# VSB ENGINEERING COLLEGE, KARUR-639111

# IBM NALAYA THIRAN

# PROJECT REPORT

| | |
|---|---|
| **Team ID** | **PNT2022TMID33523** |
| **Project Name** | **Project – IOT ENABLED SMART FARMING APPLICATION** |

**TEAM LEAD : KALPANA D**

**TEAM MEMBER 1: ABINAYA R**

**TEAM MEMBER 2: ABIRAMI R**

**TEAM MEMBER 3: DHANUSUYA M**

**MENTOR : NANDHINI P**

# 1. INTRODUCTION

## IOT- internet of things:

The Internet of things (IoT) describes physical objects (or groups of such objects) with sensors. processing ability, software  and other technologies that connect and exchange data with other devices and systems over the Internet or other communications networks.Internet of things has been considered a misnomer because devices do not need to be connected to the public internet, they only need to be connected to a network and be individually addressable.

The field has evolved due to the convergence of multiple technologies, including ubiquitous computing, commodity sensors, increasingly powerful embedded systems, as well as machine learning. Traditional fields of embedded systems, wireless sensor networks, control systems, automation(including home and building automation), independently and collectively enable the Internet of things. In the consumer market, IoT technology is most synonymous with products pertaining to the concept of the "smart home", including devices and appliances(such as lighting fixtures, thermostats, home security systems, cameras, and other home appliances) that support one or more common ecosystems, and can be controlled via devices associated with that ecosystem, such as smartphones and smart speakers. IoT is also used in healthcare systems.

There are a number of concerns about the risks in the growth of IoT technologies and products, especially in the areas of privacy and security, and consequently, industry and governmental moves to address these concerns have begun, including the development of international and local standards, guidelines, and regulatory frameworks.

## 1.1 PROJECT OVERVIEW:

A Smart Farming and “Crop Monitoring Technology” Using IOT in Agriculture. Agriculture is basic source of livelihood People in India. It plays major role in economy of country. But now a days due to migration of people from rural to urban there is hindrance in agriculture. Monitoring the environmental factor is not the complete solution to increase the yield of crops. There are no of factors that decrease the productivity to a great extent. Hence Automation must be implemented in agriculture to overcome these problems. An automatic irrigation system thereby saving time, money, and power of farmer. The Traditional Farmland irrigation techniques require manual intervention. With the automated technology of irrigation, the human intervention can be minimized. Continuous sensing and monitoring of crops by convergence of sensors with Internet of things (IOT) and making farmers to aware about crops growth, harvest time periodically and in turn making high productivity of crops and ensuring correct delivery of products to end, consumers at right place and right time. So, to overcome this problem we go for smart agriculture technique using IOT. This Project includes sensors such as temperature, humidity, soil moisture and rain detector for collection the field data and processed. These sensors are combined with well-established web technology in the form of wireless sensor network to remotely control and monitor data from the sensors.

## 1.2 PURPOSE :

The main purpose of reducing the smart farming application using the aurdino UNO is to make an sealed cut down of human interference in the process of irrigation due to this irrigation process becomes simple and easy for farmers.

## 2. LITRATURE SURVEY:

## 2.1 EXISTING PROBLEM:

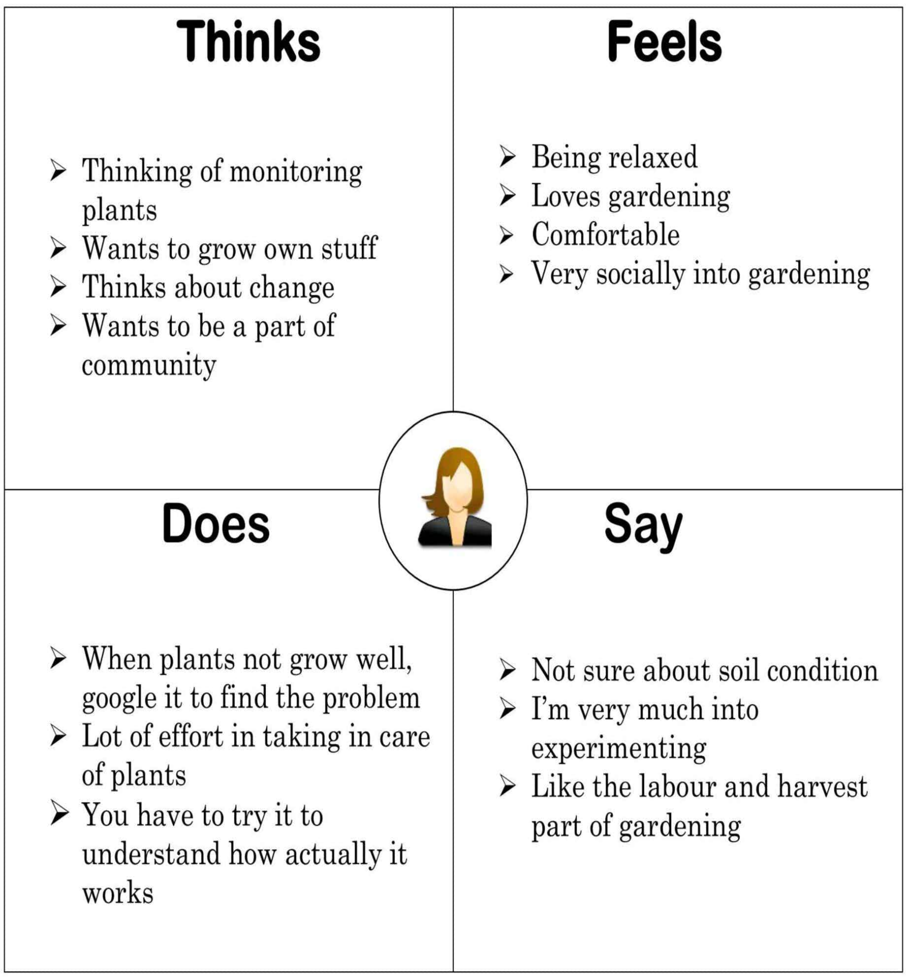
To incorporate the process of working and also elevate the smart farming using IOT enabled smart irrigation technique since the traditional irrigation technique which is very complex one.

## 2.2 PROBLEM STATEMENT EXPLANATION:-

Farmers are under pressure to produce more food and use less energy and water in the process. A remote monitoring and control system will help farmers deal effectively with these pressure. IOT plays a major role in agricultural field This paper is mainly applied to agricultural field Smart irrigation and farming can help farmers to grow healthy plants. The existing system only checks the soil water stress and automates the process of watering. The paper is about IOT based smart farming and irrigation system. The ultimate agenda of this paper is to automate the process of watering to plants. This work helps us to know the values of various parameters such as humidity, moisture and temperature of plants and water them accordingly. The system consists of three sensors which sense the values r off the motor according to the conditions given. If the sensor values are decreased, it turns on the motor else it turns off the motor. The ultimate significance of this paper is that most of the manual work is reduced and watering process is of humidity, moisture and temperature of plants. If any of the values decreases the motor automatically turns on the water for plants. This is done using Arduino board, voltage regulator and relay which controls the motor. WIFI module is used to inform the user about the exact field condition. The various sensors send the values to the Arduino board which has been coded with if else conditions will further pass the commands to the relay which turns on oautomated with the help of devices as a result of which healthy plants can be grown, Water and electricity usage are saved by this paper. Even elderly people can easily do farming. The paper has been used to grow a tomato plant and it was successfully grown by automatic process. This methodology with the use of IOT technology had made us achieve a healthy farming. Increase in agriculture also helps us to increase the economical state of the country.

## 3. IDEATION AND PROPOSED SOLUTION:-

### 3.1 EMPATHY MAP:



## 3.2 IDEATION AND BRAINSTROMING:-

### Team Ideas:

**KALPANA D :**

- Get alert for any abnormal situation
- Cattle monitoring and management

**ABIRAMI R :**

- Monitoring climatic conditions
- Green house automation

**ABINAYA R :**

- Crop monitoring
- Smart pest control

**DHANUSUYA M :**

- Weather forecasting
- Harvesting automation

**Best Three Ideas:-**

- Get alert for abnormal situation
- Monitoring climatic conditions
- Pest control and harvesting automation

## 3.3 PROPOSED SOLUTION:-

## Proposed Solution Template:

| S. No. | Parameter | Description |
|---|---|---|
| 1. | Problem Statement (Problem to be solved) | Farmers are under pressure to produce more food and use less energy and water in the process. |
| 2. | Idea / Solution description | A remote monitoring and control system will help farmers deal effectively with these pressure. |
| 3. | Novelty / Uniqueness | Smart Farming majorly depends on IoT thus eliminating the need of physical work of farmers and growers and thus increasing the productivity in every possible manner. |
| 4. | Social Impact / Customer Satisfaction | Internet of Things in Agriculture has not only saved the time of the farmers but has also reduced the extravagant use of resources such as Water and Electricity. It keeps various factors like humidity, temperature, soil etc. under check and gives a crystal clear real-time observation. |
| 5. | Business Model (Revenue Model) | The smart farming devices designed in such a way that should be profitable compared to traditional farming methods and the device should be reusable . The cost of the devices should be less compared to cost required for traditional farming. Hence the product must be profitable it does not make losses in any cases |
| 6. | Scalability of the Solution | This has helped bridge the gap between production and quality and quantity yield. The data analytics helps in the analysis of weather conditions, livestock conditions, and crop conditions. |

