# Smart Farmer-IOT Enabled smart farming Application Team ID: PNT2022TMID14185

**TEAM MEMBERS:**

# R.SWEDHA - TEAM LEAD S.L.NIVETHA -MEMBER 1

**B.SNEHA-MEMBER 2**

# M.RAVEENA-MEMBER 3

**S.YOGALAKSHMI-MEMBER 4**

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# SMART FARMING

**INTRODUCTION:**

PROJECT OVERVIEW:

This is system that enables framers to monitor and their forms with a web based application build with Node-RED.

It uses the IBM IOT Watson cloud platform as its Backend.

**PURPOSE:**

Smart Farming reduce the ecological foodprint of farming. Minimized or site specific application of inputs, such as fertilizers and pesticides ,in precision agriculture systems will mitigate leaching problems as well as the emission ofgreenhouse gases.

1. **LITERATURE SURVEY:**

### EXISTING PROBLEM:

The biggest challenges faced by IoT in the agriculturalsector are lack of information, high adoption costs , and security concers , etc. Most of the farmers are not aware of the implementationof IoT in agriculture.

### REFERENCES:

It is the application of modern ICT (Information and Communication Technologies) into agriculture. In IOT- based smart farming, asystem is built for monitoring the crop field with the help of sensors (light, humidity, temperature, soil moisture, etc.). The farmers can monitor the field conditions from anywhere.

### PROBLEM STATEMENT DEFINITION:

Overuse of pesticides and fertilizer in agricultural fields leads to destruction of the crop as well as reduces the efficiency of the field increasing the soil vulnerability toward pest. IoT applications may be used to update the farmer/user about type & quantity of pesticide required by the crop.

### ABSTRACT:

* 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.

**Project objectives**

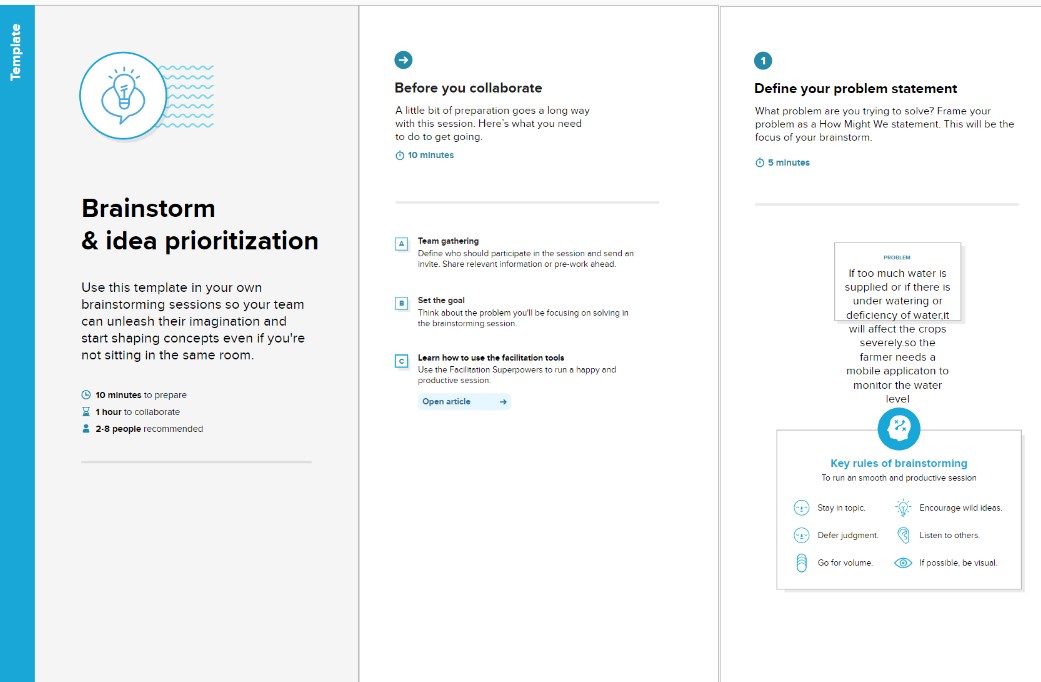
* + 1. Sustainably increasing agricultural productivity and incomes 2.Adaptating and building resilience to climate change

3.To increase agricultural production and income of farmers

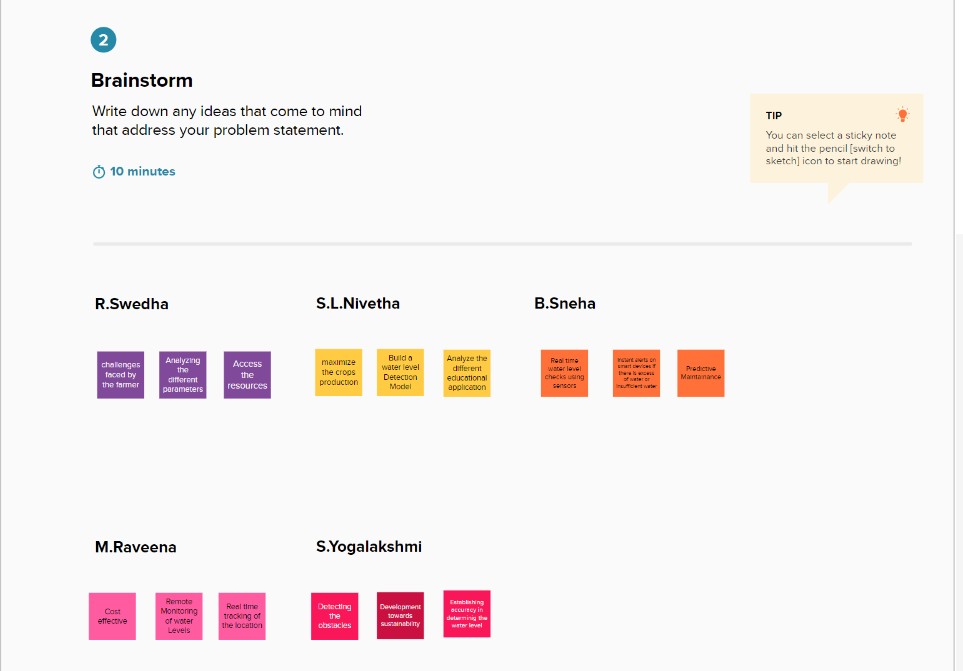
**Ideation phase**

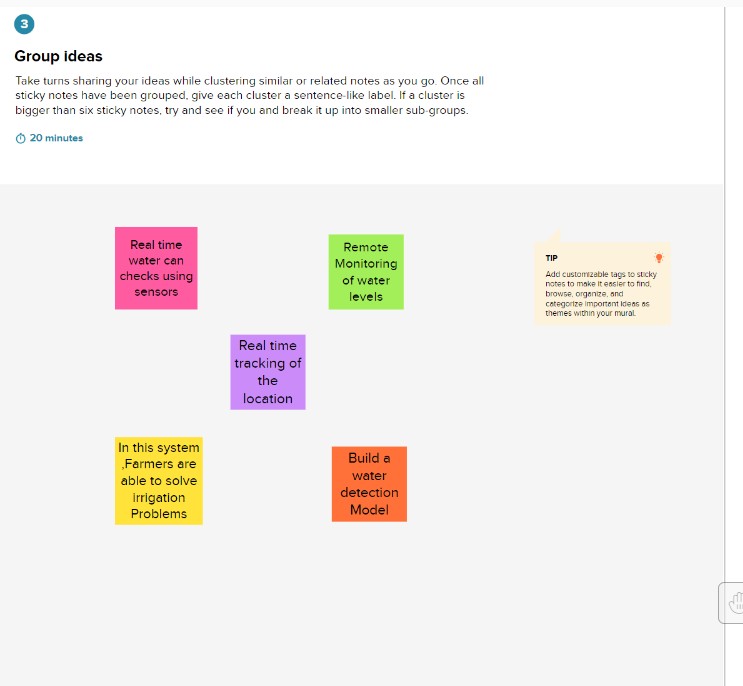
**Brainstorm and idea Prioritization Template**

