SMART AGRICULTURE SYSTEM BASED ON IOT

PROJECT REPORT

Contents:

1.INTRODUCTION:

1.1 Overview

- Smart Agriculture System based on IoT can monitor soil moisture and climatic conditions to grow and yield a good crop.
- The farmer can also get the realtime weather forecasting data by using external platforms like Open Weather API.
- Farmer is provided a mobile app using which he can monitor the temperature,humidity and soil moisture parameters along with weather forecasting data.

- Based on all the parameters he can water his crop by controlling the motors using the mobile application.

- Even if the farmer is not present near his crop he can water his crop by controlling the motors using the mobile application

- Here we are using the Online IoT simulator for getting the Temperature,Humidity and Soil Moisture values.

- The farmer can get the weather forecasting data by external platforms like open weather API.By using IBM cloud platform we will perform all the required activities.This platform will provide us simulators that enable the users to represent the test phenomena likely to occur in actual performance.

- From the IBM cloud platform we will connect the we will connect the IOT Simulator to the IBM watson IOT platform.This platform enables us to create a new device and we use Node-Red programming tool for wiring together hardware devices,API's and online services.

- We need to build a web application by using IBM cloud services in such a way that the farmer can access his motor through his mobile and also he gets the information about the weather conditions in his field.

1.2 Purpose

- With the rapid growth in world population, food consumption worldwide also grows rapidly. A rapid escalation in food production to cater to the growing demand is not an easy task. Agriculture being the oldest industry has evolved so far to the age of what can now be termed as The Third Green Revolution. Modern Information and Communication Technologies are implemented into agriculture, in order to deliver a sustainable agricultural production.

- By using this smart agriculture farmers can be benefited a lot as there is no use of going to farm everytime.With the help of mobile application farmer can operate his motor from his home comfortably.We are using IOT simulator to get the temperature,humidity and soil moisture.

2.LITERATURE SURVEY:

2.1 Existing problem

- Farmers are facing problem to yield the crops,as they have to visit farms frequently to check the crops and for watering them,even in hot summers they have to visit farms for taking care of their fields.

- So we need to design Smart Agriculture System based on IoT that can monitor soil moisture and climatic conditions to grow and yield a good crop.

- The farmer can also get the realtime weather forecasting data by using external platforms like Open Weather API.

- Based on all the parameters he can water his crop by controlling the motors using the mobile application.
- Even if the farmer is not present near his crop he can water his crop by controlling the motors using the mobile application from anywhere.

2.2 Proposed Solution

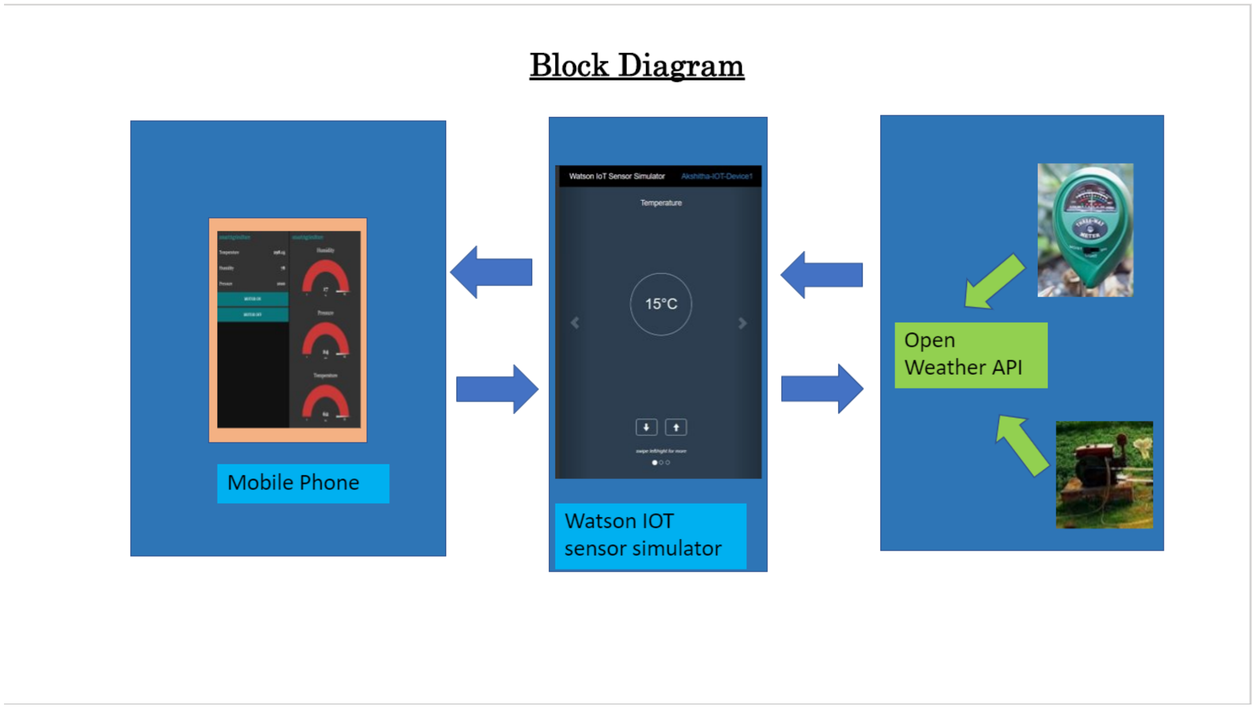
- We need to create a device using IBM Watson IOT platform and IOT sensor is also available in IOT platform to sense the weather conditions.

- In Node-Red we have to create required nodes and develop a web UI which is easily accessible to farmers.

- Next we need to write a python code and configure our device to receive the data from the webapplication and control our motors and then we are done with our project.

3.THEORETICAL ANALYSIS

3.1 Block Diagram

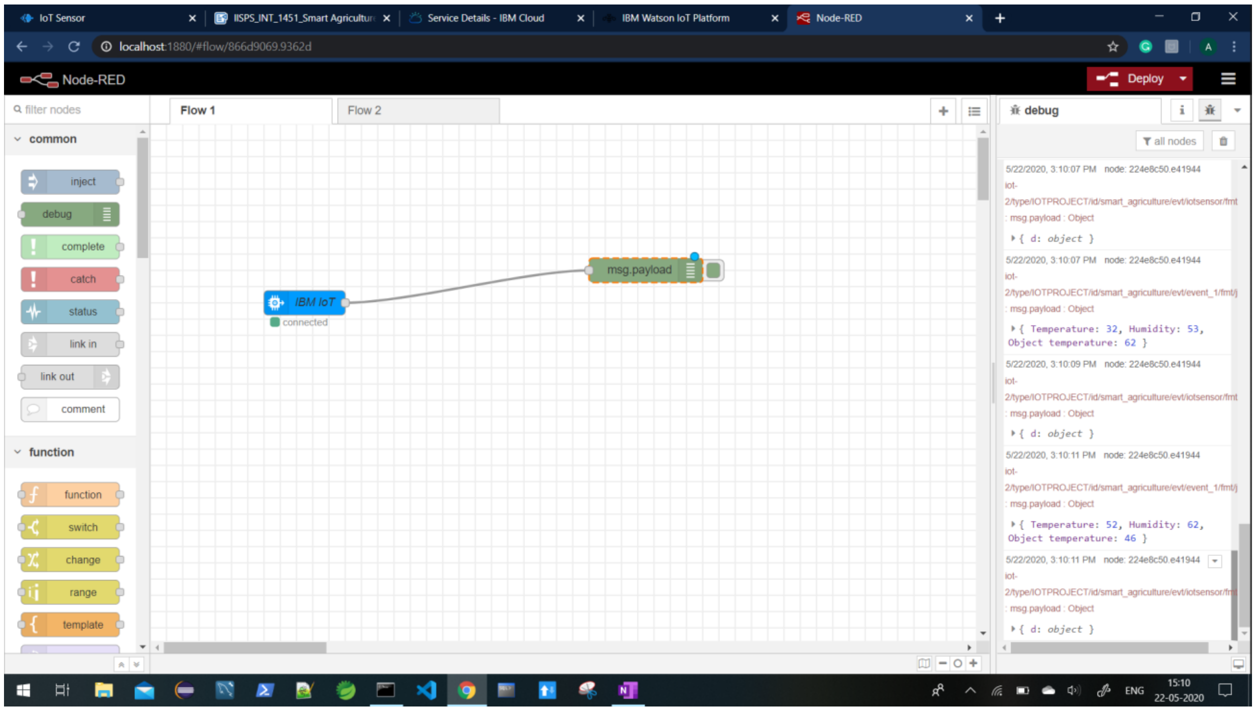


3.2 Required Software Installation

3.2 (A)Node Red

Node-Red is a flow based development tool for visual programming developed originally by IBM wiring together hardware devices,API's and online services as part of Internet of Things.

