LOYOLA INSTITUTE OF TECHNOLOGY,CHENNAI

ANNA UNIVERSITY,CHENNAI – 600025

PROJECT TITLE: IoT BASED SMART CROP PROTECTION SYSTEM

FOR AGRICULTURE

A NALAIYA THIRAN PROJECT REPORT

SUBMITTED BY

TEAM SIZE: 4

TEAM LEADER: ARUN K_210919106014

TEAM MEMBER: KURALARASAN K_210919106049

TEAM MEMBER: DHINAKAR S_210919106023

TEAM MEMBER: NAVEEN KURAM S_210919106057

TEAM ID: PNT2022TMID25614

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INTRODUCTI

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1.1 PROJECT OVERVIEW

The main focus of our project is to protect the crops from the damage caused by animals and birds. A proximity sensor detects the movement of animals and birds in the crop fields. Once the movement is detected, the camera should be turned on and the pictures should be taken and the buzzer should be activated to threaten the animals in the crop fields and the pictures taken will be stored in the Cloudant database. Then the alert message should be sent to the registered email of the user. The python code is developed for measuring the weather monitoring factors such as temperature, humidity and soil moisture levels and it can be displayed in Node-Red application. The motors and sprinkler systems in the crop fieldscan be controlled by using the mobile application. Then the user cancontrol the motor and sprinkler systems using the mobile application.

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 willbe 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:

Nowadays farmers are suffering a lot due to birds and animals vandalization in the field. Due to their outbreaks, most of the crop production were affected. The total yield of the crop has been reduced. It is difficult for the farmers to guard thefield 24/7.

The challenges of a smart agriculture system include the integration of sensors and tying the sensor data to the analytics driving automation and response activities. The biggest challenges faced by IoT in the agricultural sector are lack of information, high adoption costs, security concerns, etc. Most farmers are not aware of the implementation of IoT in agriculture. Farmers need to deal with many problems, including how to cope with climate change, soil erosion, and biodiversity loss.Even though the farmers employ manpower to monitor the field to protect it from the birds and animals, it is not possible for them 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 plays the buzzer when movement is detected in the field in order to scare the birds and animals and drive them away from the field. The problem here is that the birds and animals get used to it after a very few times, and the user won't be able to know about this and be notified.

2.2 SURVEY WORK

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

The smart crop protection system assists us in keeping such wild animals away from farmlands while also providing surveillance functionality. This project is based on surveillance using an animal ward-off system in farmlands to prevent crop vandalism by wild animals. In addition to providing security, this system uses RFID tags to distinguish between an intruder and an authorized person, and various PIR sensors are placed throughout the area to detect any movement. The Raspberry Pi board is connected to all of the sensors and components. As a result, we developeda product that can be very useful for farmers; it prevents crop loss and increases yield while also protecting the farm from intruders. This is an Arduino-powered system. A motion sensor is used in this system to detectanimals and birds in the field. In this case, the sensor instructs the Arduinoto act. Here, we decided to monitor the animals and birds where the PIR sensor detects their presence. It is made up of a power supply section, a PIR sensor, an Arduino, a buzzer, and an LED. When animals and birds enterthe farm area, PIR sensors are used to detect them. The Arduino board will immediately turn on, and the sound will be played to distract the animal. The LED will be turned on at night. This device is powered by an Embedded PIC Microcontroller. It includes a PIR sensor, a PIEZO buzzer, a 12v adapter,and an LED. When animals attack crops in an agricultural field, this systemdetects the sound produced by the buzzer and generates it.

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

Sensors are used to detect intrusion in the field and are connected to an Arduino Uno. When the sensor inputs data, the Arduino Uno turns on the camera to capture the image and classify it using image processing to determine whether the animal is domestic or wild. The camera's input is processed. Convolution Neural Network is used to classify images. Identifying whether the animal is domestic or wild. Taking appropriate action based on the intruder after image processing and classification. If awild animal is detected, the processor activates an alarm and sends an alert to the farmer. If animals or birds are detected during the process, an alarm or buzzer should be activated. If a domestic animal is detected, a notification will be sent to farmers via the GSM module. If the detected animal is wild, a notification will be sent to both farmers and forest officers, along with the animal's GPS location. Notification will be sent to farmers and forest officials. A warning about the presence of animals is sent to the farmer. We use GSM/Wi-Fi Messenger to send notifications to farmers. A warning about the presence of animals is sent to the farmer.

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

Agriculture meets the population's food needs while also providing various raw materials to industries. Animal interference in agricultural lands results in massive crop losses. Crop damage caused by wild animal raiding has recently become a major source of concern. Animals such as wild boars, macaques, porcupines, deer, monkeys, and bears are extremely destructive and have occasionally resulted in human casualties. In villages, crop yield losses are high for potatoes and wheat. Small farmers lose up to 50% of their crops to wild animals and are unable to take harsh measures due to strict wildlife laws. Elephants are a highly conflict-prone wildlife species, particularly in India, so human-elephant conflict is on therise. As a result, there is a need for a system that can assist farmers in driving away these animals as soon as they become aware of their presence. There are three levels of alerts in this system: low, moderate, and high, which allow the extent of the danger posed by the intruder to beeasily determined. The Passive Infrared (PIR) sensor is positioned in sucha way that it provides a wider detection range. Thus, the novelty of the paper lies in the availability of a Thin Field Transistor (TFT) display that acts as a visual alarm that other villagers can see and use to protect the farm if the farmer is delayed in arriving. The TFT display's pixel control feature provides the benefit of clearer images as output.

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

Authors have proposed numerous methodologies for utilizing WSN and electronics technologies in agriculture sectors to increase crop yields. Authors have also discussed hybrid networks, which include both terrestrial and underground wireless networks, which are very important to formers. Karan Kansara and others the authors provided a detailed review of sensor-based irrigation systems that use microcontroller WSN technology. They also explained how to use water resources essentially for free by using moisture sensors. Author Narayut Putjaika created an intelligent and controlled forming using sensors, the Internet of Things (IoT), and an Arduino Microcontroller. Here authors have considered two sets of sensors first set to monitor actual weather conditions and the second set of data from sensors kept in the pot, both data are used to predict weather conditions using a decision tree. Kavita Bhole et al. Novelty of this paper is authors have used solar panels to generate the required power supply to microcontrollers and other peripherals, also authors have used moisture sensors to measure the moisture level of soilbased on the moisture level, and a water pump will be turned on and off. Shweta B. Saraf et al. have used a combination of WSN and actuator networks to collect the sensed data from the irrigation fields, authors usedcloud computing technology to provide optimal usage of water or any nutrition to plants. M. Newlin Rajkumar et. Al Traditional farming consumes more water and results in water wastage. Moreover, in dry

areas where there is inadequate rainfall, irrigation becomes difficult. Hence, we require an automatic system that will precisely monitor and control the water essential in the field. Installing a Smart irrigation systemsaves time and ensures judicious usage of water.

