A PROJECT REPORT

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GitHub Link

TEAM ID	PNT2022TMID38806
PROJECT NAME	IoT Based Smart Crop Protection System For Agriculture
TEAM LEADERS	R.SOWMIYA
TEAM MEMBERS	P.SUGANTHI P.PRIYADHARSHINI V.NARMATHA

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 helps farmers to monitor the soil moisture levels in the field and also the temperature

and humidity values near the field. The motors and sprinklers in the field can be controlled using the mobile application.

1.2 Purpose

Agriculture is the foundation of the economy, nevertheless would bring , would bring about gigantic harvest misfortune due to creature interruption in agricultural land. Elephants and other creatures entering into people's place of residence has bought adverse consequence in different ways, for example, crop annihilation, harm to food stores, water supply, homes and other properties, injury and human demise.

2. LITERATURE SURVEY

2.1 Existing problem

The most common challenge for the Internet of Things in agriculture is connectivity. Every area doesn't have proper internet connectivity. The second most common challenge for Internet of Things based Advanced Farming is the **lack of awareness among consumers**.

The biggest problem faced by IoT in the agricultural sector are **lack of information, high adoption costs, and security concerns**, etc. Most of the farmers are not aware of the implementation of IoT in agriculture.

Lack of regular patches and updates and weak update mechanism. Insecure interfaces. Insufficient data protection. Poor IoT device management

2.2 References

1. k.lakshmisudha, swathi hegde, neha cole, shruti iyer, " good particularity most stationed cultivation spinning sensors", state-of-theart weekly going from microcomputer applications (0975-8887), number 146-no.11, july 2011
2. nikesh gondchawar, dr. r.complexion.kawitkar, "iot based agriculture", all-embracing almanac consisting of contemporary analysis smart minicomputer additionally conversation planning (ijarcce), vol.5, affair 6, june 2016. Overall Journal on Recent and Innovation Trends in Computing and Communication ISSN: 2321- 8169 Volume: 5 Issue: 2 177 – 181
3. M.K.Gayatri, J.Jayasakthi, Dr.G.S.Anandhamala, "Giving Smart Agriculture Solutions to Farmers for Better Yielding Using IoT", IEEE International Conference on Technological Innovations in ICT for Agriculture and Rural
4. Lustiness. r. nandurkar, slant. r. thool, r. tumor. thool, "plan together with situation coming from rigor horticulture technique executing trans-missions sensor network", ieee world consultation toward telemechanics, regulate, intensity also wiring (aces), 2014. Development (TIAR 2015).

5. Paparao Nalajala, D. Hemanth Kumar, P. Ramesh and Bhavana Godavarthi, 2017. Design and Implementation of Modern Automated Real Time Monitoring System for Agriculture using Internet of Things (IoT). Journal of Engineering and Applied Sciences, 12: 9389- 9393.

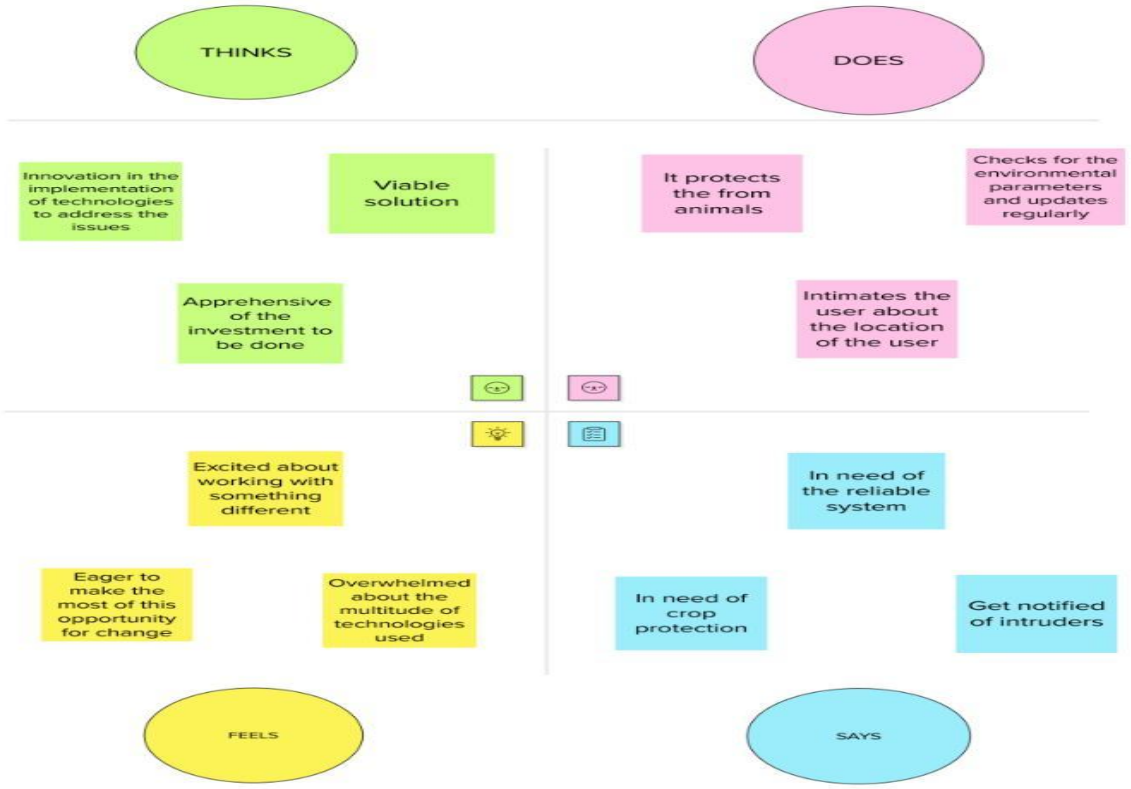
6. Joaquín Gutiérrez, Juan Francisco Villa-Medina, Alejandra Nieto Garibay, and Miguel Ángel PortaGándara, "Computerized Irrigation System Using a Wireless Sensor Network and GPRS Module", IEEE

