PROJECT REPORT

Team ID	**PNT2022TMID43471**
Project Name	**SMART FARMING– IOT enabled smart farming application**

TEAM MEMBERS :

1. TEAM LEADER : KARTHI .S
2. TEAM MEMBER: HARIKRISHNAN. S
3. TEAM MEMBER: HARIPRIYA .U
4. TEAM MEMBER :HARIPRIYA.J

CONTENT:

1.INTRODUCTION:

Agriculture is done in every country from ages. Agriculture is the science and art of cultivating plants. Agriculture was the key development in the rise of sedentary human civilization. As the world is trending into new technologies and implementations it is a necessary goal to trend up with agriculture also. IoT plays a very important role in smart agriculture.

1.1 PROJECT OVERVIEW

Smart agriculture farming system is a new idea of farming in agriculture, because IoT sensors are capable of providing information about agriculture fields which uses IoT technology to monitor the crop 24/7 and sends the information to the cloud.
we have proposed an IoT and smart agriculture monitoring system using Mobile Application .This emerging system increases the quality and quantity of agricultural products. IoT technology provides the information about farming fields and then takes action depending on the farmer input. This IoT based Agriculture monitoring system makes use of wireless sensor networks that collects data from different sensors deployed at various nodes and sends it through the wireless protocol .we can design an IoT based advanced solution for monitoring the soil conditions and atmosphere for efficient crop growth is presented.

1.2 PURPOSE

The developed system is capable of monitoring temperature, humidity, soil moisture and nutrients levelusing Node RED and different sensors connected to the controller – ESP-32 . Also, a notification is shown in farmer's phone using Wi-Fi about environmental condition and water levels of the crop field. Farmers can monitor all 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.

2. LITERATURE SURVEY :

2.1 EXISTING PROBLEM

Many environmental issues affect whether farmers have a good year or not. Soil quality, water quality, climate, and terrain are just a few of the environmental issues that may impact profits and productivity for farmers in any given growing season.

Where as climate also plays a very critical role for farming. And having improper knowledge about climate heavily deteriorates the quantity and quality of the crop production. But IoT solutions enable you to know the real-time weather conditions. Sensors are placed inside and outside of the agriculture fields. They collect data from the environment which is used to choose the right crops which can grow and sustain in the particular climatic conditions. The whole IoT ecosystem is made up of sensors that can detect real-time weather conditions like humidity, rainfall, temperature and more very accurately. There are numerous no. of sensors available to detect all these parameters and configure accordingly to suit your smart farming requirements.

If a farmer doesn't have the right terrain and goodqualitysoil they aren't going to be able to yield the best quality crops, no matter how hard they try.Drought or lack of moisture in the soil can't just be fixed by dumping a bunch of water onto it. Properirrigation is critical to provide the exact right amount of moisture.

2.2 REFERENCES

https://ieeexplore.ieee.org/document/9432085

https://ijirt.org/Article?manuscript=151824

https://www.sciencedirect.com/science/article/pii/S1877050919317168

https://wwjmrd.com/upload/iot-enabled-smart-farming-using-android-phone_1571128323.pdf

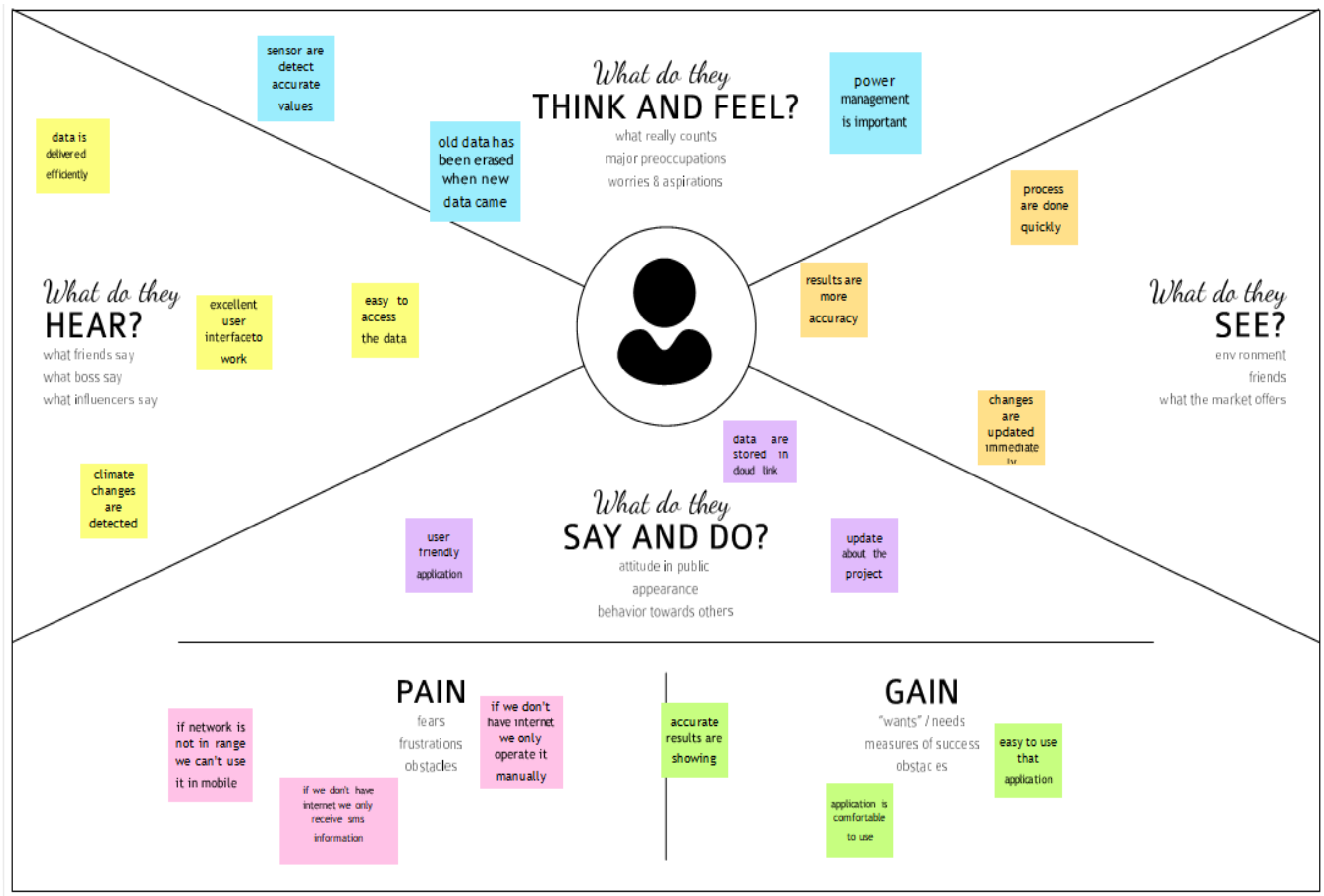
The IoT systems contributed in many fields and proven. It is time for farmers need to introduce the Smart Agricultural systems for higher crop yield. With a compilation of data from sensors and modern electronic gadgets, the farmer can monitor agricultural fields. Smart Agriculture can forecast weather data, switching ON the pump motor and switch ON the bulb for artificial light due to less light intensity, for farms acknowledging the dampness of soil of moisture levels. The IR sensor detects the pest and humans by their temperature; the sensors are interfaced to process module Arduino-UNO. The Smart agriculture system can be operated from anywhere with the help of networking technology.