5. PROTECTION OF CROPS FROM WILD ANIMALS USING AN INTELLIGENT SURVEILLANCE SYSTEM (Mriganka Gogoi et al, YEAR: 2018)

To make the best use of mobile communication technology, the goals of this paper are to use the global system for mobile communication (GSM) and to provide short message service (SMS). This system assists us in keeping such wild animals away from farmlands while also providing surveillance functionality. It has been discovered that the odor of rotten eggs deters wild pigs and deer from destroying crops, so farmers manually spray the rotten egg solution on their fields, and firecrackers are used to deter wild elephants from destroying crops. This project is based on surveillance with an animal ward-off system used in farmlands to prevent crop vandalism by wild animals. In addition to providing protection, this system uses RFIDS to distinguish between an intruder and an authorized person. Various PIR sensors are deployed in the area to detect any motion and thus turn on a camera when movement is detected, providing real-timemonitoring. It entails the automation of certain rotten egg sprays. We also

use Haar feature-based cascade classifiers for object detection to distinguish between animals and humans. When such intrusions occur, a message is automatically generated, and the cameras are turned on, capturing an image and beginning to record the video for some time, whichis then stored on the SD card as well as on the cloud, i.e., Dropbox. The landowner can then view the video on any smart device and access it later.The Raspberry Pi board is connected to all of the sensors and components.

2.3 PROBLEM STATEMENTS

Create a problem statement to understand your customer's point of view. A customer problem statement template helps to focus on matters that will create positive experiences for farmers and users. Our main aim is to prevent crops from being destroyed by birds and animals and to prevent the wastage of crops

Problem Statement (PS)	I am (Customer)	I'm trying to	But	Because	Which makes me feel
PS-1	Farmer	Protect crops	Crops are being damaged	Birds and animals vandalization	Frustrated
PS-2	Land Owner	Prevent damage of crops	Loss of investment in crops	Wastage of crops	Stressed

Figure.2.3.Problem Statement

CHAPTER-3

IDEATION AND PROPOSED SOLUTION

3.1 EMPATHY MAP

The empathy map is easy to understand, but the problem is associated with the user's feelings. It is a very useful tool for helping companies understand their users. The most effective way to create a requirement is to know what the person's true problem is, and what his pain is. It involvescreating a map from the user's perspective, based on their goals andchallenges.

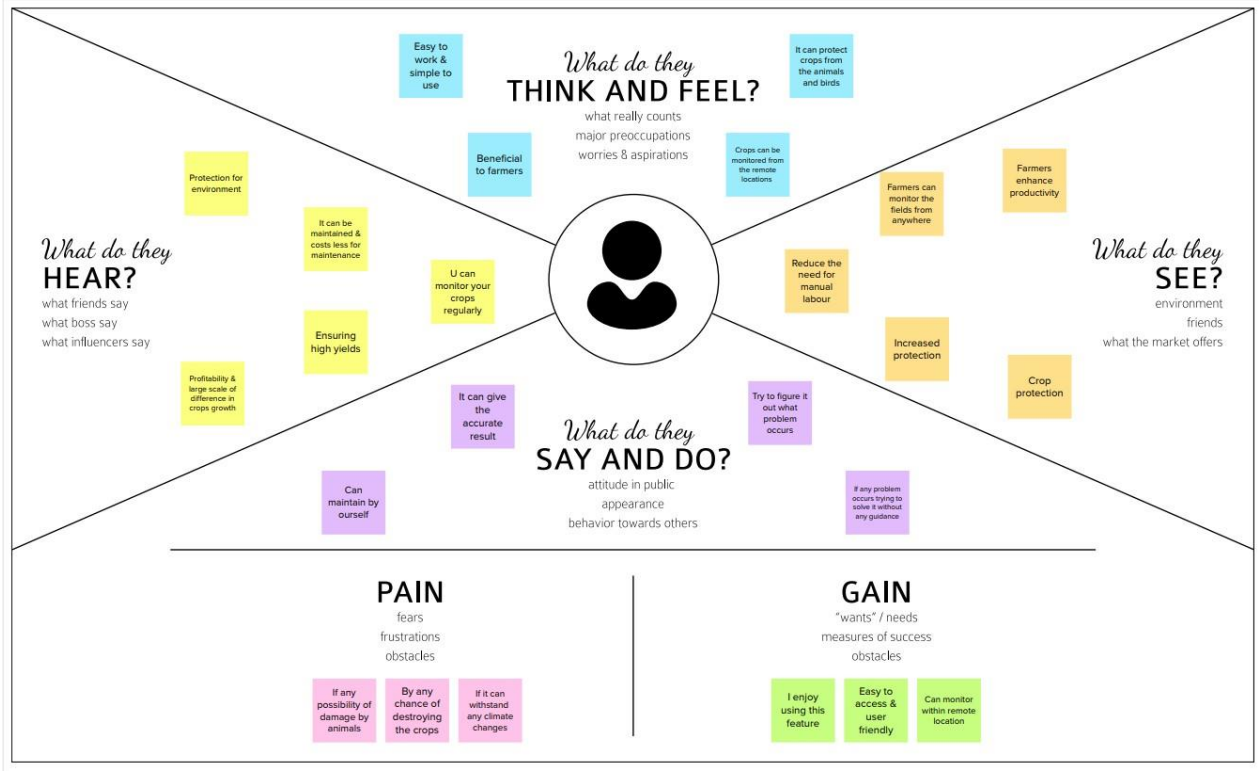


Figure 3.1. Empathy Map

3.2 BRAINSTORMING AND IDEA PRIORITIZATION

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

This step consists of forming the team, gathering problems in the domainwe have chosen, and synthesizing the information into a single problem statement.

