SMART FARMER- IoT ENABLED SMART FARMING USING APPLICATION

A PROJECT REPORT

Submitted by

BALAJI R -311019104013

MATHANKUMAR S -311019104046

PRIYAN A -311019104065

POZHILAN -311019104059

BACHELOR OF ENGINEERING

IN

COMPUTER SCIENCE ENGINEERING

KCG COLLEGE OF TECHNOLOGY

TEAM ID: PNT2022TMID27262

BONAFIDE CERTIFICATE

Certified that this project report titled "Smart Farmer - IoT Enabled Smart Farming Application" is the bonafide work of "BALAJI R(311019104013), PRIYAN A (311019104065), MATHAN KUMAR(311019104046), POZHILAN S (311019104059)" who carried out the project work under my supervision.

MENTOR,

Swati Saxena

Department of CSE

KCG COLLEGE OF TECHNOLOGY,

KARAPAKKAM , CHENNAI-600097.

Submitted the report for the final release of the project on **19/11/2022**

ABSTRACT

IoT plays a major role in the agricultural field This project is mainly applied to the agricultural field Smart irrigation and farming can help farmers to grow healthy plants. The existing system only checks the soil water stress and automates the process of watering. The project is about IoT-based smart farming and irrigation systems. The ultimate agenda of this project is to monitor the farm and water plants using the mobile application. This work helps us to know the values of various parameters such as humidity, moisture, location, and temperature of plants and water them accordingly just by tapping the motor ON/OFF button from the user's Mobile. We used firebase to store user data and python code for the backend process of our application and linked our designing process in the MIT inventor app with the IBM cloud by using NODE-RED. The ultimate significance of this project is that most of the manual work is reduced and the watering process is automated with the help of devices as a result of which healthy plants can be grown, Water and electricity usage are saved by this project. Even elderly people can easily do farming. This methodology with the use of IoT-enabled mobile application technology had made us achieve healthy farming. An increase in agriculture also helps us to increase the economical state of the country.

TABLE OF CONTENTS

S.NO CONTENTS

INTRODUCTION

1.2 PROJECT OVERVIEW

The objectives of this report are to propose a Smart farmer-IoT Enabled Smart Farming Application that will enable farmers to have live data of soil moisture, environment temperature, and humidity level at a very low cost so that live monitoring can be done. The structure of the report is as follows: chapter I will cover an overview of IoT Technology and agriculture concepts and definition, IoT enabling technologies, IoT application in agriculture, benefits of IoT in agriculture, and IOT and agriculture current scenario and future forecasts. Chapter II will cover the existing problem, references, and the detection of the problem statement. Chapter III will cover the empathy of farmers, the solutions and brainstorming, the proposed solution for the problem, customer constraints, and the available solution. Chapter IV consists of the functional requirement and also the Non-functional requirement of the project. Chapter v will cover the design of the project with data flow, Solution architecture, and User stories in it. Chapter VI consists of the planning of the sprint and the estimation, the delivery schedule of the sprint, and the roadmap of our sprint deliverables from JIRA. Chapter VII will consist of the solutioning of the project and also point out the features along with the code. Chapter VIII will have the test analysis of the application such as the registration page, login portal, and dashboard with temperature, humidity, moisture, pressure level, and also the location. Chapter IX results and performance metrics of the project application. Chapter X will consist of the advantages and disadvantages of our project. Chapter XI will cover the conclusion and vision of the project. Chapter XII defines the future scope of this project. Chapter XIII consists of the source code with a GitHub link and with the project Demo link.

.

1.2 PURPOSE

The purpose of our project is to monitor the agriculture field smartly by farmers using IoT enabled Smart Farming application that aims to **improve the entire Agriculture system by monitoring the field in real-time as it** shows the temperature value of the environment, the humidity level in the air, and the pressure level and the weather condition. This system assists farmers by helping them automatically ON/OFF the motor based on the moisture level of the soil. The main purpose of this project is to help the farmers to monitor their fields from anywhere and anytime. The status of the farm is updated every five minutes so the farmers can be updated with the weather condition and also prevent their crops from some species by using ultrasonic sensors and information will send to their mobile through the notification. The Internet of Things in Agriculture has not only saved the time of the farmers but has also reduced the extravagant use of resources such as Water and Electricity.

LITERATURE SURVEY

2.1 Existing problem

In the existing system, there may be some difficulties with the login page and also the registration page where the user finds trouble while entering their credentials which results in farmers getting frustration and reducing the usage of existing applications. But in our project, the login process is easy and effective as our application is user-friendly.

In the existing system, only the soil moisture level is monitored by using a moisture sensor, and also internet connection is lower in some rural areas, this may cause some difficulties while sending notifications to the user when water is required for the plants. Even though it sends a notification to the user there will be automatic ON/OFF motor control button is not available in the application.

2.2 REFERENCES

1. Smart farming: IoT-based smart sensor agriculture stick for live temperature and humidity monitoring
S Panigrahi - Available at SSRN 3651933, 2020 - papers.ssrn.com

2. Smart Farming using IoT, a solution for optimally monitoring farming conditions J Doshi, T Patel, S Kumar Bharti - Procedia Computer Science, 2019 - Elsevier

3. Smart farming–IoT in agriculture
R Dagar, S Som, SK Khatri - 2018 International Conference on …, 2018 - ieeexplore.ieee.org

