SmartFarmer - IoT Enabled Smart Farming Application

A PROJECT REPORT

Submitted by

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CHAPTER-I

1.INTRODUCTION

1.1. Project Overview

- The parameters like temperature, humidity, and soil moisture are updated to the Watson IoT platform
- The device will subscribe to the commands from the mobile application and control the motors accordingly
- APIs are developed using Node-RED service for communicating with Mobile Application
- A mobile application is developed using the MIT App inventor to monitor the sensor parameters and control the motors.

1.2. Purpose

- 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.

CHAPTER - II

2. LITERATURE SURVEY

2.1. Existing problem

[1] Aishwarya Kagalkar (2017) , has proposed a paper titled "Smart Irrigation System "; The proposed Irrigation System in this paper aims at fulfilling water requirements of the crops, by monitoring the soil moisture and other environmental parameters. The system, which is based on the Internet of Things, logs the sensor data to the cloud and the farmer can monitor and control all the water pumps remotely over the internet using an Android application. It consists of a wireless sensor node with Arduino publishing sensor data to the cloud using Wi-Fi module and controlling the pump using relay. The paper presents an automated irrigation system providing precision agriculture and thus preventing water wastage.

Advantage : Farmers can control all water pumps remotely over the internet. All the data is stored in the cloud.

Disadvantage : The mobile app doesn't display the weather conditions in the field.

Hardware Details : Arduino , Relay ,Wifi module

Software Details : Android Application

[2] Dr. S.Kanchana (2018) , has proposed a paper titled "IoT in Agriculture : Smart Farming"; In this project it mainly focuses on climatic conditions that can be programmed into a microcontroller-based gateway to control water quantity. The system is powered by electric power and it also focuses on remotely detecting soil quality, weather conditions, crop growth, and crop damage using wireless monitoring sensors with a cloud based platform.

Advantage : Increase quality of food product and decrease production cost and this also detects plant growth.

Disadvantage : This device doesn't have motor control features in mobile applications.

Hardware Details : Temperature sensor, moisture sensor

Software Details : Web application

[3] K. Lakshmi Sudha, et.al(2016), has proposed a paper titled “Smart Precision Based Agriculture Using Sensors”;It focuses on developing devices and tools to manage, display and alert the users using the advantages of a wireless sensor network system. A smart system based on precision agriculture would pave the way to a new revolution in agriculture. The user can monitor the agriculture environment from a remote location, thus providing a greenhouse condition for the plants. India being an agro based economy.

Advantage : Wireless monitoring of field reduce man power, and it send the SMS to the farmer about environmental conditions.

Disadvantage : This project doesn't have mobile application for users to control the motor.

Hardware Details : Raspberry pi, Relay , Moisture sensor,

Software Details : Web Application.

[4] Dr. Madhu Kumari and Anant Kumar Sah (2021) have proposed a paper titled “IoT Enabled Smart Irrigation System, Monitoring and Water Harvesting in Different Soils” ; In this paper, we are able to realize the cost effective and reliable device whose aim is to irrigate fields only when there is a need of water and to provide information. The farmers can monitor their farm’s field simply by just browsing the channel link of thing speak. The information is sent to the farmers by using a cloud website called thing speak. All the data is uploaded by the Wi-Fi module inbuilt in MICROCONTROLLER, to thing speak cloud database.

Advantage : The farmers can monitor their farm’s field using simply by just browsing the channel link of thing speak.

Disadvantage : This device cant check the Environmental weather conditions.

Hardware Details : NodeMICROCONTROLLER-8266, soil moisture sensor, DHT11 sensor, Relay, Arduino Uno.

Software Details : Thinkspeak

[5] Neha Kailash Nawandar and Vishal Satpute (2019) have proposed a paper titled "IoT based intelligent irrigation support system for smart farming applications "; A crop irrigation management system with sensor data fetch, transfer and operate functionalities is proposed to meet the expectations. The system comprises of: sensing, data processing and actuator sections, with a network of ambient temperature and humidity at a height and, soil moisture sensor placed at the root zone of the subject. The sensor generated data is compressed and then sent to an FTP server for processing. At the server, a 2-layer Neural Network with 4-Inputs, plant growth, temperature, humidity and soil moisture is used for decision making that controls water supply.

Advantage : Less expensive techniques by which the necessary help can be provided to the Farmers and production of the crop will be increased.

Disadvantage : It will automatically irrigate the field even if the farmer didn't want to irrigate.

Hardware Details : Soil moisture sensor, Arduino-UNO ATmega328p, IR sensor.

Software Details : Cloud Server.

[6] CH Nishanthi,et.al(2021) have proposed a paper titled " Smart Farming Using IOT". In this project, we are able to realize with a compilation of data from sensors and modern electronic gadgets, the farmer can monitor agricultural fields. Smart Agriculture can forecast weather data, switching ON the pump motor and switching ON the bulb for artificial light due to less light intensity, for farms acknowledging the dampness of soil or moisture levels . It also focuses on detecting the pest and humans by their temperature using IR sensors and the sensors are interfaced to process module Arduino-UNO.

Advantage : A compilation of data from sensors and modern electronic gadgets, the farmers can monitor agricultural fields.

Disadvantage : This device can't detect if the water is in the well or not.

Hardware Details : Humidity sensor,Temperature sensor, Arduino UNO microcontroller, IR sensor, ESP8266 Wi-Fi Module.

Software Details : Arduino IDE,Web Application.

[7] Pankaj Kumar Kashyap, et.al (2021) have proposed a paper titled ,"Towards Precision Agriculture: IoT-Enabled Intelligent Irrigation Systems Using Deep Learning Neural Network"; Precision irrigation is the solution to deliver bigger, better, and more profitable yields with fewer resources. Several machine learning-based irrigation models have been proposed to use water more efficiently.a deep learning neural network-based Internet of Things (IoT)-enabledintelligentirrigation system for precision agriculture (DLiSA). This is a feedback integrated system that keeps its functionality better in the weather of any region for any period of time. DLiSA utilizes a long short-term memory network (LSTM) to predict the volumetric soil moisture content for one day ahead, irrigation period, and spatial distribution of water required to feed the arable land
Advantage : Water pumps contol remotely over the internet. All the datas is stored in the cloud.
Disadvantage : They are not well suited to unpredictable climates.
Hardware Details : Moisture sensor, Temperature sensor.
Software Details : Deep learning neural network-based Internet of Things (IoT)-enabledintelligentirrigation.

[8] Dr. V.Vidya Devi and G. Meena Kumari (2014), have proposed a paper titled, "Real Time Automation and Monitoring System for Modernized Agriculture"; It proposes an idea about how an automated irrigation system was developed to optimize water use for agricultural crops. In addition, a gateway unit handles sensor information.
Advantage : Online interaction can be made with the farmers by the consultant to give them the knowledge and Partial Root Zone Drying Process can be implemented to save water at the maximum extent.
Disadvantage : This device does not measure water level in the well and motor control features to users is not given in the application.
Hardware Details : Temperature sensor, humidity sensor and ARM Microcontroller.
Software Details : Web Application.

2.2. References

[1] Aishwarya Kagalkar, “Smart Irrigation System “ , in International Journal of Engineering Research & Technology (IJERT) ,ISSN: 2278-0181 ,Vol. 6 Issue 05, May - 2017.

[2] Dr. S.Kanchana, “IoT in Agriculture : Smart Farming” , in International Journal of Scientific Research in Computer Science, Engineering and Information Technology, Volume 3, Issue 8, ISSN : 2456-3307, December 2018, DOI : https://doi.org/10.32628/CSEIT183856.

[3] K. Lakshmisudha, Swathi Hegde, Neha Kale, Shruti Iyer “Smart Precision Based Agriculture Using Sensors”, in International Journal of Computer Applications (0975 – 8887) , Volume 146 – No.11, July 2016 .

[4] Dr. Madhu Kumari and Anant Kumar Sah, “IoT Enabled Smart Irrigation System, Monitoring and Water Harvesting in Different Soils”, in International Journal of Engineering Research & Technology (IJERT), ISSN: 2278-0181,Vol. 10 Issue 03, March-2021 .

