SMARTFARMER - IOT ENABLED SMART FARMING APPLICATION

INTERNET OF THINGS DOMAIN

TEAM ID: PNT2022TMID07443

A PROJECT REPORT

Submitted by

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NOVEMBER 2022

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BONAFIDE CERTIFICATE

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INTERNAL EXAMINER **EXTERNAL EXAMINER**

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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

2.1Existing Problems:

A. Poor Internet Connectivity:

Most of the farming lands are in isolated locations where internet connectivity may not be sufficient to allow fast transmission. The communication path may be blocked by crops, trees and other physical barriers.

B. High Hardware and software Costs:

Components required to implement smart farming with IoT is expensive. Though sensors are available at least cost, farmer has to invest on software, cloud and other technologies. Maintenance of hardware is also expensive. In some cases, the sensors used in farming are more expensive because to get accurate result. Moreover, farmer must learn to use the components used in smart farming.

C. Interoperability issue:

Interoperability means the ability of components that communicate with each other, irrespective of their manufacturer or technical specifications. As many sensor hardware and software are used to create a smart farming system, however it is difficult to integrate heterogeneous data from different sensors.

D. Storage issue:

In smart farming large amount of data are generated by each sensor which were deployed in the field, normally database in some cases used to store the collected but it is not enough to store. Cloud storage has been preferred for storing the sensor data which has to be paid for usage

CONCLUSION:

This paper discusses about the Smart farming in detail. IoT have a major role in developing smart farming that increases the production of agriculture products by monitoring different factors such as temperature, humidity, soil moisture, soil fertility which are important in the growth and production of crops. Smart farming increases the income of farmers by increase the production reduces labor requirement, wastage of water, suggest required amount of fertilizer. In this paper a survey on technologies along with Internet of Things (IoT) in Smart farming and the challenge of IoT in agriculture is explained. Even though several researches have been existing but they are all not user friendly (i.e illiterate farmers cannot handle it.) and not taking the demand of the crop in the market as a parameter to select a suitable crop for the particular land. This will be implemented in future which will improve the economic life of farmers.

2.2 REFERENCES:

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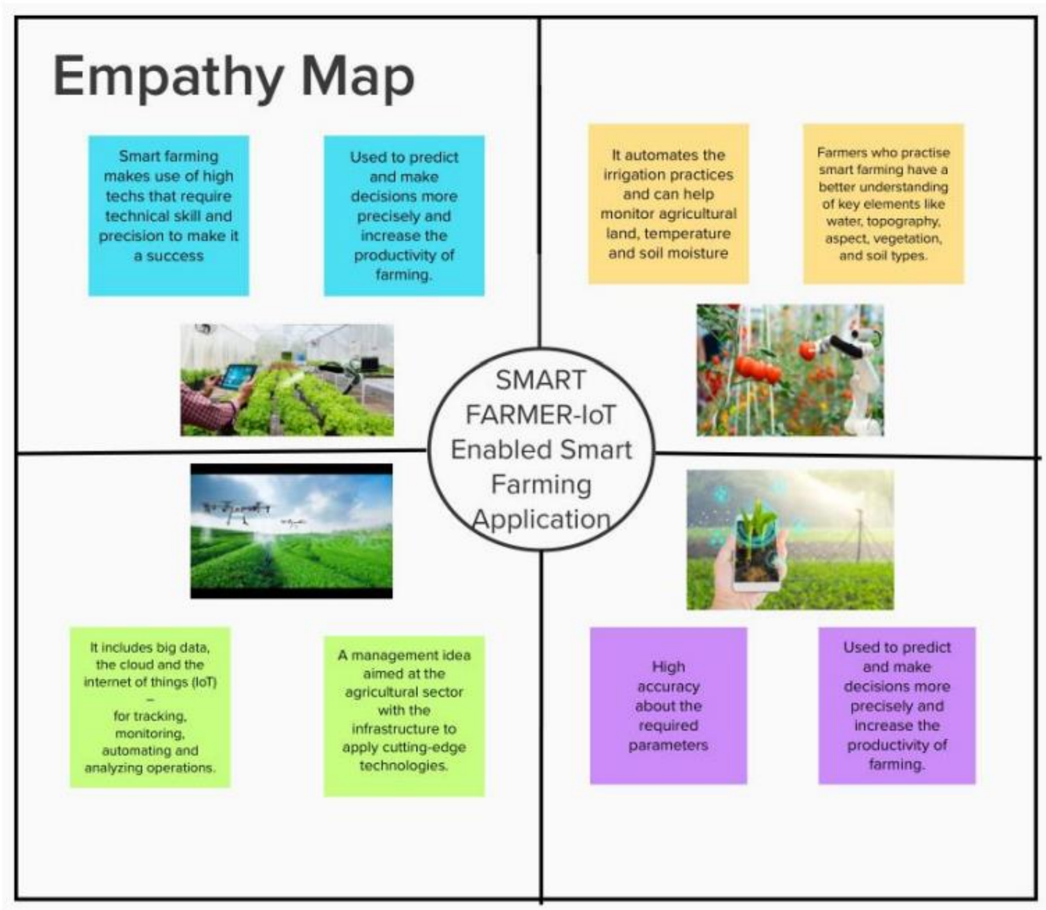
2.3 Problem Statement Definition:

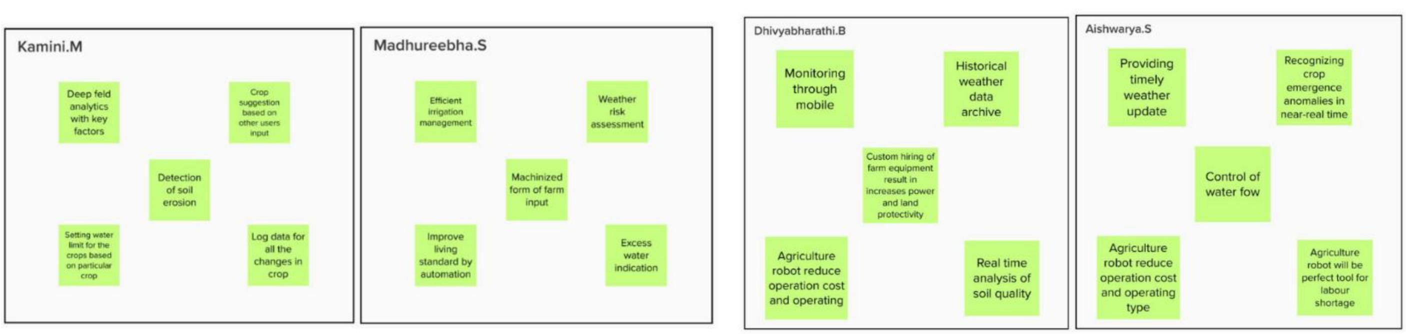
IoT in farming is used to improve time efficiency, irrigation, crop monitoring, and reduce the usage of insecticides and pesticides due to early detection of disease etc. It also to reduces labor work and streamlines the farming. IoT in farming is used to collect data on temperature, humidity, windspeed, and soil fertility in real time. These data are used to automate the farming, minimize labor requirement and reduces difficulty required to monitor the crops. Smart Irrigation System: Farmer, usually pumps the water more or less to the crop which leads too a stage of water or insufficient water to the crop to overcome this situation smart irrigation comes into existence. The system is used in active super vision of the irrigation for agriculture field is designed with the WSAN technologies that are used to collect and control various heterogeneous environmental parameters and the functioning of the irrigation system. The Fuzzy Logic-based system is used which works based on the suggestion made by of the farmers to get more accurate result. The integration of WSAN and Fuzzy Logic system hasan advantage in improved saving water and provide accurate suggestion to the farmers. The research is intensive on the combination of other sensors that are required for measuring the parameter that are required to support the farmers to under go smart farming. The comparison between the threshold-based strategy and FL-based DSS results an average water saving 29.5%more by using the proposed FL-based DSS (i.e., an irrigated water volume V (t) = 7.9linsteadofV(t) = 11.2 l). The system measures temperature and humidity, soil moisture and water level of the tank from the field without any human intervention. The system contains wireless sensor nodes which are used to collect the real time values from the field. The valves that are collected by each sensor nodes are sent to a master node through Zigbee. A master node act as a gateway between sensor nodes in the field and cloud server. It transmits information that are acquired from the nodes to the cloud for decision making. The cloud server makes prediction by comparing sensor values and predefined threshold values. Once the prediction is made then master node forwards the decision to control section, which helps to irrigate the field automatically without human intervention. The automated irrigation system was designed with GSM and weather forecast using Hargreaves equation. The system suggests a suitable amount of water required for particular crop by taking soil type, rainfall and evapotranspiration (amount of water that are evaporated due to the temperature) into consideration hence it reduces the wastage of water resource. The information about the possibility of rainfall are collected from a weather forecasting. The fire accidents are also prevented by premature detection of smoke and temperature and automatically switch on the sprinklers. The automated irrigation system which monitors and controls all the activities of drip irrigation system efficiently in a real time. More over this system uses color sensor to predict the level of soil fertility. Smart irrigation uses about 30% less energy per unit crop yield compared to the normal farming. The issue in this paper is colour sensor will not predict accurate and details of the nutrients. Smart Insect and Pest Detection: Excessive use of pesticides for crop to removal of pest will increase the danger to human beings and environment. According to World Health Organization (WHO) every year there are millions of cases of pesticides poisoning and death occurring. Farmers do not have information about accurate application of pesticides which leads harmful effects. Exposing to more pesticides leads to health effects like allergies and asthma and other health issues. There were different method used to kill the pests such as glue boards, toxic baits, pesticides. But due to technology growth there are various types of methods are emerging for removal of pest without applying pesticides. Use Electronic devices to avoid pests. Different pests exist at different range of frequency. Internet of Things will play an important role for pest detection and pest control. Almost pests are predicted in advance through monitoring device at the field. These values are given to or stored that can be used by farmers. Changes in the weather like temperature and humidity are measured using weather stations or through sensors for a particular area. Precaution measures are taken based on information or alert provided by IoT system. Farmer will get awareness or alerts about the pests on time and can avoid spread of pest and yield loss and when to use pesticides. The system uses image processing technique to identify pests in the greenhouse environment and the pests can be detected using the SVM classification with RBF Kernel function in which100sample are taken totally 80 samples were used to train and remaining 20samples were used to test. The image processing with SVM method was effective in spotting the parasite with an error less than 2.5%. The system uses Hidden Marko Model for data analysis and to detect the diseases of grapes plant in early stage which help the farmer to use little amount of pesticide and also provide suggestion of pesticides to protect the crop from that particular diseases. This system also helps the farmer get the information regarding the use of fertilizers, pesticides spraying and irrigation. It provides an efficiency rate of about 90.9% in classification. The system uses linear SVM algorithm with decision tree to predict the crop. The system is trained with a dataset and linear SVM and decision tree algorithm are applied on new data to predict the output. The system predicts the crop for the farmer based on the soil parameter given by the farmer. This system also helps the farmer by providing information regarding the pests that usually affect the crop. The information also includes what pesticides can be used for removal of pests. This system provides about 89.66% accuracy. Crop Selection: The system uses IoT and machine learning algorithm to predict suitable crop for particular land based on climatic factors such as temperature, humidity, soil moisture, soil nutrient content such as nitrogen, phosphorus, potassium. The system analysis and predict soil nutrient by getting real time data from sensor in the field. It measures nutrients like Nitrogen, Phosphorus, and Potassium(NPK). The system upload soil nutrient level required for various crops. Decision is made by comparing real time sensor data with database data. The result is displayed using a developed mobile application. The issue is it consider only few nutrient values to decide the soil nutrients. An Intelligent Agriculture platform, in which IoT sensors are used to collect various environmental parameter that are required to predict suitable crop. The data from the IoT sensors are transmitted to the server using 4G networks for processing purpose. The sensor data is cleaned before processing to accurate result. This systemuses3D cluster correlation to predict a suitable crop for particular land based on sensor data. This helps farmer to increase crop production. This paper mainly discusses on network requirement such as throughput, latency and mobility for smart farming application. The communication between component infield are carried out by 6LoWPAN. Usually, the connection between the field and cloud are carried out by Wi-Fi connection. This connection increases latency to overcome this issues fog computing concept come into existence, which has lesser delay and this saves bandwidth in the network. The system is designed as an Android Application, in which user has to feed their inputs to get the necessary information. Artificial Neural Network is used for modelling that help in prediction and it is implemented using Feed forward Back Propagation Network. This paper suggest farmer a suitable crop for their land and also help in suggesting the fertilizer and also suggest whether the farmer chosen crop will provide high yielding or not. Disadvantage of this paper is user have to collect data by testing his soil in laboratory and weather data from weather station to feed the input to system. The system provides 92% prediction accuracy

