

PROJECT REPORT OF CLOUD COMPUTING



Project Name:

**SMART AGRICULTURE SYSTEM BASED CLOUD
COMPUTING**

Submitted To:

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CHAPTER-01

INTRODUCTION

1.1 OVERVIEW

Agriculture plays a important role in country's economy and provides a large-scale employment to the people. However, agriculture is highly dependent upon weather and climate. For example, changes in temperature, soil moisture, carbon dioxide may result in low yield of crops. It is Significant to monitor environmental parameters in order to manage crop growth and increase the agricultural production yield. The sensed information is not only important for decision making but also for evaluating impacts of agricultural practices on environment.

Nowadays, it is more necessary than ever to increase the crop yields food grain production. Cloud connected, wireless system aid in this crop yield maximization, which automates day-to-day agricultural tasks and real time monitoring for smart decision-making.

1.2 PURPOSE

- Need for technology to monitor important parameters like soil moisture, temperature, Humidity etc. to improve the cultivation process.
- Need for technology to monitor weather of particular area with reliable source to save the crops at the time of natural calamities like flood, cyclone etc.
- Development of certain techniques to reduce the workforce, energy and time for cultivation.
- Development of a feasible method to control the electrical equipment in the farm from any part of the world.

CHAPTER-02

LITERATURE SURVEY

2.1 SMART AGRICULTURAL SYSTEM

Sukpal Singh Gill et al (2017) modeled an cloud based autonomic information system for delivering Agriculture-as-a-service, through the use of clouds and big data technology. From the experimental results it was observed that the proposed system offers better service and the quality of service was also better in terms of Qos parameter.

Ravi Kishore Kodali et al(2016) proposed a low cost weather monitoring device to retrieve the weather condition of any location from cloud data base management system. Since it is not using any peripheral device monitoring the weather. It was observed that cost of the device can be reduced.

Ibrahim Mat et al (2018) developed a smart Agricultural system using Iot. It was concluded that above proposed system using IoT can play a important role in conventional and large farming area. And a comparison b/w IoT and Conventional Mushrom farming was conducted. It was observed that the farm monitored by IoT had better growth rate than the conventional method.

Prathibha et al (2017) modeled a smart farming using IoT. The important parameters like Temperature and Humidity in agricultural field was monitored by using CC3200 chip and camera was interfaced with CC3200 to capture image and the captured image was forwarded to the farmer using MMS. The proposed system can be used in green house and temperature dependent plants.

Yifan Bo et al (2011) conducted a study on integrating cloud computing and IoT in the field of agriculture. It was observed that cloud computing and IoT had high reliability, expansibility and high accuracy.

Tien Wo-Hoang et al (2017) proposed an IoT System architecture based on wireless Sensor Network. The various parameters like temperature, relative humidity, luminosity, air pressure etc were monitored from a web browser. A WIFI interface device was used to transfer this environmental data's from sensor to the web browser. It was observed that yield of crops can be improved by this method.

M.K.Gayatri et al (2015) proposed a technology to hold the huge data's coming from the agrarian output. ZigBee module was used to measure various parameters like temperature, humidity, and illumination. A Wireless communication was used to communicate between the sensor and the data centre.

Samudra et al (2019) developed an intelligent farming with wireless Networking and MQTT, to monitor the real time agricultural environment. The parameters like luminicence, Soil moisture and Temperature were monitored. By comparing these data's the output like motor was controlled.

Qiulan Wu et al (2017) developed an smarter agricultural system based on technologies like GIS, Cloud computing, IoT, Big data and sensing technology. This method allows the user to get the information at faster rate. This method will reduce the cost and energy consumption.

2.2 EXISTING PROBLEM

1. Controlling the device from longer distance from web application.
2. Getting the weather data from weather station.
3. Transfer of node data to the gateway at faster rate.
4. Unavailability of data's such as PH level, potassium, Nitrogen etc related to the soil.

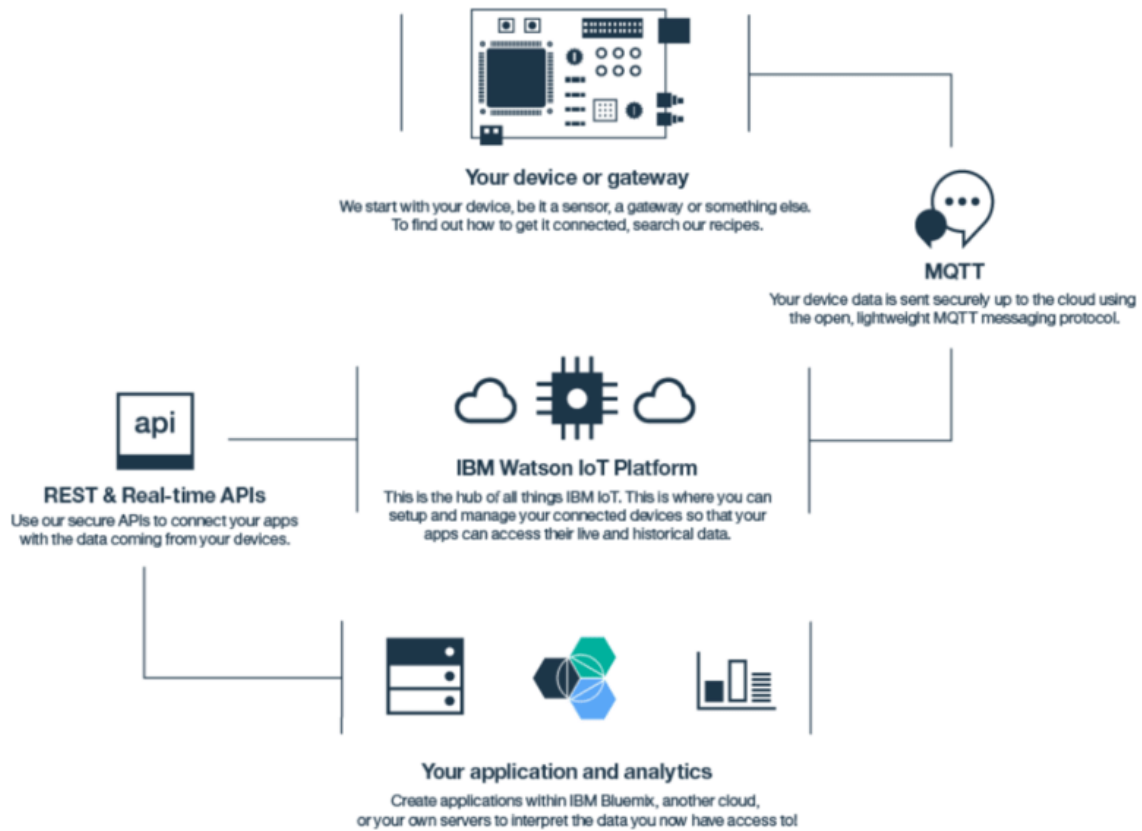
2.3 PROPOSED SOLUTION

1. To control a device from longer distance from web application.
2. To get the weather details like wind speed, temperature, humidity from weather station through weather API.
3. To display the data in the web and android application.
4. To help farmer in increasing the crop yield by suggesting the farmer the motor status based on soil moisture, humidity, temperature and number of days the farming of crop started.