## Step-1: Team Gathering , Collaboration and Select the problem Statement



### Step-2: Brainstorm, Idea Listing and Grouping

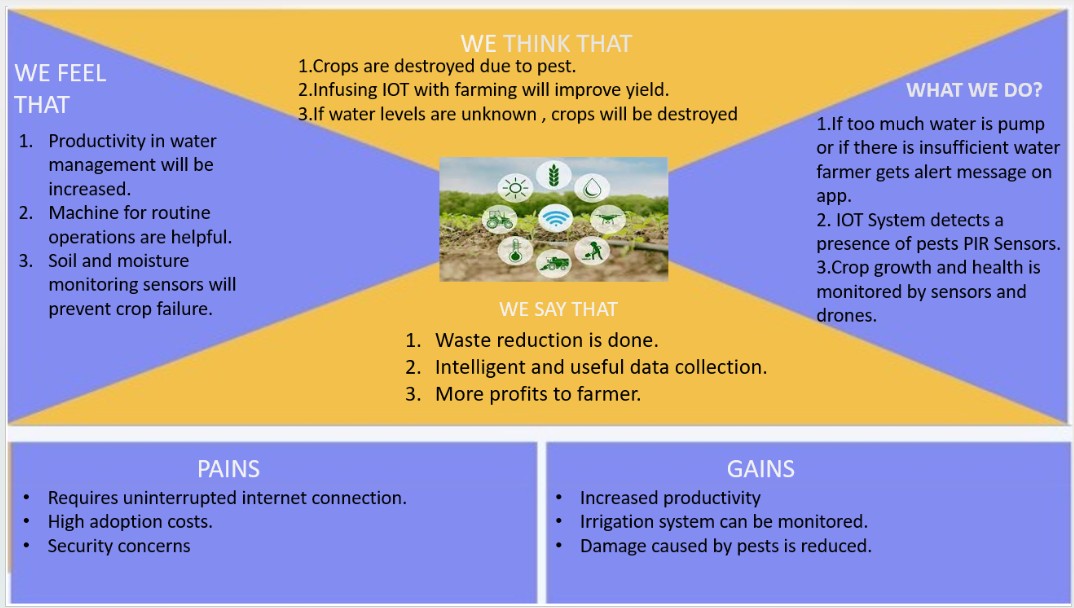




Step-3: Idea Prioritization:



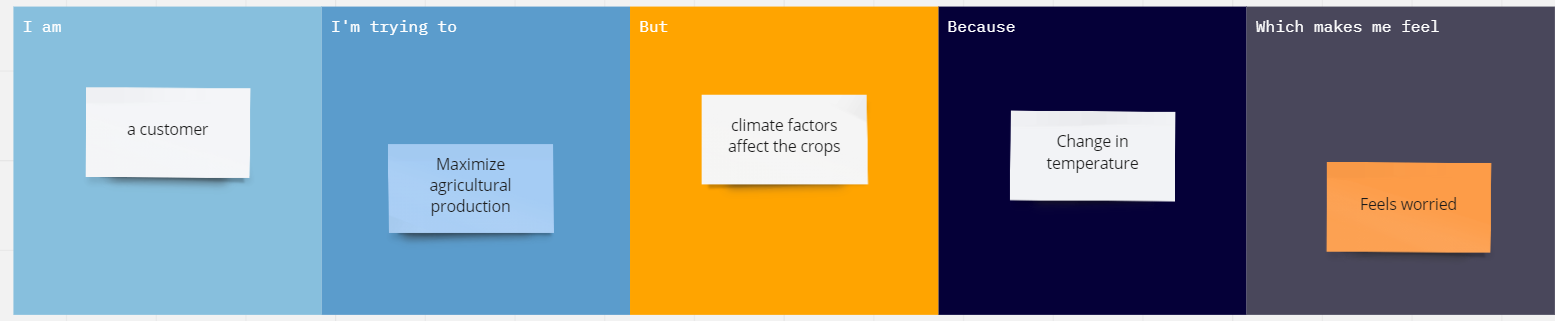
### Empathy Map Canvas



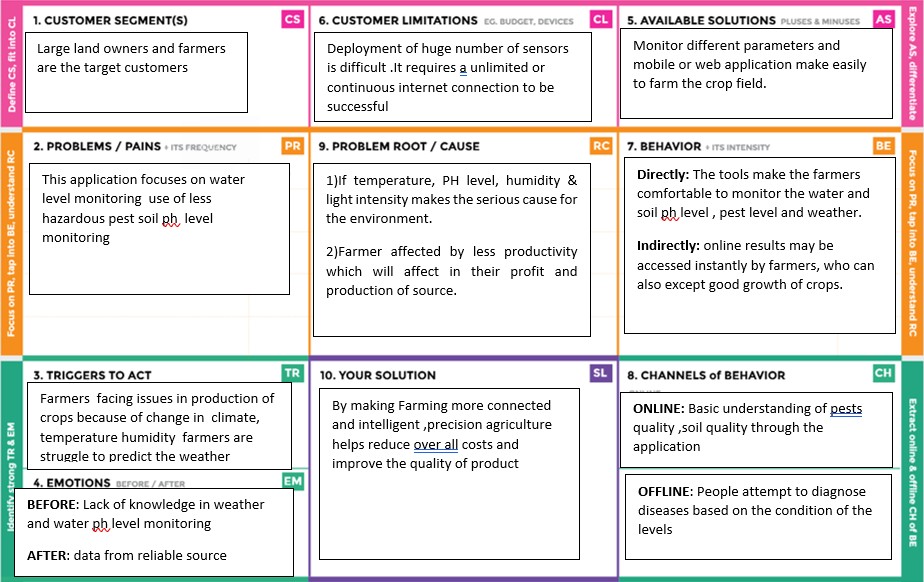
Deﬁne the problem statements

#### Customer Problem Statement Template

Create a problem statement to understand your customer's point of view. The Customer Problem Statement template helps you focus on what matters to create experiences people will love.



**PROJECT DESIGN PHASE-I PROBLEM SOLUTION FIT**



# Proposed Solution Template:

|  |  |  |
| --- | --- | --- |
| **s.no** | **Parameter** | **Description** |
| 1. | Problem statement (Problem to be  solved) | Overuse of pesticides and  Fertilizers in agricultural ﬁelds leads to destruction of the crops as well as reduces the eﬃciency of  the ﬁeld |
| 2. | Idea/ Solution description | Integrated pest management ,  sustainable agriculture techniques such as poly culture, Agronomic practices, use of less hazardous  pesticides |
| 3. | Novelty/Uniqueness | Lots of new research in terms of  smart IOT based products to facilitate smart farming in terms of pest management .It is developed for monitoring of  pesticides level through sensors |
| 4. | Social Impact/customer satisfaction | Improving productivity ,  protection of crop losses and  disease control |
| 5 | Business model (Revenue model) | The project involves  Thermography sensors which is  cheaper than the existing ideas |
| 6. | Scalability of the solution | Based on all the inputs from the  system ,it recommends the good  quality fertilizer to the soil |

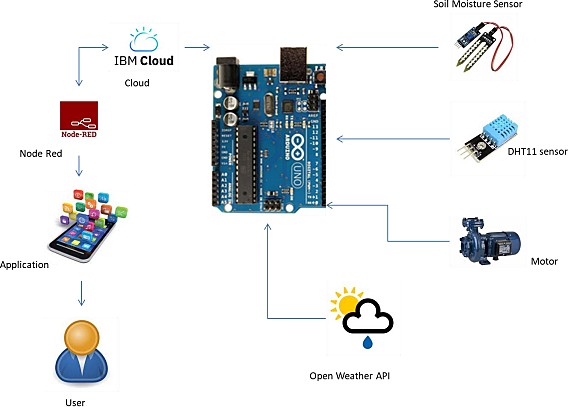
**Solution Architecture:**

Solution architecture is a complex process – with many sub-processes – that bridges the gap between business problems and technology solutions. Its goals are to:

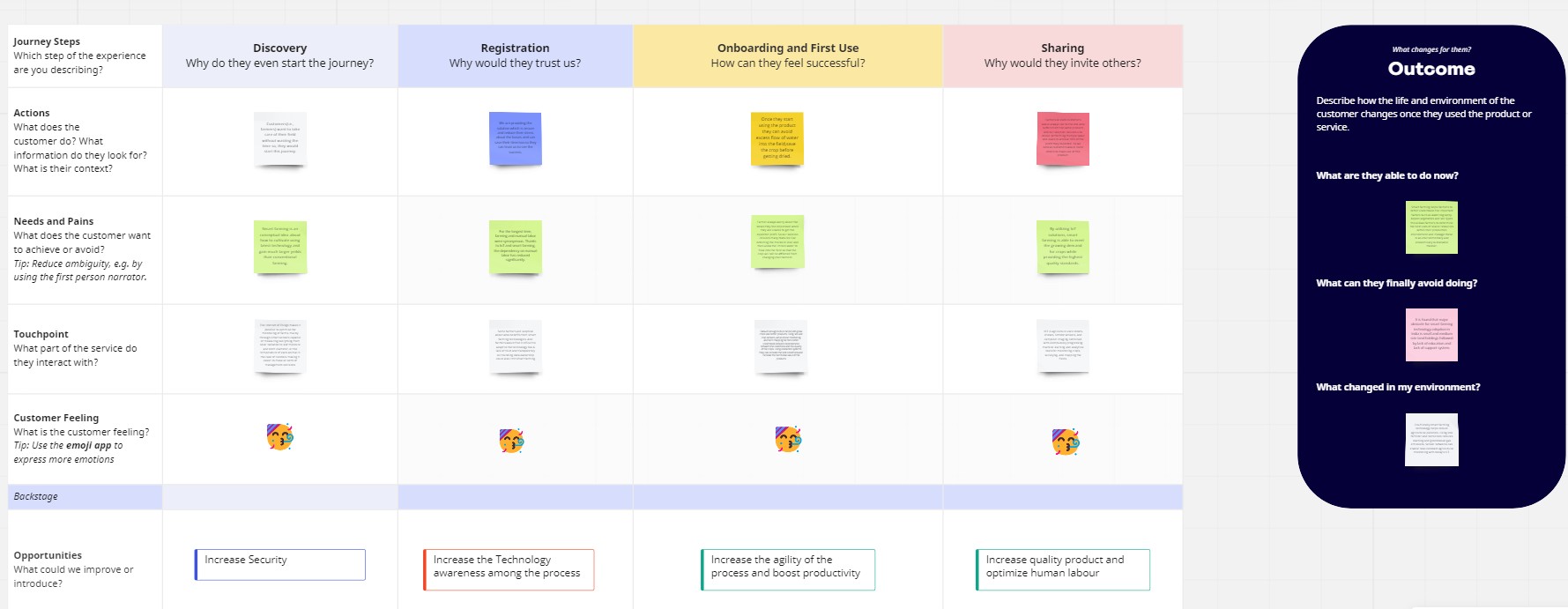
1. Find the best tech solution to solve existing business problems
2. Describe the structure, characteristics, behaviour , and other aspects of the software to project stakeholders.
3. Deﬁne features, development phases, and solution requirements.
4. Provide speciﬁcations according to which the solution is deﬁned, managed,

and delivered.

### Solution Architecture Diagram



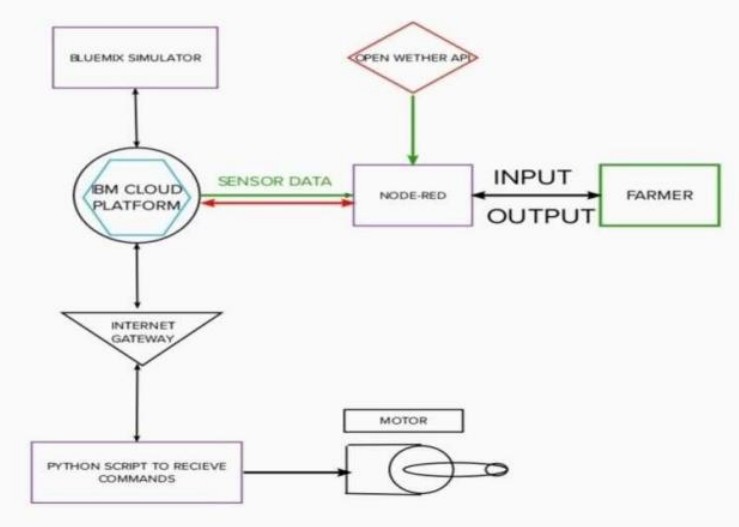
**Phase-II**

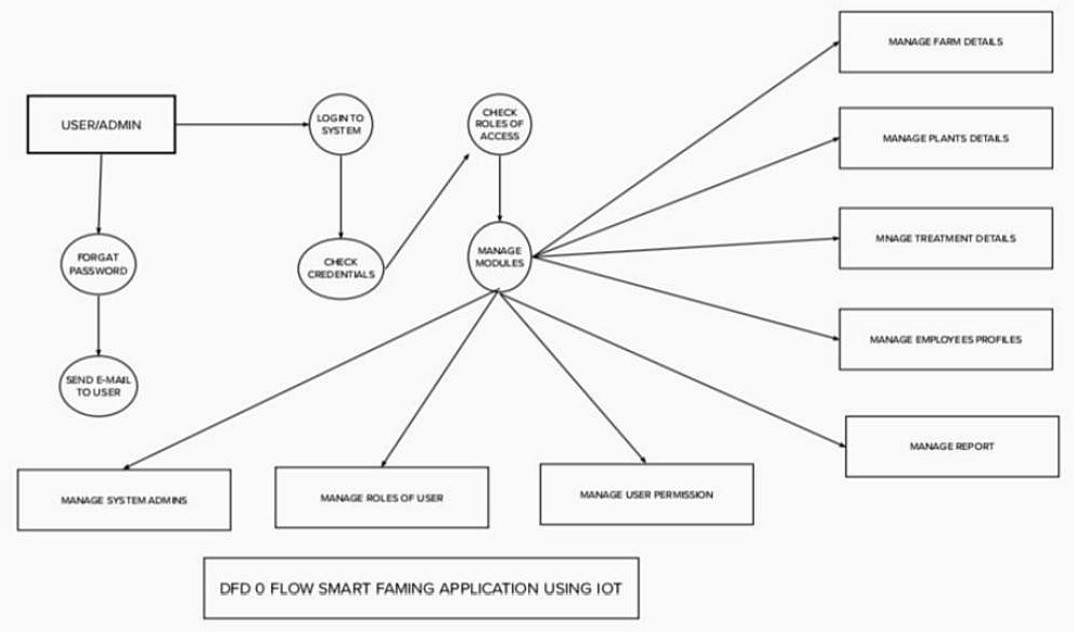
**CUSTOMER JOURNEY MAP**

# Data Flow Diagram & User Stories

#### 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.





**User Stories**

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

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| **User type** | **Functional Requirement**  **(Epic)** | **User Story**  **Number** | **User Story / Task** | **Acceptance criteria** | **Priority** | **Release** |
| Customer (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 |
| Customer (Web user) | Dashboard | 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 |
|  | Registration | USN-3 | As a user, I can register for the application through  Facebook |  | 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 |  |  |  |  |  |
| Customer (Web user) |  |  |  |  |  |  |

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| Customer  Care Executive | Help | USN-1 | As a user, if I  have any queries or issues , I can reach out to the Support team | I will receive  a reply from the support team that my message is accepted and later my queries or issues will be resolved | Medium | Sprint-3 |
| Administrator | Management | USN-1 | As a user, I  need the resource management team to use quality products at the reasonable price | I get a  warranty card and details about the product | Medium | Sprint-4 |
|  |  | USN-2 | As a user , if I  didn’t receive a quality product  ,I want a refund. | I can receive  a free service or a change of product | Medium | Sprint-4 |

**Functional Requirements:**

Following are the functional requirements of the proposed solution

|  |  |  |
| --- | --- | --- |
| **FR No.** | **Functional Requirement (Epic)** | **Sub Requirement (Story / Sub-Task)** |
| **FR-1** | a. ***User Registration*** | 1. ***Registration through Gmail*** 2. ***Registration through phone number*** |
| **FR-2** | b. ***User Conﬁrmation*** | 1. ***Confirmation via Email*** 2. ***Confirmation via OTP*** 3. ***Confirmation via verification link sent to registered mail id*** |
| **FR-3** | c. ***Roles and service*** | 1. ***Choose roles (ex: farmer, student etc.)*** 2. ***Enter the personal details.*** 3. ***Choose the type of service or options (ex: irrigation, pest management, crop*** |

|  |  |  |
| --- | --- | --- |
|  |  | ***management etc.)*** |
| **FR-4** | d. ***Terms and conditions*** | 1. ***Accepts the terms and condition for the chosen role and options*** |
| **FR-5** | e. ***Details of farm and plans*** | 1. ***Enter the details of farming land and vegetation.*** 2. ***Choose the crop you want to plant*** 3. ***Choose the types of plans (ex: regular and premium)*** |
| ***FR-6*** | f. ***Details according to farm information*** | 1. ***Check the weather information*** 2. ***Enter the soil nutrient and pH value*** 3. ***click SAVE*** 4. ***Soon the details will share to registered mail*** 5. ***EXIT*** |

