NALAIYA THIRAN - IBM PROJECT REPORT

(19EC406T - Professional Readiness for Innovation, Employability and Entrepreneurship)

ON

SMART FARMER- IOT ENABLED SMART FARMING APPLICATION

Submitted by

TEAM ID: PNT2022TMID23526

THANGAPRABAGARAN J (113219041123)

BARATH KUMAR S (113219041018)

THARUNKUMAR S (113219041126)

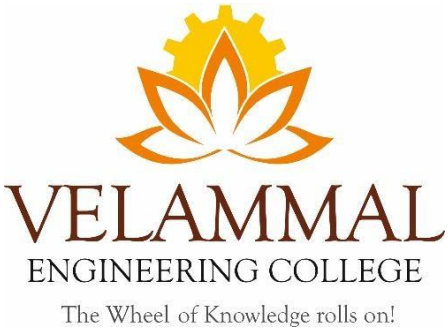
NITIN KUMAR L (113219041077)

in partial fulfillment for the award of the degree of

BACHELOR OF ENGINEERING

IN

ELECTRONICS AND COMMUNICATION ENGINEERING



VELAMMAL ENGINEERING COLLEGE, CHENNAI-66.

(An Autonomous Institution, Affiliated to Anna University, Chennai)

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BONAFIDE CERTIFICATE

Certified that this NALAIYA THIRAN – IBM PROJECT REPORT **"SMART FARMER-IOT ENABLED SMART FARMING APPLICATION"** is the Bonafide work of **"THANGAPRABAGARAN.J (113219071123), BARATH KUMAR.S (113219071018), THARUNKUMAR.S (113219071126), NITIN KUMAR.L (113219071019)"** carried out in "PROFESSIONAL READINESS FOR INNOVATION, EMPLOYABILITY AND ENTREPRENEURSHIP (NALAIYA THIRAN-IBM PROJECT)" during the Academic Year 2022-2023.

Mrs J. DOLLY IRENE
ASSISTANT PROFESSOR I
FACULTY EVALUATOR

Department of Electronics & Communication Engineering
Velammal Engineering College
Ambattur - Redhills road,
Chennai-66.

Dr.S.MARY JOANS
PROFESSOR &
HEAD OF THE DEPARTMENT

Department of Electronics & Communication Engineering
Velammal Engineering College
Ambattur - Redhills road,
Chennai-66.

ABSTRACT

Due to population growth and demand for resources, water shortage is a major threat to agriculture. Determination of soil fertility also plays a vital role. Hence this project proposes an innovative smart solution using “SMART AGRI App” which runs on IoT platform and addresses all the above mentioned issues. The user has to feed the data about the land area and the type of crop planted in the app. With the given data we can calculate the amount of water, fertilizers, pesticides needed for the given land area. The App provides the information about the soil fertility, humidity, water overflow, field animals. Thus, smart irrigation system helps to improve the crop yield and thereby meet the demand. This idea will improve the crop yield and manage them. Over 58% of the rural households depend on agriculture as their principal means of livelihood. Agricultural export constitutes 10% of the country's exports. So the farmer's and even the nation's economy will be ruined if there are no proper yields due to lack of knowledge of the soil nature, timely unavailability of water. Thus the government should take steps for a better and profitable irrigation. It is a smart farming stick based on IOT (Internet of things) technology which has brought revolution to each and every field of common man’s life by making everything smart and intelligent.

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CHAPTER 1

INTRODUCTION

1.1 PROJECT OVERVIEW:

Smart farming is certainly a leading enabler in producing more food with less for an increasing world population. Smart farming enables increased yield through more efficient use of natural resources and inputs, and improved land and environmental management. While this is crucial to sustainably feeding the world's growing population, there are other benefits that smart farming provides farmers and communities all around the world. Conventional supply chains have been characterized by a power imbalance with farmers often having less power because they've had less information about how their product performs relative to customer requirements. Smart farming provides a vital link between all players in the supply chain by enabling the efficient and equitable flow of information and in doing so, facilitating better decision making. This has the potential to rebalance power and redistribute profits more equitably throughout the supply chain.

1.2 PURPOSE:

Smart farming helps farmers to better understand the important factors such as water, topography, aspect, vegetation and soil types. This allows farmers to determine the best uses of scarce resources within their production environment and manage these in an environmentally and economically sustainable manner. One of the goals of smart farming is to make better use of the land and improve yields as a first step in solving world hunger.

CHAPTER 2

LITERATURE SURVEY

2.1 EXISTING PROBLEM:

SNO	TITLE	DESCRIPTION	FEATURE	DRAWBACKS
1.	Smart Farm Monitoring Using LoRa Enabled IOT	LPWAN technologies serve IOT applications in a better possible way so that LoRa WAN protocol or LoRa in LPWAN space gives additional advantages like scalability, security and robustness in designing IoT applications	1.Scalable Bandwidth 2.High Robustness 3.Doppler resistance	This system has Gateway infrastructure barriers such as public network coverage scarce.
2.	IOT enabled aquaponics with wireless Sensor smart monitoring	Aquaponics is an advanced and emerging farming style in which fish farming and vegetable farming turned out to be more professional and precise.	A mobile application is developed in the Android platform to support the farmers.	It requires an unlimited or continuous internet connection to be successful.
3.	Smart Farm Monitoring via the Blynk IoT Platform	**1.**Blynk is an IoT platform that support both iOS and Android **2.** Blynk application, which is used to control a device and display data.	This smart system can be used to improve the productivity and quality of modern farming.	Leakage monitoring technologies are expensive, limited in their application

2.2 PROBLEM STATEMENT AND DEFINITION:

1. Even if the farmers adopt IOT technology they won't be able to take benefit of this technology due **to poor communication infrastructure**. Farms are located in remote areas and are far from access to the internet. A farmer needs to have access to crop data reliably at any time from any location, so connection issues would cause an advanced monitoring system to be useless.

2. In smart farming the communication protocol used for interaction within the smart farms, these protocols were effective for only **shortage distance coverage areas** and the intelligent devices have been operated using batteries, this has reduced the operational hours of the edge nodes devices since they stop transmitting data once they run out of power

3. Since IOT devices interact with older equipment they have access to the internet connection, there is no guarantee that they would be able to access drone mapping data or sensor readouts by taking benefit of public connection. An enormous amount of data is collected by IOT agricultural systems which is **difficult to protect.** Someone can have unauthorized access IOT providers database and could steal and manipulate the data.

4. Equipment needed to implement IOT in agriculture is **expensive.** However sensors are the least expensive component, yet outfitting all of the farmers' fields to be with them would cost more than a thousand dollars. Automated machinery cost more than manually operated machinery as they include cost for farm management software and cloud access to record data. To earn higher profits, it is significant for farmers to invest in these technologies however it would be difficult for them to make the initial investment to set up IOT technology at their farms.

