

SMART FARMER-IOT ENABLED SMART FARMING APPLICATION

NAALAIYATHIRAN IBM PROJECT REPORT

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01. INTRODUCTION

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.

PURPOSE:

India is agriculture sector, on either sides, is losing ground every day, affecting the ecosystems output capacity. In order to restore vitality and put agriculture system necessitates a great deal of upkeep, knowledge, and oversight.

The IoT is a network of interconnected devices that can transmit and receive data over the internet and carry out tasks without human involvement.

Agriculture provides a wealth of data analysis parameter, resulting in increased crop yields. The use of IoT devices in smart farming aids in the modernization of information and communication.

For better crop growth moisture, mineral, light and other factors can be assumed. This research looks into a few of these characteristics for data analysis with the goal of assisting users in making better agriculture decision using IoT.

The technique is intended to help farmers increase their agricultural output.

02. LITERATURE SURVEY

PROBLEM STATEMENT:

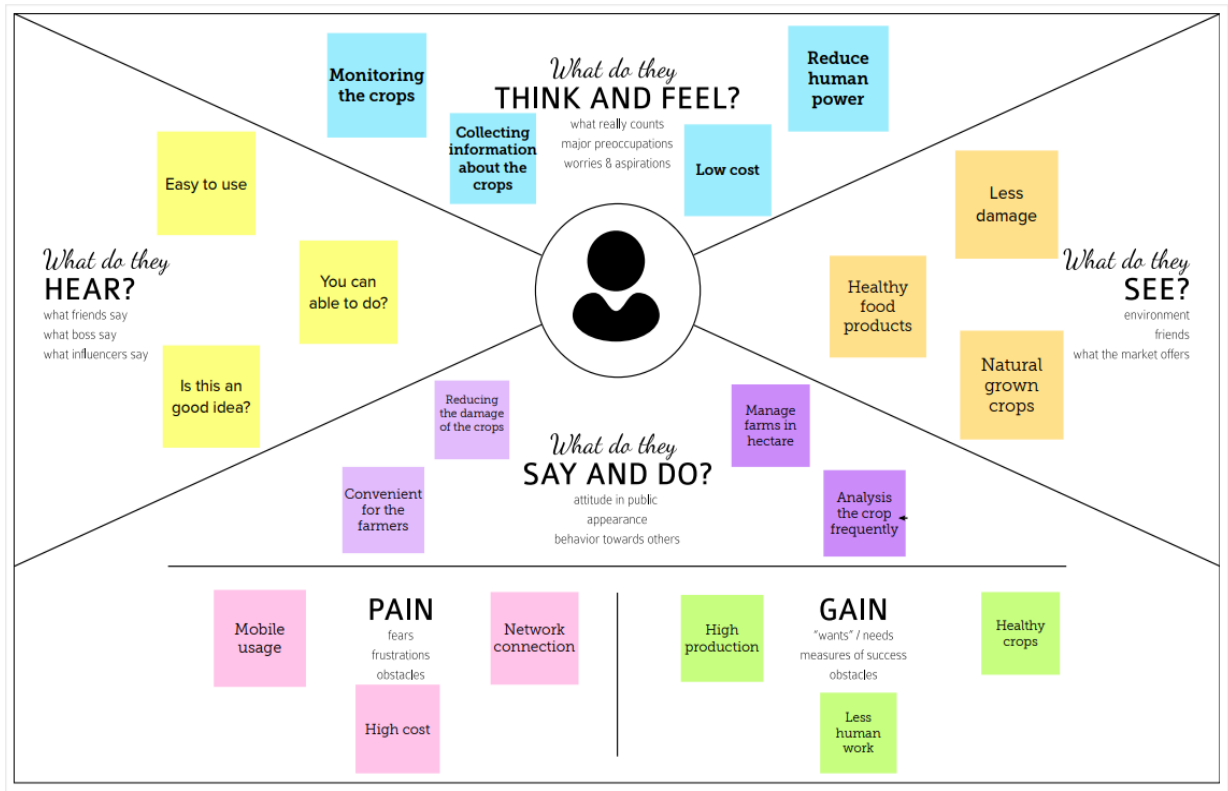
Problem statement	I am	I'm trying to	But	Because	Which makes me feel
How the plants get the requirements?	Agriculturist	Gets sufficient nutrition	Areas is in hectare	Production is large	Difficult
By which method the agriculturist know the needs of crop form they are?	Agriculturist	Get information from where they are	The distance is too long	The agriculture field is in huge sectors	Hard to monitor
How can they use pesticides?	Agriculturist	Detect the pests to use the pesticides	Different crops needed various level or various types of pesticide	Each crop has its unique nature	confusion
What is the role of IoT in agriculture?	Agriculturist	Better crop production	Expensive, require continuous internet	Need is huge and mandatory	Highly critical

The four quadrants reflect four key traits, which the user demonstrated/possessed during the observation/research stage.

