Project presentation on,

# Remote Health Monitoring System with Analytics Dashboard


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# Agenda

- Introduction to the project
- Literature Review
- Existing problem
- Proposed Solution
- Block Diagram
- Hardware/Software Design
- Experimental Investigation
- Flow Chart
- Result Analysis
- Advantages and Disadvantages
- Application
- Conclusion
- References

# Introduction

- This project addresses the current demand of wearable which could be developed further to function and meet the need of patients effectively.
- Utilization of sensors decreases the possibility of human mistake, ensures better care and treatment, reduces medical expenses, lessens the involved space of the room and improves overall performance.
- This system is much practical in maintaining social distancing and to avoid spread of the Covid-19 or such contagious diseases.

# Purpose

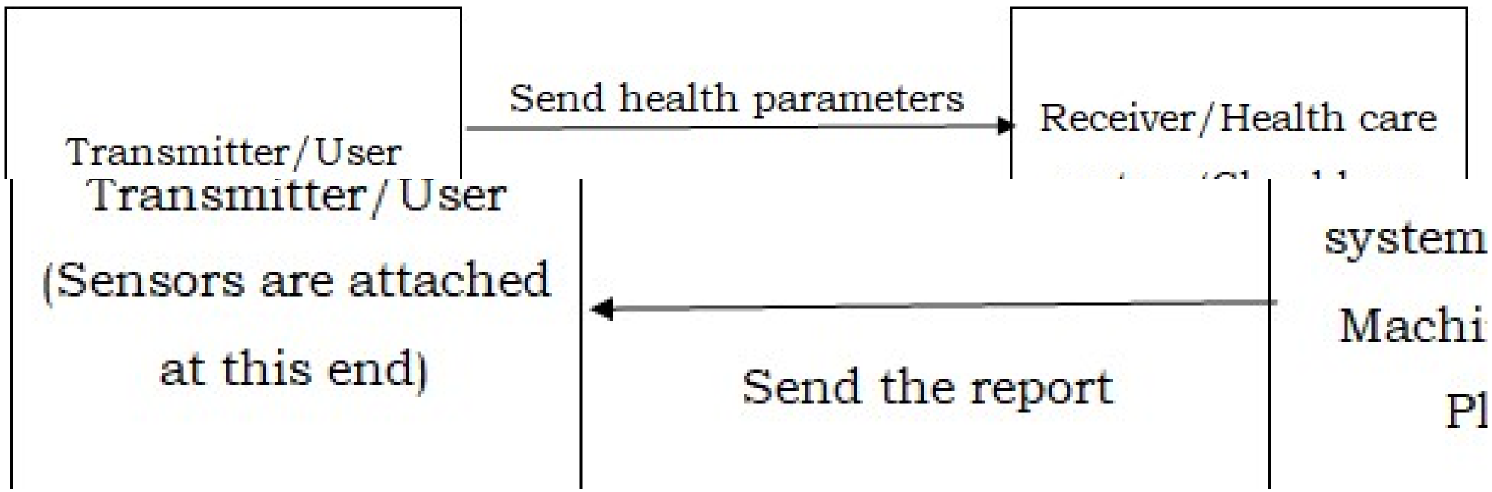
- The purpose of this project is to use ICT in healthcare.
- Bustling time schedule and unpredictable situations of life increases the probability of health risk, independent of the age of a person.
- Though we cannot replace the healthcare system with this, but this project ultimately supplements the existing healthcare system.

# Existing Problem

- Hesitation to move to a hospital.
- Busy schedule of the people. The denial will increase the health issue and subsequently results into a health hazard.
- The numbers of health professionals are limited, which increases the personal overhead to each health professionals. For example, a single doctor can check or treat up to a certain number of patients in specific time duration.
- Patients who met with an accident, patients at the time of child-birth (delivery cases) or such patients in critical condition need emergency attention. A wearable can be much helpful in observing the status of such patients. The doctor can observe remotely to such patients till they arrive the hospital.

# Proposed Solution

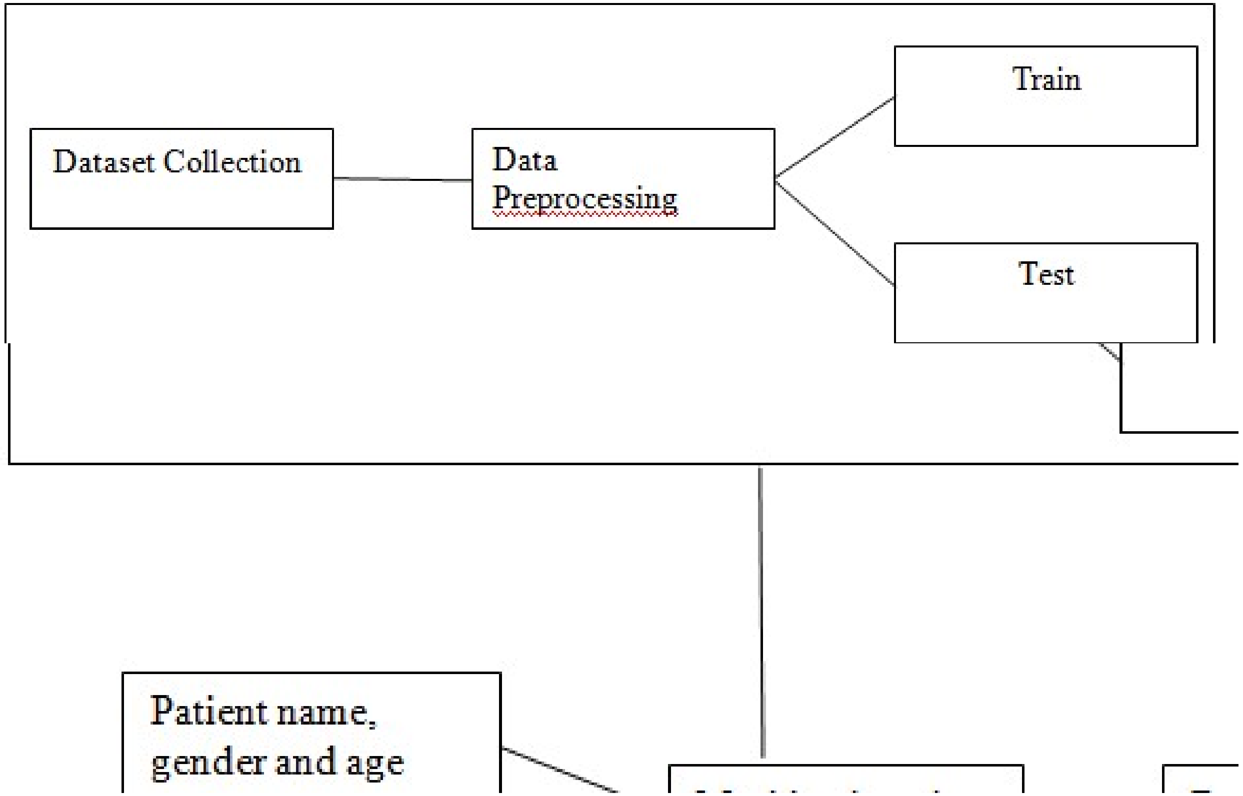
- Integrate sensors with handheld devices or wearable.



# Block Diagram

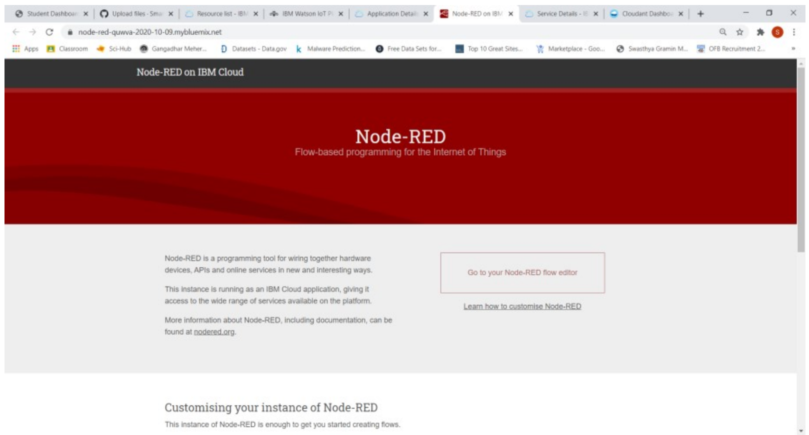
- The system is composed of three components such as,
  - User interface to enter name, gender and age
  - IoT interface to collect the health parameters
  - Machine learning model in the cloud to evaluate the data

# Block Diagram (Cont…)



# Hardware/Software Design

- IoT Service (IBM Watson IoT Platform)
  - Temperature Sensor
  - Blood Pressure Sensor
  - Pulse Sensor
- Node-RED user interface
- Machine Learning Model design
- Cloudant Database Design