2.3 PROBLEM STATEMENT DEFINITION

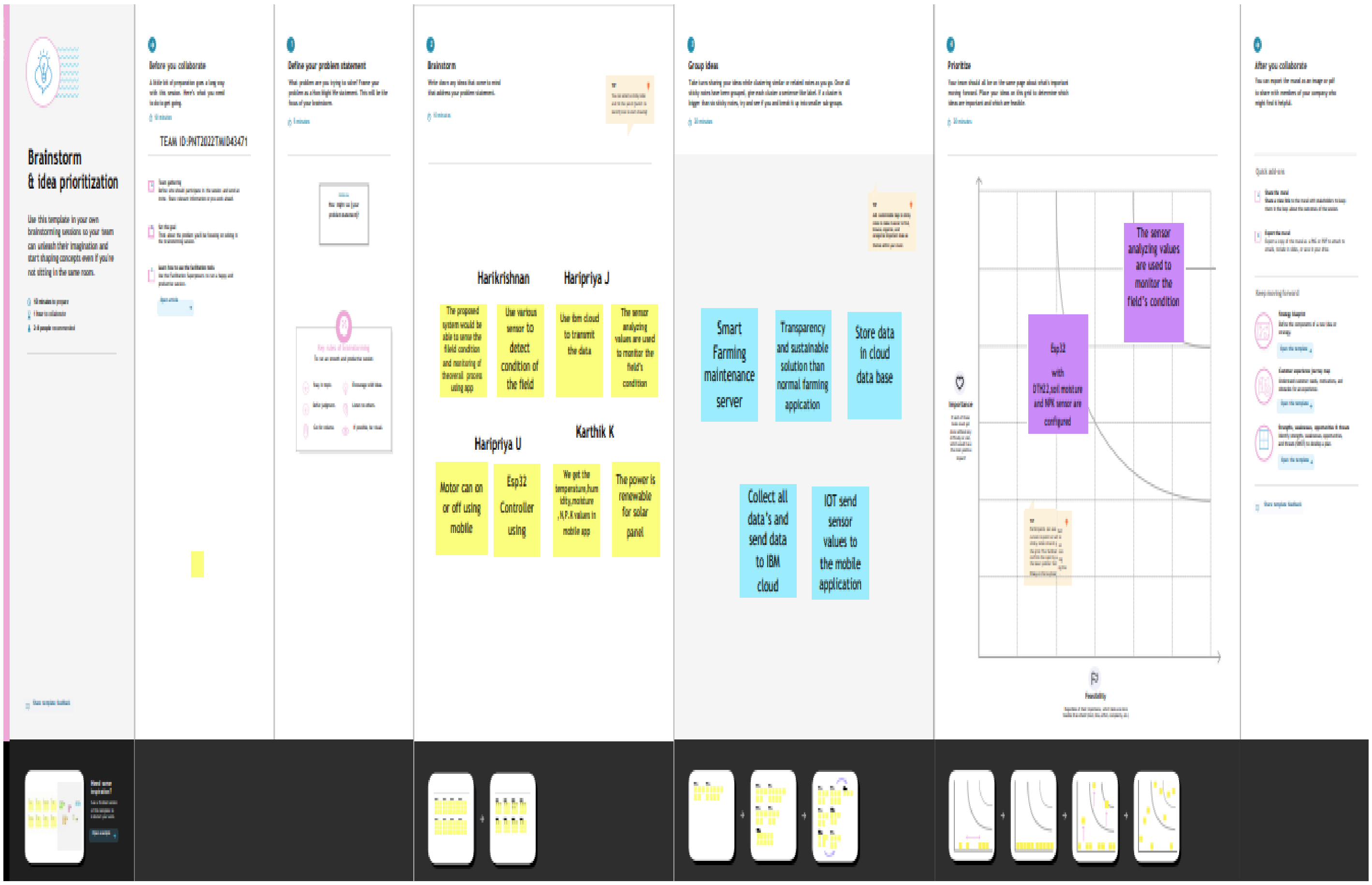
Despite a growing population, now predicted to reach 9.6 billion by 2050, the agriculture industry must rise to meet demand, regardless of environmental challenges like unfavorable weather conditions and climate change. To meet the needs of that growing population, the agriculture industry will have to adopt new technologies to gain a much-needed edge. New agricultural applications in smart farming and precision farming through IoT will enable the industry to increase operational efficiency, lower costs, reduce waste, and improve the quality of their yield. IoT-based agriculture system helps the farmer in monitoring different parameters of his field like soil moisture, Temperature, 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 control the motor pumps from the mobile application itself. All the sensor parameters are stored in the IBM Cloudant DB.

3. IDEATION & PROPOSED SOLUTION

3.1 EMPATHY MAP CANVAS



3.2 IDEATION & BRAINSTROMING



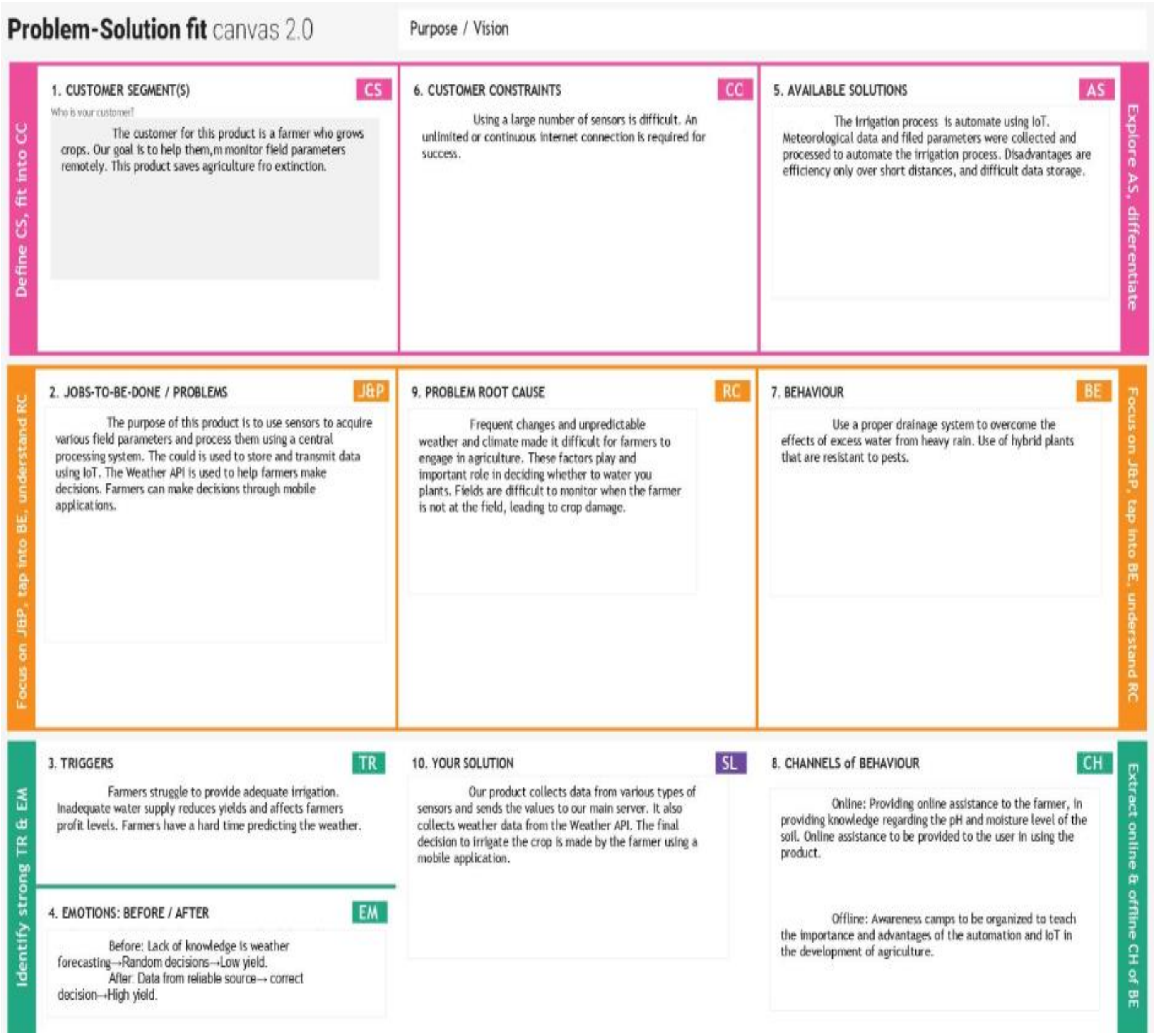
3.3 PROPOSED SOLUTION

Despite a growing population, now predicted to reach 9.6 billion by 2050, the agriculture industry must rise to meet demand, regardless of environmental challenges like unfavorable weather conditions and climate change. To meet the needs of that growing population, the agriculture industry will have to adopt new technologies to gain a much-needed edge. New agricultural applications in smart farming and precision farming through IoT will enable the industry to increase operational efficiency, lower costs, reduce waste, and improve the quality of their yield.

S.no	Parameters	Description
1	Idea	IoT-based agriculture system helps the farmer in monitoring different parameters of his field like soil moisture, Temperature, 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 control the motor pumps from the mobile application itself. All the sensor parameters are stored in the IBM Cloudant DB.

