IOT BASED SMART CROP PROTECTION SYSTEM FORAGRICULTURE .

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INDEX

1. INTRODUCTION

a. Project overview

i. The device will detect the animals and birds using the Clarifai service.
ii. If any animal or bird is detected the image will be captured and stored in theIBM Cloud object storage.
iii. It also generates an alarm and avoid animals from destroying the crop .
iv. The image URL will be stored in the IBM Cloudant DB service.
v. The device will also monitor the soil moisture levels, temperature, and humidityvalues and send them to the IBM IoT Platform.
vi. The image will be retrieved from Object storage and displayed in the webapplication.
vii. A web application is developed to visualize the soil moisture, temperature, and humidity values .
viii. Users can also control the motors through web application.

b. 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

a. Existing Problem

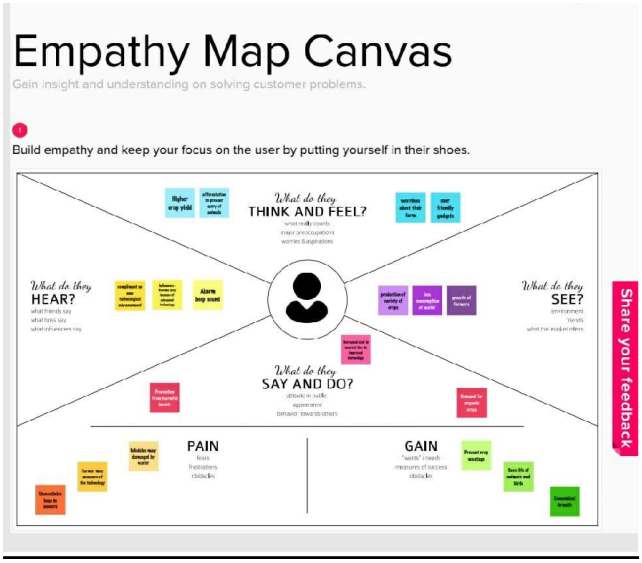
Most of the farmers are facing many problems nowadays due to many reasons.Our problem to solve is the invasion of various species such as birds and animals that harm the crops that are being cultivated. Various types of species such as birds and animals come to the cultivation field according to the crop that is being cultivated and also according to the season of cultivation. Some wild animals enter the field during night times when the field is near a forest region or when the farm cultivates some fruits and other crops that attract animals. 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 but they also damage the entire field by walking upon the crops and also by spoiling the food crops. The birds, by entering the field they come to eat seeds of the crops and also they tend to drag the crops and ruin the entire field. Some birds enter the field to eat the insects and pestsin the field.

