PROJECT REPORT

SMART FARMER-IOT ENABLED SMART FARMING APPLICATION

Team ID:PNT2022TMID34110

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1.INTRODUCTION

1.1 Project Overview:

Internet of Things (IOT) technology has brought revolution to each and every field of common man's life by making everything smart and intelligent. IOT refers to a network of things which make a self-configuring network. The development of Intelligent Smart Farming IOT based devices is day by day turning the face of agriculture production by not only enhancing it but also making it cost-effective and reducing wastage. The aim / objective of this report is to propose IOT based Smart Farming System assisting farmers in getting Live Data (Temperature, Soil Moisture) for efficient environment monitoring which will enable them to increase their overall yield and quality of products. The IOT based Smart Farming System being proposed via this report is integrated with Arduino Technology mixed with different Sensors and a Wi-Fi module producing live data feed that can be obtained online from Thingsspeak.com. The product being proposed is tested on Live Agriculture Fields giving high accuracy over 98% in data feeds. The agriculture system proposed in this project is integrated with Node MCU technology consisting of various sensors which provide live on field data that can be obtained on android mobile phone.

1.2 Purpose:

IoT based Smart Farming improves the entire Agriculture system by monitoring the field in real-time. With the help of sensors and interconnectivity, 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. It keeps various factors like humidity, temperature, soil etc. under check and gives a crystal clear real-time observation.

2.LITERATURE SURVEY

2.1 Existing Solutions:

S. N0	TITLE	AUTHOR	YEAR & PUBLICATIONS	METHODOLOGY	ADVANTAGE	DRAWBACK
1	A Low-Cost Platform for Environmental Smart Farming Monitoring System Based on IoT and UAVs	Faris A. Almalki , Ben Othman Soufiene ,Saeed H. Alsamhi and Hedi Sakli	Multidisciplinary Digital Publishing Institute,2021	*A low-cost platform for environmental parameter monitoring using UAV–IoT for smart farming. *IoT devices can collect environmental data. * The data are sent to a gateway that is attached to a UAV and then transmitted to a cloud server. *Optimized propagation path loss is considered. *This platform is deployed and tested in a real scenario on a farm in Medenine, Tunisia	This low-cost platform can help farmers, governmental, or manufacturers to predict environmental conditions data over the geographically large farm field, which leads to enhancement of crop productivity and farm management in a cost-effective and timely manner.	*Power consumption of the drone should be optimized to enhance flight time. *Considering machine learningapproach would enhance actions to be taken autonomously
2	LoRaFarM : LoRaWAN-Based Smart Farming Modular IoT Architecture	Gaia Codelippi,Antonio Cilfone, Luca Davoli and Gianluigi Ferrari.	Multidisciplinary Digital Publishing Institute,2020	*LoRaFarM aimed at supporting the management of an arbitrary farm through the integration of heterogeneous IoT technologies. * Based on the LoRaWAN architecture. * Has been evaluated in a real farm in Italy.	*Collected environmental data(air/soil temperature and humidity) related to the growth of farm products over a period of three months. *Web-based dashboard is also presented, to validate the LoRaFarM architecture	*Cost of system * Power consumption

3	Advanced UAV-WSN system for Intelligent Monitoring in Precision Agriculture	Dan Popescu , Florin Stoican , Grigore Stamatescu , Loretta Ichim and Cristian Dragana	Multidisciplinary Digital Publishing Institute,2020	*The measurements are collected at the ground level by the local nodes. *A UAV must pass above the Cluster heads to extract the relevant data from that area. * The UAV sends the data to a central unit forback-end cloud computing processing decision.	*Intelligent data collection and processing. * Data Management and Interpretation level	*Intelligent data collection and processing. * Data Management and Interpretation level
4	Design & Implementation of Innovative IoT Based Smart Agriculture Management System For Efficient Crop Growth.	Korada Ratnakumari, Surapaneni Koteswari	Journal of Engineering Sciences,2020	*The system is capable of monitoring temperature, humidity, soil moisture level using NodeMCU. *A notification in the form of SMS will be sent to the farmer's phone about the environmental condition of the field.	*Monitoring temperature,humidity, soil moisture level *A notification in the form of SMS will be sent to farmer's phone	*Communication covering * Power consumption increases with communication range
5	Internet of things for smart farming and frost intelligent control in greenhouses	Alejandro Castañeda-Miranda (Dr.), Victor M. Castaño-Meneses (Dr.)	Elsevier,2020	*An intelligent antifrost irrigation management system is presented. *The system is self-sustaining using solar panels. *The ANN could be used to optimally predict the inside temperature of greenhouses. *FES controls the activation of a water pump	*Intelligent control with Weather Station and Artificial Neural Network. *The fuzzy control and ANN allow the prediction of the internal temperature of the greenhouse.	*Solar cell system is generally irregular and extensively influenced by the weather changes

6	A Low-Cost Wireless Mesh-based Smart Irrigation System	Nestor Michael Tiglao, Melchizedek Alipio, Jezy Verence Balanay, Eunice Saldivar, Jean Louise Tiston.	Elsevier,2020	*An application for water irrigation called Agrinex. *This application is connected to several in-field sensors such as a water level sensor, temperature sensor, and a field weather station. *The drip irrigation mechanism was utilized for feasibility reasons as water conserved was adequately measured.	Agrinex system features a mesh-like configuration of in-field nodes that act both as the sensor for soil moisture, temperature, and humidity and actuator on a valve that regulates drip irrigation.	*High power consumption in the case of the sensor nodes far from Sink.
7	Genetic Algorithm based Internet of Precision Agricultural Things (IopaT) for Agriculture 4.0	Sayan Kumar Roy, Debashis De.	Elsevier,2020	*Propose a system that will recommend whether water is needed or not by predicting the rainfall using a Genetic Algorithm. *If the moisture level of the soil crosses the predefined threshold value, then plant watering is performed by quadrotor UAV	A system that will recommend whether water is needed or not by predicting the rainfall using Genetic Algorithm	Gateway consumes more power because it is always awake.
8	A Framework for Agricultural Pest and Disease Monitoring based on Internet-of-Things and Unmanned Aerial Vehicles	Demin Gao, Quan Sun, Bin Hu and Shuo Zhang	Multidisciplinary Digital Publishing Institute,2020	*Framework for Agricultural Pest and Disease Monitoring Based on Internet of Things and UAV for providing profound insights into the specific relationship between the occurrence of pests/diseases and weather parameters. *The images captured by UAV are transmitted to the cloud for analyzing the degree of damage of pests and	The results demonstrate that wheat is susceptible to disease when the temperature is between 14 C and 16 C, and high rainfall decreases the spread of wheat powdery mildew.	*Power consumption of drone * Solar cell weight and size may restrict flight endurance

				diseases based on spectrum analysis technology		
9	Smart agriculture with internet of things in cornfields	Murtaza Cicio glu a, Ali Calhan	Elsevier,2020	*Heterogeneous IoT sensor nodes system to sense acoustic, rain, wind, light, temperature,and pH levels of the cornfields. *The system aims to achieve productive corn harvest in large-scale fields using a drone that gathers data and sends it to a gateway. *Simulation results offer maximum efficiency of soil, reduction workload, and disease and pest risk; besides optimizing irrigation, which all lead to better quality products at low cost	The system uses heterogeneous sensor nodes which are capable of sensing acoustic, rain, wind, light, temperature, and pH levels.	*Communication covering *Power consumption increases with communication range.

10	Smart Farming : IoT-Based Water Managing System	Anupama H S, Durga Bhavani A, Afra Zayab Fayaz, Allen Benny	International ajournal of Innovative Technology and Exploring Engineering(IJITEE),2020	* If the soil moisture goes below the threshold value thet indicates that the water is required for the plants. Hence,the pump automatically water the plants. * Soil moisture detector is connected to a power supply and Arduino UNO board. * The WiFi module is connected to the board and coupled with the laptop, which is used to give the appropriate instructions. * A LCD display is connected to all these components so as to display the required information about the overall status of the farm. * All the components are given commands through the WiFi module.	*This will help the farmers to reserve the water for later use. *Sensors are used to detect the water level. * Proper planning & necessary machines which is of low cost has to be used.	* It is used only for small farms because sensors whatever is been used will detect the moisture level for certain area

11	Smart farming using IoT, a solution for optimally monitoring farming conditions	Jash Doshi, Tirthkumar Patel, Santosh Kumar Bharti	Elsevier,2019	* The device monitors the farm or greenhouse and based upon the readings of different kind of sensors like temperature, humidity, soil moisture,UV,IR, soil nutrients and give different types of messages to the farmer about the present conditions so that the farmer can take quick action.	* Remote monitoring for farmers. * Water & other natural resource conservation. * Good management also aiiows improved livestock farming. * Good quality as well as improved quantity.	*The smart agriculture need availability on internet continuously rural part of developing countries did not fulfil this requirement *Fault sensors or data processing engines can cause faulty decisions which may lead to over use of water, fertilizers & otherw wastage of resources. *Smart farming based equipment require farmer to understand and learn the use of technology

2.2 References:

1.Codeluppi, G.; Cilfone, A.; Davoli, L.; Ferrari, G. LoRaFarM: A LoRaWAN-Based Smart Farming Modular IoT Architecture.

Sensors 2020, 20, 2028. [CrossRef] [PubMed]

2. Popescu, D.; Stoican, F.; Stamatescu, G.; Ichim, L.; Dragana, C. Advanced UAV–WSN System for Intelligent Monitoring in

Precision Agriculture. Sensors 2020, 20, 817. [CrossRef]

3. Ratnakumari, K.; Koteswari, S. Design & implementation of innovative IoT based smart agriculture management system for

efficient crop growth. J. Eng. Sci. 2020, 11, 607–616.

4. Castañeda-Miranda, A.; Castaño-Meneses, V.M. Internet of things for smart farming and frost intelligent control in greenhouses.

Comput. Electron. Agric. 2020, 176, 105614. [CrossRef]

5. Tiglao, N.M.; Alipio, M.; Balanay, J.V.; Saldivar, E.; Tiston, J.L. Agrinex: A low-cost wireless mesh-based smart irrigation system.