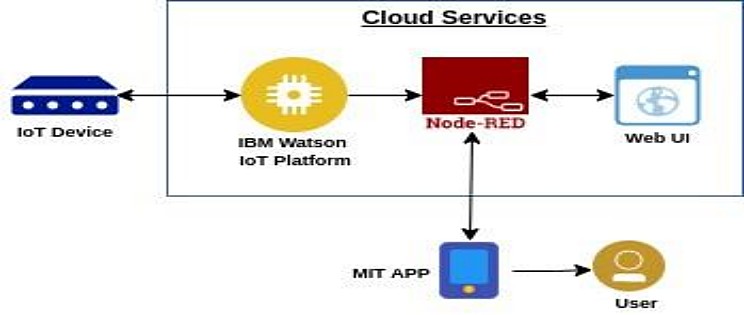
**Non-functional Requirements:**

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

|  |  |  |
| --- | --- | --- |
| **FR No.** | **Non-Functional Requirement** | **Description** |
| ***NFR-1*** | a. ***Usability*** | 1. ***A system is built for monitoring the crop ﬁeld with the help of sensors and automating the irrigation***  ***system and helps the farmer to***  ***understand the important aspects.*** |
| ***NFR-2*** | b. ***Security*** | 2. ***Applications must be designed with the security of their use in mind.***  ***This includes personal data and***  ***their user’s well-being.*** |
| ***NFR-3*** | c. ***Reliability*** | 1. ***It allows farmers to maximize***  ***yields using minimum resources*** |

|  |  |  |
| --- | --- | --- |
|  |  | ***such as water, fertilizers, seeds etc.*** |
| ***NFR-4*** | d. ***Performance*** | 2. ***It increases eﬃciency and reduce the environmental impacts and to implement technology properly to***  ***minimize cost.*** |
| ***NFR-5*** | e. ***Availability*** | 3. ***This concept focused on providing the agricultural industry with the infrastructure to leverage advanced***  ***technology.*** |
| ***NFR-6*** | f. ***Scalability*** | 4. ***It provides the recognition of each object that makes up a solution and ensure communication. The***  ***system must remain operational***  ***regardless.*** |

### TECHNOLOGY ARCHITECTURE



**Project Planning Phase Prepare Milestone& Activity List**

|  |  |  |  |
| --- | --- | --- | --- |
| **S. NO** | **ACTIVITY TITLE** | **ACTIVITY DESCRIPTI ON** | **DURATI ON** |
| 1 | **Understanding the project** | Assign the team members afterthat create repository in the GitHub and then assigntask to each member and guide them how to access the GitHub whilesubmitting the  assignments | 1 week |
| 2 | **Staring The Project** | Team Members to Assign All the Tasks Based on Sprints and Work on It  Accordingy. | 1 week |

|  |  |  |  |
| --- | --- | --- | --- |
| 3 | **Completing Every Task** | Team Leader  shouldensure that whether every teammember  have completed the assigned taskor not | 1 week |
| 4 | **Stand Up Meetings** | Team LeadMust Have  a Stand-Up Meeting with The Team and Work on The Updates and Requirement Session | 1 week |

|  |  |  |  |
| --- | --- | --- | --- |
| 5 | **Deadline** | Ensure that team members are completing every taskwithin the  deadline | 1 week |
|  | **Budget and Scope**  **ofproject** | Analyze the |  |
| 6 | overall budget  which must be | 1 week |
|  | within certainlimit |  |
|  | it |  |
|  | should be |  |
|  | favorable toevery |  |
|  | person |  |

### Sprint Delivery Plan

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| **Sprint** | **Functional Requireme nt(Epic)** | **User Story Numb er** | **User Story/Task** | **Story Poin ts** | **Priori ty** | **Team Member** |
| **Sprin t-1** | Registration (Farmer MobileUser) | UNS-1 | As a user, I can register for the application by entering my email, password, and confirming my password. | 2 | High | R.Swedha (Leader) |
| **Sprin t-1** | Login | UNS-2 | As a user, I will receive confirmati on email once I have registered  for the | 1 | High | S.L.Nivet ha (Member 1) |
|  |  |  | application |  |  |  |

**Product Backlog, Sprint Schedule, and Estimation**

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| **Sprin t-2** | User Interface | UN S-3 | As a user, I can registerfor the application through  Facebook | 3 | Low | B.Sneha (Member 2) |
| **Sprin t-1** | Data Visualizati on | UN S-4 | As a user, I can register  for the | 2 | Medi um | M.Raveena (Member 3) |
|  |  |  | applicati |  |  |  |
|  |  |  | onthrough |  |  |  |
|  |  |  | GMAIL |  |  |  |
| **Sprin t-3** | Registration (Farmer - WebUser) | USN  - 1 | As a user, I can log intothe application by entering email and  password | 3 | High | S.Yogalakshmi (Member4) |
| **Sprint - 2** | Login | USN  - 2 | As a registered user, I need to  easily loginlog | 3 | High | R.Swed ha (Leader) |
|  |  |  | into my |  |  |  |
|  |  |  | registered |  |  |  |
|  |  |  | account via the |  |  |  |
|  |  |  | web pagein |  |  |  |
|  |  |  | minimum time |  |  |  |

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| **Sprint - 4** | Web UI | USN  - 3 | As a user, I need to have a friendly user interface to easily view and access the resources | 3 | Medi um | S.L.Nivetha (Member 1) |
| **Sprint - 1** | Registration (Chemical Manufacturer  -Web user) | USN  - 1 | As a new user, I want tofirst register using my organization email and create a password for the account. | 2 | High | B.Sneha (Member 2) |

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| **Spri nt - 4** | Login | USN  - 2 | As a registered user, Ineed to easily log in using the registered account via theweb page. | 3 | High | M.Raveena (Member 3) |
| **Spri nt - 3** | Web UI | USN  - 3 | As a user, I need to havea user friendly interface to easily view and access  theresources. | 3 | Medium | S.Yogalakshmi (Member4) |

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| **Spri nt - 1** | Registration (Chemical Manufactur er -  Mobile User) | USN  - 1 | As a user, I want to first register using my emailand create a password  for the  account. | 1 | High | R.Swedha (Leader) |
| **Spri nt - 1** | Login | USN  - 2 | As a registered user, I need to  easily log in tothe  application. | 2 | Low | S.L.Nivetha (Member 1) |

**Project Tracker,Velocity & Burndown Chart: (4 Marks)**

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| **Sprint** | **Total Story Points** | **Durati on** | **Sprint Start Date** | **Sprint End Date (Planned)** | **Story PointsComplet ed (ason Planned End**  **Date)** | **Sprint ReleaseDate (Actual)** |
| Sprint-  1 | 12 | 6Days | 24Oct 2022 | 29Oct 2022 | 20 | 29Oct 2022 |
| Sprint-  2 | 6 | 6Days | 31Oct 2022 | 05Nov 2022 | 20 | 30OCT 2022 |
| Sprint-  3 | 6 | 6Days | 07Nov  2022 | 12Nov 2022 | 20 | 6NOV 2022 |
| Sprint-  4 | 6 | 6Days | 14Nov  2022 | 19Nov 2022 | 20 | 7NOV 2022 |

### PROJECT DEVELOPMENT PHASE

**Sprint-1**

#### PROGRAM

#include

<Servo.h> Servo s; int

Sensor z= 0;int data = 0;

int motorPin = 9;

void setup()

{

Serial.begin(96 00);

pinMode(A0,N PUT);

//Temperature Sensor pinMode(A1,INPUT);

//Soil Moisture Sensor pinMode(10,OUTPUT);

//GREEN light for LED pinMode(11,OUTPUT);

//BLUE light for LED pinMode(12,OUTPUT);

//RED light for LED s.attach(3);

//Servo Motor

pinMode(motorPin, OUTPUT);//DC motor

}

void loop(){

Sensor = analogRead(A1); //Reads data from Soil Moisture sensor

data = map(Sensor,0, 1023, 0, 100); //Low analog value indicates HIGH moisture level and High analog valueindicates LOW moisturelevel