CHAPTER 3

IDEATION & PROPOSED SOLUTION

3.1 EMPATHY MAP CANVAS:

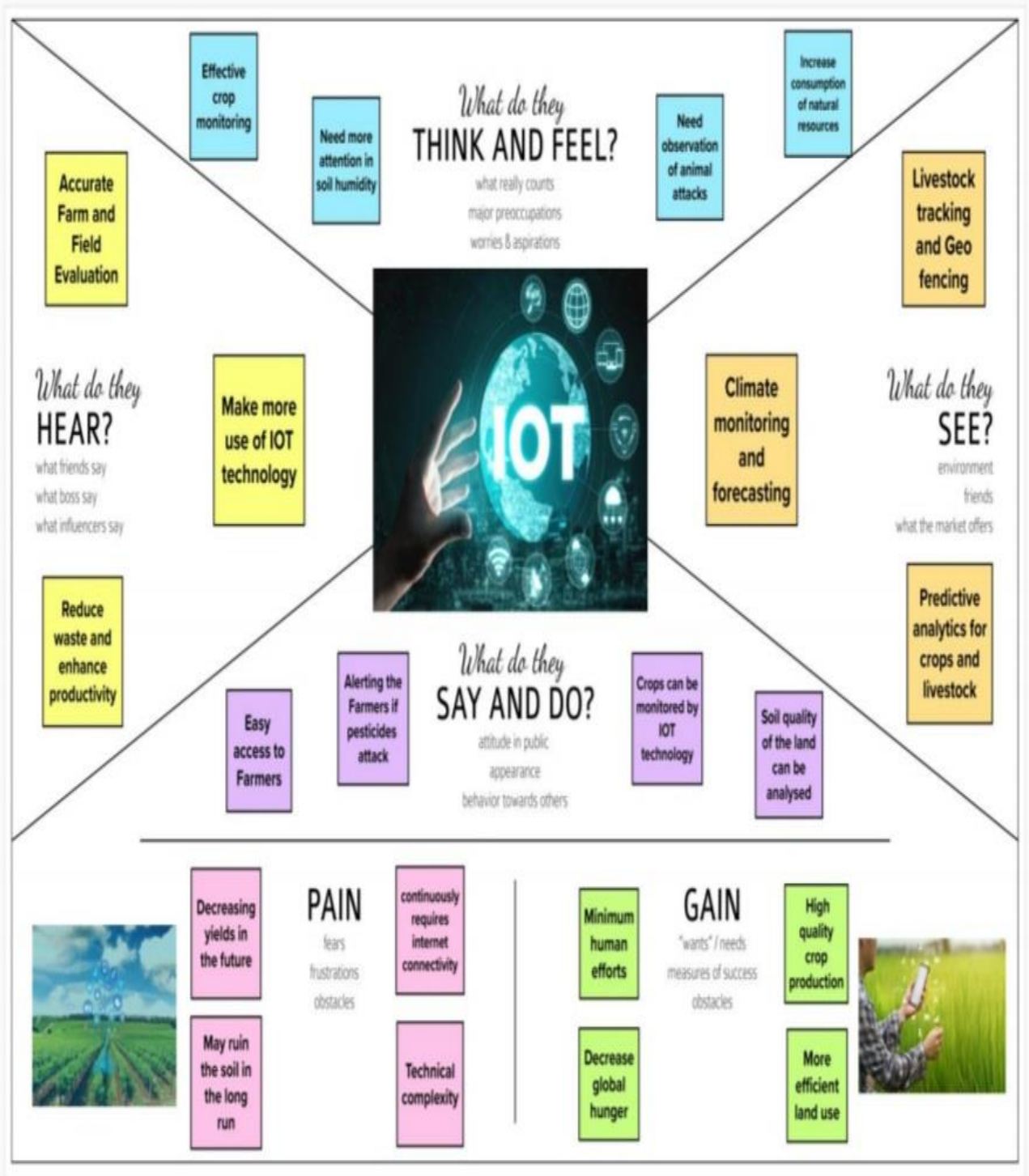


Fig 3.1 Empathy canvas map

3.2 IDEATION & BRAINSTORMING:

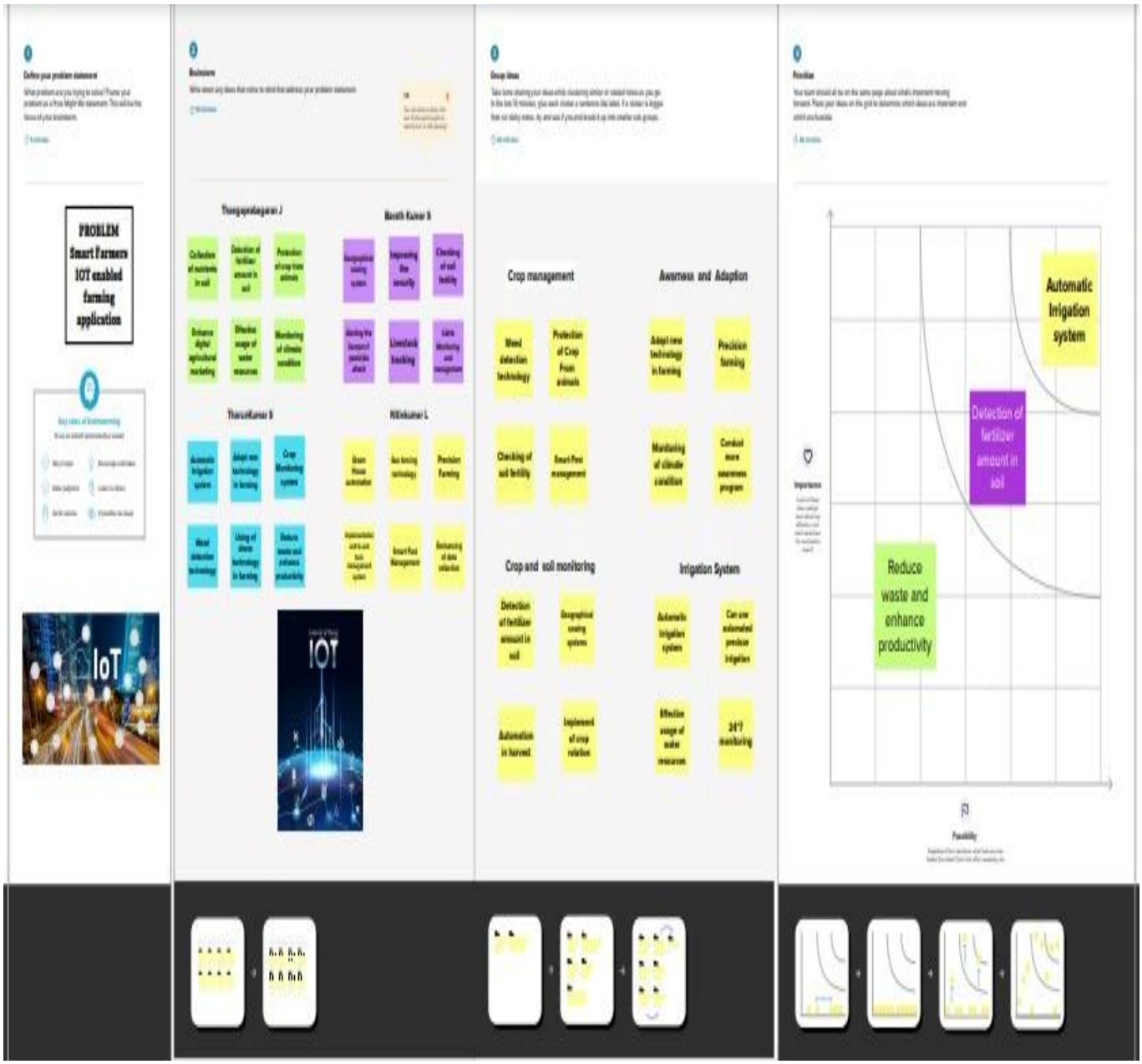


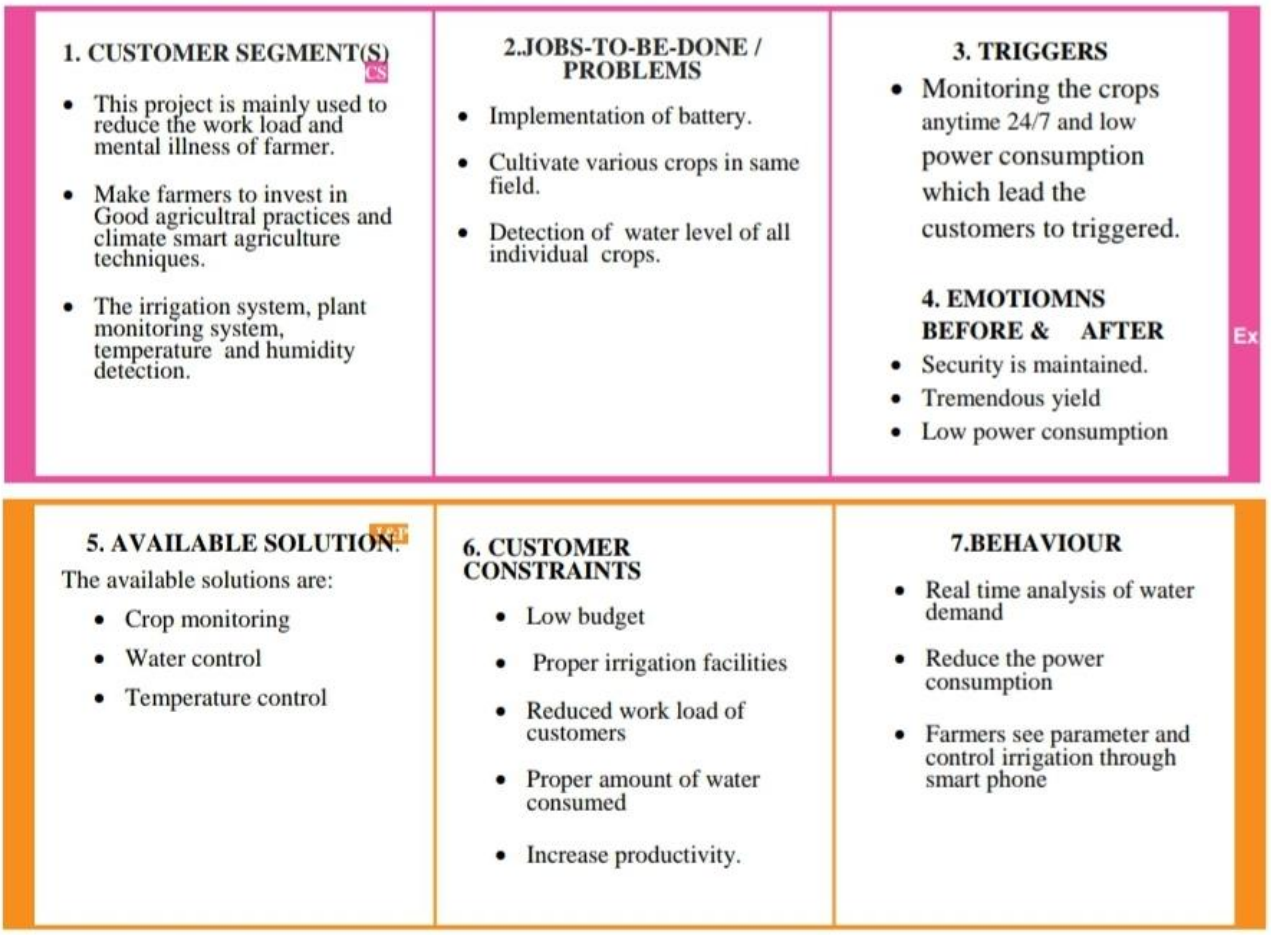
Fig 3.2 Ideation and Brainstorming

3.3 PROPOSED SOLUTION:

S.NO	Parameter	Description
1.	Problem Statement (Problem to be solved)	In smart farming the communication protocol used for interaction within the smart farms, these protocols were effective for only shortage distance coverage areas and the intelligent devices have been operated using batteries, this has reduced the operational hours of the edge nodes devices since they stop transmitting data once they run out of power.
2.	Idea / Solution description	Agricultural practices need to be transformed in order to overcome future food scarcity due to overpopulation across the globe. By employing emerging, disruptive technologies like IoT in the agricultural sector, it is possible to monitor farm fields using low-cost and low power consuming devices, to automate irrigation systems for efficient usage of water resources.
3.	Novelty / Uniqueness	Agri-IoT, a semantic framework for IoT based smart farming applications, which supports reasoning over various heterogeneous sensor data streams in real time.