Measurement 2020, 161, 107874. [CrossRef]

6. Roy, S.K.; De, D. Genetic Algorithm based Internet of Precision Agricultural Things (IopaT) for Agriculture 4.0. Internet Things

2020, 100201. [CrossRef]

7.Cicio˘ glu, M.; Çalhan, A. Smart agriculture with internet of things in cornfields. Comput. Electr. Eng. 2021, 90, 106982. [CrossRef]

8. Gao, D.; Sun, Q.; Hu, B.; Zhang, S. A Framework for Agricultural Pest and Disease Monitoring Based on Internet-of-Things and

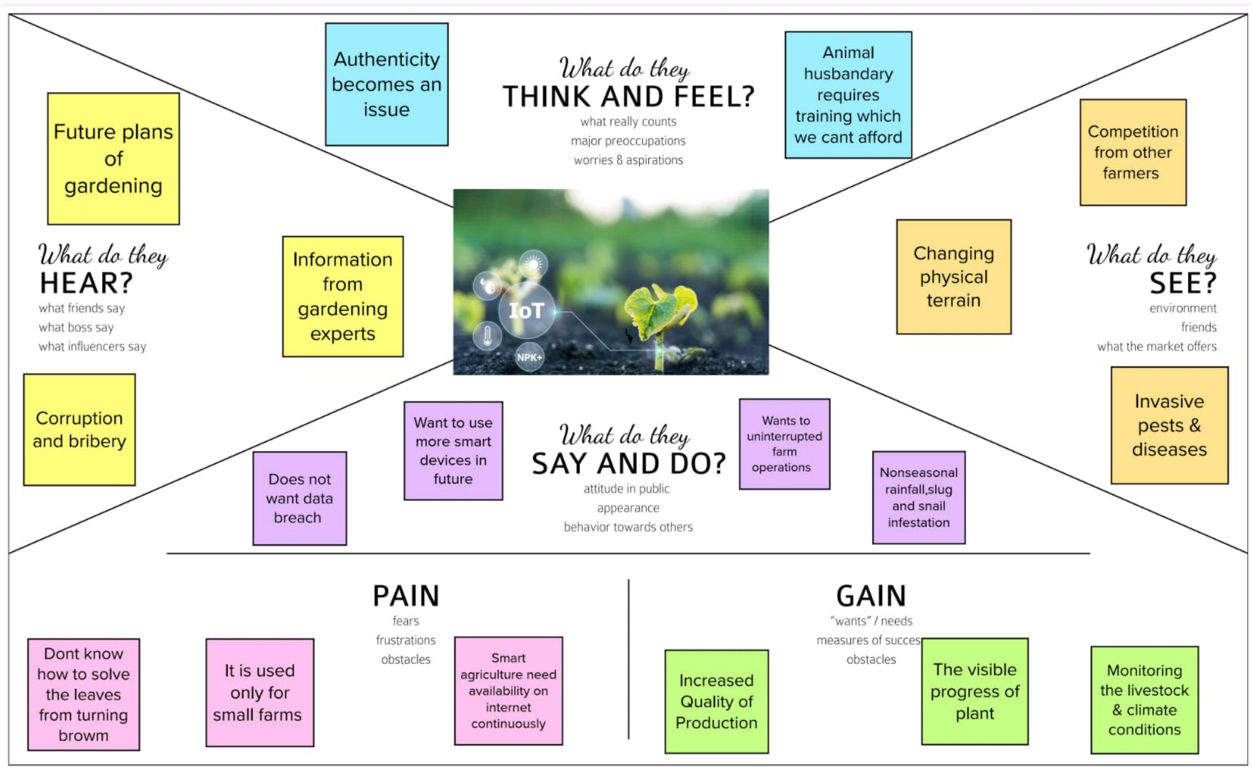
Unmanned Aerial Vehicles. Sensors 2020, 20, 1487. [CrossRef] [PubMed]

2.3 Problem statement definition:

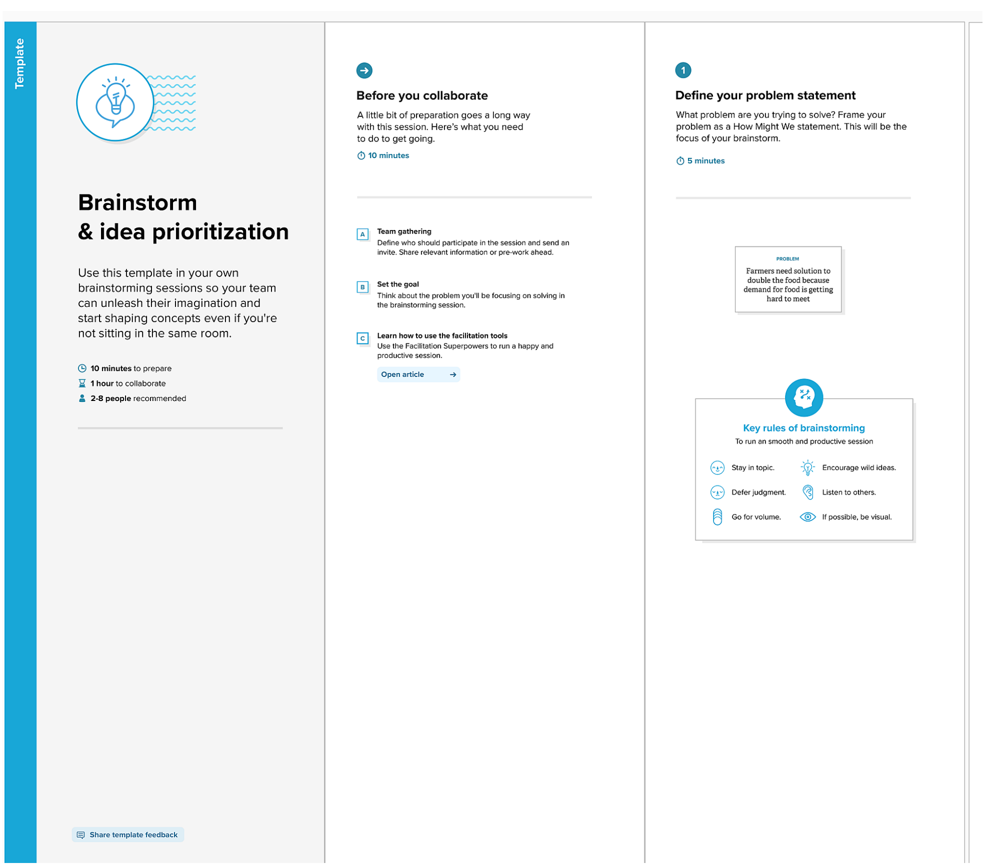
Farmers need to meet demand of food, regardless of environmental challenges like unfavorable weather conditions and climate change. To meet the needs of that growing population, the agriculture industry will have to adopt new technologies. Here comes the role of smart Farming. IoT-based smart farming is highly efficient. In IoT-based smart farming, a system is built for monitoring the crop field with the help of sensors (light, humidity, temperature, soil moisture, etc.) and automating the irrigation system. The farmers can monitor the field conditions from anywhere.