2.3 Problem Statement Definition

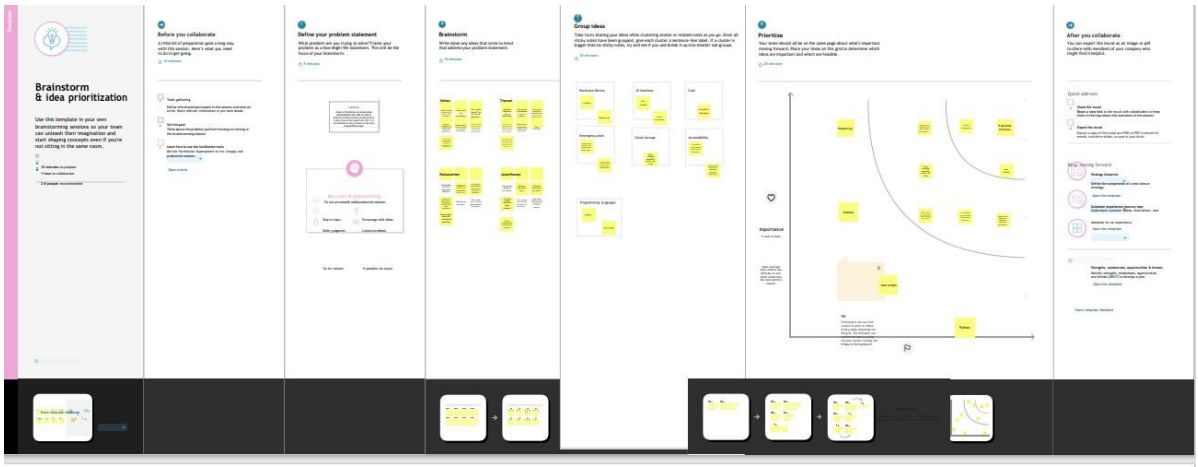
Problem Statement (PS)	I am (Customer)	I am trying to	But	Because	Which makes me feel
PS-1	Farmer	Monitoring the growing condition	It involves risk on related equipment and understand the use of technology	Requires more knowledge and skills	Irritated
PS-2	Farmer	Smart and precision irrigation	Climates changes to increased maintenance of channels	Purchasing and installing costs high	Suitable for mass crop protection