## 3.4 PROBLEM SOLUTION FIT:

| | | |
|---|---|---|
| **1.Customer segments:-**<br>Farmers can be sub-segmented under three categories.<br>➢ Micro, small, or marginal<br>➢ Emerging and large<br>➢ Commercial Farmers<br>Based on farm:<br>➢ Surplus<br>➢ Gross revenue<br>➢ Land under cultivation | **6.Customer constrains:-**<br>The country's sustainable agricultural development has many obstacles. These includes<br>➢ Agricultural water-use shortage<br>➢ Cultivated land loss<br>➢ Inappropriate usage of fertilizers and pesticides<br>➢ Environmental degradation | **5.Available solutions**<br>**IoT** in agriculture uses **robots, drones, remote sensors, and computer imaging** combined with continuously progressing machine learning and analytical tools for **monitoring crops, surveying, and mapping the fields**, and **providing data to farmers** for rational farm management plans to save both time and money |
| **2.Jobs to be done :-**<br>Smart farming involves providing training to farmers and local village based trained persons for using technology and incorporating data guided decisions with their traditional agriculture practices. | **9.Problem route cause:-**<br>Farmers are under pressure to produce more food and use less energy and water in the process. The main problem is to feed an increasing global population while at the same time reducing the environmental impact and preserving natural resources for future generation. Agriculture can have significant impact on environment | **7.Behavior:-**<br>The behavioral approach focuses on the nature of decision making by farmers and on the many influences which affect such decisions. Agriculture has been mainly of an economic nature but the quite different social approach has grown more recently. |
| 3.Triggers:-<br>Experimentation is an essential tool for farmers to develop their farming system. Through experimenting farmers learn, gain experience and innovate.<br>4.Emotions:-<br>Every year planting season stirs up a wide range of feelings in farmers around the country, It's an emotional roller coaster. | **10.Solution**:-<br>Smart agriculture aims to help farmers to make decisions to maximize crop yield and quality, optimize water and other inputs, and maintain soil health. This is important for livelihood of marginal farmers in the context of climate change uncertainty. | 8.Channels of behavior:-<br>Behavior change principles as evidenced across various sectors such as health, business, advertising and agriculture. The mediums used in smart agriculture are **Video, TV, Radio, Cell phone, The internet as a knowledge resource, Social media.** |

# 4. REQUIREMENT ANALYSIS:

## 4.1Functional requirement

Following are the functional requirements of the proposed solution.

| FR No. | Functional Requirement (Epic) | Sub Requirement (Story / Sub-Task) |
|---|---|---|
| FR-1 | User Registration | User has to register through Gmail. |
| FR-2 | User Confirmation | User receives a confirmation via Gmail and also receives confirmation via OTP. |
| FR-3 | Log in | After receiving confirmation mail, login to the system and check the credentials. |
| FR-4 | Credentials Check | Once the credentials are checked, go to manage modules. |
| FR-5 | Manage modules | Manage module describes the following functions<br>1. Manage system admins<br>2. Manage roles of user<br>3. Manage user permission |
| FR-6 | Logout | Temperature, humidity and moisture is being checked. After checking these parameters logout or exit the application. |

## 4.2 Non-Functional requirements

Following are the non-functional requirements of the proposed solution.

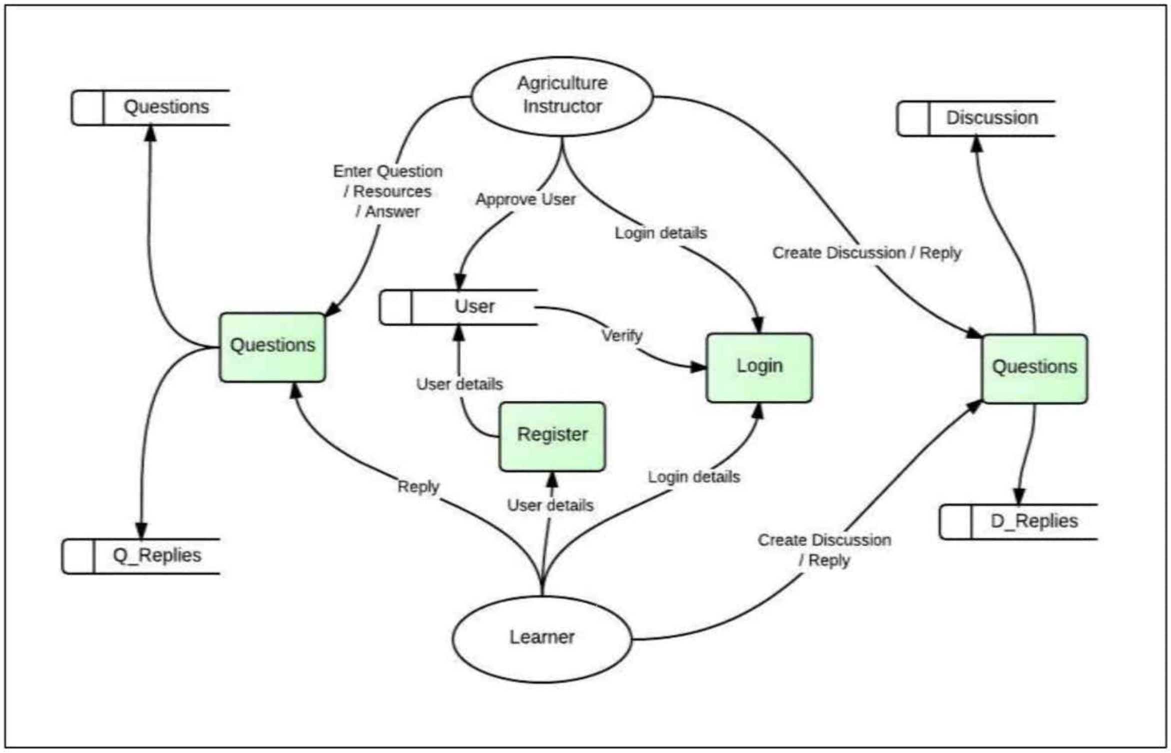
| FR No. | Non-Functional Requirement | Description |
|---|---|---|
| NFR-1 | **Usability** | Indicates how effectively and easily the users can learn and use the system. |
| NFR-2 | **Security** | Assuring all data inside the system or its part will be protected against malware attacks or unauthorized access. |
| NFR-3 | **Reliability** | Specifies how likely the system or its element would run without a failure for a given period of time under predefined conditions. Traditionally, this probability of the agricultural parameters are expressed in percentages. |
| NFR-4 | **Performance** | Deals with the measure of the system's response time under different weather conditions. |
| NFR-5 | **Availability** | Describes how likely the application is accessible for a user at a given point of time. |
| NFR-6 | **Scalability** | Assesses the highest workloads under which the system will still meet the performance requirements of measurements of temperature, humidity and moisture. |

## 5. PROJECT DESIGN:

### 5.1 Data Flow Diagrams

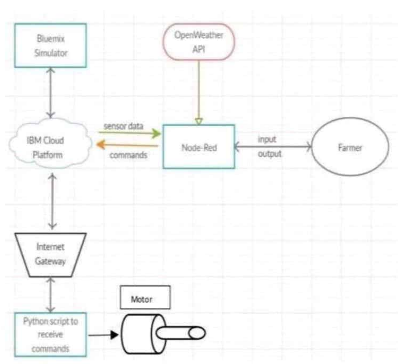
A Data Flow Diagram (DFD) is a traditional visual representation of the information flows within a system. A neat and clear DFD can depict the right amount of the system requirement graphically. It shows how data enters and leaves the system, what changes the information, and where data is stored.

## Data Flow Diagram




## 5.2 SOLUTION AND TECHNICAL ARCHITECTURE:

The Deliverable shall include the architectural diagram as below and the information as per the table1 & table 2




Guidelines:

1. Include all the processes (As an application logic / Technology Block)
2. Provide infrastructural demarcation (Local / Cloud)
3. Indicate external interfaces (third party API's etc.)
4. Indicate Data Storage components / services
5. Indicate interface to machine learning models (if applicable)

- The different soil parameters temperature, soil moistures and then humidity are sensed using different sensors and obtained value is stored in the IBM cloud.
- **Arduino UNO** is used as a processing Unit that process the data obtained from the sensors and whether data from the weather API.
- **NODE-RED** is used as a programming tool to write the hardware, software, and APIs. The MQTT protocol is followed for the communication.
- All the collected data are provided to the user through a mobile application that was developed using the MIT app inventor. The user could decide through an app, weather to water the crop ornot depending upon the sensor values. By using the app, they can remotely operate the motor switch.

