SMARTBRIDGE: PROJECT

Predictive Maintenance Of Industrial Motors Using IBM Cloud

TEAM MEMBERS:

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INTRODUCTION:

OVERVIEW:

To predict the industrial motor will work or won't, we can achieve this by measuring the values of the motors.

OBJECTIVE:

We have to measure the values of current, voltage, temperature. We can measure this characters by using ML, a machine learning model can be developed by using IBM CLOUD. To develop it we are using AUTO AI mode of IBM cloud.

SURVEY:

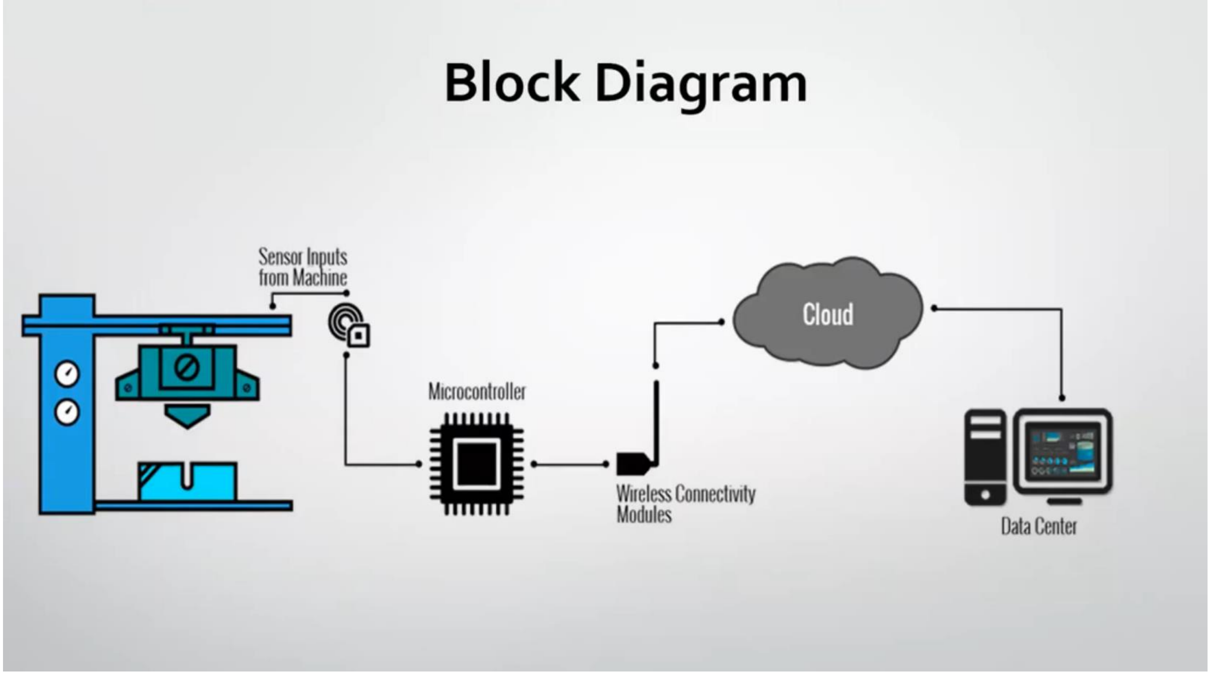
a. Existing model:

General model which can detect without proper data.

b. Solution:

We can integrate this model with IBM cloud with introducing to AUTO AI .to get the data correctly

BLOCK DIAGRAM:



REQUIREMENTS:

Python IDLE

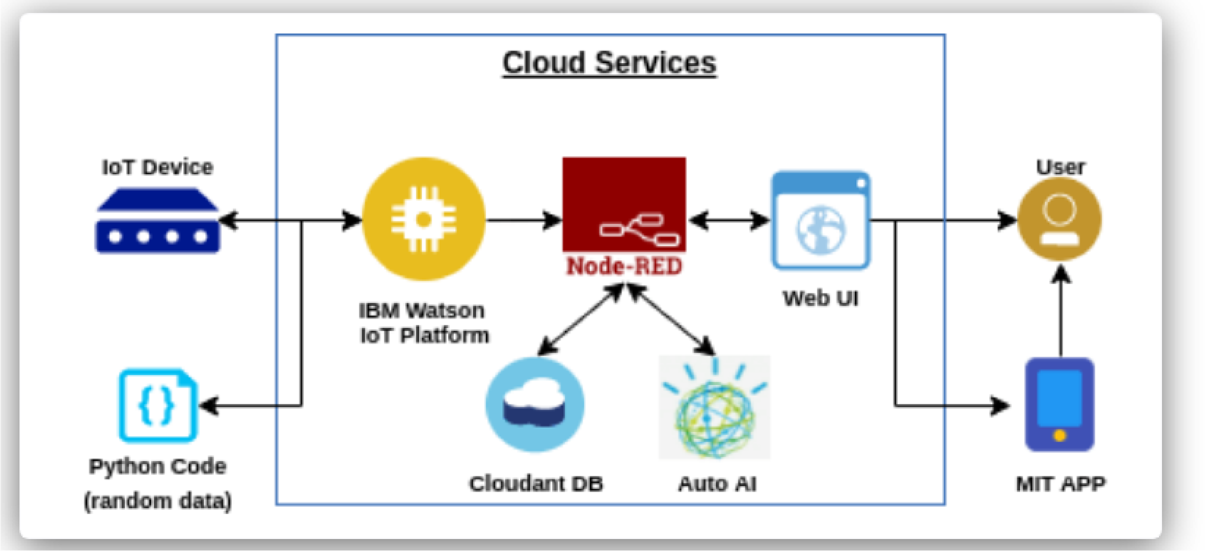
IBM ACCOUNT

Node-red

AUTO AI

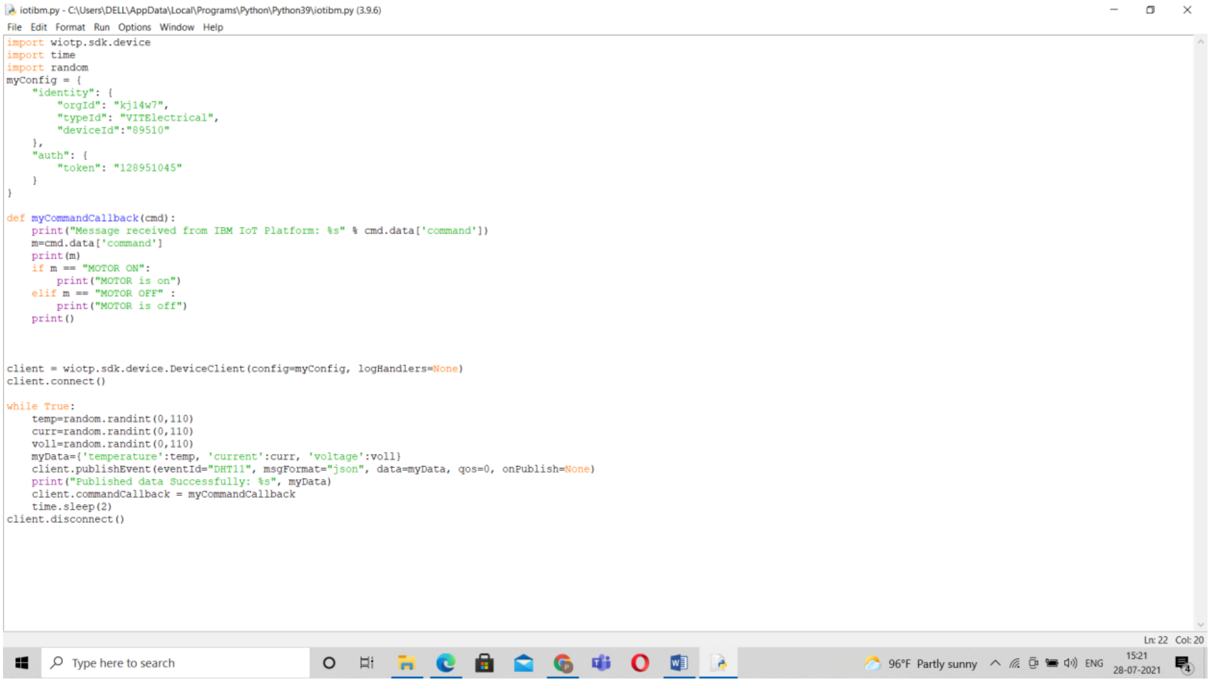
MIT APP

FLOW CHART:



PROCEDURE:

