V.S.B College of Engineering Technical Campus

Coimbatore

Department of Electronics And Communication Engineering

IBM- NALAYA THIRAN

TITLE:-SMART FARMER IOT –ENABLED SMART FARMING APPLICATION

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CONTENTS

SMART FARMER IOT –ENABLED SMART FARMING APPLICATION

1. INTRODUCTION

1.1 Project Overview:-

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

1.2 Purpose:-

Increasing control over production leads to better cost management and waste reduction. The ability to trace anomalies in crop growth or livestock health, for instance, helps eliminate the risk of losing yields. Additionally, automation boosts efficiency. Smart farming reduces the ecological footprint 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 of greenhouse gases.

2. LITERATURE SURVEY

2.1 Existing problem:-

IoT based Smart Farming improves the entire Agriculture system by monitoring the field in real-time. With the help of sensors and interconnectivity, the Internet of Things in Agriculture has not only saved the time of the farmers but has also reduced the extravagant use of resources such as Water and Electricity. Climate plays a very critical role for farming. And having improper knowledge about climate heavily deteriorates the quantity and quality of the crop production. Precision Agriculture/Precision Farming is one of the most famous applications of IoT in Agriculture. It makes the farming practice more precise and controlled by realizing smart farming applications such as livestock monitoring, vehicle tracking, field observation, and inventory monitoring. To make our greenhouses smart, IoT has enabled weather stations to automatically adjust the climate conditions according to a particular set of instructions. Adoption of IoT in Greenhouses has eliminated the human intervention, thus making entire process cost-effective and increasing accuracy at the same time.

2.2 References:-

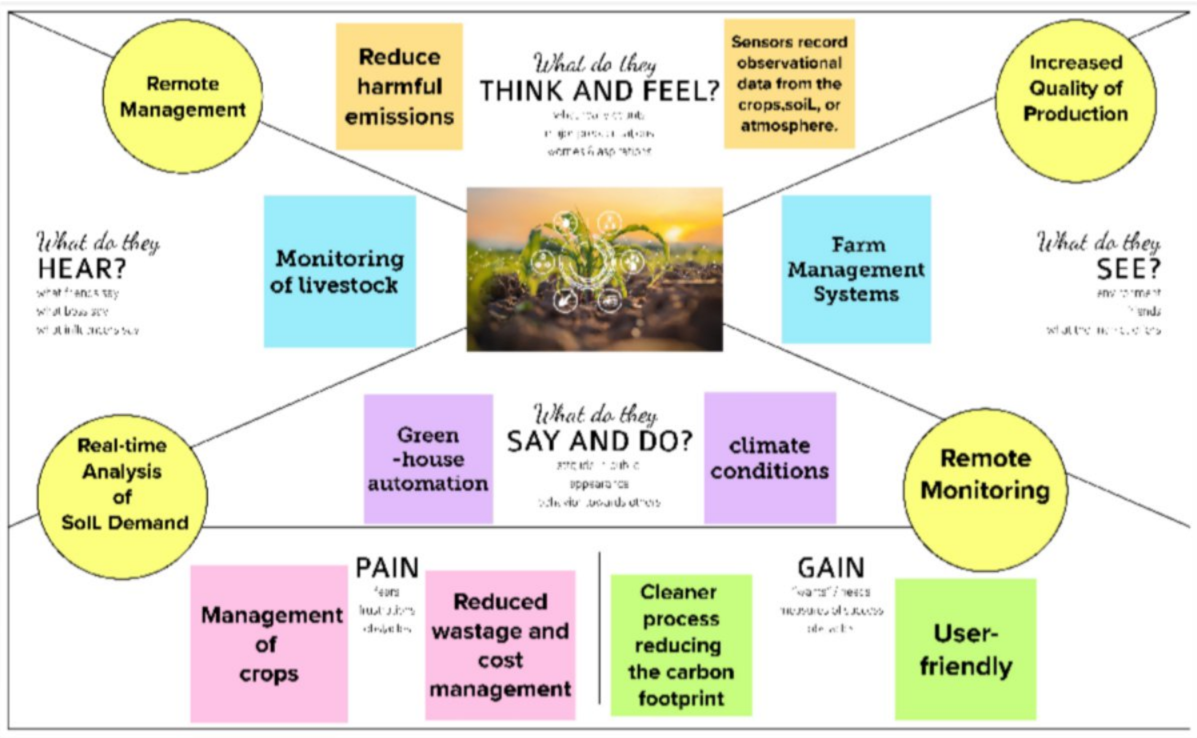
- ✓ **Divya J., Divya M.,Janani V."IoT based Smart Soil Monitoring System for Agricultural Production" 2017.**
- ✓ **R. NageswaraRao, B.Sridhar,"IOT BASED SMART CROP-FIELD MONI- TORING AND AUTOMATION IRRIGATION SYSTEM". 2018**
- ✓ **Anushree Math, Layak Ali, PruthvirajU "Development of Smart Drip Irriga- tion System Using IoT"2018.**

2.3 Problem Statement Definition:-

The traditional agriculture and allied sector cannot meet the requirements of modern agriculture which requires high-yield, high quality and efficient output. Thus, it is very important to turn towards modernization of existing methods and using the information technology and data over a certain period to predict the best possible productivity and crop suitable on the very particular land. The adoptions of access to high-speed internet, mobile devices, and reliable, low-cost satellites (for imagery and positioning) are few key technologies characterizing the precisionprecisionagriculture0 agriculture trend. Precision agriculture is one of the most famous applications of IoT in the agricultural sector and numerous organizations are leveraging this technique around the world. Some products and services in use are VRI optimization, soil moisture probes, virtual optimizer PRO, and so on. VRI (Variable Rate Irrigation) optimization maximizes profitability on irrigated crop fields with topography or soil variability, improve yields, and increases water use efficiency.IoT has been making deep inroads into sectors such as manufacturing, health-care and automotive. When it comes to food production, transport and storage, it offers a breadth of options that can improve India's per capita food availability. Sensors that offer information on soil nutrient status, pest infestation, moisture conditions etc. which can be used to improve crop yields over time.