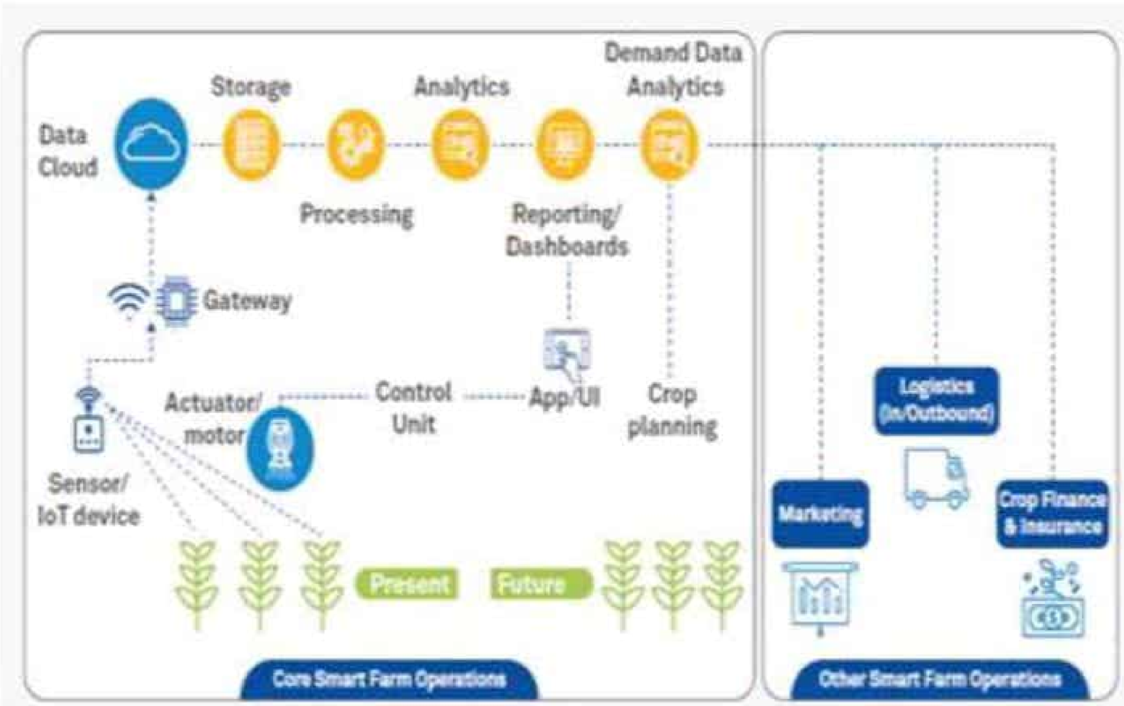
**Table-1 : Components & Technologies:**

| S.No | Component | Description | Technology |
|---|---|---|---|
| 1. | User Interface | How user interacts with application e.g. Web UI, Mobile App, Chatbot etc. | HTML, CSS, JavaScript / Angular Js / React Js etc. |
| 2. | Application Logic-1 | Logic for a process in the application | Python |
| 3. | Application Logic-2 | Logic for a process in the application | IBM Watson IOT service |
| 4. | Application Logic-3 | Logic for a process in the application | IBM Watson Assistant |
| 5. | Database | Data Type, Configurations etc. | MySQL, NoSQL, etc. |
| 6. | Cloud Database | Database Service on Cloud | IBM Cloud |
| 7. | File Storage | File storage requirements | IBM Block Storage or Other Storage Service or Local Filesystem |
| 8. | External API-1 | Purpose of External API used in the application | IBM Weather API, etc. |
| 9. | Machine Learning Model | Purpose of Machine Learning Model | Object Recognition Model, etc. |
| 10. | Infrastructure (Server / Cloud) | Application Deployment on Local System / Cloud<br>Local Server Configuration:<br>Cloud Server Configuration | Local, Cloud Foundry, Kubernetes, etc. |

**Table-2: Application Characteristics:**

| S.No | Characteristics | Description | Technology |
|---|---|---|---|
| 1. | Open-Source Frameworks | List the open-source frameworks used | Technology of Opensource framework |
| 2. | Security Implementations | Sensitive and private data must be protected from their production until the decision-making and storage Stages. | e.g. Node-Red, Open weather App API,MIT App Inventor, etc. |
| 3. | Scalable Architecture | Scalability is a major concern for IoT platforms. It has been shown that different architectural choices of IoT platforms affect system scalability and that automatic real time decision-making is feasible in an Environment composed of dozens of thousand. | Technology used |
| 4. | Availability | Automatic adjustment of farming equipment made possible by linking information like crops/weather and equipment to auto-adjust temperature, humidity, etc. | Technology used |
| 5. | Performance | The idea of implementing integrated sensors with sensing soil and environmental or ambient parameters in farming will be more efficient for overall monitoring. | Technology used |

## 5.3 USER STORIES:




# 6. PROJECT PLANNING & SCHEDULING:

## 6.1 SPRINT PLANNING AND ESTIMATION:

| User Type | Functional Requirement (Epic) | User Story Number | User Story / Task | Acceptance criteria | Priority | Release |
|---|---|---|---|---|---|---|
| Customer (Mobile user) | Registration | USN-1 | As a user, I can register for the application by entering my email, password, and confirming my password. | I can access my account / dashboard | High | Sprint-1 |
| | | USN-2 | As a user, I will receive confirmation email once I have registered for the application | I can receive confirmation email & click confirm | High | Sprint-1 |
| | | USN-3 | As a user, I can register for the application through Facebook | I can register & access the dashboard with Facebook Login | Low | Sprint-2 |
| | | USN-4 | As a user, I can register for the application through Gmail | | Medium | Sprint-1 |
| | Login | USN-5 | As a user, I can log into the application by entering email & password | | High | Sprint-1 |
| | Dashboard | USN-6 | As a User can view the dashboard , and this dashboard include the check roles of access and then move to the manage modules. | I can view the dashboard in this smart farming application system | Medium | Sprint-2 |
| Customer (Web user) | | USN-7 | As a user can view the list of web pages from which they can select the web page they want | I can see the list of web pages | Medium | Sprint-2 |
| Customer Care Executive | | | These professional performs a number of duties including responding to the customer questions and assisting with their questions | | High | Sprint-1 |
| Administrator | | | As a user once view the manage modules this describes the Manage system Admins and Manage Roles of User and etc.. | | High | Sprint-1 |

| Sprint | Functional Requirement (Epic) | User Story Number | User Story / Task | Story Points | Priority | Team Members |
|---|---|---|---|---|---|---|
| Sprint-1 | Hardware | USN-1 | Sensors and wi-fi module with python code | 2 | High | Kalpana D, Abinaya R, Abirami R, Dhanusuya M |
| Sprint-2 | Software | USN-2 | IBM Watson IoT platform, Workflows for IoT scenarios using Node-red | 2 | High | Kalpana D, Abinaya R, Abirami R, Dhanusuya M |
| Sprint-3 | MIT app | USN-3 | To develop an mobile application using MIT | 2 | High | Kalpana D, Abinaya R, Abirami R, Dhanusuya M |
| Sprint-4 | Web UI | USN-4 | To make the user to interact with software. | 2 | High | Kalpana D, Abinaya R, Abirami R, Dhanusuya M |

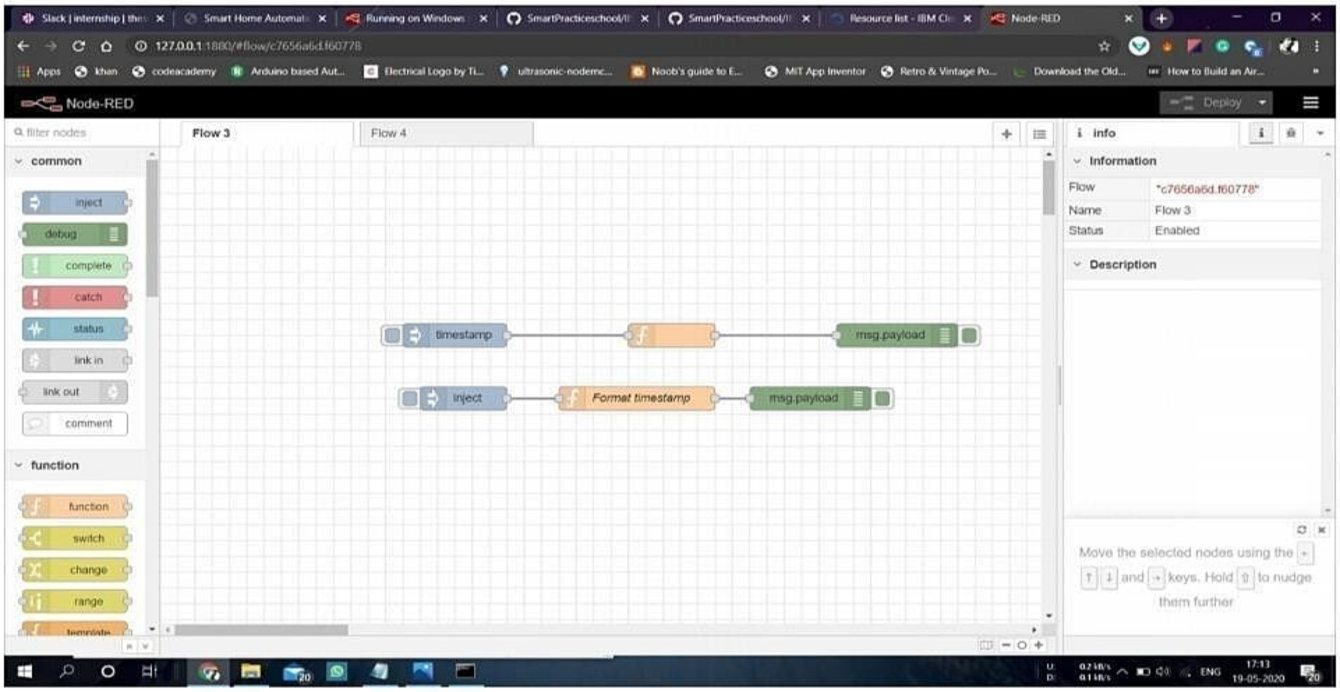
## 6.2 SPRINT DELIVERY SCHEDULE:

| Sprint | Total Story Points | Duration | Sprint Start Date | Sprint End Date (Planned) | Story Points Completed (as on Planned End Date) | Sprint Release Date (Actual) |
|---|---|---|---|---|---|---|
| Sprint-1 | 20 | 6 Days | 24 Oct 2022 | 29 Oct 2022 | 20 | 29 Oct 2022 |
| Sprint-2 | 20 | 6 Days | 31 Oct 2022 | 05 Nov 2022 | | 05 Nov 2022 |
| Sprint-3 | 20 | 6 Days | 07 Nov 2022 | 12 Nov 2022 | | 12 Nov 2022 |
| Sprint-4 | 20 | 6 Days | 14 Nov 2022 | 19 Nov 2022 | | 12 Nov 2022 |
| | | | | | | |
| | | | | | | |
| | | | | | | |
| | | | | | | |