CHAPTER-03

THEORITICAL ANALYSIS

3.1 BLOCK DIAGRAM

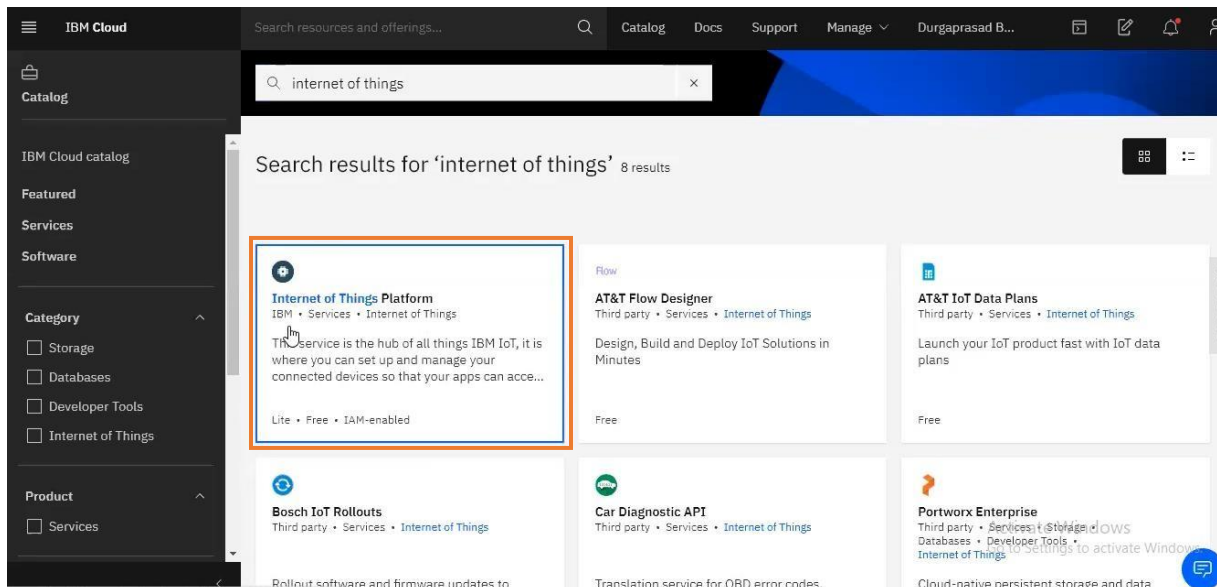


CHAPTER-04

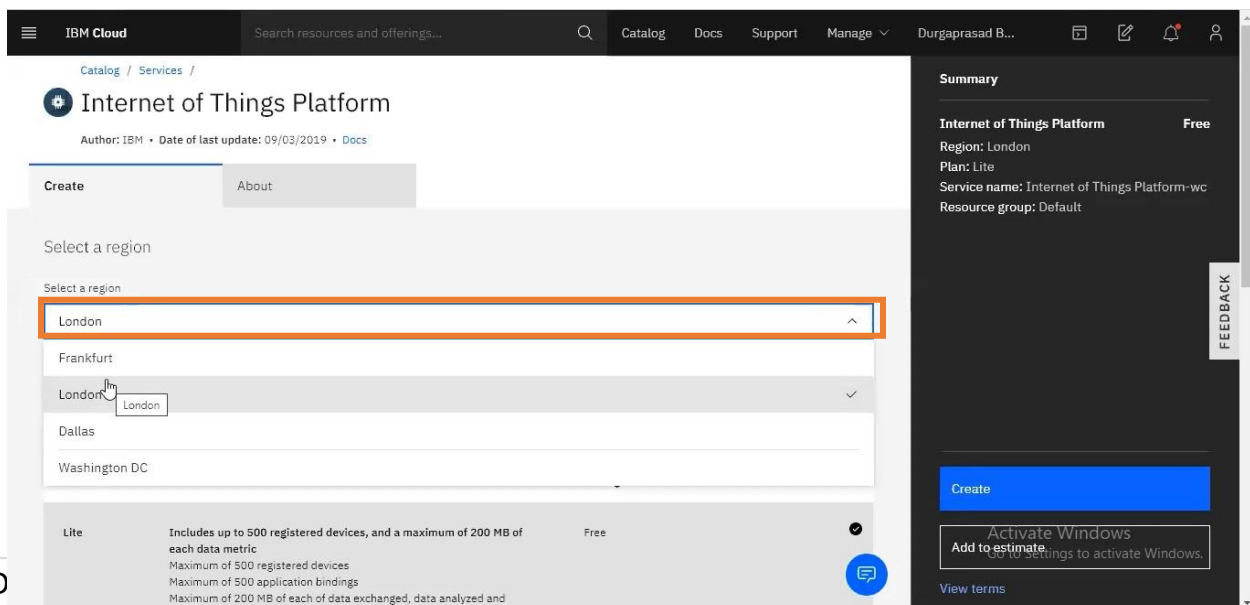
EXPERIMENTAL INVESTIGATION

4.1 SETTING THE DEVICE IN IOT PLATFORM IN IBM CLOUD

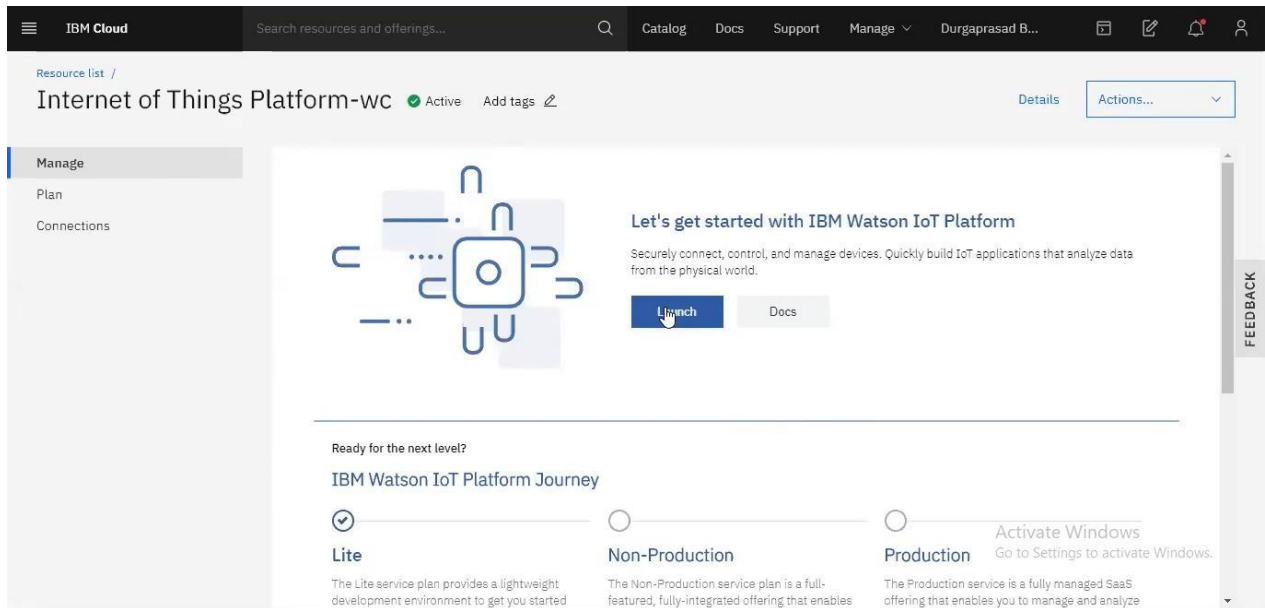
Step1: After logging into the system a dash board will appear and in the search pane type IBM IoT platform.



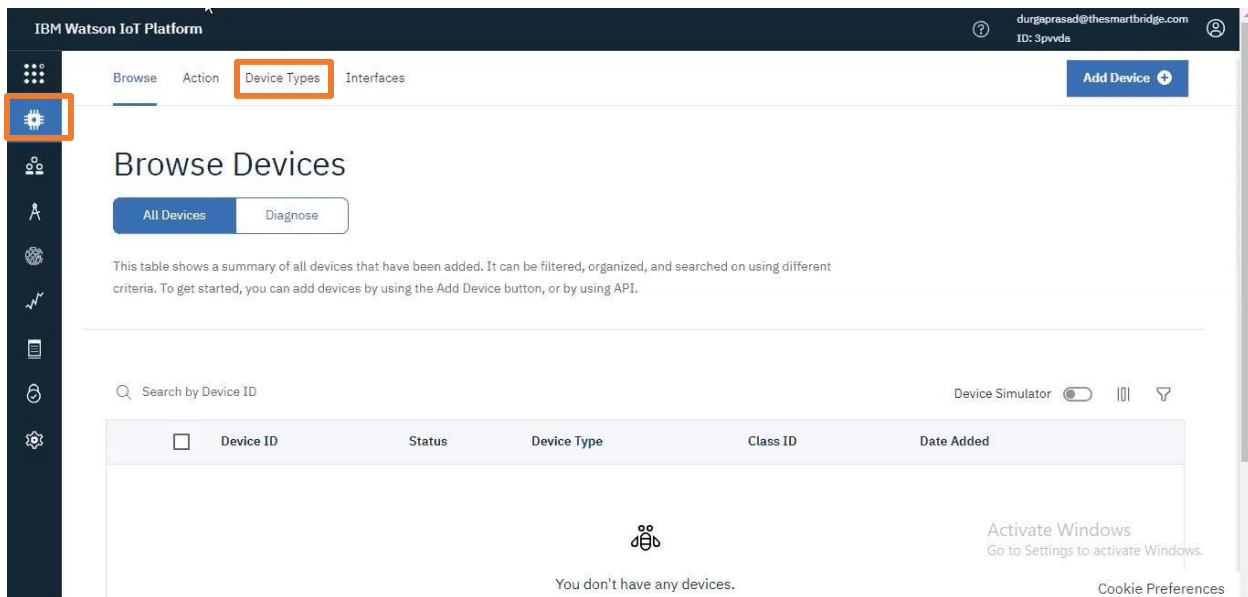
Step2: Select the London option from drop down list and click create.



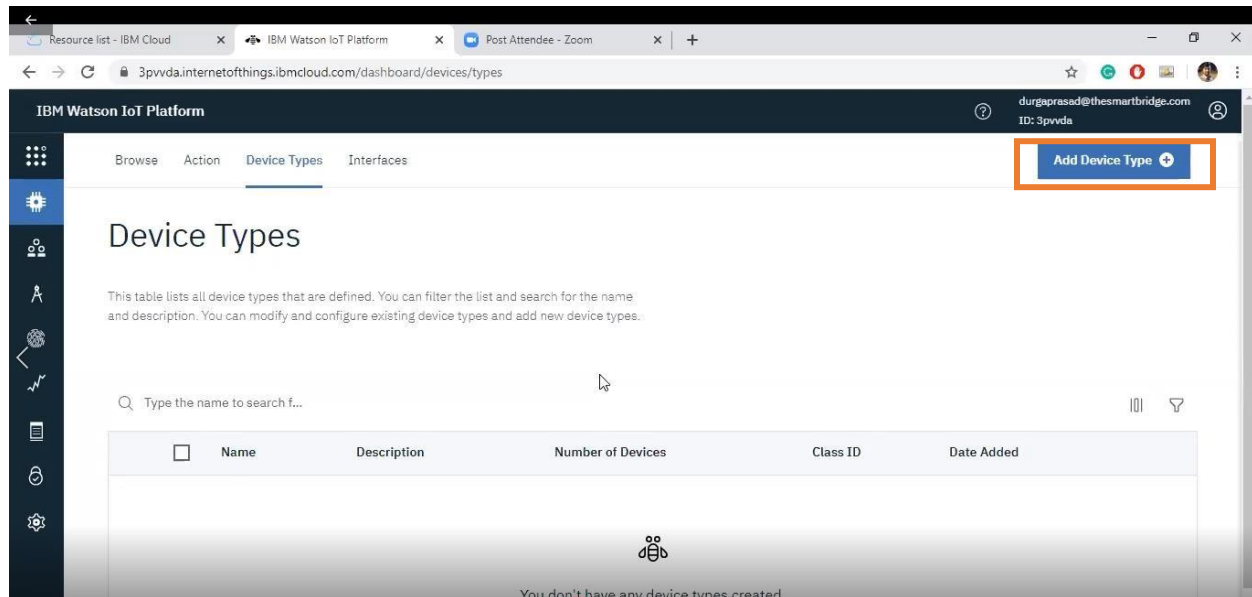
Step3: Click on the Launch button.



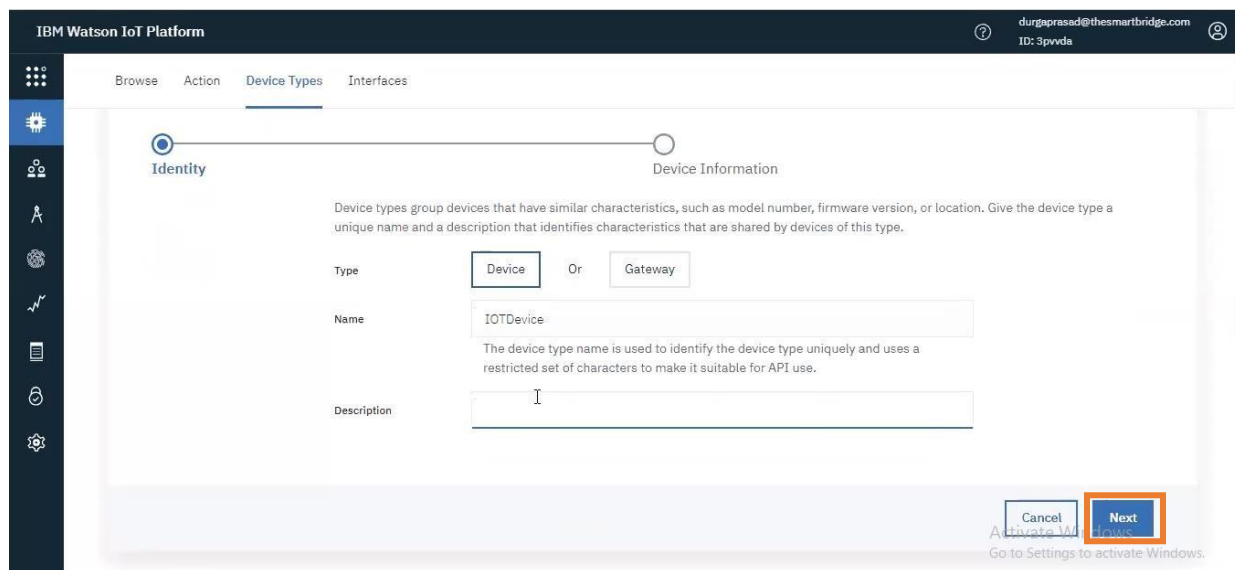
Step4: Click on the Device type.



Step5: Click on the add device button



Step6: Enter the Device name and Description and click Next.



Step7: No need to fill the field of the Device Information and click Finish.

IBM Watson IoT Platform

durgesaprasad@thesmartbridge.com
ID: 3pvvda

Browse Action **Device Types** Interfaces

Identity Device Information

These attributes will be used as a template for new devices that are assigned this device type

Edit Metadata

Serial Number Enter Serial Number

Model Enter Model

Description Enter Description

Hardware Version Enter Hardware Version

Manufacturer Enter Manufacturer

Device Class Enter Device Class

Firmware Version Enter Firmware Version

Descriptive Location Enter Descriptive Location

Back Finish

Activate Windows
Go to Settings to activate Windows.

Step8: Click on the Register Device.

IBM Watson IoT Platform

durgesaprasad@thesmartbridge.com
ID: 3pvvda

Browse Action **Device Types** Interfaces

Register Device Advanced Flow

Optional

Register Devices, Define Interfaces

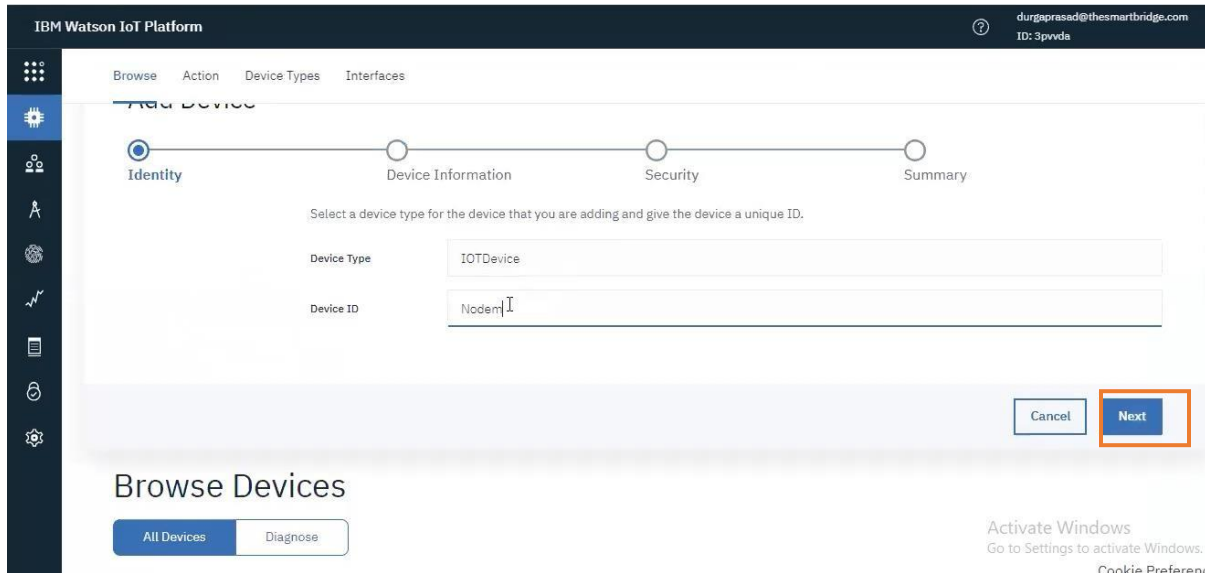
Now that you added a device type, you can register and connect devices for this type.

Register Devices

Cancel Next

Activate Windows
Go to Settings to activate Windows.

