SmartFarmer - IoT Enabled Smart Farming Application

A PROJECT REPORT

Submitted by

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1 Introduction:

1.1 Overview:

In this project I have developed a mobile application usingwhich a farmer can monitor the temperature, humidity,pressure and soil moisture parameters along with weather forecasting details. Based on these details he can water the cropsby controlling the motors throughthe app .

1.2 Purpose:

Agriculture plays a crucial role in the life of an economy. It is the backbone of our economic system,so improving the quality and way of production is crucial. Here comes the Smart Agriculture system. Smart agriculture helps in automated farming, collection of data from the field and then analyses it so that the farmer can make accurate decision in order to growhighquality crop.

IoT based Smart Farming improves the entire Agriculture system by monitoring the field in real-time. With the help of sensors and interconnectivity, the Internetof Things in Agriculture has not only saved the time of the farmersbut has also reduced the extravagant use of resources such as Water. and Electricity.

2. LITERATURE SURVEY

2.1 Existing problem

The author describes the increasing global population demands improved production to provide food in all sectors, especially in agriculture. Still, at certain periods, demand and supply will not match. Managing and sustaining capital and manpower is still a demanding challenge for improving agricultural production. Smart agriculture is a better option for growing food production, resource management, and labour. This research provides an overview of predictive analysis,

The author describes Farming is the backbone of the economy and it is the fundamental method for occupation. The large population of the world depends on farming for living day to day life. Around 70% of the Indian population depends on cultivation. Most of the cultivation cannot be productive only by physical activities so have to be handled by innovative technologies. Therefore, they use IoT innovation and SMS notification to address the critical part of farming. The past method of incorporating a keen water supplty system with smart ideas. This undertaking is a follow up to a past method whose highlight features incorporates a keen water system with excellent control and insightful basic leadership in terms of exact continuous field information which regulates temperature, moisture and soil dampness of a particular crop. Controlling of every one of these activities will be monitored by PC with Internet and the tasks being performed by interfacing sensors and Arduino. With the observation results decisions are to be made. The author describes .Internet of Things (IoT) technology has brought revolution to eachand every field of the common man's life by making everything smart and intelligent. IoT refers to a network of things which make a self configuring network. The development of Intelligent Smart Farming IoT based devices is day by day turning the face of agriculture production by not only enhancing it but also making it cost-effective and reducing wastage. The aim / objective of this report is to propose an IoT based Smart Farming System assisting farmers in getting Live Data (Temperature, Soil Moisture) for efficient environment monitoring which will enable them to increase their overall yield and quality of products.

The author describes.Today's different types of technologies, techniques and tools are used in the agriculture sector. To improve productivity, efficiency and reduce the time, cost and human intervention, there is a need for a new technology called the Internet of Things. To automate the agricultural activities like water management, soil monitoring, crop management, livestock monitoring etc. different types of sensor are used. Smart Greenhouses protect the plants from extreme weather. To control all these operations remote smart devices, computers connected with the internet, sensor, camera, micro-controller etc. are used. Growth in the agriculture sector affects the economic condition of the country. This paper focuses on the Role of IoT in Agriculture that defines Smart Farming

2.2 References:

[1] Farooq, M. S., Riaz, S., Abid, A., Abid, K., & Naeem, M. A. (2019). A Survey on theRole ofIoT in Agriculture for the Implementation of Smart Farming. Ieee Access, 7, 156237-156271.

[2] Farooq, M. S., Sohail, O. O., Abid, A., & Rasheed, S. (2022). A survey on the role ofiot inagriculture for the implementation of smart livestock environment. IEEE Access, 10, 9483-9505.

[3] A Study On Smart Irrigation Systems For Agriculture Using Iot (Dr. J. JegatheshAmalraj, S. Banumathi, J. JereenaJohn) International Journal Of Scientific & Technology Research Volume 8, Issue 12, December 2019

[4] IoT-Based Smart Irrigation Systems: An Overview on the Recent Trends on Sensors and IoT Systems for Irrigation in Precision Agriculture Laura García ,Lorena Parra , Jose M. Jimenez , Jaime Lloret and Pascal Lorenz , Sesnors 2020

[5] Sungheetha, Akey, and Rajesh Sharma. "Real Time Monitoring and Fire Detection using Internet of Things and Cloud based Drones." Journal of Soft Computing Paradigm (JSCP) 2, no. 03 (2020): 168-174.

[6] J.Arumai Ruban, C.Balakrishnan, S.Santhoshkumar, G.Jagan Study of Smart Farming Techniques in Drip Irrigation using IoT ” International Journal of Advanced Science and TechnologyVol. 29, No. 2, (2020), pp. 4595-4613.

[7] An IOT based Smart Irrigation System using Soil Moisture and Weather Prediction, S. Velmurugan , V. Balaji, T.Manoj Bharathi, K. Saravanan, International Journal of Engineering Research & Technology (IJERT) ISSN: 2278-

0181

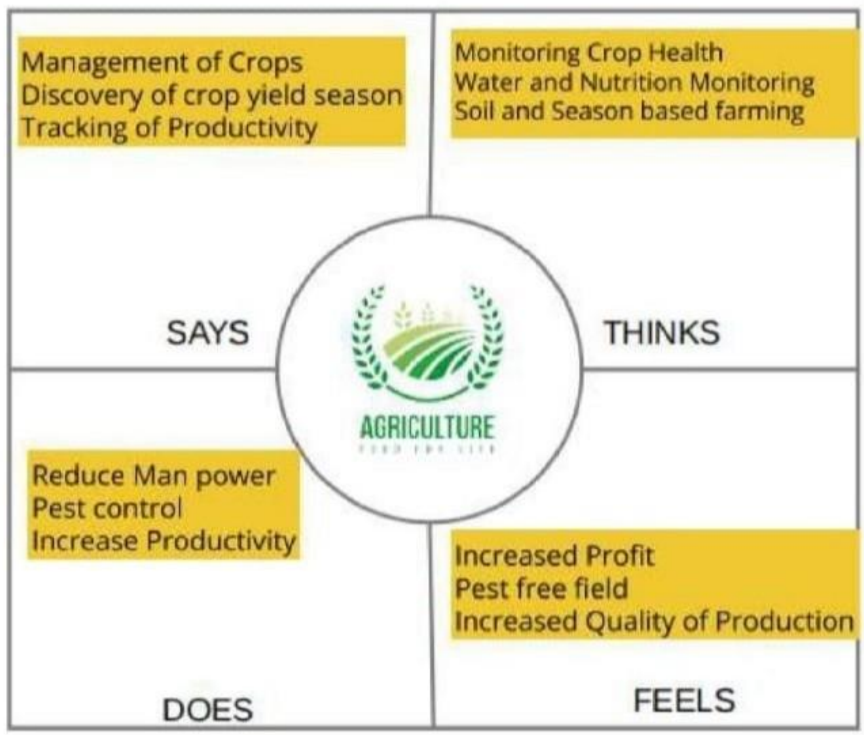
[8] Climate-Smart Agriculture and Smallholder Farmers' Income: The Case of Soil Conservation Practice-Adoption at Qamata Irrigation Scheme, South Africa, I.D. Ighodaro, A. Mushunje , B.F. Lewu1 and B.E. Omoruyi, JHE, 2020

2.3 Problem Statement Definition

IoT-based agriculture system helps the farmer in monitoring different parameters of his field like soil moisture, temperature, and humidity using some sensors. Farmers can monitor all the sensor parameters by using a web or mobile application even if the farmer is not near his field. Watering the crop is one of the important tasks for the farmers. They can make the decision whether to water the crop or postpone it by monitoring the sensor parameters and controlling the motor pumps from the mobile application itself.

3. IDEATION & PROPOSED SOLUTION

3.1 Empathy Map Canvas



3.2 Ideation & Brainstorming:

- IoT-based agriculture system helps the farmer in monitoring different parameters of his field like soil moisture, temperature, and humidity using some sensors.

- Farmers can monitor all the sensor parameters by using a web or mobile application even if the farmer is not near his field. Watering the crop is one of the important tasks for the farmers.

- They can make the decision whether to water the crop or postpone it by monitoring the sensor parameters and controlling the motor pumps from the mobile application itself.

