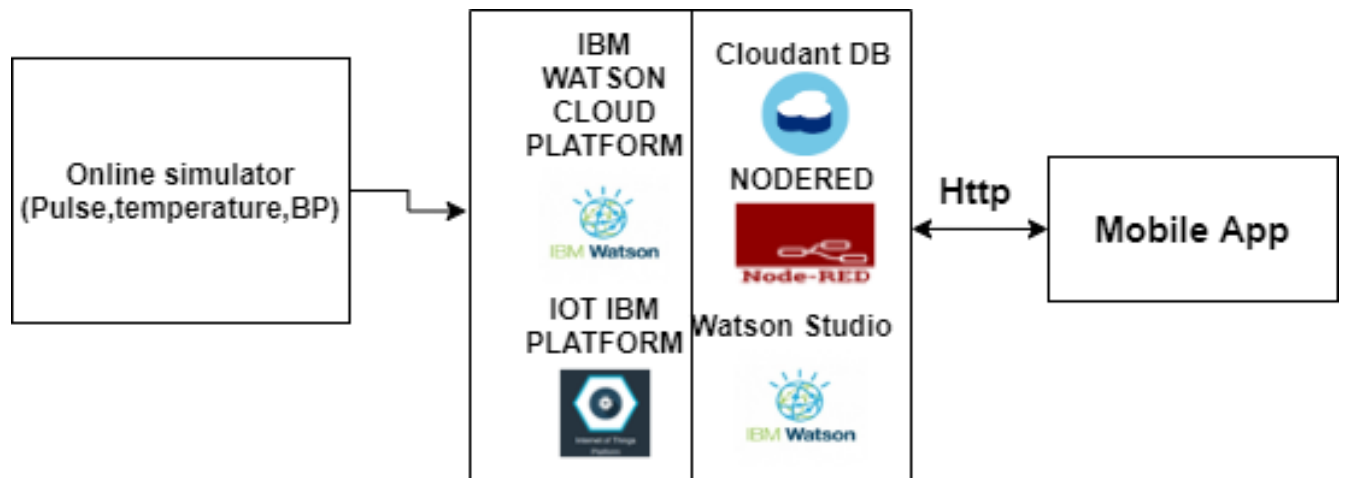
4 EXPERIMENTAL INVESTIGATIONS

In this process of developing the project I have undergone many investigation processes to learn and understand new concepts so that I can build the Remote Health monitoring application successfully. For I had to learn and investigate following:

1. IBM Cloud.
2. Node Red.
3. Watson Studio.

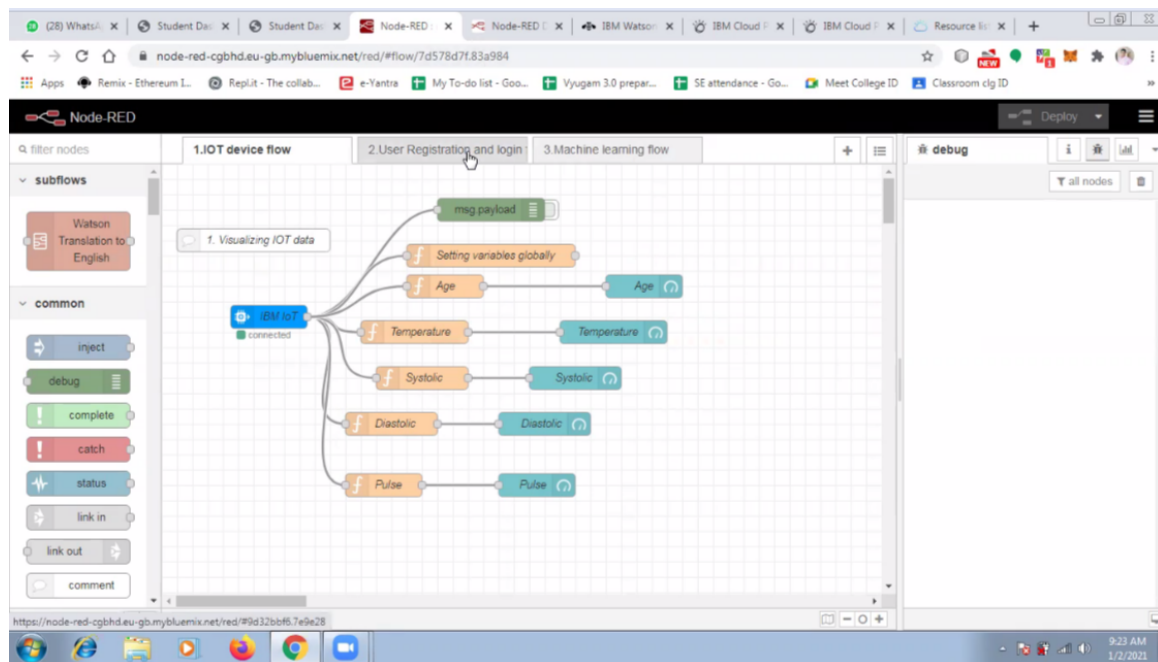
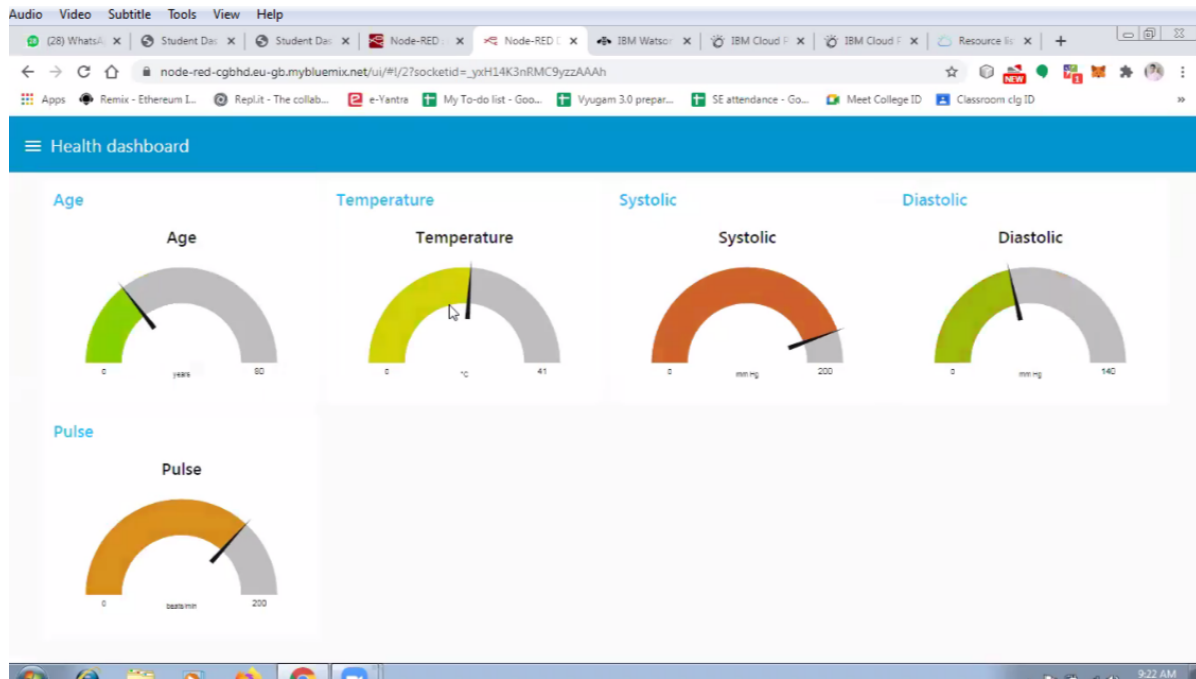
4. IBM IOT Platform.
5. IBM Cloudant.
6. ZOHO Writer.

