SMART FARMER – IOT ENABLED SMART FARMING APPLICATION

NALAYA THIRAN PROJECT BASED LEARNING

SUBMITTED BY

TEAM ID: PNT2022TMID04701

PRIYA DHARSHINI K

NITHISH V S

RUBESH K

PRIYADHARSHINI M

In partial fulfilment for the award of the degreeof

BACHELOR OF ENGINEERING IN

ELECTRONICS AND COMMUNICATION

KONGU ENGINEERING COLLEGE

(Autonomous) PERUNDURAI, ERODE - 638 060

INDEX

1.INTRODUCTION

1.1 Introduction Project overview:

The farmer can monitor several field characteristics, such as soil moisture, temperature, and humidity, using an IoT-based agriculture system. Even when the farmer is far from his field, he or she can use a web or mobile application to monitor all the sensor parameters. One of the crucial tasks for farmers is to water the crops. By keeping an eye on the sensor parameters and managing the motor pumps from the mobile application itself, they may decide whether to water the crop or delay it.

Lack of enough irrigation when the crop is needed results in lower agricultural output. Agricultural land is lost as a result of low soil moisture. The loss of biodiversity, soil erosion, and climate change were too much for the farmers to handle.

1.2 Purpose:

They find it quite challenging to physically monitor the field individually. Promote agricultural yields and preserve soil fertility to support the growth of higher-quality food items. Utilizing a mobile application to track all sensor parameters and collect various data from the field. By doing so, he can decide whether to water the crops now or later and manage the motor pumps.

2.LITERATURE SURVEY

2.1 Existing problem:

A farmer who is new to farming, in his early years, he needs some mentoring and a technology to track several field parameters including soil moisture, temperature, and humidity. He also needs tools that will minimize the amount of work, increase production, increase yield, offer advice on how to enhance the soil, and provide planting suggestions for the following crop. He is looking for a solution that would meet all of his needs.

2.2 References:

[1] Jash Doshi, Tirthkumar Patel, Santosh Kumar Bharti (2019) proposed a paper titled “Smart Farming using IoT, a solution for optimally monitoring farming conditions”. This method is to propose a technology which can generate a message on different platforms to notify farmers. The product will assist farmers by getting live data (Temperature, humidity, soil moisture, UV index, IR) from the farmland and gives different types of messages to the farmer about the present conditions so that the farmer can take quick action. The quick actions taken by the farmers will help them increase the productivityin their farming and proper use of natural resources.

Hardware: ESP32s, DHT11 Temperature and Humidity Sensor, Soil Moisture Sensor, SI1145 Digital UV Index/IR/Visible Light Sensor.

Software: Serial Monitor, Blynk mobile

Advantages: Remote monitoring for farmers, water and other natural resource conservation, good management also allows improved livestock farming, the things which are not visible to necked eye can be seen resulting is accurate farmland and crop evaluation, good quality as well as improved quantity, the facility to get the real- time data for useful insights.

Disadvantages:

1. The smart agriculture need availability on internet continuously. Rural part of the developing countries did not fulfil this requirement. Moreover, internet is slower.
2. Fault sensor or data processing engines can cause faulty l decisions which may lead to over use of water, fertilizers and other wastage of resources.

[2] Stephen C. Kerns, Joong-Lyul Lee (2017) proposed a paper titled "Automated Aeroponics System Using IoT for Smart Farming"in 8th International Scientific Forum. Aeroponics farming is an efficient and effective process for growing plants without using soil. The Aeroponics system uses IOT technologies. It is designed in three phases: mobile application, Service platform and IOT devices with sensors. Applying IOT technology to an Aeroponics system decreases the water wastage ,increasing plant yield, minimizing rate of growth and reducing the workforce.

Hardware: Raspberry PI Zero, DHT11 temperature and humidity sensor, Atlas scientific pHprobe and EZO circuit, water level sensor.

Software: HTML5, CSS Flexbox, JavaScript, and SVG. Apache 2.4.26, MariaDB 10.1.25, and PHP 7.1.7.

Advantages:

1. Proposed system is expected to be a promising application to help farmers increase the production of organic crops in a smart farming system.
2. Increase productivity in farming.

Disadvantages:

1. Rural part of the developing countries did not have continuous internet connection.
2. Moreover, internet is slower.

[3] Manasa Sandeep, C. Nandini2, Bindu L, Champa P, Deepika K H, Anushree NS (2018) proposed a paper titled “IOT based smart farming system” in International Research journal of Engineering and Technology. Proposed system developed an automated irrigation system and rooftop management system for the farmer on the basis of wireless sensor network. This system monitors the parameters temperature, humidity, rainfall and moisture of the soil. An algorithm is used with threshold values of soil moisture to be maintained continuously. System starts or stops the irrigationbased on the moisture content of soil.

Hardware: Arduino Uno, Soil moisture sensor, Image capturing module. Software:

Mobile application, Bluetooth module.

Advantages: The entire system gives the field automation in agriculture, which makes farmer’s work easier. It helps in increasing the agricultural production and reduces the time and money of the farmer.

Disadvantages: Rooftop is useful for smaller farms as it is costly to implement.

[4] Vu Khanh Quy, Nguyen Van Hau , Dang Van Anh, Nguyen Minh Quy , Nguyen Tien Ban, Stefania Lanza, Giovanni Randazzo and Anselme Muzirafuti (2022) proposed a paper titled “IoT-Enabled Smart Agriculture: Architecture, Applications, and Challenges”. This study presents a survey of IoT solutions and demonstrates how IoT can be integrated into the smart agriculture sector. The vision of IoT-enabled smart agriculture ecosystems by evaluating their architecture (IoT devices, communication technologies, big data storage, and processing), their applications, and research timeline are used to achieve the objective.

Hardware: FGPA/processor, Energy module, RAM, I/O interface module, location sensor, optical sensor, mechanical sensor, electrochemical sensor,airflow sensor.

Software: ZigBee, Wi-Fi, Sigfox and LoRa

Advantages:

1. IoT in smart agriculture, aiming to enhance productivity, reduce human labour, and improve production efficiency.
2. Provide clean and green foods, support food traceability.
Disadvantages:

1. Most IoT devices are expected to be deployed outdoors (in fields and farms). Harsh work environments lead to the rapid degradation of IoT devices' quality and can lead to unexpected manufacturer failures. 2. One of the most important problems of policies regards the validity and legal statusof farm data.

[5] Nermeen Gamal Rezk1 & Ezz El-Din Hemdan2 & Abdel-Fattah Attia & Ayman ElSayed2 & Mohamed A. El-Rashidy(2021) proposed a paper titled "An efficient IoT based smart farming system using machine learning algorithms". This paper suggests an IoT based smart farming system along with an efficient prediction method called WPART based on machine learningtechniques to predict crop productivity and drought for proficient decision support making in IoT based smart farming systems. The crop productivity and drought predictions is very important to the farmers and agriculture's executives, which greatly help agricultureaffected countries around the world.

Hardware: Sensors and actuators WSN Software:

Machine learning, Mobile applications

Advantages:

1. The projected method is robust, accurate, and precise to classifyand predict crop productivity and drought in comparison with the existing techniques.

2. The proposed method proved to be most accurate in providing drought prediction as well as the productivity of crops like Bajra, Soybean, Jowar, and Sugarcane.

Disadvantages:

1. This method includes multiple steps of process formonitoring.

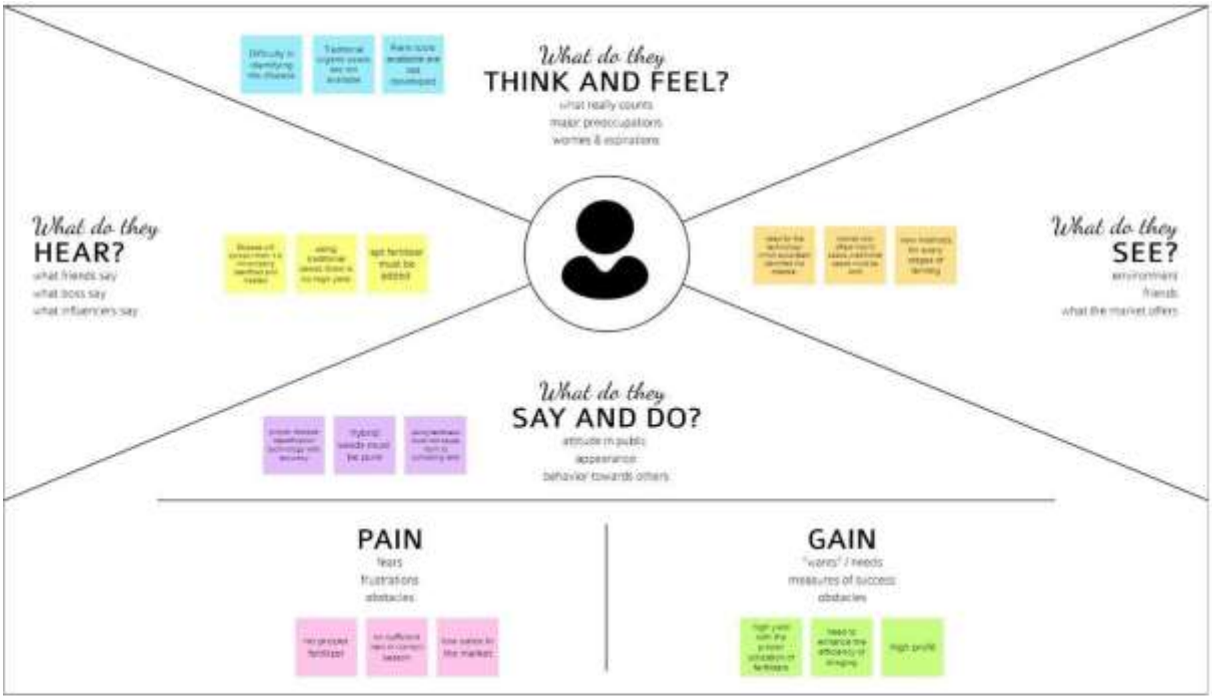
2. It is quite complex.

2.3 Problem statement definition:

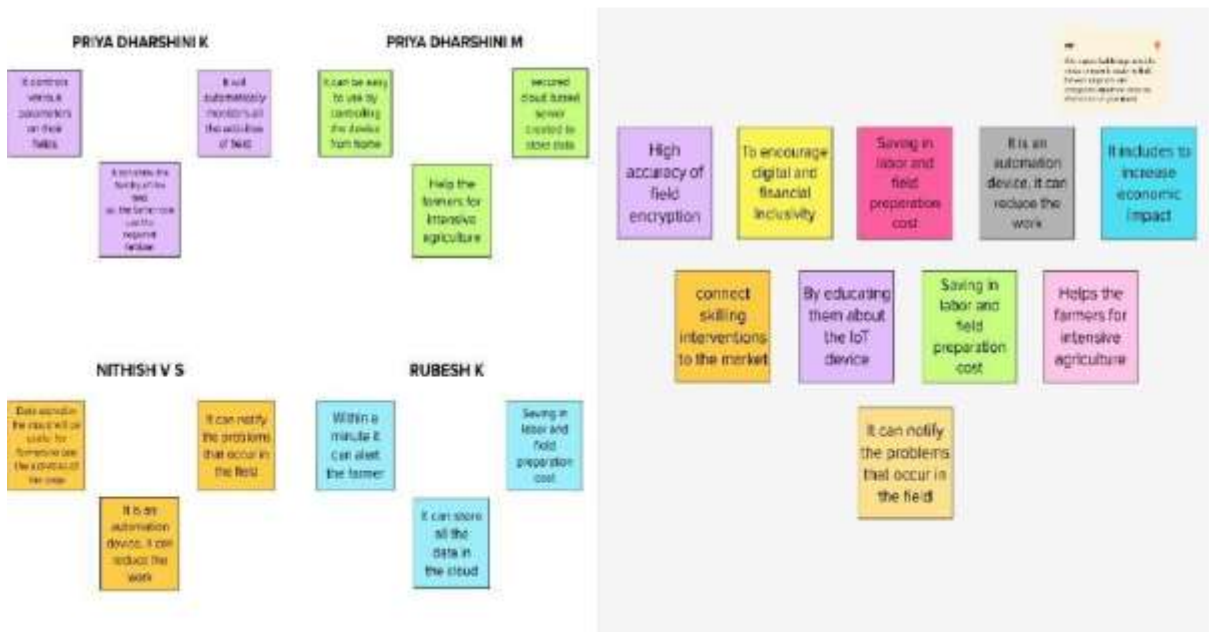
Increase crop production as much as possible and keep the soil rich topromote the growth of superior quality food products.
The best solution is to use a mobile application to monitor all of the sensorsettings and collect varied data from the field. By doing so, he can decide whether to water the crops now or later and manage the motor pumps.