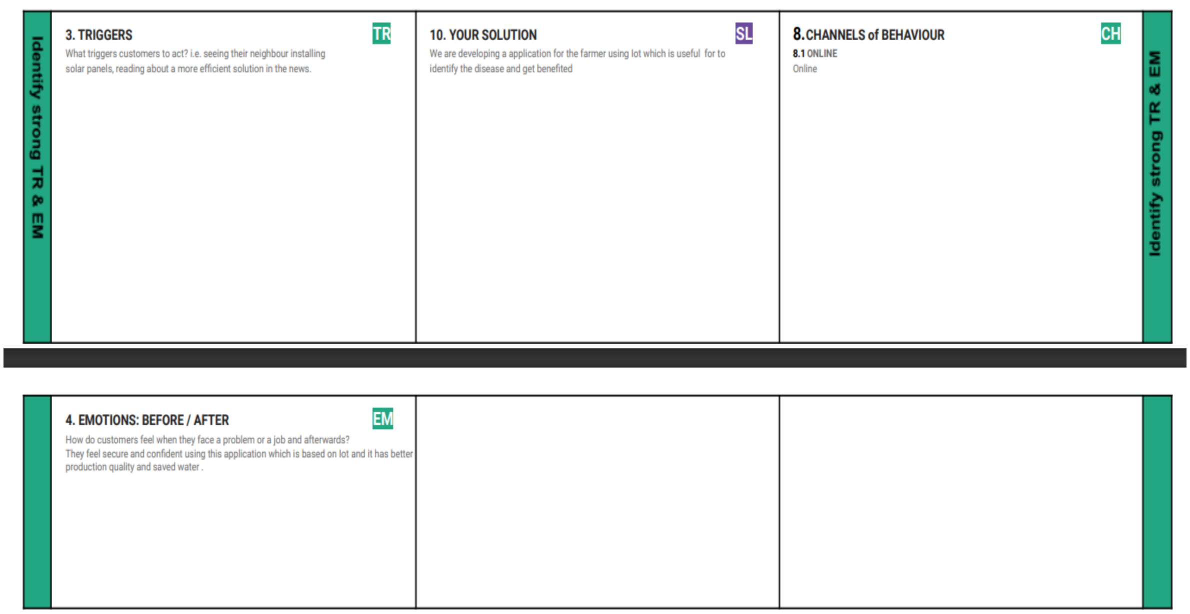
Building IoT based Intelligent Farming	Precision Livestock Farming	Agriculture Monitoring System
Smart Farming has enabled farmers to reduce waste and enhance productivity with the help of sensors (light, humidity, temperature, soil moisture, etc.) and automation of irrigation systems. Further with the help of these sensors, farmers can monitor the field conditions from anywhere. Internet of Things based Advanced Farming is highly efficient when compared with the conventional approach. The applications of intelligent Agriculture solutions not only targets conventional, large farming. With operations, but couldalso be new levers to uplift other growing or common trends in agricultural like organic farming, family farming (complex or small spaces, particular cattle and/or cultures, preservation of specific or high-quality varieties, etc.), and enhance highly transparent Farming	Cattle ranching can also be optimized with IoT technologies. Internet of Things devices allow each animal to be monitored and tracked individually, for health conditions as well as location. To optimize beef production, the farmer can adjust the nutrition of each animal individually, as well as monitor the well-being of the animals and identify potential disease outbreaks. This will help by allowing sick animals to be separated from the herd before the problem has a chance to spread, so as to treat the animal before its condition worsens. This helps farmers cut expenses on vets and	Real time health updates of livestock results in saving a huge sum as profit for the farmer. With the help of Livestock wearables, close monitoring of the respiratory rate, heart rate, blood pressure, temperature, reproductive cycles and other vitals can be monitored. At the first sign of illness or feeding problems, they can be segregated from the herd and start on the path to recovery.With the help of smart farming system, moisture and fertility of soil along with crops growth rate can be monitored remotely through real time animation and graphics via a smartphones. This helps the farmer make environmental variables and informed decisions for the farm.IoT in smart farming is not restricted to a particular section. Smart farming sensors can be placed right in the ground. There, it shall read and analysis the derived data and help improve farming practices. Primarily,

	regular checkups.	the leaf to soil ratio and soil humidity help increase quantity and quality of the produce. Wearables for cattle are the best bet against poaching and cattle napping.

3.3 Proposed Solution :

S.NO	PARAMETER	DESCRIPTION
1.	Problem Statement	To provide efficient decision support system using wireless sensor network which handle different activities of farm and gives useful information related to farm field to farmer
2.	Solution description	Smart Farming solutions provide an integrated IOT platform in agriculture that allows farmers to leverage sensor, smart gateways and monitoring systems to collect information, control various parameters on their farms and analyse real-time data in order to make informed decisions
3.	Novelty/Uniqueness	It is based on four domains namely monitoring ,control ,prediction and logic
4.	Social Impact	· Conservation of water · Better crop yield · Pollution prevention · Time efficiency ,accurate diagnosis of nutrient deficiency
5.	Business Model	Smart farming which involves the application of sensor and automated irrigation practices can help monitor land , temperature , soil moisture

3.4 Problem Solution fit:



4. REQUIREMENT ANALYSIS

4.1 Functional requirement

"IoT device includes every object that can be controlled through the Internet. IoT devices have become commonplace in consumer markets with wearable IoWT (Internet of Wearable Things), such as smartwatches, and home management products, like Google home. It is estimated over 30 billion devices could be connected to the Internet of Things by 2020. The applications of the Internet of Things in agriculture target conventional farming operations to meet the increasing demands and decrease production losses. 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

In IOT-based Smart farming system there are some requirements are needed. In that requirements,some of them mentioned below.

Smart farming refers to managing farms using modern Information and communication technologies to increase the quantity and quality of products while optimizing the human labor required.

Among the technologies available for present-day farmers are:

● Sensors: soil, water, light, humidity, temperature management

● Software: specialized software solutions that target specific farm types or applications agnostic IoT platforms

● Connectivity: cellular, LoRa

● Location: GPS, Satellite

● Robotics: Autonomous tractors, processing facilities

● Data analytics: standalone analytics solutions, data pipelines for downstream solutions.

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 systemrequirement graphically. It shows how data entersand leaves the system, whatchanges the information, and where data is stored.

Smart Farming Data Flow:

5.2 Solution & Technical Architecture

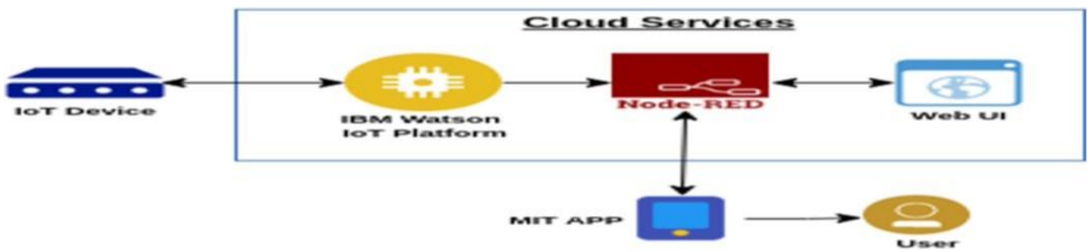


Table-1 : Components & Technologies:

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

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	Java / Python
3.	Application Logic-2	Logic for a process in the application	IBM Watson STT 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 DB2, IBM Cloudant etc.
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.	External API-2	Purpose of External API used in the application	Aadhar API, etc.
10.	Machine Learning Model	Purpose of Machine Learning Model	Object Recognition Model, etc.
11.	Infrastructure (Server / Cloud)	Application Deployment on Local System / Cloud Local Server Configuration: 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	List all the security / access controls implemented, use of firewalls etc.	e.g. SHA-256, Encryptions, IAM Controls, OWASP etc.
3.	Scalable Architecture	Justify the scalability of architecture (3 – tier, Micro-services)	Technology used
4.	Availability	Justify the availability of application (e.g. use of load balancers, distributed servers etc.)	Technology used
5.	Performance	Design consideration for the performance of the application (number of requests per sec, use of Cache, use of CDN's) etc.	Technology used

5.3 User Stories

Use the below template to list all the user stories for the product.

User Type	Functional Requirement(Epic)	User Story Number	User Story/ Task	Acceptance criteria	Priority	Release
Customer (Mobileuser)	Registration	USN-1	As a Customer, I canregister for the application by entering my email, password, and confirmingmy password.	I can access my account / dashboard	High	Sprint-1
		USN-2	As a user, I willreceive confirmation emailonceI have registered for the application	I can receive confirmationemail& click confirm	High	Sprint-1

		USN-3	As a user, I can register for the application through Facebook	I can register & access thedashboard 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 customer, I needto receive notification anddetails.	I get the details about what need to be done in different weather condition.	High	Sprint-1
Customer (Webuser)		USN-7	As a user, I can resetmy password if I forgottheold one.	I can use my account even ifI forgot my password.	Medium	Sprint-2
Customer Care Executive	Know more	USN-8	As a user,I willbe learn more about the work tobe	Give more details from thedata.	Medium	Sprint-3

			done.			
Administrator	Assignment ofroles	USN-9	As a admin, I will be able to assign role to the user.	I can assign role to the users.	High	Sprint-1
		USN-10	As a admin,I can note donethe progress of all theexpense of thework done.	I can notedown	Low	Sprint-3

6. PROJECT PLANNING & SCHEDULING

6.1 Sprint Planning & Estimation

WEEK -1

Sprint	Functional Requirement (Epic)	User Story Number	User Story / Task	Story Points	Priority	Team Members
Sprint-1	Registration	USN-1	As a user, Ican register for the application by entering my email,password, and confirming my password.	2	High	Lokeshvar Poornisha Priyanka Thanish
Sprint-1	Registration	USN-2	As a user, I will receive confirmation email once I have registered for the application	1	High	
Sprint-2	Registration	USN-3	As a user, Ican register for the application through link	2	Low	
Sprint-1	Registration	USN-4	As a user, Ican register for the application through Gmail	2	Medium	
Sprint-1	Login	USN-5	As a user, Ican log intothe application by entering email &password	1	High	