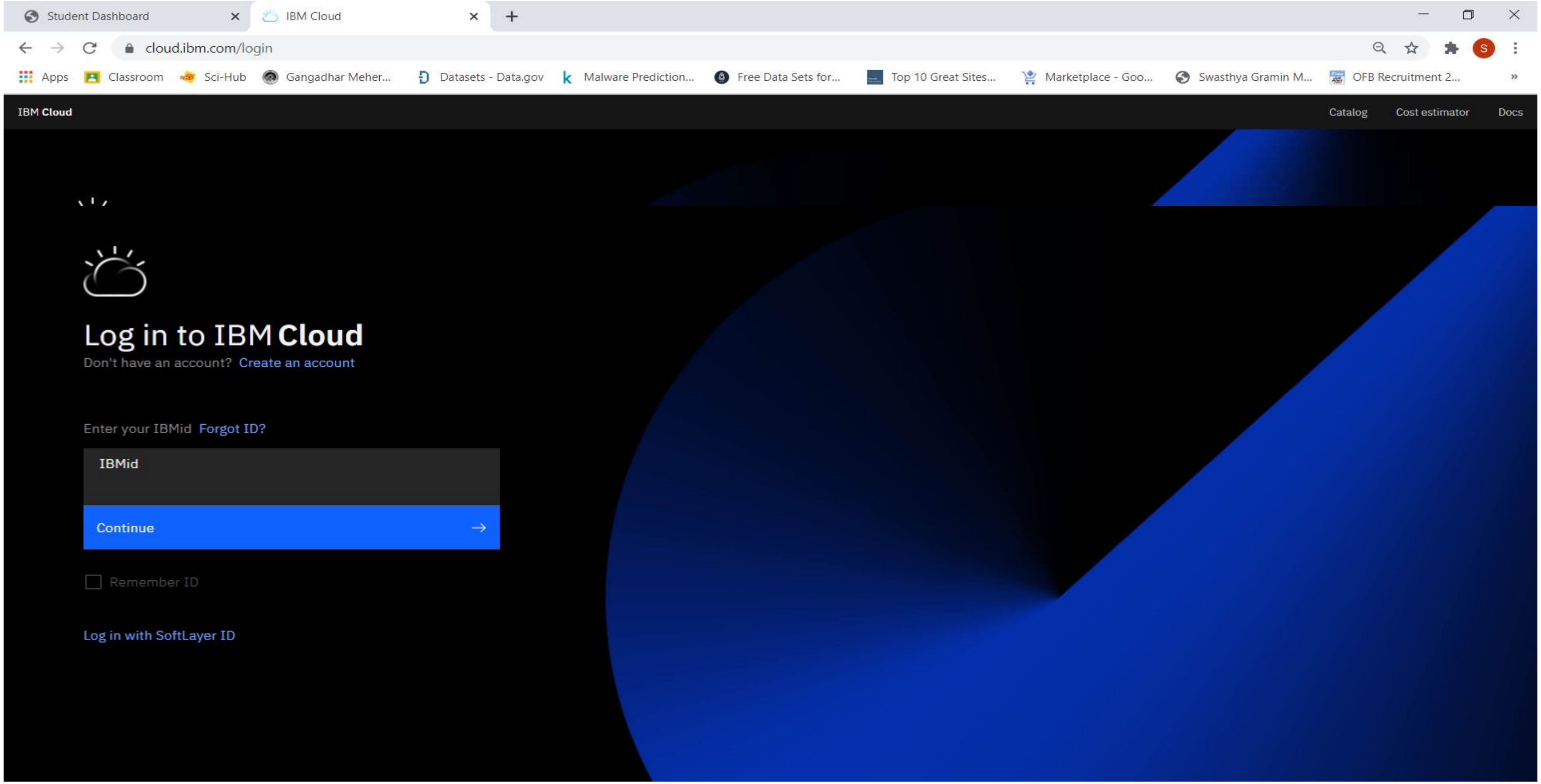


# Procedure for hardware/software design

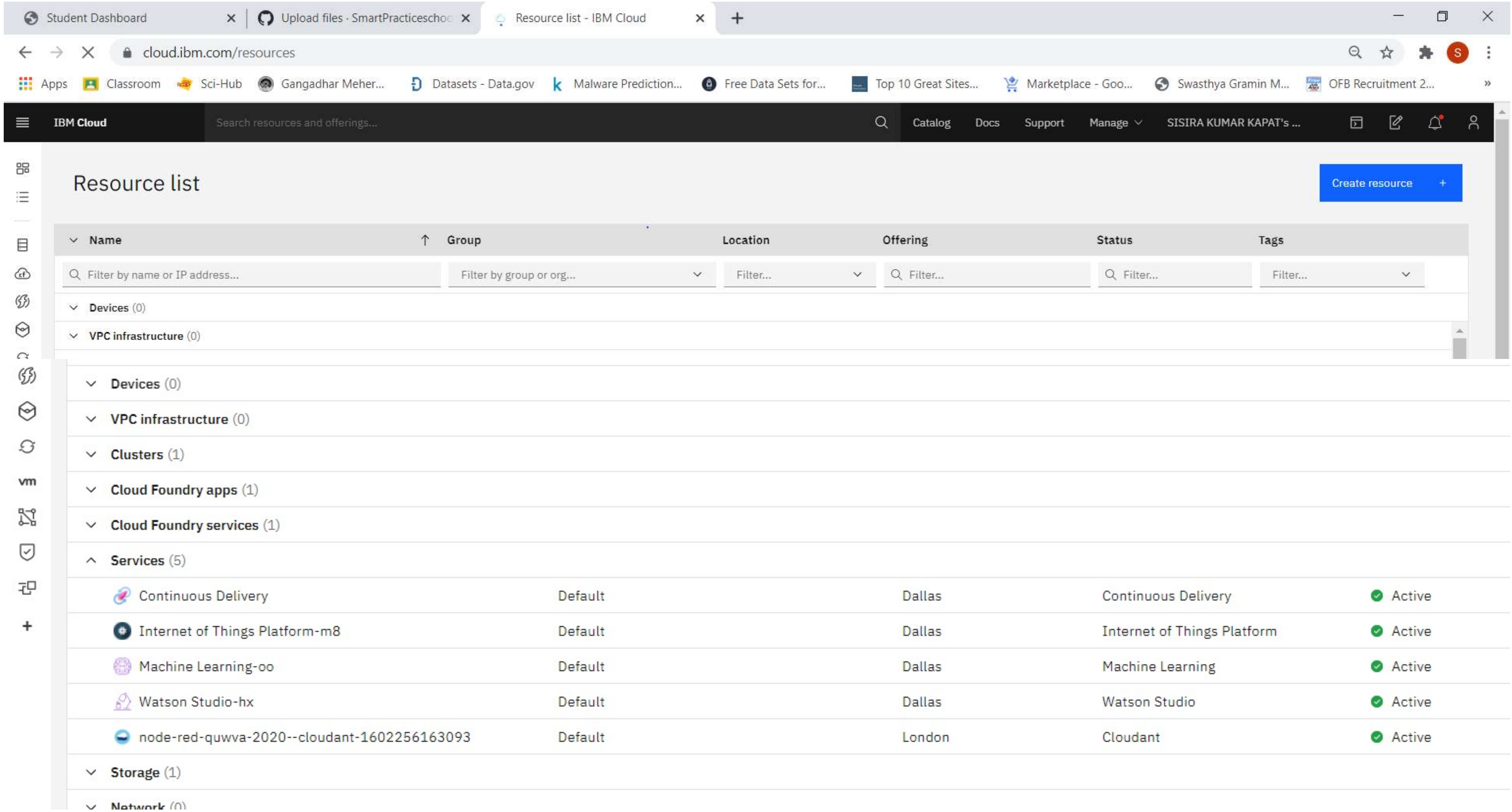
- IBM Academic Initiative account
- Create and launch Node-RED instance
- Create an IBM Watson IoT Platform
- Configure the IoT platform
- Configure the Watson Studio service
- Configure and connect the online simulator
- Build a machine learning model
- Create a node-RED flow to get data fro IBM IoT device
- Create HTTP requests
- Create UI to input user data
- Store the user data in the cloud database
- Create node-RED to display the detailed prediction

# Hardware/Software Design (cont...)

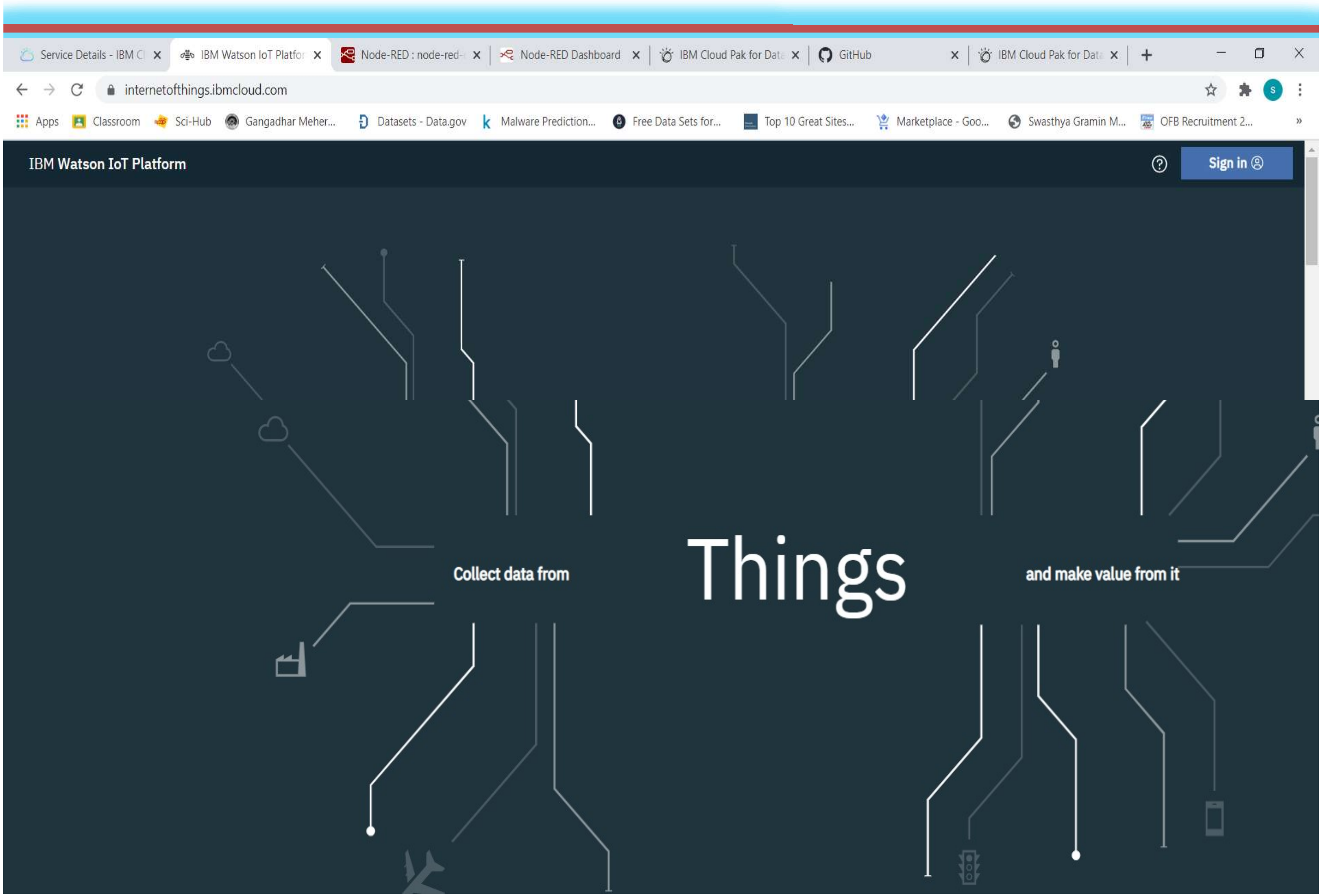
- The system is designed by using IBM cloud online resources.



# Resources used



# IBM Watson IoT Platform



# IBM Watson IoT Platform

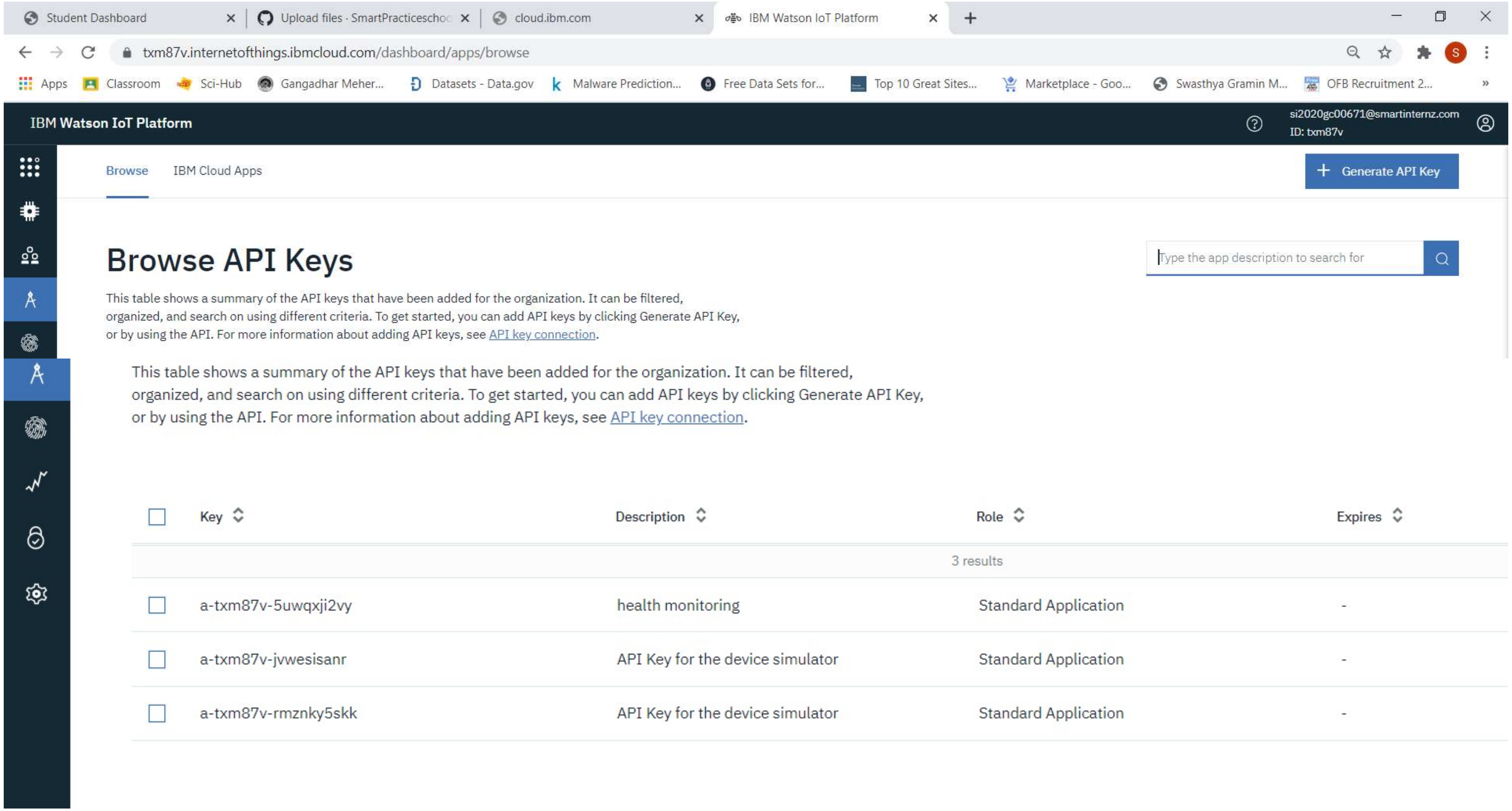
- This service is used to simulate the different sensors using IBM IoT.