Step9: Enter the device name and click Next.



IBM Watson IoT Platform

durgesaprasad@thesmartbridge.com
ID: 3pvvda

Browse Action Device Types Interfaces

Add Device

Identity Device Information Security Summary

Select a device type for the device that you are adding and give the device a unique ID.

Device Type IOTDevice

Device ID NodeM

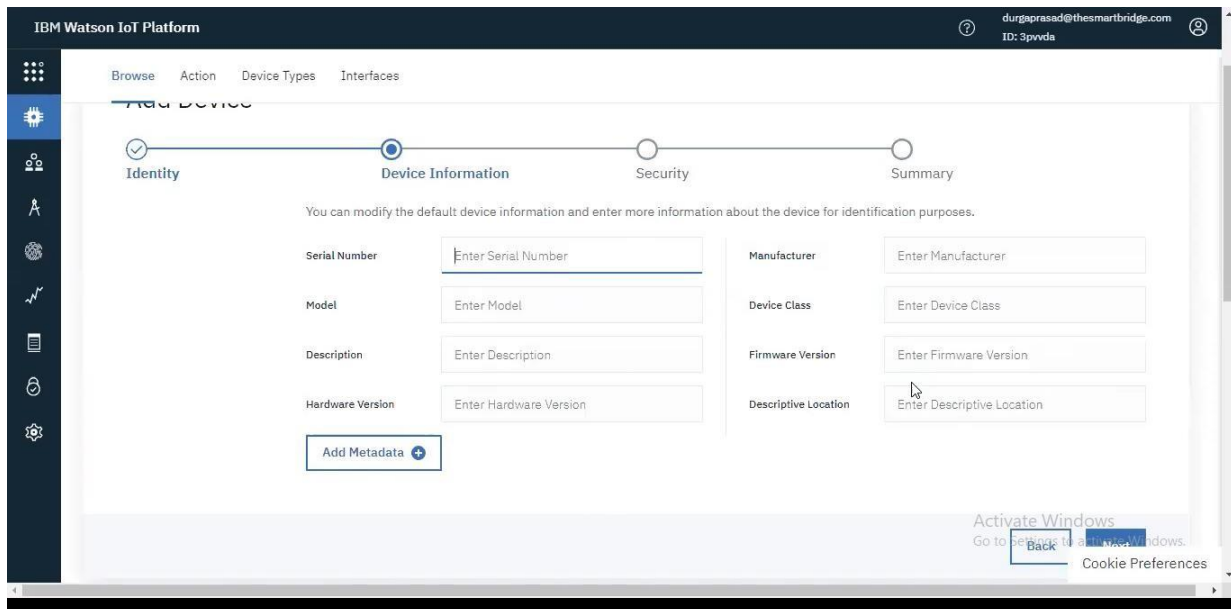
Cancel Next

Browse Devices

All Devices Diagnose

Activate Windows
Go to Settings to activate Windows.
Cookie Preferences

Step10: No need to fill the field and click Next button.



IBM Watson IoT Platform

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ID: 3pvvda

Browse Action Device Types Interfaces

Add Device

Identity Device Information Security Summary

You can modify the default device information and enter more information about the device for identification purposes.

Serial Number Enter Serial Number

Model Enter Model

Description Enter Description

Hardware Version Enter Hardware Version

Manufacturer Enter Manufacturer

Device Class Enter Device Class

Firmware Version Enter Firmware Version

Descriptive Location Enter Descriptive Location

Add Metadata

Back Next

Activate Windows
Go to Settings to activate Windows.
Cookie Preferences

Step11: Filling the Authentication token and click Next button.

IBM Watson IoT Platform

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ID: 3pvvda

Browse Action Device Types Interfaces

Add Device

Identity Device Information **Security** Summary

There are two options for selecting a device authentication token.

Auto-generated authentication token (default)

Allow the service to generate an authentication token for you. Tokens are 18 characters and contain a mix of alphanumeric characters and symbols. The token is returned to you at the end of the device registration process.

Self-provided authentication token

Provide your own authentication token for this device. The token must be between 8 and 36 characters and contain a mix: lowercase and uppercase letters, numbers, and symbols, which can include hyphens, underscores, and periods. Do not use repeated characters, dictionary words, user names, or other predefined sequences.

Authentication Token

Make a note of the generated token. Lost authentication tokens cannot be recovered. Tokens are encrypted before being stored.

Authentication token are encrypted before we store them.

Activate Windows
Go to Settings to activate Windows.

Cookie Preferences

Step12: Final summary tab will show the device type and device name information.

IBM Watson IoT Platform

durgesprasad@thesmartbridge.com
ID: 3pvvda

Browse Action Device Types Interfaces

Add Device

Identity Device Information Security **Summary**

Verify that the following information is correct then select Done

Device Type
IOTDevice

Device ID
Arduino

[View Metadata](#)

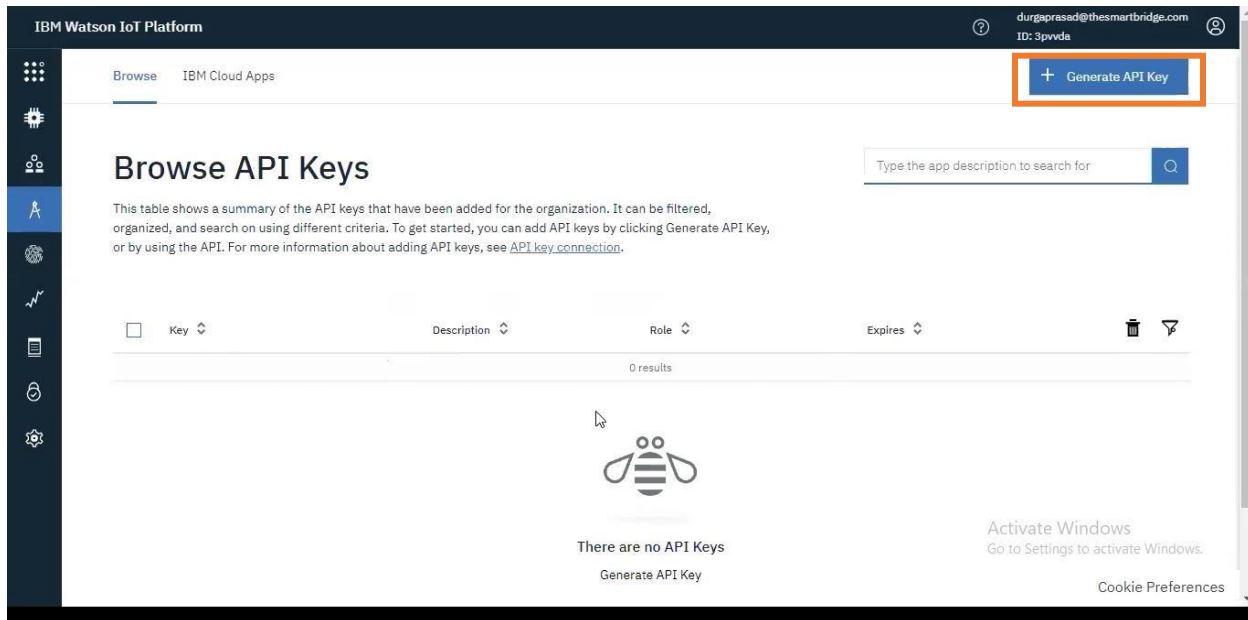
Security Token
123456789

Activate Windows
Go to Settings to activate Windows.

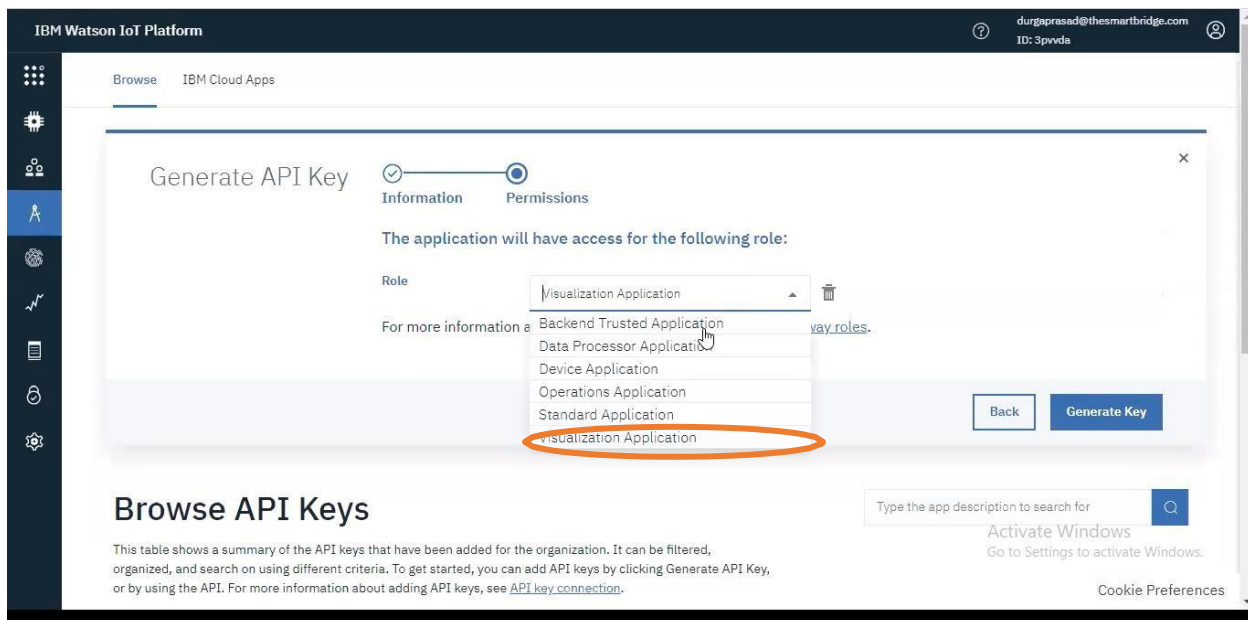
Cookie Preferences

4.2 GENERATING THE DEVICE API

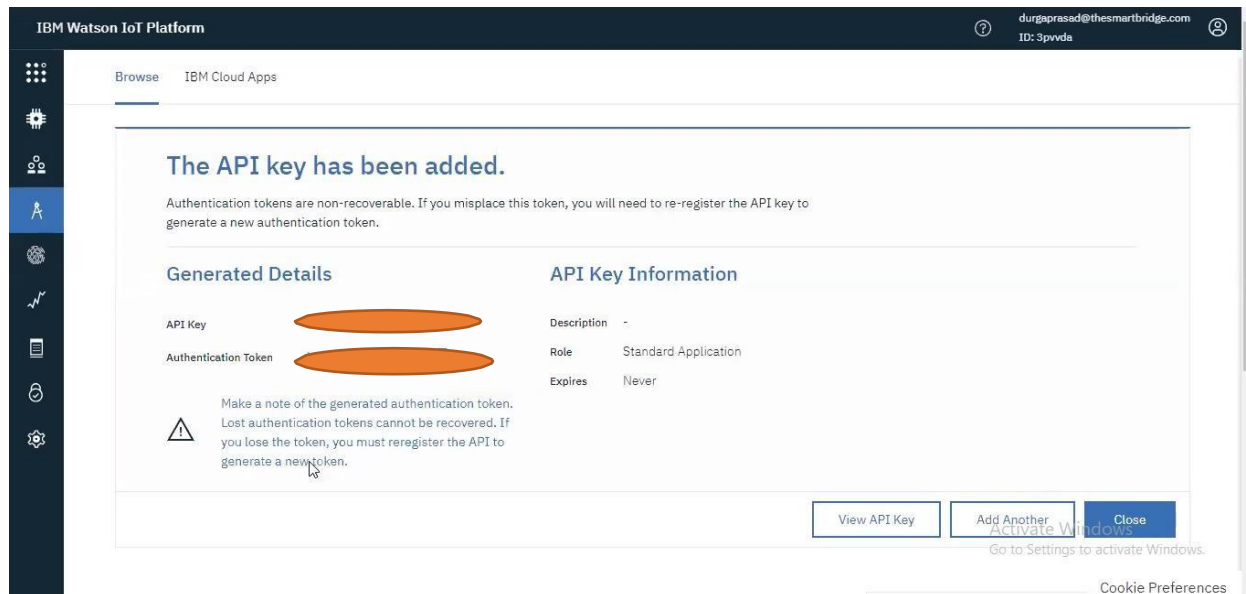
Step1: Click on the app icon and click on generate api key button.



Step2: Click on the standard application from the drop down list and click generate key.