3. IDEATION & PROPOSED SOLUTION:-

3.1 Empathy Map Canvas:-



3.1 Ideation & Brainstorming:-

3.3 Proposed Solution:-

S.No.	Parameter	Description
•	Problem Statement (Problem to be solved)	According to a report released by more than 200 NGOs from 75 countries, one person dies of hunger every four seconds. It also reported that 345 million people are acutely hungry, a figure that has doubled since 2019.Additionally, water overuse can cause water shortage, often occurs in areas of irrigation agriculture, and harms the environment in several ways including increased salinity, nutrient pollution, and the degradation and loss of flood plains and wetlands
•	Idea / Solution description	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. <u>Benefits of smart farming:-</u> Increasing control over production leads to better cost management and waste reduction. The ability to trace anomalies in crop growth or livestock health, for instance, helps eliminate the risk of losing yields. Additionally, automation boosts efficiency.

•	Novelty / Uniqueness	1. Observation . Sensors record observational data from the crops, livestock, soil, or atmosphere. 2. Diagnostics. The sensor values are fed to a cloud-hosted IoT platform with predefined decision rules and models—also called “business logic”—that ascertain the condition of the examined object and identify any deficiencies or needs. 3. Decisions . After issues are revealed, the user, and/or machine learning-driven components of the IoT platform determine whether location-specific treatment is necessary and if so, which. 4. Action . After end-user evaluation and action, the cycle repeats from the beginning.
•	Social Impact / Customer Satisfaction	One of the benefits of using IoT in agriculture is the increased agility of the processes. Thanks to real-time monitoring and prediction systems, farmers can quickly respond to any significant change in weather, humidity, air quality as well as the health of each crop or soil in the field
•	Business Model (Revenue Model)	Smart farming is an advanced and innovative way to get maximum cultivation and minimize the human efforts.
•	Scalability of the Solution	Automatic adjustment of farming equipment made possible by linking information like crops/weather and equipment to auto adjust temperature, humidity, etc. It has enabled farmers to reduce waste and enhance productivity with the help of sensors.

3.4 Problem Solution fit:-

Project Design Phase-I - Solution Fit Template

Project Title: Smart Farmer-IOT Enabled Smart Farming

1. CUSTOMER SEGMENT(S)

- ✓ Farmers
- ✓ Working employees who wants to do farming in his land
- ✓ People who want to do small scale planting

6. CUSTOMER CONSTRAINTS

IOT based Smart farming helps farmers to better understand the important factors such as water, topography, vegetation, soil types. This allows farmers to determine the best uses of scarce resources within their production environment.

5. AVAILABLE

Internet of Things (IoT) enables various applications of crop growth monitoring and selection, automatic irrigation decision support. Remote crop monitoring

2. JOBS TO BE DONE / PROBLEMS

- ✓ Cope with climate change, soil erosion and bio-diversity loss.
- ✓ Satisfy customer's changing taste and expectations.
- ✓ Meet rising demand for more food of higher quality.
- ✓ Accept and learn new technology.
- ✓ Stay resilient against global economic factors

9. PROBLEM ROOT CAUSE

- ✓ Plants grow is were affected.
- ✓ Should not give better crop yield.
- ✓ Some plants are died.
- ✓ Wastage of water.

7. BEHAVIOUR

In addition the behaviour is influenced by behavioural intention. it was further found that technology readiness plays a significant role in the adoption of smart product . Sales and marking skills

3. TRIGGERS

- ✓ Automation and robotics about irrigation.
- ✓ Irrigation and crop management.
- ✓ Drones and sensors.

4. EMOTIONS: BEFORE / AFTER

Farmers faced loss due to wrong prediction due to lack of knowledge in technology but now they can seek a hike in their field.

10. YOUR SOLUTION

- To make the product with many features
- Customer Can control that irrigation on anywhere at anytime.
- Change their economic level.

8.1 ONLINE CHANNELS

The emerging out of convergences of IT and farming techniques, it enhances the agricultural value chain through the application of Internet and related

8.2 OFFLINE CHANNELS

Users are in offline they are only know about the previous information about the field

4. REQUIREMENT ANALYSIS

4.1 Functional requirement:-

FR 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 viaEmail Confirmation via OTP
FR-3	Log in to system	Check Credentials. Check Rolesof Access.
FR-4	Manage Modules	Manage SystemAdmin Manage Rolesof User .Manage User permission
FR-5	Check whether details	Temperature details Humidity details Soil moisturedetails

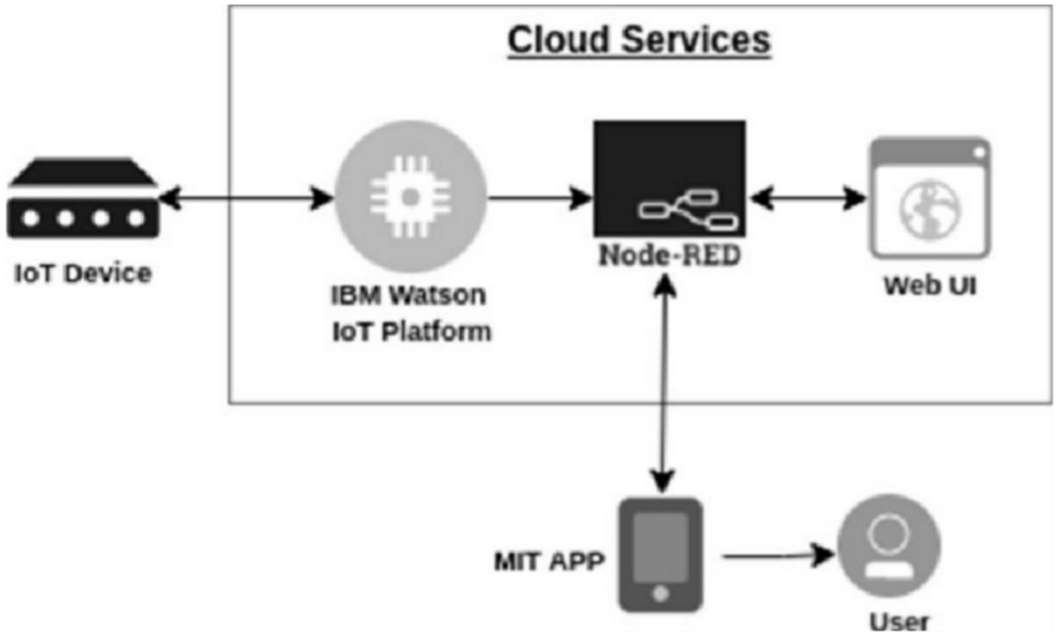
4.2 Non-Functional requirements:-

FR No.	Non-Functional Requirement	Description
NFR-1	**Usability**	The temperature sensor, humidity sensor, soil moisture sensor and irrigation system(motor) is connected to raspberry pi which is connected to IBM cloud ,the farmercan view temperature ,humidity and soil moisture in his smart phoneandcan also control irrigation using his smart phone connected to internet