[5] Neha Kailash Nawandar and Vishal Satpute, “IoT based intelligent irrigation support system for smart farming applications “; in Advances in Distributed Computing and Artificial Intelligence Journal (ADCAIJ), ISSN: 2255-2863, Vol. 8 N. 2, 2019.

[6] CH Nishanthi , Dekonda Naveen , Chiramdasu Sai Ram , Kommineni Divya , Rachuri Ajay Kumar , “ Smart Farming Using IOT”, in International Journal of Innovative Research in Technology (IJIRT 151824), ISSN: 2349-6002, Volume 8 Issue 1 , June 2021.

[7] Pankaj Kumar Kashyap , Sushil Kumar , Ankita Jaiswal, Mukesh Prasad,and Amir H. Gandomi ,"Towards Precision Agriculture: IoT-Enabled Intelligent Irrigation Systems Using Deep Learning Neural Network" , in IEEE SENSORS JOURNAL, vol. 21, No. 16, August 15, 2021.

[8] Dr. V.Vidya Devi and G. Meena Kumari, "Real Time Automation and Monitoring System for Modernized Agriculture", in International Journal of Review and Research in Applied Sciences and Engineering (IJRRASE), ISSN: 2231 – 0061X, Vol 3 No.1, PP 7-12, March 2013

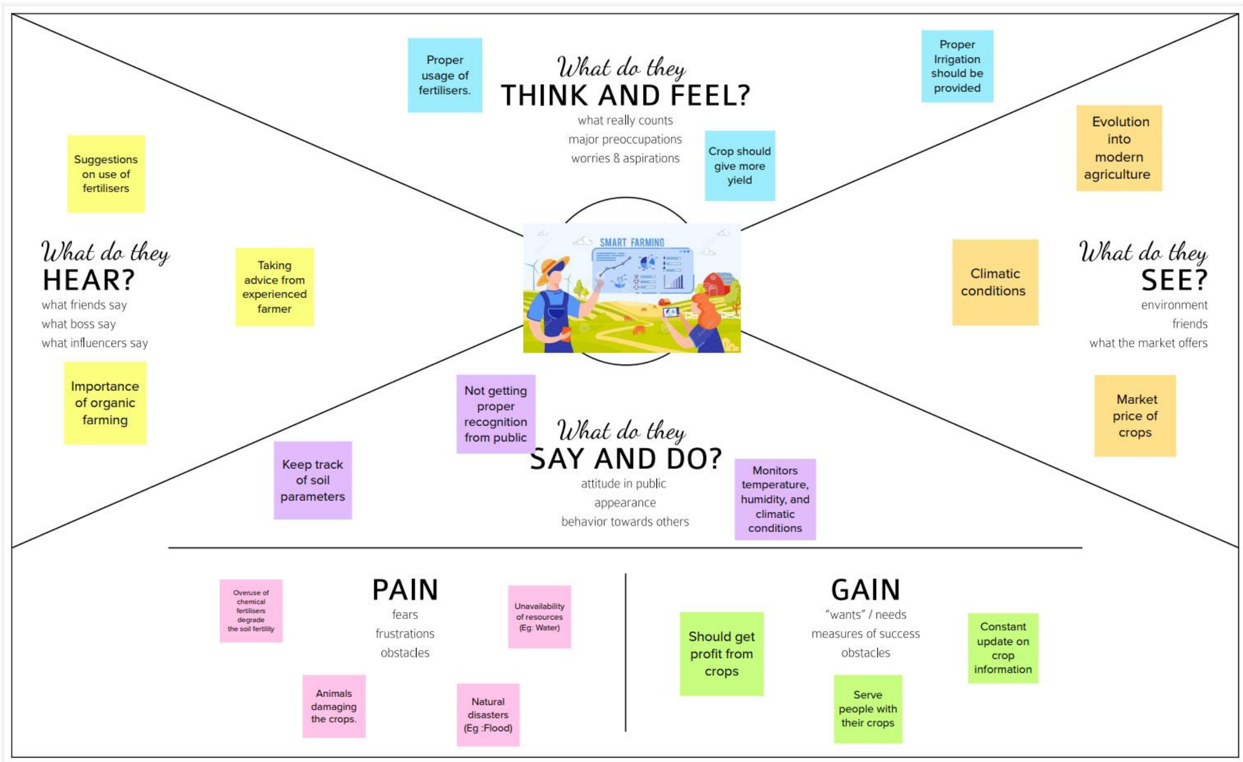
2.3. Problem Statement Definition

- If the farmer is not near his field. Watering the crop is one of the important tasks for the farmers.
- And the farmers don't know the weather condition in the place where the place is located.