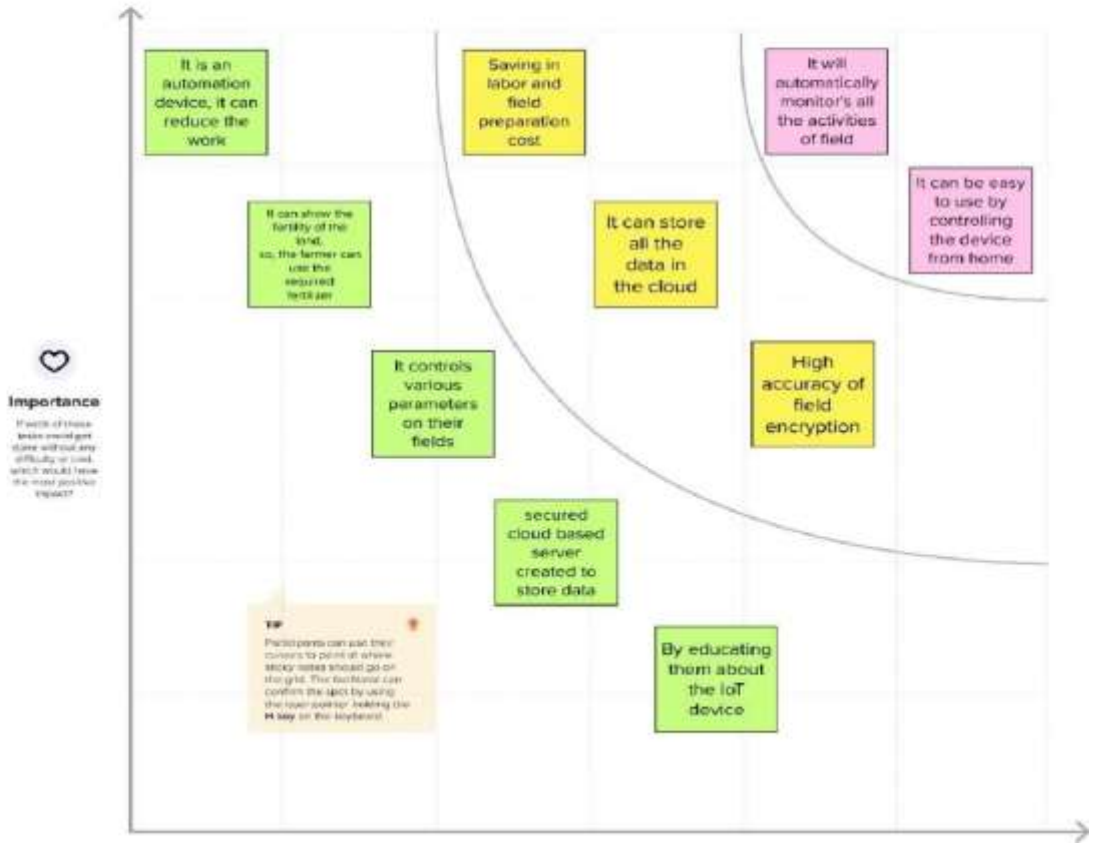
3.IDEATION AND PROPOSED SOLUTION

3.1 Empathy map canvas:



3.2 Ideation and Brain Storming:





Importance
It is an automation device, it can reduce the work
Saving in labor and field preparation cost
It will automatically monitor's all the activities of field
It can be easy to use by controlling the device from home
It can store all the data in the cloud
It controls various perameters on their fields
High accuracy of field encryption
secured cloud based server created to store data
By educating them about the IoT device

3.3 Proposed solution:

Problem Statement (Problem to be solved). The primary issue faced by the farmers nowadays is knowing the characteristics of their soil like soil moisture, humidity, temperature, deficiency of minerals, etc. Another problem is that supplying water to the field by monitoring its moisture content for which they need to stay near the fields all the time Idea / Solution description We can use sensors to monitor the temperature, humidity, moisture of the soil so that he can plant the crop accordingly to that. The lack of certain minerals in the soil so thatit will be helpful for the farmers to use appropriate fertilizers and manures to improve the yield of the crop. Sensors can be used to check the water content inthe field and pump the water from the well using the motor All these things can be monitored by the farmer from anywhere else through his phone and he can work accordingly

S.No.	Parameter	Description
1.	Problem Statement (Problem to be solved)	The primary issue faced by the farmers nowadays is knowing the characteristics of their soil like soil moisture,humidity,temperature,deficiency of minerals,etc. Another problem is that supplying water to the field by monitoring its moisture content for which they need to stay near the fields all the time
2.	Idea / Solution description	We can use sensors to monitor the temperature,humidity,moisture of the soil so that he can plant the crop accordingly to that The lack of certain minerals in the soil so that it will be helpful for the farmers to use appropriate fertilizers and manures to improve the yield of the crop. Sensors can be used to check the water content in the field and pump the water from the well using the motor All these things can be monitored by the farmer from anywhere else through his phone and he can work accordingly
3.	Novelty / Uniqueness	The data collected by the sensors will be shared to the cloud and then to the mobile phone through the internet and the farmer can his decisions. If the field is dry the sensor which monitors the moisture content of the soil will send the information to his phone and he can switch on the motor to pump the water
4.	Social Impact / Customer Satisfaction	First of all it will save his time and also reduce the labour cost upto a certain level. By planting the right crop at the right time he can improve the yield of the crop which would increase his income.

3.4 Problem statement fit:

Define CS, fit into CC

1. CUSTOMER SEGMENT(S) CS

The customers are farmers who cultivate crops in the field. The aim is to to help them in monitoring the crops and give better yield with less physical work.

6. CUSTOMER CONSTRAINTS CC

Internet connection is mandatory to store the data in the cloud.Using many sensors to monitor the field may cause some difficulty

5. AVAILABLE SOLUTIONS AS

Previously the irrigation process is automated using IOT. Meteorological data and field parameters were collected and processed to automate the irrigation process. Disadvantages of this method are efficiency is only over short distances and difficult data storage.

Explore AS, differentiate

Focus on J&P, tap into BE, understand RC

2. JOBS-TO-BE-DONE / PROBLEMS J&P

This project IOT based agricultural system aims at collecting data from sensors after monitoring the different parameters like soil moisture,temperature and humidity.The cloud is used to store and transmit data using IOT. With the help of information collected in sensor farmers can take decision on their own by using mobile application

9. PROBLEM ROOT CAUSE RC

Frequent changes in weather causes difficulty for the farmers in watering the plants whether to water or to postpone it. Due to the lack of instruments in measuring soil moisture, humidity and temperature cause field to produce low yield.

7. BEHAVIOUR BE

Directly related:
Many Smart farming companies are ready to install their technologies in the farmers field.

Indirectly related:
Save time and reduce work

Focus on J&P, tap into BE, understand RC

Identify strong TR & EM

3. TRIGGERS TR

When customers are attracted by technology or new methodology in irrigation and on /off of water pumps using single application.

4. EMOTIONS: BEFORE / AFTER EM

Before : Lack of technology and Knowlege in weather deduction -> random decisions -> Low yield
After: Data collected -> correct prediction -> high yield

10. YOUR SOLUTION SL

Our product consists of many sensors to collect varying parameters from the parts of the field. Data collected by sensors are then transferred to main server. Weather data is given by Weather API and it is stored in cloud. Based on these data irrigation is done by using mobile application.

8. CHANNELS of BEHAVIOUR CH

8.1 ONLINE:

Assistance must be provided to farmers in online about the usage of the product.

8.2 OFFLINE:

Awareness must be given to boost people to know about automation and IOT in the development of agriculture.

Extract online & offline CH of BE

4.REQUIREMENT ANALYSIS

4.1 Functional requirement:

·R No.	Functional Requirement (Epic)	Sub Requirement (Story / Sub-Task)
FR-1	User Registration	Registration through Form Registration through Gmail Registration through LinkedIN
FR-2	User Confirmation	Confirmation via Email Confirmation via OTP
FR-3	Log in to the system	Check the credentials Rcles of access
FR-4	Manage the modules	Manage the roles of the Uer and his permission Manage the system's Admin
FR-5	Check the details	Temperature of the soil Humidity and moisture content Minerals and Nutrients the soil lacks
FR-6	Logout	Exit

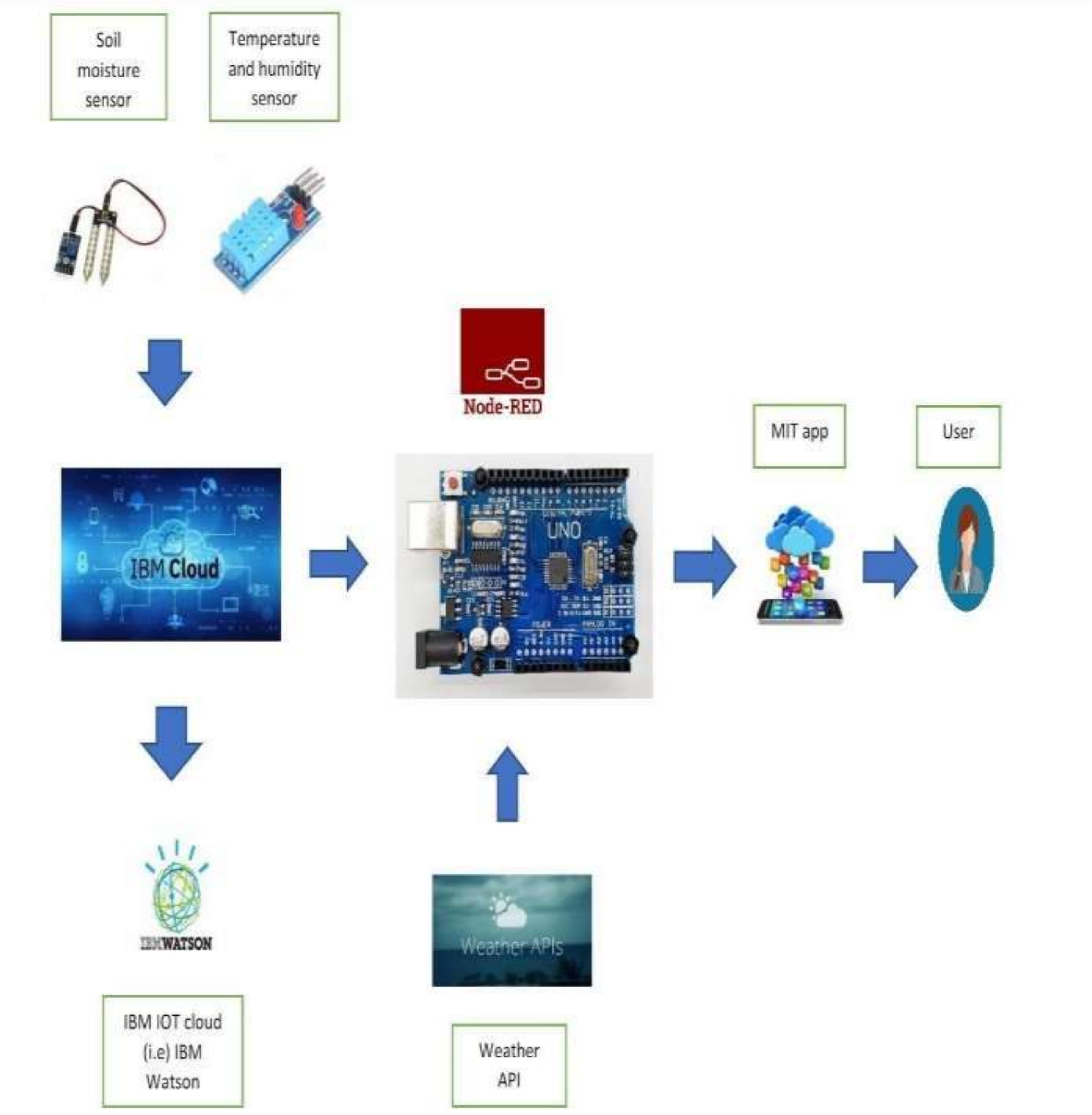
4.2 Non-Functional requirements:

The device should collect the temperature, humidity and moisture of the soil and send the received data to the IBM cloud through the IBM Watson IOT Platform. The Node Red platform is used to connect the nodes which is here the cloud and the farmer's mobile phone. The Fast2SMS is used to send the alert message to his mobile phone So he can decide to switch on the motor to pump water to his fields

FR No.	Non-Functional Requirement	Description
NFR-1	**Usability**	It include how easily one can learn to use and system and remember it There shouldn't be any problem while using the system. The User should be happy while using it and be satisfied with the system.
NFR-2	**Security**	The data collected and stored should be kept safe until the User takes his decision or till the final stage of his cultivation. The data should be not available to anyone without the knowledge of the User.
NFR-3	**Reliability**	The system should provide shared protection so that there is a trade off between the cost and reliability Also it should avoid farm service outages.
NFR-4	**Performance**	Sensors can be used to monitor the soil parameters such as its minerals .nutrient contents.moisture contents,etc and environmental parameters such as humidity and temperature.
NFR-5	**Availability**	Farming equipments can be made to operate automatically based on the field condition. If the field is dry motor can be automatically switched on to pump water from the well to the field ca
NFR-6	**Scalability**	Scalability is a major issue in IOT field based on the architecture of the system and it is more important in an environment where it has to make its decision based the problem.

5.PROJECT DESIGN

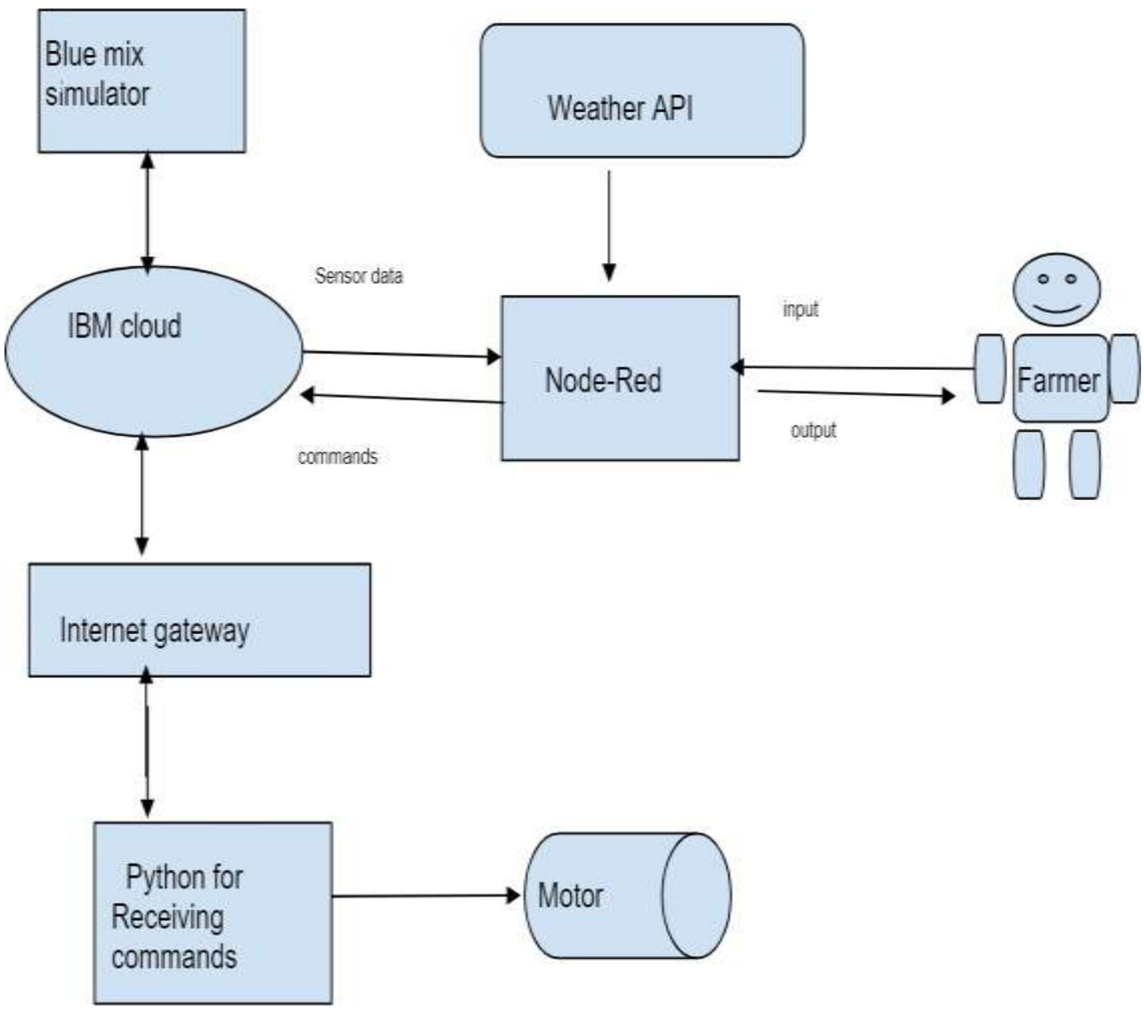
5.1 Data Flow Diagrams:



5.2 solution & Technical Architecture:

IOT based Smart agriculture system aims at providing best monitoring facilities for the farmers. Sensors like Soil moisture sensor, temperature andhumidity sensor that monitors the farmers field and provide data. These data are stored in the IOT cloud for the further process.