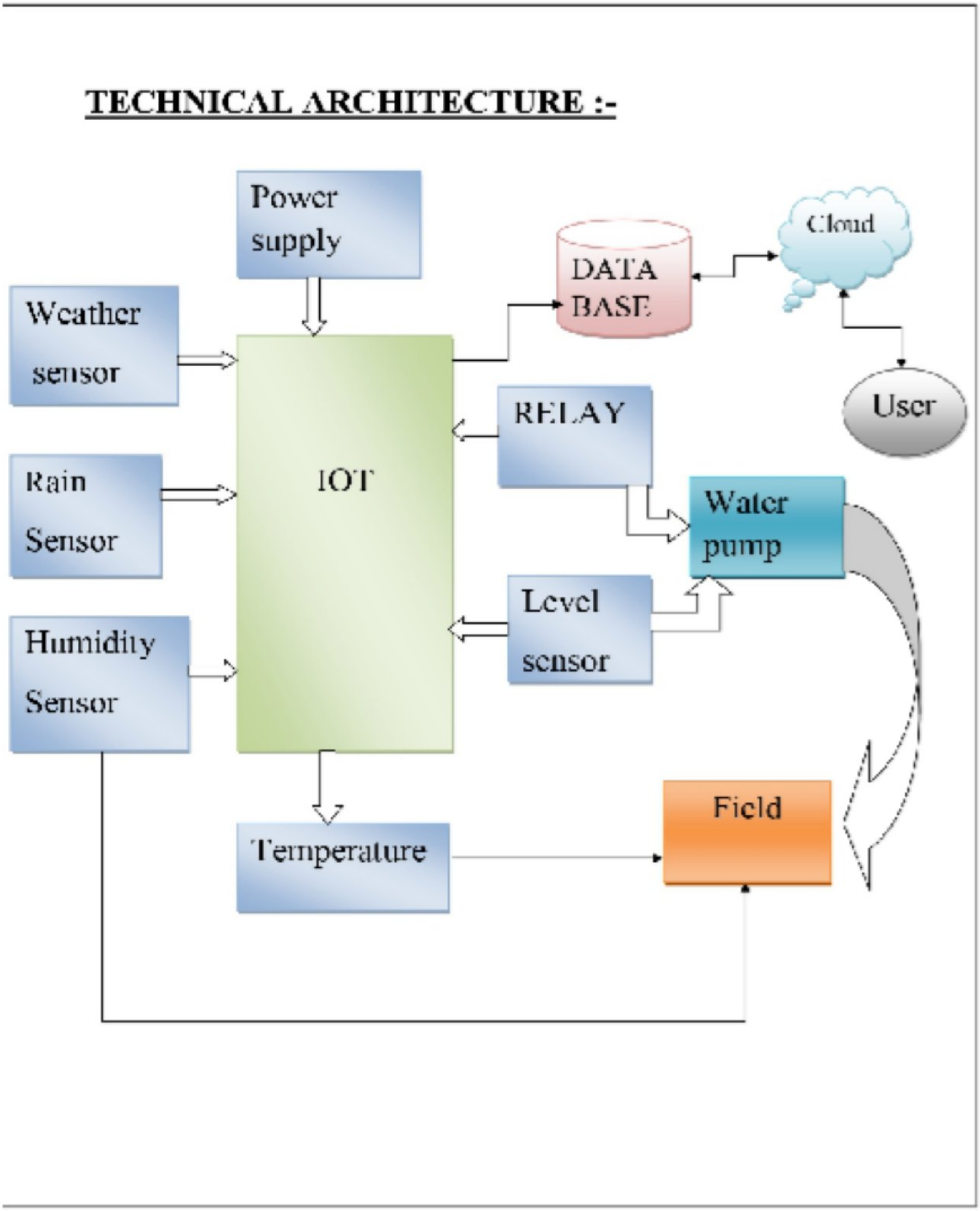
NFR-2	**Security**	User id and password is provided to farmer toprevent thirdparty access
NFR-3	**Reliability**	It specifies how likely the system or its element would runwithout a failure.
NFR-4	**Performance**	Every 10 seconds to IOT will update sensorparameters to cloud
NFR-5	**Availability**	Automatic adjustment of farming equipment made possible by linking information like crops/wealth
NFR-6	**Scalability**	Scalability is another requirement that should be considered in a smart farming platform. Scalability refers to the ability to increase available resources and system capability without the needto go through a major systemredesign or implementation.

5. PROJECT DESIGN:-

5.1 Data Flow Diagrams:-



5.2 Solution & Technical Architecture:-



5.3 User Stories:-

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 canregister for theapplication by entering my email, password, and confirming my password.	I can access myaccount / dashboard	High	Sprint-1
		USN-2	As a user, I will receive confirmation email once I haveregistered for the application	I can receive confirmation email& click confirm	High	Sprint-1
		USN-3	As a user, I canregister for theapplication through Gmail	I can receive confirmation email & click confirm to login	Medium	Sprint-1
	Login	USN-4	As a user, I can log into the application by entering email& password		High	Sprint-1

