MAHENDRA INSTITUTE OF TECHNOLOGY
MALLASAMUDRAM

"SMARTFARMER-IOT ENABLED SMART FARMING APPLICATION"

NALAIYATHIRAN IBM PROJECT

TEAM ID:PNT2022TMID17172

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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.

1.2 PURPOSE

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.

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.

Automatic adjustment of farming equipment made possible by linking information like crops/weather and equipment to auto-adjust temperature, humidity, etc.

In large farmland, Internet of Things equipped drone helps to receive the current state of crops and send the live pictures of farmland.

2 LITERATURE SURVEY

2.1 EXISTING PROBLEM

Problem Statement (PS)	Iam (Customer)	I'm trying to	But	Because	Which makes me feel
PS-1	Searching for upto date news about smart farming	Find the technology on trend	The cost of the gadget was not effectively sufficient to use	It shows a incorrect location and insufficient battery life	It make some tracking Confusion
PS-2	Searching for upto date news about smart farming	To get smart Farming equipment's	I couldn't able to get proper network connection	There are so Many equipment's are shared over the internet	It make a lot of confusion to buy the sensors and Smart farming gadget

2.2 PROBLEM STATEMENT DEFINITION

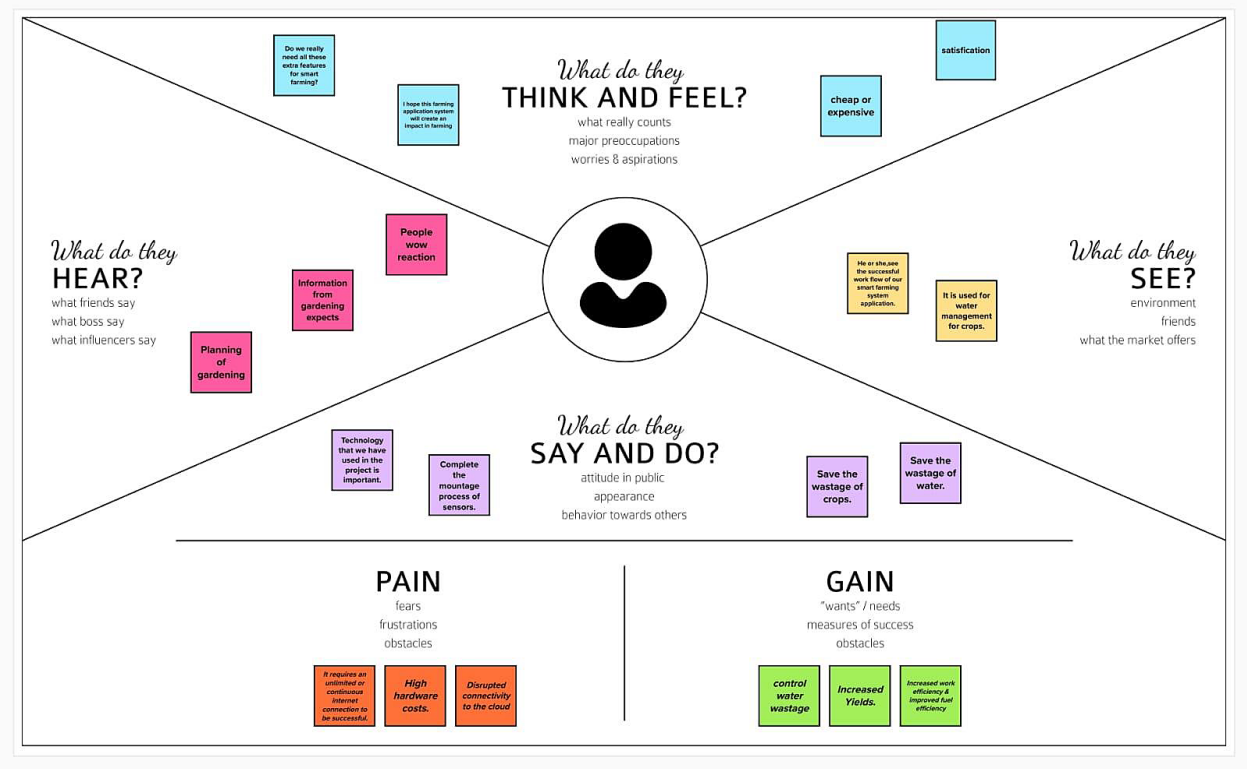
A strong customer problem statement should provide a detailed description of your customer's current situation. Consider how they feel, the financial and emotional impact of their current situation, and any other important details about their thoughts or feelings.

Creating a customer problem statement is easy with Miro. Using our collaborative online whiteboard, you can create an online problem statement that's easy to follow and shareable with your team. All you have to do is sign up for free, select this template, and follow your template.

3 IDEATION AND PROPOSED SOLUTION

3.1 EMPATHY MAP CANVAS

An empathy map is a simple, easy-to-digest visual that captures knowledge about a user's behaviours and attitudes.
It is a useful tool to helps teams better understand their users.
Creating an effective solution requires understanding the true problem ant the person who is experiencing it.The exercise of creating the map helps participants consider things from the user's perspective along with his or her goals and challenges.