//data = map(analogValue,fromLOW,fromHIGH,toLOW,toHIGH) Serial.print("Soil Moisturevalue:");

Serial.println(data);

//'data = 0' indicates wet and 'data = 100' indicates dry

double a = analogRead (A0); //Reads data from Temperature sensordoublet = (((a/1024)\*5)-0.5)\*100;

Serial.print("Temperature value:");Serial.println(t);

if (t>40& t<50)

{

digitalWrite (10,0);

digitalWrite (11,1);

digitalWrite

(12,0);s.wri te(90);

digitalWrite(motorPin, HIGH); Serial.println("Water PartiallyFlows");

}

else if (t>50)

{

digitalWrite(10,0); digitalWrite(11,0); digitalWrite(12,1); s.write(180); digitalWrite(motorPin, HIGH);

Serial.println("WaterFully Flows");

}

else if (t>30 & data<30)

{

digitalWrite (10,1);

digitalWrite (11,1);

digitalWrite (12,0);

s.write(90); digitalWrite(motorPin, HIGH);

Serial.println("Water PartiallyFlows");

}

else if (data<50)

{

digitalWrite (10,0);

digitalWrite (11,1);

digitalWrite (12,1);s.wri te(90);

digitalWrite(motorPin, HIGH); Serial.println("Water PartiallyFlows");

}

else

{

digitalWrite(1 0,1);

digitalWrite(1 1,0);

digitalWrite(1 2,0);

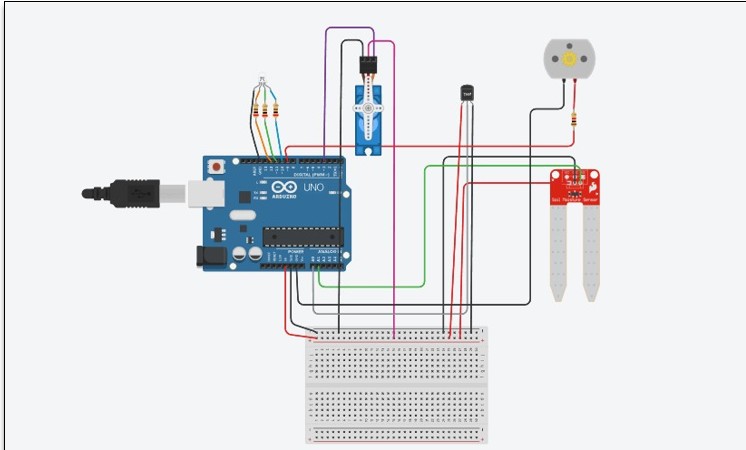
s.write(0); digitalWrite(motorPin, LOW);Serial.println(" "); delay(1000);

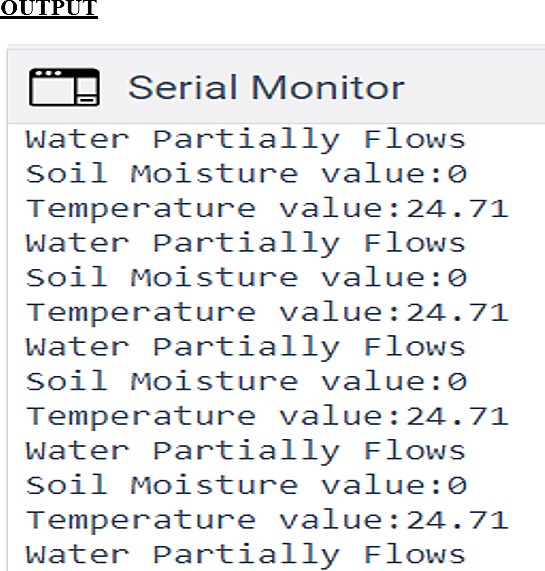
}

}

**COMPONENTS**

|  |  |  |
| --- | --- | --- |
| **S. NO** | **COMPONENTS** | **QUANTITY** |
| 1 | Arduino uno r3 | 1 |
| 2 | Micro servo | 1 |
| 3 | Led rgb | 1 |
| 4 | 200 Ω Resistor | 3 |
| 5 | Soil Moisture Sensor | 1 |
| 6 | DC Motor | 1 |
| 7 | 1KΩ Resistor | 1 |
| 8 | Temperature  sensor(TMP36) | 1 |

**CIRCUIT DIAGRAM**

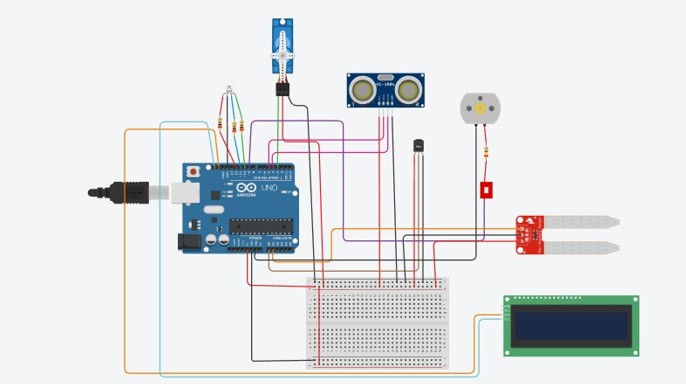


### SPRINT-2

**COMPONENTS**

|  |  |  |
| --- | --- | --- |
| **S. NO** | **COMPONENTS** | **QUANTITY** |
| 1 | Arduino uno r3 | 1 |
| 2 | Micro servo | 1 |
| 3 | Led rgb | 1 |
| 4 | 200 Ω Resistor | 3 |
| 5 | Soil Moisture Sensor | 1 |
| 6 | DC Motor | 1 |
| 7 | 240Ω Resistor | 1 |
| 8 | Temperature  sensor(TMP36) | 1 |
| 9 | Ultrasonic Distance  sensor | 1 |
| 10 | 32 LCD 16x 2 (I2C) | 1 |
| 11 | DIP Switch DPST | 1 |

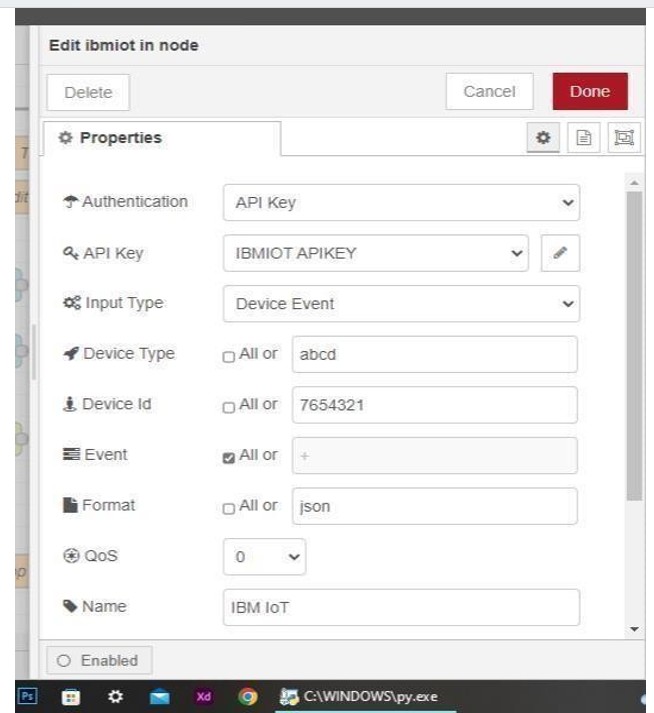
**CIRCUIT CONNECTION**

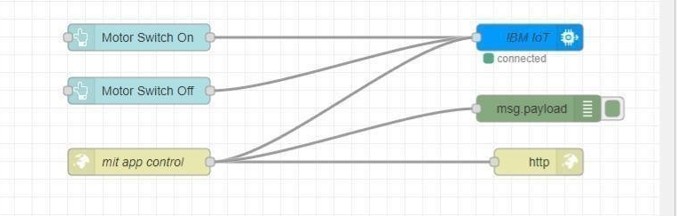


# SPRINT-3

**Conﬁguration of Node-Red to send commandsto IBM cloud**

Ibm iot out node I used to send data from Node-Red to IBM Watson device. So, after adding it to the ﬂow we need to conﬁgure it with credentials of our Watsondevice.





