A PROJECT REPORT

CONTENTS

IoT Based Smart Crop Protection System For Agriculture

TEAM ID	PNT2022TMID41422
PROJECT NAME	Project-IoT Based Smart Crop Protection System For Agriculture
TEAM MEMBERS	Sharathy.K Priyadharshini.V Ramya.S Roja.M

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

2.1 Existing Problem

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 fieldduring night times when the field is near a forest region or when the farm cultivates some fruits and other crops that attract animals. Some animals cross the field in search of food and water and also the birds enter the field for food and they damage all the crops. When the animals enter the field they not only eat food butthey also damage the entire field by walking upon the crops and also by spoiling the food crops. The birds, byentering the field they come to eat seeds of the crops and also they tend to

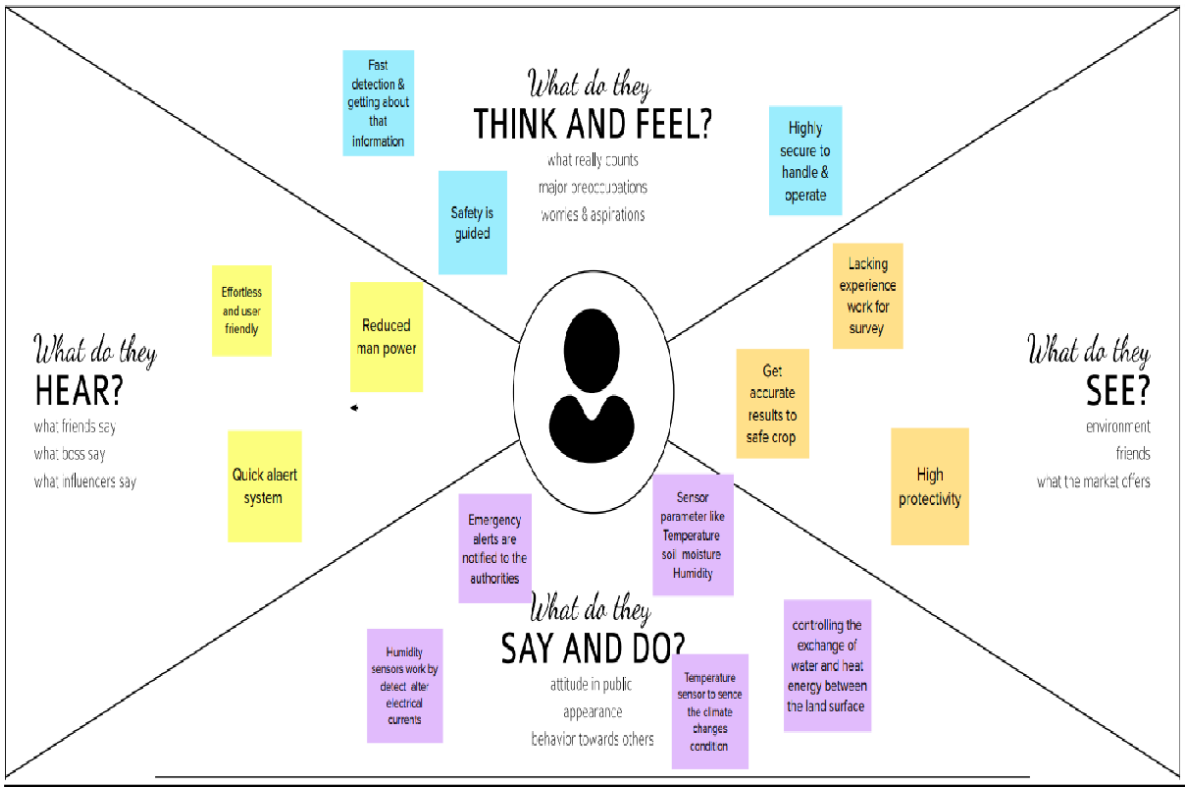
drag the crops and ruin the entirefield. Some birds enter the field to eat the insects and pests in the field.

2.2 Problem Statement Definition

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 fieldduring night times when the field is near a forest region or when the farm cultivates some fruits and other crops that attract animals.