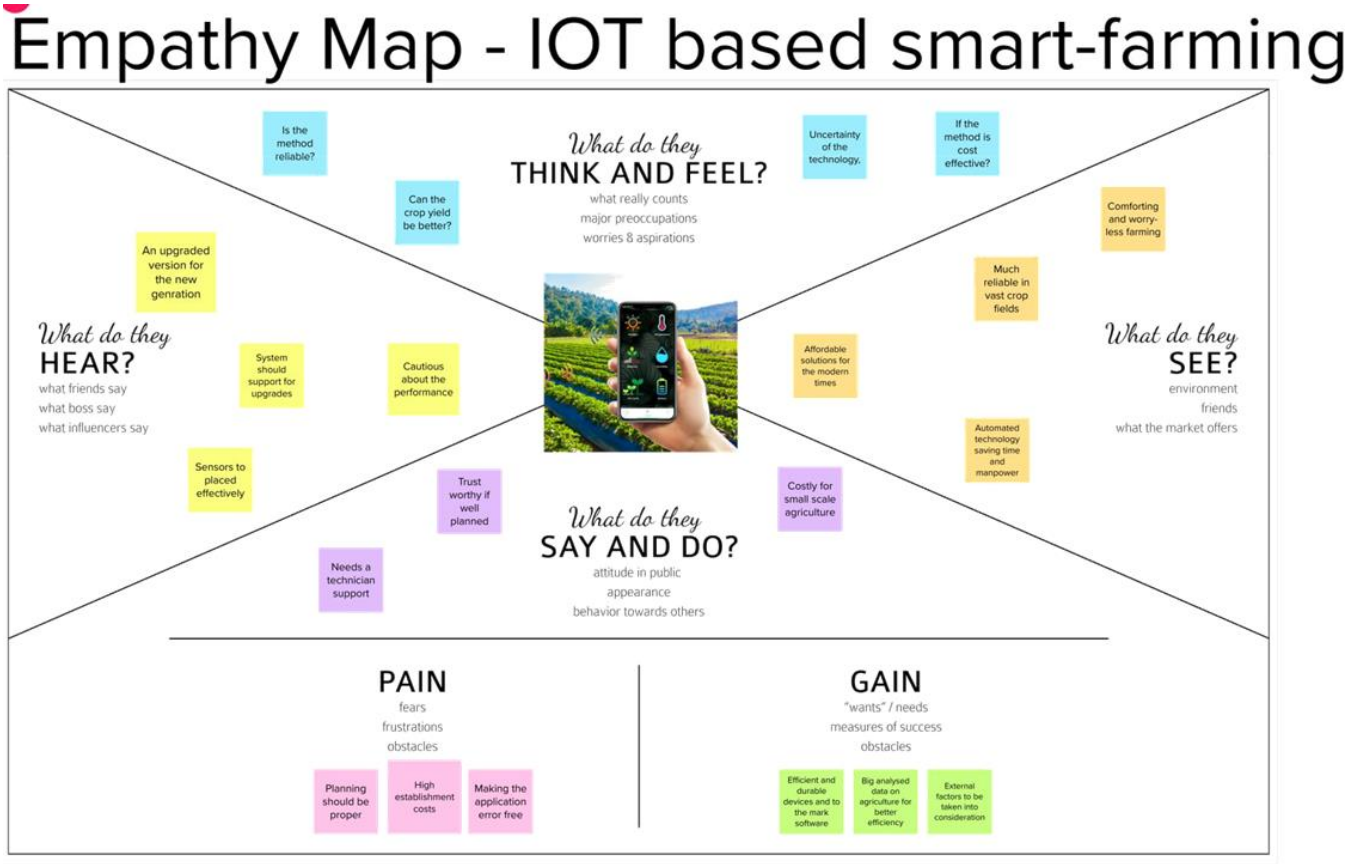
4. IoT and agriculture data analysis for smart farm
J Muangprathub, N Boonnam, S Kajornkasirat… - … and electronics in …, 2019 - Elsevier

5. A Survey on the Role of IoT in Agriculture for the Implementation of Smart Farming MS Farooq, S Riaz, A Abid, K Abid, MA Naeem - Ieee Access, 2019 - ieeexplore.ieee.org

6. [HTML] Applicability of the internet of things in smart farming
K Phasinam, T Kassanuk, M Shabaz - Journal of Food Quality, 2022 - hindawi.com

