IOT BASED SMART CROP PROTECTION SYSTEM FOR AGRICULTURE

NALAIYATHIRAN PROJECT REPORT

Submitted by

BACHELOR OF ENGINEERING

IN

ELECTRONICS AND COMMUNICATION ENGINEERING

TEAM ID – PNT2022TMID24757

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1.INTRODUCTION

1.1 PROJECT OVERVIEW:

An intelligent crop protection system helps the farmers in protecting the crop from the animals and birds which destroy the crop. This system also help farmers to monitor the soil moisture levels in the field and also the temperature and humidity values near the field. The monitors and sprinklers in the field can be controlled using the mobile application.
The device will detect the animals and birds using the clarify service. If any animal or bird is detected the image will be captured and stored in the IBM cloud object storage. It also generates an alarm and avoid animals from destroying the crops.The image URL will stored in the IBM cloudant DB service. The device will also monitor the soil moisture levels, temperature and humidity values and send them to the IBM IoT Platform. The image will retrieved from object storage and displayed in the web application. A web application is developed to visualize the soil moisture, temperature and humidity values. Users can also control the motors through web applications.

1.2 PURPOSE:

1.Gain knowledge of Watson IoT platform.
2.Connecting IoT devices to the Watson IoT platform &exchanging the sensor data.
3.Gain knowledge on cloudant do.
4.Gain knowledge on using the clarifai service.
5.Gain knowledge of storing images in IBM object storage & retrieving images.
6.Creating a web application through which the user interacts with the device.

2.LITERATURE SURVEY

2.1 EXISTING PROBLEM:

One of the biggest problems farmers face in India is the attack on crops by wild animals in their fields. The damage from these attacks significantly and adversely affects the crop yield. Most of the farmers are using electrical fencing around the fields to keep away wild animals. But due to many accident which caused the death of farmers as well as animals this approach is not so appreciated by the farmers. As an alternative to electrical fencing the farmers keep vigil at night to keep the wild animals away. They use flash lights to ward them off. This is a very strenuous task and the lack of sleep adversely affect the farmers work during the day time. The damage caused by the animals to the crops affects the total yield of the harvest immensely and the farmers have to suffer a loss their income because of this. HuT labs designed a solar powered IoT based intelligent system that can be used to prevent crop damage due to wild animals. The system implements IoT technology along with simple sensors.

2.2 REFERENCES:

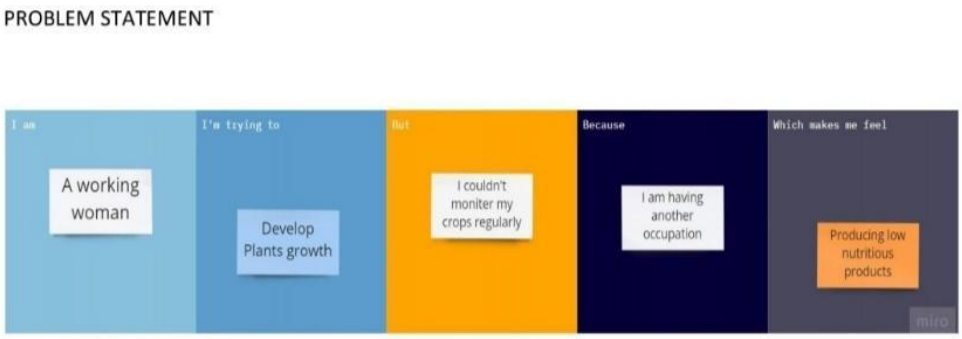
1.Krunal Mahajan1,Riya parate2,Ekta Zade3,Shubbam Khante4,Shishir bagal5,"REVIEW PAPER ON SMART CROP PROTECTION SYSTEM", International Research Journal of engineering and technology,volume:08 issue 02 Feb 2021.

2.Dr. M. Chandhra, MohanReddy, Keerthi Raju , Kamakshikodi, BabithaAnapalli, Mounika Pulla,"SMART CROP PROTECTION SYSTEM FROM LIVING OBJECT AND FIRE USING ARDUINO",Science,technology and development, volume IX,PG.NO 261-265,Sept 2020

3.https://www.electronicshub.org/arduino-Flame-sensor-interface/#:-:text=Flame%20sensor%20has%20three%20pins.fire%2C%20A%20Buzzer%20is%20used

4.Anjana,Sowmiya,Charan kumar, Monisha,Sahana,"Review on IoT in Agricultural crop protection and power Generation",international Research Journal of Engineering and technology(IRJET),Volume06,Issye 11,Nov 2019.