4.	Social Impact / Customer Satisfaction	FIWARE is present in many different sectors in Europe, for example, healthcare, telecommunications, environmental services, and recently agriculture. The key of FIWARE is to be an open architecture and a reference implementation of a service infrastructure, building upon generic and reusable building blocks, available through Application Program Interfaces (APIs) called Generic Enablers (GEs).
5.	Business Model (Revenue Model)	The agri-food value chain can be characterized by its: **Diversity:** There are many different food types, with its own distinctive and often fragmented supply chain. **Complexity:** There are many specific actors from input companies, farmers, traders, food companies and retailers to consumers. **Volatility:** Which is mainly linked to unpredictable weather and yields, climate change, political actions and social changes.
6.	Scalability of the Solution	Smart Farming has enabled farmers to reduce waste and enhance productivity with the help of sensors (light, humidity, temperature, soil moisture, etc.) and automation of irrigation systems. Further with the help of these sensors, farmers can monitor the field conditions from anywhere. Internet of Things based Advanced Farming is highly efficient when compared with the conventional approach. The applications of intelligent Agriculture solutions not only targets conventional, large farming.

3.4 PROBLEM SOLUTION FIT:



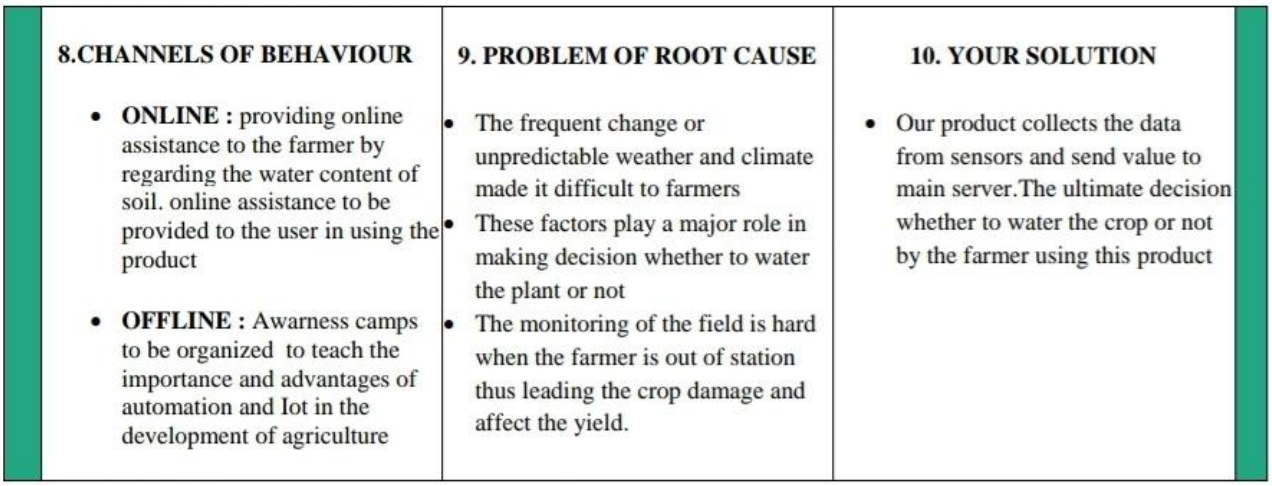


Fig 3.4 Problem solution fit

CHAPTER 4

REQUIREMENT ANALYSIS

4.1 FUNCTIONAL REQUIREMENT:

The following are the functional requirements of the proposed solution.

