SMART FARMER-IOT ENABLED SMART FARMING APPLICATION

NAALAIYATHIRAN IBM PROJECT REPORT

Date	**20 November 2022**
Team ID	**PNT2022TMID29937**
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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 thit 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.
- 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

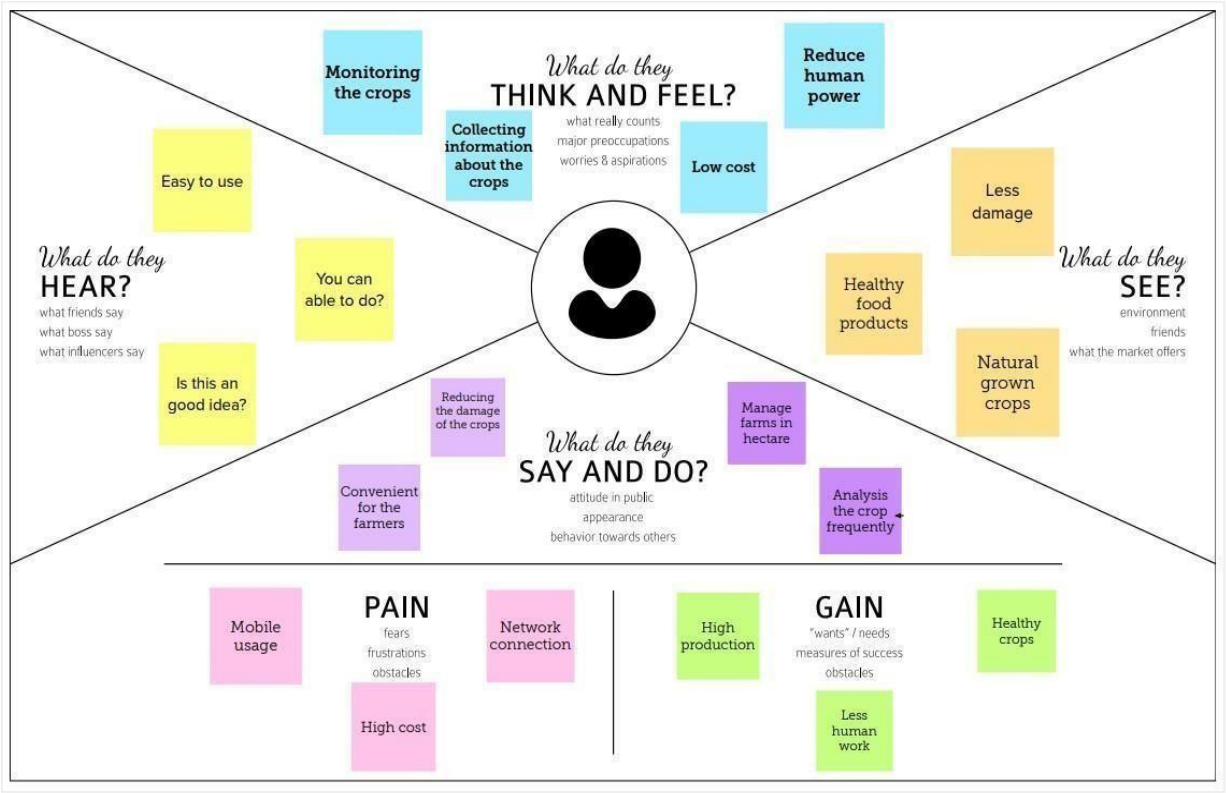
PROBLEM STATEMENT:

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

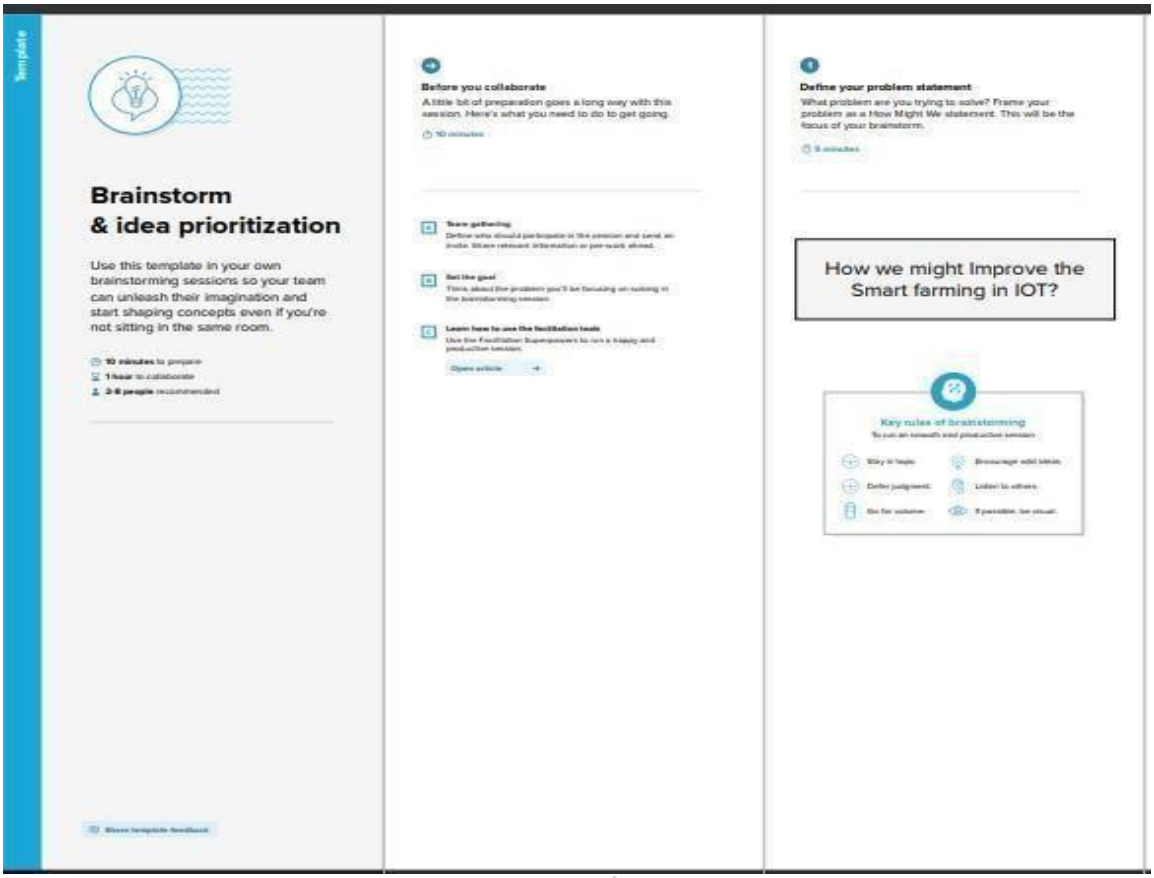
03.IDEATION AND PROPOSED SOLUTION

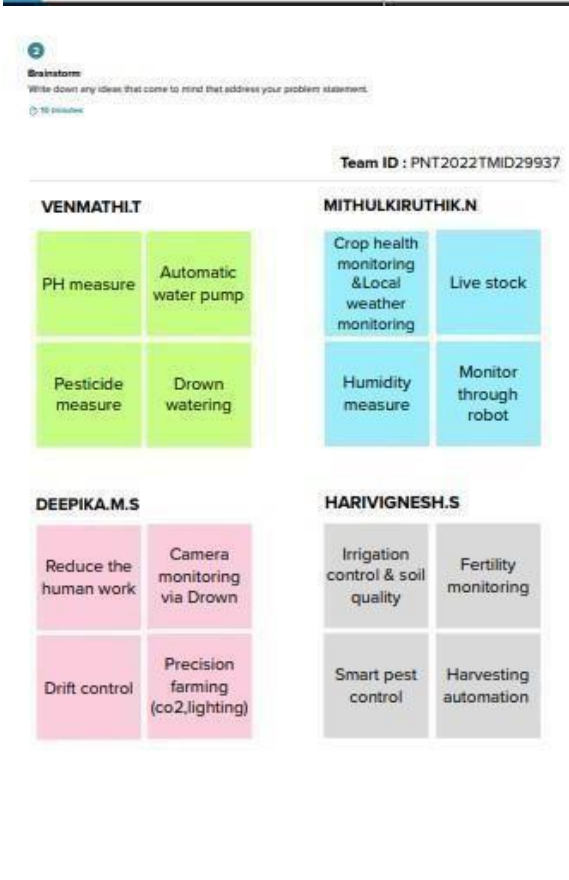
EMPATHY MAP:

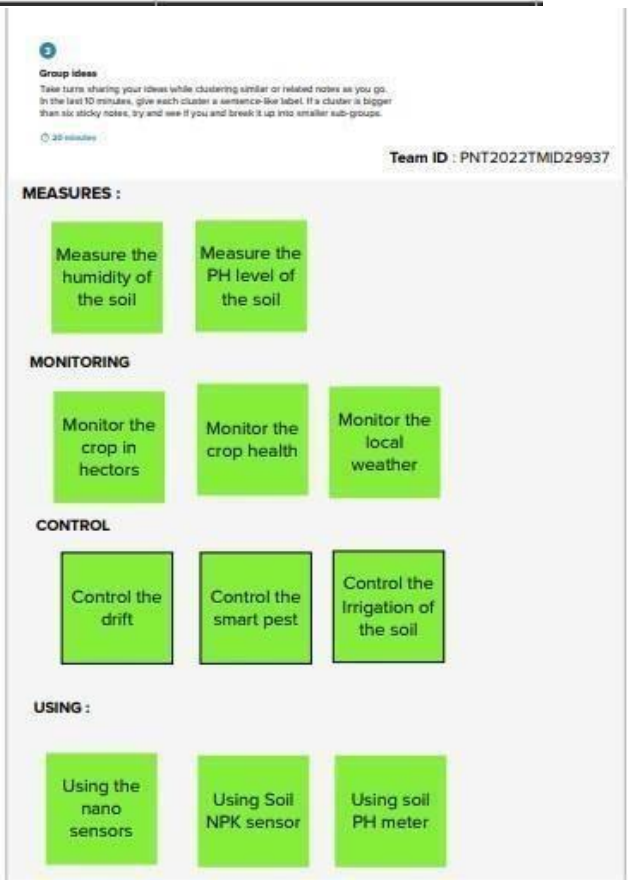
It is a collaborative tool teams can use to gain a deeper insight into the (customers) agriculturist. An empathy map will help you understand your users(agriculturist) needs while we develop a deeper understanding of the person. The four quadrants reflect four key traits, which the user demonstrate during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