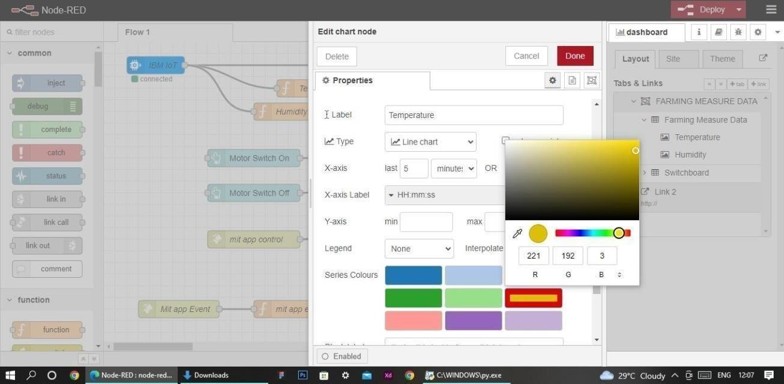
This is the programﬂow for sendingcommands to IBM cloud.

Adjusting User Interface

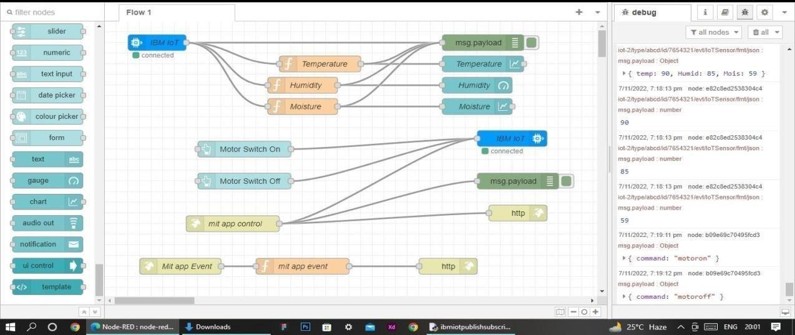
In order to displaythe parsed JSON data a Node-Red dashboardis created

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

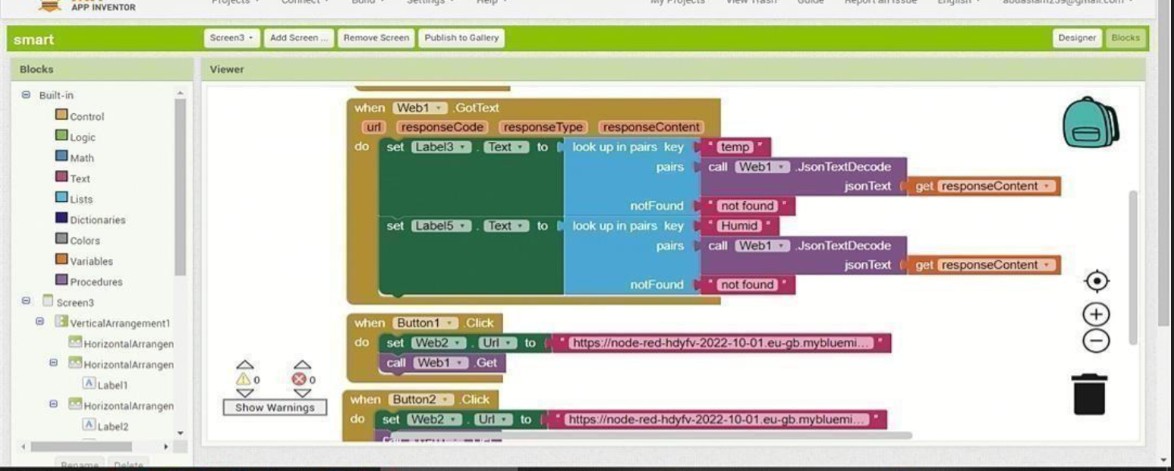
Below imagesare the Gauge, text and button node conﬁgurations.