3.2 IDEATION AND BRAINSTORMING

Brainstorming provides a free and open environment that encourages everyone within a team to participate in the creative thinking process that leads to problem solving. Prioritizing volume over value, out-of-the-box ideas are welcome and built upon, and all participants are encouraged to collaborate, helping each other develop a rich amount of creative solutions.

Use this template in your own brainstorming sessions so your team can unleash their imagination and start shaping concepts even if you're not sitting in the same room.

1

Define your problem statement

What problem are you trying to solve? Frame your problem as a How Might We statement. This will be the focus of your brainstorm.

5 minutes

PROBLEM

How can we stop the water flow after the fields get enough water if our network is disconnected?

Key rules of brainstorming

To run an smooth and productive session

- Stay in topic.
- Encourage wild ideas.
- Defer judgment.
- Listen to others.
- Go for volume.
- If possible, be visual.

2

Brainstorm

Write down any ideas that come to mind that address your problem statement.

10 minutes

Allwin Joshua	Amarnath	Aravindhan	Arulkumaran
Asethetic UI Design	User Friendly	Keeping facilities among users	Neat compartment available
Storing personal details like address in a secure manner	Responsive UI	Posters and social media marketing	The boundary of the problem is battery
Email notification funcionality	Collaboration with corporation	clear instructions	quality foods
Dynamic database updation	Message and E mail notification of sender and receiver	user feedback	clear instructions
Simple and direct buttons and instructions	User security	Dark moder and light mode UI	customer details safe and secure
Collaborating with government	Keep track of users	Fast fixing of bugs	Arrange anytime pesticidefertilizer

3

Group ideas

Take turns sharing your ideas while clustering similar or related notes as you go. Once all sticky notes have been grouped, give each cluster a sentence-like label. If a cluster is bigger than six sticky notes, try and see if you and break it up into smaller sub-groups.

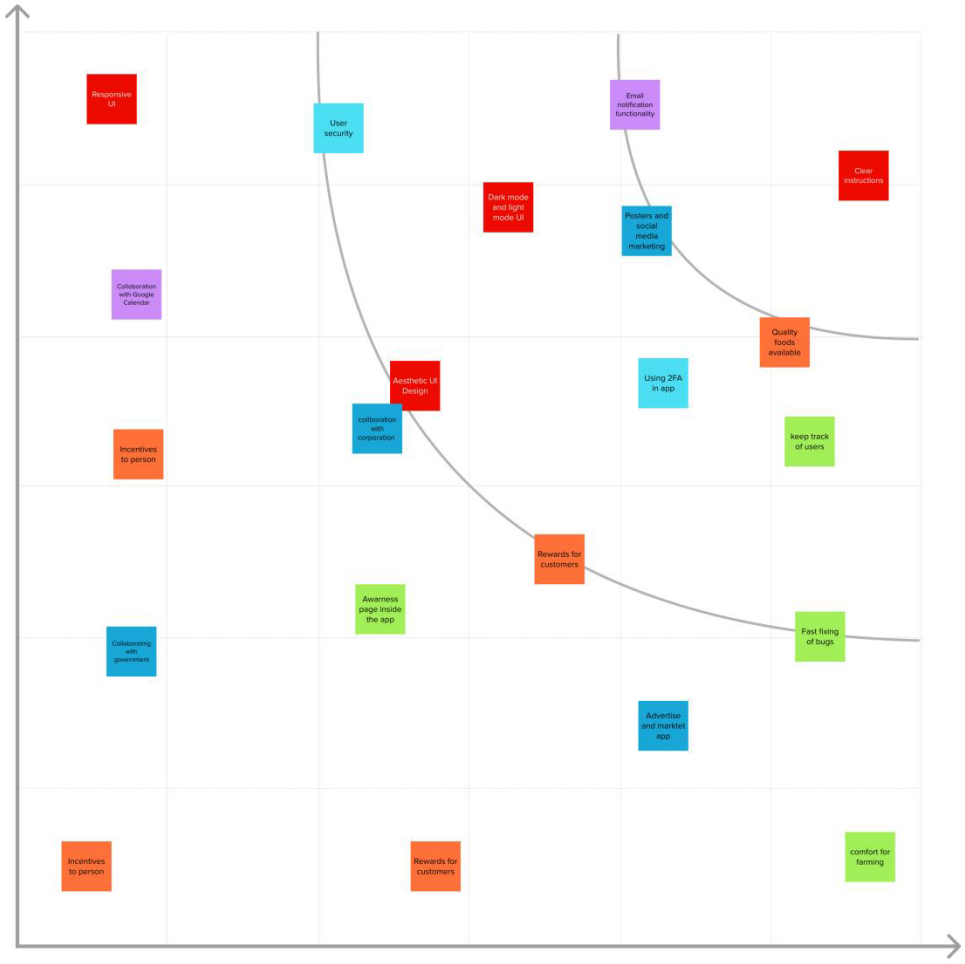
⏱ 20 minutes

4

Prioritize

Your team should all be on the same page about what's important moving forward. Place your ideas on this grid to determine which ideas are important and which are feasible.

20 minutes



3.3 PROPOSED SOLUTION

Proposed Solution Template:

Project team shall fill the following information in proposed solution template.