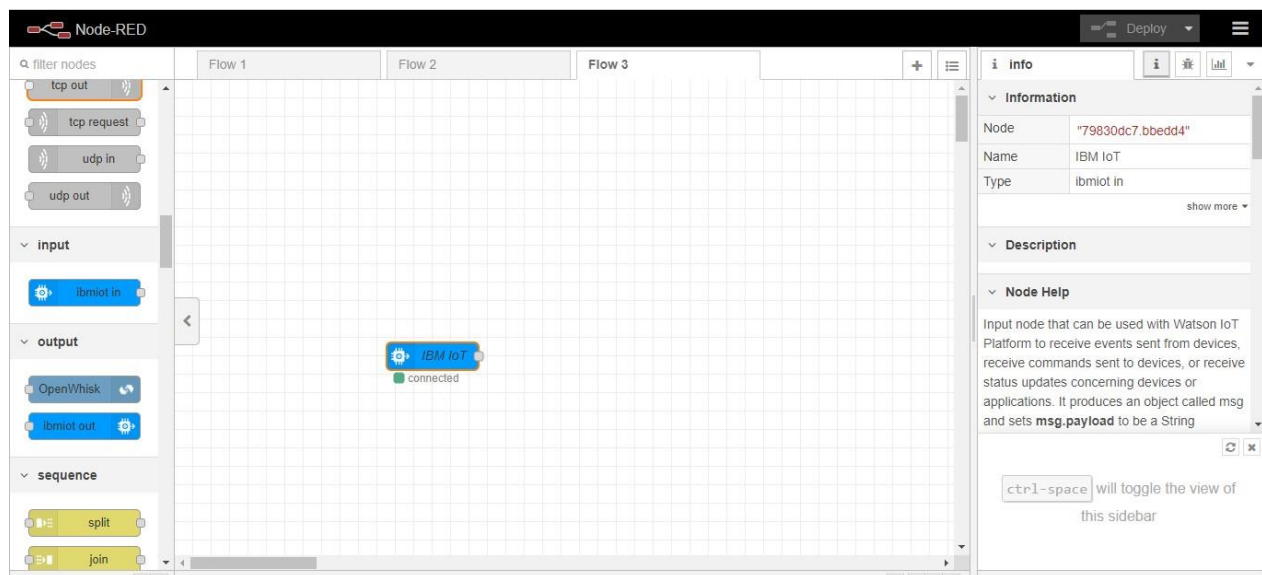


Step3: Note the Api key and authentication token for future reference

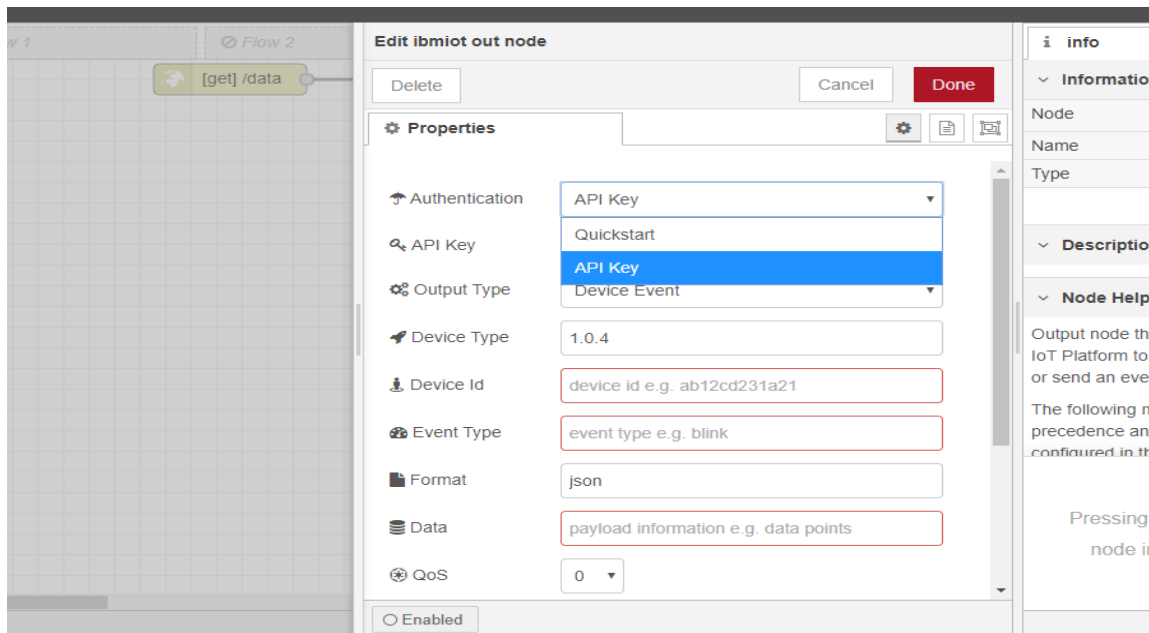


4.3 SETTING UP THE UI USING NODE-RED

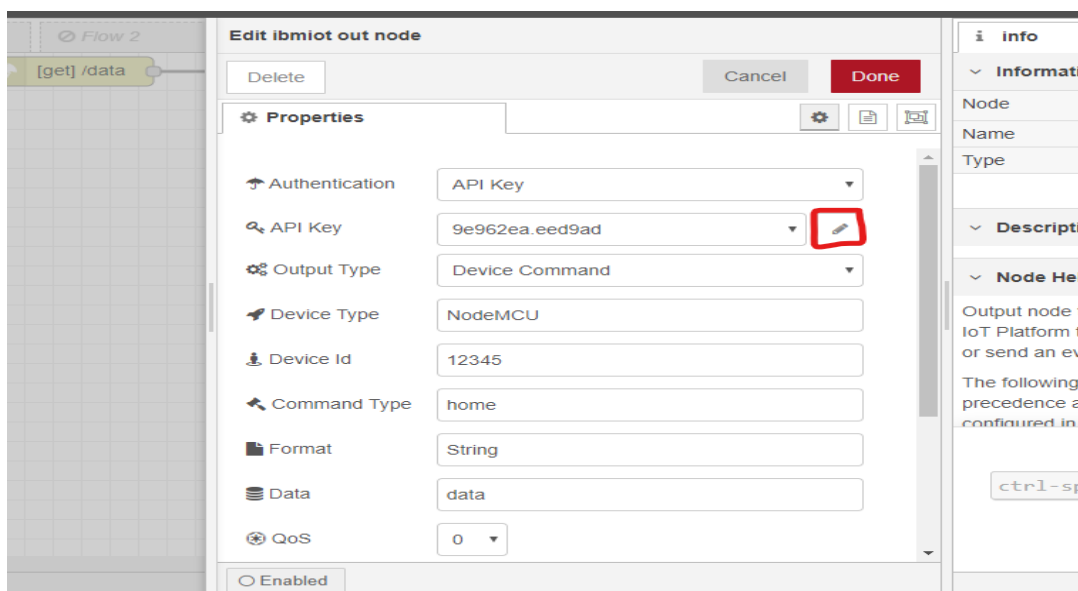
Step1: Select the IBM IoT in node from pallet



Step2: Double click the IBM IoT node, select the API option from the drop down and click the **Device Event**.



Step3: Click the pencil key icon in the API key.



Step4: Enter the API key, API token and click update button.

Flow 2

Edit ibmiot out node > Edit ibmiot node

Delete Cancel **Update**

Properties

Name

API Key

API Token

Server-Name n51a7p.messaging.internetofthings.ibmcloud.com

Scalable Application ID

Keep Alive 60 Seconds ☒ Use Clean Session

Enabled 6 nodes use this config On all flows

Info

Information

Node "9e962ea.eed9ad"

Type ibmiot

Description

Node Help

To use Shared subscription, check **Scala** and provide the **Application ID**. The **Application ID** must be same across different clients.

Hold down when you click node to also select all of its connected nodes

Step5: click on the Done button and click the deploy button.

Edit ibmiot out node

Delete Cancel **Done**

Properties

Authentication API Key

API Key api_key

Output Type Device Event

Device Type motor

Device Id motor1

Event Type status

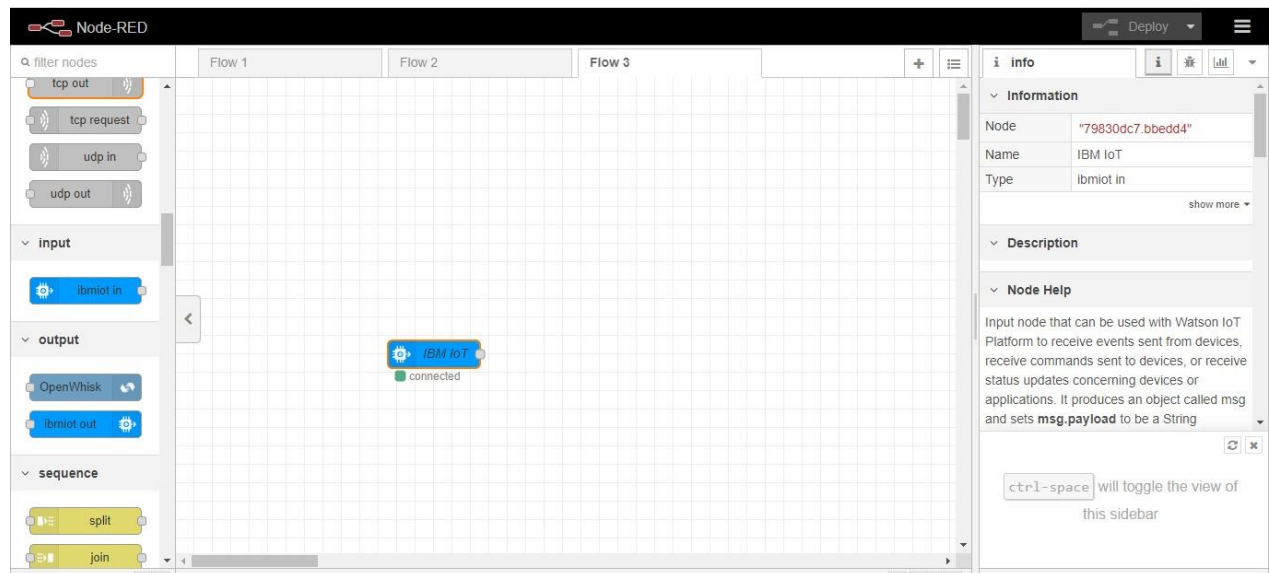
Format json

Data payload

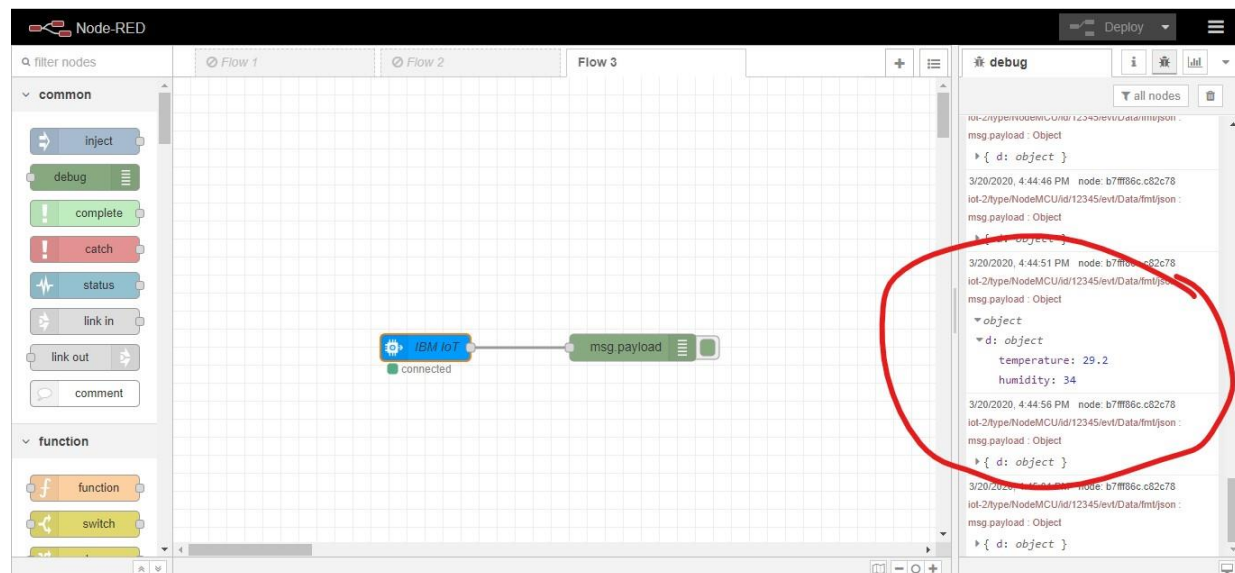
QoS 0

Name Motor

Step6: After deploying Connection indication will be highlighted in the IBM IoT node.

