

Sri Shakthi Institute of Engineering and Technology

DEPARTMENT OF ELECTRONICS AND COMMUNICATION ENGINEERING

**PROJECT BASED EXPERIENTIAL LEARNING PROGRAM
(NALAIYA THIRAN)**

TITLE OF THE PROJECT

**SMART FARMER- IOT ENABLED SMART
FARMING APPLICATION**

PROJECT REPORT

TEAM ID : PNT2022TMID53765

Submitted by

SARAN A	- 714019106096
SANJAY T	- 714019106094
SARAVANAKUMAR D	- 714019106098
SIVA SUDHARSANAM K	- 714019106105

CONTEXT

1. INTRODUCTION

1.1 Project Overview

1.2 Purpose

2. LITERATURE SURVEY

2.1 Existing problem

2.2 References

2.3 Problem Statement Definition

3. IDEATION & PROPOSED SOLUTION

3.1 Empathy Map Canvas

3.2 Ideation & Brainstorming

3.3 Proposed Solution

3.4 Problem Solution fit

4. REQUIREMENT ANALYSIS

4.1 Functional requirement

4.2 Non-Functional requirements

5. PROJECT DESIGN

5.1 Data Flow Diagrams

5.2 Solution & Technical Architecture

5.3 User Stories

6. PROJECT PLANNING & SCHEDULING

6.1 Sprint Planning & Estimation

6.2 Sprint Delivery Schedule

6.3 Reports from JIRA

7. CODING & SOLUTIONING (Explain the features added in the project along with code)

7.1 Feature 1

7.2 Feature 2

7.3 Database Schema (if Applicable)

8. TESTING

8.1 Test Cases

8.2 User Acceptance Testing

9. RESULTS

9.1 Performance Metrics

10. ADVANTAGES & DISADVANTAGES

11. CONCLUSION

12. FUTURE SCOPE 13. APPENDIX Source Code

GitHub Link

1. INTRODUCTION

1.1 Project Overview

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.

1.2 Purpose

The purpose of this project is to automate the irrigation process. Sensors can be used to monitor different parameters in the field. Different parameters like soil moisture, temperature and humidity can be sensed using sensors. Making arrangements to monitor these parameters through web or mobile applications. The decision for watering crops can be taken by the farmers based on the sensed parameters. The motors operating for irrigation can be controlled through the mobile application. The application can be used even if the farmer is far away from the field.

2. LITERATURE SURVEY

2.1 Existing problem

This system uses Raspberry pi as its processor and is connected to ADC with a soil moisture sensor producing output. Here, Ubidots cloud is connected to Raspberry pi through Wi-Fi connectivity. The data collected from sensors is transmitted to the cloud and gets stored in Ubidots server through Raspberry pi. For irrigation water will be turned ON when a

specific condition is satisfied (i.e) When soil moisture value is below 14,000 the soil should continue to dry. The dangerous state is when the surface becomes too dry where soil moisture is below 18,000.

Soil moisture has a specific value which reacts with water after adding every 25ml of water, soil moisture value increases. The ADC value of soil moisture will be obtained by using ADS1015/ADS1115 library. When the soil moisture value obtained will be calculated through the map function to obtain the appropriate percentage moisture content. Then the water pump will be active if the current time is at 7AM & 6PM at the same time soil moisture level is below the desired level.

Disadvantages: Not able to run as a windows operating system and Impractical as a desktop computer

2.2 References

TITLE: AUTOMATED IRRIGATION SYSTEM - IOT BASED APPROACH

ABSTRACT OF THE PAPER 1 : Agriculture is a major source of earning of Indians and agriculture has made a big impact on India's economy. The development of crops for a better yield and quality delivery is exceptionally required. So suitable conditions and suitable moisture in beds of crop can play a major role for production. Mostly irrigation is done by traditional methods of stream flows from one end to other. Such supply may leave varied moisture levels in field. The administration of the water system can be enhanced utilizing programmed watering framework. This paper proposes a programmed water system with framework for the terrains which will reduce manual labour and optimizing water usage increasing productivity of crops. For formulating the setup, Arduino kit is used with moisture sensor with Wi-Fi module. Our experimental setup is connected with a cloud framework and data acquisition is done. Then data is analysed by cloud services and appropriate recommendations are given.

PUBLISHED IN:

<https://ieeexplore.ieee.org/xpl/conhome/8502671/proceeding>

AUTHORS: Dweepayan Mishra ,Arzeena Khan Rajeev Tiwari ,
Shuchi Upadhay.

TITLE: INTELLIGENT IRRIGATION SYSTEM - AN IOT BASED APPROACH

ABSTRACT OF THE PAPER 2: The Internet of Things (IOT) has been denoted as a new wave of information and communication technology (ICT) advancements. The IOT is a multidisciplinary concept that encompasses a wide range of several technologies, application domains, device capabilities, and operational strategies, etc. The ongoing IOT research activities are directed towards the definition and design of standards and open architectures which still have the issues requiring a global consensus before the final deployment. This paper gives an overview about IOT technologies and applications related to agriculture with comparison of other survey papers and proposes a novel irrigation management system. Our main objective of this work is for Farming where various new technologies yield higher growth of the crops and their water supply. Automated control features with the latest electronic technology using microcontroller which turns the pumping motor ON and OFF on detecting the dampness content of the earth and GSM phone line is proposed after measuring the temperature, humidity, and soil moisture.

TITLE: SOLAR POWERED SENSOR BASED IRRIGATION SYSTEM

ABSTRACT OF THE PAPER 3: This paper throws light on the development procedure of an embedded system for solar based Off-

Grid irrigation systems. Solar power is absolutely perfect for use with irrigation systems. Using Solar panels, the sun's energy will be converted to electrical power and saved into batteries. When the sun is rising and shining, the solar panel will absorb the energy of the sun and the energy will stay in the battery. Light Detecting Resistors (LDR's) are placed on the solar panel which helps in tracking maximum intensity of sunlight. For generation of maximum energy, it is important to maintain solar panels face always perpendicular to the sun. This tracking movement of the panel is achieved by mounting the solar panel on the stepped motor. This stepped motor rotates the mounted panel as per signal received from the programmed microcontroller. The microcontroller used in this project is from the AVR family. Soil moisture sensor is placed inside soil to sense the moisture conditions of the soil. Based on moisture sensor values, the water pump is switched on and off automatically. When moisture level of the soil reaches too low, the soil moisture sensor is sending the signal to the microcontroller to start the pump by using stored solar energy. Same time, using GSM technique microcontroller is sending a message on farmers mobile about pump status. The microcontroller completes the above job as it receives signals from the soil moisture sensors, and these signals function as per program stored in the ROM of the microcontroller. The LDR's values, soil moisture values, condition of the pump i.e., on/off are displayed on a 16x2 LCD which is interfaced to the microcontroller.

PUBLISHED IN:

<https://www.irjet.net/archives/V3/i2/IRJET-V3I279.pdf>

AUTHORS: Kavita Bhole , Dimple Chaudhari 17 4.4

TITLE: SENSOR BASED AUTOMATED IRRIGATION SYSTEM WITH IOT

ABSTRACT OF THE PAPER 4: India's population has reached beyond 1.2 billion and the population rate is increasing day by day then after 25-30 years there will be serious problems with food, so the development of agriculture is necessary. Today, the farmers are

suffering from the lack of rains and scarcity of water. The main objective of this paper is to provide an automatic irrigation system thereby saving time, money & power of the farmer. The traditional farm-land irrigation techniques require manual intervention. With the automated technology of irrigation the human intervention can be minimized. Whenever there is a change in temperature and humidity of the surroundings these sensors sense the change in temperature and humidity and gives an interrupt signal to the microcontroller.

PUBLISHED IN:

<https://ijcsit.com/docs/Volume%206/vol6issue06/ijcsit20150606104.pdf>

AUTHORS: Karan Kansara ,Vishal Zaveri ,Shreyans Shah 18 4.5
TITLE: WIRELESS MONITORING OF SOIL MOISTURE,
TEMPERATURE AND HUMIDITY USING ZIGBEE IN
AGRICULTURE.

ABSTRACT OF THE PAPER 5: The main objective of the present paper is to develop a smart wireless sensor network (WSN) for an agricultural environment. Monitoring the agricultural environment for various factors such as soil moisture, temperature and humidity along with other factors can be of significance. A traditional approach to measure these factors in an agricultural environment meant individuals manually taking measurements and checking them at various times. This paper investigates a remote monitoring system using Zigbee. These nodes send data wirelessly to a central server, which collects the data, stores it and will allow it to be analyzed then displayed as needed and can also be sent to the client mobile.

PUBLISHED IN:

<http://www.ijettjournal.org/archive/ijett-v11p296>

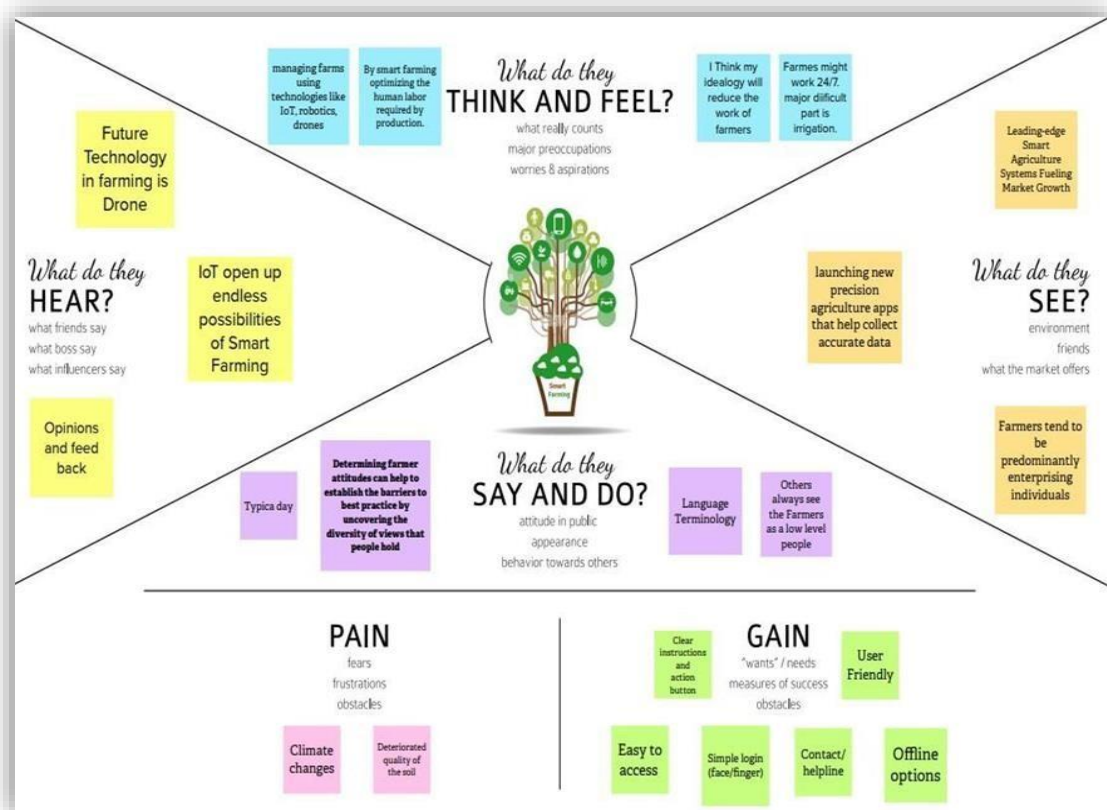
AUTHORS: C.H. Chavan , P.V. Karande

2.3 Problem Statement Definition

Ideally, each field should get just the right amount of water at just the right time. Under-watering causes crop stress and yield reduction. Overwatering can also cause yield reduction and consumes more water and fuel than necessary.

3. IDEATION & PROPOSED SOLUTION

3.1 Empathy Map Canvas



3.2 Ideation & Brainstorming

Problem statement

Ideally, each field should get just the right amount of water at just the right time. Under-watering causes crop stress and yield

reduction. Overwatering can also cause yield reduction and consumes more water and fuel than necessary.