FR No	Functional Requirement	Sub Requirement
FR-1	User Registration	Registration through Form Registration through Gmail
FR-2	User Confirmation	Confirmation via Email Confirmation via OTP Thanks for your email.
FR-3	Sensor Function for framing System	Measure the Temperature and Humidity Measure the Soil Monitoring Check the crop water level.
FR-4	Manage Modules	Manage Roles of User Manage User permission
FR-5	Check whether details	Temperature details Humidity details
FR-6	Data Management	Manage the data of weather conditions Manage the data of crop conditions Manage the data of livestock conditions

4.2 NON FUNCTIONAL REQUIREMENTS:

The following are the non-functional requirements of the proposed solution

FR No	Non-Functional Requirement	Description
NFR-1	Usability	User friendly guidelines for users to avail the features. Most simplistic user interface for ease of use.
NFR-2	Security	All the details about the user are protected from unauthorized access. Detection and identification of any misfunctions of sensors.
NFR-3	Reliability	Implementing Mesh IoT Networks Building a Multi-layered defense for IoT Networks.
NFR-4	Performance	The use of modern technology solutions helps to achieve the maximum performances thus resulting in better quality and quantity yields.
NFR-5	Availability	This app is available for all platform
NFR-6	Scalability	Scalability refers to the ability to increase available resources and system capability without the need to go through a major system redesign or implementation