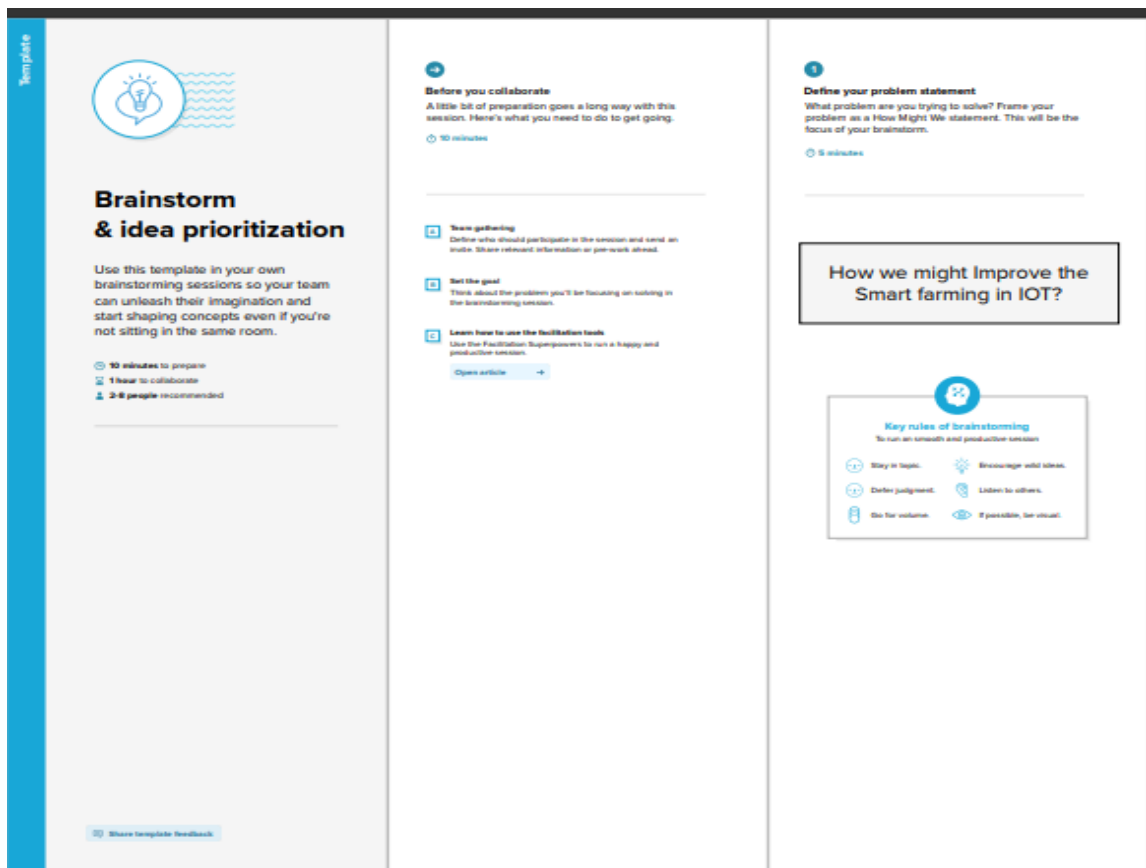
03.IDEATION AND PROPOSED SOLUTION

EMPATHY MAP:

It is a collaborative tool teams can use to gain a deeper insight into the (customers) agriculturist. An empathy map will help you understand your users(agriculturist) needs while we develop a deeper understanding of the person. The four quadrants reflect four key traits, which the user demonstrate during the observation stage.



IDEATION AND BRAINSTORMING:



2

Brainstorm

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

10 minutes

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VENMATHIL

PH measure	Automatic water pump
Pesticide measure	Drown watering

MITHULKIRUTHIK.N

Crop health monitoring & Local weather monitoring	Live stock
Humidity measure	Monitor through robot

DEEPIKA.M.S

Reduce the human work	Camera monitoring via Drown
Drift control	Precision farming (co2,lighting)

HARIVIGNESH.S

Irrigation control & soil quality	Fertility monitoring
Smart pest control	Harvesting automation

3

Group ideas

Take turns sharing your ideas while clustering similar or related notes as you go. In the last 10 minutes, give each cluster a sentence-like label. If a cluster is bigger than six sticky notes, try and see if you can break it up into smaller sub-groups.

