Internship Project Report on

“SMART AGRICULTURE SYSTEM BASED ON IOT”

at

SMARTBRIDGE

(An edTech organization with a vision to bridge the gap between academia & industry.)

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INTRODUCTION

1.1 Overview

Agricultural lands are the heart of any country for economic development. Thus, it is the primary duty of the Government to preserve and protect the fields by any means. Science and new technologies have evolved but nothing could replace the dependency on agricultural farm lands. New technologies have been proposed for the betterment of the farmers, so that they can get a better result with more accuracy and less effort but with some limitations.

India holds the 2nd position in the farm output. Over 70% of the rural households depend on agriculture as their principal means of livelihood. But the pressure on farms increased due to increase in population. This leads to more consumption of non-renewable energy sources.

Keeping in mind the practical problems faced by the farmers, With the collaboration of SMARTBRIDGE(through RSIP-2020), I put forward an alternative agricultural model for the betterment of the next generation. We are going to use various modules like soil moisture sensor, pH sensor, humidity sensor, temperature sensor, electronic scarecrow (PIR sensor) under a single agriculture system to make it smarter. We get the information about various parameters that effect the crop production through these sensors and make decisions to monitor the crop production even from distant places using cloud technology. We also incorporate remote monitoring of the system, control of water pump through cell phones, keeping track of more than one field and assessing the records of each field for future study, under a single system. In this project, we assumed the simulated data coming to the cloud from the sensors due to the corona pandemic. As it may be a smart move towards the next generation agriculture, thus it can be called as ‘Smart Agriculture System based on IOT’.

1.2 Purpose

I have tried to focus on different scientific applications which could be put together in agricultural field for better accuracy with better productivity using less manpower. Moreover, I have included a method for monitoring the agricultural fields from any remote location and assess the basic condition of the field.

This is the project from the motivation of the farmers, working in the farmlands, is solely dependent on the rains and bore wells for irrigation of their land. In recent times, the farmers have been using irrigation technique through the manual control in which the farmers irrigate the land at regular intervals by turning the water-pump ON/OFF when required.

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LITERATURE SURVEY

2.1 Existing Problem

Horticulture is the foundation of our Nation. In past days, agriculturists used to figure the ripeness of soil and influenced presumptions to develop the product. They didn't think about the dampness, level of water and especially climatic conditions which affect an agriculturist more. They utilize pesticides in view of a few suspicions which made lead a genuine impact to the yield if the supposition isn't right. The profitability relies upon the last phase of the harvest on which agriculturist depends. Here are few solutions offered earlier but with limitations:

1. Ravi Kishore Kodali in 2016 proposed a low cost weather monitoring device to retrieve the weather condition of any location from cloud data base management system. Since it does not use any peripheral device monitoring the weather, it was observed that cost of the device can be reduced.

2. M.K.Gayatri etal in 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.

2.2 Proposed Solution

To improve the efficiency of the product there by supporting both farmers and country we need to utilize the innovation which appraises the nature of harvest and giving recommendations. The Internet of things (IOT) is revamping the agribusiness engaging the farmers by the broad assortment of techniques, for instance, accuracy and conservative cultivation to go up against challenges in the field. In this project, on a farm, management can monitor different environmental parameters effectively using sensor devices such as temperature sensor, relative humidity sensor and soil moisture sensor. Periodically (30 seconds) the sensors are collecting information of agriculture field area and are being logged and stored online using cloud computing and Internet of Things. By using wireless transmission, the sensed data forwarded towards to web server database. If irrigation is automated, then that means if the moisture and temperature fields fall below of the potential range. The user can monitor and control the system remotely with the help of application which provides a web interface to the user.

CHAPTER-03

THEORITICAL ANALYSIS

3.1 Block Diagram

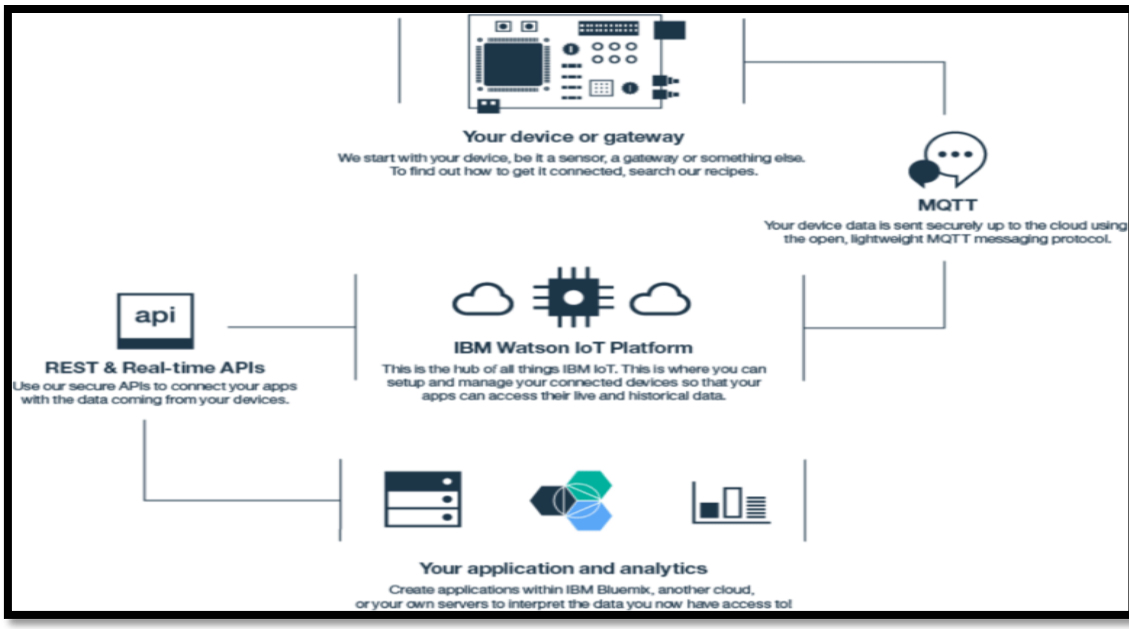


Fig.3.1: Diagram showing the integration of cloud through MQTT protocol.

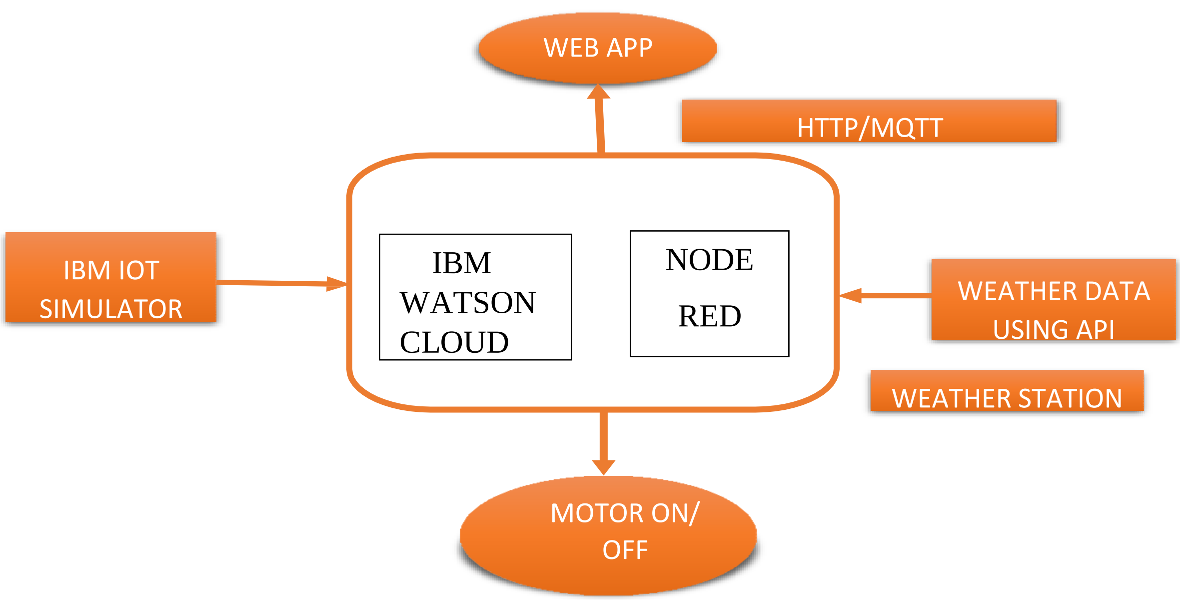


Fig.3.2: Block diagram of IOT technology in Agriculture

3.2 Software Designing:

1. Watson IOT Platform:

Two devices have been created in IBM Watson IOT Platform. One for sending the command to the User and another to receive the data from an IOT simulator (Temperature, humidity & soil moisture) and Open Weather API (recent weather information of the farm). Device is connected to the IOT Simulator to get the simulator data.

2. Node Red

Node-RED is a programming tool for wiring together hardware devices, APIs and online services in new and interesting ways. It provides a browser-based editor that makes it easy to wire together flows using the wide range of nodes in the palette that can be deployed to its runtime in a single-click.

Node red is installed on the PC and required nodes is installed in the node red to configure the device to display the received data from simulator and open weather api to user interface dashboard.

3. Web App

A web application is created which displays the temperature, humidity, and soil moisture data of past one hour that is received by the device from the IOT simulator. It also displays live weather parameters of the farm using open weather api.

There are set of buttons on the web application that can be used to control the motor and light on the farm to turn them ON/OFF remotely.

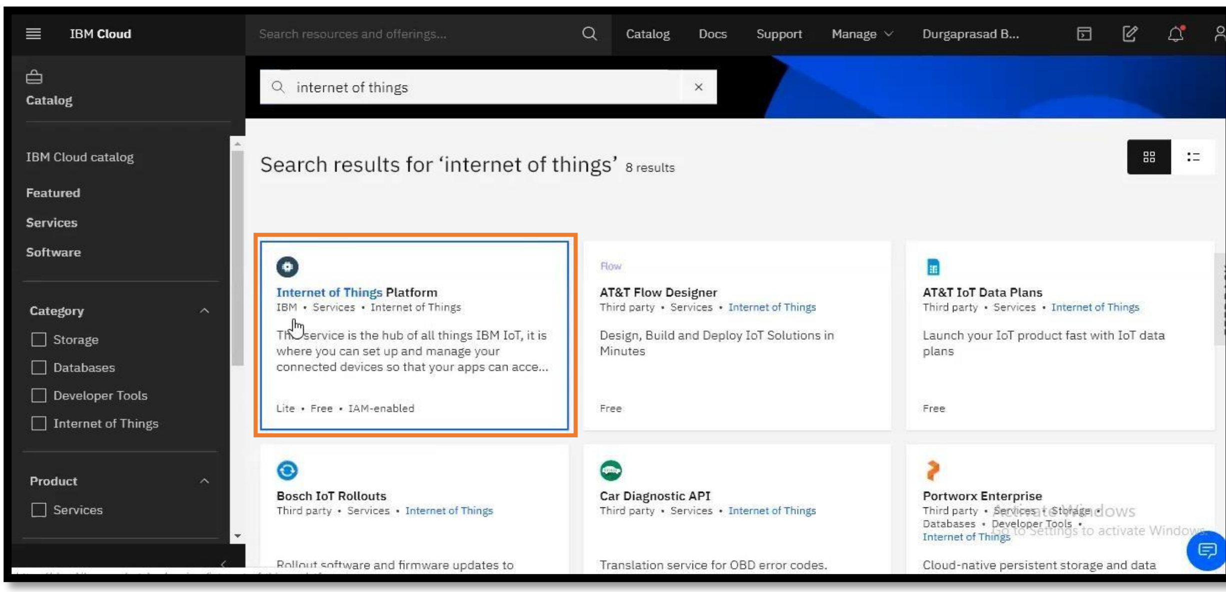
A python code is written to track down the commands (like turning motor and light ON/OFF) that are being sent by the user through web application