Node-Red provides a web browser based flow editor,which can be used to create javascript functions.



```
5/22/2020, 3:10:07 PM   node: 224e8c50.e41944
iot-2/type/IOTPROJECT/id/smart_agriculture/evt/iotsensor/fmt
: msg.payload : Object
▸{ d: object }
5/22/2020, 3:10:07 PM   node: 224e8c50.e41944
iot-2/type/IOTPROJECT/id/smart_agriculture/evt/event_1/fmt/j
: msg.payload : Object
▸{ Temperature: 32, Humidity: 53,
Object temperature: 62 }
5/22/2020, 3:10:09 PM   node: 224e8c50.e41944
iot-2/type/IOTPROJECT/id/smart_agriculture/evt/iotsensor/fmt
: msg.payload : Object
▸{ d: object }
5/22/2020, 3:10:11 PM   node: 224e8c50.e41944
iot-2/type/IOTPROJECT/id/smart_agriculture/evt/event_1/fmt/j
: msg.payload : Object
▸{ Temperature: 52, Humidity: 62,
Object temperature: 46 }
5/22/2020, 3:10:11 PM   node: 224e8c50.e41944
iot-2/type/IOTPROJECT/id/smart_agriculture/evt/iotsensor/fm
: msg.payload : Object
▸{ d: object }
```

Installation:

- First install the the Node js.
- open command prompt
- Type ->npm install node-red

To Run the application:

- open command prompt
- And then type "node-red"
- Now open http://localhost:1880/ in browser

Installation of IBM IOT nodes and Dashboard nodes for Node-Red

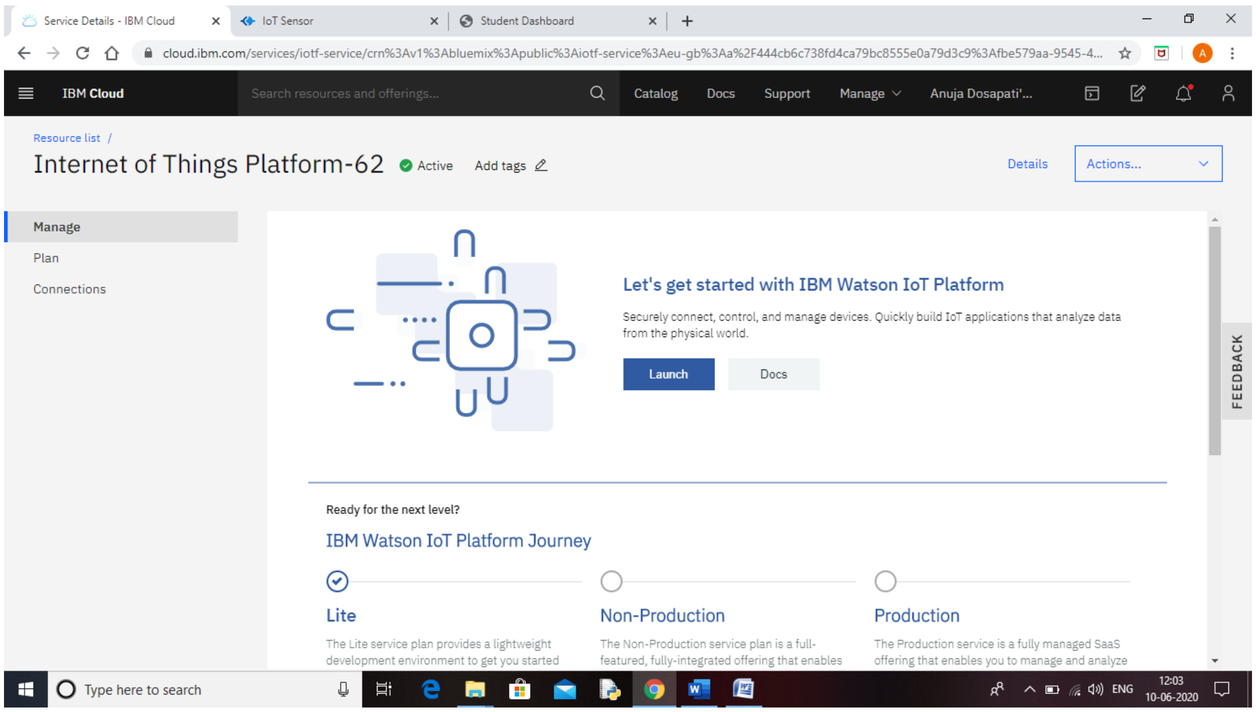
- In order to connect to IBM Watson IOT platform and create the web UI these nodes are required

1. IBM IOT Node.

2. Dash Board Node.

3.2(B) IBM Watson IOT Platform

- A fully managed cloud hosted service with capabilities for device registration, connectivity, control, rapid visualization and datastorage,IBM Watson IOT is a managed,cloud-hosted service designed to make it simple to derive value from your IOT devices.


Service Details - IBM Cloud
IoT Sensor
Student Dashboard
cloud.ibm.com/services/iotf-service/crn%3Av1%3Abluemix%3Apublic%3Aiotf-service%3Aeu-gb%3Aa%2F444cb6c738fd4ca79bc8555e0a79d3c9%3Afbe579aa-9545-4...
IBM Cloud
Search resources and offerings...
Catalog
Docs
Support
Manage
Anuja Dosapati'...
Resource list /
Internet of Things Platform-62
Active
Add tags
Details
Actions...
Manage
Plan
Connections
Launch
Docs
FEEDBACK
Type here to search
ENG
12:03
10-06-2020

Let's get started with IBM Watson IoT Platform

Securely connect, control, and manage devices. Quickly build IoT applications that analyze data from the physical world.

Ready for the next level?