IDEATION AND BRAINSTORMING:


Template
Brainstorm
& idea prioritization
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.
10 minutes to prepare
1 hour to collaborate
2-8 people recommended
Before you collaborate
A little bit of preparation goes a long way with this session. Here's what you need to do to get going.
10 minutes
Team gathering
Set the goal
Learn how to use the facilitation tools
Open article
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
How we might Improve the Smart farming in IOT?
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
Team ID : PNT2022TMID29937
VENMATHI.T
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 and 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
MONITORING
Monitor the crop in hectors
Monitor the crop health
Monitor the local weather
CONTROL
Control the drift
Control the smart pest
Control the Irrigation of the soil
USING :
Using the nano sensors
Using Soil NPK sensor
Using soil PH meter

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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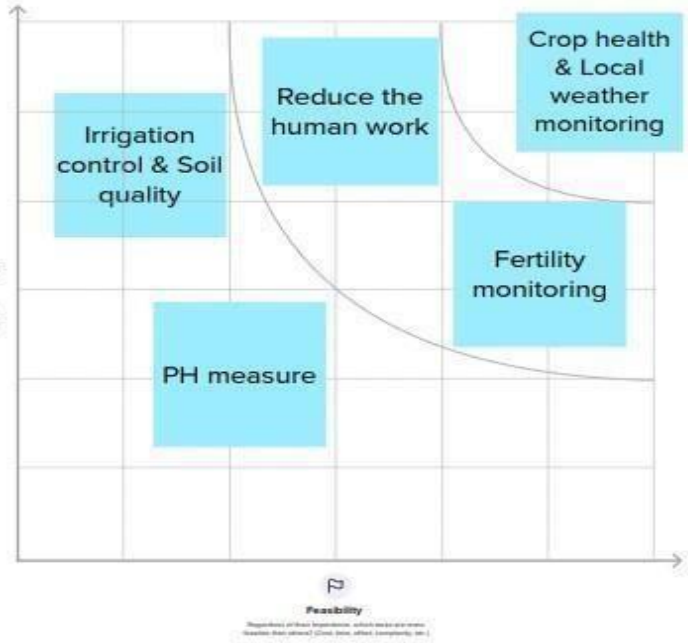


After you collaborate

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 in 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 →

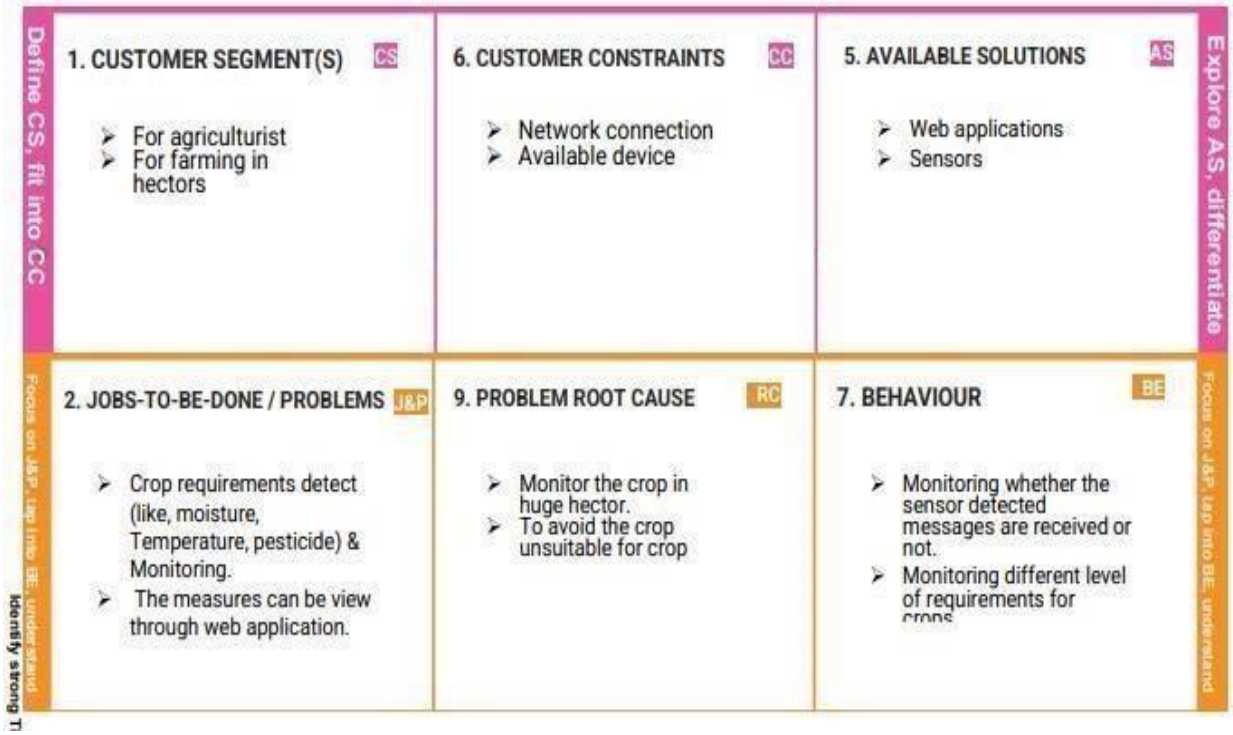
Strengths, weaknesses, opportunities & threats
Identify strengths, weaknesses, opportunities, and threats (SWOT) to develop a plan.
Open the template →