CHAPTER 5

PROJECT DESIGN

5.1 DATA FLOW DIAGRAM:

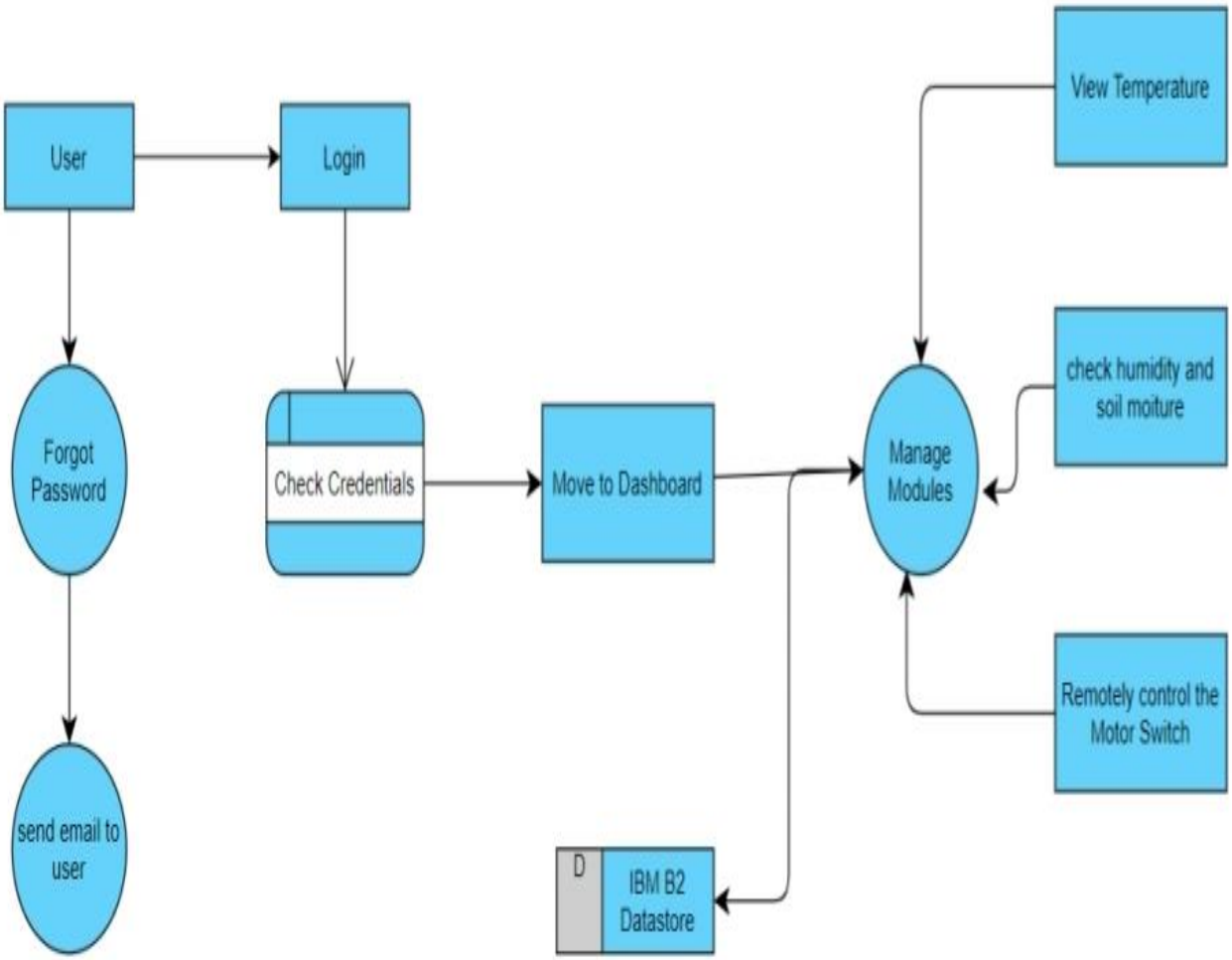


Fig 5.1 Data Flow Diagram

5.2 SOLUTION & TECHNICAL ARCHITECTURE:

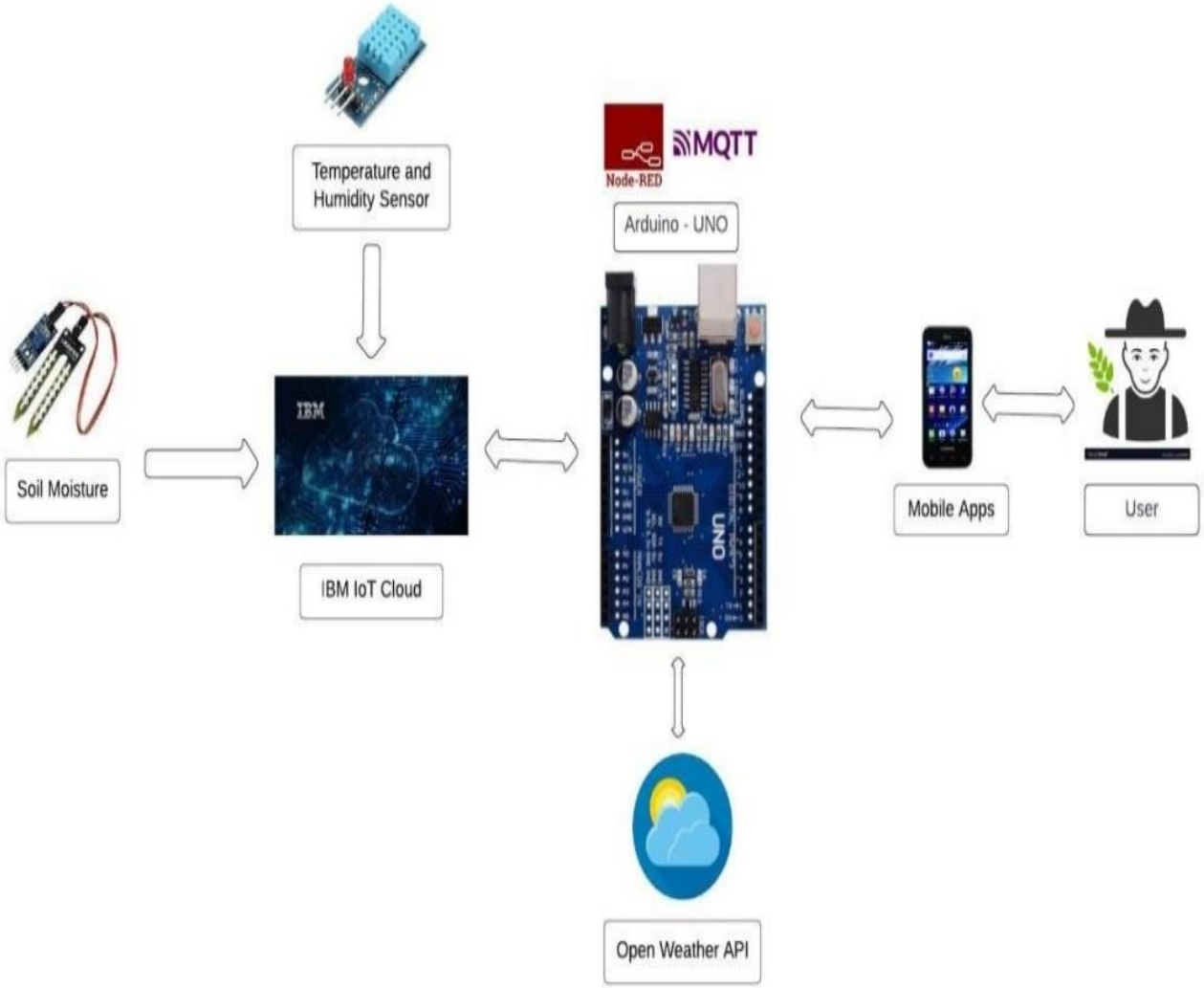


Fig 5.2 Solution Architecture

5.3 USER STORIES:

User Type	Functional Requirement	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 Gmail		Medium	Sprint-1
	Login	USN-4	As a user, I can log into the application by entering email & password		High	Sprint-1
Customer(Web user)	Dashboard	USN-5	As a User can view the dashboard, and this dashboard include the check roles of access and then move to the manage modules.	I can view the dashboard in this smart farming application system.	High	Sprint-2

		USN-6	User can remotely access the motor switch	In the smart farming app	High	Sprint-3
Administrator			As a user once view the manage modules this describes the Manage system Admins and Manage Roles of User and etc.		High	Sprint-2

CHAPTER 6

PROJECT PLANNING & SCHEDULING

6.1 SPRINT PLANNING & ESTIMATION:

Sprint	Functional Requirement	User story Number	User Story/Task	Story Points	Priority	Team Member
Sprint-1	Registration (Farmer Mobile User)	UNS-1	As a user, I can register for the application by entering my email, password, and confirming my password	2	Medium	Thangaprabagaran J (Leader)
Sprint-1	Login	UNS-2	As a user, I will receive confirmation email once I have registered for the application	1	High	Barath Kumar S (Member 1)
Sprint-2	User Interface	UNS-3	As a user, I can register for the application through Facebook	3	Low	Tharunkumar S (Member 2)
Sprint-1	Data Visualization	UNS-4	As a user, I can register for the application through GMAIL	2	Medium	Nitin Kumar L (Member 3)
Sprint-3	Registration (Farmer - Web User)	UNS-1	As a user, I can log into the application by entering email and password	3	High	Tharunkumar S (Member 2)
Sprint-2	Login	UNS-2	As a registered user, I need to easily login log into my registered	3	High	Thangaprabagaran J (Member 4)

			account via the web page in minimum time			
Sprint-4	Web UI	UNS-3	As a user, I need to have a friendly user interface to easily view and access the resources	3	Medium	Barath Kumar S (Member 1)
Sprint-1	Registration (Chemical Manufacturer - Web user)	UNS-4	As a new user, I want to first register using my organization email and create a password for the account.	2	High	Tharunkumar S (Member 2)
Sprint-4	Logi	UNS-1	As a registered user, I need to easily log in using the registered account via the web page	3	High	Nitin Kumar L (Member 3)
Sprint-3	Web UI	UNS-2	As a user, I need to have a user friendly interface to easily view and access the resources.	3	Medium	Thangaprabagaran J (Member 4)
Sprint-1	Registration (Chemical Manufacturer - Mobile User)	UNS-3	As a user, I want to first register using my email and create a password for the account.	1	High	Thangaprabagaran J (Member 4)
Sprint-1	Login	UNS-1	A registered user, I need to easily log in to the application.	2	Low	Barath Kumar S (Member 1)

6.2 SPRINT DELIVERY SCHEDULE:

Title	Description	Date
Literature Survey & Information Gathering	Literature survey on the selected project & gathering information by referring the, technical papers, research publications etc.	03 OCTOBER 2022
Prepare Empathy Map	Prepare Empathy Map Canvas to capture the user Pains & Gains, Prepare list of problem statements.	25 SEPTEMBER 2022
Brainstorming ideas	List the ideas by organizing the brainstorming session and prioritize the top 3 ideas based on the feasibility & importance.	25 SEPTEMBER 2022
Proposed Solution	Prepare the proposed solution document, which includes the novelty, feasibility of idea, business model, social impact, scalability of solution, etc.	04 OCTOBER 2022
Problem Solution Fit	Prepare problem - solution Fit document.	08 OCTOBER 2022
Solution Architecture	Prepare solution Architecture document.	05 OCTOBER 2022
Customer Journey	Prepare the customer journey maps to understand the user interactions & experiences with application	28 OCTOBER 2022
Data Flow Diagrams	Draw the data flow Diagrams and submit for review.	29 OCTOBER 2022
Technology Architecture	Architecture diagram.	16 OCTOBER 2022
Sprint Delivery	Prepare the Sprint delivery on Number of Sprint planning meetings organized, Minutes of meeting recorded.	01 NOVEMBER 2022
Milestone & Activity List	Prepare the milestones & Activity list of the project.	02 NOVEMBER 2022
Project Development Delivery of Sprint-1,2,3&4	Develop & submit the developed code by testing it.	14 NOVEMBER 2022

