IOT-BASED SMART CROP PROTECTION SYSTEM FOR AGRICULTURE

PROJECT REPORT

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Submitted By

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CHAPTER-1
INTRODUCTION

1.1 PROJECT OVERVIEW

IoT based smart crop protection system improves the entire agriculture system by monitoring the field in real time to increase crop production. The Internet of Things in agriculture has not only saved farmers' time but has also reduced crop damage in fields thanks to sensors and interconnectivity. Its purpose is to track animal and bird outbreaks as well as environmental conditions for crop safety. When the sensor detects an animal, a photograph is taken, the buzzer is activated, and the user is notified via the registered email address. The owner/user can also use an app to control the sprinkler and motor with an on/off button. This is intended to boost growth while also protecting the crop from animals and birds.

1.2 PURPOSE:

IOT-based smart crop protection system improves the entire agriculture system by monitoring the field in real-time to increase crop production. With the help of sensors and interconnectivity, the Internet of Things in agriculture has not only saved the time of farmers but has also reduced the major damage of crops in fields. It is intended to monitor animal and bird outbreaks and environmental conditions for crop safety. Once the animal is detected by the sensor, a picture will be taken, the buzzer will be turned on, and the user will be notified through the registered email address. The owner/user can also use an app that can control the motor and sprinkler with an on/off button. This is meant to improve growth and protect the crop from animals and birds.

CHAPTER-2
LITERATURE SURVEY

2.1 EXISTING PROBLEM:

Farmers are currently suffering greatly as a result of bird and animal vandalism in the field. Most crop production was harmed as a result of their outbreaks. The crop's total yield has been reduced. Farmers find it difficult to protect the crops field 24/7.

A smart agriculture system's challenges include sensor integration and connecting sensor data to analytics that drive automation and response activities. The most significant challenges for IoT in agriculture are a lack of information, high adoption costs, security concerns, and so on. The majority of farmers are unaware of the use of IoT in agriculture. Farmers must deal with a variety of issues, including climate change, soil erosion, and biodiversity loss. Even though farmers use manpower to monitor the field to protect it from birds and animals, they are unable to monitor it at night. It is difficult to prevent the crop from damage in the day time from the birds, as it became used to all the precautions taken like scarecrows.

Some farms have a movement detection system that sounds a buzzer when movement is detected in the field, scaring birds and animals away and driving them away. The issue here is that the birds and animals become accustomed to it after a few instances, and the user is unable to detect this and be notified.

2.2 REFERENCES:

1. SMART CROP PROTECTION SYSTEM FOR BIRDS AND ANIMALS (SHASHIKIRANV et al, YEAR:2022)

The smart crop protection system helps us keep such wild animals away from farmlands while also providing surveillance capabilities. This project is based on surveillance through the use of an animal ward-off system.farmlands to keep wild animals from destroying crops This system, in addition to providing security, uses RFID tags to differentiate between an intruder and an authorised person, and various PIR sensors are strategically placed throughout the area to detect any movement. All of the sensors and components are linked to the Raspberry Pi board. A PIR sensor, a PIEZO buzzer, a 12v adapter, and an LED are all included. When animals attack crops in an agricultural field, this system detects and generates the buzzer sound.

2. SMART CROP PROTECTION SYSTEM FROM WILD ANIMALS AND BIRDS USING IOT (HARISH.N. J et al, YEAR: 2021)

Sensors detect intrusion in the field and are linked to an Arduino Uno. When the sensor sends data, the Arduino Uno activates the camera, which captures the image and uses image processing to determine whether the animal is domestic or wild. The camera's input is analysed. To classify images, a Convolution Neural Network is used. Determining whether an animal is domestic or wild After image processing and classification, take appropriate action based on the intruder. If a wild animal is detected, the processor sounds an alarm and notifies the farmer. If animals or birds are detected during the process, an alarm or buzzer should be activated.

3. SMART INTRUSION DETECTION SYSTEM FOR CROP PROTECTION BY USING ARDUINO (SRUSHTI YADAHALLI et al, YEAR: 2020)

Agriculture provides food for the population while also providing various raw materials to industries. Animal encroachment on agricultural lands as a result of massive crop losses Crop damage from wild animal raiding has recently emerged as a major source of concern. Wild boars, macaques, porcupines, deer, monkeys, and bears are extremely dangerous and have occasionally resulted in human fatalities. Crop yield losses for potatoes and wheat are high in villages. Due to strict wildlife laws, small farmers lose up to 50% of their crops to wild animals and are unable to take harsh measures. Human-elephant conflict is on the rise because elephants are a highly conflict-prone wildlife species, particularly in India. As a result, a system that can assist farmers in driving away these animals as soon as they become aware of their presence is required.

4. INTELLIGENT CROP MONITORING AND PROTECTION SYSTEM IN AGRICULTURAL FIELDS USING IOT (Ramaprasad S et al, YEAR: 2019)

Numerous methodologies for utilising WSN and electronics technologies in agriculture sectors to increase crop yields have been proposed by the authors.