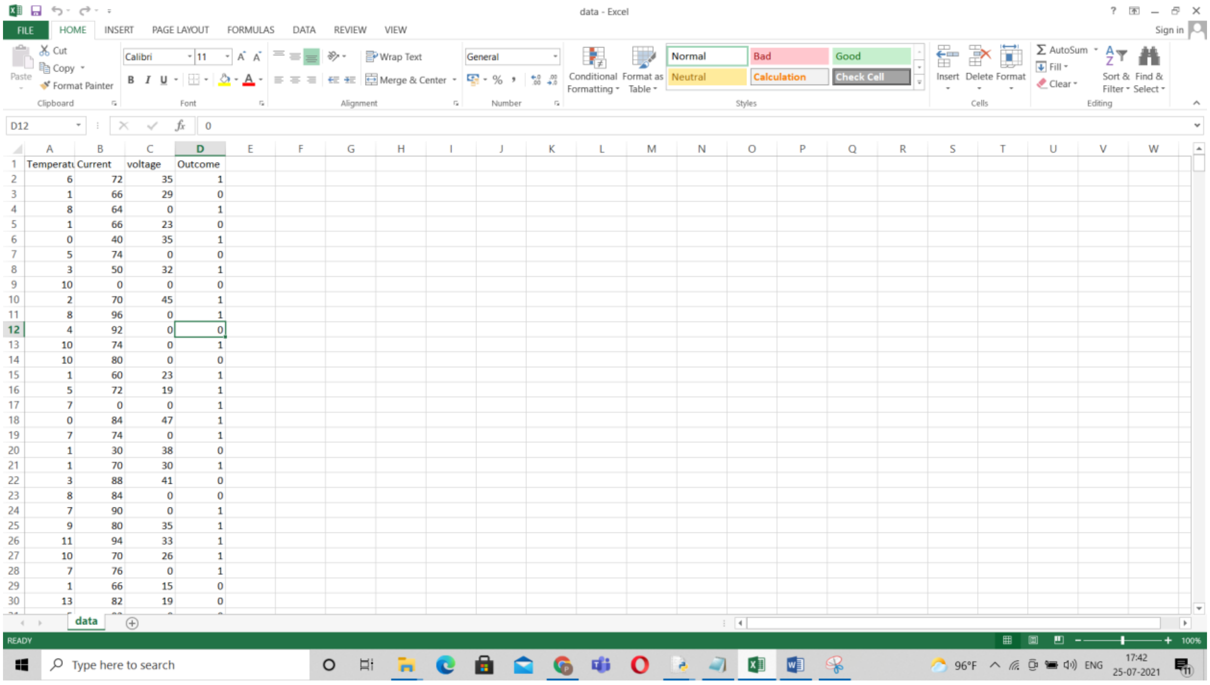
Develop the code


iotibm.py - C:\Users\DELL\AppData\Local\Programs\Python\Python39\iotibm.py (3.9.6)
File Edit Format Run Options Window Help
Ln: 22 Col: 20
Type here to search
96°F Partly sunny
ENG
15:21
28-07-2021

```python
import wiotp.sdk.device
import time
import random
myConfig = {
    "identity": {
        "orgId": "kj14w7",
        "typeId": "VITElectrical",
        "deviceId":"89510"
    },
    "auth": {
        "token": "128951045"
    }
}

def myCommandCallback(cmd):
    print("Message received from IBM IoT Platform: %s" % cmd.data['command'])
    m=cmd.data['command']
    print(m)
    if m == "MOTOR ON":
        print("MOTOR is on")
    elif m == "MOTOR OFF" :
        print("MOTOR is off")
    print()



client = wiotp.sdk.device.DeviceClient(config=myConfig, logHandlers=None)
client.connect()

while True:
    temp=random.randint(0,110)
    curr=random.randint(0,110)
    voll=random.randint(0,110)
    myData={'temperature':temp, 'current':curr, 'voltage':voll}
    client.publishEvent(eventId="DHT11", msgFormat="json", data=myData, qos=0, onPublish=None)
    print("Published data Successfully: %s", myData)
    client.commandCallback = myCommandCallback
    time.sleep(2)
client.disconnect()
```

Creating the AUTO-AI application

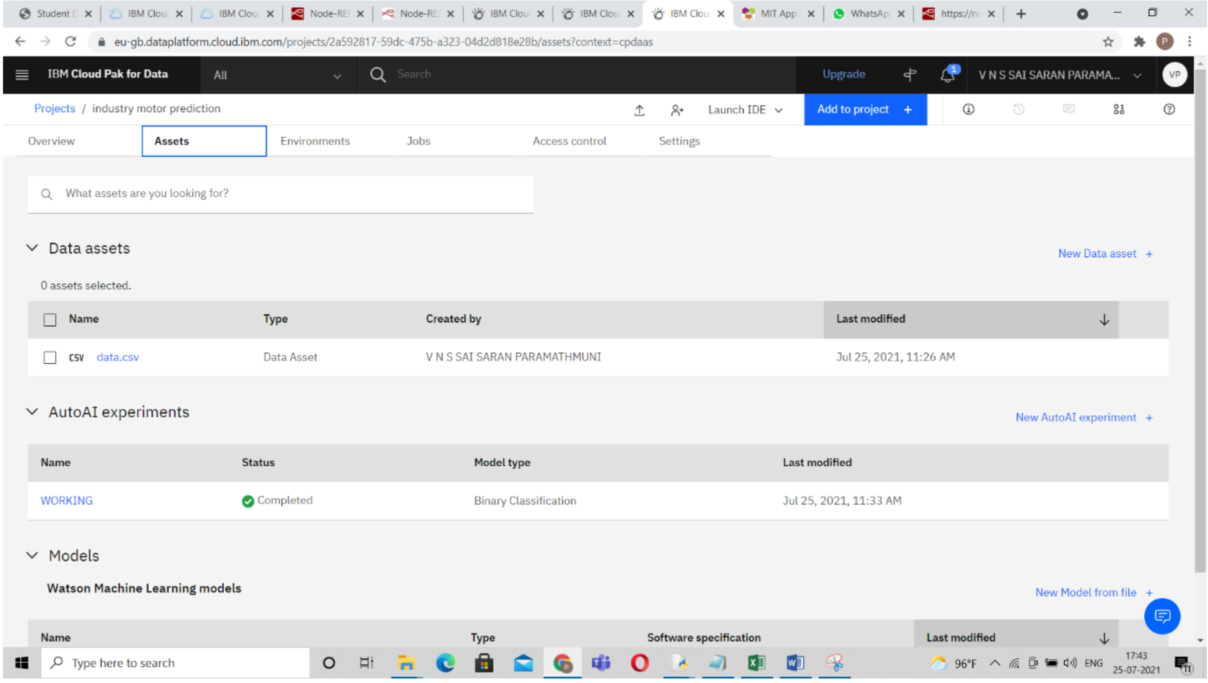
To get the application we need to add a dataset of the motor



D12 = 0

	A	B	C	D
1	Temperatu	Current	voltage	Outcome
2	6	72	35	1
3	1	66	29	0
4	8	64	0	1
5	1	66	23	0
6	0	40	35	1
7	5	74	0	0
8	3	50	32	1
9	10	0	0	0
10	2	70	45	1
11	8	96	0	1
12	4	92	0	0
13	10	74	0	1
14	10	80	0	0
15	1	60	23	1
16	5	72	19	1
17	7	0	0	1
18	0	84	47	1
19	7	74	0	1
20	1	30	38	0
21	1	70	30	1
22	3	88	41	0
23	8	84	0	0
24	7	90	0	1
25	9	80	35	1
26	11	94	33	1
27	10	70	26	1
28	7	76	0	1
29	1	66	15	0
30	13	82	19	0

After giving the data set we will get our ML page in IBM Cloud



eu-gb.dataplatform.cloud.ibm.com/projects/2a592817-59dc-475b-a323-04d2d818e28b/assets?context=cpdaas

Projects / industry motor prediction

Data assets

0 assets selected.

Name	Type	Created by	Last modified
data.csv	Data Asset	V N S SAI SARAN PARAMATHMUNI	Jul 25, 2021, 11:26 AM

AutoAI experiments

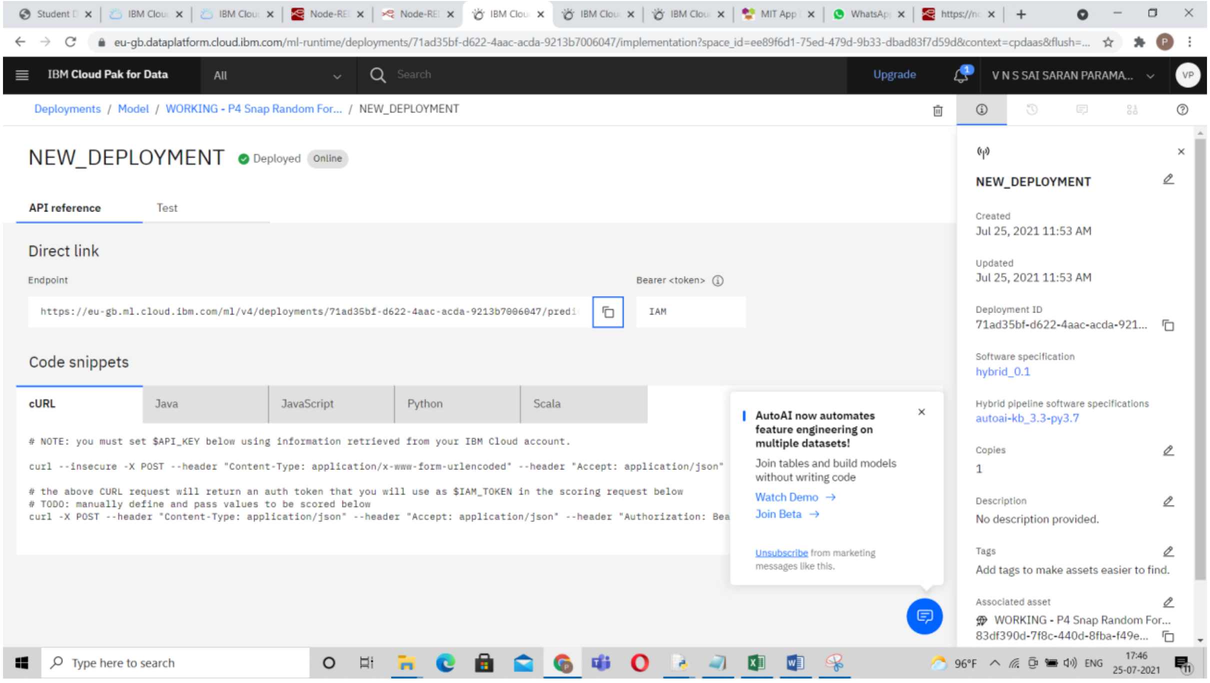
Name	Status	Model type	Last modified
WORKING	Completed	Binary Classification	Jul 25, 2021, 11:33 AM

Models

Watson Machine Learning models

Name	Type	Software specification	Last modified

We need to select the model from the created pipelines, after that we need to get the end point URL for the model which we have deployed



eu-gb.dataplatform.cloud.ibm.com/ml-runtime/deployments/71ad35bf-d622-4aac-acda-9213b7006047/implementation?space_id=ee89f6d1-75ed-479d-9b33-dbad83f7d59d&context=cpdaas&flush=...