6.3 REPORTS FROM JIRA:

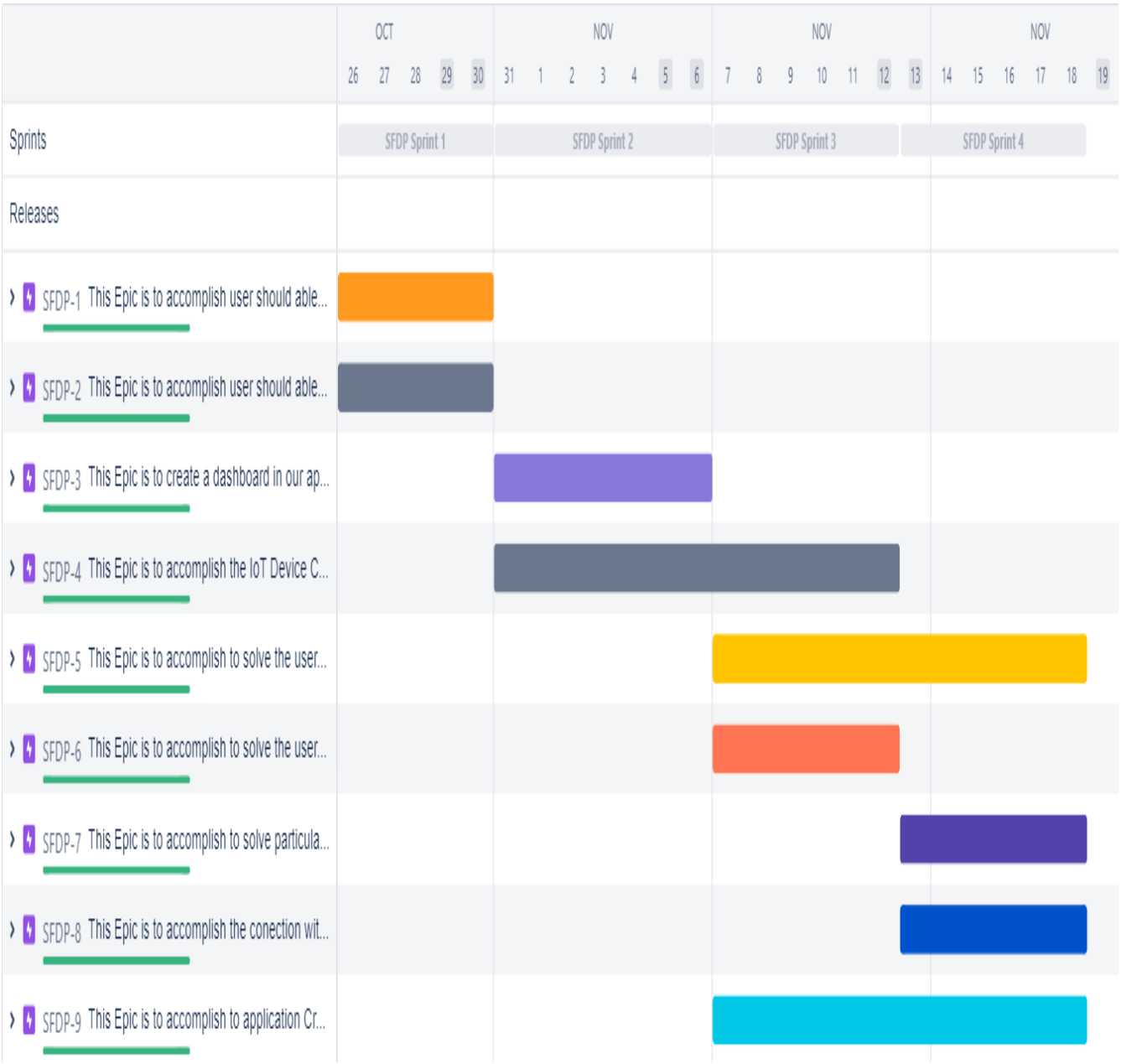


Fig 6.3 Reports from JIRA

CHAPTER 7

CODING & SOLUTIONING

7.1 FEATURE 1(OPEN WEATHER API):

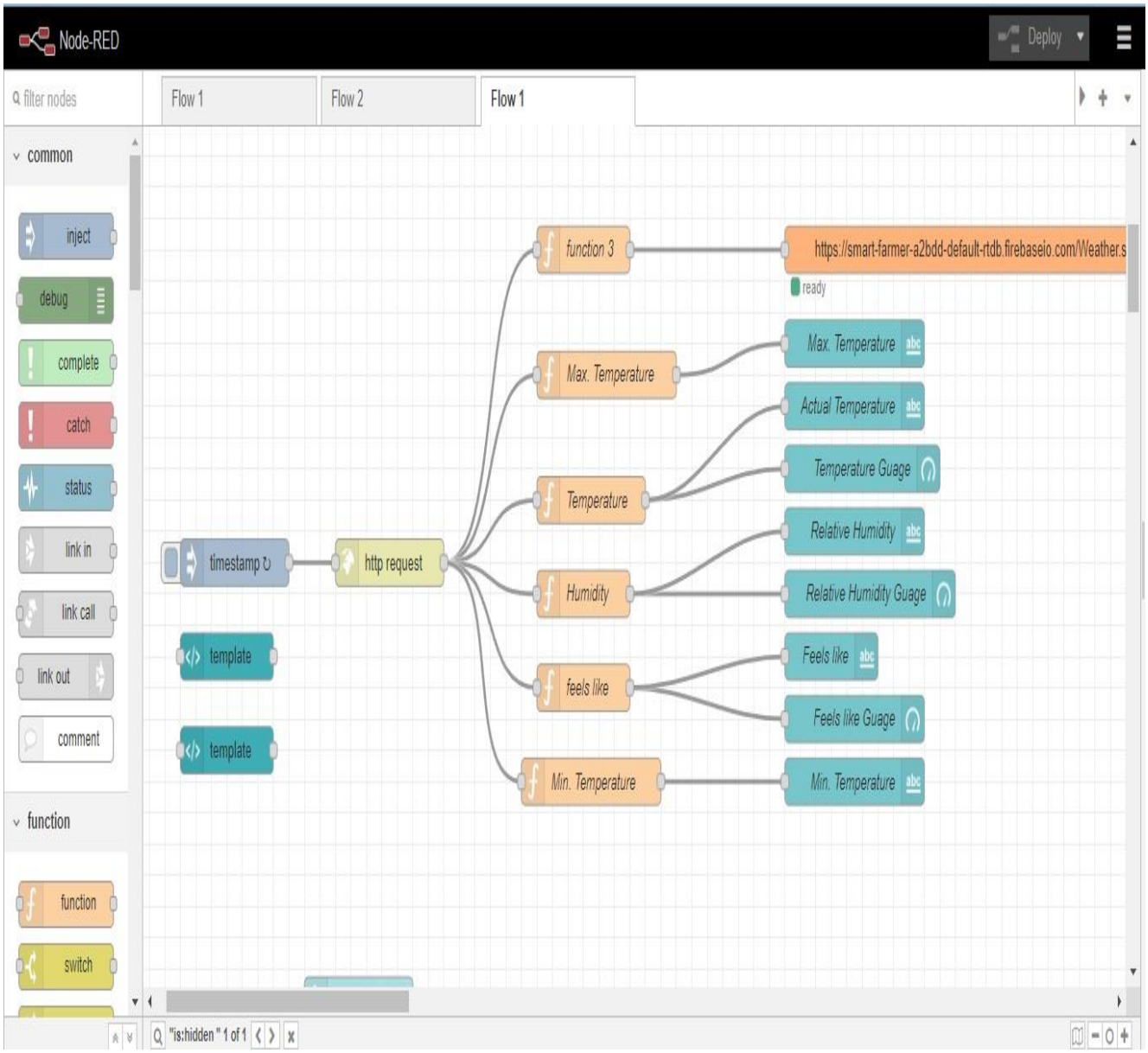


Fig 7.1 Feature 1

7.2 FEATURE 2(MOTOR ON/OFF/30 MINUTES):

```
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")
    elif status == "motor30":
        print("motor is on for 30 minutes")
        print("motor Started")
        for i in range(1,31):
            print("%d minutes to stop"%(30-i))  # use time.sleep(60) for delay of one minute in each iteration
        print("motor stopped")
```

Farmers can control their motor in three ways one is motor on, motor off, motor for 30minutes where they can run motor for 30 minutes and motor will automatically off.