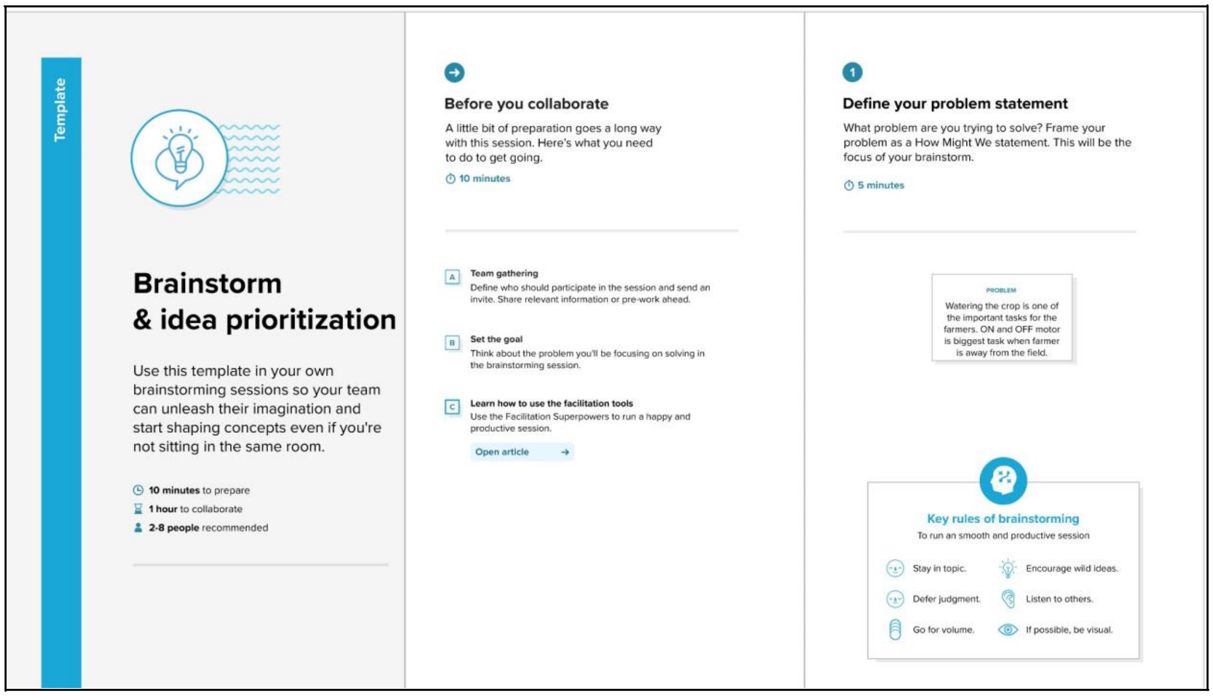
CHAPTER - III

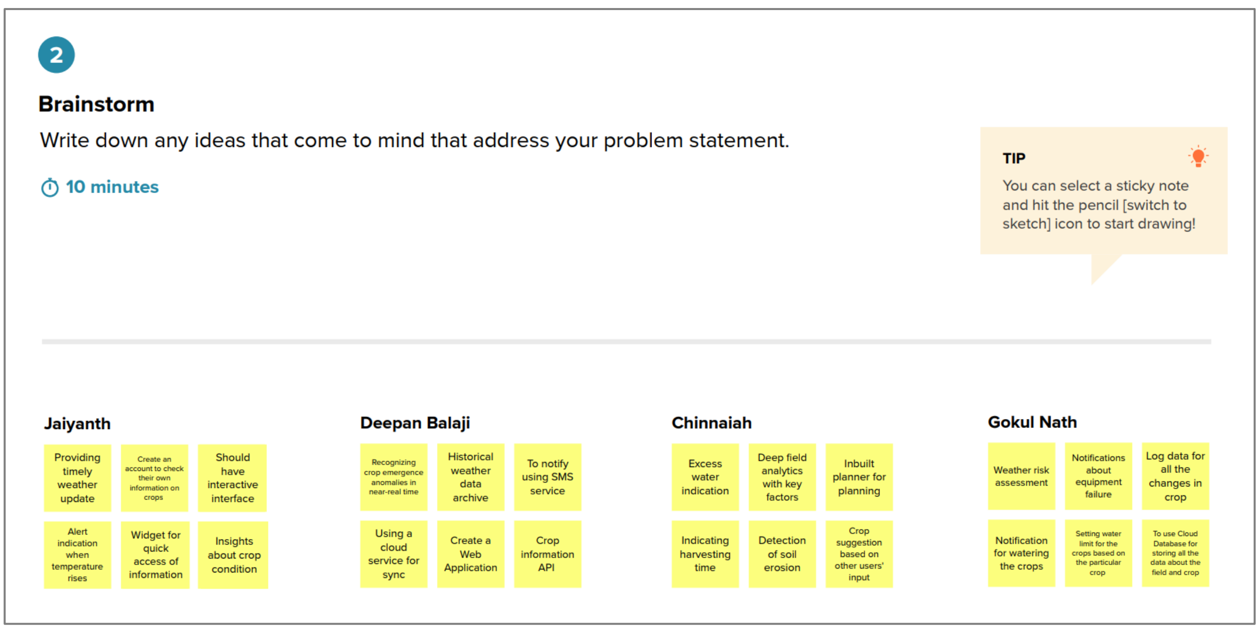
3. IDEATION & PROPOSED SOLUTION

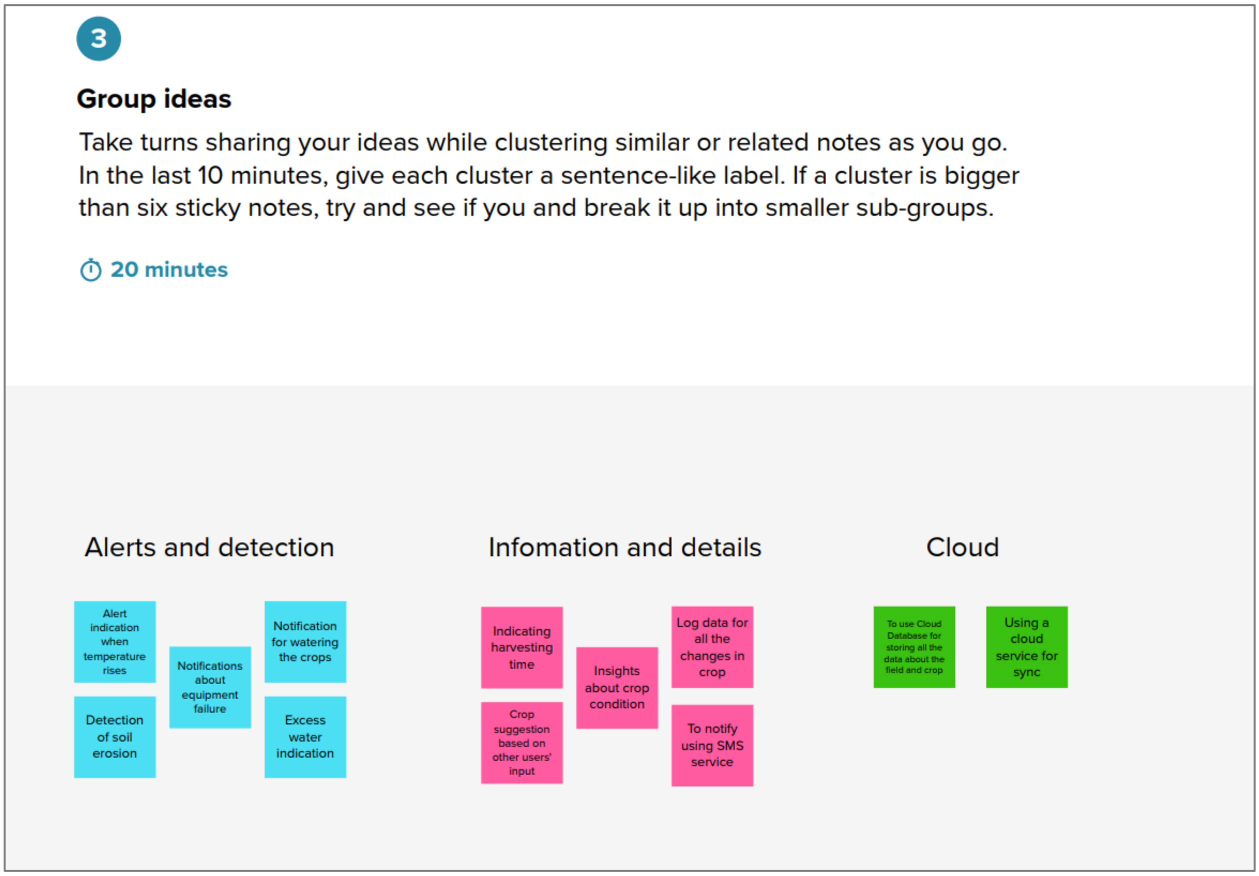
3.1. Empathy Map Canvas

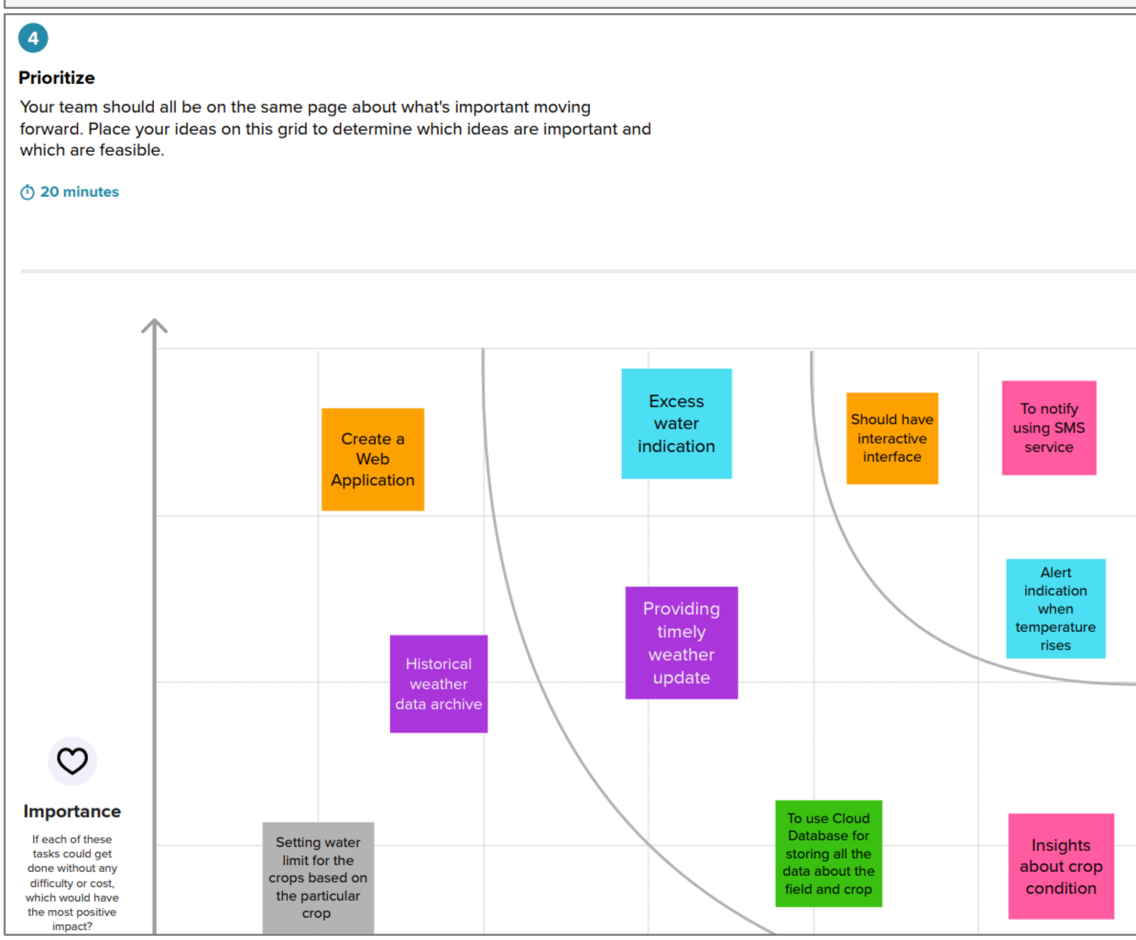


3.2. Ideation & Brainstorming






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
Alerts and detection
Alert indication when temperature rises
Notifications about equipment failure
Notification for watering the crops
Detection of soil erosion
Excess water indication
Infomation and details
Indicating harvesting time
Insights about crop condition
Log data for all the changes in crop
Crop suggestion based on other users' input
To notify using SMS service
Cloud
To use Cloud Database for storing all the data about the field and crop
Using a cloud service for sync