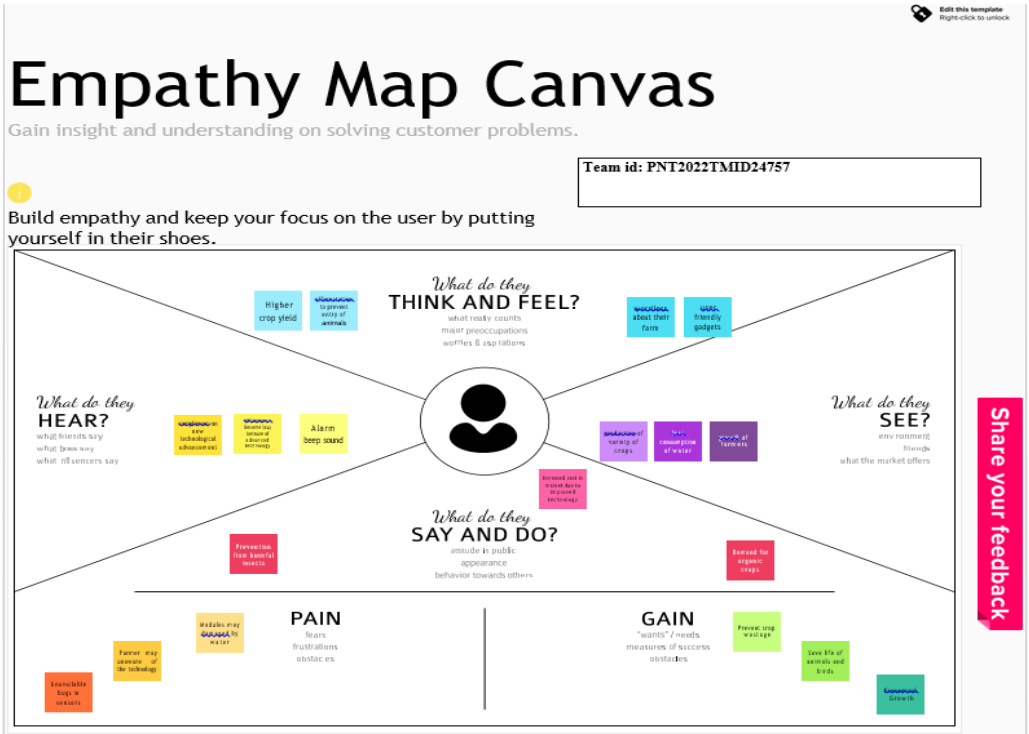
2.3 PROBLEM STATEMENT DEFINITION:



A working women is trying to develop plants growth but she couldn't monitor her crops regularly, Because she have another occupation which makes her feel producing low nutritious products.

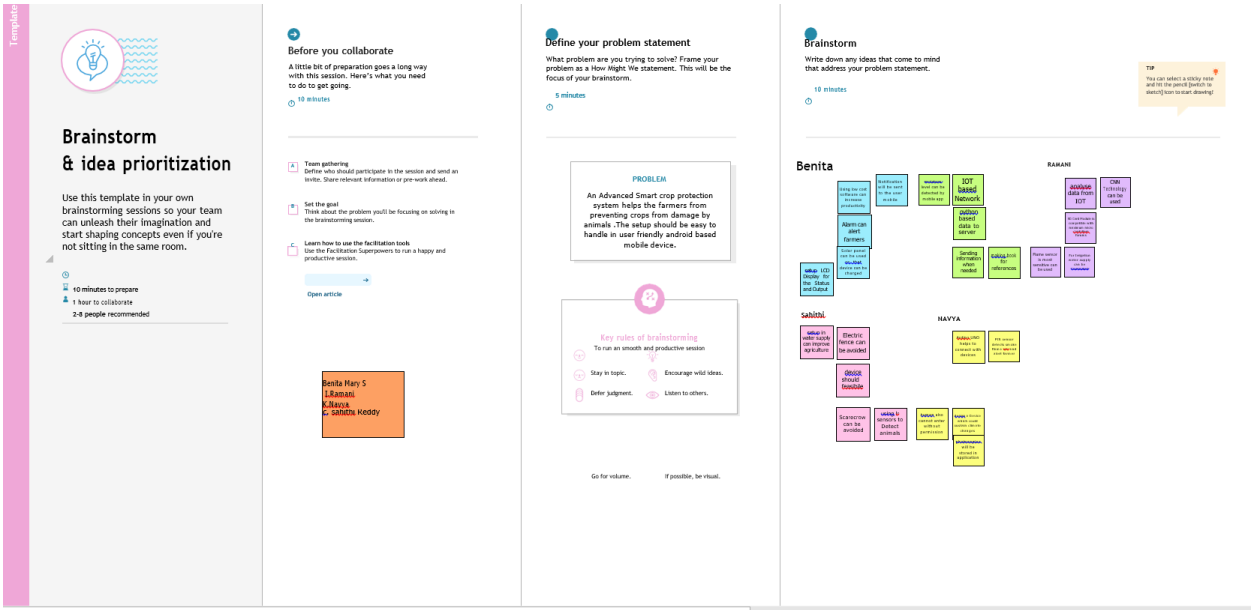
3.1 EMPATHY MAP:

An empathy map allows us to sum up our learning from engagements with people in the field of design research. The map provides four major areas in which to focus our attention on,thus providing an over view of a person's experience.



3.2 IDEATION &BRAINSTORMING:

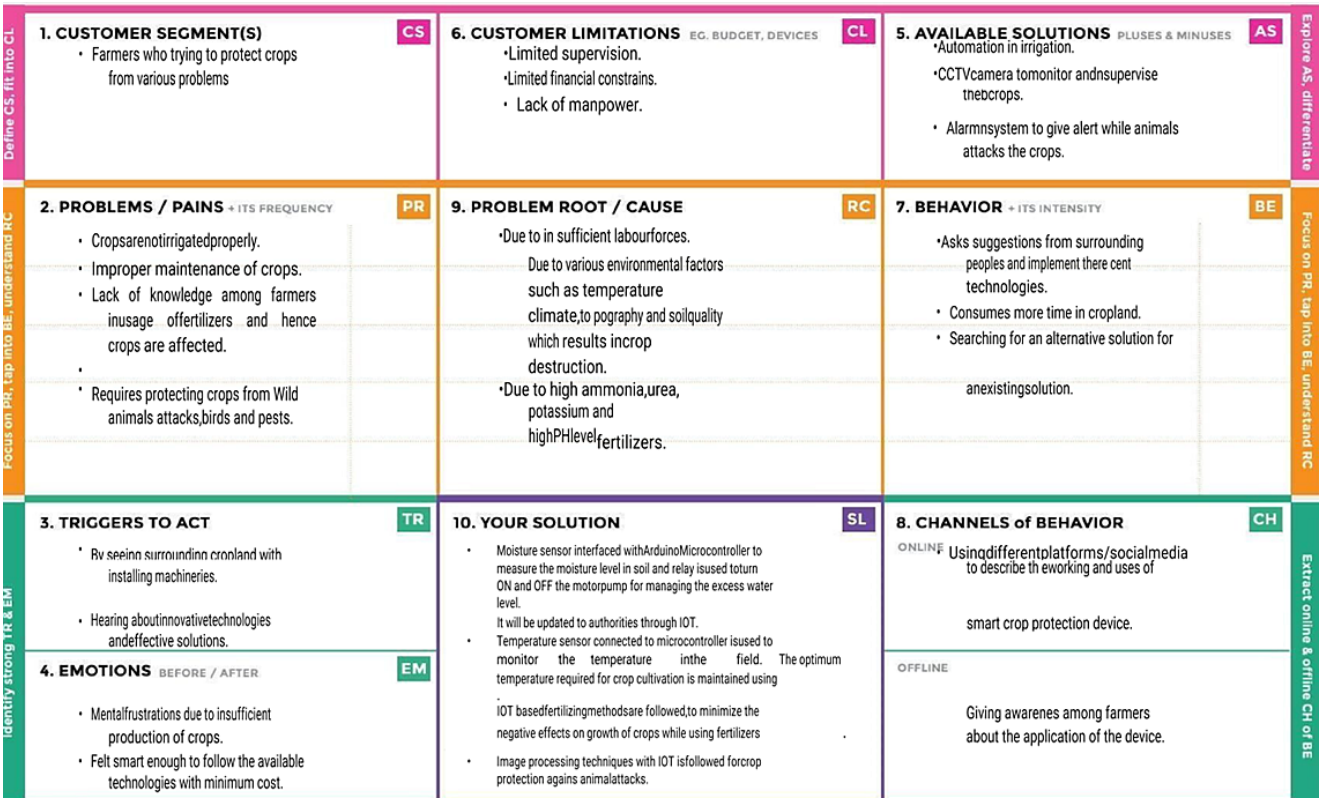
Ideation is often closely related to the practice of brainstorming, a specific technique that is utilized to generate new ideas. A principal difference between ideation and brainstorming is that ideation is commonly more thought of as being an individual pursuit, while brainstorming is almost always a group activity



