IOT BASED SMART CROP PROTECTION SYSTEM FOR AGRICULTURE .

TEAM ID: PNT2022TMID04108

NALAIYA THIRAN PROJECT BASED LEARNING ON PROFESSIONAL READINESS FOR INNOVATION EMPLOYMENT AND ENTERPRENEURSHIP .

A PROJECT REPORT BY

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CONTENTS

1. INTRODUCTION

1.1 Project overview

- The device will detect the animals and birds using the Clarifai 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 crop .
- The image URL will be 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 be 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 application.

1.2 PURPOSE

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.

2.LITERATURE SURVEY

Agriculture is the primary source of livelihood for about 58% of India's population . There is an increasing demand for advanced crop yield, the need to use natural resources efficiently, the growing use and sophistication of information and communication knowledge and the increasing need for climate-smart agriculture in this modern world . Farmers are facing difficulties in protecting their crops againt disasters and animals . Hence continuous monitoring is highly essential . Modern farming is considered a revolution in agriculture because of its capability to produce surplus food in a limited region . 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 .

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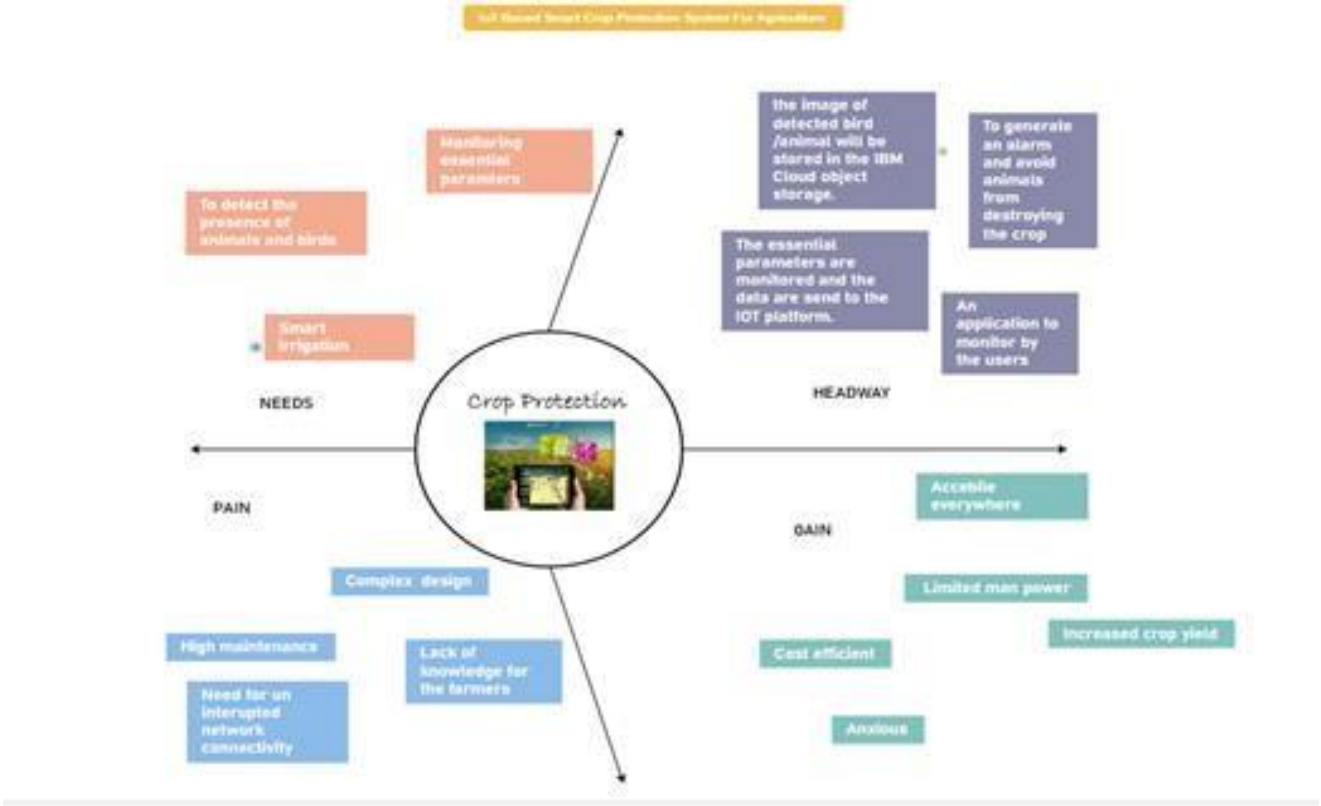
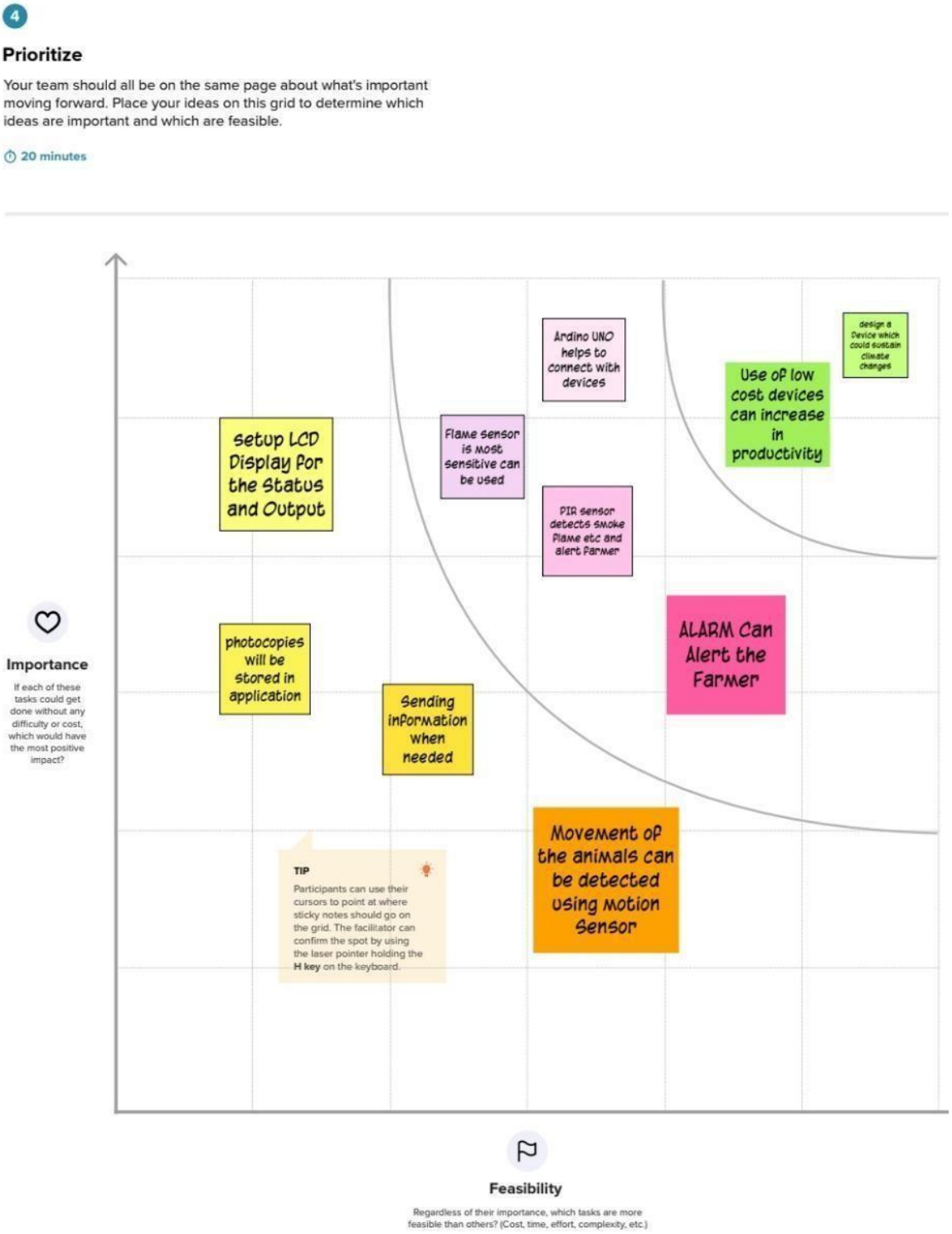
2. IDEATION & PROPOSED SOLUTION