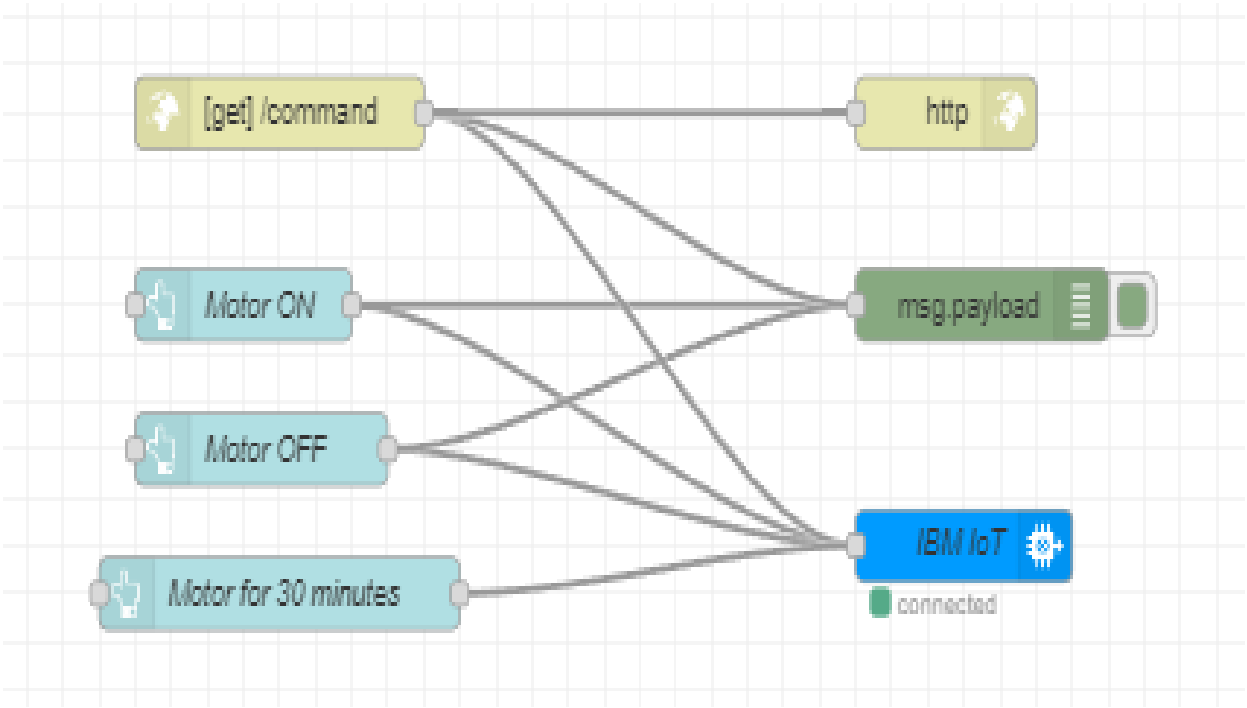


Fig 7.2 Feature 2

CHAPTER 8

TESTING

8.1 TEST CASE:

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

8.2 USER ACCEPTANCE TESTING:

Resolution	Severity 1	Severity 2	Severity 3	Severity4	Subtotal
By -Design	1	1	0	0	2
Duplicate	0	0	0	0	0
External	1	1	0	0	2
Fixed	1	1	1	0	3
Not Reproduced	0	0	0	0	0
Skipped	0	1	0	0	1
Won't Fix	0	0	0	0	0
Totals	3	4	1	0	8