6.PROJECT PLANNING & SCHEDULING:-

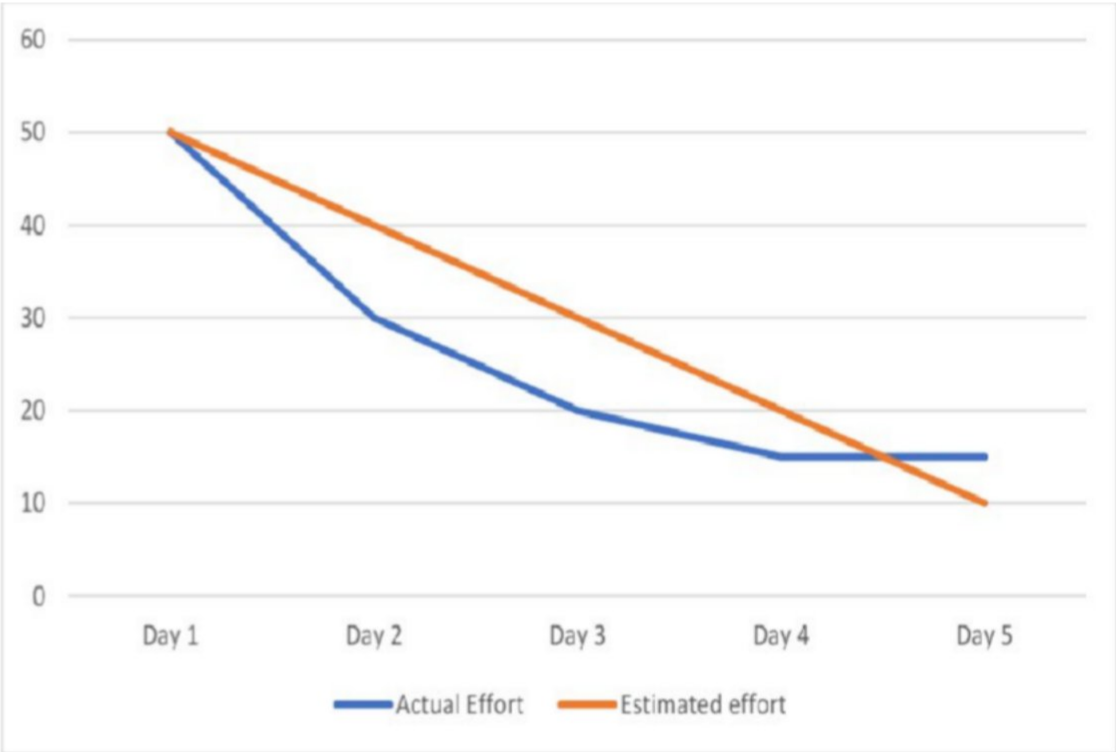
6.1 Sprint Planning & Estimation:-

Sprint	Functional Requirement (Epic)	User StoryNumber	User Story / Task	Story Points	Priority	Team Members
Sprint-1	Simulation creation	USN-1	Connect Sensors and Arduino with pythoncode	2	High	Deenadhayalan ,Sugendran, Kesavaraj, Mohammadharis.
Sprint-2	Software	USN-2	Creating device in the IBM Watson IoT platform, workflow for IoT scenarios usingNode-Red	2	High	Deenadhayalan ,Sugendran, Kesavaraj, Mohamma dharis.
Sprint-2	MIT AppInventor	USN-3	Develop an application for the Smart farmerproject usingMIT App Inventor	2	High	Deenadhayalan ,Sugendran, Kesavaraj, Mohammad haris.
Sprint-3	Dashboard	USN-4	Design the Modules and test the app	2	High	Deenadhayalan ,Sugendran, Kesavaraj, Mohammad haris.
Sprint-4	Web UI	USN-5	To make the user to interact with software.	2	High	Deenadhayalan ,Sugendran, Kesavaraj, Mohammad

6.2 Sprint Delivery Schedule:-

Sprint	Total Story Points	Duration	Sprint StartDate	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		05 Nov 2022
Sprint-3	20	6 Days	07 Nov 2022	12 Nov 2022		12 Nov 2022
Sprint-4	20	6 Days	14 Nov 2022	19 Nov 2022		19 Nov 2022

Burndown Chart:



7.CODING & SOLUTIONING:-

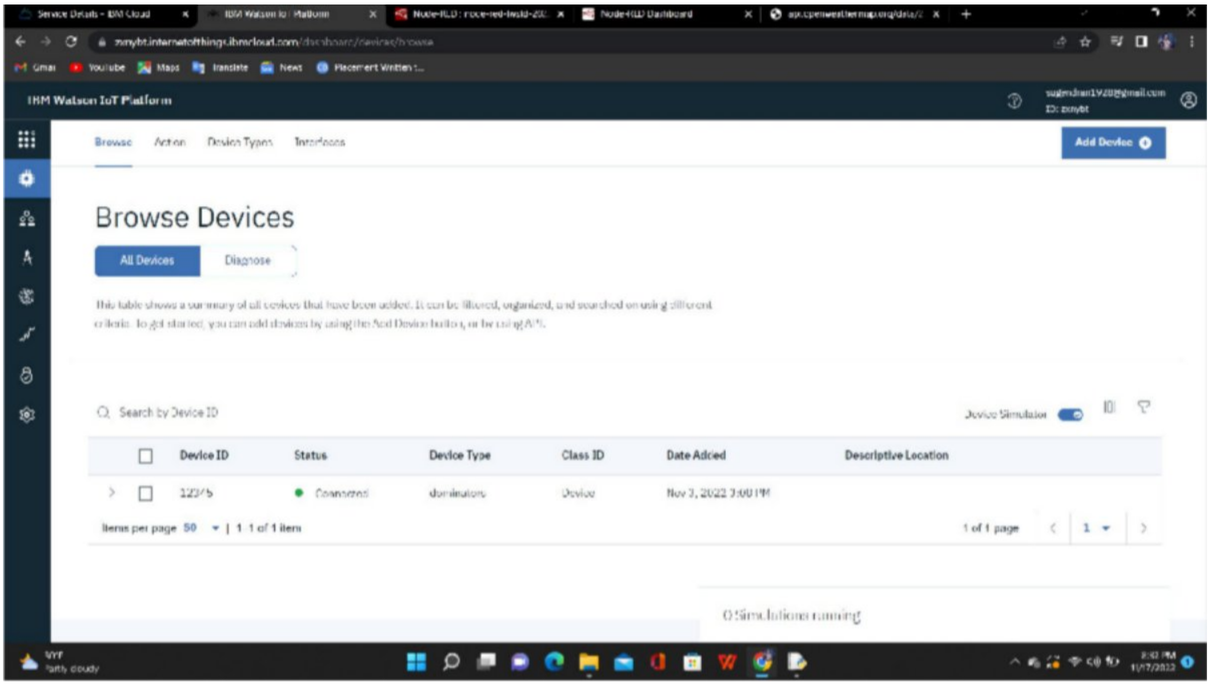
7.1 Feature 1:-

PYTHON CODE:-

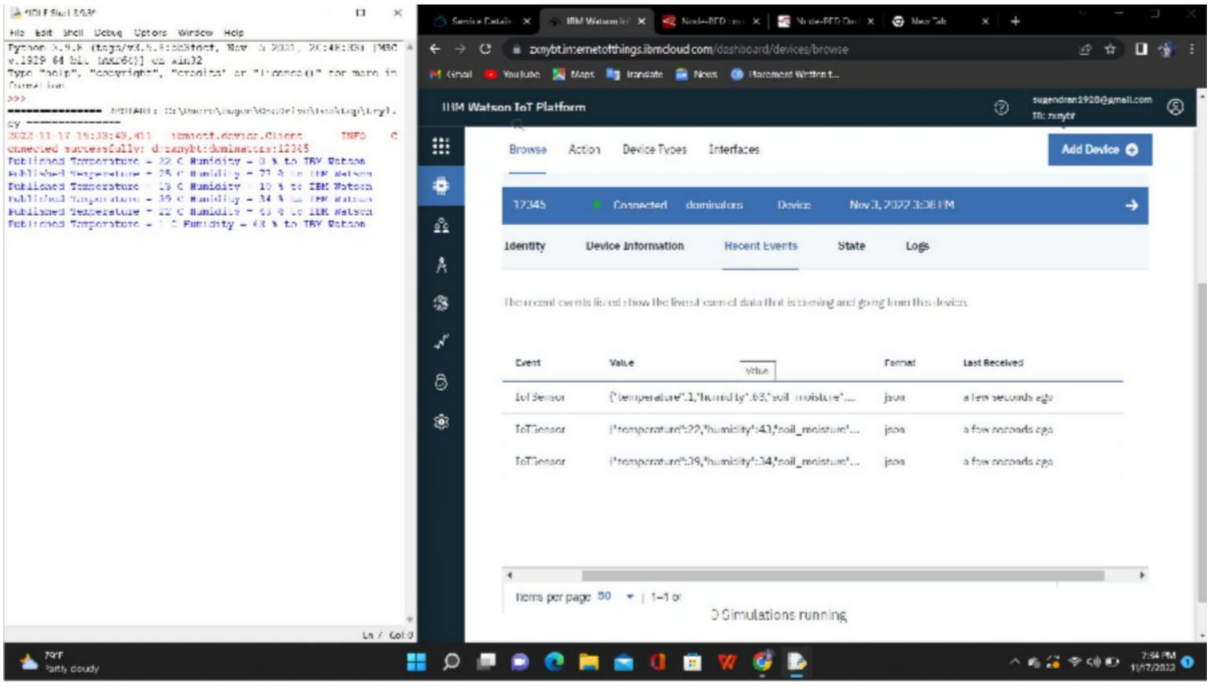
```
import time
import sys
import ibmiotf.application
import ibmiotf.device
import random



organization = "zxnybt"
deviceType = "dominators"
deviceId = "12345"
authMethod = "token"
```

```
authToken = "123456789"


def myCommandCallback(cmd):
    print("Command received: %s" % cmd.data)
    for key in cmd.data.keys():
      if key == 'motor':
         if cmd.data['motor'] == 'ON':
            print("MOTOR is turned ON")

         elif cmd.data['motor'] == 'OFF':
            print("MOTOR is turned OFF")
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()

deviceCli.connect()

while True:



      temp=random.randint(0,40)
      Humid=random.randint(0,100)
      moist=random.randint(0,40)
      data = { 'temperature' : temp, 'humidity': Humid, 'soil_moisture':moist }

      def myOnPublishCallback():
```

```
        print ("Published Temperature = %s C" % temp, "Humidity = %s %%" %
Humid,"Soil moisture = %s" % moist , "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


deviceCli.disconnect()
```



7.2 Feature 2:-



8. TESTING:-

8.1 Test Cases:-

Date	3-Nov-22
Team ID	PNT2022TMIDxxxxx
Project Name	Project - xxx
Maximum Marks	4 marks

Test case ID	Feature Type	Component	Test Scenario	Pre-Requisite	Steps To Execute	Test Data	Expected Result	Actual Result	Status	Commnets	TC for Automation(Y/N)	BUG ID	Executed By
LoginPage_TC_OO1	Functional	Home Page	Verify user is able to see the Login/ Signup popup when user clicked on My account button		1.Enter URL and click go 2.Click on My Account dropdown button 3.Verify login/Singup popup displayed or not	MIT App Inventor https://appinventor.mit.edu	Login popup should display		Fail	Steps not Clear to follow		Bug-1234	
LoginPage_TC_OO2	UI	Home Page	Verify the UI elements in Login/Signup popup		1.Enter Smart App 2.Verify login/Singup popup with below UI elements: a.Username text box b.password text box c.Submit button d.New customer? Create account link e.Last password? Recovery password	MIT App Inventor https://appinventor.mit.edu	Application should show below UI elements: a.email text box b.password text box c.Login button with orange colour d.New customer? Create account link e.Last password? Recovery password link	Working as expected	Pass				
LoginPage_TC_OO3	Functional	Home page	Verify user is able to log into application with Valid credentials		1.Enter MIT App Inventor URL (https://appinventor.mit.edu) Smart app and click go 2.Click on My Account dropdown button 3.Enter Valid username/email in Email text box 4.Enter valid password in password text box	Username: IBM password: IBM	User should navigate to user account homepage	Working as Expected	Pass				
LoginPage_TC_OO4	Functional	Login page	Verify user is able to log into application with InValid credentials		1.Enter URL MIT App Inventor https://appinventor.mit.edu and smart app click go 2.Click on My Account dropdown button 3.Enter InValid username/email in Email text box 4.Enter valid password in password text box	Username: chalam@gmail password: Testing123	Application should show 'Incorrect email or password ' validation message.	Working as Expected	Pass				

8.2 User Acceptance Testing:-

1. Purpose of Document

The purpose of this document is to briefly explain the test coverage and open issues of the [ProductName] project at the time of the release to User Acceptance Testing (UAT).

Increasing control over production leads to **better cost management and waste reduction**. The ability to trace anomalies in crop growth or livestock health, for instance, helps eliminate the risk of losing yields. Additionally, automation boosts efficiency. Smart farming **reduces the ecological footprint 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 of greenhouse gases.