5 FLOWCHART



6 RESULT

UI Interface:



Audio Video Subtitle Tools View Help

eu-gb.dataplatform.cloud.ibm.com/ml/auto-ml/4e28daa0-0d7b-432f-b09f-c41499852ca5/train?projectId=61d7cf60-ba48-4997-8160-de...

IBM Cloud Pak for Data All Search Upgrade Naveen Kumar K's Account

Projects / Remote Health Monitoring / Remote health-ML

Experiment summary Pipeline comparison Rank by: Accuracy (Optimize... Score: Cross validation Holdout

Rank	Name	Algorithm	Accuracy (Optimized)	Enhancements	Build time
1	Pipeline 3	Decision Tree Classifier	0.959	HPO-1 FE	00:00:35 Save as
2	Pipeline 4	Decision Tree Classifier	0.959	HPO-1 FE HPO-2	00:00:13
3	Pipeline 1	Decision Tree Classifier	0.958	None	00:00:01
4	Pipeline 2	Decision Tree Classifier	0.958	HPO-1	00:00:06
5	Pipeline 7	Random Forest Classifier	0.953	HPO-1 FE	00:01:06
6	Pipeline 8	Random Forest Classifier	0.953	HPO-1 FE HPO-2	00:00:58
7	Pipeline 5	Random Forest Classifier	0.940	None	00:00:06
8	Pipeline 6	Random Forest Classifier	0.940	HPO-1	00:00:22

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eu-gb.dataplatform.cloud.ibm.com/projects/61d7cf60-ba48-4997-8160-ded026706c54/data-assets/85e655ca-c041-4768-a5f5-f3418fa2...

IBM Cloud Pak for Data All Search Upgrade Naveen Kumar K's Account

Projects / Remote Health Monitoring / Health monitoring.csv

Preview Activities

Schema: 6 Columns
Preview: First 1000 rows
Last refresh: 36 seconds ago Refine

Age String	Temperature String	Systolic String	Diastolic String	Pulse String	status String
18	36.4	60	40	60	Hypotension
60	36.5	61	41	70	Hypotension
9	36.6	62	42	80	Hypotension
18	36.7	63	43	100	Hypotension
18	36.8	64	44	60	Hypotension
18	36.9	65	45	80	Hypotension
25	37	66	46	100	Hypotension
25	37.1	67	47	71	Hypotension
25	37.2	68	48	81	Hypotension
25	37.3	69	49	90	Hypotension