IBM Cloud Pak for Data

Deployments / Model / WORKING - P4 Snap Random For... / NEW_DEPLOYMENT

NEW_DEPLOYMENT Deployed Online

API reference Test

Direct link

Endpoint

https://eu-gb.ml.cloud.ibm.com/ml/v4/deployments/71ad35bf-d622-4aac-acda-9213b7006047/predi

Bearer <token>

IAM

Code snippets

cURL Java JavaScript Python Scala

```
# NOTE: you must set $API_KEY below using information retrieved from your IBM Cloud account.

curl --insecure -X POST --header "Content-Type: application/x-www-form-urlencoded" --header "Accept: application/json"

# the above CURL request will return an auth token that you will use as $IAM_TOKEN in the scoring request below
# TODO: manually define and pass values to be scored below
curl -X POST --header "Content-Type: application/json" --header "Accept: application/json" --header "Authorization: Bea
```

AutoAI now automates feature engineering on multiple datasets!

Join tables and build models without writing code

Watch Demo →

Join Beta →

Unsubscribe from marketing messages like this.

NEW_DEPLOYMENT

Created
Jul 25, 2021 11:53 AM

Updated
Jul 25, 2021 11:53 AM

Deployment ID
71ad35bf-d622-4aac-acda-921...

Software specification
hybrid_0.1

Hybrid pipeline software specifications
autoai-kb_3.3-py3.7

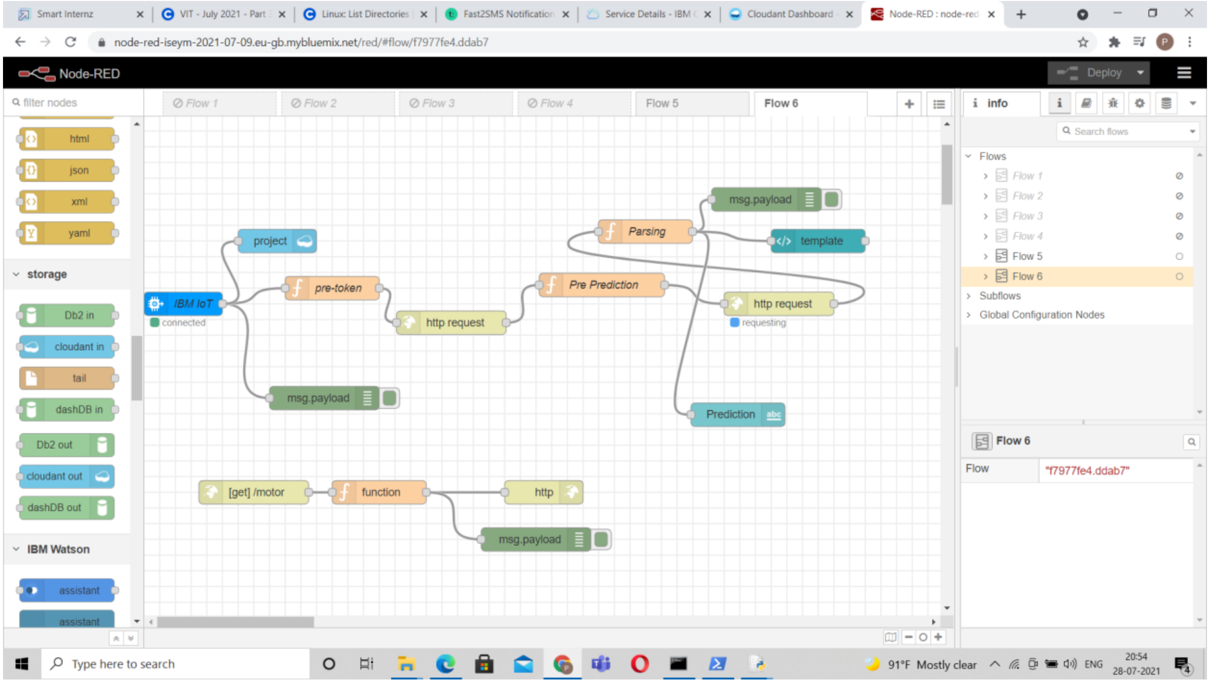
Copies
1

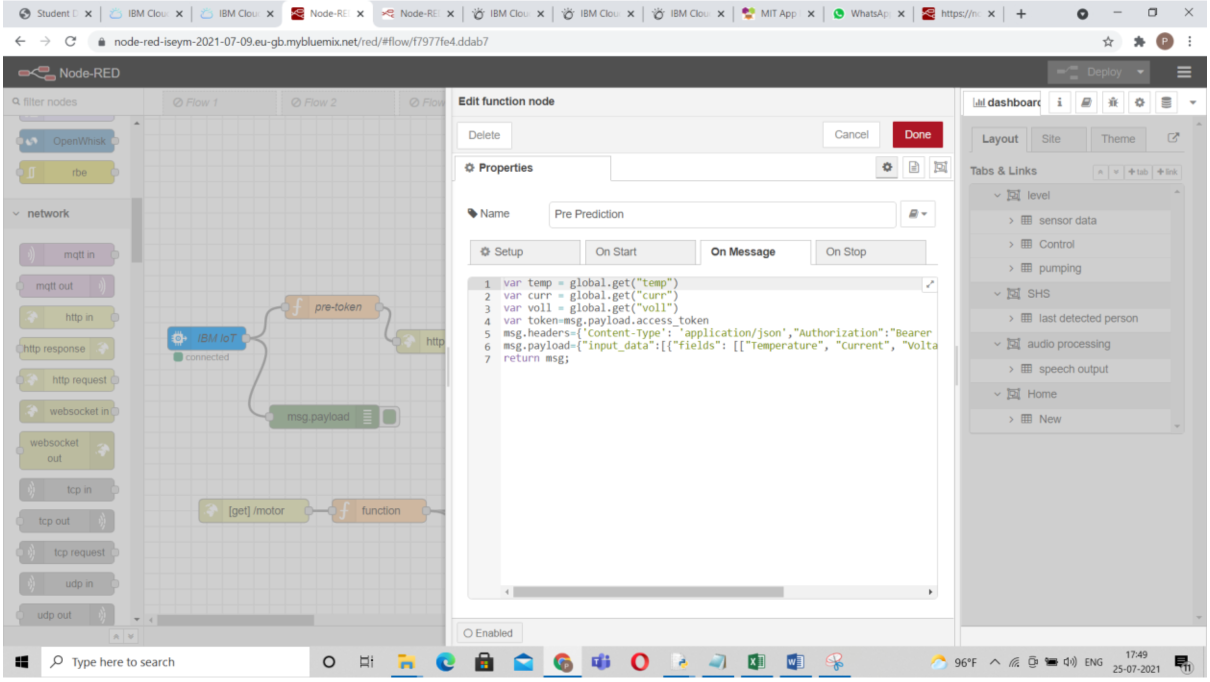
Description
No description provided.

Tags
Add tags to make assets easier to find.

Associated asset
WORKING - P4 Snap Random For...
83df390d-7f8c-440d-8fba-f49e...

To develop a node-red application we need to get an “JSON” file to run after getting that json file into the node red, just fill the required details which are needed





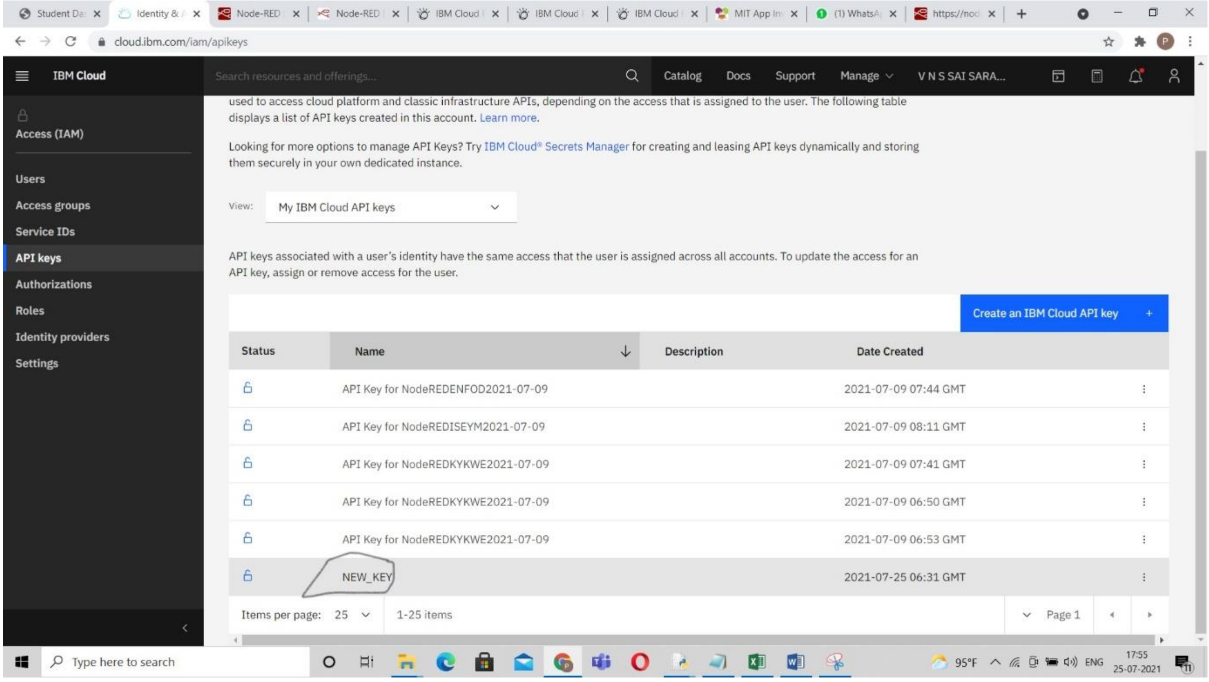
Edit function node

Name: Pre Prediction

Setup | On Start | On Message | On Stop

```
var temp = global.get("temp")
var curr = global.get("curr")
var voll = global.get("voll")
var token=msg.payload.access_token
msg.headers={'Content-Type': 'application/json',"Authorization":"Bearer
msg.payload={"input_data":[{"fields": [["Temperature", "Current", "Volta
return msg;
```