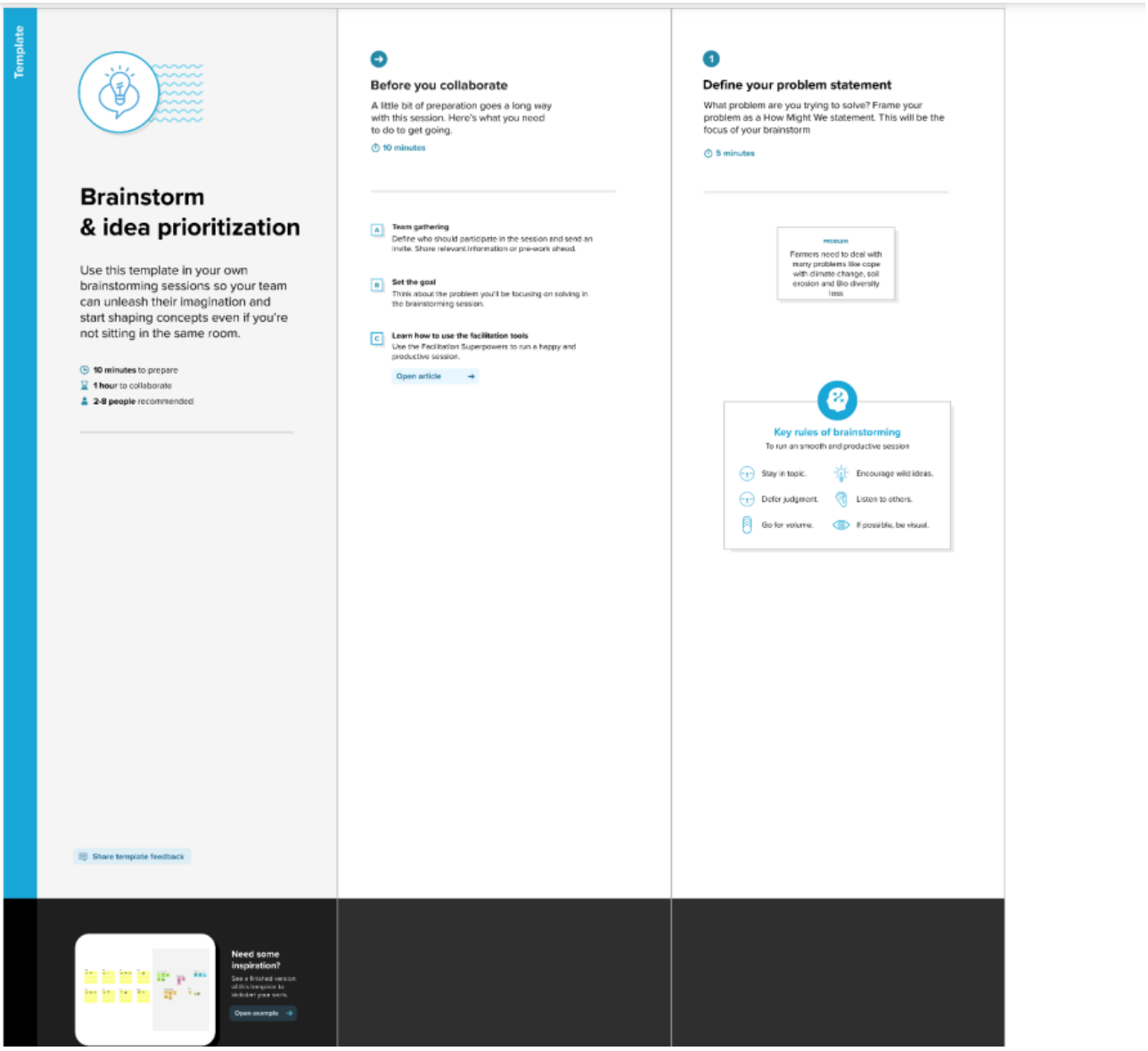
IDEATION AND PROPOSED SOLUTION

3.1 EMPATHY MAP CANVAS



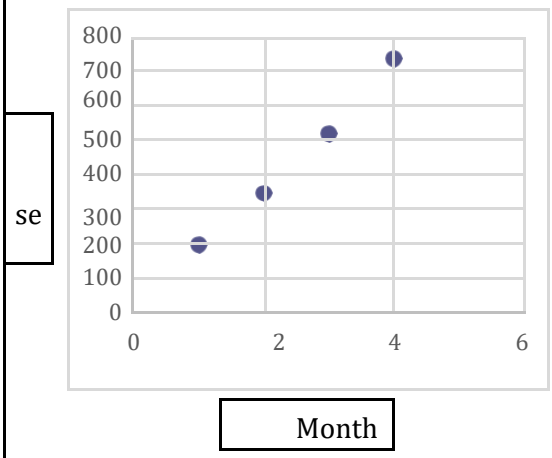
The term “empathy” is used to describe a wide range of experiences. Emotion researchers generally define empathy as the ability to sense other people's emotions, coupled with the ability to imagine what someone else might be thinking or feeling. The empathy of farmers can help us to understand the recent problems and the current situation of agriculture.

3.2 IDEATION & BRAINSTORMING

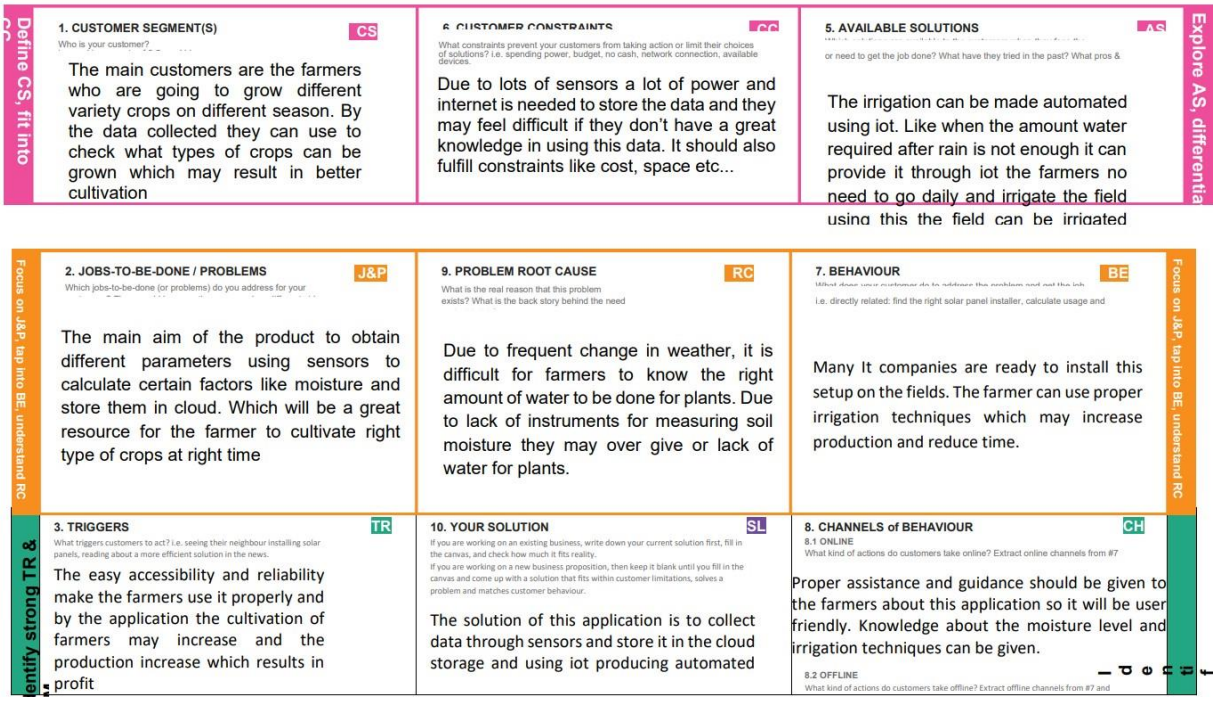


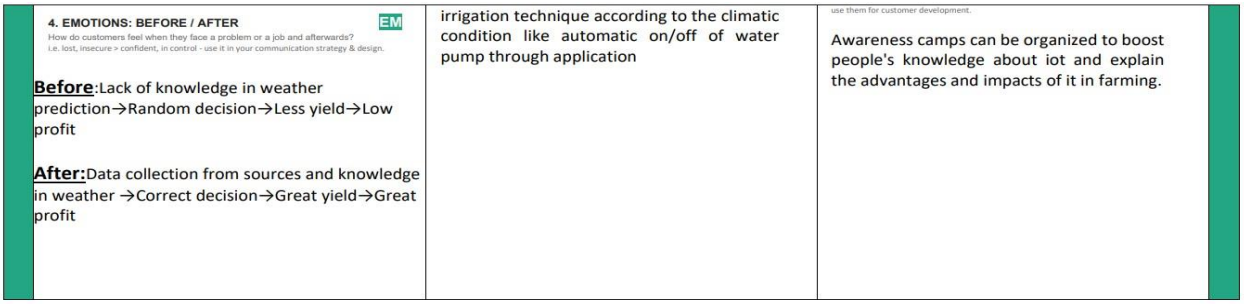
3.3 PROPOSED SOLUTION

S.No.	Parameter	Description
1.	Problem Statement (Problem to be solved)	The main problems include • Climate change affects farmers' ability to grow vital food. • Adding to that volatile weather and extreme events like sudden floods and droughts can lead to the change in growing seasons, limit the availability of water, lead to weeds, pests, and fungi thriving, and can reduce crop productivity. • Irrigation plays a major role in agriculture for a tropical monsoon country like India where rainfall is uncertain, unreliable, and erratic. • Watering the crop is one of the important tasks for farmers. • Crop rotation is also the main problem for farmers. It should be properly planned for yielding better outcomes. For example, if cereals are grown on a plot of land their fertility is reduced to some extent.
2.	Idea / Solution description	• Using Local weather API, we can monitor the weather conditions. • moisture level, temperature, humidity, Object distance, and weather conditions will be monitored by sensors • Application will be created to monitor the user's farm status. • The login process is easy and effective as our application is user-friendly. • The user can also able on/off the motor and light from anywhere using our application. • Email Id of the user will be stored in our database (Firebase DB) which they entered during the signup process. • Automatic email will be sent to the user when moisture is below 30% (Turn on motor) and above 60% (Turn off motor) and if any object is less than or equal to 100m around their

		field then the user will get an email notification as (someone is near your field).
3.	Novelty / Uniqueness	• Email will be sent to users when there is a requirement for irrigation and sends a notification to switch off the motor when its reached the threshold level.
4.	Social Impact / Customer Satisfaction	• Doubles the farmer's income • Higher Production and good yield • Reduces the wages for laborers who work in the agricultural field. • Healthy Crops
5.	Business Model (Revenue Model)	Revenue (no. of users vs months) 
6.	Scalability of the Solution	Business-to-business and business the customer can be implemented and it can be used for enhancing the profit on a large scale.