20 minutes

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MEASURES :

Measure the humidity of the soil	Measure the PH level of the soil
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MONITORING

Monitor the crop in hectors	Monitor the crop health	Monitor the local weather
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CONTROL

Control the drift	Control the smart pest	Control the Irrigation of the soil
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USING :

Using the nano sensors	Using Soil NPK sensor	Using soil PH meter
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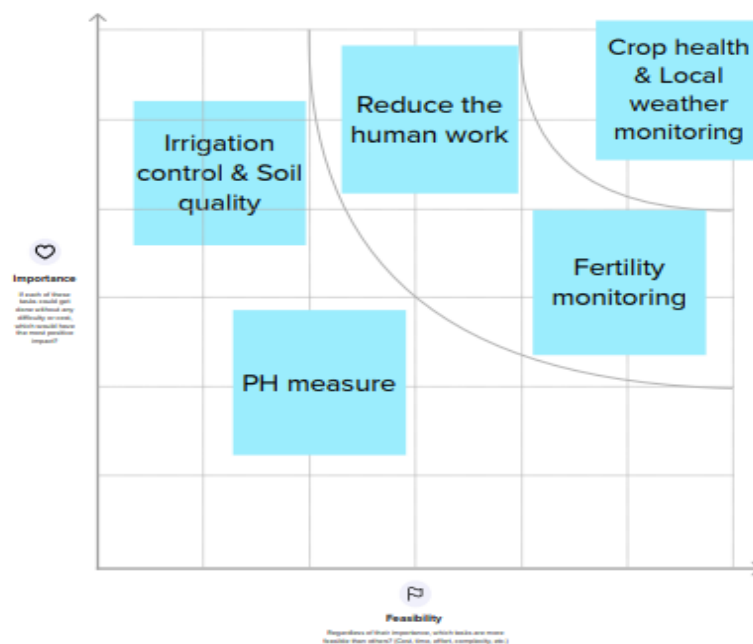
4

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

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5

After you collaborate

You can export the mural as an image or pdf to share with members of your company who might find it helpful.

Quick add-ons

- Share the mural**
Share a view link to the mural with stakeholders to keep them in the loop about the outcomes of the session.
- Export the mural**
Export a copy of the mural as a PNG or PDF to attach to emails, include in slides, or save to your drive.

Keep moving forward

- Strategy blueprint**
Define the components of a new idea or strategy.
[Open the template](#)
- Customer experience journey map**
Understand customer needs, motivations, and obstacles for an experience.
[Open the template](#)
- Strengths, weaknesses, opportunities & threats**
Identify strengths, weaknesses, opportunities, and threats (SWOT) to develop a plan.
[Open the template](#)

[Share template feedback](#)

PROPOSED SOLUTION:

S.NO	PARAMETER	DESCRIPTION
1	Problem statement	Smart farming – detect the crop needed from where we are.
2	Idea/ solution description	This project helps the farmers to detect the needs of the crops (like, level of nutrition, pesticides, temperature, soil moisture & so on.,) and to know the cultivating and harvesting period of the crop. That we can know in the form of automatic message in mobile by using the sensors.
3	Novelty /Uniqueness	Each & every crop situation can be detect & send their need to admin through GPS.
4	Social impact / Customer satisfaction	Agriculturist can provide the healthy foods & crops to the consumers without the damage of the crops
5	Business model (Revenue model)	➡ Easy to yield the large production ➡ Huge profit ➡ Easy to implement
6	Scalability of the solution	High scalability

PROBLEM SOLUTION FIT:

Define CS, fit into CC	1. CUSTOMER SEGMENT(S) CS <ul style="list-style-type: none"> ➤ For agriculturist ➤ For farming in hectors 	6. CUSTOMER CONSTRAINTS CC <ul style="list-style-type: none"> ➤ Network connection ➤ Available device 	5. AVAILABLE SOLUTIONS AS <ul style="list-style-type: none"> ➤ Web applications ➤ Sensors 	Explore AS, differentiate
	2. JOBS-TO-BE-DONE / PROBLEMS J&P <ul style="list-style-type: none"> ➤ Crop requirements detect (like, moisture, Temperature, pesticide) & Monitoring. ➤ The measures can be view through web application. 	9. PROBLEM ROOT CAUSE RC <ul style="list-style-type: none"> ➤ Monitor the crop in huge hector. ➤ To avoid the crop unsuitable for crop 	7. BEHAVIOUR BE <ul style="list-style-type: none"> ➤ Monitoring whether the sensor detected messages are received or not. ➤ Monitoring different level of requirements for crops 	