After setting the function we need to generate API-KEY



used to access cloud platform and classic infrastructure APIs, depending on the access that is assigned to the user. The following table displays a list of API keys created in this account. Learn more.

Looking for more options to manage API Keys? Try IBM Cloud® Secrets Manager for creating and leasing API keys dynamically and storing them securely in your own dedicated instance.

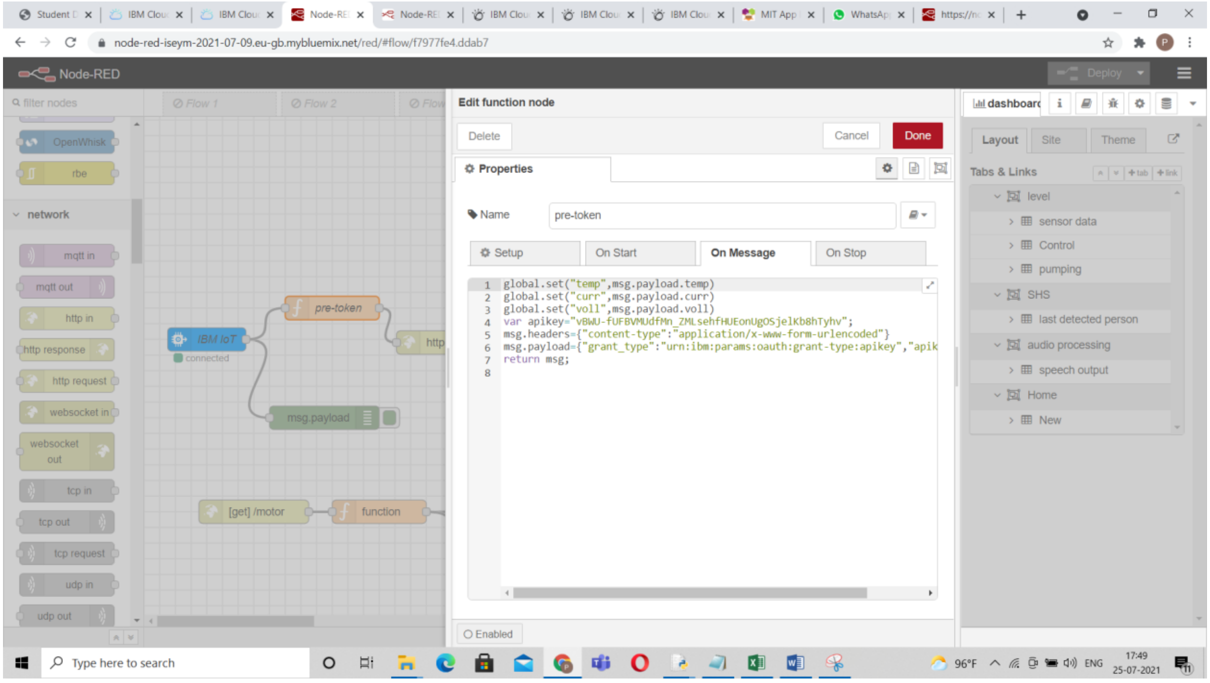
View: My IBM Cloud API keys

API keys associated with a user's identity have the same access that the user is assigned across all accounts. To update the access for an API key, assign or remove access for the user.

Status	Name	Description	Date Created
	API Key for NodeREDENFOD2021-07-09		2021-07-09 07:44 GMT
	API Key for NodeREDISEYM2021-07-09		2021-07-09 08:11 GMT
	API Key for NodeREDKYKWE2021-07-09		2021-07-09 07:41 GMT
	API Key for NodeREDKYKWE2021-07-09		2021-07-09 06:50 GMT
	API Key for NodeREDKYKWE2021-07-09		2021-07-09 06:53 GMT
	NEW_KEY		2021-07-25 06:31 GMT

Items per page: 25 1-25 items Page 1

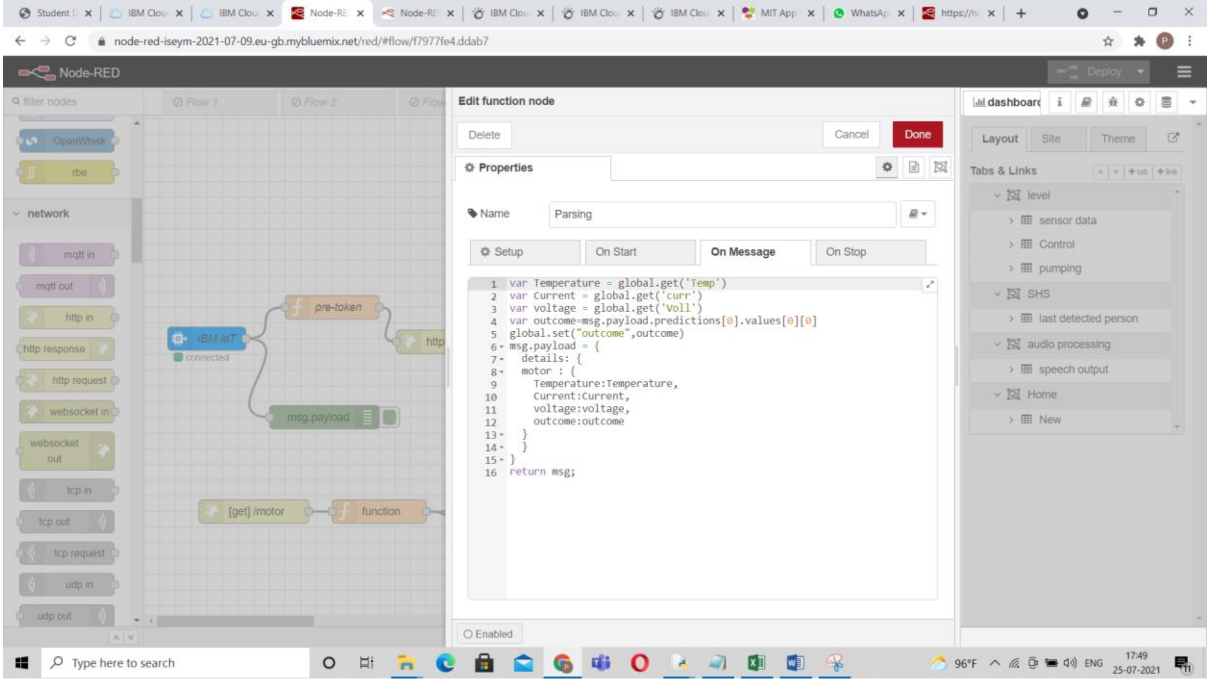
Giving that API-KEY in the function and create that function



Name: pre-token

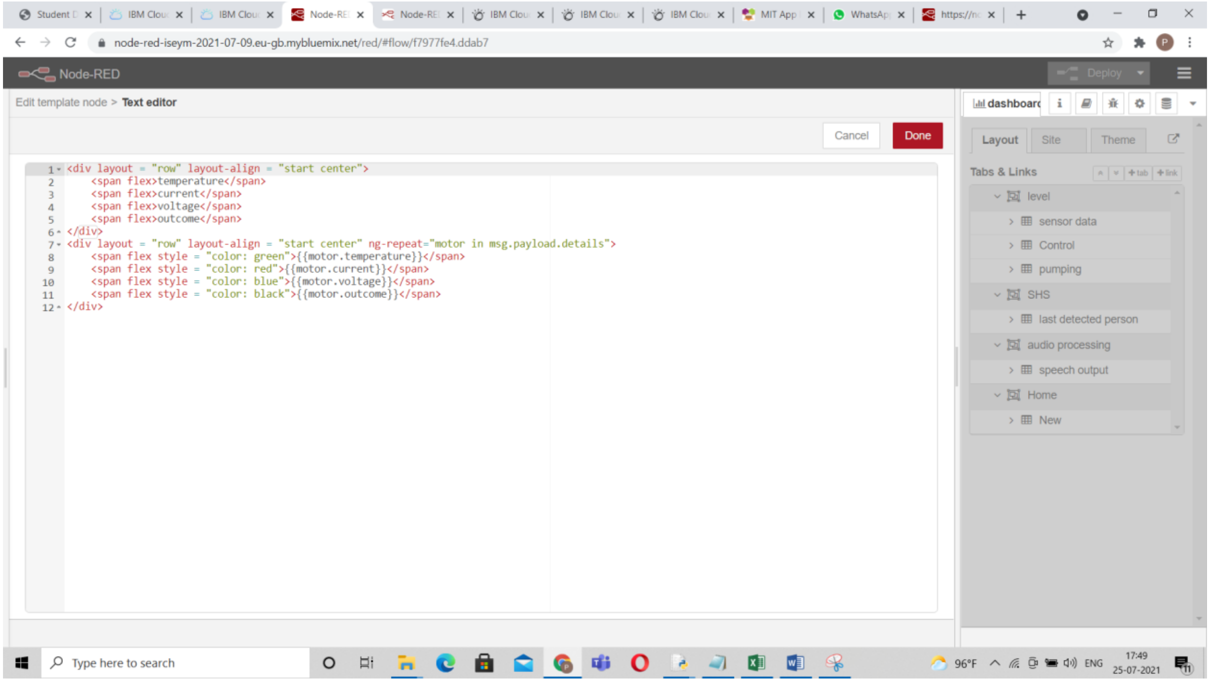
```
global.set("temp",msg.payload.temp)
global.set("curr",msg.payload.curr)
global.set("voll",msg.payload.voll)
var apikey="vBWU-fUFBVMUdfMn_ZMLsehfHUEonUgOSjelKb8hTyhv";
msg.headers={"content-type":"application/x-www-form-urlencoded"}
msg.payload={"grant_type":"urn:ibm:params:oauth:grant-type:apikey","apik
return msg;
```