CHAPTER-04

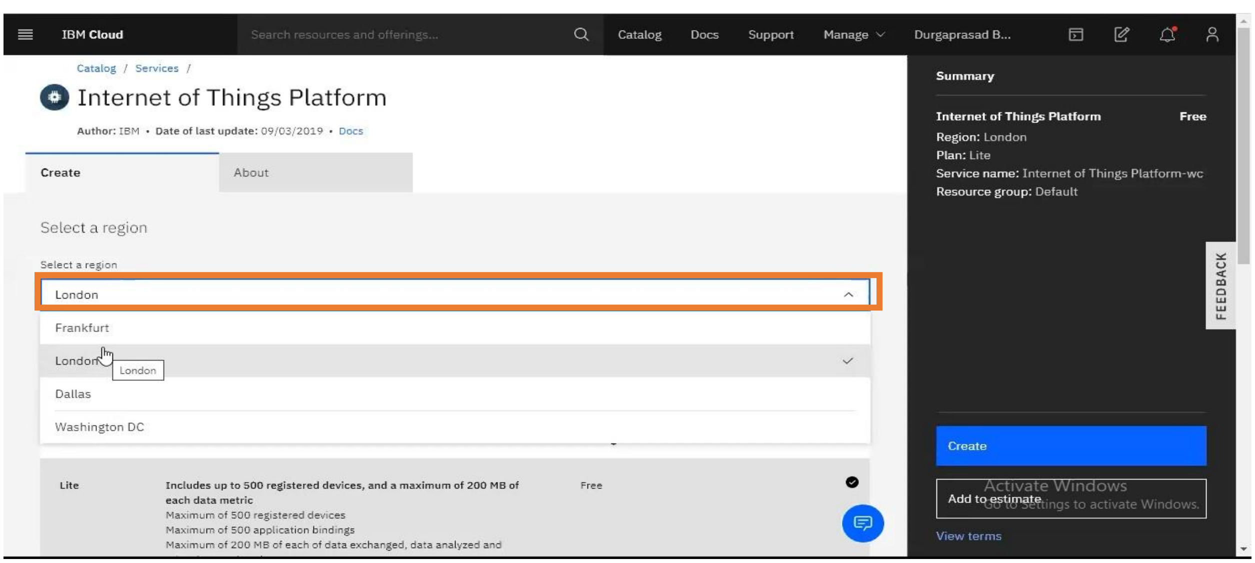
EXPERIMENTAL INVESTIGATION

4.1 Setting the device in IBM Watson IOT Platform:

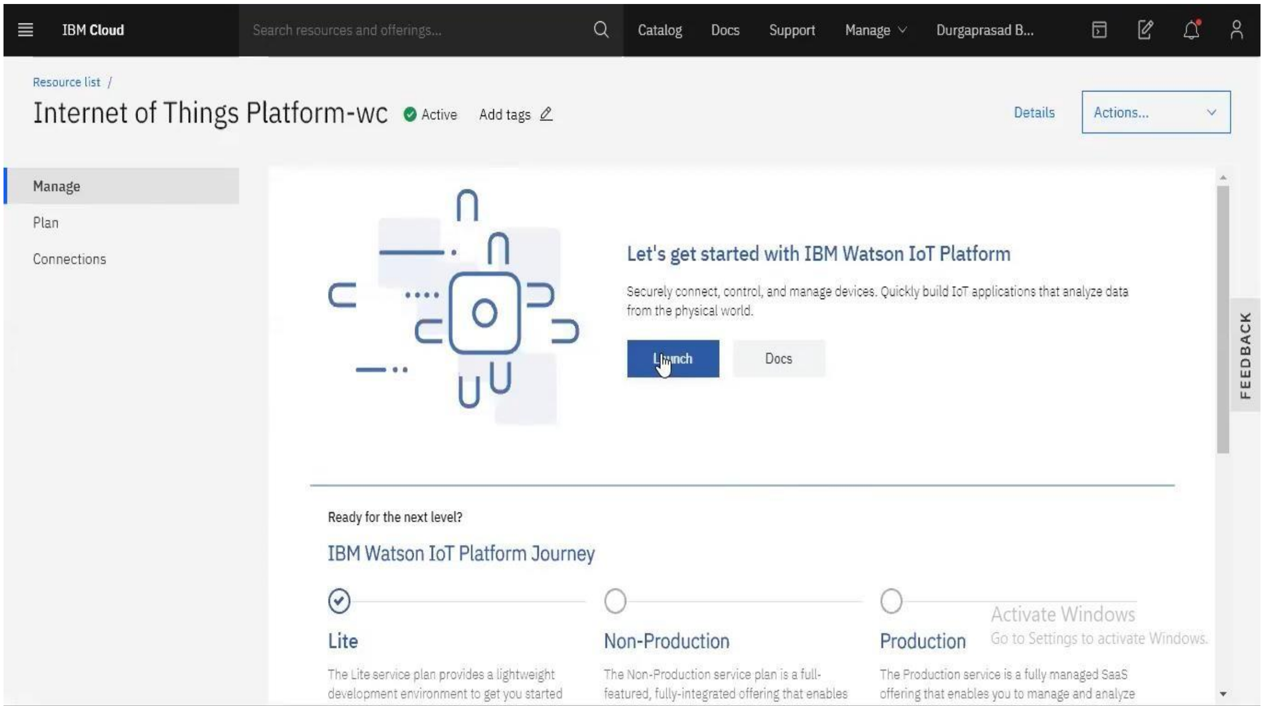
Step 1: After logging into the system a dashboard will appear and in the search panel type IBM IOT platform.



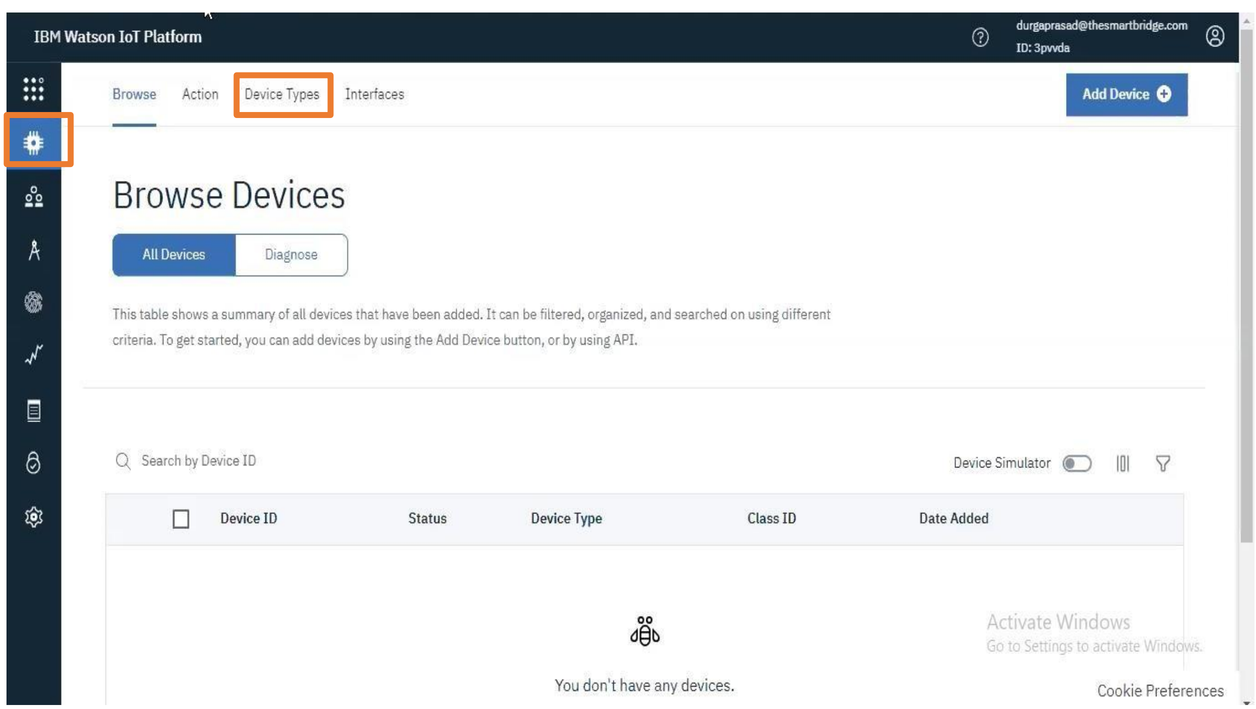
Step 2: Select the London option from drop down list and click create.



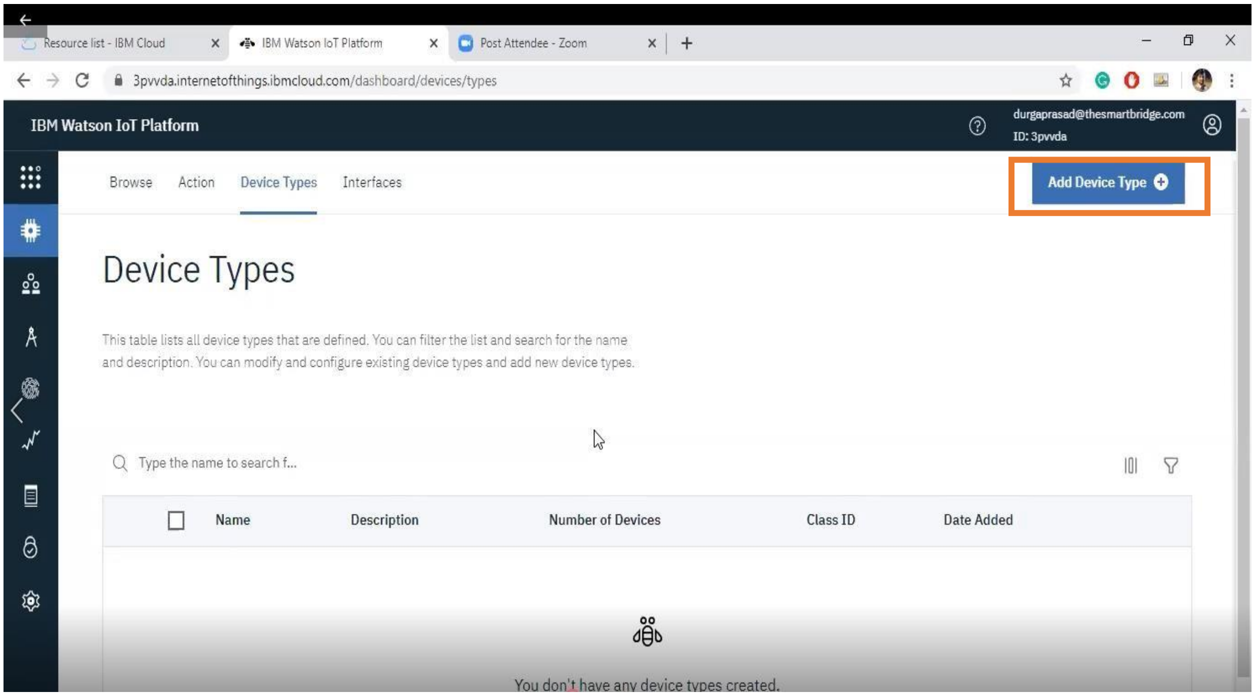
Step 3: Click on the Launch button.



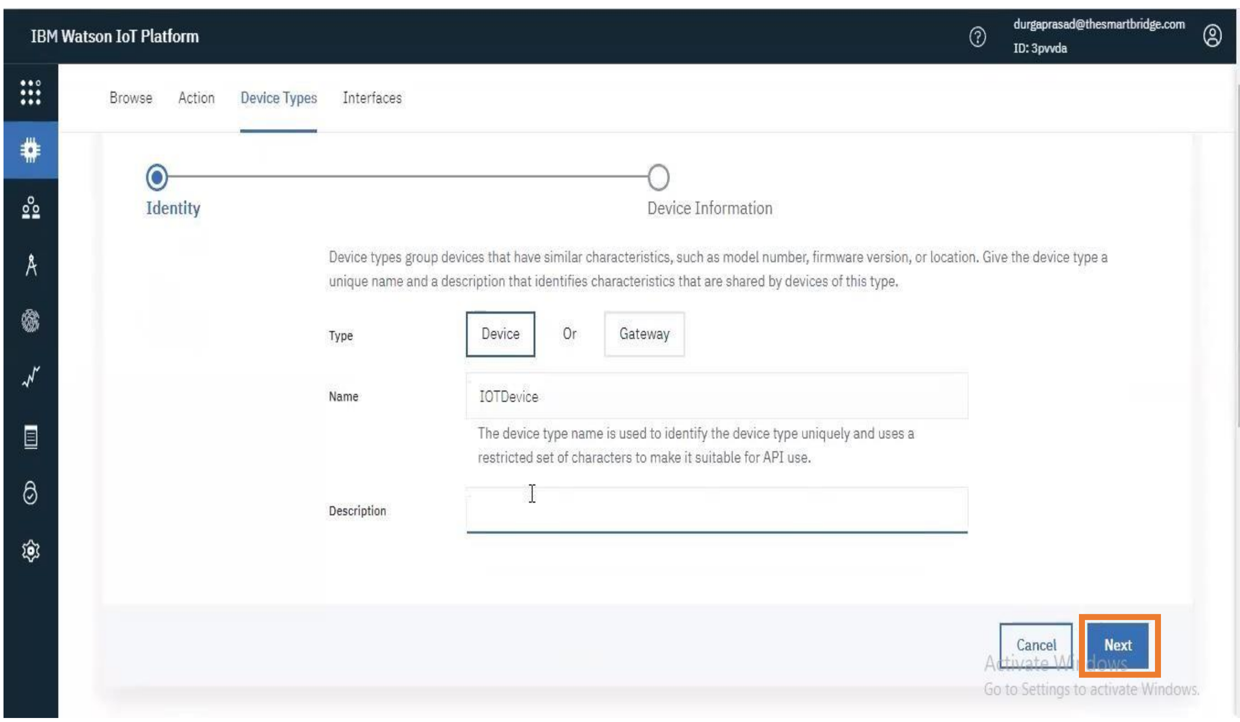
Step 4: Click on the Device type.