SNO	PARAMETER	DESCRIPTION
1	Problem statement(problem to be solved)	Crops are affected by animals and birds
2	Idea/solution description	These animals and birds are detected before a particular distance from the crop by using PIR sensors
3	Novelty/uniqueness	Through mobile phones we can able to know the status of the sensor.
4	Social impact/customer satisfaction	Customer can know the
5	Business model (revenue model)	Application
6	Scalability of the solution	Mobile phone is portable .The crops are protected by insects, animals, etc through the use of deliberate sensors connected in the form field

3.4 PROBLEM SOLUTION FIT:

The problem solution fit simply means that you have found a problem with your customer and that the solution you have realized for it actually solve the customers problem.



4.REQUIREMENTS ANALYSIS

4.1 FUNCTIONAL REQUIREMENTS:

FR	FUNCTIONAL REQUIREMENT(EPIC)	SUB REQUIREMENT(STORY/SUB TASK)
FR-1	User registration	Install the app Sign up with gmail or phone number creating a profile Understand the guidelines
FR-2	User confirmation	Email or phone number verification required via OTP
FR-3	Accessing datasets	Data's are obtained by cloudant DB
FR-4	Interface sensor	Connect the sensor and application When animals enter the field,the alarm is generated
FR-5	Mobile application	It is used to control sensors and field sprinklers

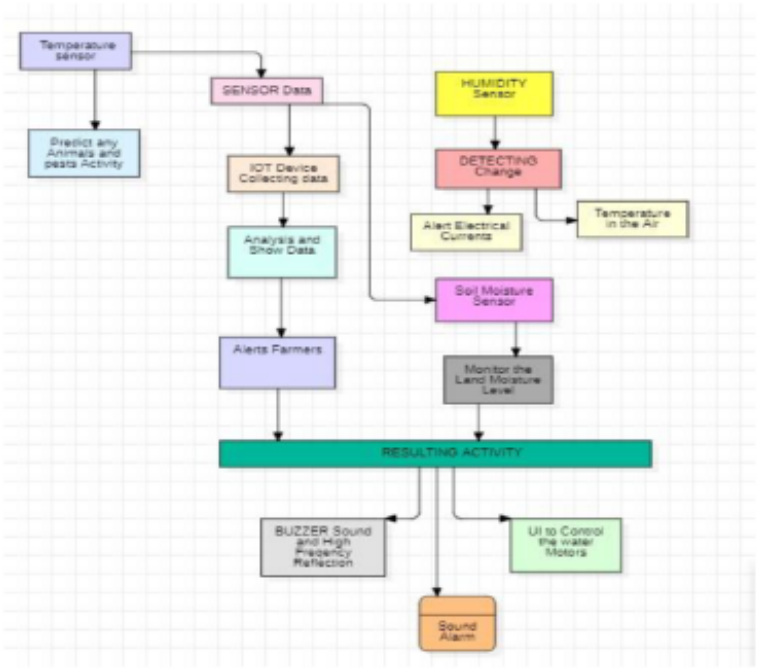
4.2 NON FUNCTIONAL REQUIREMENTS:

FR. NO	NON FUNCTIONAL REQUIREMENT	DESCRIPTION
NFR-1	Usability	This project's contributes the farm protection through the smart protection system
NFR-2	Security	It was created to protect the crops from animals
NFR-3	Reliability	Farmers are able to safeguard their lands by help of this technology they will also benefits from higher crop yields,which will improve our economic situation
NFR-4	Performance	When animals attempt to enter the field,IOT devices and sensors alert the farmer via message
NFR-5	Availability	We can defend the crops against wild animals by creating and implementing resident hardware and software
NFR-6	Scalability	This system's integration of computer vision algorithms with IBM cloudant services makes it moreefficient to retrieve photos at scale,enhancing scalability

5.PROJECT DESIGN

5.1 DATA FLOW DIAGRAM:

Flow diagram (DFD) is a traditional visual representation of the information flows with in a system. A neat and clear DFDbcan 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.