2	Novelty	IoT based Smart Farming improves the entire Agriculture system by monitoring the field in real-time. Data collected by smart sensors can track things such as weather conditions, soil quality, crop's growth progress.
3	Social Impact	IoT in agriculture is designed to help farmers monitor vital information like humidity, air temperature and soil quality using remote sensors, and to improve yields, plan more efficient irrigation, and make harvest forecasts. easy to operate and use and easy to maintain. Remote Management. With farms being located in far-off areas and distant lands, farmers are seeking a better solution to their management issues.
4	Business Model	This model focuses on the farmers who wish to change their working process smartly. The sensors can be monitored remotely using a software which tracks the data real time and provides statistics of the usage. Alerts are triggered to respective persons when needed. The stats of the fields can be viewed through a dashboard with various details about the events. The field’s current condition and nutrients level was provided and can be viewed in realtime. farmers can decrease the fertilizers and pesticides they use, there is less runoff into groundwater and rivers.
5	Scalability Of the Solution	The components used for the building up the set up is cheap and the solution is effective as the components are easily available. The sensors in the fields collects the data and sends it to the cloud. IBM Cloud supports thousands of users to access the cloud simultaneously. The system is capable of handling multiple requests and handles data without any flaw. Thus sensors can be handled and viewed remotely there is a vast growth in our product that will be scalable and useful.

3.4 PROBLEM SOLUTION FIT



4. REQUIREMENT ANALYSIS

4.1 FUNCTIONAL REQUIREMENT

FRNo.	FunctionalRequirement(Epic)	SubRequirement(Story/Sub-Task)
FR-1	UserRegistration	RegistrationthroughGmail
FR-2	UserConfirmation	ConfirmationviaEmai lConfirmationviaOTP
FR-3	Logintosystem	Check Roles of Access.CheckCreden tials

FR-4	ManageModules	ManageSystemAdmins Manage Roles of UserManageUserperm ission
FR-5	Checkwhetherdetails	Temperature detailsHumidityde tails
FR-6	Logout	Exit

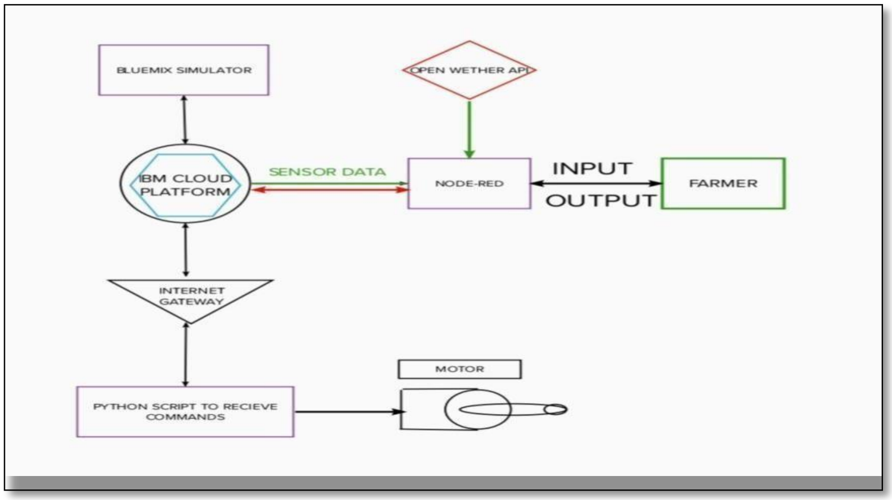
4.2 NON-FUNCTIONAL REQUIREMENT

FRNo.	Non-FunctionalRequirement	Description
NFR-1	Usability	Usabilityisdefinedastheabilitytolearnquickly,useso methingeffectively,remembersomething, operatesomethingwithoutmakingamistake,andenj oysomething.
NFR-2	Security	Privateandconfidentialinformationmustbekeptsec ureatalltimes,includingduringcollection, processing,andstorage.
NFR-3	Reliability	A superior cost-to-reliability trade-off is achievedwithsharedprotection. Topreventagriculturalserviceinterruptions,the approachemploysspecializedandsharedprotection methods.
NFR-4	Performance	Itwill bemoreeffectivetomonitorfarming operationsoverallifintegratedsensorsareusedtoM easuresoil andambientcharacteristics.
NFR-5	Availability	By tying information about crops, weather, andequipmenttogether,itisfeasibletoautomaticall yaltertemperature,humidity,andotherfactorsin Farmingequipment.
NFR-6	Scalability	For IOT platforms, scalability is a big challenge. It hasbeen demonstrated that different IOT platform architectural decisions impact system scalability and that automatic real-time decision-making is possible in a setting with thousands of users.

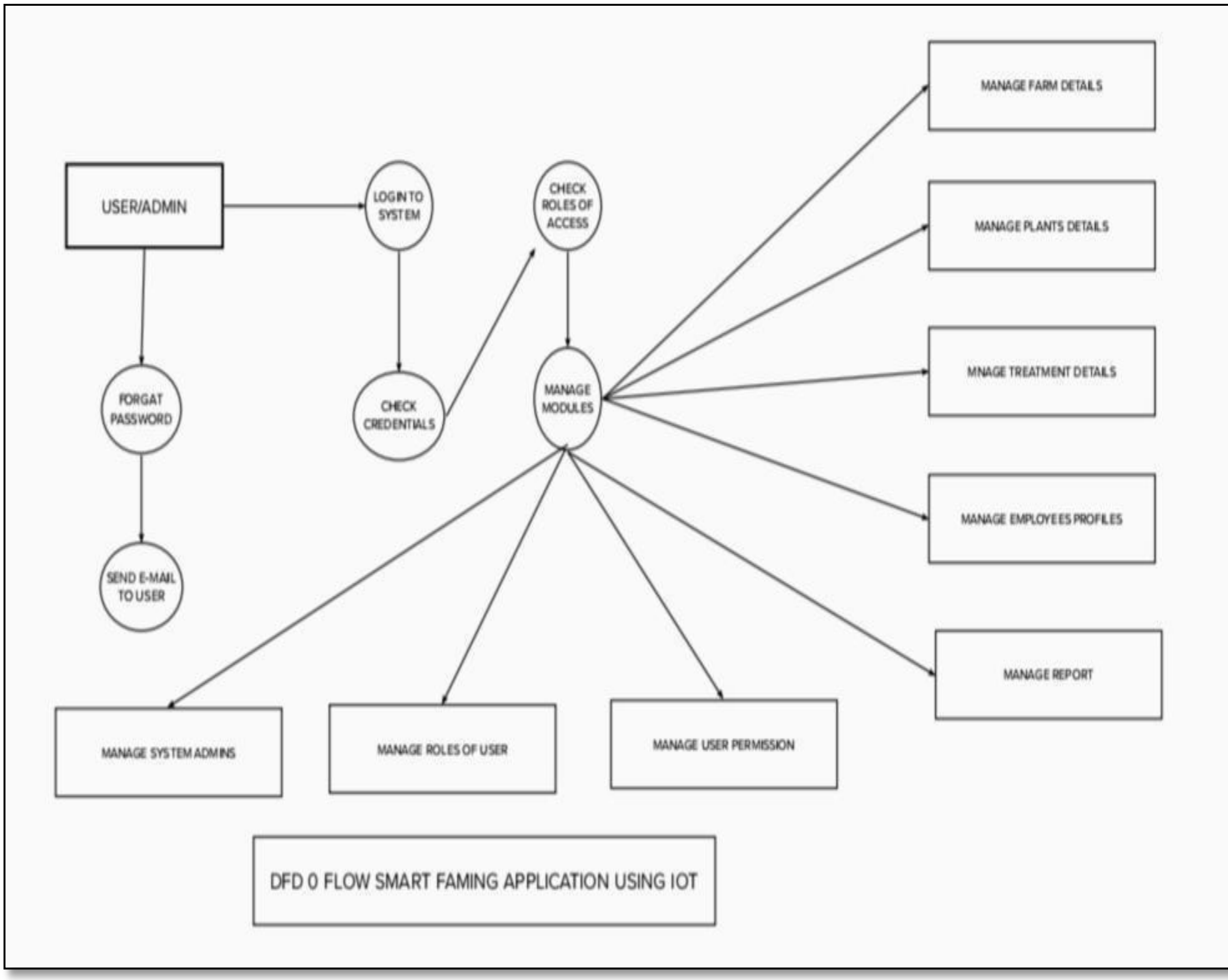
5. PROJECT DESIGN

5.1 DATA FLOW DIAGRAMS

A Data flow diagram (DFD) is a common visual representation of how information moves through a system. A clean andunderstandableDFDcangraphicallyrepresenttheappropriatequantityofthesystemn eed.Itdisplays howinformationentersand exitsthesystem,whatmodifiesthedata,and whereinformation iskept.