S.No.	Parameter	Description
1.	Problem Statement (Problem to besolved)	To incorporate the process of working andalso elevate the smart farming using IOT enabled smart Farming technique since the traditional Farmingtechnique I very complex one.
2.	Idea / Solution description	To automate irrigation in accordance to theamountof moisture presentin soil
3.	Novelty / Uniqueness	Automation of irrigation to amount of moisture
4.	Social Impact / Customer Satisfaction	The problems faced by the farmers in the process of irrigation gets solved and this full fillsand saves theircrops from over irrigation
5.	Business Model (Revenue Model)	The process of fulfilling this process brings revolution in drip irrigation systems also makesa revolutionary changein market
6.	Scalability of the Solution	The designscale of solution has been plannedin a compact manner

3.4 PROBLEM SOLUTION FIT

1.Customer segments:- the customers who are goingto adapt thisproject contains of 1. large scalefarmers 2. remote farmers	**5.Customer constrains:-** The customerwants a device which could solve theproblems in irrigation when he is remote or absenceof humans and that device should fulfill all the following constrains 1.cost efficient 2. space efficient 3. time efficient 4. resource efficient	**8.Available solutions** The moisture controlled irrigation system could be the best solution for this problem statement that has been provided by the farmers andalso it specifically satisfies the customer constrains also

2.Jobs to be done :- the customers want to automate the process ofirrigation in cost, energy and reduced power consumption and also reliable manner	**6.Problem routecause:-** The problem has its route stabled at the rate of the fast moving worldsince people movemost of thetimes andsince they have their work to be stagnated similarly farmersface the inability in the processof irrigation	1. **Channelsof behavior:-** The channels of behavior recombines the ration of the following a. Online b. offline

4 . REQUIREMENT ANALYSIS

4.1 FUNCTIONAL REQUIREMENT

Functional Requirements:

Following are the functional requirements of the proposed solution.

FR No.	Functional Requirement (Epic)	Sub Requirement (Story / Sub-Task)
FR-1	Measure Temperature	Soil thermometers are the most common tool for measuring soil temperature.The voltage across the diode terminals
FR-2	Measure soil moister	Sensor for soil scanning and water,light,humidity and temperature management
FR-3	Calculating the date and time	Time of day : Between 1 and 2 p.m. Depth :4 inches below the soil surface Soil Location:Same area of field,soil type weather and precipitation
FR-4	Irrigating the soil if needed	A moisture supply for plant growth which also transports essential nutrients. A flow of water to leach or dilute salts in the soil

4.2 NON-FUNCTIONAL REQUIREMENT

Following are the non-functional requirements of the proposed solution

FR No.	Non-Functional Requirement	Description
NFR-1	**Usability**	Indicates how effectively and easy users can learn and use a system
NFR-2	**Security**	Assures all data inside the system or its part will be protected against malware attacks or unauthorised access.
NFR-3	**Reliability**	The system provides an accurate measurement of data,and it can have a longer lifespan
NFR-4	**Performance**	The present system can be improved easily by integrating new components with enhanced features
NFR-5	**Availability**	The proposed product can be available and operable successfully all the time
NFR-6	**Scalability**	The proposed system is user friendly .The usage of product doesn’t require any prior learning

5.PROJECT DESIGN

5.1 DATA FLOW DIAGRAM

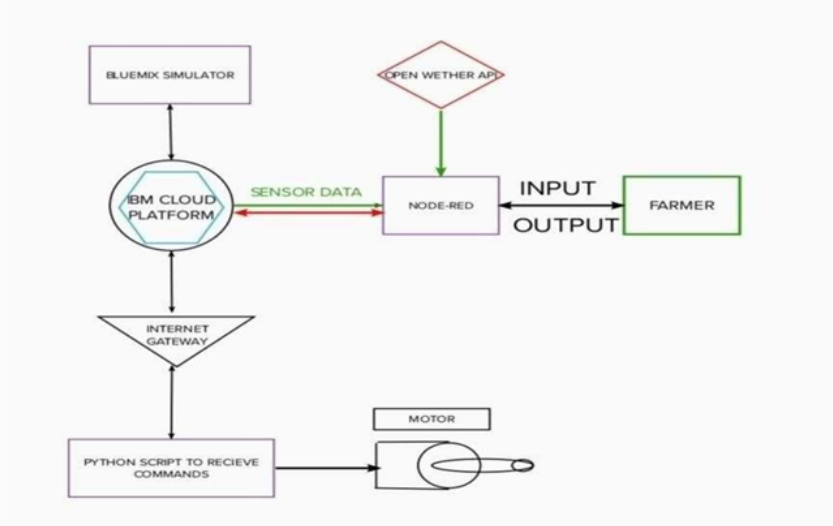
ADataFlowDiagram(DFD) is a traditional visual representation of the information flows within a system.A neat and clear DFD can depicttheright amount of the system requirement graphically. It shows how data enters and leaves the system, what changes the information, and where data is stored.