Team ID PNT2022TMID53765

Project Name Smart Farmer - IoT Enabled Smart Farming Application

Ideas or solutions

Brainstorm & idea prioritization
For Smart Farming - IoT enabled Smart Farming Application

10 minutes to prepare
1 hour to collaborate
2-8 people recommended

1 Problem Statement for Smart Farming

PROBLEM
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 pressures.

2 Brainstorm
Write down any ideas that come to mind that address your problem statement.
10 minutes

HARINI R
Majority of Indian farmers use traditional tools for agriculture such as plough, tillage, etc. This leads to the wastage of energy and manpower and too much per acre labour force. They have to check the field for 30 min once.

KAVIYA V
Crop of pesticides and herbicides in agricultural field leads to destruction of the crops and also the efficiency of the field. Increasing the soil salinity for weeds of pest, IoT applications may be used to update the farmer user about type & quantity of pesticide required by the crop.

KAVIYAPRIYA S
Remote sensing in agriculture is revolutionizing the way data is acquired from different nodes in a farm. IoT based remote sensing system sensors placed along with the farm like weather stations for gathering data, which is transmitted to analytical tools for analysis.

KIRANRAKSHANA T
It consists of Temperature sensor, Moisture sensor, water level sensor, DC motor and GPS module. When the IoT based agriculture monitoring system starts to check the water level, humidity and moisture level.

In Farming Watering
The plants is one of the difficult process and they have to wait for the whole field to pour water. he had to check the field for 30 min once.

Smart farming based on IoT
technologies enables growers awareness to reduce waste and energy consumption. ranging from the quantity of fertilizer used to the number of passes the farm vehicles have made, and enabling efficient utilization of resources such as water, electricity, etc.

The biggest challenges
faced by IoT in the agricultural sector are lack of information, high adoption costs, and security concerns, etc. Most of the farmers are not aware of the implementation of IoT in agriculture.

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 field.

One of the benefits of using IoT in agriculture is the increased ability of the process. Thanks to real-time monitoring and prediction systems, farmers can quickly respond to any significant change in weather, humidity, or quality as well as the health of each crop or soil in the field.

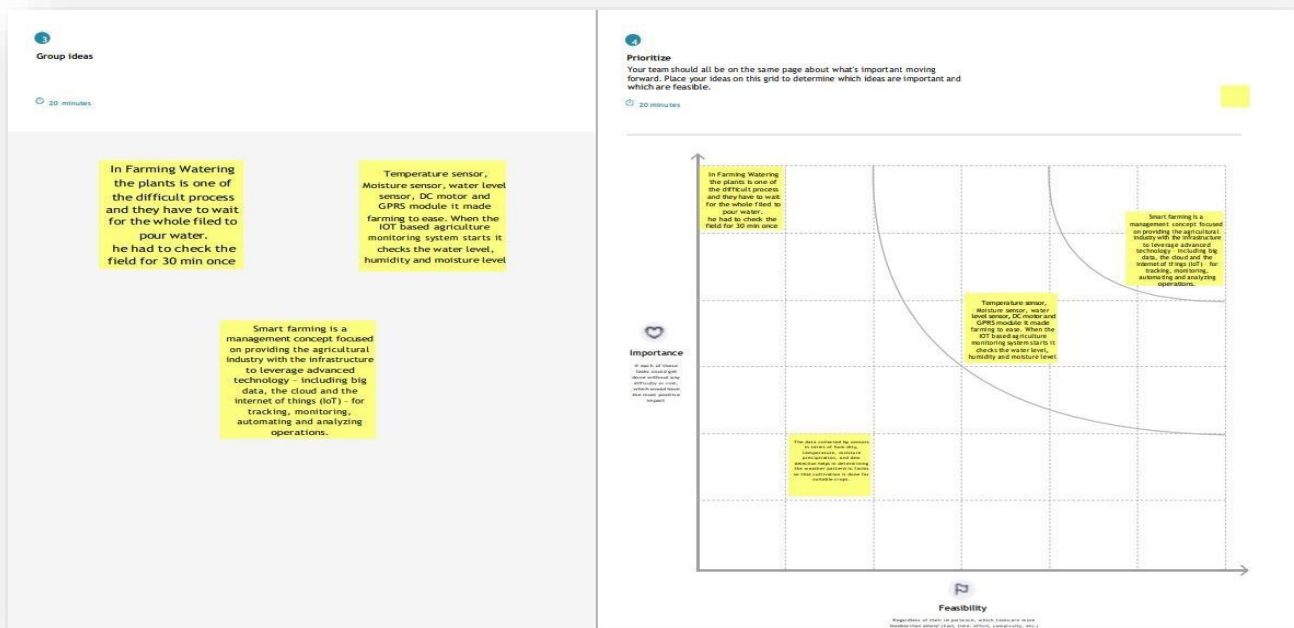
Smart farming is a management concept focused on providing the agricultural industry with the infrastructure to leverage advanced technology including big data, the cloud and the Internet of Things (IoT) for tracking, testing, automating and analyzing operations.

One of the biggest problems in the farming sector is the lack of information. Most of the farmers are not aware of the implementation of IoT in agriculture. They will gain awareness and knowledge to provide the services from being released.

Abstract

To automate the farming process by monitoring various parameters and controlling it through web or mobile application for the ease of farmers

3.3 Proposed Solution



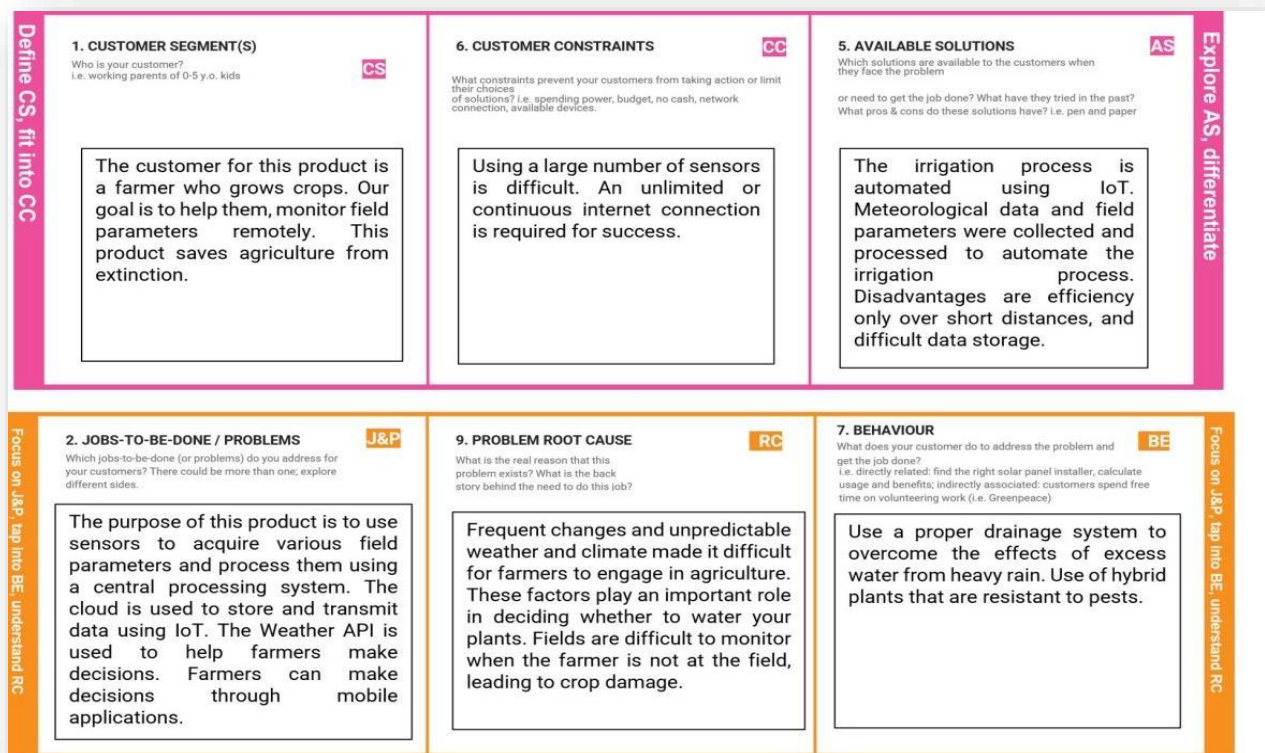
S.N o.	Parameter	Description
1.	Problem Statement (Problem to be solved)	<ul style="list-style-type: none"> Watering the field is a difficult process, Farmers have to wait in the field until the water covers the whole farm field. Power Supply is also one of the problems. In Village Side, the power supply may vary. The Biggest Challenges Faced by IoT in the Agricultural Sector are Lack of Information, High Adoption, Cost and Security Concerns, etc

2.	Idea / Solution description	<ul style="list-style-type: none"> As is the case of precision Agriculture Smart Farming Technique Enables Farmers better to monitor the fields and maintain the humidity level accordingly. The Data collected by sensors, In terms of humidity, temperature, moisture, and dew detections help in determining the weather pattern in Farms. So cultivation is done for suitable crops.
3.	Novelty / Uniqueness	ALERT MESSAGE – IoT sensor nodes collect information from the farming environment, such as soil moisture, air humidity, temperature, nutrient ingredients of soil, pest images, and water quality, then transmit collected data to IoT backhaul devices.
		REMOTE ACCESS – It helps the farmer to operate the motor from anywhere.
4.	Social Impact / Customer Satisfaction	<ul style="list-style-type: none"> Reduces the wages for labors who work in the agricultural field. It saves a lot of time. IoT can help improve customer relationships by enhancing the customer's overall experience. Easily identify maintenance needs, build better products, send personalized communications, and more. IoT can also help e-commerce businesses thrive and increase sales. It make a wealthy society

5.	Business mode(revenue mode)	<p>Revenue No of users vs months</p> <p>User</p> <p>Month</p>
6.	Scalability of the Solution	<p>Scalability in smart farming refers to the adaptability of a system to increase the capacity, for example, the number of technology devices such as sensors and actuators, while enabling timely analysis.</p>

3.4 Problem Solution fit

REQUIREMENT ANALYSIS



4.1 Functional requirement

Functional Requirements:

Following are the functional requirements of the proposed solution.

FR No.	Functional Requirement (Epic)	Sub Requirement (Story / Sub-Task)
FR-1	User Registration	Registration through Gmail
FR-2	User Confirmation	Verifying by Email Verifying by OTP

FR-3	Temperature measurement	DHT11 Temperature and Humidity Sensor is used for measuring temperature since high temperature can damage the roots resulting in substantial reduction in shoot growth.
FR-4	Humidity measurement	DHT11 Temperature and Humidity Sensor is used for measuring relative humidity which is important to make photosynthesis possible.
FR-5	Soil moisture measurement	YL69 Soil moisture sensor is used. Soil moisture is the critical parameter in agriculture. If there is a shortage or over abundance of water, plants may die.
FR-6	Irrigation of soil if needed	If there is shortage in soil moisture then motor is turned on for irrigation to improve crop growth and quality.