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
Create a Web Application
Excess water indication
Should have interactive interface
To notify using SMS service
Alert indication when temperature rises
Providing timely weather update
Historical weather data archive
Importance
If each of these tasks could get done without any difficulty or cost, which would have the most positive impact?
Setting water limit for the crops based on the particular crop
To use Cloud Database for storing all the data about the field and crop
Insights about crop condition

3.3. Proposed Solution

S.No.	Parameter	Description
1.	Problem Statement (Problem to be solved)	● Smart Farmer – Iot enabled smart farming application helps the farmer in monitoring different parameters of his field like soil moisture, temperature, and humidity using some sensors. ● Watering the field is a difficult process, Farmers have to wait in the field until the water covers the whole farm field.
2.	Idea / Solution description	● loT-based remote sensing utilizes sensors placed along with the farms like weather stations for gathering data, which is transmitted to analytical tools for analysis. ● The Data collected by sensors, In terms of humidity, temperature and moisture detections help in determining the weather pattern in Farms. So irrigation is done by farmer easily.
3.	Novelty/ Uniqueness	**ALERT MESSAGE** – Alerts the farmers through SMS messages in extreme conditions. **REMOTE ACCESS –** It helps the farmer to operate the motor from anywhere. Uses cloud services for synchronization.

4	Social Impact / Customer Satisfaction	● Gives timely update for the farmers regarding temperature and humidity levels of the fields. ● It saves a lot of time. ● IoT can help improve customer relationships by enhancing the customer's overall experience. ● Easily identify maintenance needs, build better products, send personalized communications, and more. ● It will be helpful for small scale farm and organic farm.
5	Business Model (Revenue Model)	● Subscription based application for providing analysis of crops and fields. ● Everything can be controlled from anywhere through cloud.
6	scalability and 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 timely analysis.

3.4. Problem Solution fit

Define CS, fit into CL

1. CUSTOMER SEGMENT(S) CS

Farmers

Horticulturist

6. CUSTOMER LIMITATIONS EG. BUDGET, DEVICES CL

- No proper internet connection in most villages.
- Time consuming work to do manually.
- Equipment required is expensive.

5. AVAILABLE SOLUTIONS PLUSES & MINUSES AS

- Initial setup is expensive.
- Requires high maintenance.

Explore AS, differentiate

Focus on PR, tap into BE, understand RC

2. PROBLEMS / PAINS + ITS FREQUENCY PR

~ Cannot predict weather approximately.

~ Crops fail to produce more yield.

~ Farmers often find themselves unable to compete with large scale farms because they cannot afford the latest technological advances.

9. PROBLEM ROOT / CAUSE RC

- One of the key factors influencing agricultural productivity in India is the unpredictable behavior of monsoons.
- Due to the Global warming and other climatic conditions the farming could get affected.

7. BEHAVIOR + ITS INTENSITY BE

- Farmers can only predict the weather approximately.
- Farmers cannot predict the harvesting time exactly.

Focus on PR, tap into BE, understand RC

Identify strong TR & EM

3. TRIGGERS TO ACT TR

- Gives quick updates on the temperature and humidity of the crops.
- Less expensive and gives accurate results to the farmer.

4. EMOTIONS BEFORE / AFTER EM

Before: No profit and does extra work.

After: Has control over his crops and gains more time for other work.

10. YOUR SOLUTION SL

- Farmers 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.
- Farmers can monitor all the sensor parameters by using a web or mobile application even if the farmer is not near his field.

8. CHANNELS of BEHAVIOR CH

ONLINE

It analyses the data from the crops and predict accurate results and alerts the farmers to make the work easy.

OFFLINE

Senors present in the field monitor the temperature and humidity.

Extract online & offline CH of BE

CHAPTER - IV

4. REQUIREMENT ANALYSIS

4.1. Functional requirement

Following are the functional requirements of the proposed solution.

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
FR-3	User Login	Login with Email Id and password Check Credentials.
FR-4	Sensor Data	To display all the data from different sensors like temperature sensor, humidity sensor etc.
FR-5	Weather Info	To show the climatic weather conditions of the location in real-time and other data using a weather API.
FR-6	Calendar and Notes	Add information about the plants and add remainder in the calendar.
FR-7	Alerts and Notification	Checks for any abnormalities and alerts the user.
FR-8	Logout	After checking all the details, user can exit.

4.2. Non-Functional requirements

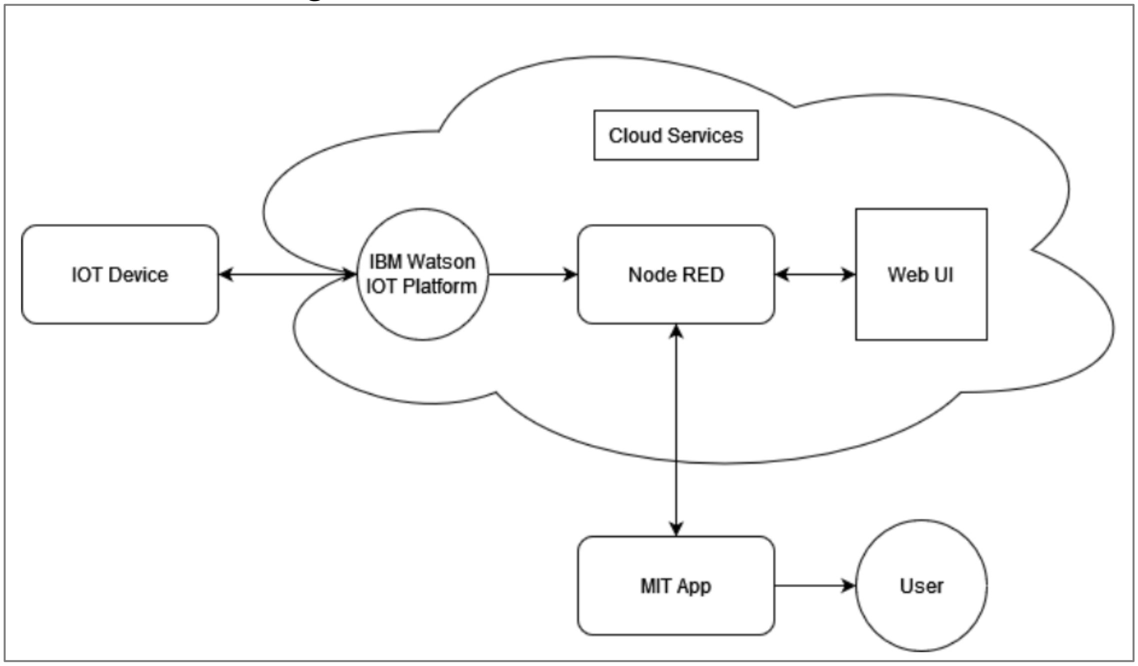
Following are the non-functional requirements of the proposed solution.

FR No.	Non-Functional Requirement	Description
NFR-1	**Usability**	Easy and effective to use Easy to learn and clean UI
NFR-2	**Security**	All the details are protected from unauthorized access. Detection and identification of any malfunction of sensors.
NFR-3	**Reliability**	It gives the accurate results.
NFR-4	**Performance**	It requires low power consumption and low data transmission rates.
NFR-5	**Availability**	With minimum internet connectivity it is accessible all time and all the data are synced to the cloud.
NFR-6	**Scalability**	It supports third party sensors and can be easily scalable for large scale farming.