Identify strong T

3. TRIGGERS TR <ul style="list-style-type: none"> ➤ Efficient solution. ➤ Easy farming. 	10. YOUR SOLUTION SL <ul style="list-style-type: none"> ➤ Monitor the crop requirements. ➤ Location of the crop detect through GPS. 	8. CHANNELS of BEHAVIOUR CH <ul style="list-style-type: none"> ➤ Measured information can send to web application through online ➤ Offline location doesn't send
4. EMOTIONS: BEFORE / AFTER EM <ul style="list-style-type: none"> ➤ BEFORE Maybe yield decreases due to lack of monitor. ➤ AFTER Can yield more by proper monitoring. 		

03. REQUIREMENT ANALYSIS

FUNCTIONAL REQUIREMENT:

FR No.	Functional Requirement (Epic)	Sub Requirement (Story / Sub-Task)
FR-1	User Registration	Registration through Gmail Registration through form
FR-2	User Confirmation	Confirmation via Email Confirmation via OTP
FR-3	User Login	Login with Email Id and Password
FR-4	Weather	To find the information of climate in a particular area
FR-5	Sensors	To show data from different sensors like humidity, soil moisture, temperature, weather etc...
FR-6	Exit	After user checked every information, user can exit the application

NON-FUNCTIONAL REQUIREMENT:

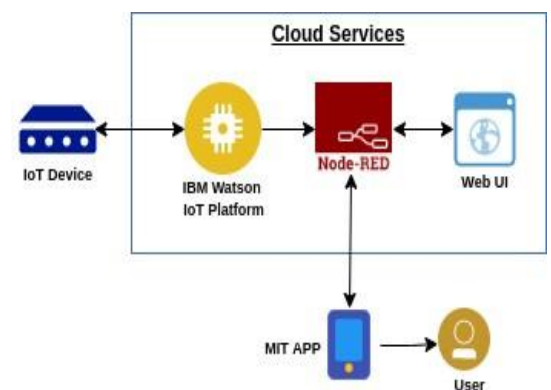
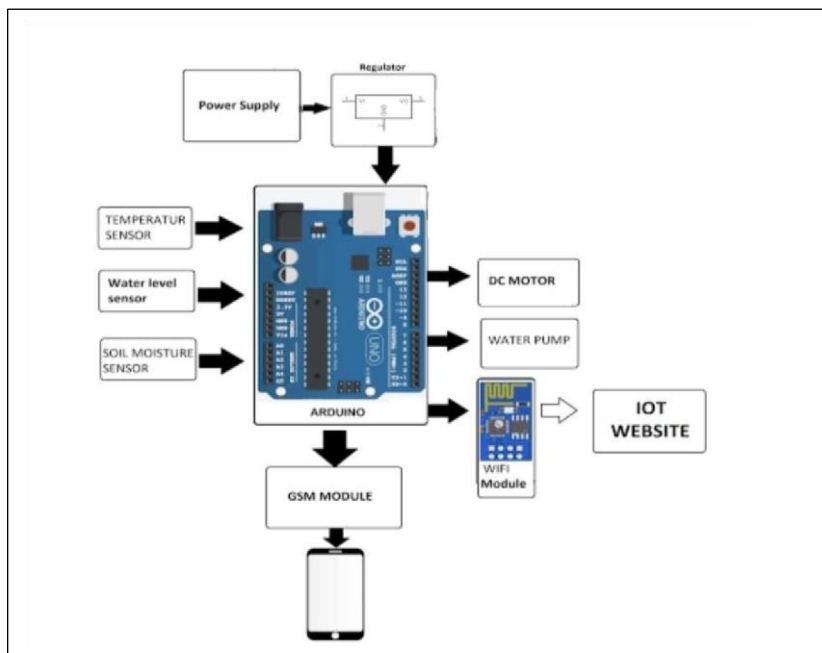
FR No.	Non-Functional Requirement	Description
NFR-1	Usability	Effective and Easy to Use, Time consumption is less
NFR-2	Security	The data will be protected from the unauthorized users
NFR-3	Reliability	To know the real-time status of the crops by capturing the data from sensors.
NFR-4	Performance	Due to the high performance, productivity is high
NFR-5	Availability	All the time, 24/7 it will be available
NFR-6	Scalability	Scalability is main concern for IoT platform. It is perfectly scalable many new constraints can be added