4.2 Non-Functional requirements

Non-functional Requirements:

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

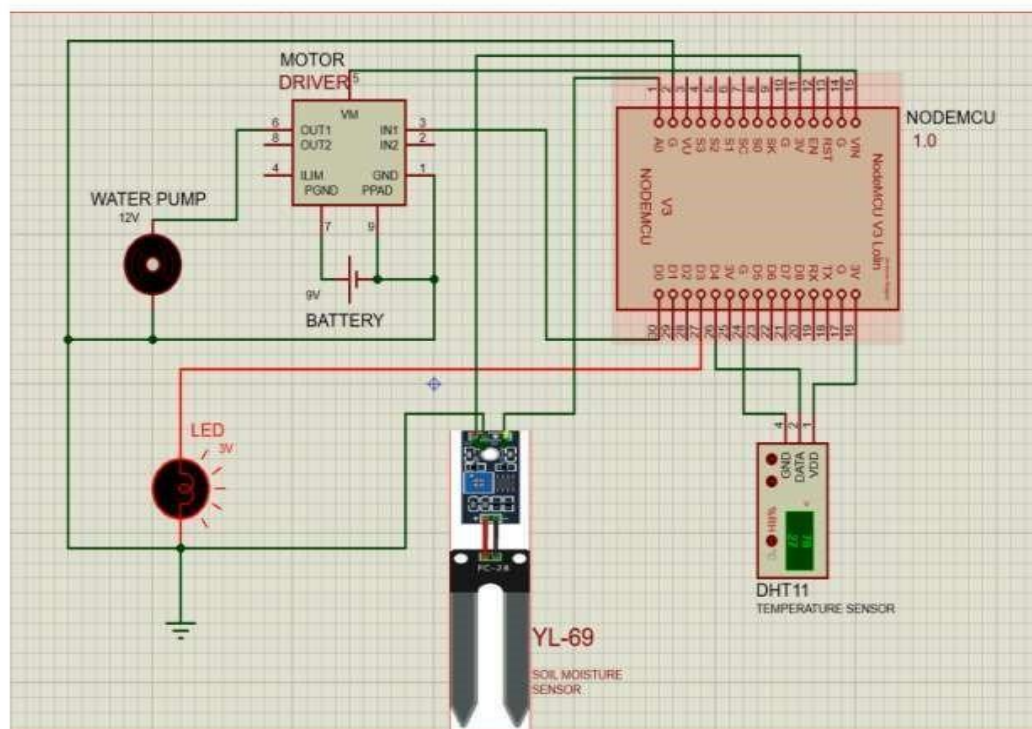
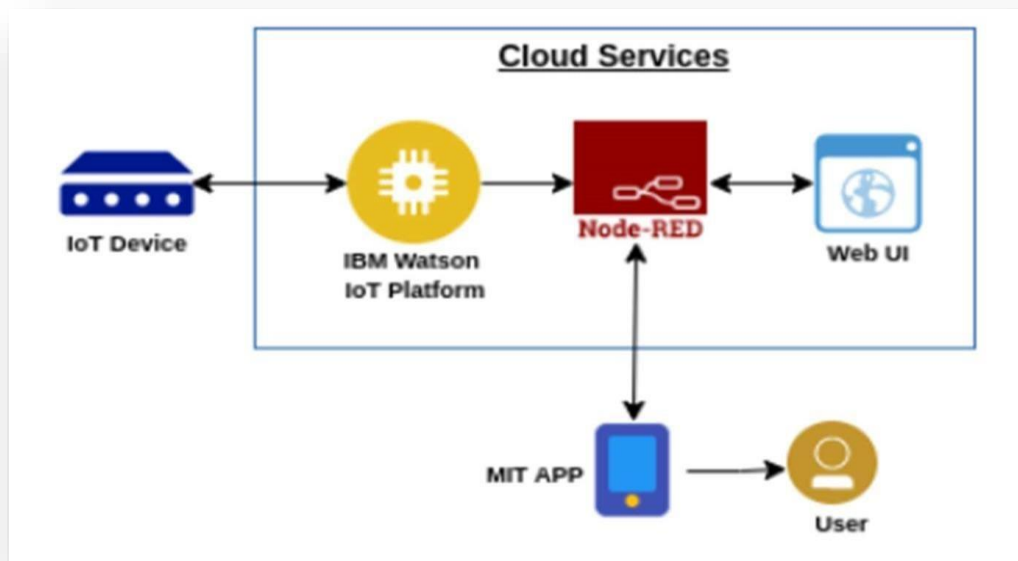
FR No.	Non-Functional Requirement	Description
NFR-1	Usability	Usability is a quality attribute that assesses how easy user interfaces are to use. It is a measure that the user feels easy to access the project.

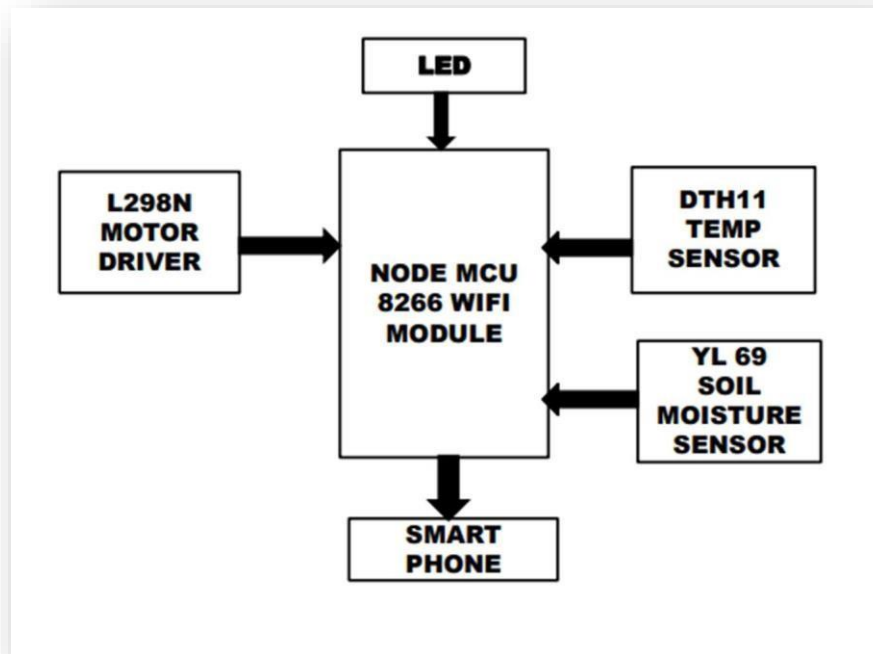
NFR-2	Security	Ensure that all the data within the system will be protected against theft, malware attacks or unauthorised access.
NFR-3	Reliability	The degree to which the result of a measurement is accurate and longer Life Span.
NFR-4	Performance	It should be effective to monitor plant growth.
NFR-5	Availability	It must be available for 24/7 and should be easy to alter the soil moisture at home.
NFR-6	Scalability	Scalability is the ability of a device to adapt to the changes in the environment and meet the changing needs in the future. The proposed work can be integrated with new components in future if needed.

5. PROJECT DESIGN

5.1 Data Flow Diagrams

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.





5.2 Solution & Technical Architecture

Technical Architecture:

1. The three soil parameter measurements are Temperature, Soil moisture, and humidity which are made using various sensors and recorded in the IBM cloud.

2. Using an Arduino UNO as a processing unit the data from the sensors and weather are processed. 3. The programming tool used to write the hardware, software and APIs is NODE-RED. The MQTT protocol is followed for the communication.

4. The user is given access to all the collected data through a smartphone application created with the aid of MIT App Inverter. Depending on the sensor results, the user might decide whether or not to irrigate the crop using an app. The motor switch can be controlled remotely by utilising the app.

5.3 User Stories

User Type	Functional Requirement (Epic)	User Story Number	User Story / Task	Acceptance criteria	Priority	Release
Customer (Mobile user)	Registration	1	Can register for the application by entering my email, password, and confirming my password.	Can access my account / dashboard	High	Sprint-1
		2	Will receive confirmation email once I have registered for the application	Receive confirmation email & click confirm	High	Sprint-1
		3	As a user, I can register for the application through Facebook	Can register & access the dashboard with Facebook Login	Low	Sprint-2
		4	As a user, I can register for the application through Gmail		Medium	Sprint-1
	Login	5	As a user, I can log into the		High	Sprint-1
User Type	Functional Requirement (Epic)	User Story Number	User Story / Task	Acceptance criteria	Priority	Release
			application by entering email & password			
	Dashboard					

Customer (Web user)	Registration	1	Can register for the application by entering my email, password, and confirming my password.	Can access my account / dashboard	High	Sprint-1
		2	Will receive confirmation email once I have registered for the application	Receive confirmation email & click confirm	High	Sprint-1
		3	As a user, I can register for the application through Facebook	Can register & access the dashboard with Facebook Login	Low	Sprint-2
		4	As a user, I can register for the application through Gmail		Medium	Sprint-1
		5	As a user, I can log into the application by entering email & password		High	Sprint-1
Customer Care Executive						
Administrator						

6. PROJECT PLANNING & SCHEDULING

6.1 Sprint Planning & Estimation

Sprint	Functional Requirement	User Story	User Story / Task	Story Points	Priority	Team Members

	(Epic)	Number				
Sprint1	Simulation creation	USN-1	Connect the Arduino and sensors with python code	2	High	SARAN A SANJAY T SARAVANAKUMAR SIVA SUDHARSANAM K
Sprint2	Software	USN-2	Creation of device in the IBM Watson IoT platform, checking the workflow for IoT scenarios using Node-Red	1	High	SARAN A SANJAY T SARAVANAKUMAR SIVA SUDHARSANAM K
Sprint3	MIT App Inventor	USN-3	To develop an application for the Smart Farmer - IoT Enabled Smart Farming Application project using MIT App Inventor	2	High	SARAN A SANJAY T SARAVANAKUMAR SIVA SUDHARSANAM K
Sprint4	Dashboard	USN-4	To design the Modules	2	High	SARAN A SANJAY T SARAVANAKUMAR SIVA SUDHARSANAM K,

			and test the application			
Sprint5	Web UI	USN-5	To make the user interact with the software.	1	High	SARAN A SANJAY T SARAVANAKUMAR SIVA SUDHARSANAM K

6.2 Sprint Delivery

Sprint Delivery – 1

Introduction

Agriculture is the backbone of the Indian Economy"- said Mahatma Gandhi. The main aim of our project is to help farmers with a Web App to monitor Temperature, soil moisture, humidity and to control water motor remotely via internet without going to their field.

Problem Statement

Farmers should be present in their field anytime irrespective of their health, climatic conditions even without considering their family time. They have to check the soil moisture, Temperature, Humidity before watering the crops and also ensure that the crops are well watered.

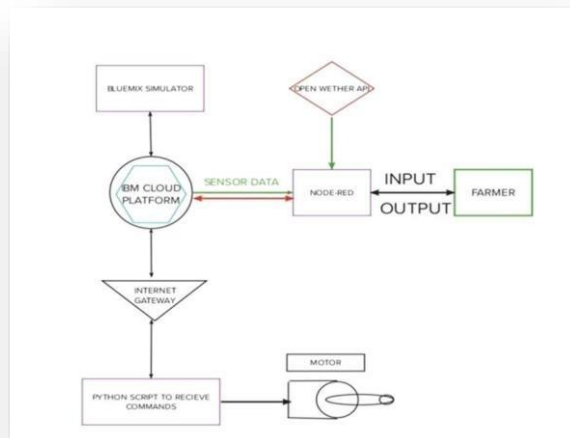
Proposed Solution

We aim to help the Farmers and provide easier working environment also accurate. We introduce IOT services to them which

connect cloud services and internet to ensure that farmers can work remotely via internet. Also, He can monitor the field parameters and control the devices in farm.