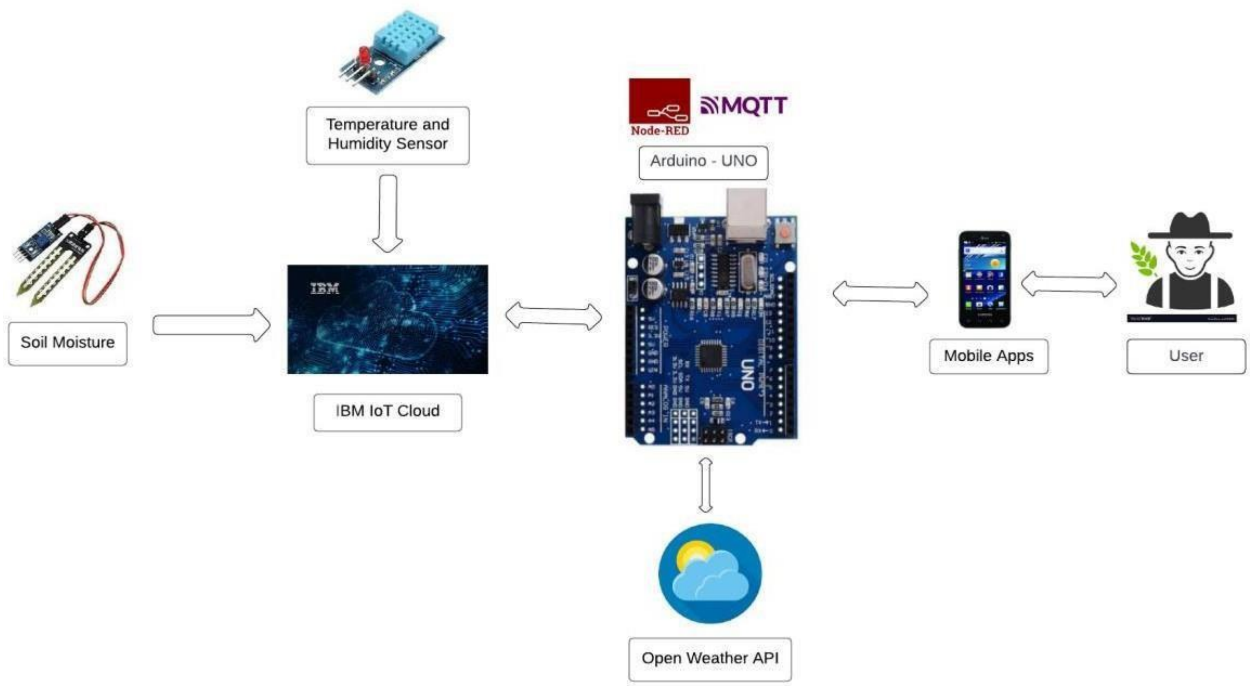


- ✓ Usingvarioussensors,thevarioussoilparameters,includingtemperature,moisturecontentandhumidityaremeasured.TheresultsarethenstoredintheIBMcloud.
- ✓ TheArduinoUNOisutilizedasaprocessingunittoprocess thedatafromthesensorsandweatherAPI.
- ✓ Towritethehardware,software, andAPIs. NODE-REDisemployedasaprogrammingtool. Inordertocommunicate, theMQTTprotocolisused.
- ✓ AmobileapplicationcreatedwithMITAppInventor makesallthecollecteddataavailabletotheuser.Dependingonthesensor results, the user might decide whether or not to irrigate the crop using an app. They can control the motor switchremotelybyutilizingtheapp.



5.2 SOLUTION & TECHNICAL ARCHITECTURE

- ✓ The various soil characteristics, including temperature, humidity, and soil moisture, are measured using various sensors, and the results are saved in the IBM cloud.
- ✓ The processing unit, Arduino UNO, is utilized to process weather data from weather API as well as input from sensors.
- ✓ The hardware, software, and APIs are wired using Node-red as a programming tool. For communication, the MQTT protocol is used.
- ✓ Through a smartphone application created with the help of MIT App Inventor, the user is given access to all the collected data. Depending on the sensor results, the user may decide whether to irrigate the crop or not using an app. They can control the motor switch from a distance using the app.



5.3 USER STORIES

UserType	Functional Requirement(Epic)	User StoryNum-ber	User Story/Task	Acceptancecriteria	Priority	Release
Customer(Mobileuser)	Registration	1	Can register for the application by enteringmy email, password, and confirming mypassword.	Canaccess myaccount / dashboard	High	Sprint-1
		2	WillreceiveconfirmationemailonceIhaveregisteredfortheapplication	Receive confirmationemail&click confirm	High	Sprint-1
		3	CanregisterfortheapplicationthroughFacebook	Can register & accessthe dashboard withFacebookLogin	Low	Sprint-2
		4	Can Register for the application throughGmail		Medium	Sprint-1
	Login	5	CanLogintotheapplicationbyenteringemail&password		High	Sprint-1
	Dashboard					
Customer (Webuser)						
Customer CareExecutive						
Administrator						