3.4 PROBLEM-SOLUTION FIT





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	Basic Requirements	Smart Phone with minimum 2GB RAM & 8GB ROM
FR-2	User Registration	Registration through Email Registration through Form Registration through Mobile Number
FR-3	User Confirmation	Confirmation via Email Confirmation via OTP
FR-4	Access Permission	User should enable their Audio, Contacts, Location, Wi-Fi & Camera
FR-5	User Details	Name, Mobile Number, Email-id, Address, Type of crop, Land details, etc

4.2 NON-FUNCTIONAL REQUIREMENT

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

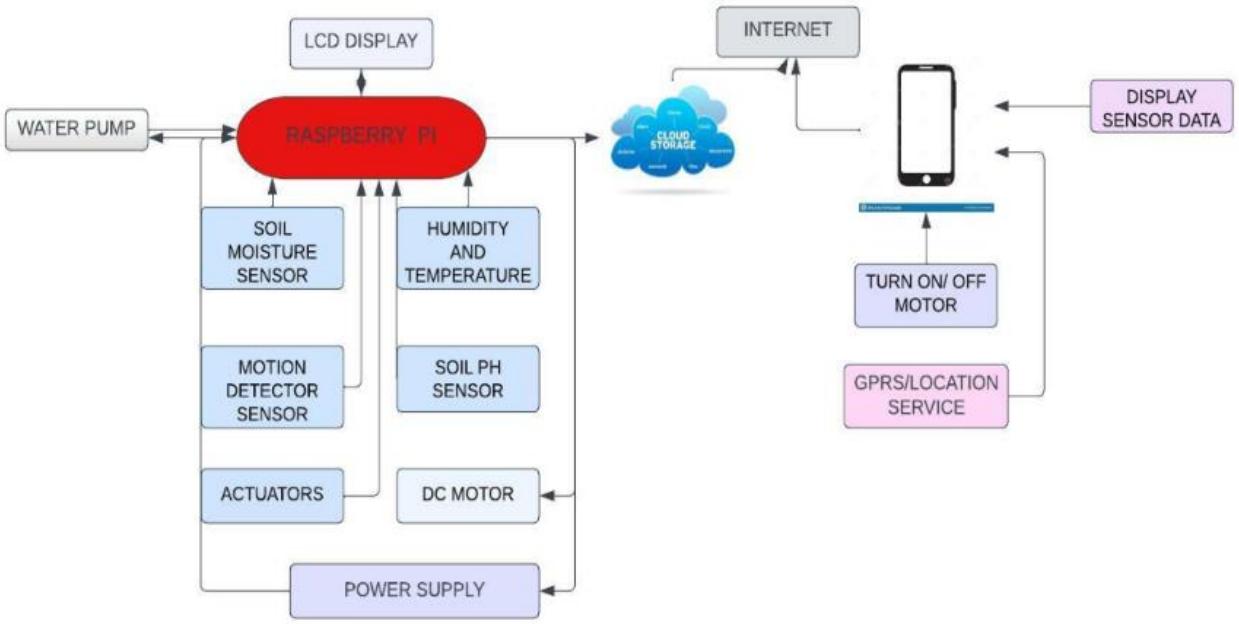
FR No.	Non-Functional Requirement	Description
NFR-1	**Usability**	➢ Can be used in all agricultural fields. ➢ Can Monitor their field from anywhere at any time. ➢ Irrigation can be easily done to all crops at regular time intervals.
NFR-2	**Security**	➢ Confidentiality-Requires information in a computer only is accessible for reading by authorized parties. ➢ Access be available only to authorized users. ➢ All the details about the user are protected from unauthorized access. ➢ Detection and identification of any misfunction of sensors.
NFR-3	**Reliability**	➢ High speed of data results in better monitoring. ➢ Efficient of the system consisting for a long period. ➢ Cost-effective. ➢ Easily Accessible by the users.
NFR-4	**Performance**	➢ The idea of implementing integrating sensors with soil sensing and environmental or ambient parameters in farming will be more efficient for overall monitoring.

NFR-5	**Availability**	➢ Information about Water, Crop conditions, Soil, and Weather is available through the use of sensors that are linked to the cloud and can be accessed via an application or Website. ➢ The application can be available in the Play Store.
NFR-6	**Scalability**	➢ Business-to-business and business the customer can be implemented and it can be used for enhancing the profit on a large scale.