Theoretical Analysis

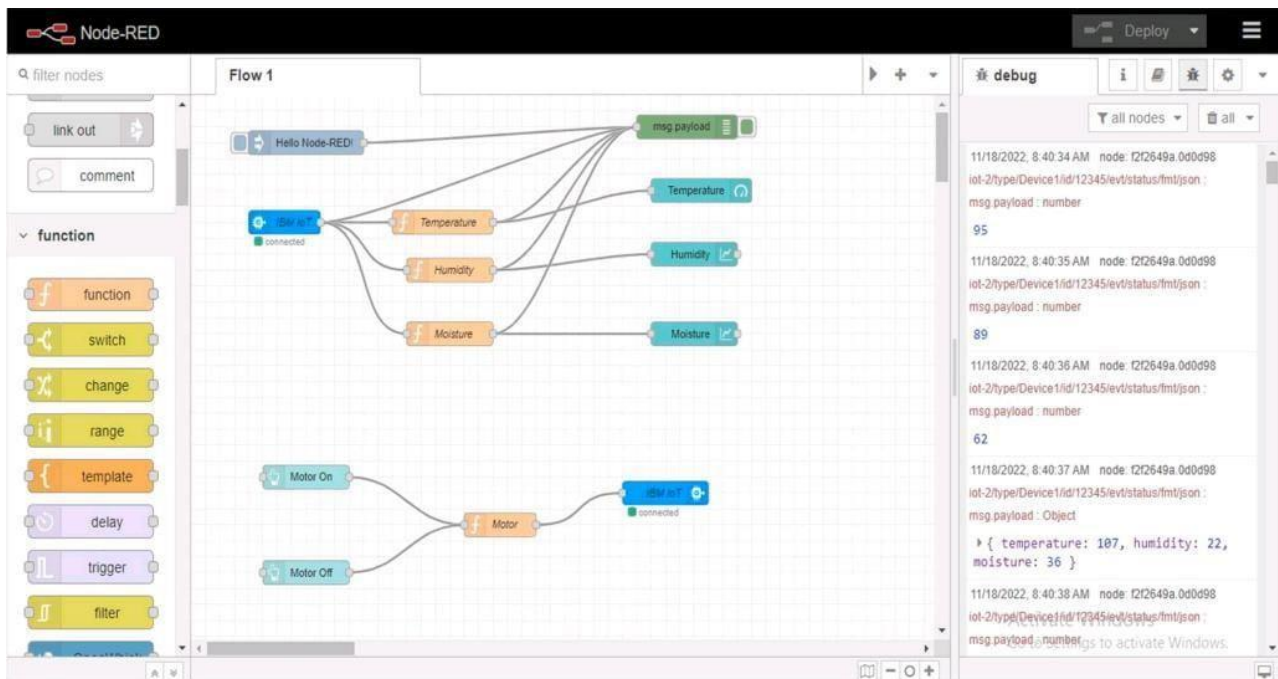
Block Diagram



Required Software Installation

Node-Red

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.



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

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
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

Arduino Code In Wokwi:

```
#include //library for wifi
#include //library for MQTT
#include "DHT.h"// Library for dht11
#define DHTPIN 15 // what pin we're connected to
#define DHTTYPE DHT22 // define type of sensor DHT 11
#define LED 2
DHT dht (DHTPIN, DHTTYPE);// creating the instance by passing pin
and typr of dht connected
void callback(char* subscribetopic, byte* payload, unsigned int
payloadLength);
//-----credentials of IBM Accounts-----
#define ORG "14dcvs"//IBM ORGANITION ID
#define DEVICE_TYPE "Device1"//Device type mentioned in ibm
watson IOT Platform
#define DEVICE_ID "12345"//Device ID mentioned in ibm watson IOT
Platform
#define TOKEN "87654321" //Token
String data3;
float h, t;
```

```

//----- Customise the above values -----
char server[] = ORG ".messaging.internetofthings.ibmcloud.com";//
Server Name
char publishTopic[] = "iot-2/evt/Data/fmt/json";// topic name and type of
event perform and format in which data to be send
char subscribetopic[] = "iot-2/cmd/command/fmt/String";//
cmd REPRESENT command type AND COMMAND IS TEST OF
FORMAT STRING
char authMethod[] = "use-token-auth";// authentication method
char token[] = TOKEN;
char clientId[] = "d:" ORG ":" DEVICE_TYPE ":" DEVICE_ID;//client
id
// _____
WiFiClient wifiClient; // creating the instance for wificlient PubSubClient
client(server, 1883, callback ,wifiClient); //calling the predefined client id
by passing parameter like server id,portand wificredential
void setup()// configureing the ESP32
{
Serial.begin(115200);
dht.begin();
pinMode(LED,OUTPUT);
delay(10);
Serial.println();
wificonnect();
mqttconnect();
}
void loop()// Recursive Function
{ h = dht.readHumidity();
t = dht.readTemperature();
Serial.print("temp:");
Serial.println(t);
Serial.print("Humid:");
Serial.println(h);
PublishData(t, h);
}

```

```
delay(1000);
if (!client.loop()) {
  mqttconnect();
} }
```

```
/*.....retrieving to Cloud .....*/
```

```
void PublishData(float temp, float humid) {
  mqttconnect();//function call for connecting to ibm
/* creating the String in in form JSon to update the data to ibm cloud */
String payload = "{\"temp\":";
  payload += temp;
  payload += "," "\"Humid\":";
  payload += humid;
  payload += "}";
```

```
Serial.print("Sending payload: ");
Serial.println(payload);
```

```
if (client.publish(publishTopic, (char*) payload.c_str())) {
  Serial.println("Publish ok");// if it sucessfully upload data on the cloud
  then it will print publish ok in Serial monitor or else it will print publish
  failed
} else {
  Serial.println("Publish failed");
}
}

void mqttconnect() {
  if (!client.connected()) {
    Serial.print("Reconnecting client to ");
    Serial.println(server);
    while (!client.connect(clientId, authMethod, token))
```

```

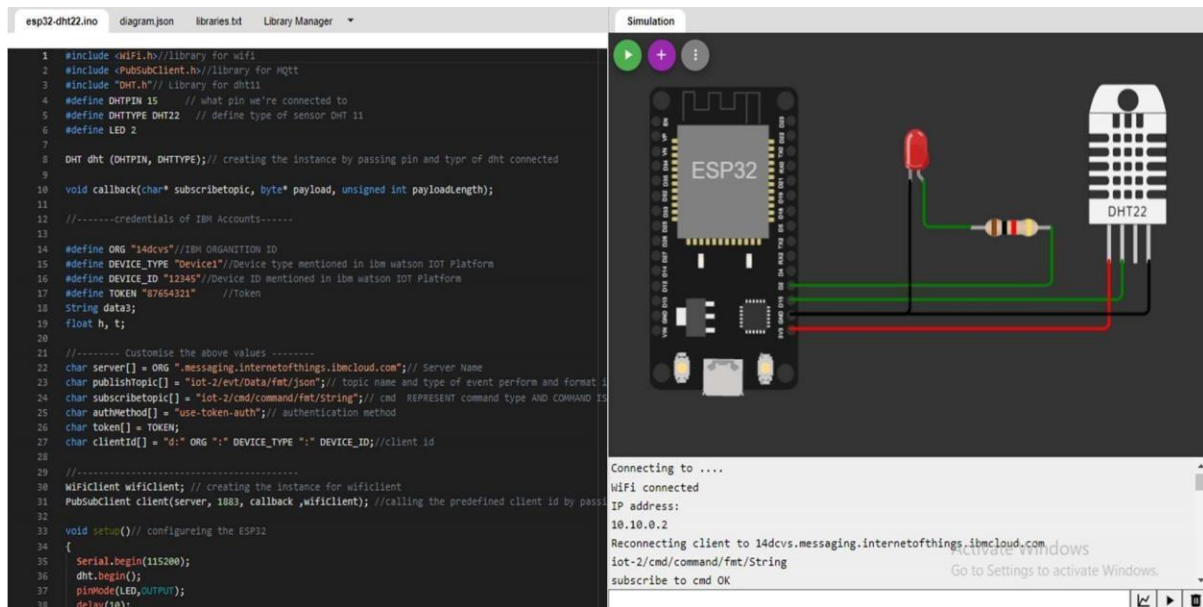
    Serial.print(".");
    delay(500);
}

initManagedDevice();
Serial.println();
}
}
void wificonnect() //function defination for wificonnect
{
Serial.println();
Serial.print("Connecting to ");
    WiFi.begin("Wokwi-GUEST", "", 6);//passing the wifi credentials to
establish the connection
while (WiFi.status() != WL_CONNECTED) {
    delay(500);
    Serial.print(".");
}
Serial.println("");
Serial.println("WiFi connected");
Serial.println("IP address: ");
Serial.println(WiFi.localIP());
}
void initManagedDevice() {
    if (client.subscribe(subscribetopic)) {
        Serial.println((subscribetopic));
        Serial.println("subscribe to cmd OK");
    } else {
        Serial.println("subscribe to cmd FAILED");
    }
} void callback(char* subscribetopic, byte* payload, unsigned int
payloadLength)
{
    Serial.print("callback invoked for topic: "); Serial.println(subscribetopic);
    for (int i = 0; i < payloadLength; i++) {

```

```
//Serial.print((char)payload[i]);  
data3 += (char)payload[i];  
}  
Serial.println("data: "+ data3);  
if(data3=="lighton")  
{  
    Serial.println(data3);  
    digitalWrite(LED,HIGH);  
}  
else  
{  
    Serial.println(data3);  
    digitalWrite(LED,LOW);  
}  
data3="
```

Sprint Delivery – 2



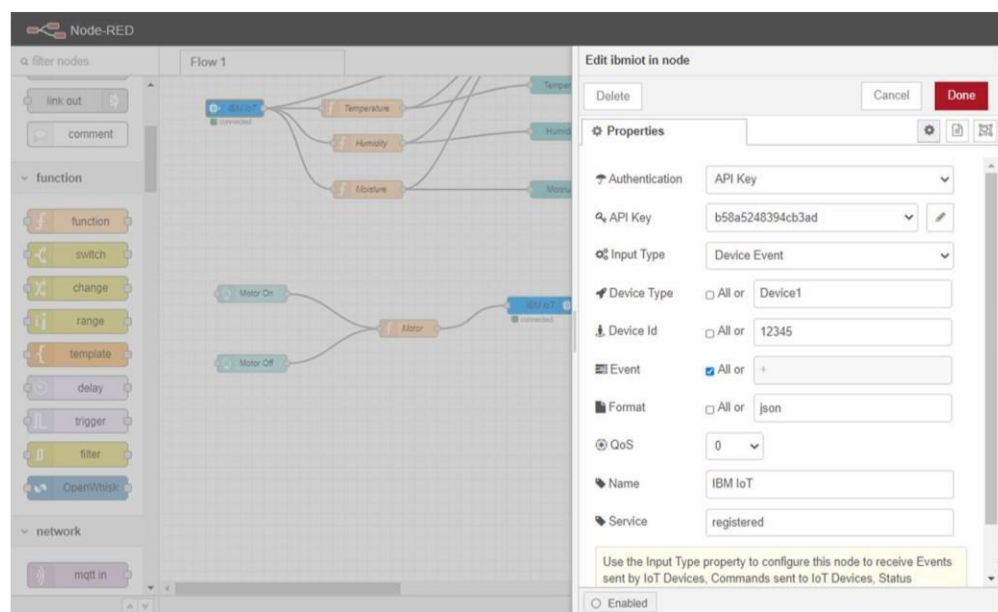
Building Project Connecting IOT Simulator to IBM Watson IOT Platform

- ☐ Open link provided in above section 4.3
- ☐ Give the credentials of your device in IBM Watson IOT Platform
- ☐ Click on connect My credentials given to simulator are:
- ☐ Org ID: 14dcvs
- ☐ Api key : a-14dcvs-xzoonjld1n
- ☐ Device type: Device1
- ☐ Authentication token: FSaB@(rp7jt2hUXduI
- ☐ Device ID: 12345
- ☐ Device Token: 87654321
- ☐ You can see the received data in graphs by creating cards in Boards tab

Configuration of 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 device, Display the data using debug node for verification. Connect function node and write the Java script code to get each reading separately.