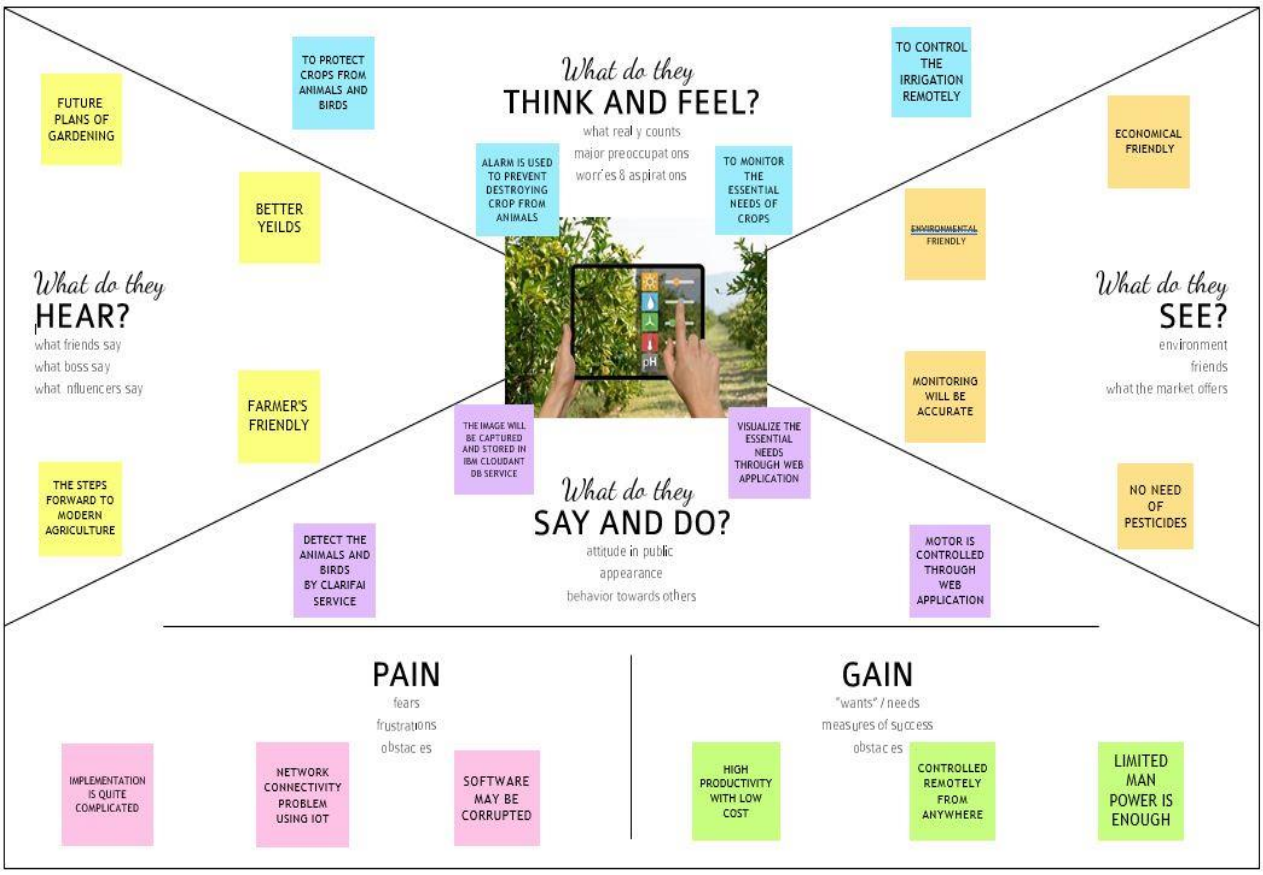
Authors have also discussed hybrid networks, which include both terrestrial and underground wireless networks, both of which are critical to formers. Karan Kansara and colleagues provided a thorough examination of sensor-based irrigation systems that employ microcontroller WSN technology. They also demonstrated how to use moisture sensors to use water resources for free. Author Narayut Putjaika used sensors, the Internet of Things (IoT), and an Arduino Microcontroller to create an intelligent and controlled forming.

2.3 PROBLEM STATEMENTS

Most of the farmers are facing many problems nowadays due to many reasons. Our problem to solve is the invasion of various species such as birds and animals that harm the crops that are being cultivated. Various types of species such as birds and animals come to the cultivation field according to the crop that is being cultivated and also according to the season of cultivation. Some wild animals enter the field during night times when the field is near a forest region or when the farm cultivates some fruits and other crops that attract animals.