<u>WEEK (2-4)</u>

Sprint	Functional Requirement (Epic)	User Story Number	User Story / Task	Priority	Team Members
Sprint-1	Literature Survey	USN-1	Literature survey on the selected project andinformation gathering	High	Poornisha
Sprint-2	Empathy Map	USN-2	Prepare Empathy Map Canvas to capture the userPains and gainsand also preparethe list of problemstatement	High	Priyanka
Sprint -3	Ideation	USN-2	List the ideas by organizing the brainstorming session	High	Lokeshvar and Thanish

WEEK 5-6 (Project Design Phase -I)

Sprint	Functional Requirement (Epic)	User Story Number	User Story / Task	Priority	Team Members
Sprint-1	Proposed Solution	USN-1	Prepare the proposed solution document, whichincludes the novelty, feasibility of idea, business model, social impact, scalability ofsolution, etc.	High	Poornisha
Sprint-2	Problem- Solution Fit	USN-2	Prepare problem - solution fit document	High	Priyanka
Sprint -3	Solution Architecture	USN-2	Prepare problem - solution architecture	High	Thanish

WEEK 7-8 (Project Design Phase -II)

Sprint	Functional Requirement (Epic)	User Story Number	User Story / Task	Priority	Team Members
Sprint-1	Requirement Analysis	USN-1	Prepare the requirement analysis	High	Poornisha
Sprint-2	Customer Journey	USN-2	Prepare the customer journey maps to understand the user interactions & experiences with the application (entry to exit)	High	Lokeshvar
Sprint -3	Data FlowDaigrams	USN-2	prepare the Functional Requirement Document& Data Flow Daigrams	High	Thanish

6.2 Sprint Delivery Schedule

1.Introduction

The main aim of this project is to help farmers automate their farms by providingthem with a Web App through which they can monitor the parameters of the field like Temperature, soil moisture, humidity and etc and control the equipment like water motor and other devicesremotely via internetwithout their actualpresencein the field.

2.Problem Statement

Farmers are to be present at farm for its maintenance irrespective of the weather conditions. They have to ensure that the crops are well wateredand the farm status is monitored by them physically. Farmer have to stay most of the time in field in order to get a good yield. In difficult times like in the presence of pandemic also they have to work hard in their fields risking their lives to provide food for the country.

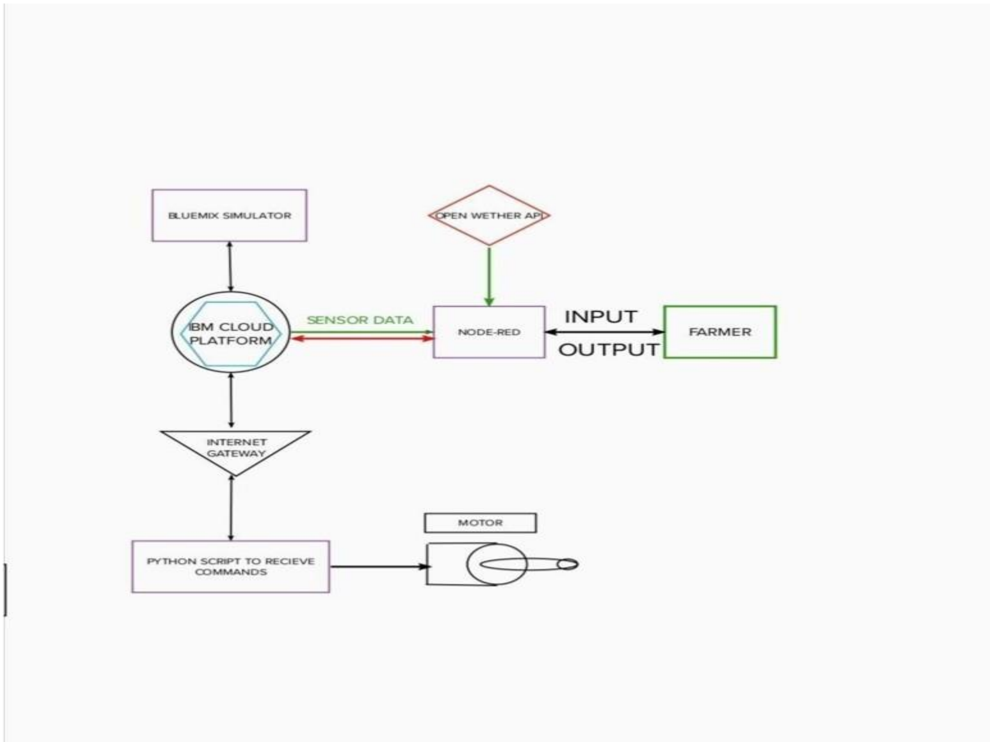
3.Proposed Solution

In order to improve the farmer's working conditions and make them easier, we introduce IoT services to him in which we use cloud services and internet to enable farmerto continue his work remotelyvia internet. He can monitorthe field parameters and control the devicesin farm.

4.TheoreticalAnalysis

4.1 Block Diagram

In order to implement the solution , the following approach as shown in the blockdiagram is used



4.2 Required SoftwareInstallation

4.2.ANode-Red

Node-RED is a flow-based development tool for visualprogramming developedoriginally by IBM for wiring togetherhardware devices, APIs and online services as

part of the Internet of Things. Node-RED provides a web browser-based flow editor,whichcan be used to create JavaScript functions.

Installation :

1. First installnpm/node.js
2. Open cmd prompt
3. Type => npm installnode-red

To run the application :

4. Open cmd prompt
5. Type=>node-red

6. Then open http://localhost:1880/ in browser

Installation of IBM IoT and Dashboard nodes for Node-Red

In order to connect to IBM Watson IoT platform and create the Web App UI these nodes are required 1. IBM IoT node

2. Dashboard node

4.2.B IBM WatsonIoT 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 designedto make it simple to derive value fromyour IoT devices.

Steps to configure:

1. Create an account in IBM cloud using your email ID
2. Create IBM Watson Platformin services in your IBM cloud account

3. Launch the IBM WatsonIoT Platform

4. Create a new device

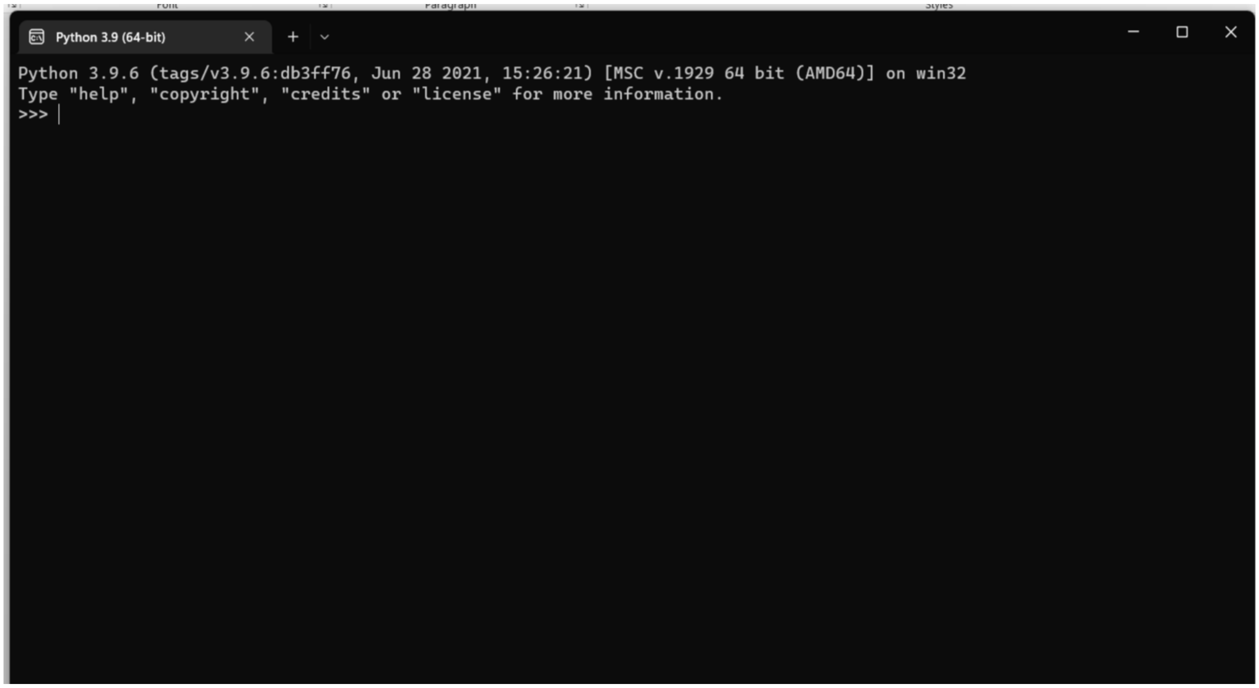
5. Give credentials like device type, device ID, Auth. Token

Create API key and store API key and token elsewhere

4.2.C Python IDE

Install Python3compiler

Install any python IDE to execute python scripts, in my case I used Spyder to executethe code.