2. Defect Analysis

This report shows the number of resolved or closed bugs at each severity level, and how they were resolved

Resolution	Severity 1	Severity 2	Severity 3	Severity 4	Subtotal
By Design	8	3	2	2	16
Duplicate	1	0	2	0	3
External	2	3	0	1	6
Fixed	9	2	3	17	31
Not Reproduced	0	0	1	0	1
Skipped	0	0	1	1	2
Won't Fix	1	4	1	1	7
Totals	21	12	9	22	66

3. Test Case Analysis

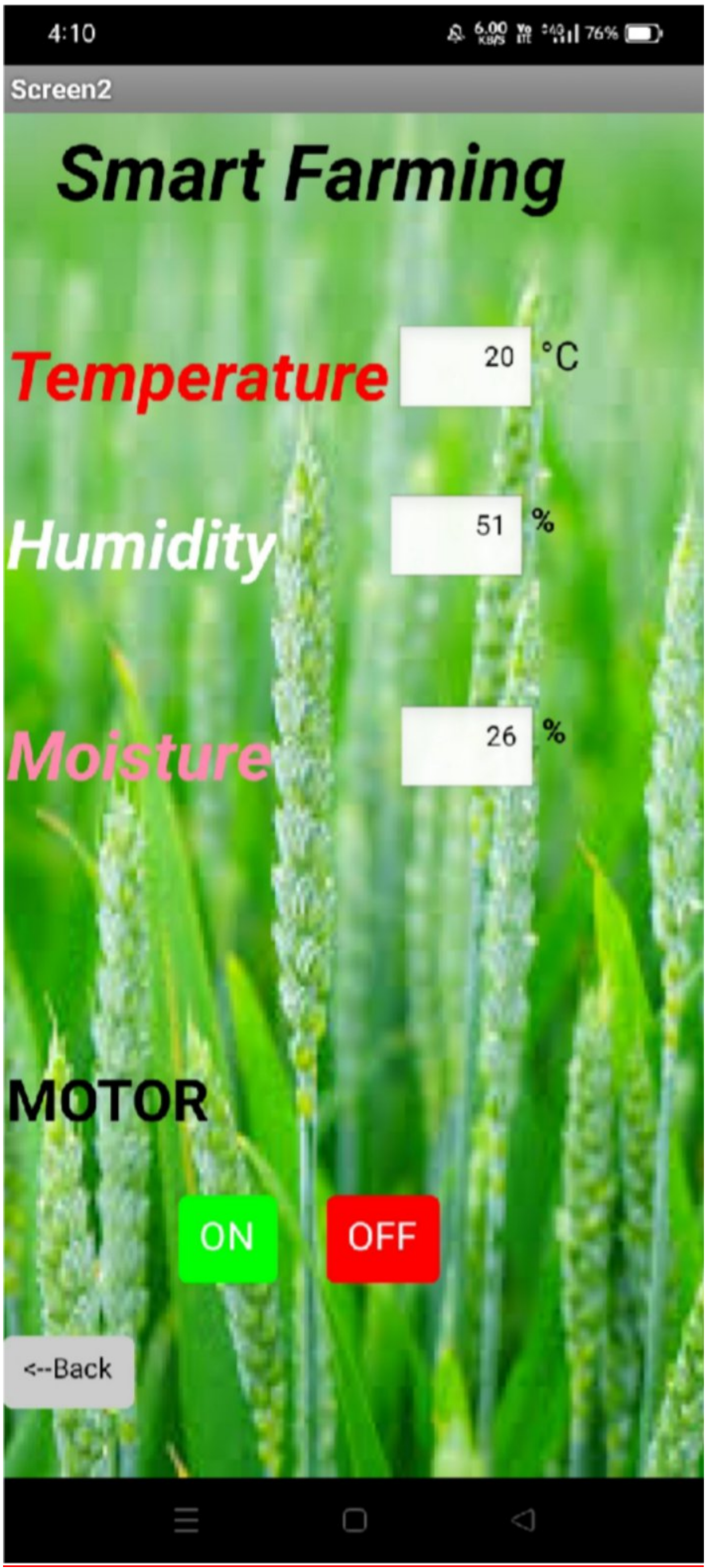
This report shows the number of test cases that have passed, failed, and untested

Section	Total Cases	Not Tested	Fail	Pass
Print Engine	5	0	0	5
Client Application	30	0	0	30
Security	2	0	0	2
Outsource Shipping	2	0	0	2
Exception Reporting	9	0	0	9
Final Report Output	4	0	0	4
Version Control	1	0	0	1

