PROJECT REPORT

SmartFarmer- IOT Enabled Smart Farming Application

***Team ID* – PNT2022TMID40267**

- Submitted by

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Project Report

2. Sprint Delivery Schedule

3. Reports from JIRA

7. CODING & SOLUTIONING (Explain the features added in the project along with code)

1. Feature 1

2. Feature 2

3. Database Schema (if Applicable)

8. TESTING

4. Test Cases

5. User Acceptance Testing

9. RESULTS

1. Performance Metrics

10. ADVANTAGES & DISADVANTAGES

11. CONCLUSION

12. FUTURE SCOPE

13. APPENDIX

1. INTRODUCTION

1.1 PROJECT OVERVIEW

IoT device includes every object that can be controlled through the Internet. IoT devices have become commonplace in consumer markets with wearable IoWT (Internet of Wearable Things), such as smartwatches, and home management products, like Google home. It is estimated over 30 billion devices could be connected to the Internet of Things by 2020.

Internet of Things Smart technology enables new digital agriculture. Today technology has become a necessity to meet current challenges and several sectors are using the latest technologies to automate their tasks. Advanced agriculture, based on Internet of Things technologies, is envisioned to enable producers and farmers to reduce waste and improve productivity by optimizing the usage of fertilizers to boost the efficiency of plants. It gives better control to the farmers for their livestock, growing crops, cutting costs, and resources.

1.2 PURPOSE

We need smart farming to:

- Improve crop health. Optical smart farming technologies allow farmers to identify crop diseases and other problems earlier.
- Reduce the ecological footprint of farming. Precision agriculture systems can reduce the use of harmful chemicals and carbon emissions.
- Help feed the increasing global population. The UN data suggests that the world's population will grow from 7.7 billion in 2020 to 9.7 billion in 2050.
- Provide food security in climate change scenarios. More efficient smart farming helps to adapt to changing climates while maintaining production levels.
- Achieve higher yields while reducing operating costs. Smart farms achieve higher yields (by 1.75%), lower water use (by 8%), and lower energy costs ($17 to $23 per hectare).
- To reduce the Manpower of farming by giving him easy access to the fields through Handy User interface.

2. LITERATURE SURVEY

2.1 EXISTING PROBLEM

For large-area, more traditional farming, sensors placed within the ground may record real-time data on soil moisture, temperature and pH, while environmental sensors may record sun exposure, rainfall, wind speed, air temperature and humidity. Aerial drones may also be used for surveillance of crops and pests. For smaller, indoor farming, LED lighting, precise control of photoperiod, and soil and environmental sensors can reduce the cost of energy and increase yields.

The challenges of a smart agriculture system include the integration of these sensors and tying the sensor data to the analytics driving automation and response activities. When integrated, the use of data analytics can reduce the overall cost of agriculture and contribute to higher production from the same amount of area through precise control of water, fertilizer and light. Smart methods allow for farming on smaller and more distributed lands through remote monitoring, whether indoor or outdoor.

2.2 REFERENCES

[1] Joaquín Gutiérrez, Juan Francisco Villa-Medina, Aracely López-Guzmán, and Miguel Ángel Porta Gándara, “Smartphone Irrigation Sensor”, Proceedings of IEEE Sensors Journal Sensors 2015, P.3-4

[2] F. Viani, M. Bertolli, M. Salucci, “Low-Cost Wireless Monitoring and Decision Support for Water Saving in Agriculture’’, Proceedings of IEEE Sensors Journal, Vol 0, 2017, P.6-9.

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

[4] Soumil Heble, Ajay Kumar, K.V.V Durga Prasad, Soumya Samirana, P.Rajalakshmi, U. B. Desai, ”A Low Power IoT Network for Smart Agriculture”, Proceedings of Data Science Based Farming Support System for Sustainable Crop Production under Climatic Changes, 2016, P.609-613.

[5] Ravi Kishore Kodali, Vishal Jain and Sumit Karagwal,”IoT based Smart Farming”, Proceedings of IEEE Conference, 2017, P.2-6.

[6] R. Nageswara Rao, B.Sridhar, “IoT Based Smart Crop-Field Monitoring and Automation Irrigation System”, Proceedings of the Second International Conference on Inventive Systems and Control, 2018, P.478-483.