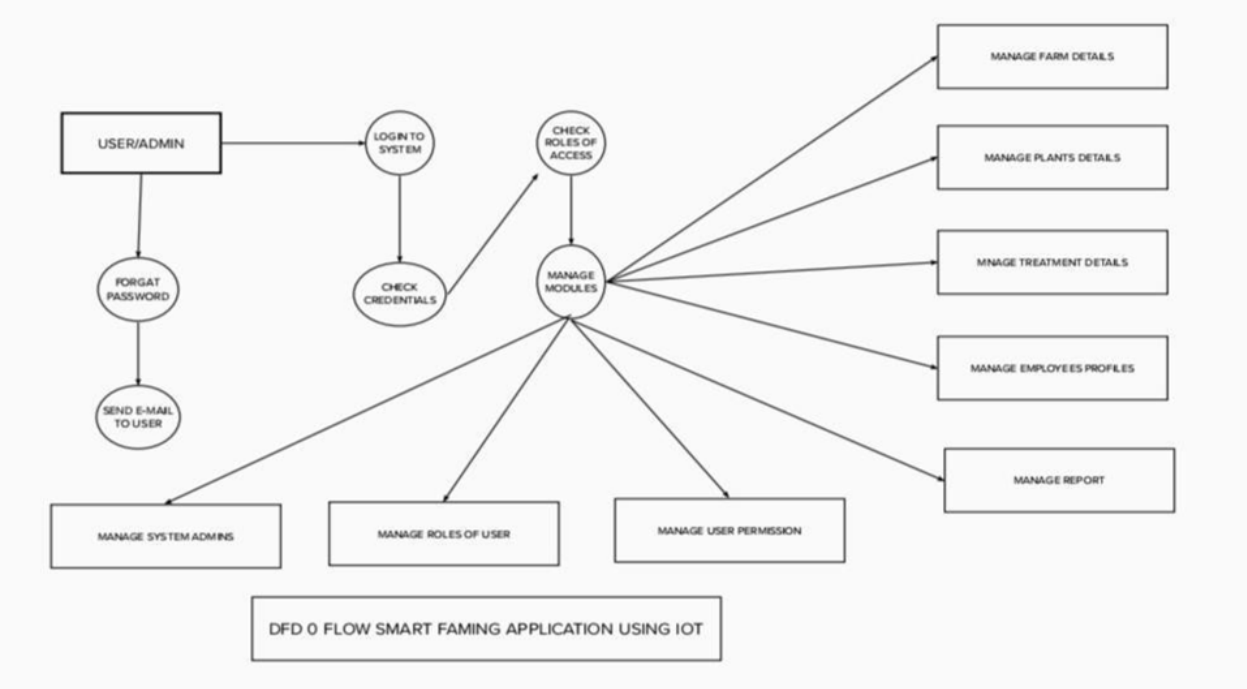
1. The different soil parameters temperature,soil moistures and then humidity are sense during different sensors and obtained value is stored in the IBMcloud.

2. ArduinoUNOis used as a processing Unit that process the data obtained from the sensors and whether data from the weatherAPI.

3. NODE-RED is used as a programming tool to write the hardware, software, and APIs. The MQTTprotocol is followed forthecommunication.

4. All the collected data are provided to the user through a mobile application that was developed using the MIT appinventor.The user could plan through an app , weather to water the crop or not depending upon the sensor values. By using the app they can remotely operate to the motor switch



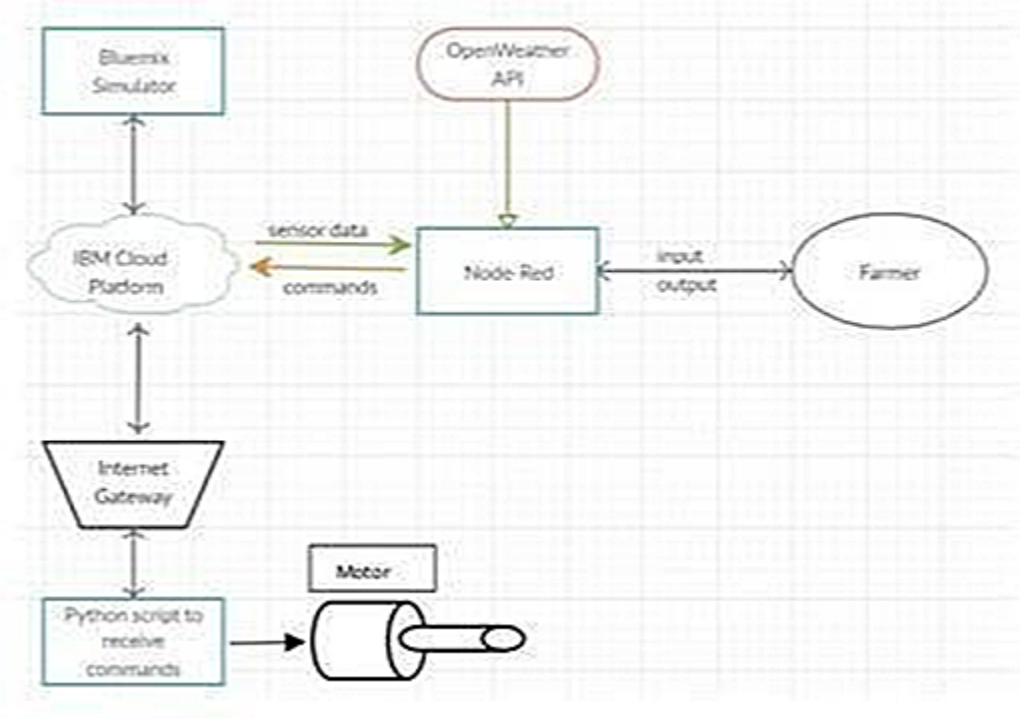


DFD 0 FLOW SMART FAMING APPLICATION USING IOT

5.2 SOLUTION AND TECHNICAL ARCHITECTURE

The Deliverable shall include the architectural diagram as below and the information as per the table1 & table 2 Guidelines:

1. The different soil parameters temperature, soil moistures and then humidity are sensed using different sensors and obtained value is stored in the IBM cloud.
2. Arduino UNO is used as a processing Unit that process the data obtained from the sensors and whether data from the weather API.
3. NODE-RED is used as a programming tool to write the hardware, software, and APIs. The MQTT protocol is followed for the communication.
4. All the collected data are provided to the user through a mobile application that was developed using the MIT app inventor. The user could decide through an app, weather to water the crop or not depending upon the sensor values. By using the app, they can remotely operate the motor switch.



5.3 USER STORIES

Use the below template to list all the userstories fortheproduct.

UserType	FunctionalRequirement(Epic)	User Story Number	UserStory/Task	Acceptancecriteria	Priority	Release
Customer(Mobileuser)	Registration	USN-1	As auser, Icanregisterfor theapplicationby entering my email,password,andconfirmingmypass word.	Icanaccessmyaccount/dashboard	High	Sprint-1

		USN-2	As a user, I will receiveconfirmationem ail oncelhaveregisteredfor theapplic ation	Icanreceiveconfi rmationem ail&clickconfirm	High	Sprint-1
		USN-3	Asauser,Icanregisterfor theapplica tion throughFacebook	Icanregister&acc essthedash board with FacebookLogin	Low	Sprint-2
		USN-4	Asauser,Icanregisterfor theapplica tion throughGmail		Medi um	Sprint-1
	Login	USN-5	As a user, I can log into theapplication by entering email &password		High	Sprint-1
	Dashbo ard					
Custome r(W ebuser)						
Custome rCar eExecuti ve						
Administ rator						

6.PROJECT PLANNING AND SCHEDULING

6.1 SPRINT PLANNING AND ESTIMATION

	Functional Requirement (Epic)	User Story Number		Points	
Sprint-1	Simulation creation	USN-1	Connect Sensors and Arduino with python code	2	High
Sprint-2	Software	USN-2	Creating device in the IBM Watson IoT platform, workflow for IoT scenarios using Node-Red	2	High
Sprint-3	MIT App Inventor	USN-3	Develop an application for the Smart farmer project using MIT App Inventor	2	High

Sprint			User Story / Task	Story	Priority
Sprint-3	Dashboard	USN-3	Design the Modules and test the app	2	High
Sprint-4	Web UI	USN-4	To make the user to interact with software.	2	High

6.2 SPRINT DELIVERY AND SCHEDULE

Sprint	Functional Requirement (Epic)	User Story Number	UserStory/Task	Story Points	Priority
Sprint-1	Registration(FarmerMobileUser)	UNS-1	As a user, I can registerfor the application byentering my email,password, andconfirming my password.	2	High
Sprint-1	Login	UNS-2	As a user, I will receiveconfirmation emailonceIhaveregistered fortheapplication	1	High

Sprint-2	UserInterface	UNS-3	As a user, I can registerfor the applicationthrough Facebook	3	Low
Sprint-1	DataVisualizati on	UNS-4	As auser,I can register for the applicationthroughGMAIL	2	Medium
Sprint-3	Registration(Farmer - WebUser)	USN - 1	As a user, I can log intothe application byentering email and Password	3	High
Sprint -2	Login	USN - 2	As a registered user, Ineedtoeasilyloginloginto my registeredaccount via the webpageinminimumtime	3	High
Sprint -4	WebUI	USN - 3	Asauser,Ineedtohave a friendly userinterface to easily viewandaccesstheresources	3	Medium