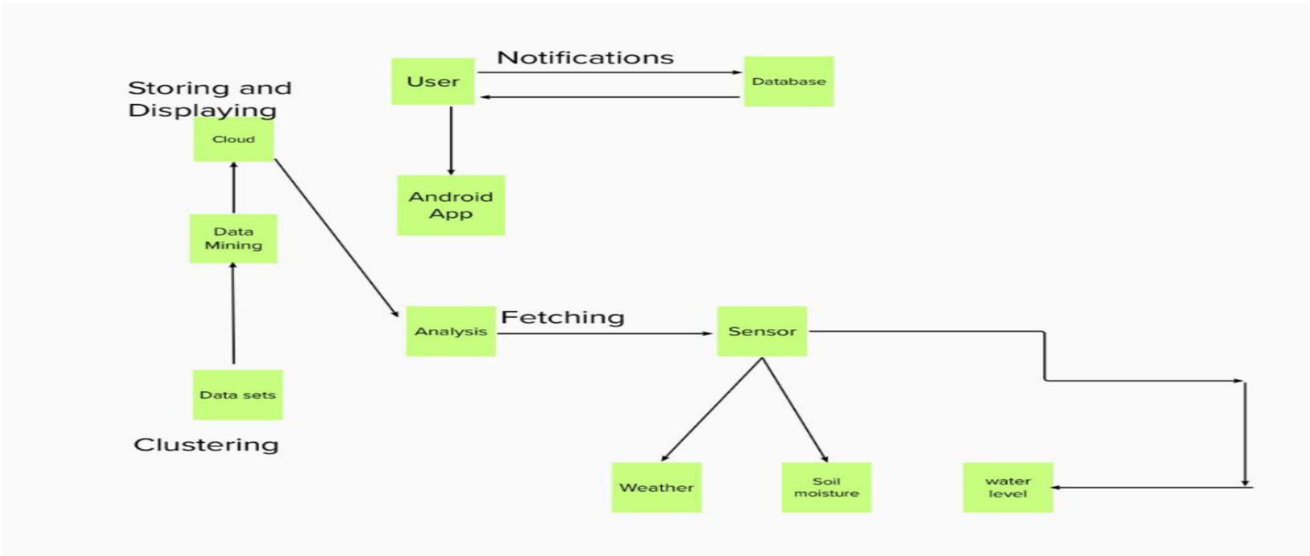
3.Ideation:

3.1. Empathy Map Canvas



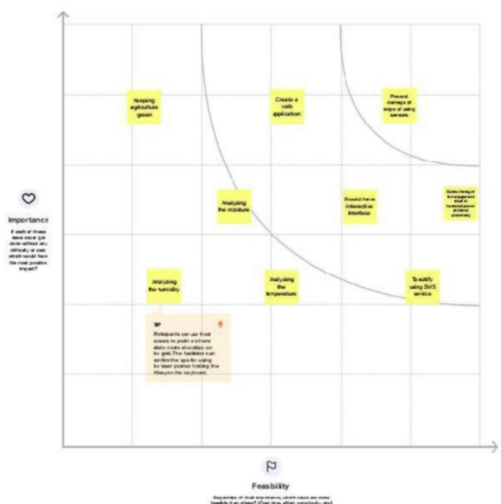
3.2 Ideation and Brain Storming:





Notifications
User
Database
Storing and Displaying
Cloud
Android App
Data Mining
Analysis
Fetching
Sensor
Data sets
Clustering
Weather
Soil moisture
water level

Prioritize:



Keeping agriculture green
Create a web application
Analyzing the moisture
Should have interactive interface
Analyzing the humidity
Analyzing the temperature
To notify using SMS service
Importance
Feasibility

3.3 Proposed Solution

S.No.	Parameter	Description
1.	Problem Statement (Problem to be solved)	To provide efficient decision support system using wireless sensors network which handle different activities of farm and gives useful information related to soil moisture, Temperature and Humidity content. Due to the weather condition, water level increasing Farmers get lot of distractions which is not good for Agriculture
2.	Idea / Solution description	It is a network of different devices which make a self-configuring network. The new developments of Smart Farming with use of IoT, by day turning the face of conventional agriculture methods by not only making it optimal but also making it cost efficient for farmers and reducing crop wastage
3.	Novelty / Uniqueness	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.
4.	Social Impact / Customer Satisfaction	Smart farming, the dependency on manual labour has reduced significantly. The processes like pest control, fertilizing, and irrigation are increasingly becoming automated, and farmers can control them remotely. The use of smart IoT sensors can maintain these processes, increasing crop production.
5.	Business Model (Revenue Model)	It is trying to execute this technique as we need to introduce an Arduino gadget which was modified with an Arduino that takes received signals from sensors. Easy operability and maintenance. Required low time for maintain. Cost is reasonable.
6.	Scalability of the Solution	Scalability in smart farming refers to the adaptability of a system to increase the capacity. For example, the number of technology devices such as sensors and actuators while enabling time analysis

3.4 Problem Solution Fit:

Define CS, fit into CC

1. CUSTOMER SEGMENT(S) CS

The customer of this product are the farmers who cultivate crops. Our aim is to assist, aid and help them to monitor the field parameters remotely and to keep track of the parameters. This product saves the agriculture from extinction.

6. CUSTOMER CONSTRAINTS CC

Deployment of huge number of sensors is difficult. It requires an unlimited or continuous internet connection to be successful.

5. AVAILABLE SOLUTIONS AS

The irrigation process is automated using IoT. weather data and field parameters were obtained and processed to automate the process of irrigation. The drawbacks are high cost of installation, efficient only for short distance, difficulty in storing the data.

Explore AS, differentiate

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

2. JOBS-TO-BE-DONE / PROBLEMS

The objective of this product is to obtain the different field parameters using sensor and process it using a central processing system. Cloud is used to store and transmit the data by using IoT. Weather APIs are employed to assist the farmer in making decision. The farmer could take decision through a mobile application

9. PROBLEM ROOT CAUSE RC

The frequent change or unpredictable weather and climate, made it difficult for the farmers to do agriculture. These factors play a major role in making decision whether to water the plant or not. The monitoring of the field is hard when the farmer is out of station, thus leading to crop damage

7. BEHAVIOUR BE

Using proper drain system to overcome the effects of excess water due to heavy rain. Using hybrid varieties of crop that are resistant to pests

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

3. TRIGGERS TR

Farmers facing issues in providing proper irrigation. No proper supply of water leads to reduced production which affects the profit level of the farmer. Farmer's struggle to predict the weather

4. EMOTIONS: BEFORE / AFTER EM

BEFORE: Lack of knowledge in weather forecasting

→Random decisions →low yield.