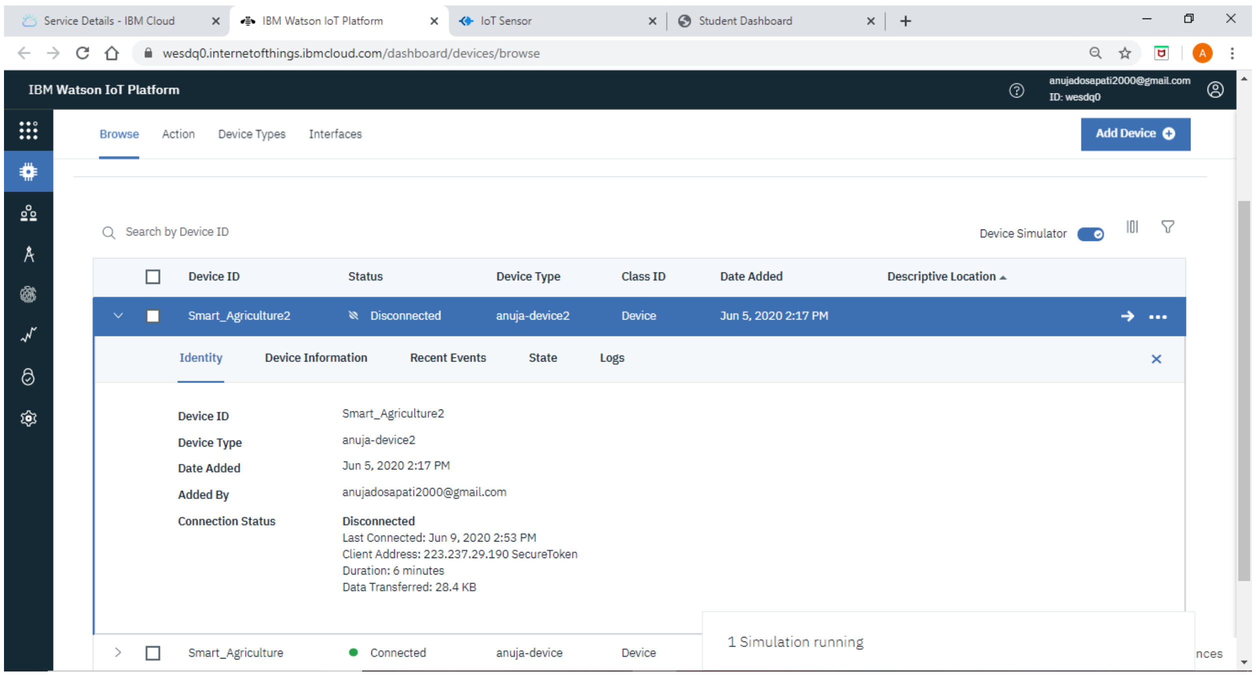
IBM Watson IoT Platform Journey

Lite
The Lite service plan provides a lightweight development environment to get you started

Non-Production
The Non-Production service plan is a full-featured, fully-integrated offering that enables

Production
The Production service is a fully managed SaaS offering that enables you to manage and analyze

- Steps To Configure:
- Create an account in IBM cloud using your email ID
- Create IBM Watson Platform in services in your IBM cloud account
- Launch the IBM Watson Iot Platform
- Create a new device
- Give credentials like device type, device ID, Auth. Token
- Create API key and store API key and token elsewhere



	Device ID	Status	Device Type	Class ID	Date Added	Descriptive Location
	Smart_Agriculture2	Disconnected	anuja-device2	Device	Jun 5, 2020 2:17 PM	
	Smart_Agriculture	Connected	anuja-device	Device		

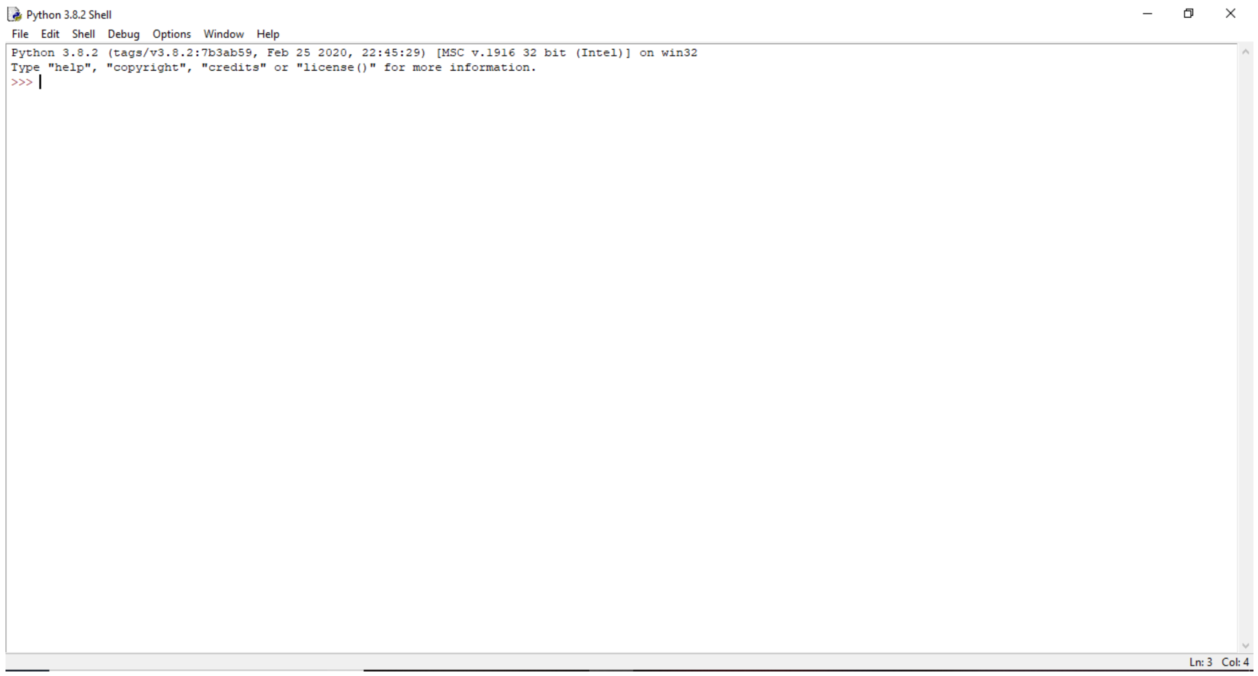
Device ID	Smart_Agriculture2
Device Type	anuja-device2
Date Added	Jun 5, 2020 2:17 PM
Added By	anujadosapati2000@gmail.com
Connection Status	Disconnected Last Connected: Jun 9, 2020 2:53 PM Client Address: 223.237.29.190 SecureToken Duration: 6 minutes Data Transferred: 28.4 KB

<u>3.2 (C) Python IDE</u>

- Install python 3 Compiler
- I Installed PyCharm Community Edition 2020

<u>3.3 IOT Simulator</u>

- In our project in the place of sensors we are going to use IoT sensor simulator which give random readings to the connected cloud.



```
Python 3.8.2 (tags/v3.8.2:7b3ab59, Feb 25 2020, 22:45:29) [MSC v.1916 32 bit (Intel)] on win32
Type "help", "copyright", "credits" or "license()" for more information.
>>> 
```

- The link to simulator: https://watson-iot-sensor-simulator.mybluemix.net/
- We need to give the credentials of the created device in IBM Watson lot Platform to connect cloud to simulator.

3.4 OpenWeather API

- OpenWeatherMap is an online service that provides weather data. It provides current weather data,forecasts and historical data to more than 2 million customer.
- Website link: https://openweathermap.org/guideSteps to configure:
- Create account in OpenWeather
- Find the name of your city by searching
- Create API key to your account
- Replace "city name” and “your api key" with your city and API key in below text

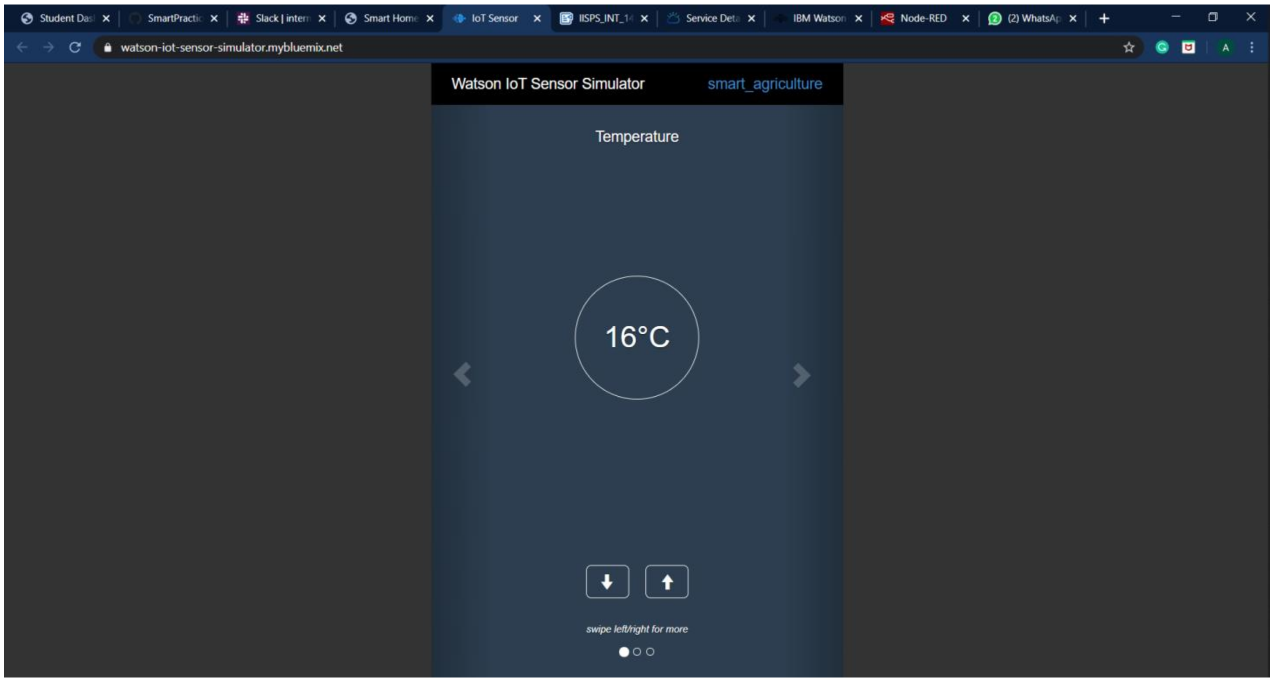
api.openweathermap.org/data/2.5/weather?q={city name}&appid={your api key}