3. IDEATION & PROPOSED SOLUTION

3.1 Empathy Map Canvas



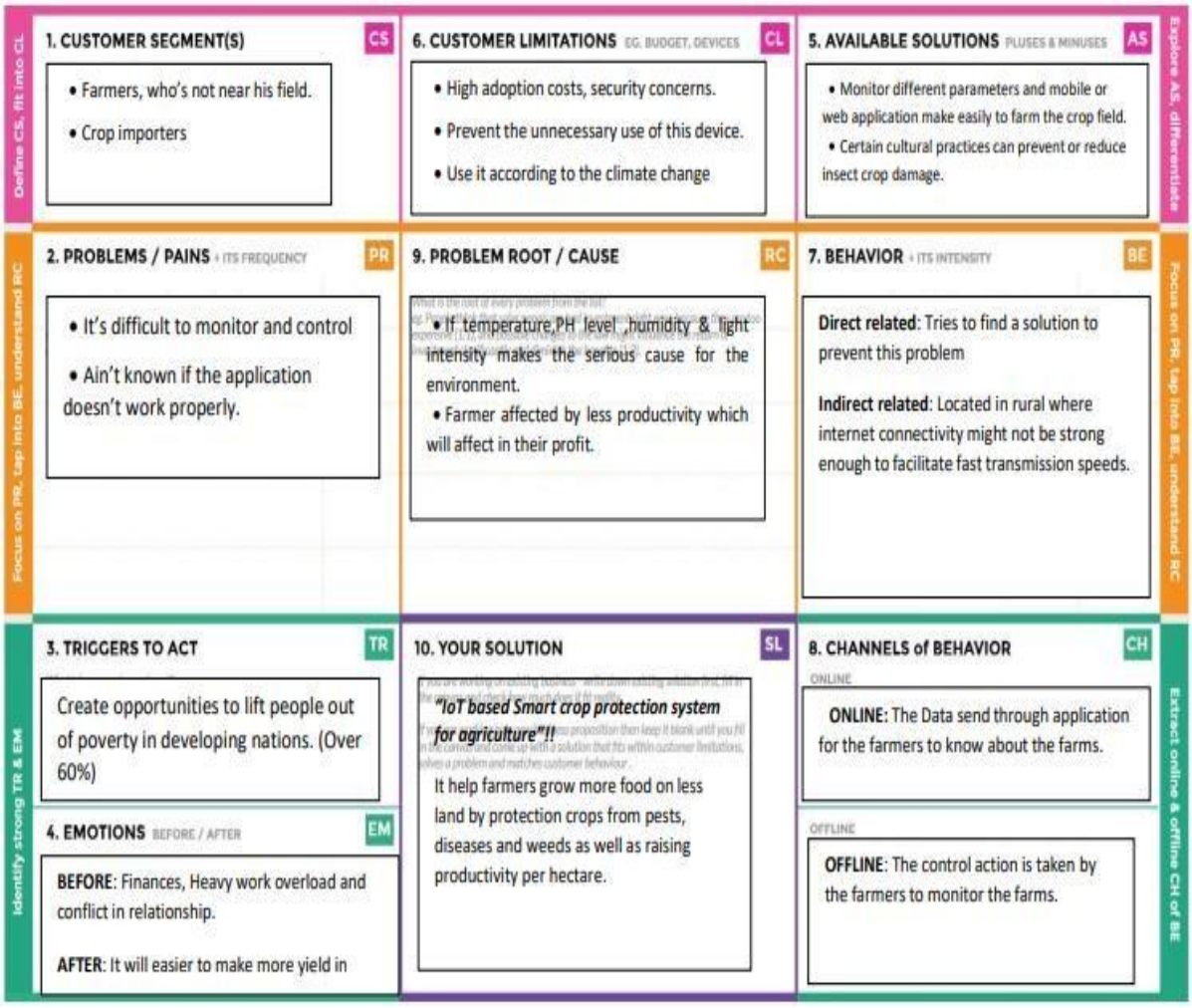
3.2 Ideation & Brainstorming



3.3 Proposed Solution

S.No	Parameter	Description
1.	Problem Statement (Problemtobesolved)	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


Define CS, fit into CL
1. CUSTOMER SEGMENT(S)
CS
• Farmers, who's not near his field.
• Crop importers
6. CUSTOMER LIMITATIONS EG. BUDGET, DEVICES
CL
• High adoption costs, security concerns.
• Prevent the unnecessary use of this device.
• Use it according to the climate change
5. AVAILABLE SOLUTIONS PLUSES & MINUSES
AS
• Monitor different parameters and mobile or web application make easily to farm the crop field.
• Certain cultural practices can prevent or reduce insect crop damage.
Explore AS, differentiate
Focus on PR, tap into BE, understand RC
2. PROBLEMS / PAINS + ITS FREQUENCY
PR
• It's difficult to monitor and control
• Ain't known if the application doesn't work properly.
9. PROBLEM ROOT / CAUSE
RC
• If temperature,PH level ,humidity & light intensity makes the serious cause for the environment.
• Farmer affected by less productivity which will affect in their profit.
7. BEHAVIOR + ITS INTENSITY
BE
Direct related: Tries to find a solution to prevent this problem
Indirect related: Located in rural where internet connectivity might not be strong enough to facilitate fast transmission speeds.
Focus on PR, tap into BE, understand RC
Identify strong TR & EM
3. TRIGGERS TO ACT
TR
Create opportunities to lift people out of poverty in developing nations. (Over 60%)
4. EMOTIONS BEFORE / AFTER
EM
BEFORE: Finances, Heavy work overload and conflict in relationship.
AFTER: It will easier to make more yield in
10. YOUR SOLUTION
SL
"IoT based Smart crop protection system for agriculture"!!
It help farmers grow more food on less land by protection crops from pests, diseases and weeds as well as raising productivity per hectare.
8. CHANNELS of BEHAVIOR
CH
ONLINE
ONLINE: The Data send through application for the farmers to know about the farms.
OFFLINE
OFFLINE: The control action is taken by the farmers to monitor the farms.
Extract online & offline CH of BE

4. REQUIREMENT ANALYSIS

4.1 Functional requirement

Following are the functional requirements of the proposed solution:

FR No	Functional Requirement (Epic)	Sub Requirement (Story / Sub-Task)
FR-1	User Visibility	Sensor animal's nearing the crop field and sounds alarm to woo them away as well as sends SMS to farmer using cloud service.
FR-2	User Reception	The Data like values of Temperature, Humidity, Soil moisture sensors are received via SMS
FR-3	User Understanding	Based on the sensor data value to get the information about present of farming land
FR-4	User Action	The user needs take action like destruction of crop residues, deep plowing, crop rotation, fertilizers, strip cropping, scheduled planting operations.