AFTER: Data from reliable source

→ correct decision →high yield

10. YOUR SOLUTION SL

Our product collects the data from different types of sensors and it sends the value to the main server. It also collects the weather data from API. The ultimate decision whether to water the crop or not is taken by the farmer using a mobile application.

8. CHANNELS of BEHAVIOUR CH

8.1 ONLINE

Providing online assistance to the farmer, in providing knowledge regarding the pH and moisture level of the soil. Online assistance to be provided to the user in using the product

8.2 OFFLINE

Awareness camps to be organized to teach the importance and advantages of automation and IoT in the development of agriculture.

4.Requirement Analysis:

4.1. Functional Requirements:

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 via Email Confirmation via OTP Confirmation via verification link sent to registered mail id.
FR-3	Roles and service	Choose roles (ex: farmer, student etc.) Enter the personal details. Choose the type of service or options (ex: irrigation, pest management, crop management etc.)
FR-4	Terms and conditions	Accepts the terms and condition for the chosen role and options
FR-5	Details of farm and plans	Enter the details of farming land and vegetation. Choose the crop you want to plant Choose the types of plans (ex: regular and premium)
FR-6	Details according to farm information	Check the weather information Enter the soil nutrient and pH value Click SAVE Soon the details will share to registered mail Exit

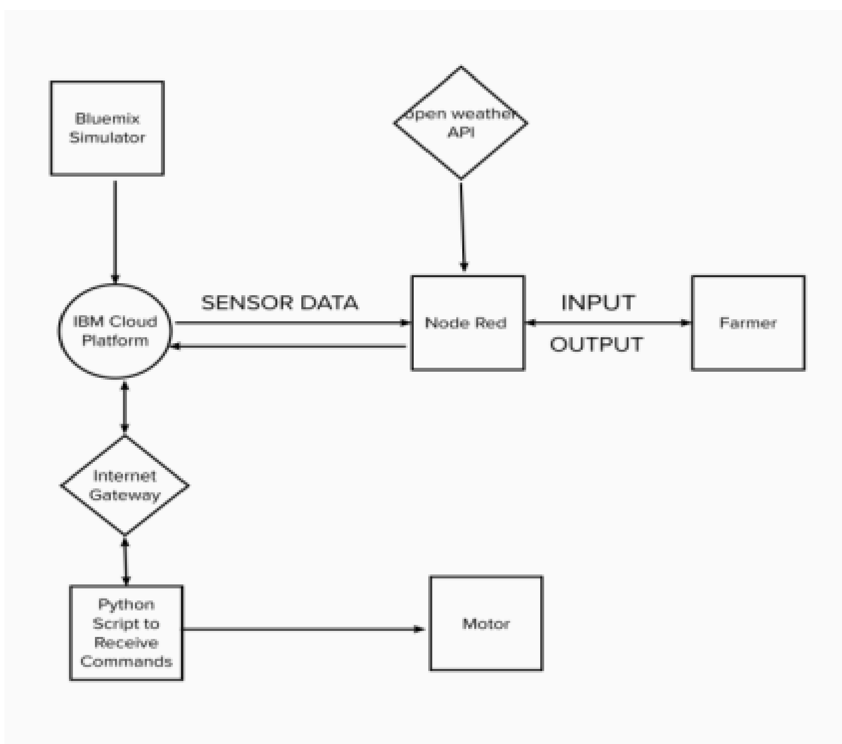
4.2. Non Functional Requirements:

FR No.	Non-Functional Requirement	Description
NFR-1	**Usability**	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	**Security**	Applications must be designed with the security of their use in mind. This includes personal data and their user's well-being.
NFR-3	**Reliability**	It allows farmers to maximize yields using minimum resources such as water, fertilizers, seeds etc.

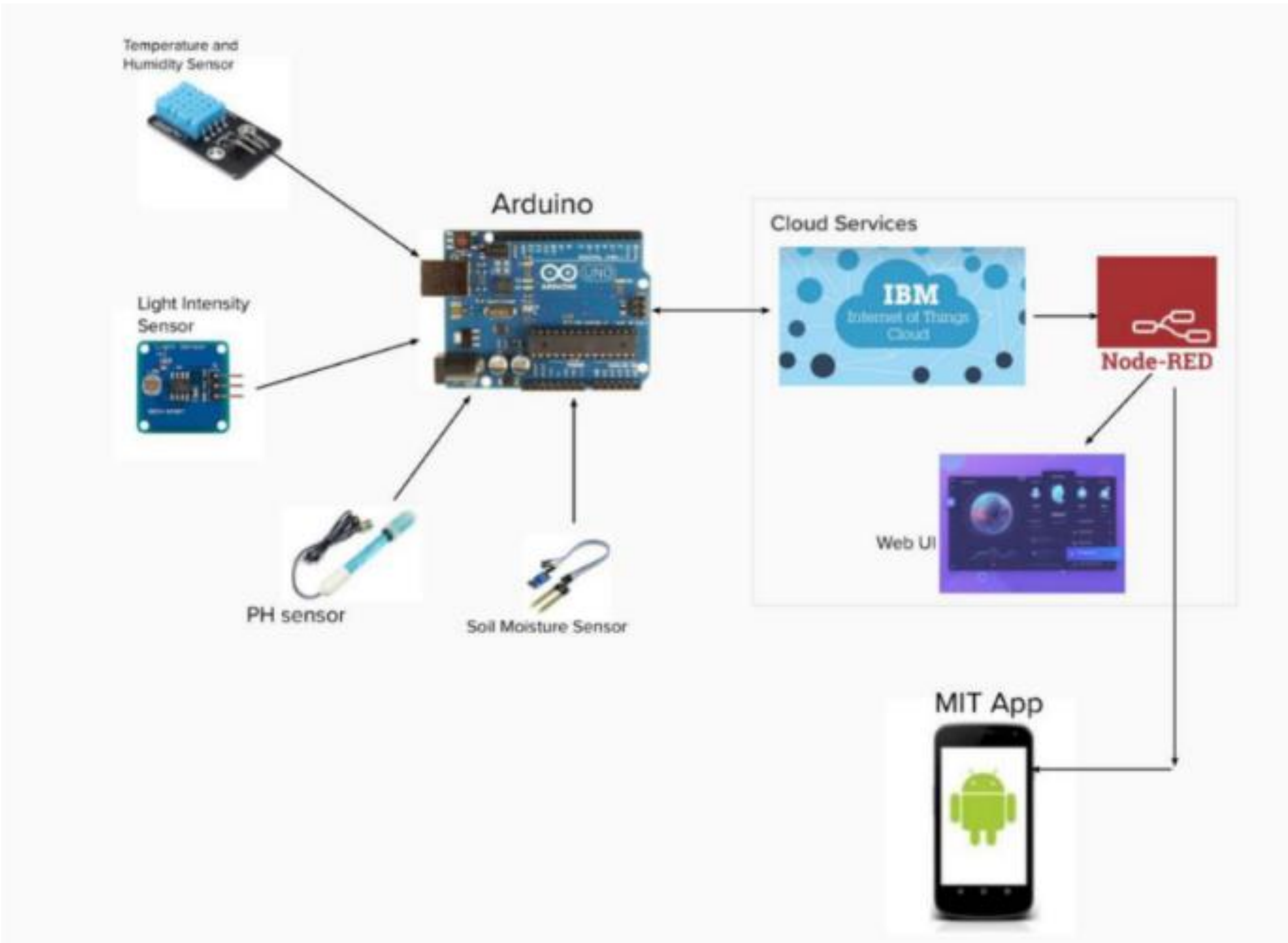
NFR-4	**Performance**	It increases efficiency and reduce the environmental impacts and to implement technology properly to minimize cost.
NFR-5	**Availability**	This concept focused on providing the agricultural industry with the infrastructure to leverage advanced technology.
NFR-6	**Scalability**	It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