- Link I used in my project:
- http://api.openweathermap.org/data/2.5/forecast?q=Hyderabad,IN&appid=8a08849b0607450809f12a6855f2e9ac
- The below link is for getting weather Forecasting data:
- http://api.openweathermap.org/data/2.5/forecast?q=Hyderabad,IN&appid=8a08849b0607450809f12a6855f2e9ac

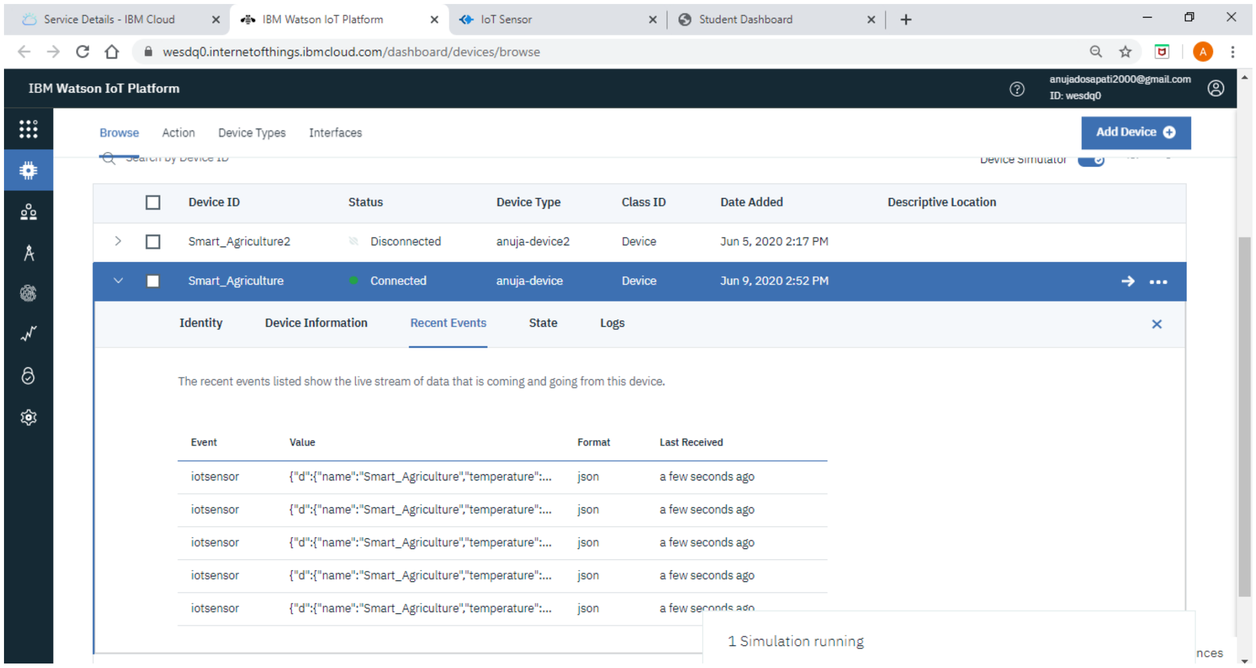
4.Building Project :-

4.1 Connecting IOT Simulator to IBM Watson IOT Platform

- Open link Provided in section 3.4
- Give the credentials of your device in IBM Watson IOT Platform.
- Click on Connect
- My credentials given to simulator are:
- Organization ID:wesdq0
- Device Type:anuja-device2
- Device ID:Smart_Agriculture2
- Authentication Method:use-token-auth
- Authentication Token:123456789


watson-iot-sensor-simulator.mybluemix.net
Watson IoT Sensor Simulator
smart_agriculture
Temperature
16°C
swipe left/right for more

- You Will recieve the simulator data in cloud
- You can see the received data in Recent events
- Data is received in this format (json)

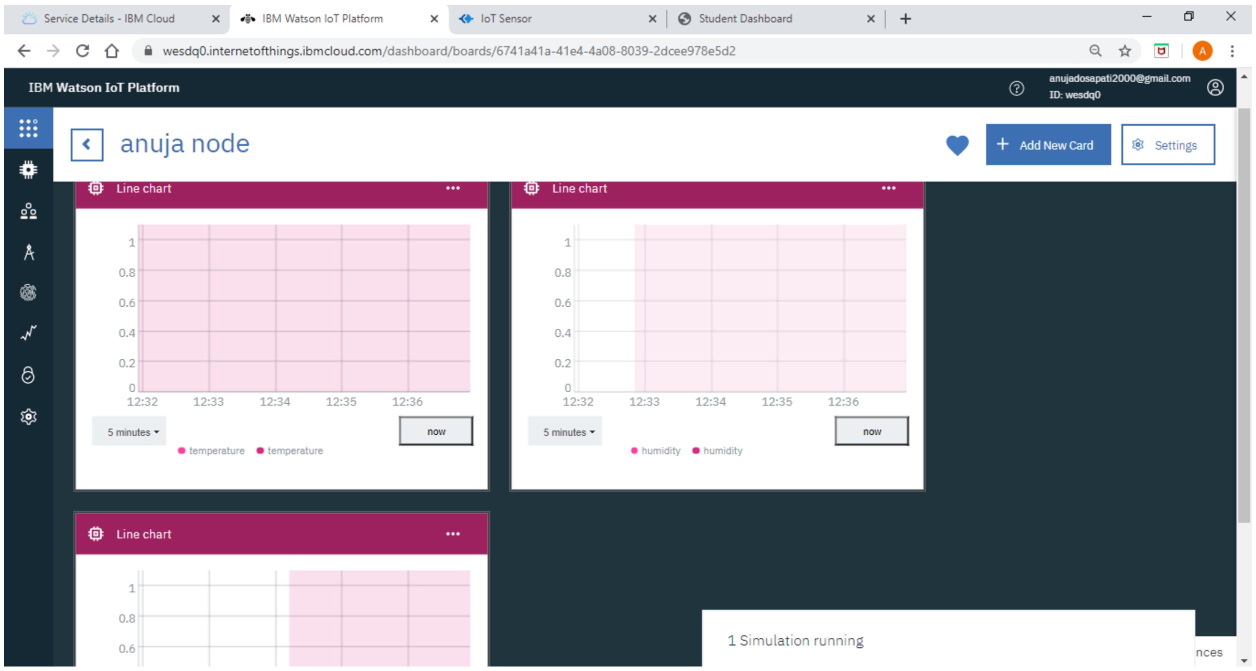


Device ID	Status	Device Type	Class ID	Date Added	Descriptive Location
Smart_Agriculture2	Disconnected	anuja-device2	Device	Jun 5, 2020 2:17 PM	
Smart_Agriculture	Connected	anuja-device	Device	Jun 9, 2020 2:52 PM	