7.Code:

```
import wiotp.sdk.device
import time
import random
myConfig = {
    "identity": {
        "orgId": "trodnx",
        "typeId": "testmydevice",
        "deviceId":"12345"
    },
    "auth": {
        "token": "12345678"
    }
}

def myCommandCallback(cmd):
```

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

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

while True:
    soil=random.randint (10,45)
    temp=random.randint (-20, 125)
    hum=random.randint (0, 100)
    myData={' moisture': soil, 'temperature':temp, 'humidity':hum}
    client.publishEvent (eventId="status", msgFormat="json", data=myData, qos=0 ,
onPublish=None)
    print ("Published data Successfully: %s", myData)
    time.sleep (2)
client.commandCallback = myCommandCallback
client.disconnect ()
```

Aurdino code for C :

```
//include libraries
#include <dht.h>
#include <SoftwareSerial.h>
//define pins
#define dht_apin A0 // Analog Pin sensor is connected
SoftwareSerial mySerial(7,8);//serial port of gsm
const int sensor_pin = A1; // Soil moisture sensor O/P pin
int pin_out = 9;
```

```
//allocate variables
dht DHT;
int c=0;
void setup()
{
pinMode(2, INPUT); //Pin 2 as INPUT
pinMode(3, OUTPUT); //PIN 3 as OUTPUT
pinMode(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/Buzz OFF
delay(100);
}
Serial.begin(9600);
delay(1000);
DHT.read11(dht_apin); //temprature
float h=DHT.humidity;
floatt=DHT.temperature;
delay(5000);
Serial.begin(9600);
float moisture_percentage;//moisture
int sensor_analog;
sensor_analog = analogRead(sensor_pin);
moisture_percentage = ( 100 - ( (sensor_analog/1023.00) * 100 ) );
float m=moisture_percentage;
delay(1000);
if(m<40)//pump
```

```
{
while(m<40)
{
digitalWrite(pin_out,HIGH);//open pump
sensor_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(9600);
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
mobil
e number
delay(1000);
Serial.print((String)"update-
>"+(String)"Temprature="+t+(String)"Humidity="+h+(String)"Moisture="+m);
delay(1000);
Serial.write(0x1A);
delay(1000);
mySerial.println("AT+CMGF=1");//Sets the GSM Module in Text Mode
delay(1000);
mySerial.println("AT+CMGS=\"+XXXXXXXXXX\"\r"); //replace X with 10 digit
```