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

3. IDEATION &PROPOSED SOLUTION

a. Empathy Map Canvas



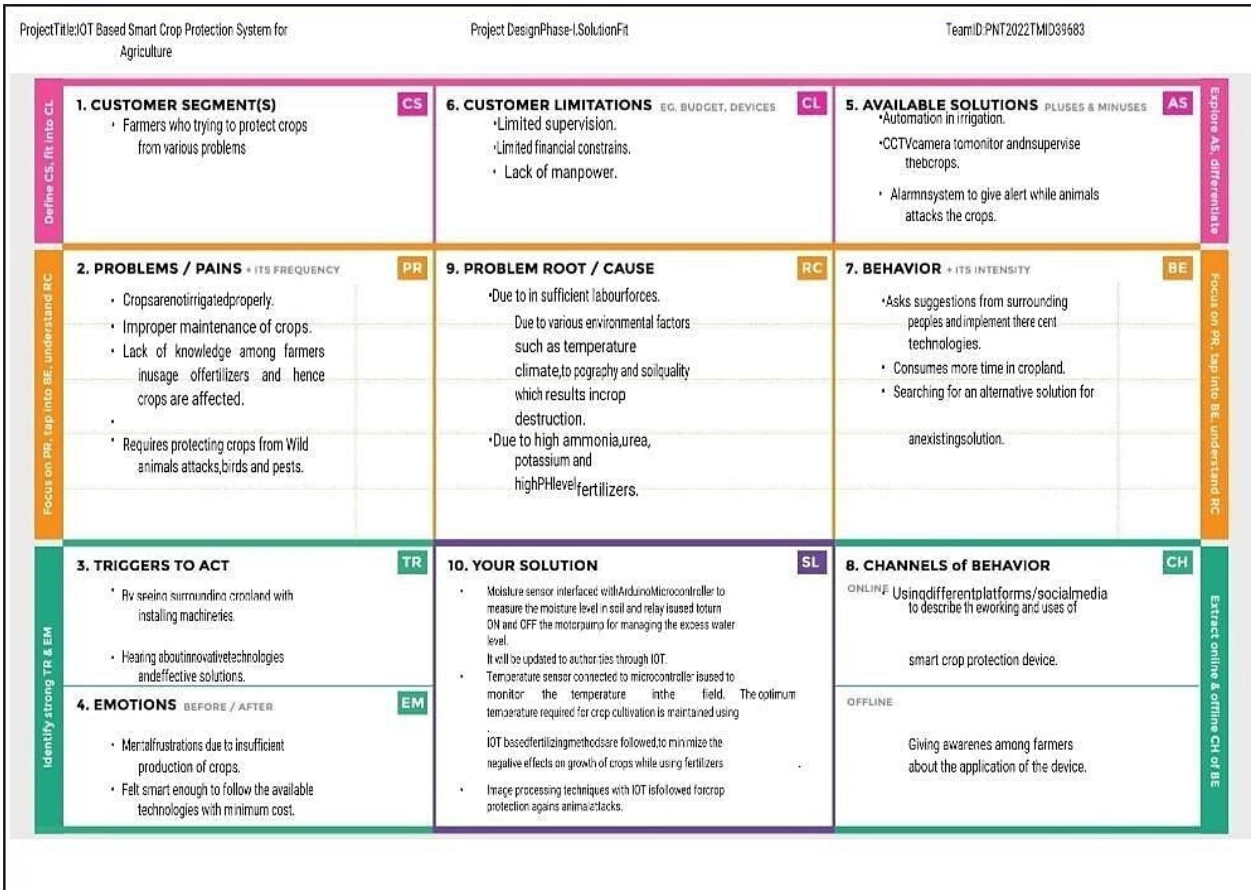
b. Ideation and Brainstorming

c. Proposed Solution

S.No	Parameter	Description
1.	• Problem Statement (Problem tobe 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 Arduous 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 protectionusing 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 withminimum cost with high performance .
6.	Scalability of theSolution	• This can be developed to a scalable product by using sensors and transmitting the data through Wireless Sensor Network andAnalysing the data in cloud and operations is performed using robots .

d. Problem Solution Fit



4. REQUIREMENT ANALYSIS

a. Functional Requirement

Following are the functional requirements of the proposed solution.

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

b. 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 youto cut down on unnecessary spending