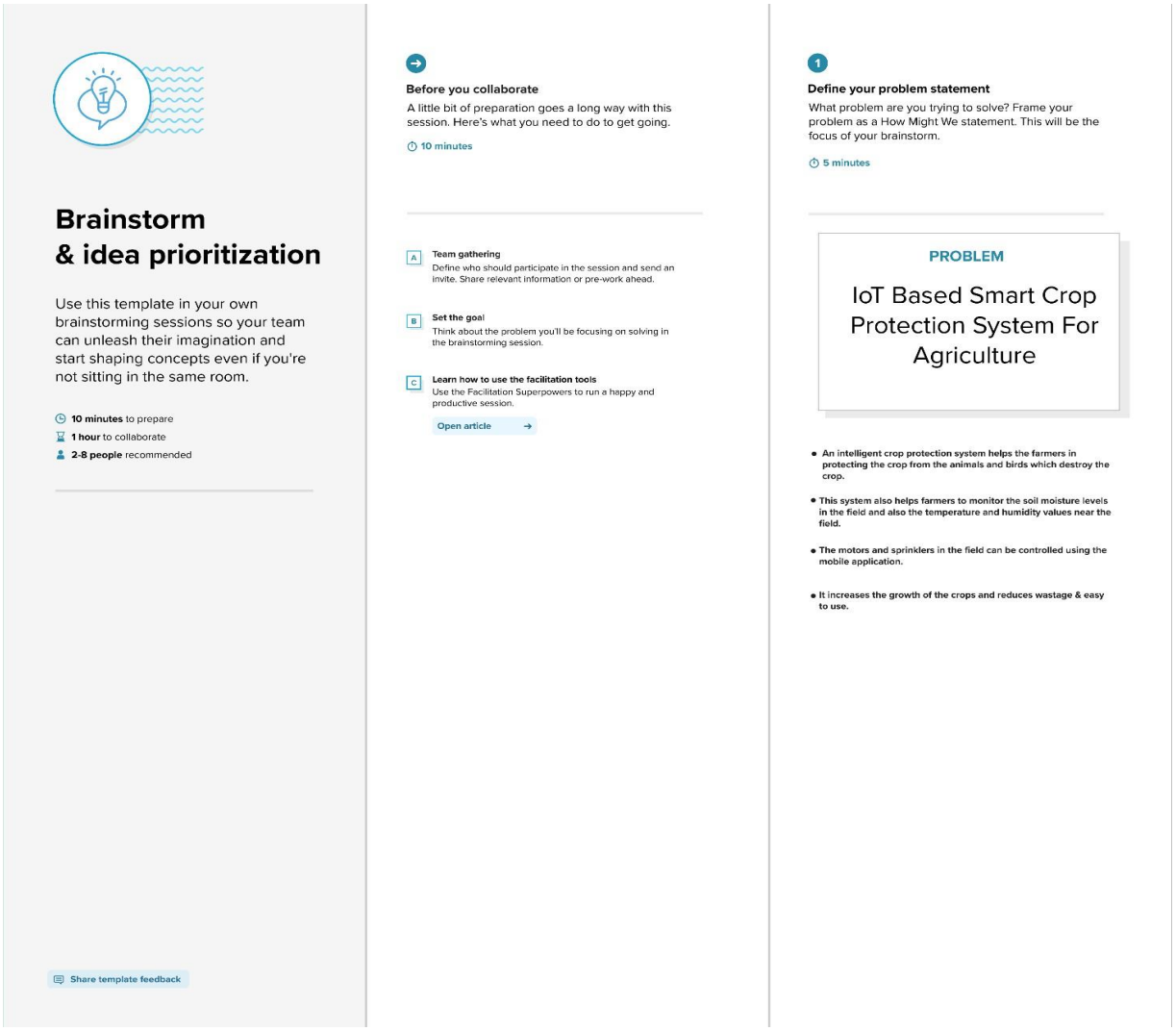


Figure 3.2.a. Ideation And Brainstorming

Step 2: Brainstorm, Idea Listing, and Grouping

In this step of ideation, teammates list their ideas to help solve the framed problems. All the individual ideas have been valued and grouped into their clusters.

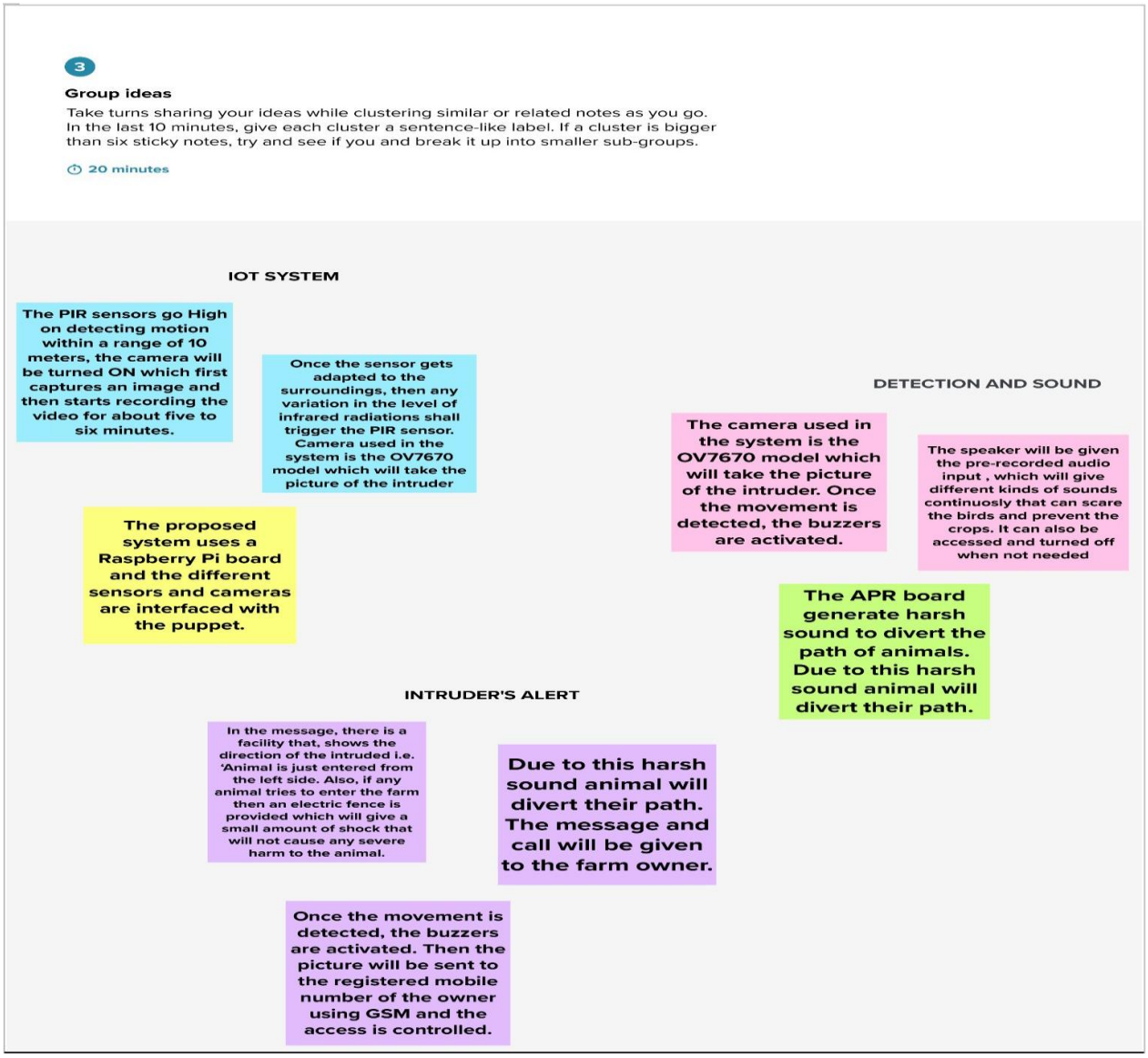


Figure 3.2.b. Brainstorm, Idea Listing and Grouping

Step 3: Idea Prioritization

This step includes the process of listing the necessary components to come up with a working solution. It also includes the process of making a hierarchy chart by prioritizing components based on their importance. Higher represents the backend, while lower represents the user interface.

