SMART FARMER-IoT ENABLED SMART FARMING APPLICATION

NALAIYATHIRAN PROJECT REPORT

TEAM ID: PNT2022TMID49483

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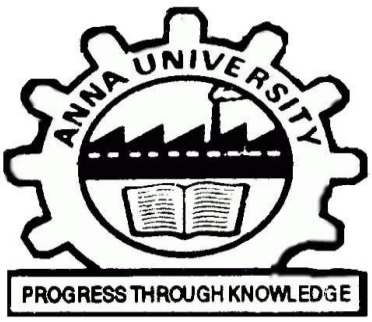

ANNA UNIVERSITY: CHENNAI 600 025

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1. INTRODUCTION:

1.1 Project Overview

The Internet of Things is an emerging topic of technical, social, and economic significance. Consumer products, durable goods, cars and trucks, industrial and utility components, sensors, and other everyday objects are being combined with Internet connectivity and powerful data analytic capabilities that promise to transform the way we work, live, and play.

Internet of Things aim towards making life simpler by automating every small task around us. As much is IoT helping in automating tasks, the benefits of IoT can also be extended for Farming Applications.

Smart Farming based on IoT, this is an emerging system increases the quantity and quality of agricultural products. IoT devices provide information about nature of farming fields and then take action depending on the user's input. In this an IoT based advanced solution for monitoring the soil conditions and atmosphere for efficient crop growth is presented.

1.2 Purpose

The main aim of this project is to help farmers automate their farms by providing them with a Web App through which they can monitor the parameters of the field like Temperature, soil moisture, humidity and etc. and control the equipment like water motor and other devices remotely via internet without their actual presence in the field. . The developed system is capable of sending a notification to the user's phone about environmental conditions (parameters) of the field.

The purpose of this project is to monitor the parameters in the agricultural field. By making farming more connected and intelligent, precision

agriculture helps reduce overall costs and improve the quality and quantity of products, the sustainability of agriculture and the experience for the consumer.

2. LITERATURE SURVEY:

2.1 Existing Problem

Farmers need to deal with many problems, including how to:

- Cope with climate change, soil erosion and biodiversity loss
- Meet rising demand for more food of higher quality
- Invest in farm productivity
- Adopt and learn new technologies
- Stay resilient against global economic factors
- Inspire young people to stay in rural areas and become future farmers

2.2 References

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2.3 Problem Statement Definition

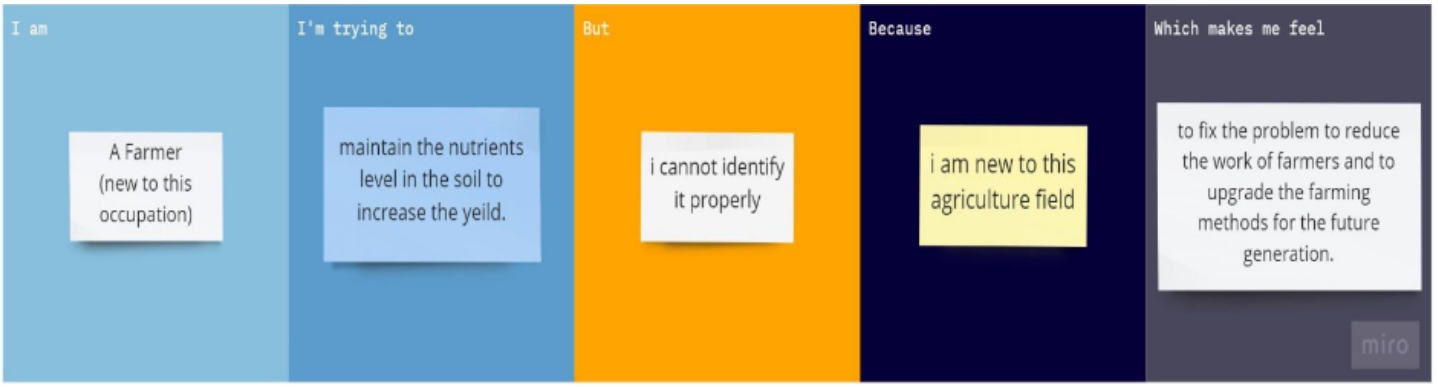
The Problem statement Comprises set of questions which the project seeks to address. It identifies the current state and future state and any gaps between the two.

Farmers are to be present at farm for its maintenance irrespective of the weather conditions. They have to ensure that the crops are well watered and the farm status is monitored by them physically. Farmer have to stay most of the time in field in order to get a good yield. In difficult times like in the presence of pandemic also they have to work hard in their fields risking their lives to provide food for the country.

The Problem arises here in this project is:

Problem-1:

Problem-2:



3. IDEATION AND PROPOSED SOLUTION:

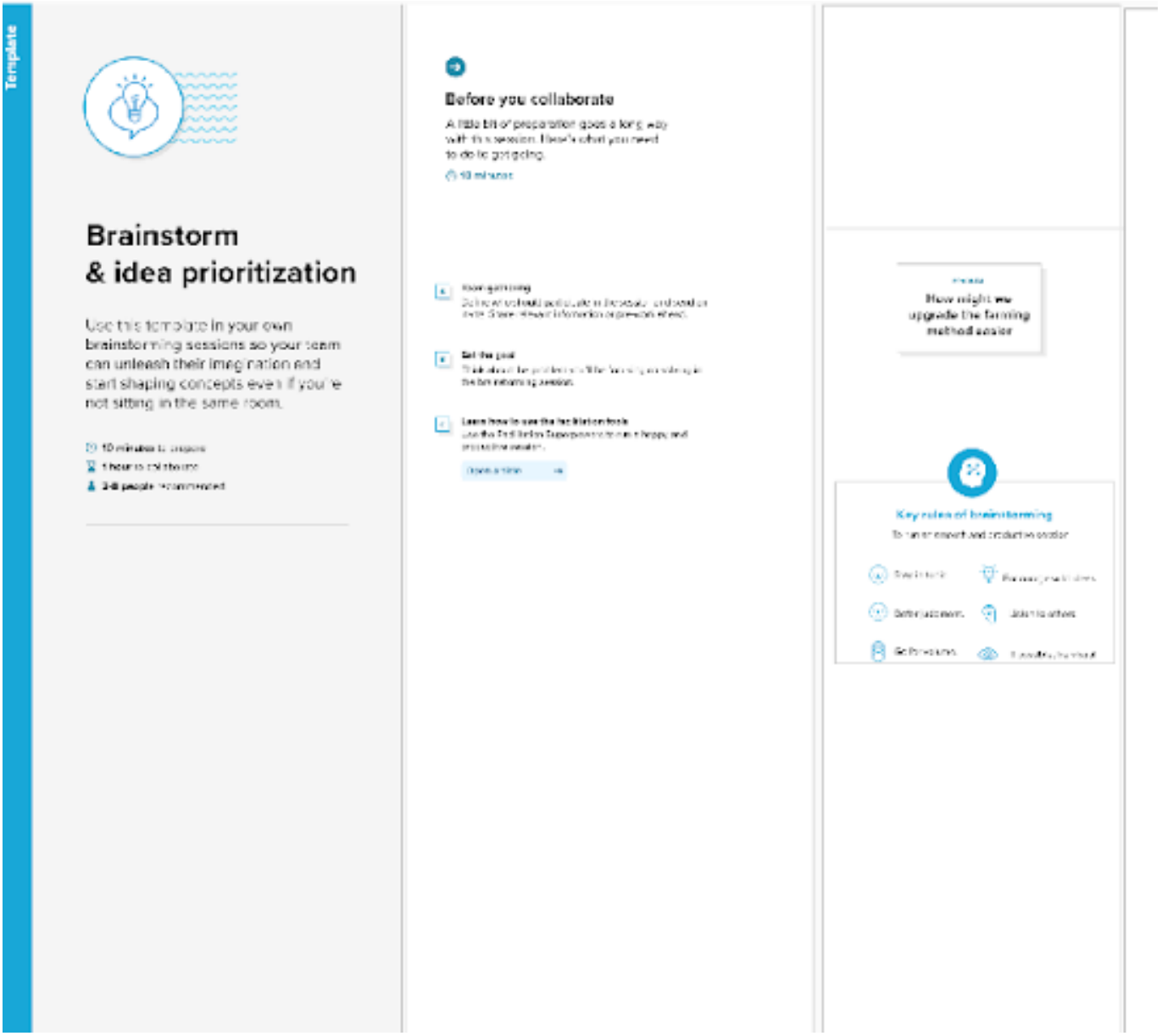
3.1 Empathy Map Canvas

An empathy map is a collaborative tool teams can use to gain a deeper insight into their customers.

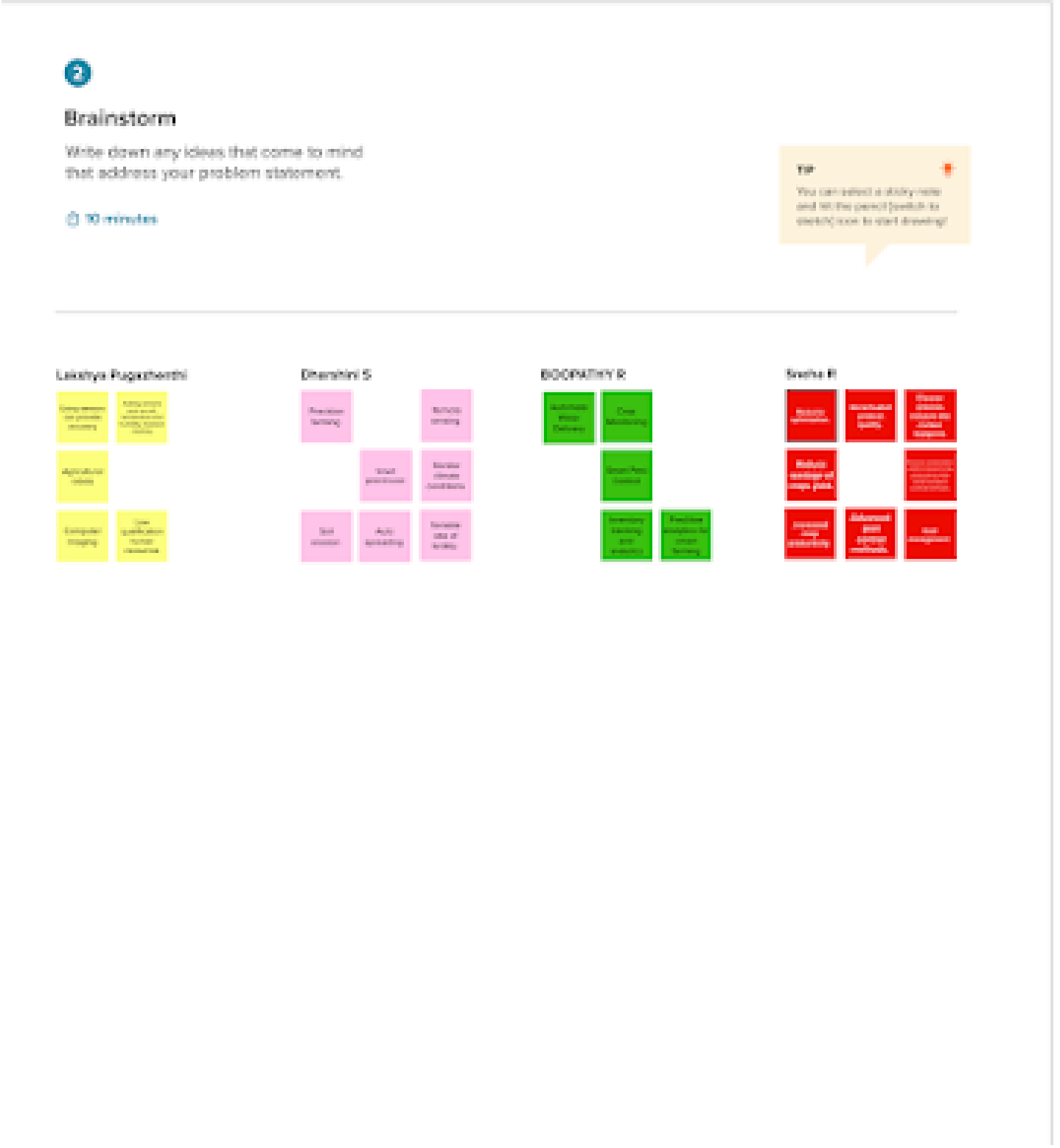
3.2 Ideation and Brainstorming

Brainstorm & Idea Prioritization:

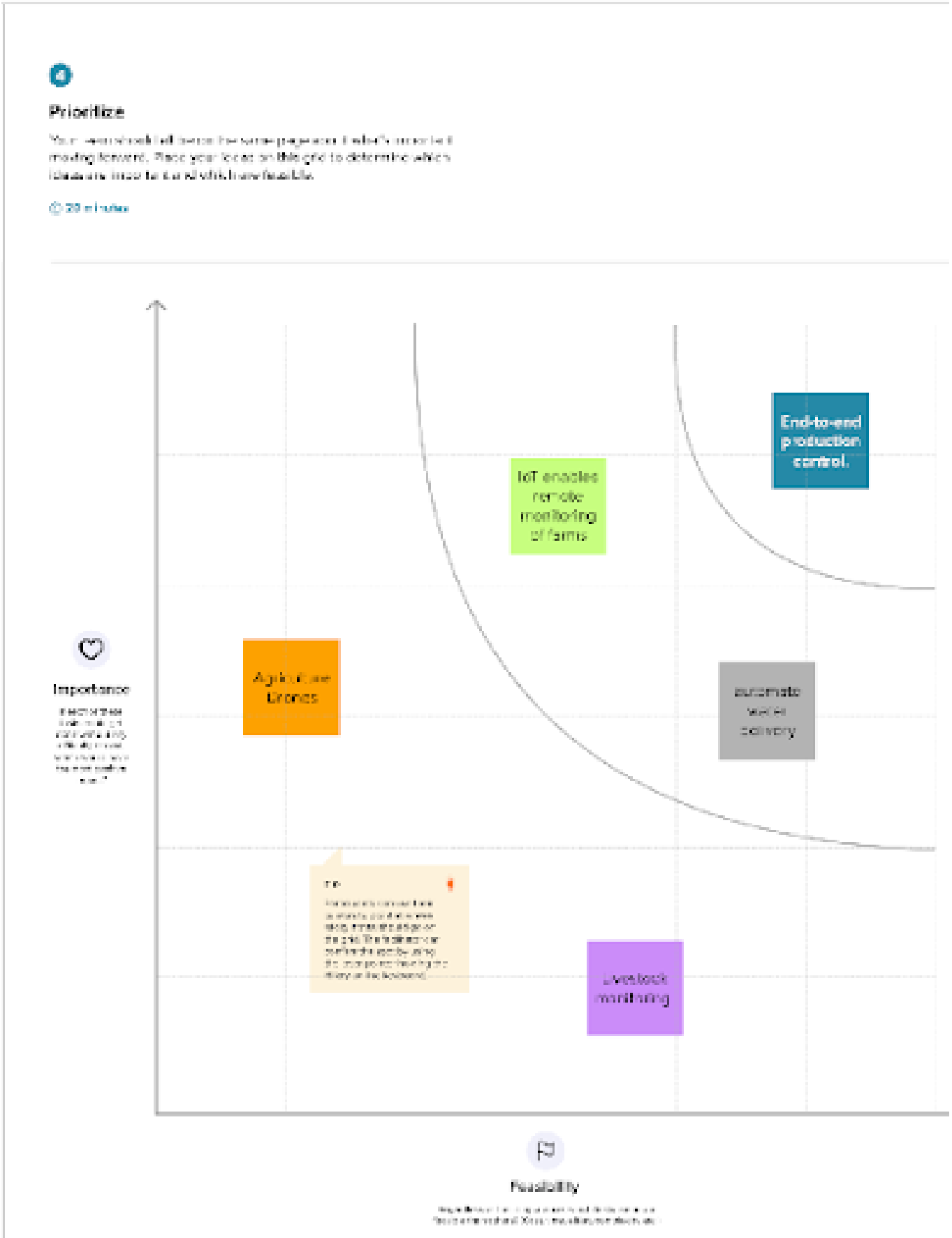
Step-1: Team Gathering, Collaboration and Select the Problem Statement:



Step-2: Brainstorm, Idea Listing and Grouping:



Step-3: Idea Prioritization:



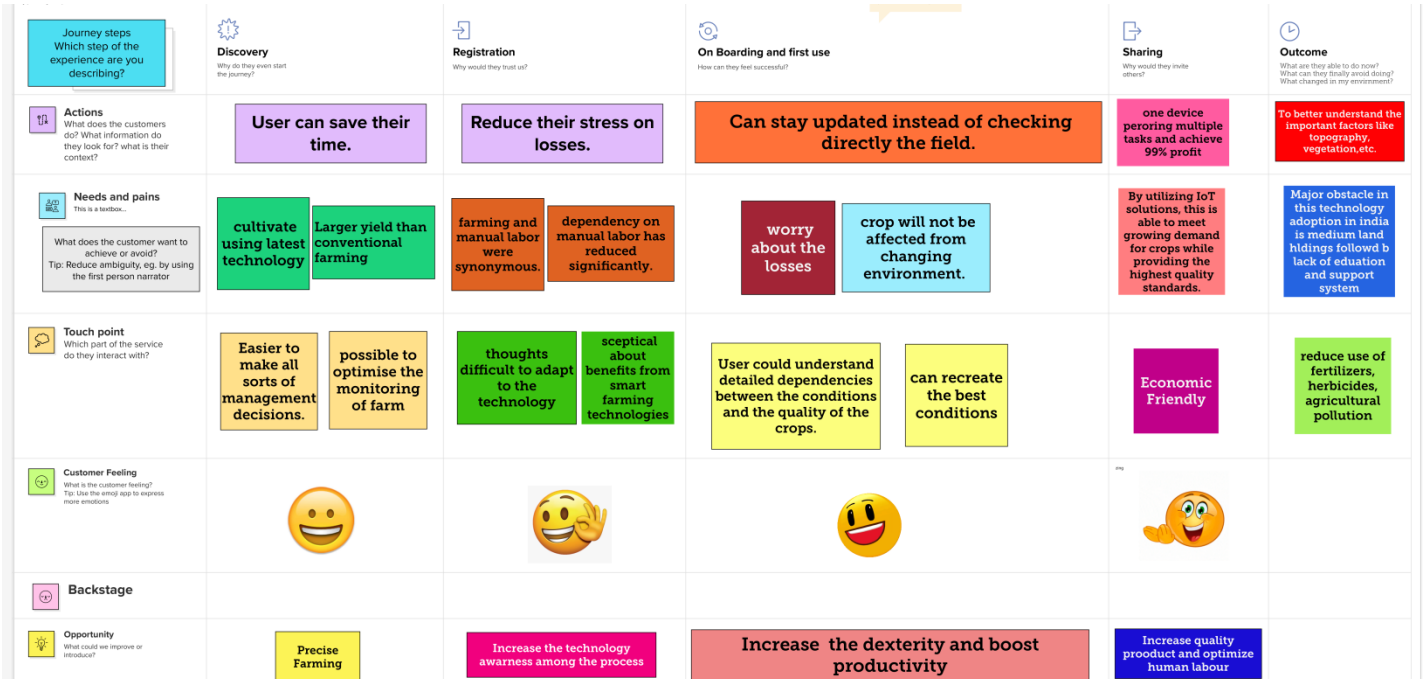
3.3 Proposed Solution

The proposed solution should relate the current situation to a desired result and describe the benefits that will accrue when the desired result is achieved. So, begin your proposed solution by briefly describing this desired result.

S.No.	Parameter	Description
1.	Problem Statement (Problem to be solved)	To make farming easier by choosing several constraints in agriculture and to overcome those constraints, to increase production quality and quantity using IOT.
2.	Idea / Solution description	Using smart techniques like monitoring farms climate, smart irrigation and soil analysis.
3.	Novelty / Uniqueness	Solar power smart irrigation system which helps you to monitor temperature, moisture, humidity, using smart sensors.
4.	Social Impact / Customer Satisfaction	This will be better than the present modern irrigation and user friendly application. There will be better production yield.
5.	Business Model (Revenue Model)	As the productivity increases customer satisfaction also increases and hence need for the application also increases, which can raise the income of the business.
6.	Scalability of the Solution	It is definitely scalable we can increase the Constraints when the problem arises.