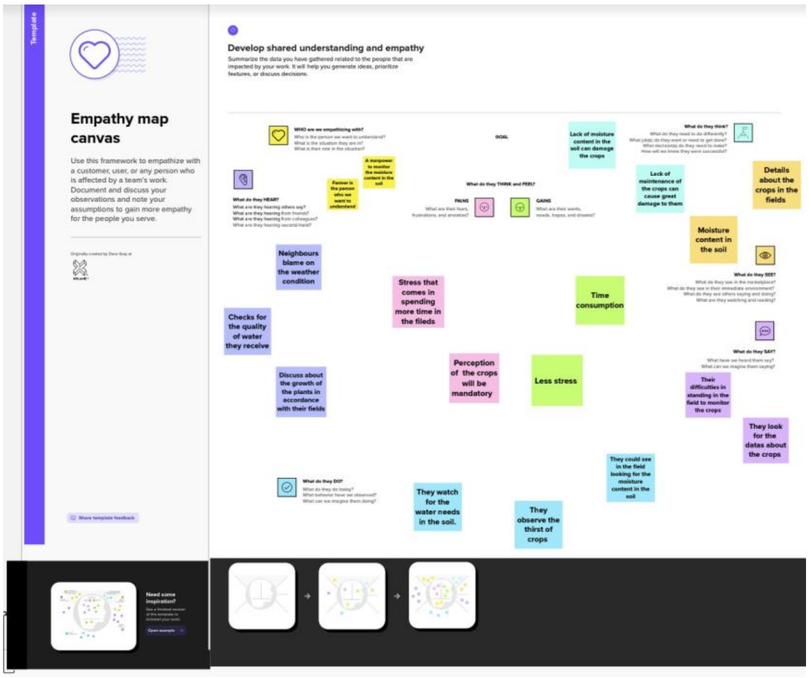
2.3 PROBLEM STATEMENT DEFINITION

The irrigation sensor consists of a camera embedded in a waterproof and closed chamber. Camera takes image of the soil to determine the water content in it. A gray scale analysis is used to differentiate between light pixel and dark pixel. The contents are forwarded to gateway router. An app is developed on a smartphone which has computation and connectivity capabilities

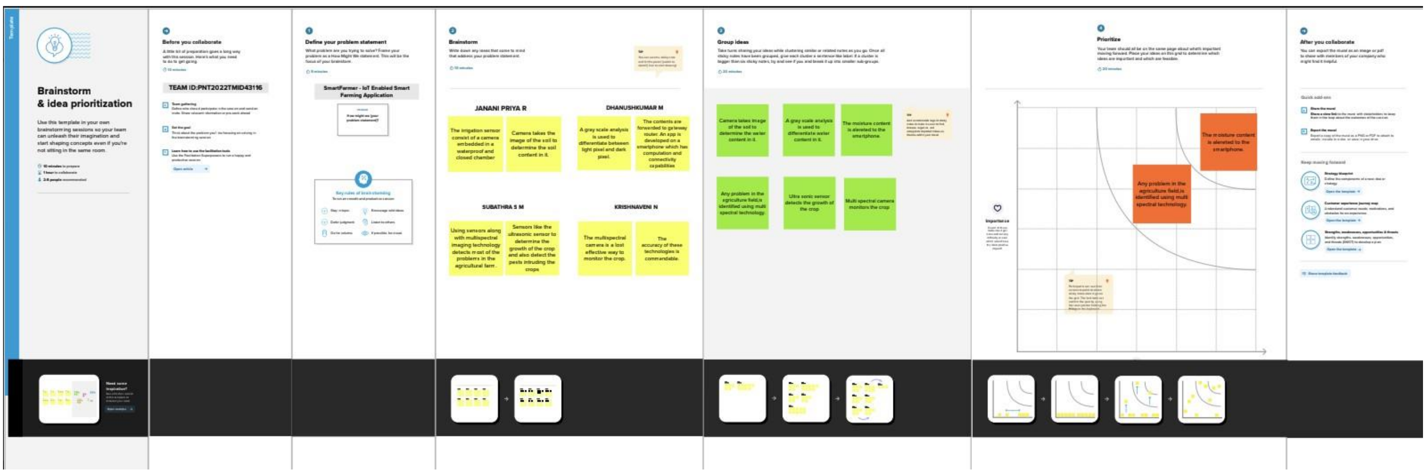
Using sensors along with multispectral imaging [11] technology detects most of the problems in the agricultural farm. Sensors like the ultrasonic sensor to determine the growth of the crop and also detect the pests intruding the crops. The multispectral camera is a lost effective way to monitor the crop. The accuracy of these technologies is commendable.