2.1 Empathy Map Canvas



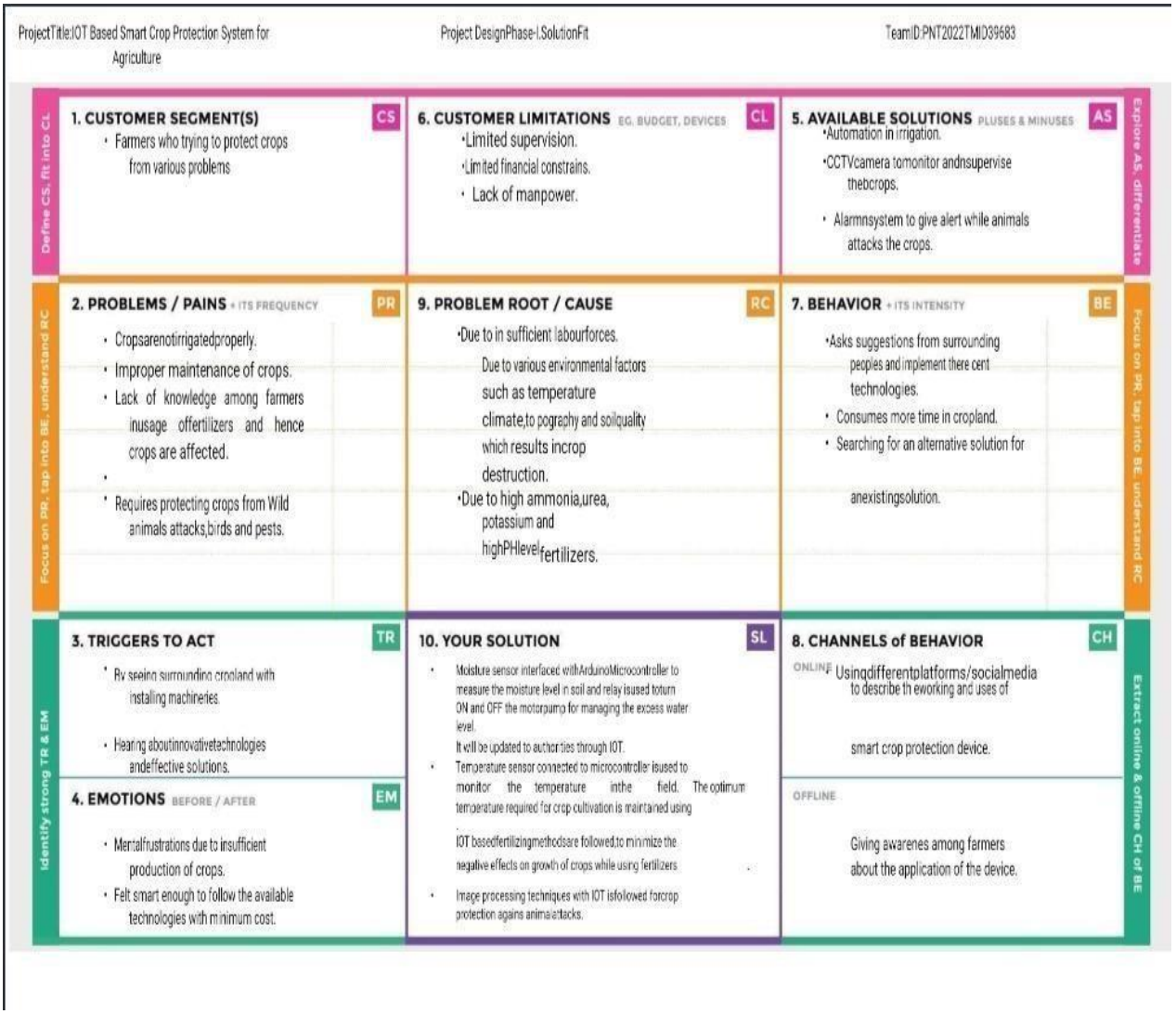
2.2 Ideation and Brainstorming



2.3 Proposed Solution

S.No	Parameter	Description
1.	• Problem Statement (Problem to be solved)	• Crops are not irrigated properly due to insufficient labour forces. • Improper maintenance of crops against various environmental factors such as temperature climate, topography and soil quality which results in crop destruction. • Requires protecting crops from Wild animals attacks, birds and pests.
2.	• Idea / Solution description	• Moisture sensor is interfaced with Arduino Microcontroller to measure the moisture level in soil and relay is used to turn ON and OFF the motor pump for managing the excess water level. It will be updated to authorities through IOT. • Temperature sensor connected to microcontroller is used to monitor the temperature in the field. • Image processing techniques with IOT is followed for crop protection against animal attacks.
3.	Novelty / Uniqueness	• Automatic crop maintenance and protection using embedded and IOT technology.
4.	Social Impact / Customer Satisfaction	• This proposed system provides many facilities which helps the farmers to maintain the crop field without much loss.
5.	Business Model (Revenue Model)	• This prototype can be developed as product with minimum cost with high performance .
6.	Scalability of the Solution	• This can be developed to a scalable product by using sensors and transmitting the data through Wireless Sensor Network and Analysing the data in cloud and operations is performed using robots .

2.4 Problem Solution Fit



ProjectTitle:IOT Based Smart Crop Protection System for Agriculture

Project DesignPhase-I.SolutionFit

TeamID:PNT2022TMID39683

Define CS, fit into CL

1. CUSTOMER SEGMENT(S) CS

- Farmers who trying to protect crops from various problems

6. CUSTOMER LIMITATIONS EG. BUDGET, DEVICES CL

- Limited supervision.
- Limited financial constrains.
- Lack of manpower.

5. AVAILABLE SOLUTIONS PLUSES & MINUSES AS

- Automation in irrigation.
- CCTV camera to monitor and nsupervise the crops.
- Alarm nsystem to give alert while animals attacks the crops.

Explore AS, differentiate

Focus on PR, tap into BE, understand RC

2. PROBLEMS / PAINS + ITS FREQUENCY PR

- Crops are not irrigated properly.
- Improper maintenance of crops.
- Lack of knowledge among farmers in usage of fertilizers and hence crops are affected.