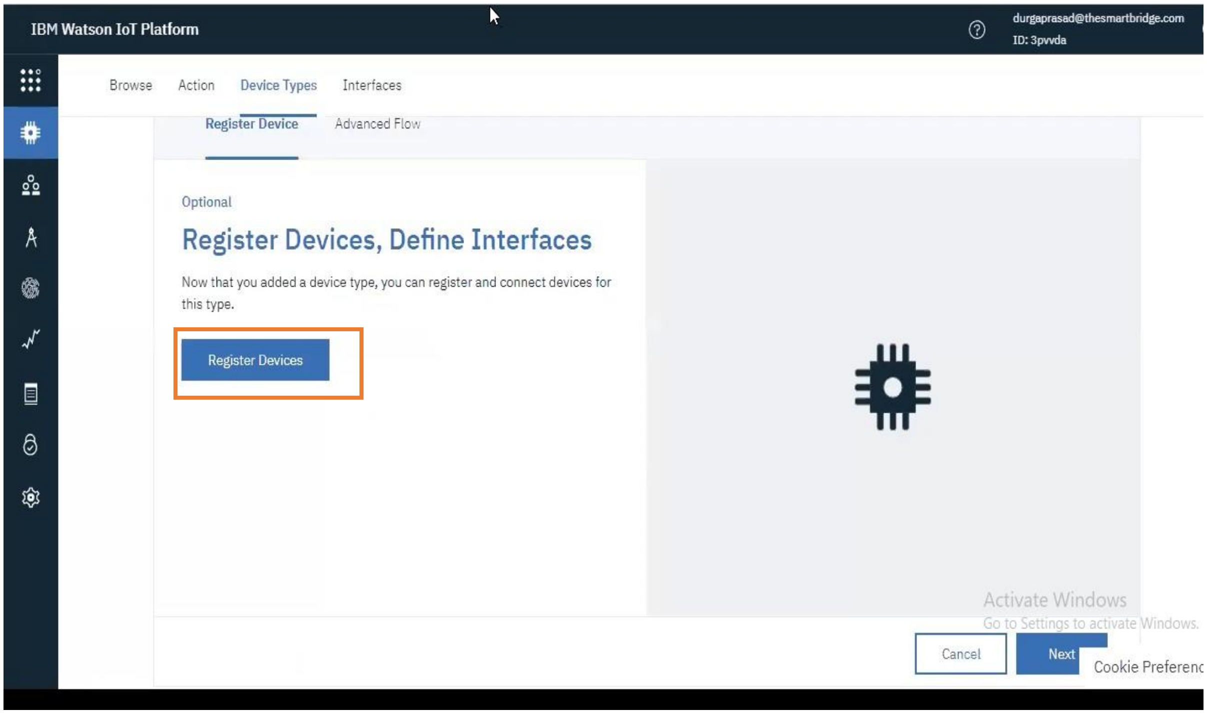
Step 5: Click on the add device button



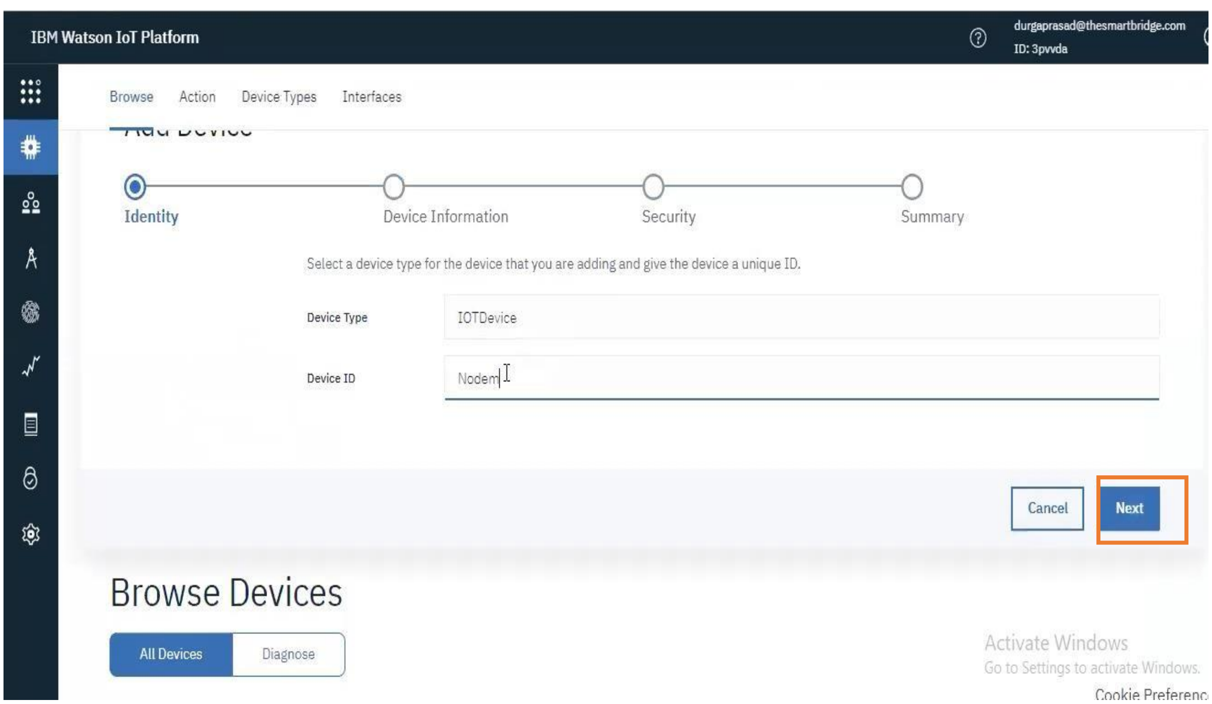
Step 6: Enter the Device name, Description, click next and then click on Finish.



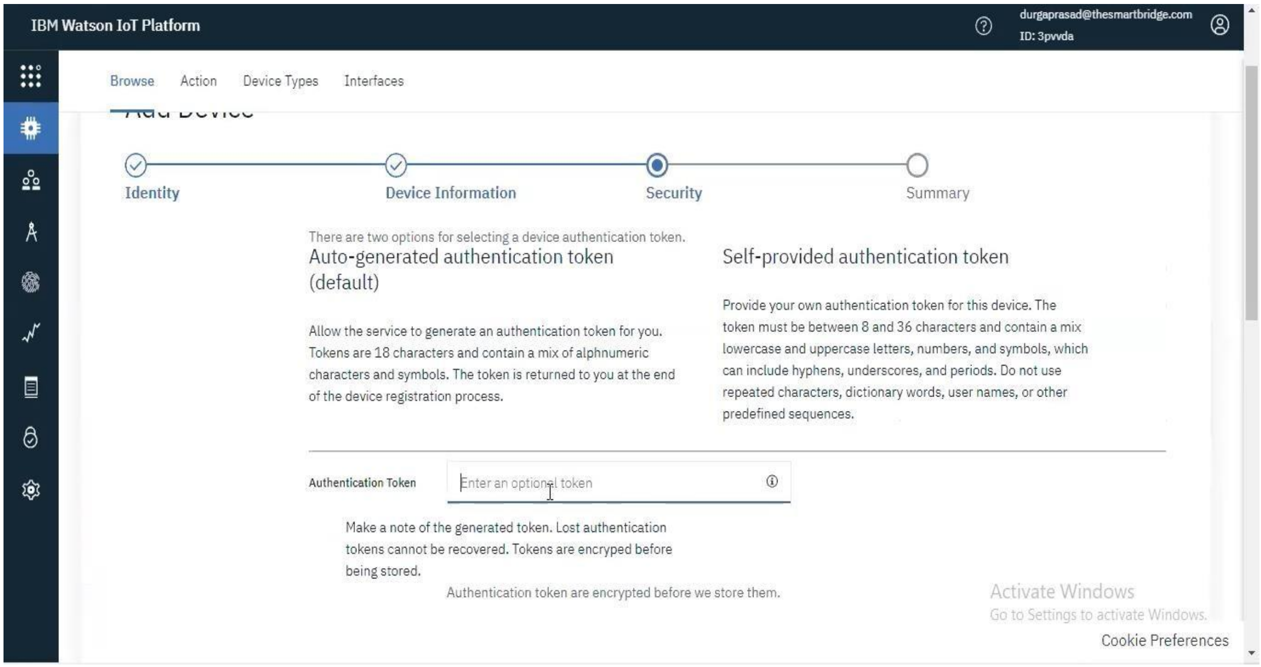
Step 7: Click on the Register Device.



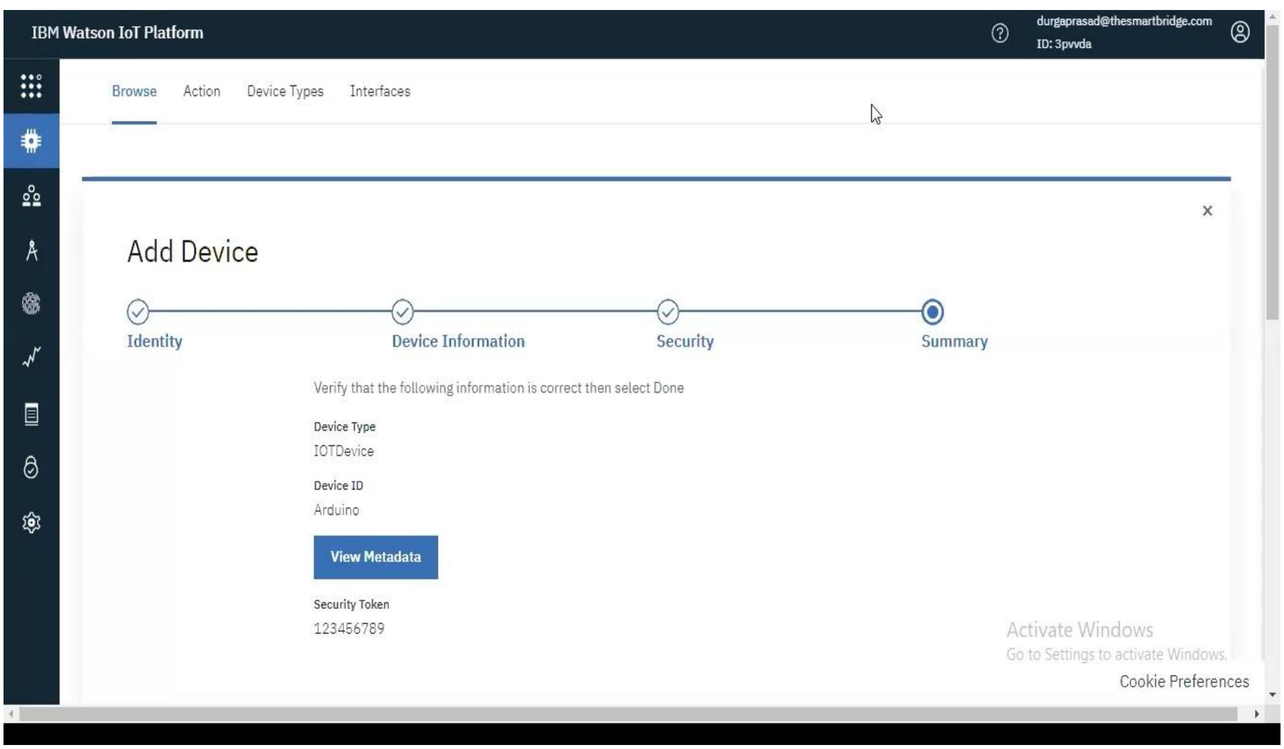
Step 8: Enter the device name and click Next and then on Finish.