```
mobile number
delay(1000);
mySerial.println((String)"update-
>"+(String)"Temprature="+t+(String)"Humidity="+h+(String)"Moisture="+m);//
message format
mySerial.println();
delay(100);
Serial.write(0x1A);
delay(1000);
c++;
}
```

7.1 IoT Simulator

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

The link to simulator:

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

We need to give the credentials of thecreated device in IBM

WatsonIoT Platformto 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 Findthe 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}

7.2. Building Project

Connecting IoT Simulatorto IBM Watson IoT Platform

Open link providedin above section 4.3

Give the credentials of your device in IBM

Watson IoT PlatformClickon connect

My credentials given to simulatorare:

OrgID: **157uf3** api: **a-**

157uf3- f5rg4qxpd3

Device type: **abcd**

token:

6ogMaaQHNWFEgO

D8R?

Device ID : **7654321**
Device Token: **87654321**

You can see the received data in graphs by creatingcards in Boardstab

1. You will receive the simulator data in cloud
2. You can see the received data in RecentEvents under your device
3. Data receivedin this format(json)

{

"d": {

1. "name": "abcd",
2. "temperature": 17,
3. "humidity": 76,

4. "Moisture ":25

}

}

8. Testing:

8.1 Configurationof Node-Red to collect IBM cloud data

The node IBM IoT App In is added to Node-Red workflow. Then the appropriate device credentials obtained earlier are entered into the node to connect and fetch device telemetry to Node-Red.

Once it is connected Node-Red receives data

from the deviceDisplaythe data using debug

node for verification

Connect function node and write the Java script code to get each readingseparately.

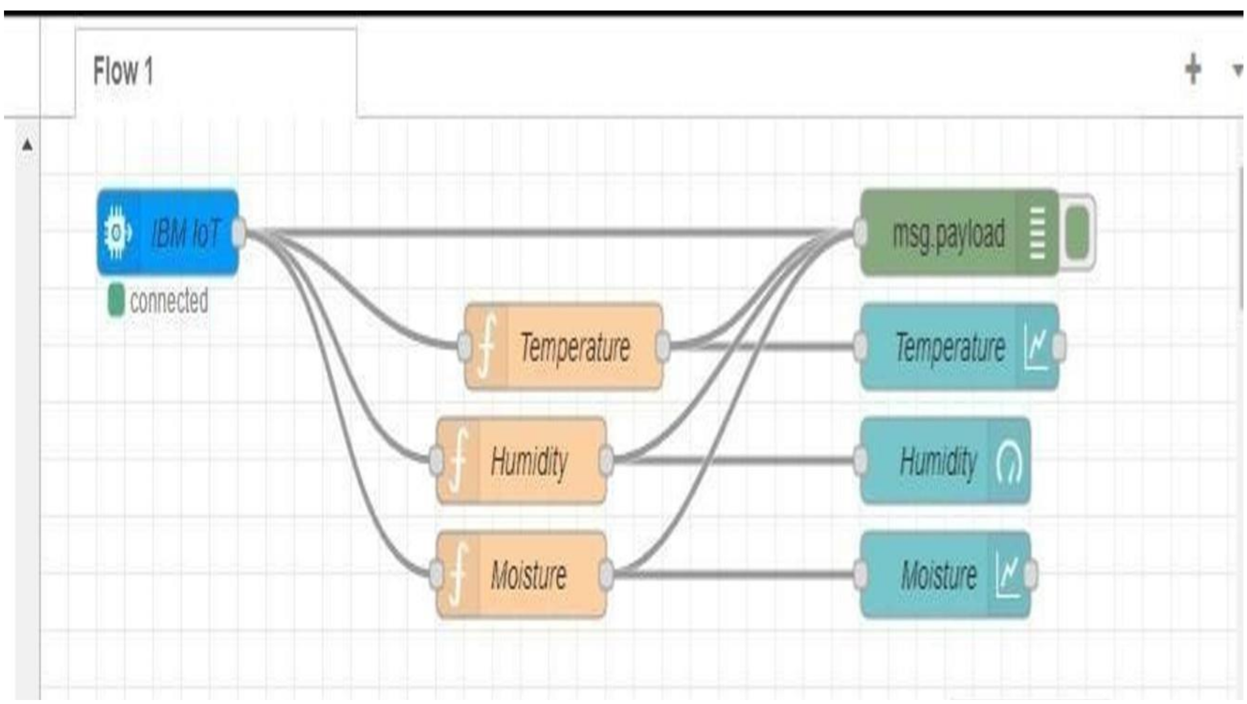
The Java script code for the function node is:

msg.payload=msg.payload.d.temperature

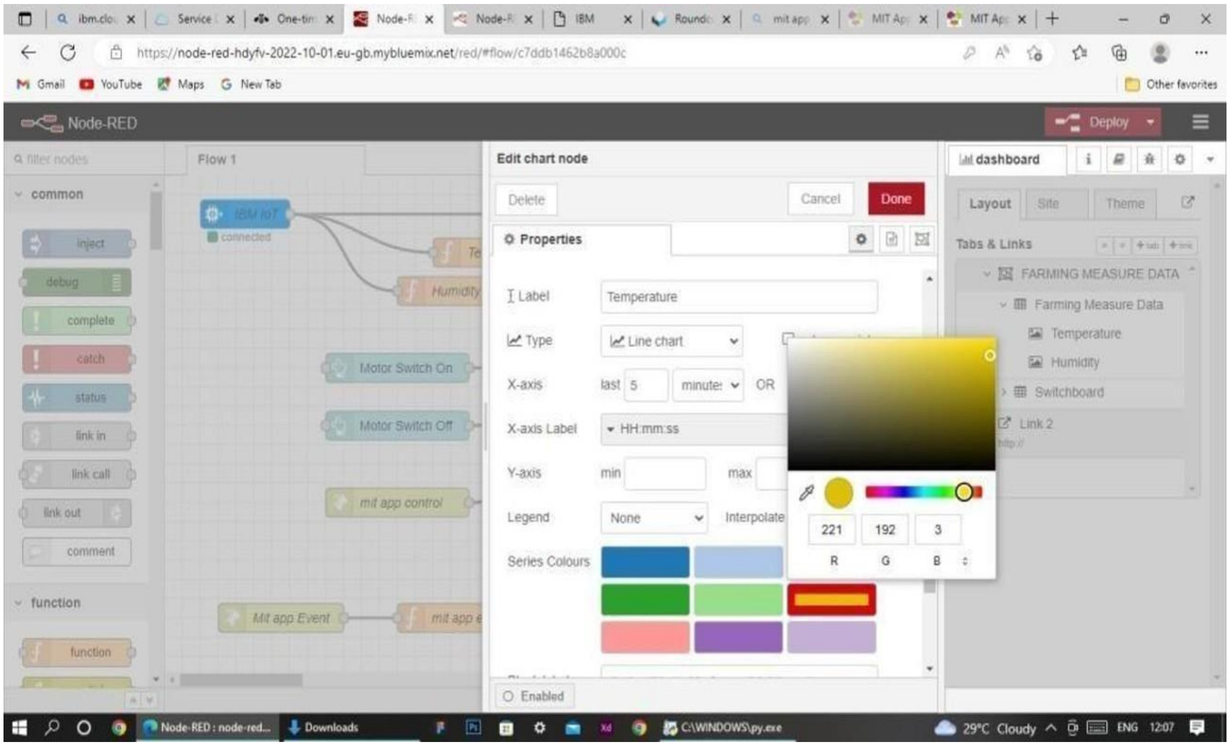
returnmsg;

Finally connectGauge nodes from dashboard to see the data in UI

Data receivedfrom the cloudin Node-Red console



Nodes connectedin following manner to get each readingseparately



This is the Java scriptcode I written for the function node to get Temperatureseparately.

Configurationof Node-Red to collect data from OpenWeather

The Node-Red also receive data from the OpenWeather API by HTTP GET request.An inject triggeris added to perform HTTP request for every certain interval.