- Requires protecting crops from Wild animals attacks, birds and pests.

9. PROBLEM ROOT / CAUSE RC

- Due to in sufficient labour forces. Due to various environmental factors such as temperature climate, to pography and soil quality which results in crop destruction.
- Due to high ammonia, urea, potassium and high PH level fertilizers.

7. BEHAVIOR + ITS INTENSITY BE

- Asks suggestions from surrounding peoples and implement there cent technologies.
- Consumes more time in cropland.
- Searching for an alternative solution for an existing solution.

Focus on PR, tap into BE, understand RC

Identify strong TR & EM

3. TRIGGERS TO ACT TR

- By seeing surrounding cropland with installing machineries
- Hearing about innovative technologies and effective solutions.

4. EMOTIONS BEFORE / AFTER EM

- Mental frustrations due to insufficient production of crops.
- Felt smart enough to follow the available technologies with minimum cost.

10. YOUR SOLUTION SL

- Moisture sensor interfaced with Arduino Microcontroller to measure the moisture level in soil and relay is used to turn ON and OFF the motor pump for managing the excess water level. It will be updated to authorities through IOT.
- Temperature sensor connected to microcontroller is used to monitor the temperature in the field. The optimum temperature required for crop cultivation is maintained using IOT based fertilizing methods are followed, to minimize the negative effects on growth of crops while using fertilizers.
- Image processing techniques with IOT is followed for crop protection agains animal attacks.

8. CHANNELS of BEHAVIOR CH

ONLINE: Using different platforms/social media to describe th eworking and uses of smart crop protection device.

OFFLINE: Giving awarenes among farmers about the application of the device.

Extract online & offline CH of BE

3. REQUIREMENT ANALYSIS

3.1 Functional Requirement

Following are the functional requirements of the proposed solution.

- FR-1 User Registration,Registration through Form Registration through Gmail Registration through LinkedIN
- FR-2 User Confirmation ,Confirmation via Email Confirmation via OTP
- FR-3 Tracking Expense Helpful insights about money management
- FR-4 Alert Message Give alert mail if the amount exceeds the budget limit
- FR-5 Category This application shall allow users to add categories of their expenses