Payload

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

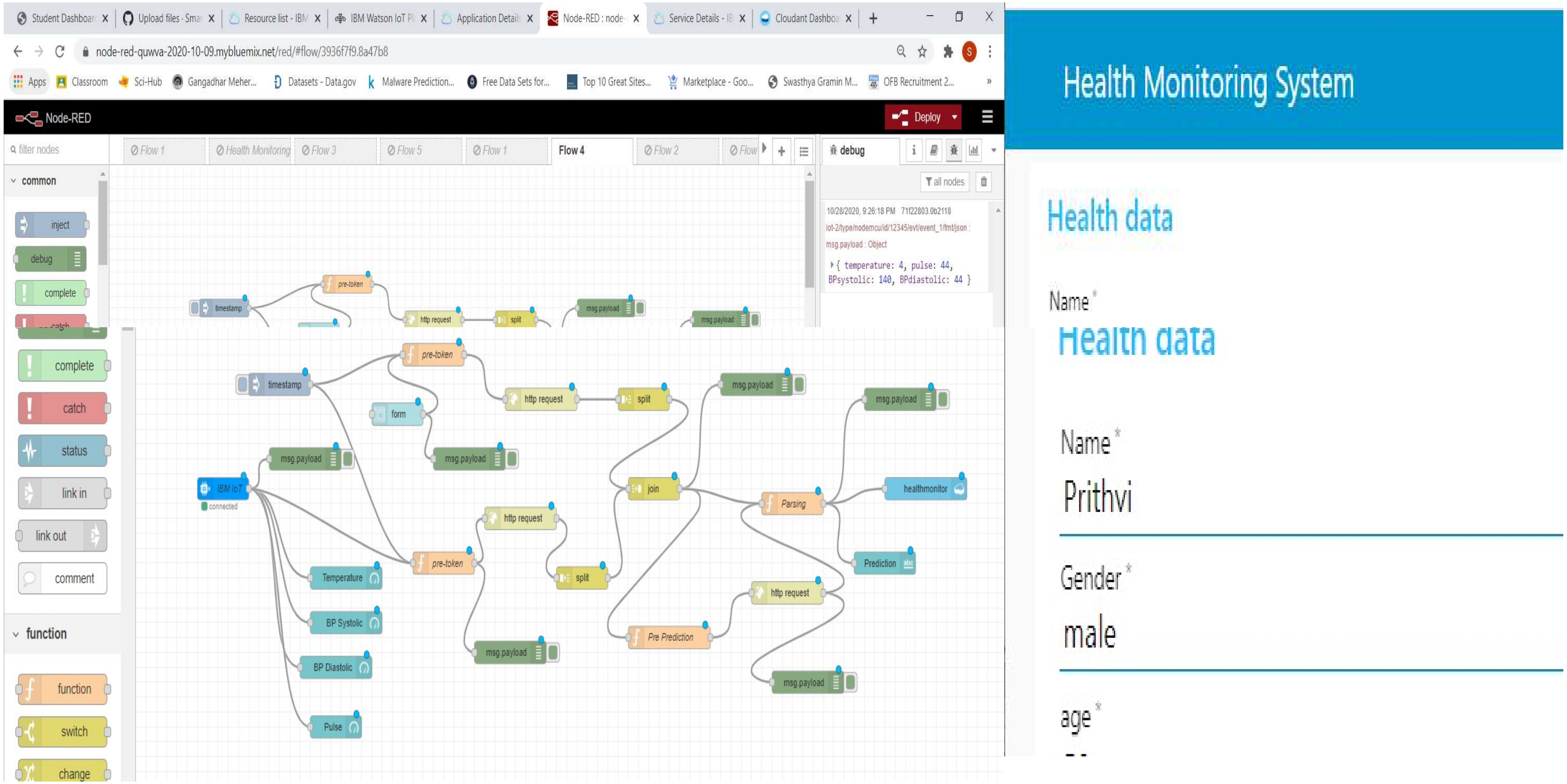
```
{
  "temperature": random(0, 41),
  "pulse": random(0,200),
  "BPsystolic": random(0,200),
  "BPdiastolic": random(0,140)
```

# API keys

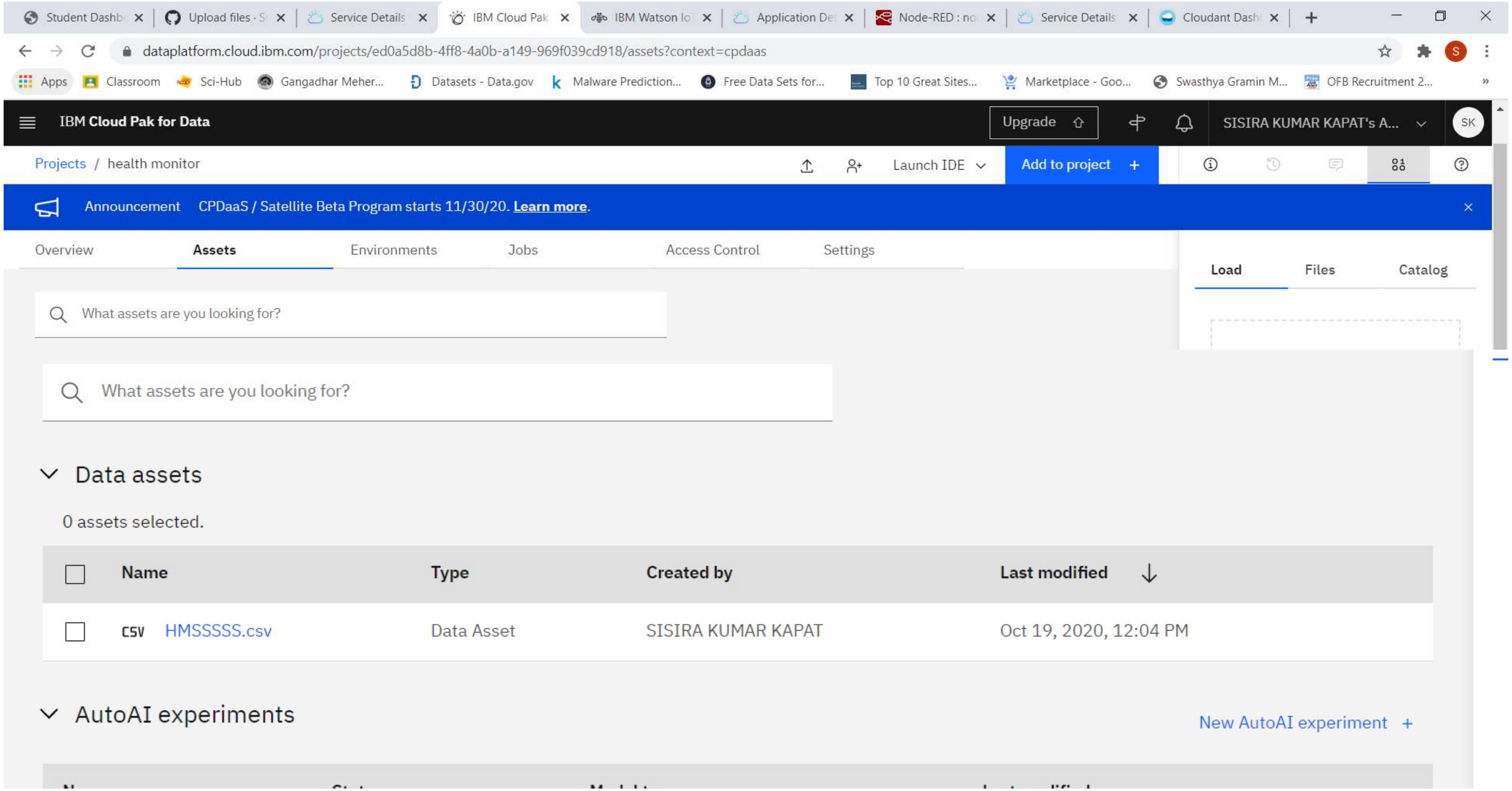


Student Dashboard
Upload files · SmartPracticeschoo
cloud.ibm.com
IBM Watson IoT Platform
txm87v.internetofthings.ibmcloud.com/dashboard/apps/browse
Apps
Classroom
Sci-Hub
Gangadhar Meher...
Datasets - Data.gov
Malware Prediction...
Free Data Sets for...
Top 10 Great Sites...
Marketplace - Goo...
Swasthya Gramin M...
OFB Recruitment 2...
IBM Watson IoT Platform
si2020gc00671@smartinternz.com
ID: txm87v
Browse
IBM Cloud Apps
Generate API Key
Browse API Keys
Type the app description to search for
This table shows a summary of the API keys that have been added for the organization. It can be filtered, organized, and search on using different criteria. To get started, you can add API keys by clicking Generate API Key, or by using the API. For more information about adding API keys, see API key connection.
This table shows a summary of the API keys that have been added for the organization. It can be filtered, organized, and search on using different criteria. To get started, you can add API keys by clicking Generate API Key, or by using the API. For more information about adding API keys, see API key connection.
Key
Description
Role
Expires
3 results
a-txm87v-5uwqxji2vy
health monitoring
Standard Application
-
a-txm87v-jvwesisanr
API Key for the device simulator
Standard Application
-
a-txm87v-rmznky5skk
API Key for the device simulator
Standard Application
-

# Node-RED UI Creation



# Machine Learning model Creation

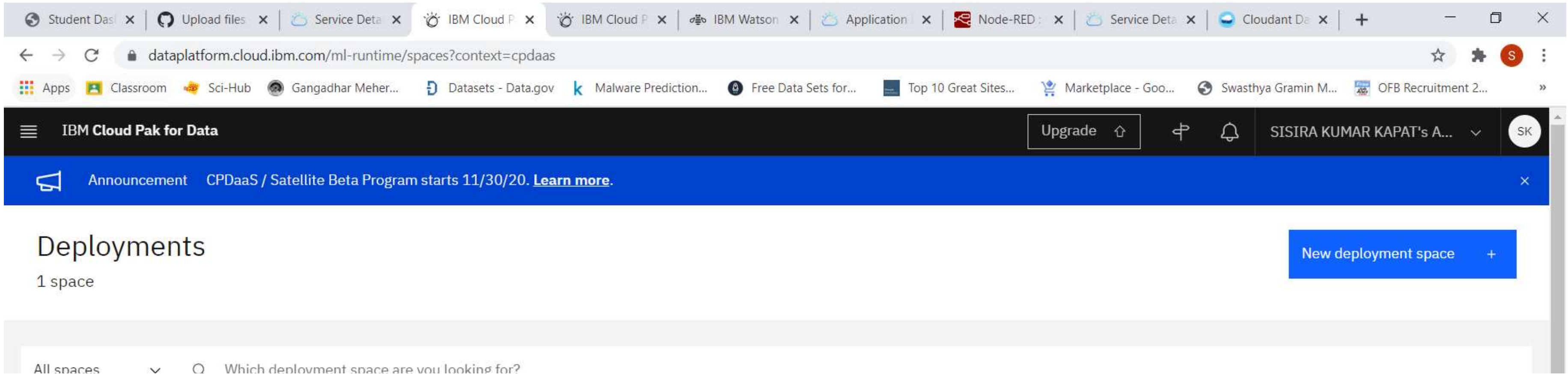


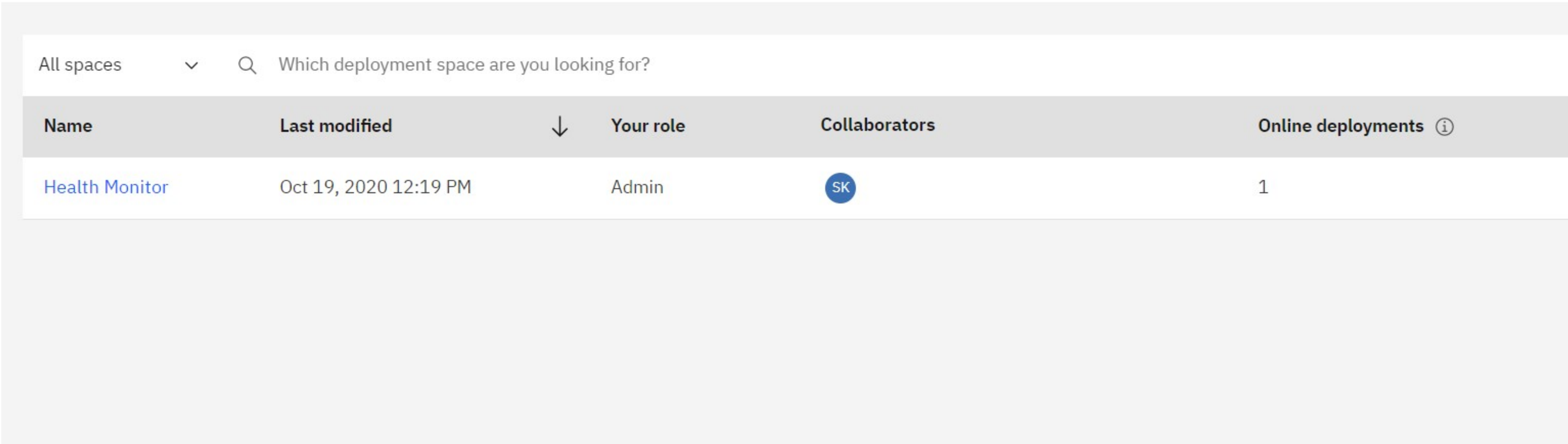
# Dataset

| Attribute | Range |
|---|---|
| Age | 0 to 80 |
| Temperature | 0 to 41 |
| BP (Cistole) | 0 to 200 |
| BP (Distole) | 0 to 140 |