Giving some commands in the functions:



Name: Parsing

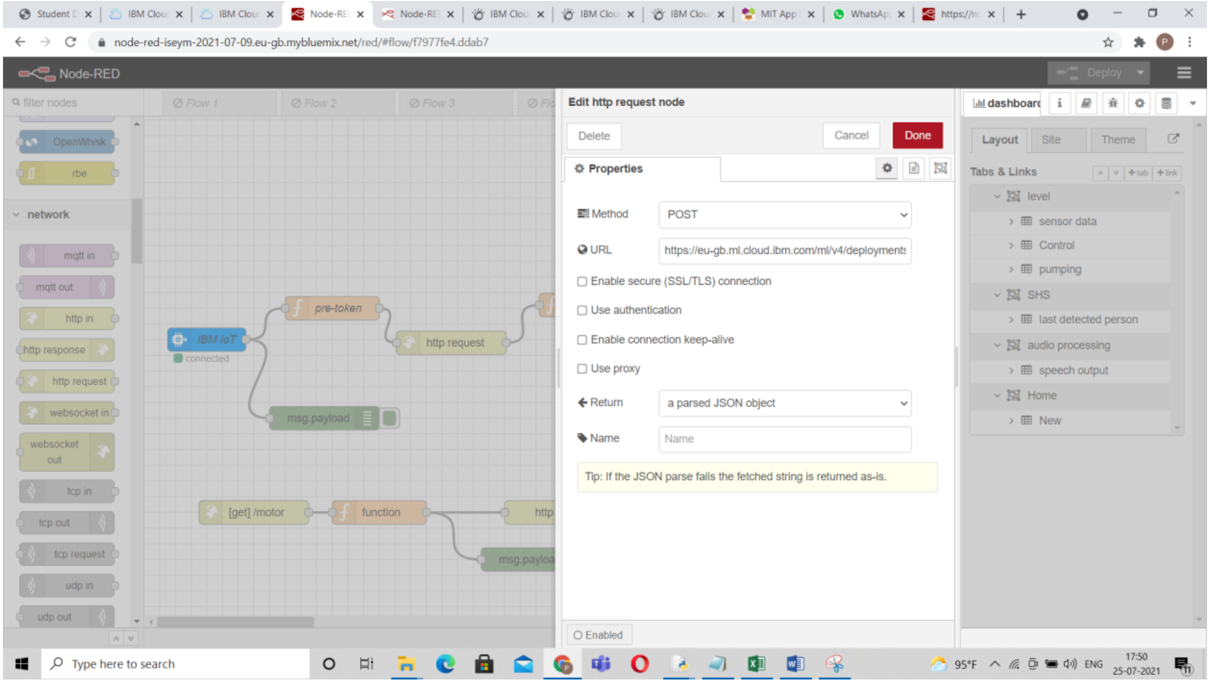
```
var Temperature = global.get('Temp')
var Current = global.get('curr')
var voltage = global.get('Voll')
var outcome=msg.payload.predictions[0].values[0][0]
global.set("outcome",outcome)
msg.payload = {
  details: {
  motor : {
    Temperature:Temperature,
    Current:Current,
    voltage:voltage,
    outcome:outcome
  }
  }
}
return msg;
```



Edit template node > Text editor

```
<div layout = "row" layout-align = "start center">
    <span flex>temperature</span>
    <span flex>current</span>
    <span flex>voltage</span>
    <span flex>outcome</span>
</div>
<div layout = "row" layout-align = "start center" ng-repeat="motor in msg.payload.details">
    <span flex style = "color: green">{{motor.temperature}}</span>
    <span flex style = "color: red">{{motor.current}}</span>
    <span flex style = "color: blue">{{motor.voltage}}</span>
    <span flex style = "color: black">{{motor.outcome}}</span>
</div>
```

We need to give that end point URL at the one http request node



Edit http request node

Method: POST

URL: https://eu-gb.ml.cloud.ibm.com/ml/v4/deployments

☐ Enable secure (SSL/TLS) connection

☐ Use authentication

☐ Enable connection keep-alive

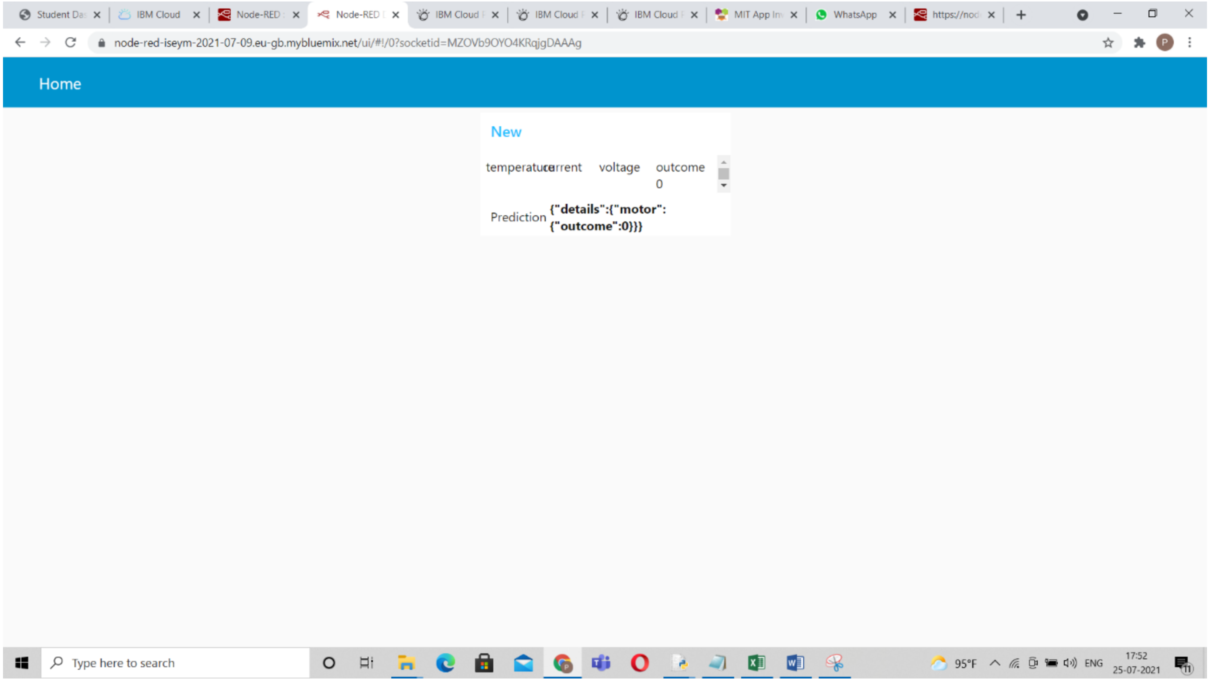
☐ Use proxy

Return: a parsed JSON object

Name: Name

Tip: If the JSON parse fails the fetched string is returned as-is.