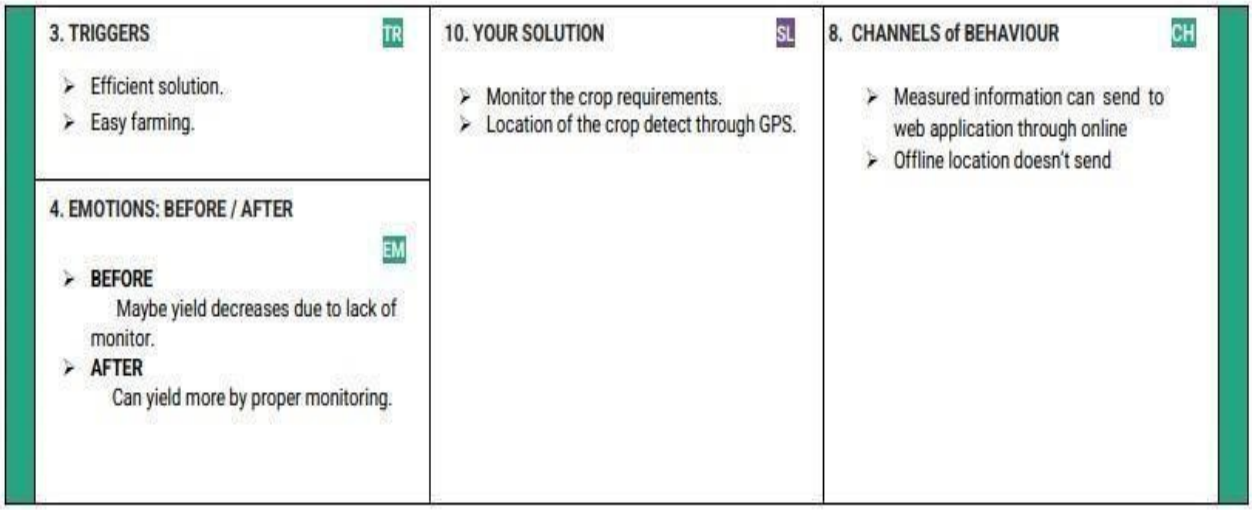
Share template feedback

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:





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:

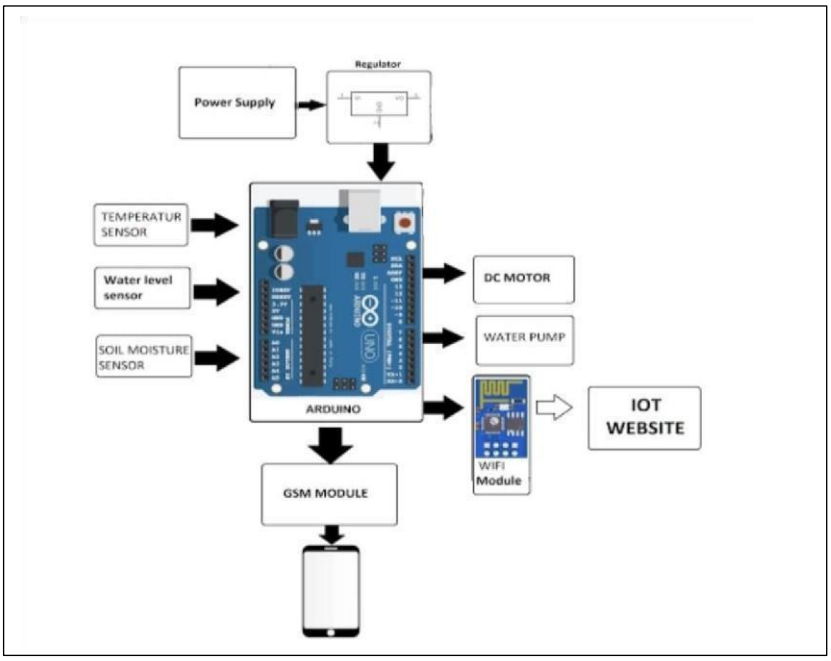
FR No.	Non-Functional Requirement	Description
NFR-1	**Usability**	Effective and Easy to Use, Time consumption is less
NFR-2	**Security**	The data will be protected from the unauthorized users
NFR-3	**Reliability**	To know the real-time status of the crops by capturing the data from sensors.
NFR-4	**Performance**	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