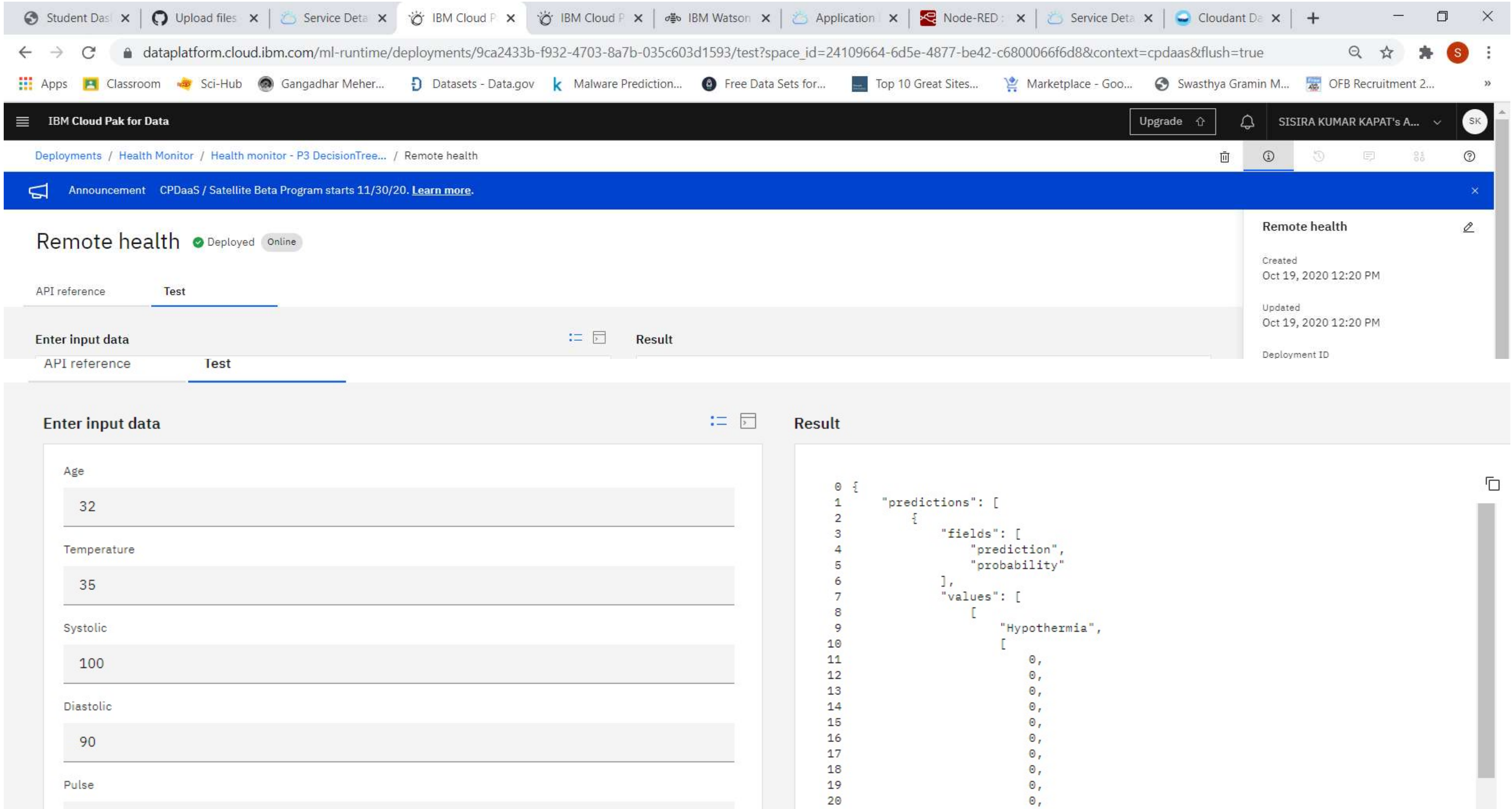
BP (Distole) 0 to 140

# Machine Learning model Creation (cont…)

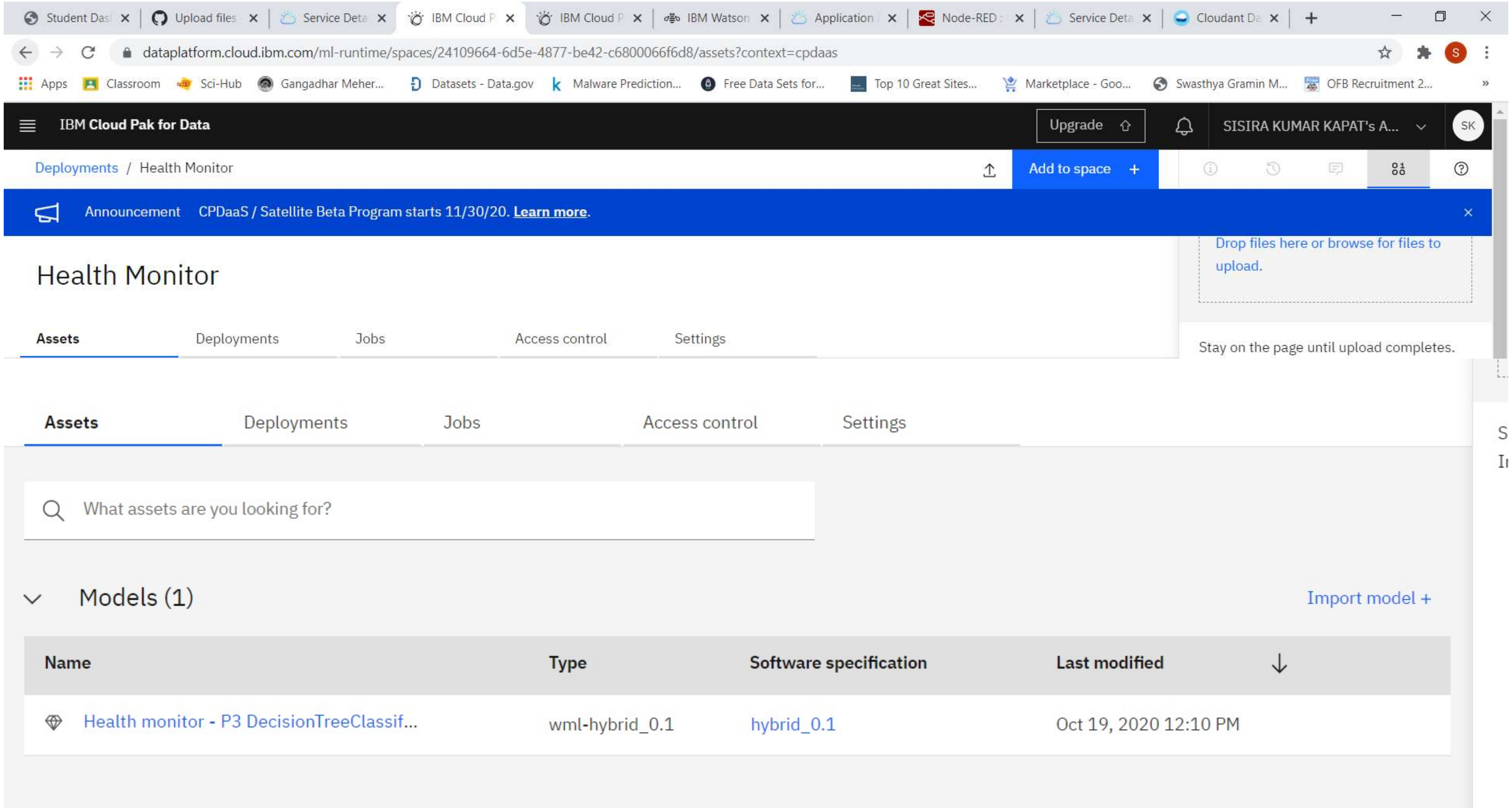


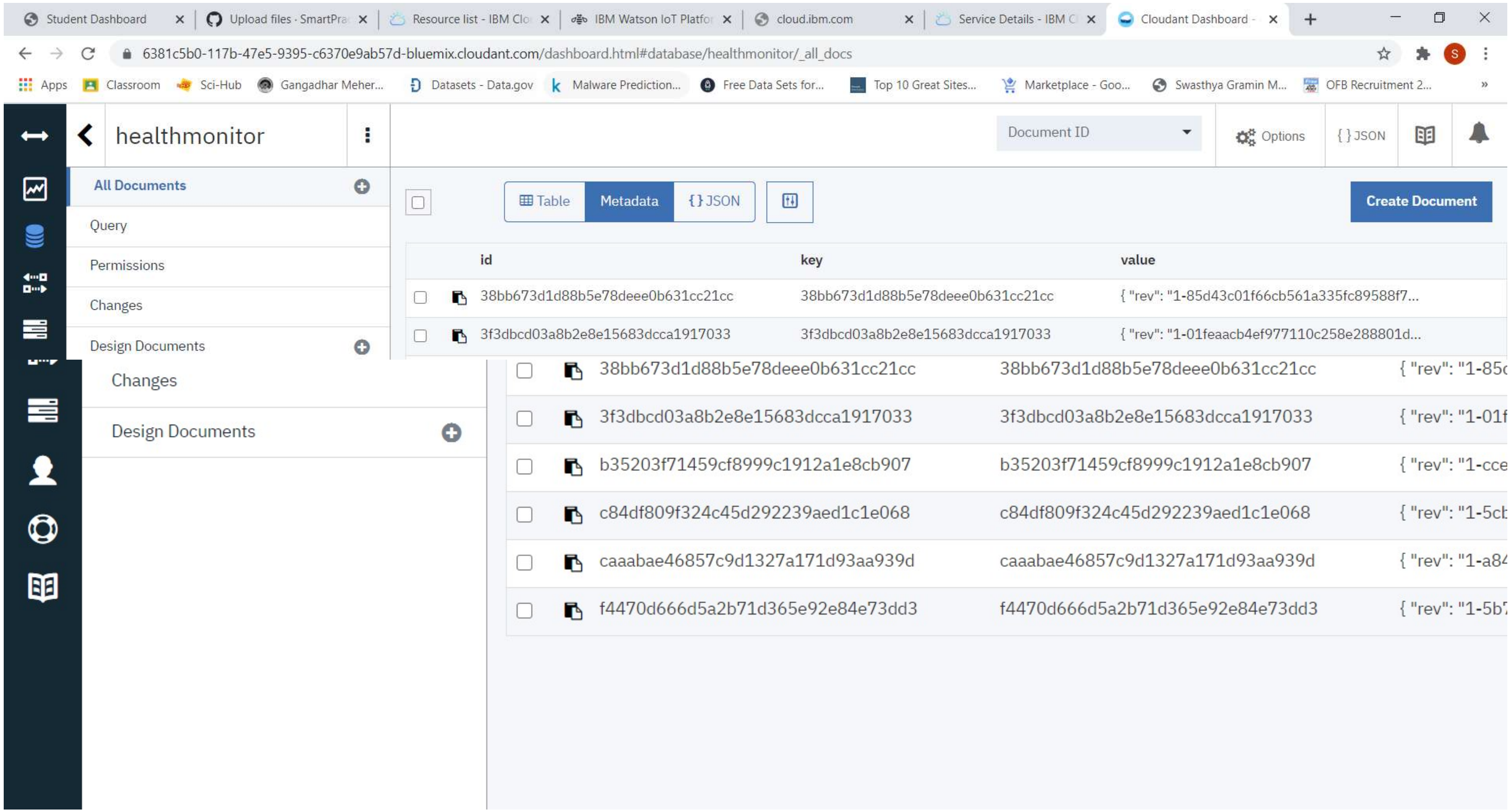
# Machine Learning model Testing(cont…)