7.CODING AND SOLUTIONING

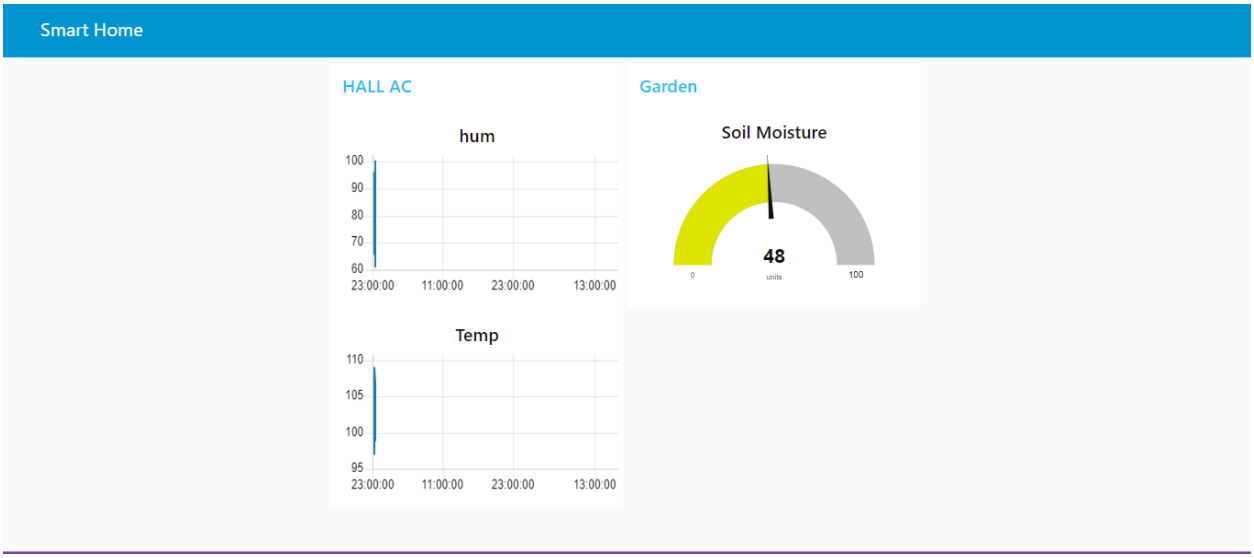
7.1 FEATURE 1

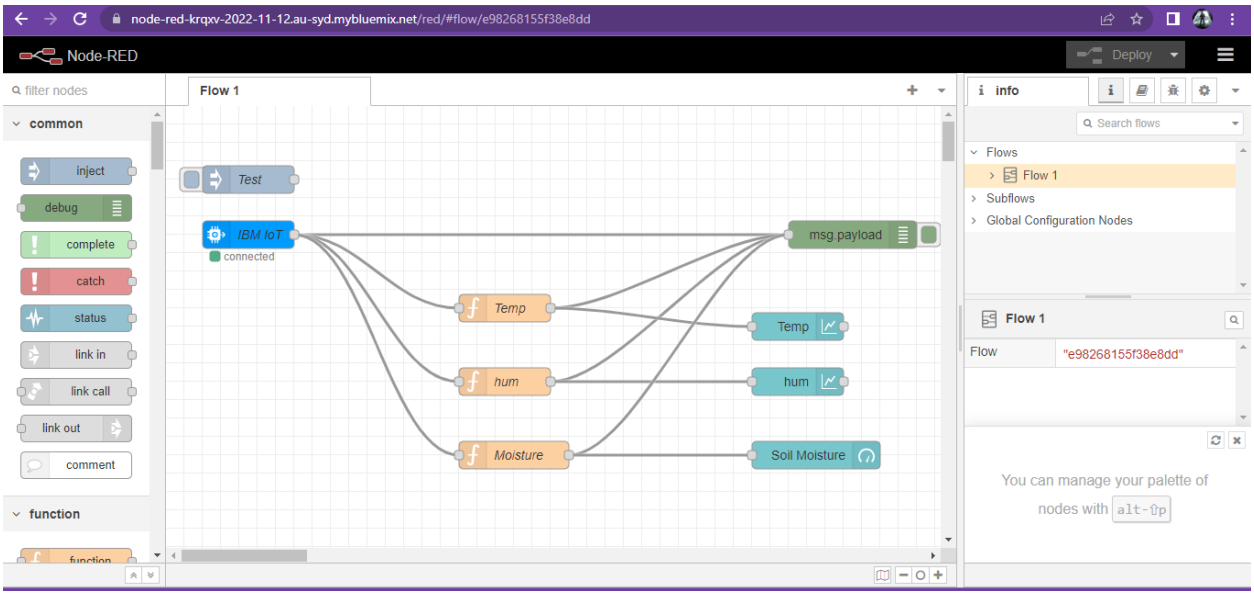
```
import wiotp.sdk.device
import time
import os
import datetime
```

```
import random myConfig ={
   "identity": {
        "orgId": "0hzydu",
        "typeId": "NodeMCU",
        "deviceId": "12345"
   },
   "auth": {
      "token": "12345678"
   } } client =
wiotp.sdk.device.DeviceClient(config=myConfig,logHa
ndlers=None) client.connect () def
myCommandCallback (cmd) :
   print("Message received from IBM IoT Platform: %s"
%cmd.data['command'])    m=cmd.data['command']    if
(m=="motoron"):
            print("Motor  is
switchedon")          elif
(m=="motoroff"):
       print ("Motor is
switchedOFF")    print
(" ") while True:
moist
=random.randint
(0,100)
temp=random.randint
(-20, 125)
hum=random.randint
(0, 100)
   myData={'moisture':moist,'temperature':temp,'humidity':hum}
             client.publishEvent    (eventId="status",    msgFormat="json",
data=myData, qos=0 , onPublish=None)
       print  ("Published  data  Successfully:
%s",myData)    time.sleep (2)
                              client.commandCallback
=myCommandCallback client.disconnect ()
```