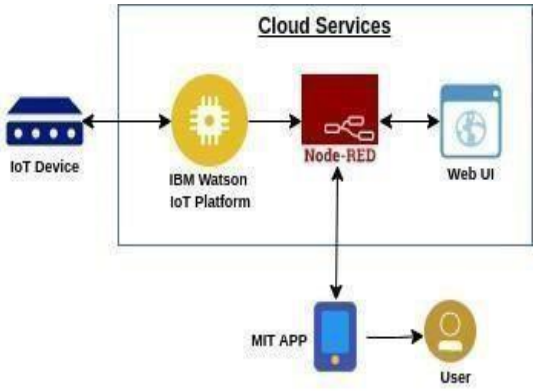
05.PROJECT DESIGN

DATA FLOW DIAGRAM:

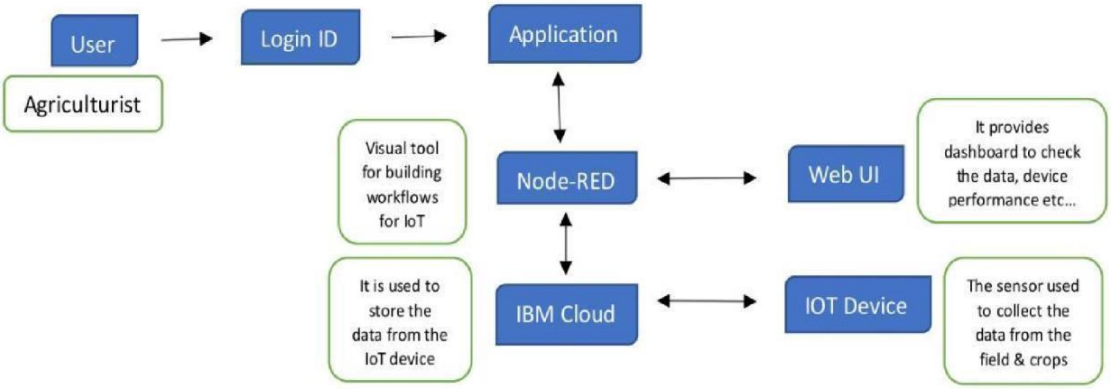
A Data Flow Diagram (DFD) is a traditional visual representation of the information flows within a system. A neat and clear DFD can depict the right amount of the system requirement graphically. It shows how data enters and leaves the system, what changes the information, and where data is stored.

- 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, volve 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

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

#Provide your IBM Watson Device Credentials

orgId = "n1eaxk"
deviceType = "smartfarming"
deviceId = "TamilNadu"
Token = "q3(u4iv5-4L+OHy@wm"
authMethod = "use-token-auth"

# Initialize GPIO

def myCommandCallback(cmd):
    print("Command received: %s" % cmd.data['command'])
    status=cmd.data['command']
    if status=="motoron":
        print ("motor is on")
    else:
        print ("motor is off")

    #print(cmd)

try:

  deviceOptions = {"org": orgId, "type": deviceType, "id": deviceId, "auth-method": authMethod, "auth-token": Token}
  deviceCli = ibmiotf.device.Client(deviceOptions)
  #.....................................

except Exception as e:
  print("Caught exception connecting device: %s" % str(e))
  sys.exit()

# Connect and send a datapoint "hello" with value "world" into the cloud as an event of type "greeting" 10 times
```

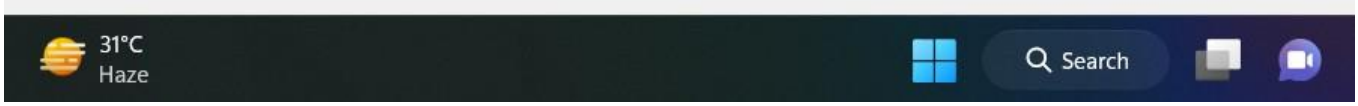
IBM.py

```
    #print(cmd)

try:

  deviceOptions = {"org": orgId, "type": deviceType, "id": deviceId, "auth-method": authMethod, "auth-token": Token}
  deviceCli = ibmiotf.device.Client(deviceOptions)
  #.....................................

except Exception as e:
  print("Caught exception connecting device: %s" % str(e))
  sys.exit()