Step 9: Filling the Authentication token and click Next button.

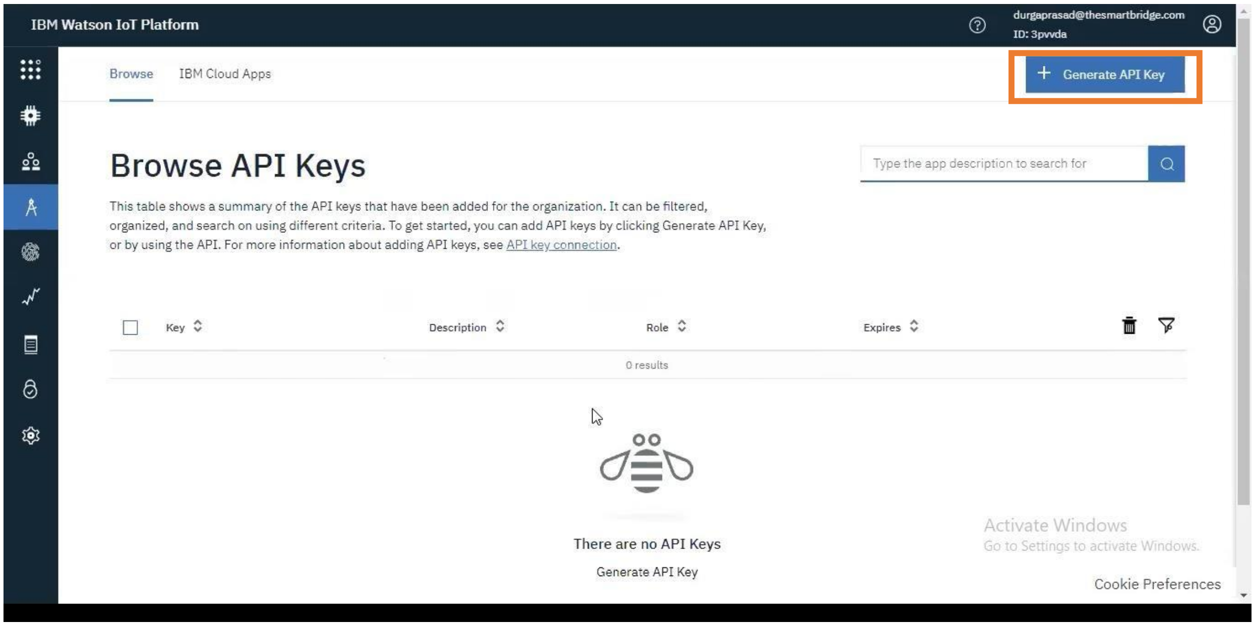


Step 10: Final summary tab will show the device type and device name information. Copy all the information displayed in a separate file.

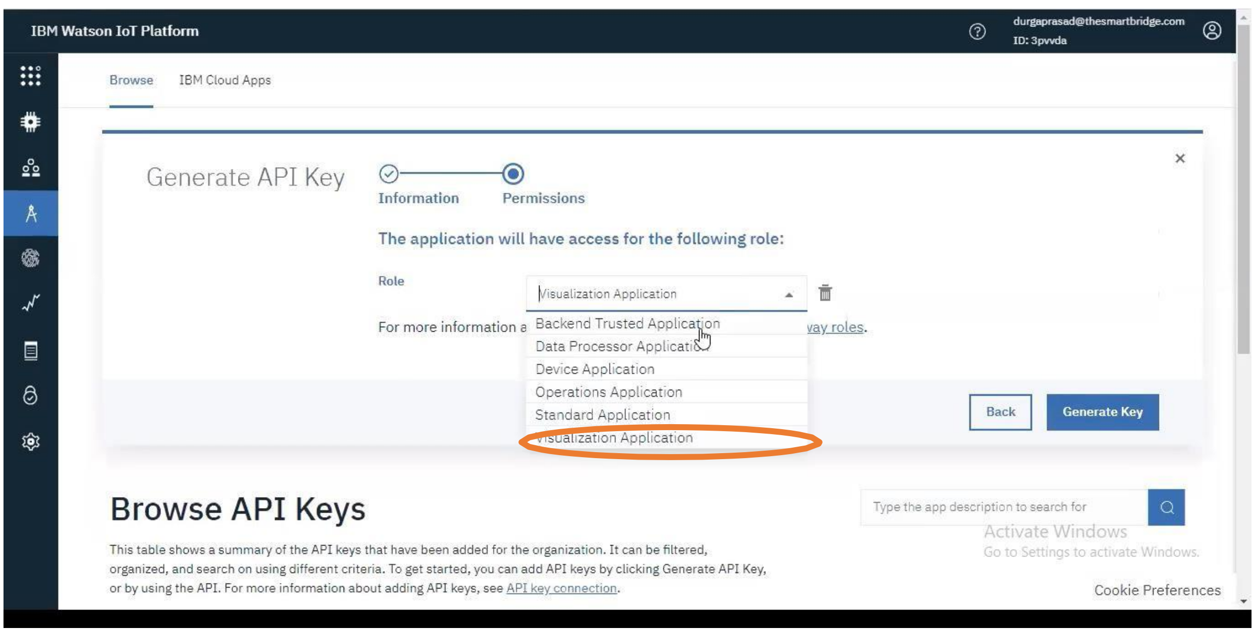


4.2 Generating the Device API

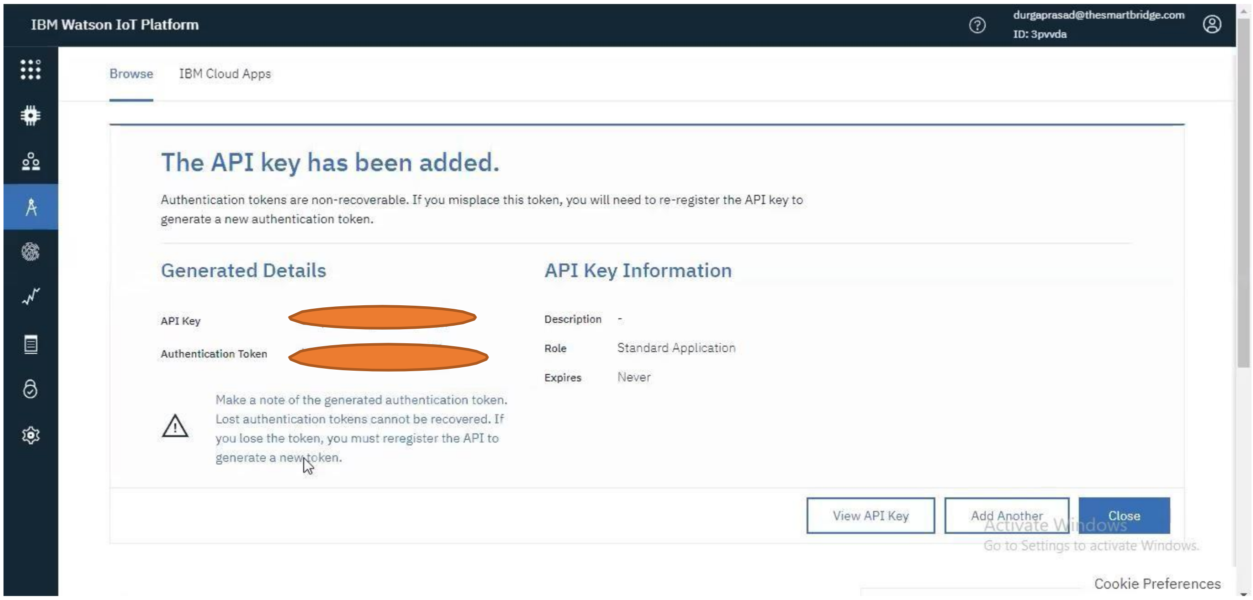
Step 1: Click on the app icon and click on generate API key button.



Step 2: Click on the standard application from the drop down list and click generate key.