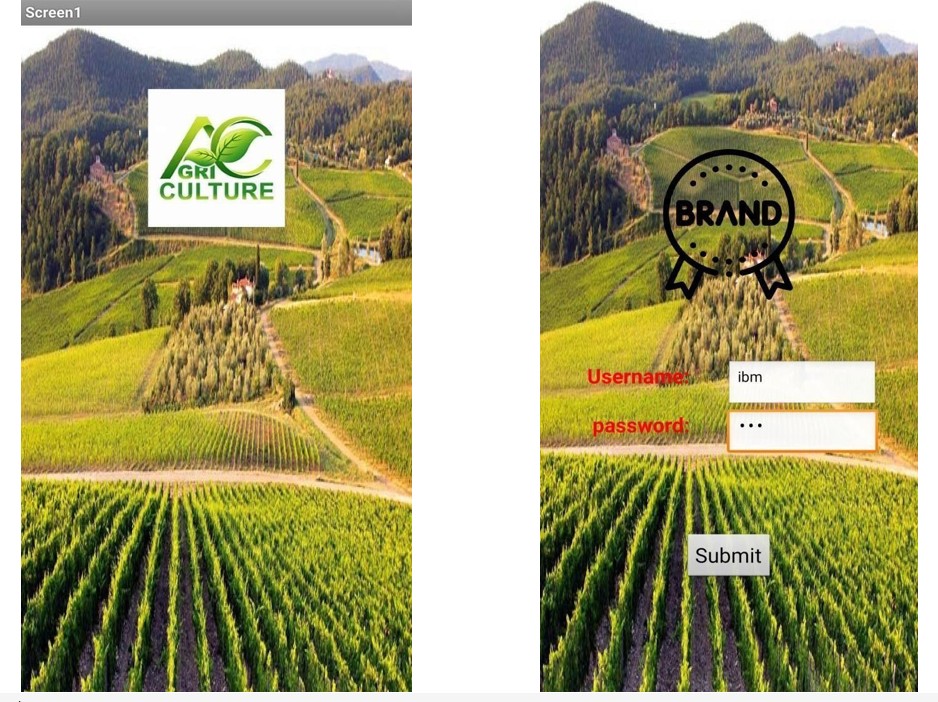
**COMPLETE PROGRAM FLOW**



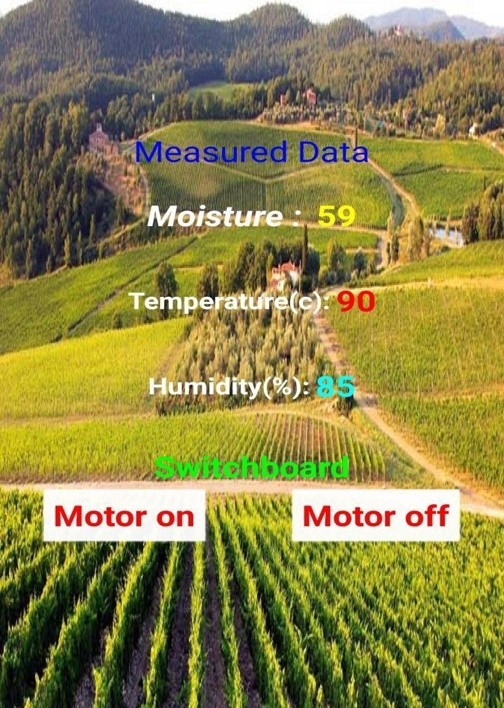
**MOBILE APP WEB**



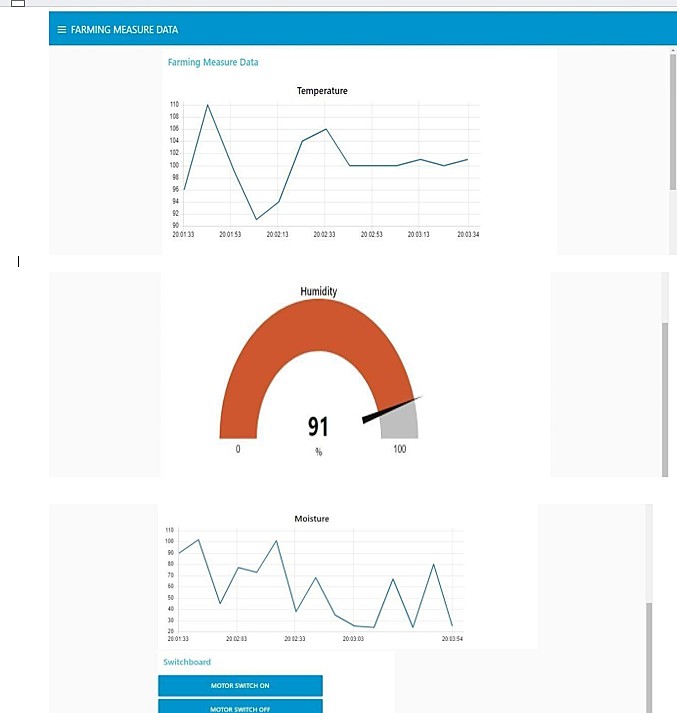
### BLOCK DIAGRAM



**SCREEN-1 SCREEN-2**



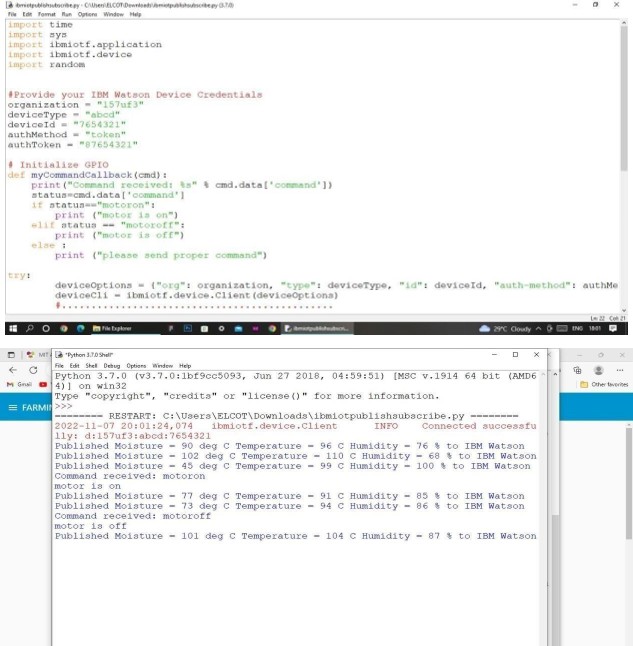
**SCREEN-3**



**WEB APP UI HOME TAB**

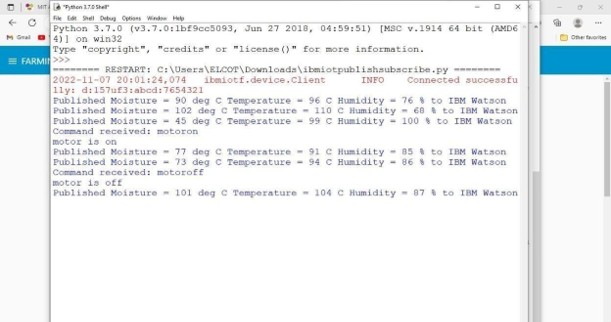
**SPRINT-4**

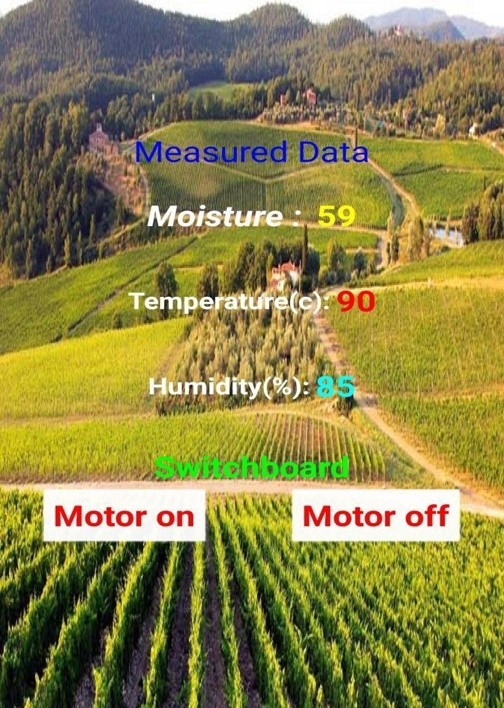
**RECEIVING COMMANDS FROM IBM CLOUD USING PYTHON PROGRAM**

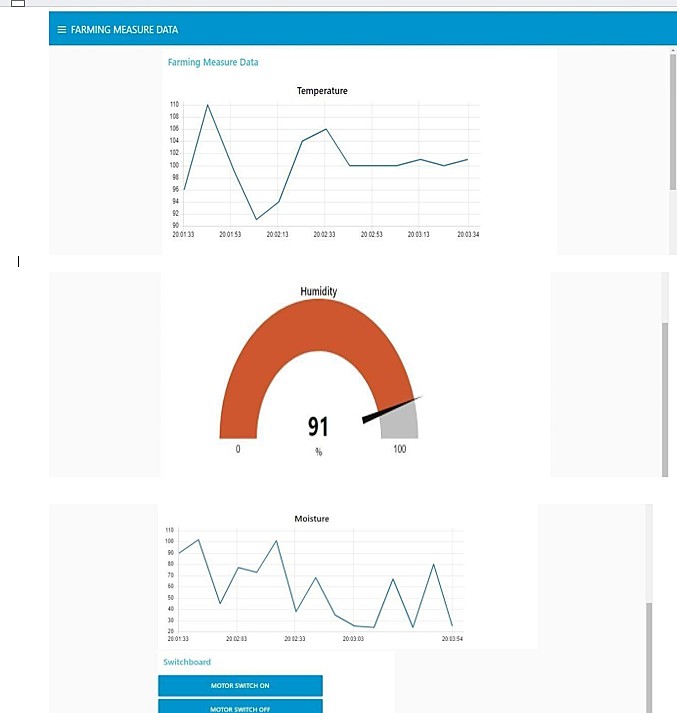


### FLOW CHART

**OBSERVATIONS AND RESULTS**

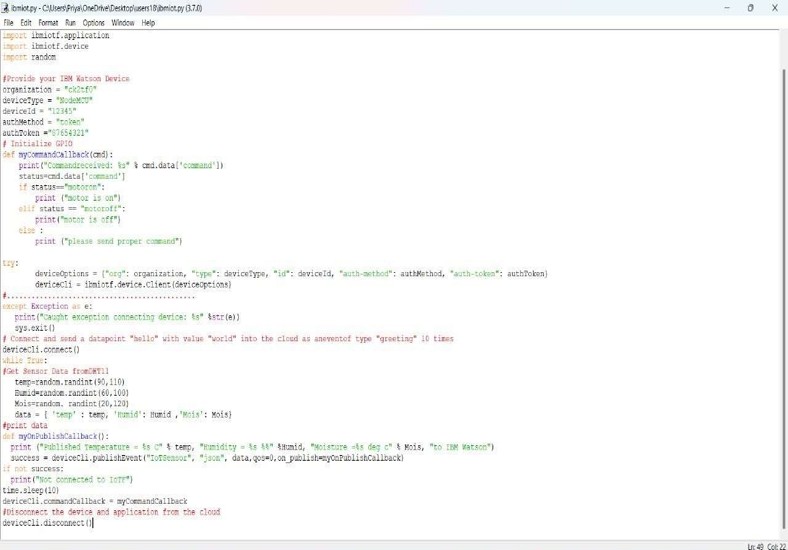






### CODING &SOLUTIONS:

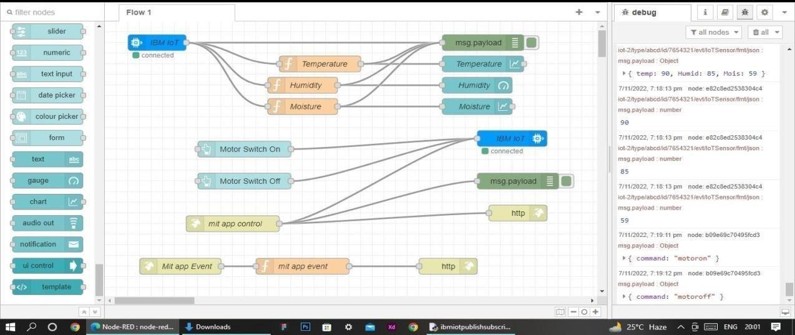
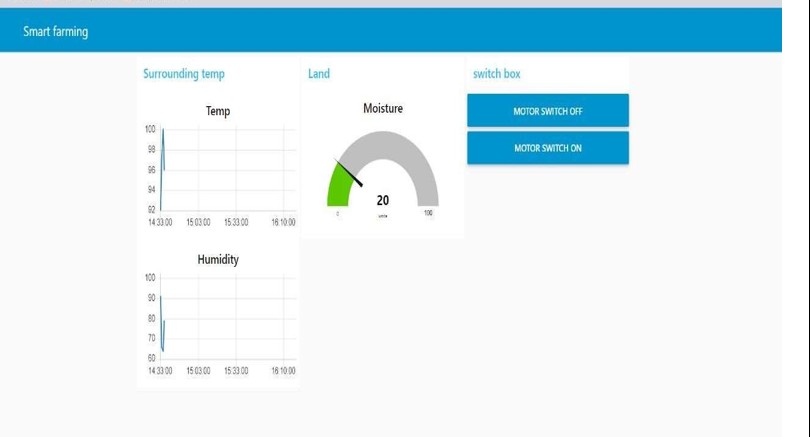
FEATURE:

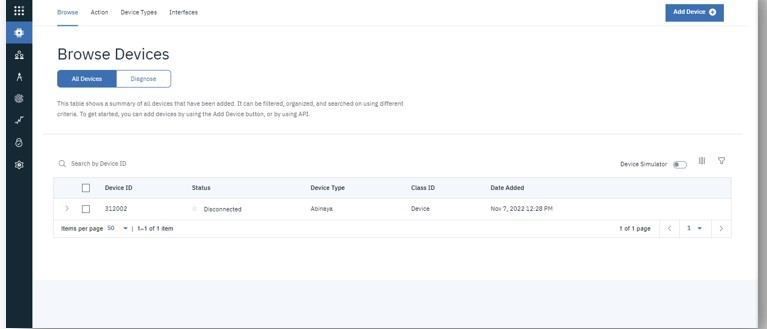


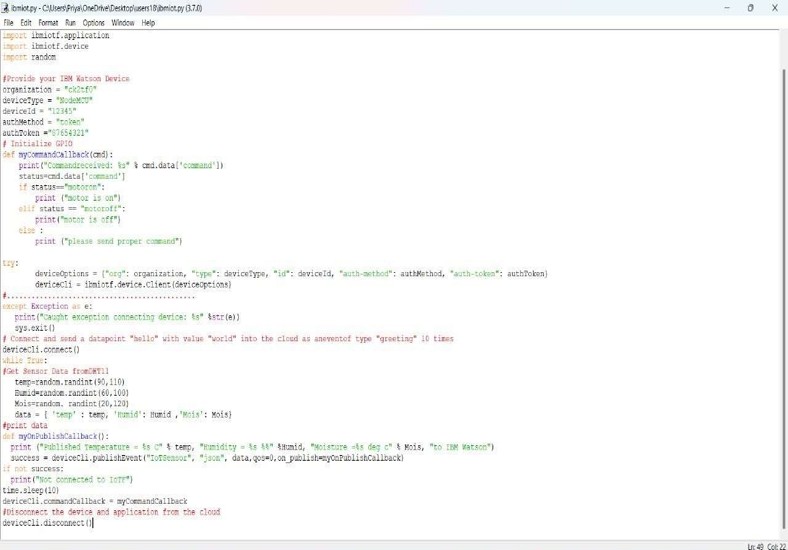
### TESTING:

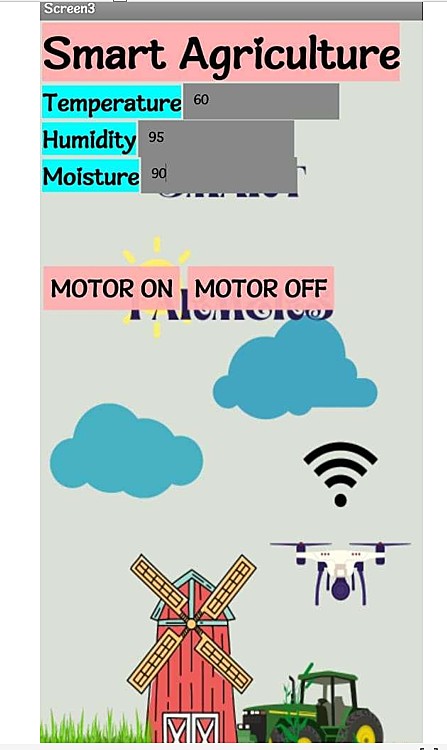
* 1. TEST CASE:

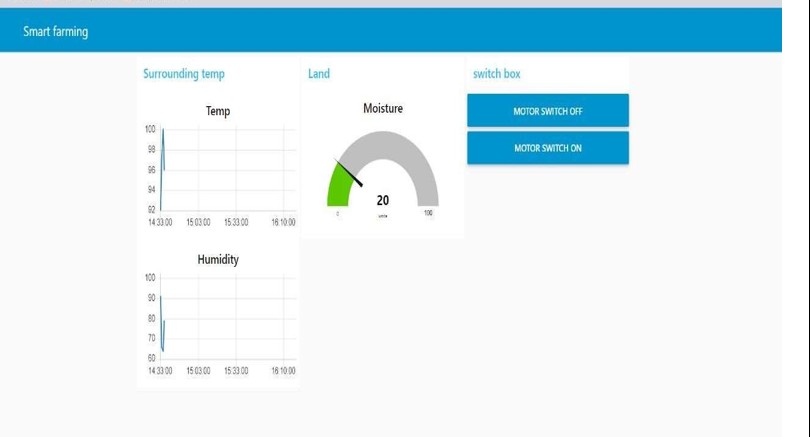
**Web Application Using Node-RED.**







1. **USER ACCEPTANCE TESTING**
2. RESULT:

Performance Metrics

### Advantages and disadvantages Advantages:

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

### Disadvantages:

1. Lack of internet/connectivity issues.
2. Added cost of internet and internet gatewayinfrastructure.
3. Farmers wanted to adapt the use of Mobile App.

### Conclusion

Thus the objective of the project to implement an IOT systemin order to help farmers to control and monitor their farms has been implemented successfully

#### 12 .FUTURE SCOPE:

In future due to more demand of good and more farming in less time, for betterment of the crops and reducing the usage of extravagant resources like electricity and water IOT can be implemented in most of the places.

13.APPENDIX:

SOURCE CODE:

import wiotp.sdk.device import time

import sys

importibmiotf.application import ibmiotf.device import random

#Provide your IBM Watson Device organization = "ck2tf0" deviceType = "NodeMCU" deviceId = "12345"

authMethod = "token" authToken="87654321 "# Initialize GPIO

def myCommandCallback(cmd): print("Commandreceived: %s" %cmd.data['command'])

status=cmd.data['command'] if status=="motoron":

print ("motor is on")

elif status == "motoroff":

print("motor is off")else :

print ("please send proper command")

try:

deviceOptions = {"org": organization, "type": deviceType, "id": deviceId, "auth-method": authMethod, "auth-token": authToken}

deviceCli = ibmiotf.device.Client(deviceOptions) #..............................................

except Exceptionas e:

print("Caught exception connecting device: %s" %str(e))

sys.exit()

# Connect and send a datapoint "hello" with value "world" into the cloudas aneventoftype "greeting" 10 times

devicecli while True:

#Get Sensor DatafromDHT11 temp=random.randint(9 0,110)

Humid=random.randint( 60,100)Mois=random. randint(20,120)

data = { 'temp' : temp, 'Humid':Humid ,'Mois':

Mois}#printdata

def myOnPublishCallback():

print ("Published Temperature = %s C" %temp, "Humidity = %s %%"

%Humid, "Moisture =%s deg c" % Mois, "to IBM Watson")

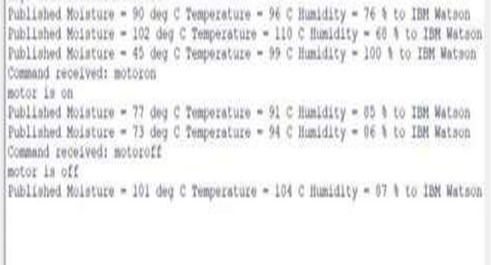
success = deviceCli.publishEvent("IoTSensor", "json",data,qos=0,on\_publish=myOnPublishCallback)

if not success:

print("Not connected to IoTF")time.sleep(10)

deviceCli.commandCallback = myCommandCallback #Disconnect the device and application from the clouddeviceCli.disconnect()

# OUTPUT:



#### GITHUB LINK: https://github.com/IBM-EPBL/IBM-Project-38160-1660373925.git