Arduino UNO is used as a processing unit that process data obtained from sensors and weather API. Node-red is a programming tool to wire a hardware, software and APIs. MQTT Protocol is used for communication. The data processed by the Arduino can reach user with the help of the MIT app. Based on the data collected, user makes decision whether to water the plant or postpone it. By using this app, they can also operate Motor pumps.



5.3 User Stories:

The farmers were made to use our service. They felt difficult to use it at first but then onwards they got used to use the service. Whenever they are far away from the field, they could monitor the field and control the irrigation of the field. Irrigating the field at the right time saved their crop from dryness and increased the yield of the crop.

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 I want to see everything in single widget		Medium	Sprint-2
		USN-7	As a user I want a organised widgets section		High	Sprint-2
		USN-8	As a user I want a graphical/pictorial representation		Low	Sprint-2

6.PROJECT PLANNING & SCHEDULING

6.1 Sprint planning & Estimation

Sprint 1 consists of the following requests. As a user I need to register for the application through my Gmail account and as a result I will get a confirmation mail. While registering I should give my mail id and password so that wheneverI am logging in I need to give my mail id and password to get into the application.

Sprint	Functional Requirement (Epic)	User Story Number	User Story / Task
Sprint-1	Registration	USN-1	As a user, I can register for the application by entering my email, password, and confirming my password.
Sprint-1		USN-2	As a user, I will receive confirmation email once I have registered for the application
Sprint-2		USN-3	As a user, I can register for the application through Facebook
Sprint-1		USN-4	As a user, I can register for the application through Gmail
Sprint-1	Login	USN-5	As a user, I can log into the application by entering email & password

Sprint 2 consists of the following user requests. As a user I want to visualizethe entire application in a single screen. Each and every section should be organized in a graphical manner. There should be a dashboard for the user to I can monitor my activities.

Sprint-2	Dashboard	USN-6	As a user, I want to see everything in single widget
Sprint-2		USN-7	As a user, I want an organised widgets section
Sprint-2		USN-8	As a user, I want a graphical/pictorial representation
Sprint-2	Dashboard	USN-9	As a user, I want a graphical representation of data for better understanding
Sprint-2		USN-10	As a user, I want to see a dashboard where I can customize myself
Sprint-2	IoT device setup	USN-11	Have to use a least sensor and get better output
Sprint-2		USN-12	As a user, I need a low cost IoT devices for farming
Sprint-2		USN-13	As a user, I need multiple sensors for various data
Sprint-3	User Problems	USN-14	As a user, I don't how to use the application
Sprint-3		USN-15	As a user, I need my application to work on most of the mobiles
Sprint-3		USN-16	As a user, I am facing issue in the application
Sprint-3	Query Clarification	USN-17	As an admin, I give solutions to their queries
Sprint-3	Particular Access	USN-18	As an admin, I give access only to authorised person

In sprint 3 the user expects that the device should be at low cost IOT device. The device should have several sensors to monitor various aspects of the field. The application should be used on all the mobiles. The admin should give access only to the authorized person.

In sprint 4 the admin should know the information about the plants under the application. The admin should be intimated if any problem arises while using the application and he should be able to control the application.

Sprint-4	Connection with IoT devices	USN-19	As an admin, I ensure the correct working of the devices. If any problem arises it will be shared to user
Sprint-4	Application	USN-20	As a user, I need to control my devices
Sprint-4		USN-21	As a user, I need events for better productivity
Sprint-4		USN-22	As a user, I need a more info about plants inside an application

6.2 Sprint Delivery Schedule

The sprint delivery schedule has be shown in the following table.The start date of the four sprints and the end date of the four sprints are shown.The sprintrelease dates are also displayed.

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	20	5 Nov 2022
Sprint-3	20	6 Days	07 Nov 2022	12 Nov 2022	20	12 Nov 2022
Sprint-4	20	6 Days	14 Nov 2022	19 Nov 2022	20	17 Nov 2022

7.CODING & SOLUTIONING

7.1.Feature 1:

```
#include "Arduino.h"#include "dht.h"

#include "SoilMoisture.h"#include "Pump.h" #define DHT_PIN 2Q

#define SOILMOISTURE_PIN A3

#define WATERPUMP_PIN 5dht DHT;

int c=0; void setup()

{

Serial.begin(9600);

pinMode(5, OUTPUT);// Output for Pump delay(1000);

}

void loop()

{ DHT.read11(DHT_PIN);

float h=DHT.humidity; float t=DHT.temperature;delay(1000);

float moisture_percent;int moisture_analog;

moisture_analog = analogRead(SOILMOISTURE_PIN); moisture_percent = ( 100 - (

(moisture_analog/1023.00) *100 ) );float moist= moisture_percent;

delay(1000);if(moist=0)

{

Serial.Print("\r");delay(1000);

Serial.print((String)"update>"+(String)"Temprature="+t+(String)"Humidity
="+h+(String)"Moisture="+moist);delay(1000);

c++;

}

}
```

Python Code:

```
import ibmiotf.application import ibmiotf.device import random
```

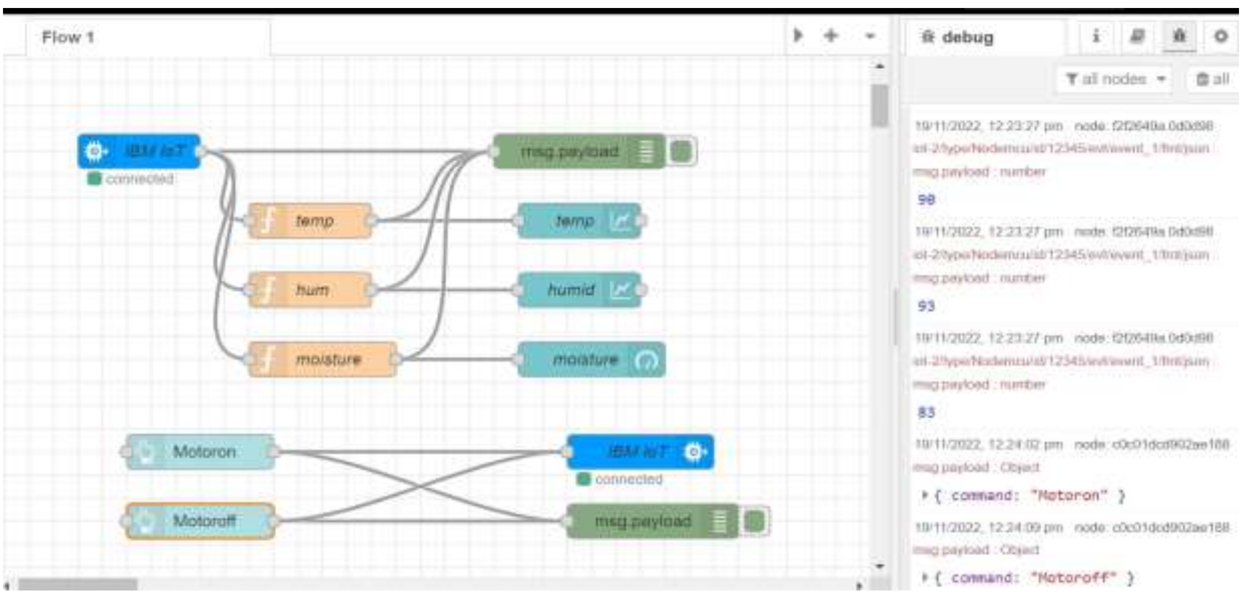
#Provide your IBM Watson Device Credentials:

```
Organization ="639sac" deviceType = "Nodemcu" deviceId = "12345"
authMethod = "token" authToken="1234567890"
```

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")
```

1.Node-red:



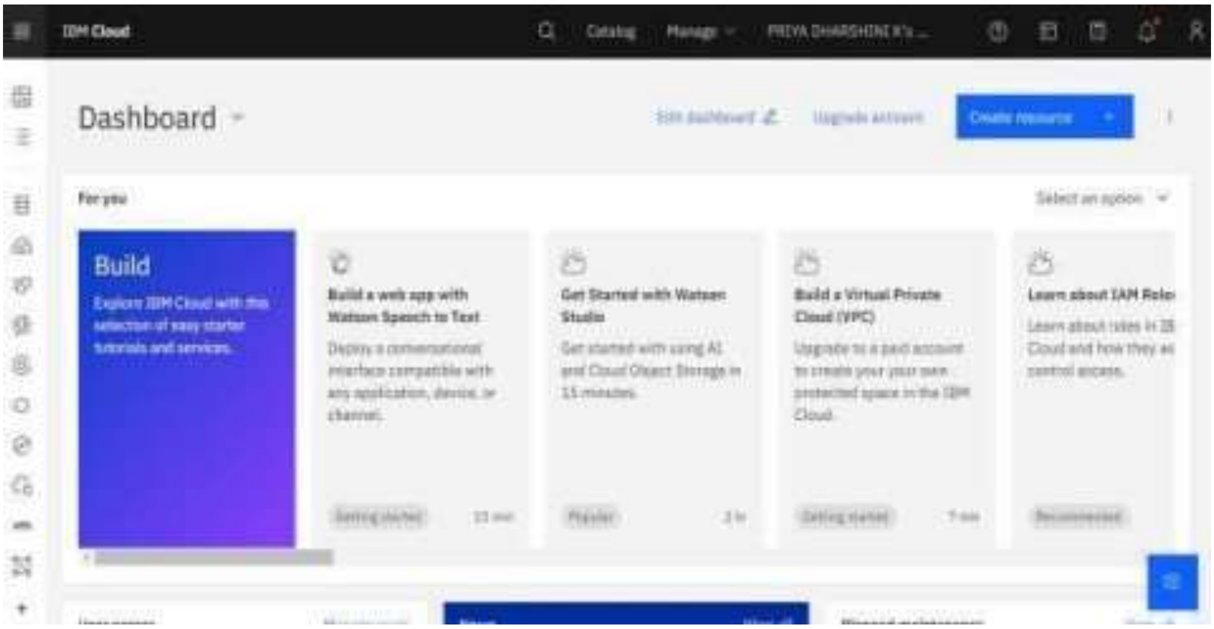
Steps to install:

1. Download Node.js
2. Do the installation process
3. Open command prompt and run the command “node –version&& npm - -version”
4. Install Node-red by running the command “npm install --g –unsafe-perm node-red”
5. Run Node red by simply typing “node-red” in commandprompt 6. In any web browser can access node-red by http://localhost:1880
6.

2.IBM cloud services:

Steps:

1. Create an account in IBM cloud using your email ID
2. Create IBM Watson Platform in services in your IBM cloudaccount
3. 3. Launch the IBM Watson IoT Platform
4. Create a new device
5. Give credentials like device type, device ID, Auth. TokCreate API key and store API key and token elsewhere



PYTHON CODE:

```
import timeimport sys
import ibmiotf.applicationimport ibmiotf.device import random
```

#Provide your IBM Watson Device Credentials

```
Organization = "639sac" deviceType = "Nodemcu"deviceId = "12345" authMethod =
"token" authToken="1234567890"
```

 # 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 Exception as e:
   print("Caught exception connecting device: %s" % str(e))sys.exit()
```

 # Connect and send a datapoint

```
deviceCli.connect()

while True:
      temp=random.randint(0,100) # Temperature value Humid=random.randint(0,100) #
      Humidity value moisture = random.randint(0,100) # Soil moisture value

      data = { 'temp' : temp, 'Humid': Humid, 'Moisture' : moisture }
```