3.4 Problem Solution fit

Problem-Solution canvas is a tool for entrepreneurs, marketers and a corporate innovator, which helps them identify solutions with higher chances for solution adoption, reduce time spent on solution testing and get a better overview of current situation.



4. REQUIREMENT ANALYSIS

4.1 Functional requirement

Functional requirements may involve calculations, technical details, data manipulation and processing and other specific functionality that define what a system is supposed to accomplish. Behavioral requirements describe all the cases where the system uses the functional requirements; these are captured in use cases.

FR No.	Functional Requirement (Epic)	Sub Requirement (Story / Sub-Task)
FR-1	**User Registration**	Registration through Username
FR-2	**User Confirmation**	Through password
FR-3	**Login to system**	Check credentials
FR-4	**Check details**	Temperature details Humidity details Soil Moisture details
FR-5	**Log out**	Exit

4.2 Non-Functional requirements

A Non-functional requirement (NFR) is a requirement that specifies criteria that can be used to judge the operation of a system, rather than specific behaviors.

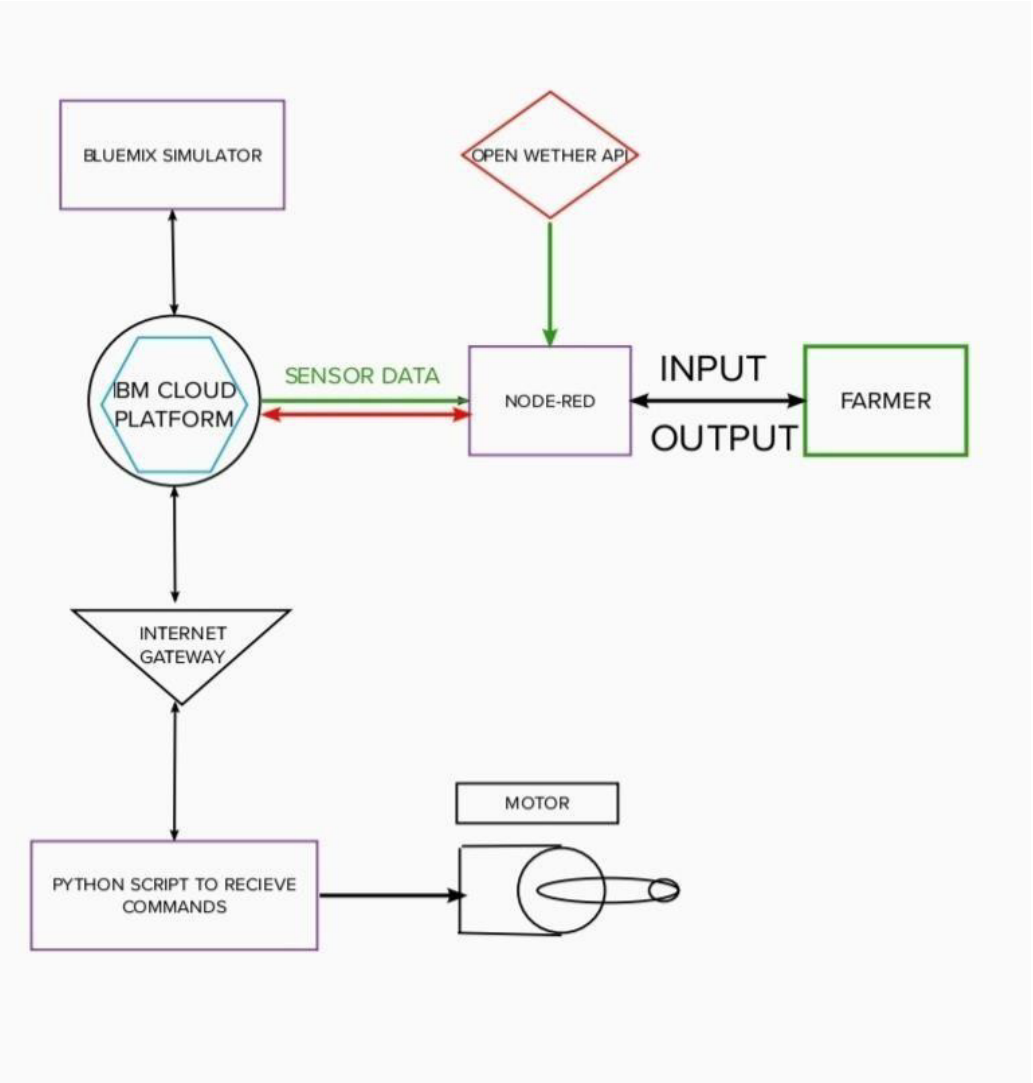
FR No.	Non-Functional Requirement	Description
NFR-1	**Usability**	• High productivity • Less time consumption • Easy to learn
NFR-2	**Security**	Sensitive and private data must be protected from their production until the decision making and storage stages
NFR-3	**Reliability**	Accuracy of data and hence it is Reliable.
NFR-4	**Performance**	The idea of implementing the integrated sensors with sensing soil and environmental or ambient parameters in farming will be more eminent for overall monitoring

NFR-5	**Availability**	Automatic adjustment of farming equipment made possible by linking information like crops, weather and equipment to auto adjust temperature, humidity, watering crops, etc.
NFR-6	**Scalability**	Scalability is a major concern for IoT platforms. It has shown that different architectural choices of IoT platforms a system scalability and that automatic real time decision making is feasible in an environment composed of dozens of thousands.