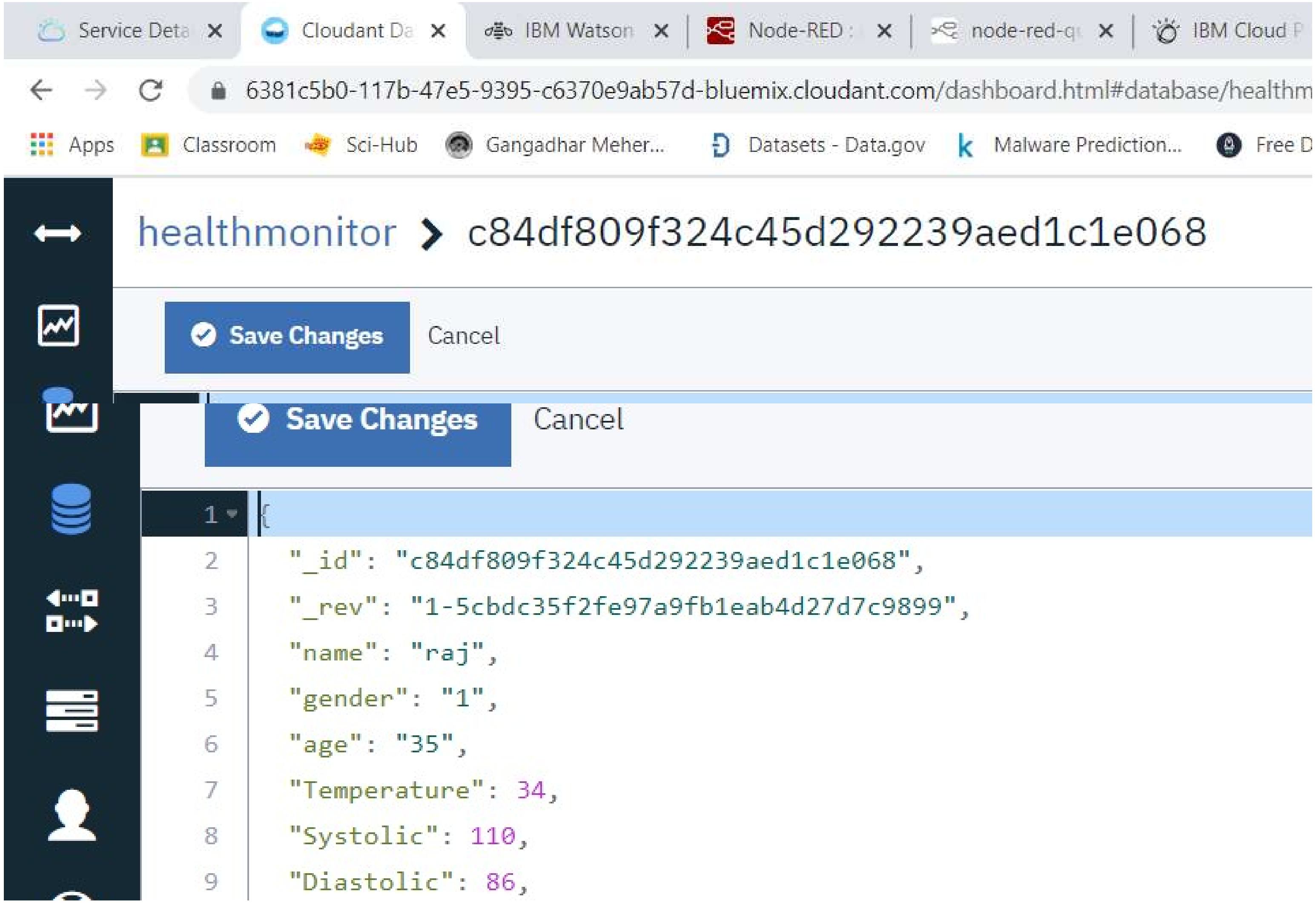
# Machine Learning model Creation (cont…)



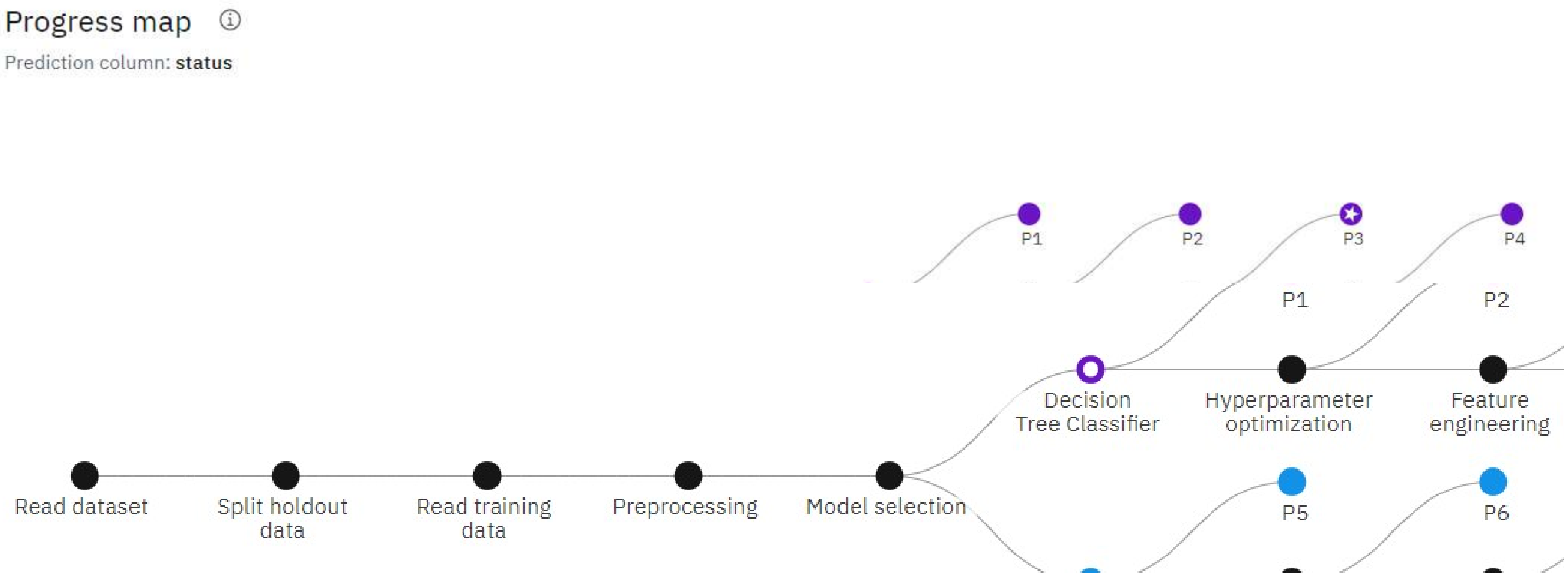
# Database Creation



# Data in the database



# Experimental Investigation (Progress map)



# Pipeline Leaderboard (CV)

Pipeline leaderboard

| Rank ↑ | Name | Algorithm | Accuracy (Opt... | Enhancements | Build time |
|---|---|---|---|---|---|
| ★ 1 | Pipeline 3 | Decision Tree Classifier | 0.959 | HPO-1 FE | 00:00:36 |
| 2 | Pipeline 4 | Decision Tree Classifier | 0.959 | HPO-1 FE HPO-2 | 00:00:13 |

| | | | | |
|---|---|---|---|---|
| 2 | Pipeline 4 | Decision Tree Classifier | 0.959 | HPO-1 FE HPO- |
| 3 | Pipeline 1 | Decision Tree Classifier | 0.958 | *None* |
| 4 | Pipeline 2 | Decision Tree Classifier | 0.958 | HPO-1 |
| 5 | Pipeline 7 | Random Forest Classifier | 0.953 | HPO-1 FE |
| 6 | Pipeline 8 | Random Forest Classifier | 0.953 | HPO-1 FE HPO- |

# Some Terminologies associated with ML

- The accuracy of the classifier is the probability of correctly classifying the records in the test dataset.

$$Accuracy = \frac{True\ Positive + True\ negative}{Total}$$

- In multi-class classification, the true positive is the sum of all the true positive case of all the pipelines and similarly false positive, false negative and true negative is calculated.

# Some Terminologies associated with ML

- The precision of the classifier is the probability of records actually being in a class if they are classified to be in that class.

$$Precision = \frac{True\ Positive}{True\ Positive + False\ Positive}$$

- The recall of the classifier is the probability that a record is classified as being in a class if it actually belongs to that class.

$$Recall = \frac{True\ Positive}{True\ Positive + False\ N}$$

- The F-measure is the harmonic mean of precision and recall.

$$F - measure = \frac{2 \times Recall \times Pr}{Recall + Preci}$$

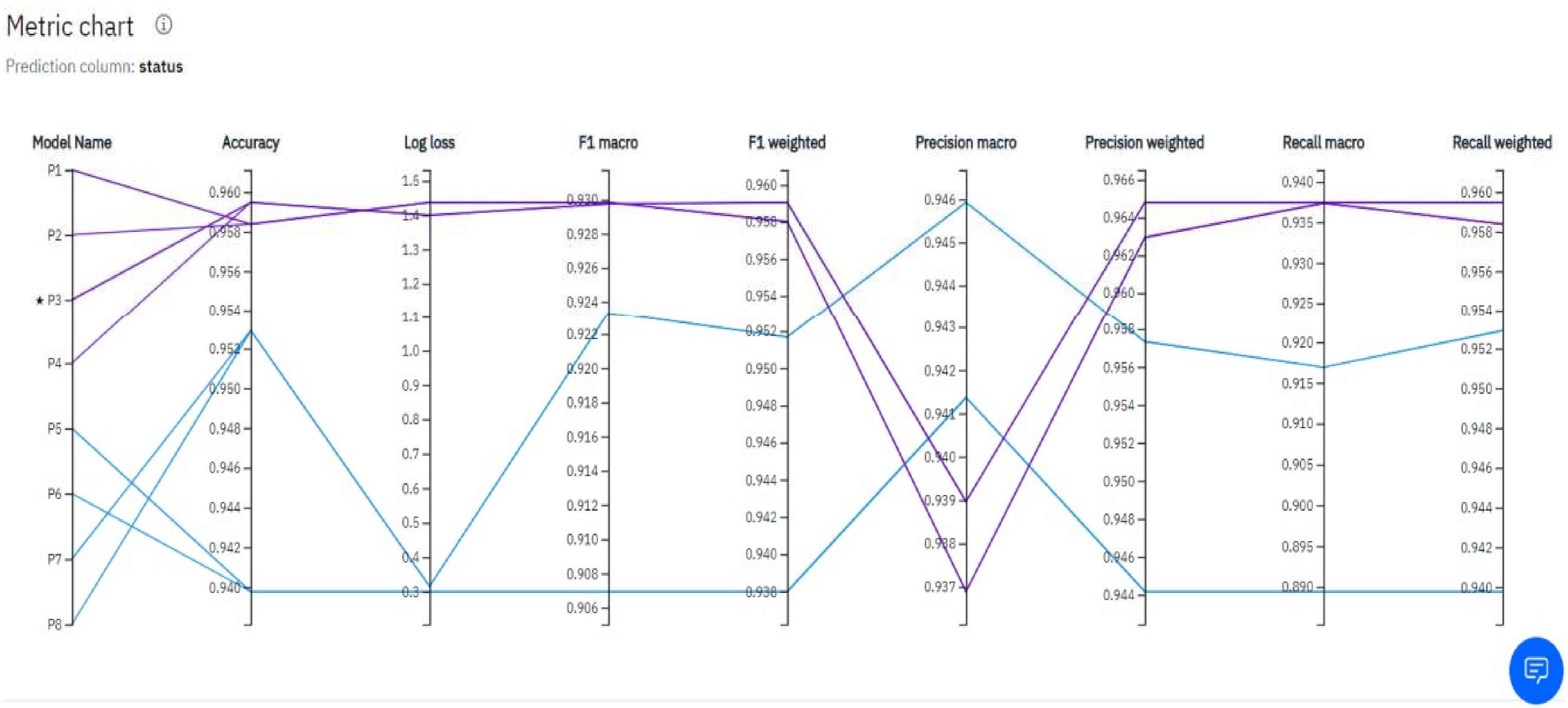
# Detailed Accuracy (CV)