CHAPTER - V

5. PROJECT DESIGN

5.1. Data Flow Diagrams



5.2. Solution & Technical Architecture

The Deliverable shall include the architectural diagram as below and the information as per the table 1 and table 2

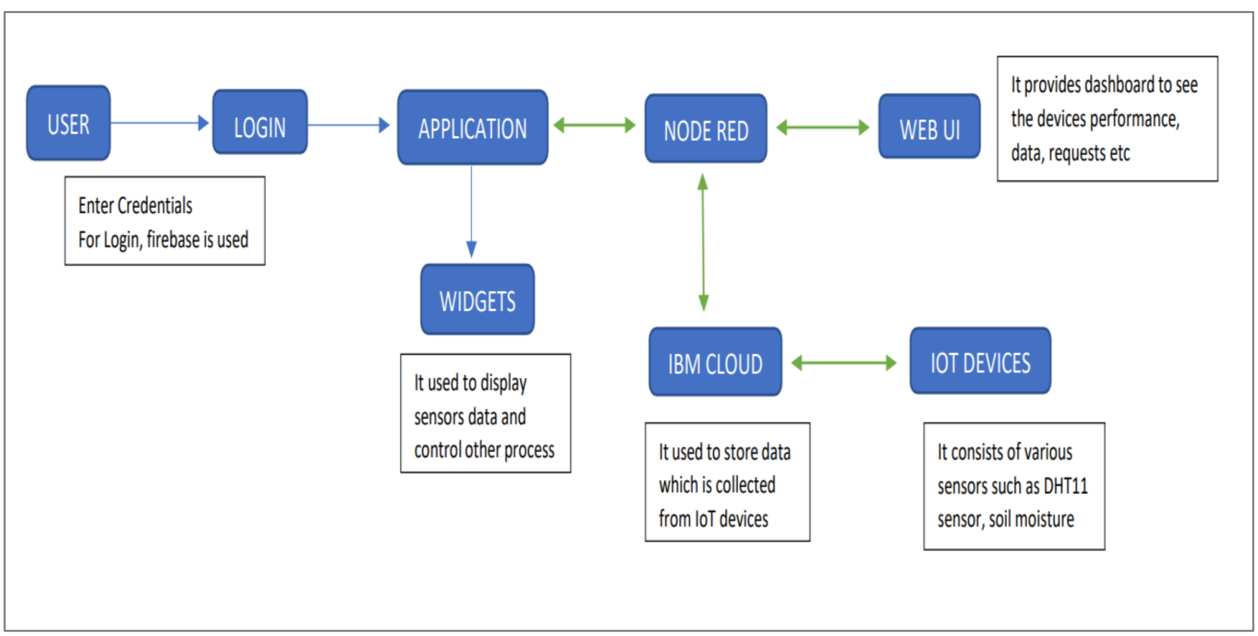


Table-1 : Components & Technologies:

S.No	Component	Description	Technology
1.	User Interface	Mobile app. In our application, were data are displayed using widgets like structure. Users interacts with widgets to additional info	MIT App Inventor
2.	Application Logic-1	Logic for a process in the application	Python
3.	Application Logic-2	Logic for a process in the application	IBM Watson STT service
4.	Application Logic-3	Logic for a process in the application	IBM Watson Assistant
5.	Database	Data base type	Firebase is Nosql database
6.	Cloud Database	Database Service on Cloud	Firebase, IBM Watson IoT Cloud Platform
7.	File Storage	File storage requirements	IBM Block Storage or Other Storage Service or Local Filesystem
8.	External API-1	Purpose of the API is get to weather information	Open Weather API
9.	External API-2	Purpose of the API is to connect with firebase for login purpose	Firebase API
10.	Infrastructure (Server / Cloud)	Application Deployment on Local System / Cloud Local Server Configuration: Cloud Server Configuration :	Local, IBM Cloud, Firebase
11.	DHT11 sensor, Soil Moisture sensor	It used to monitor the soil, temperature, humidity.	

Table-2: Application Characteristics:

S.No	Characteristics	Description	Technology
1.	Open-Source Frameworks	Node Red, MIT App Inventor, Arduino IDE Node Red for connecting with application, MIT App Inventor for building app, Arduino is open source electronics platform to build hardware and software.	It is a software, which helps in connecting and building application. Node Red, MIT App Inventor, Arduino IDE.
2.	Security Implementations	HTTPS Connections, X-Force Red IoT Testing	Encryptions, Secured Connection
3.	Scalable Architecture	Architecture is scalable from 10 devices to 300 devices easily and account is also scalable upto thousand connections. For very high scalability we need to upgrade our cloud plan.	Firebase, IBM Cloud
4.	Availability	Availability of our application is 24/7 because which use a cloud technology. Firebase will use commercially reasonable efforts to make Firebase available with a Monthly Uptime Percentage of at least 99.95% and distributed servers.	Firebase, IBM Cloud
5.	Performance	No of requests is 2 requests per 20 seconds or 4 requests per 30 second and sometimes user request will be added with respective to the requests	MIT App Inventor, Node Red, Cloud

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
	Dashboard					
Customer (Web user)						
Customer Care Executive						
Administrator						

CHAPTER - VI

6. PROJECT PLANNING & SCHEDULING

6.1. Sprint Planning & Estimation

Sprint	Functional Requirement (Epic)	User Story Number	User Story / Task	Story Points	Priority	Team Members
Sprint-1	Registration	USN-1	As a user, I can register for the application by entering my email, password, and confirming my password.	10	High	Jaiyanth P Deepan Balaji R Chinnaiah M Gokul Nath H
Sprint-1	Login	USN-2	As a user, I can log into the application by entering email & password.	10	High	Jaiyanth P Deepan Balaji R Chinnaiah M Gokul Nath H
Sprint-2	Cloud Services	USN-3	Creation of cloud services for collection and processing of data from the IoT devices.	20	High	Jaiyanth P Deepan Balaji R Chinnaiah M Gokul Nath H
Sprint-3	Dashboard	USN-4	Creation of a web application to monitor the data from the field through cloud.	10	High	Jaiyanth P Deepan Balaji R Chinnaiah M Gokul Nath H
Sprint-3	Mobile App	USN-5	Creation of a mobile application to integrate it with cloud services and fast SMS service.	10	High	Jaiyanth P Deepan Balaji R Chinnaiah M Gokul Nath H

Sprint	Functional Requirement (Epic)	User Story Number	User Story / Task	Story Points	Priority	Team Members
Sprint-4	Setup and Installation of devices	USN-6	IoT devices will be installed in the field and the necessary setup will be done.	20	High	Jaiyanth P Deepan Balaji R Chinnaiah M Gokul Nath H

6.2. Sprint Delivery Schedule

Sprint	Total Story Points	Duration	Sprint Start Date	Sprint End Date (Planned)	Story Points Completed (as on Planned End Date)	Sprint Release Date (Actual)
Sprint-1	20	6 Days	24 Oct 2022	29 Oct 2022		29 Oct 2022
Sprint-2	20	6 Days	31 Oct 2022	05 Nov 2022		05 Nov 2022
Sprint-3	20	6 Days	07 Nov 2022	12 Nov 2022		12 Nov 2022
Sprint-4	20	6 Days	14 Nov 2022	19 Nov 2022		19 Nov 2022

Velocity:

Imagine we have a 10-day sprint duration, and the velocity of the team is 20 (points per sprint). Let's calculate the team's average velocity (AV) per iteration unit (story points per day)

$$AV = \frac{sprint\ duration}{velocity} = \frac{20}{10} = 2$$

6.3. Reports from JIRA

CHAPTER - VII

7. CODING & SOLUTIONING

7.1. Feature

- **PYTHON CODE**

ibmiotpython.py - D:\IBM PROJECT\python 3.7\ibmiotpython.py (3.7.0)