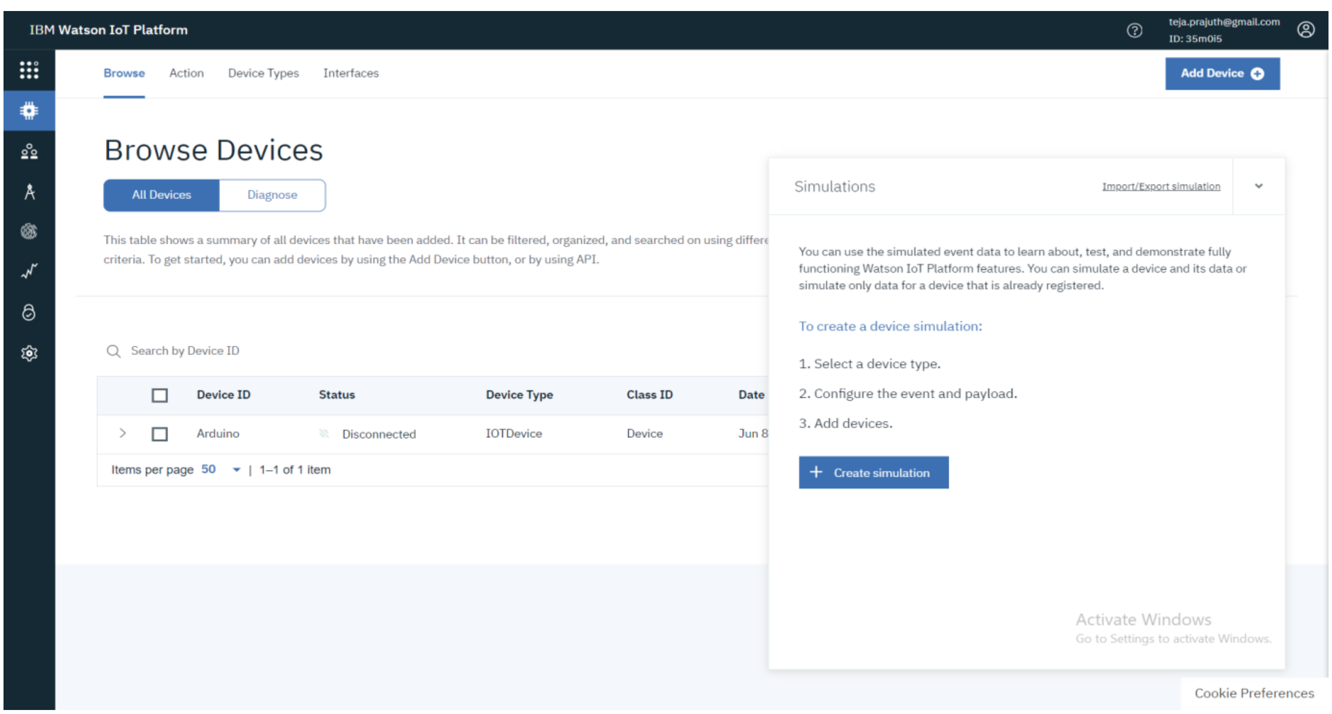


Step 3: Note the API key and authentication token for future reference

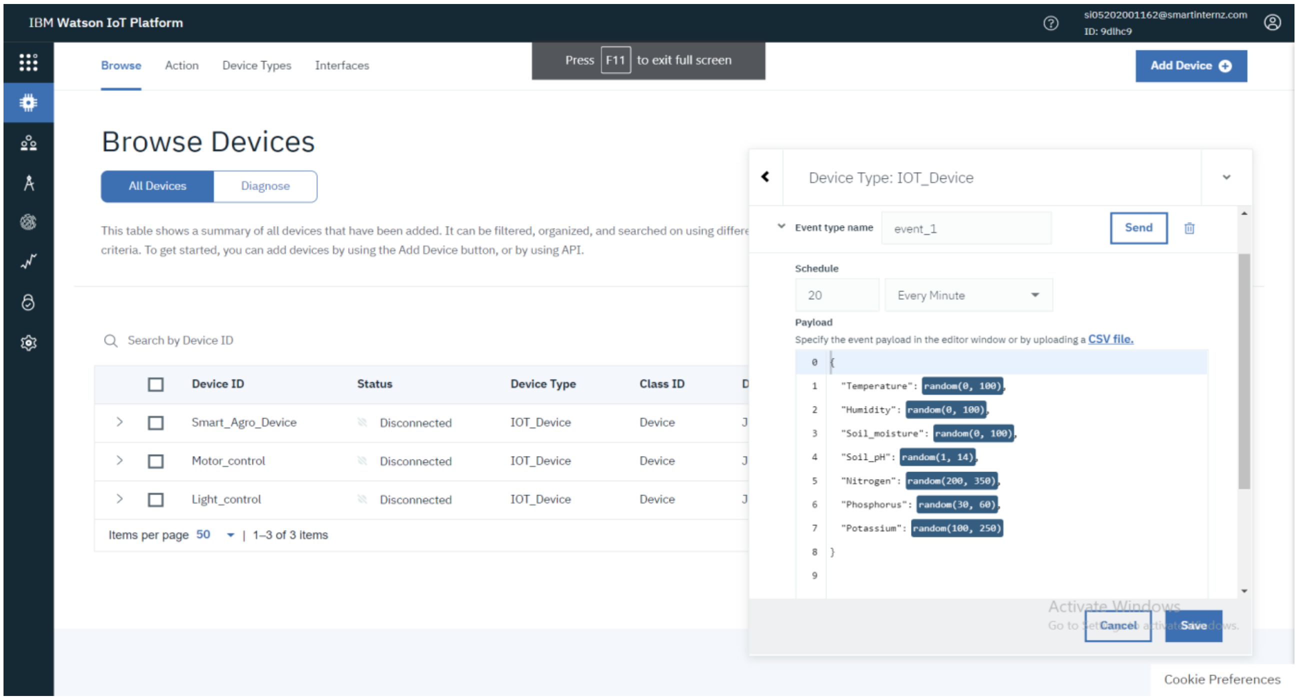


4.3 Setting the IBM cloud in-build IOT simulator and developing of cloud dashboard.

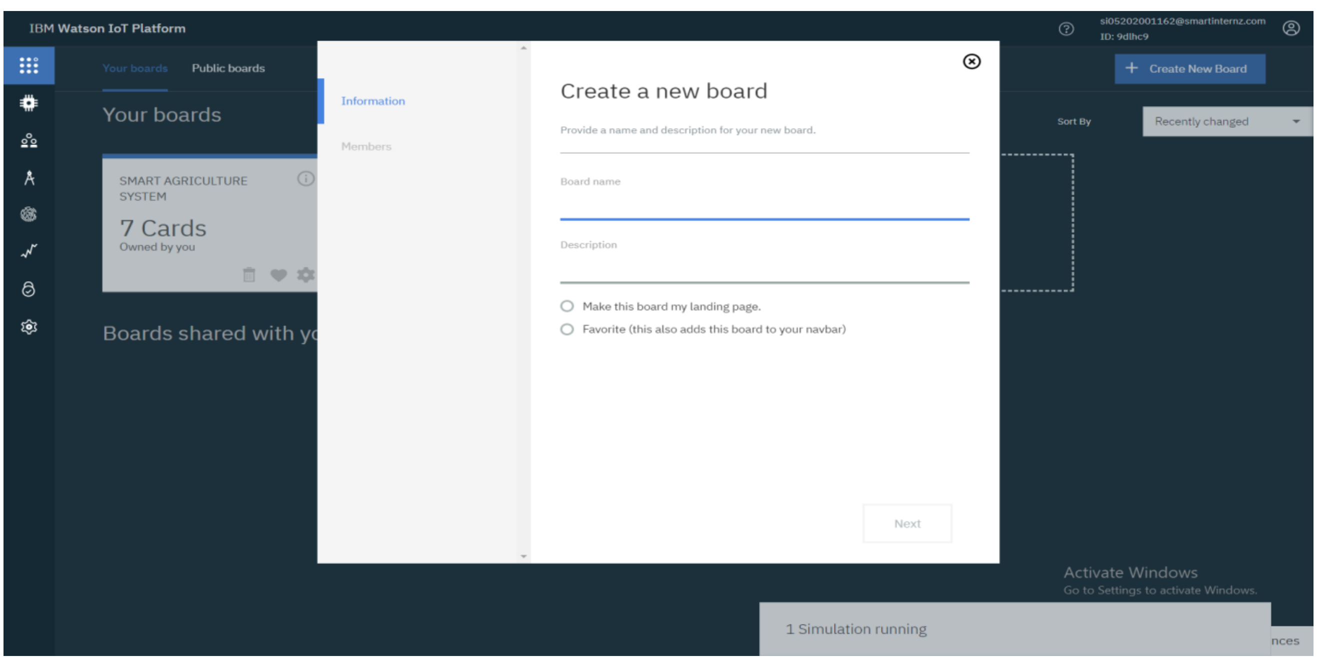
Step 1: Click on the Devices on the left top and then on the simulation on the right bottom.



Step 2: Click on the create simulation and give the required data that is needed to be simulated. Run the simulation after selecting the device id.

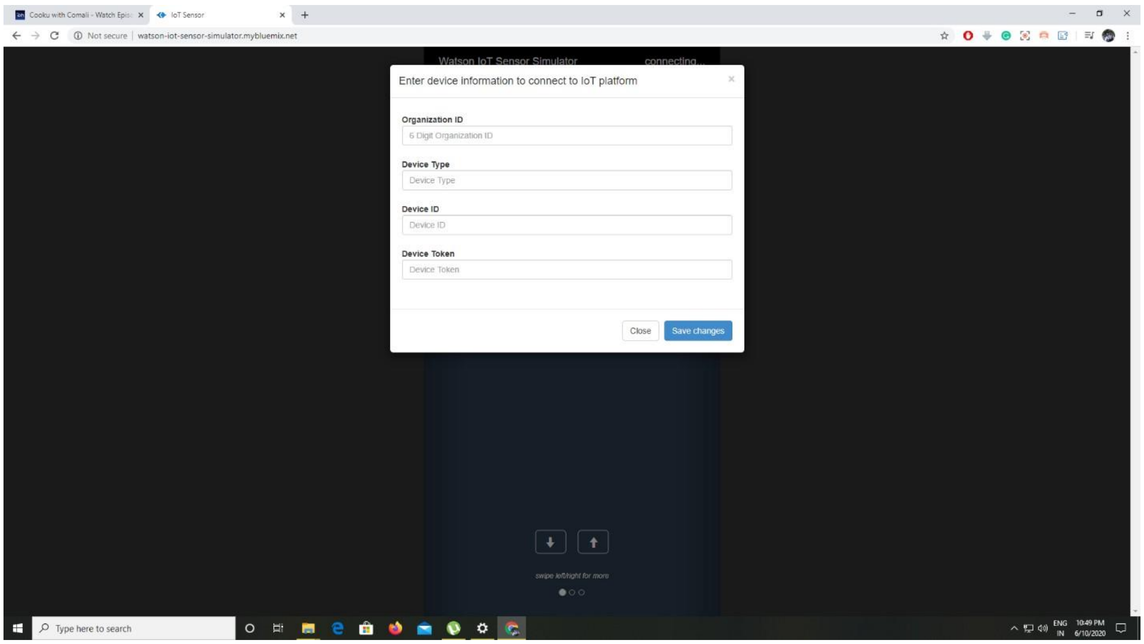


Step 3: Click on the boards on the top left of the platform and add the cards into cloud dashboard. Add all the required credentials that are necessary to be displayed.



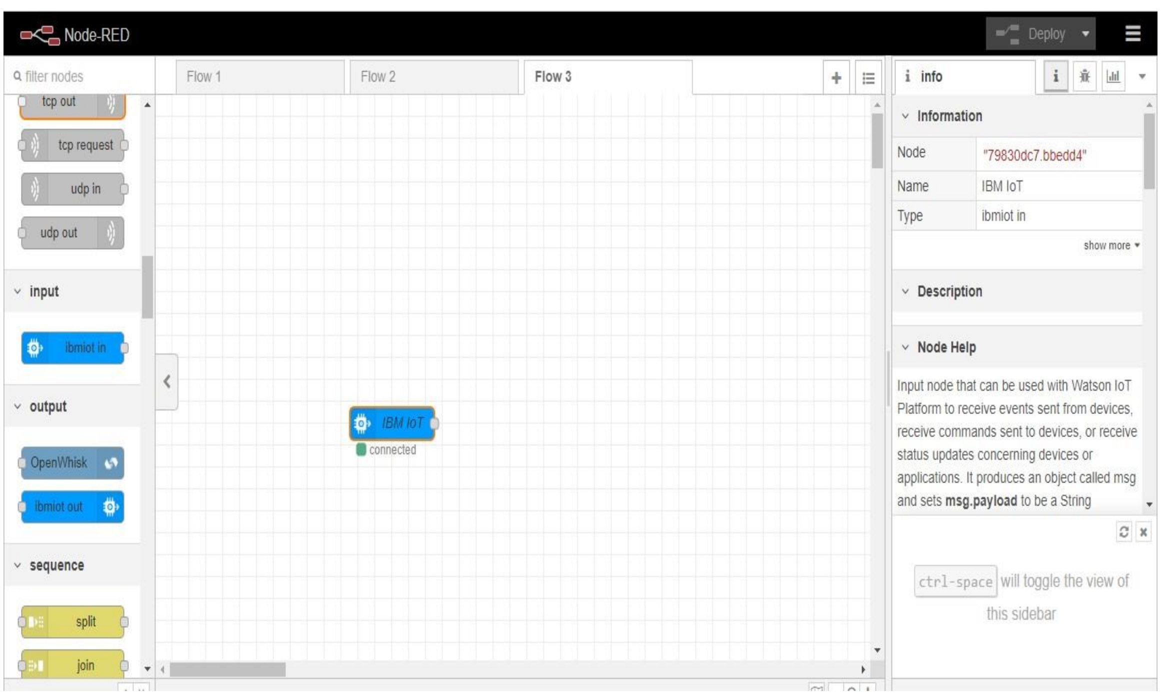
4.4 Setting the IBM IOT Sensor

Step 1: Enter the details like Organization ID, Device Type, Device ID and Device token.