Information

Data Asset

Health monitoring.csv

Description

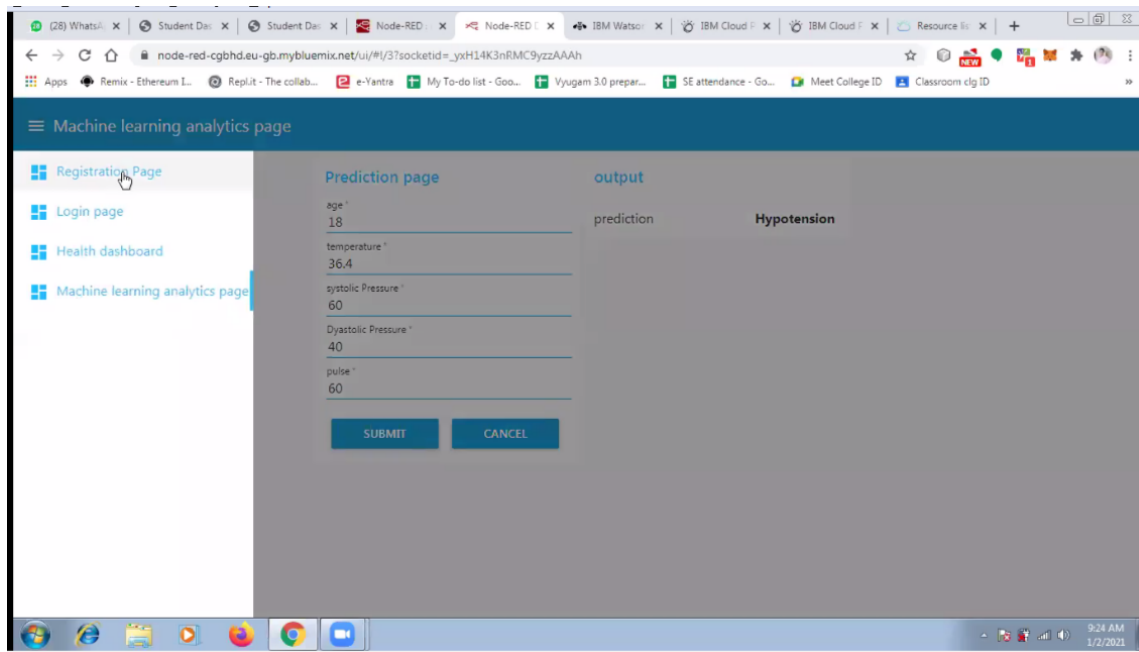
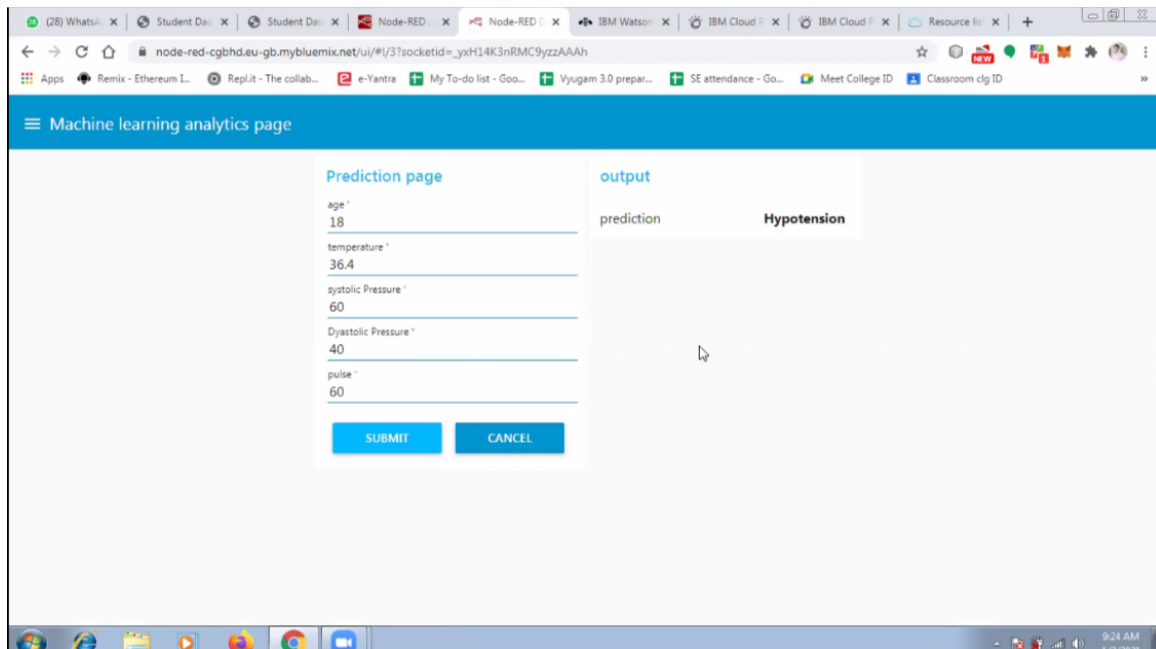
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