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

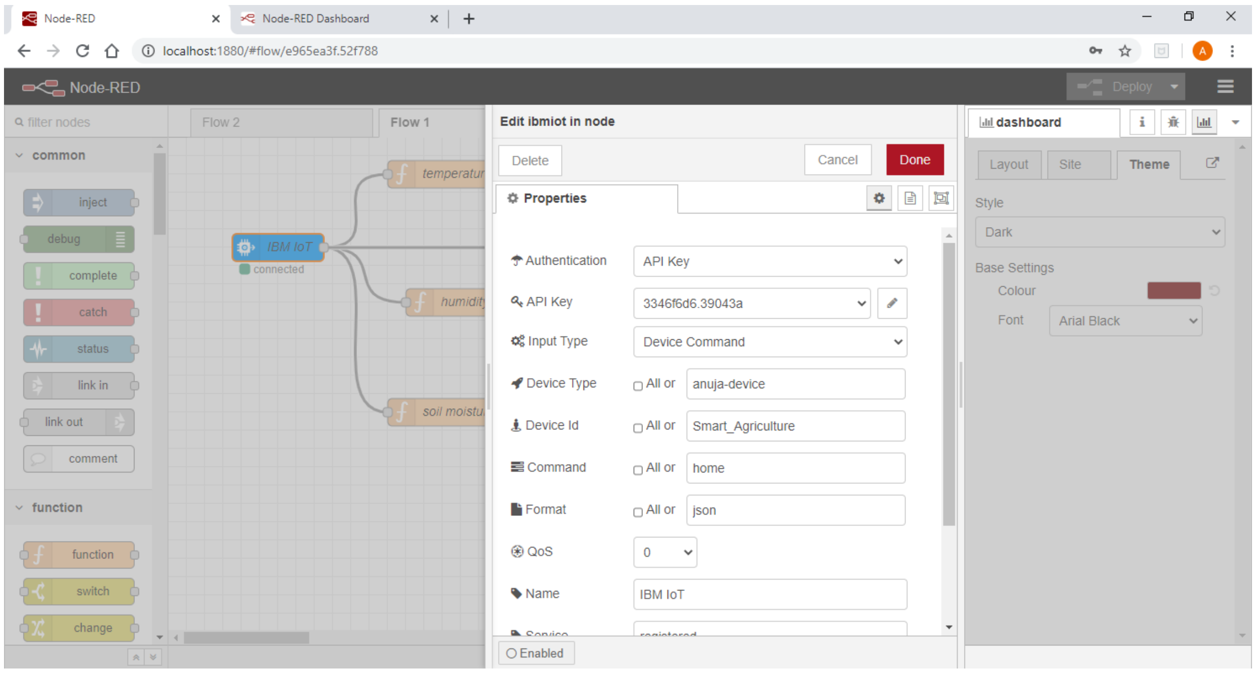
Event	Value	Format	Last Received
iotsensor	{"d":{"name":"Smart_Agriculture","temperature":...	json	a few seconds ago
iotsensor	{"d":{"name":"Smart_Agriculture","temperature":...	json	a few seconds ago
iotsensor	{"d":{"name":"Smart_Agriculture","temperature":...	json	a few seconds ago
iotsensor	{"d":{"name":"Smart_Agriculture","temperature":...	json	a few seconds ago
iotsensor	{"d":{"name":"Smart_Agriculture","temperature":...	json	a few seconds ago

- You can see the received data in cards by creating cards in Boards Tab



4.2 Configuration of Node-Red to collect IBM Cloud Data

- The Node-Red IBM IOT App is added in Node-Red Work flow.The appropriate device credentials obtained earlier are entered into node to connect and fetch device to Node-Red



Edit ibmiot in node

Delete | Cancel | Done

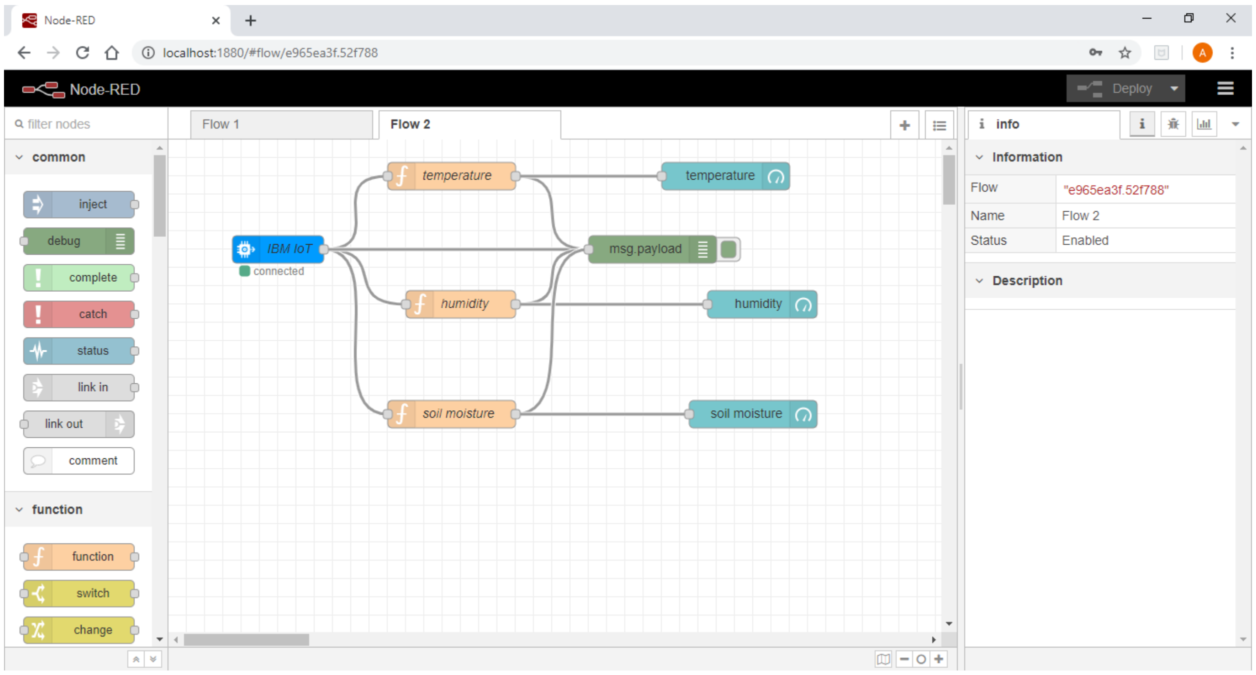
Properties

Authentication: API Key
API Key: 3346f6d6.39043a
Input Type: Device Command
Device Type: All or anuja-device
Device Id: All or Smart_Agriculture
Command: All or home
Format: All or json
QoS: 0
Name: IBM IoT
Service: registered