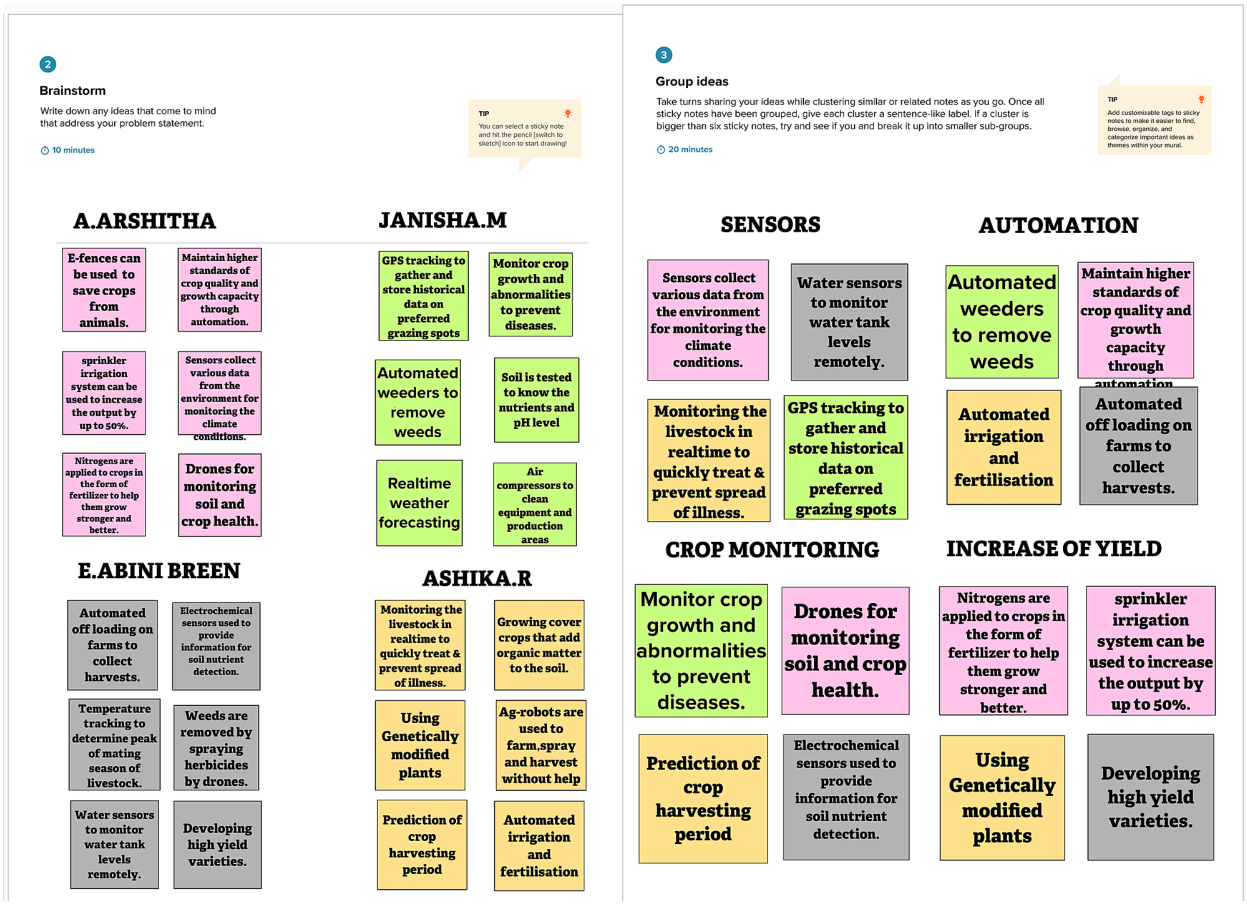
3.IDEATION & PROPOSED SOLUTION

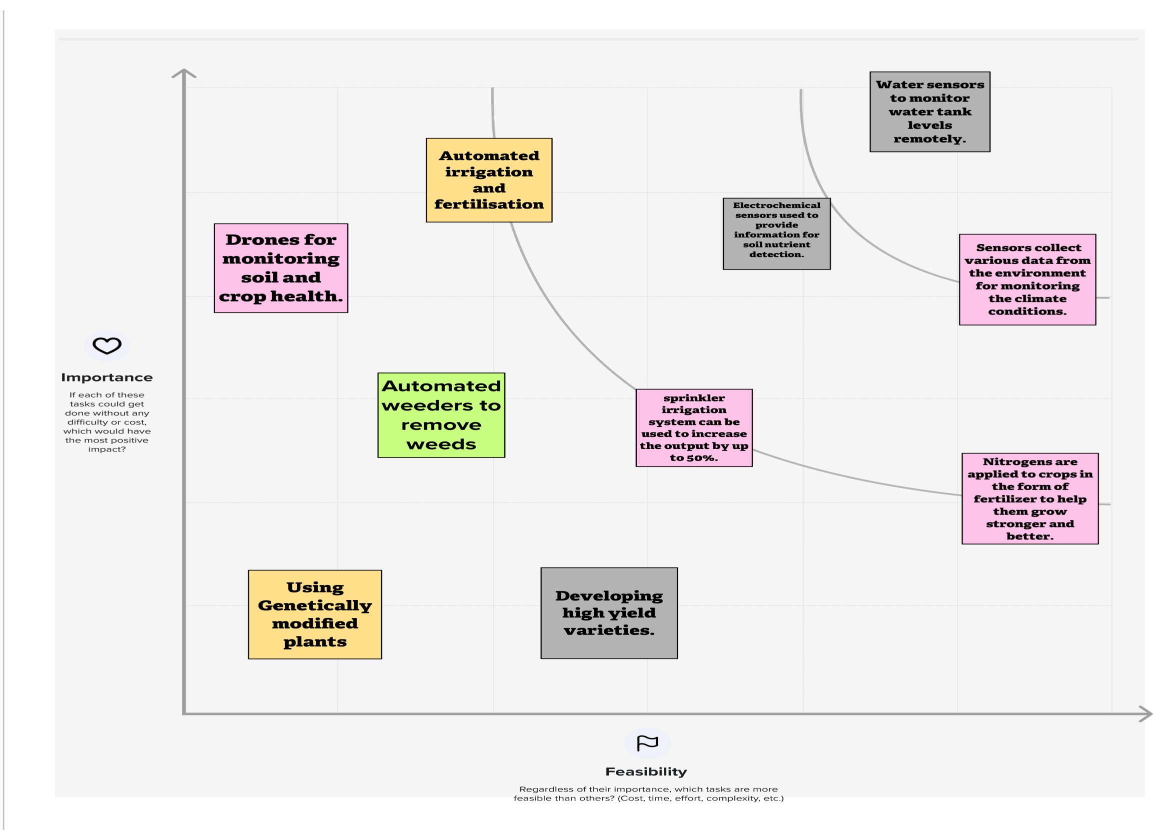
3.1 Empathy Map Canvas:



3.2 Ideation & Brainstorming:




2
Brainstorm
Write down any ideas that come to mind that address your problem statement.
10 minutes
TIP
You can select a sticky note and hit the pencil [switch to sketch] icon to start drawing!
A.ARSHITHA
E-fences can be used to save crops from animals.
Maintain higher standards of crop quality and growth capacity through automation.
sprinkler irrigation system can be used to increase the output by up to 50%.
Sensors collect various data from the environment for monitoring the climate conditions.
Nitrogens are applied to crops in the form of fertilizer to help them grow stronger and better.
Drones for monitoring soil and crop health.
JANISHA.M
GPS tracking to gather and store historical data on preferred grazing spots
Monitor crop growth and abnormalities to prevent diseases.
Automated weeders to remove weeds
Soil is tested to know the nutrients and pH level
Realtime weather forecasting
Air compressors to clean equipment and production areas
E.ABINI BREEN
Automated off loading on farms to collect harvests.
Electrochemical sensors used to provide information for soil nutrient detection.
Temperature tracking to determine peak of mating season of livestock.
Weeds are removed by spraying herbicides by drones.
Water sensors to monitor water tank levels remotely.
Developing high yield varieties.
ASHIKA.R
Monitoring the livestock in realtime to quickly treat & prevent spread of illness.
Growing cover crops that add organic matter to the soil.
Using Genetically modified plants
Ag-robots are used to farm,spray and harvest without help
Prediction of crop harvesting period
Automated irrigation and fertilisation
3
Group ideas
Take turns sharing your ideas while clustering similar or related notes as you go. Once all sticky notes have been grouped, 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
TIP
Add customizable tags to sticky notes to make it easier to find, browse, organize, and categorize important ideas as themes within your mural.
SENSORS
Sensors collect various data from the environment for monitoring the climate conditions.
Water sensors to monitor water tank levels remotely.
Monitoring the livestock in realtime to quickly treat & prevent spread of illness.
GPS tracking to gather and store historical data on preferred grazing spots
AUTOMATION
Automated weeders to remove weeds
Maintain higher standards of crop quality and growth capacity through automation
Automated irrigation and fertilisation
Automated off loading on farms to collect harvests.
CROP MONITORING
Monitor crop growth and abnormalities to prevent diseases.
Drones for monitoring soil and crop health.
Prediction of crop harvesting period
Electrochemical sensors used to provide information for soil nutrient detection.
INCREASE OF YIELD
Nitrogens are applied to crops in the form of fertilizer to help them grow stronger and better.
sprinkler irrigation system can be used to increase the output by up to 50%.
Using Genetically modified plants
Developing high yield varieties.


Water sensors to monitor water tank levels remotely.
Automated irrigation and fertilisation
Electrochemical sensors used to provide information for soil nutrient detection.
Drones for monitoring soil and crop health.
Sensors collect various data from the environment for monitoring the climate conditions.
Importance
If each of these tasks could get done without any difficulty or cost, which would have the most positive impact?
Automated weeders to remove weeds
sprinkler irrigation system can be used to increase the output by up to 50%.
Nitrogens are applied to crops in the form of fertilizer to help them grow stronger and better.
Using Genetically modified plants
Developing high yield varieties.
Feasibility
Regardless of their importance, which tasks are more feasible than others? (Cost, time, effort, complexity, etc.)

3.3 <u>Proposed Solution</u>:

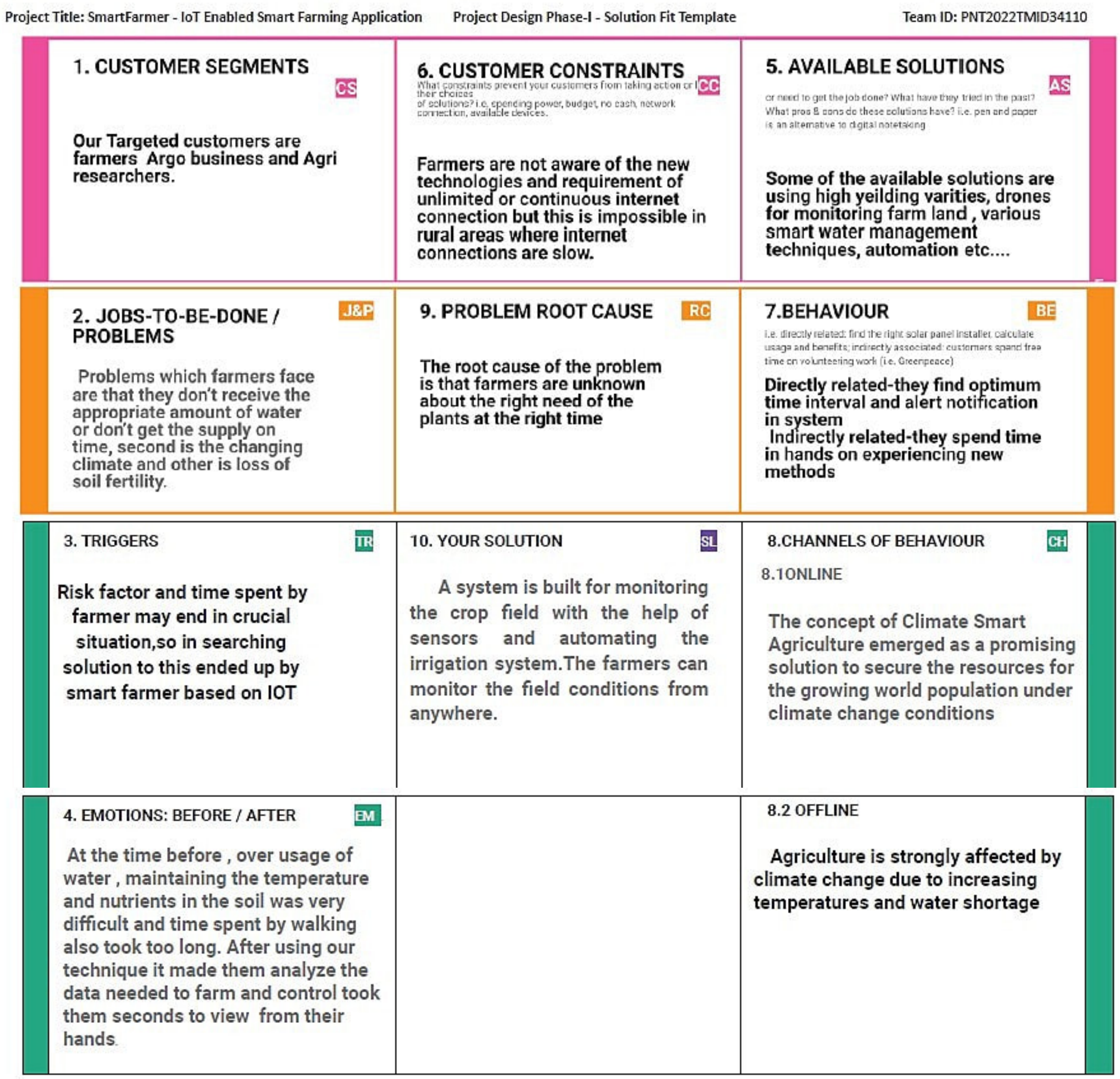
S.No.	Parameter	Description
1.	Problem Statement (Problem to be solved)	Farmer needs solution to double the food because demand for food is getting hard to meet.
2.	Idea / Solution description	Farmers need to meet demand of food, regardless of environmental challenges like unfavorable weather conditions and climate change. To meet the needs of that growing population, the agriculture industry will have to adopt new technologies. Here comes the role of smart Farming. IoT-based smart farming is highly efficient. In IoT-based smart farming, a system is built for monitoring the crop field with the help of sensors (light, humidity, temperature, soil moisture, etc.) and automating the irrigation system. The farmers can monitor the field conditions from anywhere.
3.	Novelty / Uniqueness	1. Sensors are used to sense the surroundings and collect information about the soil, temperature, humidity and so on. 2. The information collected from sensors are sent to IoT based cloud platforms for data analytics. 3. Based on the analysis done the farmers make relevant decisions to generate better outputs. 4. When the tasks are operated the cycle repeats itself from the beginning.

4.	Social Impact / Customer Satisfaction	1. The farmer does not even have to step on the field. 2. The cost of manual labour reduces. 3. Integrates and connects the entire farm to improve quality and quantity of crops and other produce. 4. Decrease in the waste generation and a phenomenal increase in productivity. 5. Increase in profitability by providing help to both farmers and consumers.