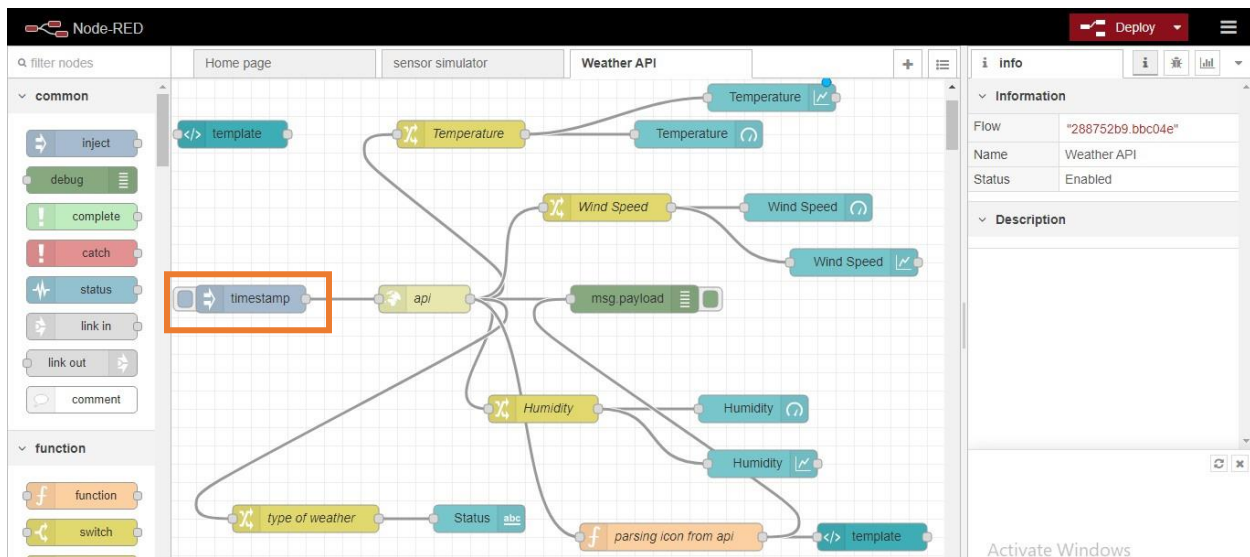


Step7: Place the debug node in the flow editor and click on deploy to see the temperature and humidity value in the debug tab.

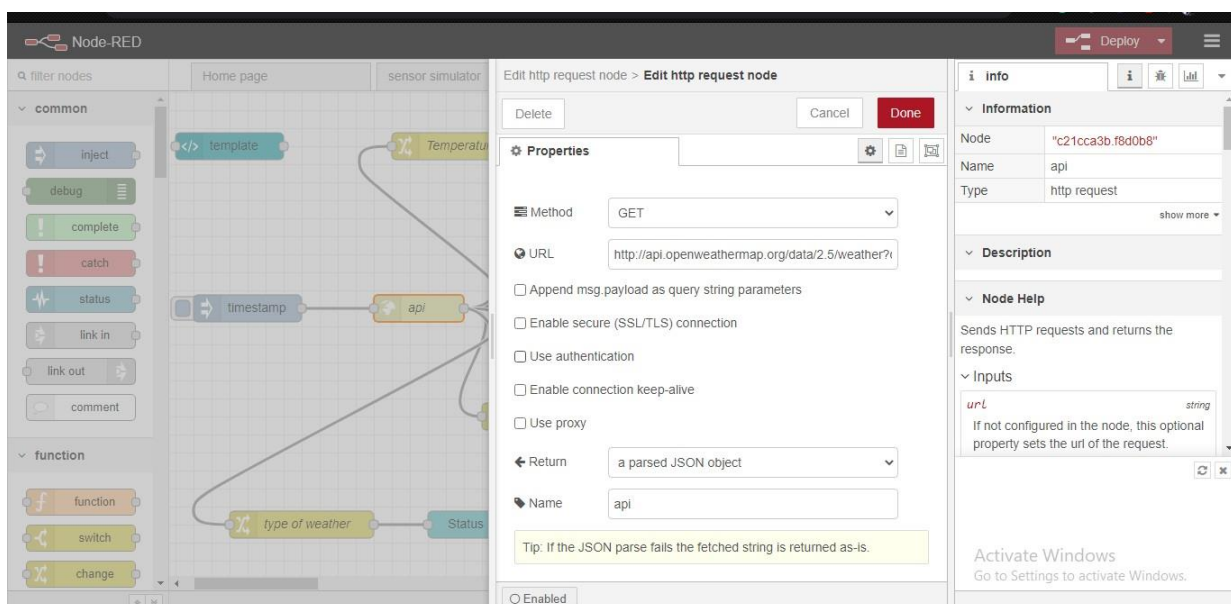


4.4 SETTING THE API FROM OPEN WEATHER.

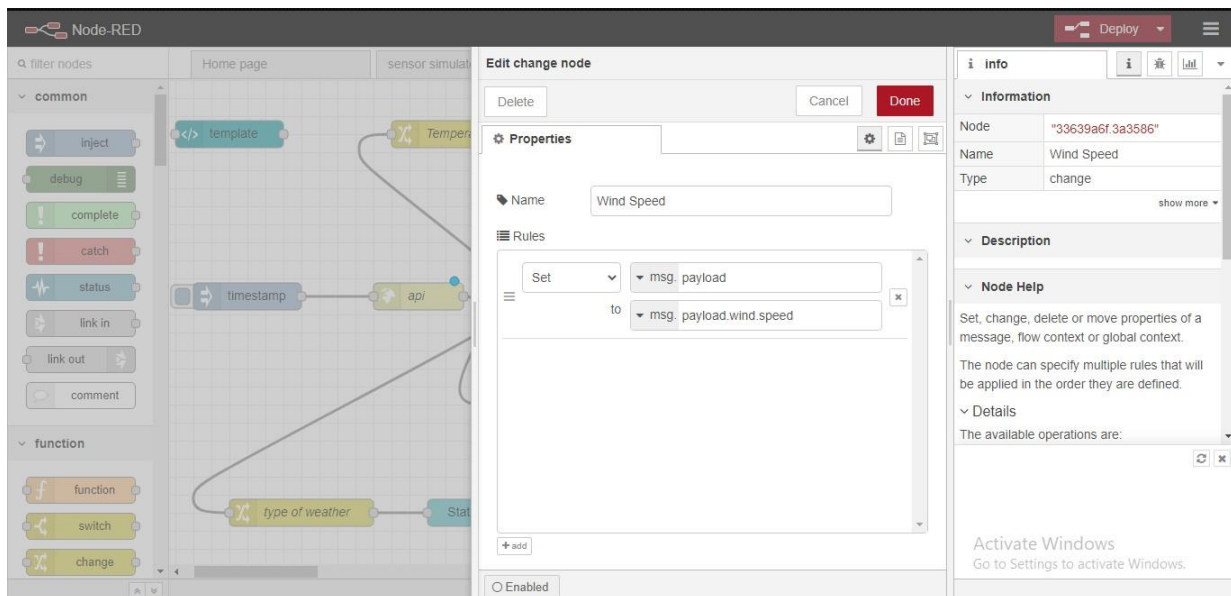
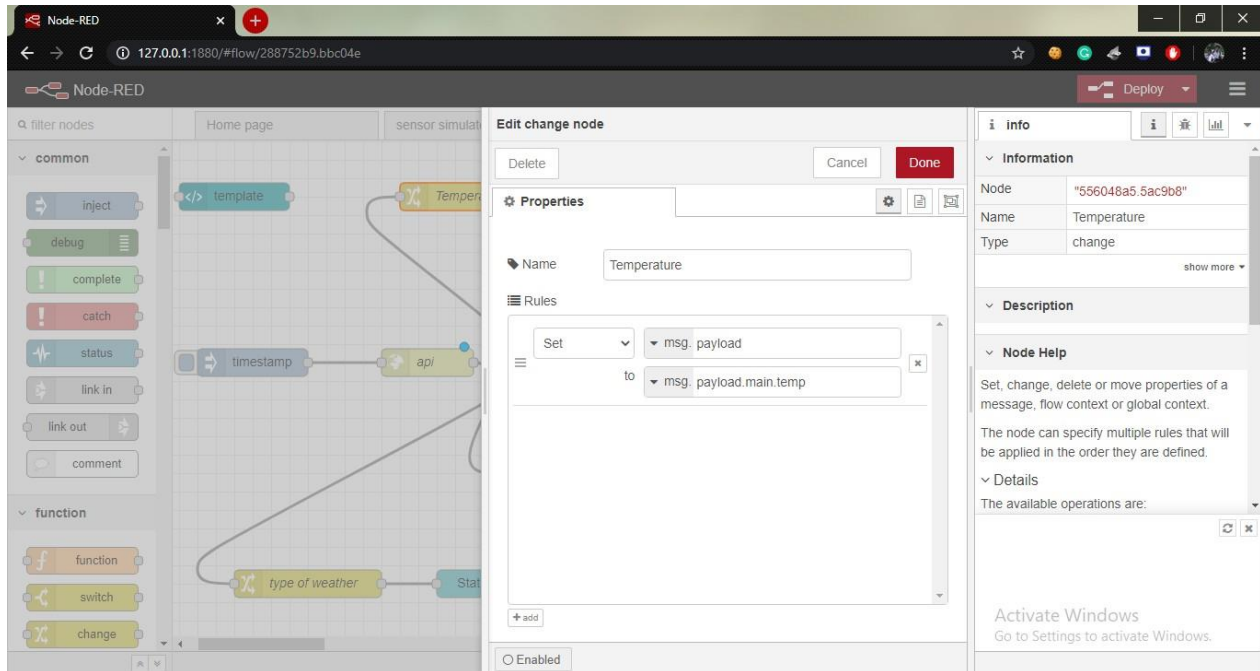
Step1: Timestamp node will trigger the API for certain interval of time. Set the required timing for the triggering.



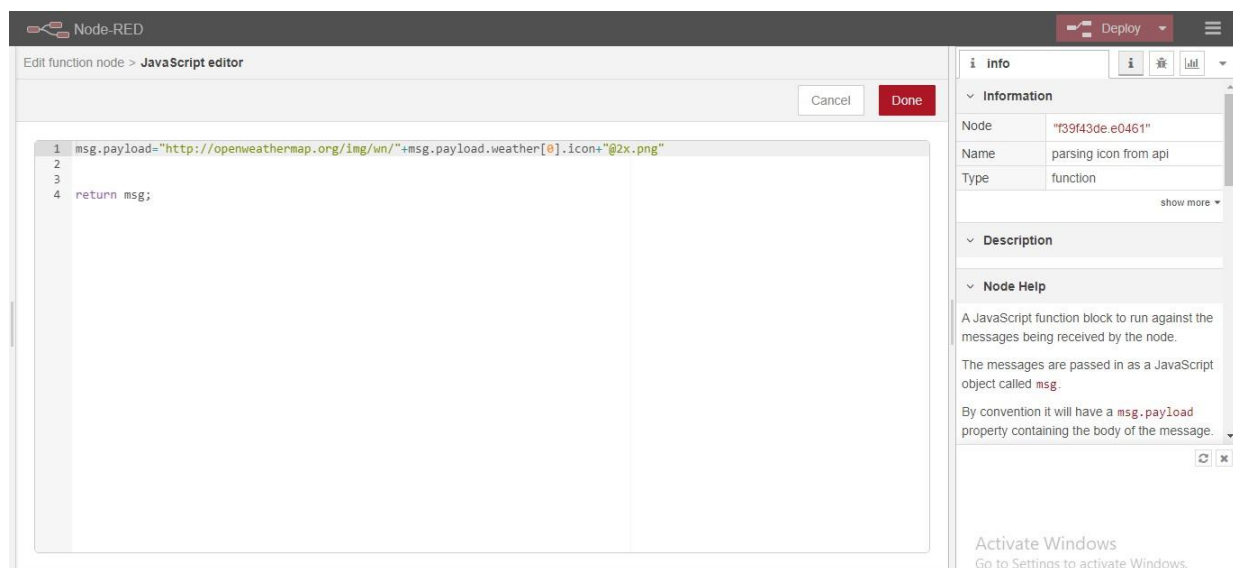
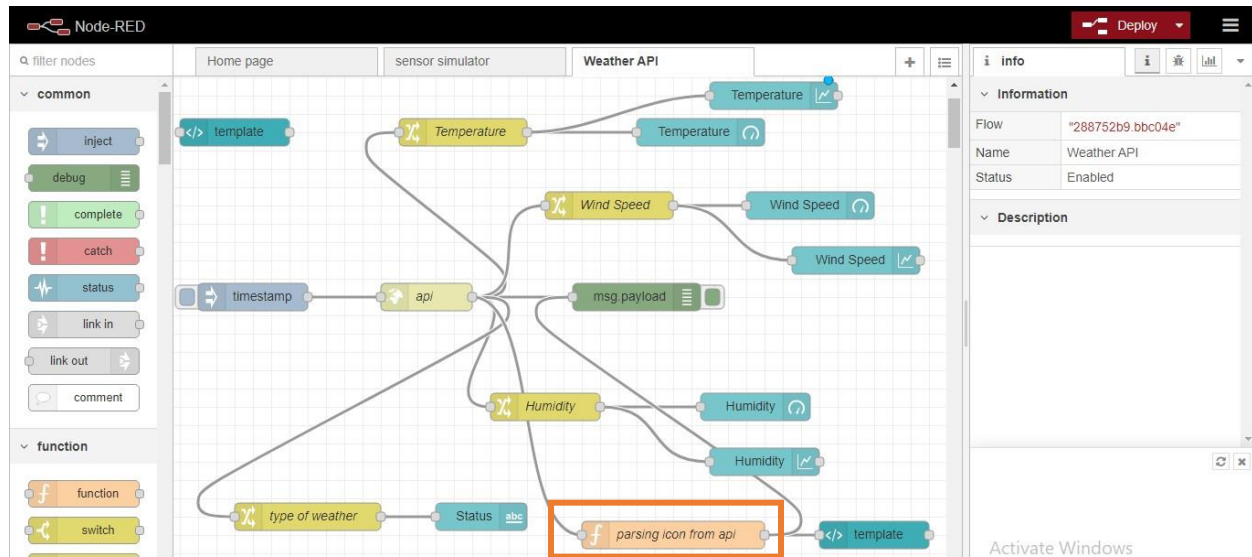
Step2: In the API node, give the API link and Return type as Jason parson to separate the API data.