9. **RESULTS:-**

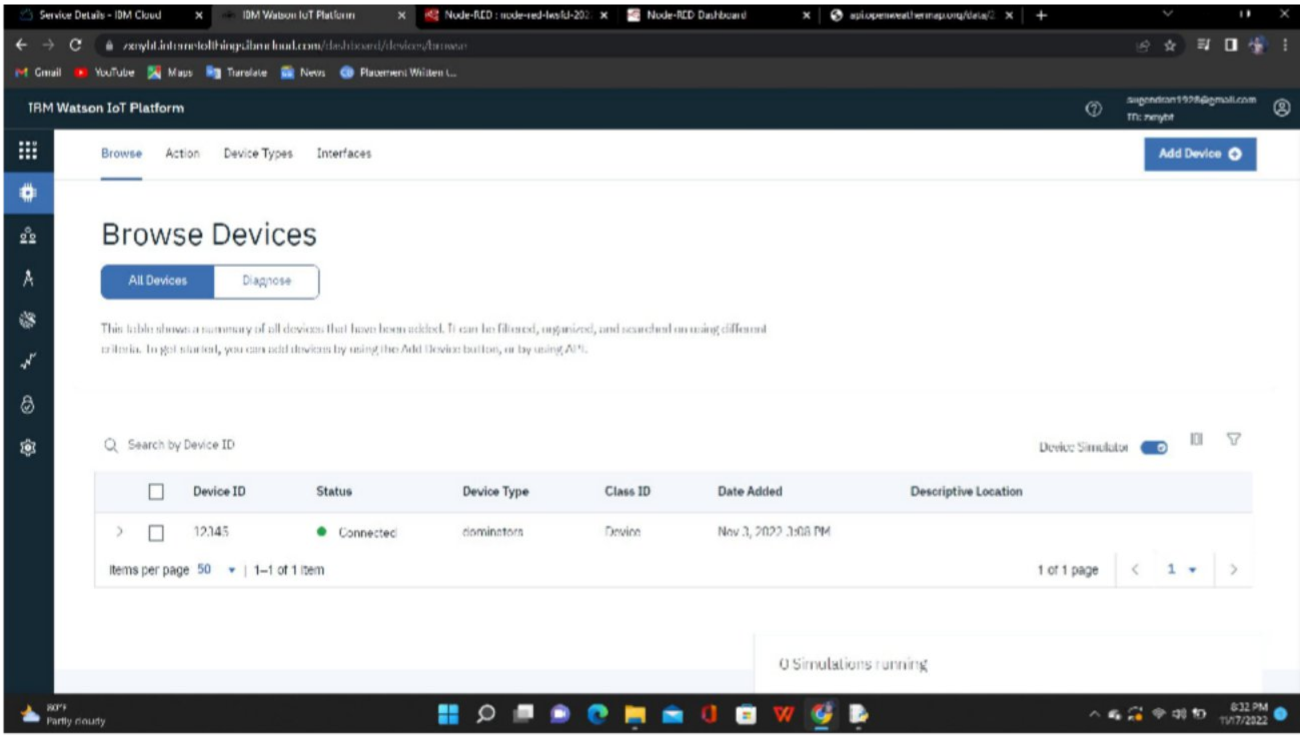
SCREEN 1

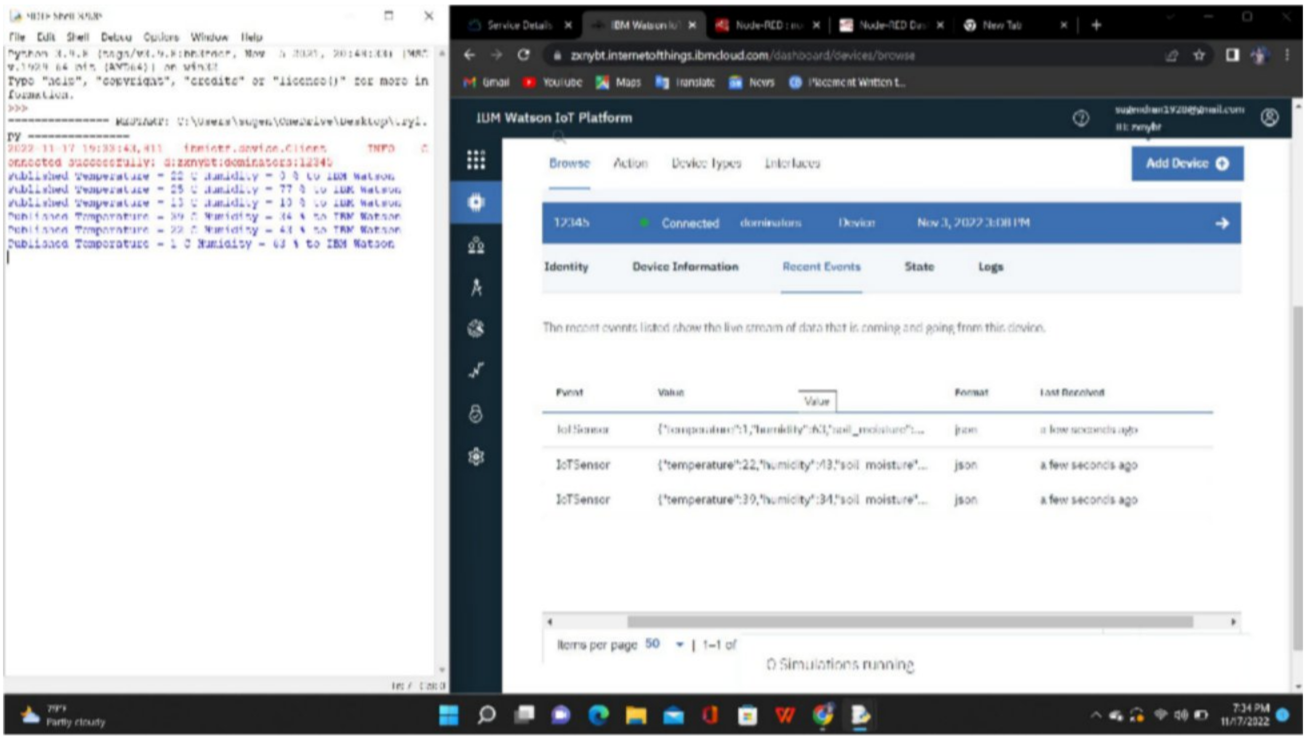
Click welcome button go to second screen


4:10
76%
Screen2
Smart Farming
Temperature
20
°C
Humidity
51
%
Moisture
26
%
MOTOR
ON
OFF
<--Back