# 7. CODING & SOLUTIONING :

## 7.1 Feature 1:

Node-RED is a flow-based development tool for visual programming developed originally by IBM for wiring together hardware devices, APIs and online services as part of the Internet of Things. Node-RED provides a web browser-based flow editor, which can be used to create JavaScript functions.




**Installation :**

• First install npm/node.js

• Open cmd prompt

• Type => npm install node-red

**To run the application :**

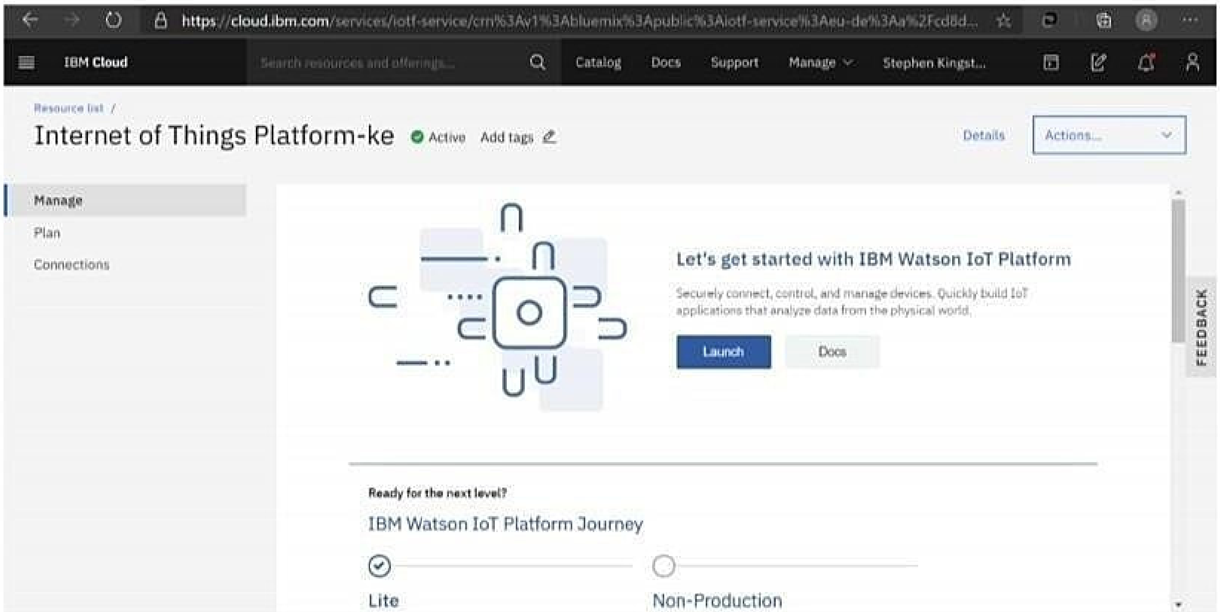
• Open cmd prompt

• Type=>node-red

• Then open http://localhost:1880/ in browser

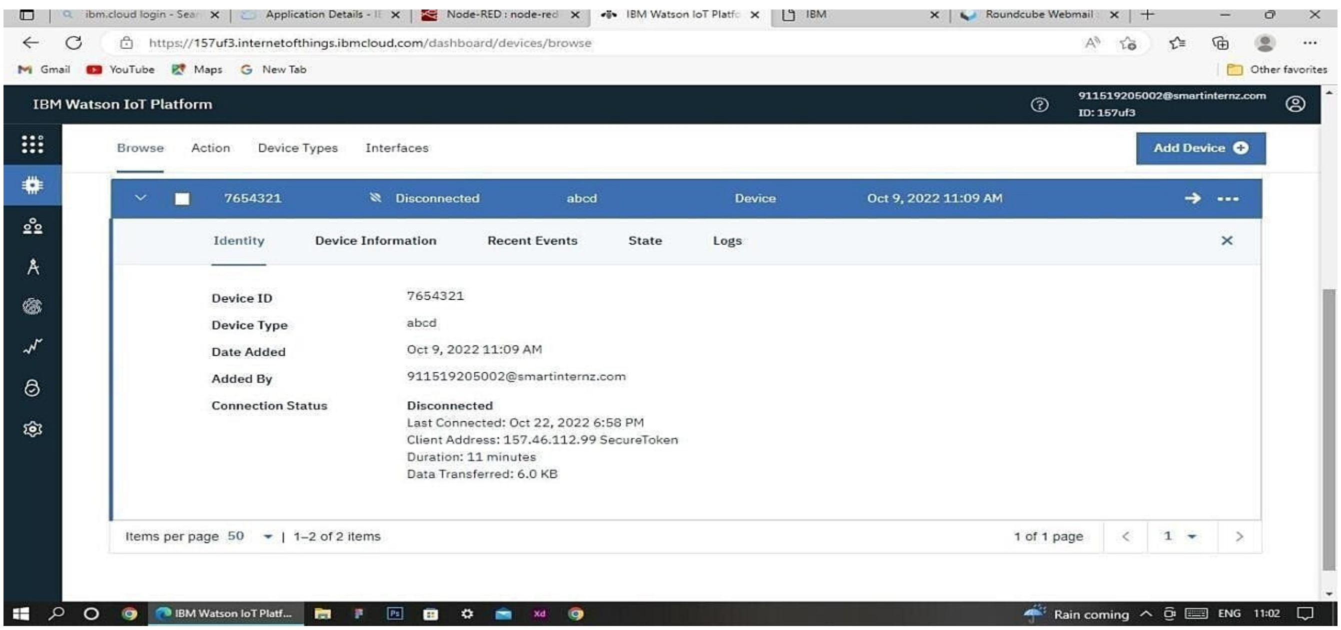
**IBM Watson IoT Platform:**

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



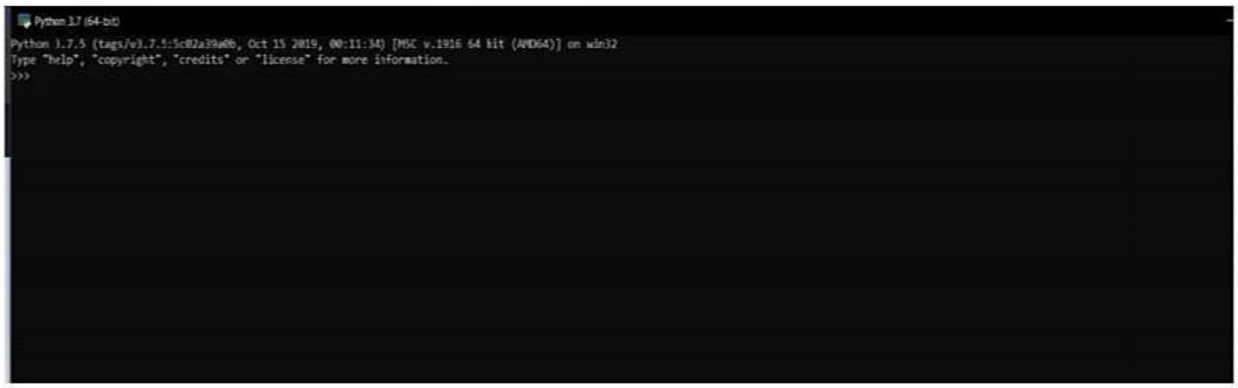

**Steps to configure:**

- 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.



**Python IDE:**

Install Python3 compiler Install any python IDE to execute python scripts. The python code subscribed to IoT platform to form the connectivity layer with node -red commands.