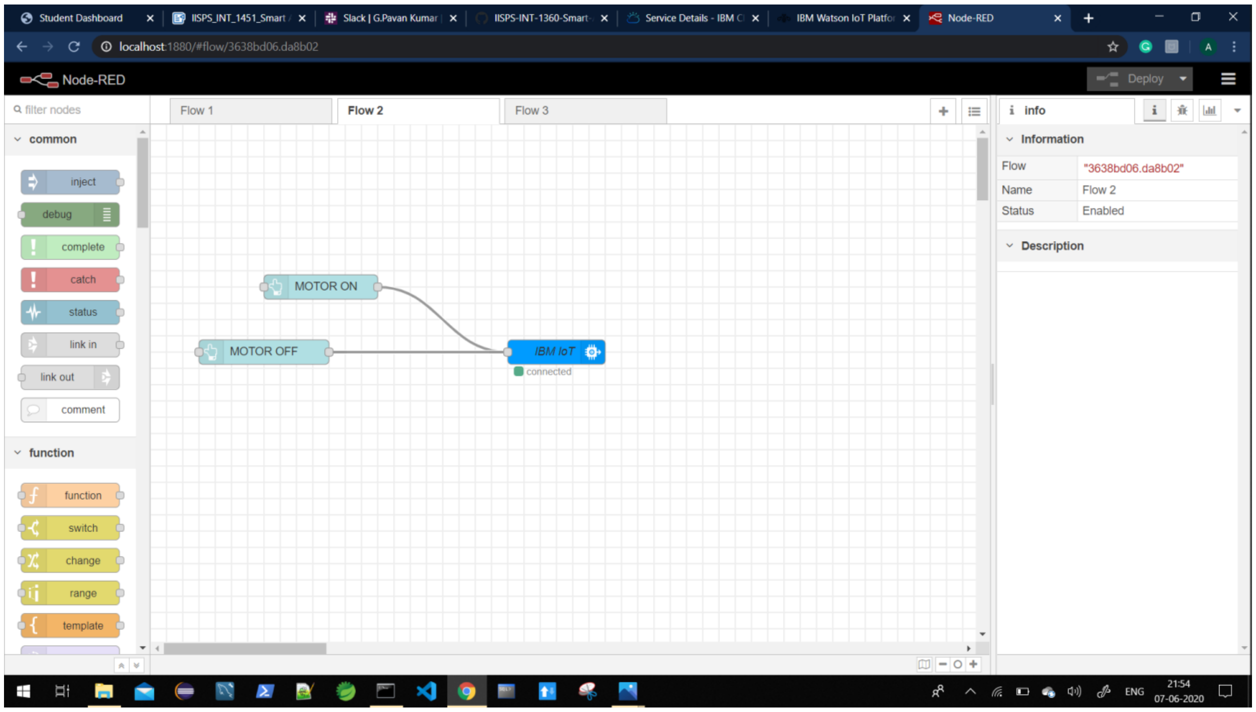
Enabled

- Once it is connected Node-Red receives data from the device
- Display the data using debug node for verification.
- These are my flows

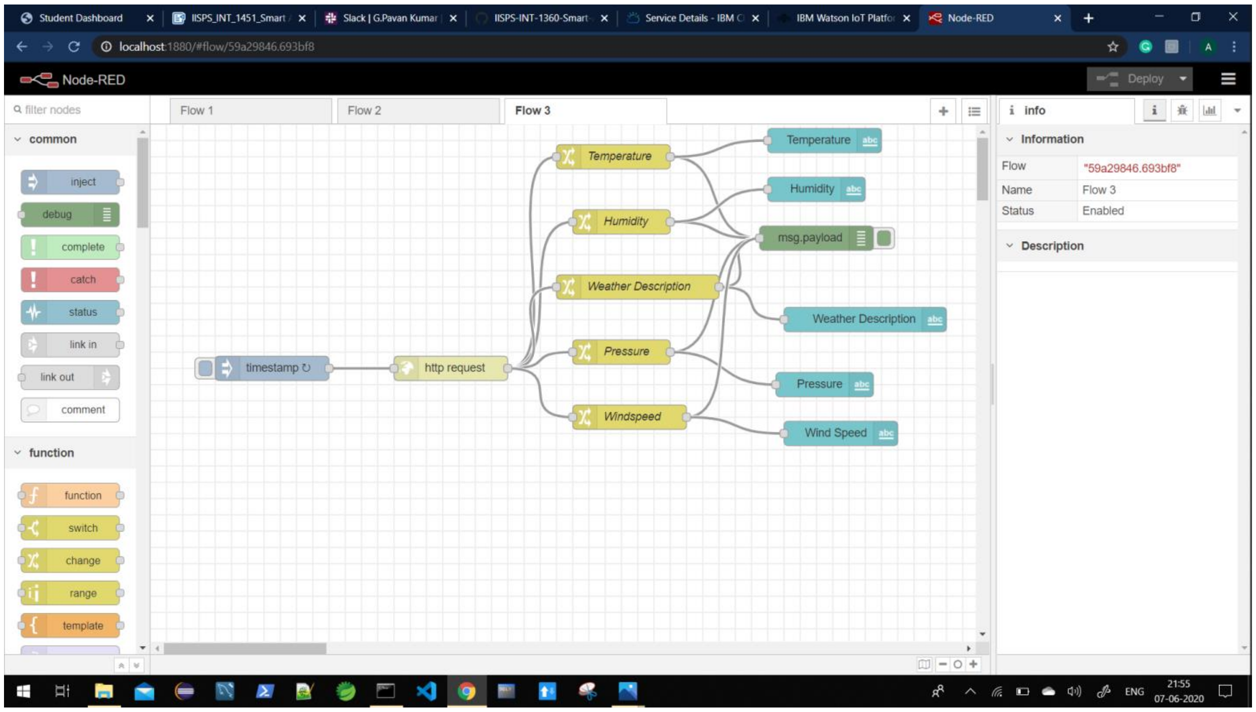
- FLOW 1 :-


Node-RED
localhost:1880/#flow/e965ea3f.52f788
Deploy
filter nodes
Flow 1
Flow 2
common
inject
debug
complete
catch
status
link in
link out
comment
function
function
switch
change
IBM IoT
connected
temperature
humidity
soil moisture
msg.payload
temperature
humidity
soil moisture
info
Information
Flow
"e965ea3f.52f788"
Name
Flow 2
Status
Enabled
Description

- FLOW 2 :-


Node-RED
localhost:1880/#flow/3638bd06.da8b02
Deploy
filter nodes
Flow 1
Flow 2
Flow 3
common
inject
debug
complete
catch
status
link in
link out
comment
function
function
switch
change
range
template
MOTOR ON
MOTOR OFF
IBM IoT
connected
info
Information
Flow
"3638bd06.da8b02"
Name
Flow 2
Status
Enabled
Description
21:54
07-06-2020

- FLOW 3 :-



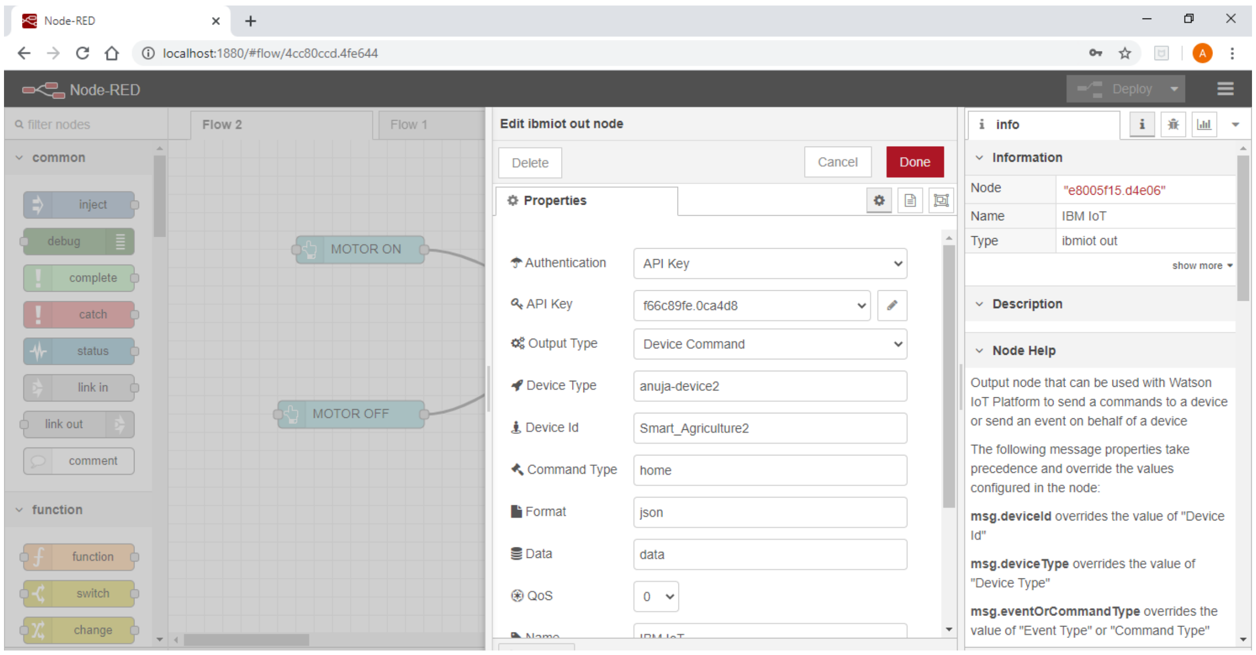
4.3 Configuration of Node-Red to collect data from Open weather API

- The Node-Red also receive data from the OpenWeather API by HTTP GET request. An inject trigger is added to perform HTTP request for every certain interval.
- The data we receive from OpenWeather after request is in below JSON format:

{"coord":{"lon":78.47,"lat":17.38},"weather":[{"id":803,"main":"Clouds","description":"broken clouds","icon":"04n"}],"base":"stations","main":{"temp":303.93,"feels_like":306.13,"temp_min":303.71,"temp_max":304.15,"pressure":1008,"humidity":55},"visibility":6000,"wind":{"speed":2.6,"deg":270},"clouds":{"all":75},"dt":1591547220,"sys":{"type":1,"id":9213,"country":"IN","sunrise":1591488668,"sunset":1591535950},"timezone":19800,"id":1269843,"name":"Hyderabad","cod":200}

4.4 Configuration of Node-Red to send commands to IBM Cloud

- By using IBM Iot out Node I used to send data from Node-Red to IBM Watson device.So,after adding it to flow we need to configure it with credentials of our Watson device.