Before deploying the schematic we need to run the python code and after that deploy the schematic we need to view (user interface) the web view of the application

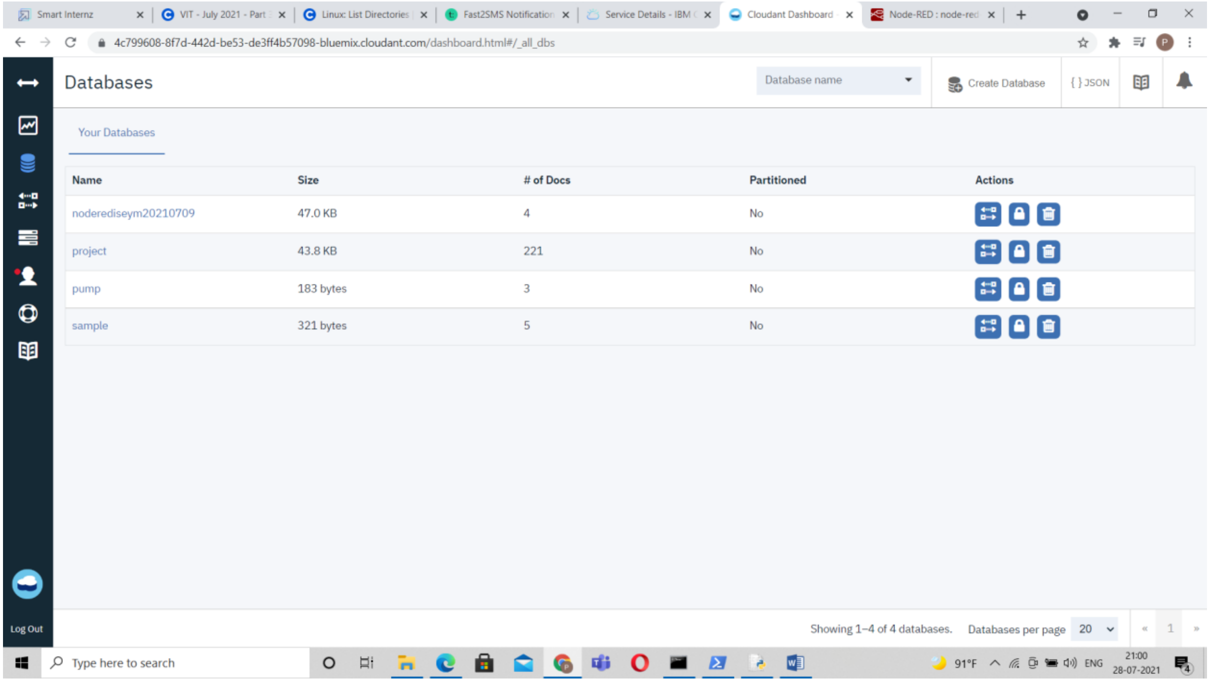

node-red-iseym-2021-07-09.eu-gb.mybluemix.net/ui/#!/0?socketid=MZOVb9OYO4KRqjgDAAAg
Home
New

temperaturecurrent voltage outcome
0

Prediction {"details":{"motor":{"outcome":0}}}

Type here to search
95°F
ENG
17:52
25-07-2021

Here we can view our data in the cloudant DB

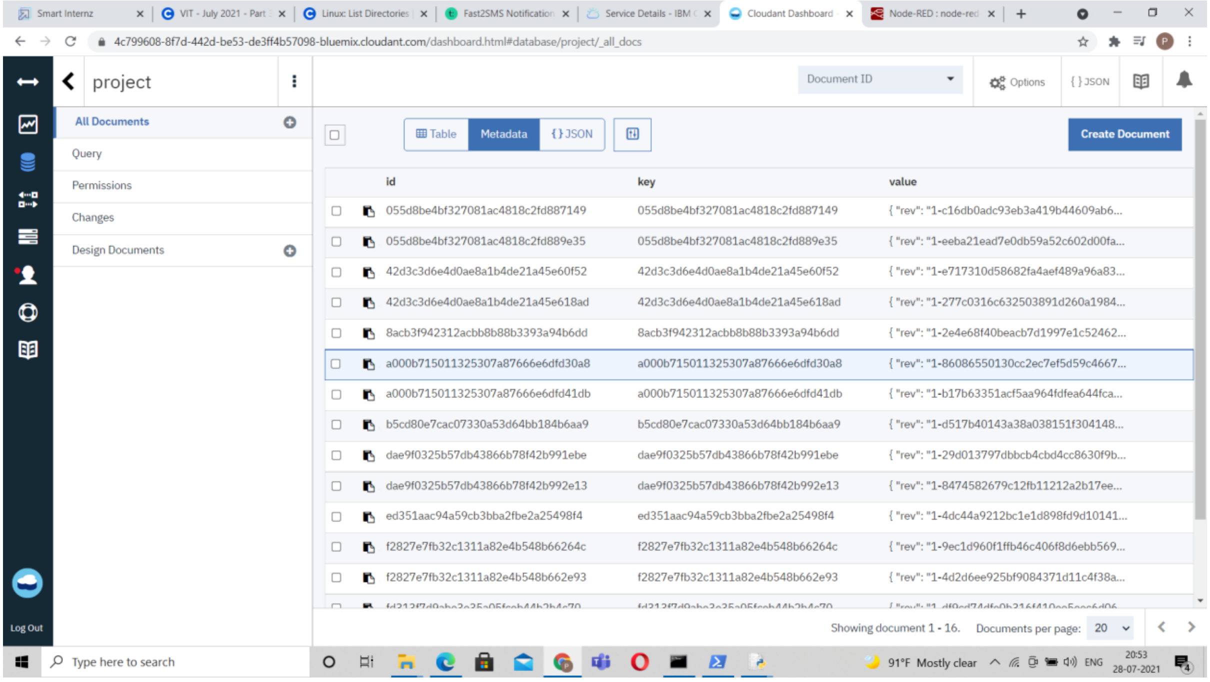

4c799608-8f7d-442d-be53-de3ff4b57098-bluemix.cloudant.com/dashboard.html#/_all_dbs
Databases
Database name
Create Database
{ } JSON
Your Databases
Log Out

Name	Size	# of Docs	Partitioned	Actions
noderediseym20210709	47.0 KB	4	No	
project	43.8 KB	221	No	
pump	183 bytes	3	No	
sample	321 bytes	5	No	

Showing 1–4 of 4 databases. Databases per page 20

We have created the database with a name called: “project”

Giving this name in the cloudant out; we can view the data in that cloudant database



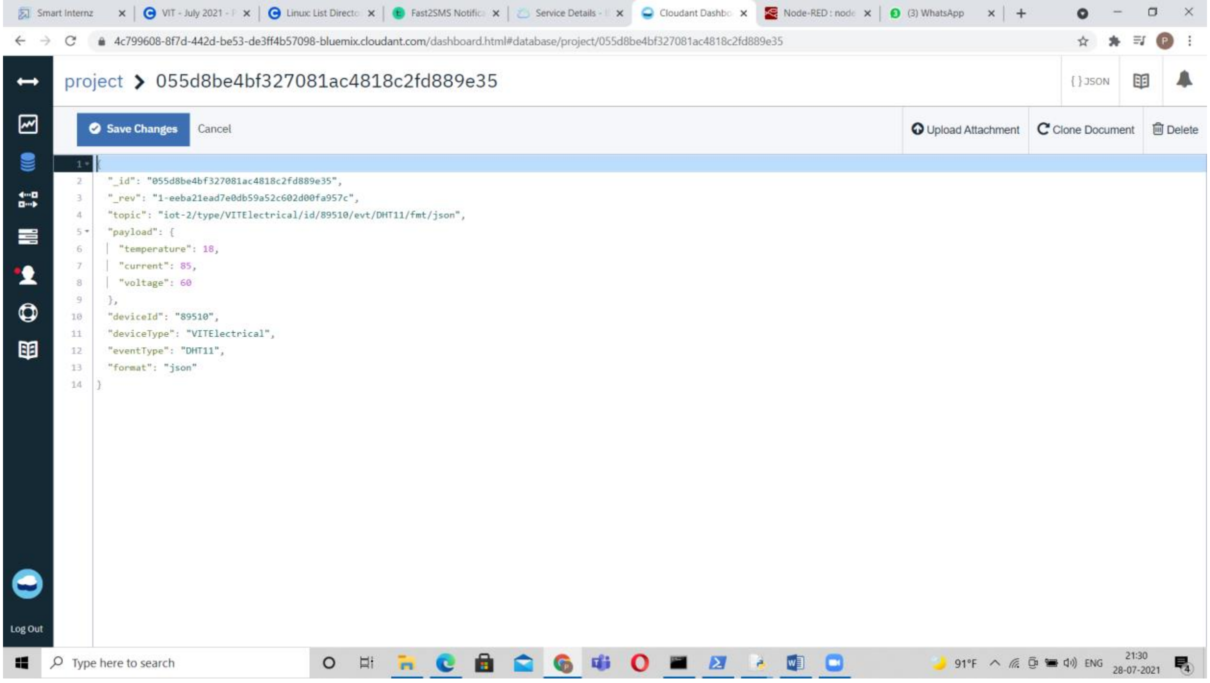
4c799608-8f7d-442d-be53-de3ff4b57098-bluemix.cloudant.com/dashboard.html#database/project/_all_docs

project

	id	key	value
□	055d8be4bf327081ac4818c2fd887149	055d8be4bf327081ac4818c2fd887149	{ "rev": "1-c16db0adc93eb3a419b44609ab6...
□	055d8be4bf327081ac4818c2fd889e35	055d8be4bf327081ac4818c2fd889e35	{ "rev": "1-eeba21ead7e0db59a52c602d00fa...
□	42d3c3d6e4d0ae8a1b4de21a45e60f52	42d3c3d6e4d0ae8a1b4de21a45e60f52	{ "rev": "1-e717310d58682fa4aef489a96a83...
□	42d3c3d6e4d0ae8a1b4de21a45e618ad	42d3c3d6e4d0ae8a1b4de21a45e618ad	{ "rev": "1-277c0316c632503891d260a1984...
□	8acb3f942312acbb8b88b3393a94b6dd	8acb3f942312acbb8b88b3393a94b6dd	{ "rev": "1-2e4e68f40beacb7d1997e1c52462...
□	a000b715011325307a87666e6dfd30a8	a000b715011325307a87666e6dfd30a8	{ "rev": "1-86086550130cc2ec7ef5d59c4667...
□	a000b715011325307a87666e6dfd41db	a000b715011325307a87666e6dfd41db	{ "rev": "1-b17b63351acf5aa964fdfea644fca...
□	b5cd80e7cac07330a53d64bb184b6aa9	b5cd80e7cac07330a53d64bb184b6aa9	{ "rev": "1-d517b40143a38a038151f304148...
□	dae9f0325b57db43866b78f42b991ebe	dae9f0325b57db43866b78f42b991ebe	{ "rev": "1-29d013797dbbcb4cbd4cc8630f9b...
□	dae9f0325b57db43866b78f42b992e13	dae9f0325b57db43866b78f42b992e13	{ "rev": "1-8474582679c12fb11212a2b17ee...
□	ed351aac94a59cb3bba2fbe2a25498f4	ed351aac94a59cb3bba2fbe2a25498f4	{ "rev": "1-4dc44a9212bc1e1d898fd9d10141...
□	f2827e7fb32c1311a82e4b548b66264c	f2827e7fb32c1311a82e4b548b66264c	{ "rev": "1-9ec1d960f1ffb46c406f8d6ebb569...
□	f2827e7fb32c1311a82e4b548b662e93	f2827e7fb32c1311a82e4b548b662e93	{ "rev": "1-4d2d6ee925bf9084371d11c4f38a...
□	fd213f7d9abe3e35a05feeb44b2b4c70	fd213f7d9abe3e35a05feeb44b2b4c70	{ "rev": "1-df9cd74dfe0b316f410ee5eec6d06...