**CODE:**

import time import

sys import

ibmiotf.application

importibmiotf.device

import random

#Provide your IBM Watson Device

Credentialsorganization = "157uf3"

deviceType = "abcd" deviceId =

"7654321" authMethod = "token"

authToken = "87654321"

# Initialize GPIO

def myCommandCallback(cmd):

```
print("Command received: %s" %
cmd.data['command'])
status=cmd.data['command']      if
status=="motoron": print ("motor is on")
elif status== "motoroff":            print("motor is
off")                          else :
      print ("please send proper command")


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


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


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


while True:
      #Get SensorData from DHT11
```

```
temp=random.randint(90,11
0)
Humid=random.randint(60,10
0)

Mois=random.randint(20,120)


data = { 'temp' : temp, 'Humid':Humid,
'Mois' :Mois}#print data     def
myOnPublishCallback():
print ("Published Temperature
= %s C" % temp, "Humidity = %s
%%" % Humid,
"Moisture =%s
deg c" %Mois,
"to IBM
Watson")


success = deviceCli.publishEvent("IoTSensor", "json", data, qos=0,
on_publish=myOnPublishCallback)          if   not   success:
print("Not connectedto IoTF")  time.sleep(10)


deviceCli.commandCallback = myCommandCallback


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

## Aurdino code for C :

```
//in
clu
de
libr
ari
es
#in
clu
de
<d
ht.
h>
#include <SoftwareSerial.h>

//define pins
#define dht_apin A0 // Analog Pin sensor is
connectedSoftwareSerial mySerial(7,8);//serial port of
gsm
const int sensor_pin = A1; // Soil moisture
sensor O/P pinint pin_out= 9;
//allo
cate
varia
bles
dht
DHT;
int c=0;

void setup()
{
pinMode(2, INPUT); //Pin 2 as
INPUT pinMode(3, OUTPUT);
//PIN 3 as OUTPUTpinMode(9,
OUTPUT);//output for pump
}
```

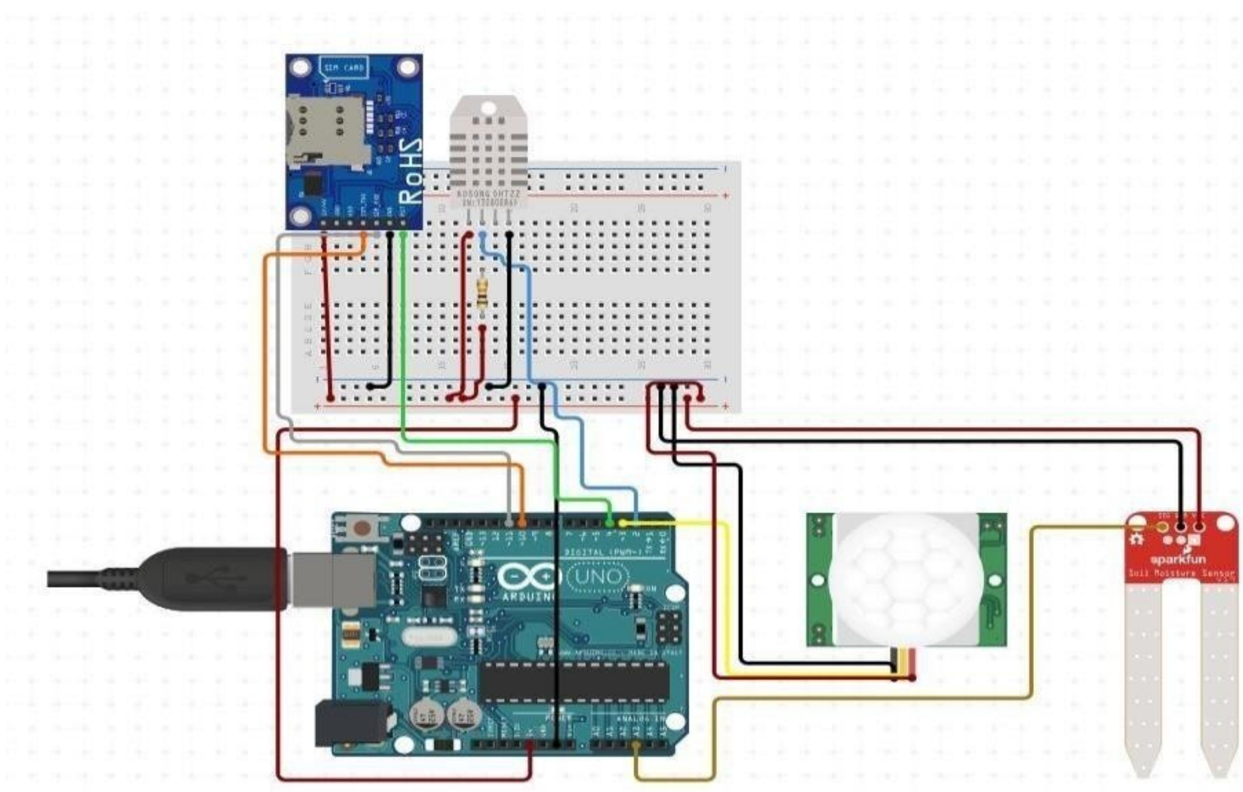
```
void loop()
{
 if (digitalRead(2) == HIGH)
 {
 digitalWrite(3, HIGH); // turn the
 LED/Buzz ON delay(10000); // wait for
 100 msecond digitalWrite(3, LOW);  //
 turn the LED/BuzzOFFdelay(100);
 }
  Seri
   al.
   be
   gin
   (96
   00
   );
   del
   ay(
   10
   00
   );
  DHT.read11(dht_apin);
 //temprature
 floath=DHT.humidity;
 float
  t=DHT.tem
  perature;
  delay(500
  0);
  Serial.beg
  in(9600);
   float
 moisture_percentage;//mo
 istureint sensor_analog;
 sensor_analog = analogRead(sensor_pin);
 moisture_percentage = ( 100 - ( (sensor_analog/1023.00) * 100 ) );

 float
 m=moisture_per
 centage;delay(1
```

```
000);
if(m<40)//pump
{
while(m<40)
{
digitalWrite(pin_out,HIGH);/
/open pumpsensor_analog
= analogRead(sensor_pin);
moisture_percentage = ( 100 - ( (sensor_analog/1023.00) * 100 ) );
m=moisture_percentage;
delay(1000);
}
digitalWrite(pin_out,LOW);//closepump
}
if(c>=0)
{
mySerial.begin(
9600);
delay(15000);
Serial.begin(96
00);
delay(1000);
Serial.print("\r"
); delay(1000);
Serial.print("AT
+CMGF=1\r");
delay(1000);
Serial.print("AT+CMGS=\"+XXXXXXXXXX\"\r"); //replace X with 10
digit mobile number
delay(1000);
Serial.print((S
tring)"update-
>"+(String)"Temprature="+t+(String)"Humidity="+h+(String)"Moisture
="+m); delay(1000);
Seri
al.w
rite(
0x1
A);
```

```
dela
y(10
00);
mySerial.println("AT+CMGF=1");//Sets the GSM Module
in Text Modedelay(1000);

mySerial.println("AT+CMGS=\"+XXXXXXXXXX\"\r"); //replace X
with 10 digitmobile number
delay(1000); mySerial.println((String)"update-
>"+(String)"Temprature="+t+(String)"Humidity="+h+(String)"Moisture="+m);//
message format
mySerial.prin
tln();
delay(100);
Serial.write(0
x1A);
delay(1000);
c++;
  }
}
```



## 7.2 FEATURE 2:

**Connecting IoT Simulator to IBM Watson IoT Platform:**

Give the credentials of your device in IBM Watson IoT Platform Click on connect My credentials given to simulator are:

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

The link to simulator:

https://watson-iot-sensor-simulator.mybluemix.net/

We need to give the credentials of the createddevice in IBM Watson IoT Platform to connect cloud tosimulator.
OpenWeather API

OpenWeatherMap is an online service that provides weather data. It provides current weatherdata, forecasts and historical data to more than 2 million customer.

Website link: https://openweathermap.org/guide

**Stepsto configure:**

- Create account in OpenWeather o Find the name ofyour city by searching o Create API key to your account
- Replace “city name” and “your api key” with your cityand API key in below red text

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

{"coord":{"lon":79.0667,"lat":12.2167},"weather":[{"id":804,"main":"Clouds","description":"overcast clouds","icon":"04n"}],"base":"stations","main":{"temp":295.77,"feels_like":296.54,"temp_min":295.77,"temp_max":295.77,"pressure":1015,"humidity":94,"sea_leve l":1015,"grnd_level":995},"visibility":10000,"wind":{"speed":2.05,"deg":29, "gust":4.22},"clouds":{"all":96},"dt":1668440978,"sys":{"country":"IN","sunrise" :1668386454,"sunset":1668428130},"timezone":19800,"id":1254327,"name": "salem","cod":200}

In order to parse the JSON string we use Java script functions and get each parameters