5.	Business Model (Revenue Model)	1. Key activities: > Product development >Platform development, integrationand maintain. 1. key resources: > Sensors > Cloud service(software) > IoT dedicated network > Digital platform 1. Value propositions: > Convenient > Customization > Performance 1. Customer relationships: > Self - service > Network effect > Support 1. Channels: > Internet > Mobile 1. Customer segments: > Farmers > Agribusinesses 1. Cost structure: > Digital infrastructure > Maintenance 1. Revenue streams: > Advertising > Subscription fees

6.	Scalability of the Solution	By using more gateways, tens of thousands of seniors we deployed easily. This capability is vital to support cases like temperature monitoring. Once the infrastructure is in place, it is vital that new applications can be added without the need to change or replace the infrastructure (gateways)

3.4 **<u>Problem solution fit:</u>**



Project Title: SmartFarmer - IoT Enabled Smart Farming Application   Project Design Phase-I - Solution Fit Template   Team ID: PNT2022TMID34110

1. CUSTOMER SEGMENTS CS

Our Targeted customers are farmers Argo business and Agri researchers.

6. CUSTOMER CONSTRAINTS CC

What constraints prevent your customers from taking action or l their choices of solutions? i.e. spending power, budget, no cash, network connection, available devices.

Farmers are not aware of the new technologies and requirement of unlimited or continuous internet connection but this is impossible in rural areas where internet connections are slow.

5. AVAILABLE SOLUTIONS AS

or need to get the job done? What have they tried in the past? What pros & cons do these solutions have? i.e. pen and paper is an alternative to digital notetaking

Some of the available solutions are using high yeilding varities, drones for monitoring farm land , various smart water management techniques, automation etc....

2. JOBS-TO-BE-DONE / PROBLEMS J&P

Problems which farmers face are that they don't receive the appropriate amount of water or don't get the supply on time, second is the changing climate and other is loss of soil fertility.

9. PROBLEM ROOT CAUSE RC

The root cause of the problem is that farmers are unknown about the right need of the plants at the right time

7.BEHAVIOUR BE

i.e. directly related: find the right solar panel installer, calculate usage and benefits; indirectly associated: customers spend free time on volunteering work (i.e. Greenpeace)

Directly related-they find optimum time interval and alert notification in system
Indirectly related-they spend time in hands on experiencing new methods

3. TRIGGERS TR

Risk factor and time spent by farmer may end in crucial situation,so in searching solution to this ended up by smart farmer based on IOT

10. YOUR SOLUTION SL

A system is built for monitoring the crop field with the help of sensors and automating the irrigation system.The farmers can monitor the field conditions from anywhere.

8.CHANNELS OF BEHAVIOUR CH

8.1ONLINE

The concept of Climate Smart Agriculture emerged as a promising solution to secure the resources for the growing world population under climate change conditions

4. EMOTIONS: BEFORE / AFTER EM

At the time before , over usage of water , maintaining the temperature and nutrients in the soil was very difficult and time spent by walking also took too long. After using our technique it made them analyze the data needed to farm and control took them seconds to view from their hands.

8.2 OFFLINE

Agriculture is strongly affected by climate change due to increasing temperatures and water shortage

4. REQUIREMENT ANALYSIS:

4.1 Functional requirement:

FR No.	Functional Requirement (Epic)	Sub Requirement (Story / Sub-Task)
FR-1	**Registration**	User need to register through Gmail and the module contains farmer's data which includes full names,farm location, type of crop grown, farm land area, town, state and mobile number. The farmer is also asked to create username and password.
FR-2	**User Confirmation**	OTP will be sent to the user's phone number for confirmation.
FR-3	**Selection of user's language**	This provides different languages which makes more widely accessible. The availability of regional languages breaks the language barrier and it delivers relevant information in the simplest form.
FR-4	**Subscription**	It is based on the location and area of user farmland as well as the period that the user uses.
FR-5	**Monitoring details**	1. The sensors are implanted on the user farmland by which farmers make informed decisions through customized information related to their needs. 2. The interface that provides a. Information on current weather and also forecast for the next 5 days. b. Information on the soil moisture level which turns ON and OFF the pipes of drip irrigation automatically.

FR-6	**Alerts and Popups**	1. It generates alerts on the farmer's mobile phone. 2. The information that can be transmitted through popups include weather forecasts and soil moisture level which helps the farmers to take timely action.
FR-7	**Rating**	Users can rate the app between 1-5,based on the satisfaction of the user.

4.2 <u>Non- Functional Requirements:</u>

FR No.	Non-Functional Requirement	Description
NFR-1	**Usability**	1. The app can be easily downloaded in mobile, laptop and desktop. 2. It is the most convenient and easy medium for the farmers to use. 3. The simple interface helps the farmers to get farm information.
NFR-2	**Security**	• The authentication is included for security features. User verification using username and password.
NFR-3	**Reliability**	1. It is accessible from anywhere with a network connection. 2. Access to accurate information in the field allows them to harness the power of data to make the best decisions for their operations. 3. Cloud based records eliminate the headache of storing, sorting and retrieving physical records.

NFR-4	**Performance**	1. Sensors are used to sense the surroundings and collect information about the soil, temperature, humidity and so on. 2. The information collected from sensors are sent to IoT based cloud platforms for data analytics. 3. Based on the analysis done the farmers make relevant decisions to generate better outputs. 4. When the tasks are operated the cycle repeats itself from the beginning.
NFR-5	**Availability**	1. Sensors are easy to operate and use and easy to maintain. 2. They are cheaper in price and best in quality which are easily available for the users. 3. Apps are very easy to use and are compatible with IOS and most android mobile devices.
NFR-6	**Scalability**	● By using more gateways,tens of thousands of sensors are deployed easily .This compatibility is vital to support cases like temperature monitoring. Once the infrastructure is in place, it is vital that new applications can be added without the need to change or replace the infrastructure(gateways).

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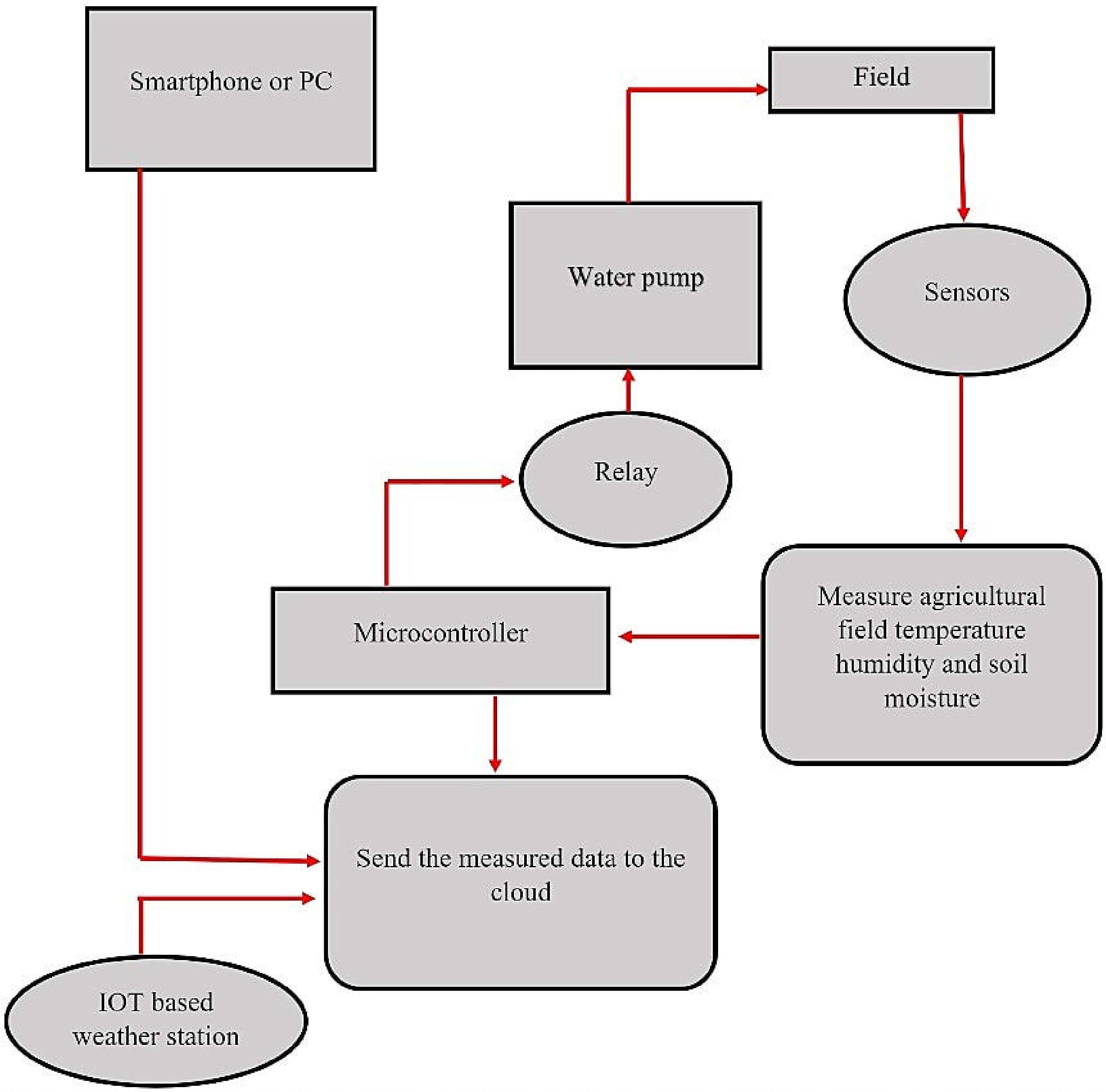
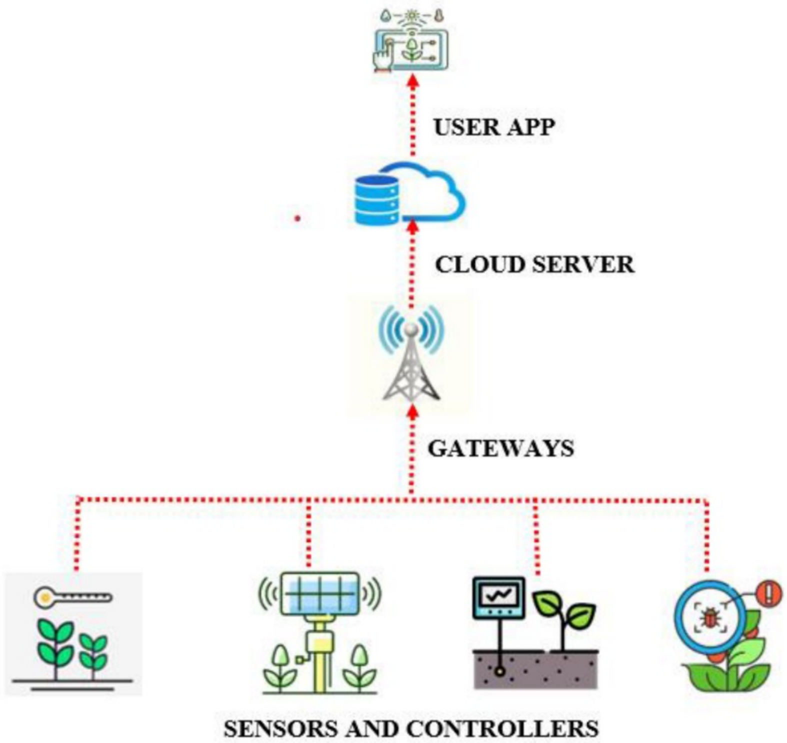
5. PROJECT DESIGN