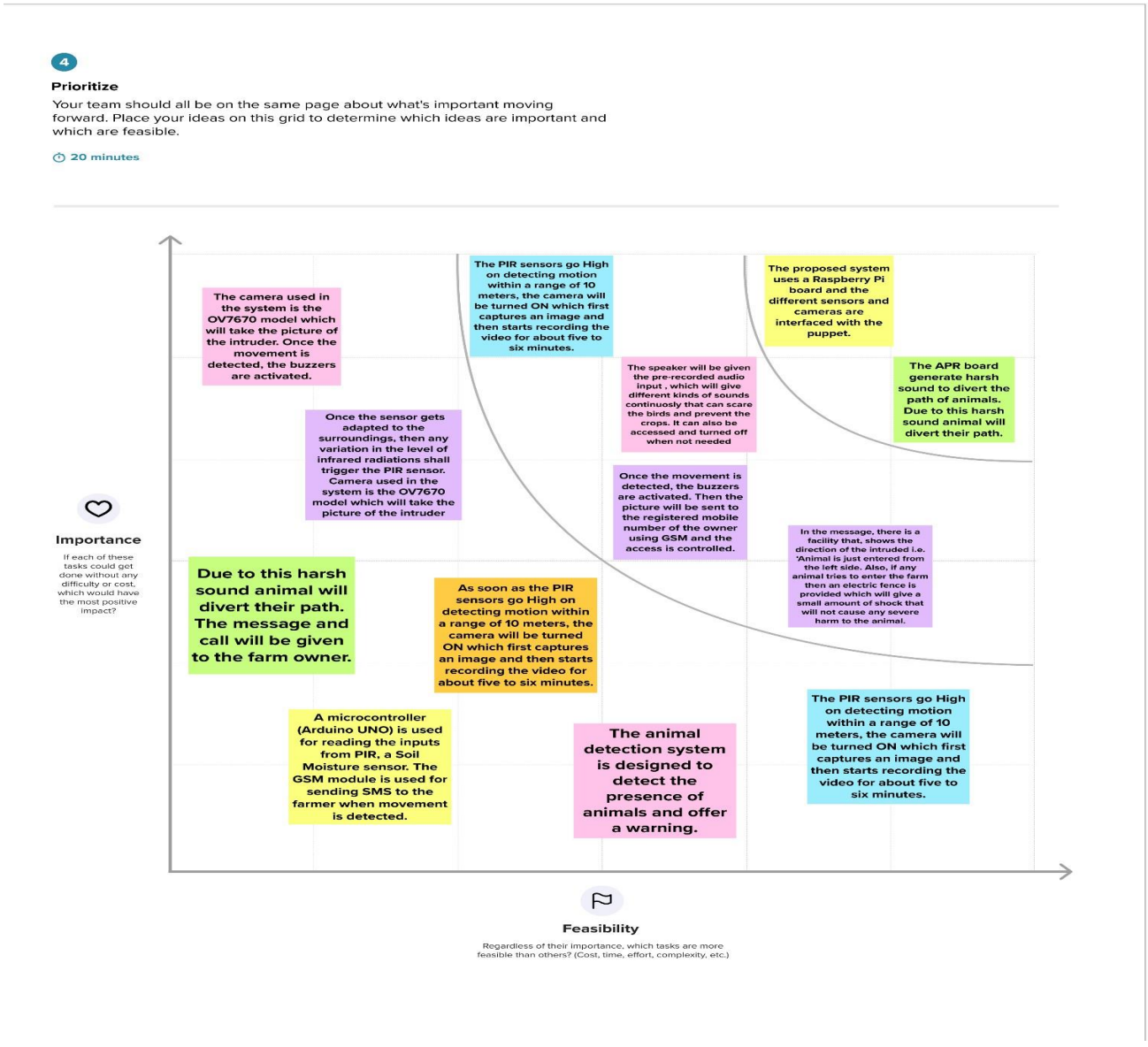


Figure 3.2.c. Idea Prioritization

3.3 PROPOSED SOLUTION

1. Problem Statement (Problem to be solved):

To prevent crop damage from birds and animals and also to enhance production of crop yields. For improving crop maintenance,weather factorssuch as soil moisture, humidity, and temperature are monitored.

2. Idea / Solution description:

Our ultimate aim is to protect crops from birds and animals. Our system will have a PIR sensor which detect the movement in the field and also havethe buzzer to scare the birds and animals.Once the movement is detected in the field, the camera will be activated that captures the image and store it in the Cloudant database and the alert message will be sent to the registered email of the user.

3. Novelty / Uniqueness:

Our system consists of a camera which is very useful to identify whether itis human or animal. By which we can identify the authorized and unauthorized entry in the field. The speaker will have a different sound so that the animals or birds can't get used to it. As it is manually controllable, we can switch off the buzzer, speaker, and camera when it is not needed.

4. Social Impact / Customer Satisfaction:

It is power saving system due to the usage of solar panels. This system supports mobility and ensures portability and can be safeguarded when there is no requirement for the maintenance of the crops. The speaker thatis used to scare birds can also switch off in the night time or fieldwork timeto avoid nuisance when it is not needed.

5. Business Model (Revenue Model):

A maximum number of farmers are being affected by this crop damage due to birds and animals. So, it will help them to keep monitoring their fields using IoT devices effectively. This model consists of a PIR sensor, GPS, Buzzer, Camera, Speaker, Soil moisture, and also humidity and temperature sensor for the effective monitoring of the crops.

6. Scalability of the Solution:

Agriculture plays an ultimate role in our livelihood. It is not only suitable fora particular area, people, community, or age. To protect that we are proposing this solution, which can be extended and implemented all over the world. Any updated version of this system will have a direct effect on the resultant crop production rate.

3.4 PROBLEM-SOLUTION FIT TEMPLATE:

The problem-solution fit simply means that you have found a problem withyour customer and that the solution you have realized for it solves the customer's problem. it helps entrepreneurs, marketing and corporate innovators identify behavioral patterns and recognize what would work andwhy.