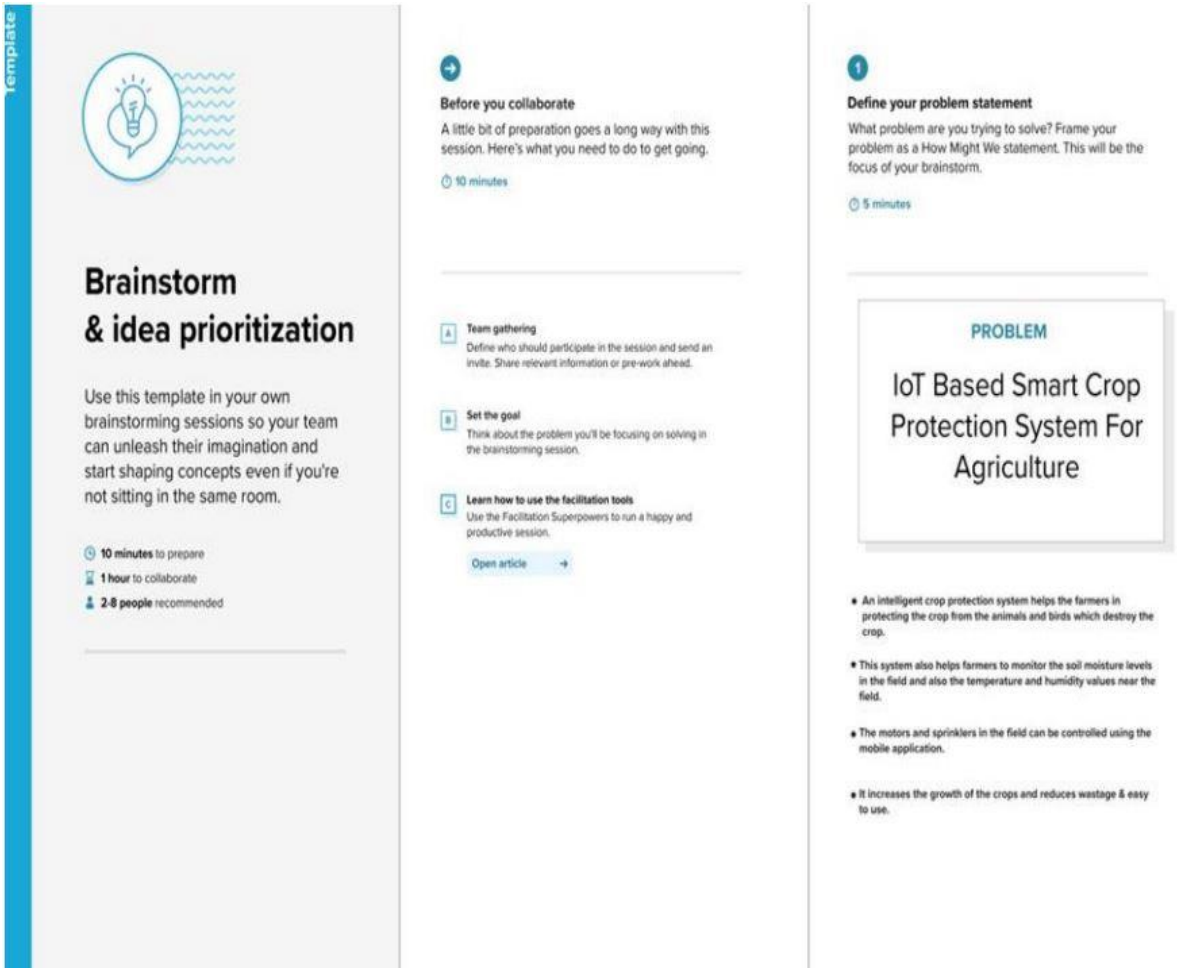
CHAPTER-3
IDEATION AND PROPOSED SOLUTION

3.1 EMPATHY MAP



3.2 BRAINSTORMING AND IDEA PRIORITIZATION

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



Step 2: Brainstorm, Idea Listing, and Grouping

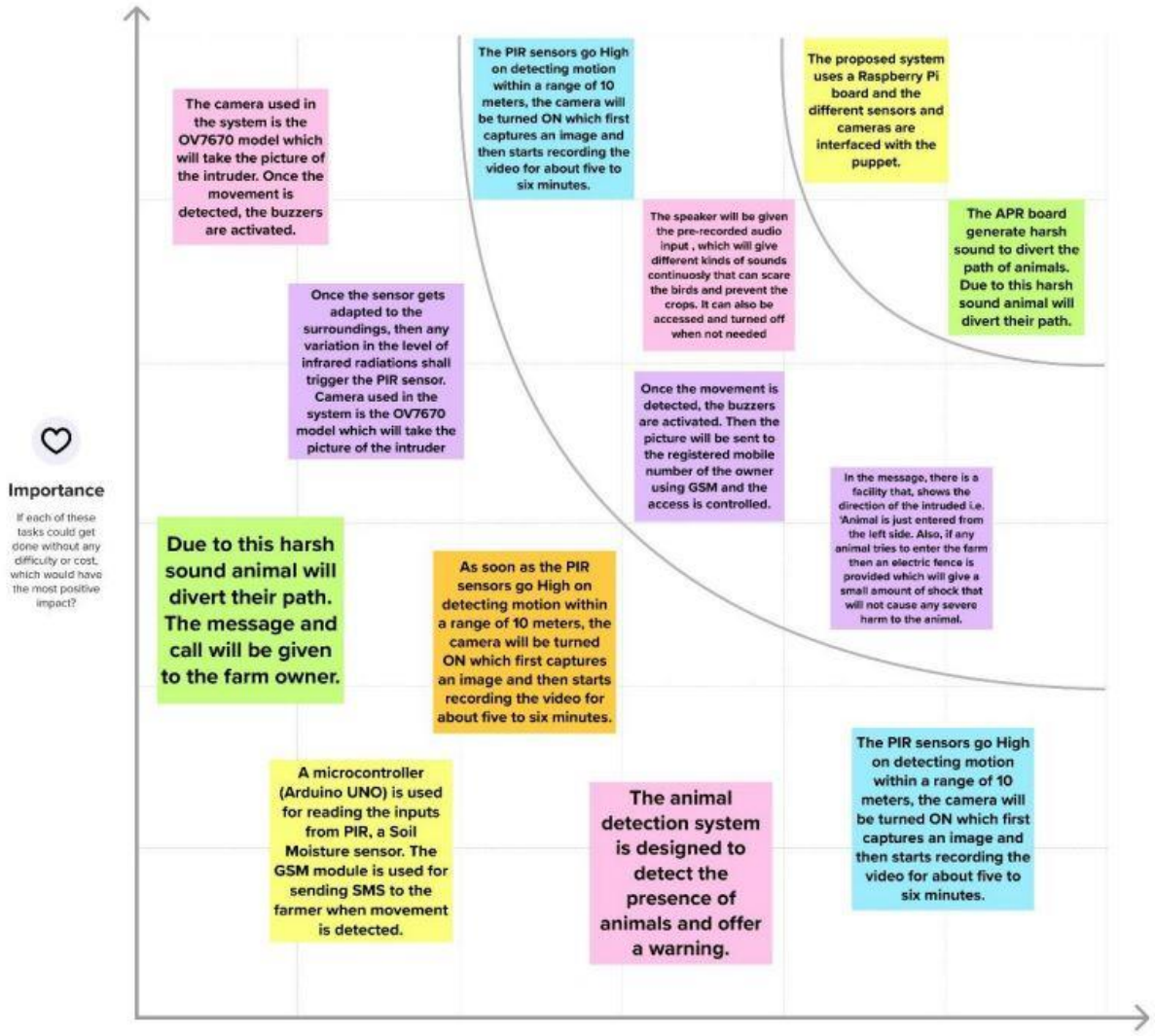
Step 3: Idea Prioritization

4

Prioritize

Your team should all be on the same page about what's important moving forward. Place your ideas on this grid to determine which ideas are important and which are feasible.