5.Project Design:

5.1.Project Data Flow Diagram:



5.2 Solution & Technical Architecture:-



5.3 User Stories:

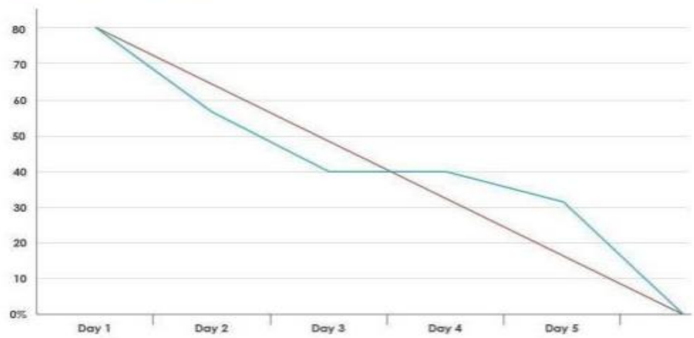
User Type	Functional Requirement (Epic)	User Story Number	User Story / Task	Acceptance criteria	Priority	Release
Customer (Mobile user)	Registration	USN-1	As a user, I can register for the application by entering my email, password, and confirming my password.	I can access my account / dashboard	High	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
Customer (Web user)	Dashboard	USN-6	As a user, I can register by entering my email, password, and confirming my password	I can access my account / dashboard	High	Sprint-2
		USN-7	As a user, I will receive confirmation email once I have registered for the application	I can receive confirmation email & click confirm	High	Sprint-2
		USN-8	As a user, I can register for the application through Gmail	I can receive confirmation email & click confirm to login	Medium	Sprint-2
	Login	USN-9	As a user, I can log into the application by entering email & password		High	Sprint-2
		USN-10	If I forgot my password or username, I can reset it again through my email	I can receive reset Mail to the registered Email Id	High	Sprint-3
Customer Care Executive		USN-11	If I have any doubt in using application or web, I can clarify it by clicking Help option in the dashboard.	I can get proper guidance from the supportive team	High	Sprint-3
Administrator		USN-12	I Can give my feedback about the application and I can post my queries.	I can receive acknowledgement	Low	Sprint-4

6. PROJECT PLANNING AND SCHEDULING

6.1. SPRINT PLANNING AND ESTIMATION

Sprint	Functional Requirement (Epic)	User Story Number	User Story / Task	Story Points	Priority	Team Members
Sprint-1	Registration (Farmer Mobile User)	USN-1	As a user, I can register for the application by entering my email, password, and confirming my password.	2	High	B.Dhivyabharathi (Leader)
Sprint-1	Login	USN-2	As a user, I will receive confirmation email once I have registered for the application	1	High	S.Madhureebha (Member 1)
Sprint-2	User Interface	USN-3	As a user, I can register for the application through Facebook	3	Low	S.Aishwarya (Member 2)
Sprint-1	Data Visualization	USN-4	As a user, I can register for the application through Gmail	2	Medium	M.Kamini (Member 3)
Sprint-3	Registration (Farmer -Web User)	USN-1	As a user, I can log into the application by entering email & password	3	High	B.Dhivyabharathi (Leader)
Sprint-2	Login	USN-2	As a registered user, I need to easily login log into my registered account via the web page in minimum time	3	High	S.Madhureebha (Member 1)
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	Medium	S.Aishwarya (Member 2)
Sprint-1	Registration (Chemical Manufacturer - Web user)	USN-1	As a new user, I want to first register using my organization email and create a password for the account.	2	High	M.Kamini (Member 3)

Burndown Chart:



6.2 SPRINT DELIVERY SCHEDULE:

S.NO	ACTIVITY TITLE	ACTIVITY DESCRIPTION	DURATION
1	Understanding the project	Assign the team members after that create repository in the GitHub and then assign task to each member and guide them how to access the GitHub while submitting the assignments	1 Week
2	Staring The Project	Team Members to Assign All the Tasks Based on Sprints and Work on It Accordingly	1 Week
3	Completing Every Task	Team Leader should ensure that whether every team member have completed the assigned task or not	1 Week
4	Stand Up Meetings	Team Lead Must 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 task within the deadline	1 Week
6	Budget and Scope of project	Analyze the overall budget which must be within certain limit it should be person	1 Week