05.PROJECT DESIGN

DATA FLOW DIAGRAM:

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

- The Arduino UNO is a processing unit to process the data from the sensors.
- By using the various sensors the soil, temperature, moisture content and humidity parameters are measured.
- As a result of these, the information from the sensors and other equipments are stored in IBM cloud



SOLUTION AND TECHNICAL ARCHITECTURE:

- The various parameters like temperature, soil moistures, weather detection, humidity, valve control are sensed and control by using the different sensors.
- The sensed values are transfer to the Arduino UNO that process the data obtained from the sensors.
- The GSM module is connected to the Arduino UNO and the data transfer happens then the data will be stored in cloud storage.
- NODE-RED is used to write the hardware, software, and APIs.
- The MQTT protocol is followed for the communication.
- All the collected data are provided to the users (Agriculturist) through a mobile application that was developed using the MIT app inventor.
- The user (Agriculturist) can decide through an app, whether to water the crop or not depending upon the sensor detection. By using the app, users (Agriculturist) can operate the motor switch by remotely.

USER STORIES:

User Type	Functional Requirement (Epic)	User Story Number	User Story / Task	Acceptance criteria	Priority	Release
Customer (Mobile user)	Registration	USN-1	Agriculturist can register the application through Gmail. While registering through Gmail, by entering the password.	I can access my account / dashboard	High	Sprint-1
		USN-2	Agriculturist will receive confirmation email once they have registered for the application.	I can receive confirmation email & click confirm	High	Sprint-1
		USN-3	User can also 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
	Dashboard					
Customer (Web user)						
Customer Care Executive						
Administrator						

06.PROJECT PLANNING AND SCHEDULING

SPRINT PLANNING AND 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 python code	2	High	Mithulkiruthik N
Sprint-2	Software	USN-2	IBM Watson IoT platform, workflow for IoT scenarios using Node-Red	2	High	Deepika M.S
Sprint-3	MIT app inventor	USN-3	Develop an application for the Smart farmer project using MIT App Inventor	2	High	Harivignesh.s Mithulkiruthik N
Sprint-3	Dashboard	USN-3	Design the mobile application using MIT	2	High	Venmathi.T Deepika.M.S Harivignesh.s Mithulkiruthik N
Sprint-4	Web UI	USN-4	To make the user to interact with software.	2	High	Venmathi.T Deepika.M.S