3. IDEATION & PROPOSED SOLUTION

3.1 EMPATHY MAP CANVAS



3.2 IDEATION AND BRAINSTORMING



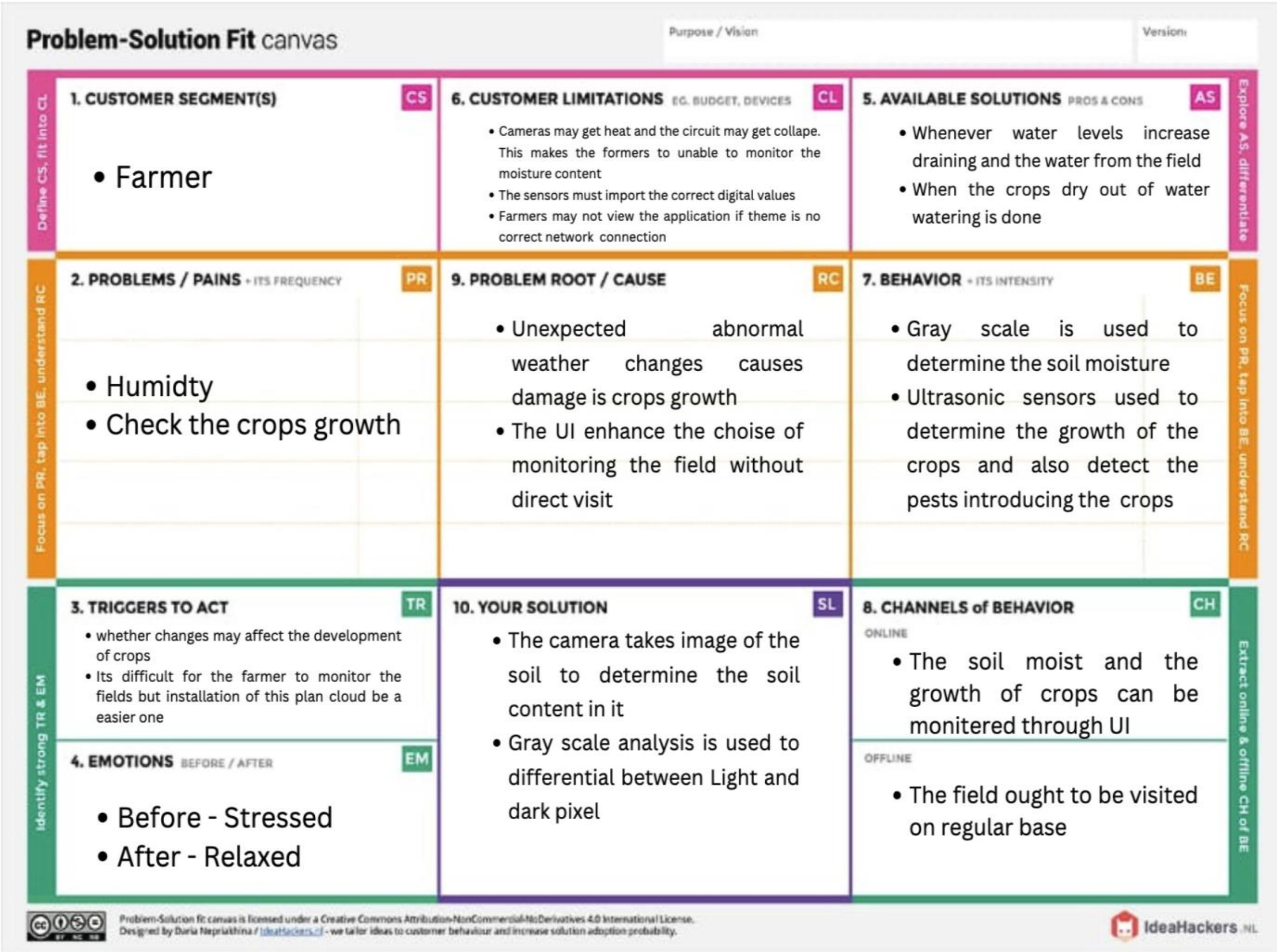
3.3 PROPOSED SOLUTION

Proposed Solution Template:

S.No	Parameter	Description
1.	Problem Statement (Problem to be solved)	Developing a smart farming application to monitor and crop growth.
1.	Idea / Solution description	Irrigation sensor consist of a camera embedded in a waterproof and closed chamber.
1.	Novelty / Uniqueness	Grey scale analysis is used to differ between light and dark pixel.
1.	Social Impact / Customer Satisfaction	Farmer can monitor live movements in the field directly via UI.
1.	Business Model (Revenue Model)	The sensors installed in field imported in application.
1.	Scalability of the Solution	The crop growth can be monitored via camera and ultrasonic sensor providing the scalability of 100% .

3.4 PROBLEM SOLUTION FIT

The Problem-Solution Fit simply means that we have found a problem with our customer and that the solution we have realized for it actually solves the customer’s problem. It helps entrepreneurs, marketers and corporate innovators identify behavioral patterns and recognize what would work and why. The purpose is to solve complex problems in a way that fits the state of your customers and succeed faster and increase your solution adoption by tapping into existing mediums and channels of behavior



4. REQUIREMENT ANALYSIS

4.1 FUNCTIONAL REQUIREMENTS

Functional Requirements:

Following are the functional requirements of the proposed solution.

FR No.	Functional Requirement (Epic)	Sub Requirement (Story / Sub-Task)
FR-1	Visiting website	Checking for the humidity. Monitoring the whole field. Checking for the pest intrusion in the field.
FR-2	Analysis	Analysing the growth of the crops. Analysing the disease affected in the crops.