20 minutes

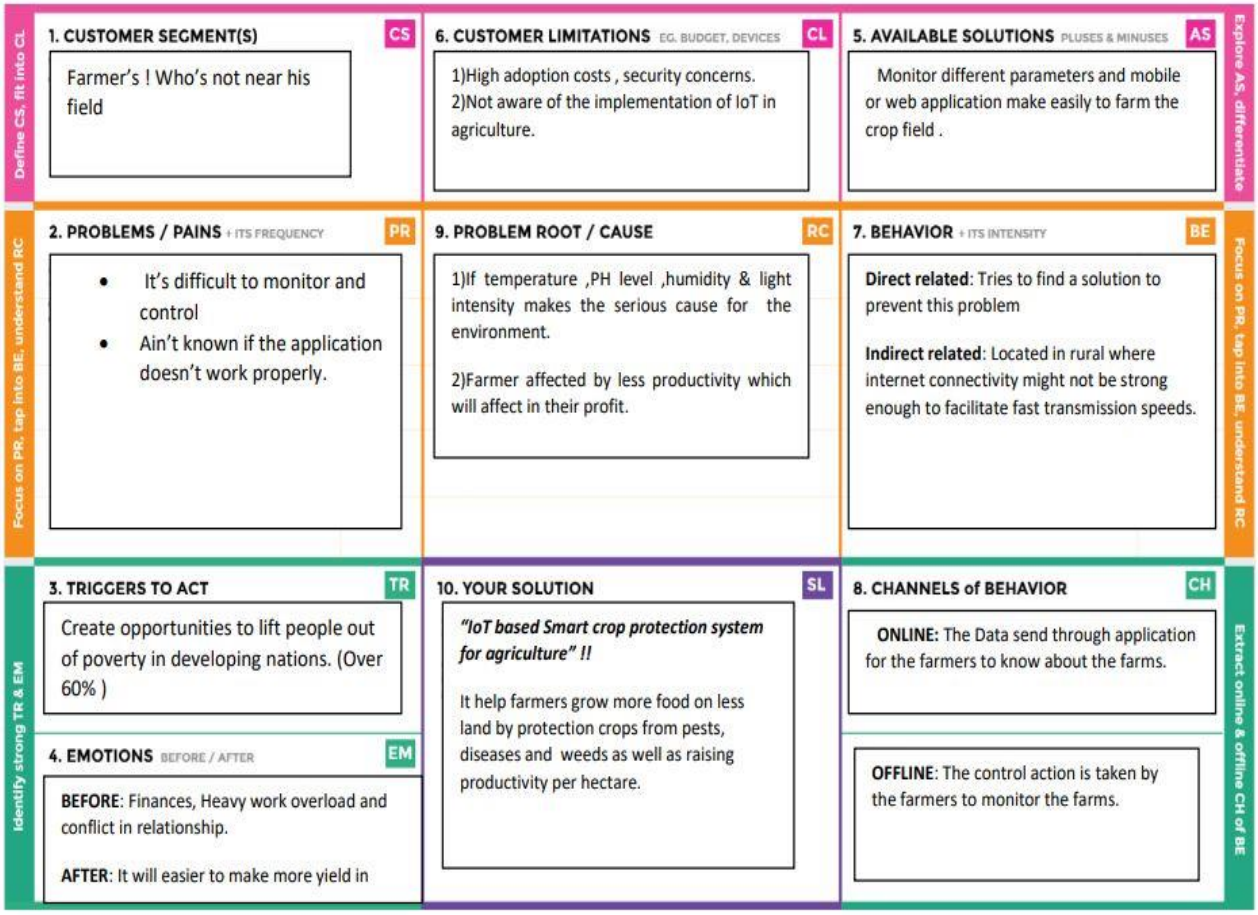


3.3 PROPOSED SOLUTION

S.No.	Parameter	Description
1.	Problem Statement (Problem to be solved)	Develop an efficient system & an application that can monitor and alert the users(farmers)
2.	Idea/Solution description	➢ This product helps the field in monitoring the animals other disturbance ➢ In several areas, the temperature sensors will be integrated to monitor the temperature & humidity ➢ If in any area feel dry or wetless is detected by admins, will be notified along with the location in the web application
3.	Novelty/Uniqueness	➢ Fastest alerts to the farmers ➢ The increasing demand for quality food ➢ User friendly

4.	Social Impact/Customer Satisfaction	➢ Easy installation and provide efficient results ➢ Can work with irrespective of fear
5.	Business Model(Revenue Model)	➢ As the product usage can be understood by everyone, it is easy for them to use it properly for their safest organization ➢ The product is advertised all over the platforms. Since it is economical, even helps small scale farming land from disasters.
6.	Scalability of the Solution	➢ Even when the interruption is more, the product sense the accurate location and alerts the farmers effectively

3.4 PROBLEM-SOLUTION FIT TEMPLATE:



CHAPTER 4
REQUIREMENT ANALYSIS

4.1 FUNCTIONAL REQUIREMENTS:

1. Proper detection - When movement is detected, the PIR sensor connected to the camera is triggered, and images are sent to the Farmer's registered mobile number.