- NFR-2 SecurityMore 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

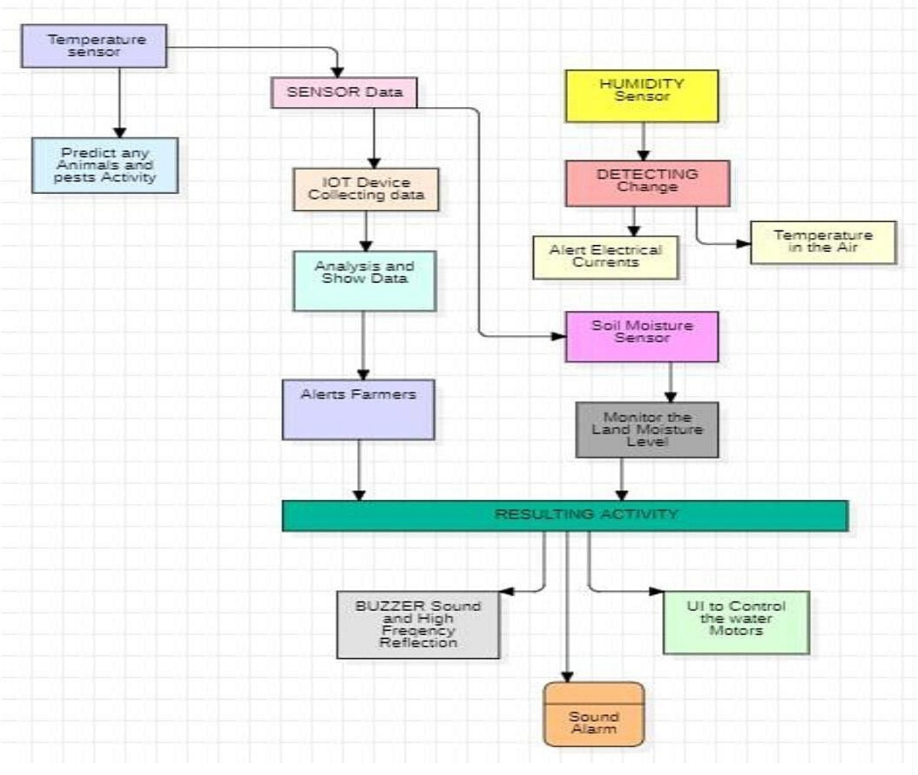
  .Throughput of the system is increased due to light weight database support.

- 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

a. 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.

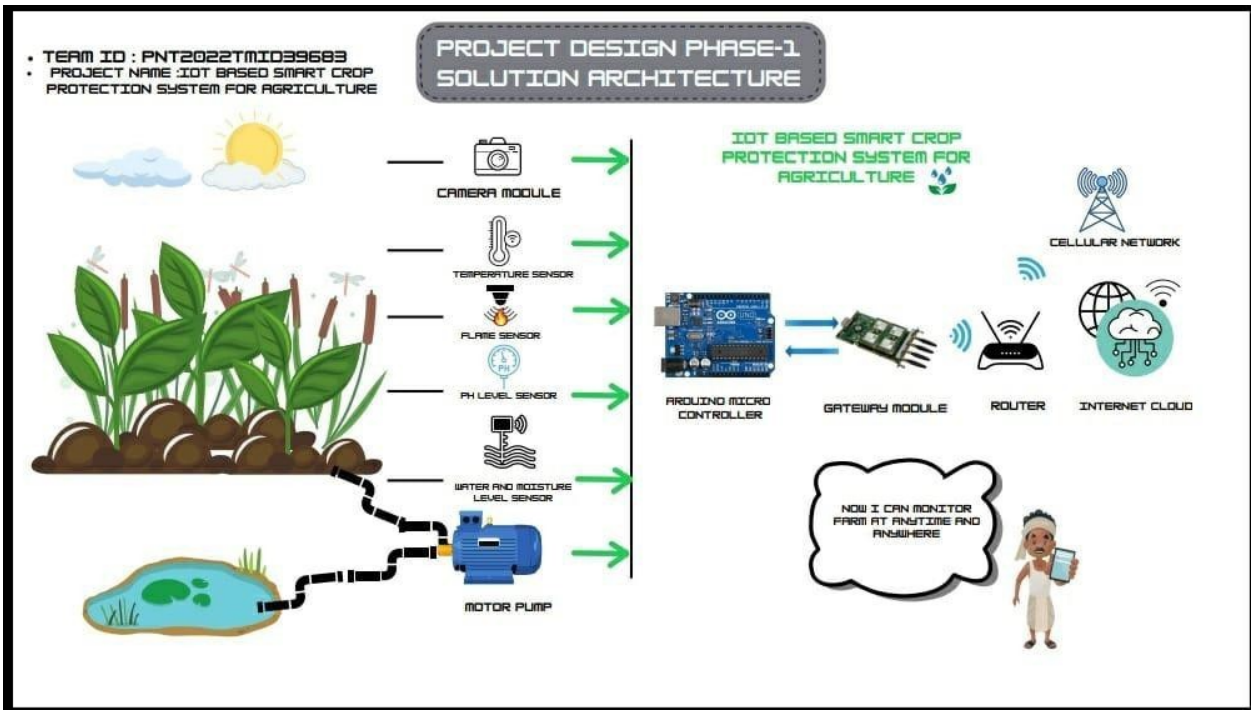


b. Solution Architecture:

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

1. Find the best tech solution to solve existing business problems.
2. Describe the structure, characteristics, behaviour, and other aspects of the software to project stakeholders.
3. Define features, development phases, and solution requirements.
4. Provide specifications according to which the solution is defined, managed,anddelivered.

c. Solution Architecture Diagram:



6.1 Sprint Planning & Estimation

Sprint	Functional Requirement(Epic)	UserStory Number	User Story / Task	Story Points	Priority	Team Members
Sprint1	Sensor Data(pythonscript)	USN-1	The Data of sensor which are feed tothe Raspberry pi .Here we are using python script to generate a random sensor data.	3	High	(Team leader)

Sprint1	Automation (python script)	USN-2	Some activities are made to automationto overcome insufficient of labourforce in the field. Hence that also included in python script toimplement automation	5	High	(Team leader)
Sprint2	IBM IOT platform	USN-3	To Send the raspberry pidata to IOT platform, we create an IBM IOTplatform and connect the raspberry pi to the device created in IBM IOT.	5	High	(Team Member)
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	(Team Member)
Sprint3	API Key	USN-5	To protect the IBM IOTplatform creating an API Key .		High	(Team Member)
Sprint4	User Application	USN-6	To monitor and control the fieldsensors the User is provided with an User application created byMIT app inventor	8	High	(Team Member)

Project Tracker,Velocity & BurndownChart :

Sprint	Total StoryPoints	Duration	SprintStart Date	Sprint End Date (Planned)	Story Points Completed (as on Planned End Date)	Sprint Release Date (Actual)
Sprint-1	8	6Days	24 Oct 2022	29 Oct 2022	8	29Oct 2022
Sprint-2	5	6Days	31 Oct 2022	05 Nov 2022	5	05Nov 2022
Sprint-3	8	6Days	07 Nov 2022	12 Nov 2022	8	12Nov 2022
Sprint-4	8	6Days	14 Nov 2022	19 Nov 2022	8	19 Nov 2022

1. Coding And Solutioning :

a. Features

Feature 1: Detect the TemperatureFeature 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 Credentialsorganization = "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== "light off":
        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 data point "hello" with value "world" into
the cloud as anevent of type "greeting" 10 times
deviceCli.connect()


while True:
        #Get SensorData from DHT11


temp=random.randint(
90,110)
Humid=random.randin
t(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, "PublishedAnimal 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
clouddeviceCli.disconnect()

NODE RED CODE:

TEMPERATURE:

msg.payload=msg.pa

yload.”temp”return

msg;

HUMIDITY:

msg.payload=msg.payl

oad.”Humid”return

msg;

MOISTURE:

msg.payload=msg.pay

load.”Moist”return

msg;

ANIMAL DETECTION:

msg.payload=msg.payload.”

Animal_dect”return msg;

2. TESTING:

a. TESTING :

i. PYTHON CODE TO IBM
ii. IoT SENSOR OUTPUT
iii. IBM CLOUD TO NODE RED OUTPUT

b. User Acceptance Testing:

a. 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).