Showing document 1 - 16. Documents per page: 20

Here the values are hitting for every second so we can see many values

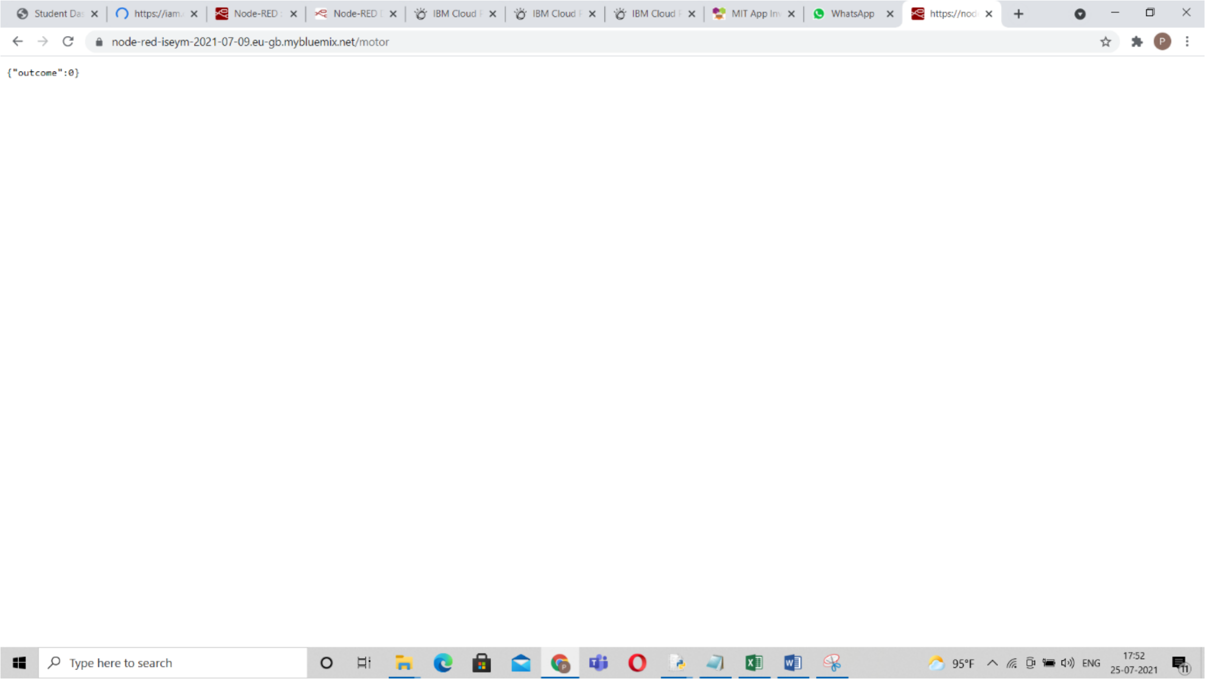


4c799608-8f7d-442d-be53-de3ff4b57098-bluemix.cloudant.com/dashboard.html#database/project/055d8be4bf327081ac4818c2fd889e35

project > 055d8be4bf327081ac4818c2fd889e35

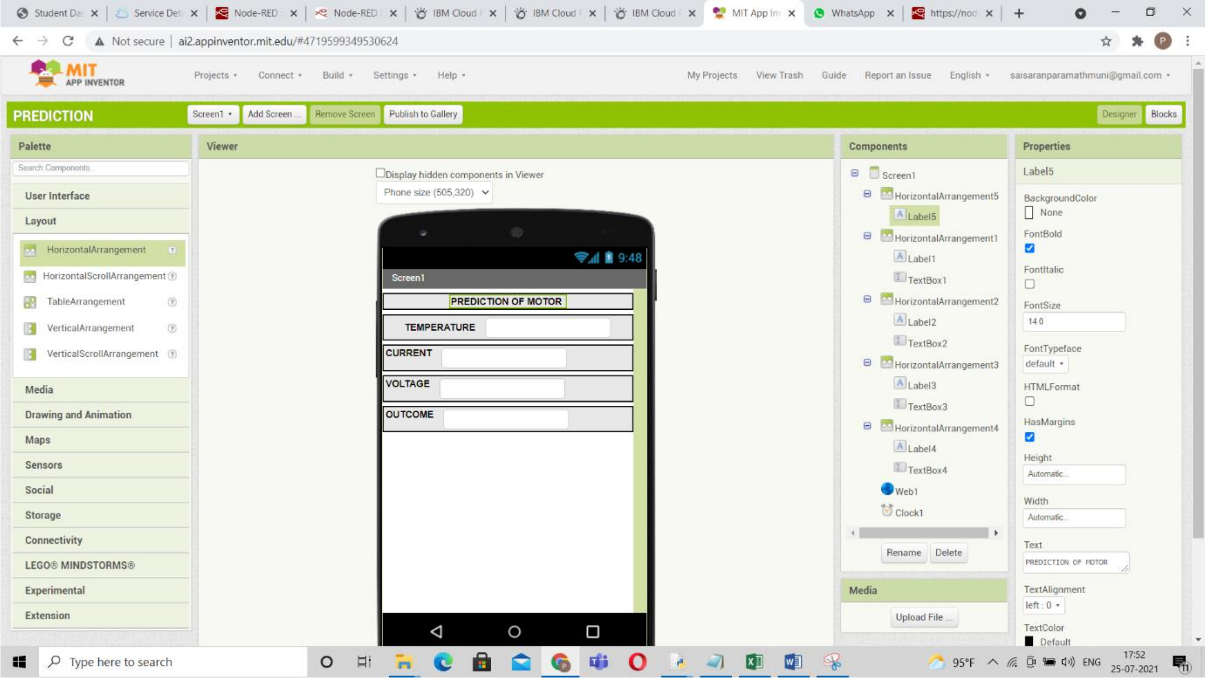
```
{
  "_id": "055d8be4bf327081ac4818c2fd889e35",
  "_rev": "1-eeba21ead7e0db59a52c602d00fa957c",
  "topic": "iot-2/type/VITElectrical/id/89510/evt/DHT11/fmt/json",
  "payload": {
    "temperature": 18,
    "current": 85,
    "voltage": 60
  },
  "deviceId": "89510",
  "deviceType": "VITElectrical",
  "eventType": "DHT11",
  "format": "json"
}
```

After setting this we need to develop for the app view for that we need get some connections with the same “http/in “ & “http/response” node with including some functions and to develop an app we are using the help of MIT APP INVERTER