# Connect and send a datapoint "hello" with value "world" into the cloud as an event of type "greeting" 10 times
deviceCli.connect()

while True:
    #Get Sensor Data from DHT11
    temp=random.randint(-20,125)
    hum=random.randint(0,100)
    soil=random.randint(0,100)
    data = { 'temp' : temp, 'hum': hum , 'soil': soil}
    #print data def myOnPublishCallback( ):
    print (f"Published temp = {temp} C , hum = {hum} , soil = {soil} deg c 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
    # Disconnect the device and application from the cloud
    deviceCli.disconnect()
```

Python 3.7.0 Shell

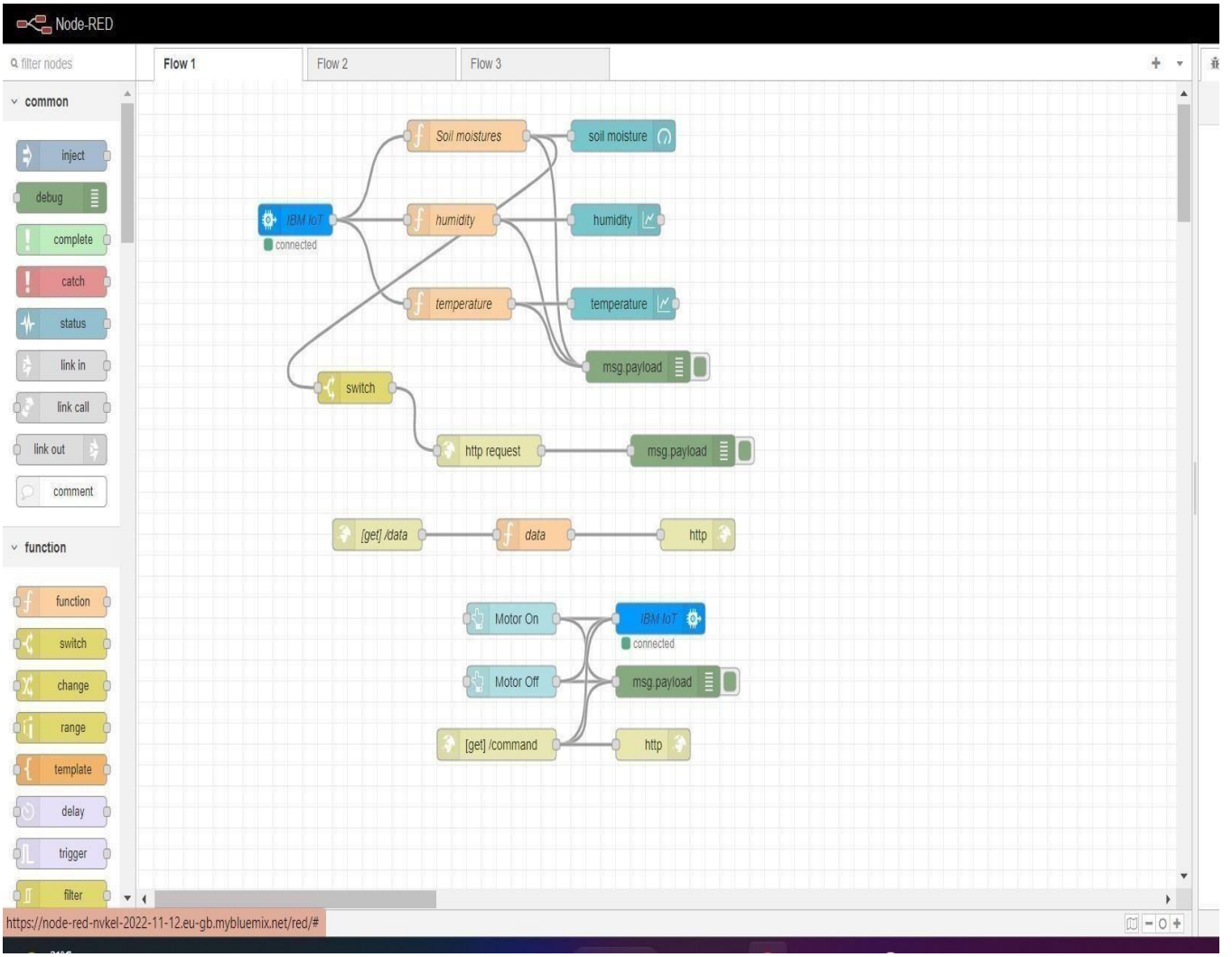
File Edit Shell Debug Options Window Help