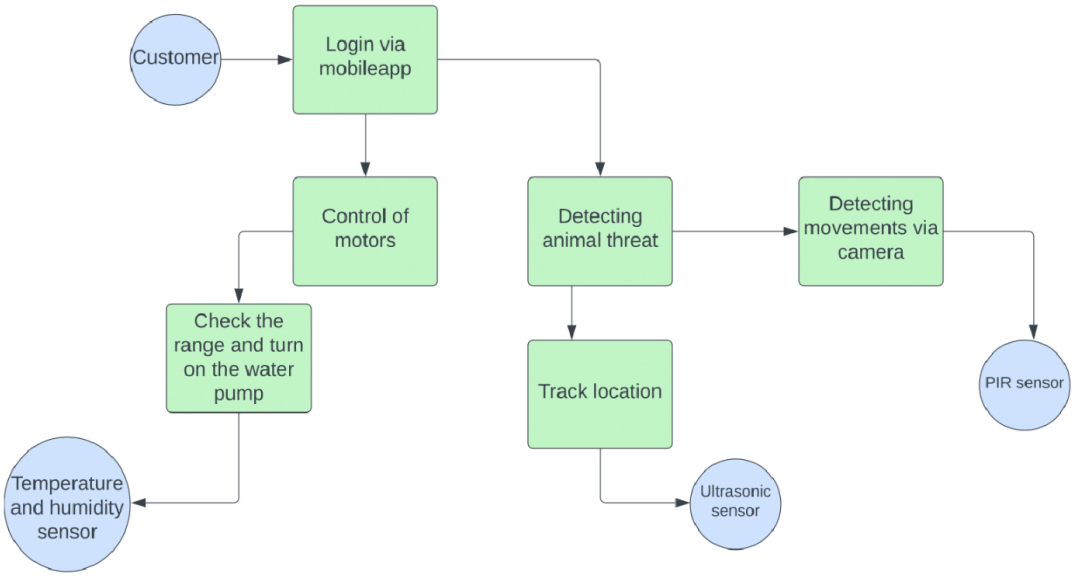
3.2 Non Functional requirement

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

- NFR-1 Usability You will able to allocate money to different priorities and also help you to cut down on unnecessary spending
- NFR-2 Security More security of the customer data and bank account details.
- NFR-3 Reliability Used to manage his/her expense so that the user is the path of financial stability. It is categorized by week, month, and year and also helps to see more expenses made. Helps to define their own categories.
- NFR-4 Performance The types of expense are categories along with an option .Throughput of the system is increased due to light weight database support.
- NFR-5 Availability Able to track business expense and monitor important for maintaining healthy cash flow. NFR-6 Scalability The ability to appropriately handle increasing demands.

4. PROJECT DESIGN

4.1 Data Flow Diagrams



4.2 Solution Architecture:

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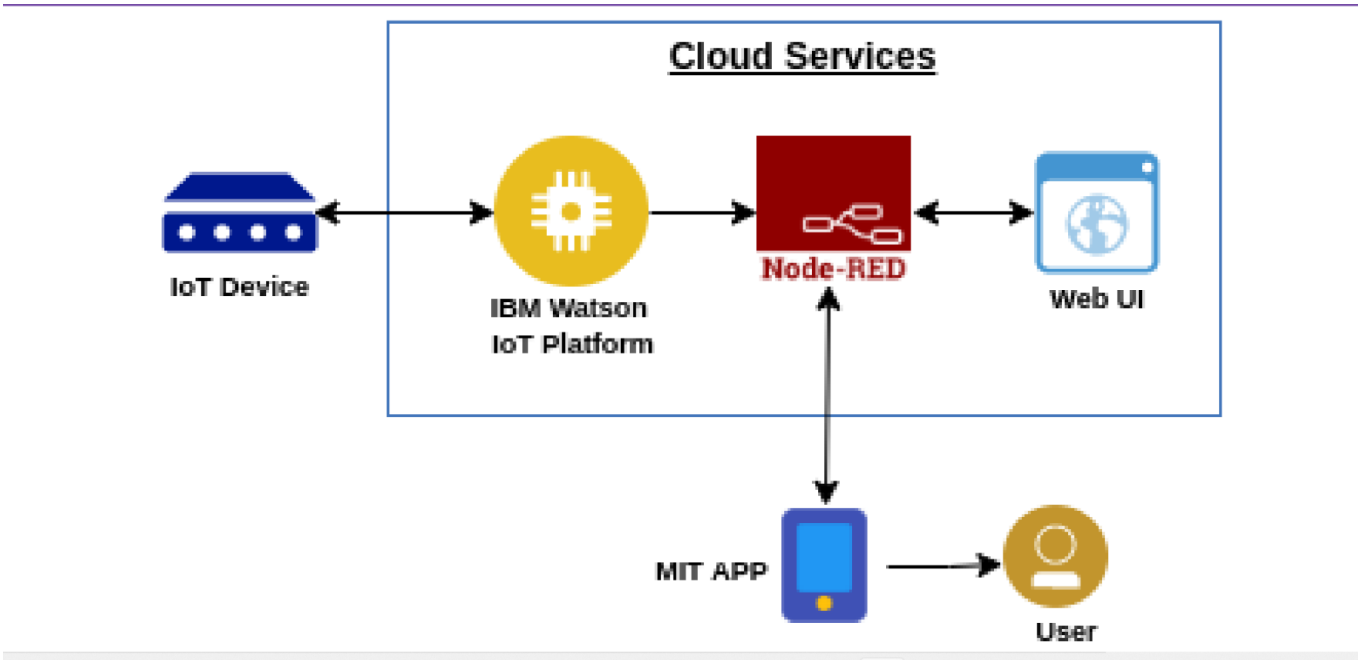
4.3 Solution Architecture Diagram:



WORK FLOW

- Configuring IBM Cloud Services and develop a python script to publish the sensor parameters like Temperature, Humidity, and Soil Moisture to the IBM IoT platform .
- Detect the presence of animals and birds in video streaming using Clarifai platform .
- Develop a web Application using Node-RED Service. Display the image in the Node-RED web UI and also display the temperature, humidity, and soil moisture levels. Integrate the buttons in the UI to control the motors

6.1 Sprint Planning & Estimation

Sprint	Functional Requirement (Epic)	User Story Number	User Story / Task	Story Points	Priority
Sprint1	Establishing interface	USN-1	Various development platforms are configured and interfaced	3	High
Sprint1	Develop of python script	USN-2	Python code is developed in shell with various libraries are imported inorder to fetch the essential growth parameters and store in database	5	High
Sprint2	IBM IOT platform And IBM cloud	USN-3	IBM IOTplatform is created and the device is created and configured and simulated . Database is created in IBM cloud and the port number is taken	5	High
Sprint3	Node RED service	USN-4	To access the IBM IOT platform from external application or from external UI Node red service is established.	5	High
Sprint3	API Key	USN-5	To protect the IBM IOTplatform creating an API Key .		High
Sprint4	Mobile application	USN-6	To monitor and have a control mobile app is developed in MITapp Inventor	8	High

Project Tracker, Velocity & Burndown Chart :

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	8	5 Days	22 Oct 2022	26 Oct 2022	8	26 Oct 2022
Sprint-2	5	5 Days	27 Oct 2022	31 Oct 2022	5	31 Oct 2022
Sprint-3	8	5 Days	05 Nov 2022	09Nov 2022	8	09 Nov 2022
Sprint-4	8	5 Days	12 Nov 2022	16 Nov 2022	8	16 Nov 2022

7. Coding And Solutioning :

PYTHON CODE TO IBM:

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

#Provide your IBM Watson Device Credentials
organization = "iritj7"
deviceType = "NodeMCU"
```

```
deviceId = "12345"
authMethod = "token"
authToken = "pooja123$S


# 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:

8.1 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).