5. PROJECT DESIGN

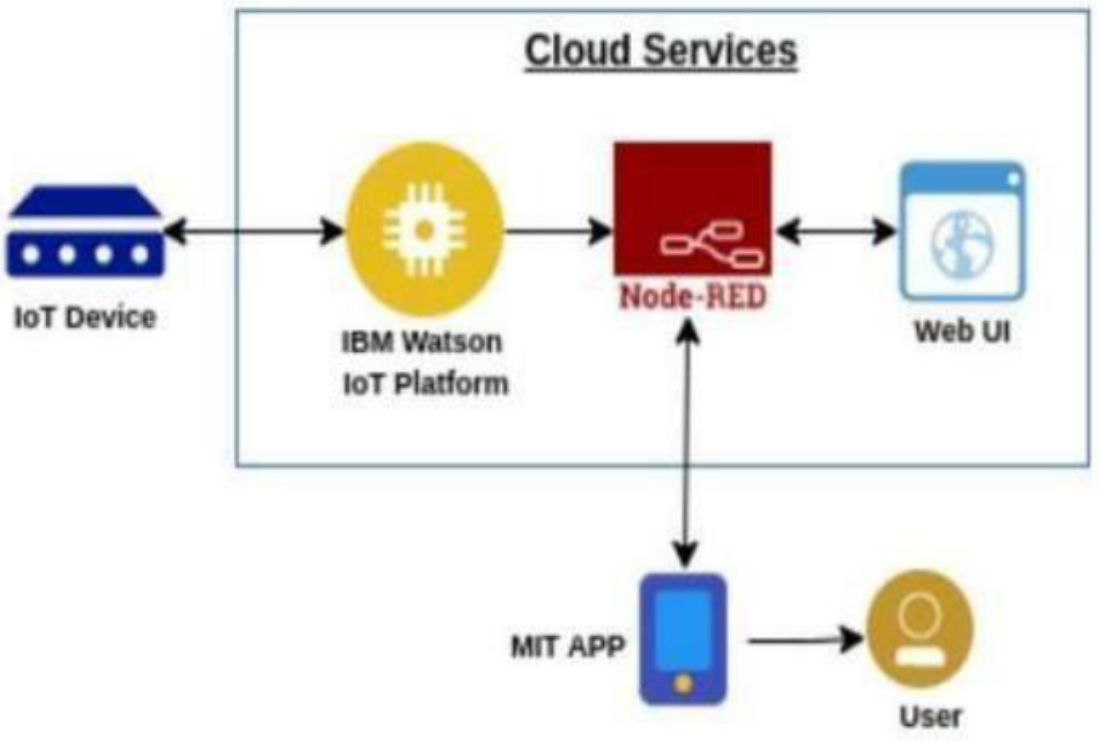
5.1 Data Flow Diagrams

A data flow diagram shows the way information flows through a process or system. It includes data inputs and outputs, data stores, and the various sub processes the data moves through. DFDs are built using standardized symbols and notation to describe various entities and their relationships.



5.2 Solution & Technical Architecture

Solution architecture (SA) is architectural description idea of a specific solution. SA's combine guidance from different enterprise architecture viewpoints (business, information and technical), as well as from the enterprise solution architecture (ESA).



5.3 User Stories

A user story is an informal, general explanation of a software feature written from the perspective of the end user or customer. The purpose of a user story is to articulate how a piece of work will deliver a particular value back to the customer.

6. PROJECT PLANNING & SCHEDULING:

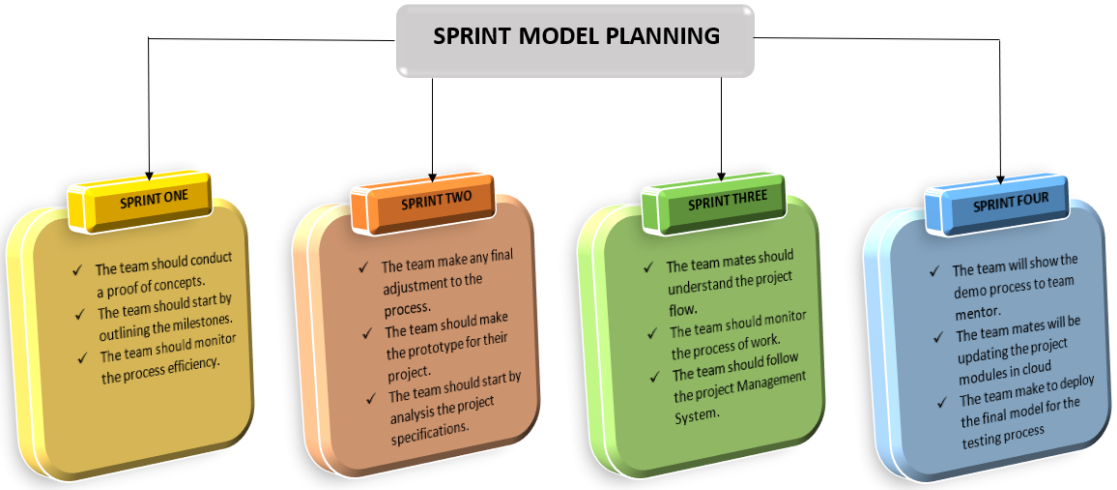
6.1 Sprint Planning & Estimation

The objective of the Estimation would be to consider the User Stories for the Sprint by Priority and by the Ability of the team to deliver during the Time Box of the Sprint.

Sprint	Functional Requirement (Epic)	User Story number	User Story / Task	Story Points	Priority	Team Members
Sprint-1	Software	USN-1	Sensors and Wi-Fi module with python code.	2	High	Lakshya, Dharshini, Boopathy Sneha
Sprint-2	Software	USN-2	IBM Watson IoT platform, Workflows for IoT scenarios using Node-red	2	High	Lakshya, Dharshini, Boopathy Sneha
Sprint-3	MIT app	USN-3	To develop an mobile application using MIT	2	High	Lakshya, Dharshini Boopathy Sneha
Sprint-4	Web UI	USN-4	To make the user to interact with software.	2	High	Lakshya, Dharshini Boopathy Sneha