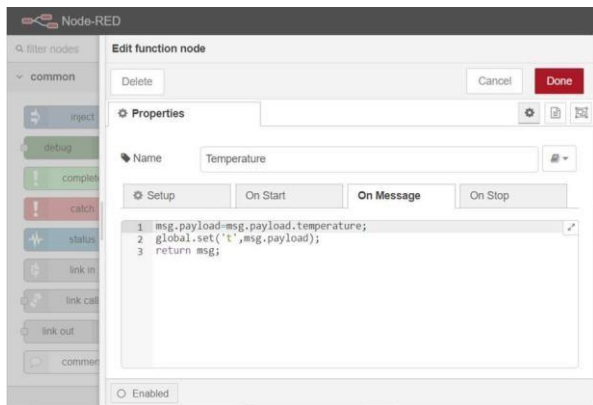


The Java script code for the function node is:

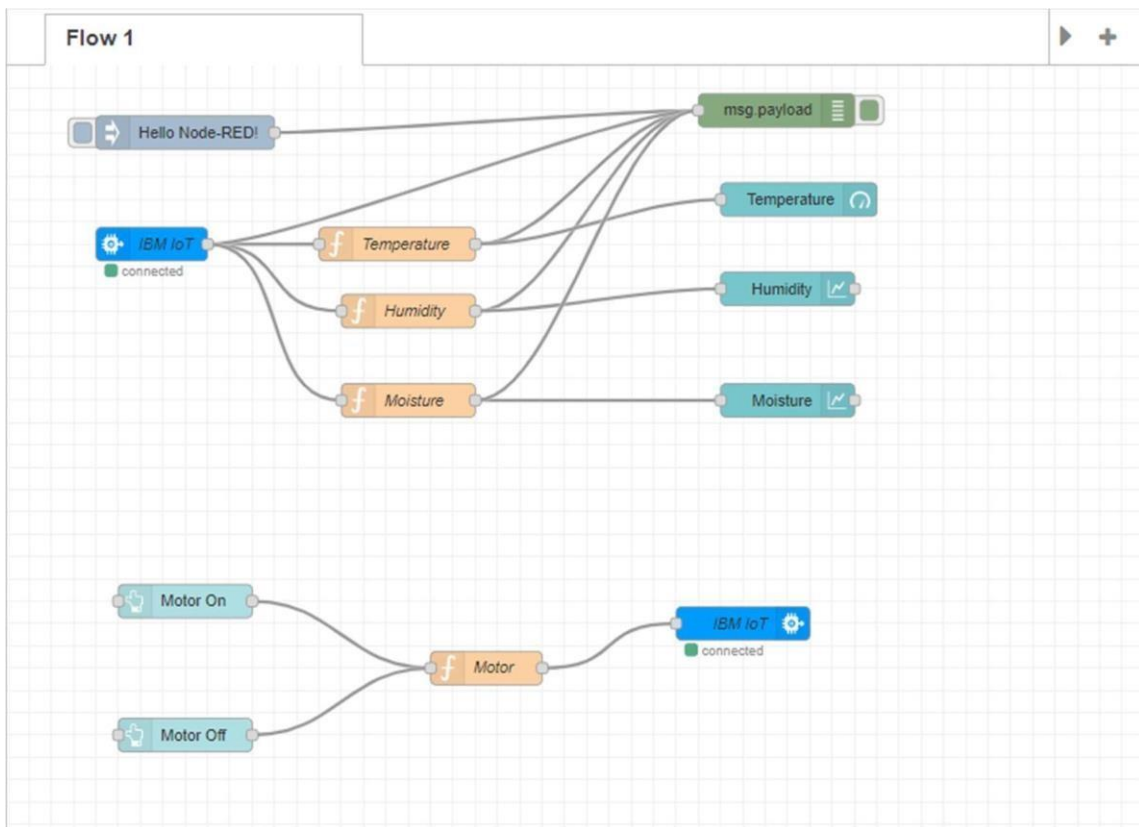
```
msg.payload = msg.payload.temperature;
```

```
return msg;
```

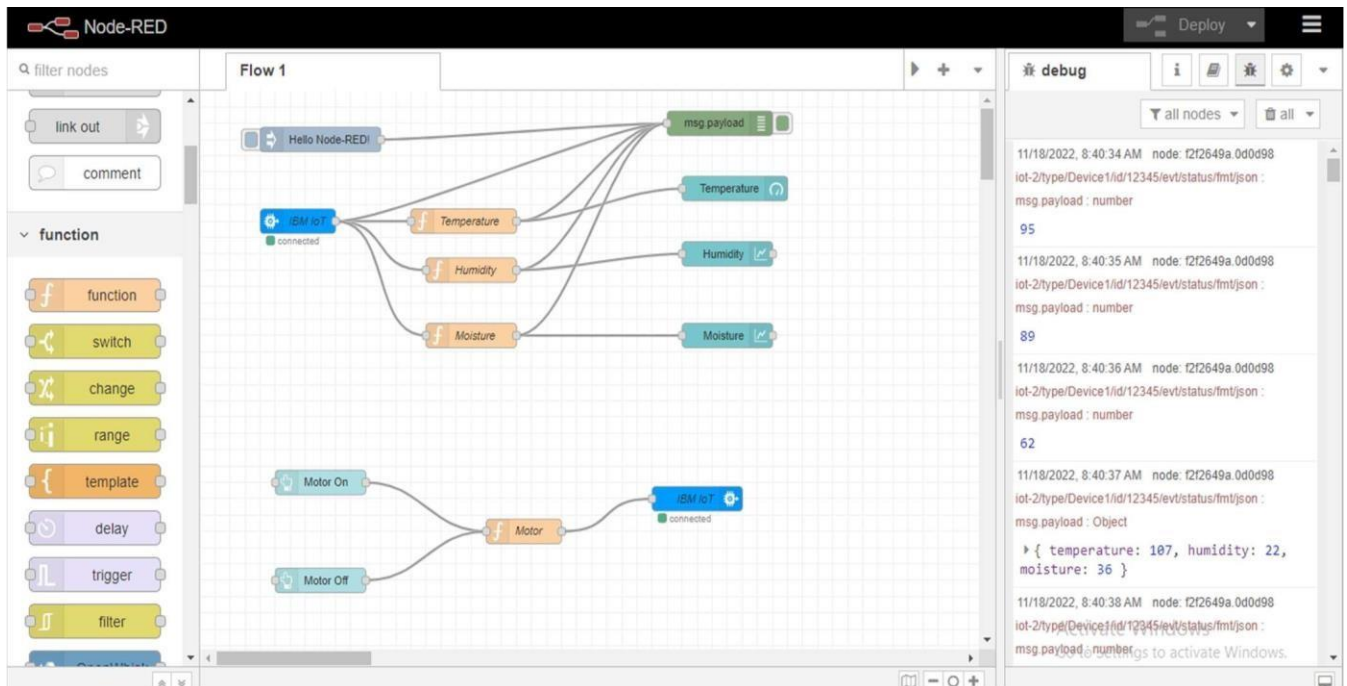
Finally connect Gauge nodes from dashboard to see the data in UI.



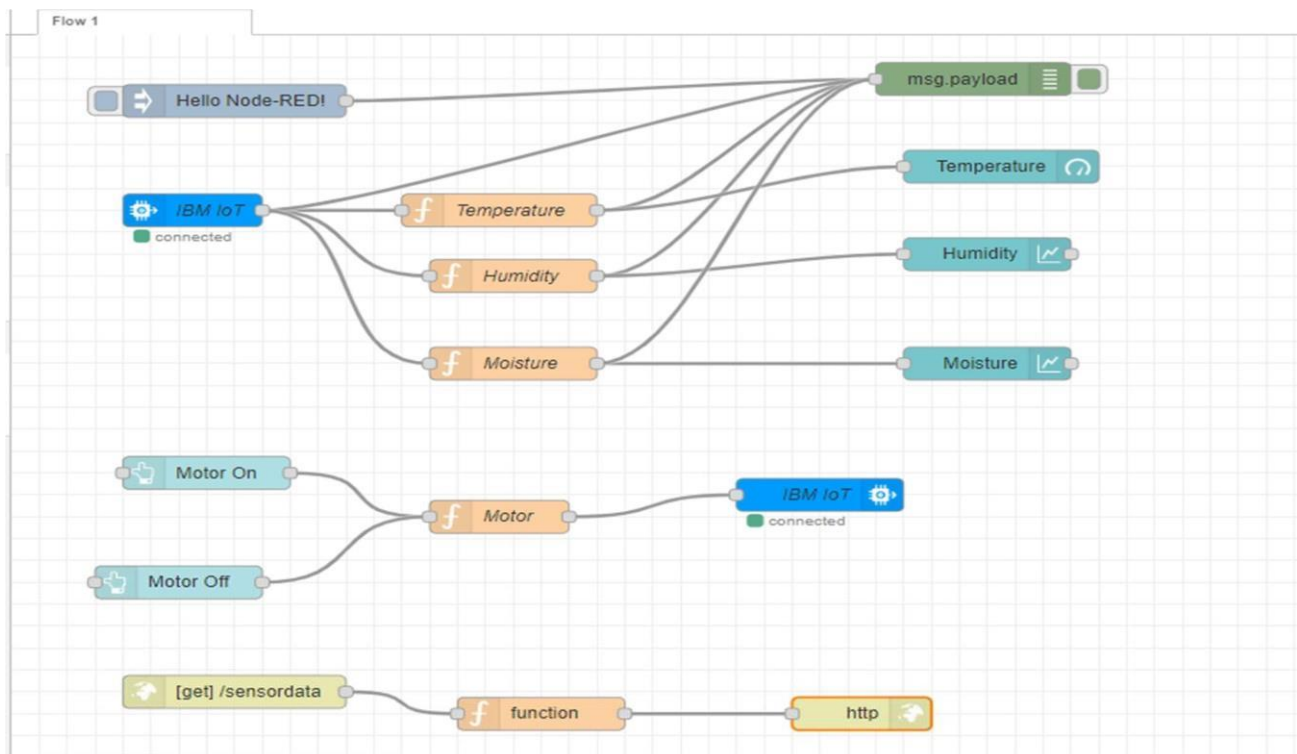
Nodes connected in following manner to get each reading separately.



Data received from the cloud in Node-Red console.



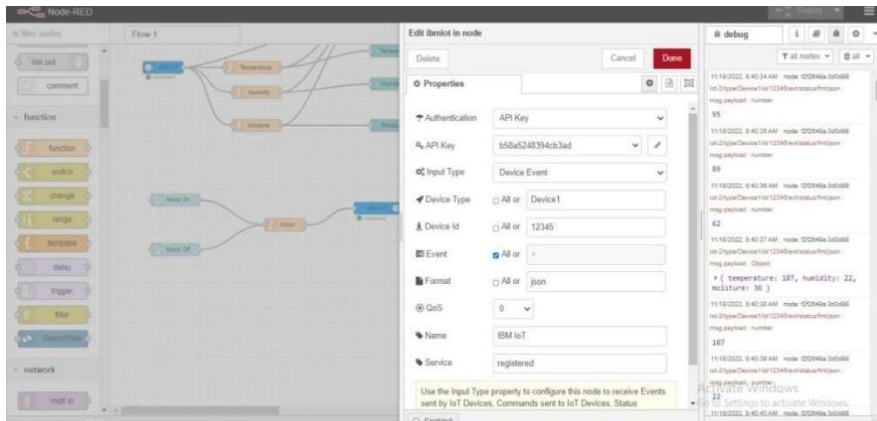
Data from Node-Red to MIT app Inventor



Sprint delivery – 3

Configuration of Node-Red to send commands to IBM cloud

We used IBM IOT in node to get IBM Watson to Node Red. IBM out node 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.