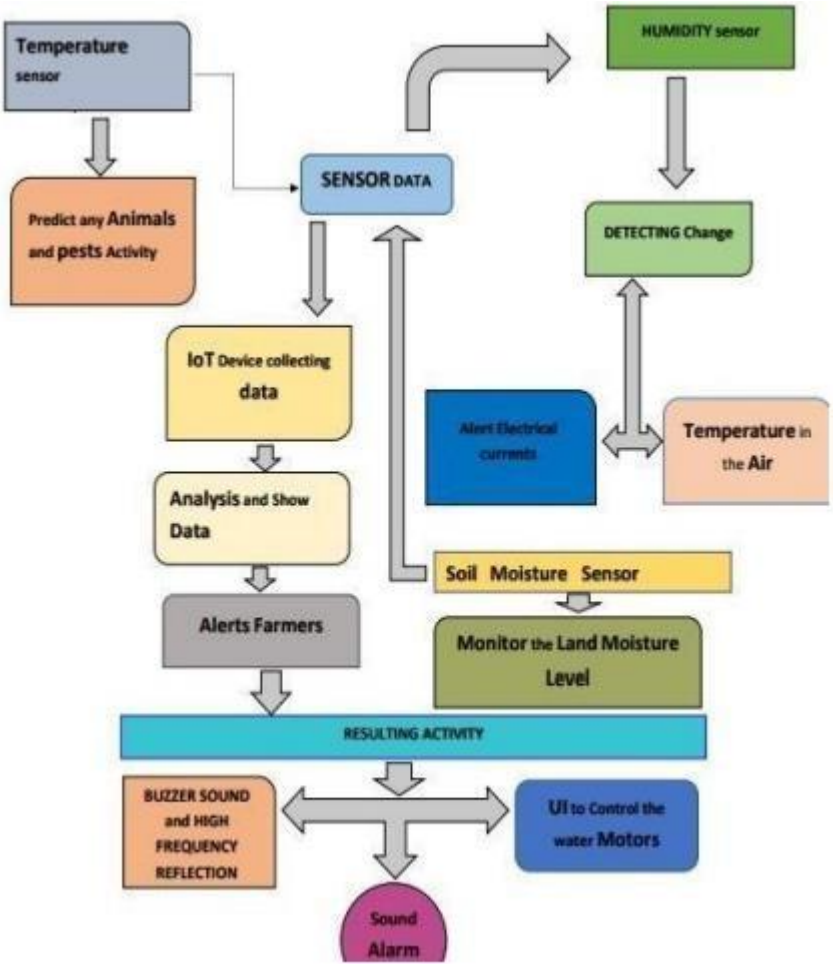
4.2 Non functional Requirements

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

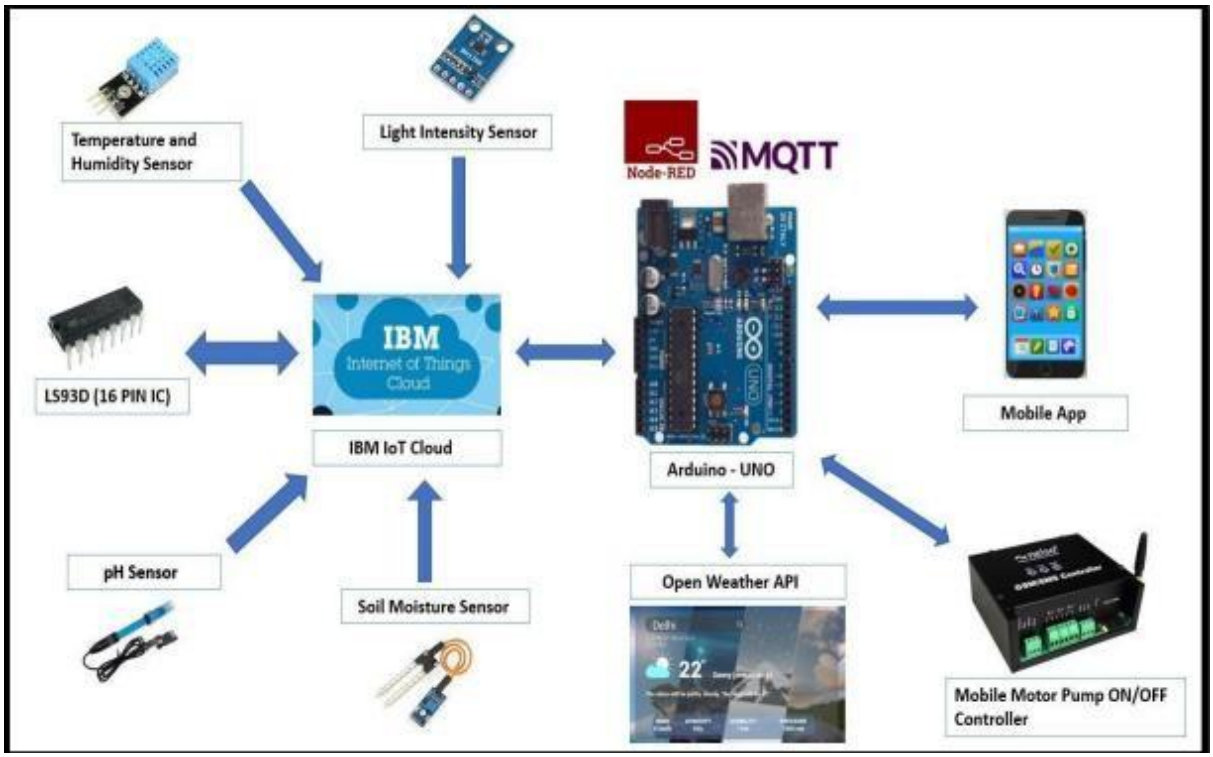
FR No	Non-Functional Requirement	Description
NFR-1	**Usability**	Mobile support. Users must be able to interact in the same roles & tasks on computers & mobile devices where practical, given mobile capabilities.
NFR-2	**Security**	Data requires secure access to must register and communicate securely on devices and authorized users of the system who exchange information must be able to do.
NFR-3	**Reliability**	It has a capacity to recognize the disturbance near the field and doesn't give a false caution signal.
NFR-4	**Performance**	Must provide acceptable response times to users regardless of the volume of data that is stored and the analytics that occurs in background. Bidirectional, near real-time communications must be supported. This requirement is related to the requirement to support industrial and device protocols at the edge.
NFR-5	**Availability**	IOT solutions and domains demand highly available systems for 24x7 operations. Isn't a *critical production* application, which means that operations or production don't go down if the IOT solution is down.
NFR-6	**Scalability**	System must handle expanding load and data retention needs that are based on the upscaling of the solution scope, such as extra manufacturing facilities and extra buildings.