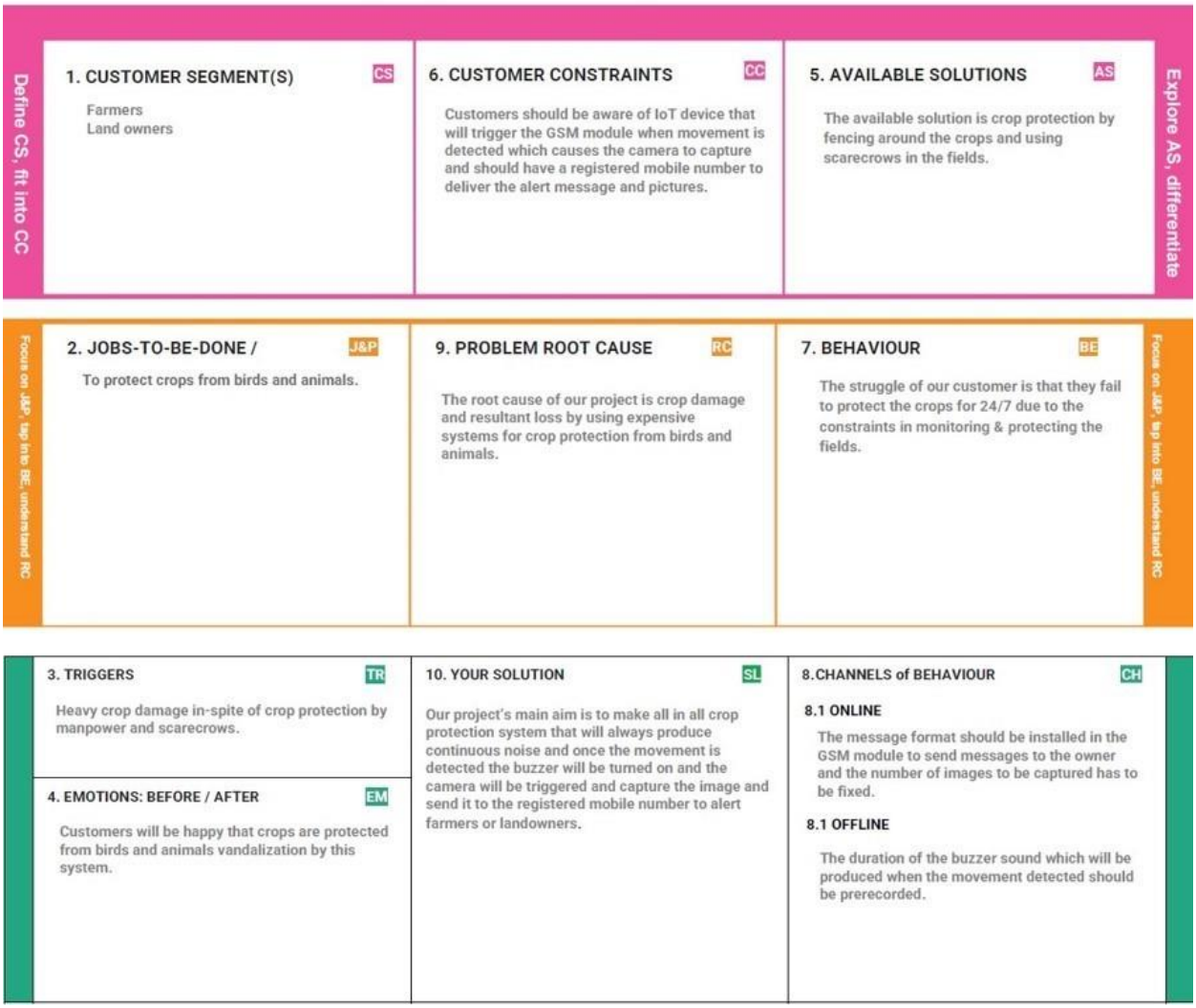


Figure 3.4. Solution Fit

CHAPTER 4

REQUIREMENT

ANALYSIS

4.1 FUNCTIONAL REQUIREMENTS:

1. **Proper detection -** PIR sensor connected to the camera will be triggered once the movement is detected and pictures will be sent to the registered Mobile number of the Farmer.

2. **Notification alert** —– Once the movement is detected, the audio alert will be sent to theregistered email of the user

3. **Control** – The motor and the sprinkler systems can be controlled on the dashboard and it will be displayed in the debug window.

4. **Mobile application** – The updated values can be displayed on the dashboard and can be controlled by the user.

4.2 NON-FUNCTIONAL REQUIREMENTS:

1. Usability - IOT is useful to protect crops from birds and animals and itwill increase crop production.

2. Security- IOT is the best way for monitoring crops, yields, and birds.

3. Reliability - IOT is used for agriculture protection from birds and animalsand for farmers to yield and save money.

4. Performance - IOT helps the farmers when any animal can be detected inthe fields immediately it captures the image and sends it to the registered Mobile number. It is easy to monitor and it will give higher productivity.

5. Availability - The available solution is to protect the crops from birdsusing the IOT system and give better yields to the farmers.

6. Scalability – IOT-based smart crop protection helps us to keep away such animals from the farmlands as well as provides surveillance functionality in the field

CHAPTER 5

PROJECT DESIGN

5.1 DATA FLOW DIAGRAM:

Data flow representation are an easily understandable tool. These templates are explained our project step by step.

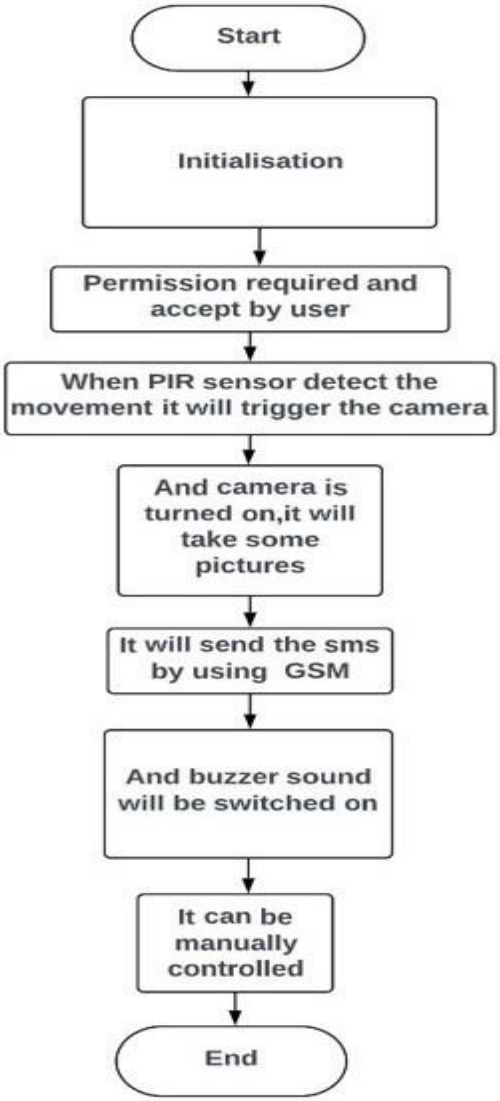


Figure 5.1. Data flow Diagram

5.2 SOLUTION AND TECHNICAL ARCHITECTURE

The solution architecture is performed. This task is to understand how all parts work together including processes, operating systems, and application architectures.