4.2 NON-FUNCTIONAL REQUIREMENTS

Non-functional Requirements:

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

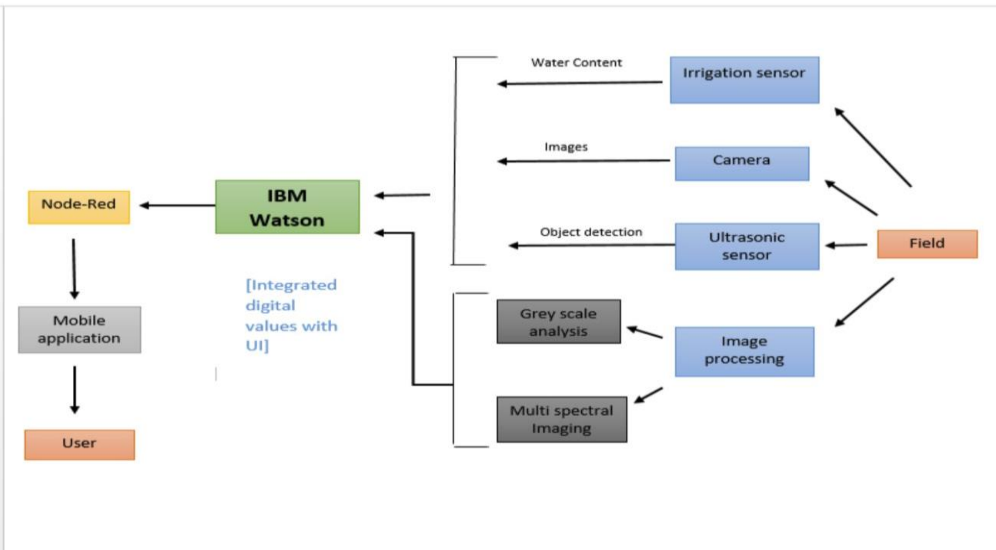
FR No.	Non-Functional Requirement	Description
NFR-1	**Usability**	The UI should be simple enough for everyone to understand
NFR-2	**Security**	The website must be secure enough to trust by the users.
NFR-3	**Reliability**	The UI should be able to withstand any errors in the data.
NFR-4	**Performance**	The live plot for the humidity conditions is presented in the dashboard.
NFR-5	**Availability**	The UI should respond to the users within 2 seconds.
NFR-6	**Scalability**	Different images could be captured and multispectral imaging can be done.

5. PROJECT DESIGN

(Data Flow Diagrams, Solution & Technical Architecture)

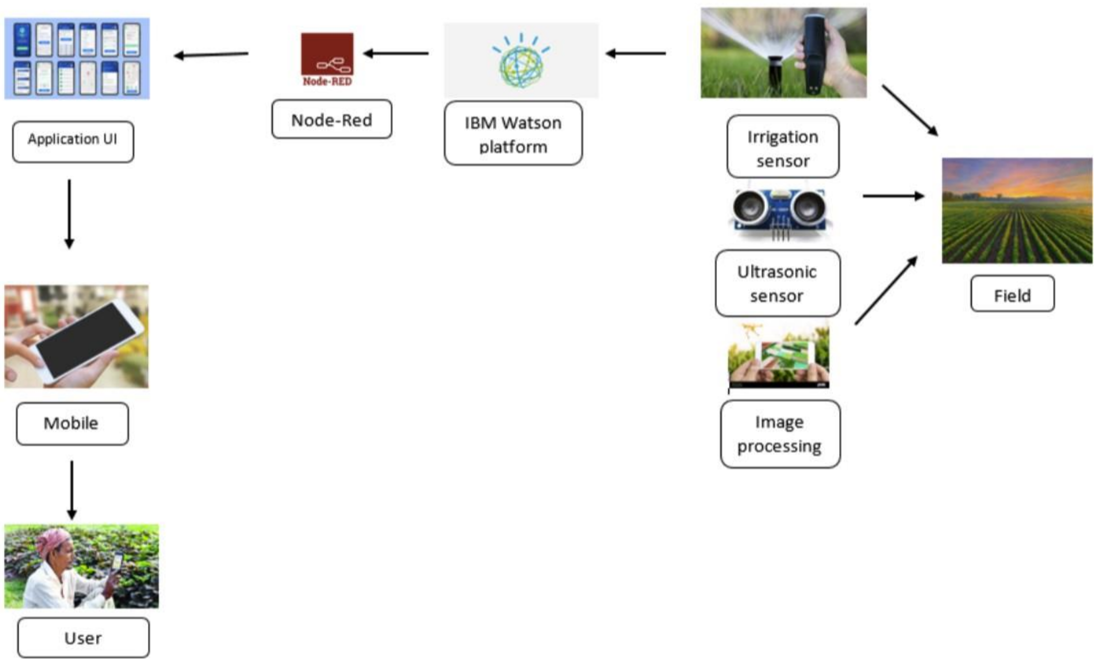
5.1 DATA FLOW DIAGRAM

Data Flow Diagrams:



5.2 SOLUTION ARCHITECTURE

Solution Architecture Diagram:



6. PROJECT PLANNING & SCHEDULING

6.1 SPRINT PLANNING & ESTIMATION

Product Backlog, Sprint Schedule, and Estimation (4 Marks)