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 by entering my Email,password and conforming my password	I can access my account/dashboard	High	Sprint-1
Customer	Registration	USN-2	As a user , I will receive confirmation message once I have registered for the application	I can receive conformation message and clock confirm	High	Sprint-1
Administrator	Login page	USN-3	As a user entering user name and password which is already existing	Redirecting to user account	medium	Sprint-1
Weather station	Forecasting the weather	USN-4	As a user,we can monitor the weather fundamentals like(humidity, temperature)	Notified about weather conditions.	High	Sprint-1
Controlling the motor pump	Controlling	USN-5	It is used to control motors and field sprinklers	Switching on and off the motor pump manually via mobile application	High	Sprint-2
Fencing	Detecting the motion in certain range	USN-6	Fencing system are helpful in providing security against unauthorized access of human and animal	I can receive notification prevention has been taken	High	Sprint-3

Warehouse management	Connecting database at crops	USN-7	Here former need to update	Generate the popup message	High	Sprint-4

5.2 SOLUTION AND TECHNICAL ARCHITECTURE:

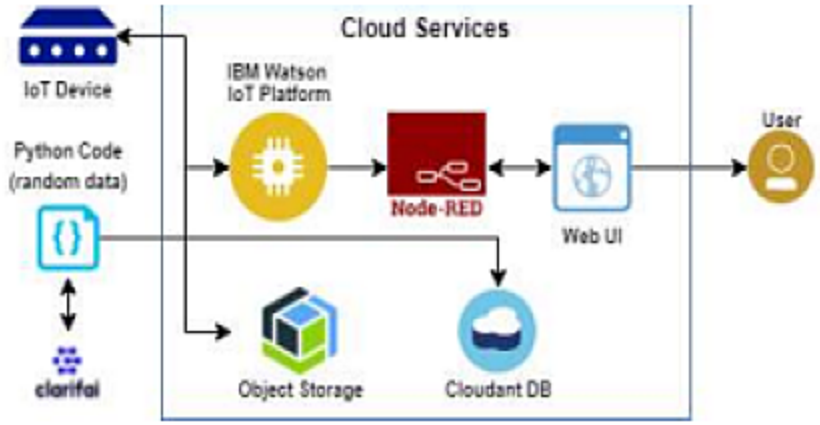


TABLE-1:COMPONENTS&TECHNOLOGIES

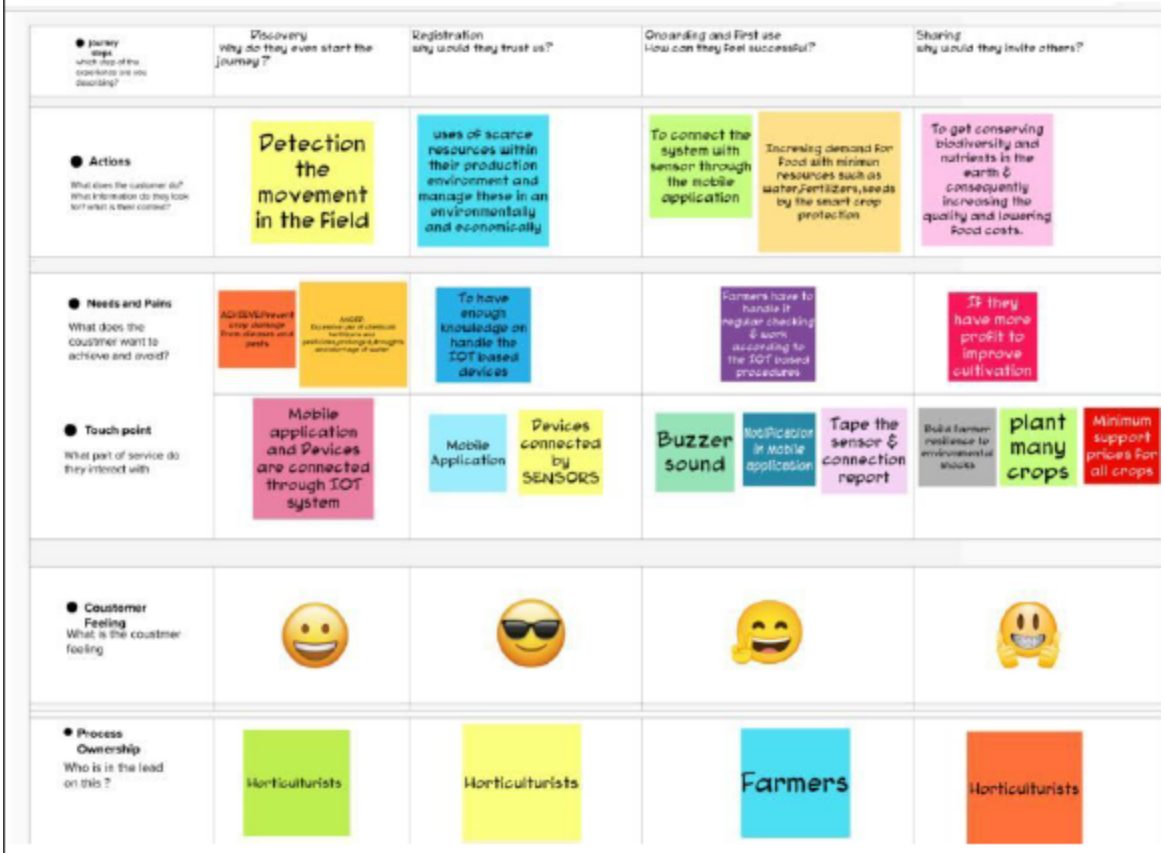
S.No	Component	Description	Technology
1.	User Interface	How user interacts with application e.g. Web UI, Mobile App, Chatbot etc.	HTML, CSS, JavaScript / Angular Js/ ReactJs etc.
2.	Application Logic-1	Logic for a process in the application	Python
3.	Application Logic-2	Logic for a process in the application	IBM Watson/node red
4.	Application Logic-3	Logic for a process in the application	IBM Watson/node red
5.	Database	Data Type, Configurations etc.	MySQL, NoSQL, etc.
6.	Cloud Database	Database Service on Cloud	IBM Cloudant.