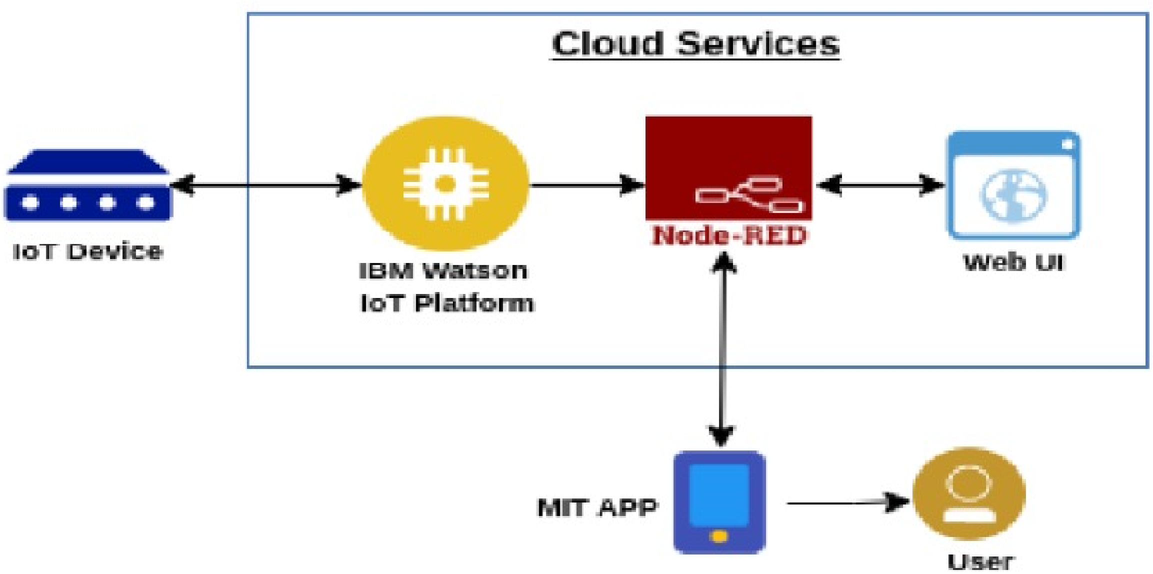
5.1 Data flow diagrams:



5.2 <u>Solution & Technical architecture:</u>

5.3 User stories:





5.3 User stories:

User Type	Functional Requirement (Epic)	User Story Number	User Story/Task	Acceptance criteria	Priority	Release
Customer	Registration	USN-1	As a user,I can register for the application through gmail and also by creating user name and password.	I can access my account /dashboard	High	Sprint
	Login	USN-2	As a admin, I can log into the application by entering my email and password.	I can handle my account	High	Sprint
		USN-3	As a user,I can reset my password if I have forgetten my password.	I can manage the password	High	Sprint
	My Account	USN-4	As a user,I can view my personal information.	I can handle my information	High	Sprint

		USN-5	As a user,I can edit my email.Iwill receive a confirmation email to my new email address.	I can access my new email	Medium	Sprint
		USN-6	As a user ,I can logout of the application from my account.	I can logout my account	High	Sprint
Administrator	Registration	USN-7	As a admin,I can assign username and password	Can access secure content	High	Sprint
	Login	USN-8	As a admin , I can request to login user	Ensuring security	High	Sprint

6.PROJECT PLANNING & SCHEDULING

6.1 Sprint Planning & Estimation:

Sprint	Functional Requirement (Epic)	User Story Number	User Story / Task	Priority	Story points	Team Members
Sprint-1	Login	USN-1	Develop an application with MIT app inventor (Login page)	High	**8**	Ashika.R
Sprint-1	Simulation	USN-2	Connect sensors and esp32	Medium	5	Abini Breen.E
Sprint-2	Software	USN-3	Develop a python script to publish random sensor data	Medium	3	Janisha.M
Sprint-2	Software	USN-4	Publish data to the IBM cloud	High	5	Arshitha.A
Sprint-2	Simulation	USN-5	Connect the circuit with the IBM Cloudant API integration	High	5	Ashika.R

Sprint-3	Simulation	USN-6	Establishing Node-RED connection	Medium	5	Janisha.M
Sprint-3	App development	USN-7	Application development using MIT app inventor	High	8	Ashika.R
Sprint-4	Simulation	USN-8	Connecting the developed application with Node-RED	High	3	Abini Breen.E
Sprint-4	App development	USN-9	Testing the developed application	High	5	Arshitha.A

6.2 Sprint Delivery Schedule:

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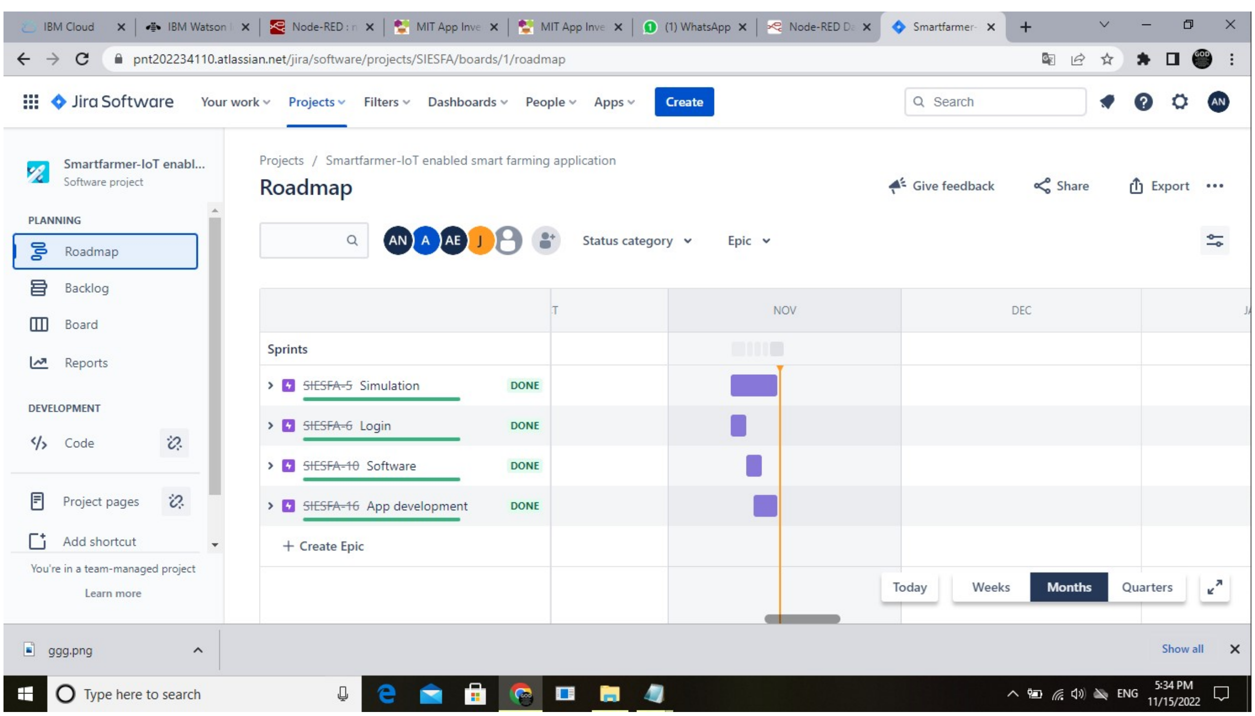
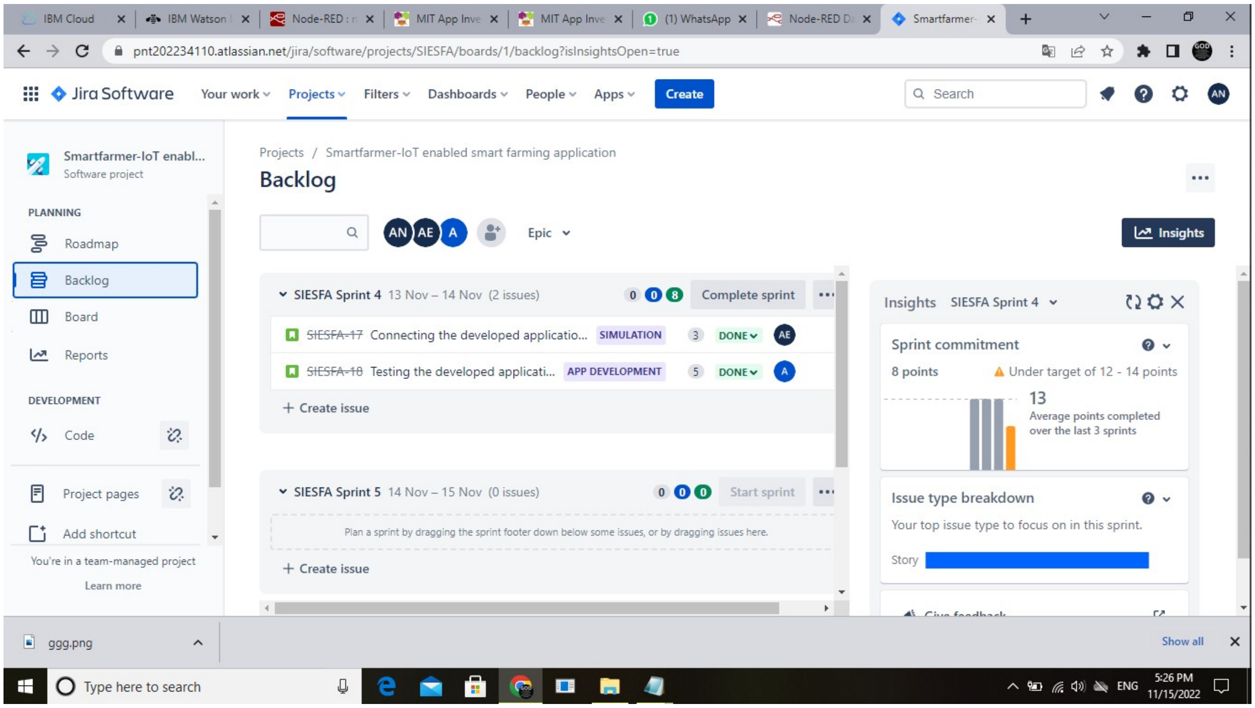
Sprint	Total Story Points	Duration	Sprint Start Date	Sprint End Date (Planned)	Sprint Release Date (Actual)
Sprint-1	13	6 Days	24 Oct 2022	29 Oct 2022	12 Nov 2022
Sprint-2	13	6 Days	31 Oct 2022	05 Nov 2022	13 Nov 2022
Sprint-3	13	6 Days	07 Nov 2022	12 Nov 2022	14 Nov 2022
Sprint-4	4	6 Days	14 Nov 2022	19 Nov 2022	14 Nov 2022