HTTP request node is configured with URL we saved beforein section

4.4 Thedata we receivefrom OpenWeather after request is in below

JSON

format:{"coord":{"lon":79.85,"lat":14.13},"weather":[{"id":803,"main":"Clouds","description":"brokenclouds","icon":"04n"}],"base":"stations","main":{"temp":307
59,"feels_like":305.5,"temp_min":307.59,"temp_max":307.59,"pre

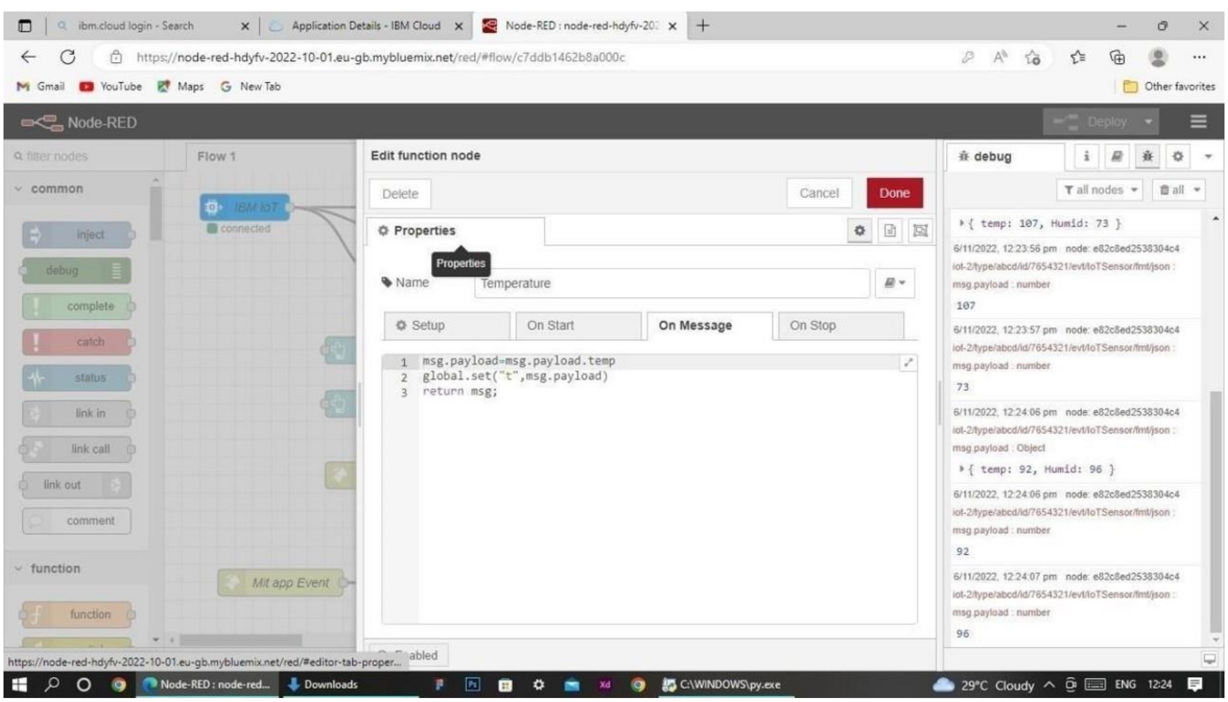
ssure":1002,"humidity":35,"sea_level":1002,"grnd_level":1000},"
wind":{"speed":6.23,"deg":170}
,"clouds":{"all":68},"dt":1589991979,"sys":{"country":"IN","sunr
ise":1589933553,
"sunset":1589979720},"timezone":19800,"id":1270791,"name":"G
ūdūr","cod":20 0}

In order to parse the JSON stringwe use Java script functions and get eachparameters

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

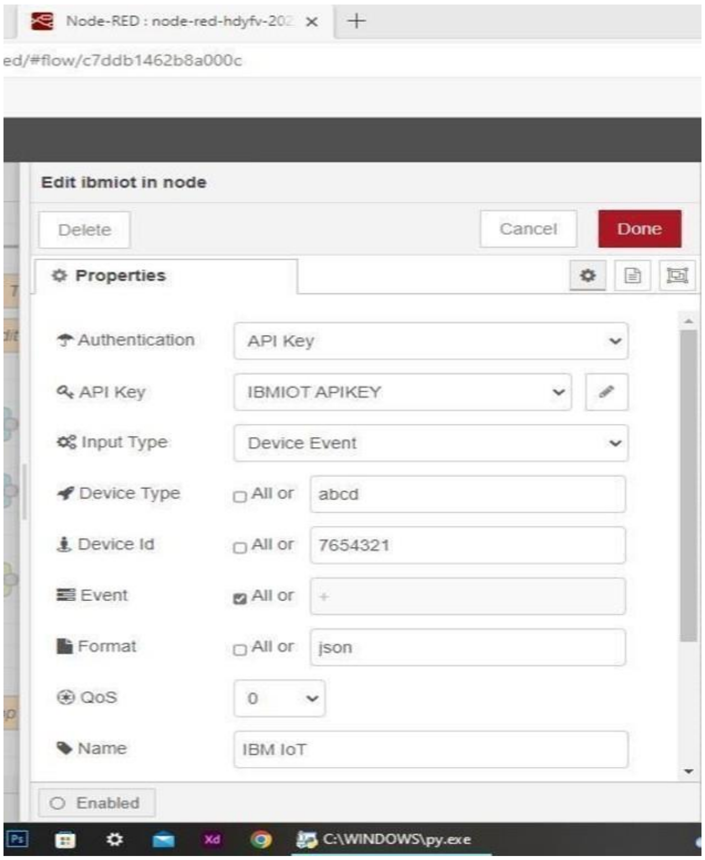
In the above Java script code we take temperature parameter into a new variableand convert it from kelvin to Celsius

Then we add Gauge and text nodes to represent data visually in UI



8.2 Configurationof 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 Watsondevice.



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"};

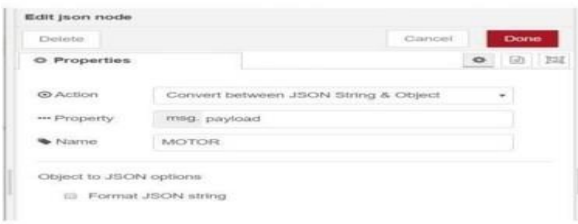
Then we use another function node to parse the data and get the command and represent it visually with text node.

The Java script code for that function node is:

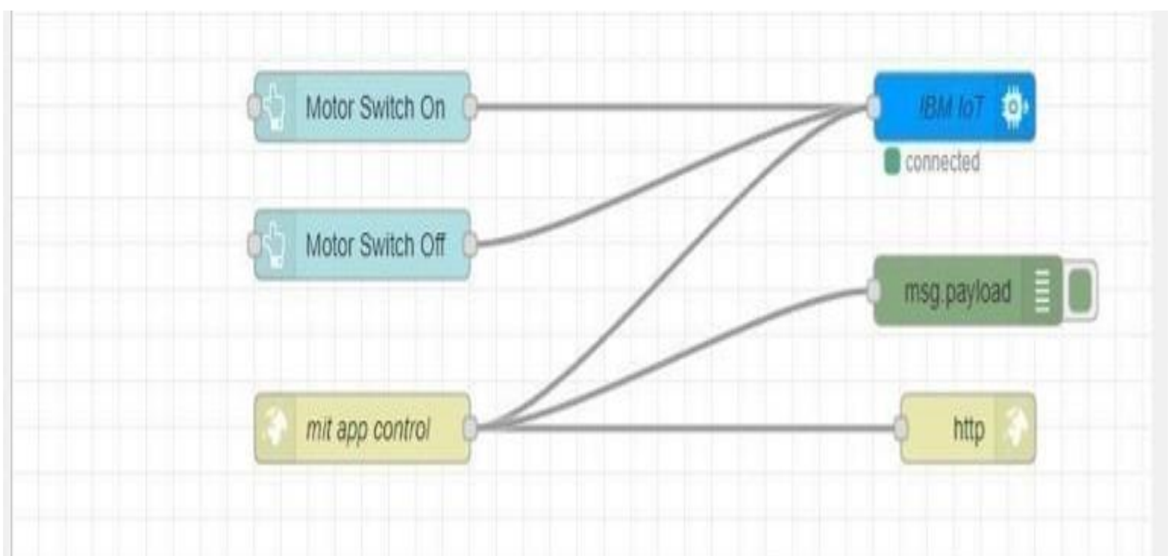
- var state=msg.payload;
  msg.payload = state.command;
- return msg;

The above images show the java script codes of analyser and state function nodes.

Then we add edit Json node to the conversion between JSON string & object and finally connect it to IBM IoT Out.



Edit JSON node needs to be configured like this



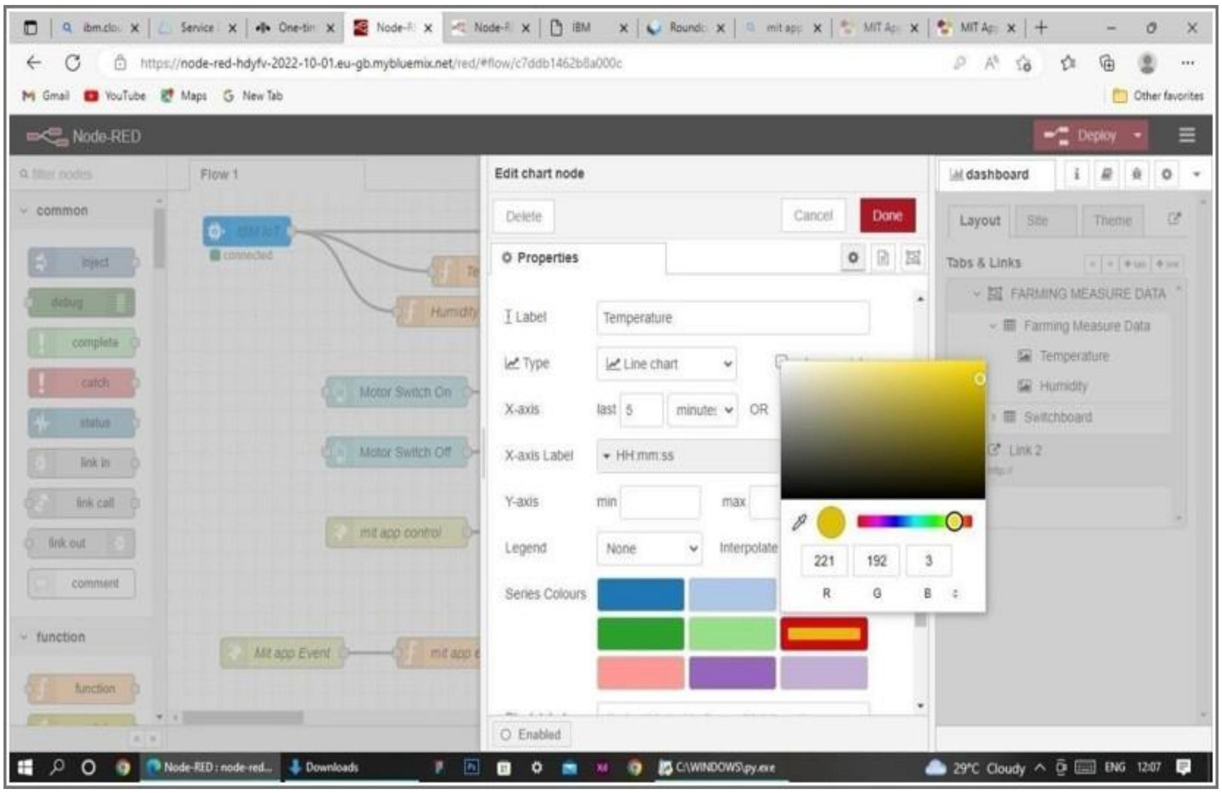
This is the programflow for sendingcommands to IBM cloud.

Adjusting User Interface

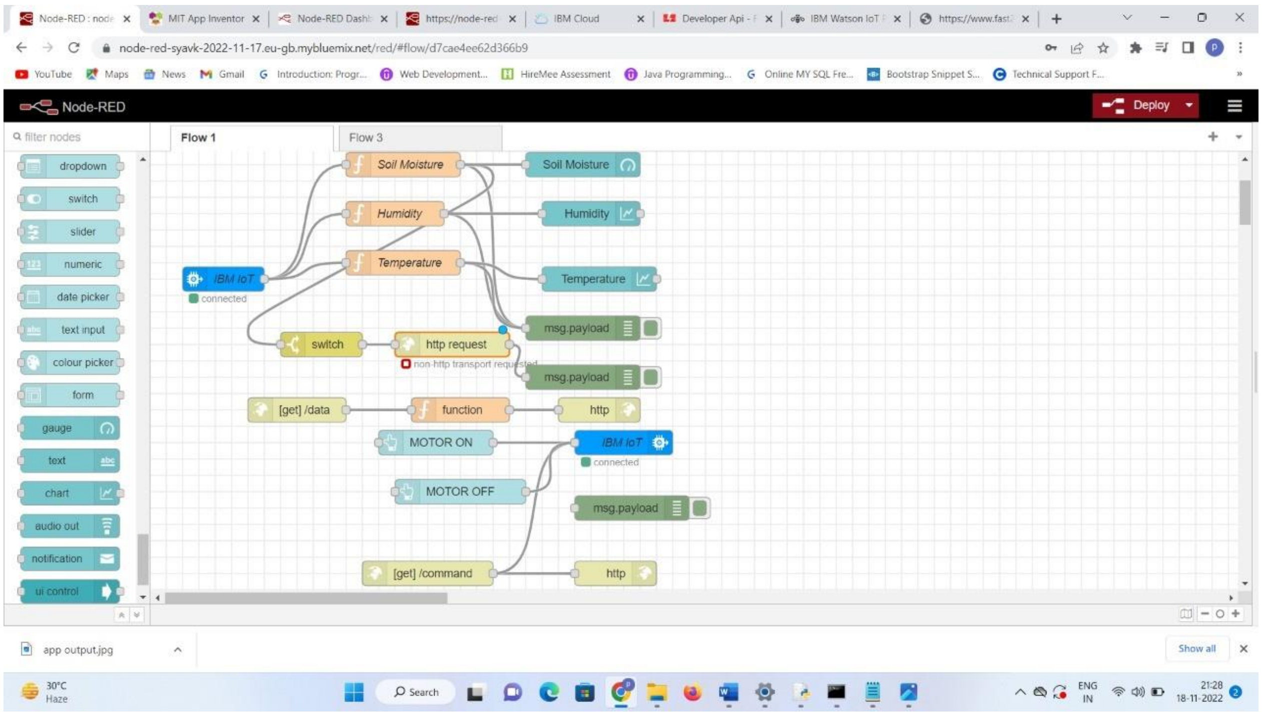
In order to displaythe parsed JSON data a Node-Red dashboard is created

Here we are using Gauges,text and button nodes to display in the UI and helps tomonitorthe parameters and control the farm equipment.

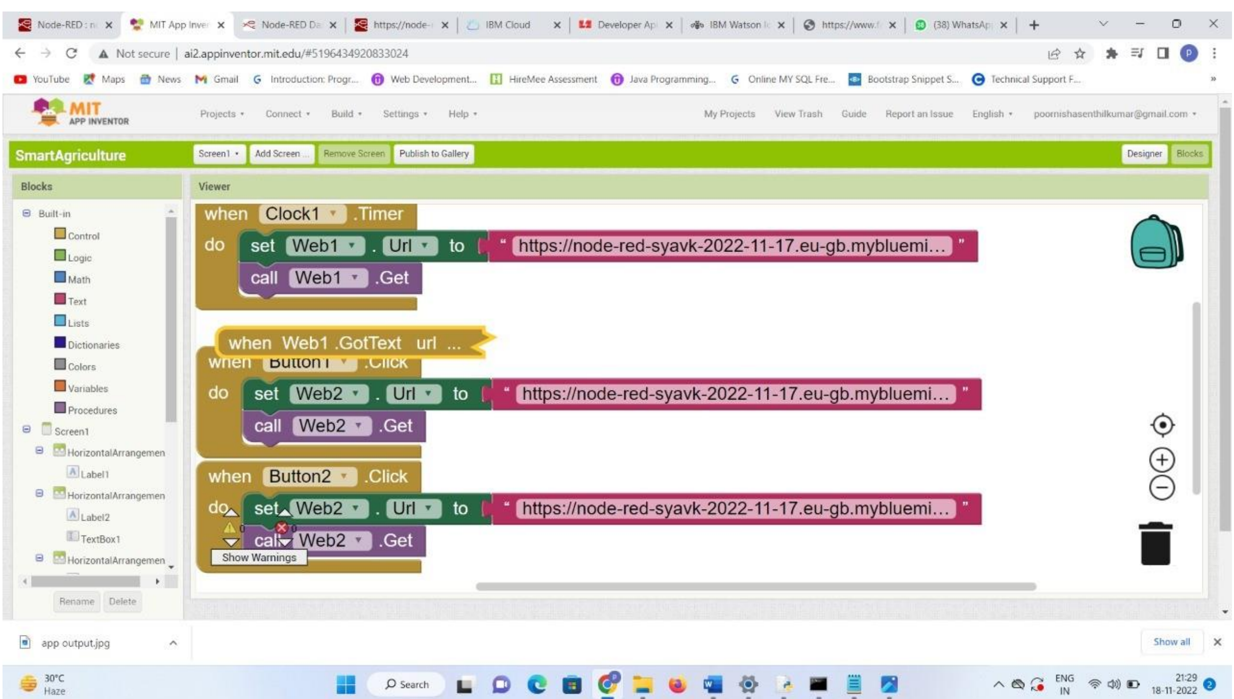
Below images are the Gauge, text and button node configurations



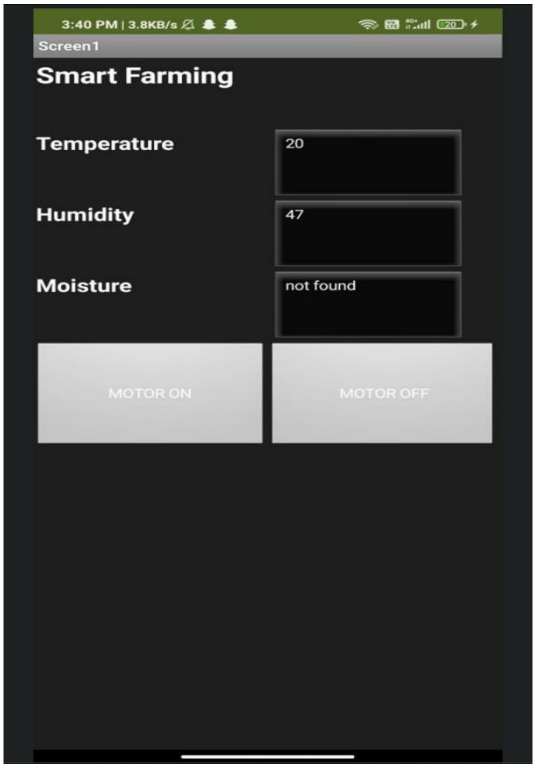
Complete Program Flow



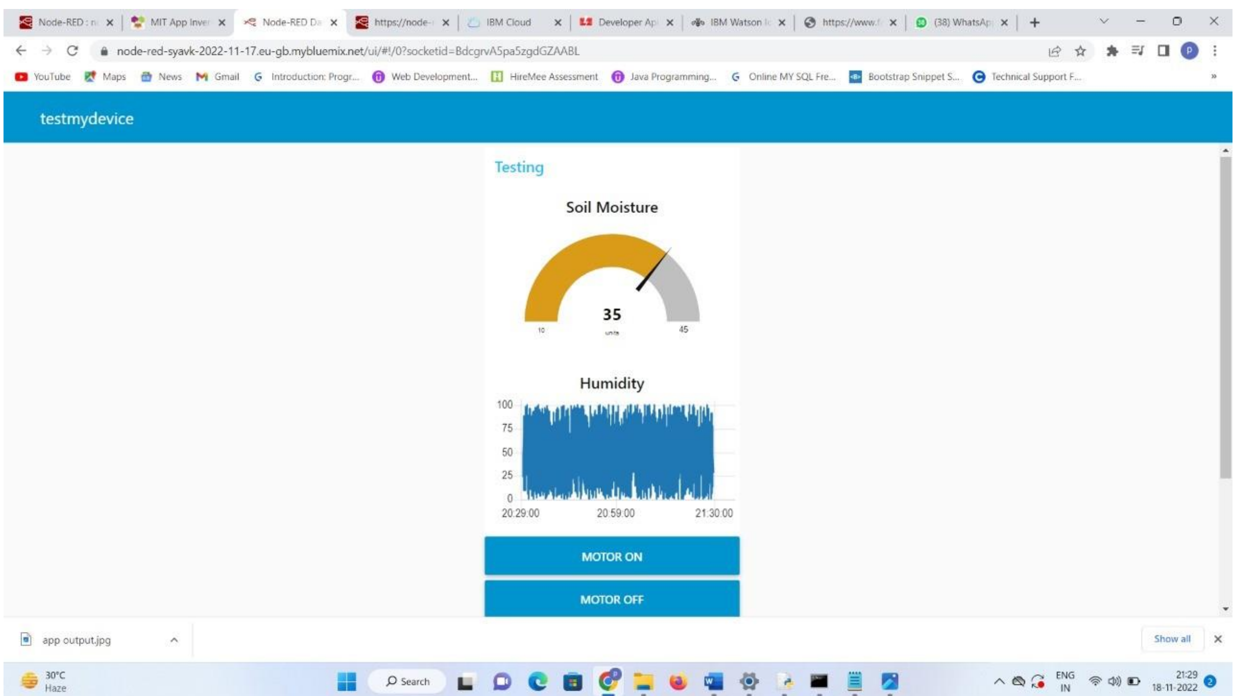
MOBILE APP WEB :



BLOCK DIAGRAM



WebAPP UI Home Tab



Receiving commands from IBM cloud using Python program