Use the below template to create product backlog and sprint schedule

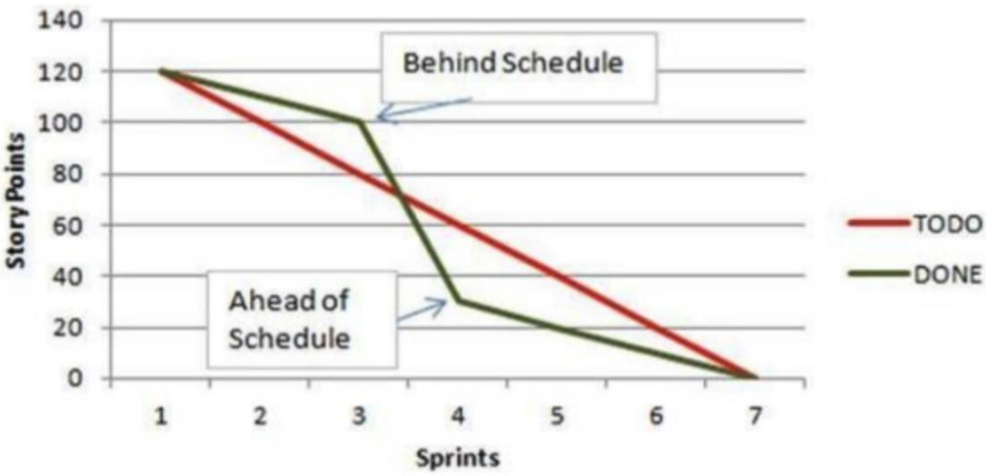
Sprint	Functional Requirement (Epic)	User Story Number	User Story / Task	Story Points	Priority	Team Members
Sprint-1	Dashboard	USN-1	As a User, I can differentiate the wet and dry soil	2	High	Janani Priya R Dhanushkumar M
Sprint-2	Dashboard	USN-2	As a User, I can detect the moisture content in the soil	1	High	Janani Priya R Subathra S.M
Sprint-3	Dashboard	USN-3	As a User ,detect the pest intrusion in the field	2	Medium	Krishnaveni N Subathra S.M
Sprint-4	Dashboard	USN-4	As a User , I can get control our the sensor on and off	2	High	Dhanushkumar M Janani Priya R

6.2 SPRINT DELIVERY SCHEDULE

Project Tracker, Velocity & Burn down Chart: (4 Marks)

Sprint	Total Story Points	Duration	Sprint Start Date	Sprint End Date (Planned)	Story Points Completed (as on	Sprint Release Date (Actual)

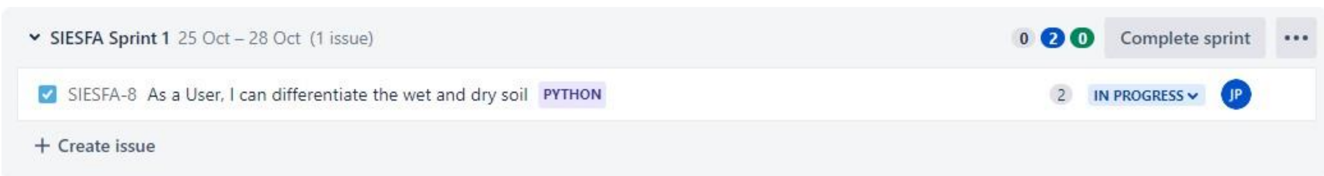
Burn down Chart:



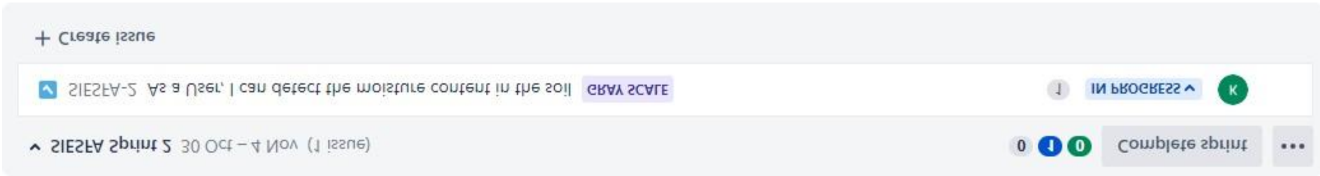
BURN DOWN CHART

6.3 REPORTS FROM JIRA

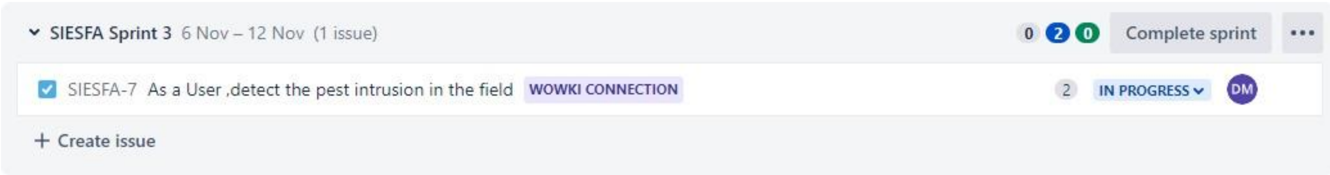
Sprint 1



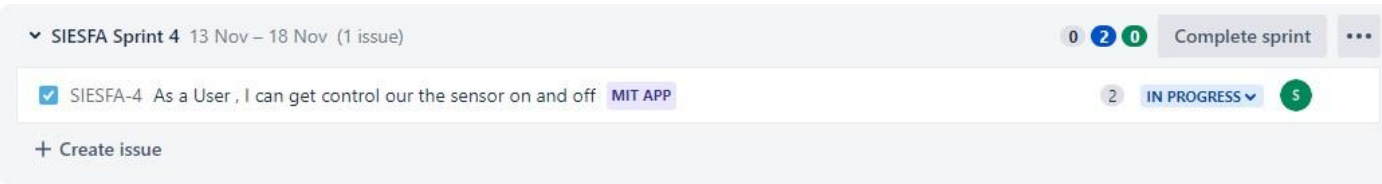
Sprint 2



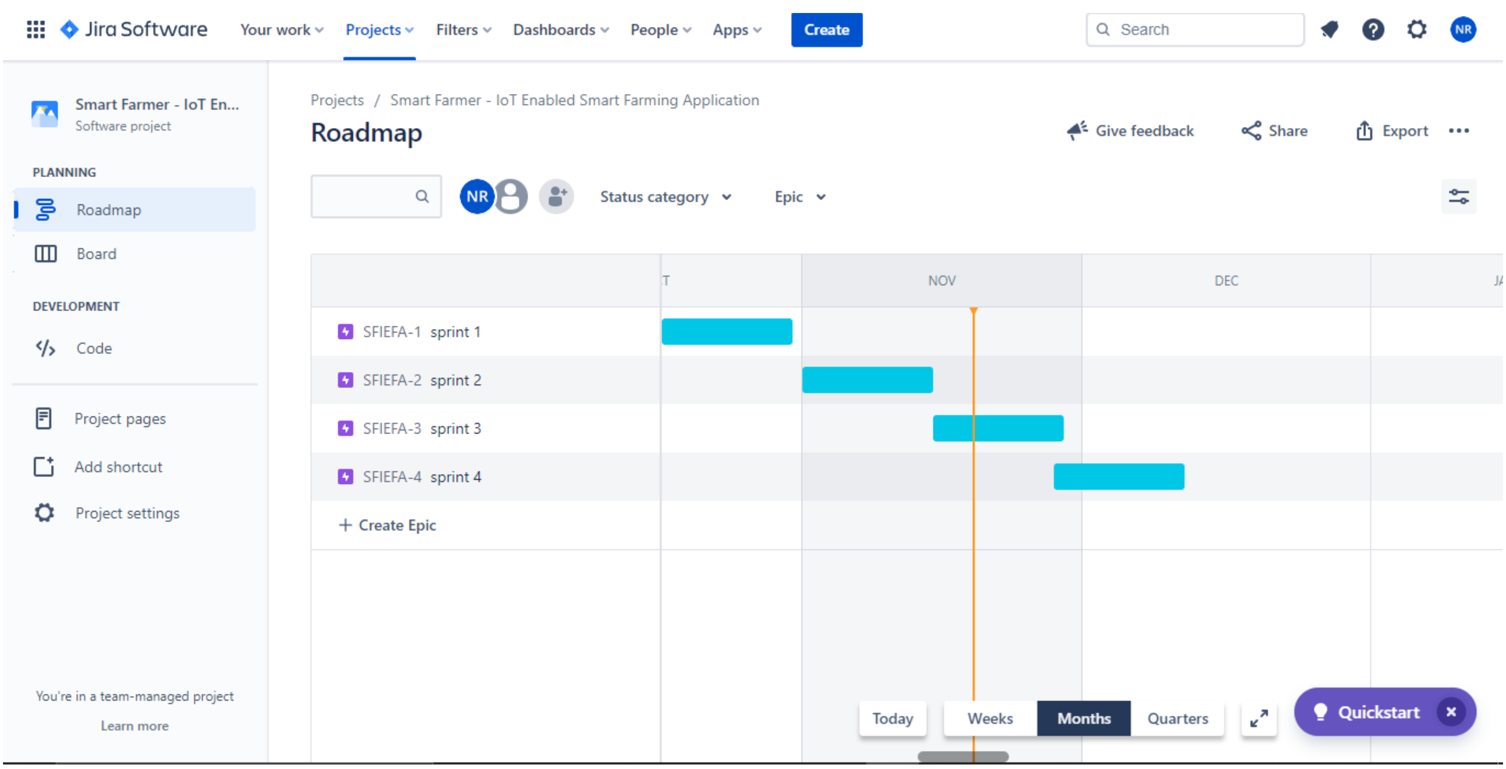
Sprint 3



Sprint 4



Roadmap



7 CODING & SOLUTIONING

Code

```
#define TOKEN "jT5zeckaBwxeHIiyZ_"      //Token
String data3;
float h, t;
#include <WiFi.h>
long duration;
int distance;

void setup()
{
pinMode (trigPin, OUTPUT);
pinMode(echoPin, INPUT);
pinMode(led1, OUTPUT);
Serial.begin(115200);
{
Serial.begin(115200);
Serial.print("Connecting to WiFi");
WiFi.begin("Wokwi-GUEST", "", 6);
while (WiFi.status() != WL_CONNECTED) {
 delay(100);
 Serial.print(".");
}
Serial.println(" Connected!");
}
}

void loop()
{
digitalWrite(trigPin, LOW);
delayMicroseconds(2);
digitalWrite(trigPin, HIGH);
delayMicroseconds(10);
digitalWrite(trigPin, LOW);
duration=pulseIn(echoPin, HIGH);
distance=duration*0.034/2;
Serial.println("duration:"+String(distance)+ "cm");