#print data

```
      def myOnPublishCallback():
            print ("Published Temperature = %s C" % temp, "Humidity = %s
      %%" % Humid, "Soil Moisture = %s %%" % moisture, "to IBMWatson")

      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

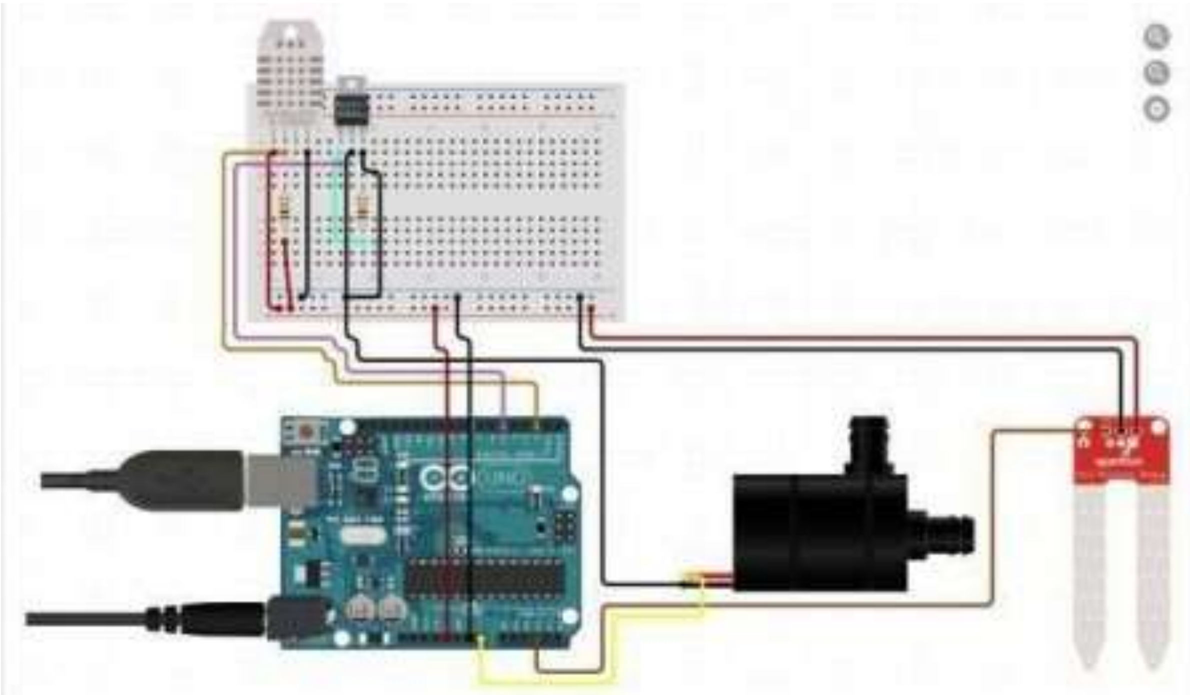
```
        deviceCli.disconnect()
```

Arduino Code:

```
#include "Arduino.h"#include "dht.h"
#include "SoilMoisture.h"
#include "Pump.h"

#define DHT_PIN 2
#define SOILMOISTURE_PIN A3#define WATERPUMP_PIN 5
dht DHT;int c=0;

void setup()
{
    Serial.begin(9600);
    pinMode(5, OUTPUT);// Output for Pump
    delay(1000);
}

void loop()
{
  DHT.read11(DHT_PIN);
  float h=DHT.humidity;
```

```
float t=DHT.temperature;delay(1000);

float moisture_percent;int moisture_analog; moisture_analog =

analogRead(SOILMOISTURE_PIN); moisture_percent

= ( 100 - ( (moisture_analog/1023.00) *100 ) );float moist= moisture_percent;

 delay(1000);

if(moist<40)// Pump functions

{

    while(moist<40)

   {

               digitalWrite(5 ,HIGH); // Pump ON

               moisture_analog = analogRead(SOILMOISTURE_PIN);moisture_percent = (

               100 - ( (moisture_analog/1023.00)

               *100 ) ); moist=moisture_percent;delay(1000);

    }

    digitalWrite(5 ,LOW); // Pump OFF

}

if(c>=0)

{
      Serial.print("\r");