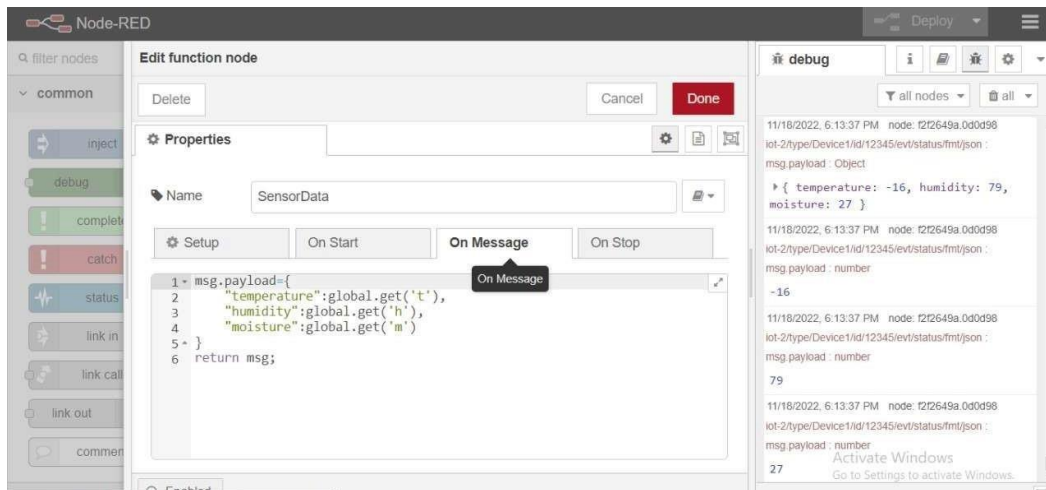
PROGRAM:

```
Sensor data: msg.payload={
    "temperature":global.get('t'),
    "humidity":global.get('h'),
    "moisture":global.get('m')
}    return
msg;
Temp:
msg.payload=msg.payload.temperature
global.set('t',msg.payload);
return msg; Motor:

msg.payload={
    "command": msg.payload
}    return
msg;
```

The data from NODE RED to MIT APP INVENTOR. The following data are:

SENSOR DATA:

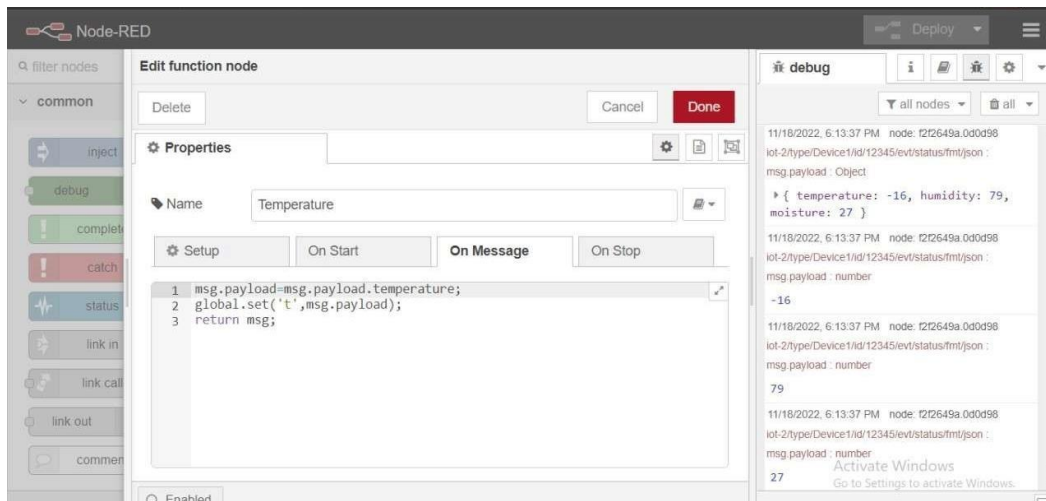


The screenshot shows the Node-RED web interface. On the left, the 'common' tab is selected in the node palette. The main workspace displays an 'Edit function node' for a node named 'SensorData'. The 'On Message' tab is active, showing the following JavaScript code:

```
1 - msg.payload={
2   "temperature":global.get('t'),
3   "humidity":global.get('h'),
4   "moisture":global.get('m')
5 - }
6 return msg;
```

On the right, the 'debug' console shows a log of messages. The first message is an object: `{ temperature: -16, humidity: 79, moisture: 27 }`. Subsequent messages show the individual values: `-16`, `79`, and `27`.

TEMPERATURE:

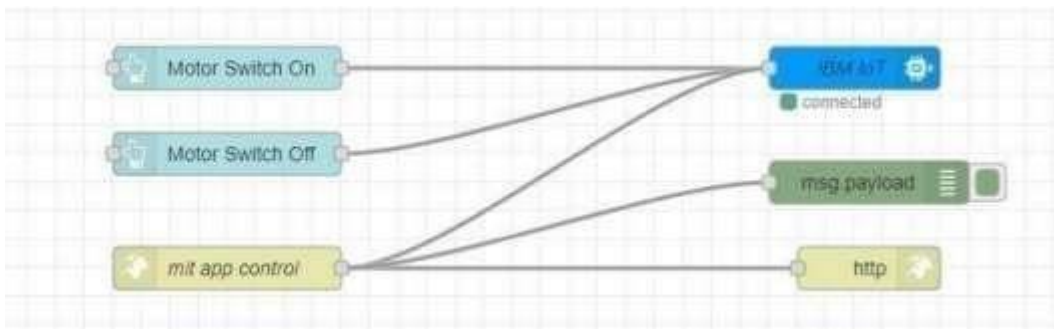
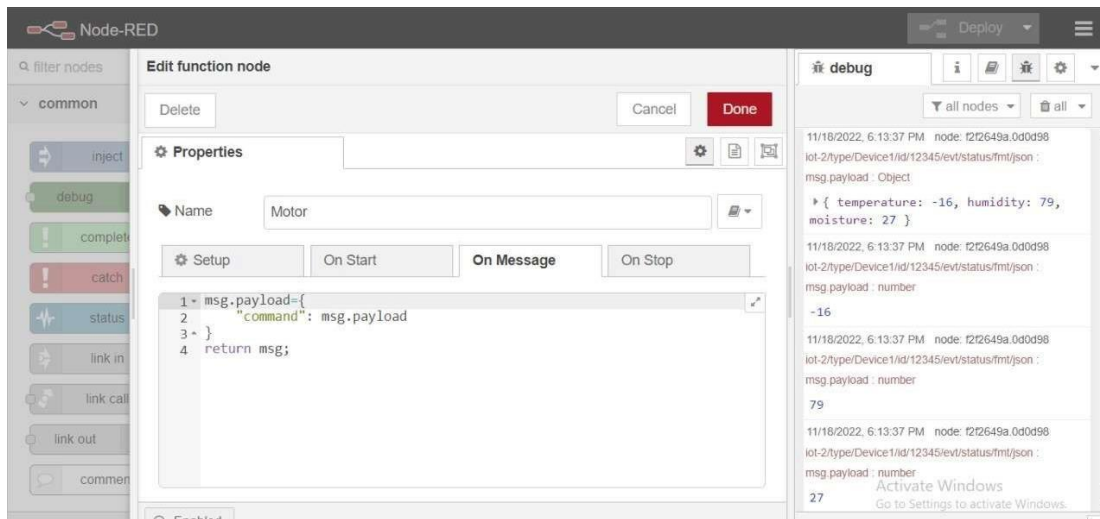


The screenshot shows the Node-RED web interface. On the left, the 'common' tab is selected in the node palette. The main workspace displays an 'Edit function node' for a node named 'Temperature'. The 'On Message' tab is active, showing the following JavaScript code:

```
1 msg.payload=msg.payload.temperature;
2 global.set('t',msg.payload);
3 return msg;
```

On the right, the 'debug' console shows a log of messages. The first message is an object: `{ temperature: -16, humidity: 79, moisture: 27 }`. Subsequent messages show the individual values: `-16`, `79`, and `27`.

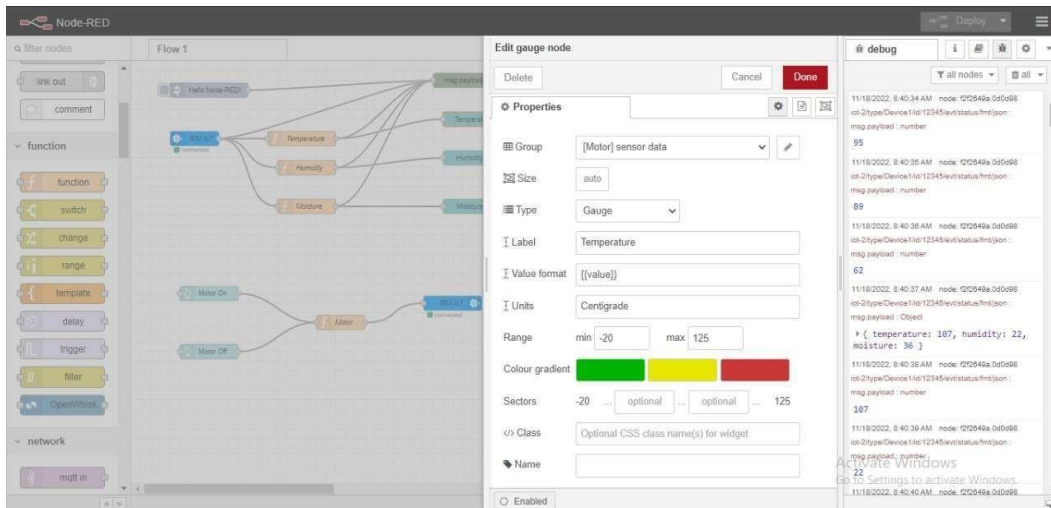
MOTOR:



This is the program flow for sending commands to IBM cloud.

Adjusting User Interface

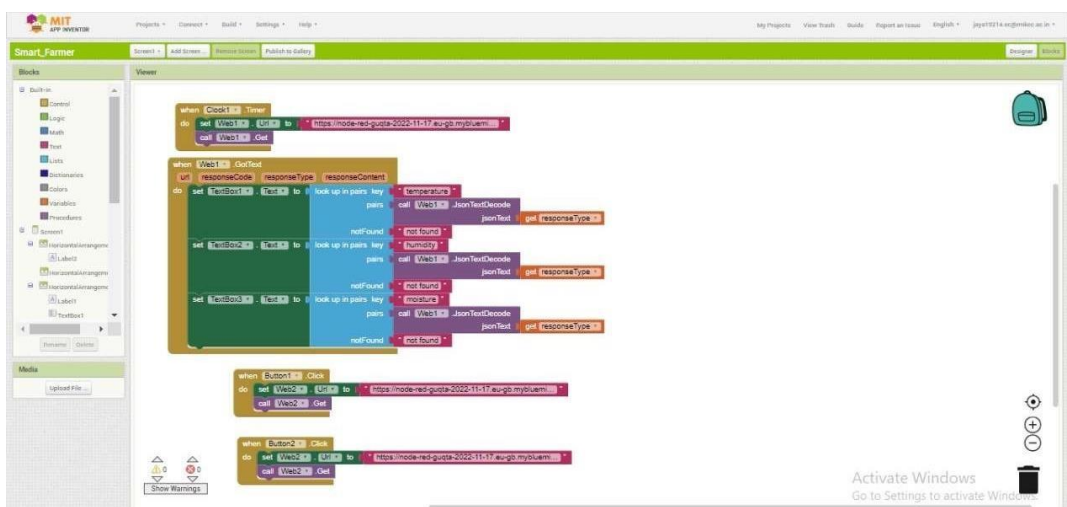
In order to display the parsed JSON data a Node-RED dashboard is created Here we are using Gauges, text and button nodes to display in the UI and helps to monitor the parameters and control the farm equipment. Below images are the Gauge, text and button node configurations.