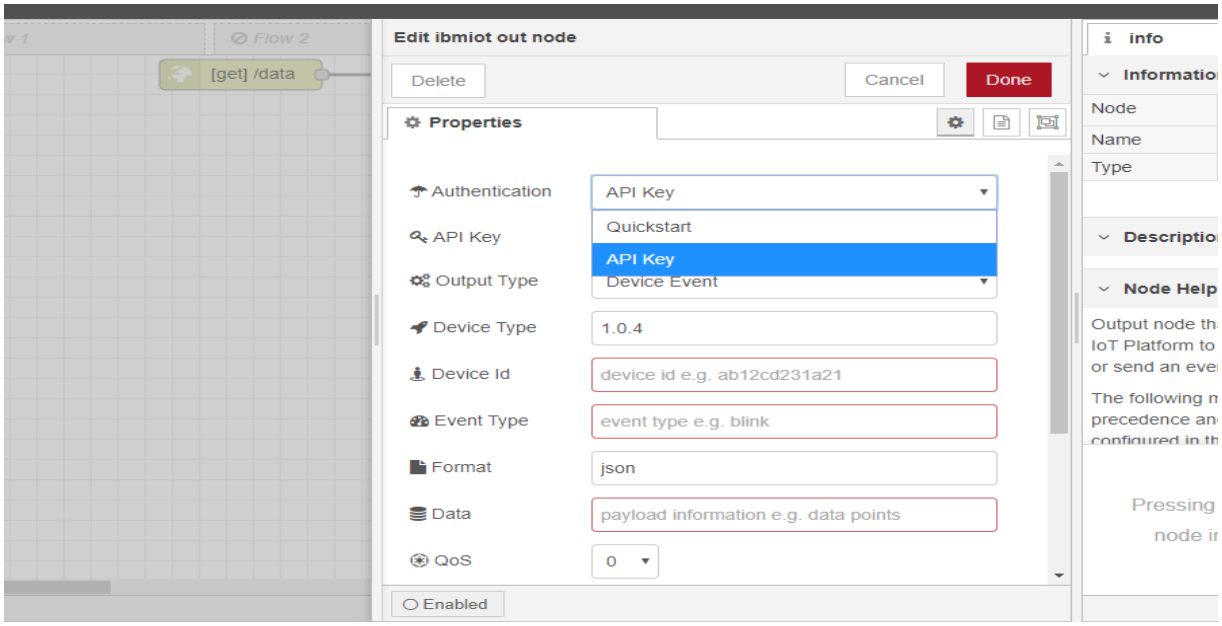


4.5 Setting the Node-Red UI

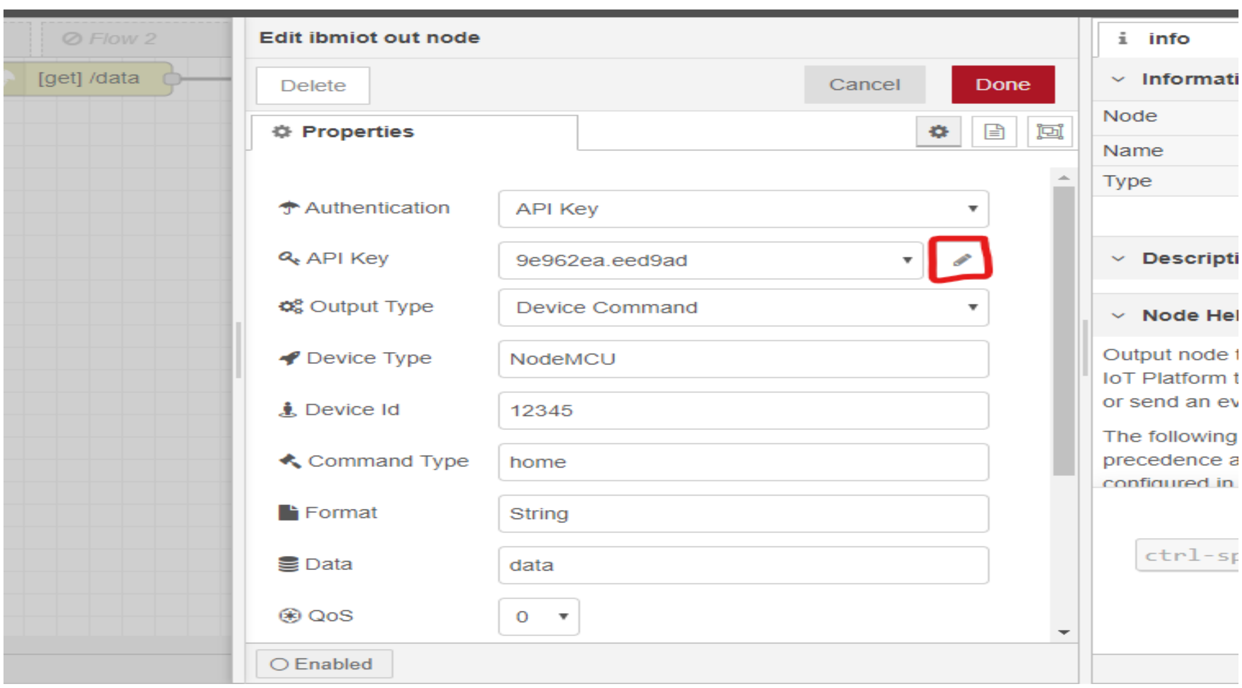
Step 1: Select the IBM IOT in node from the pallet.



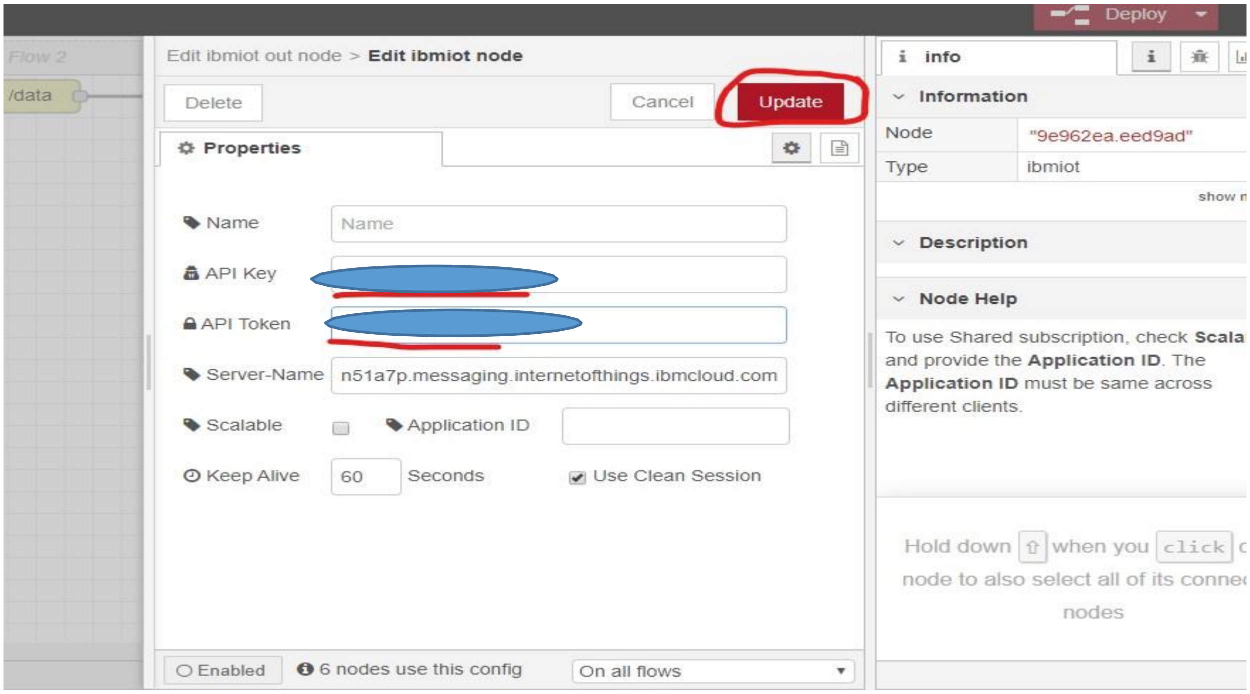
Step 2: Double click the IBM IOT node, select the API option from the drop down and click the **Device Event**. Give all the required data.



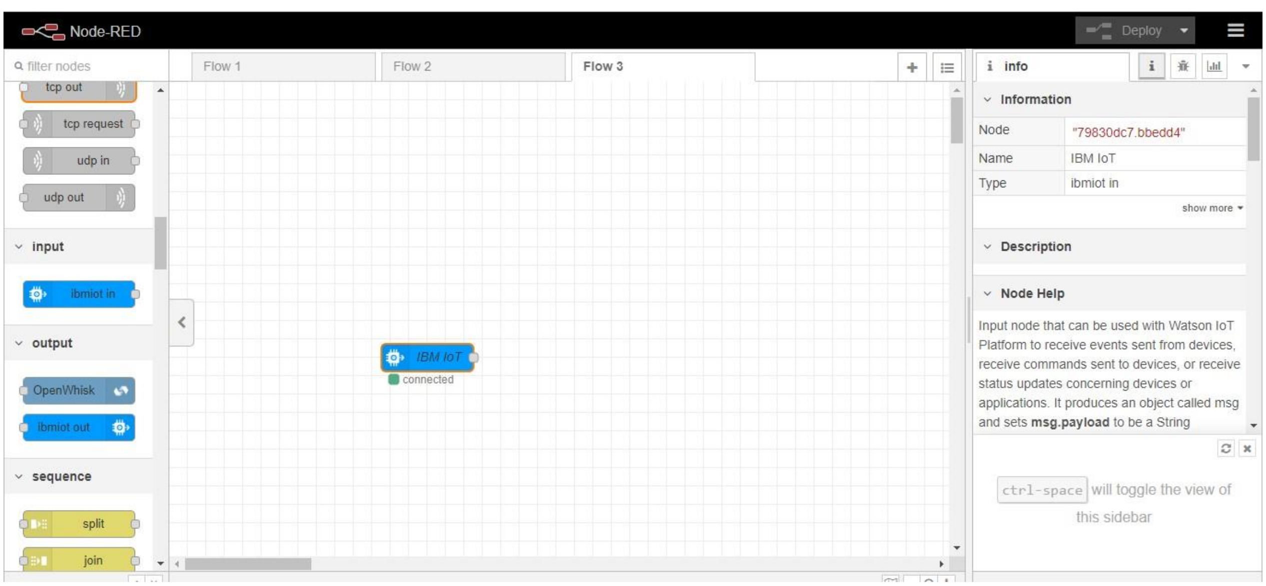
Step 3: Click the pencil key icon in the API key.



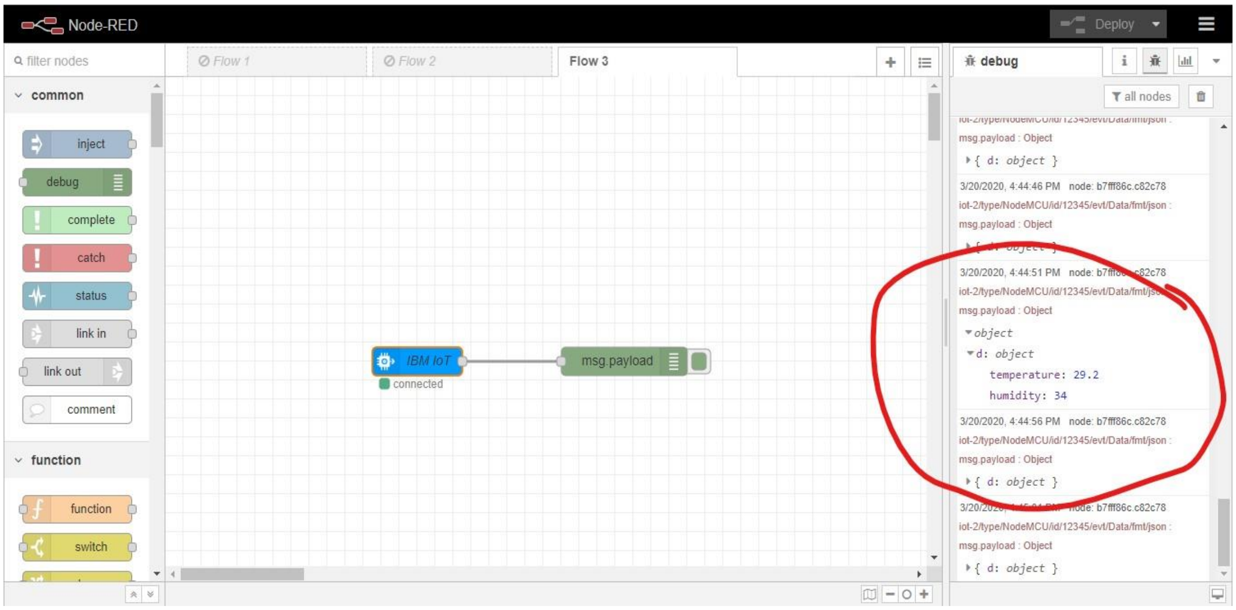
Step 4: Enter the API key, API token and click update button and then on done button.



Step 5: After deploying Connection indication will be highlighted in the IBM IoT node.



Step 6: Place the debug node in the flow editor and click on deploy to see the temperature and humidity value in the debug tab.



Step 8: Similarly, Configure the remaining required nodes and create the flow as per the required dashboard. These nodes include IBM iot output, template, debugger, guage, text, function, http request,…etc.