        delay(100); // TODO: Build something amazing!

if (distance >=50)
        digitalWrite(led1,HIGH);
```

```
        else

        }
digitalWrite (led1,HIGH);
```

```
                #define TOKEN "jT5zeckaBwxeHIiyZ_"
                                                                    //Token
String data3;
float h, t;
#include <WiFi.h>
long duration;
int distance;

void setup()
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pinMode (trigPin, OUTPUT);
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void loop()
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digitalWrite(trigPin, LOW);
delayMicroseconds(2);
digitalWrite(trigPin, HIGH);
delayMicroseconds(10);
digitalWrite(trigPin, LOW);
duration=pulseIn(echoPin, HIGH);
distance=duration*0.034/2;
Serial.println("duration:"+String(distance)+ "cm");
            delay(100); // TODO: Build something amazing!

if (distance >=50)
            digitalWrite(led1,HIGH);
```
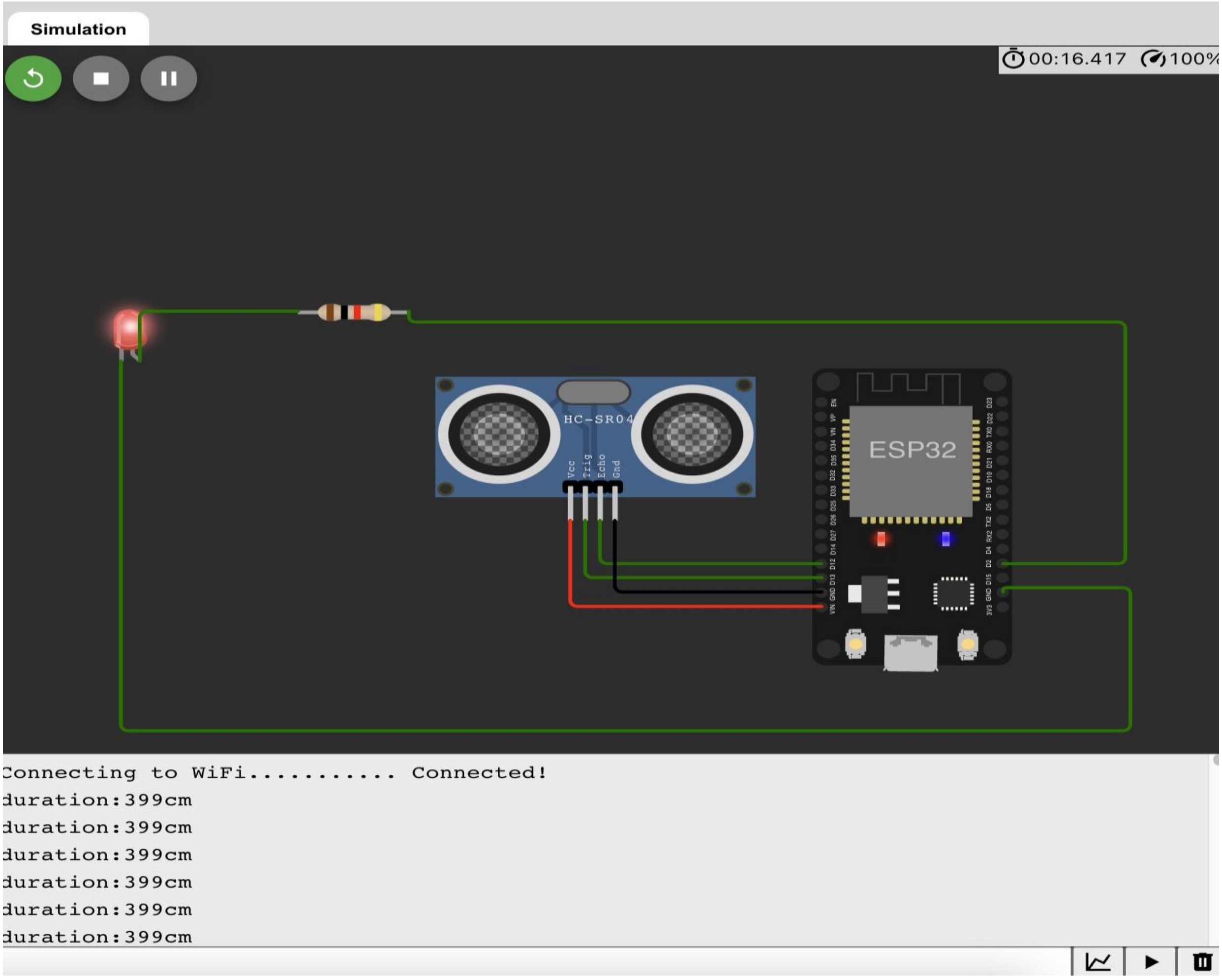