5. PROJECT DESIGN

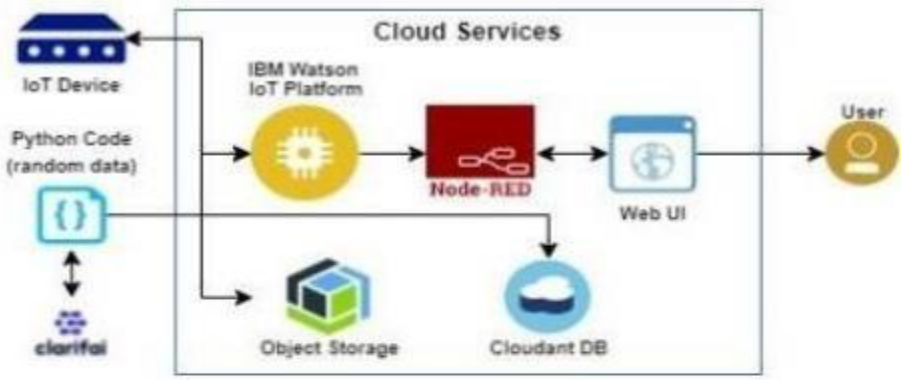
5.1 DATA FLOW DIAGRAM

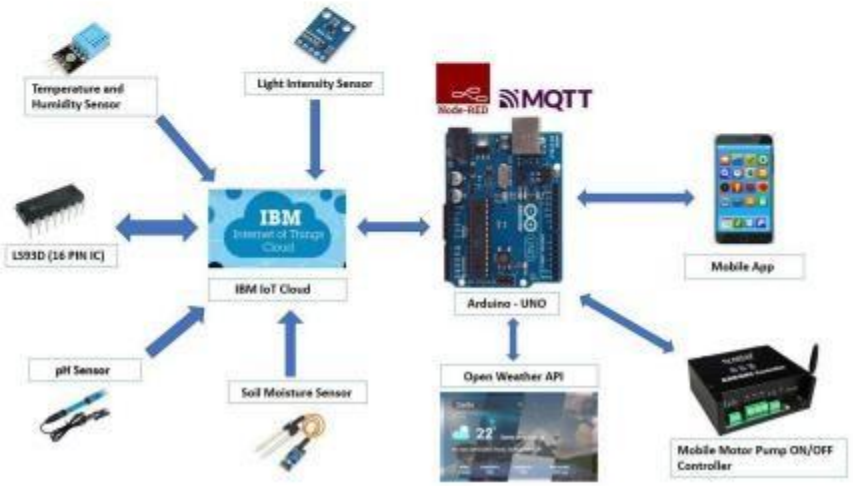


SOLUTION ARCHITECTURE



TECHNICAL ARCHITECTURE


Cloud Services
IoT Device
IBM Watson
IoT Platform
Python Code
(random data)
Node-RED
Web UI
User
clarifai
Object Storage
Cloudant DB