4.6 Node Red Flows:

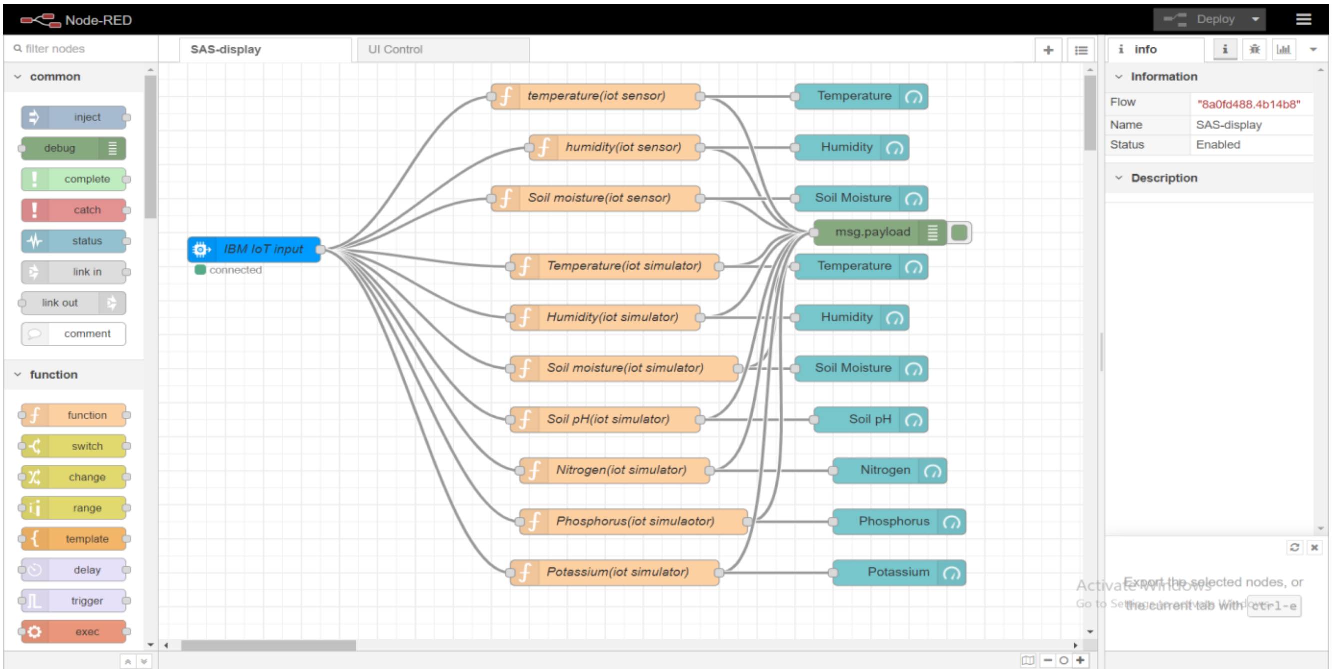


Fig.4.6.1: Flow deploying the data from IBM sensor and simulator into the UI.

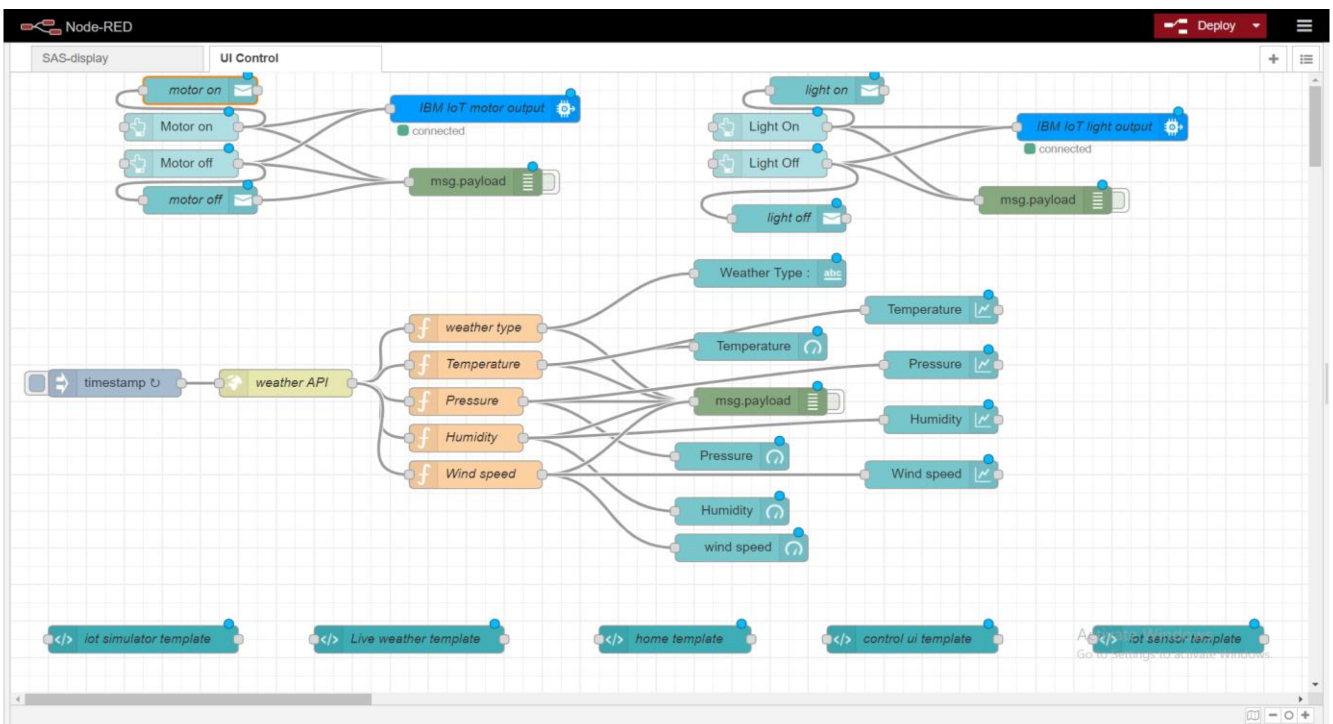


Fig.4.6.2: Flow deploying the weather data from openweather.com and controls.

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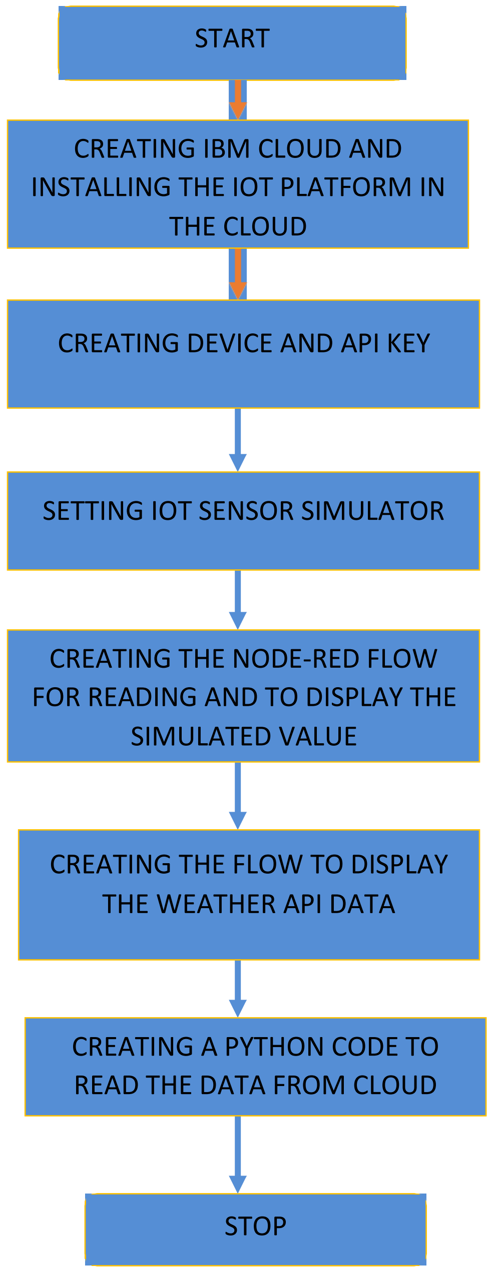
FLOW CHART



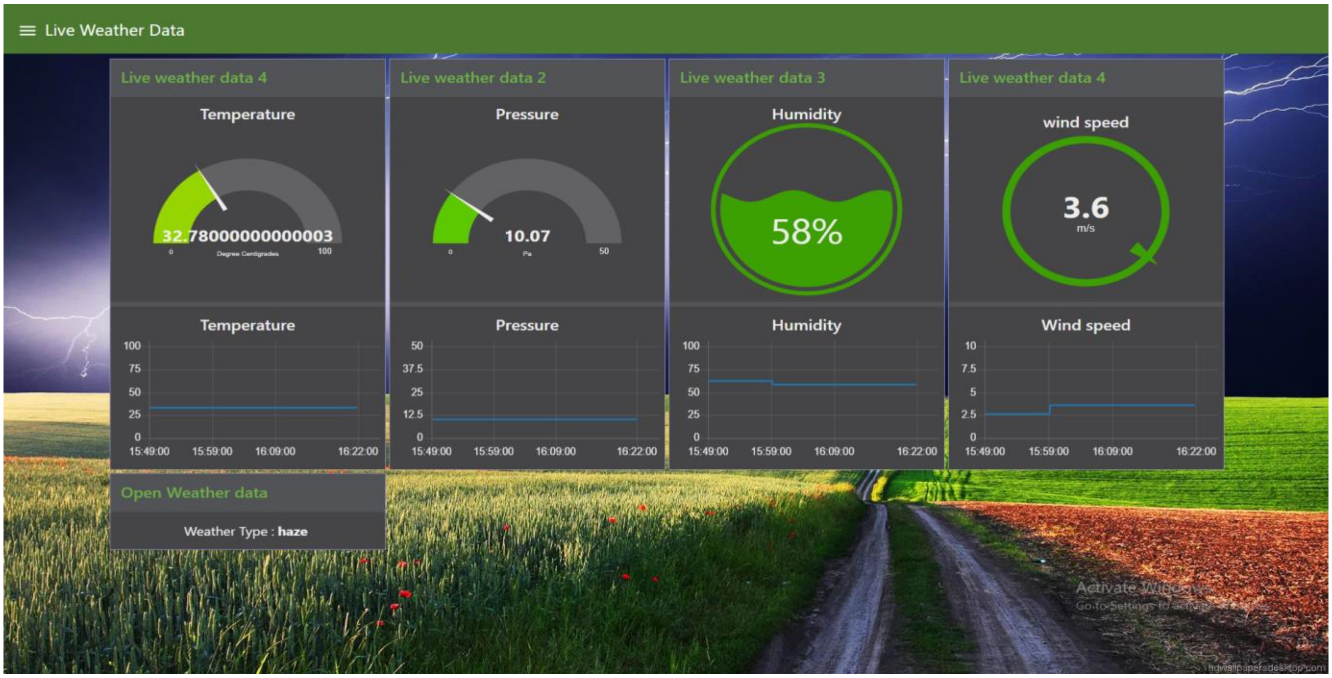
CHAPTER-06

RESULT

The yield appeared beneath signifies the temperature, soil moisture and humidity data received from the IOT simulator sensor and open weather API. The web app displays all these data of past one hour. There are set of buttons on the web application that can be used to control the motor and light on the farm to turn them ON/OFF remotely.