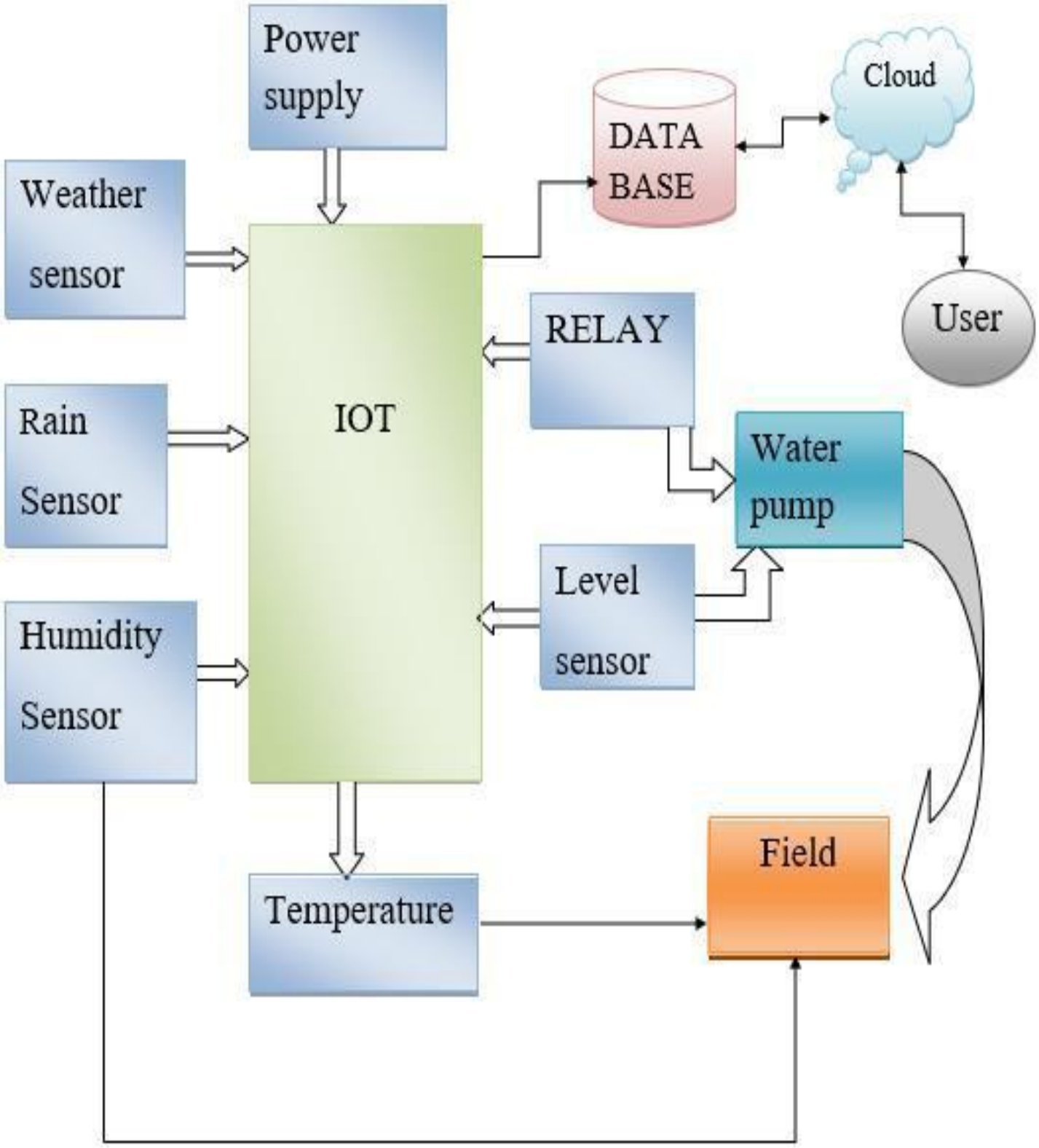
PROJECT DESIGN

5.1 DATA FLOW DIAGRAM

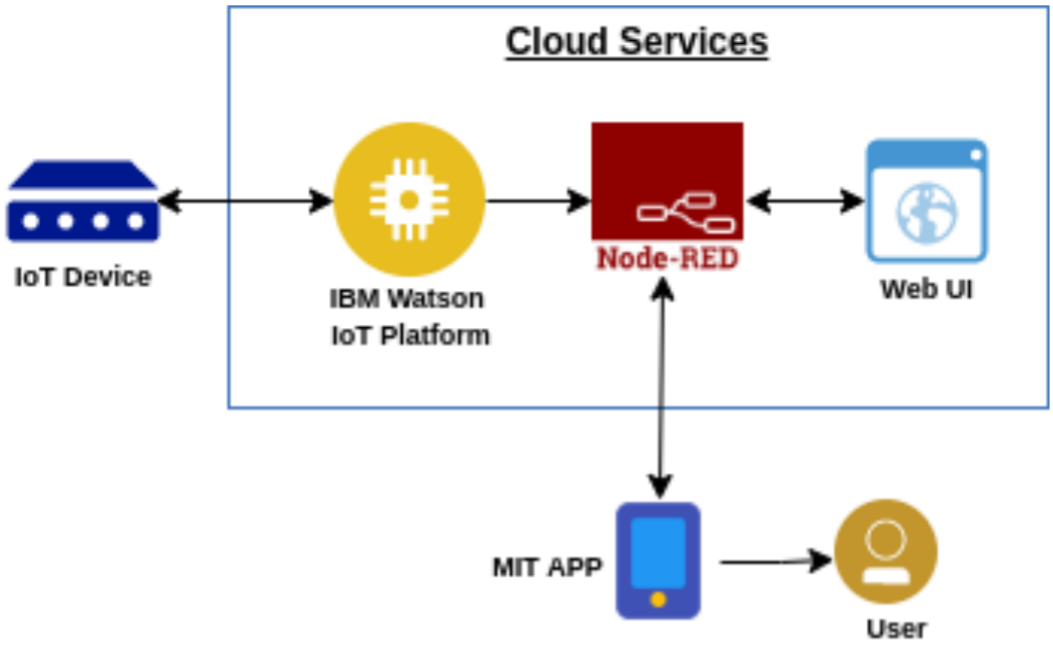
A Data Flow Diagram (DFD) is a traditional visual representation of the information flows within a system. A neat and clear DFD can depict the right amount of the system requirement graphically. It shows how data enters and leaves the system, what changes the information, and where data is stored.



5.2 SOLUTION ARCHITECTURE



5.2.1TECHNICAL ARCHITECTURE



S.No	Component	Description	Technology
1.	User Interface	How user interacts with application e.g. Web UI, Mobile App, Chatbot etc.	IBM Cloud, Node-RED, LoRa WAN
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.	Cloud Database	Database Service on Cloud	IBM DB2, IBM Cloudant etc.
6.	File Storage	File storage requirements	IBM Block Storage or Other Storage Service or Local Filesystem
7.	External API-1	Purpose of External API used in the application	IBM Weather API
8.	External API-2	Purpose of External API used in the application	Open Weather API
9.	Infrastructure (Server / Cloud)	Application Deployment on Local System / Cloud Local Server Configuration: Cloud Server Configuration :	Local, Cloud Foundry, Kubernetes, etc.

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 Gmail	I can receive confirmation email & click confirm to login	Medium	Sprint-1
	Login	USN-4	As a user, I can log into the application by entering email & password		High	Sprint-1
		USN-5	If I forgot my password or username, I can reset it again through my email	I can receive reset Mail to the registered Email Id	High	Sprint-2
Dashboard		USN-6	I can monitor my farm status from my dashboard	I can access it to the Node-red dashboard	High	Sprit-3
Feedback	Google form	USN-7	I Can give my feedback about the application and I can post my queries.	I can post my feedback in google form	Low	

PROJECT PLANNING AND SCHEDULING

6.1 SPRINT PLANNING AND 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, and password, and confirming my password.	2	High	1.Padmapriya.p 2. Deeksha Kumari 3. Menaka 4. Majula 5. Chandra Kala

Sprint-1	USN-2	As a user, I will receive a confirmation email once I have registered for the application	1	High	1.Padmapriya.p 2. Deeksha Kumari 3. Menaka 4. Majula 5. Chandrakala
Sprint-1	USN-3	As a user, I can register for the application through Gmail	1	Medium	1.Padmapriya.p 2.Deeksha Kumari 3. Menaka 4. Majula 5. chandrakala

Sprint-1	Login	USN-4	As a user, I can register for the application through Gmail	2	High	1.Padmapriya.p 2. Deeksha Kumari 3. Menaka 4. Majula 5. chandrakala
Sprint-2		USN-5	If I forgot my password or username, I can reset it again through my email	1	High	1.Padmapriya.p 2.Deeksha Kumari 3. Menaka 4. Majula 5.