```
published temp = 69 C humid = is 52 % moisture= is 33 % to IBM Watson
published temp = 21 C humid = is 87 % moisture= is 87 % to IBM Watson
published temp = 81 C humid = is 57 % moisture= is 16 % to IBM Watson
published temp = 35 C humid = is 90 % moisture= is 65 % to IBM Watson
published temp = 86 C humid = is 41 % moisture= is 95 % to IBM Watson
published temp = 89 C humid = is 76 % moisture= is 4 % to IBM Watson
published temp = 77 C humid = is 87 % moisture= is 22 % to IBM Watson
published temp = 39 C humid = is 84 % moisture= is 2 % to IBM Watson
published temp = 39 C humid = is 98 % moisture= is 18 % to IBM Watson
published temp = 76 C humid = is 27 % moisture= is 0 % to IBM Watson
published temp = 32 C humid = is 23 % moisture= is 31 % to IBM Watson
published temp = 9 C humid = is 74 % moisture= is 46 % to IBM Watson
published temp = 70 C humid = is 30 % moisture= is 5 % to IBM Watson
published temp = 4 C humid = is 84 % moisture= is 79 % to IBM Watson
published temp = 11 C humid = is 63 % moisture= is 1 % to IBM Watson
published temp = 60 C humid = is 68 % moisture= is 42 % to IBM Watson
published temp = 53 C humid = is 24 % moisture= is 78 % to IBM Watson
published temp = 30 C humid = is 17 % moisture= is 1 % to IBM Watson
published temp = 18 C humid = is 95 % moisture= is 71 % to IBM Watson
published temp = 23 C humid = is 100 % moisture= is 89 % to IBM Watson
published temp = 41 C humid = is 96 % moisture= is 4 % to IBM Watson
published temp = 2 C humid = is 86 % moisture= is 46 % to IBM Watson
published temp = 64 C humid = is 52 % moisture= is 38 % to IBM Watson
published temp = 26 C humid = is 37 % moisture= is 55 % to IBM Watson
published temp = 60 C humid = is 12 % moisture= is 48 % to IBM Watson
published temp = 44 C humid = is 88 % moisture= is 28 % to IBM Watson