6.1 Home Page

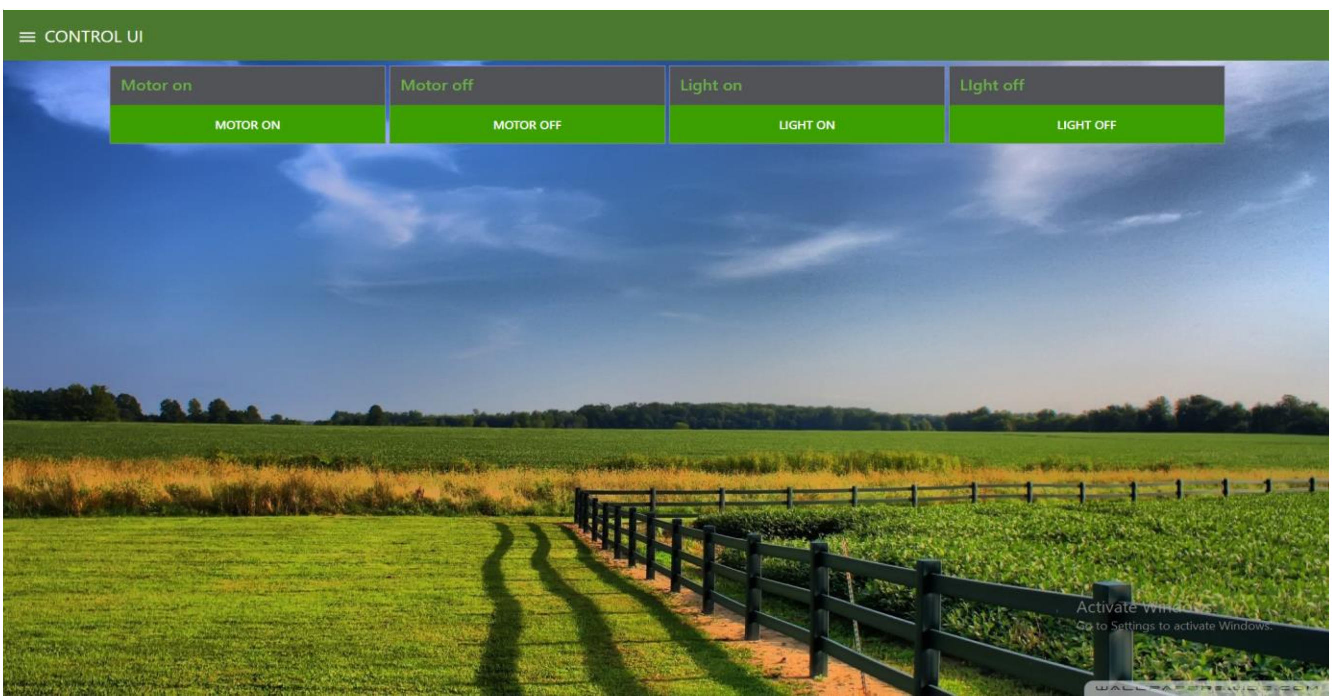
6.2 Live weather data from openweather.org



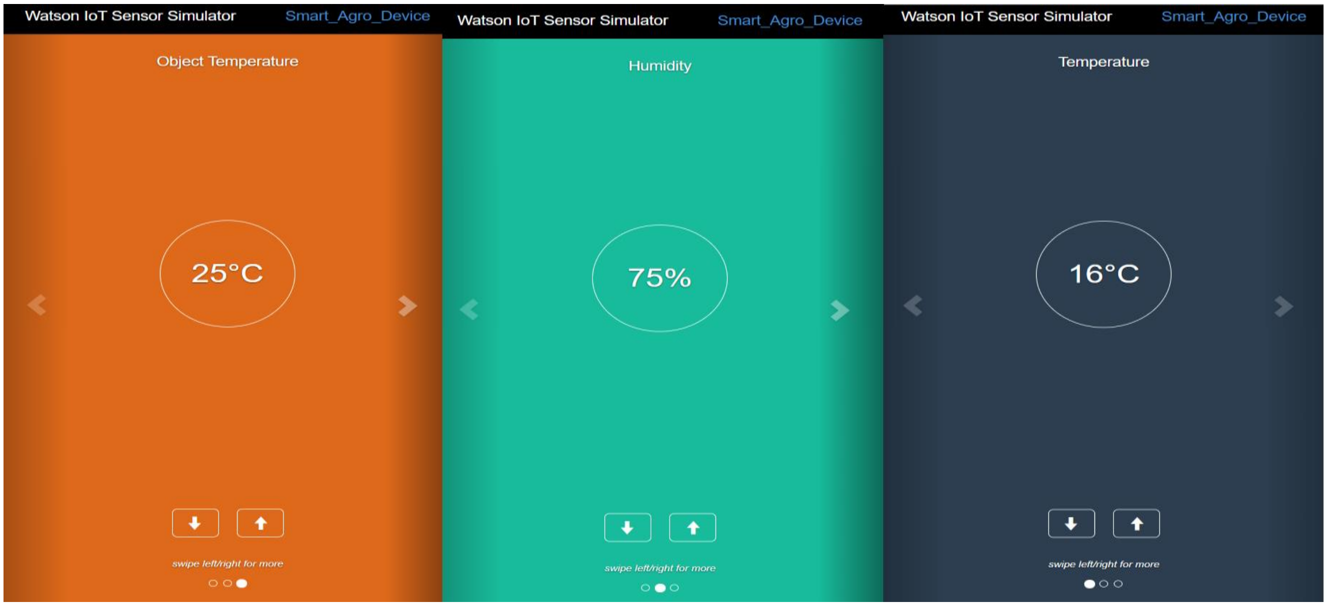
6.3 Different parameters from IBM cloud in-built simulator :

6.4 Data from IBM IOT Sensor:

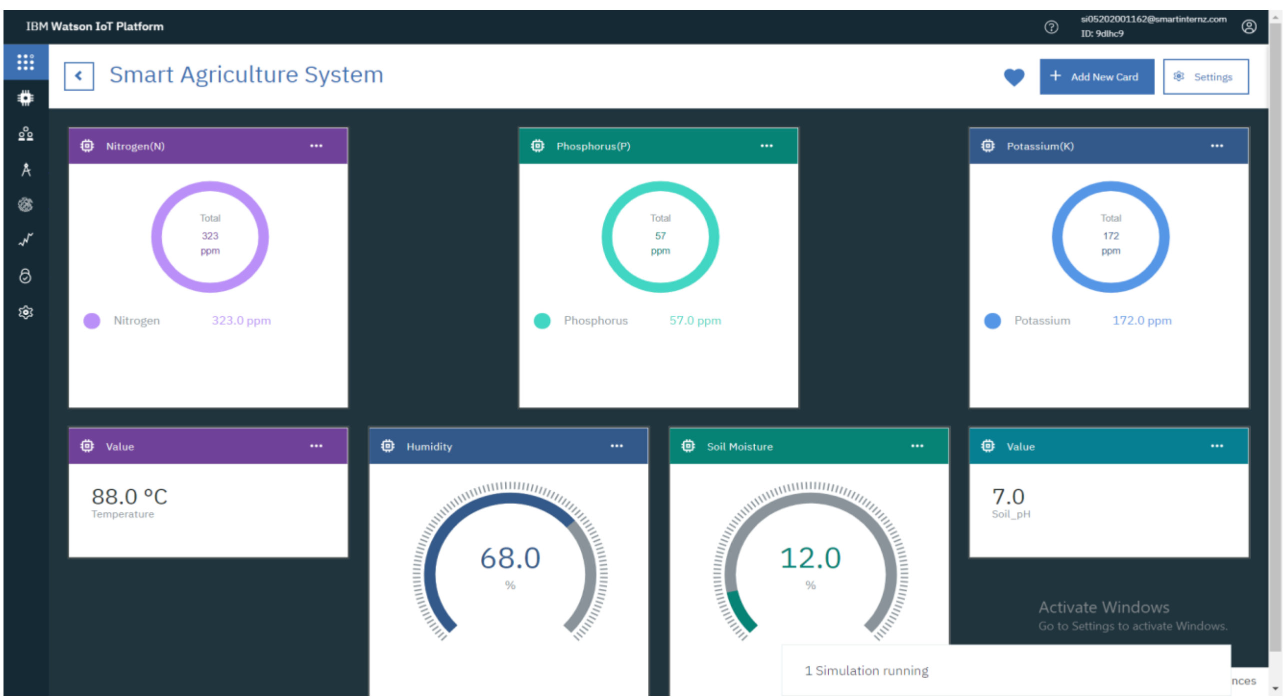
6.5 Controlling of motors and lights:



6.6 IBM IOT sensors showing different inputs



6.7 IBM Cloud dashboard showing different parameters received from simulator.



CHAPTER-07

ADVANTAGES AND DISADVANTAGES

7.1 Advantages

1. Monitoring the parameters like temperature, humidity…etc will play an important role in improving the growth of the plant.
2. 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.
3. IOT solution enables us to know the real-time weather conditions. Sensors are placed inside and outside of the agriculture fields. They collect data from the environment which is used to choose the right crops which can grow and sustain in the particular climatic conditions.
4. The goal of precision farming is to analyze the data, generated via sensors, to react accordingly. Precision Farming helps farmers to generate data with the help of sensors and analyze that information to take intelligent and quick decisions. With the help of Precision farming, you can analyze soil conditions and other related parameters to increase the operational efficiency.
5. To make our greenhouses smart, IOT has enabled weather stations to automatically adjust the climate conditions according to a particular set of instructions. Adoption of IOT in Greenhouses has eliminated the human intervention, thus making entire process cost- effective and increasing accuracy at the same time.
6. Cloud based data storage and an end-to-end IOT Platform plays an important role in the smart agriculture system. These systems are estimated to play an important role such that better activities can be performed. In the IOT world, sensors are the primary source of collecting data on a large scale. The data is analyzed and transformed to meaningful information using analytics tools. The data analytics helps in the analysis of weather conditions, livestock conditions, and crop conditions.

7. 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.

7.2 Disadvantages

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

CHAPTER-08

APPLICATIONS

8.1 APPLICATIONS

By implementing the latest sensing and IOT technologies in agriculture practices, every aspect of traditional farming methods can be fundamentally changed. Currently, seamless integration of wireless sensors and the IOT in smart agriculture can raise agriculture to levels which were previously unimaginable. By following the practices of smart agriculture, IOT can help to improve the solutions of many traditional farming issues, like drought response, yield optimization, land suitability, irrigation, and pest control. Following are some applications:

1. This technique can be used in the field of home automation.
2. This method can also be used in the field of POKA YOKE verification in industry.
3. It can also in the field where maintaining the process parameters are essential.
4. It can also be used in controlling the wheel chair for physically challenged people.
5. It can be used in hospital to monitor the patient temperature, heart rate etc. During this COVID- 19 situation, it will play a huge role.
6. It can also be used in material handling equipment in hospitals.

CHAPTER-09

CONCLUSION

IOT based SMART AGRICULTURE SYSTEM for Live Monitoring of Temperature and Soil Moisture and to control motor and light remotely has been proposed using Node Red and IBM Cloud Platform. The System has high efficiency and accuracy in fetching the live data of temperature and soil moisture. The IOT based smart farming System being proposed via this project will assist farmers in increasing the agriculture yield and take efficient care of food production as the System will always provide helping hand to farmers for getting accurate live feed of environmental temperature and soil moisture with more than 99% accurate results. Therefore, the project proposes a thought of consolidating the most recent innovation into the agrarian field to turn the customary techniques for water system to current strategies in this way making simple profitable and temperate trimming.

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 devices like motor, light etc can also controlled by the web application.

CHAPTER-10

FUTURE SCOPE

1. Future work would be focused more on increasing sensors on this system to fetch more data especially with regard to Pest Control and by also integrating GPS module in this system to enhance this Agriculture IOT Technology to full- fledged Agriculture Precision ready product.
2. The various data's of soil nutrients is not added in the web browser that can be added to the web application.
3. Long range forecast is not available in the web application. It can also be added to provide accurate information about weather.
4. Controlling the device through mobile application and voice will play important role in enhancing this project.
5. Providing the GPS and GIS information will also improve productivity of farming.

CHAPTER-11

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[6] https://smartinternz.com/assets/docs/Smart%20Home%20Automation%20using%20IBM%20cloud%20Service s%20(1).pdf

[7] https://smartinternz.com/assets/docs/Smart%20Home%20Automation%20using%20IBM%20cloud%20Service s%20(1).pdf

[8] https://openweathermap.org/

[9] https://smartinternz.com/assets/docs/Sending%20Http%20request%20to%20Open%20weather%20map%20web site%20to%20get%20the%20weather%20forecast.pdf

[10] https://www.youtube.com/watch?v=cicTw4SEdxkhttps://smartinternz.com/assets/docs/Smart%20Home%20Automation%20using%20IBM%20cloud%20Service s%20(1).pdf

[8] https://github.com/rachuriharish23/ibmsubscribe

APPENDIX

A. Python Code

```
import time
import sys
import ibmiotf.application
import ibmiotf.device

#Provide your IBM Watson Device Credentials
organization = "9dlhc9" # repalce it with organization ID
deviceType = "IOT_Device" #replace it with device type
deviceId = "Smart_Agro_Device" #repalce with device id
authMethod = "token"
authToken = "loZhO?ENW4g+pwRn46"#repalce with token

def myCommandCallback(cmd): # function for Callback
        print("Command received: %s" % cmd.data)
        if cmd.data['command']=='motoron':
                print("Turn Motor ON")

        elif cmd.data['command']=='motoroff':
                print("Turn Motor OFF")
        elif cmd.data['command']=='lighton':
                print("Turn Light ON")
        elif cmd.data['command']=='lightoff':
                print("Turn Light OFF")


        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()
```