Complete Program Flow

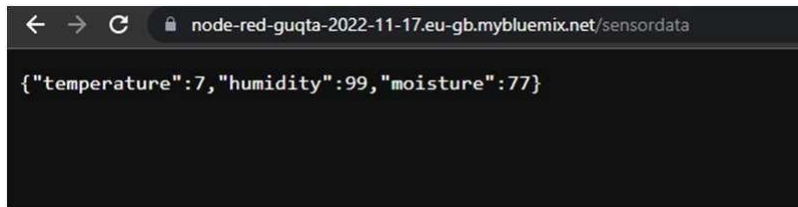


MOBILE APP WEB : BLOCK DIAGRAM



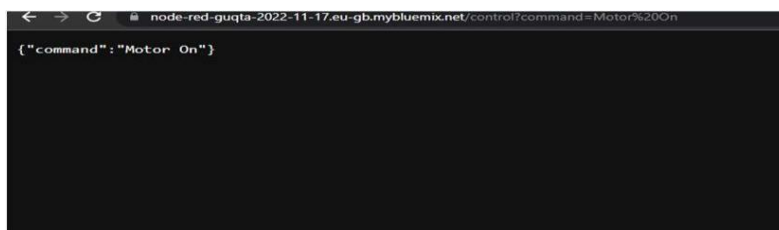
To get information from NODE RED to MIT APP. The following are used:

SENSOR DATA

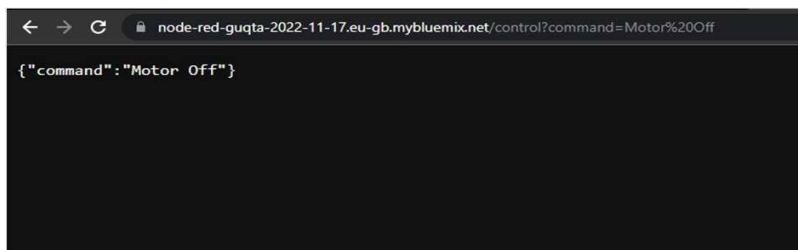


A screenshot of a web browser window. The address bar shows the URL `node-red-guqta-2022-11-17.eu-gb.mybluemix.net/sensordata`. The main content area displays a JSON object: `{"temperature":7,"humidity":99,"moisture":77}`.

COMMAND:



A screenshot of a web browser window. The address bar shows the URL `node-red-guqta-2022-11-17.eu-gb.mybluemix.net/control?command=Motor%20On`. The main content area displays a JSON object: `{"command":"Motor On"}`.

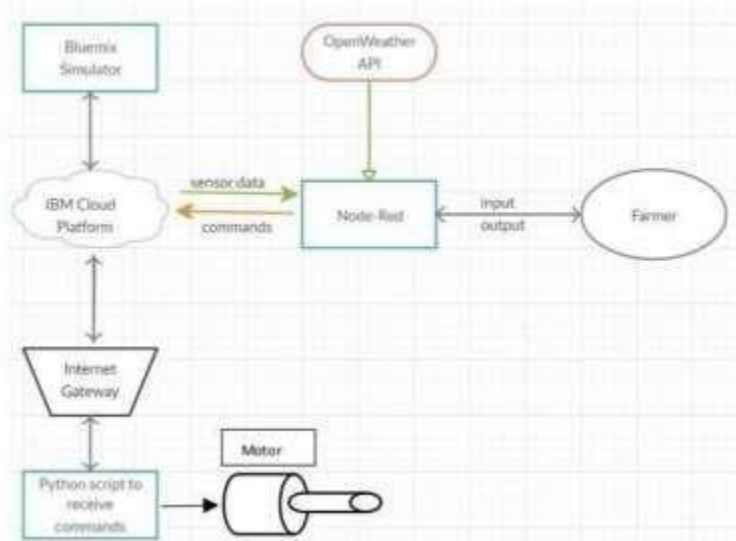


A screenshot of a web browser window. The address bar shows the URL `node-red-guqta-2022-11-17.eu-gb.mybluemix.net/control?command=Motor%20Off`. The main content area displays a JSON object: `{"command":"Motor Off"}`.

Sprint delivery – 4

Receiving commands from IBM cloud using Python program

FLOWCHART



7. CODING & SOLUTIONING

```
#IBM Watson IOT
Platform #pip install
wiotp-sdk import
wiotp.sdk.device import
time import random
myConfig = {
    "identity": {
        "orgId": "14dcvs",
        "typeId": "Device1",
        "deviceId": "12345"
    },
    "auth": {
        "token": "87654321"
    }
}

def myCommandCallback(cmd):
    print("Message received from IBM IoT Platform: %s" % cmd.data['command'])
    m=cmd.data['command']
    if(m=="Motor On"):
        print("****//Motors ARE ON//****")
    else:
        print("****//Motors ARE OFF//****")
```

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

```
while True:    temp=random.randint(-
20,125)    hum=random.randint(0,100)
Mois=random.randint(20,120)
    myData={'temperature':temp, 'humidity':hum, 'moisture':Mois}
client.publishEvent(eventId="status", msgFormat="json", data=myData, qos=0,
onPublish=None)
    print("Published data Successfully: %s",
myData)    client.commandCallback =
myCommandCallback    time.sleep(2)
client.disconnect()
```

8.TESTING

8.1 Test Cases

Device creation

Python Script

```
File Edit Format Run Options Window Help
#IBM Watson IoT Platform
#pip install wiotp-sdk
import wiotp.sdk.device
import time
import random
myConfig = {
    "identity": {
        "orgId": "14dcvs",
        "typeId": "Device1",
        "deviceId": "12345"
    },
    "auth": {
        "token": "87654321"
    }
}

def myCommandCallback(cmd):
    print("Message received from IBM IoT Platform: %s" % cmd.data['command'])
    m=cmd.data['command']
    if(m=="Motor On"):
        print("*****//Motors ARE ON//*****")
    else:
        print("*****//Motors ARE OFF//*****")

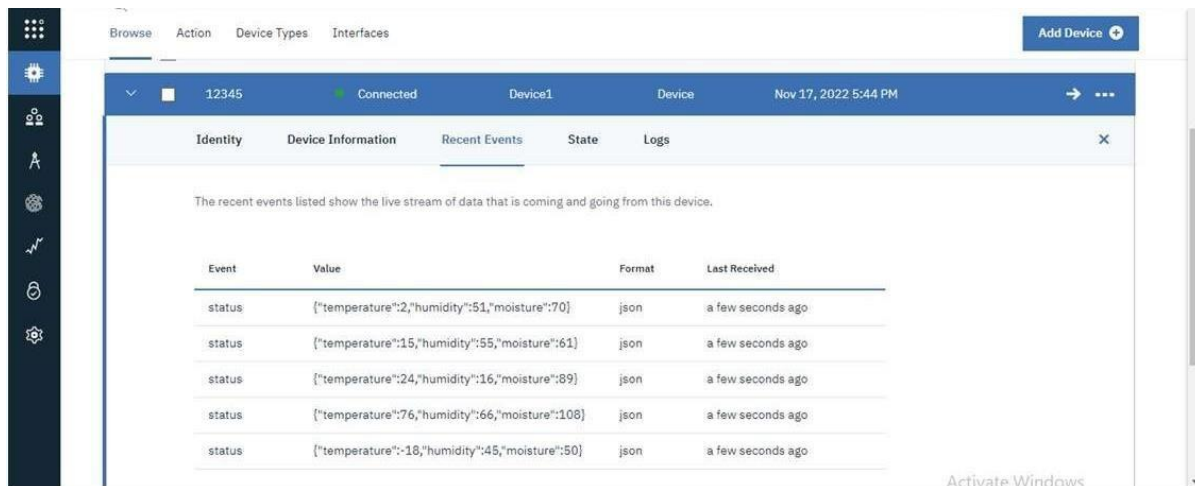
client = wiotp.sdk.device.DeviceClient(config=myConfig, logHandlers=None)
client.connect()

while True:
    temp=random.randint(-20,125)
    hum=random.randint(0,100)
    Mois=random.randint(20,120)
    myData={'temperature':temp, 'humidity':hum, 'moisture':Mois}
    client.publishEvent(eventId="status", msgFormat="json", data=myData, qos=0, onPublish=None)
    print("Published data Successfully: %s" % myData)
    client.commandCallback = myCommandCallback
    time.sleep(2)
client.disconnect()
```

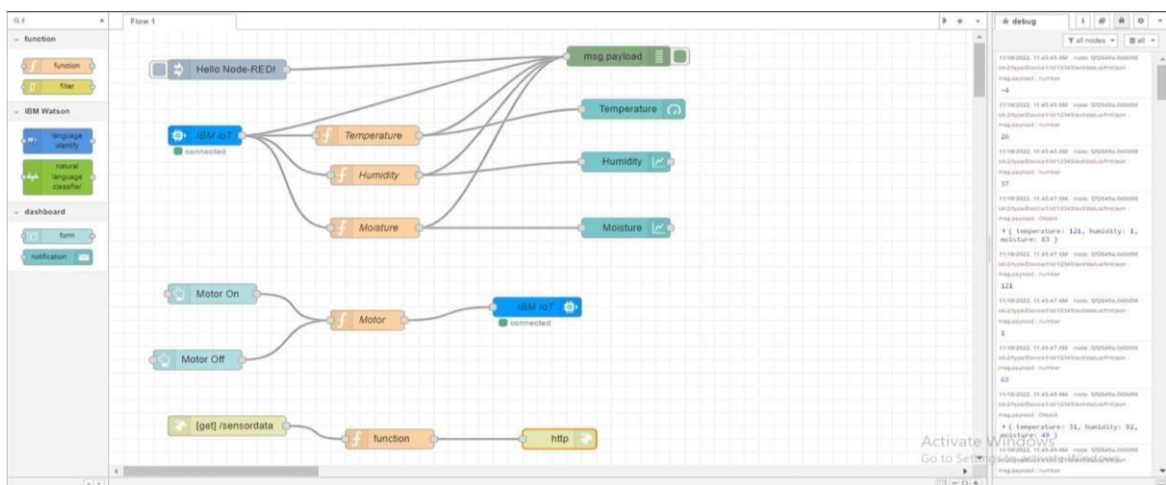
Ln: 9 Col: 18

```
2022-11-18 19:06:01,244 wiotp.sdk.device.client.DeviceClient INFO Connected successfully: d:14dcvs:Device1:12345Published data Successfully: %s
({'temperature': 75, 'humidity': 58, 'moisture': 22})
Published data Successfully: %s ('temperature': 44, 'humidity': 33, 'moisture': 39)
Published data Successfully: %s ('temperature': 11, 'humidity': 62, 'moisture': 93)
Published data Successfully: %s ('temperature': 102, 'humidity': 10, 'moisture': 32)
Published data Successfully: %s ('temperature': 107, 'humidity': 51, 'moisture': 32)
Published data Successfully: %s ('temperature': -7, 'humidity': 58, 'moisture': 77)
Published data Successfully: %s ('temperature': 97, 'humidity': 90, 'moisture': 23)
Published data Successfully: %s ('temperature': 58, 'humidity': 100, 'moisture': 21)
```