Edit ibmiot out node

Authentication	API Key
API Key	f66c89fe.0ca4d8
Output Type	Device Command
Device Type	anuja-device2
Device Id	Smart_Agriculture2
Command Type	home
Format	json
Data	data
QoS	0
Name	IBM IoT

Information

Node	"e8005f15.d4e06"
Name	IBM IoT
Type	ibmiot out

show more

Description

Node Help

Output node that can be used with Watson IoT Platform to send a commands to a device or send an event on behalf of a device

The following message properties take precedence and override the values configured in the node:

msg.deviceId overrides the value of "Device Id"

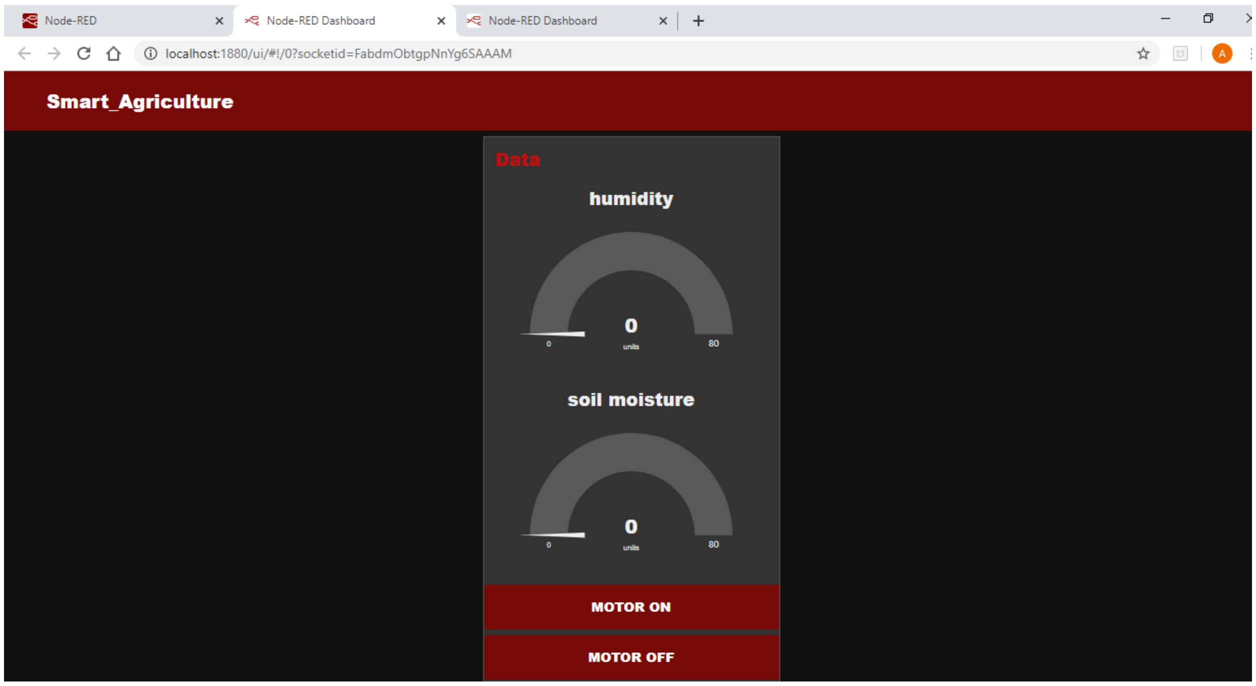
msg.deviceType overrides the value of "Device Type"

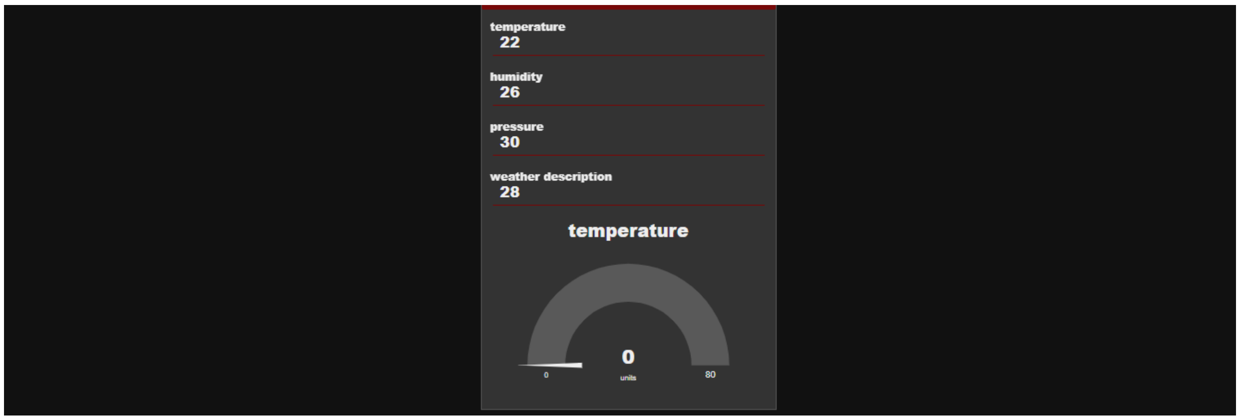
msg.eventOrCommandType overrides the value of "Event Type" or "Command Type"

4.5 Adjusting UserInterface

- By connecting all the flows shown above
- We can display our UI by clicking on the dashboard tab in Node red platform.

In this below page we can display the sensor data and motor commands.





In this page we open weather API data is displayed

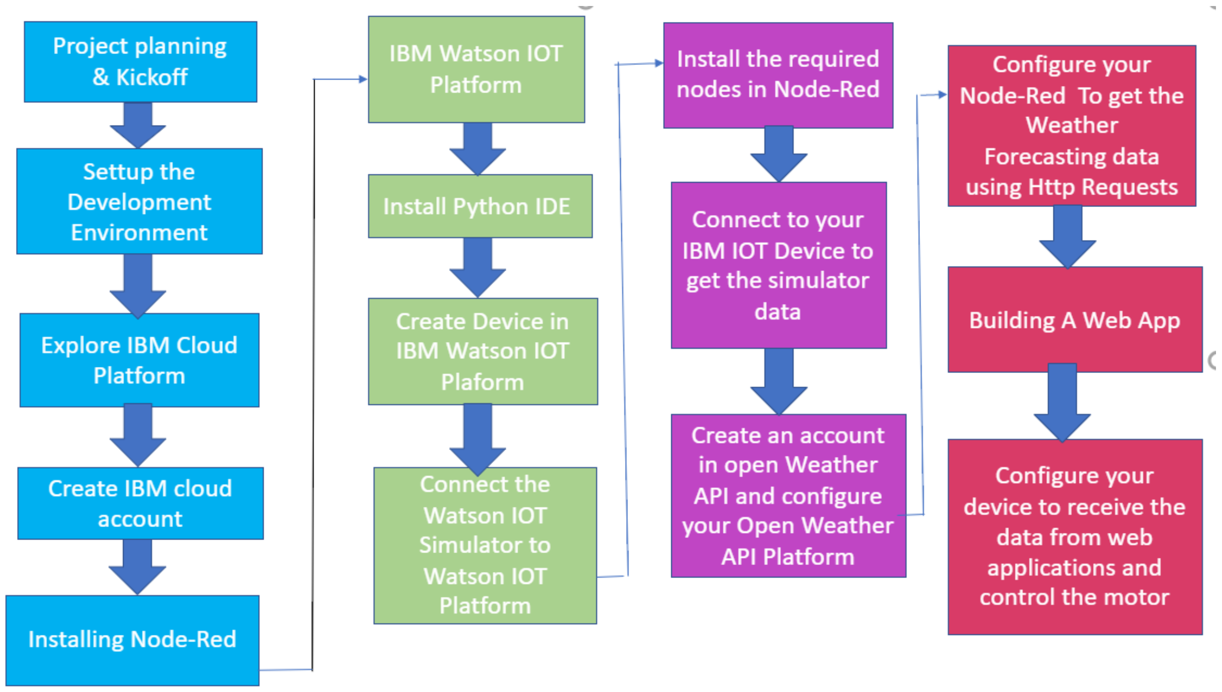
4.6 Receiving Commands from IBM Cloud using python program