7.	Temperature sensor	Monitor the temperature	TMP36
8.	Humidity sensor	Monitor the humidity	DHT11
9.	Soil moisture sensor	Measure the amount of water in the soil	Soil maoisture sensor
10.	Weather monitoring	Monitor the weather	Temperature sensor

Table-2: Application Characteristics:

S.No	Characteristics	Description	Technology
1.	Open-Source Frameworks	Clarifai,Node- red	Software
2.	Security Implementations	Sensitive and private data must be protected from their protection until the decision-making and storage stages.	Encryption process
3.	Scalable Architecture	Scalability is a major concern for IOT platform it has been shown that different architectural choices of IOT platform affect system capability and that automatic real time decision making is feasible in an environment composed of dozens of thousand.	Software
4.	Availability	Automatic adjustment of farming equipment made possible by linking information like crops/weather and temperature,humidity etc.	Software
5.	Performance	The ideas of implementing integrated sensors with sensing soil and environmental or ambient parameters in framing will be more efficient for overall monitoring .	Software

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:

SPRINT	FUNCTIONAL REQUIREMENT (EPIC)	USER STORY NUMBER	USER STORY/TASK	STORY POINTS	PRIORITY	TEAM MEMBERS
Sprint-1	CLARIFAI	USN-1	Sensors an WiFi module with python code To create application in clarifai and run the python code	2	High	Aishwarya, Dhinesh, Subhaharini, Tejashree
Sprint-2	SOFTWARE	USN-2	IBM Watson IOT platform, workflows for IOT scenarios using node-red	2	High	Aishwarya, Subhaharini, Dhinesh, Tejashree
Sprint-3	SOFTWARE	USN-3	Connecting iot device with object storage	2	High	Aishwarya, subhaharini, dhinesh, tejashree
Sprint-4	WEB UI	USN-4	To make the user to intract with software	2	High	Aishwarya, subhaharini, dhinesh, tejashree

PROJECT TRACKER,VELOCITY&BURNDOWN CHART:

SPRINT	TOTAL STORY POINTS	DURATION	SPRINT START DATE	SPRINT END DATE (PLANNED)	STORY POINT COMPLETED (AS AN PLANNED END DATE)	SPRINT RELEASE DATE (ACTUAL)
Sprint-1	20	6Days	24 Oct 2022	29 Oct 2022	20	29 Oct 2022
Sprint-2	20	6Days	31Oct 2022	05 Nov 2022	20	05 Nov 2022
Sprint-3	20	6Days	07Nov 2022	12 Nov 2022	20	12 Nov 2022
Sprint-4	20	6Days	14Nov 2022	19 Nov 2022	20	14 Nov 2022

VELOCITY:

Image we have a 10-days sprint duration and the velocity of the team is 20 (points per sprint).Let's calculate the team's average velocity(AV) per iteration unit (story points per days)

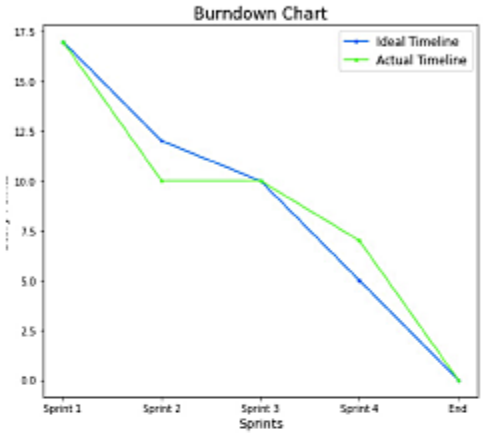
$$\frac{AV = Sprint\ duration}{velocity} = \frac{20}{10} = 2$$

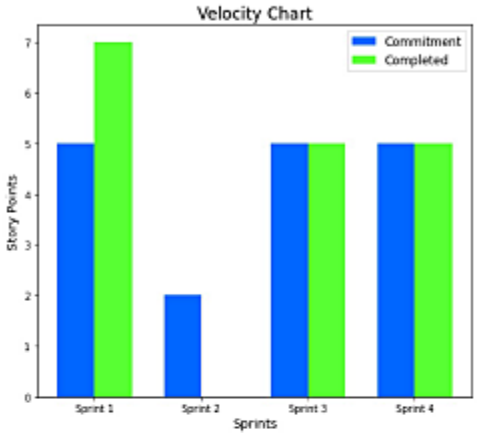
BURNDOWN CHART:

A born down chart is a graphical representation if 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.

6.3 REPORT FROM JIRA:

BURNDOWN CHART:





7.CODING & SCHEDULING

7.1 FEATURE 1:

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

myConfig = { "identity": {
    "orgId": "XXXXX", "typeId": "YYYYYYYYY",
    "deviceId":"ZZZZZZ"
        }, "auth": {
    "token": "XXYYZZ"
        }
    }
def myCommandCallback(cmd): print("Message received from IBM
IoT Platform: %s" %

cmd.data['command']) m=cmd.data['command']
```

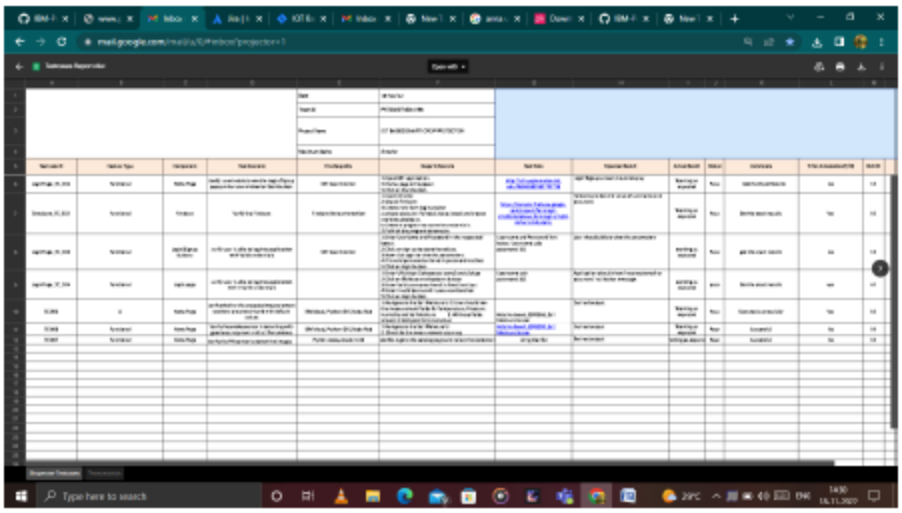
```
client = wiotp.sdk.device.DeviceClient(config=myConfig,
logHandlers=None)
client.connect()