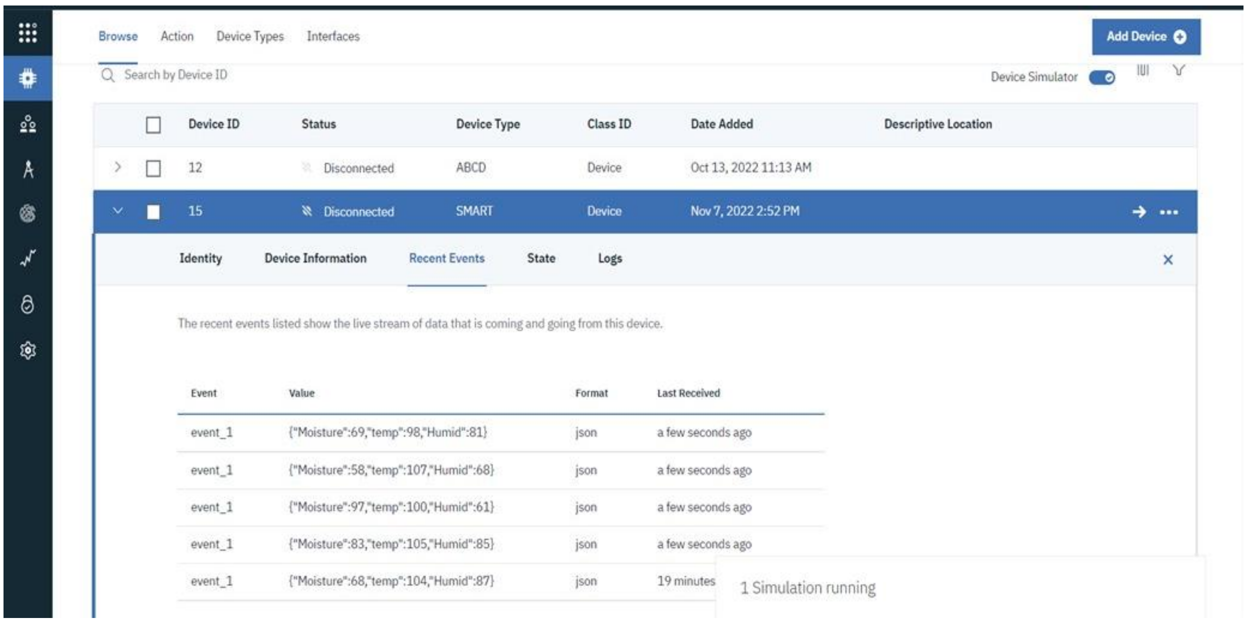
File Edit Format Run Options Window Help

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


#Provide your IBM Watson Device Credentials
organization = "p2cfk6"
deviceType = "SMART"
deviceId = "15"
authMethod = "token"
authToken = "12345678"

# Initialize GPIO
def myCommandCallback(cmd):
    print("Command received: %s" % cmd.data['command'])
    status=cmd.data['command']
    if status=="motoron":
        print ("motor is on")
    elif status=="motoroff":
        print ("motor is off")
    else :
        print ("Please send Proper Command")

try:
        deviceOptions = {"org": organization, "type": deviceType, "id": deviceId
        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 e
deviceCli.connect()