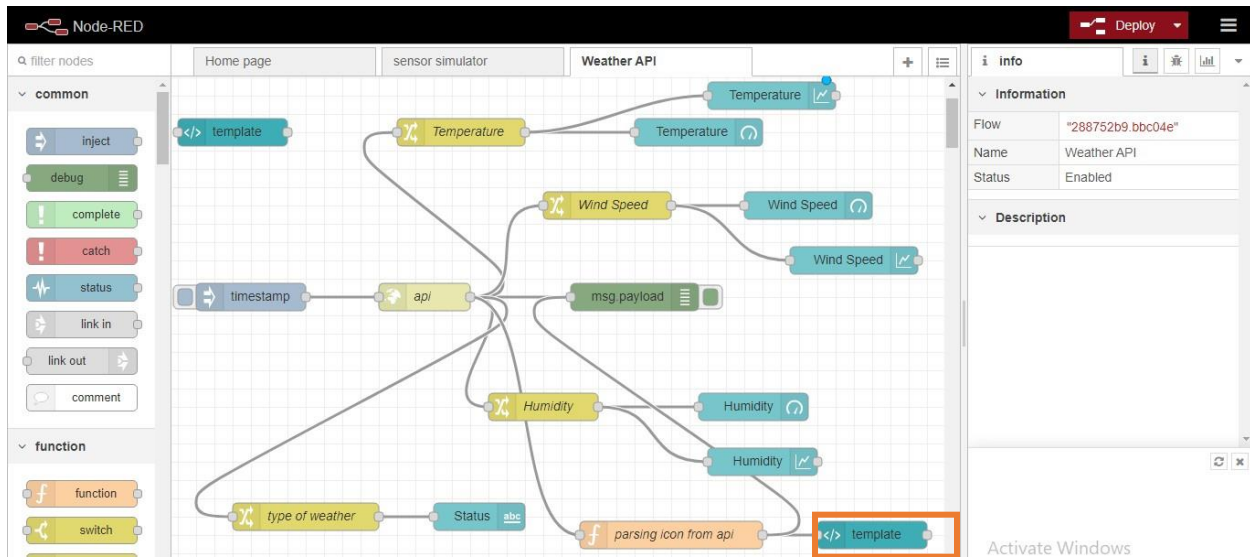
Step3: In the change node separate temperature value from the payload by following code given in the image. Repeat the same procedure for wind speed and Humidity.



Step4: To get set the different images based on the cloud condition. We need to get the id of the image and to concatenate the id to the API link.



Step5: To display the image in the HTML. A template node was created and image will be displayed in the particular layout.



Node-RED Edit template node > Text editor

```

1 <iframe id="myFrame" width="140" height="140" src = ""></iframe>
2
3 <script>
4 (function(scope) {
5   // watch msg object from Node-RED
6   scope.$watch('msg', function(msg) {
7     // new message received
8     var x = document.getElementById('myFrame');
9     x.setAttribute('src', msg.payload);
10  });
11 })(scope);
12 </script>
13
14
15
16

```

Cancel Done

Info panel:

- Node: "ed2981e9 7f509"
- Type: ui_template

Node Help:

The template widget can contain any valid html and Angular/Angular-Material directives. This node can be used to create a dynamic user interface element that changes its appearance based on the input message and can send back messages to Node-RED.

For example:

CHAPTER-05

Creating Machine learning model

Machine learning technology can play important role in smart irrigation system. It uses computational method to learn agriculture data. The focus of the learning process is to learn from training data to perform a given task. Set of examples in data which is described by set of features. That feature can be a nominal, binary or numeric. Irrigation system uses machine learning for water management, plant growth, and soil management. Also in agriculture it uses for crop management.

We have used the data for Rice crop where based on temperature, humidity, soil moisture and age of crop (in days) the status of motor is suggested.

Dataset example:

	Soil Moisture	Temperature	Humidity	Time	Status
0	54	22	70	21	ON
1	12	20	40	104	OFF
2	34	26	35	62	ON
3	7	44	44	93	OFF
4	50	38	23	92	OFF

Based on data and comparing different classifiers the accuracy of Random Forest Classifier comes to be 99.963% which is the highest.

```
accuracy=metrics.accuracy_score(Y_test,y_pred)
accuracy
```

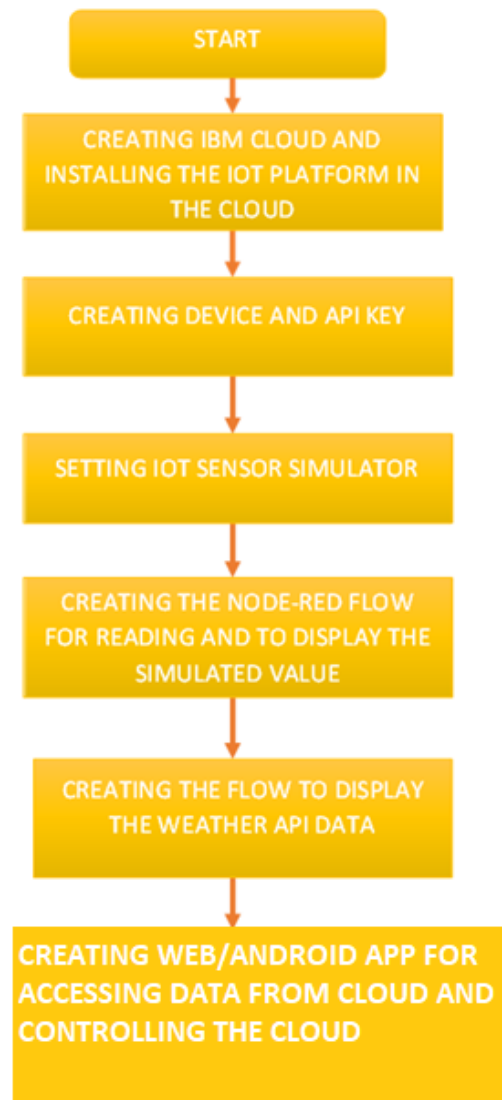
```
0.9996333333333334
```

Hence Random Forest Classifier is used for training the model.

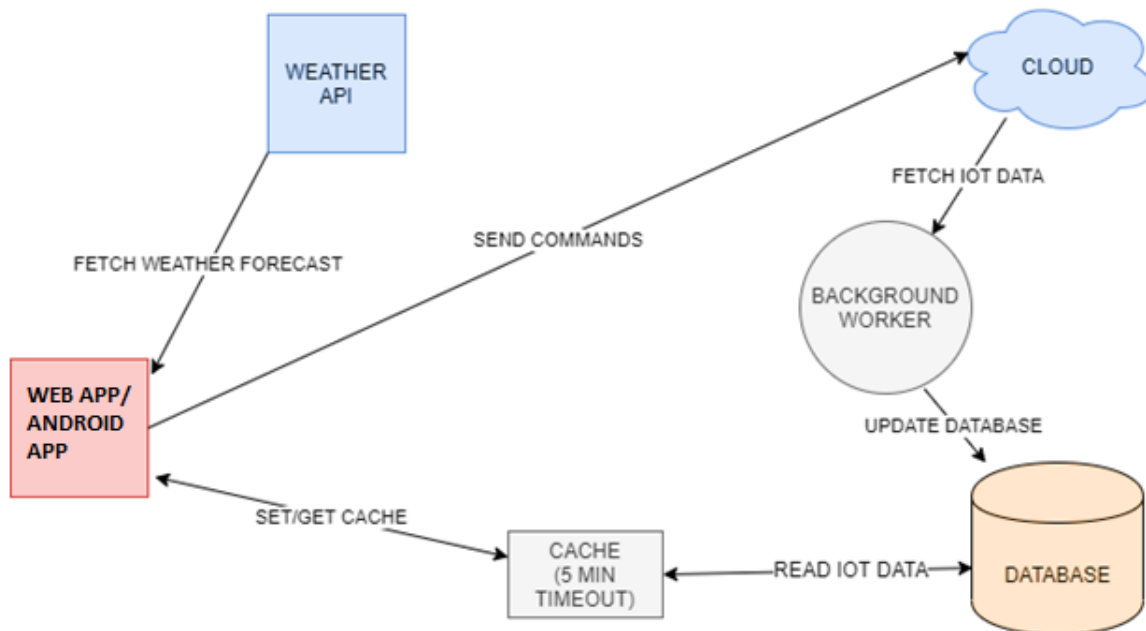
CHAPTER-06

FLOW CHART

6.1 METHODOLOGY



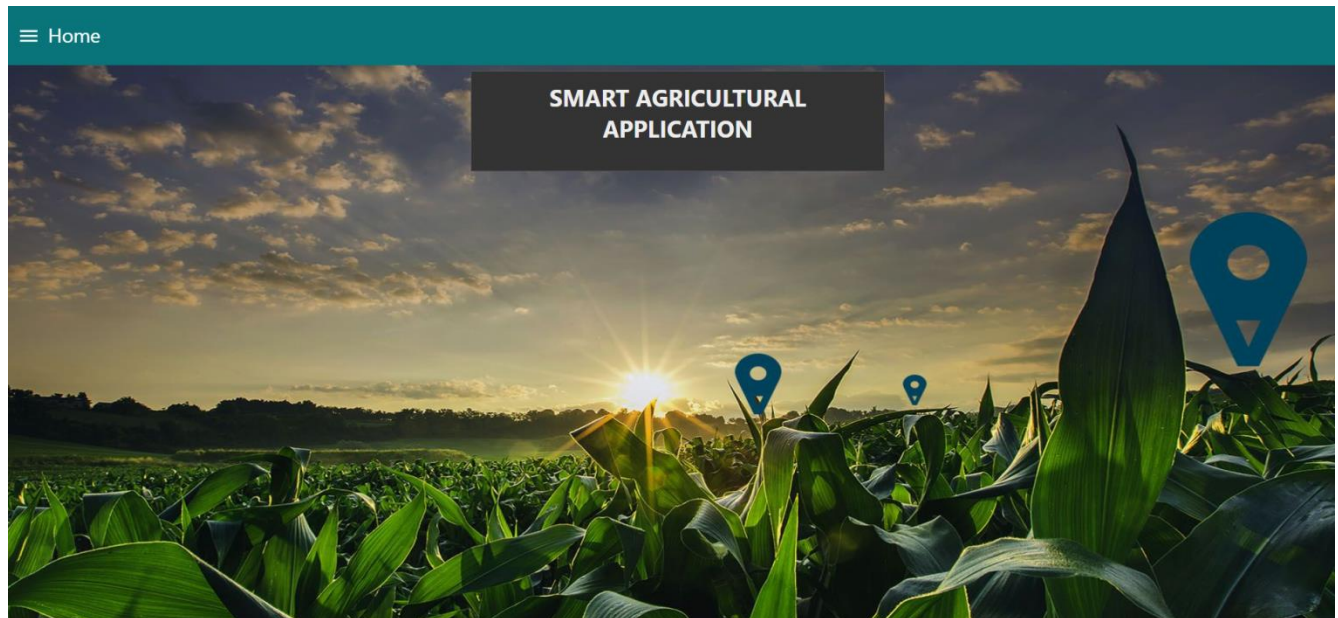
6.2 Data Flow Diagram for the Web / Android App