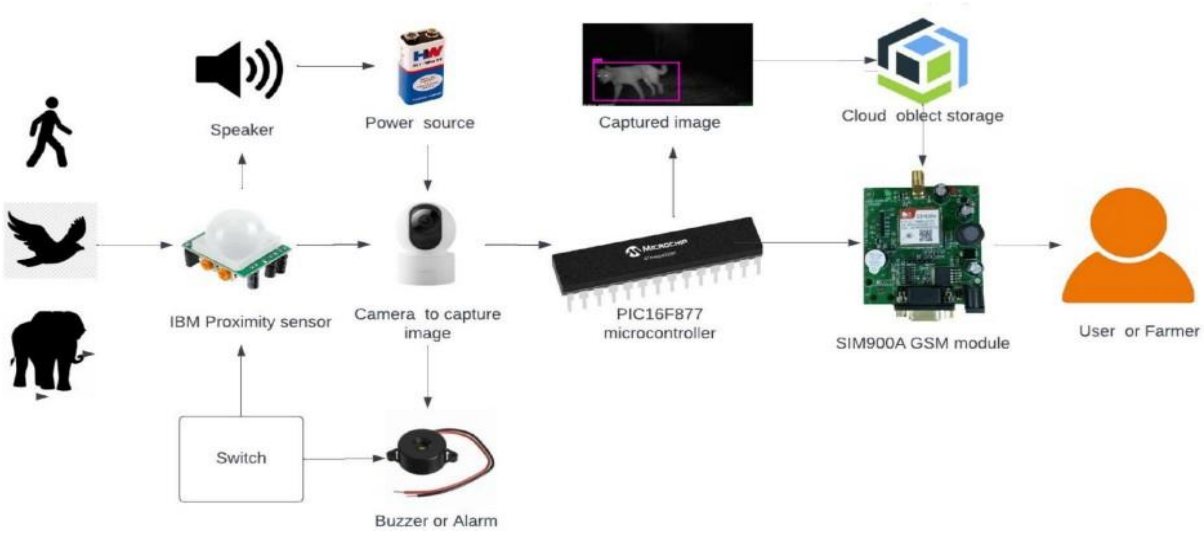


Figure 5.2.a.Technology Architecture

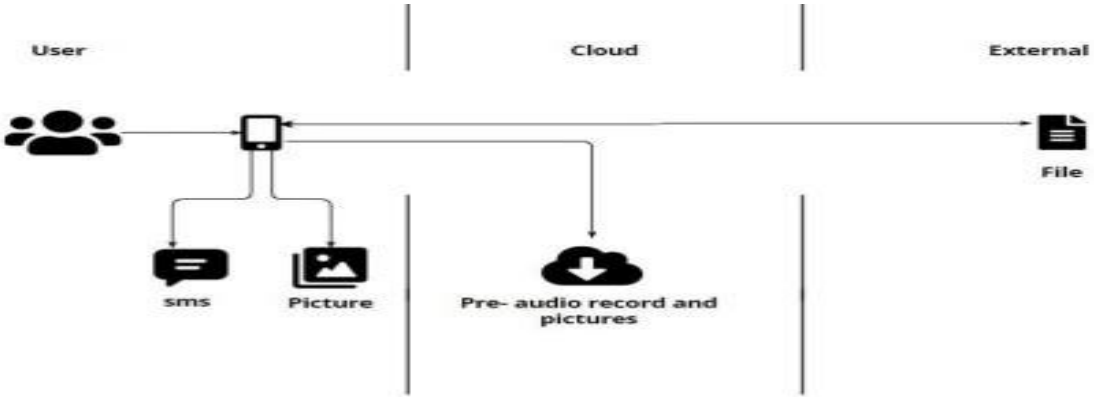


Figure 5.2.b. Solution Architecture

5.3 USER STORIES:

Table 5.1. User Stories

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

Table 5.3. User Stories

CHAPTER - 6

PROJECT PLANNING AND SCHEDULING

6.1 SPRINT PLANNING & ESTIMATION:

SPRINT 1: PROPER DETECTION

In the Sprint 1, the values of temperature, humidity and soil moisture shouldbe monitored. And the movement of the intruder in the field should be detected, resulting in the buzzer alert. In the real time application this can be achieved by using different sensors like PIR (Passive Infra-Red) sensor for movement detection and DHT11 sensor for temperature & humidity.

In this project, the python code has been developed through which the values for temperature, humidity and soil moisture will be fetched by usingthe random data. For movement detection, the motion is stimulated in the wokwi platform where the circuit is designed using Arduino UNO, PIRSensor and Piezoelectric buzzer.

Once the motion is stimulated, the LED will glow which is assumed as camera and the buzzer will be turned on in order to scare the birds and animals and to drive away them from the field. The duration of the buzzer alarm can be set and adjusted in the Arduino code.

SPRINT 2: NOTIFICATION ALERT

In the Sprint 2, the IBM cloud account has been created and the Internet of Things platform has been launched. In that IoT Watson platform, new device has been created.

It was connected with the source code through the device credentials and published in cloud where the events can be monitored. As part of this, Node-Red flow editor has been launched to create the dashboard options and published in the cloud using API key, API authentication and device credentials.

In the real time application, once the movement is detected the camera will be triggered which will capture the images of the intruder in the field in order to send it user for intruder alert. In this project, the cloud object storage and Cloudant DB has been used in order to store the pictures. The bucket has been created in the cloud object storage and the picture was uploaded there and the object public URL has been generated which is then given to the Cloudant DB. Through which the picture can be accessed and displayed in the node-red dashboard.

The condition has been set in the source code to assume there is a movement under which the alert audio will be played in the node red dashboard and in order to alert the farmer or land owner the email will be sent to their given mail id, once the condition has met in the code.

SPRINT 3: CONTROL

In the Sprint 3, the motors and sprinklers in the field should be controlled through the node red dashboard. In the Node-Red flow editor motor on, motor off, sprinkler on and sprinkler off buttons has been created and connected with the message payload in order to display the status in the debug window.

An audio notification has set in order to notify while clicking on each control buttons. In this part, the values of temperature, humidity and soil moisture has been set global for the external access.