7. CODING AND SOLUTIONING

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")
```

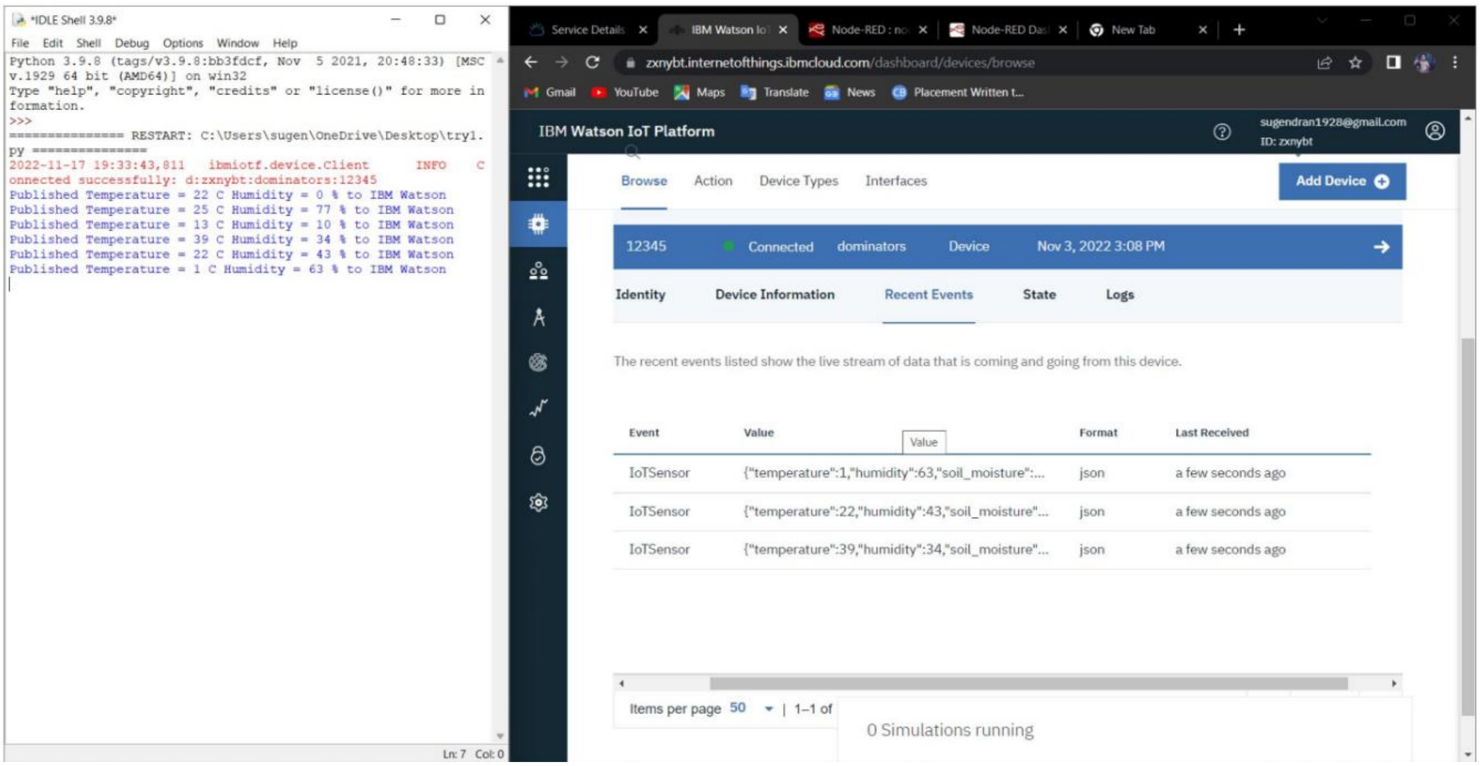
```
try:
    deviceOptions = {"org": organization, "type": deviceType, "id":
deviceId, "auth-method": authMethod, "auth-token": authToken}
    deviceCli = ibmiotf.device.Client(deviceOptions)