Pipeline leaderboard

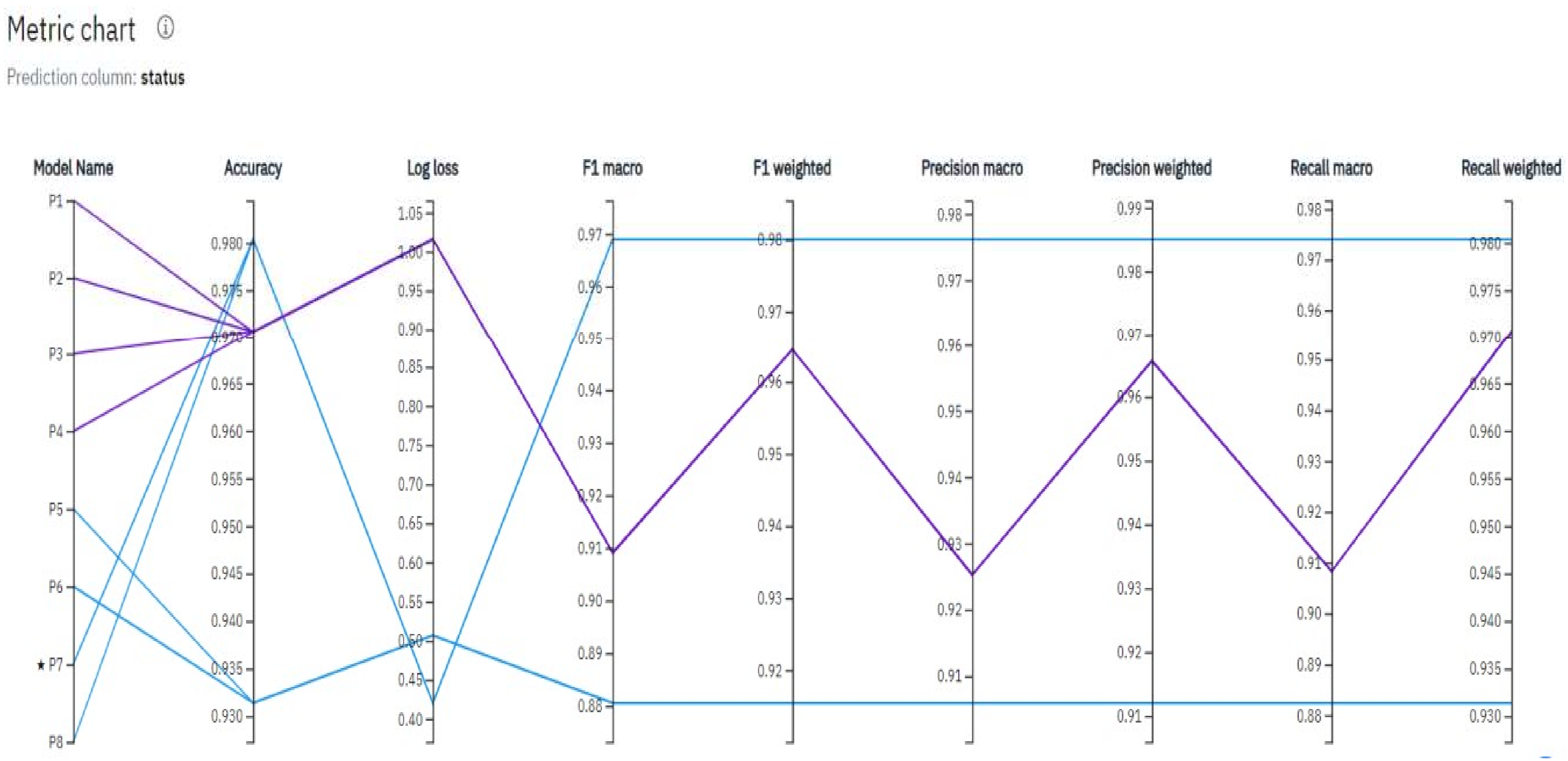
| Rank | Name | Algorithm | Accuracy (Optimiz... | F1 macro | F1 micro | F1 weighted | Log loss | Precision m... | Precision m... | Precision w... | Recall macro | Recall micro | Recall weig... |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| ★ 1 | Pipeline 3 | Decision Tree Classifier | 0.959 | 0.930 | 0.959 | 0.959 | 1.400 | 0.939 | 0.959 | 0.965 | 0.937 | 0.959 | 0.959 |
| 2 | Pipeline 4 | Decision Tree Classifier | 0.959 | 0.930 | 0.959 | 0.959 | 1.400 | 0.939 | 0.959 | 0.965 | 0.937 | 0.959 | 0.959 |
| 3 | Pipeline 1 | Decision Tree Classifier | 0.958 | 0.930 | 0.958 | 0.958 | 1.437 | 0.937 | 0.958 | 0.963 | 0.937 | 0.958 | 0.958 |

| | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| 3 | Pipeline 1 | Decision Tree Classifier | 0.958 | 0.930 | 0.958 | 0.958 | 1.437 | 0.937 | 0.958 | 0 |
| 4 | Pipeline 2 | Decision Tree Classifier | 0.958 | 0.930 | 0.958 | 0.958 | 1.437 | 0.937 | 0.958 | 0 |
| 5 | Pipeline 7 | Random Forest Classifier | 0.953 | 0.923 | 0.953 | 0.952 | 0.315 | 0.946 | 0.953 | 0 |
| 6 | Pipeline 8 | Random Forest Classifier | 0.953 | 0.923 | 0.953 | 0.952 | 0.315 | 0.946 | 0.953 | 0 |

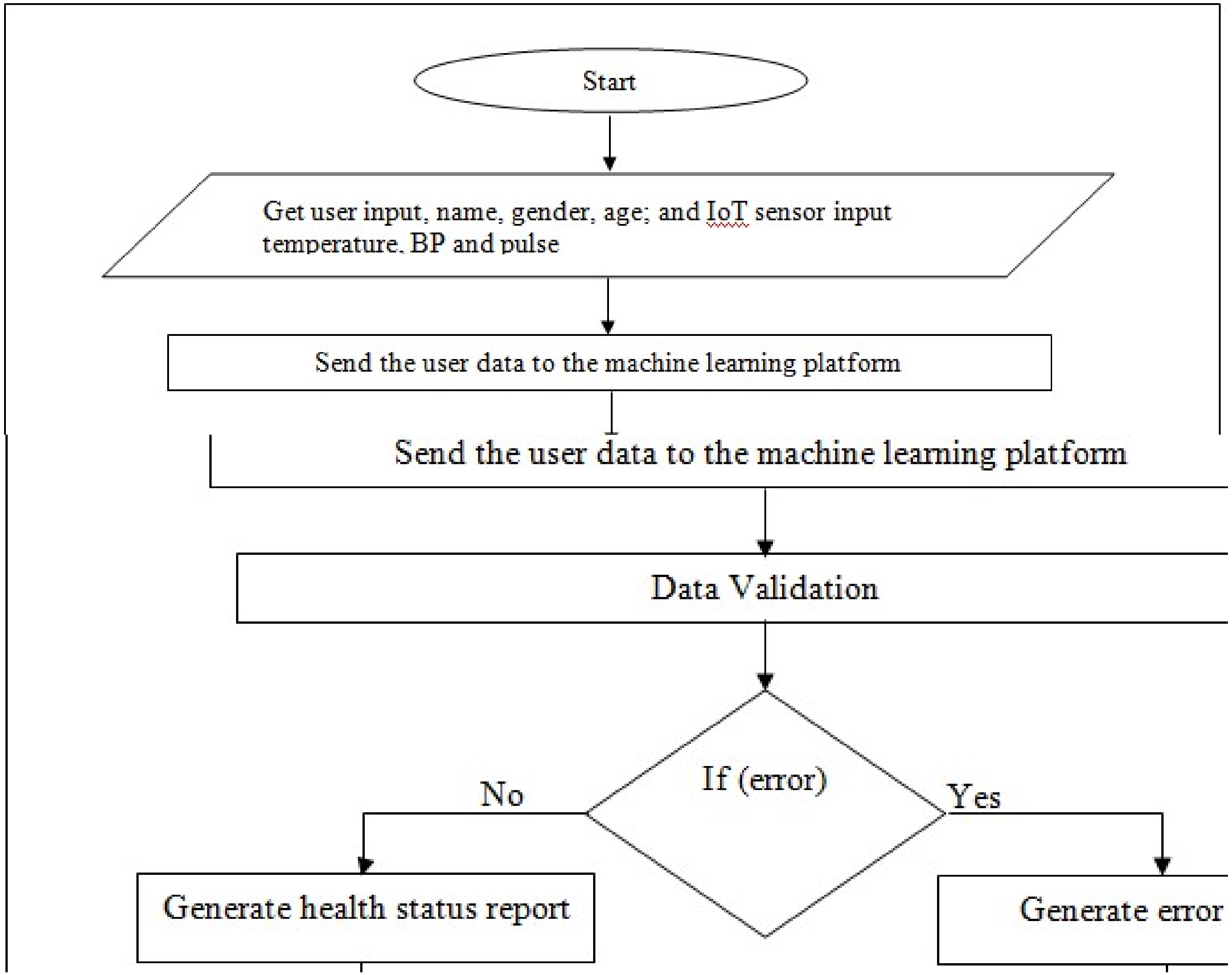
# Comparative analysis of different pipelines of cross validation



# Comparative analysis of different pipelines of Holdout



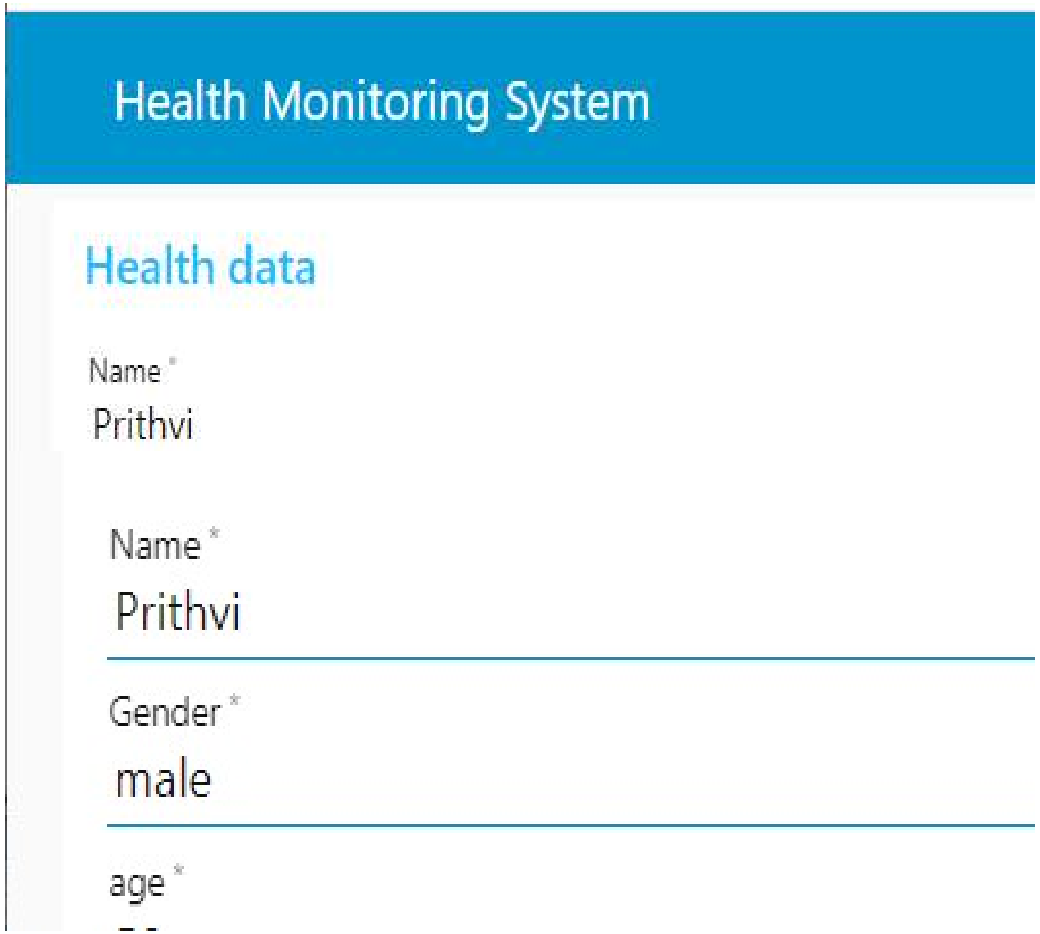
# Flowchart


Start
Get user input, name, gender, age; and IoT sensor input temperature, BP and pulse
Send the user data to the machine learning platform
Send the user data to the machine learning platform
Data Validation
If (error)
No
Yes
Generate health status report
Generate error