Temperature and
Humidity Sensor
Light Intensity Sensor
Node-RED
MQTT
L293D (16 PIN IC)
IBM
Internet of Things
Cloud
IBM IoT Cloud
Arduino - UNO
Mobile App
pH Sensor
Soil Moisture Sensor
Open Weather API
Mobile Motor Pump ON/OFF
Controller

USER STORIES

User Type	Functional requirement (Epic)	User Story number	User Story/Task	Acceptance criteria	Priority	Release
Mobile users	Registration	USN-1	User can enter into the web application	I can access my account /dashboard	High	Sprint 1
		USN-2	User can register their credentials like email id and password	I can receive confirmation email & click confirm	High	Sprint 1
	Login	USN-3	User can log into the application by entering email & password	I can login to my account	High	Sprint 1
	Dashboard	USN-4	User can view the temperature	I can view the data given by the device	High	Sprint 2
		USN-5	User can view the level of sensor monitoring value	I can view the data given by the device	High	Sprint 2
Web users	Usage	USN-1	User can view the web page and get the information	I can view the data given by the device	High	Sprint 3
Customer	Working	USN-1	User act according to the alert given by the device	I can get the data work according to it	High	Sprint 3
		USN-2	User turns ON the water motors/Buzzer/Sound Alarm when occur the disturbance on field.	I can get the data work according to it		Sprint 4

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	Registration	USN-1	As a user, I can register for the application by entering my email, password, and confirming my password.	3	High	C.Ramanathan
Sprint-1		USN-2	As a user, I will receive confirmation email once I have registered for the application	2	High	C.Ramanathan
Sprint-2	Cloud Service	USN-3	As a user, I can register for the application through Facebook or any social media	1	Low	S Janarthanan
Sprint-4		USN-4	As a user, I can register for the application through Gmail / web service	2	Medium	P Bavatharani
Sprint-3	Login	USN-5	As a user, I can log into the application by entering email & password	4	High	C.Sithan
Sprint-2	Pre processing	USN-6	As a farmer, the user must be able to find the system easy to access so the Prep-processes and other task must be perfect	3	High	S Janarthanan
Sprint-1	Collecting Dataset	USN-7	To collect various sources of animal threats and keep developing a dataset using Clarifai.	3	Medium	C Ramanathan
Sprint-4	Integrating	USN-8	To integrate the available dataset and keep improving the accuracy of finding animals	2	Medium	P Bavatharani.
Sprint-3		USN-9	To find and use appropriate compiler to run and test the data so that we can implement our program	1	Low	C.Sithan
Sprint-2		USN-10	Request AVS Engineering College to deploy the project in our campus and test	1	Low	S Janarthanan

Sprint	Functional Requirement (Epic)	User Story Number	User Story / Task	Story Points	Priority	Team Members
Sprint-1	Training	USN-11	As programmer, we need to train our data perfectly so that the program runs smoothly	3	High	C Ramanathan
Sprint-3		USN-12	Train the data using out available service and IBM dataset from server and improve that	2	Medium	C.Sithan
Sprint-4	Coding	USN-13	To modify the code according to our program and improve the efficiency of that code	4	High	P Bavatharani.
Sprint-2		USN-13	To improve performance	1	Low	S Janarthanan
Sprint-2	Record	USN-5	To record the data and plot the graph to show the characteristics officially	4	Medium	S Janarthanan
Sprint-1	Planning	USN-4	Plan the programming language and feasibility	3	High	C Ramanathan
Sprint-4		USN-14	Demonstrate the working and improve accuracy overall	2	Low	S Janarthanan

Project Tracker, Velocity & Burndown Chart: (4 Marks)

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	20Oct 2022	24 Oct 2022	20	21 Oct 2022
Sprint-2	20	6 Days	25 Oct 2022	29 Oct 2022	20	27 Oct 2022
Sprint-3	20	6 Days	31 Oct 2022	4 Nov 2022	20	2 Nov 2022
Sprint-4	20	6 Days	5 Nov 2022	11 Nov 2022	20	8 Nov 2022

7. CODING AND SOLUTIONS

7.1 FEATURES 1

Feature 1: Detect the Temperature

Feature 2: Detect the Humidity

Feature 3: Detect the Moisture

Feature 4: Detect the Animals

Codes:

PYTHON CODE TO IBM:

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

#Provide your IBM Watson Device Credentials
organization = "c5ah4g"
deviceType = "App-1"
deviceId = "13"
authMethod = "use-token-au"
authToken = "12345678"


# Initialize GPIO def myCommandCallback(cmd):
print("Command received: %s" % cmd.data['command'])
status=cmd.data['command']     if  status=="lighton":
print ("led is on")     elif status == "lightoff":
        print ("led is off")
else :
        print ("please send proper command")



try:
deviceOptions = {"org": organization, "type": deviceType, "id": deviceId,
```

```
"auth-method": authMethod, "auth-token": authToken}
deviceCli = ibmiotf.device.Client(deviceOptions)
#.....

except Exception as e:
print("Caught exception connecting device: %s" % str(e))
sys.exit()