2. Notification alert - When movement is detected, an audio alert is sent to the user's registered email address.

3. Control - The sprinkler and motor systems can be controlled from the dashboard and displayed in the debug window.

4. Mobile application - The user can control and view the updated values on the dashboard.

4.2 NON-FUNCTIONAL REQUIREMENTS:

1. Usability - IOT can protect crops from birds and animals while also increasing crop production.

2. Security - IoT is the most effective method of monitoring crops, yields, and birds.

3. Reliability - IOT is used to protect agriculture from birds and animals, as well as to help farmers increase yield and save money.

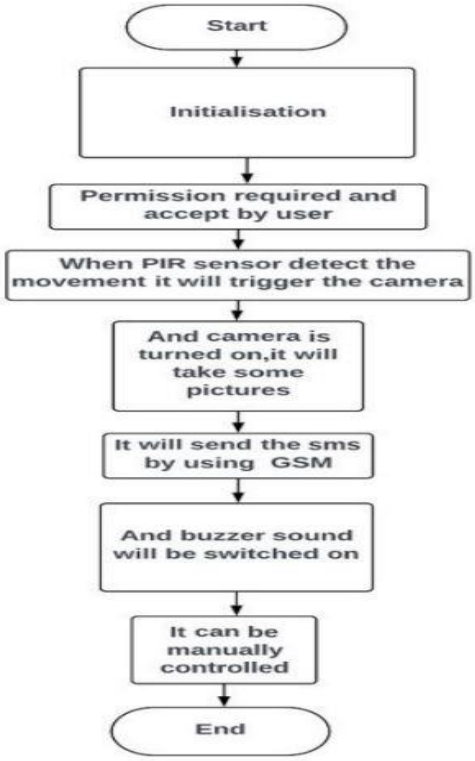
4.Performance - When an animal is detected in the fields, the IOT immediately captures the image and sends it to the registered mobile number. It is simple to monitor and will increase productivity.

5. Availability - The available solution is to use the IOT system to protect crops from birds and provide farmers with higher yields.

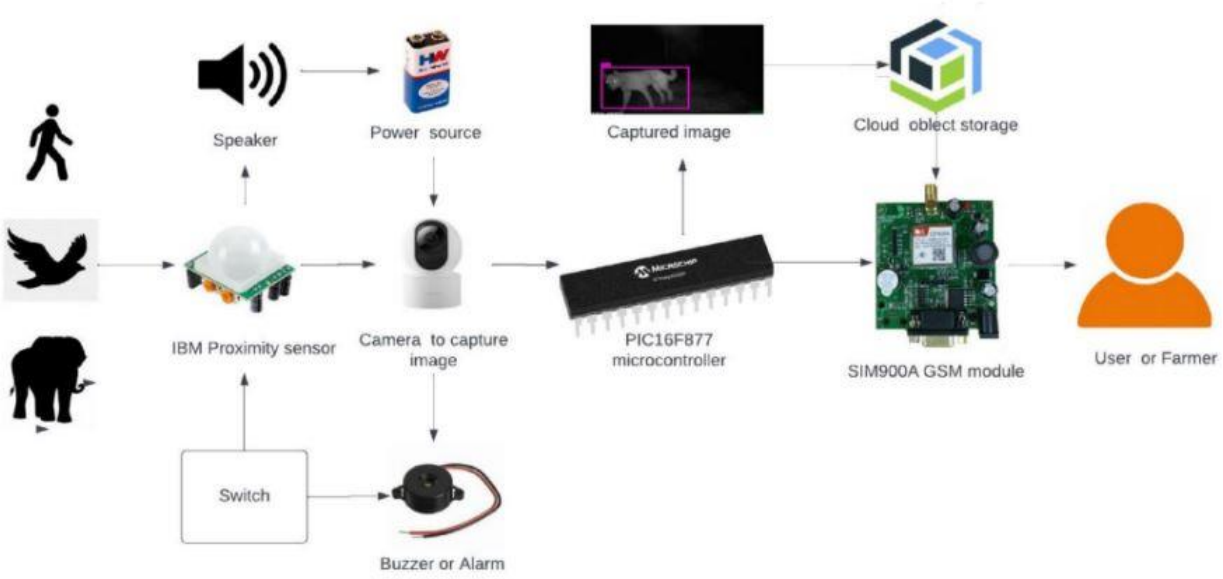
6. Scalability - IoT-based smart crop protection helps us keep such animals away from farmlands while also providing field surveillance functionality.

CHAPTER 5
PROJECT DESIGN

5.1 DATA FLOW DIAGRAM:



5.2 SOLUTION AND TECHNICAL ARCHITECTURE



5.3 USER STORIES:

User Type	Functional Requirement (Epic)	User Story Number	User Story / Task	Acceptance criteria	Priority	Release
Customer (Citizen)	Employee	USN-1	As a user, my owner wants to access the machine remotely and manually	My owner wants to access the machine manually and remotely	High	Sprint-1
Customer (Farmers)	Family members	USN-2	As a user, I want to monitor it in a different location in a simple way	I want to monitor it in a different location in a simple way	High	Sprint-1
Customer (Landowners)	Family members	USN-3	As a user, I want to access the camera for 24 hours and save the data in the picture or video format to access any time	I want to access the camera for 24 hours and save the data in the picture or video format	Medium	Sprint-2
Customer (workers)	Retainer	USN-4	As a user, my owner wants to access full control of the machine remotely and tries to deny the accessibility of permission to access the machine	my owner wants to access full control of the machine remotely	Low	Sprint-4