b. Defect Analysis

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

Resolution	Severity1	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

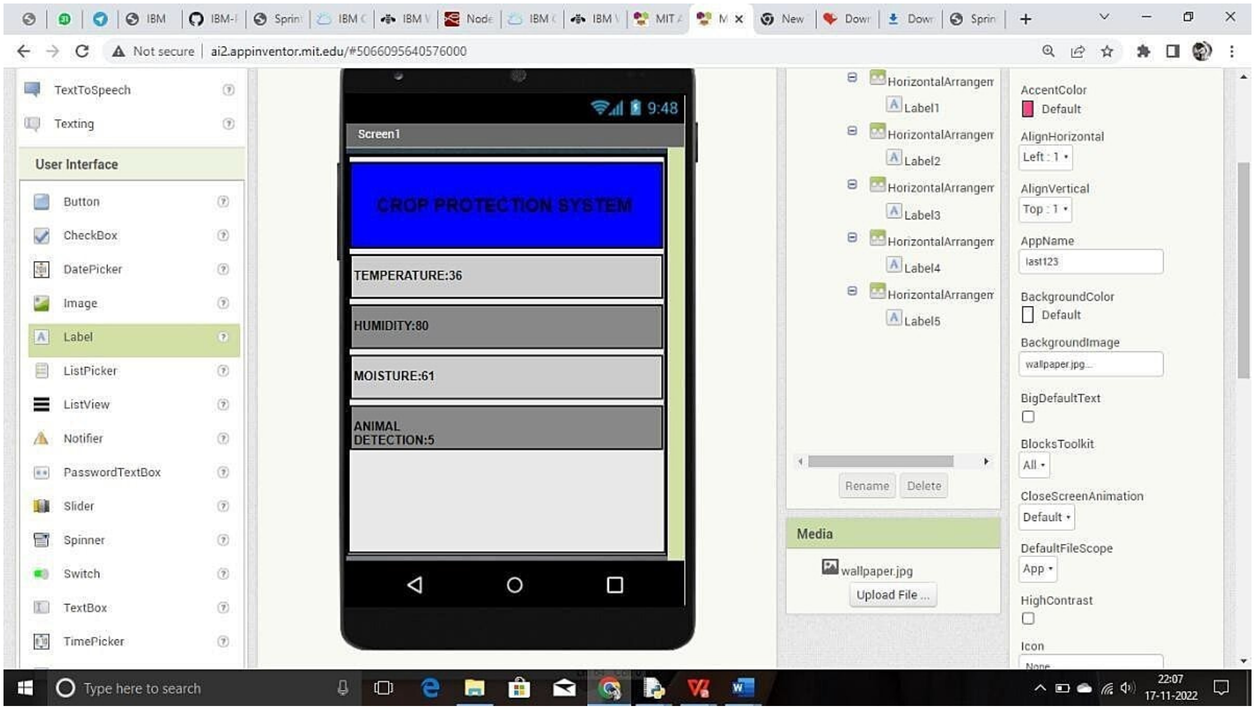
c. Test Case Analysis

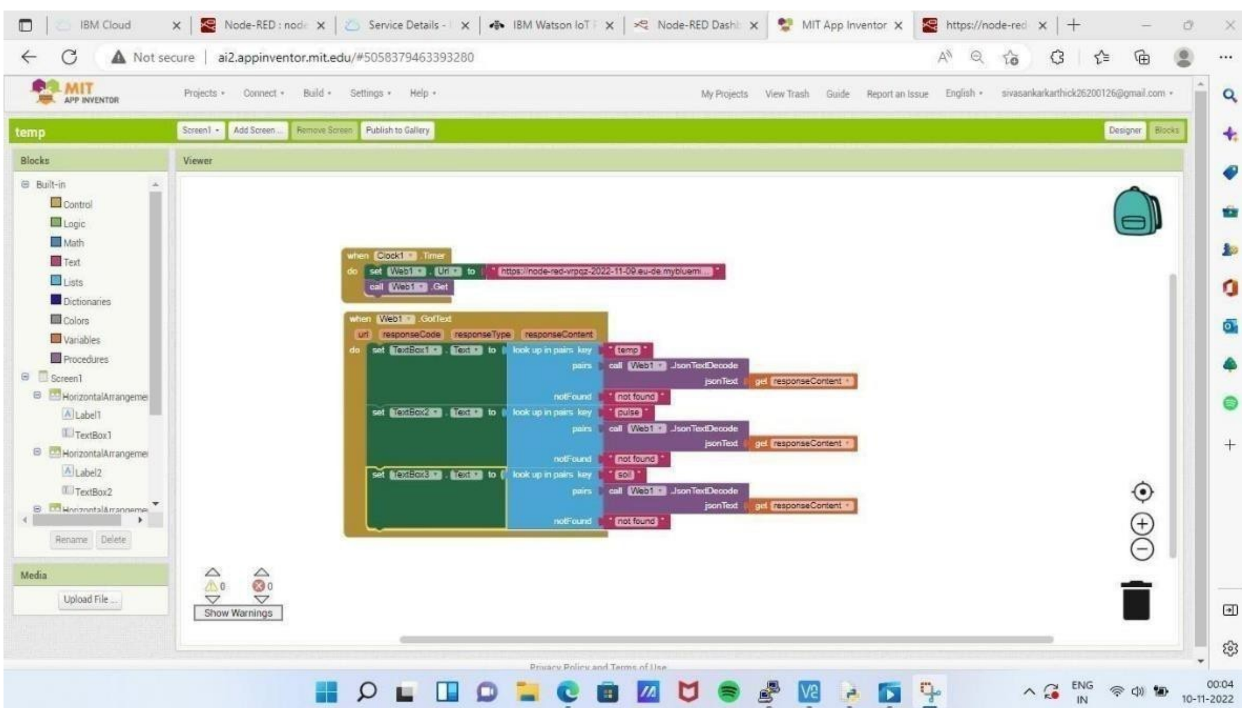
This report shows the number of test cases that have passed,failed, anduntested