Ln: 10 Col: 0

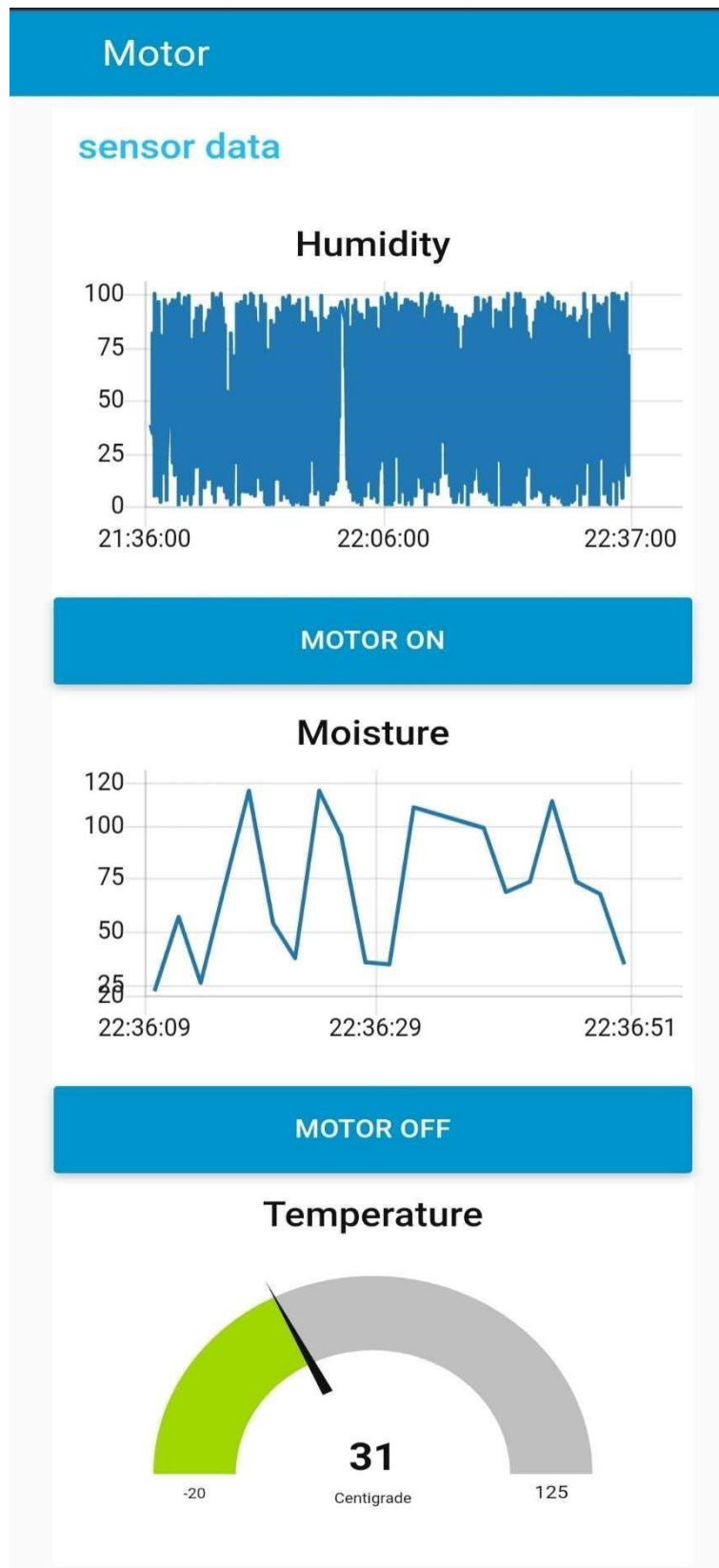


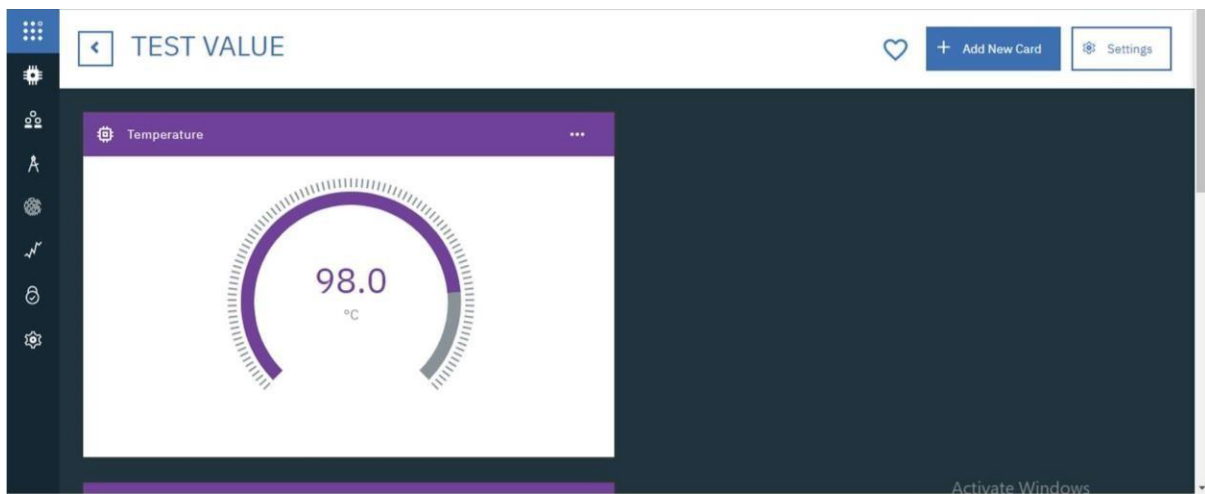
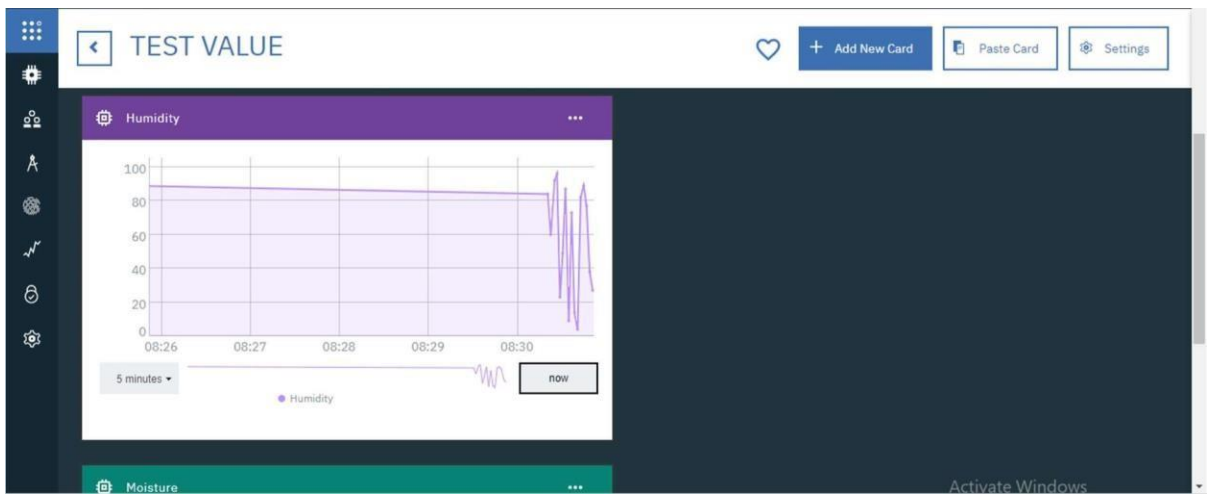
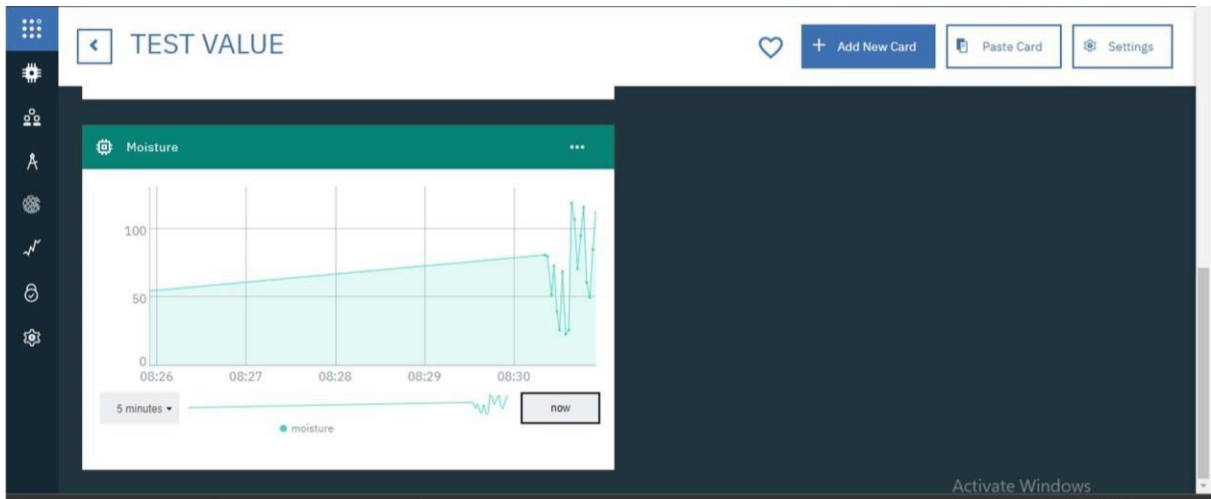
8.2 User Acceptance Testing



9. RESULTS

Metrics







9. ADVANTAGES & DISADVANTAGES

Advantages :

- Various solutions are available to monitor engine statistics and starting or stopping the engine. When the client chooses to begin or stop the motor, the program transmits a sign to the unit within seconds by means of a mobile phone system.
- A remote control system can help in working irrigation system valves dependent on schedule. Irrigating remote farm properties can be exceptionally troublesome and labour intensive. It gets hard to comprehend when the valves were started and whether the ideal measure of water was distributed.
- For situations where a quick reaction is required, manual valve actuation may not be conceivable constantly. Thus, remote observing and control of irrigation systems, generators or wind machines or some other motor-driven hardware become the next logical step.

Disadvantages:

- The smart agriculture needs availability of internet continuously. Rural part of most of the developing countries do not fulfil this requirement. Moreover internet connection is slower.
- The smart farming based equipment require farmers to understand and learn the use of technology. This is major challenge in adopting smart agriculture farming at large scale across the countries .

11. CONCLUSION

The project concludes that this system is easy to implement and time, money, and manpower saving solution for irrigating fields. It will be comfortable for farmers to operate the irrigation at remote locations i.e. from home. A farmer should visualize his agricultural land's moisture content from time to time and whether the water level of the source is sufficient or not. The IOT based irrigation system displays the values of the sensors continuously in smart phones and farmers can operate them anytime from and anywhere. This will save time and avoid the problem of continuous vigilance. Not only this, it will also control the consumption of water for the irrigation of the field, thus preventing the water wastage and would help in sustaining productivity, increasing the yield.

An IoT based irrigation system aims to utilize the features of embedded systems to make agriculture simple. Having sensors connected to the controller, the system reads the soil moisture and temperature of the soil and then the sensed data is processed in the controller. The microcontroller is the decision maker of this system. It checks for moisture value and the temperature. Initially, the threshold moisture and temperature value must be defined. When the sensed moisture value goes above the threshold value, the controller checks for the temperature. Only if the sensed temperature value is higher than

the threshold value, irrigation is done and the user is acknowledged. This is because all crops can withstand the dry soil moisture condition if the temperature is moderate. This would conserve the water for irrigation. Sending SMS to the user about the field enables the user to remotely monitor the agriculture area. The SMS includes the warning and suggestion to the affected system.

12.

FUTURE SCOPE

- The system can not only used in field by the farmers but can be used to solve other problems where continuous monitoring of water supply is required like in a garden, or a personal small field, or in the watering the stadium when necessary etc.
- This project can be made further more innovative by adding – controlling and monitoring the sprinkles, checking the faults in the irrigation network and correcting them remotely and visualization the live working of integrated systems in the field area by mobile.
- Also the future aspect of this model can be made into an intelligent system, wherein the system predicts user actions, rainfall pattern, time to harvest and many more features which will make the system independent of human operation.
- Systems can also be upgraded to Real Time systems, such that users receive real time updates and status of condition of the field. Thereby, enabling the user to take immediate action in case of any problems

13. APPENDIX

Source Code

```
#IBM Watson IOT
Platform #pip install
wiotp-sdk import
wiotp.sdk.device import
time import random
myConfig = {
    "identity": {
        "orgId": "14dcvs",
        "typeId": "Device1",
        "deviceId": "12345"
    },
    "auth": {
        "token": "87654321"
    }
}

def myCommandCallback(cmd):    print("Message received from IBM IoT
Platform: %s" % cmd.data['command'])    m=cmd.data['command']
if(m=="Motor On"):
    print("*****//Motors ARE ON//*****")
else:
    print("*****//Motors ARE OFF//*****")

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

while True:    temp=random.randint(-
20,125)    hum=random.randint(0,100)
Mois=random.randint(20,120)
    myData={'temperature':temp, 'humidity':hum, 'moisture':Mois}
client.publishEvent(eventId="status", msgFormat="json", data=myData, qos=0,
onPublish=None)
    print("Published data Successfully: %s",
myData)    client.commandCallback =
myCommandCallback    time.sleep(2)
client.disconnect()
```


GitHub & Project Demo Link

GitHub Link

<https://github.com/IBM-EPBL/IBM-Project-29915-1660134023>

Demo Link

<https://youtu.be/4TxdXOgybL4>