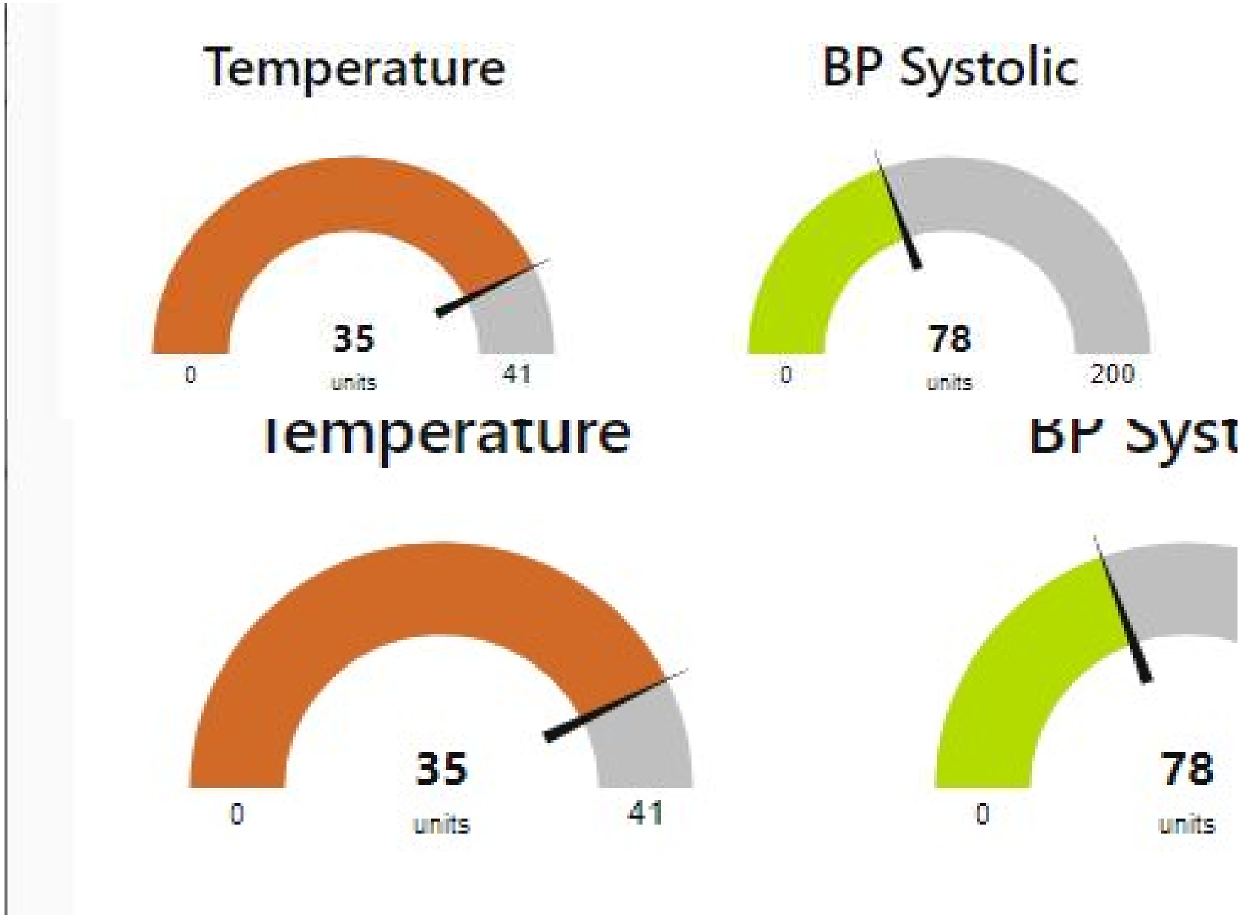
# Result Analysis

- Input
  - Form input
  - Sensor input
- Output

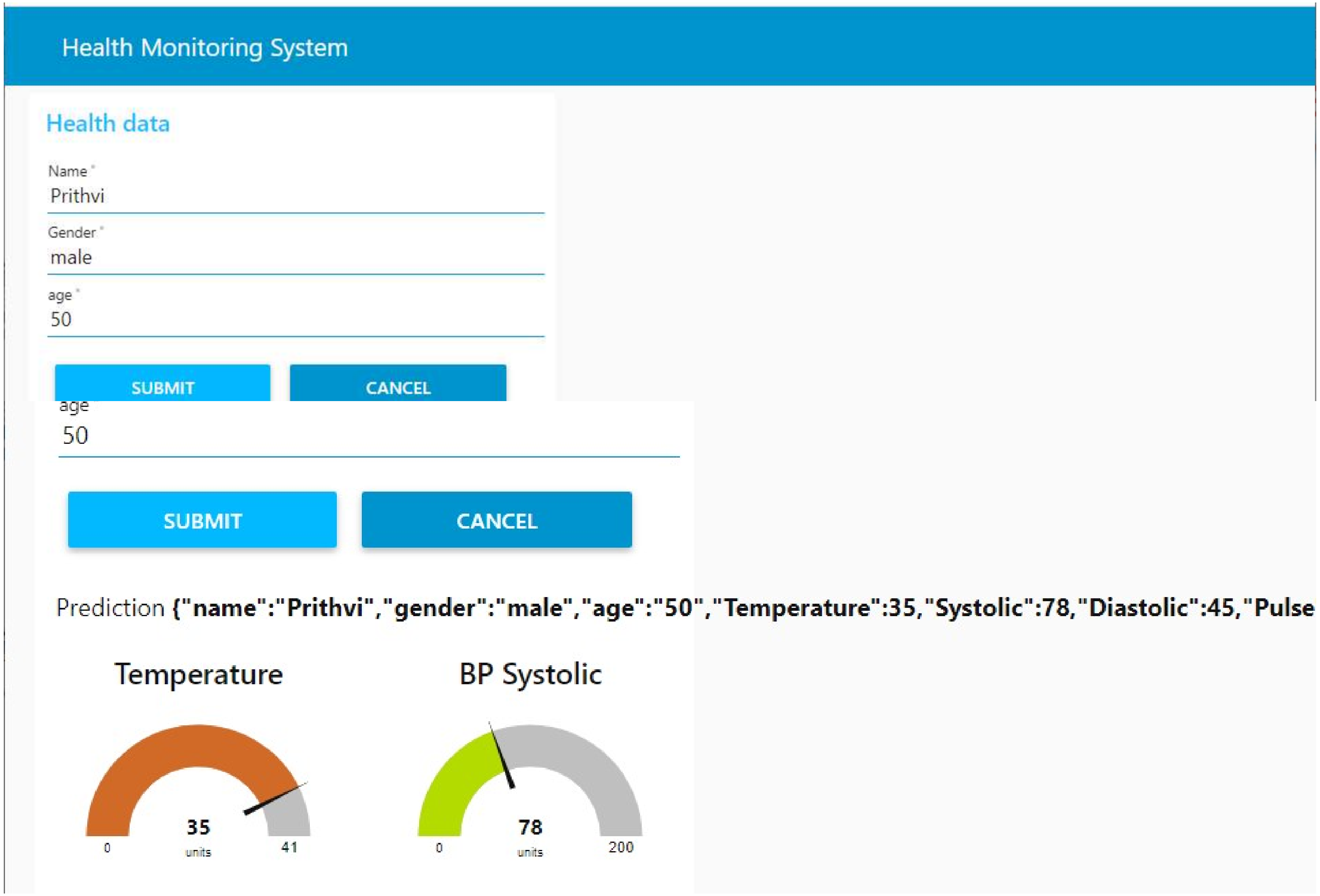
# Form Input

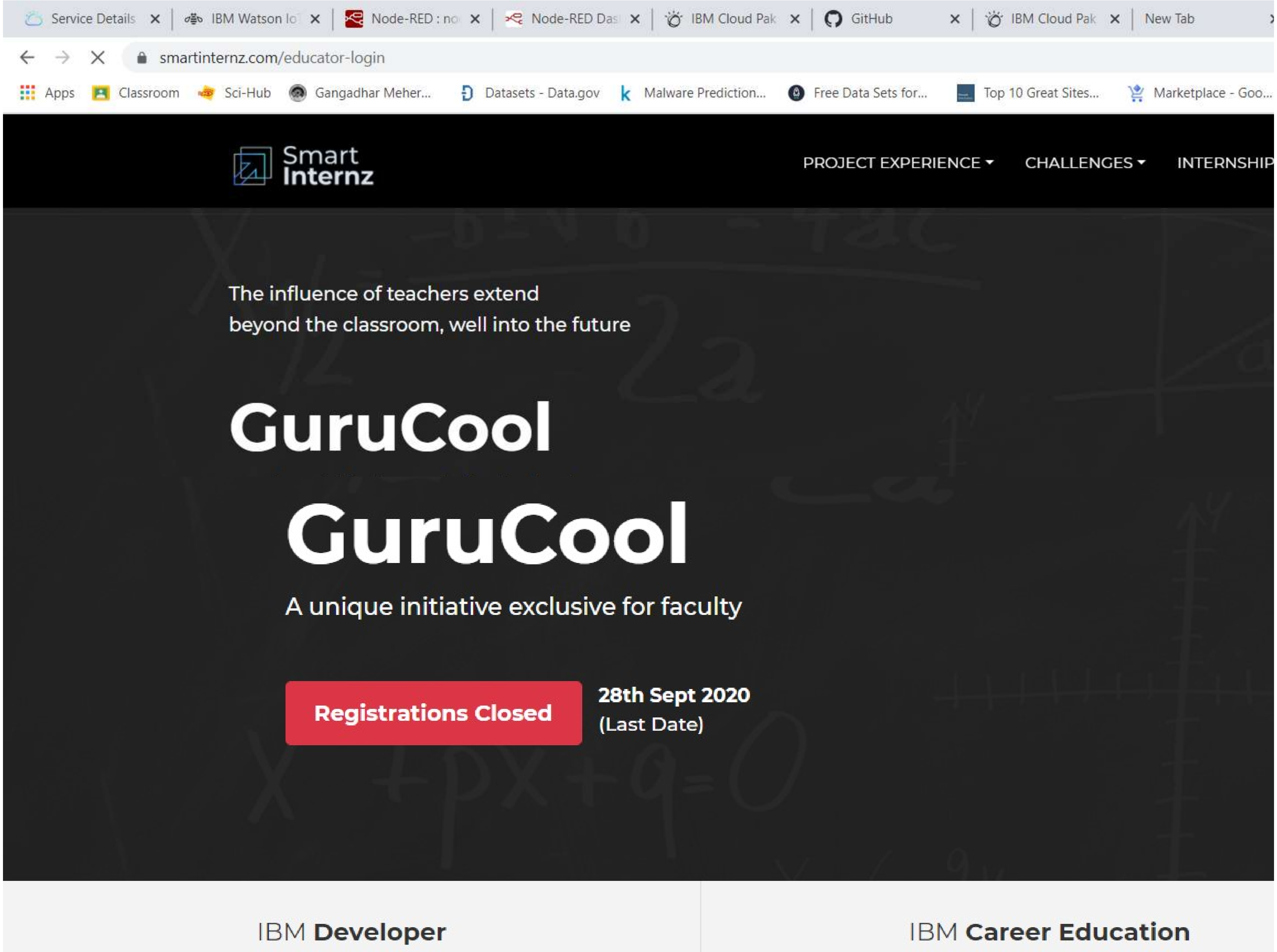

Health Monitoring System
Health data
Name *
Prithvi
Name *
Prithvi
Gender *
male
age *