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()
```

PYTHON CODE CONNECTED WITH IBM:-



8.TESTING

8.1 Test Cases

Date	3-Nov-22
Team ID	PNT2022TMID[illegible]
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	Comments	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:

8.2.1: 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	1	1	0	0	2
Duplicate	0	0	0	0	0
External	1	1	0	0	2
Fixed	1	1	1	0	3
Not Reproduced	0	0	0	0	0
Skipped	0	1	0	0	1
Won't Fix	0	0	0	0	0
Totals	3	4	1	0	8

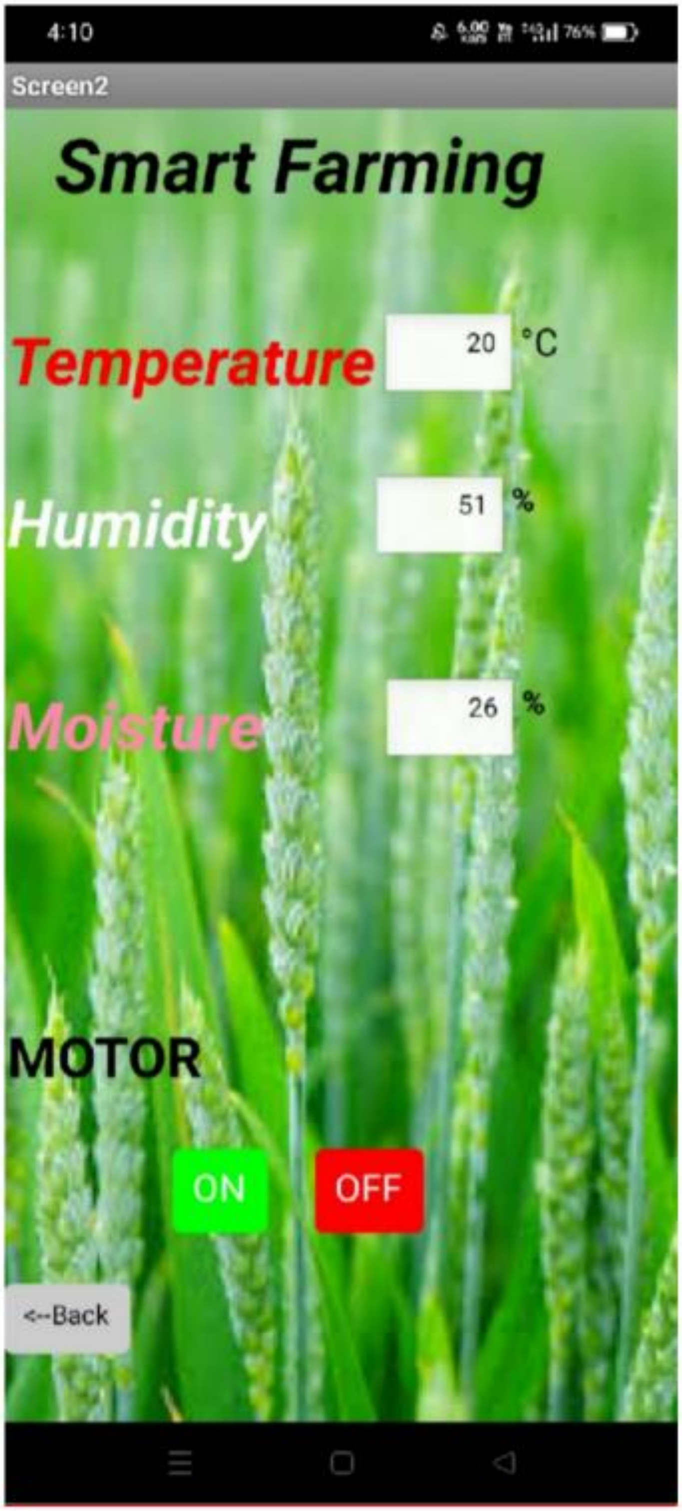
8.2.2 TEST CASE ANALYSIS:

Section	Total Cases	Not Tested	Fail	Pass
Print Engine	0	0	0	0
Client Application	5	0	0	5
Security	1	0	0	1
Outsource Shipping	3	0	0	3
Exception Reporting	5	0	0	0
Final Report Output	4	0	0	4
Version Control	2	0	0	2

9.RESULTS:

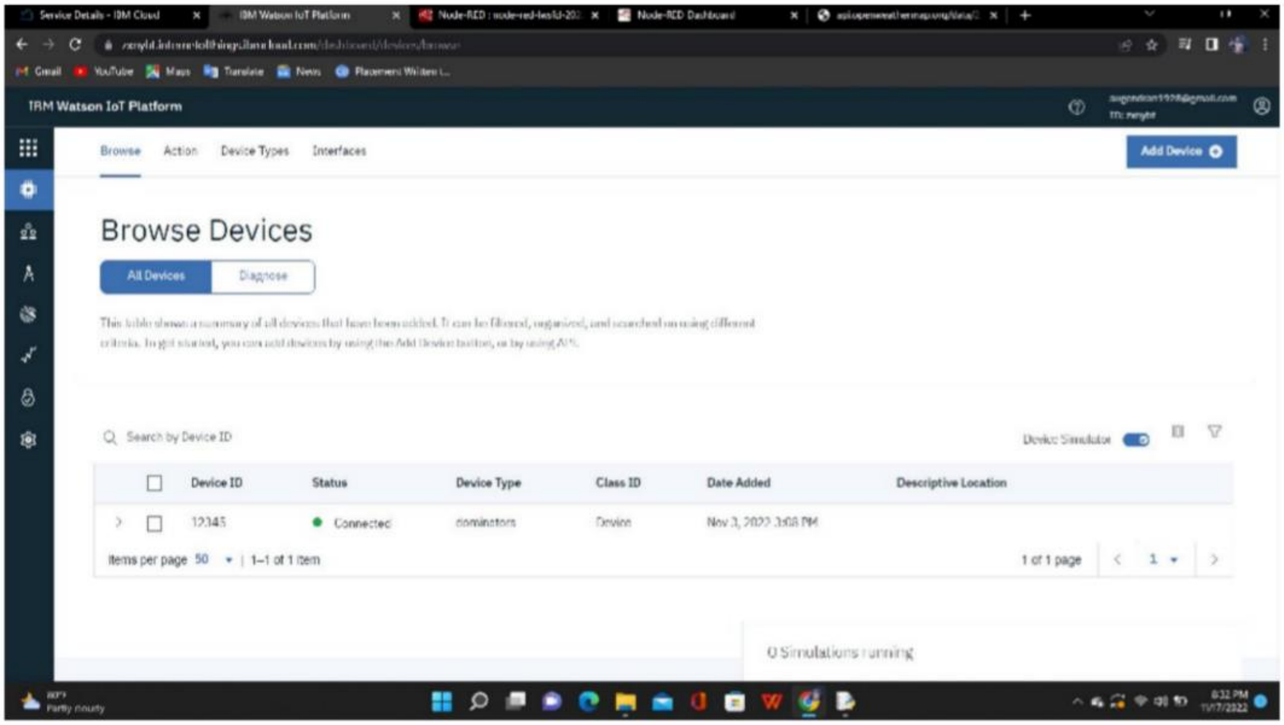
SCREEN 1

Click welcome button go to second screen

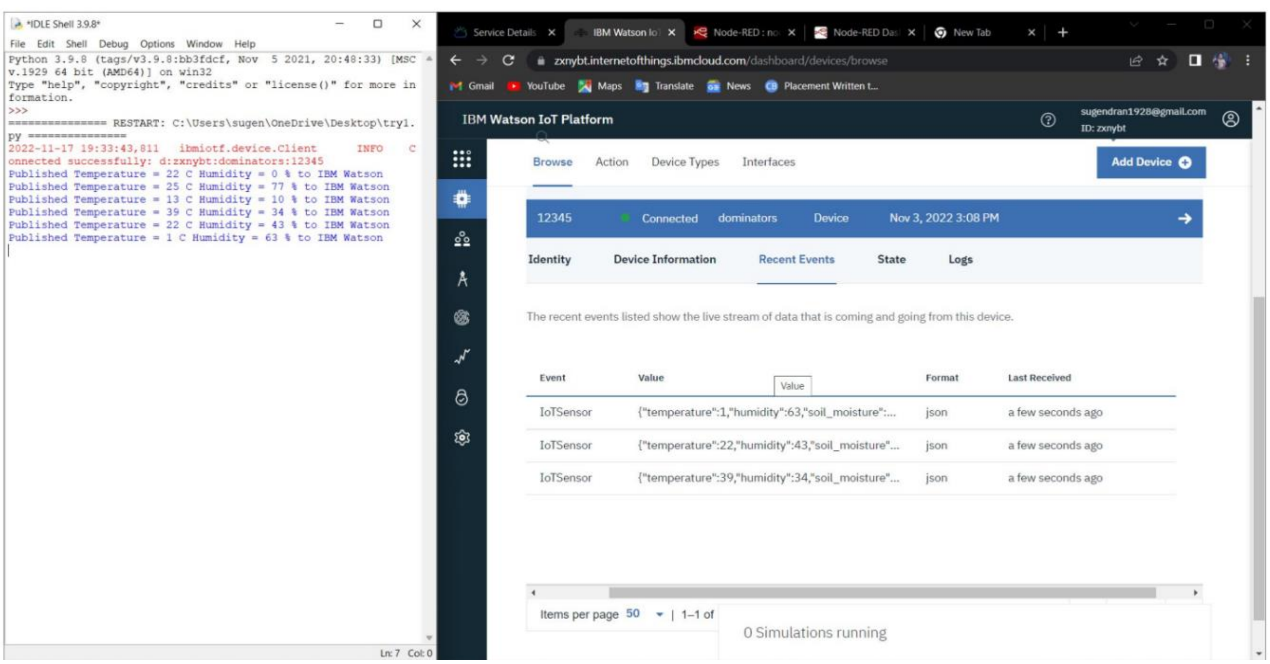

4:10