3. IDEATION & POPOSED SOLUTION

3.1 Empathy Map Canvas



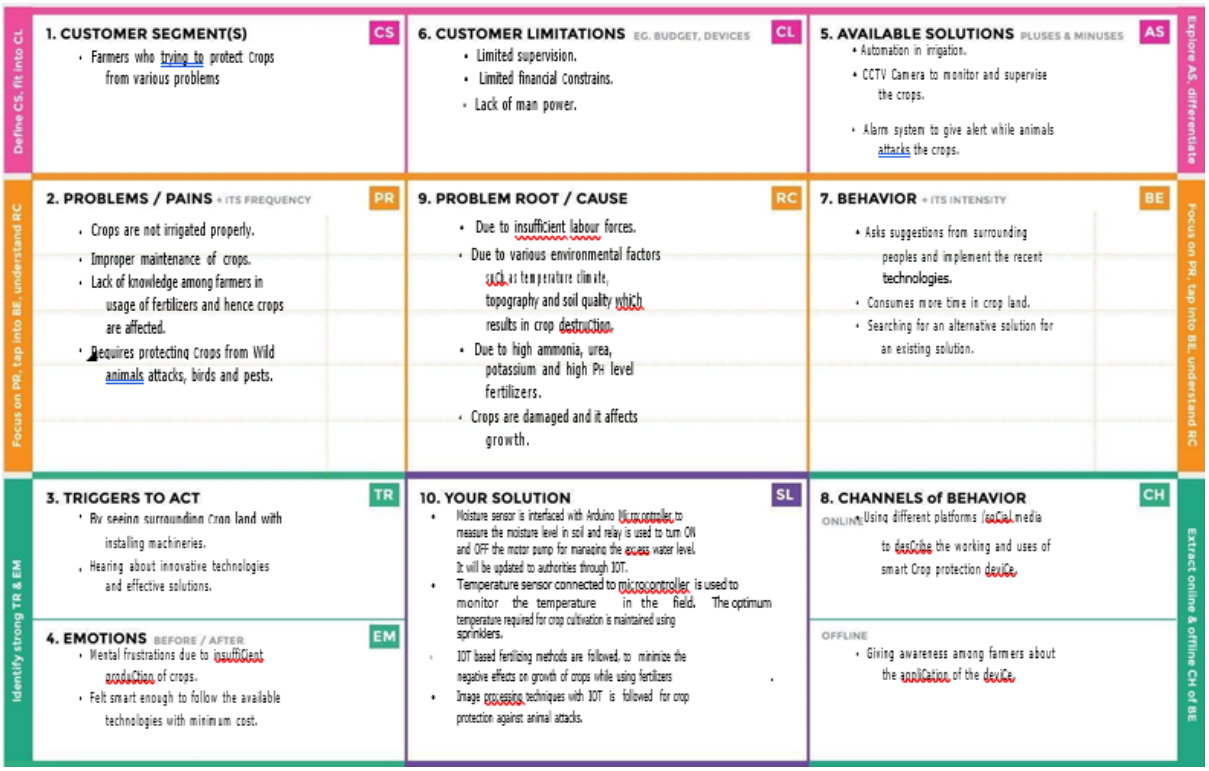
3.2 Ideation and Brainstorming

3.3 Proposed Solution

S.No	Parameter	Description
1.	Problem Statement (Problem to be solved)	• Crops are not irrigated properly due to insufficientlabour forces. • Improper maintenance of crops against various environmental factors such as temperature climate, topography and soil quality which results in crop destruction. •Lack of knowledge among farmers in usage of fertilizersand hence crops are affected due to high ammonia, urea, potassium and high PH level fertilizers. • 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. The optimum temperature required for crop cultivation is maintained using sprinklers. • IOT based fertilizing methods are followed, to minimize the negative effects on growth of crops while usingfertilizers. • 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 whichhelps 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

		operation is performed using robots

3.4 Proposed Solution Fit



4. REQUIREMENT ANALYSIS

4.1 Functional Requirement

Following are the functional requirements of the proposed solution.

- FR-1 User Registration ,Registration through Form Registration through Gmail Registrationthrough 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

4.2 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.

5. PROJECT DESIGN

5.1 Data Flow Diagrams

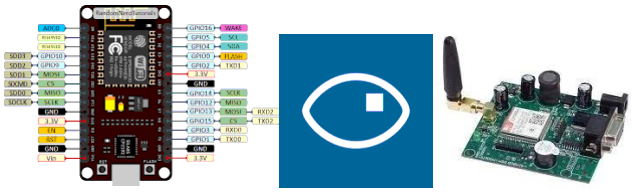
A Data Flow Diagram (DFD) is a traditional visual representation of the information flows within a system. A neat and clear DFD can depict the right amount of the system requirement graphically. It shows how data enters and leaves the system, what changes the information, and where data is store.