6.3 Reports from JIRA:

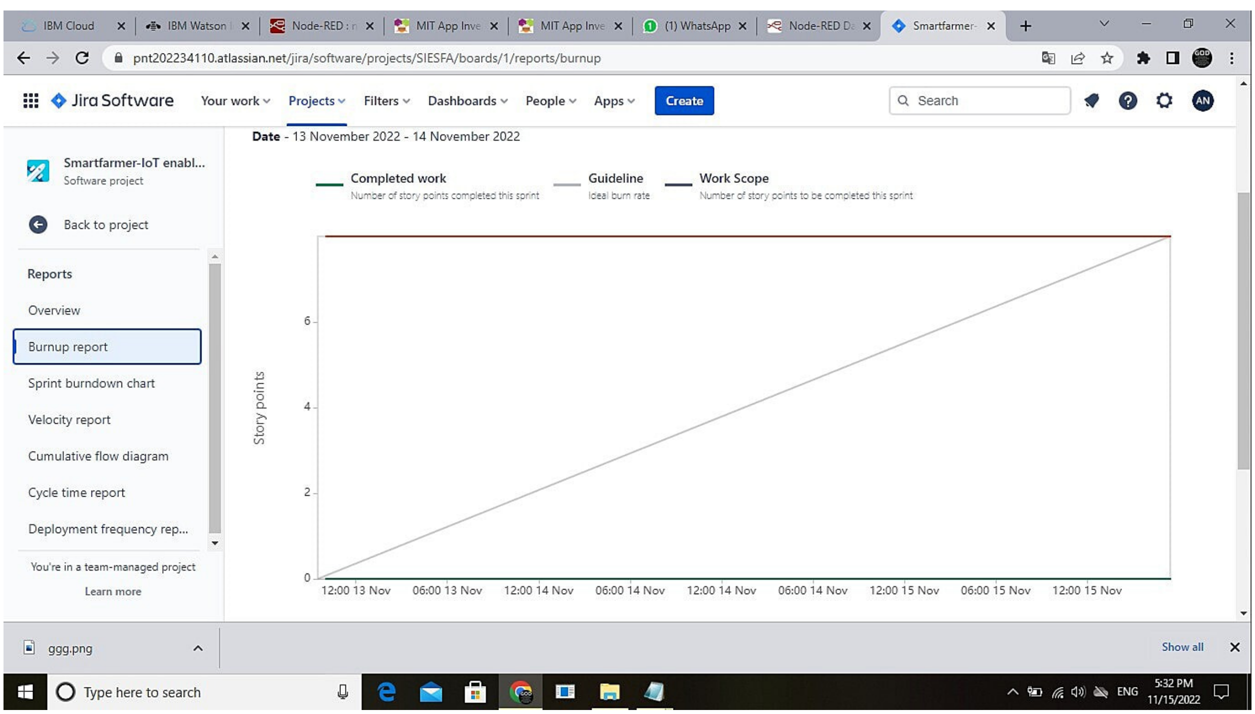
Roadmap:



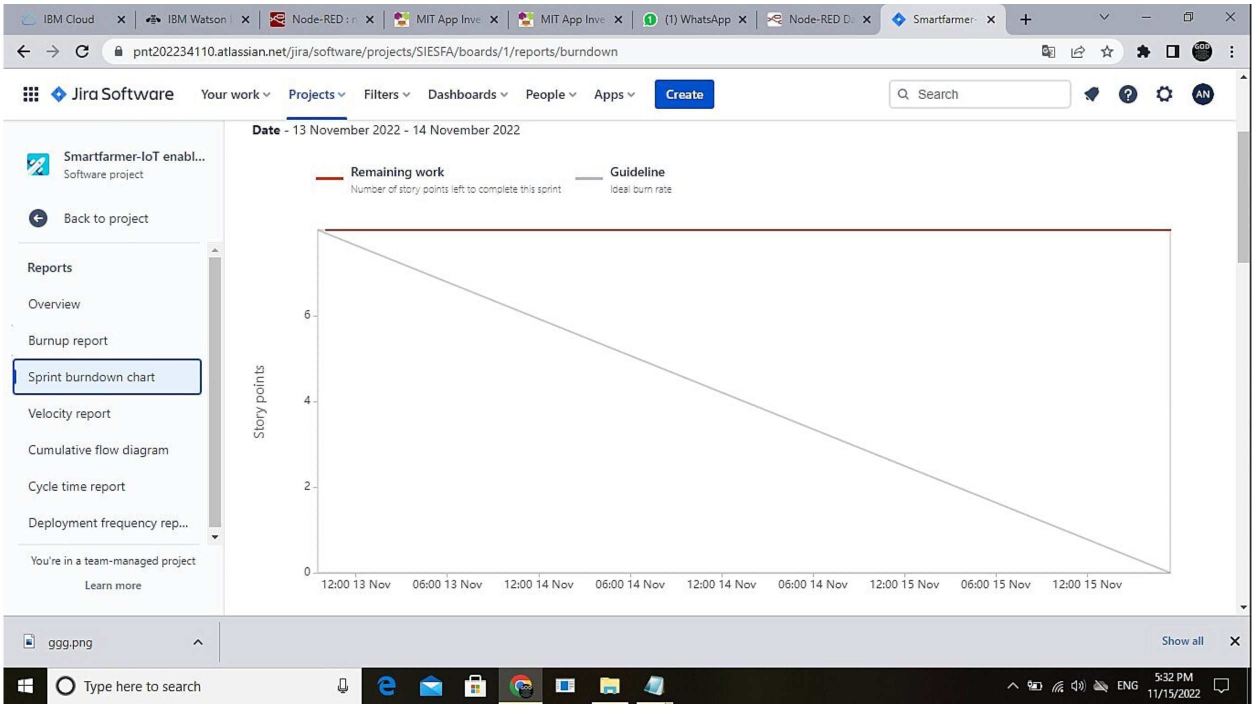
Sprint completion:



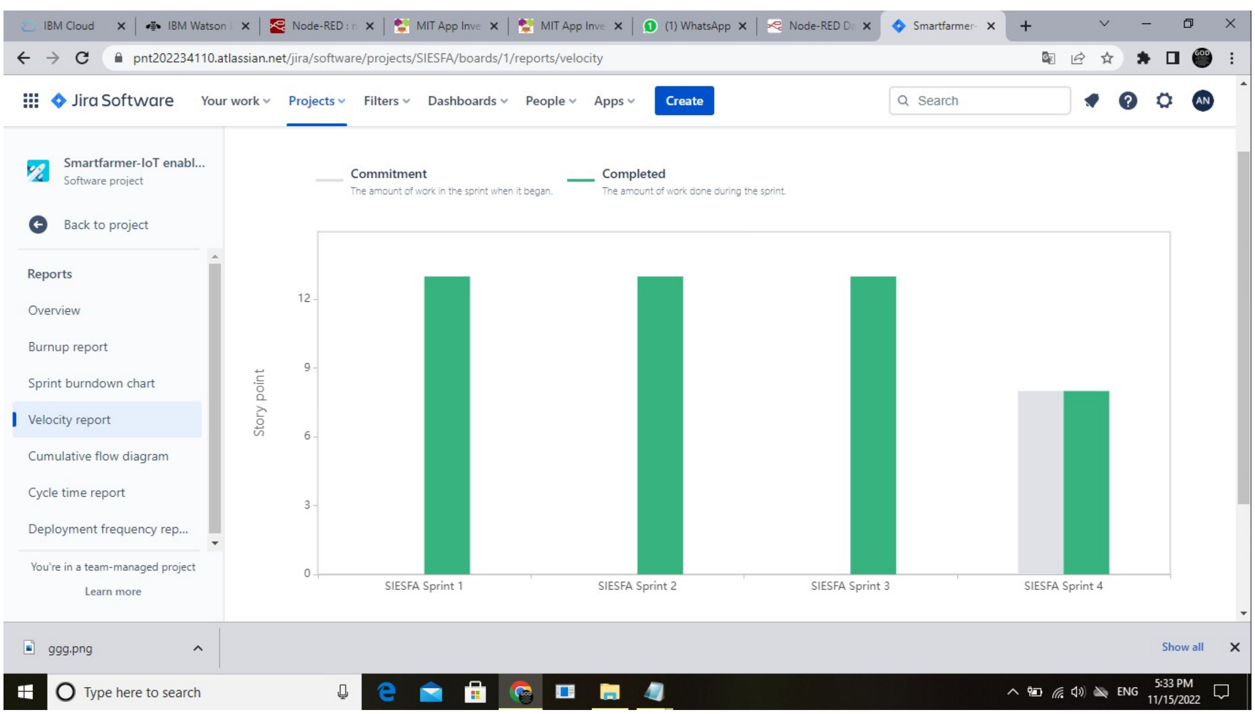
Burnup chart:



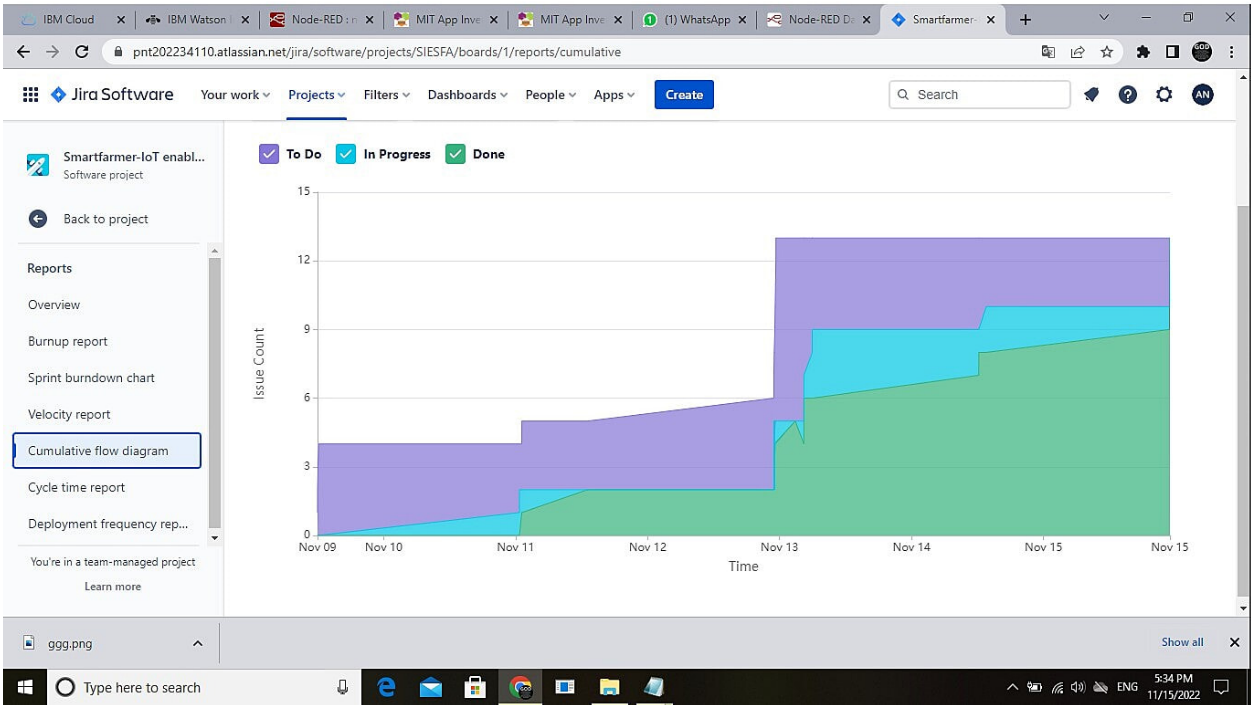
Sprint burndown chart :