6. PROJECT PLANNING & SCHEDULING

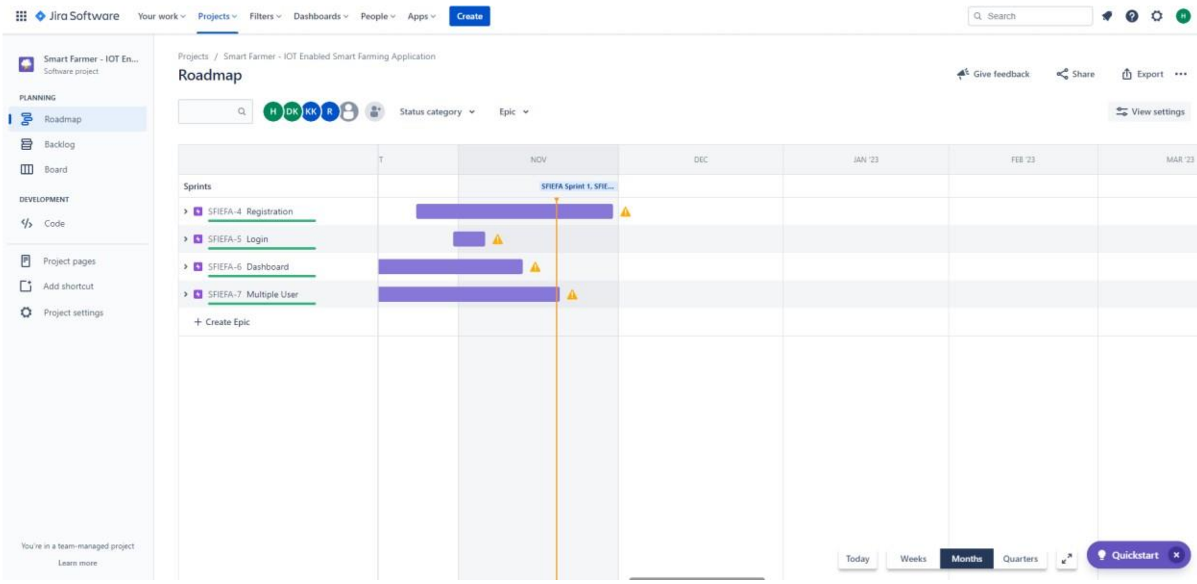
6.1 SPRINT PLANNING & ESTIMATION

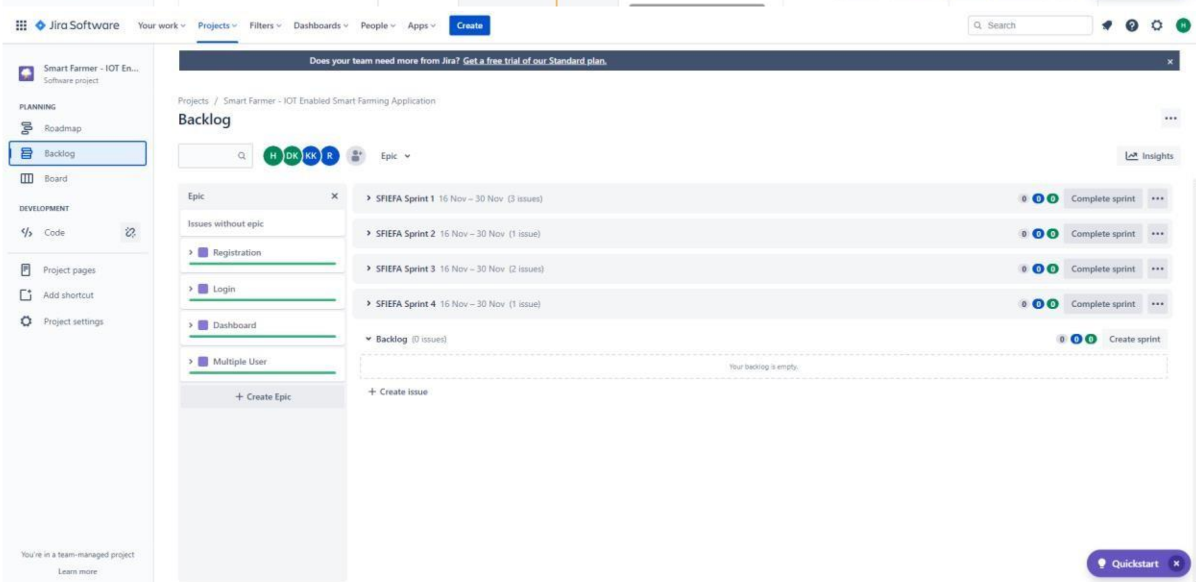
Sprint	Functional requirement (EPIC)	User Story Number	User story /task	Story points	priority	Team members
Sprint-1	Simulation creation	USN-1	Connect Sensors and Arduino with code	2	High	Haripriya u, karthik k
Sprint-2	Software	USN-2	Creating device in the IBM Watson IoT platform, workflow for IoT scenarios using Node-Red	2	High	Harikrishnan s, haripriya j
Sprint-3	MIT App Inventor	USN-3	Develop an application for the Smart farmer project using MIT App Inventor	2	High	Karthik k, harikrishnans,haripriya u
Sprint-3	Dashboard	USN-3	Design the Modules and test the app	2	High	Haripriya j, haripriya u
Sprint-4	Web UI	USN-4	To make the user to interact with software.	2	High	Haripriya j, Karthik k, Harikrishnan s

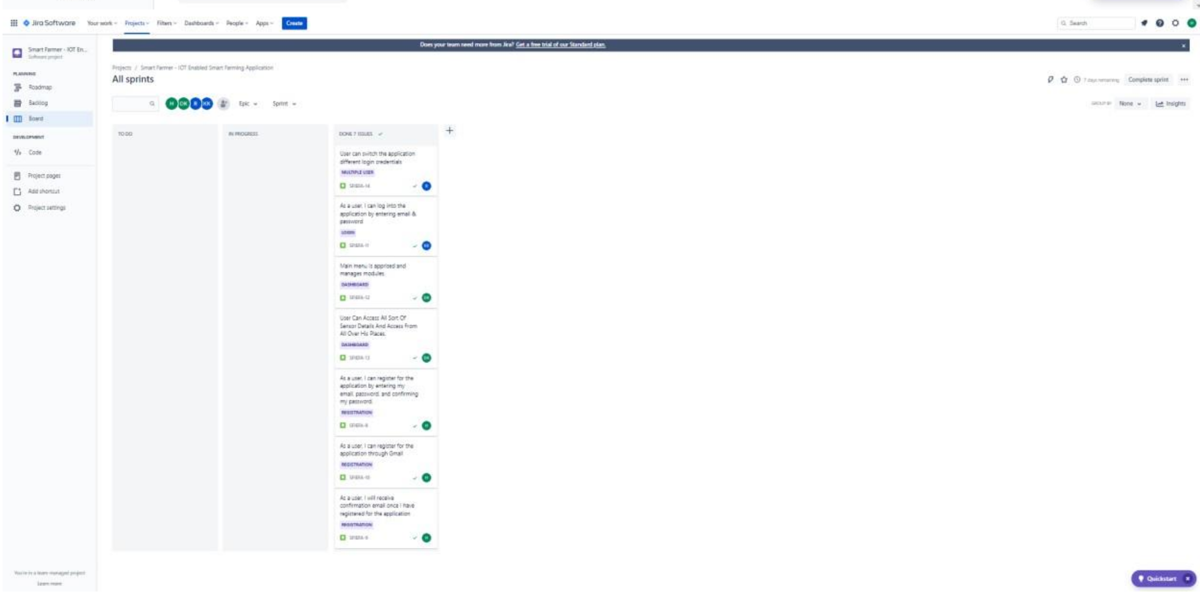
6.2 SPRINT DELIVERY SCHEDULE

Sprint	Total Story Points	Duration	Sprint Start Date	Sprint End Date (Planned)	Story Points Completed (as on Planned End Date)	Sprint Release Date (Actual)
Sprint-1	20	6 Days	28 Oct 2022	03 Nov 2022	20	03 Nov 2022
Sprint-2	20	6 Days	04 Nov 2022	10 Nov 2022	20	10 Nov 2022
Sprint-3	20	6 Days	11 Nov 2022	17 Nov 2022	20	17 Nov 2022
Sprint-4	20	6 Days	18 Nov 2022	24 Nov 2022	20	24 Nov 2022

6.3 REPORT FROM JIRA


Jira Software
Your work
Projects
Filters
Dashboards
People
Apps
Create
Search
Smart Farmer - IOT En...
Software project
PLANNING
Roadmap
Backlog
Board
DEVELOPMENT
Code
Project pages
Add shortcut
Project settings
You're in a team-managed project
Learn more
Projects / Smart Farmer - IOT Enabled Smart Farming Application
Roadmap
Give feedback
Share
Export
Status category
Epic
View settings
NOV
DEC
JAN '23
FEB '23
MAR '23
Sprints
SFIEFA Sprint 1, SFIE...
SFIEFA-4 Registration
SFIEFA-5 Login
SFIEFA-6 Dashboard
SFIEFA-7 Multiple User
Create Epic
Today
Weeks
Months
Quarters
Quickstart


Jira Software
Your work
Projects
Filters
Dashboards
People
Apps
Create
Search
Does your team need more from Jira? Get a free trial of our Standard plan.
Smart Farmer - IOT En...
Software project
PLANNING
Roadmap
Backlog
Board
DEVELOPMENT
Code
Project pages
Add shortcut
Project settings
You're in a team-managed project
Learn more
Projects / Smart Farmer - IOT Enabled Smart Farming Application
Backlog
Epic
Insights
Epic
Issues without epic
Registration
Login
Dashboard
Multiple User
Create Epic
SFIEFA Sprint 1 16 Nov – 30 Nov (3 issues)
SFIEFA Sprint 2 16 Nov – 30 Nov (1 issue)
SFIEFA Sprint 3 16 Nov – 30 Nov (2 issues)
SFIEFA Sprint 4 16 Nov – 30 Nov (1 issue)
Complete sprint
Backlog (0 issues)
Create sprint
Your backlog is empty.
Create issue
Quickstart


Jira Software
Create
Does your team need more from Jira? Get a free trial of our Standard plan.
All sprints
Complete sprint
Insights
TO DO
IN PROGRESS
DONE
User can switch the application different login credentials
As a user, I can log into the application by entering email & password
Main menu is approved and manages modules
User Can Access All Sort Of Sensor Details And Access From All Over His Places
As a user, I can register for the application by entering my email, password, and confirming my password
As a user, I can register for the application through Gmail
As a user, I will receive confirmation email once I have registered for the application
Quickstart

7. CODING & SOLUTIONING

7.1 FEATURE 1

ConnecttheSensorandArduinowithCode :