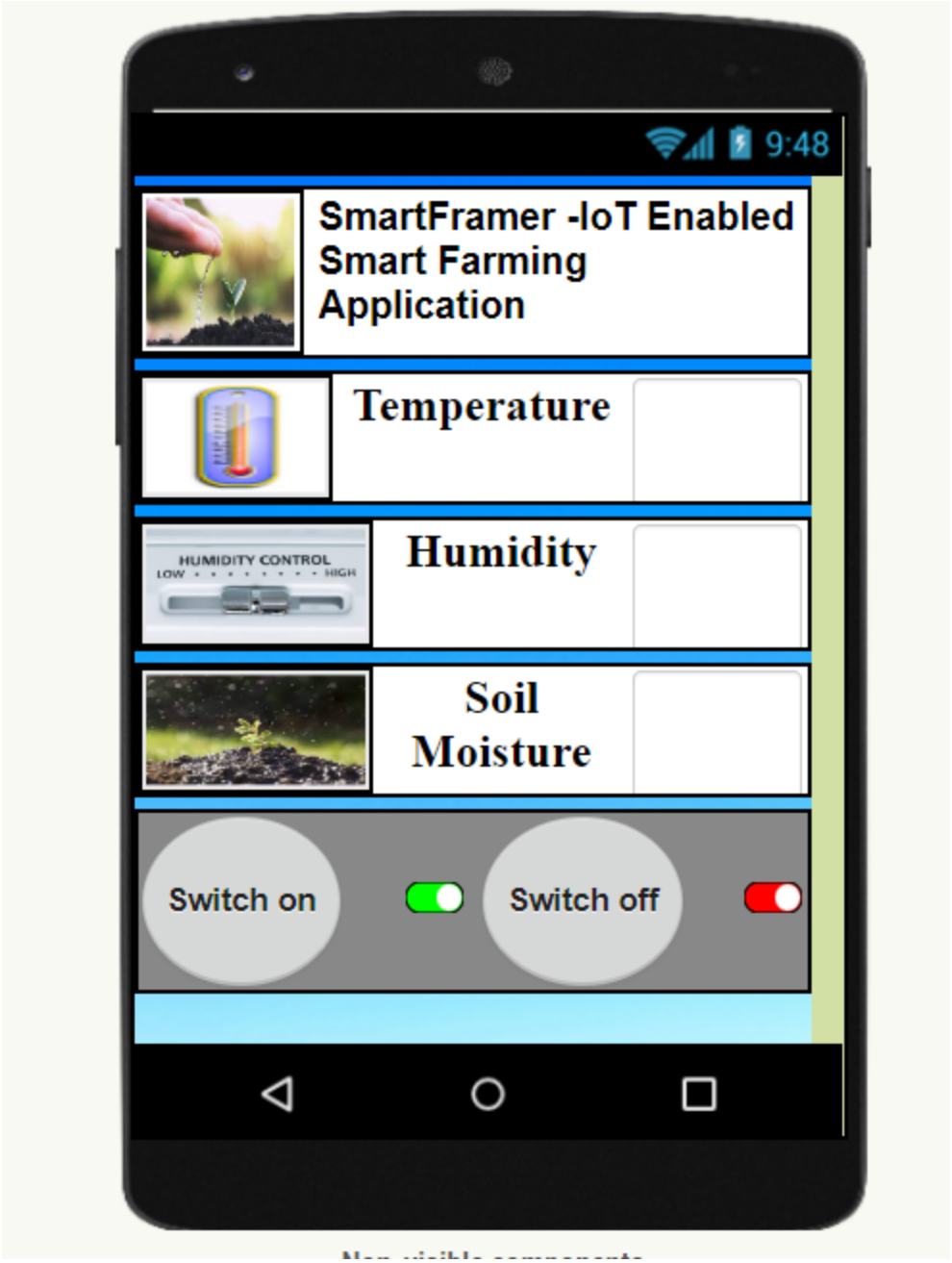
8.TESTING

8.1 TEST CASES



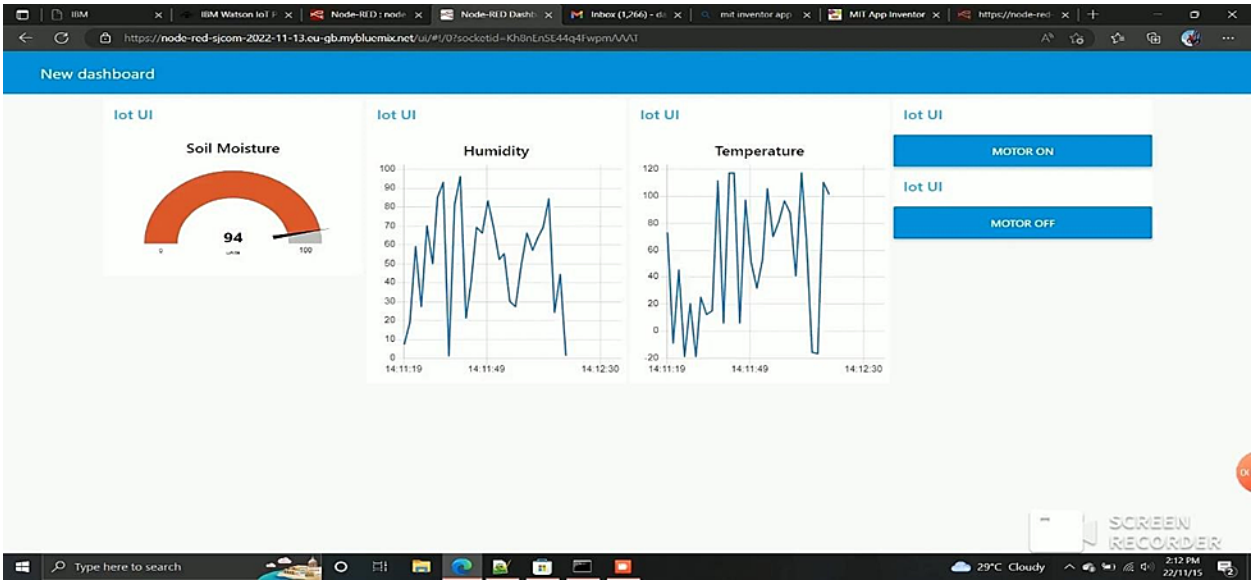


8.2 USER ACCEPTENCE TESTING



9.RESULTS

9.1 PERFORMANCE METRICS



10.ADVANTAGES AND DISADVANTAGES

ADVANTAGES:

1. A remote control system can help in working irrigation system valves dependent on schedule. Irrigating remote farm properties can be exceptionally troublesome and laborintensive. It gets hard to comprehend when the valves were started and whether the ideal measure of water was distributed.

2. For situations where a quick reaction is required, manual valve actuation may not be conceivable constantly. Thus, remote

observing and control of irrigation systems, generators or wind machines or some other motor-driven hardware become the next logical step.

3. Various solutions are available to monitor engine statistics and starting or stopping the engine. When the client chooses to begin or stop the motor, the program transmits a sign to the unit within seconds by means of a mobile phone system.

4. Submersible weight sensors or ultrasonic sensors can screen the degree of tanks, lakes, wells and different kinds of fluid stockpiling like fuel and compost. The product figures volume dependent on the tank or lake geometry after some time. It conveys alarms dependent on various conditions.

DISADVANTAGES:

1. The smart agriculture needs availability of internet continuously. Rural part of most of the developing countries do not fulfil this requirement. Moreover internet connection is slower.
2. The smart farming based equipment require farmers to understand and learn the use of technology. This is major challenge in adopting smart agriculture farming at large scale across the countries

11.CONCLUSION

Farmers can benefit greatly from an IoT-based smart agriculture system. As a result of the lack of irrigation, agriculture suffers. Climate factors such as humidity, temperature, and moisture can be

adjusted dependent on the local environmental variables. This technology also detects animal invasions, which are a major cause of crop loss. This technology aids in the scheduling of irrigation based on present data from the field and records from a climate source. It helps in deciding the farmer to whether to do irrigation or not to do. Continuous internet connectivity is required for continuous monitoring of data from sensors. This also can be overcome by using GSM unit as an alternative of mobile app. By GSM, SMS can be sent to farmers phone.