CHAPTER - 6

PROJECT PLANNING AND SCHEDULING

6.1 SPRINT PLANNING & ESTIMATION:

Sprint	Functional Requirement (Epic)	User Story Number	User Story / Task	Story Points	Priority	Team Members
Sprint-1	Proper detection	USN-1	As a user, I want to detect the movement ofintruder in the field	5	High	Gokul vigneesh S
		USN-2	As a user, I want to know about the intruderhence the camera is activated	4	High	Gokul vigneesh S
		USN-3	As a user, I want to capture the pictures of theintruder	3	Medium	Gokul vigneesh S
Sprint-2	Buzzer	USN-4	As a user, I should ensure the crop protectionfrom birds using speaker	2	Medium	Ganesh kumar S
		USN-5	As a user, I should protect crop from intruderusing buzzer once the pictures are captured	4	High	Ganesh kumar S

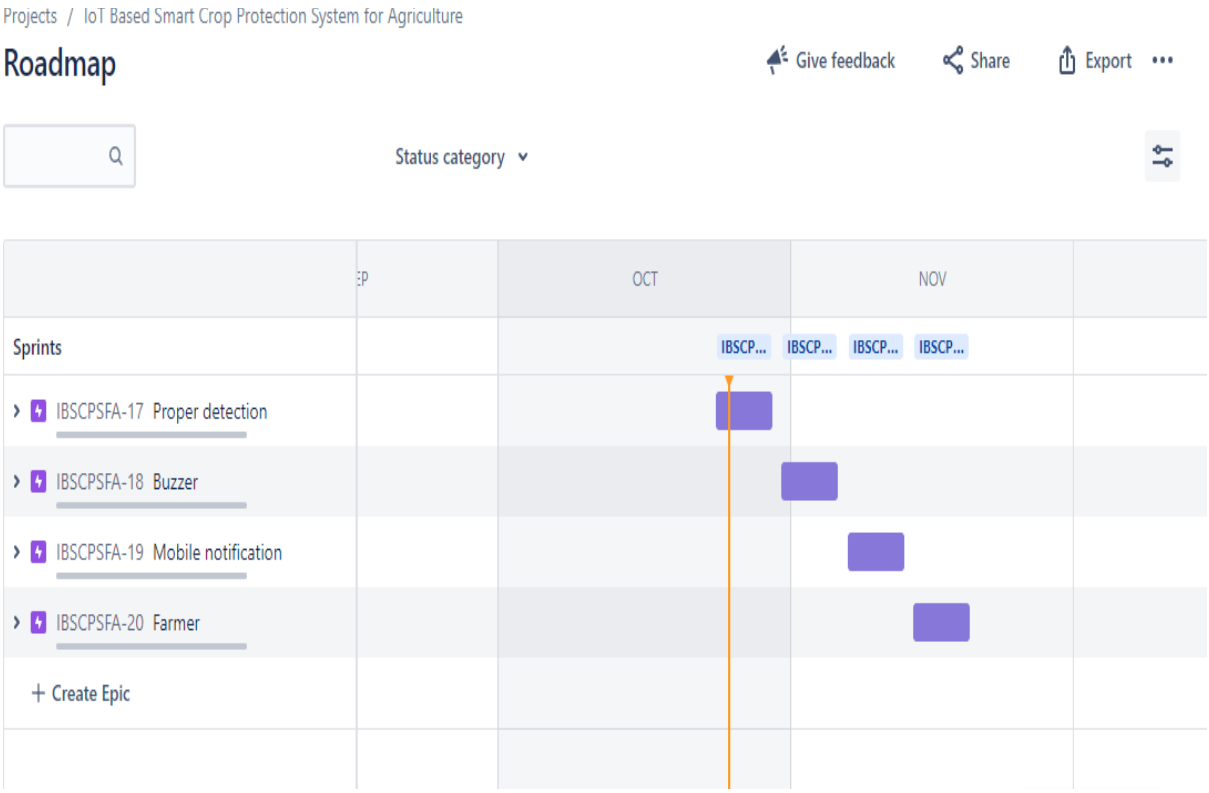
Sprint-3	Mobile notification	USN-6	As a user, I will receive the pictures of theintruder through SMS	5	High	Madan Durkesh T
		USN-7	As a user, I can monitor the activity through thedata stored in the cloud	3	Medium	Madan Durkesh T
Sprint-4	Farmer	USN-8	As a user, I will receive the alert message forthe identification of intruder	5	High	Bathri Nath V
		USN-9	As a user, I can access the system from remote region through which I can switch off the buzzerwhen not needed	1	Low	Bathri Nath V
		USN-10	As a user, I can use the system at different region so that the animals won’t get used to it	1	Low	Bathri Nath V
		USN-11	As a user, I should ensure the power efficiency using the solar power source	2		Bathri Nath V