      delay(1000); Serial.print((String)"update>"+(String)"Temprature="+t+(String)"
      Humidity ="+h+(String)"Moisture="+moist);
      delay(1000);c++;
}
}
```

Circuit Diagram:



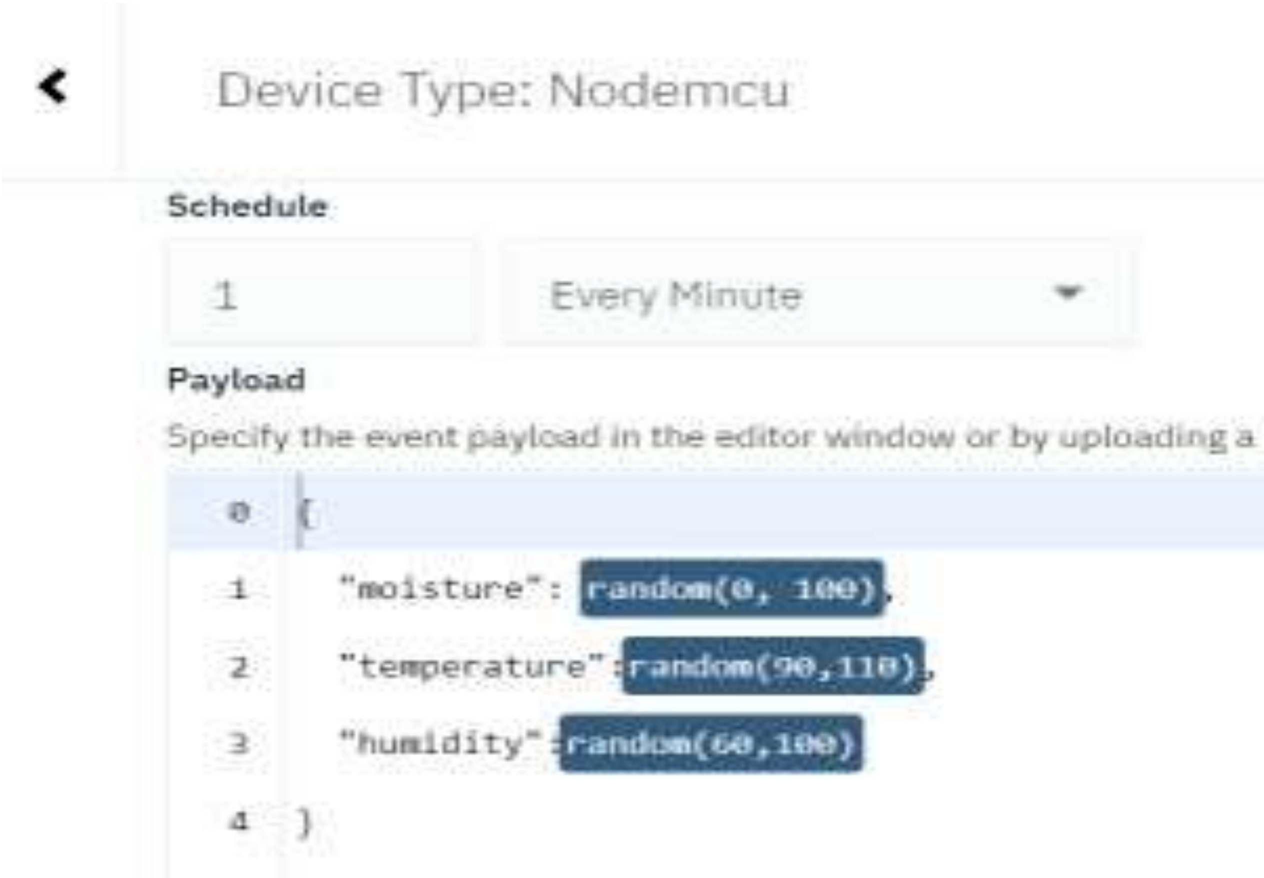
Iot Simulator to Iot Watson platform:

1.Create a device in IBM IOT Watson platformCredentials:
OrgID: 639sac
Device type: Nodemcu
Device ID: 12345
Token: 1234567890

2.For simulation give the data for temperature, humidity, moisture

3.Create an event and select the device for simulation and run the process and send data to cloud which is visible in recent events of the device.

Simulation:



Simulation Result:

Event	Value	Format	Last Received
event_1	{"moisture":97,"temperature":93,"humidity":71}	json	a few seconds ago
event_1	{"moisture":96,"temperature":106,"humidity":81}	json	a few seconds ago
event_1	{"moisture":63,"temperature":98,"humidity":94}	json	a few seconds ago
event_1	{"moisture":47,"temperature":99,"humidity":91}	json	a few seconds ago
event_1	{"moisture":67,"temperature":99,"humidity":74}	json	a few seconds ago

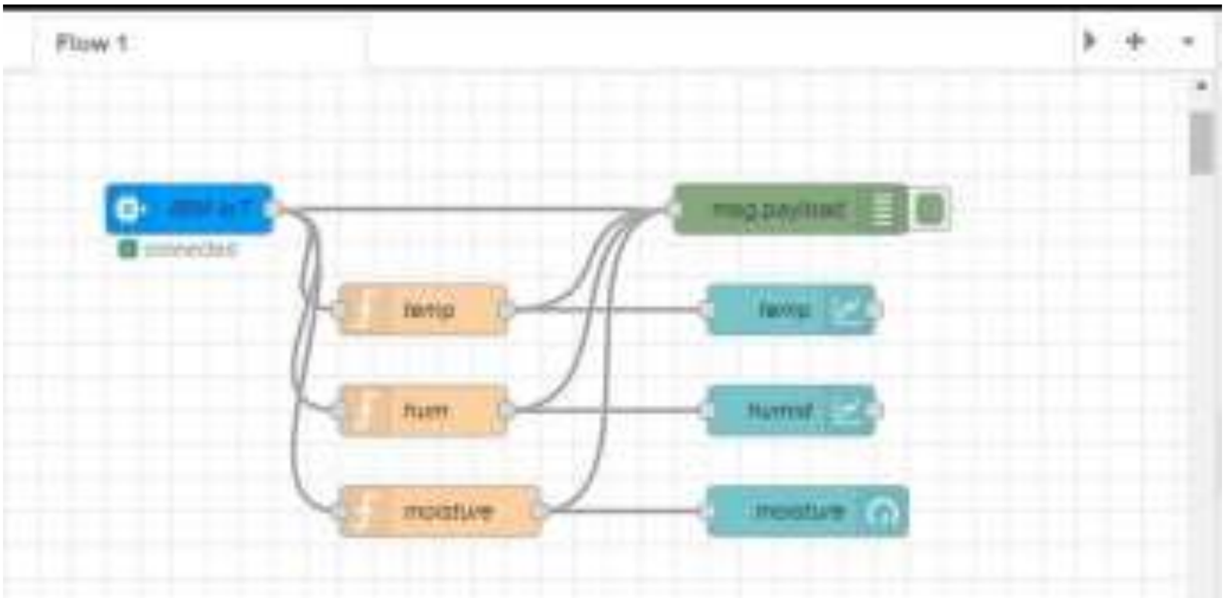
Board Creation:

1. Go to boards and create a new board by giving anyname.
2. Inside the board create new card.
3. Choose cards either in the form of line chart, donut etc
4. Send the respective data from the IBM cloud simulation to thecard.
5. Then, the respective graphs are obtained for the given data.

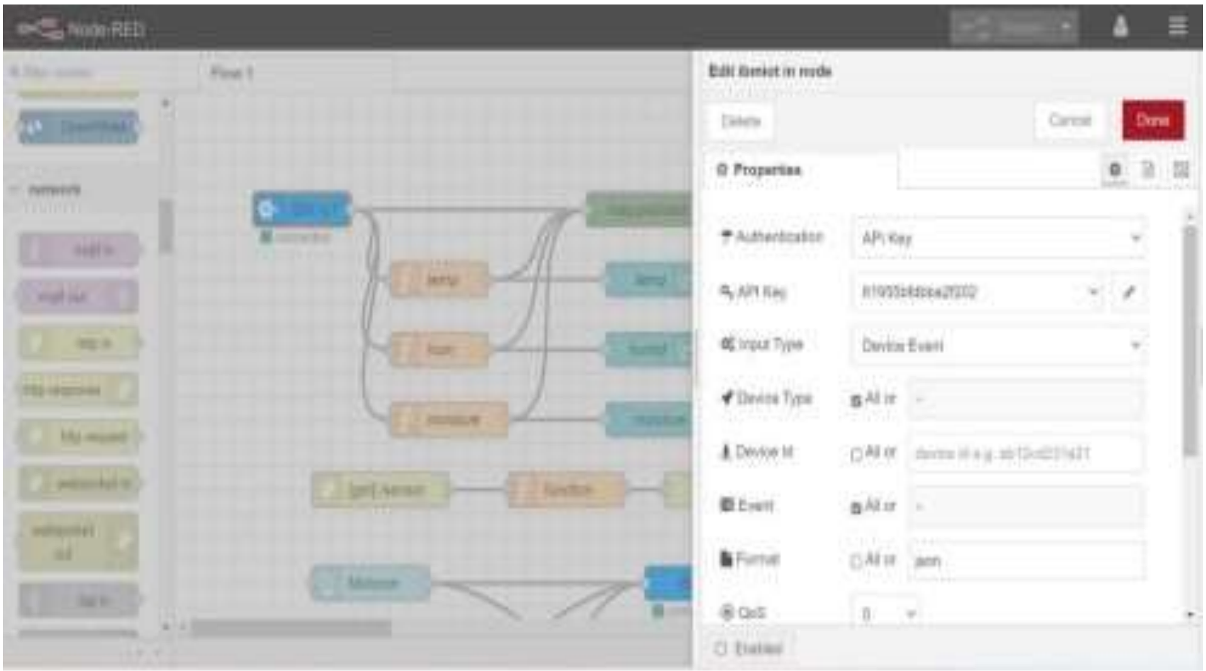
Line chart:

DONUT Charts:

Node red connection:



Connect IBM IOT to the IBM Watson Platform using API keyand API token API key: a-639sac-yo7pymp6pk
API token: rPqVaDVHeKe0xOXEpd



1.Temperature, Humidity and Moisture are in the form of function and are connected to chart and gauge.

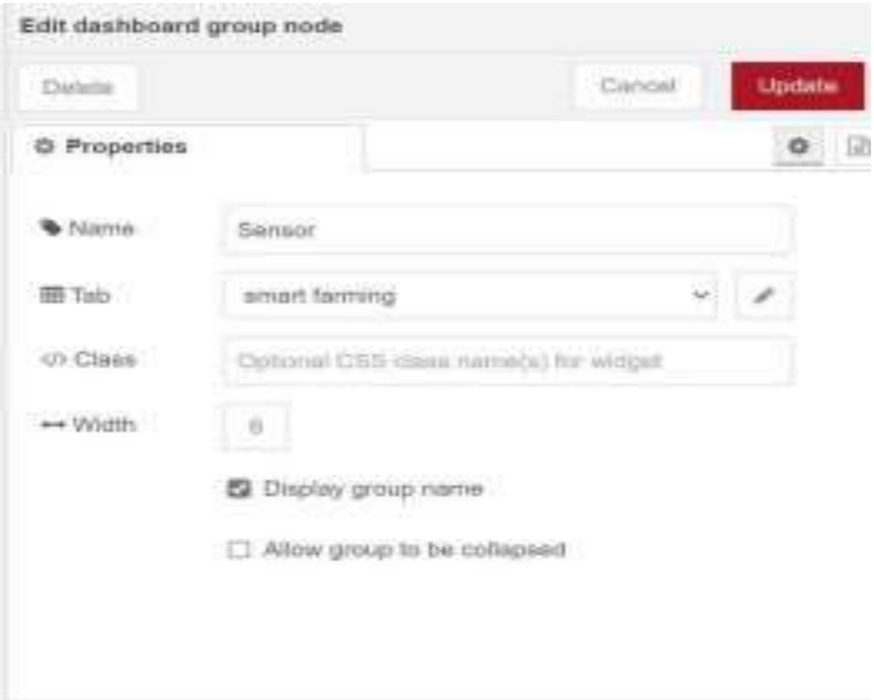
2.Function code:

msg.payload = msg.payload.temperature

This code is written to connect the output of all data to Msg payload.

3.After this separate group must be formed.

Group: Smart farmTab: Sensor



3.3a Inside the tab there will be temperature, humidity and moisture.

4. Deploy the connection and go to Manage Pallete -> node-red-dashboard -> install

5. After installing the dashboard then go the dashboard.

6. separate dialog box will be open showing the result of the node-redconnection

Result:


smart farming
temp sensor
irrigation
humid
moisture
100
90
80
70
01:00:00
01:02:00
01:04:00
01:06:00
97
temp
110
108
106
104
102
100
98
01:00:00
01:02:00
01:04:00
01:06:00

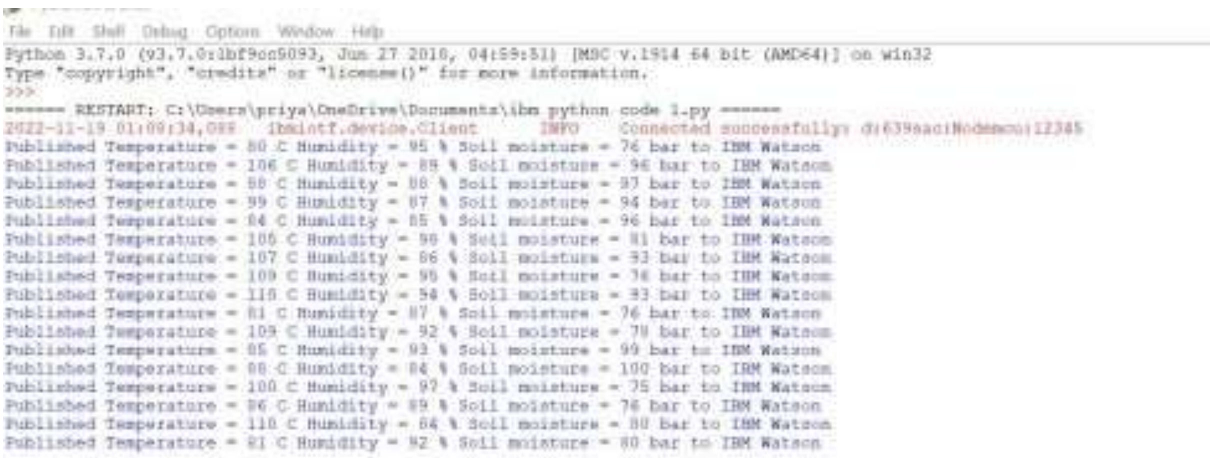

smart farming
temp sensor
irrigation
humid
moisture
18
temp

Python code connection:

1.Open PYTHON IDLE 3.7.0 and open the file which the python code isalready written.

2.Run the code by giving the device name, device ID, Authentication method and token.

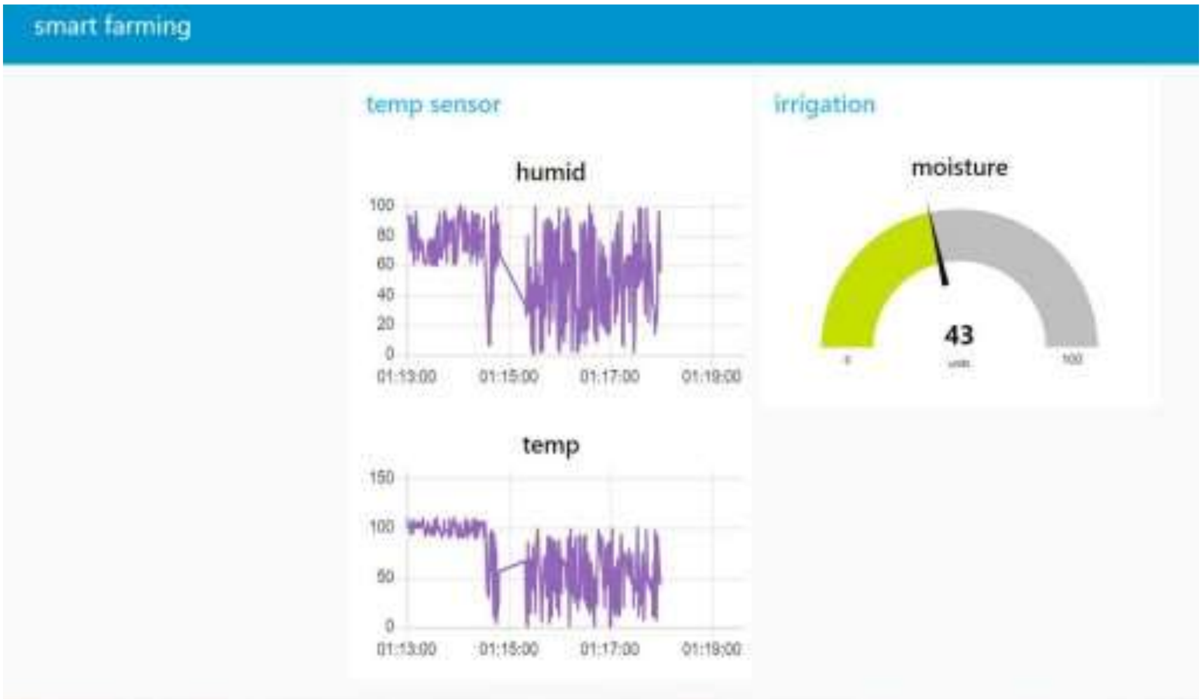
3.The following result will be obtained after the connection with IBM Watson platform.

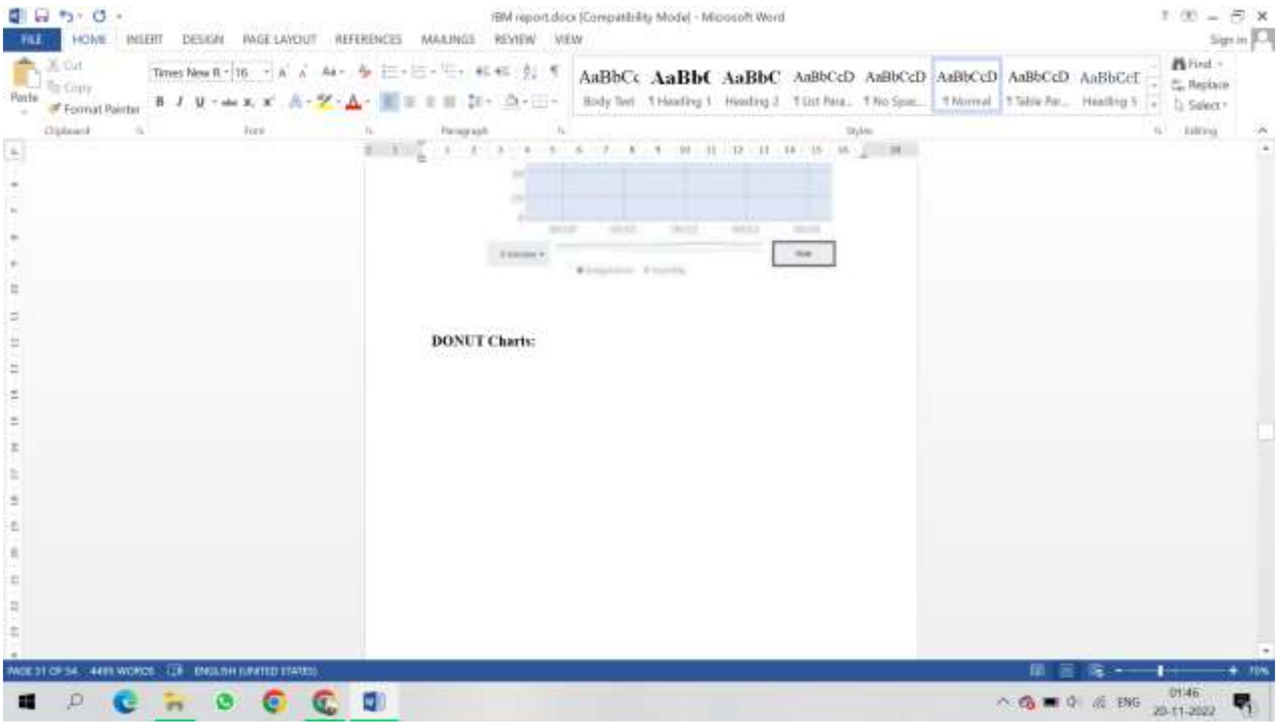


4.The data given and send in IBM platform is received here. 5.The device simulator in the IBM cloud is turned off and the data is given through the python code and the

result is obtained in Node-red dashboard.

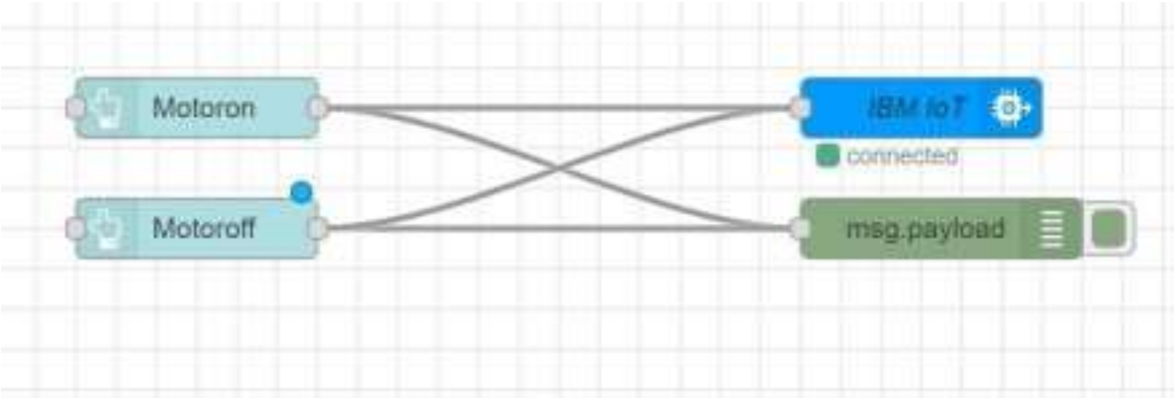
Result:


smart farming
temp sensor
irrigation
humid
100
80
60
40
20
0
01:13:00
01:15:00
01:17:00
01:19:00
moisture
43
100
temp
150
100
50
0
01:13:00
01:15:00
01:17:00
01:19:00


IBM report.docx [Compatibility Mode] - Microsoft Word
FILE
HOME
INSERT
DESIGN
PAGE LAYOUT
REFERENCES
MAILINGS
REVIEW
VIEW
DONUT Charts:

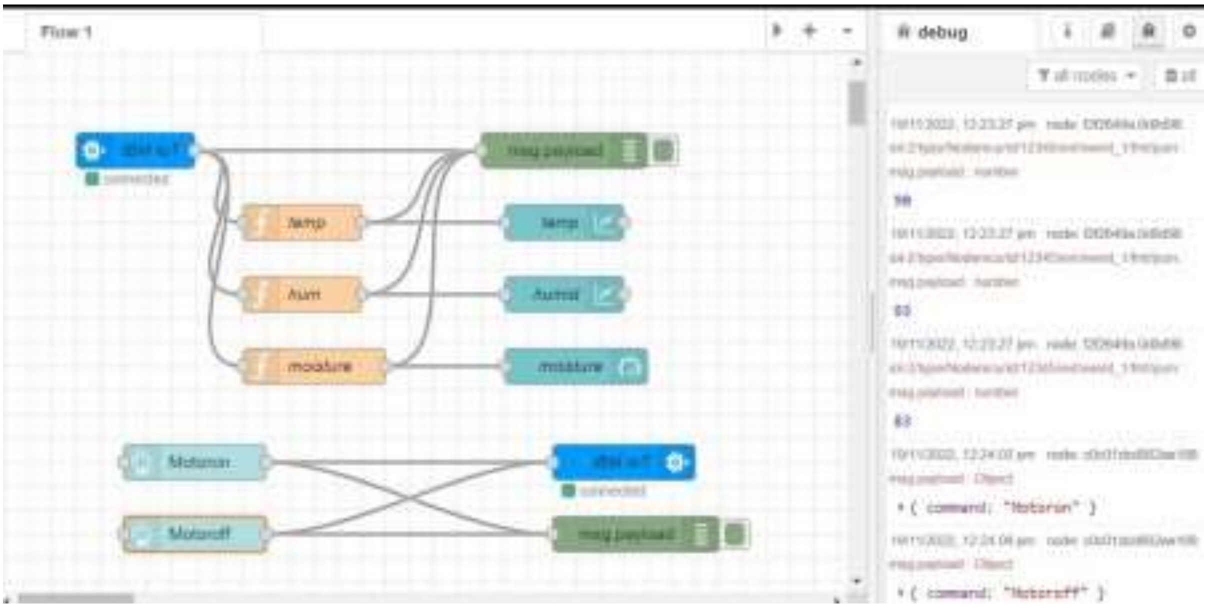
MOTOR CONNECTION:

1. Develop a node-red connection to turn on motor and turn off motor.

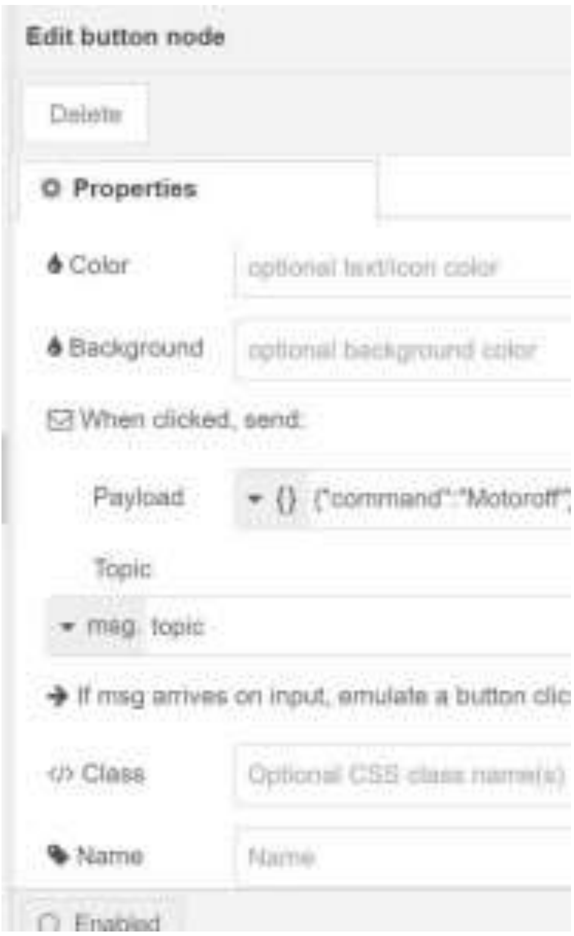


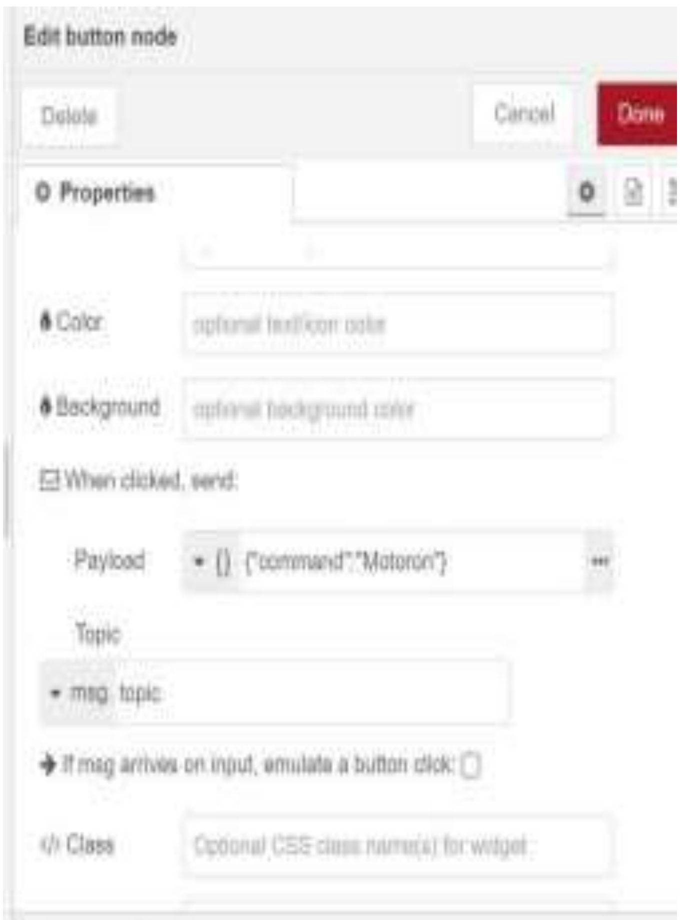
2. This new connection is visible in the dashboard as

Configuration of node-red to send commandsto IBM:



Motor on and off the format is changed as JSON and commandtype=cmd
MOTORON: MOTOROFF:





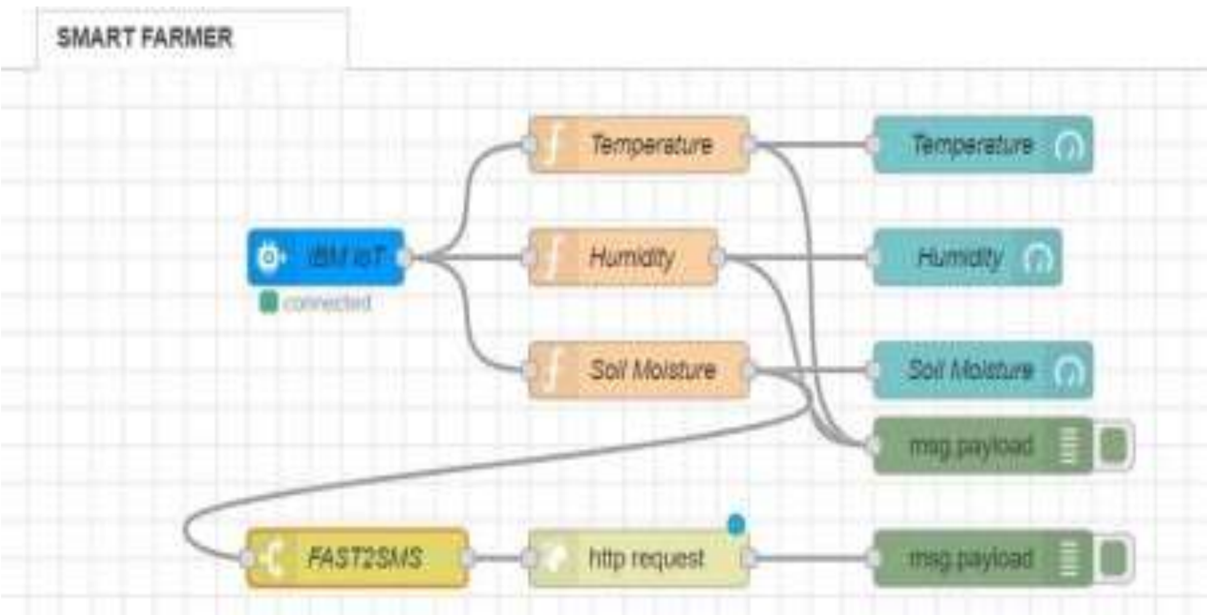
1. When “Motoron” from Node-red dashboard is touched it will show motor ison in the python code result.