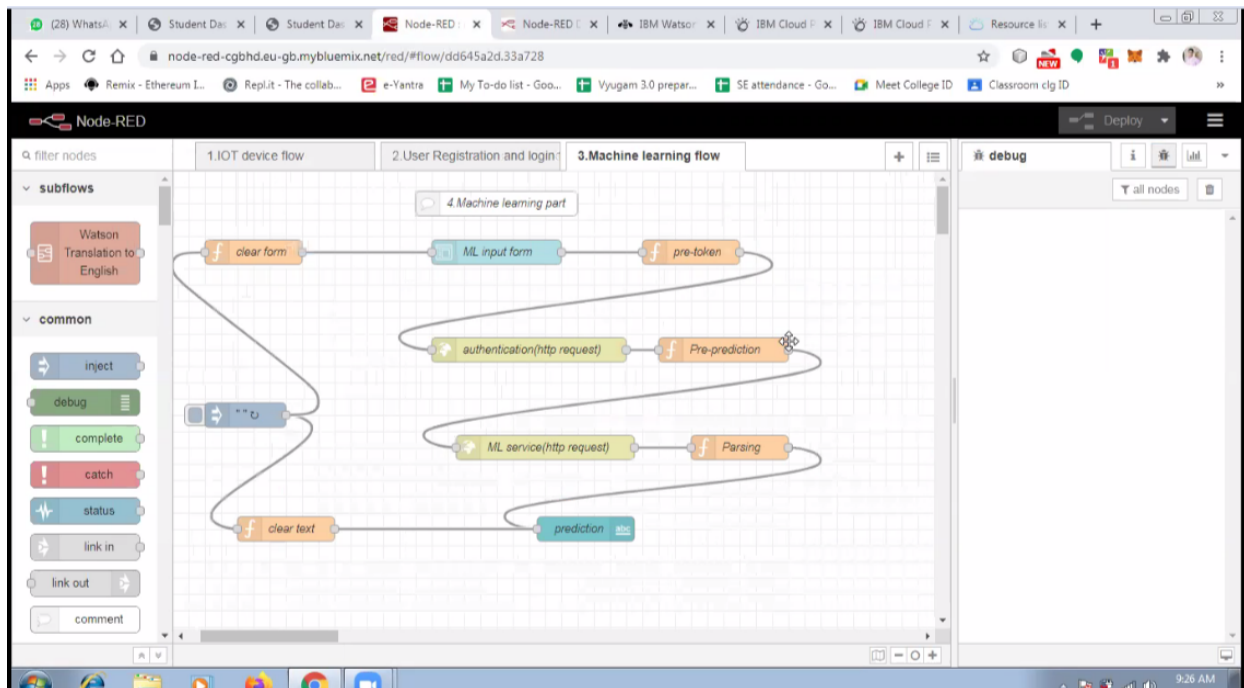
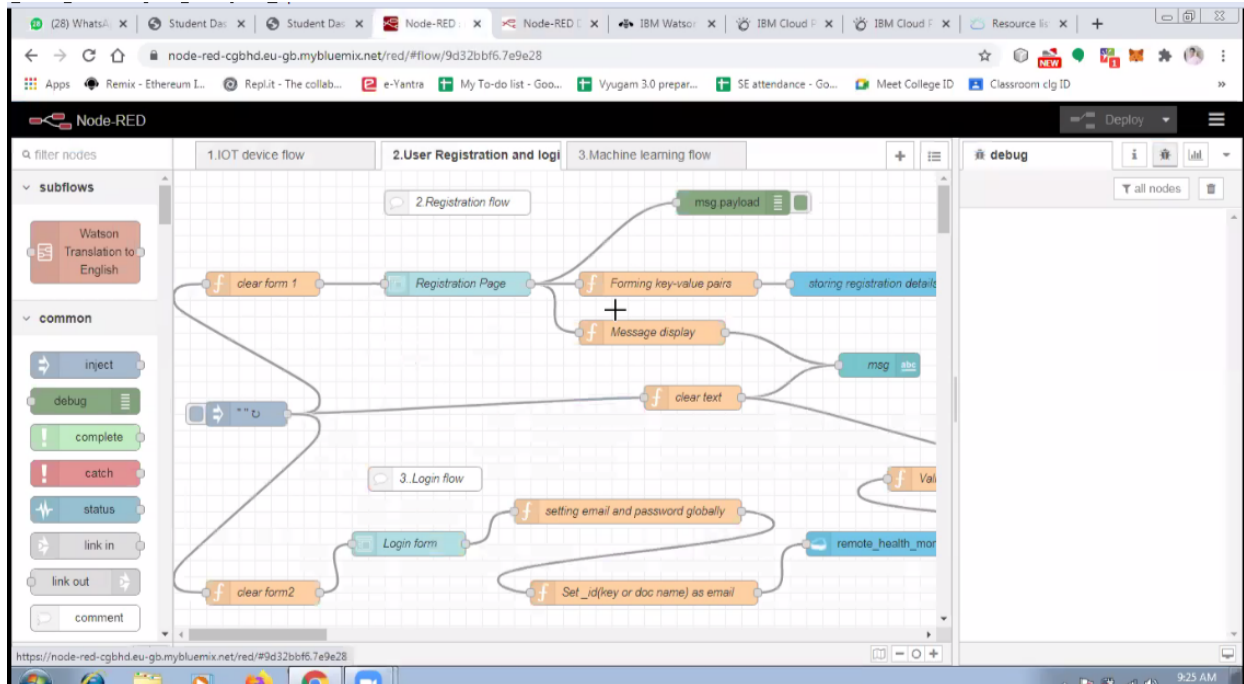
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7 a) ADVANTAGES