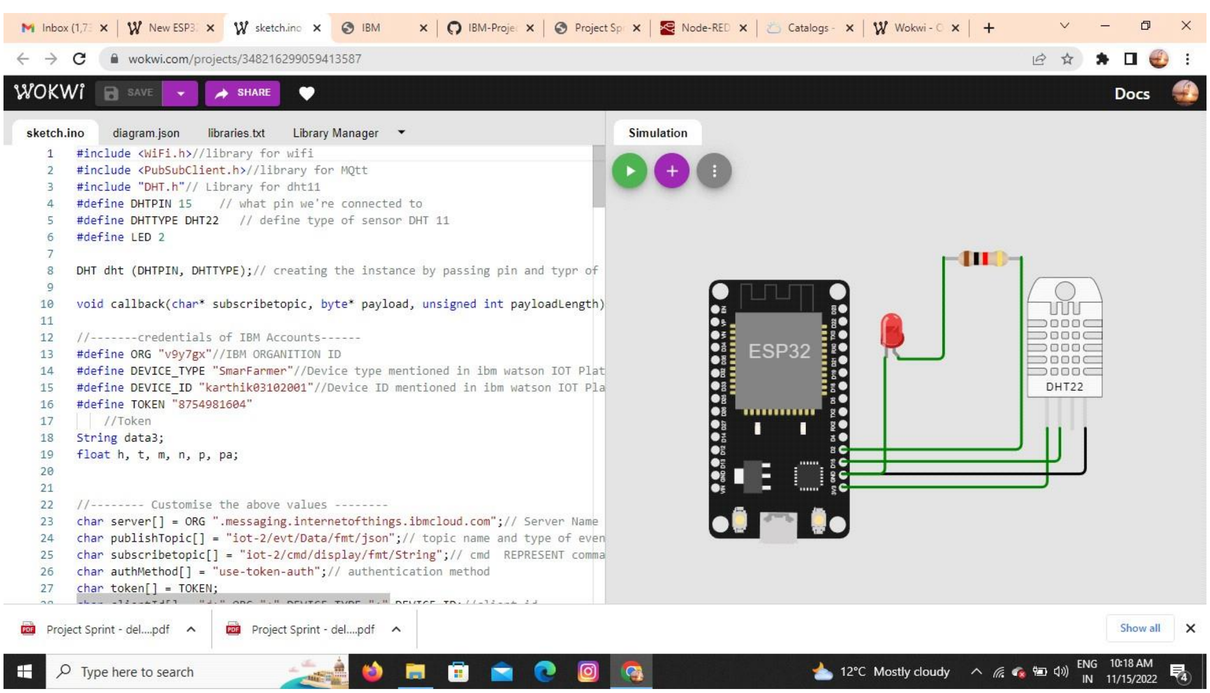
```
#include<WiFi.h>//library for wifi

#include<PubSubClient.h>//libraryforMQt

t#include"DHT.h"//Libraryfordht11
#defineDHTPIN15             // what pin we're connected to
#defineDHTTYPEDHT22         // define type of sensor DHT 11
#defineLED2

DHTdht(DHTPIN,DHTTYPE);// creatingthe instancebypassingpinandtyprofdhtconnected

voidcallback(char*subscribetopic,byte*payload,unsignedintpayloadLength);

//-------credentialsofIBMAccounts------
#defineORG"v9y7gx"//IBMORGANITIONID
#defineDEVICE_TYPE"SmarFarmer"//DevicetypementionedinibmwatsonIOTPlatform
#defineDEVICE_ID"karthik03102001"//DeviceIDmentionedinibmwatsonIOTPlatform
#defineTOKEN"8754981604"
        //TokenString
data3;
floath,t,m,n,p,pa;


//--------Customisetheabovevalues--------
charserver[] = ORG ".messaging.internetofthings.ibmcloud.com";// Server NamecharpublishTopic[]="iot-
2/evt/Data/fmt/json";//topicnameandtypeofeventperformandformatinwhichdatatobesend
charsubscribetopic[]="iot-
2/cmd/display/fmt/String";//cmdREPRESENTcommandtypeANDCOMMANDISTESTOFFORMATSTRING
charauthMethod[]="use-token-auth";//authenticationmethodchartoken[]=TOKEN;
charclientId[]="d:"ORG":"DEVICE_TYPE":"DEVICE_ID;//clientid


//    ----------------------------------------
WiFiClientwifiClient;//creatingtheinstanceforwificlient
PubSubClientclient(server,1883,callback,wifiClient);//callingthepredefinedclientidbypassingparameterlikeserverid,por
tandwificredential


voidsetup()//configureingtheESP32
{
      Serial.begin(115200);dht.begi
      n();pinMode(LED,OUTPUT)
      ;delay(10);Serial.println();wif
      iconnect();mqttconnect();
}

voidloop()//RecursiveFunction
{
```

```
    h=dht.readHumidity();
    t=dht.readTemperature();m=random(
    40,100);
    n   =   random(40,100);p   =
    random(40,100);pa=random
    (40,100);
    Serial.print("temp:");Serial.println(t);Serial
    .print("Humid:");Serial.println(h);Serial.pri
    nt("Moisture:");Serial.println(m);Serial.prin
    t("naitrajen:");Serial.println(n);Serial.print(
    "potas:");Serial.println(p);Serial.print("pass
    parus:");




    Serial.println(pa);


    PublishData(t,h,m,n,p, pa);delay(1000);
    if(!client.loop()){mqttconnect
      ();
    }
}



/*...................................retrievingto
Cloud. ..................................................................... */

voidPublishData(floattemp,floathumid,floatsoil,floatnai,floatpot,floatpass){
    mqttconnect();//functioncallforconnectingtoibm
    /*
        creatingtheStringininformJSontoupdatethedatatoibmcloud
    */
    String payload =
    "{\"temp\":";payload+=temp;
    payload += ","
    "\"Humid\":";payload+=humid;
    payload += ","
    "\"Moisture\":";payload+=soil;
    payload += "," "\"naitrajen\":";payload+=nai;
    payload += ","
    "\"potasiyum\":";payload+=pot;
    payload += ","
    "\"passparus\":";payload+=pass;

    payload+="}";
```

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



if(client.publish(publishTopic,(char*)payload.c_str())){
```

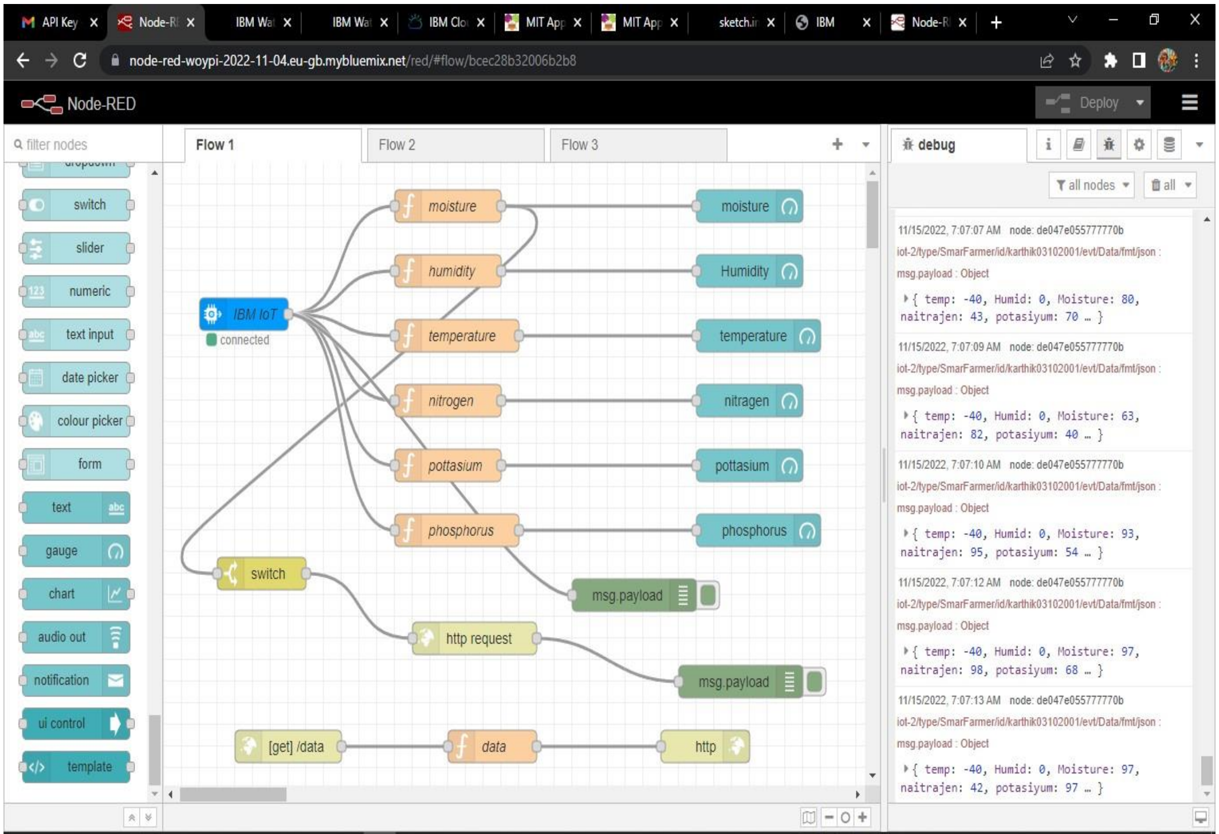
```
    Serial.println("Publish ok");// if it sucessfully upload data on the cloudthen it will print publish ok in Serial
monitor or else it will print publishfailed
   }else{
       Serial.println("Publishfailed");
   }