```
import time

importsys

import

ibmiotf.application

import ibmiotf.device

importrandom


#Provide your IBM WatsonDevice Credentials

organization = "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 oftype "greeting" 10 times deviceCli.connect()

while True:

#Get Sensor Data from

DHT11temp=random.randint(

90,110)

Humid=random.randint(60,10

0) Mois=random.

Randint(20,120)

data = { 'temp' : temp,

'Humid':Humid ,'Mois': Mois}

#print data

def

myOnPublishCallb

ack():

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:

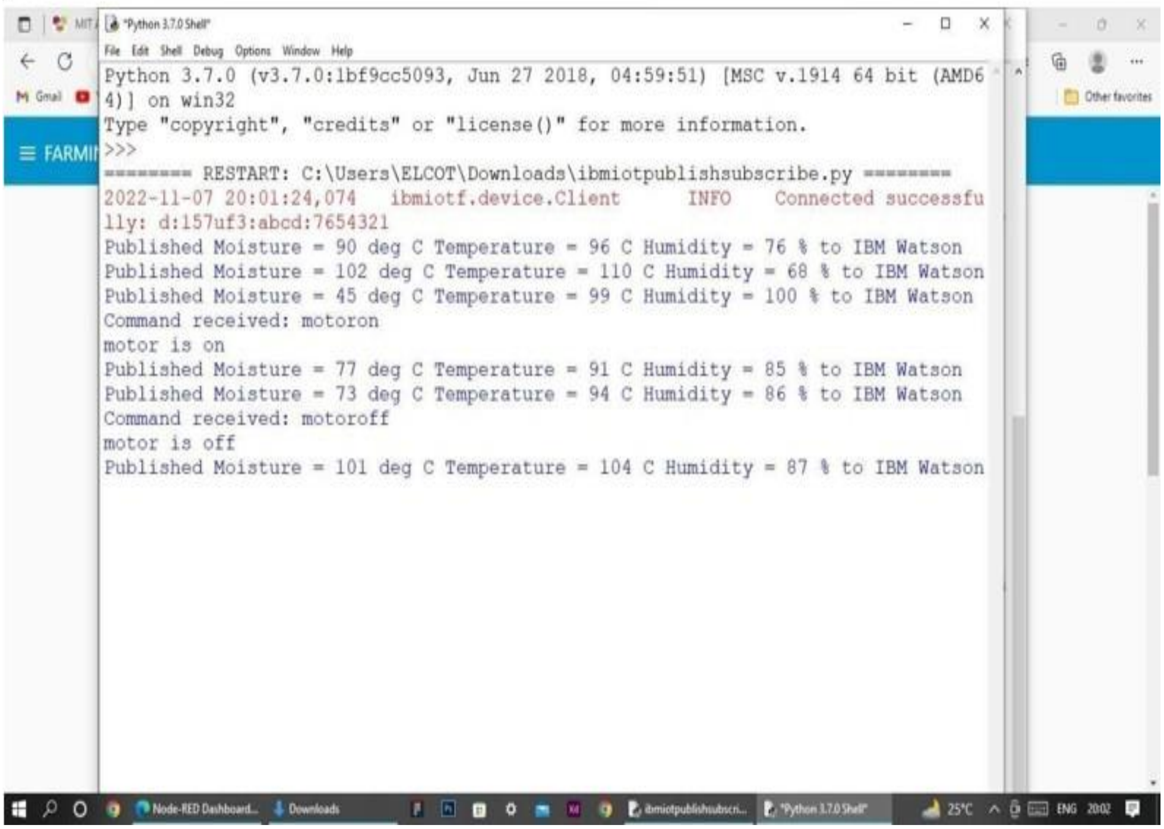
print("Not connected to

IoTF")time.sleep(10)