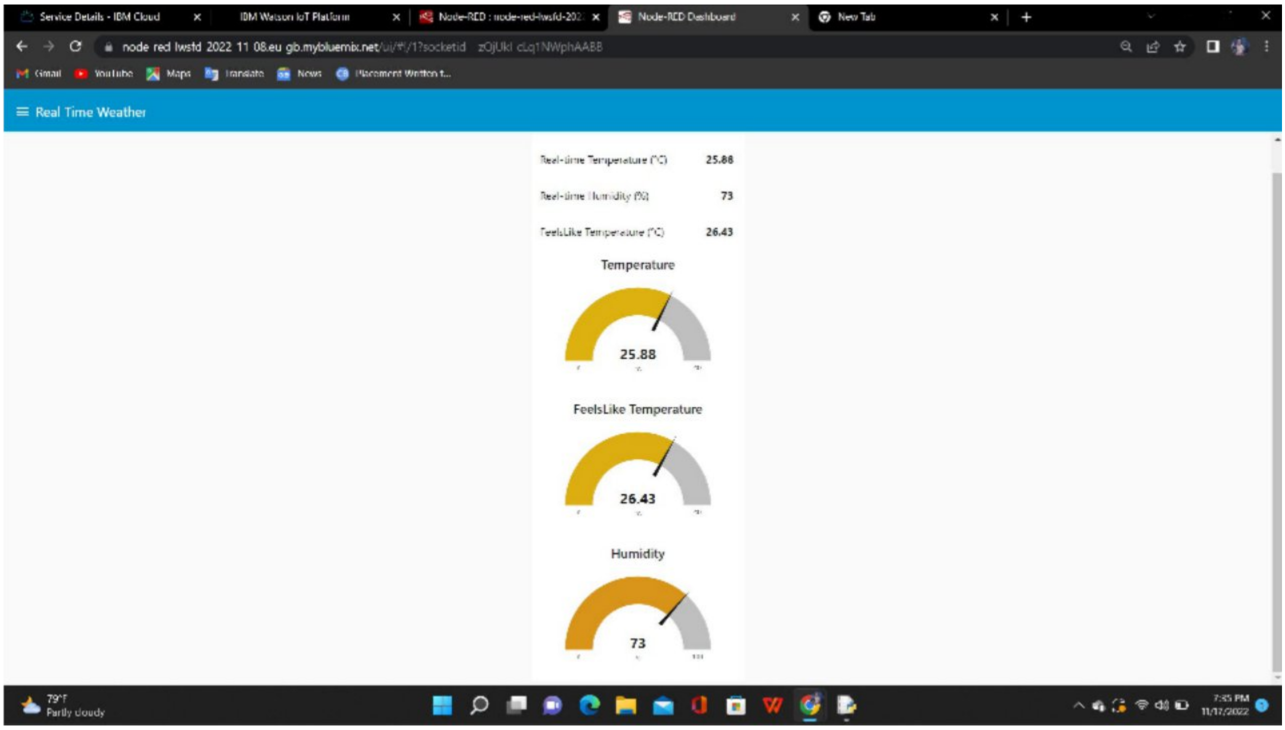
SCREEN 2

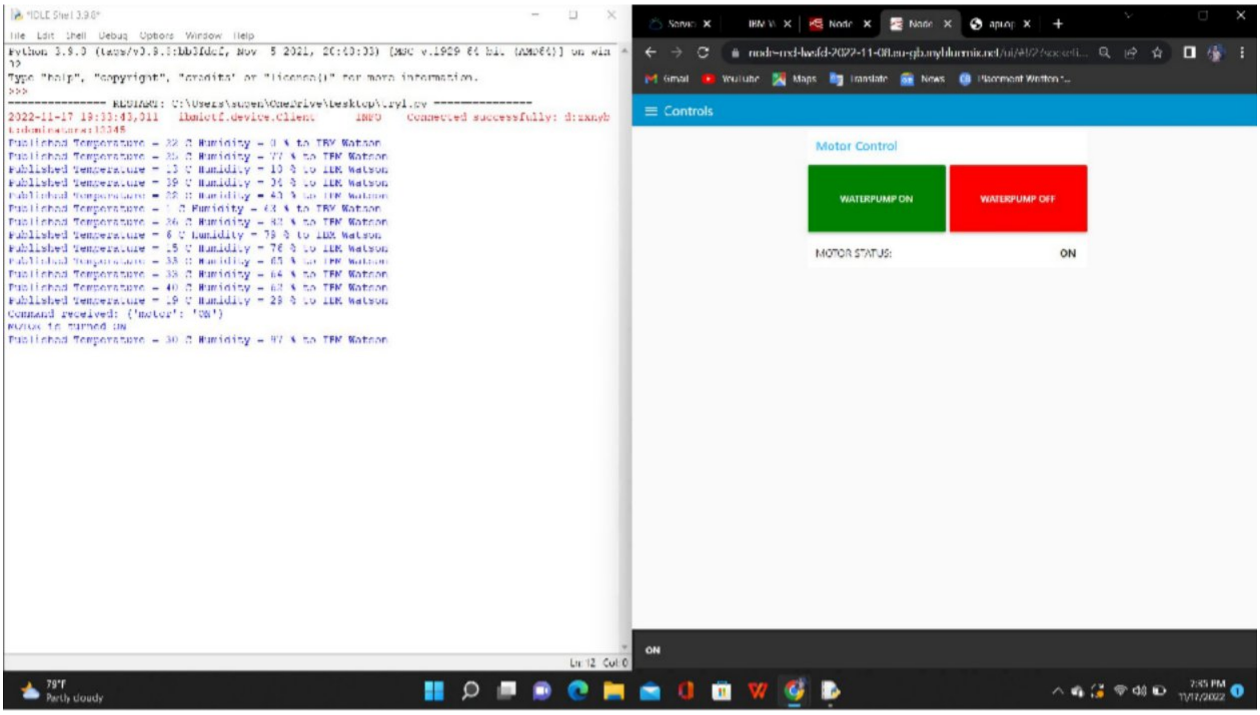
IBM WATSON IOT PLATFORM





NODE-RED PLATFORM





10. ADVANTAGES & DISADVANTAGES:-

Advantages:-

- • Farms can be monitored and controlled remotely.
- • Increase in convenience to farmers.
- • Less labour cost.
- • Better standards of living.

Disadvantage:-

- • Lack of internet/connectivity issues.
- • Added cost of internet and internet gateway infrastructure.
- • Farmers wanted to adapt the use of WebApp

11. CONCLUSION:-

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

By using this system farmers can effectively produce more yield and can save water from wastage. With help of weather forecast service farmer can water their land as per weather. He can also turn off motor when water content in soil is sufficient.

12 . FUTURE SCOPE:-

Through collecting data from sensors using IoT devices, you will learn about the real-time state of your crops. The future of IoT in agriculture allows predictive analytics to help you make better harvesting decisions.

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. IOT TECHNOLOGIES IN AGRICULTURE.

IoT smart agriculture products are designed to help monitor crop fields using sensors and by automating irrigation systems. As a result, farmers and associated brands can easily monitor the field conditions from anywhere without any hassle.

With help of artificial intelligence and Machine Learning algorithms, we can suggest farmers to grow a particular crop based on soil data from the sensors. We can also control the water supply to crops with help of artificial learning based on soil moisture.

13.APPENDIX:-

Source Code:-

IoT Enabled Smart Farming Application

Source Code (Python)

```
import time
import sys
import ibmiotf.application
import ibmiotf.device
import random


organization = "zxnybt"
deviceType = "dominators"
deviceId = "12345"
authMethod = "token"
authToken = "123456789"
```

```
def myCommandCallback(cmd):
    print("Command received: %s" % cmd.data)
    for key in cmd.data.keys():
      if key == 'motor':
         if cmd.data['motor'] == 'ON':
            print("MOTOR is turned ON")

         elif cmd.data['motor'] == 'OFF':
            print("MOTOR is turned OFF")
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()

deviceCli.connect()

while True:



      temp=random.randint(0,40)
      Humid=random.randint(0,100)
      moist=random.randint(0,40)
      data = { 'temperature' : temp, 'humidity': Humid, 'soil_moisture':moist }

      def myOnPublishCallback():
         print ("Published Temperature = %s C" % temp, "Humidity = %s %%" %
Humid,"Soil moisture = %s" % moist , "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


deviceCli.disconnect()
```

LINKS:-

Github link:- **https://github.com/IBM-EPBL/IBM-Project-33228-1660216502**

Demo link :-
https://drive.google.com/file/d/18YzxHUfhm63V4gZ_45hEoP8BGhnH5gJS/view?usp=drivesdk