						chandrakala
Sprint-2	Web register	USN-6	As a user, I can register by entering my email, and password, and confirming my password	2	High	1.Padmapriya.p 2. Deeksha Kumari 3. Menaka 4. Majula 5. Chandrakala
Sprint-2		USN-7	As a user, I will receive a confirmation email once I have registered for the application	1	High	1.Padmapriya.p 2. Deeksha Kumari 3. Menaka 4. Manjula

						5. Chandrakala
Sprint-2		USN-8	As a user, I can register for the application through Gmail	1	Medium	1.Padmapriya.p 2. Deeksha Kumari 3. Menaka 4. Majula 5. chandrakala
Sprint-2	Web login	USN-9	As a user, I can log into the application by entering my email & password	2	High	1.Padmapriya.p 2. Deeksha Kumari 3. Menaka 4. Majula 5.

						chandrakala
Sprint-3		USN-10	If I forgot my password or username, I can reset it again through my email	1	High	1.Padmapriya.p 2. Deeksha Kumari 3. Menaka 4. Majula 5. Chandra Kala
Sprint-3	Help	USN-11	If I have any doubts about using an application or web, I can clarify them by clicking the Help option in the dashboard.	1	High	1.Padmapriya.p 2. Deeksha Kumari 3. Menaka 4. Majula 5. Chandra Kala

Sprint-4	Feedback	USN-12	I Can give my feedback about the application and I can post my queries.	1	Low	1.Padmapriya.p 2. Deeksha Kumari 3. Menaka 4. Majula 5. Chandra Kala

6.2 SPRINT DELIVERY SCHEDULE

Sprint	Functional Requirement (Epic)	User Story Number	User Story / Task	Story Points	Priority	Team Members
Sprint-1	Registration (Farmer Mobile App user)	USN-1	As a user, I can register for the application by entering my email, password, and confirming my password.	2	High	Team Leader (MathanKumar)
Sprint-1	Login	USN-2	As a user, I will receive confirmation email once I have registered for the application	1	High	Team Member 1 (R. Balaji)
Sprint-2	User Interface	USN-3	As a user, I can register for the application through Facebook	2	Low	Team Member 2 (Pozhilan)
Sprint-1	Data Integration	USN-4	As a user, I can register for the application through Gmail	2	Medium	Team Member 3 (Priyan)
Sprint-1	Registration (Chemical Manufacture-Web user)	USN-1	As a new user, I want to first register using my organization email and create a password for the account for the whole organization. So that important representatives can access it.	2	High	Team Member 1 (R. Balaji)

Sprint	Functional Requirement (Epic)	User Story Number	User Story / Task	Story Points	Priority	Team Members
Sprint-4	Login	USN-2	As a registered user, I need to easily log in using the registered account via the web Page, so that web page should be user interactive and easy to use	3	High	Team Leader (MathanKumar)
Sprint 3	Web UI	USN-3	As a user, I need to have a user-friendly interface to easily view and access the Resources, the UI should be easy and user interactive	3	Medium	Team Member 2 (Pozhilan)
Sprint-3	Registration (Farmer-Web User)	USN-1	As a user, I can log into the application by entering email and password I can create account using my Gmail, Facebook etc..	3	High	Team Leader (MathanKumar)
Sprint - 2	Login	USN-2	As a registered user, I need to easily login log into my registered account via the web page in minimum time	3	Medium	Team Member 3 (Priyan)
Sprint-4	Web Ui	USN-3	As a user, I need to have a friendly user interface to easily view and access the resources	3	Medium	Team Member 1 (R. Balaji)
Sprint-1	Registration (Chemical Manufacturer - Mobile User)	USN-1	As a user, I want to first register using my email and create a password for the account.	1	High	Team Member 3 (Priyan)
Sprint-1	Login	USN-2	As a registered user, I need to easily log in to the application	2	Low	Team Member 2 (Pozhilan)

6.3 REPORTS FROM JIRA

A burndown chart is a tool used by Agile teams to gather information about work completed on a project and work to be done in a given time period. So that we are using JIRA software, to make burndown chart for our team project as a prediction tool that allows us to visualize when our project will be completed.