node-red-iseym-2021-07-09.eu-gb.mybluemix.net/motor

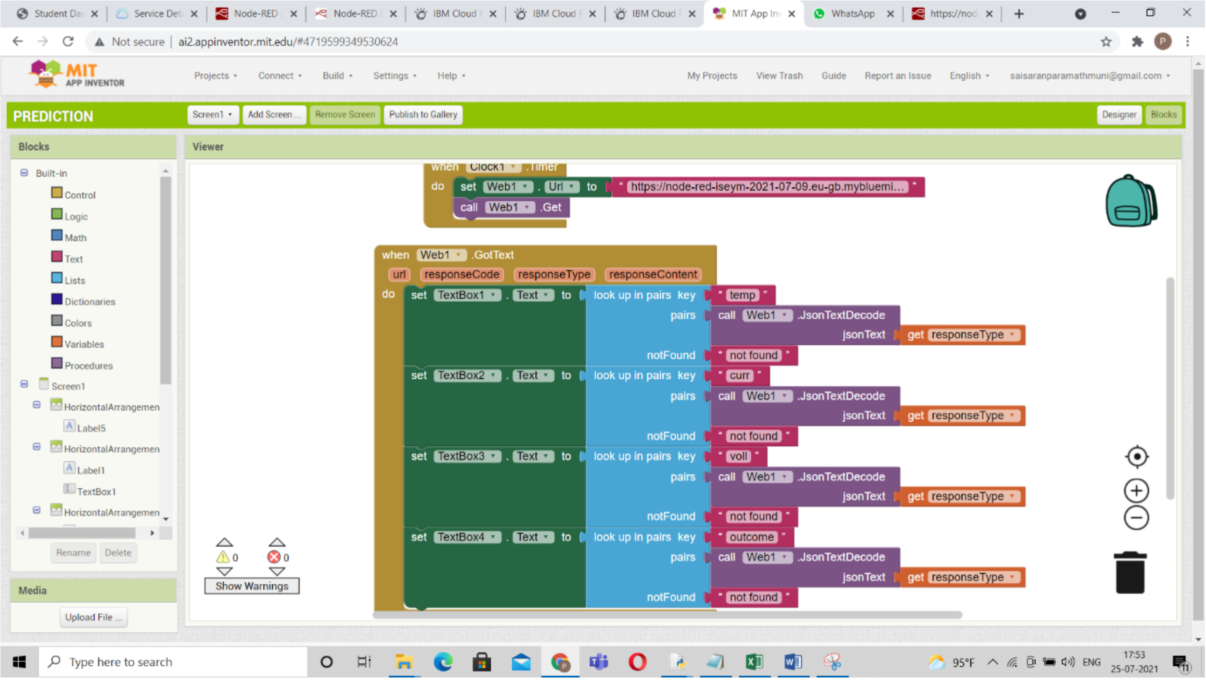
```
{"outcome":0}
```



ai2.appinventor.mit.edu/#4719599349530624

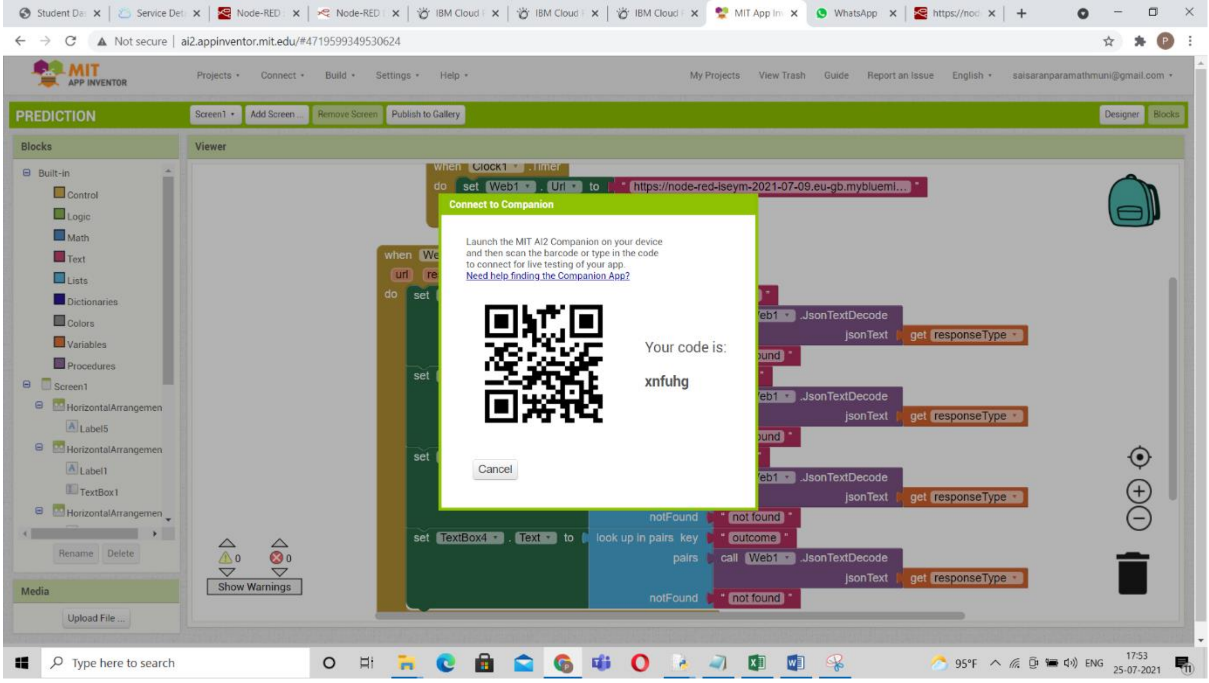
Components: Screen1, HorizontalArrangement5, Label5, HorizontalArrangement1, Label1, TextBox1, HorizontalArrangement2, Label2, TextBox2, HorizontalArrangement3, Label3, TextBox3, HorizontalArrangement4, Label4, TextBox4, Web1, Clock1

Properties: Label5
BackgroundColor: None
FontBold: ☑
FontItalic: □
FontSize: 14.0
FontTypeface: default
HTMLFormat: □
HasMargins: ☑
Height: Automatic...
Width: Automatic...
Text: PREDICTION OF MOTOR
TextAlignment: left : 0
TextColor: Default



```
when Clock1 .Timer
do  set Web1 . Url to "https://node-red-iseym-2021-07-09.eu-gb.mybluemi..."
    call Web1 .Get

when Web1 .GotText
  url  responseCode  responseType  responseContent
do  set TextBox1 . Text to  look up in pairs  key "temp"
                                              pairs  call Web1 .JsonTextDecode
                                                          jsonText  get responseType
                                              notFound "not found"
    set TextBox2 . Text to  look up in pairs  key "curr"
                                              pairs  call Web1 .JsonTextDecode
                                                          jsonText  get responseType
                                              notFound "not found"
    set TextBox3 . Text to  look up in pairs  key "volt"
                                              pairs  call Web1 .JsonTextDecode
                                                          jsonText  get responseType
                                              notFound "not found"
    set TextBox4 . Text to  look up in pairs  key "outcome"
                                              pairs  call Web1 .JsonTextDecode
                                                          jsonText  get responseType
                                              notFound "not found"
```

After creating the interface and back-end of the app we need to scan and view it in the app in the phone



Connect to Companion

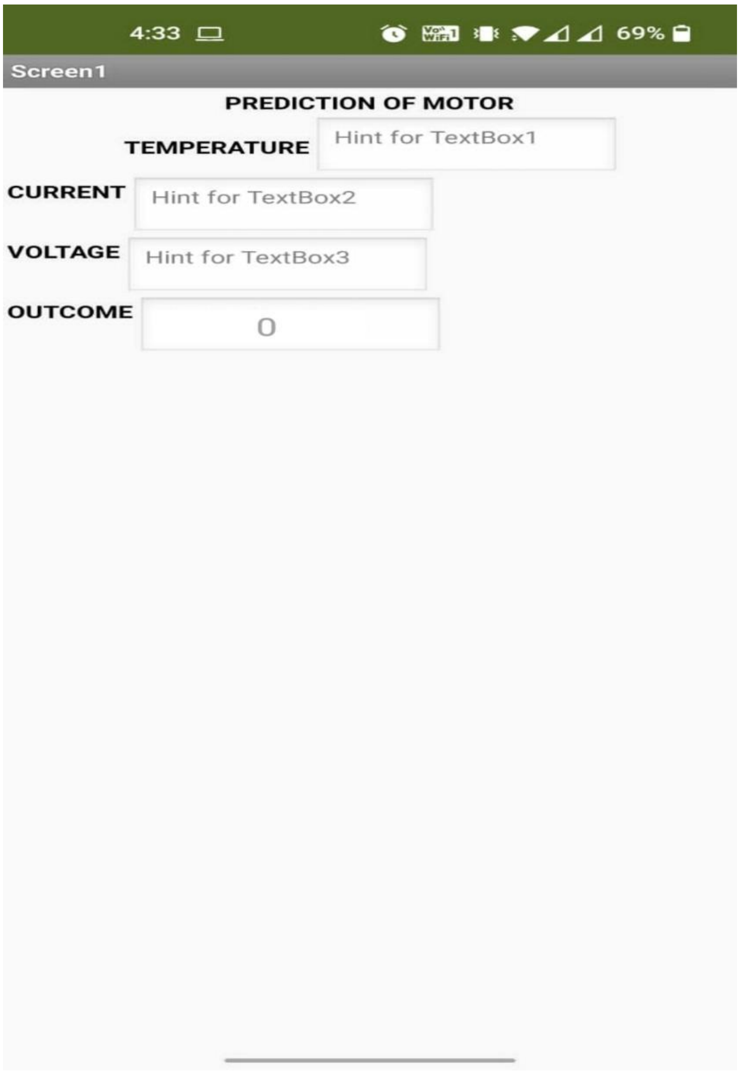
Launch the MIT AI2 Companion on your device and then scan the barcode or type in the code to connect for live testing of your app.
Need help finding the Companion App?

Your code is:

xnfuhg

Cancel

https://github.com/gnaneshwarbandari/IOT/blob/main/ibm_code.p



Screen1

PREDICTION OF MOTOR

TEMPERATURE Hint for TextBox1

CURRENT Hint for TextBox2

VOLTAGE Hint for TextBox3

OUTCOME 0

The user will have a connection to this app so he can view it

ADVANTAGES & DISADVANTAGES:

Reduction in maintenance costs

Reduction in machine failures

Life time of service parts will increase

Safety operator

Increases investment in diagnostic equipment

Savings potential is readily seen by management

Increases investment in staff training

CONCLUSION:

This project is mainly focused on the problem of carrying out predictive maintenance in a industrial motors and presented the results of the preliminary data analysis and feature selection that were performed on a sample of the collected data sheet. The derived data from IOT device gives the status of industrial motors about temperature, current & voltage from the equipment is continuously monitored to avoid any short circuits and line breakage. So predictive maintenance of industrial motors plays a major roll in maintaining it. In order to reduce the risk factor in this the process has to be carefully planned and carried out by well trained workers

0 – it won’t work

1 – it will work

BIBLIOGRAPHY:

Smart bridge lecture videos

IBM platform videos

https://drive.google.com/file/d/1W4skAVwWkVhKBbSMAMXtnrvP6MbdqvtG/view?usp=sharing

https://drive.google.com/file/d/1tX2MhuhqvMfHpirDlRhpSODV1gFtXqL9/view?usp=sharing

https://drive.google.com/file/d/1oL_KpIKNeSuwVNnsJhQ6rgY3MlRogHvS/view?usp=sharing

SOURCE CODE:

https://github.com/gnaneshwarbandari/IOT/blob/main/ibm_code.py