07.CODING AND SOLUTION

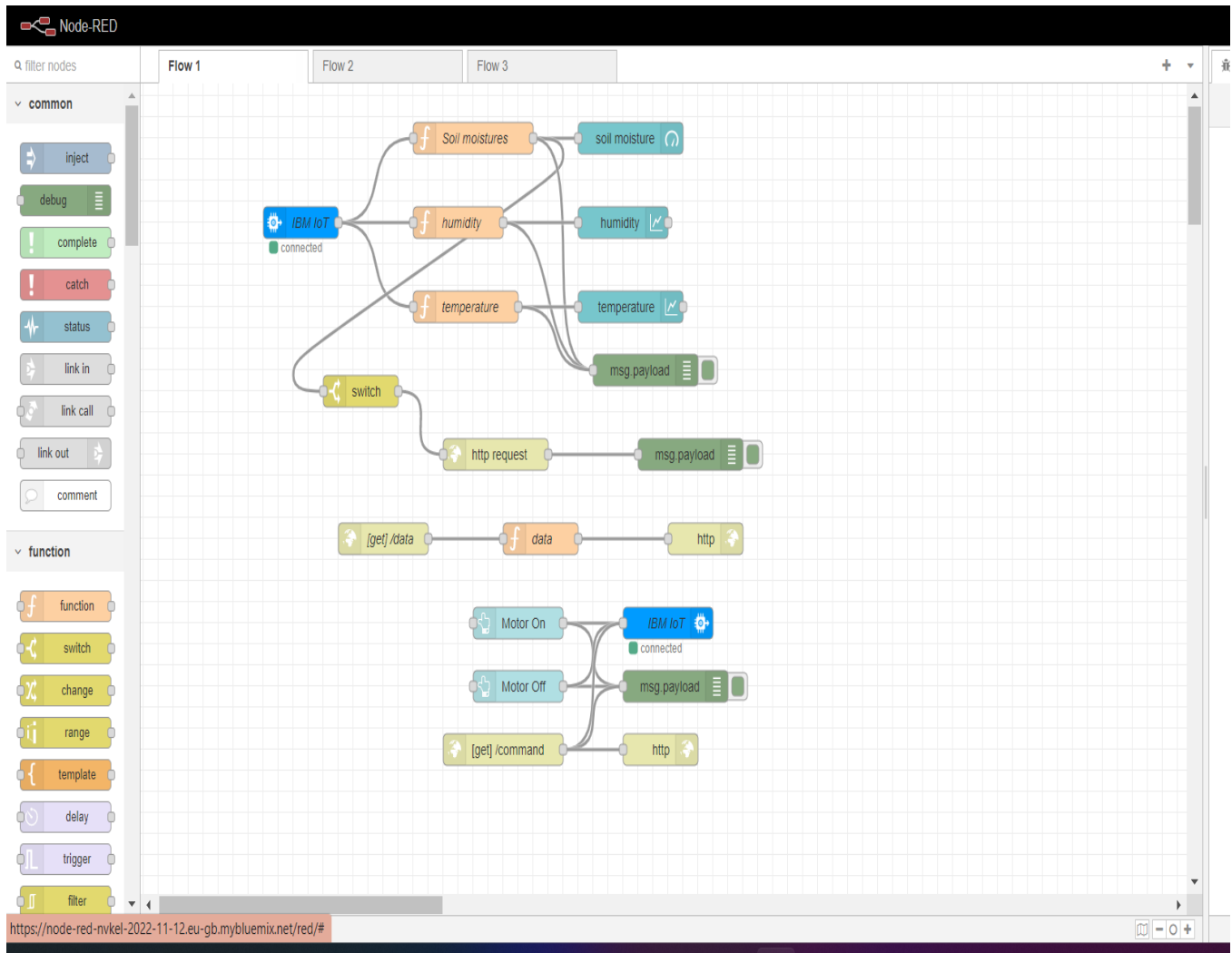
```
IBM.py
D: > IBM.py
1 import time
2 import sys
3 import ibmiotf.application
4 import ibmiotf.device
5 import random
6
7 #Provide your IBM Watson Device Credentials
8
9 orgId = "n1eakxk|"
10 deviceType = "smartfarming"
11 deviceId = "TamilNadu"
12 Token = "q3(u4iv5-4L+OHY@wm"
13 authMethod = "use-token-auth"
14
15 # Initialize GPIO
16
17 def myCommandCallback(cmd):
18     print("Command received: %s" % cmd.data['command'])
19     status=cmd.data['command']
20     if status=="motoron":
21         print ("motor is on")
22     else:
23         print ("motor is off")
24
25     #print(cmd)
26
27 try:
28
29     deviceOptions = {"org": orgId, "type": deviceType, "id": deviceId, "auth-method": authMethod, "auth-token": Token}
30     deviceCli = ibmiotf.device.Client(deviceOptions)
31     #.....
32
33 except Exception as e:
34     print("Caught exception connecting device: %s" % str(e))
35     sys.exit()
36
37 # Connect and send a datapoint "hello" with value "world" into the cloud as an event of type "greeting" 10 times
```