else

}

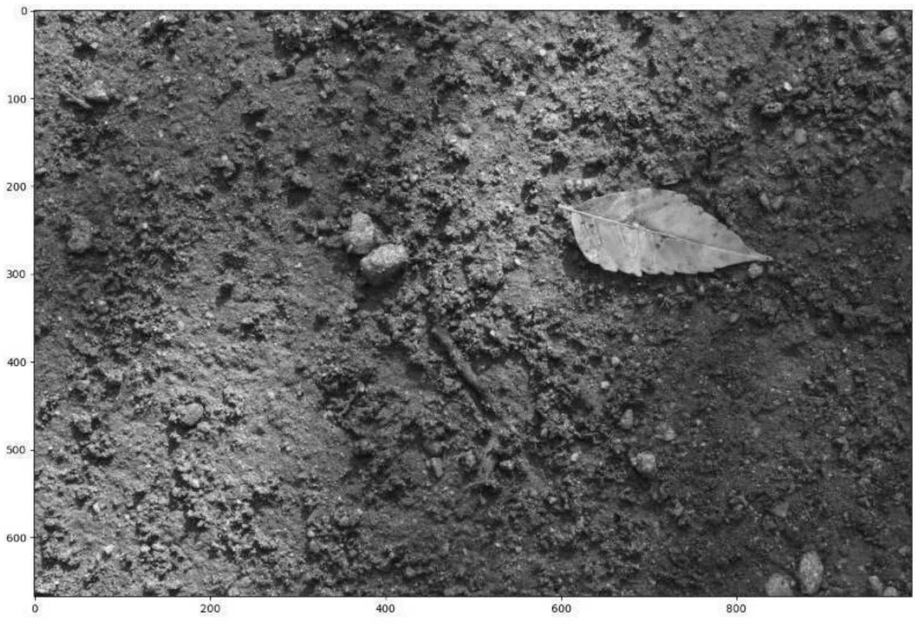


7.1 PYTHON CODE (GRAYSCALE ANALYSIS)

```
import tkinter
import matplotlib
matplotlib.use('TkAgg')
import matplotlib.pyplot as plt

from skimage import color
from skimage import io

def img2grey(img):
r,g,b = img[:,:,0], img[:,:,1], img[:,:,2]
return 0.1*r + 0.1*g, 0.1*b

img = io.imread('nature-image.jpg')
imgGray = img2grey(img)
plt.imshow(imgGray[0], cmap="gray")
plt.show()
```

INPUT

OUTPUT



7. TESTING

8.1 PERFORMANCE TESTING

S. No.	Parameter	Screenshot / Values
1.	Dashboard design	No of Visualizations / Graphs - 10
2.	Data Responsiveness	Good
3.	Amount Data to Rendered (DB2 Metrics)	-
4.	Utilization of Data Filters	Yes for filtering out visualizations concerning people with existing heart disease
5.	Effective User Story	No of Scene Added - 8
6.	Descriptive Reports	No of Visualizations / Graphs - 7

8.2 USER ACCEPTANCE TESTING

Resolution	Severity 1	Severity 2	Severity 3	Severity 4	Subtotal
By Design	10	4	3	3	20
Duplicate	1	0	3	0	4
External	2	3	0	1	6
Fixed	11	2	4	20	37
Not Reproduced	0	0	1	0	1
Skipped	0	0	1	1	2
Won't Fix	0	5	2	1	8
Totals	24	14	13	26	78

8. RESULTS

9.1 PERFORMANCE METRICS

Section	Total Cases	Not Tested	Fail	Pass
Print Engine	7	0	0	7
Client Application	51	0	0	51
Security	2	0	0	2
Outsource Shipping	3	0	0	3
Exception Reporting	9	0	0	9
Final Report Output	4	0	0	4
Version Control	2	0	0	2

9. ADVANTAGES & DISADVANTAGES

ADVANTAGES

- ✔ Handy User-Interface
- ✔ Less time consumption
- ✔ Less stress
- ✔ Easy user access

DISADVANTAGES

Stress that came in spending more time in the fields
Perception of the crops will be mandatory
Higher need of manpower
Not clear about the accuracy

10. CONCLUSION

An agricultural system with a concept of automated irrigation using soil moisture sensors with the help of WSN can be remotely accessed via a smartphone application. Compared to traditional methods in farming, it is significant to use sensors to monitor the crops. The sensors used in the system can be maintained and is operable for the entire cultivation period by using rechargeable batteries or solar panels. For communication, capabilities such as Bluetooth or an SMS to URL or to a smartphone is used to remotely monitor the whereabouts of the agricultural farm. The farm from going dry is avoided and the use of man power limited.

11. FUTURE SCOPE

In the image enhancement, it aim is to increase the perception or interpretability of information in the various images for viewers, or to give `better' input for different computerized image processing (IP) techniques. HE is one of the simple & effective techniques for enhancing image quality. However, CHE approaches typically outcome in the extreme contrast enhancement.

12. APPENDIX

Github link: - https://github.com/IBM-EPBL/IBM-Project-37909-1660364562

Demo link: -
https://github.com/IBM-EPBL/IBM-Project-37909-1660364562/tree/main/Final%20Deliverables/Demo%20Video