The application includes following advantages:

1. Easy to create, less coding knowledge is needed.
2. Less time required to develop, Easily built a proto type.
3. Good to understand the problem statement very well.

7 b) DISADVANTAGES:

The following are some disadvantages:

4. It's easy for prototyping but while bringing to real life usage , the tech stack involved is totally different.
5. Considering Real App developing it involves much more coding ,debugging and testing.
6. Need to more familiar with CLI. And Each Watson services cost on a time basis.

8 APPLICATIONS

- To alert the person before hand so that he/she can take preventive measures at right time , thus saving life.
- To lead a healthy and happy life by monitoring and having control over our body with help of data on the fly.

9 CONCLUSION

This project gave me a good kick start in remote health monitoring domain

to boost me in knowing deep more on the building apps that will help us in day to day life. It surely give good exposure with IBM cloud services and how to approach and build a prototype for any challenging problems .

10 FUTURE SCOPE

This project can be integrated with real IOT devices instead of online simulators to gain real time insights on data. Also some additional functionalities can be added. The web application can be integrated to an mobile application for more day to day usage by the people.

11 BIBILOGRAPHY

Name: Naveen Kumar.K

College Name: Coimbatore Institute of Technology.

Work Title: Remote Health Monitoring System with Analytics Dashboard.

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2. Machine learning in Watson studio from Docs:

<https://cloud.ibm.com/docs/solution-tutorials?topic=solution-tutorials-create-deploy-retrain-machine-learning-model>

3. IBM Cloud: <https://www.ibm.com/cloud/get-started>
4. Node red tutorial:
<https://developer.ibm.com/tutorials/how-to-create-a-node-red-starter-application/>
5. About API:
<https://www.youtube.com/watch?v=s7wmiS2mSXY&feature=youtu.be>
6. Watson services and product:
<https://www.ibm.com/watson/products-services>

APPENDIX

Link to Node Red work space:

<https://node-red-cgbhd.eu-gb.mybluemix.net/red/#flow/9d32bbf6.7e9e28>

Link to Node Red UI:

<https://node-red-cgbhd.eu-gb.mybluemix.net/ui/#!/0?socketid=omnLKh1jMO15NF7-AAAi>