published temp = 9 C humid = is 22 % moisture= is 82 % to IBM Watson
published temp = 79 C humid = is 62 % moisture= is 93 % to IBM Watson
published temp = 96 C humid = is 57 % moisture= is 68 % to IBM Watson
published temp = 76 C humid = is 58 % moisture= is 2 % to IBM Watson
published temp = 43 C humid = is 47 % moisture= is 43 % to IBM Watson
published temp = 13 C humid = is 30 % moisture= is 50 % to IBM Watson
published temp = 7 C humid = is 9 % moisture= is 70 % to IBM Watson
published temp = 64 C humid = is 91 % moisture= is 80 % to IBM Watson
published temp = 5 C humid = is 65 % moisture= is 3 % to IBM Watson
published temp = 78 C humid = is 13 % moisture= is 11 % to IBM Watson
published temp = 20 C humid = is 49 % moisture= is 15 % to IBM Watson
published temp = 80 C humid = is 18 % moisture= is 99 % to IBM Watson
published temp = 42 C humid = is 41 % moisture= is 70 % to IBM Watson
published temp = 81 C humid = is 80 % moisture= is 89 % to IBM Watson
published temp = 42 C humid = is 76 % moisture= is 3 % to IBM Watson
published temp = 99 C humid = is 58 % moisture= is 96 % to IBM Watson
published temp = 12 C humid = is 65 % moisture= is 92 % to IBM Watson
published temp = 31 C humid = is 42 % moisture= is 100 % to IBM Watson
published temp = 96 C humid = is 13 % moisture= is 35 % to IBM Watson
published temp = 84 C humid = is 70 % moisture= is 80 % to IBM Watson
published temp = 90 C humid = is 50 % moisture= is 84 % to IBM Watson
```

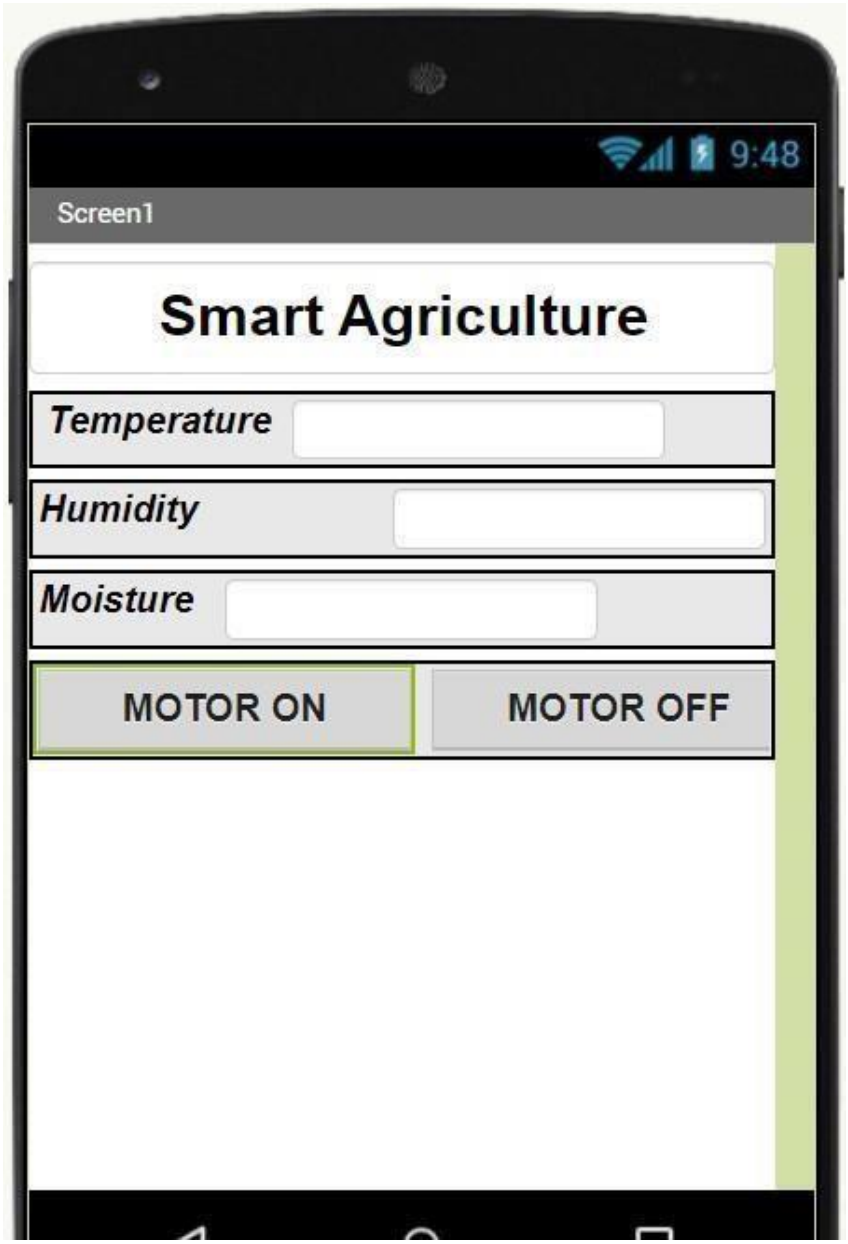


08.TESTING

TEST CASES:

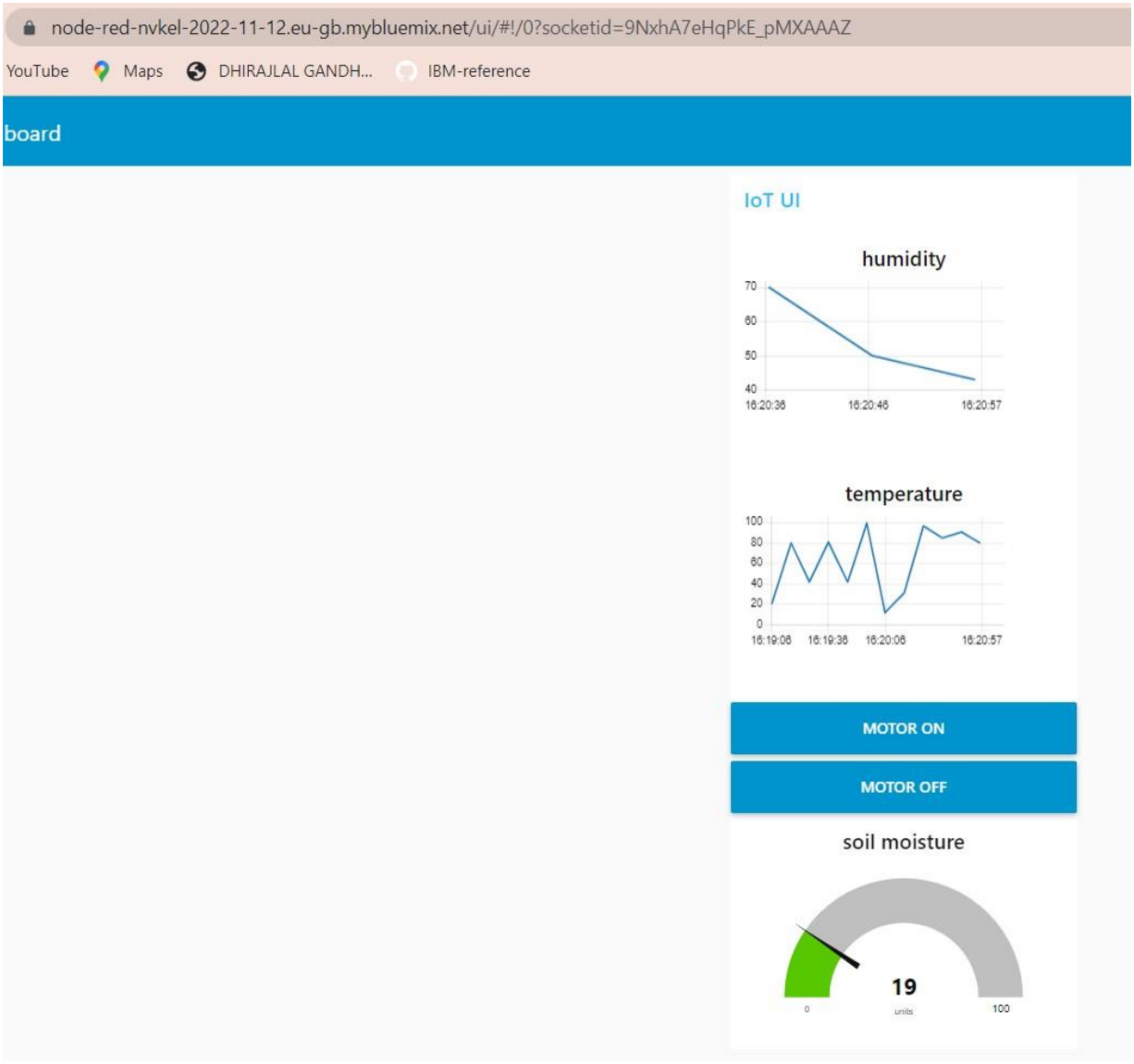


USER ACCEPTENCE TESTING:



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 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.

GITHUP LINK:

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

DEMO LINK:

https://youtu.be/Udjqm8mPUNE