Velocity report :



Cumulative diagram:



7.CODING & SOLUTIONING

7.1 Feature 1:

```
import time
import sys
import ibmiotf.application
import ibmiotf.device
import random
#Provide your IBM Watson Device Credentials
organization = "6pjvs7"
deviceType = "Arshidevicetype"
deviceId = "Arshideviceid"
```

```
authMethod = "token"
authToken = "tGfGvVl-F2luRl2bsG"
# Initialize GPIO  def
myCommandCallback(cmd):
                                        print("Commandreceived:%s"%cmd.data['command'])
status=cmd.data['command']
if status=="lighton":
         print ("led is on")
else :
       print ("led is off")
#print(cmd)
 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(0,100)
       Humid=random.randint(0,100)
       data = { 'Temperature' : temp, 'Humidity': 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(1)
  deviceCli.commandCallback = myCommandCallback
# Disconnect the device and application from the cloud
  deviceCli.disconnect()
```

7.1.1 Output:

```
*Python 3.7.0 Shell*
File Edit Shell Debug Options Window Help
Published Temperature = 90 C Humidity = 93 % soilmoisture=76 % to IBM Watson
Published Temperature = 108 C Humidity = 63 % soilmoisture=76 % to IBM Watson
Published Temperature = 110 C Humidity = 61 % soilmoisture=86 % to IBM Watson
Published Temperature = 108 C Humidity = 71 % soilmoisture=83 % to IBM Watson
Command received: motoron
motor is on
Published Temperature = 106 C Humidity = 81 % soilmoisture=101 % to IBM Watson
Published Temperature = 108 C Humidity = 76 % soilmoisture=79 % to IBM Watson
Published Temperature = 90 C Humidity = 89 % soilmoisture=53 % to IBM Watson
Published Temperature = 109 C Humidity = 64 % soilmoisture=115 % to IBM Watson
Published Temperature = 94 C Humidity = 95 % soilmoisture=63 % to IBM Watson
Published Temperature = 100 C Humidity = 82 % soilmoisture=74 % to IBM Watson
Published Temperature = 97 C Humidity = 65 % soilmoisture=63 % to IBM Watson
Published Temperature = 106 C Humidity = 90 % soilmoisture=65 % to IBM Watson
Published Temperature = 104 C Humidity = 86 % soilmoisture=91 % to IBM Watson
Published Temperature = 101 C Humidity = 87 % soilmoisture=100 % to IBM Watson
Published Temperature = 101 C Humidity = 82 % soilmoisture=78 % to IBM Watson
Published Temperature = 100 C Humidity = 76 % soilmoisture=88 % to IBM Watson
Published Temperature = 105 C Humidity = 66 % soilmoisture=96 % to IBM Watson
Published Temperature = 98 C Humidity = 97 % soilmoisture=73 % to IBM Watson
Published Temperature = 110 C Humidity = 94 % soilmoisture=81 % to IBM Watson
Published Temperature = 104 C Humidity = 66 % soilmoisture=119 % to IBM Watson
Published Temperature = 97 C Humidity = 88 % soilmoisture=70 % to IBM Watson
Published Temperature = 104 C Humidity = 71 % soilmoisture=116 % to IBM Watson
Published Temperature = 98 C Humidity = 84 % soilmoisture=111 % to IBM Watson
Published Temperature = 99 C Humidity = 98 % soilmoisture=75 % to IBM Watson
Published Temperature = 104 C Humidity = 87 % soilmoisture=57 % to IBM Watson
Published Temperature = 96 C Humidity = 92 % soilmoisture=97 % to IBM Watson
Published Temperature = 92 C Humidity = 70 % soilmoisture=70 % to IBM Watson
Published Temperature = 106 C Humidity = 79 % soilmoisture=68 % to IBM Watson
Published Temperature = 96 C Humidity = 87 % soilmoisture=106 % to IBM Watson
Published Temperature = 105 C Humidity = 74 % soilmoisture=88 % to IBM Watson
Published Temperature = 98 C Humidity = 71 % soilmoisture=102 % to IBM Watson
```

7.2 Feature 2:

```
#include <WiFi.h>//library for wifi
#include <PubSubClient.h>//library for MQtt
#include "DHT.h"// Library for dht11
#define DHTPIN 15     // what pin we're connected to
#define DHTTYPE DHT22   // define type of sensor DHT 11
#define LED 2

DHT dht (DHTPIN, DHTTYPE);// creating the instance by passing pin and typr of dht connected
void callback(char* subscribetopic, byte* payload, unsigned int payloadLength);
 //-------credentials of IBM Accounts------
#define ORG "6pjvs7"//IBM ORGANITION ID
#define DEVICE_TYPE "Arshidevicetype"//Device type mentioned in ibm watson IOT Platform
#define DEVICE_ID "Arshideviceid"//Device ID mentioned in ibm watson IOT Platform
#define TOKEN "tGfGvVl-F2luRl2bsG"     //Token
String data3;
float h, t;

//-------- Customise the above values --------
char server[] = ORG ".messaging.internetofthings.ibmcloud.com";// Server Name
char publishTopic[] = "iot-2/evt/Data/fmt/json";// topic name and type of event perform and format in which data to be send
char subscribetopic[] = "iot-2/cmd/command/fmt/String";// cmd  REPRESENT command type AND COMMAND IS TEST OF FORMAT STRING
char authMethod[] = "use-token-auth";// authentication method
char token[] = TOKEN;
```

```
char clientId[] = "d:" ORG ":" DEVICE_TYPE ":" DEVICE_ID;//clientid

//----------------------------------------
WiFiClient wifiClient; // creating the instance for wificlient
PubSubClient client(server, 1883, callback ,wifiClient); //calling the predefined client id by passing parameter like server id,portand wificredential
void setup()// configureing the ESP32
{
  Serial.begin(115200);
dht.begin();
  pinMode(LED,OUTPUT);
  delay(10);
Serial.println();
wificonnect();
mqttconnect();
}
void loop()// Recursive Function
{
h = dht.readHumidity();
t = dht.readTemperature();
Serial.print("Temperature:");
Serial.println(t);
Serial.print("Humidity:");
Serial.println(h);

PublishData(t, h);
delay(1000);   if
(!client.loop()) {
```

```
mqttconnect();
  }
}
/*....................................retrieving to Cloud..............................*/
void PublishData(float temp, float humid) {
mqttconnect();//function call for connecting to ibm
  /*     creating the String in in form JSon to update the data to ibm
cloud
  */
String payload = "{\"Temperature\":";
payload += temp;
payload += "," "\"Humidity\":";
payload += humid;
payload += "}";
  Serial.print("Sending payload: ");
  Serial.println(payload);

if (client.publish(publishTopic, (char*) payload.c_str())) {
     Serial.println("Publish ok");// if it sucessfully upload data on the cloud then it
will print publish ok in Serial monitor or else it will print publish failed
  }
 else
 {
    Serial.println("Publish failed");
  }
}

void mqttconnect()
```

```
 {
 if (!client.connected()) {
   Serial.print("Reconnecting client to ");
Serial.println(server);
   while (!!!client.connect(clientId, authMethod, token))
{
 Serial.print(".");
delay(500);
    }


    initManagedDevice();
    Serial.println();
  }
}
 void wificonnect()  //function defination for wifi
connect
{
  Serial.println();
  Serial.print("Connecting to ");

 WiFi.begin("Wokwi-GUEST", "", 6);//passing the wifi credentials to establish the
connection
while (WiFi.status() != WL_CONNECTED) {
         delay(500);
         Serial.print(".");
  }
  Serial.println("");
  Serial.println("WiFi connected");
```

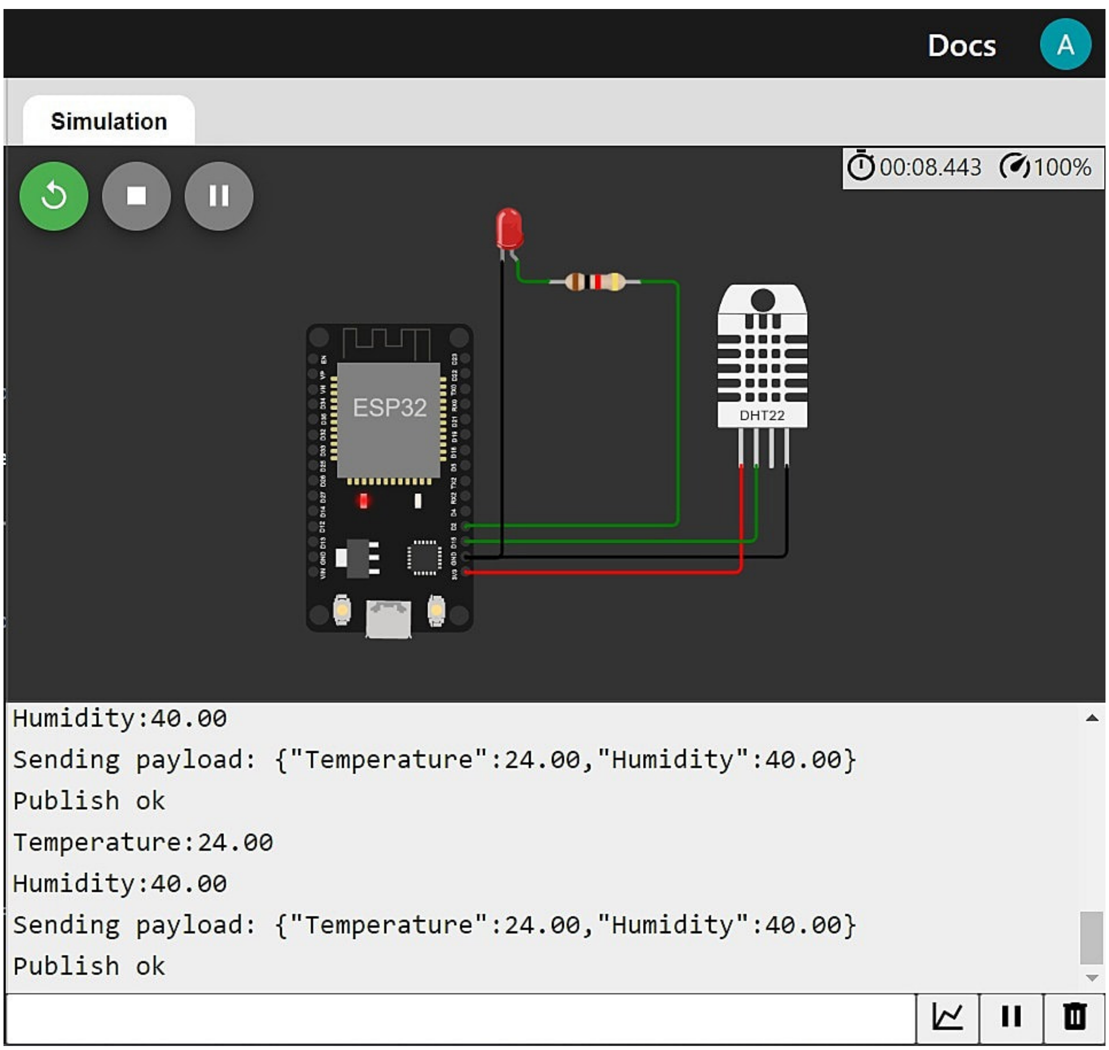
```
  Serial.println("IP address: ");
  Serial.println(WiFi.localIP());

}
void initManagedDevice() {
          if
          (client.subscribe(subscribetopic
          )) {
          Serial.println((subscribetopic));
         Serial.println("subscribe to cmd OK");
  }
else
 {
    Serial.println("subscribe to cmd FAILED");
  }
}
void callback(char* subscribetopic, byte* payload, unsigned int payloadLength)
{
Serial.print("callback invoked for topic: ");
Serial.println(subscribetopic);
for (int i = 0; i < payloadLength; i++) {
//Serial.print((char)payload[i]);
data3 += (char)payload[i];
}
Serial.println("data: "+ data3);
if(data3=="lighton")
  {
```

```
        Serial.println(data3);
        digitalWrite(LED,HIGH);
  }
else
{
Serial.println(data3);
digitalWrite(LED,LOW);
  } data3="";

}
```