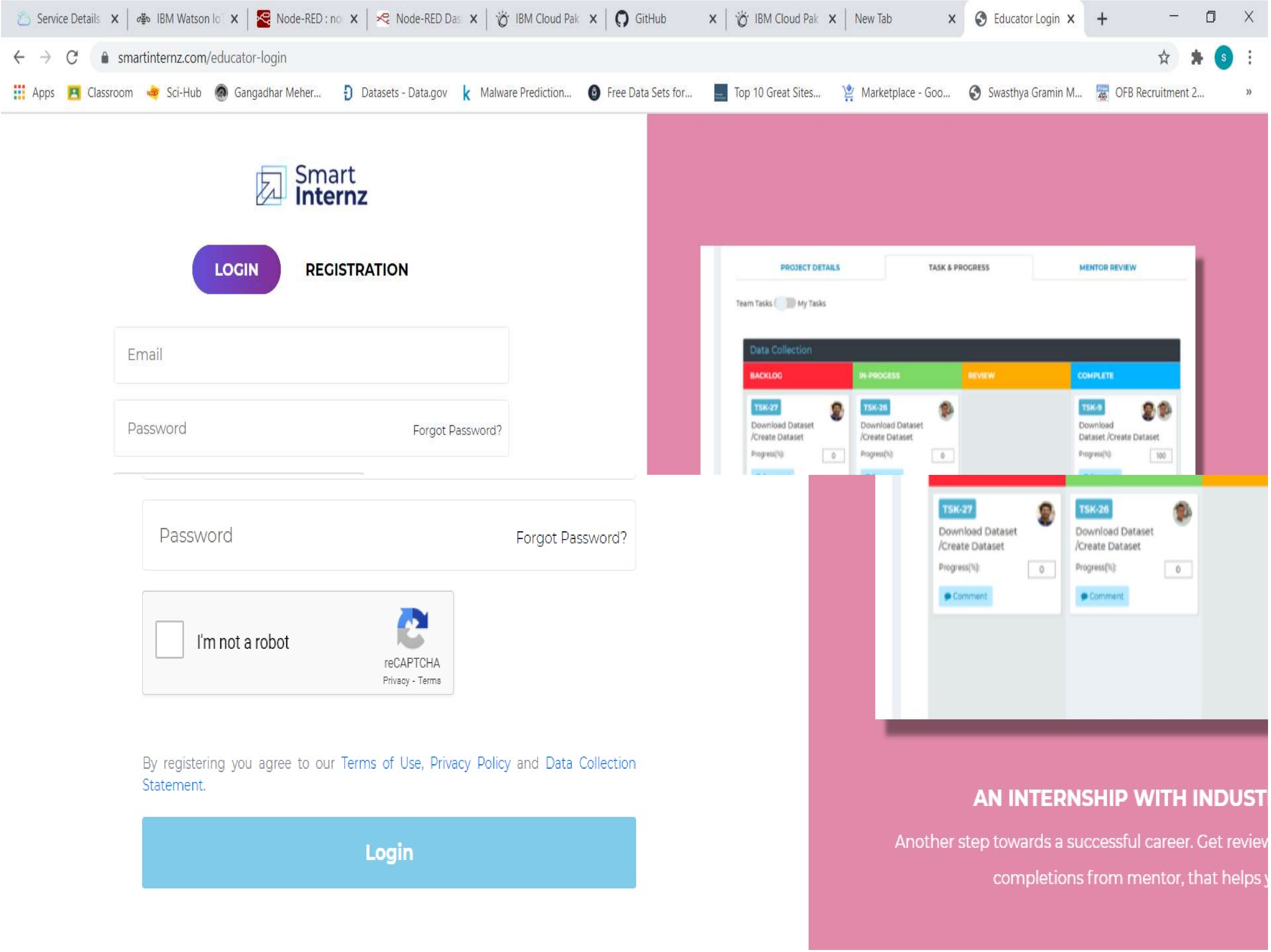
# Sensor Input

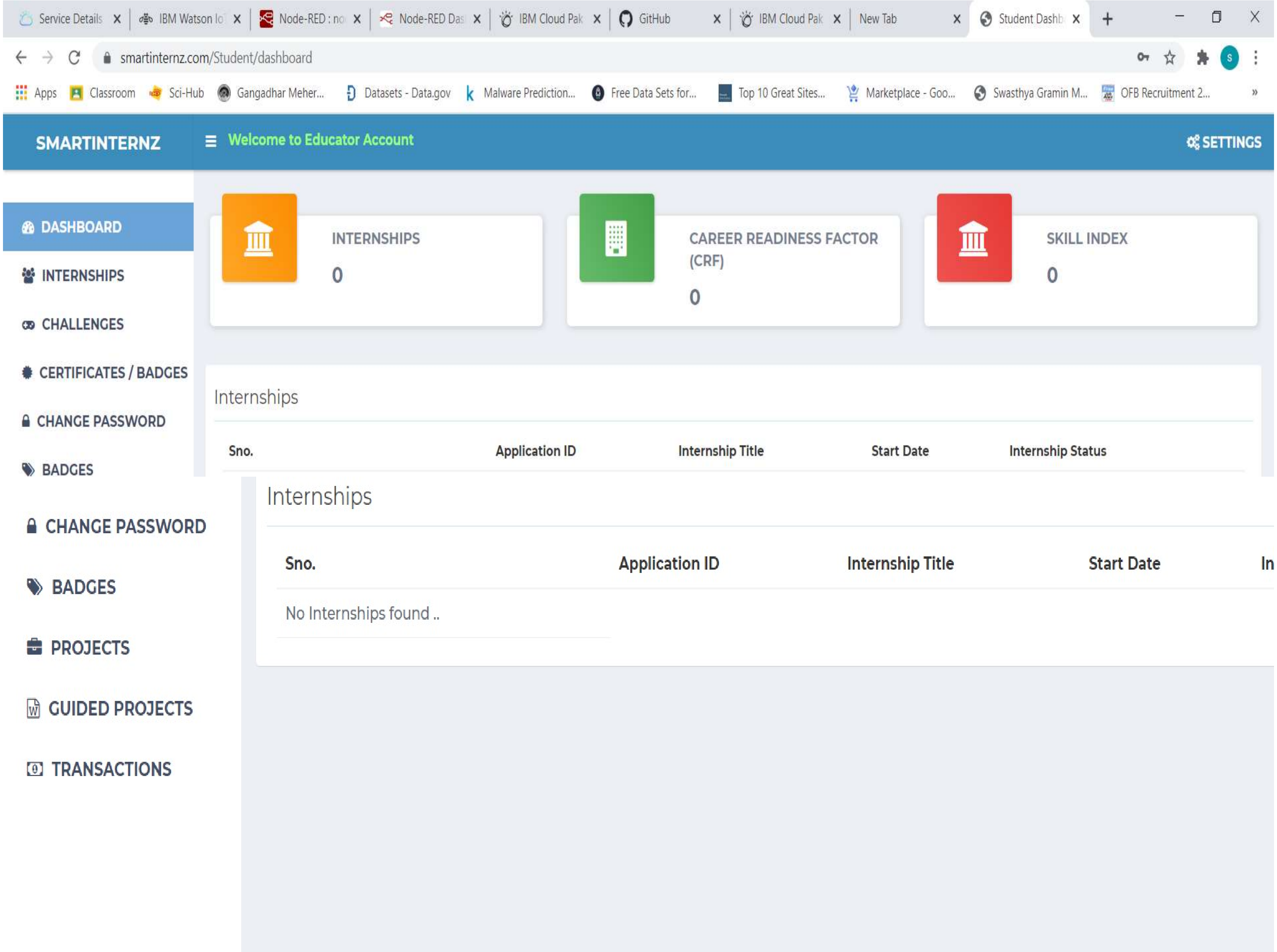


# Output


Health Monitoring System
Health data
Name *
Prithvi
Gender *
male
age *
50
SUBMIT
CANCEL
age
50
SUBMIT
CANCEL
Prediction {"name":"Prithvi","gender":"male","age":"50","Temperature":35,"Systolic":78,"Diastolic":45,"Pulse
Temperature
35
units
0
41
BP Systolic
78
units
0
200


Service Details
IBM Watson IoT
Node-RED : no
Node-RED Das
IBM Cloud Pak
GitHub
IBM Cloud Pak
New Tab
smartinternz.com/educator-login
Apps
Classroom
Sci-Hub
Gangadhar Meher...
Datasets - Data.gov
Malware Prediction...
Free Data Sets for...
Top 10 Great Sites...
Marketplace - Goo...
Smart Internz
PROJECT EXPERIENCE
CHALLENGES
INTERNSHIP
The influence of teachers extend
beyond the classroom, well into the future
GuruCool
GuruCool
A unique initiative exclusive for faculty
Registrations Closed
28th Sept 2020
(Last Date)
IBM Developer
IBM Career Education


Service Details
IBM Watson Io
Node-RED : no
Node-RED Das
IBM Cloud Pak
GitHub
IBM Cloud Pak
New Tab
Educator Login
smartinternz.com/educator-login
Apps
Classroom
Sci-Hub
Gangadhar Meher...
Datasets - Data.gov
Malware Prediction...
Free Data Sets for...
Top 10 Great Sites...
Marketplace - Goo...
Swasthya Gramin M...
OFB Recruitment 2...
Smart Internz
LOGIN
REGISTRATION
Email
Password
Forgot Password?
Password
Forgot Password?
I'm not a robot
reCAPTCHA
Privacy - Terms
By registering you agree to our Terms of Use, Privacy Policy and Data Collection Statement.
Login
PROJECT DETAILS
TASK & PROGRESS
MENTOR REVIEW
Team Tasks
My Tasks
Data Collection
BACKLOG
IN-PROCESS
REVIEW
COMPLETE
TSK-27
Download Dataset /Create Dataset
TSK-26
Download Dataset /Create Dataset
TSK-9
Download Dataset /Create Dataset
Comment
AN INTERNSHIP WITH INDUST
Another step towards a successful career. Get review
completions from mentor, that helps


Service Details
IBM Watson Io
Node-RED : no
Node-RED Das
IBM Cloud Pak
GitHub
IBM Cloud Pak
New Tab
Student Dashb
smartinternz.com/Student/dashboard
Apps
Classroom
Sci-Hub
Gangadhar Meher...
Datasets - Data.gov
Malware Prediction...
Free Data Sets for...
Top 10 Great Sites...
Marketplace - Goo...
Swasthya Gramin M...
OFB Recruitment 2...
SMARTINTERNZ
Welcome to Educator Account
SETTINGS
DASHBOARD
INTERNSHIPS
CHALLENGES
CERTIFICATES / BADGES
CHANGE PASSWORD
BADGES
INTERNSHIPS
0
CAREER READINESS FACTOR (CRF)
0
SKILL INDEX
0
Internships
Sno.
Application ID
Internship Title
Start Date
Internship Status
CHANGE PASSWORD
BADGES
PROJECTS
GUIDED PROJECTS
TRANSACTIONS
Internships
Sno.
Application ID
Internship Title
Start Date
In
No Internships found ..

# Advantages

- Quick access by means of the mobile devices.
- Avoid contagious diseases, since this platform avoids rush.
- Daily or hourly status of a patient can be maintained for observation. This facility can be helpful to keep track of the patients who are in critical condition.
- Utilization of sensors decreases the possibility of human mistake.
- Ensures better care and treatment.
- Reduces medical expenses by reducing the travelling frequency.
- Lessens the involved space of the room and improves overall performance

# Disadvantages

- Some of the diseases require privacy and confidentiality. If the database got exposure to the public, then it violates the right to privacy of a person.
- We cannot replicate the healthcare system, no matter how efficient this system is, sometimes the person has to consult the health care professional.

# Applications

- handhold devices
- wearable
- Web based monitoring

# Conclusion and future work

- The health care system has to be improvised with the evolution and revolution of engineering and technology.
- This will create a positive environment to use the ICT in health care system.
- In this system the overall accuracy 95.9%, which holds good in the prediction but has to be improved.
- This can hamper the right to privacy in some extent which has to be taken care.

# References used


- Ananda Mohon Ghosh, Debashish Halder, SK Alamgir Hossain, “Remote Health Monitoring System through IoT”, 5th International Conference on Informatics, Electronics and Vision (ICIEV), pp 921-926, 2016
- Dahlia Sam, S.Srinidhi, V. R. Niveditha, S.Amudha, D. Usha, “Progressed IOT Based Remote Health Monitoring System”, International Journal of Control and Automation, Vol. 13, No. 2s, pp. 268-273, 2020
- Ngo Manh Khoi, Saguna Saguna, Karan Mitra, Christer Ahlund, “IReHMo: An Efficient IoT-Based Remote Health Monitoring System for Smart Regions”, https://www.diva-portal.org/smash/get/diva2:1005647/FULLTEXT01.pdf
- Mohd. Hamim, Sumit Paul, Syed Iqramul Hoque, Md. Nafiur Rahman, Ifat-Al-Baqee, "IoT Based Remote Health Monitoring System for Patients and Elderly People", International Conference on Robotics, Electrical and Signal Processing Techniques (ICREST), 978-1-5386-8014-8/19, IEEE, 2019

# Thank You…