12.FUTURE SCOPE

In the current project we have implemented the project that can protect and maintain the the crop. In this project the farmer monitor and control the field remotely. In future we can add or update few more things to this project

• We can create few more models of the same project ,so that the farmer can have information of a entire.

1. We can update the this project by using solar power mechanism. So that the power supply from electric poles can be replaced with solar panels. It reduces the power line cost. It will be a one time investment. We can add solar fencing technology to this project.
2. We can use GSM technology to this project so that the farmers

can get the information directly to his home through SMS. This helps the farmer to get information if there is a internet issues.

3. We can add camera feature so that the farmer can monitor his field in real time. This helps in avoiding thefts.

13.Appendix Source

Code

```
import          time
import     os
import    datetime
import      random
myConfig ={

    "identity": {
        "orgId": "0hzydu",
        "typeId": "NodeMCU",
        "deviceId": "12345"
    },
    "auth": {
       "token": "12345678"
    }
} client =
wiotp.sdk.device.DeviceClient(config=myConfig,logHa
ndlers=None) client.connect () def
myCommandCallback (cmd) :
```

```
   print("Message received from IBM IoT Platform: %s"
%cmd.data['command'])     m=cmd.data['command']     if
(m=="motoron"):
              print("Motor  is
switchedon")           elif
(m=="motoroff"):
       print ("Motor is
switchedOFF")     print
(" ") while True:
   moist
=random.randint
(0,100)
temp=random.randint
(-20, 125)
hum=random.randint
(0, 100)
myData={'moisture':m
oist,'temperature':tem
p,'humidity':hum}
client.publishEvent
(eventId="status",
msgFormat="json",
data=myData, qos=0 ,
onPublish=None)
print ("Published data
```

```
        Successfully:
        %s",myData)
        time.sleep (2)
    client.commandCallback =myCommandCallback client.disconnect
()
```

GITHUB LINK ： https://github.com/IBM-EPBL/IBM-Project-29737-1660129047

PROJECT DEMO LINK:https://github.com/IBM-EPBL/IBM-Project-29737-1660129047/blob/main/Demo%20Link/Demo%20Link.mp4