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<25):
        print("Motor is ON") else:
        print(Motor is OFF") client.commandCallback =
    myCommandCallback time.sleep(2) client.disconnect()
```

FEATURE 2:-

```
 if(soil<25):
        print("Motor is ON")
    else:
        print("Motor is OFF")
if(soil<25):
        print("Light is ON")
    else:
        print("Light is OFF")
```

8.TESTING

8.1 TEST CASES:



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 [Product Name] 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.

Defect analysis table:

Resolution	Severity 1	Severity 2	Severity 3	Severity 4	Subtotal
By Design	10	4	2	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	77

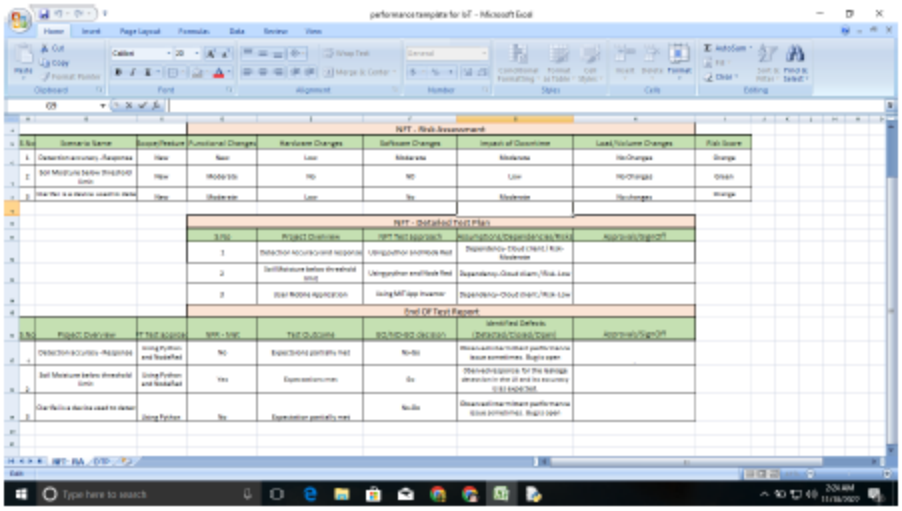
3.Test Case Analysis

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

Section	Total Cases	Not Tested	Fail	Pass
Print Engine	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. RESULT

9.1 PERFORMANCE METRICS:



10.ADVANTAGES & DISADVANTAGES

ADVANTAGES:

1.Optimized crop treatment such as accurate planting, watering ,pesticide application and harvesting directly affects production rates.

2.Weather predictions and soil moisture sensors allow for water use only when and where needed.

3.To increase the crop gain.

4.It helps to conserve the environment.

5. Sensor help to warm the farmers.

DISADVANTAGES:

1.High cost

2.Lack of infrastructure

11.CONCLUSION:

From this literature survey we have seen lots of technology that helps to farmer for to protect his farm specially IoT based system who can monitor the farm online. In above research papers they are not looking cost of system and so that did not get affordable to every farmer, Hence we want to implement a costless smart crop protection.

12.FUTURE SCOPE:

In the future, there will be a large scope for this system. The IR sensors and ultrasonic sensors are used to collect the information and transmitted through GSM. This project is further enhanced by wireless sensor network. The type of sensors like finding the moisture content of the soil, growth of the crop and nutrition content in the soil. This sensor gather information which is useful to the farmers and able to conscious of the farm land from any place in the world.

13.APENDIX

13.1 SOURCE CODE:

```
#IBM Watson IOT Platform
#pip install wiotp-sdk
import wiotp.sdk.device
import time
import random
myConfig = {
    "identity": {
        "orgId": "76fcms",
        "typeId": "adsdevice",
        "deviceId":"1109"
    },
    "auth": {
        "token": "16092001"
    }
}

def myCommandCallback(cmd):
```

```
    print("Message received from IBM IoT Platform: %s" %
cmd.data['command'])
    m=cmd.data['command']

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

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<25):
        print("Motor is ON")
    else:
        print("Motor is OFF")
    client.commandCallback = myCommandCallback
    time.sleep(2)
client.disconnect()
```

13.2 GITHUB&PROJECT DEMO LINK:

IBM-EPBL/SI-GuidedProject-46755-1667897558

https://drive.google.com/file/d/1asfThM0_YoHaEloIVAn9Hm5XiV-jto0U/view?usp=sharing