6.2 Sprint Delivery Schedule

Delivery Plan

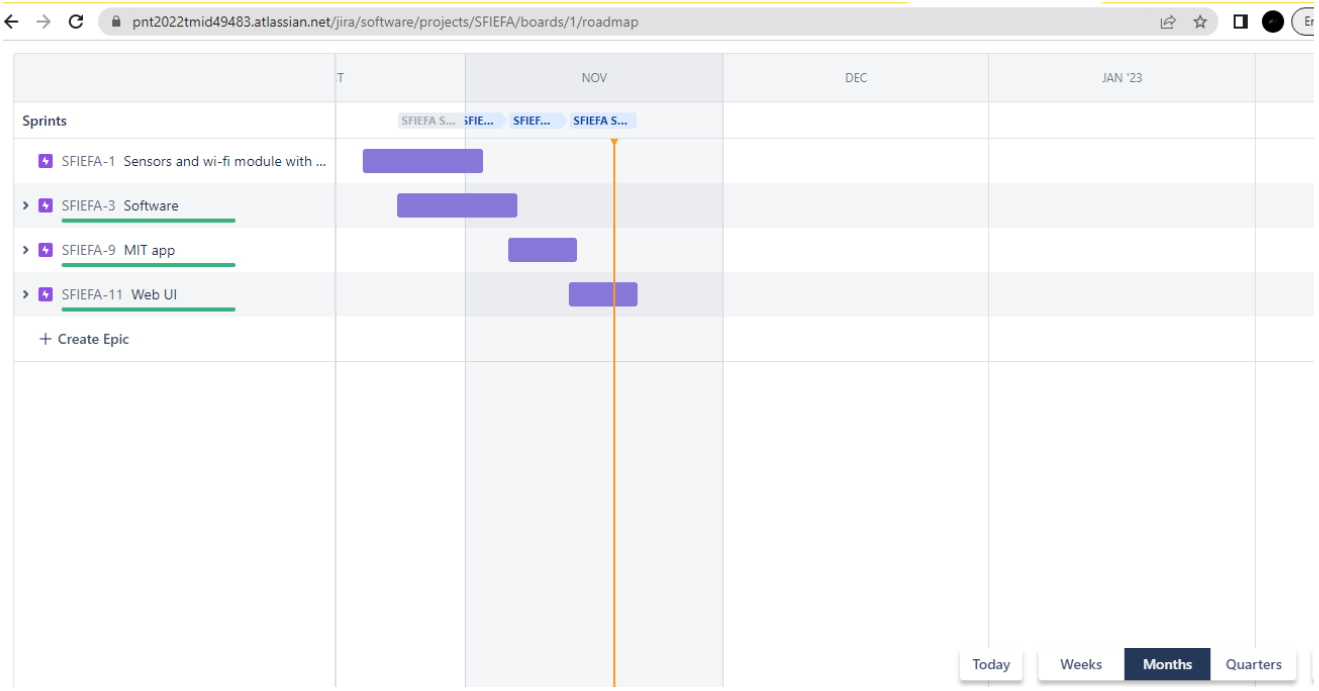


Sprint	Total Story Points	Duration	Sprint Start Date	Sprint End Date (Planned)	Story Points Completed (as on Planned End Date)	Sprint Release Date (Actual)
Sprint-1	20	6 Days	24 Oct 2022	29 Oct 2022	20	29 Oct 2022
Sprint-2	20	6 Days	31 Oct 2022	05 Nov 2022	20	5th NOV 2022
Sprint-3	20	6 Days	07 Nov 2022	12 Nov 2022	20	12th NOV 2022
Sprint-4	20	6 Days	14 Nov 2022	19 Nov 2022	20	14th NOV 2022

6.3 Reports from JIRA

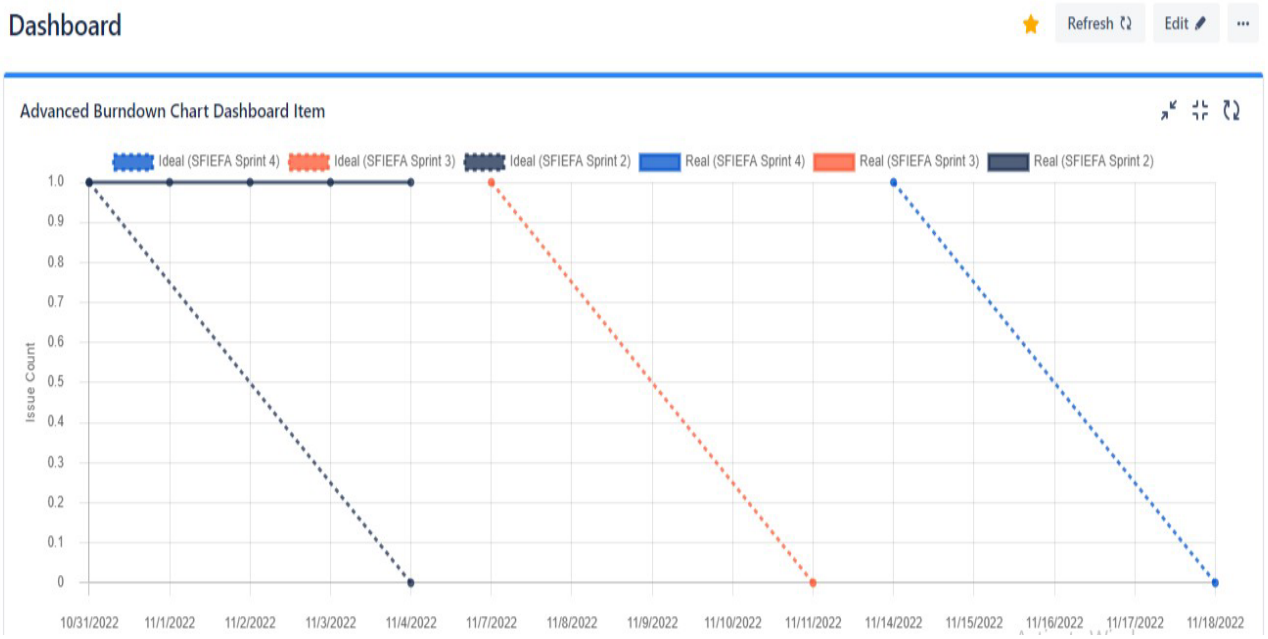
Jira Software is part of a family of products designed to help teams of all types manage work. Originally, Jira was designed as a bug and issue tracker. But today,
Jira has evolved into a powerful work management tool for all kinds of use cases, from requirements and test case management to agile software development.

Road Map:



Burndown Chart:

A burn down chart is a graphical representation of work left to do versus time. It is often used in agile software development methodologies such as Scrum. However, burn down charts can be applied to any project containing measurable progress over time.



7. CODING & SOLUTIONING:

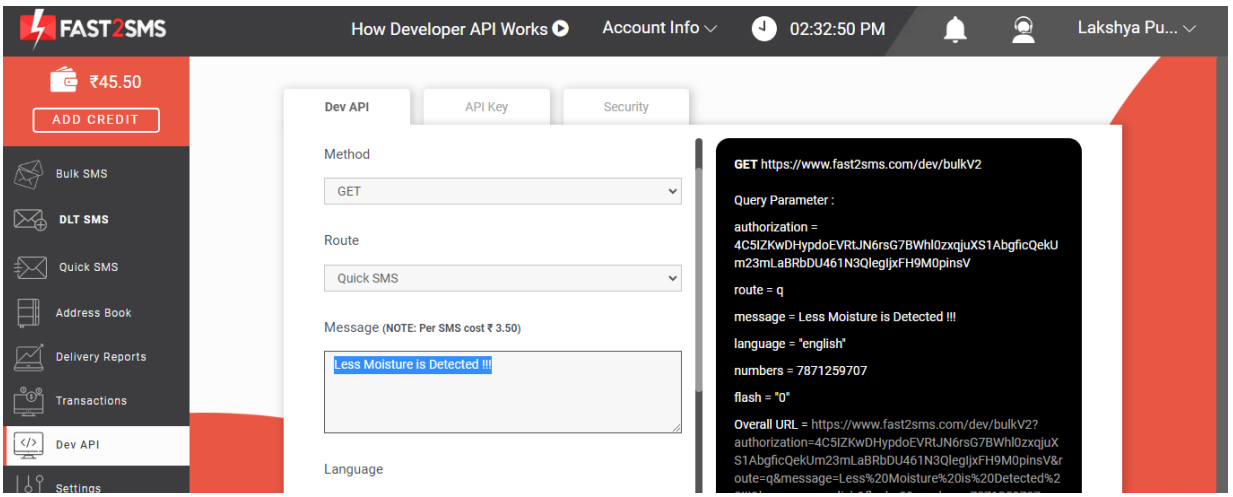
7.1 Feature-1

To indicate the less moisture level in the field, so that the user can switch on motor to reach the sufficient water level. We gave a condition using python:

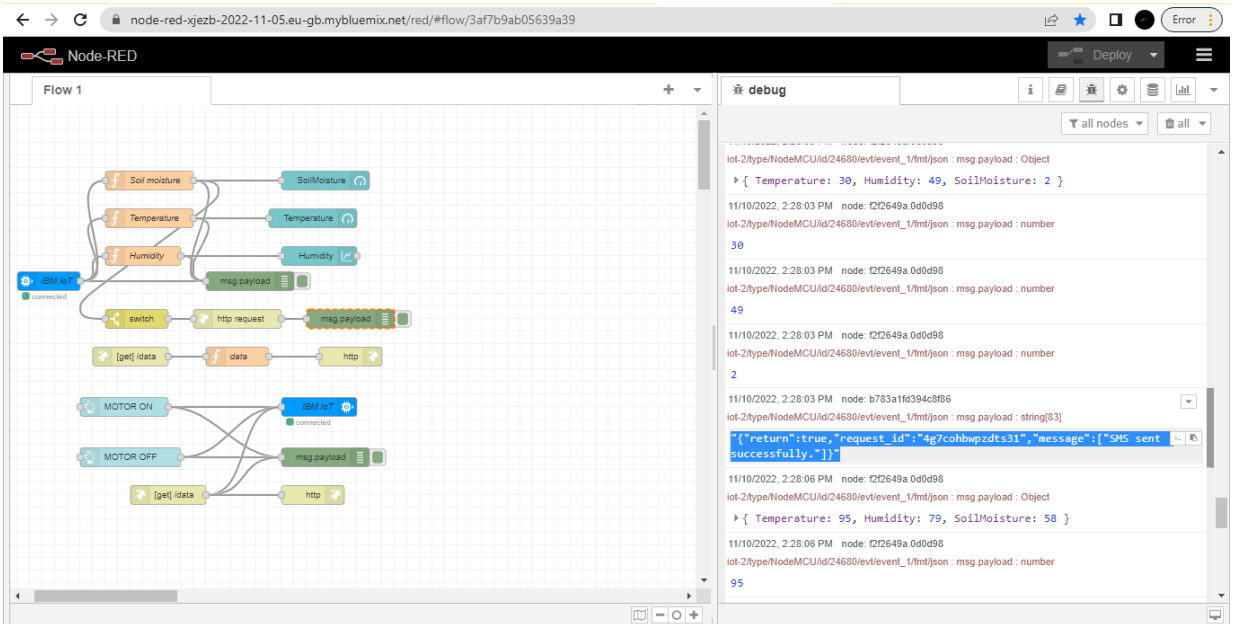
```
print("Published data Successfully: %s", myData)
  if(soil<20):
     print("Less moisture is detected")
  else:
     print("Moisture is sufficient")
```

7.2 Feature-2

We are using Fast2sms to send message to the user. Fast2SMS provides a very unique and useful feature which is not available in any other bulk SMS service provider. You can send SMS to DND and Non DND numbers even if you are not registered in the DLT portal.



After created the fast2sms service, copy the overall url and paste in the Node red flow to send SMS to whenever the moisture level went below the threshold limit.



8. TESTING

8.1 Test Cases

				Project Name	Smart Farmer-IoT enabled smart farming application								
				Maximum Marks	4 marks								
Test case ID	Feature Type	Component	Test Scenario	Pre-Requisite	Steps To Execute	Test Data	Expected Result	Actual Result	Status	Commnets	TC for Automation(Y/N)	BUG ID	Executed By
LoginPage_TC_OO1	Functional	Home Page	Verify user is able to see the Login/Signup popup when user clicked on Start button	MIT App Inventor	1.Open MIT application 2.Home page will appear. 3.Click on Start button.	http://ai2.appinventor.mit.edu/#6734083678666752	Login/Signup screen should display	Working as expected	Pass	Got the Exact Results	Yes	Nil	User
Database_TC_OO2	Functional	Firebase	Verify the Firebase	Firebase Account creation	1.Open Chrome 2.Search firebase 3.Create new form login project a.create account (if already not existed) and create realtime database. b.Create a program to store the credentials. 2.Publish the program to execute.	https://formlogin-283db-default-rtdb.firebaseio.com/	To Store and Get the value of username and password	Working as expected	Pass	Got the exact results	Yes	Nil	Developer
LoginPage_TC_OO3	Functional	Login/Signup Buttons	Verify user is able to log into application with Valid credentials	MIT App Inventor	1.Enter UserName and Password in the respected boxes. 2.Click on sign up to store the values. 3.Now click login to view the parameters. 4.If invalid password entered in password text box	Username and Password Text boxes. Username: device password: 123	User should able to view the parameters	working as expected	Pass	got the exact results	Yes	Nil	User

Shopenzer Testcases | Testscearnios

Test case ID	Feature Type	Component	Test Scenario	Pre-Requisite	Steps To Execute	Test Data	Expected Result	Actual Result	Status	Commnets	TC for Automation(Y/N)	BUG ID	Executed By
LoginPage_TC_OO4	Functional	Login page	Verify user is able to log into application with InValid credentials		1.Enter URL(https://shopenzer.com/) and click go 2.Click on My Account dropdown button 3.Enter Valid username/email in Email text box 4.Enter Invalid password in password text box	Username: dev password: 123	Application should show 'Incorrect email or password' validation message.	working as expected	pass	Got the exact results	yes	nil	User
TC-005	UI	Home Page	Verify whether the expected measurement sections are present and with default values	IBM cloud, Python IDLE,Node-Red,Fast2SMS	1.Navigate to the Soil Moisture UI 2.User should see the measurement fields for Temperature, Pressure, Humidity and SoilMoisture 3. All those fields should initially points to null value	Arduino board, ESP8266, Soil Moisture Sensor	Desired output.	Working as expected	Pass	Executed successfully	Yes	Nil	User
TC-006	Functional	Home Page	Verify the smoke sensor is detecting with good accuracy even with all	IBM cloud, Python IDLE,Node-Red,Fast2SMS	1.Navigate to the Soil Moisture UI 2. Check for the measurement accuracy	Arduino board, ESP8266, Soil Moisture Sensor	Desired output	Working as expected	Pass	Successful	No	Nil	User

Shopenzer Testcases | Testscearnios

8.2 User Acceptance Testing

1. Purpose of Document

The purpose of this document is to briefly explain the test coverage and open issues of the Smart Farmer IoT enabled smart farming application project at the time of the release to User Acceptance Testing (UAT).