```
var temperature = msg.payload.main.temp;
temperature = temperature-273.15;
return {payload : temperature.toFixed(2)};
```

In the above Java script code we take temperature parameter into a new variable and convert it from kelvin to Celsius Then we add Gauge and text nodes to represent data visually in UI.In the above Java script code we take temperature parameter into a new variable and convert it from kelvin to Celsius Then we add Gauge and text nodes to represent data visually in UI.

**Configuration of Node-Red to send commands to IBM cloud ibmiot out node:**

I used to send data from Node-Red to IBM Watson device. So, after adding it to the flow we need to configure it with credentials of our Watson device. Here we add two buttons in UI

1 -> for motor on
2 -> for motor off

We used a function node to analyses the data received and assign command to each number.

The Java script code for the analyses is:

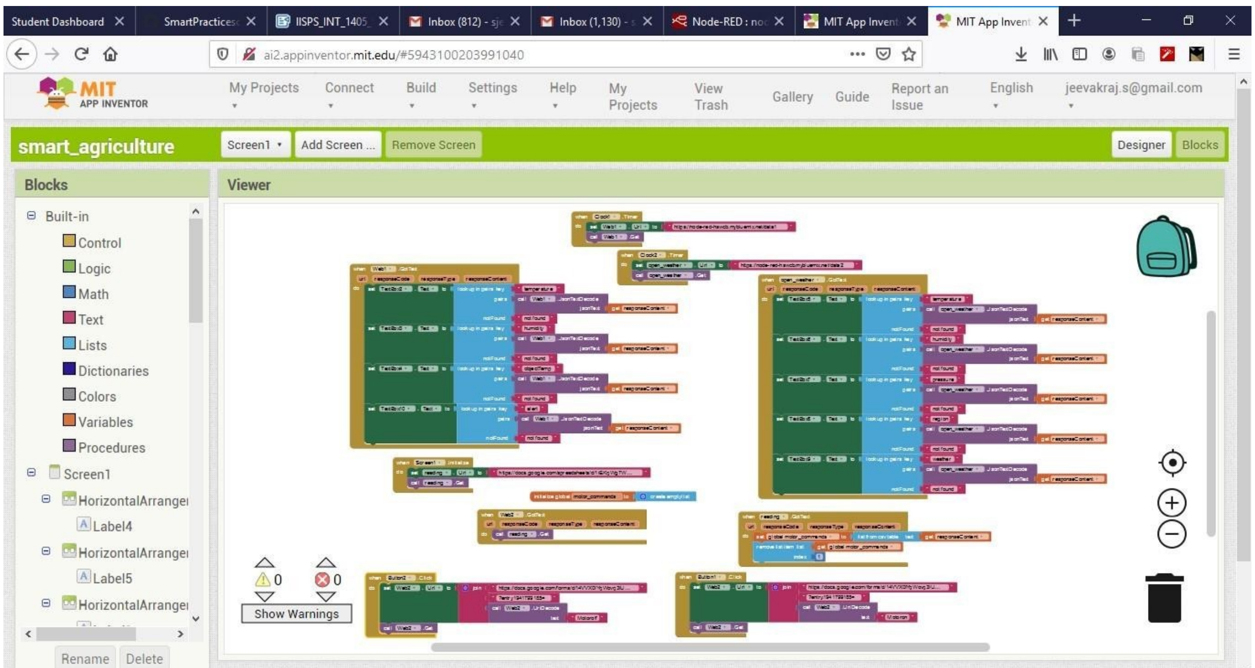
```
 if(msg.payload===1)
msg.payload={"command”: “ON"};
else if(msg.payload===0)
msg.payload={"command”: “OFF"}
```

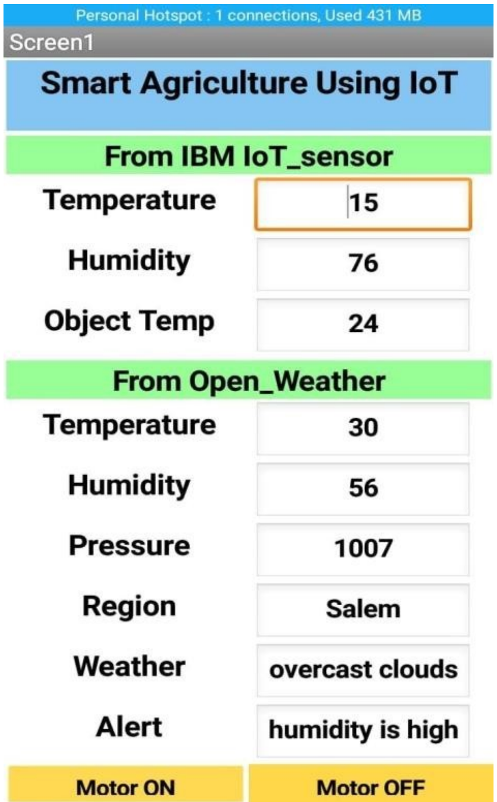
**Adjusting User Interface:**

To display the parsed JSON data a Node-Red dashboard is created Here we are using Gauges, text and button nodes to display in the UI and helps to monitor the parameters and control the farm equipment. Below images are the Gauge, text and button node configurations.

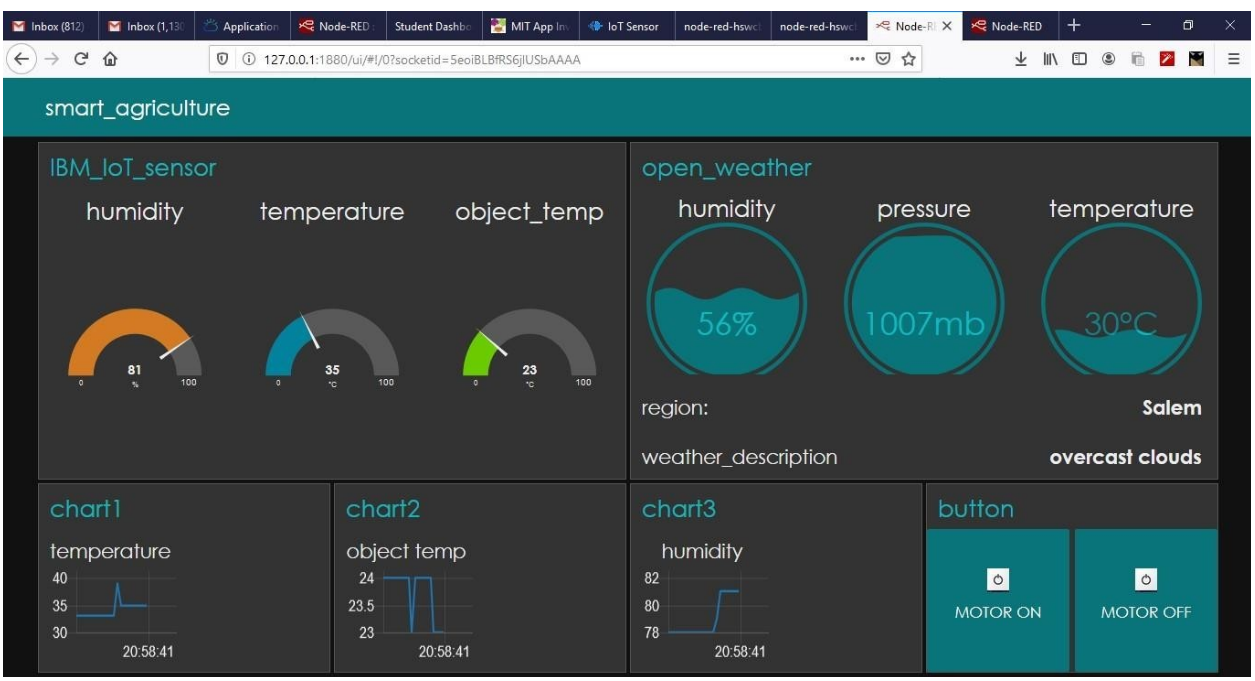
### Using MIT APP Inventor:

It facilitate farmer to know the current parameters of their land through mobile app which already connected with web UI.Farmer can turn on or off the motor according to the condition of the field.

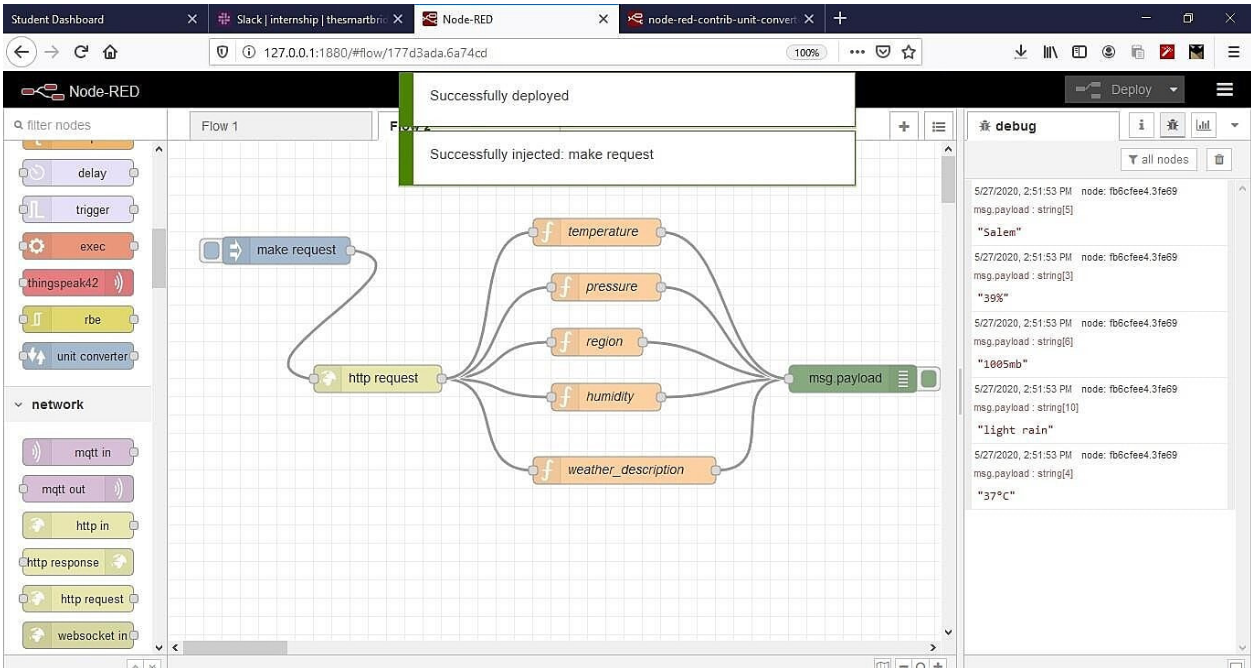


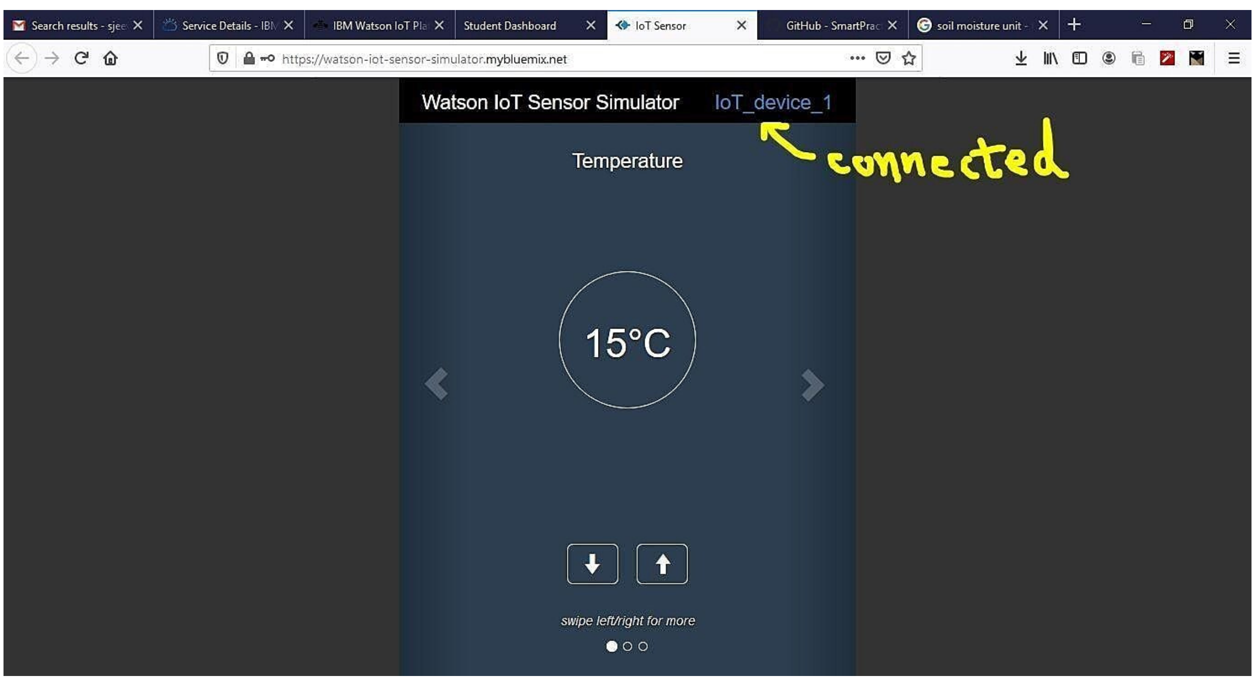


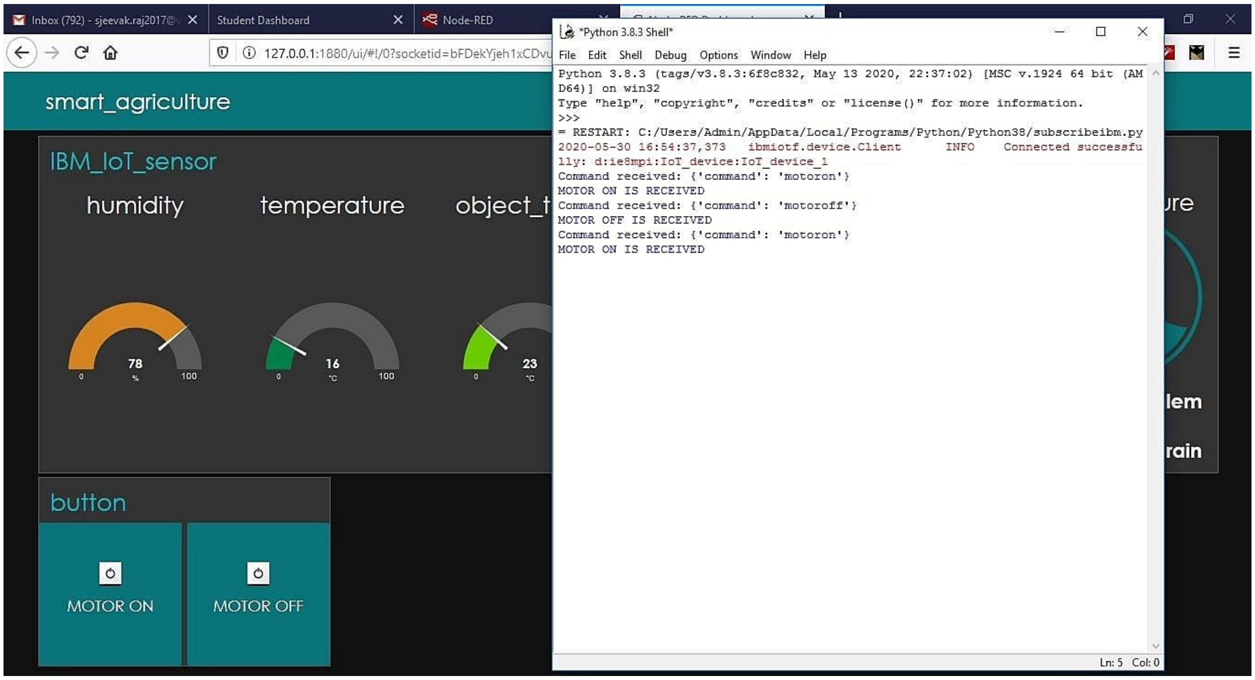

## TEST THE UI INTERFACE :

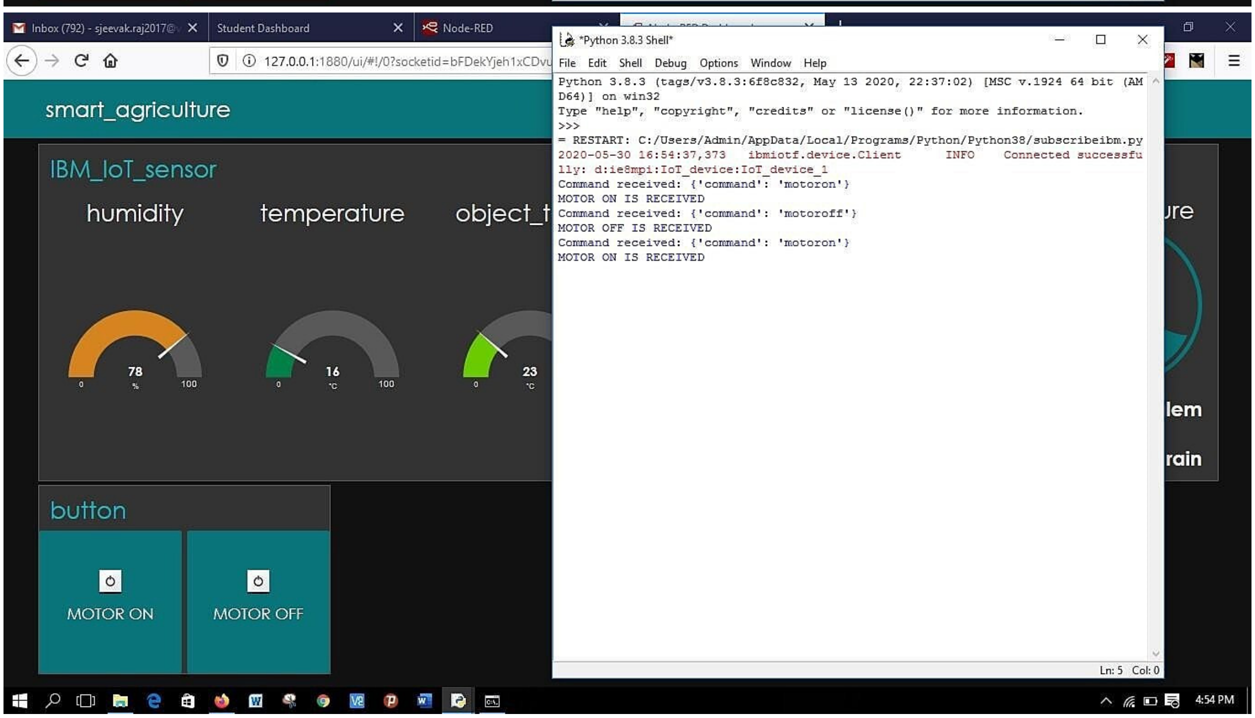


## SUCCESSFULLYDEPLOYED:




smart_agriculture
IBM_IoT_sensor
humidity
temperature
78
16
23
button
MOTOR ON
MOTOR OFF
*Python 3.8.3 Shell*
Python 3.8.3 (tags/v3.8.3:6f8c832, May 13 2020, 22:37:02) [MSC v.1924 64 bit (AMD64)] on win32
Type "help", "copyright", "credits" or "license()" for more information.
>>>
= RESTART: C:/Users/Admin/AppData/Local/Programs/Python/Python38/subscribeibm.py
2020-05-30 16:54:37,373 ibmiotf.device.Client INFO Connected successfully: d:ie8mpi:IoT_device:IoT_device_1
Command received: {'command': 'motoron'}
MOTOR ON IS RECEIVED
Command received: {'command': 'motoroff'}
MOTOR OFF IS RECEIVED
Command received: {'command': 'motoron'}
MOTOR ON IS RECEIVED


smart_agriculture
IBM_IoT_sensor
humidity
temperature
78
16
23
button
MOTOR ON
MOTOR OFF
*Python 3.8.3 Shell*
Python 3.8.3 (tags/v3.8.3:6f8c832, May 13 2020, 22:37:02) [MSC v.1924 64 bit (AMD64)] on win32
Type "help", "copyright", "credits" or "license()" for more information.
>>>
= RESTART: C:/Users/Admin/AppData/Local/Programs/Python/Python38/subscribeibm.py
2020-05-30 16:54:37,373 ibmiotf.device.Client INFO Connected successfully: d:ie8mpi:IoT_device:IoT_device_1
Command received: {'command': 'motoron'}
MOTOR ON IS RECEIVED
Command received: {'command': 'motoroff'}
MOTOR OFF IS RECEIVED
Command received: {'command': 'motoron'}
MOTOR ON IS RECEIVED
4:54 PM

# 8. TESTING:

## 8.1 Test Cases:

Team ID : PNT2022TMID21901

NFT - Risk Assessment

| No | Modules | Scope/feature | Functional Changes | Hardware Changes | Software Changes | Impact of Downtime | Load/Voluem Changes | Risk Score | Justification |
|---|---|---|---|---|---|---|---|---|---|
| 1 | Node-Red | New | Low | No Changes | Moderate | Time Complexity | >5 to 10% | ORANGE | As we have seen the chnages |