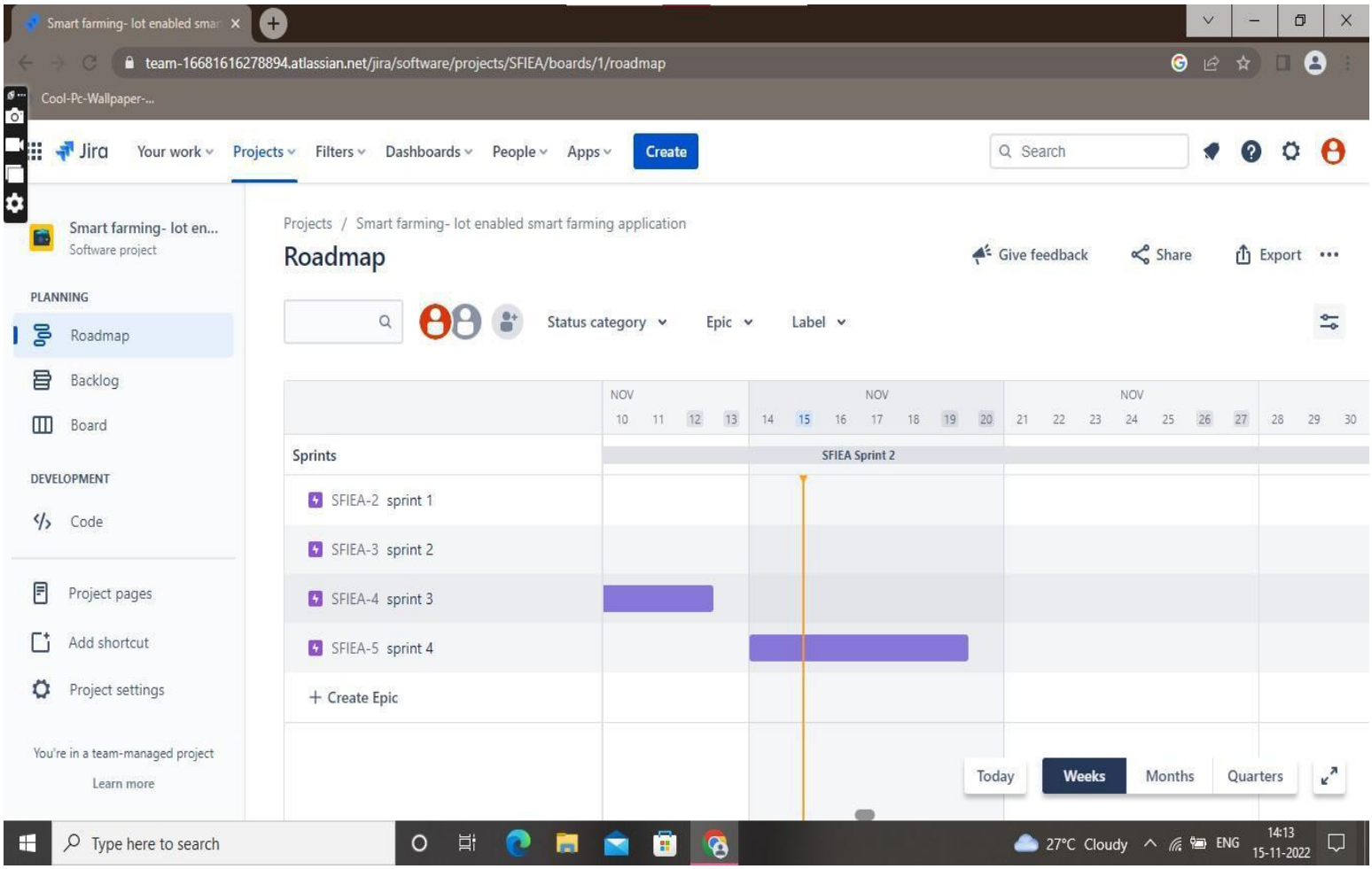


Fig: 6.3.1

The above image represents the roadmap data for the sprint release as per the schedule we planned to release our sprint-3 on 15th Nov 2022.

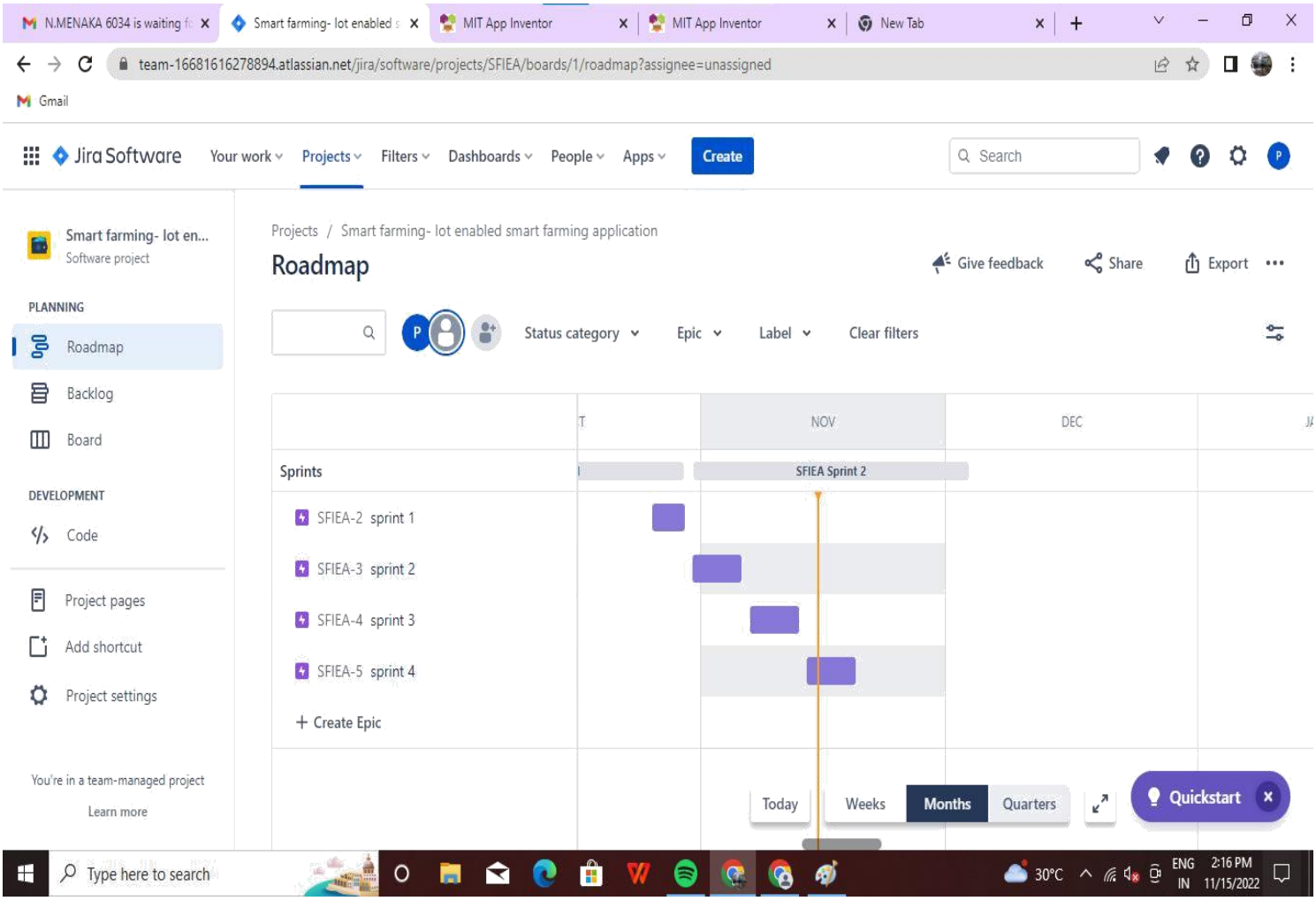


Fig.6.3.2

The above diagram shows the overall time duration for our estimation sprints that would be divided into four sprints such as sprint-1, sprint-2, sprint-3, sprint-4.

CODING & SOLUTIONING

7.1 FEATURE

```
import sys

import ibmiotf.application

import ibmiotf.device

import random



#Provide your IBM Watson Device Credentials



organization = "vy60s0"

deviceType = "abcd"

deviceId = "1234"

authMethod = "token"

authToken = "12345678"



#Initialize GPIO
```

```
def myCommandCallback (cmd):
    print ("Command received: %s" %
     cmd.data['command'])
    status=cmd.data['command']
    if status=="lighton":
        print ("led is on")
    elif status == "lightoff":
        print ("led 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 "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(90,110)
    Humid=random.randint(60,100)
```

```
data = { 'temp': temp, 'Bumid': Humid }

#print data

def myonPublishCallback():

   print ("Published Temperature = %s C" % temp,

 "Humidity = %s %%" % Humid, "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
```