while True:
        #Get Sensor Data from DHT11
```

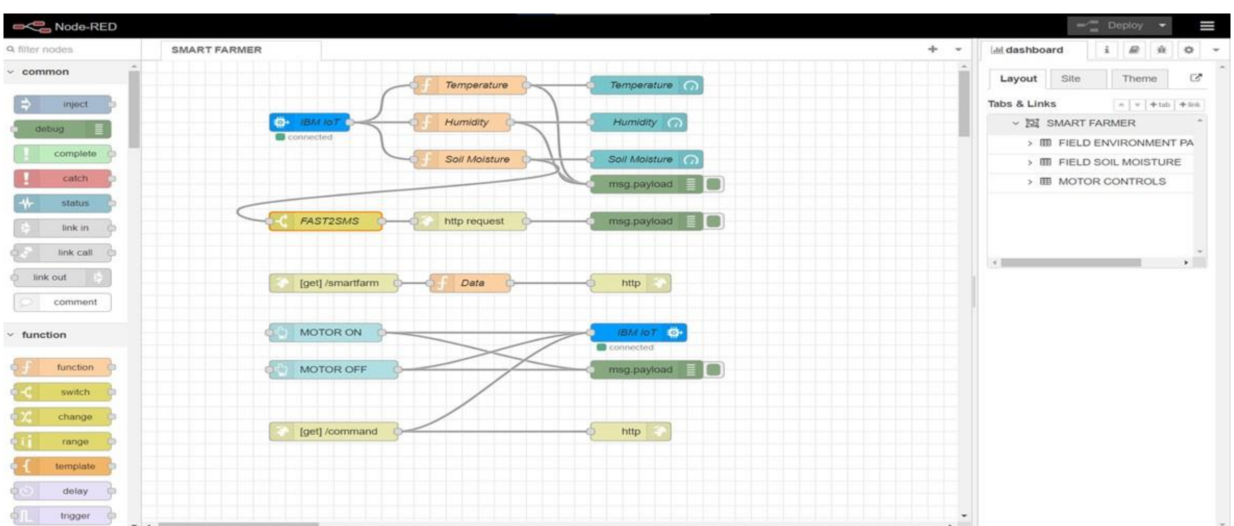
CHAPTER - VIII

8. TESTING

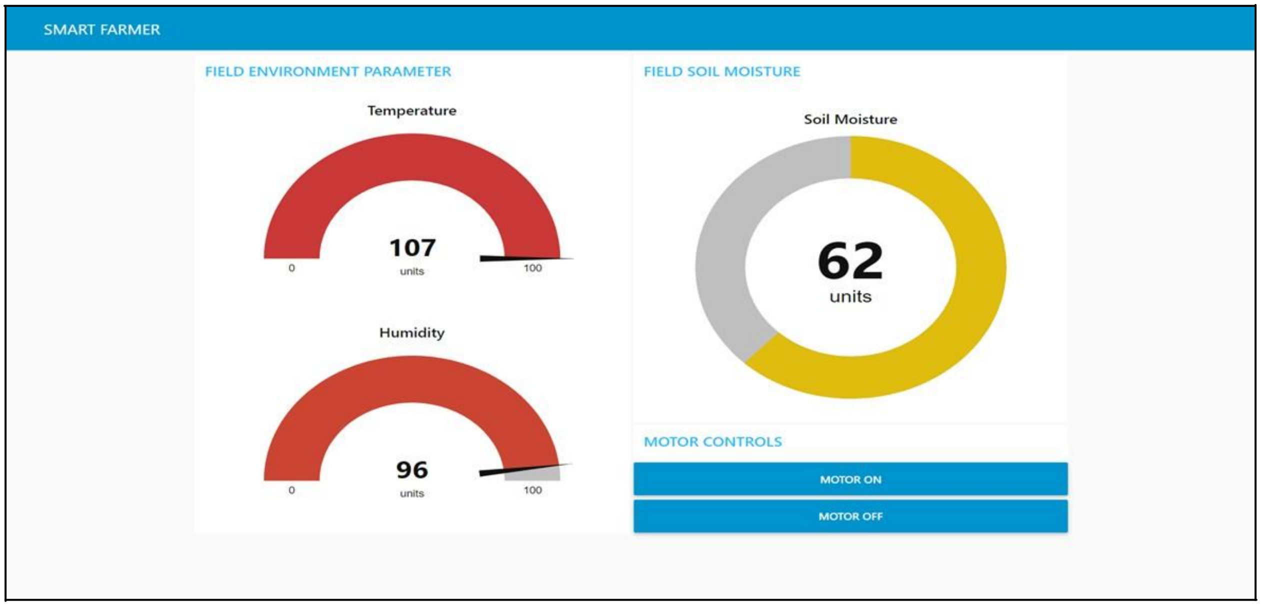
8.1. Test Cases



Node – Red Complete Program Flow:



Node – Red Dashboard (WEB APP UI):



8.2. User Acceptance Testing

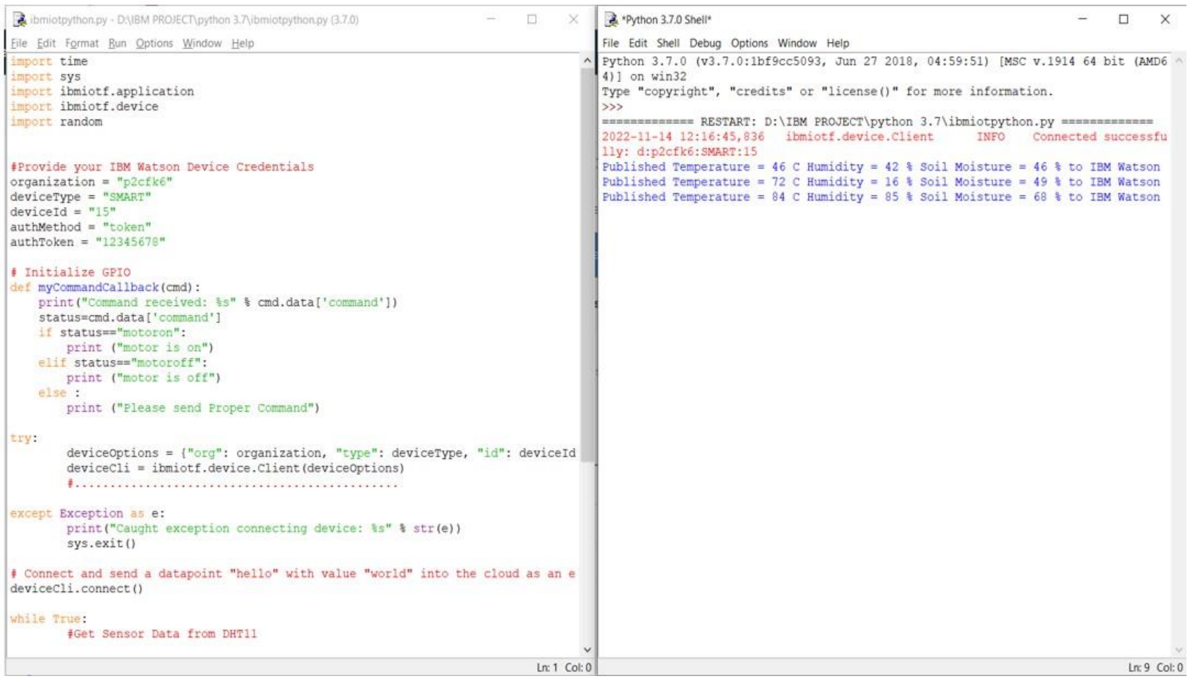
- Mobile App

CHAPTER - IX

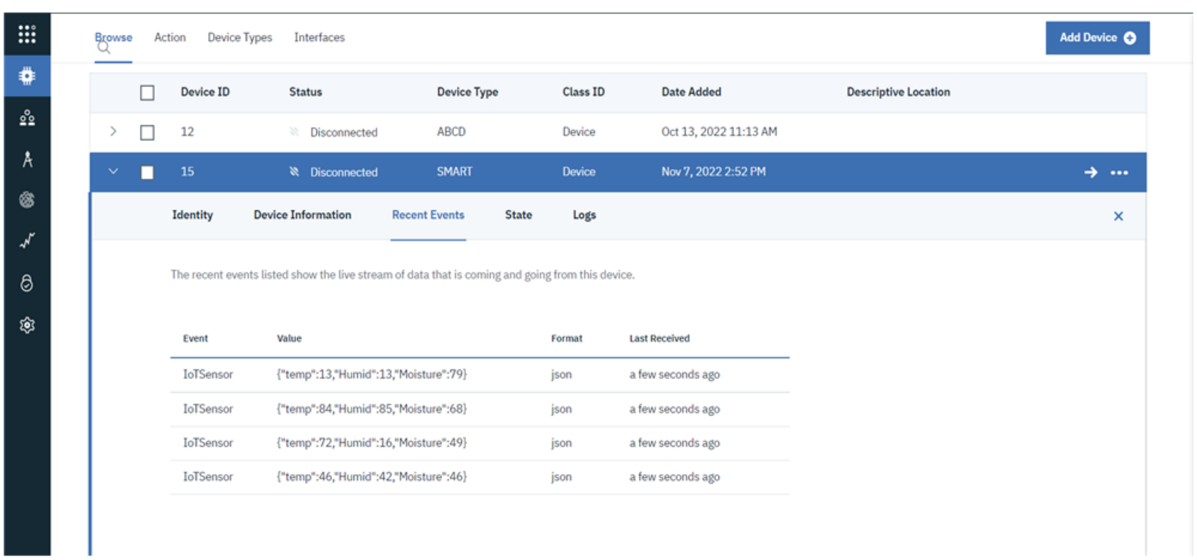
9. RESULTS

9.1. Performance Metrics

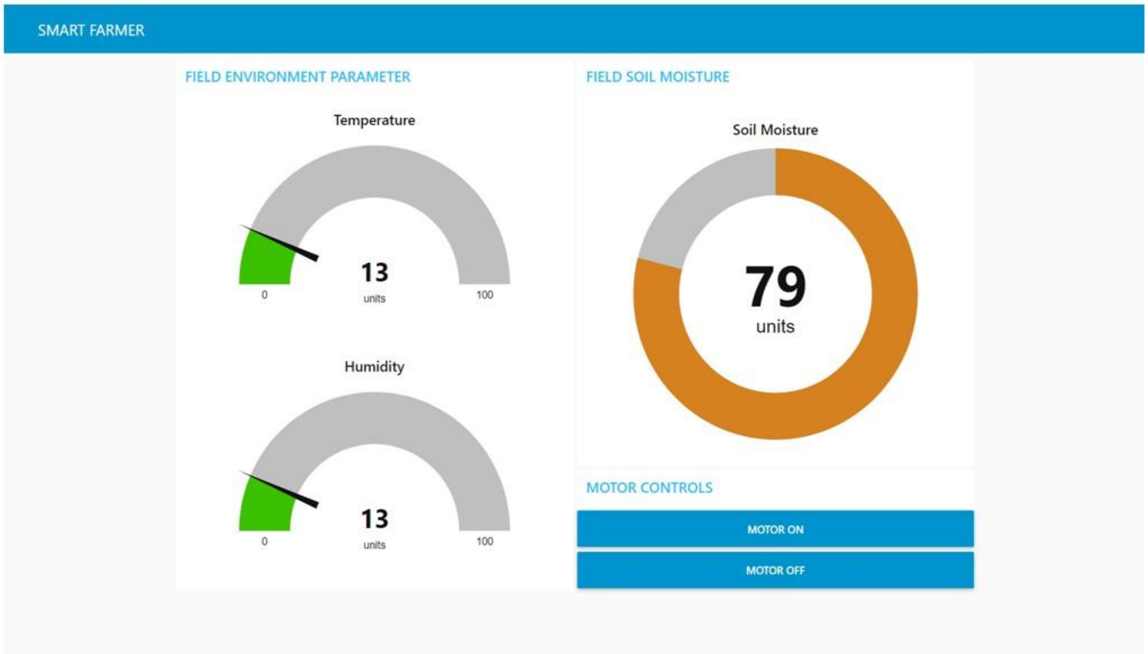
- DATA SEND FROM PYTHON PROGRAM :



- DATA RECEIVED IN IBM CLOUD :

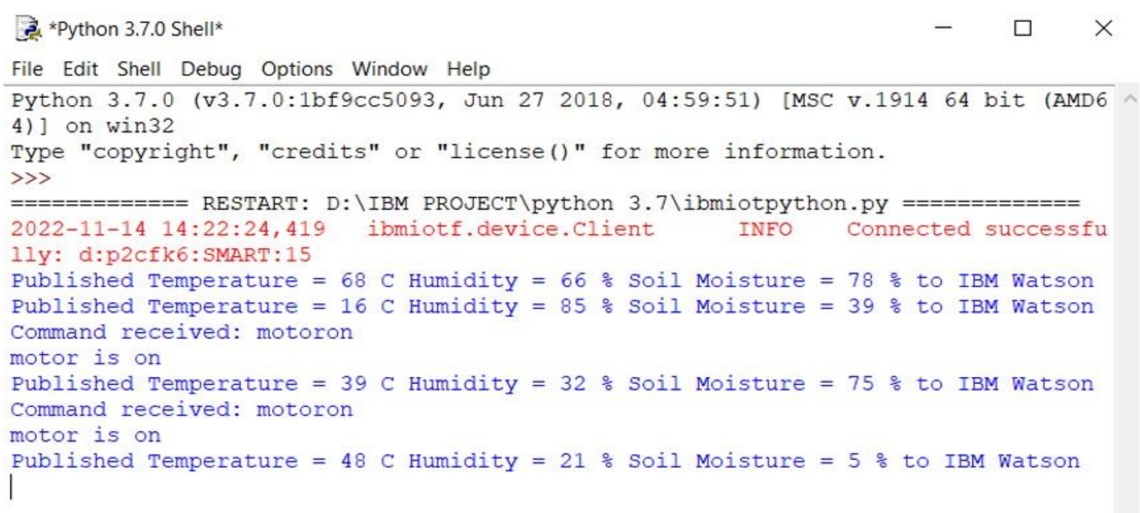


- DATA RECEIVED IN NODE – RED DASHBOARD (WEB UI)

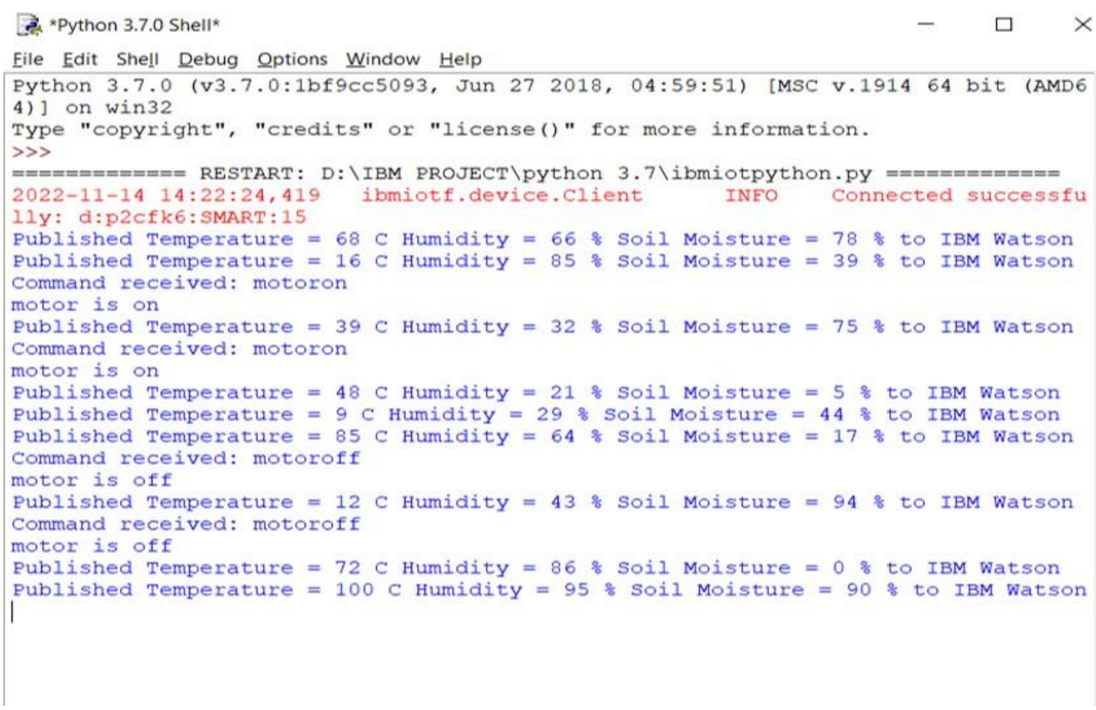


- DATA RECEIVED IN MOBILE APP

- COMMAND RECEIVED FROM WEB UI AND MOBILE APP
    - MOTOR ON COMMAND



- MOTOR OFF COMMAND



Python 3.7.0 Shell

File Edit Shell Debug Options Window Help