7.2.1 Output:



8.TESTING

8.1 Test case:

A	B	C	D	E	F	G	H
Test case IP	Feature type	Component	Test Scenario	Steps to execute	Expected result	Actual result	Status
1	Functional	Home page	Verify the user is able to see screen with the text and when clicking on the screen the next svreen is appeared	click the screen	LOGIN screen is visible	Working as expected	Pass
2	Functional	LOGIN Page	Verify the user is able to log in to the app with valid credentials	Username : Ashika, Password : 123456	User should navigale to the next screen	Working as expected	Pass
3	Functional	LOGIN Page	Verify the user is able to get the alert message when the gives the wrong credentials	Usename : Ashika,Password :234567	User should visible the alert message	Working as expected	Pass
4	Functional	Sucessful login screen	Verify the user is able to click the text screen and get to the next screen	click the screen	User should visible the weather monitoring screen	Working as expected	Pass
5	Functional	Readings display and command button	Verify user is able to see the readings and motor is controlled by buttons	click the button	User is able to see the readings and motor is controlled by buttons	Working as expected	Pass

8.2 User Acceptance Testing:

8.2.1 Purpose of Document:

The purpose of this document is to briefly explain the test coverage and open issues of the project at the time of the release to User Acceptance Testing(UAT)

Increasing control over production leads to better cost management and waste reduction. The ability to trace anomalies in crop growth,for instance,helps eliminate the risk of losing yields.Additionally automation boosts efficiency. Smart farming reduces the ecological footprint of farming.Minimized application of inputs,such as fertilizers and pesticides,in precision agriculture systems will mitigate leaching problems as well as the emission of greenhouse gases.

8.2.2 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
By design	8	3	2	2	16

Duplicate	1	0	2	0	3
External	2	3	0	1	6
Fixed	9	2	3	17	31
Not Reproduced	0	0	1	0	1
Skipped	0	0	1	1	2
Wont't fix	1	4	1	1	7
Totals	21	12	9	22	66

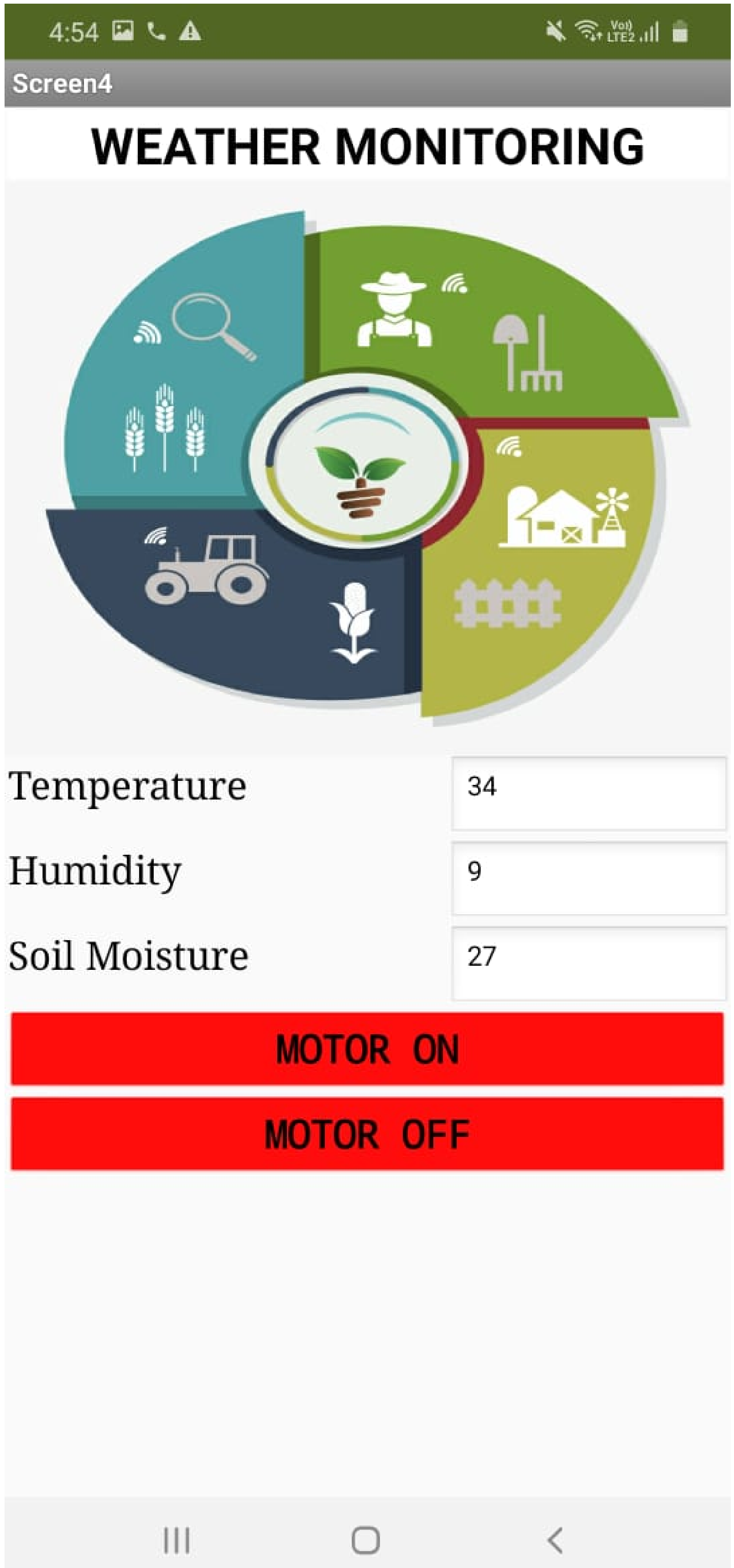
8.2.3 Test Case Analysis:

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

Section	**Total Cases**	**Not Tested**	**Fail**	**Pass**
Print engine	5	0	0	5
Client Application	30	0	0	35
Security	2	0	0	2
Outsource shipping	2	0	0	2
Exception reporting	9	0	0	9
Final report output	4	0	0	4
Version control	1	0	0	1

9.RESULTS

9.1 Performance Metrics:


4:54
Screen4
WEATHER MONITORING
Temperature
34
Humidity
9
Soil Moisture
27
MOTOR ON
MOTOR OFF

10.ADVANTAGES & DISADVANTAGES

10.1 Advantages:

➢ Various solutions are available to monitor engine statistics and starting or stopping the engine. When the client chooses to begin or stop the motor, the program transmits a sign to the unit within seconds by means of a mobile phone system.

➢ Submersible weight sensors or ultrasonic sensors can screen the degree of tanks, lakes, wells and different kinds of fluid stockpiling like fuel and compost. The product figures volume dependent on the tank or lake geometry after some time. It conveys alarms dependent on various conditions.

➢ A remote control system can help in working irrigation system valves dependent on schedule. Irrigating remote farm properties can be exceptionally troublesome and labor intensive. It gets hard to comprehend when the valves were started and whether the ideal measure of water was distributed

➢ For situations where a quick reaction is required, manual valve actuation may not be conceivable constantly. Thus, remote observing and control of irrigation systems, generators or wind machines or some other motor-driven hardware become the next logical step.

10.2 Disadvantages:

➢ The smart agriculture needs availability of internet continuously. Rural part of most of the developing countries do not fulfil this requirement. More over internet connection is slower.

➢ The smart farming based equipment require farmers to understand and learn the use of technology. This is major challenge in adopting smart agriculture farming at large scale across the countries.

11.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 farmer's phone. 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

In the current project we have implemented the project that can protect and maintain the the crop. In this project the farmer monitor and control the field remotely. In future we can add or update few more things to this project .
• We can create few more models of the same project, so that the farmer can have information of entire
. • We can update 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 use GSM technology to this project so that the farmers can get the information directly to his home through SMS. This helps the farmer to get information if there is a internet issues.
• We can add camera feature so that the farmer can monitor his field in real time. This helps in avoiding thefts.

13.APPENDIX

13.1 Source code:

```
import time

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

```
#Provide your IBM Watson Device Credentials
organization = "bxobbs"
deviceType = "b5ibm"
deviceId = "b5device"
authMethod = "token"
authToken = "b55m1eibm"

# Initialize GPIO


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

    #print(cmd)




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(0,100)
    Humid=random.randint(0,100)
    data = { 'temp' : temp, 'Humid': 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(1)
    deviceCli.commandCallback = myCommandCallback

# Disconnect the device and application from the cloud
deviceCli.disconnect()
```

13.2 **Project demo link**:

https://drive.google.com/file/d/1J0aqoI3q-GEsyu-75VmDa-_VViVPlUoS/view?usp=drivesdk