8.2 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

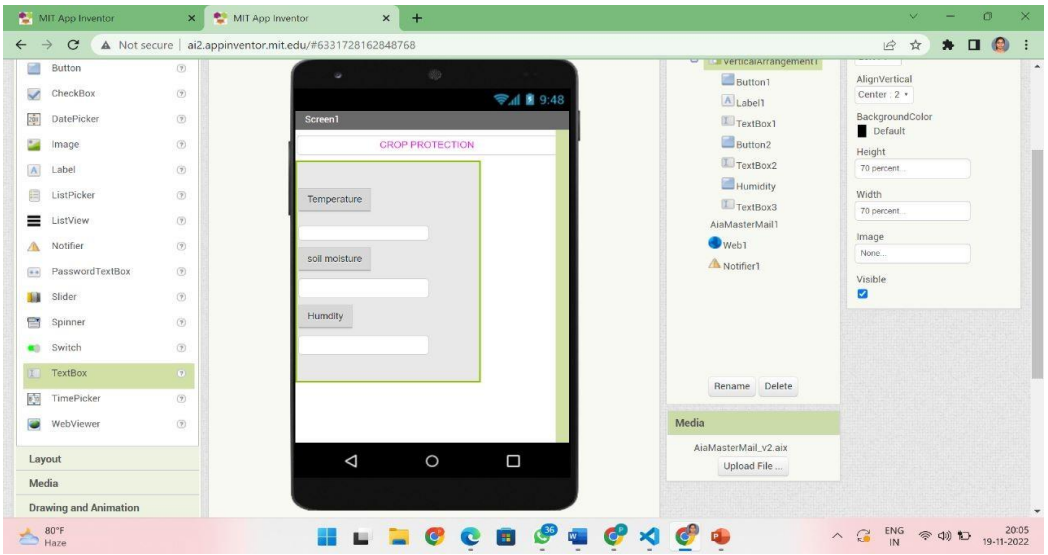
8.3 Test Case Analysis

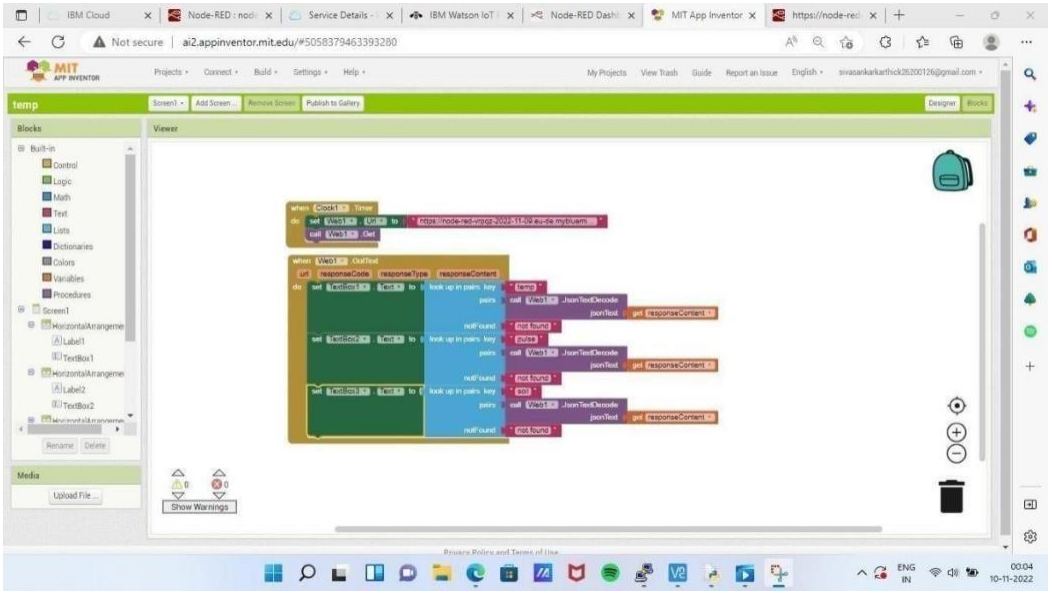
This report shows the number of test cases that have passed, failed, and untested

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

MIT APP INVENTOR- TO DESIGN THE APP




MIT App Inventor
temp
Blocks
Viewer
Show Warnings


CROP PROTECTION
Temperature : 27
Soil moisture : 0.45
Humidity : 2.2

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 managementof a greater number of resources through remote sensing.
- High reliance.
- Enhanced Security.

DISADVANTAGES:

- Implementation is quite complicated
- Requirement for uninterrupted internet connectivity
- High Cost
- Lack of enough knowledge

APPLICATIONS:

- Soiless agriculture
- Automating the irrigation system
- Continous soil Moisture and humidity monitoring

CONCLUSION:

Farmers are being badly affected as they face difficulty in monitoring and protecting their crops against various disasters . There is hence an urging need for technology such as internet of things and computer vision to cope up with agriculture

FUTURE SCOPE:

The mechanism could be extended to indoor cultivation such as hydroponics which would take improvise agriculture . The need for technology is becoming highly essential with the growing population . Moreover it would increase the yield and parallely generated more revenue for the farmers

APPENDIX :

Github link– **https://github.com/IBM-EPBL/IBM-Project-12093-1659369797**

Video link - https://drive.google.com/file/d/14wcES-M6OpGLa-USk1b1wreNh4xqWYp_/view?usp=drivesdk