th

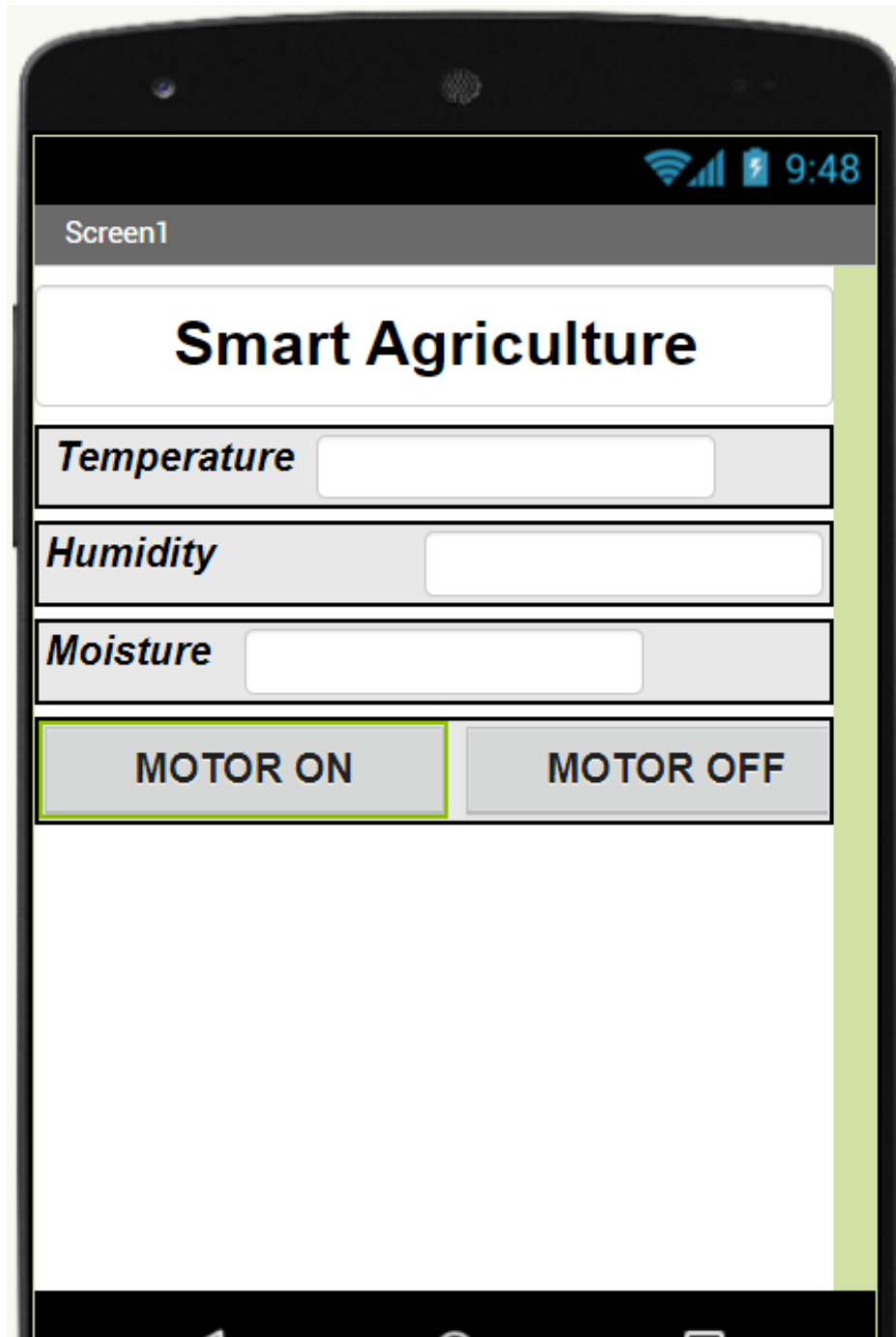
```
IBM.py
D: > IBM.py
24
25     #print(cmd)
26
27 try:
28
29     deviceOptions = {"org": orgId, "type": deviceType, "id": deviceId, "auth-method": authMethod, "auth-token": Token}
30     deviceCli = ibmiotf.device.Client(deviceOptions)
31     #.....
32
33 except Exception as e:
34     print("Caught exception connecting device: %s" % str(e))
35     sys.exit()
36
37 # Connect and send a datapoint "hello" with value "world" into the cloud as an event of type "greeting" 10 times
38 deviceCli.connect()
39
40 while True:
41     #Get Sensor Data from DHT11
42     temp=random.randint(-20,125)
43     hum=random.randint(0,100)
44     soil=random.randint(0,100)
45     data = { 'temp': temp, 'hum': hum, 'soil': soil}
46     #print data def myOnPublishCallback( ):
47     print (f"Published temp = {temp} C , hum = {hum} , soil = {soil} deg c to IBM Watson")
48     success = deviceCli.publishEvent("IoTSensor", "json", data, qos=0,on_publish=myOnPublishCallback)
49     if not success:
50         print("Not connected to IoTF")
51         time.sleep(10)
52     deviceCli.commandCallback = myCommandCallback
53     # Disconnect the device and application from the cloud
54     deviceCli.disconnect()
```

08.TESTING

TEST CASES:

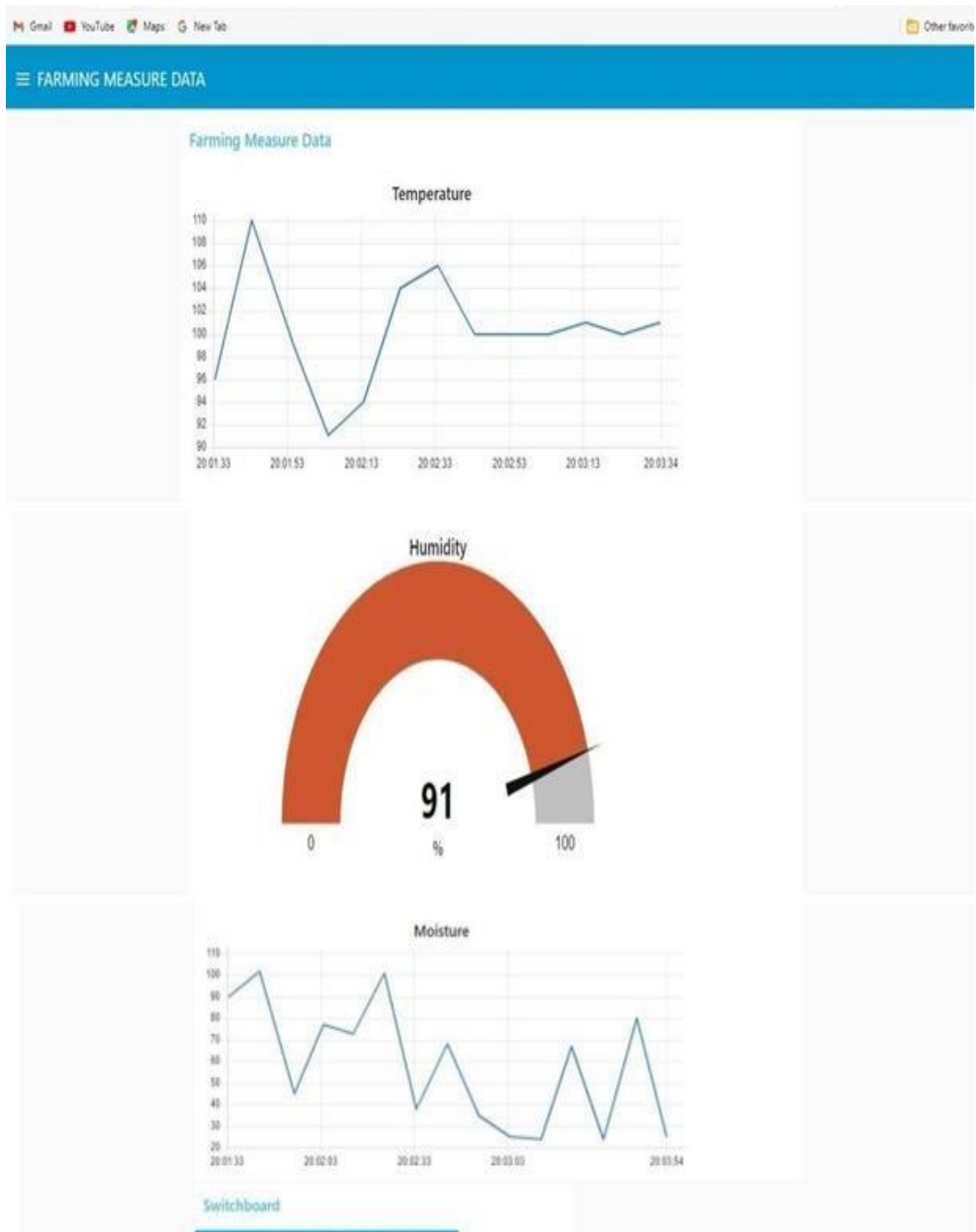


USER ACCEPTANCE TESTING:



09.RESULT

PERFORMANCE:



10.ADVANTAGES AND DISADVANTAGES

ADVANTAGES:

- Agriculturists can monitor the health of farm crops, even if the fields are far, results in high production.
- It can assist in the smarter control of homes through mobile phone.
- IoT-enabled agriculture allows agriculturist to monitor their product and conditions in real-time.
- It helps agriculturists to better understand the important factors such as water, topography, aspect, vegetation and soil types.

DISADVANTAGES:

- The smart farming based equipment require farmers to understand and learn the use of technology.
- Rural part of most of the developing countries do not fulfil this requirement.
- More over internet connection is slower

11.FUTURE SCOPE

IoT smart agriculture 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. To managing farms using modern Information and communication technologies to increase the quantity and quality of products while optimizing the human labour required. 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.

12.CONCLUSION

The agricultural sector is of vital importance for the region. It is undergoing a process of transition to a market economy, with substantial changes in the social, legal, structural & productive. The way to maintain a parity between the increasing pressure of food demand and food production in the future.

GITUP LINK:

<https://github.com/IBM-EPBL/IBM-Project-31449-1660200440>