6.2 SPRINT DELIVERY SCHEDULE:

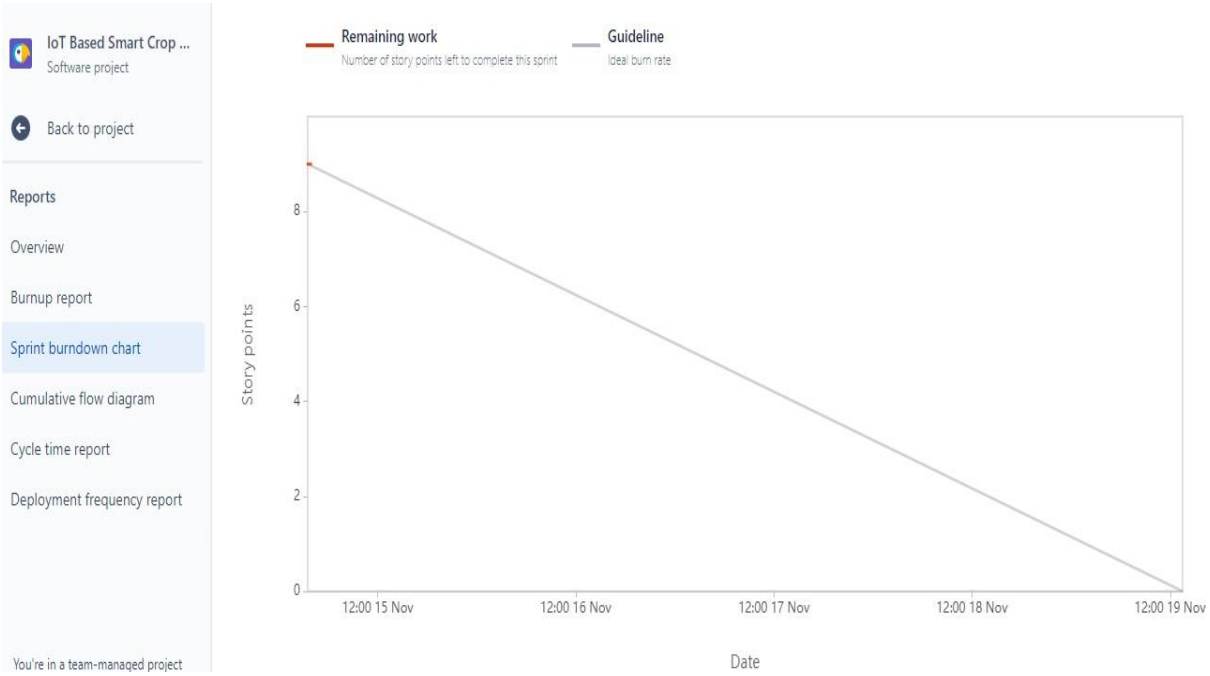
Sprint	Total Story Points	Duration	Sprint Start Date	Sprint End Date (Planned)	Story Points Completed (as on Planned End Date)	Sprint Release Date (Actual)
Sprint-1	20	6 Days	24 Oct 2022	29 Oct 2022	20	29 Oct 2022
Sprint-2	20	6 Days	31 Oct 2022	05 Nov 2022	20	05 Nov 2022
Sprint-3	20	6 Days	07 Nov 2022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

6.3 REPORT FROM JIRA:

ROADMAP:



BURNDOWN CHART:



CHAPTER-7
CODING AND SOLUTIONS

7.1 FEATURE 1:

The source code was written in Python IDLE 3.7.0. The fast-changing automotive industry has enabled IoT to revolutionise the industry. The internet of things (IoT) improves the safety and efficiency of driving. It has unleashed a slew of agricultural benefits, from increased productivity to reduced crop failure risks. The ability of IoT to diagnose a problem and avoid system failure is assisting in the prevention of a breakdown scenario.

Code:

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

7.2 FEATURE 2:

Node-RED includes a browser-based flow editor that makes it simple to connect flows using the palette's many nodes. Flows can then be deployed to runtime with a single click. A rich text editor can be used to create JavaScript functions within the editor. It includes a lightweight runtime environment as well as an event-driven, non-blocking model. The various flows created in Node-RED are saved as JSON files that can be easily imported and exported for sharing with others.

Code:

```
 msg. payload = {“temp": global.get("t"),
  "humid": global.get("h"),
  "soilmoisture": global.get("s")
  }
return msg;
```

CHAPTER- 8
TESTING

8.1 TEST CASES:

Steps To Execute	Test Data	Expected Result	Status	Executed By
1. Run the python source code. 2. The data for temperature, humidity, and soil moisture will be fetched. 3. Buzzer will turn on once the movement is detected.	https://drive.google.com/file/d/1-3vergo1RCCLMzWU6hucxCV21USGjyYM/view?usp=share_link https://wokwi.com/projects/347573917988160084	The user should see the values of temperature, humidity, and soil moisture. The buzzer should be activated in the wokwi.	Pass	Madan Durkesh T
1. Interfacing source code, IoT Watson and Node Red. 2. Captured picture storage and alerts.	https://node-red-rxabr-2022-11-15.eu-gb.mybluemix.net/red/#flow/bba954e0a65da09b	Weather monitoring values should be displayed and alert audio should be played. The user should receive the alert email. The captured image can be viewed.	Pass	Ganesh kumar S
1. Dashboard controls	https://node-red-rxabr-2022-11-15.eu-	The motor and sprinkler should	Pass	Bathri Nath V

		be controlled in the node-red red dashboard. User should hear the process done. The weather monitoring data and controls should be accessible outside the node red through the link generated.		
2. Interfacing the NodeRed dashboard values to the MIT app inventor.	gb.mybluemix.net/red/#flow/bba954e0a65da09b			
1.Mobile application development. 2.Data updates and motor &sprinkler control.	http://ai2.appinventor.mit.edu/#4718677120122880	The updated values of temperature, humidity, and soilmoisture should be displayed in the MIT app through the AI companion. The status of control should be displayed in the node-red debug window.	Pass	Gokul vigneesh S

8.2 USER ACCEPTANCE TESTING:

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).