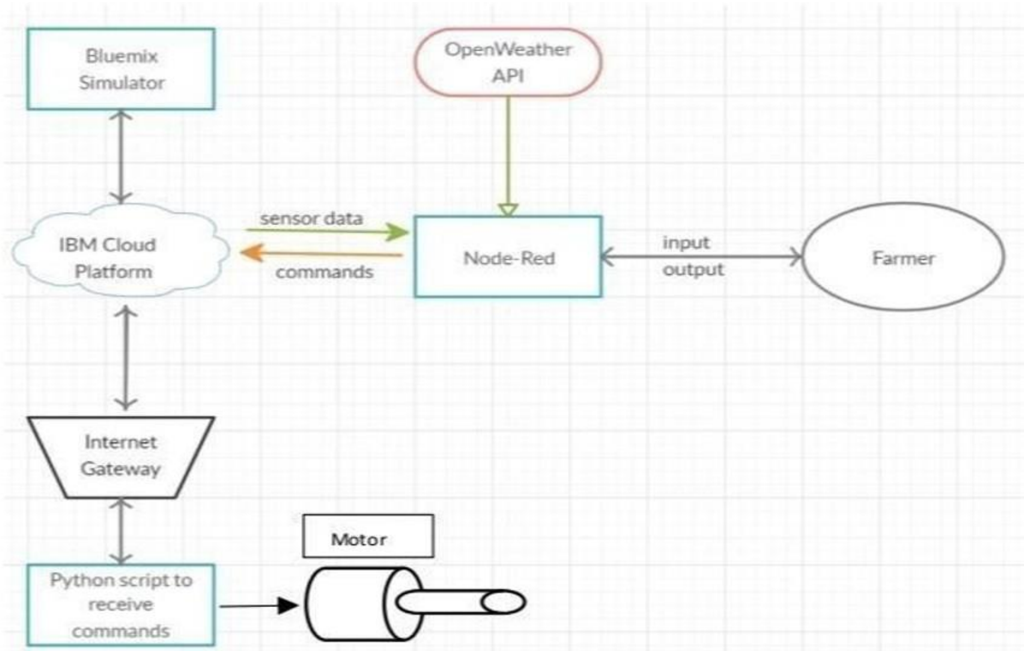
deviceCli.commandCallback =

myCommandCallback #Disconnect the device and

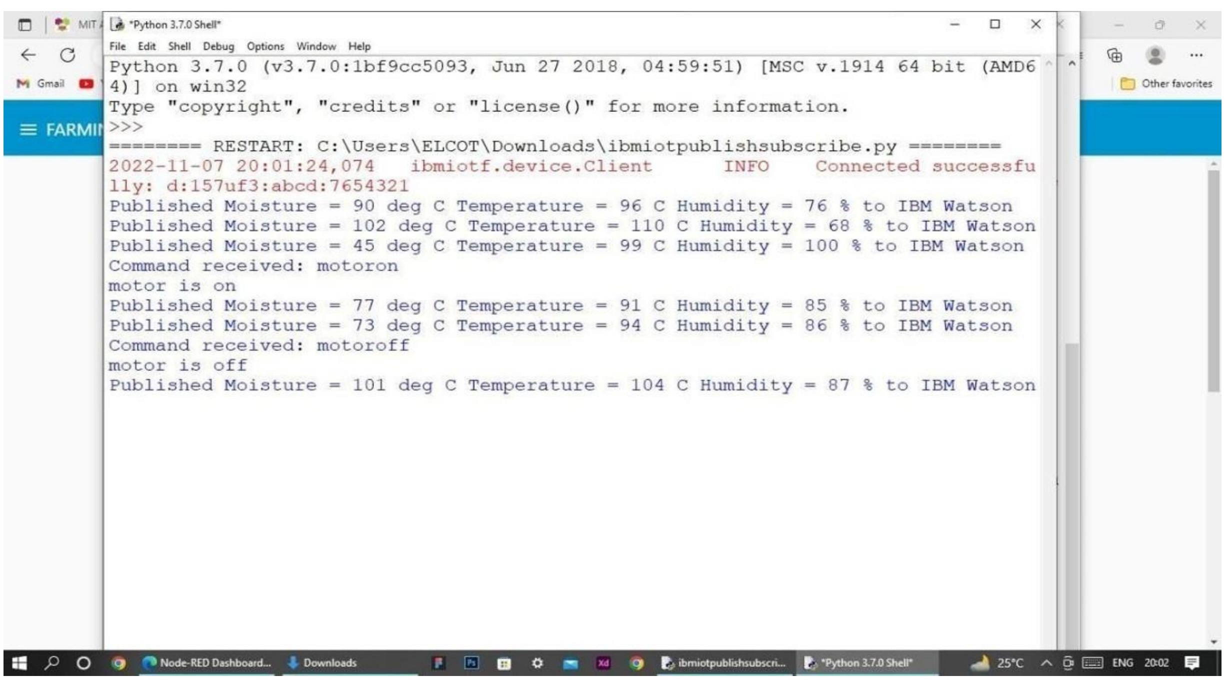
application from the cloud deviceCli.disconnect()

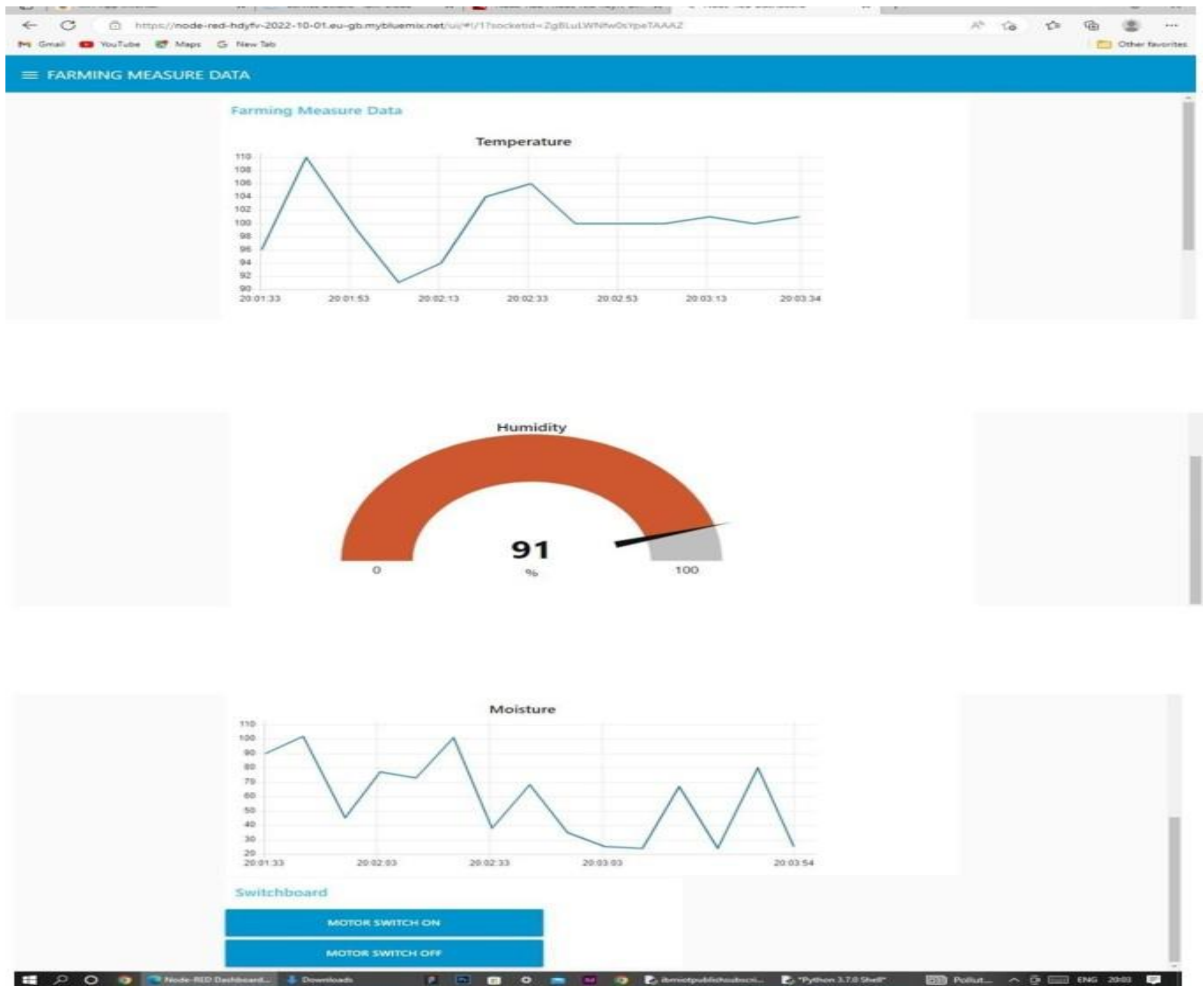


6. Flow Chart



7. Observations &Results





10. Advantages & Disadvantages

Advantages:

1. Farms can be monitored and controlled remotely.
2. Increase in convenience to farmers.
3. Less labor cost.
4. Better standards of living.

Disadvantages:

5. Lack of internet/connectivity issues.

6. Added cost of internetand internet gatewayinfrastructure.

7. Farmers wanted to adaptthe use of
   Mobile App.

11. Conclusion

Thus the objective of the projectto implement an IoT system in order to helpfarmers to control and monitor their farms has been implemented successfully.

12. Appendix

GitHub:

Team Leader:https://github.com/Lokeshvar11

Team member 1:https://github.com/poornishasenthilkumar

Team member 2:https://github.com/priyanka20s

Team member 3: https://github.com/IBM-EPBL/IBM-Project-25175-1659954606

Project Demo:

https://drive.google.com/file/d/1QnsuQKmdIQjA7G6rqS-19cJaNbVP9mp_/view?usp=share_link