```
Published Temperature = 91 C Humidity = 94 % Soil moisture = 16 % to IBM Watson
Published Temperature = 54 C Humidity = 4 % Soil moisture = 71 % to IBM Watson
Command received: Motoron
Motor is on
Published Temperature = 69 C Humidity = 73 % Soil moisture = 74 % to IBM Watson
Published Temperature = 98 C Humidity = 16 % Soil moisture = 52 % to IBM Watson
Published Temperature = 27 C Humidity = 16 % Soil moisture = 91 % to IBM Watson
Published Temperature = 20 C Humidity = 44 % Soil moisture = 54 % to IBM Watson
Published Temperature = 54 C Humidity = 85 % Soil moisture = 50 % to IBM Watson
```

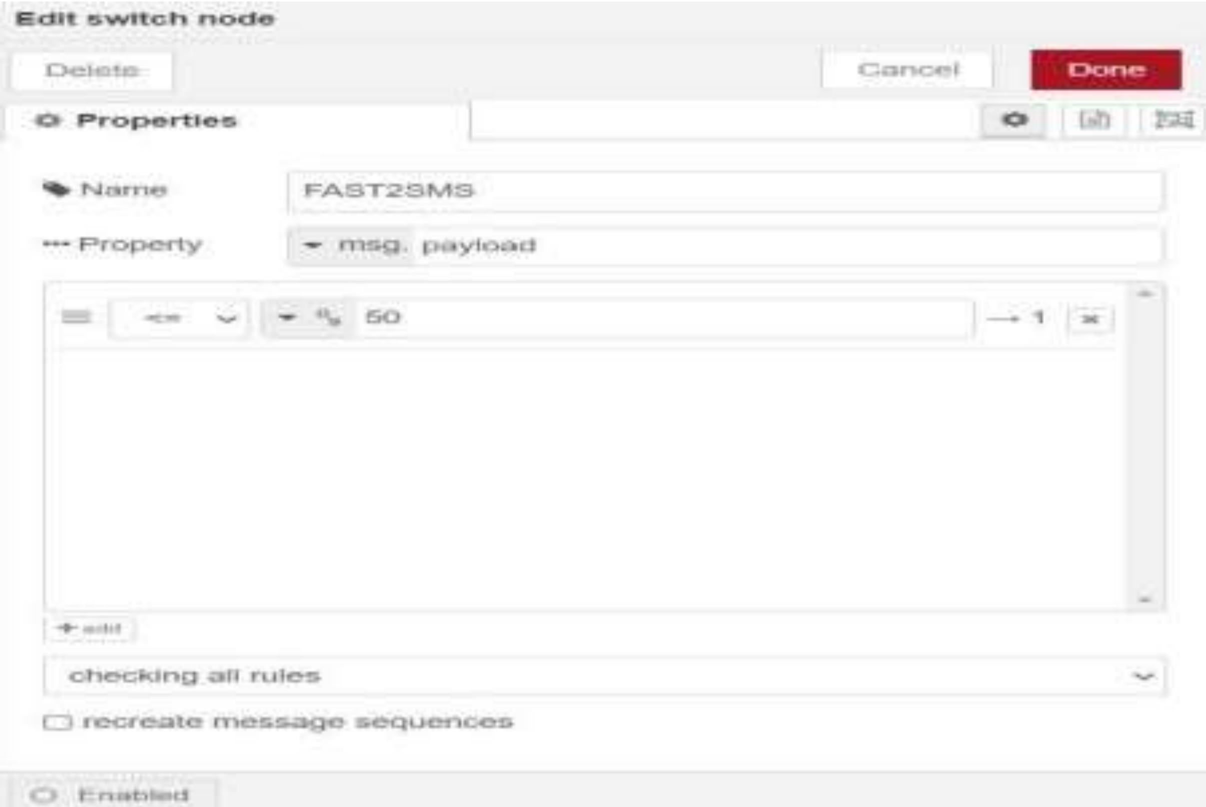
2. When it is turned off it shows “Motor is off”.