| 2 | IoT simulator | New | High | No Changes | Moderate | Time Complexity | 6% | ORANGE | seen changes |
| 3 | Devices | New | High | No Changes | High | none | 10% | GREEN | No changes |

NFT - Detailed Test Plan

| S.No | Project Overview | NFT Test approach | umptions/Dependencies/Ri | Approvals/SignOff |
|---|---|---|---|---|
| 1 | Connects simulator with node-red | speed | Assumptions | Approvals |

End Of Test Report

| No | Project Overview | NFT Test approach | NFR - Met | Test Outcome | GO/NO-GO decision | Recommendations | Identified Defects (Detected/Closed/Open) | Approvals/SignOff |
|---|---|---|---|---|---|---|---|---|
| 1 | connects with web application and mobile application | | | Good performance | GO | None | Open | Approval |

NFT- RA DTP

## 8.2 USER ACCEPTANCE TESTING:

The purpose of this document is to briefly explain the test coverage and open issues of the “SmartFarmer - IoT Enabled Smart Farming Application” project at the time of the releaseto User Acceptance Testing (UAT).Increasing control over production leads to better cost management and waste reduction. The ability to trace anomalies in crop growth or livestock health, for instance, helps eliminate the risk of losing yields.Additionally, automation boosts efficiency. Smart farming reduces the ecological footprint of farming. Minimized or site-specific application of inputs, such as fertilizers and pesticides, in precision agriculture systems will mitigate leaching problems as well as the emission of greenhouse. This report shows the number of resolved or closed bugs at each severity level, and how they were resolved. This report shows the number of test cases that havepassed, failed,and untested.

## 1. DEFECT ANALYSIS:

| Resolution | Severity 1 | Severity 2 | Severity 3 | Severity 4 | Subtotal |
|---|---|---|---|---|---|
| By Design | 8 | 3 | 2 | 2 | 16 |
| Duplicate | 1 | 0 | 2 | 0 | 3 |
| External | 2 | 3 | 0 | 1 | 6 |
| Fixed | 9 | 2 | 3 | 17 | 31 |
| Not Reproduced | 0 | 0 | 1 | 0 | 1 |
| Skipped | 0 | 0 | 1 | 1 | 2 |
| Won't Fix | 1 | 4 | 1 | 1 | 7 |
| Totals | 21 | 12 | 9 | 22 | 66 |

## 2. TEST ANALYSIS:

| Section | Total Cases | Not Tested | Fail | Pass |
|---|---|---|---|---|
| Print Engine | 5 | 0 | 0 | 5 |
| Client Application | 30 | 0 | 0 | 30 |
| Security | 2 | 0 | 0 | 2 |
| Outsource Shipping | 2 | 0 | 0 | 2 |
| Exception Reporting | 9 | 0 | 0 | 9 |
| Final Report Output | 4 | 0 | 0 | 4 |
| Version Control | 1 | 0 | 0 | 1 |

## 9. RESULT:

## 9.1 PERFORMANCE METRICS:

Hence a helpful and useful system is built for farmers to assist them in farming and also prevent them from natural calamities. It also saves farmers time to maintainall these thingsas this is working on cloud he can turn on/off motor from anywhere so basically it helps farmers and make them relived thus helping our economy to grow.

## 10. ADVANTAGES & DISADVANTAGES:

**Advantage:**

- Monitoring weather parameters such as temperature, pressure, humidity,soil moisture remotely controlling motorseasily through buttons
- alert farmers in case of any calamities
- threshold values are set any anomalieswill be reported to the farmer
- user friendlyand efficient
- low cost

**Disadvantage:**

- sensors may sometime malfunction
- maybe inaccurate sometimes
- farmer needs internet connectivity
- farmer must have a phone and have basic knowledge to operate it

**Applications:**

- Monitoring of Climate Conditions -Probably the most popular smart agriculture gadgets are weather stations, combining various smart farming sensors. Located across the field, they collect variousdata from the environment and send it to the cloud. The provided measurements can be used to map the climate conditions, choose the appropriate crops, and take the requiredmeasures to improvetheir capacity (i.e. precision farming).