```
Python 3.7.0 (v3.7.0:1bf9cc5093, Jun 27 2018, 04:59:51) [MSC v.1914 64 bit (AMD6
4)] on win32
Type "copyright", "credits" or "license()" for more information.
>>>
============= RESTART: D:\IBM PROJECT\python 3.7\ibmiotpython.py =============
2022-11-14 14:22:24,419   ibmiotf.device.Client      INFO    Connected successfu
lly: d:p2cfk6:SMART:15
Published Temperature = 68 C Humidity = 66 % Soil Moisture = 78 % to IBM Watson
Published Temperature = 16 C Humidity = 85 % Soil Moisture = 39 % to IBM Watson
Command received: motoron
motor is on
Published Temperature = 39 C Humidity = 32 % Soil Moisture = 75 % to IBM Watson
Command received: motoron
motor is on
Published Temperature = 48 C Humidity = 21 % Soil Moisture = 5 % to IBM Watson
Published Temperature = 9 C Humidity = 29 % Soil Moisture = 44 % to IBM Watson
Published Temperature = 85 C Humidity = 64 % Soil Moisture = 17 % to IBM Watson
Command received: motoroff
motor is off
Published Temperature = 12 C Humidity = 43 % Soil Moisture = 94 % to IBM Watson
Command received: motoroff
motor is off
Published Temperature = 72 C Humidity = 86 % Soil Moisture = 0 % to IBM Watson
Published Temperature = 100 C Humidity = 95 % Soil Moisture = 90 % to IBM Watson
```

CHAPTER - X

10. ADVANTAGES & DISADVANTAGES

10.1 ADVANTAGES

- It is simple to keep track of all the information, including changes in the climate, soil, and crop conditions.
- Crop damage risk can be significantly reduced by proper irrigation.
- When the process is mechanised, many challenging obstacles can be avoided, and the crops' quality can be preserved.
- Farming processes can be managed using web applications from anywhere, at any time.

10.2 DISADVANTAGES

- Rural areas cannot meet the constant internet connectivity need for smart agriculture.
- Due to inaccurate records and automated processes, any sensor flaws in agriculture can result in significant losses.
- The implementation of IOT devices is expensive.

CHAPTER - XI

11. CONCLUSION

IOT-based smart farm system is made using the IBM cloud, Node-RED, the Watson IOT platform, MIT App inventor and the Watson simulator . These systems use sensors and a controller to control irrigation valves and water distribution lines. The sensors collect data from the soil and trigger the irrigation valves when it is necessary. The controllers send this data to a data center where it is analyzed by experts. Based on this analysis, the controller adjusts the amount of water that is delivered to each field. Intelligent irrigation systems help farmers to conserve water, reduce emissions, and improve crop yields. They provide many benefits to society, including improved food security and economic growth. Thus, the objective of the project is to implement an IOT system in order to help farmers to control the motor function and monitor the environment parameters like temperature, humidity and soil moisture of their farms has been implemented successfully.

12. FUTURE SCOPE

Due to increased consumer demand for goods and the need for more farming to be done in a given amount of time, IOT can be applied in the majority of locations to improve crops and cut back on the lavish use of resources like energy and water. It can deliver water with extreme accuracy and prevent water wasting. User takes less manpower because handling is done automatically. It can precisely determine the soil moisture levels with the aid of the sensors. Using sensors, it can quickly detect and regulate the temperature, humidity, and sun radiation.

CHAPTER - XII

13. APPENDIX

Source Code

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

#Provide your IBM Watson Device Credentials
organization = "p2cfk6"
deviceType = "SMART"
deviceId = "15"
authMethod = "token"
authToken = "12345678"

# Initialize GPIO
def myCommandCallback(cmd):
  print("Command received: %s" % cmd.data['command'])
  status=cmd.data['command']
  if status=="motoron":
          print ("motor is on")
  elif status=="motoroff":
          print ("motor is off")
  else :
          print ("Please send Proper Command")

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()

# Connect and send a datapoint
deviceCli.connect()

    while True:
            temp=random.randint(0,100) # Temperature value
            Humid=random.randint(0,100) # Humidity value
            moisture = random.randint(0,100) # Soil moisture value

            data = { 'temp' : temp, 'Humid': Humid, 'Moisture' : moisture }
            #print data
            def myOnPublishCallback():
            print ("Published Temperature = %s C" % temp, "Humidity = %s %%" %
    Humid,   "Soil Moisture = %s %%" % moisture, "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()
```

Github Link : https://github.com/IBM-EPBL/IBM-Project-11028-1659254585

Demo Video Link :