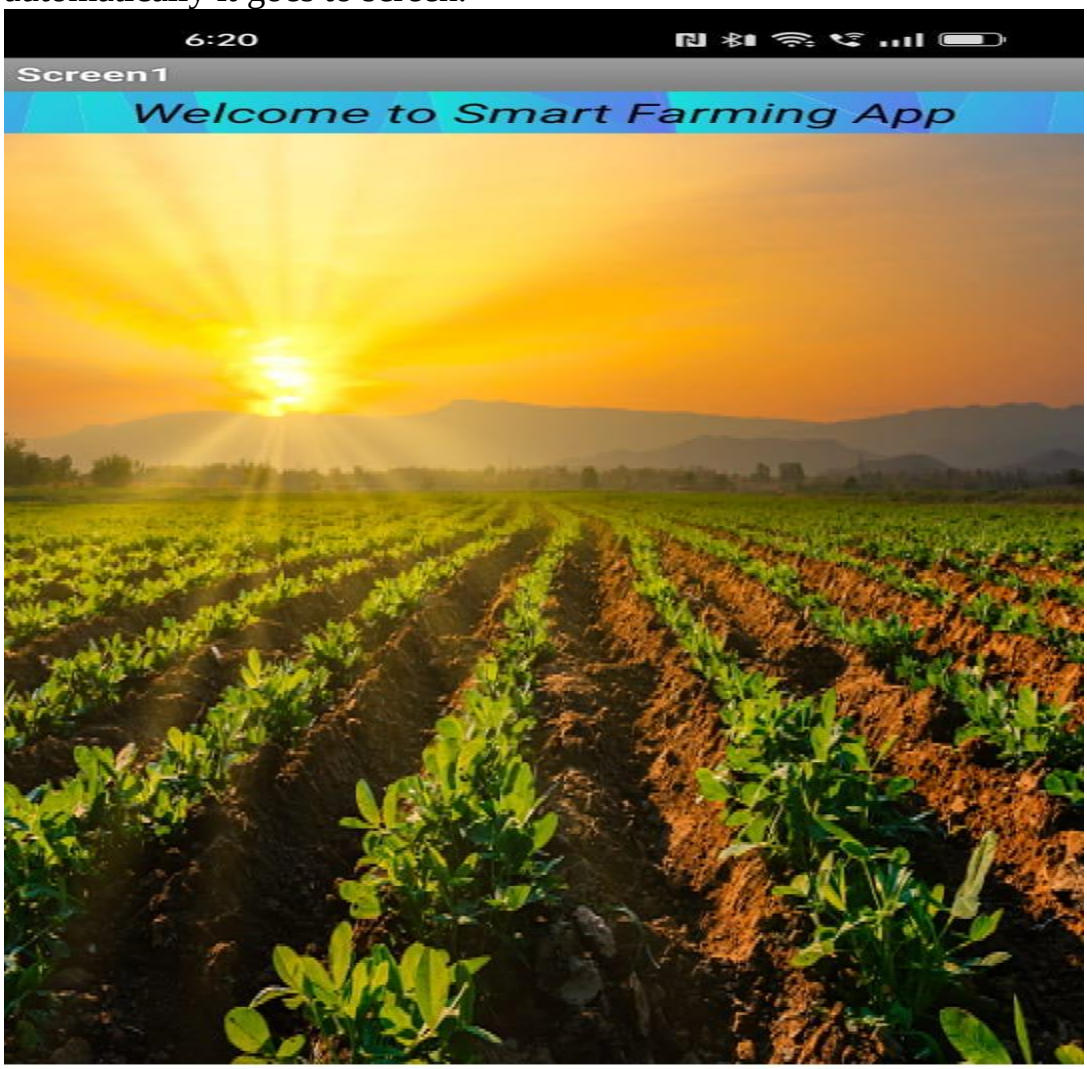
```
#Disconnect the device and application from the cloud

deviceCli.disconnect()
```

TESTING

7.1 TEST CASES

Step-1:

Screen 1 of the application has our project logo and it will display for 3 seconds then automatically it goes to screen.



Step-2:

Next in screen 2, User has to sign up for the application if they are new to the application and those who have already registered can login to the application by using their username and password.

Step-3

Users can log in with their username and password once they registered. If both the username and password are correct then it will go to screen 3 where the field data will be displayed in the dashboard.

Result:

9.1 PERFORMANCE MATRICES

Thus, this project system has introduced an IoT-based smart farming system based on the MIT App Inventor. The objective of this project is to develop a smart farming system that can help to monitor and analyze data on temperature (0 ℃ - 100 ℃), humidity (70%-100%), soil moisture (50% - 100%), and distance (<100m) of crops that have been stored in the firebase platform application. In addition to monitoring, the actuator system also can be controlled by an application developed in MIT 2 App Inventor. The system was tested using IBM Watson and the expected output has been delivered. The result revealed good

arming system

ADVANTAGES

- By using our project farmers can easily monitor their fields from anywhere and anytime
- So, it will reduce the labor work.
- Also, the time spent by the farmers on the field will be reduced therefore time saving will be achieved
- Objects that enter in farm field will be effectively monitored and a notification sent to user to prevent their crops from negative impacts.
- User can monitor and control their farm just by touch, even elderly people can easily do farming.
- It can save the resources such as water and electricity by monitor and controlling Motor ON/OFF button from the application.

DISADVANTAGES

.

- Rural part of most the developing countries do not fulfil this requirement. Moreover, the internet connection is slower which results in difficulties in transferring data
- The smart farming-based equipment requires farmers to understand and learn the use of technology.

CONCLUSION

Smart farmer-IoT-based SMART FARMING APPLICATION for Live Monitoring of Temperature, Soil Moisture, humidity, and distance monitoring with the live location has been proposed using Python script (IDE 7), node-red, Mit2 app inventor, firebase DB, and IBM Watson. The System has high efficiency and accuracy in fetching the live data of temperature, soil moisture, and humidity. The IoT-based smart farming application being proposed via this report will assist farmers in increasing the agricultural yield and taking efficient care of food production as the System will always provide helping hand to farmers for getting accurate live feed of environmental temperature and soil moisture with more than 99% accurate results.

FUTURE SCOPE

Future work would be fetched more on data especially with regard to Pest Control by integrating UV light and by also integrating GPS module in this system to enhance this Agriculture IoT Technology to full-fledged Agriculture Precision ready product.

APPENDIX

13.1SOURCE CODE

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

#Provide your IBM Watson Device Credentials

organization = " vy60s0"
deviceType = "abcd"
deviceId = "1234"
authMethod = "token"
authToken = "12345678"

#Initialize GPIO
def myCommandCallback (cmd):
    print ("Command received: %s" % cmd.data['command'])
    status=cmd.data['command']
    if status=="lighton":
        print ("led is on")
    elif status == "lightoff":
        print ("led 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 "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(90,110)
    Humid=random.randint(60,100)

    data = { 'temp': temp, 'Bumid': Humid }
    #print data
    def myonPublishCallback():
        print ("Published Temperature = %s C" % temp, "Humidity = %s %%" % Humid, "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()
```

13.2 GITHUB

GitHub link- https://github.com/IBM-EPBL/IBM-Project-313-1658252587

App Inventor:

http://ai2.appinventor.mit.edu/#5281843113754624

Demo Video Link:

https://drive.google.com/uc?id=1YATtHkQcCBi3zv8-xJsQTRkedS75XohF&export=download