}


voidmqttconnect(){
   if(!client.connected()) {Serial.print("Reconnecting client to
       ");Serial.println(server);
       while(!client.connect(clientId,authMethod,token)){
           Serial.print(".");delay(50
           0);
       }

         initManagedDevice();
         Serial.println();

   }
}
voidwificonnect()//functiondefinationforwificonnect
{
   Serial.println();Serial.print("Connectingto")
   ;


  WiFi.begin("Wokwi-GUEST","",6);//passingthewificredentialstoestablishtheconnection
   while(WiFi.status()!=WL_CONNECTED){delay(500);
       Serial.print(".");

   }
   Serial.println("");Serial.println("WiFiconnecte
   d");Serial.println("IP address:
   ");Serial.println(WiFi.localIP());

}

voidinitManagedDevice(){
   if(client.subscribe(subscribetopic))
       {Serial.println((subscribetopic));Serial.println("subsc
       ribetocmdOK");
```

```
    }else{
      Serial.println("subscribetocmdFAILED");
    }
}

voidcallback(char*subscribetopic,byte*payload,unsignedintpayloadLength)
{

    Serial.print("callbackinvokedfortopic:");
    Serial.println(subscribetopic);
    for(inti=0;i<payloadLength;i++){
      //Serial.print((char)payload[i]);data3+=(char)payload[
      i];
    }
    Serial.println("data:"+data3);if(data3=="light
    on")
    {
Serial.println(data3);digitalWrite(
LED,HIGH);
    }
    else
    {
Serial.println(data3);digitalWrite
(LED,LOW);
    }
data3="";
}
```

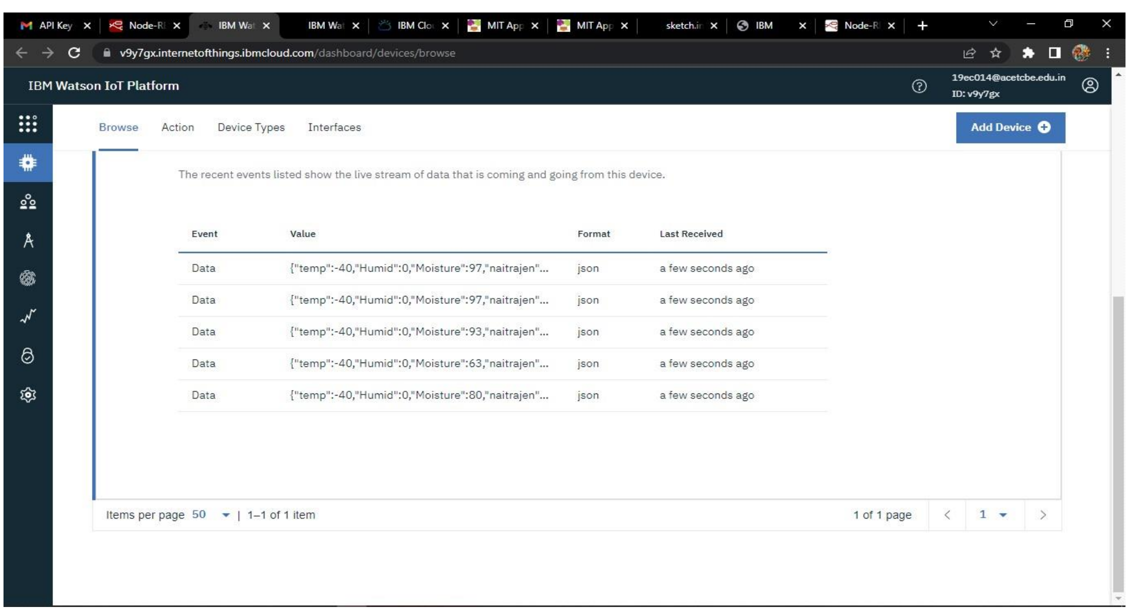


7.2 FEATURE 2

workflowforIoTscenariosusingNode-Red



7.3 DATA BASE SCHEME

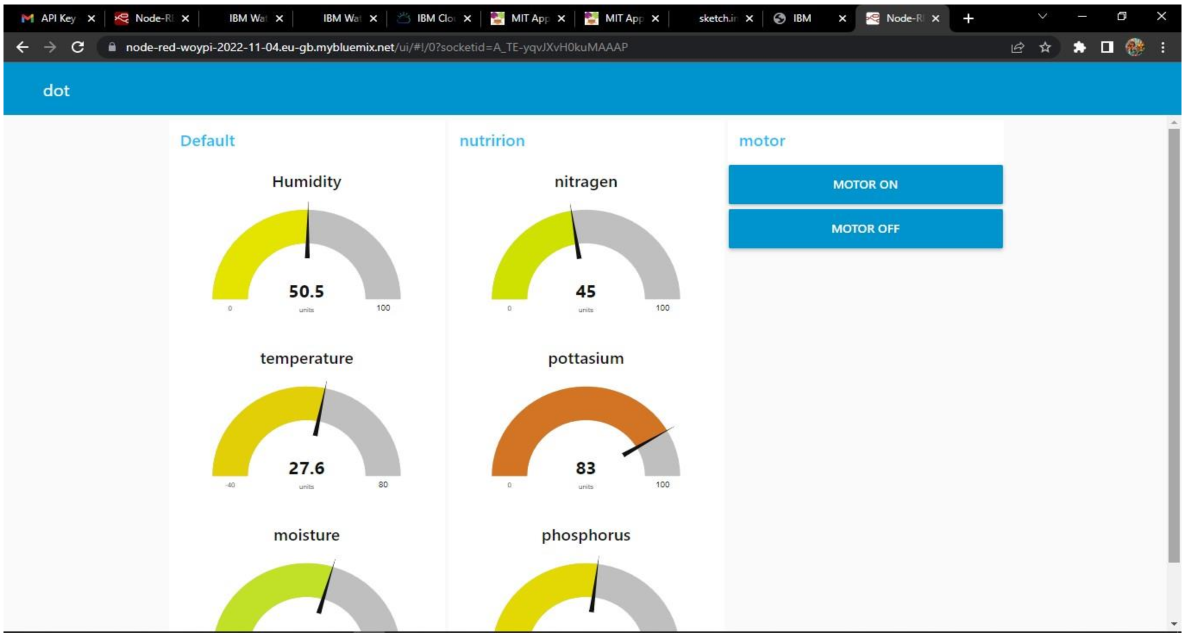


CreatingdeviceintheIBMWatsonIoTplatform,

8. TESTING

8.1 TEST CASE

Testing the device using node –red



8.2 USER ACCEPTANCE TESTING

This report shows the number of test cases that have passed, failed, and untested

Section	Total Case	Not Tested	fail	Pass
Print engine	7	0	0	7
Client Application	51	0	0	51
Security	2	0	0	2
Outsource Shipping	3	0	0	3
Exception Reporting	9	0	0	9
Final Report Output	4	0	0	4
Version Control	2	0	0	2

9. RESULTS

9.1 PERFORMANCE METRICS

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

10. ADVANTAGE & DISADVANTAGE

ADVANTAGE :

Agriculture is predominantly one of the key accelerators of the Internet of Things (IoT) development. Modern technologies are indispensable for foodstuff manufacturers in supporting the rapidly growing population of Earth. In addition, IoT enables farmers to make the rural industry as much efficient as possible, as well as to generate new revenue sources.

Atmosphere changes monitoring, as well as solar radiation intensity meters are some of the most obvious domains to apply smart sensors. Immunity to weather impact, the ability to transmit data for hundreds and thousands of kilometres and the ability to translate raw data into the corporate business intelligence (BI) make IoT indispensable when it comes to the agriculture modernization.

The use of technology in farming and agriculture making it smart agriculture, is of course, a good initiative and a much-needed one with the present increasing demand in the food supply.

DISADVANTAGES:

In the case ofcomputer-based intelligence for running the application, it is highly unlikely that a normal farmer will be able to possess this knowledge even develop them.

Farmers are not used to these high-end technologies. They do not understand computer language or the artificial intelligence.

For the smart agriculture, Internet of Things is essential which will require artificial intelligence and computer-based intelligence. This cannot be balanced here.

11 . CONCLUSION

The various parameters like temperature, humidity etc were monitored using web application. The data from weather station like wind speed, temperature, humidity etc were displayed in the web browser. The device like motor, light etc can also controlled by the web application.

12. FUTURE SCOPE

Smart farming refers to managing farms using modern Information and communication technologies to increase the quantity and quality of products while optimizing the human labor required. Among the technologies available for present-day farmers are: Sensors: soil, water, light, humidity, temperature management.Farming enterprises include crop, livestock, poultry, fish, free, sericulture etc. A combination of one or more enterprises with cropping when carefully chosen planned and executed gives greater dividends than a single enterprise, especially for small and marginal farmers.Robots and temperature and moisture sensors will all play a part in better data collection. The use of drones can help farmers monitor crops on a wider level, giving them—literally—a bird's eye view of what's happening on the ground. Drones can also reduce labor costs as it allows one person to cover acres at a time.

13. APPENDIX

13.1 PYTHON CODE