2. Defect Analysis

This report shows the number of resolved or closed bugs at each severity level, and how they were resolved.

Resolution	Severity 1	Severity 2	Severity 3	Severity 4	Subtotal
Improper network connectivity	10	6	4	2	22
Humidity alone is detected.	12	10	6	4	32
Continuous Battery Consumption	20	9	5	2	36
Detection Coverage Area	14	6	2	2	24
Altering the Calibration Curve	20	9	7	6	42
Maintenance	11	3	2	1	17
Accuracy detection of parameters	17	9	6	3	35
Totals	104	52	32	20	208

3. Test Case Analysis

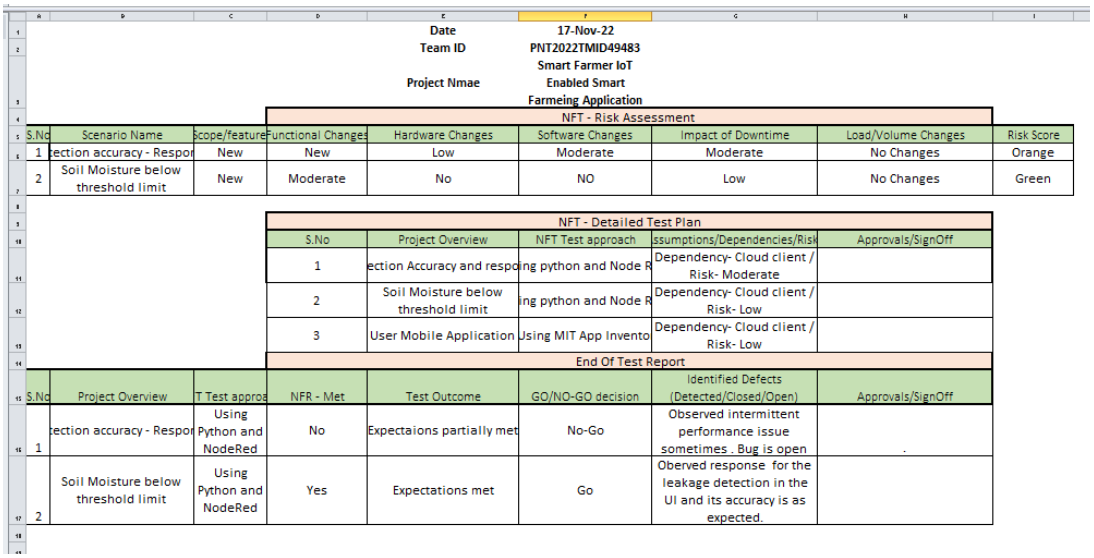
This report shows the number of test cases that have passed, failed, and untested

Section	Total Cases	Not Tested	Fail	Pass
Improper network connectivity	6	2	1	1
Humidity alone is detected.	15	0	0	15
Continuous Battery Consumption	12	0	0	12
Detection Coverage Area	5	0	1	4
Altering the Calibration Curve	4	0	0	4
Maintenance	5	0	0	5
Accuracy detection of parameters	1	0	0	1

9. RESULTS:

9.1 Performance Metrics

Performance metrics are defined as figures and data representative of an or ganization's actions, abilities, and overall quality.



Date	17-Nov-22
Team ID	PNT2022TMID49483
Project Nmae	Smart Farmer IoT Enabled Smart Farmeing Application

NFT - Risk Assessment

S.No	Scenario Name	Scope/feature	Functional Changes	Hardware Changes	Software Changes	Impact of Downtime	Load/Volume Changes	Risk Score
1	ection accuracy - Respor	New	New	Low	Moderate	Moderate	No Changes	Orange
2	Soil Moisture below threshold limit	New	Moderate	No	NO	Low	No Changes	Green

NFT - Detailed Test Plan

S.No	Project Overview	NFT Test approach	ssumptions/Dependencies/Risk	Approvals/SignOff
1	ection Accuracy and respo	ng python and Node R	Dependency- Cloud client / Risk- Moderate	
2	Soil Moisture below threshold limit	ing python and Node R	Dependency- Cloud client / Risk- Low	
3	User Mobile Application	Using MIT App Invento	Dependency- Cloud client / Risk- Low	

End Of Test Report

S.No	Project Overview	T Test approa	NFR - Met	Test Outcome	GO/NO-GO decision	Identified Defects (Detected/Closed/Open)	Approvals/SignOff
1	ection accuracy - Respor	Using Python and NodeRed	No	Expectaions partially met	No-Go	Observed intermittent performance issue sometimes . Bug is open	.
2	Soil Moisture below threshold limit	Using Python and NodeRed	Yes	Expectations met	Go	Oberved response for the leakage detection in the UI and its accuracy is as expected.	

10. ADVANTAGES & DISADVANTAGES:

Advantages

• Farms can be monitored and controlled remotely.

• Increase in convenience to farmers.

• Less labour cost.

• Better standards of living.

Disadvantages:

• Lack of internet/connectivity issues.

• Added cost of internet and internet gateway infrastructure.

• Farmers wanted to adapt the use of WebApp.

11.Conclusion

Thus the objective of the project to implement an IoT system in order to help farmers to control and monitor their farms has been implemented successfully.

12. Future Scope:

Therefore, smart farming has a real potential to deliver a more productive and sustainable form of agricultural production, based on a more precise and resource-efficient approach. New farms will finally realize the eternal dream of mankind.

13.Appendix:

13.1 Source Code

```
#IBM Watson IOT Platform
#pip install wiotp-sdk
import wiotp.sdk.device
import time
```

```
import random
#Provide your IBM Watson Device Credentials
myConfig = {
    "identity": {
        "orgId": "0lz4tn",
        "typeId": "NodeMCU",
        "deviceId":"24680"
    },
    "auth": {
        "token": "1133557799"
    }
}

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==motoroff):
        print("Motor is switched OFF")
    print(" ")

client = wiotp.sdk.device.DeviceClient(config=myConfig, logHandlers=None)
client.connect()

#Conditions
while True:
    temp=random.randint(0,100)
```

```
    hum=random.randint(0,100)
    soil=random.randint(0,100)
    myData={'Temperature':temp,
            'Humidity':hum,
        'SoilMoisture':soil}
            client.publishEvent(eventId="status",  msgFormat="json",  data=myData,
qos=0, onPublish=None)
    print("Published data Successfully: %s", myData)
    if(soil<20):
        print("Less moisture is detected")
    else:
        print("Moisture is sufficient")
    time.sleep(2)
    client.commandCallback = myCommandCallback
client.disconnect()
```

14. Bibliography

Github link: https://github.com/IBM-EPBL/IBM-Project-49483-1660820029

Project Demolink: https://drive.google.com/drive/folders/1tAnRgO7ZmH_nDLQptkTfXxP4ULZB93z3

MIT App Inventor: http://ai2.appinventor.mit.edu/#6734083678666752