- Greenhouse Automation-In addition to sourcing environmental data, weather stationscan automatically adjustthe conditions to match the given parameters. Specifically, greenhouse automation systems use a similar principle.
- Crop Management - One more type of IoT product in agriculture and another elementof precision farmingis crop management devices. Just likeweather stations, they should be placed in the field to collect data specific to crop farming; from temperature and precipitation to leaf water potential and overall crop health, these can all be used to readily collect data and information for improved farming practices.
- Cattle Monitoring and Management-Just like crop monitoring, there are IoT agriculture sensorsthat can be attached to the animalson a farm to monitortheir health and log performance. This works similarly to IoT devices for pet car
- End-to-End Farm Management Systems-A more complex approach to IoT products in agriculture can be represented by the so-calledfarm productivity management systems. They usuallyinclude a number of agriculture IoT devices and sensors, installed on the premises as well as a powerful dashboardwith analytical capabilities and in-builtaccounting/reporting features.

## 11. CONCLUSION:

Smart Farming and IoT-driven agriculture are paving the way for what can be called a Third Green Revolution.The Third Green Revolution is taking over agriculture. That revolution draws upon the combined application of data-driven analytics technologies, such as precision farming equipment, IoT, “big data” analytics, Unmanned Aerial Vehicles (UAVs or drones), robotics, etc.

In the future this smart farming revolution depicts, pesticide and fertilizer use will drop while overall efficiency will rise. IoT technologies will enable better food traceability, which in turn will lead to increased food safety. It will also be beneficial for the environment, for example, more efficient use of water, or optimization of treatments and inputs.Therefore, smart farming has a real potential to deliver a more productive and sustainable form of agricultural production,based on a more precise and resource-efficient approach. New farms will finally realize the eternal dream of mankind.

## 12. FUTURE SCOPE:

With the exponential growth of world population, according to the UN Food and Agriculture Organization, the world will need to produce 70% more food in 2050,shrinking agricultural lands, and depletion of finite natural resources, the need to enhance farm yield has become critical. Limited availability of natural resources such as fresh water and arable land along with slowing yield trends in several staple crops, have furtheraggravated the problem.Another impeding concernover the farmingindustry is the shifting structure of agricultural workforce. Moreover, agricultural labor in most of the countrieshas declined. As a resultof the declining agricultural workforce, adoption of internet connectivity solutions in farming practiceshas been triggered, to reduce the need for manual labor. IoT solutions are focusedon helping farmersclose the supplydemand gap, by ensuring high yields, profitability, and protection of the environment. The approach of using IoT technology to ensure optimum application of resources to achieve high crop yieldsand reduce operational costs is called precision agriculture.

## 13. APPENDIX:

Github repository link:
https://github.com/IBM-EPBL/IBM-Project-24073-1659937246

Demo link:

**https://drive.google.com/file/d/1-hMn1HIYLmp5PnATbZLY4zBCgUkdhNy2/view?usp=share_link**

https://www.youtube.com/embed/RGqQ3OlsXH4