CHAPTER 9

RESULTS

9.1 PERFORMANCE METRICS:

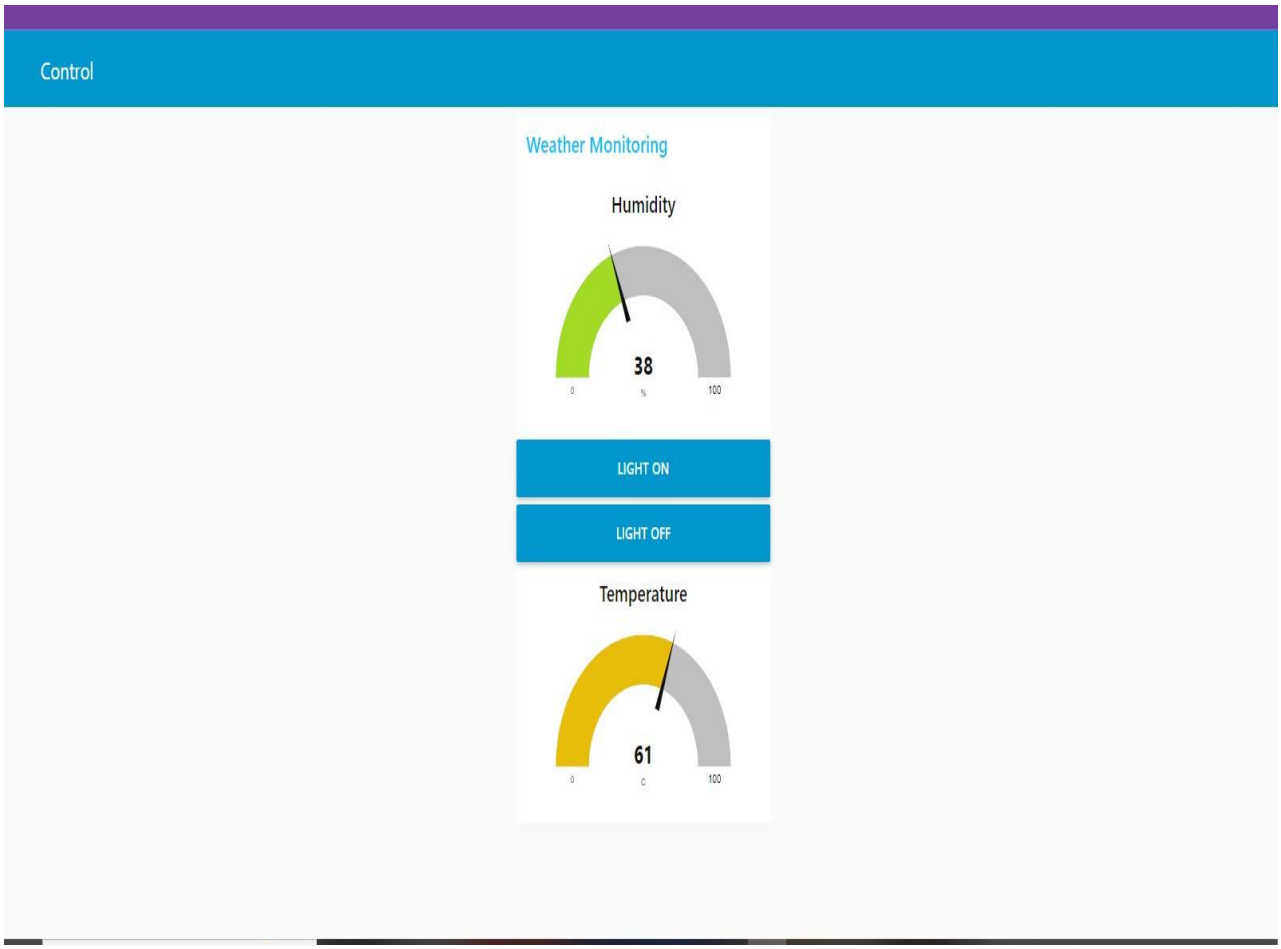


Fig 9.1 Performance analysis

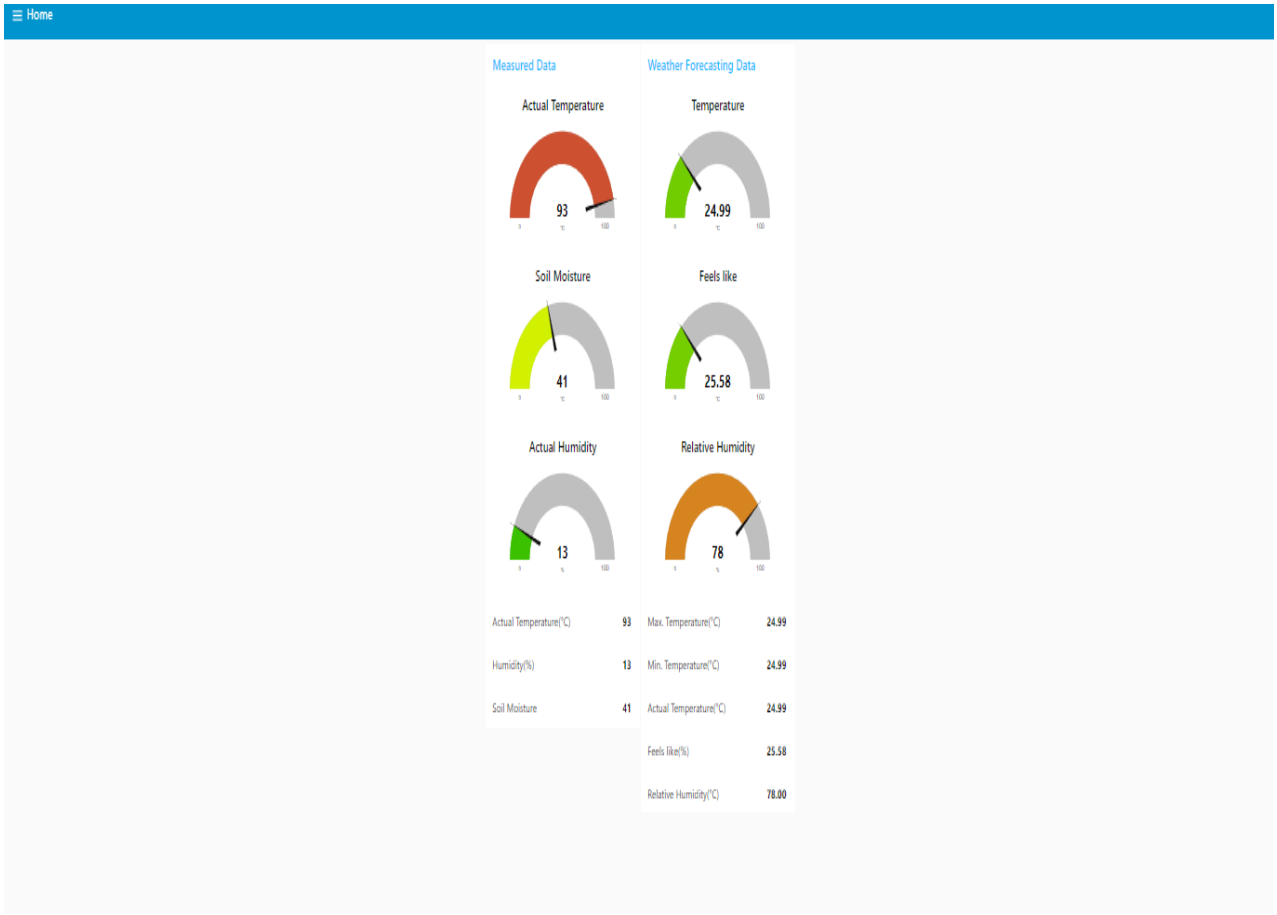


Fig 9.2 Performance analysis

9.2 ADVANTAGES

- Farms can be monitored and controlled remotely
- Increase in convenience to farmers
- Less labor cost. Better standards of living
- Increase in yield and production
- Work made easy

DISADVANTAGES

- Lack of internet/connectivity issues.
- Added cost of internet and internet gateway infrastructure.
- Farmers wanted to adapt the use of WebApp

CHAPTER 10

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. An IOT based smart agriculture system using Watson IOT platform, Watson simulator, IBM cloud and Node-RED are also provided.

FUTURE SCOPE

In future due to more demand of good and more farming in less time, for betterment of the crops and reducing the usage of extravagant resources like electricity and water IOT can be implemented in most of the places. We can create few more models of the same project ,so that the farmer can have information of a entire. 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. We can add camera feature so that the farmer can monitor his field in real time. This helps in avoiding thefts.

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[6] F. Viani, M. Bertolli, M. Salucci, "LowCost Wireless Monitoring and Decision Support for Water Saving in Agricultu re' , Proceedings of IEEE Sensors Journal, Vol 0, 2017, P.69.

[7] Jan Bauer and Nils Aschenbruck, " Design and Implementation of an Agricultural Monitoring System for Smart Farming" , Proceedings of IEEE IOT Vertical and Tropical Submit on Agriculture, 2018, P.978-982.

APPENDIX

Source Code:

```
import wiotp.sdk.device
import time
import os
import datetime
import random
myConfig = {
"identity":{
"orgId": "u9qhfi",
"typeld": "Devicetypel",
"deviceld": "DeviceID1"
};
"auth": {
"token": ")hSb7_ZD+evl2fRhXi"
}}
client=wiotp.sdk.device.DeviceClient(config=myConfig,log Handlers=
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 switched on")

elif ( m ==^ prime motoroff"):

print ("Motor is switched OFF")

print (" ")

while True:

soil-random.randint (0, 100)

temp=random.randint (- 20, 125)

hum=random.randint (0, 100)

myData={'soil moisture': soil, 'temperature':temp, 'humidity':hum}
client.publishEvent (eventid="status", msg Format=

"json", data=myData, qos = 0 , onPublish = None ) print ("Published data
Successfully: %s", myData)

time.sleep (2)

client.commandCallback = myCommandCallback

client.disconnect()
```

GitHub: https://github.com/IBM-EPBL/IBM-Project-26019-1659980040

Project Demo Link:

https://drive.google.com/file/d/1UauqGOhvldNEzUC5IPfjnvZitClsbpWv/view?usp=drive_web