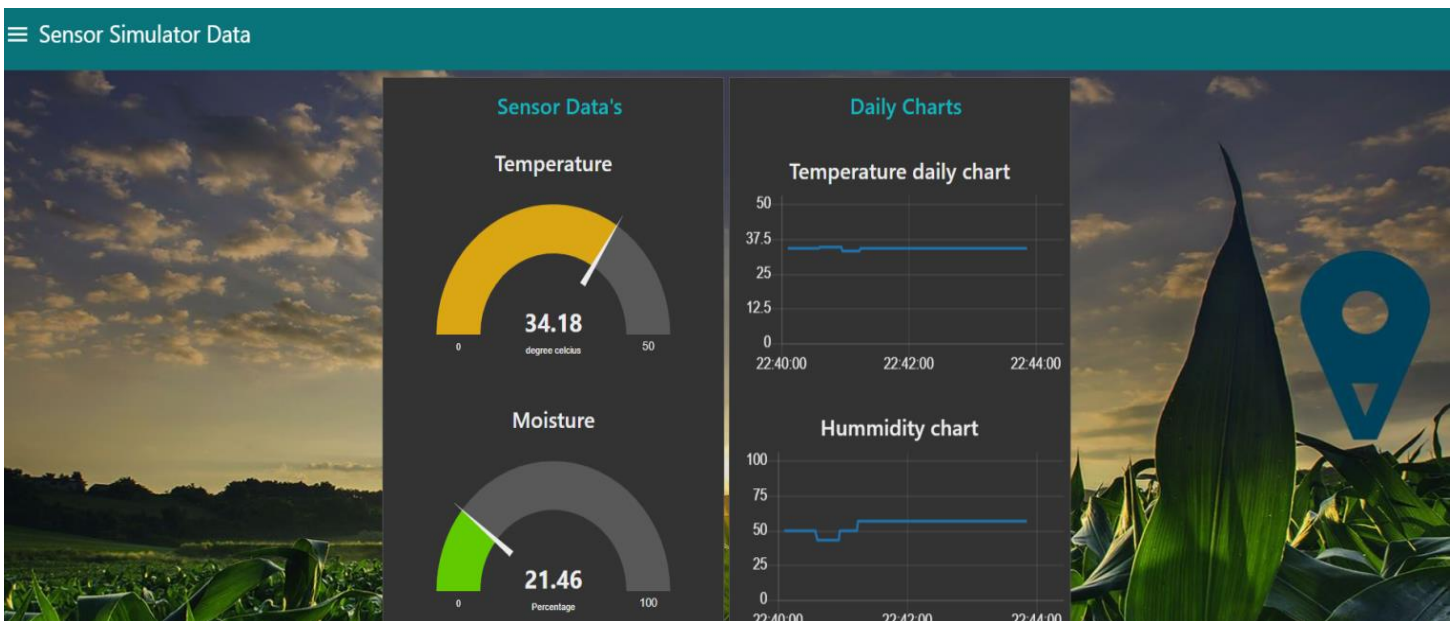
CHAPTER-07

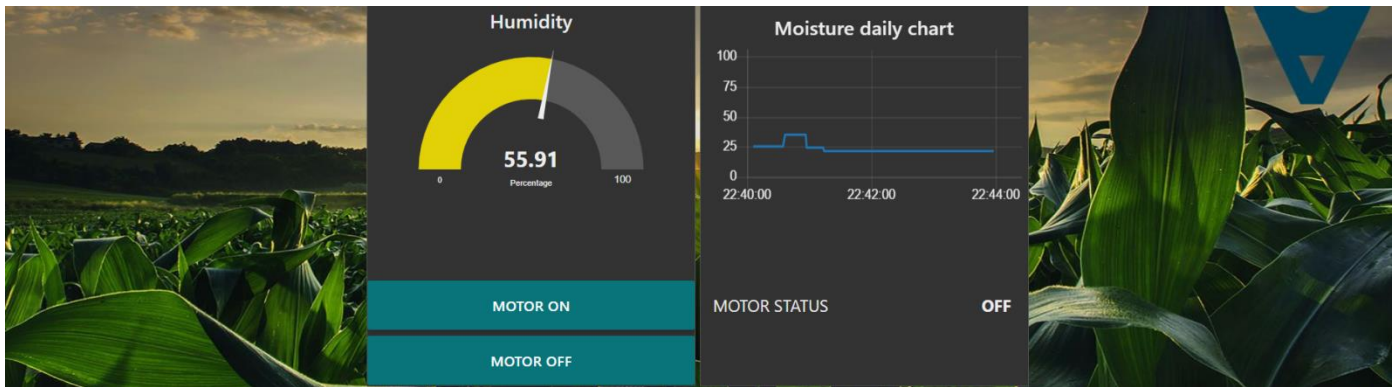
RESULT

7.1 HOME PAGE

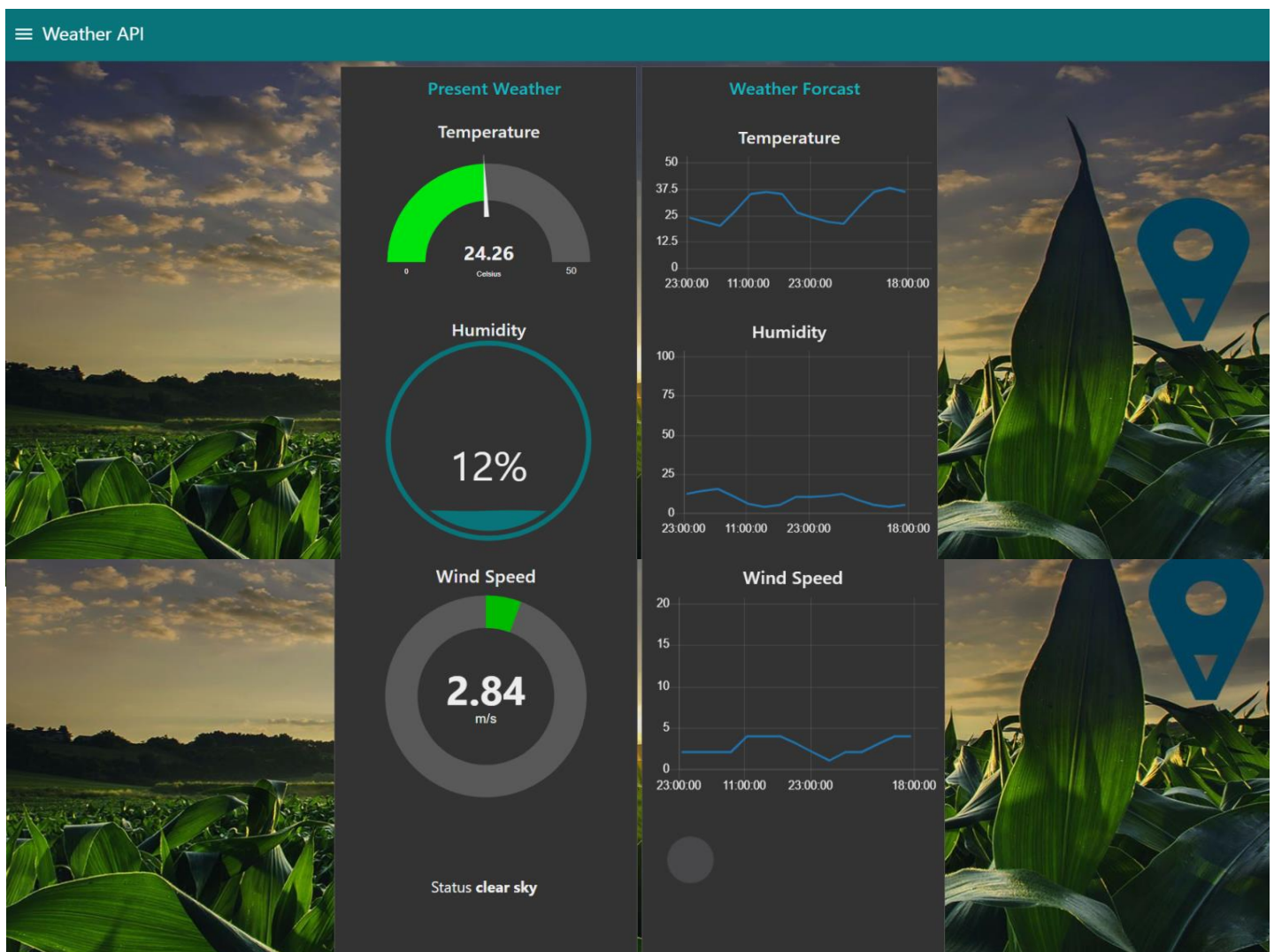


7.2 SENSOR SIMULATOR AND MOTOR CONTROL PAGE



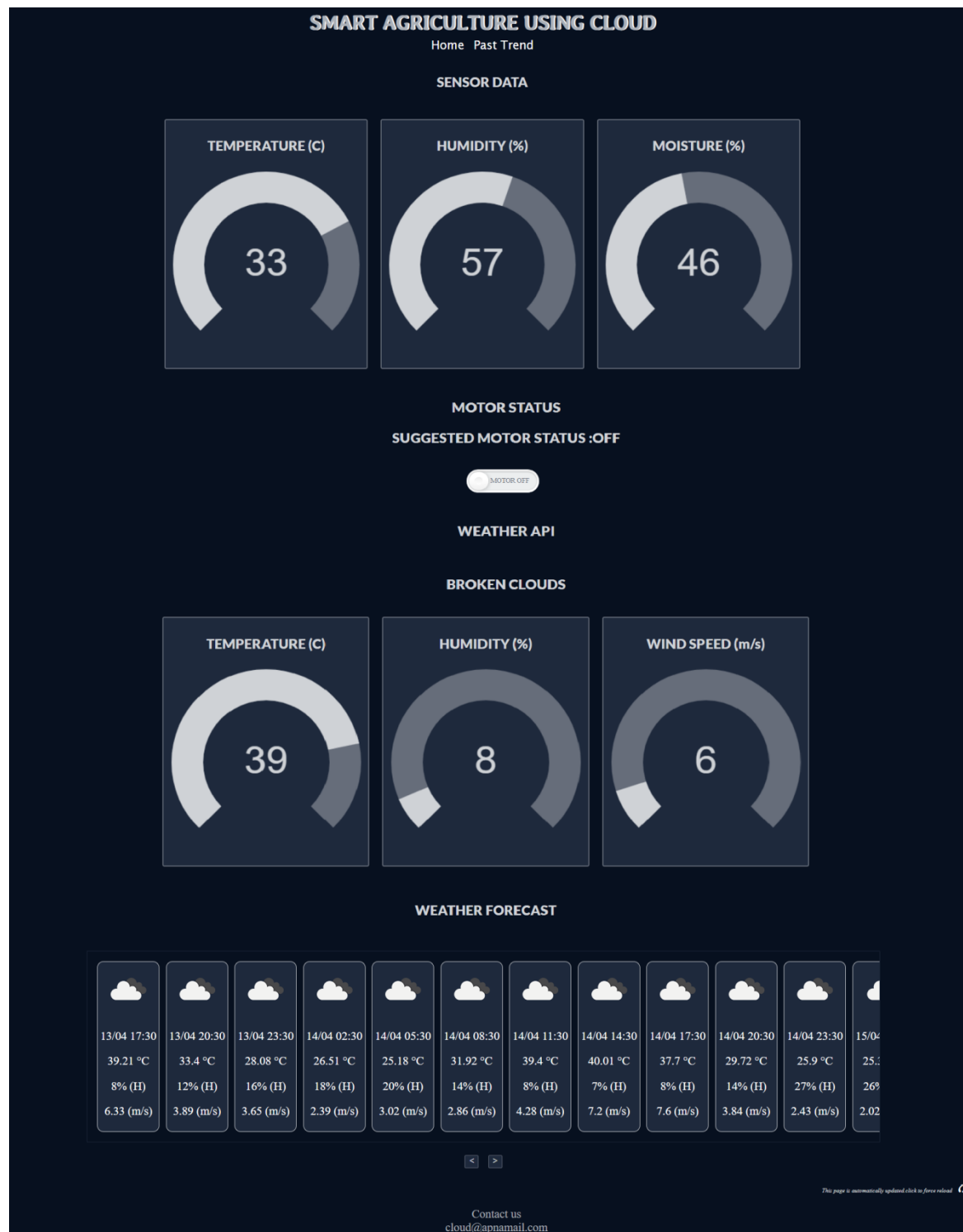


7.3 WEATHER API DATA STREAMING

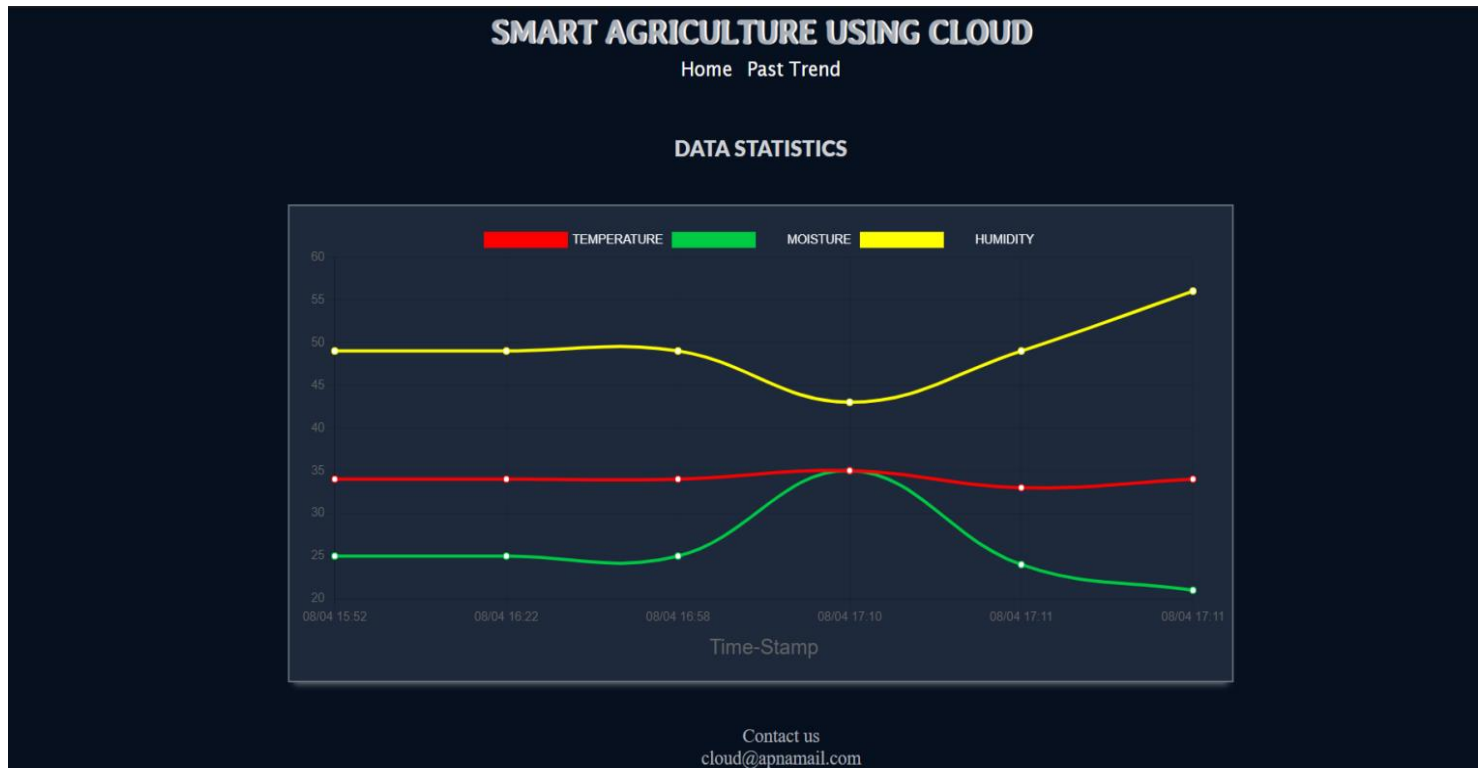


7.4 WEB APP UI

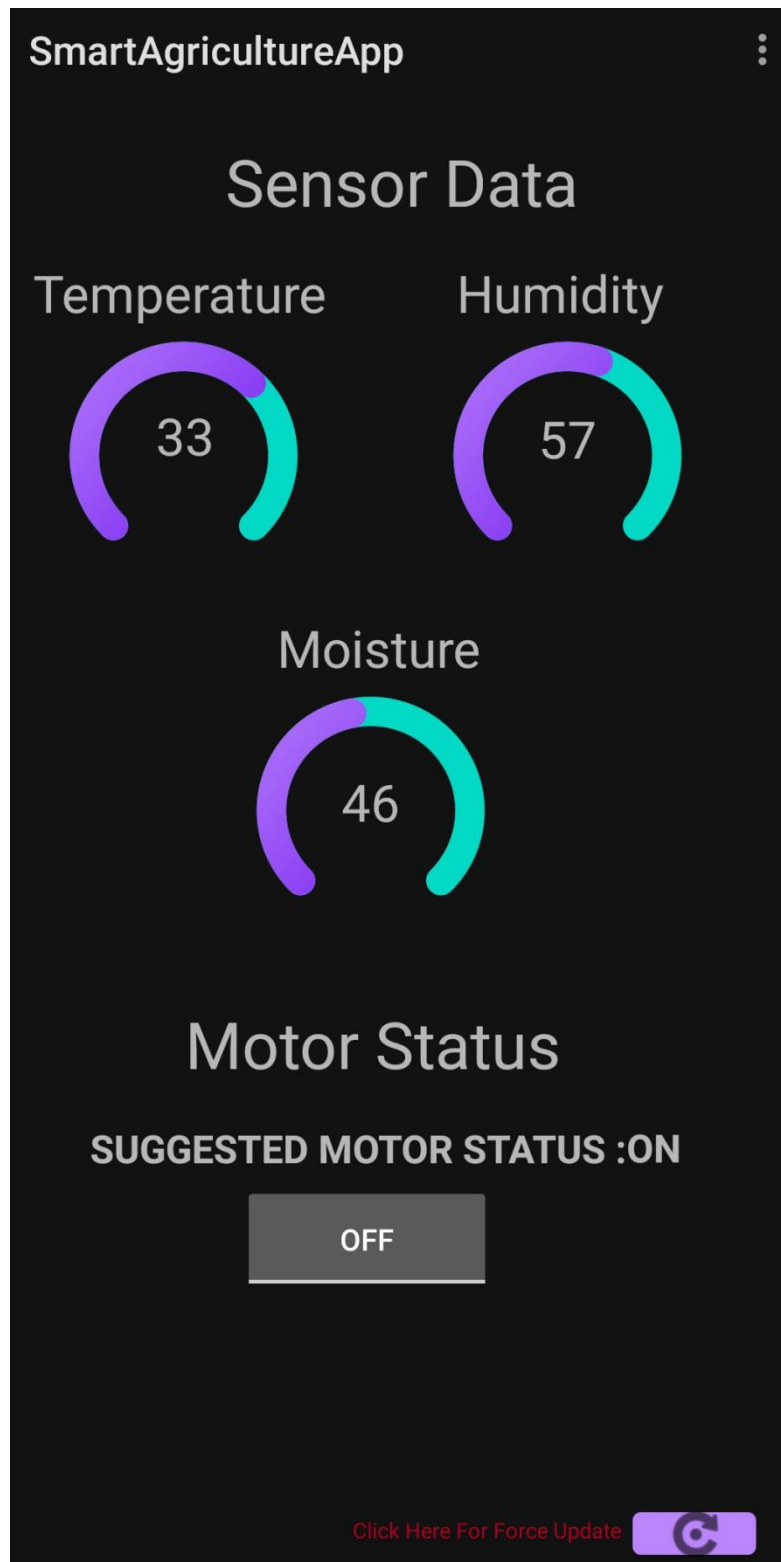
HOME



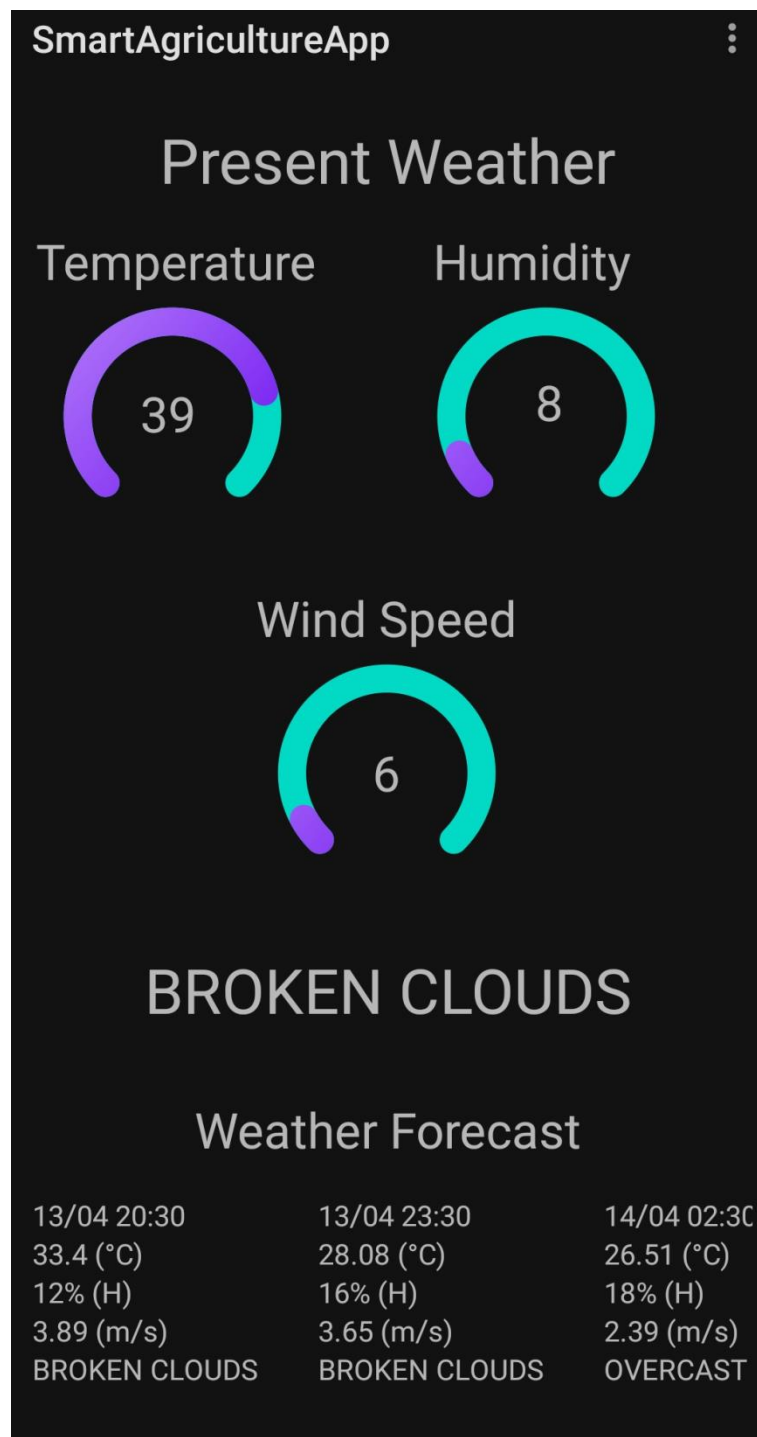
PAST TRENDS



7.5 ANDROID APP UI SENSOR DATA UI



WEATHER FORECAST UI



CHAPTER-08

ADVANTAGE AND DISADVANTAGE

8.1 ADVANTAGE

1. Communicating the device at larger distance through web application. It will play an important role in reducing the man power and travelling expenses of a farmer.
2. Monitoring the parameter like temperature, humidity etc will play an important role in improving the growth of the plant.
3. Integrating the weather station to the web browser will provide the details of status of the cloud, wind speed etc. It will allow the farmer to prevent their plants from natural calamities.

8.2DISADVANTAGE

- 8.2.1 Since the real time sensor will be connected to the controller, the controller requires continuous supply of internet to transfer the data.
- 8.2.2 Non availability of weather prediction for long period of time. Since the long weather prediction require additional payment to open weather.

CHAPTER-09

CONCLUSION

The various parameters like temperature, humidity etc were monitored using web application. The data from weather station like wind speed, temperature, humidity etc were displayed in the web browser. The device like motor, light etc can also controlled by the web application.

CHAPTER-10

FUTURE SCOPE

- The various data's of soil nutrients is not added in the web browser, that canbe added to the web application.
- Long range forecast is not available in the web application, it can also beadded to provide accurate information about weather.
- Controlling the device through voice will playimportant role in enhancing this project.
- Providing the GPS and GIS information will also improve productivity of thefarmer.

APPENDIX

The complete code and dataset can be seen by clicking on the following link:

<https://github.com/Baljotsinghchoudhary/project-iotdata>