# Connect and send a datapoint "hello" with value "world" into the cloud as an
event of type "greeting" 10 times deviceCli.connect()

while True:
        #Get Sensor Data from DHT11

        temp=random.randint(90,110)
Humid=random.randint(60,100)
        Moist=random.randint(20,100)
        Animal_dect=random.randint(1,20)



        data = { 'temp' : temp, 'Humid': Humid, 'Moist' : Moist, 'Animal_dect' :
Animal_dect }
        #print data         def myOnPublishCallback():             print ("Published
Temperature = %s C" % temp, "Humidity = %s %%"
% Humid, "to IBM Watson", "Published Moisture= %s" % Moist, "Published
Animal detection = " , Animal_dect)

        success = deviceCli.publishEvent("IoTSensor", "json", data,
qos=0, on_publish=myOnPublishCallback)         if not success:
print("Not connected to IoTF")         time.sleep(10)

        deviceCli.commandCallback = myCommandCallback

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

NODE RED CODE:

TEMPERATURE:

msg.payload=msg.payload.”temp”

return msg;

HUMIDITY:

msg.payload=msg.payload.”Humid”

return msg;

MOISTURE:

msg.payload=msg.payload.”Moist”

return msg;

ANIMAL DETECTION:

msg.payload=msg.payload.”Animal_dect”

return msg;

8. TESTING:

8.1 TESTING:

- PYTHON CODE TO IBM
- IoT SENSOR OUTPUT
- IBM CLOUD TO NODE RED OUTPUT

8.2 User Acceptance Testing:

Purpose of Document

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

Defect Analysis

This report shows the number of resolved or closed bugs at each severity level, and how they were resolved.

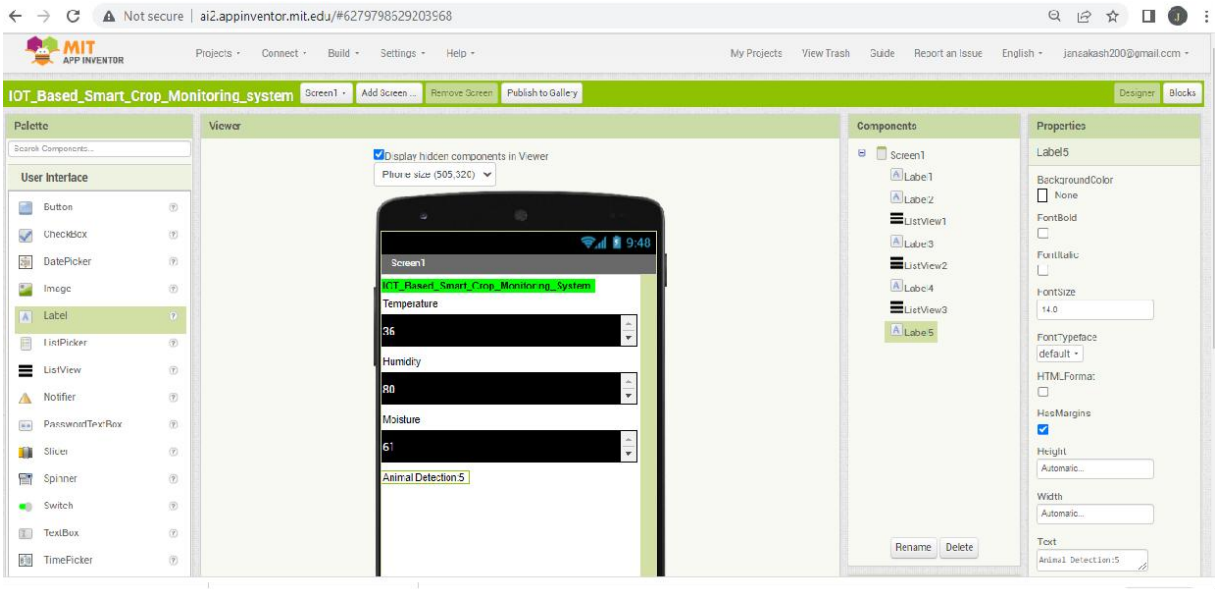
Resolution	Severity 1	Severity 2	Severity 3	Severity 4	Subtotal
By Design	10	4	2	3	20
Duplicate	1	0	3	0	4
External	2	3	0	1	6
Fixed	11	2	4	20	37
Not Reproduced	0	0	1	0	1
Skipped	0	0	1	1	2
Won't Fix	0	5	2	1	8
Totals	24	14	13	26	77