```
Published Temperature = 52 C Humidity = 62 % Soil moisture = 21 % to IBM Watson
Command received: Motoroff
Motor is off
```

Configuration of node-red with Fast2sms:



- Edit the properties of FAST2SMS Switch node
- If Soil Moisture is Less than 50, it will send the message to the particular number.

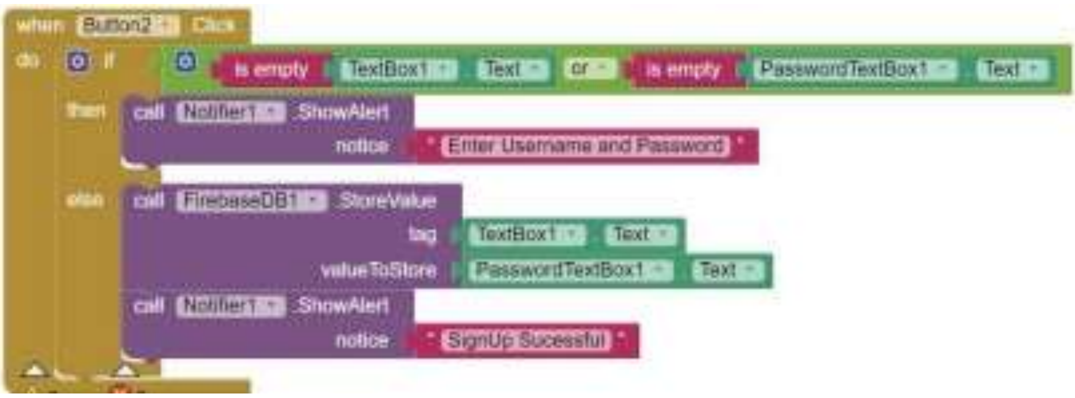


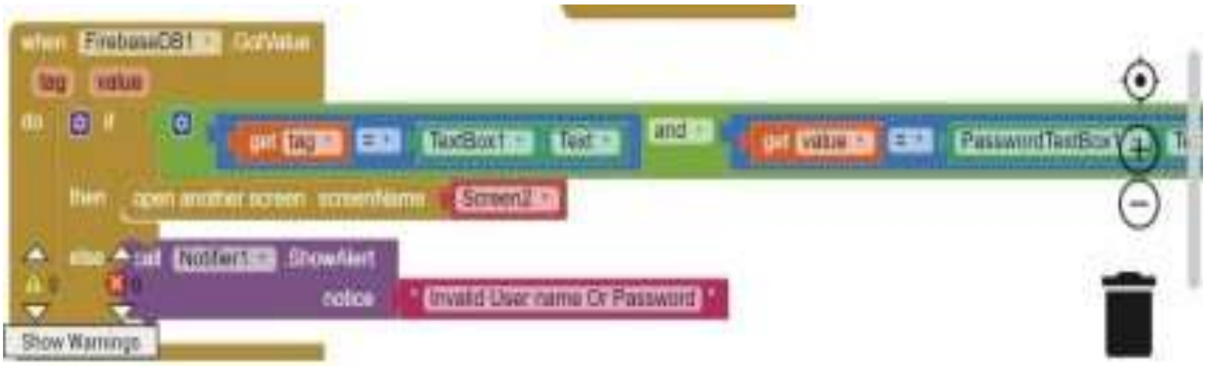
MIT APPLICATION: DESIGNER (SCREEN 1):

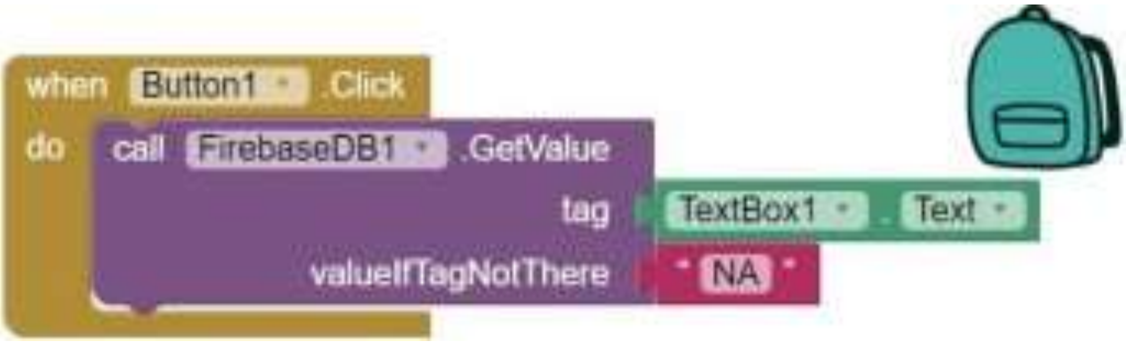
SCREEN 2:

BLOCKS:

SCREEN 1:

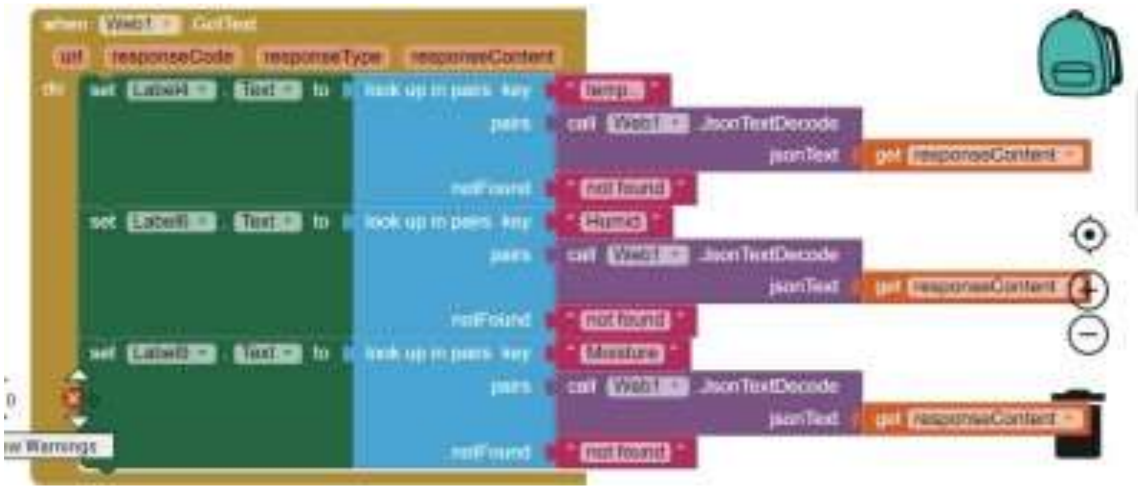


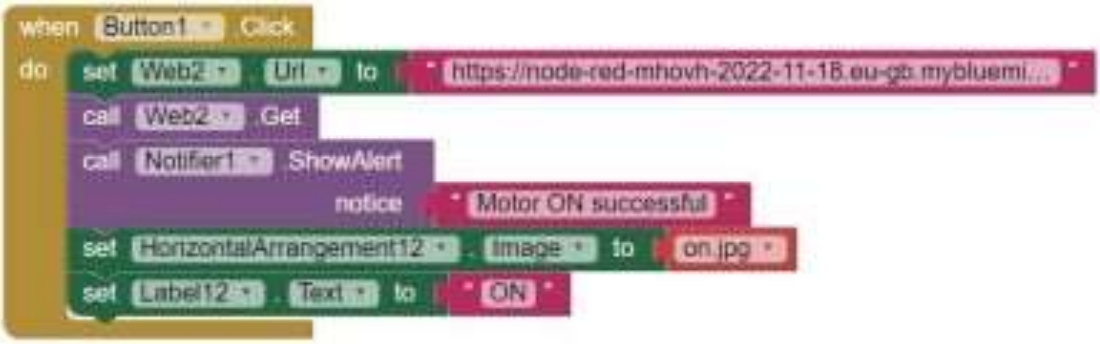

when FirebaseDB1 .GotValue
tag value
do if
get tag = TextBox1 . Text and get value = PasswordTextBox1
then open another screen screenName "Screen2"
else call Notifier1 .ShowAlert
notice "Invalid User name Or Password"
Show Warnings

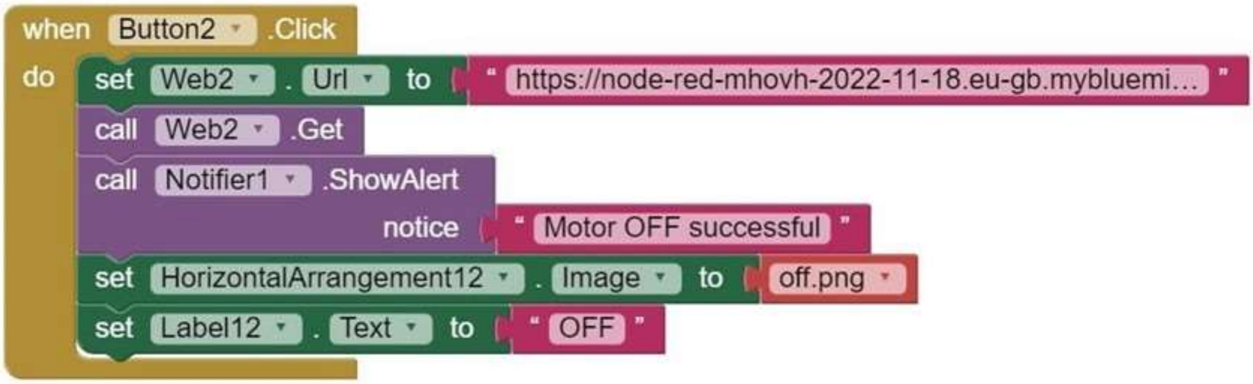

when Button1 .Click
do call FirebaseDB1 .GetValue
tag TextBox1 . Text
valueIfTagNotThere "NA"

SCREEN 2:


when Clock1 .Timer
do set Web1 . Url to "http://159.122.183.191:31618/smartfarm"
call Web1 .Get


when Web1 .GotText
url responseCode responseType responseContent
do
set Label4 . Text to look up in pairs key "temp"
pairs call Web1 .JsonTextDecode
jsonText get responseContent
notFound "not found"
set Label5 . Text to look up in pairs key "Humid"
pairs call Web1 .JsonTextDecode
jsonText get responseContent
notFound "not found"
set Label6 . Text to look up in pairs key "Moisture"
pairs call Web1 .JsonTextDecode
jsonText get responseContent
notFound "not found"


when Button1 .Click
do set Web2 . Url to "https://node-red-mhovh-2022-11-18.eu-gb.mybluemi..."
call Web2 .Get
call Notifier1 .ShowAlert
notice "Motor ON successful"
set HorizontalArrangement12 . Image to on.jpg
set Label12 . Text to "ON"

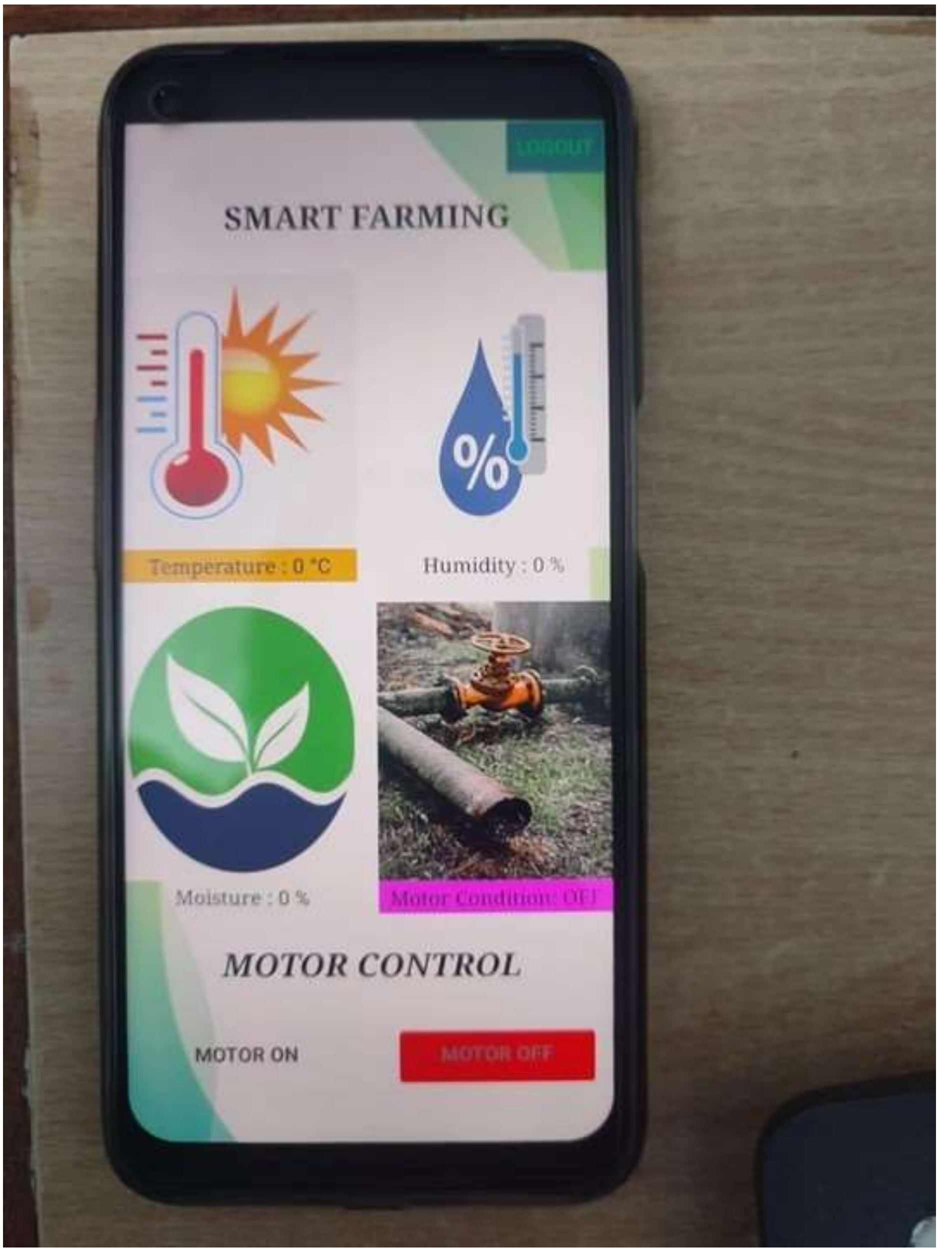

when Button2 .Click
do set Web2 . Url to "https://node-red-mhovh-2022-11-18.eu-gb.mybluemi..."
call Web2 .Get
call Notifier1 .ShowAlert
notice "Motor OFF successful"
set HorizontalArrangement12 . Image to off.png
set Label12 . Text to "OFF"


when Button3 .Click
do open another screen screenName Screen1
0
0

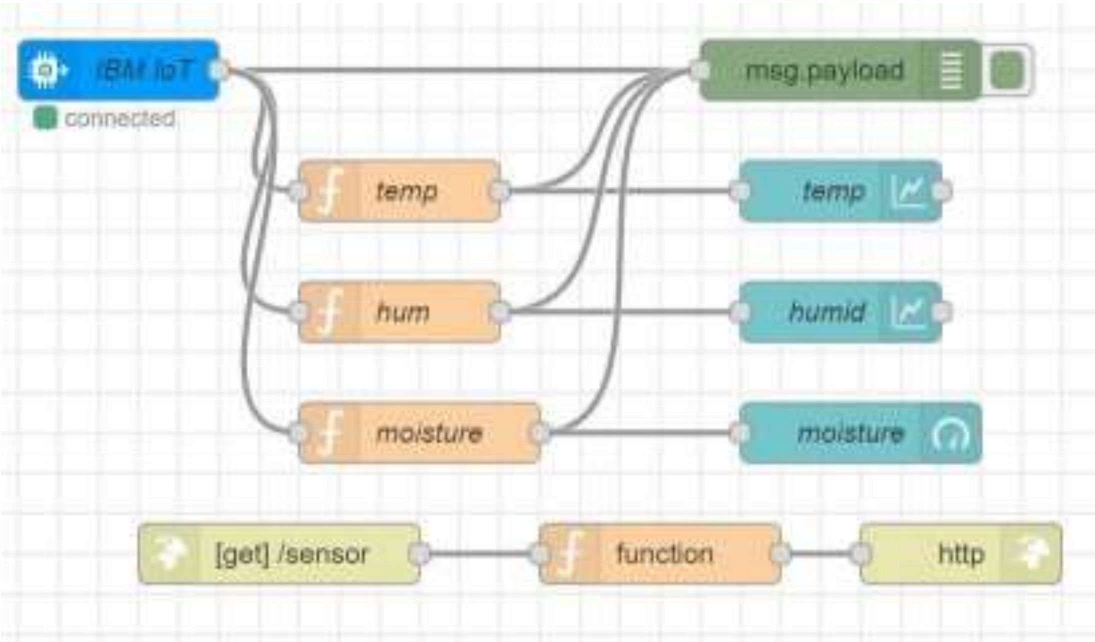
API:


YouTube
Maps
Dell
Gmail
SPV based Floating...
MIT APP INVENTOR
Projects
Connect
Build
Settings
Help
My Projects
View Trash
Guide
Report an Issue
English
kongunithish001@gmail.com
SMART_FARMING_1
Screen2
Add Screen ...
Remove Screen
Publish to Gallery
Designer
Blocks
Viewer
Built-in
Control
Logic
Math
Text
Lists
Dictionaries
Colors
Variables
Procedures
Screen2
VerticalArrangement1
HorizontalArrangen
Button3
call Web2 .Get
call Notifier1 .ShowAlert
notice "Motor OFF successful"
SMART_FARMING_1 Progress Bar
35%
Compiling part 2 (please wait)
Show Warnings

IN MOBILE PHONE:



Connection of MIT with IBM Watson:



1. The temperature function is set as globalvariable as

i. Same as temperature humidity and moisture also setas global variable for easy access.

msg.payload = msg.payload.humidityglobal.set (“h”, msg.payload)

msg.payload = msg.payload.moistureglobal.set (“m”, msg.payload) ii HTTP request and HTTP response also attached inorder to obtain input data from the MIT application.

iii URL from Node-red is analyzed and whether itaccess the data locally is checked.

Cannot GET /sensor

i. When the URL is connected to the Node-red.

YouTube Maps Dell Gmail SPV based Floating...

{"temp":90,"Humid":61,"moisture":99}

ii. While connecting the URL and deploying thefollowing data is displayed

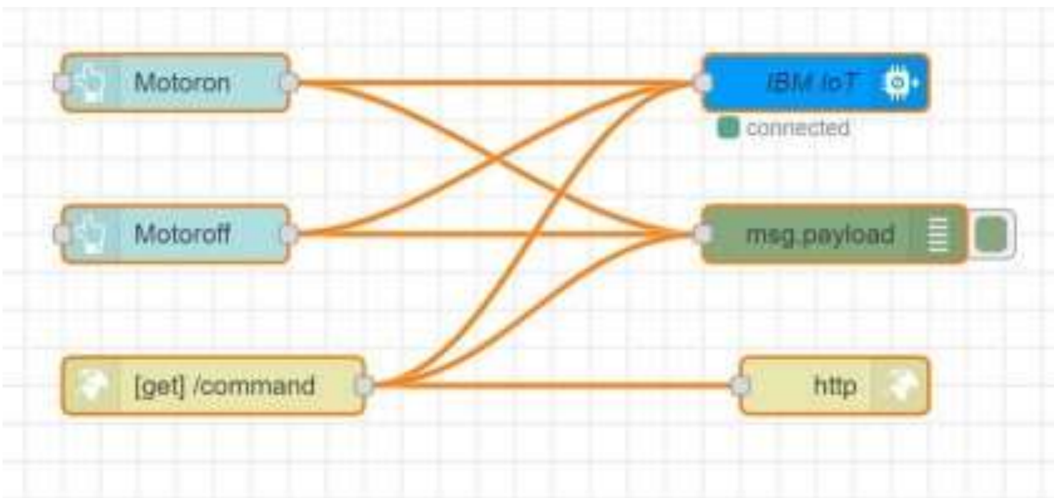
URL: https://node-red-mhovh-2022-11-18.eu gb.mybluemix.net/command?command=Motoroff

{"command":"Motoroff"}

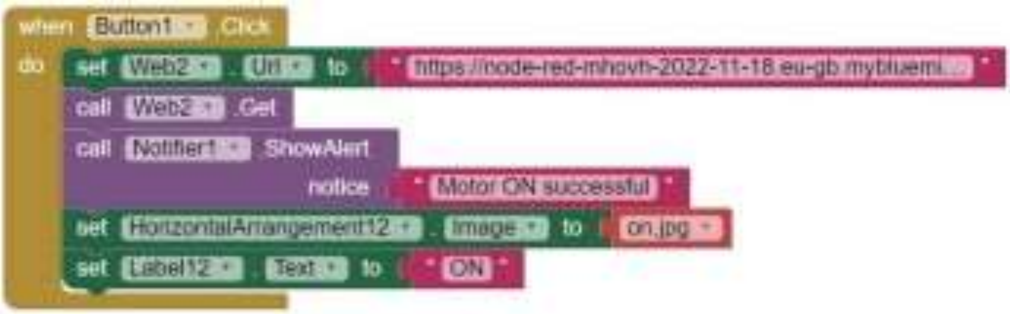
URL: https://node-red-mhovh-2022-11-18.eu gb.mybluemix.net/command?command=Motoron

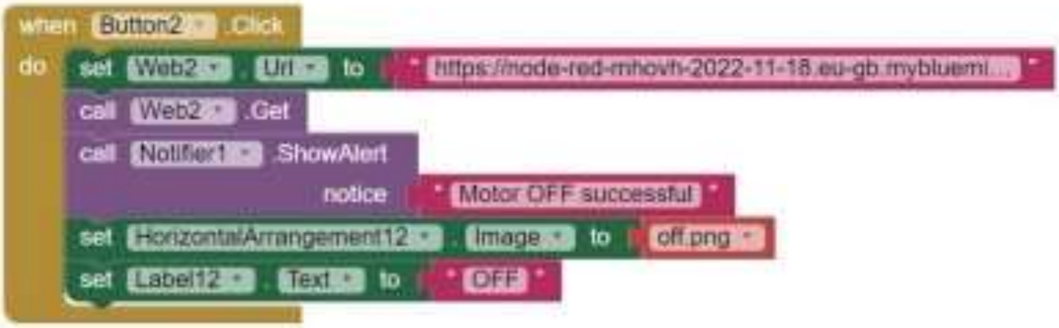
YouTube Maps Dell Gmail SPV based Floating...

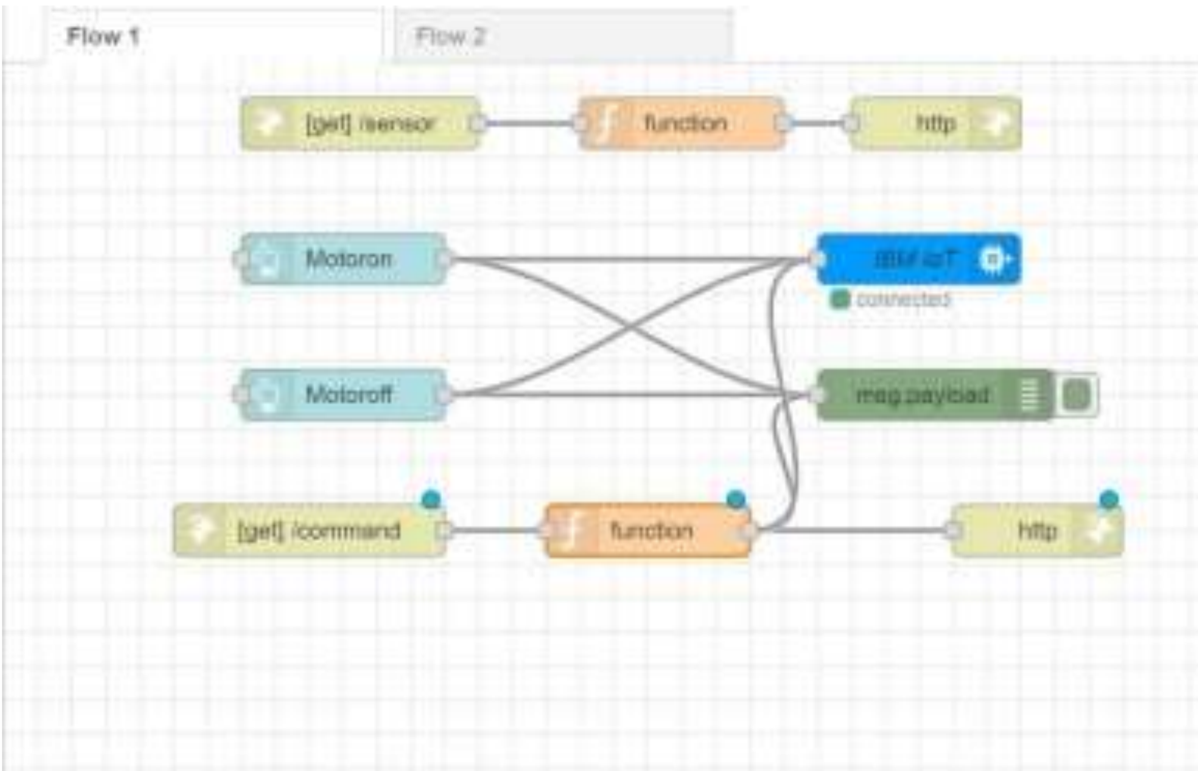
{"command":"Motoron"}



iii. Copy the link and paste it in the button 1 and 2 ofscreen 2







Python code running:

1. After when the Application connection is completed and the integration successful, the application is connected to mobile phone.
2. When the “Motoron” switch is touched in the mobile phone it shows “motor is on” in the python code.
3. When the “Motoroff” switch is touched in the mobile phone it shows “motor is off” in the python code.

Results:

```
Command received: Motoron
Motor is on
Published Temperature = 84 C Humi
Command received: Motoroff
Motor is off
Published Temperature = 35 C Humi
Command received: Motoron
Motor is on
Command received: Motoroff
Motor is off
Command received: Motoron
Motor is on
Command received: Motoroff
Motor is off
Published Temperature = 9 C Humid:
Command received: Motoron
Motor is on
Command received: Motoroff
Motor is off
Command received: Motoron
Motor is on
Published Temperature = 6 C Humid:
Command received: Motoroff
Motor is off
Command received: Motoroff
Motor is off
```

Data Received:

Event	Value	Format	Last Received
event_1	{"moisture":55,"temperature":110,"humidity":83}	json	a few seconds ago

Advantages:

1.Field can be monitored easily in the absence of farmers
2.Less labour cost
3.Soil moisture can be easily measured4.Better standards of living

Disadvantages:

1.Network connection is mandatory
2.Farmers must have awareness about use of smartphones and mobile application

8.TESTING

8.1 User Acceptance Testing:

We have asked few farmers to use our application for few weeks and asked to give their feedback about our application.The feedback will help us to improve our application and to correct the flaws.The farmers deployed our device in their fields and used our application to monitor the field.Using this application they monitored the field's temperature ,humidity and moisture content of the soil.So it was helpful to irrigate the fields at the right time using the application to switch on the motor.Through this application they saved the crop from dryness and also if the field has stagnated water it prevented them from irrigating the field.This has improved the yield of the crop and also the increased the income of the farmer.This was the feedback from the farmers who used our application.As said before it was difficult to for them to use at first but later theygot used to it and felt easy to use the application and they asked the other farmers to use the application.

9.RESULT

9.1Performance Metrics:

The application has undergone many testing and got good results.It was used to monitor the soil moisture,temperature of the open weather and humidity of the atmosphere.The received data was sent to the IBM Cloud which was connected to the cloud through IBM Watson IOT Platform and Node Red.The MIT APP INVENTOR was used to build our application.The Fast2SMS was used to send the alert message to the farmer so that he can take the right decision from where ever he his.Our device has accurately predicted the temperature,humidity and moisture content of the soil which was compared with the information collected manually.In was accessible through all the mobiles through all the networks with minimum usage of data and it was also accessible through any wifi or bluetooth connections.The speed of the application was also high and the speed was also checked.

10.ADVANTAGES

1. The ability to use soil sensing is one of the very great things about this area of farming. This component of intelligent farming allows you as a farmer to test your soil for information and measure it for a variety of significant and nutritious constituents required in ensuring the health of your farm products.
2. In order to properly control the use of real-time variable rate equipment, soil sensing is also used. This enables you to comprehend the size of your property, enabling you to devise efficient methods of saving essential farming resources like water, fertilizer, and so forth. In order to avoid harming your plants, you only need to use fertilizers and insecticides where they are necessary. Additionally, you get to minimize waste of seeds, fertilizer, water, etc. while still achieving maximum harvests. Additionally, you get access to crucial information about the volume and intensity of the air in your environment as well as its levels of sound, humidity, and temperature.
3. Minimize human effort : As IoT devices connect, communicate, and perform several tasks for us, they reduce the need for human work.
4. Saves time : It saves us time because it requires less human effort. The main resource that an IoT platform can save is time.
5. Efficient resource utilization : If we are aware of how each technology functions and how it monitors natural resources, we will be able to use resources more effectively.

DISADVANTAGES

1. The fact that smart farming requires an unrestricted or ongoing internet connection for success is a major drawback. This means that using this agricultural method in rural areas, especially in developing nations where we produce large quantities of crops, is utterly unfeasible. Smart farming won't be possible in locations with excruciatingly slow internet connections.
2. Many farmers lack the skills of employing AI and IOT. Finding someone with this level of technical proficiency is at best challenging or expensive. A lot of talented farmers may be discouraged from adopting smart farming because of its advantages and disadvantages.
3. Complexity: The huge technology to IoT system is highly complex to design, build, manage, and enable.

11.CONCLUSION

Since farmers provide food for everyone, agriculture is essential to the nation's economy. It links a wide range of businesses around the nation. Economically and socially, a nation with a sizable agricultural sector is seen as prosperous. The majority of nations depend heavily on agriculture as a source of employment. In a nation like India, irrigation makes up a considerable share of total water use. The temperature of the immediate environment, the temperature of the soil, and the relative humidity are a few of the variables that affect crop productivity. A direct correlation between agricultural irrigation and crop yield makes it essential for crop production. Successful field harvesting is heavily reliant on human supervision and expertise.

The field's water source must be protected at all costs. A major problem in modern society, water shortage has a global impact and affects people on a daily basis. In light of this, we are concerned about the likelihood of a worsening of the situation in the upcoming years. Precision farming and smart irrigation are the solutions to the difficulties raised above. Intelligent irrigation in agriculture is only made possible by the implementation of the machine learning and the internet of things. The Internet of Things (IoT) has many advantages, including increased effectiveness, reduced costs, efficient energy use, forecasting, and public convenience.

There are concerns about the dependability and security of the various data processing systems and processes. The widespread adoption of the Internet of things is being hampered by concerns regarding security and privacy. This paper suggests a system for identifying and classifying intrusions into IoT networks in agricultural areas. The precision of SVM is better than 98%, while that of random forest and logistic regression is less than 78%.

12.FUTURE SCOPE

For future improvement, we consider using time-series analysis to predict future values based on
previously observed values. Also, we can broaden our scope by also adding other parameters such as soil quality, agricultural inputs, soil nutrients, irrigated area. These parameters should account for anomalies in the data, as well as improve the accuracy by multi-fold. Unsupervised clustering to label data for classifiers will also improve accuracy. Also, we planned to use IoT based computer vision system using deep learning models to improve the quality of production in the smart farming field.

Source Code

import ibmiotf.application import ibmiotf.deviceimport random

#Provide your IBM Watson Device Credentials

Organization ="639sac" deviceType = "Nodemcu" deviceId = "12345"
authMethod = "token" authToken="1234567890"

 # 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")
```

Github link

https://github.com/IBM-EPBL/IBM-Project-23279-1659876305