- This is my python code

```
import time
import sys
import ibmiotf.application # to install pip install ibmiotf
import ibmiotf.device

#Provide your IBM Watson Device Credentials
organization = "wesdq0" #replace the ORG ID
deviceType = "anuja-device"#replace the Device type wi
deviceId = "Smart_Agriculture"#replace Device ID
authMethod = "token"
authToken = "123456789" #Replace the authtoken

def myCommandCallback(cmd): # function for Callback
        print("Command received: %s" % cmd.data)
        if cmd.data['command']=='motoron':
 print("MOTOR ON IS RECEIVED")
                #time.sleep(1)
 #print("Motor Started")
        elif cmd.data['command']=='motoroff':
 print("MOTOR OFF IS RECEIVED")
                #time.sleep(1)
 #print("Motor Stopped")
 #elif cmd.data['command'] == 'runfor30minutes':
 #print("Motor Runs For 30 Minutes")
 #print("Motor Started")
 #for i in range(1,31):
 #print("%d minutes to stop "%(30-i))
 #print("Motor Stopped")

        if cmd.command == "setInterval":

                if 'interval' not in cmd.data:
 print("Error - command is missing required information: 'interval'")
                else:
 interval = cmd.data['interval']
        elif cmd.command == "print":
                if 'message' not in cmd.data:
 print("Error - command is missing required information: 'message'")
                else:
 output=cmd.data['message']
 print(output)

try:
 deviceOptions = {"org": organization, "type": deviceType, "id": deviceId, "auth-method": authMethod, "auth-
token": authToken}
 deviceCli = ibmiotf.device.Client(deviceOptions)
   #..............................................

except Exception as e:
 print("Caught exception connecting device: %s" % str(e))
 sys.exit()

# Connect and send a datapoint "hello" with value "world" into the cloud as an event of type "greeting" 10 times
deviceCli.connect()
```

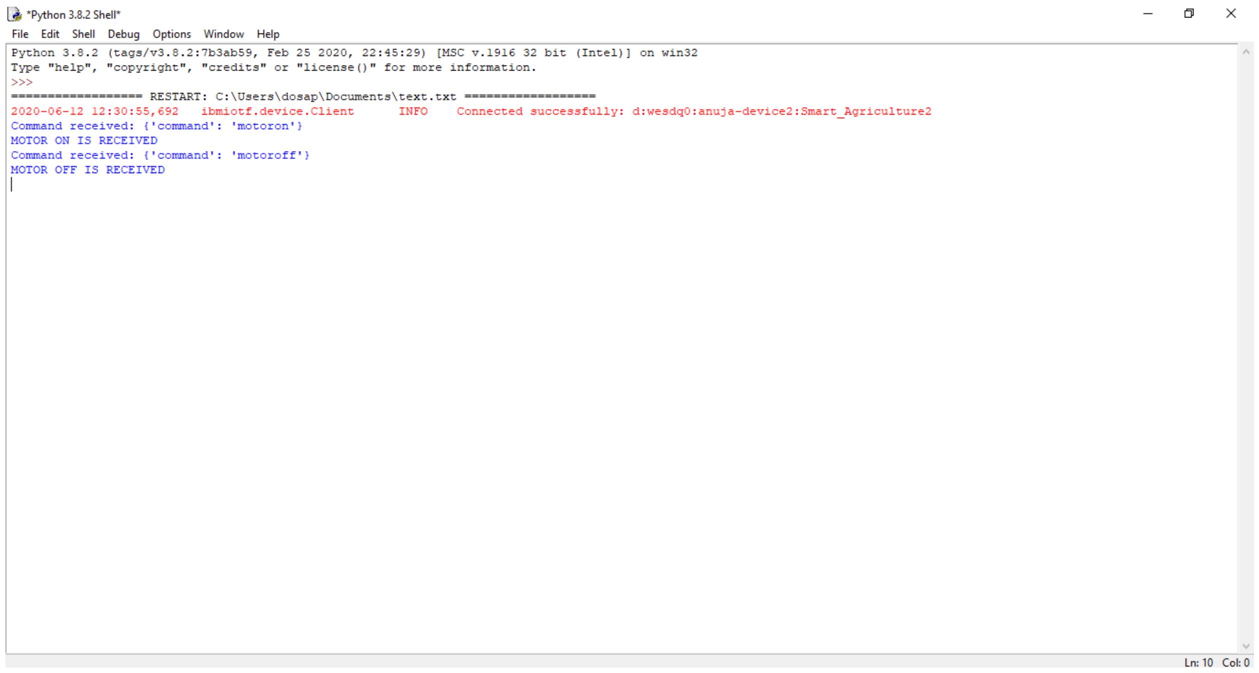
```
while True:

 deviceCli.commandCallback = myCommandCallback

# Disconnect the device and application from the cloud
deviceCli.disconnect()
```

5.FLOW CHART


Project planning & Kickoff
Settup the Development Environment
Explore IBM Cloud Platform
Create IBM cloud account
Installing Node-Red
IBM Watson IOT Platform
Install Python IDE
Create Device in IBM Watson IOT Plaform
Connect the Watson IOT Simulator to Watson IOT Platform
Install the required nodes in Node-Red
Connect to your IBM IOT Device to get the simulator data
Create an account in open Weather API and configure your Open Weather API Platform
Configure your Node-Red To get the Weather Forecasting data using Http Requests
Building A Web App
Configure your device to receive the data from web applications and control the motor

6.OBSERVATION AND RESULTS :-

- When I click Motor ON and Motor OFF on my UI I will be receving commands like below.



```
Python 3.8.2 (tags/v3.8.2:7b3ab59, Feb 25 2020, 22:45:29) [MSC v.1916 32 bit (Intel)] on win32
Type "help", "copyright", "credits" or "license()" for more information.
>>>
================== RESTART: C:\Users\dosap\Documents\text.txt ==================
2020-06-12 12:30:55,692   ibmiotf.device.Client      INFO    Connected successfully: d:wesdq0:anuja-device2:Smart_Agriculture2
Command received: {'command': 'motoron'}
MOTOR ON IS RECEIVED
Command received: {'command': 'motoroff'}
MOTOR OFF IS RECEIVED
```

7.ADVANTAGES AND DISADVANTAGES

Advantages

- Farms can be monitored and controlled remotely.
- Increase in convenience to farmers.
- Less labour cost.
- Better standards of living.

Disadvantages:

- Lack of internet/connectivity issues.
- Added cost of internet and internet gateway infrastructure.
- Farmers wanted to adapt the use of WebApp.

8. CONCLUSION

- Thus the objective of the project to implement an IoT system in order to help farmers to control and monitor their farms has been implemented successfully.

9. BIBILOGRAPHY

- IBM cloud reference: https://cloud.ibm.com/
- Python code reference: https://github.com/rachuriharish23/ibmsubscribe
- IoT simulator : https://watson-iot-sensor-simulator.mybluemix.net/

Open Weather : https://openweathermap.org/