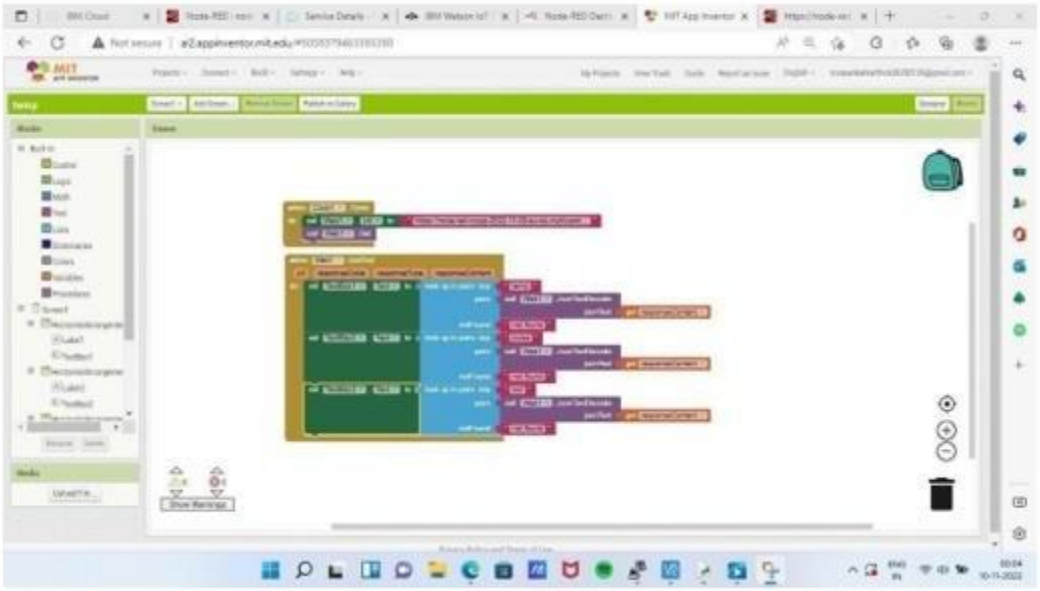
9. Test Case Analysis

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

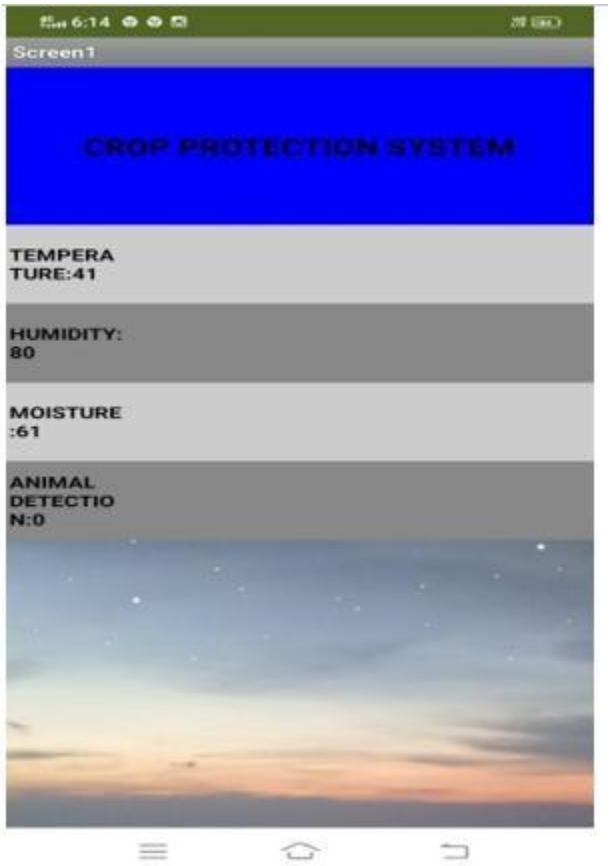
Section	Total Cases	Not Tested	Fail	Pass
Print Engine	7	0	0	7
Client Application	51	0	0	51
Security	2	0	0	2
Outsource Shipping	3	0	0	3
Exception Reporting	9	0	0	9
Final Report Output	4	0	0	4
Version Control	2	0	0	2

RESULT





MIT AI2 COMPANION APP – TO DISPLAY THE OUTPUT VIA QR CODE



9. ADVANTAGES & DISADVANTAGES :

ADVANTAGES

- Farmers can monitor the health of farm animals closely, even if they are physically distant.
- Smart farming systems reduce waste, improve productivity and enable management of a greater number of resources through remote sensing.
- High reliance.

DISADVANTAGES:

- Farms are located in remote areas and are far from access to the internet.
- A farmer needs to have access to crop data reliably at any time from any location, so connection issues would cause an advanced monitoring system to be useless.
- High Cost

Equipment needed to implement IoT in agriculture is expensive.

11.CONCLUSION

The problem of crop vandalization by wild animals and fire has become a major social problem in current time. It requires urgent attention as no effective solution exists till date for this problem. Thus, this project carries a 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 their fields. This will also help them in achieving better crop yields thus leading to their economic well being.

12.FUTURE SCOPE

Study and analysis of the developed Crop protection systems for its cost effectiveness with the development of Arduino based variable frequency Ultrasonic bird deterrent circuit. outline of the crop damage caused by a particular Wild animal if the behavioral features of the With the reduced cost in the smart phones.

APPENDIX

SOURCE CODE

The source code has been uploaded in github. To refer the final sourse code click ‘ SOURCE CODE ’

GITHUB LINK

The github link : https://github.com/IBM-EPBL/IBM-Project-40583-1660631593