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 ReportOutput	4	0	0	4
Version Control	2	0	0	2

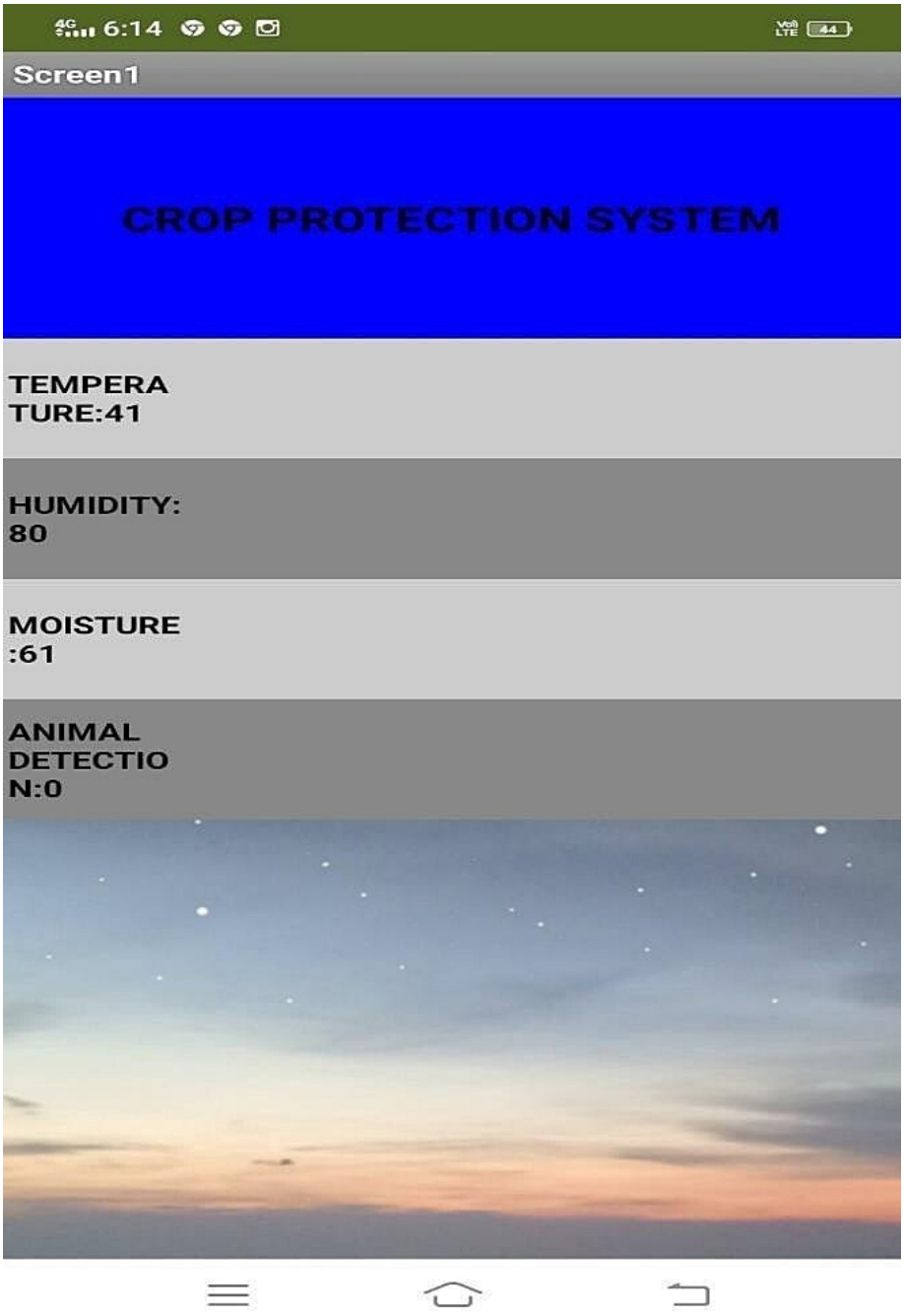
9 RESULT

MIT APP INVENTOR- TO DESIGN THE APP


Not secure | ai2.appinventor.mit.edu/#5066095640576000
TextToSpeech
Texting
User Interface
Button
CheckBox
DatePicker
Image
Label
ListPicker
ListView
Notifier
PasswordTextBox
Slider
Spinner
Switch
TextBox
TimePicker
9:48
Screen1
CROP PROTECTION SYSTEM
TEMPERATURE:36
HUMIDITY:80
MOISTURE:61
ANIMAL DETECTION:5
Label1
Label2
Label3
Label4
Label5
Rename
Delete
Media
wallpaper.jpg
Upload File ...
AccentColor
Default
AlignHorizontal
Left : 1
AlignVertical
Top : 1
AppName
last123
BackgroundColor
Default
BackgroundImage
wallpaper.jpg...
BigDefaultText
BlocksToolkit
All
CloseScreenAnimation
Default
DefaultFileScope
App
HighContrast
Icon
Type here to search
22:07
17-11-2022


IBM Cloud
Node-RED : node
Service Details
IBM Watson IoT
Node-RED Dashb
MIT App Inventor
Not secure | ai2.appinventor.mit.edu/#5058379463393280
MIT APP INVENTOR
temp
Blocks
Viewer
Built-in
Control
Logic
Math
Text
Lists
Dictionaries
Colors
Variables
Procedures
Screen1
Label1
TextBox1
Label2
TextBox2
Media
Upload File ...
when Clock1 .Timer
set Web1 . Url to
call Web1 .Get
when Web1 .GotText
url responseCode responseType responseContent
set TextBox1 . Text to
look up in pairs key
temp
pairs
call Web1 .JsonTextDecode
jsonText
get responseContent
notFound
not found
set TextBox2 . Text to
pulse
set TextBox3 . Text to
soil
Show Warnings
00:04
10-11-2022

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 physicallydistant.
- Smart farming systems reduce waste, improve productivity and enable management ofa greater number of resources through remote sensing.
- High reliance.
- Enhanced Security.

DISADVANTAGES:

i. Farms are located in remote areas and are far from access to the internet.

ii. A farmer needs to have access to crop data reliably at any time from any location, soconnection issues would cause an advanced monitoring system to be useless.

iii. High Cost

iv. Equipment needed to implement IoT in agriculture is expensive.

APPLICATIONS:

v. Monitoring the crop field with the help of sensors (light , humidity,temperature, soilmoisture, etc.)

vi. Automating the irrigation system

vii. Soil MoistureMonitoring (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 developedCrop protection systems for its cost effectiveness with the development of Arduino based variable frequency Ultrasonic birddeterrent circuit.outline of the crop damage caused by a particular Wild animal if thebehavioural features of the With the reduced cost in the smart phones.

APPENDIX:

SOURCE CODE

The source code has been uploaded in git hub.

SOURCE CODE & DEMO VIDEO