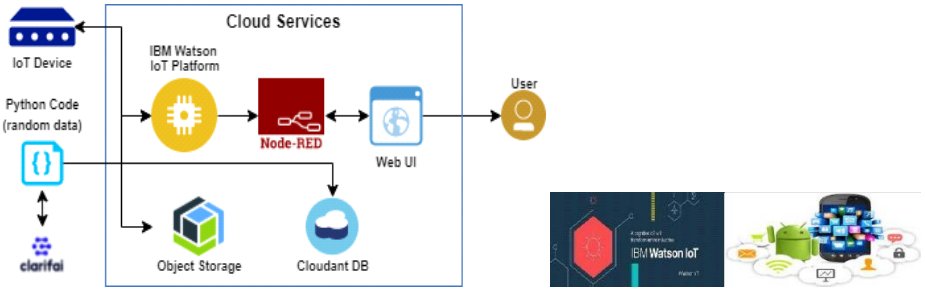
5.2 Solution Architecture:

Solution architecture is a complex process – with many sub-processes – that bridgesthe gap between business problems and technology solutions. Its goals are to:

- Find the best tech solution to solve existing business problems.
- Describe the structure, characteristics, behavior, and other aspects of thesoftware to project stakeholders.
- Define features, development phases, and solution requirements.
- Provide specifications according to which the solution is defined, managed, anddelivered.

5.3 Solution Architecture Diagram:





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	SensorData(python script)	USN-1	The Data of sensor which are feed to the Raspberrypi.Here we areusingpython scriptto generatea random sensor data.	3	High	SHARATHY K (Teamleader)
Sprint-1	Automation(python script)	USN-2	Some activities are made to automation to overcome insufficient of labourforce in the field.Hence that also included in python script to implement automationin the.	5	High	SHARATHY K (Teamleader)
Sprint-2	IBM IOTplatform	USN-3	To sendtheraspberrypi data to IOT platform, we create an IBM IOT platform and connect the raspberry pi tothe device created in IBM IOT.	5	High	RAMYA S (Team Member-1)
Sprint-3	Node RED service	USN-4	To access the IBM IOT platform from external applicationor from externalUINode red serviceis established.	5	High	Roja M (Team Member-2)
Sprint-3	API Key	USN-5	Toprotect the IBM IOT platform creating an API		High	Priyadharshini V (Team Member-3)

			Key.			
Sprint-4	User Application	USN-6	Tomonitor and control the field sensors the Useris provided with an User application created by MIT app inventor	8	High	Ramya S (TeamMember-1), Roja M (Team Member-2)

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	8	6 Days	24 Oct 2022	29 Oct 2022	8	29 Oct 2022
Sprint-2	5	6 Days	31 Oct 2022	05 Nov 2022	5	05 Nov 2022
Sprint-3	8	6 Days	07 Nov 2022	12 Nov 2022	8	12 Nov 2022
Sprint-4	8	6 Days	14 Nov 2022	19 Nov 2022	8	19 Nov 2022

7. Coding And Solutioning:

7.1 Features

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 = "iritj7"
deviceType = "abcd"
deviceId = "12345"
authMethod = "token"
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;