Defect Analysis:

Resolution	Severity 1	Severity 2	Severity 3	Severity 4	Subtotal
By Design	9	3	2	1	15
Duplicate	0	0	1	2	3
External	2	3	0	1	6
Fixed	8	2	4	14	28
Not Reproduced	0	0	1	0	1
Skipped	0	0	0	1	1
Won't Fix	0	0	0	1	1
Total	19	14	8	20	55

Test case analysis:

Section	Total Cases	Not Tested	Fail	Pass
User Application	5	0	0	5
Caretaker Application	20	0	0	20
Security	2	0	0	2
Outsource Shipping	3	0	0	3
Exception Reporting	9	0	0	9
Final Reporting	4	0	0	4
Version Control	2	0	0	2

CHAPTER - 9
RESULT

9.1 PERFORMANCE METRICS:

S. No	Project Overview	NFT Test approach	Assumption/Dependencies/ Risks	Approvals/ Sign Off
1	Web UI & App	Stress	App crash/developer team/site down	Approved
2	Web UI & App	Load	Server crash/developer team/server down	Approved

END OF TEST REPORT:

S. No	Project Overview	NFT test approach	NFR-Met	GO/NO-GO decision	Identified Defects	Approvals/SignOff
1	Web UI & App	Stress	Performance	GO	Closed	Approved
2	Web UI &App	Load	Scalability	NO-GO	NO-GO	Approved

CHAPTER-10
ADVANTAGES AND DISADVANTAGES

ADVANTAGES:

1. IoT allows farmers to avoid challenges and eliminates all issues that may arise during the farming process, resulting in increased product quantity and satisfied customers.
2. The Internet of Things system helps to continuously monitor land so that precautions can be taken at an early stage, which increases productivity, reduces manual labour, and improves farming efficiency.
3. Crop maintenance can be easily performed using IoT to monitor crop growth.
4. Enhanced agricultural productivity.
5. These sensors have wireless chips that allow them to be controlled remotely.
6. They are simple to operate, use, and maintain.

DISADVANTAGES:

1. IoT smart crops require continuous Internet availability; the rural areas of developing countries do not meet these requirements, and the Internet is slower.
2. The IoT-based equipment demanded that the farmer comprehend and learn how to use technology. This is the primary barrier to widespread adoption of smart agriculture frameworks.

CHAPTER-11
CONCLUSION

Agriculture is one of the most significant users of water. Crop vandalism by wild animals and fire has emerged as a major social issue in recent years. It requires immediate attention because there is currently no effective solution to this problem. As a result, this project has significant social significance because it seeks to address this issue. This project will assist farmers in protecting their orchards and fields, saving them from significant financial losses as well as the time and effort required to protect their fields. This will also help them achieve higher crop yields, which will improve their economic situation. As a result of this system, we can easily detect changes in the field and notify the farmers, as well as take precautions and implement appropriate remedies.

CHAPTER-12
FUTURE SCOPE

IoT smart agriculture products are intended to assist in crop field monitoring by using sensors and automating irrigation systems. As a result, farmers and associated brands can easily monitor field conditions from any location. Wireless sensors that detect soil, water, light, humidity, and temperature levels in crop fields are among the technologies available to modern farmers. By collecting data from sensors, IoTs can determine the best time to irrigate crops, as well as check temperature, soil humidity, and water level.

CHAPTER-13

APPENDIX

13.1.SOURCE CODE:

```
import time
import sys
import ibmiotf.application
import ibmiotf.device
import random
#Provide your IBM Watson Device Credentialsorganization = "z22obn"
deviceType = "IBM"
deviceId = "IBMID1"
authMethod = "token"
authToken = "TOKENIBM"#
Initialize GPIO
try:
      deviceOptions = {"org": organization, "type":
deviceType, "id":deviceId, "auth-method": authMethod,
"auth-token": authToken}
    deviceCli = ibmiotf.device.Client(deviceOptions)
     #.....
Except for Exception as e:
    print("Caught exception connecting device:
    %s" % str(e))sys.exit()
# Connect and send a datapoint "hello" with value
"world" intothe cloud as an event of type "greeting" 10
times
deviceCli.connect()
while True:
```

```
        #Get Sensor Data
        temp=random.randint(0,100)
        Humid=random.randint(0,100)
        soilmoisture = random.randint(0,100)
        #Assume
        if temp>=60 and Humid>=60 and soilmoisture>=60 :
            motion = 1
            print("_____")
            print("Motion detected..!")
        else :
       motion = 0
             data = { 'temp' : temp ,'Humid': Humid , 'soilmoisture' :
soilmoisture , 'Motion' : motion }
        #print data
        def myOnPublishCallback():
            print ("Published to IBM Watson...!")
             print ("Temperature = %s C" % temp, ", Humidity = %s %%"
% Humid, ", Soil Moisture = %s %%" % soilmoisture )

           success = deviceCli.publishEvent("IoTSensor", "json", data,
qos=0, on_publish=myOnPublishCallback)
        if not success:
            print("Not connected to IoTF")
        time.sleep(10)
        def myCommandCallback(command):
            print("Command received: %s" % command.data)
            command=command.data['command']
```

```
                print(command)
                if(command=='sprinkler has been switched on'):
                    print('sprinkleron')
                elif(command=='sprinkler has been switched off'):
                    print('sprinkleroff')
                elif(command=='motor has been switched on'):
                    print('motoron')
                elif(command=='motor has been switched off'):
                    print('motoroff')
            success = deviceCli.publishEvent("IoTSensor", "json",data,
        qos=0, on_publish=myCommandCallback)
             if not success:
            print("Command not received")

        deviceCli.commandCallback = myCommandCallback

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

13.2 GITHUB LINK

https://github.com/IBM-EPBL/IBM-Project-37078-1660300256

REFERENCES

[1] SMART CROP PROTECTION SYSTEM FROM WILD ANIMALS AND BIRDS USING IOT, International Journal of Advance Research, Ideas (AUTHOR: Harish. N.J. J) – 2021

[2] SMART INTRUSION DETECTION SYSTEM FOR CROP PROTECTION BY USING ARDUINO, Proceedings of the Second International Conference on Inventive Research in Computing Applications (AUTHOR: Srushti Yadahalli) – 2020

[3] INTELLIGENT CROP MONITORING AND PROTECTION SYSTEM IN AGRICULTURAL FIELDS USING IOT International Conference on Recent Trends in Electronics, Information, Communication & Technology(AUTHOR: Ramaprasad S) - 2019