The values of temperature, humidity and soil moisture will be updated at the fixed time interval and will be viewed in the node red dashboard in the donut type.

These values and control process has been globalized and the separatelink has been created using the get method and respective URL (/sensor or /command).

SPRINT 4: MOBILE APPLICATION

In the Sprint 4, the Mobile application should be created. Through this application the updated values of temperature, humidity and soil moisture in the field can be viewed in the mobile of the user. In this project, MIT app inventor has been used to create the mobile application.

It consists of three screens which includes home screen, weather monitoring screen and control screen.

In the home screen, two options were given to reach screen 1 and screen 2.Screen 1 consists of the three labels for temperature, humidity and soil moisture along the respective values and units in different textbox.

Screen 2 consists of the control buttons that is connected to the node red where the status will be displayed in the debug window.

6.2 SPRINT DELIVERY SCHEDULE:

Table 6.2. Sprint Delivery Schedule

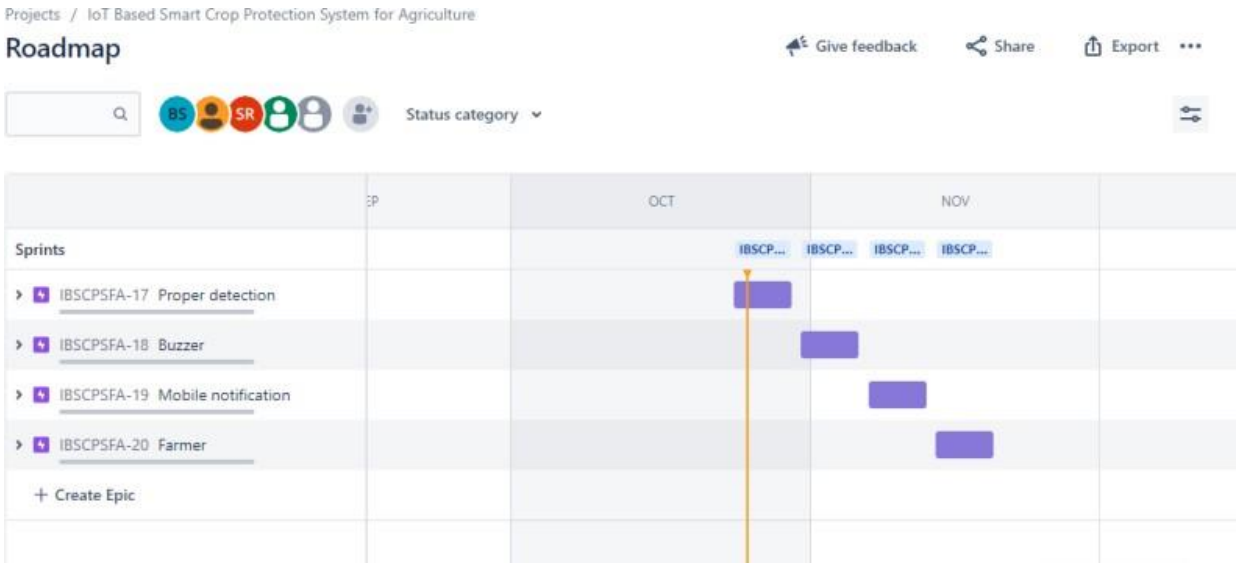
Sprint	Functional Requirement (Epic)	User Story Number	User Story / Task	Story Points	Priority	Team Members
Sprint-1	Proper detection	USN-1	As a user, I want to detect the movement of intruders in the field	5	High	ARUN K
		USN-2	As a user, I want to know about the values of temperature, humidity and soil moisture in the field	4	High	ARUN K
		USN-3	As a user, I should protect crop the from intruders using a buzzer once the movement is detected and pictures are captured	3	Medium	ARUN K
Sprint-2	Notification alert	USN-4	As a user, I want to capture the pictures of the intruder and should get alert audio	4	High	ARUN K
		USN-5	As a user, I will receive the alert message for the identification of an intruder	4	High	ARUN K
Sprint-3	Control	USN-6	As a user, I can monitor the activity through the data stored in the cloud	5	High	ARUN K
		USN-7	As a user, I can control the motors and sprinklers	5	High	ARUN K
Sprint-4	Mobile Application	USN-8	As a user, I can receive the updated values of weather monitoring in the remote region through mobile app	5	High	ARUN K

		USN-9	As a user, I can access the system from a remote region through which I can control the motors and sprinklers	5	High	ARUN K
		USN-10	As a user, I can use the system in different regions so that the animals won't get used to it	1	Low	ARUN K
		USN-11	As a user, I should ensure power efficiency using the solar power source	1	Low	ARUN K

6.3 REPORT FROM JIRA:

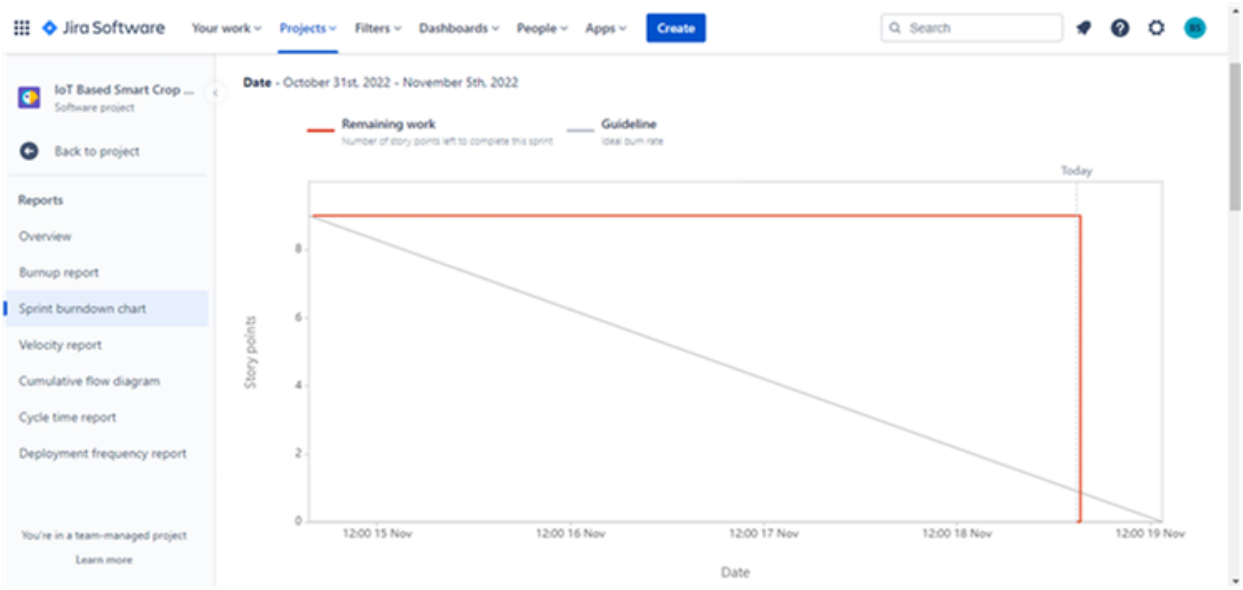
ROAD MAP:

Figure.6.3.a.Road Map



BURNDOWN CHART:

Figure.6.3.b.Burndown chart



CHAPTER-7

CODING AND

SOLUTIONS

7.1 FEATURE 1:

We have used python IDLE 3.7.0 for the source code. The rapidly changing automotive industry has allowed IoT to revolutionize the automotive industry. The internet of things (IoT) makes driving safe and efficient. It hasunleashed a range of benefits in agriculture from improving productivity to crop failure risks. The capability IoT to diagnose a problem and avoid failure of the system is helping in preventing the breakdown scenario.

Features of Python Idle

Interpreted

Portable

Object-Oriented and Procedure-OrientedExtensible

Code import
timeimport
sys

import ibmiotf.application

import ibmiotf.device import

random

7.2 FEATURE 2:

Node-RED provides a browser-based flow editor that makes it easy to wiretogether flows using the wide range of nodes in the palette. Flows can be then deployed to the runtime in a single click. JavaScript functions can be created within the editor using a rich text editor. It supports a lightweight runtime environment along with the event driven and non-blocking model. The various flows created in Node-RED are stored using JSON, which can be easily imported and exported for sharing with others.

Features of Node-Red

User friendly Accessible
and visual.
It is built on Node. js, which is a none-blocking, lightweight I/O model, making it lightweight and efficient.

Code

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

CHAPTER- 8

TESTING

8.1 TEST CASES:

A test case might be created as an automated script to verify the functionality per the original acceptance criteria. After doing manual exploratory testing.QA testers might suggest other functionalities be addedto the application, as well as updated test cases, be incorporated in the automated test suite.

Table 8.1.a Test case

Test case	Feature type	Component	Test Scenario
Weather data & Motion detection	Sensor (Random data)	Python IDLE (server)	Receives the weather monitoring data & checksthe occurrence of movement in the field.
Backend TC	E-mail notification	Node-Red (server)	Once the movement is detected, the alert email will be sent to the user's mail id.
Frontend TC	Dashboard UI	Node-Red (Client)	The values of temperature, humidity, and soil moisture will be fetched and controls will be achieved through the dashboard.

Database TC	Image storage	Cloud object storage (Client)	The captured image will be stored in the cloud object storage and fetched to display in the dashboard

Table 8.1. b.Test report

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	ARUN K
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	Suvetha R
1. Dashboard controls	https://node-red-rxabr-2022-11-15.eu-	The motor and sprinkler should	Pass	ARUN K

2. Interfacing the Node–Red dashboard values to the MIT app inventor.	gb.mybluemix.net/red/#flow/bba954e0a65da09b	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.		
1. Mobile application development. 2. Data updates and motor & sprinkler control.	http://ai2.appinventor.mit.edu/#4718677120122880	The updated values of temperature, humidity, and soil moisture 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	ARUN K

8.2 USER ACCEPTANCE TESTING:

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

Defect Analysis Table 8.2.a. 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 Table.8.2.b.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:

Table.9.1.a.NFT – Detailed test plan

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

Table.9.1.b. End of The Report

S. No	Project Overview	NFT test approach	NFR-Met	GO/NO-GO decision	Identified Defects	Approvals/Sign Off
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 makes it possible to avoid challenges and removes all issues that may arise during the farming process thus the quantity of the product is growing and customers get a good product of High quality.

2. IoT system helps to continuously monitor land so that precautions can be taken at an early stage it increases productivity, reduces manual work, and farming efficient.

3. By using IoT crop maintenance can be easily done to observe the growthof the crop.

4. Increase in agricultural productivity.

5. These sensors are equipped with wireless chips so that they can be controlled remotely.

6. They are easy to operate and use and easy to maintain.

DISADVANTAGES:

1. IoT smart crop needs availability on the Internet continuously, the rural part of the developing countries did not fulfill these requirements and the Internet is slower.

2. The IoT-based equipment required the farmer to understand and learn the use of technology. This is the main challenge in adopting smart agriculture framing at a large scale across the continues.

CHAPTER-

11

CONCLUSIO

N

IOT-based crop protection for smart farming, such as monitoring for animalattacks. Using Node-Red, notifications to registered Mail ids and live monitoring of temperature and soil moisture are possible using proximity sensors (PIR sensors). The high efficiency and accuracy of retrieving current data on temperature, humidity, and soil moisture. The paper will help farmers increase their yield and take effective care of crops. A farmer will always receive notifications, pictures, and live feeds of environmental temperature and soil moisture. With the help of these systems, various problems faced by farmers in daily life are being solved to a significant extent. The main advantage is the ability to detect the motion of animals with the proximity sensor, notify the registered mail id, and control the motor and sprinkler remotely. Therefore, this program is cheaper and moreefficient compared to other types of auto systems. The proposed system can be used to turn off / off the water spray according to soil moisture levels thus making the irrigation process one of the most time-consuming agricultural activities. Agriculture is one of the biggest uses of water. The problem of crop vandalization by wild animals and fire has become a majorsocial problem at current times. It requires urgent attention as no effectivesolution exists to date for this problem. Thus, this project carries great social relevance as it aims to address this problem. This project will help farmers in protecting their orchards and fields and save them from significant financial losses and will save them from the unproductive efforts that they endure for the protection of their fields. This will also help them in achieving better crop yields thus leading to their economic well- being.

CHAPTER-12

FUTURE

SCOPE

IoT smart agriculture products are designed to help monitor crop fields using sensors and by automating irrigation systems. As a result, farmers and associated brands can easily monitor the field conditions from anywhere without any hassle. Smart farming refers to managing farms using modern Information and communication technologies to increase the quantity and quality of products while optimizing the human labor required. Among the technologies available for present-day farmers are wireless sensors that can detect the soil, water, light, humidity, and temperature levels in crop fields. IoT's can analyze the best time to irrigate the crops, and check temperature soil humidity, and water level by collecting the datathrough sensors.

APPENDIX

13.1 SOURCE

CODE:

```
import
time import sys
import ibmiotf.application
import ibmiotf.device import
random
#Provide your IBM Watson Device Credentials
organization = "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 & PROJECT DEMO LINK

Table.13.2.Github

Content	Link
GitHub	https://github.com/IBM-EPBL/IBM-Project-53679-1661487892.git

CHAPTER - 14

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