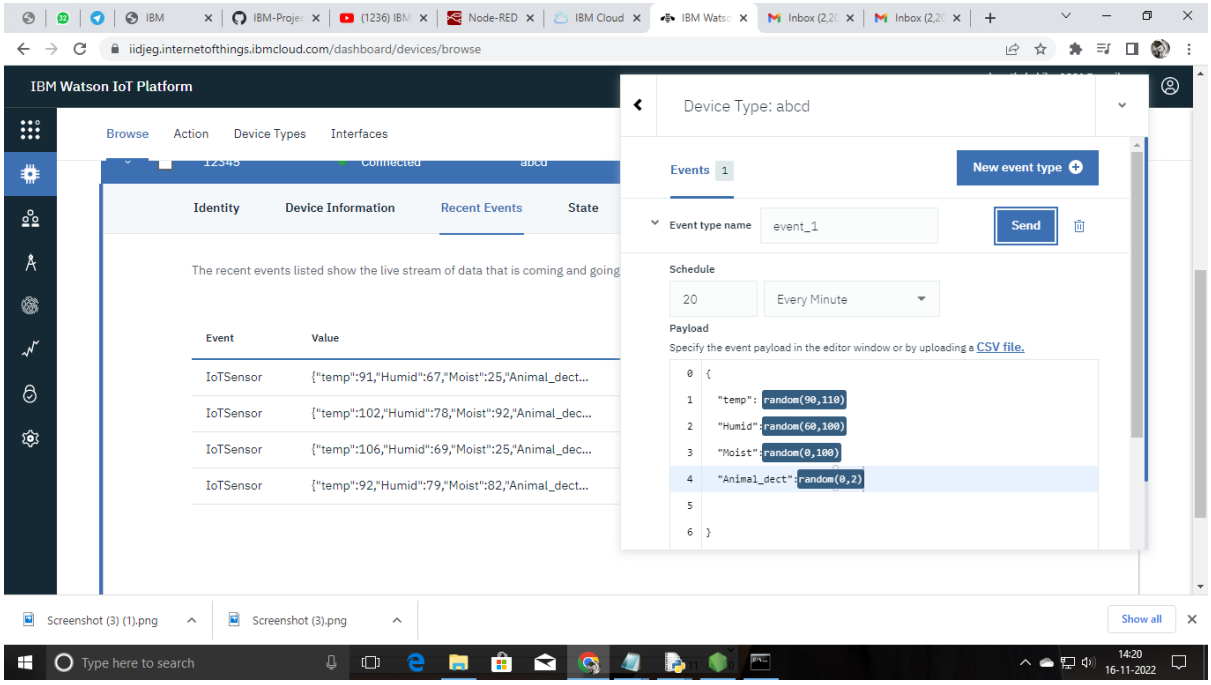
8. TESTING:

8.1 TESTING:

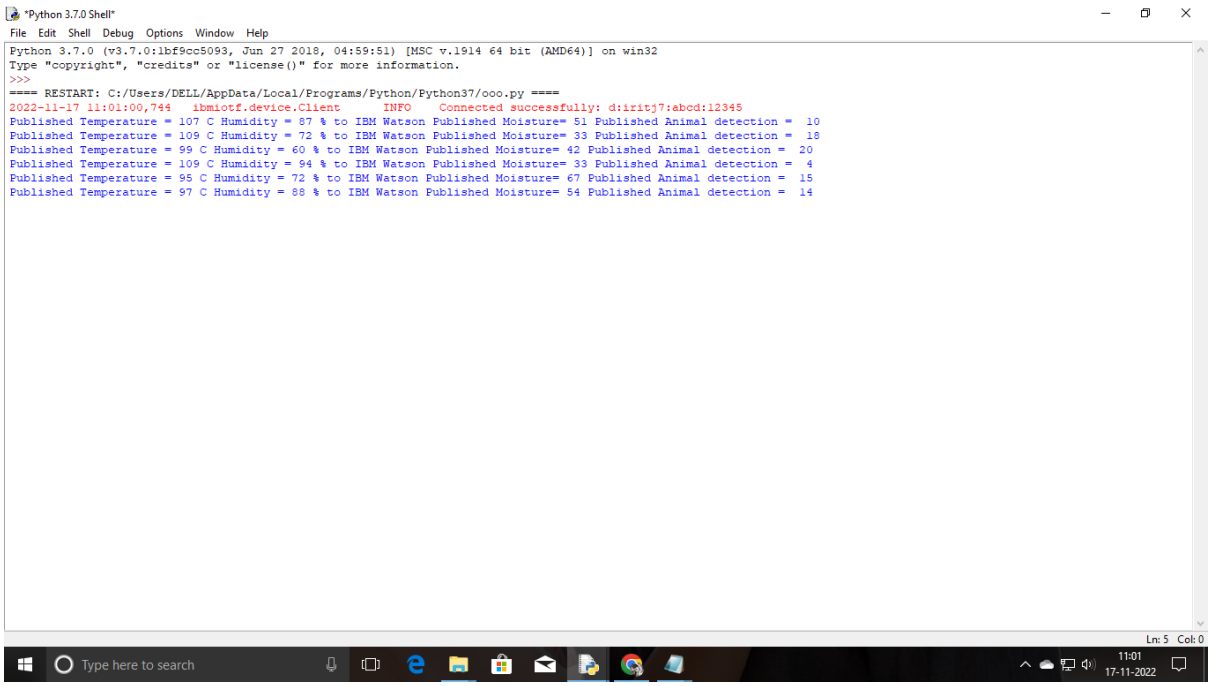
- PYTHON CODE TO IBM
- IoT SENSOR OUTPUT
- IBM CLOUD TO NODE RED OUTPUT

8.2 User Acceptance Testing:

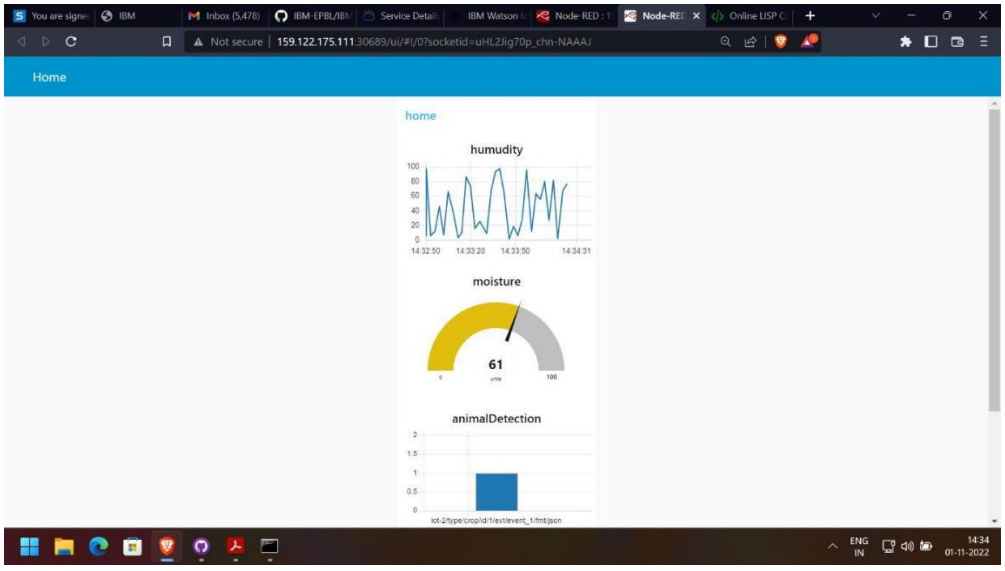
IoT SENSOR DATA OUTPUT:



PYTHON OUTPUT:

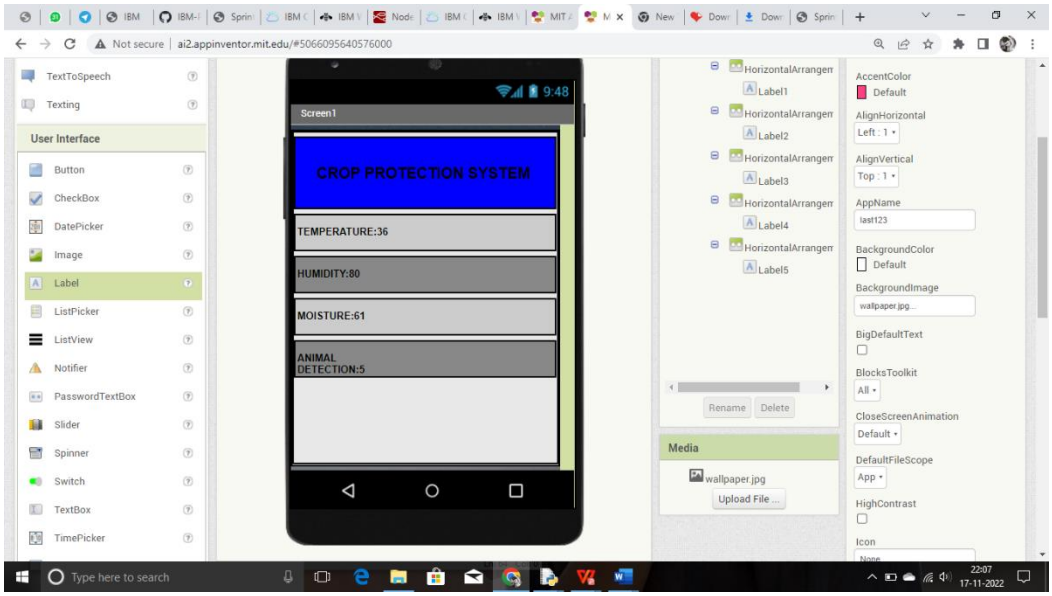


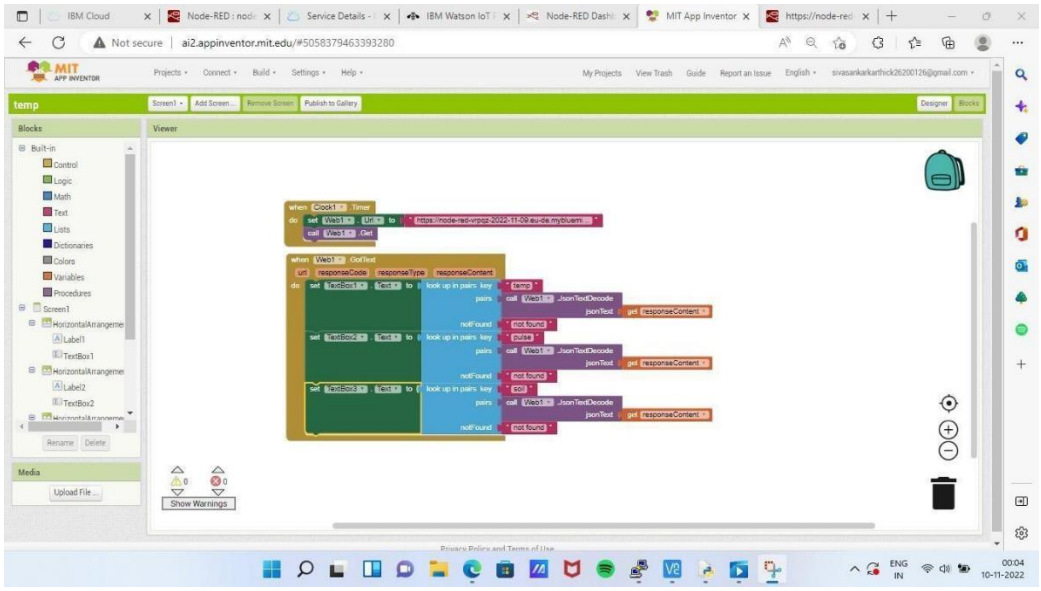
IBM TO NODE RED OUTPUT:



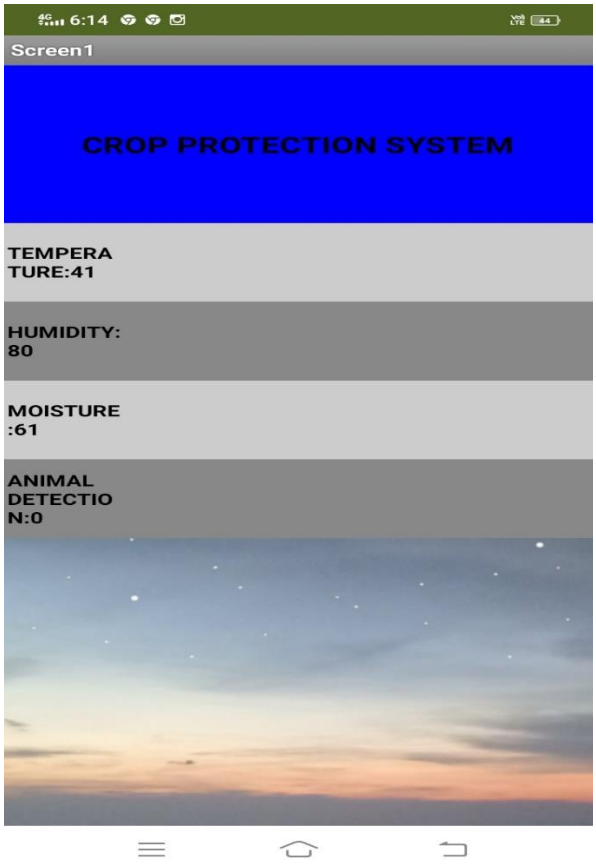
9. RESULT

MIT APP INVENTOR- TO DESIGN THE APP





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



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.
- Enhanced Security.

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.

APPLICATIONS:

- Monitoring the crop field with the help of sensors (light, humidity, temperature, soil moisture, etc.)
- Automating the irrigation system
- Soil Moisture Monitoring (including conductivity)

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.

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 ‘ SOURCECODE ’

GITHUB LINK

The github link :

https://github.com/IBM-EPBL/IBM-Project-47447-1660799402