Screen2
Smart Farming
Temperature
20
°C
Humidity
51
%
Moisture
26
%
MOTOR
ON
OFF
<--Back

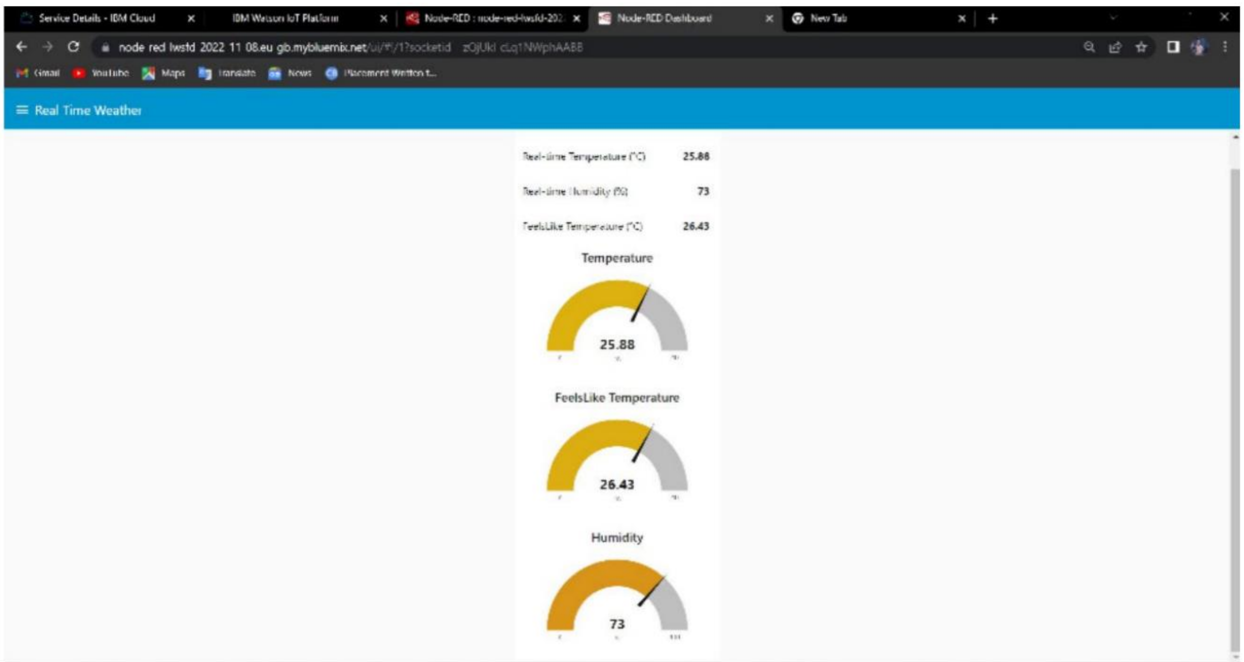
SCREEN 2

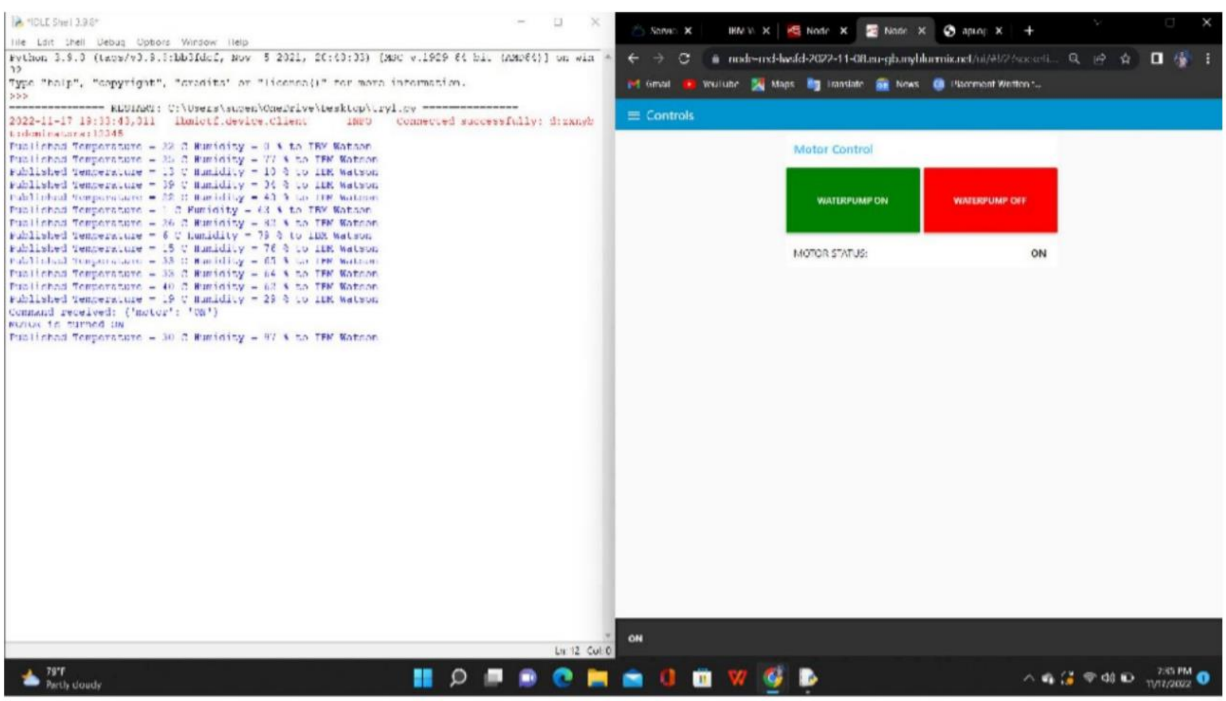
IBM WATSON IOT PLATFORM:



PYTHON CODE CONNECTED WITH IBM:-




Real Time Weather
Real-time Temperature (°C) 25.88
Real-time Humidity (%) 73
FeelsLike Temperature (°C) 26.43
Temperature
25.88
FeelsLike Temperature
26.43
Humidity
73


Controls
Motor Control
WATERPUMP ON
WATERPUMP OFF
MOTOR STATUS:
ON

10.Advantages and Disadvantages:

10.1. Advantages:

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

10.2. Disadvantages:

- ❖ 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

Appendix:

Source Code:

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()
```

Git Hub Link: https://github.com/IBM-EPBL/IBM-Project-53232-1661320766

Demo Link: https://drive.google.com/file/d/1r5qMNyFz1db5PXg9z2cMglBRDBSZ-IZo/view?usp=share_link