```
import wiotp.sdk.device

 import time

import os

import datetime

import random

myConfig = {

"identity": { "orgid": "hj5fmy", "typeid": "devicel", "deviceid": "67890" }, "auth":

 { "token": "87654321" Team ID PNT2022TMID43471 Project Name Project – IOT enabled smart farming application Maximum Marks 4 Marks23 }

 }

client = wiotp.sdk.device.deviceclient(config=myconfig, loghandlers=None) client.onnect()

def myCommendcallback(cmd): print ("message received from IBM IOT Platform: %s" % cmd.data['commend']) m=cmd.data['commend'] if(m=="motoron"):

 print("motor is switched on") elif(m=="motoroff"):

print("motor is switched OFF") print(" ")

while True:

soil=random.randint(0,100) temp=random.randint(-20,125) hum=random.randint(0,100) myData={'soil_moisture': soil,'temperature':temp, 'humidity':hum} client.publishEvent(eventId="status", msgFrmat="json", data=myData, qos=0, onPublish=None)

print("published data Successfully :%s",

myData) time.sleep(2) client.commandCallback = myCommedCallback client.disconnect()
```

13.2 SOURCE CODE

```
#include<WiFi.h>//library for wifi

#include<PubSubClient.h>//libraryforMQt

t#include"DHT.h"//Libraryfordht11
#defineDHTPIN15                 // what pin we're connected to
#defineDHTTYPEDHT22        // define type of sensor DHT 11
#defineLED2

DHTdht(DHTPIN,DHTTYPE);// creatingthe instancebypassingpinandtyprofdhtconnected
```

```
voidcallback(char*subscribetopic,byte*payload,unsignedintpayloadLength);

//-------credentialsofIBMAccounts------
#defineORG"v9y7gx"//IBMORGANITIONID
#defineDEVICE_TYPE"SmarFarmer"//DevicetypementionedinibmwatsonIOTPlatform
#defineDEVICE_ID"karthik03102001"//DeviceIDmentionedinibmwatsonIOTPlatform
#defineTOKEN"8754981604"
        //TokenString
data3;
floath,t,m,n,p,pa;


//--------Customisetheabovevalues--------
charserver[] = ORG ".messaging.internetofthings.ibmcloud.com";// Server NamecharpublishTopic[]="iot-
2/evt/Data/fmt/json";//topicnameandtypeofeventperformandformatinwhichdatatobesend


charsubscribetopic[]="iot-
2/cmd/display/fmt/String";//cmdREPRESENTcommandtypeANDCOMMANDISTESTOFFORMATSTRING
charauthMethod[]="use-token-auth";//authenticationmethodchartoken[]=TOKEN;
charclientId[]="d:"ORG":"DEVICE_TYPE":"DEVICE_ID;//clientid


//    ------------------------------------------
WiFiClientwifiClient;//creatingtheinstanceforwificlient
PubSubClientclient(server,1883,callback,wifiClient);//callingthepredefinedclientidbypassingparameterlikeserverid,por
tandwificredential


voidsetup()//configureingtheESP32
{
      Serial.begin(115200);dht.begi
      n();pinMode(LED,OUTPUT)
      ;delay(10);Serial.println();wif
      iconnect();mqttconnect();
}

voidloop()//RecursiveFunction
{

      h=dht.readHumidity();
      t=dht.readTemperature();m=random(
      40,100);
      n   =   random(40,100);p   =
      random(40,100);pa=random
      (40,100);
      Serial.print("temp:");Serial.println(t);Serial
      .print("Humid:");Serial.println(h);Serial.pri
      nt("Moisture:");Serial.println(m);Serial.prin
      t("naitrajen:");Serial.println(n);Serial.print(
      "potas:");Serial.println(p);Serial.print("pass
      parus:");
```

```
    Serial.println(pa);


    PublishData(t,h,m,n,p, pa);delay(1000);
    if(!client.loop()){mqttconnect
        ();
    }
}



/*....................................retrievingto
Cloud. ...................................................................... */

voidPublishData(floattemp,floathumid,floatsoil,floatnai,floatpot,floatpass){
    mqttconnect();//functioncallforconnectingtoibm
    /*
        creatingtheStringininformJSontoupdatethedatatoibmcloud
    */
    String payload =
    "{\"temp\":";payload+=temp;
    payload += ","
    "\"Humid\":";payload+=humid;
    payload += ","
    "\"Moisture\":";payload+=soil;
    payload += "," "\"naitrajen\":";payload+=nai;
    payload += ","
    "\"potasiyum\":";payload+=pot;
    payload += ","
    "\"passparus\":";payload+=pass;

    payload+="}";


    Serial.print("Sendingpayload:");
    Serial.println(payload);



    if(client.publish(publishTopic,(char*)payload.c_str())){
```

```
        Serial.println("Publish ok");// if it sucessfully upload data on the cloudthen it will print publish ok in Serial
monitor or else it will print publishfailed
      }else{
          Serial.println("Publishfailed");
      }

}


void mqttconnect(){
      if(!client.connected()) {Serial.print("Reconnecting client to
          ");Serial.println(server);
          while(!client.connect(clientId,authMethod,token)){
              Serial.print(".");delay(50
              0);
          }

            initManagedDevice();
            Serial.println();

      }
}
void wificonnect()//functiondefinationforwificonnect
{
      Serial.println();Serial.print("Connectingto")
      ;


    WiFi.begin("Wokwi-GUEST","",6);//passingthewificredentialstoestablishtheconnection
      while(WiFi.status()!=WL_CONNECTED){delay(500);
          Serial.print(".");

      }
      Serial.println("");Serial.println("WiFiconnecte
      d");Serial.println("IP address:
      ");Serial.println(WiFi.localIP());

}

void initManagedDevice(){
      if(client.subscribe(subscribetopic))
          {Serial.println((subscribetopic));Serial.println("subsc
          ribetocmdOK");
```

```
    }else{
        Serial.println("subscribetocmdFAILED");
    }
}

voidcallback(char*subscribetopic,byte*payload,unsignedintpayloadLength)
{

    Serial.print("callbackinvokedfortopic:");
    Serial.println(subscribetopic);
    for(inti=0;i<payloadLength;i++){
        //Serial.print((char)payload[i]);data3+=(char)payload[
        i];
    }
    Serial.println("data:"+data3);if(data3=="light
    on")
    {
Serial.println(data3);digitalWrite(
LED,HIGH);
    }
    else
    {
Serial.println(data3);digitalWrite
(LED,LOW);
    }
data3="";
}
```

DEMO LINK :

https://drive.google.com/drive/u/0/folders/18xK13infgA-SyzlskEBeZcfyIlWTOWp4