PROJECT REPORT

IoT Based Smart Crop Protection System for Agriculture

TEAM ID: PNT2022TMID04659

1. INTRODUCTION

1.1 Project Overview

The title of our project is “IOT BASED SMART CROP PROTECTION FOR AGRICULTURE” .The overview of our Projectis to Safeguard the farm from climatic changes like soil erosion, landslide and birds, animals etc… So, that we are making a cloud based project and placing IOT based sensor. Over which it will produce sounds and notification and provide results on IOT MIT app. From which we can protect our farm. And it will provide better yieldfor us.

1.2 Purpose

The main purpose of our project is to protect the farm from climatic changes, Animals, Birds, Pests and to make the crop togrow better and provide better yield.

2.LITERATURE SURVEY

2.1Existing problem

1. “Food” is the important thing, which is needed for everyone to survive in this world. For that farmers are doing their own part in a effectivemanner, during which they have to face some problems such as:

2. There are increasing pressures from climate change, soil erosion andbiodiversity loss and from consumers’ changing tastes in food and concerns about how it is produced.

3. And the natural world that farming works with – plants, pests anddiseases – continue to pose their own challenges beyond that, they have to

4. Stay resilient against global economic factors.

5. Inspire young people to stay in rural areas and become futurefarmers

6. The effects of climate change affect farmers’ ability to grow the food we all need. Increasingly volatile weather and more extreme events –like floods and droughts –change growing seasons, limit the availability ofwater, allow weeds, pests and fungi to thrive, and can reduce crop productivity.

LITERATURE SURVEY

SL.NO	TITLE	YEAR	TECHNIQUE USED	ADVANTAGE	DRAWBACK
1.	A model for smart Agriculture Using IOT	2016	ZigBee with wings	A complete real -time and historical environment information ,eff icient management and utilization of resources	The technique can achieve convenient wireless connection only within a short-distance
2.	Automatic control of Agriculture pumps based on soil Moisture sensing	2015	For testing N1 MULTISM simulation software is used.DIAC and TRIAC technique.	Achieves proper water management ,s aves human power and enhances crop or productivity	Does not support several water levels and uses old techniques.
3.	Automated Irrigation System Using a Wireless Sensor Network and GPRS module	2014	WSUs and a WIU , based on microcontroller ZigBee and GPRS technologies.	Feasible and cost effective for optimizing water resources for agricultural production	The investment in electric power supply is expensive.
4.	An effective method for Crop Monitoring Using Wireless sensor Network	2014	WSN with GSM technology	A Can collect data from locations previously inaccessible on a Micro-measurement scale.	Provides only precision values that is not accurate and is not effective.

2.2 References

1. https://smartinternz.com/assests/docs/Smart%20Home%20Automation%20using%20IBM%20cloud%20Service s%20(1).pdf
2. https://smartinternz.com/assets/docs/Smart%20Home%20Automation%20using%20IBM%20cloud%20Service s%20(1).pdf
3. https://openweathermap.org/
4. https://www.youtube.com/watch?v=cicTw4SEdxk
5. https://github.com/rachuriharish23/ibmsubscribe

2.3 Problem Statement

6. Agriculture is one of the area which required urgent attention andadvancement for high yield and efficient utilisation of resources.

7. In this paper an approach smart crop monitoring is presented throughInternet of Things (IOT).

3. A Level 4 framework is proposed namely sensing devices, sensor data level, base station level, edge computing and cloud data level for smartcrop monitoring.

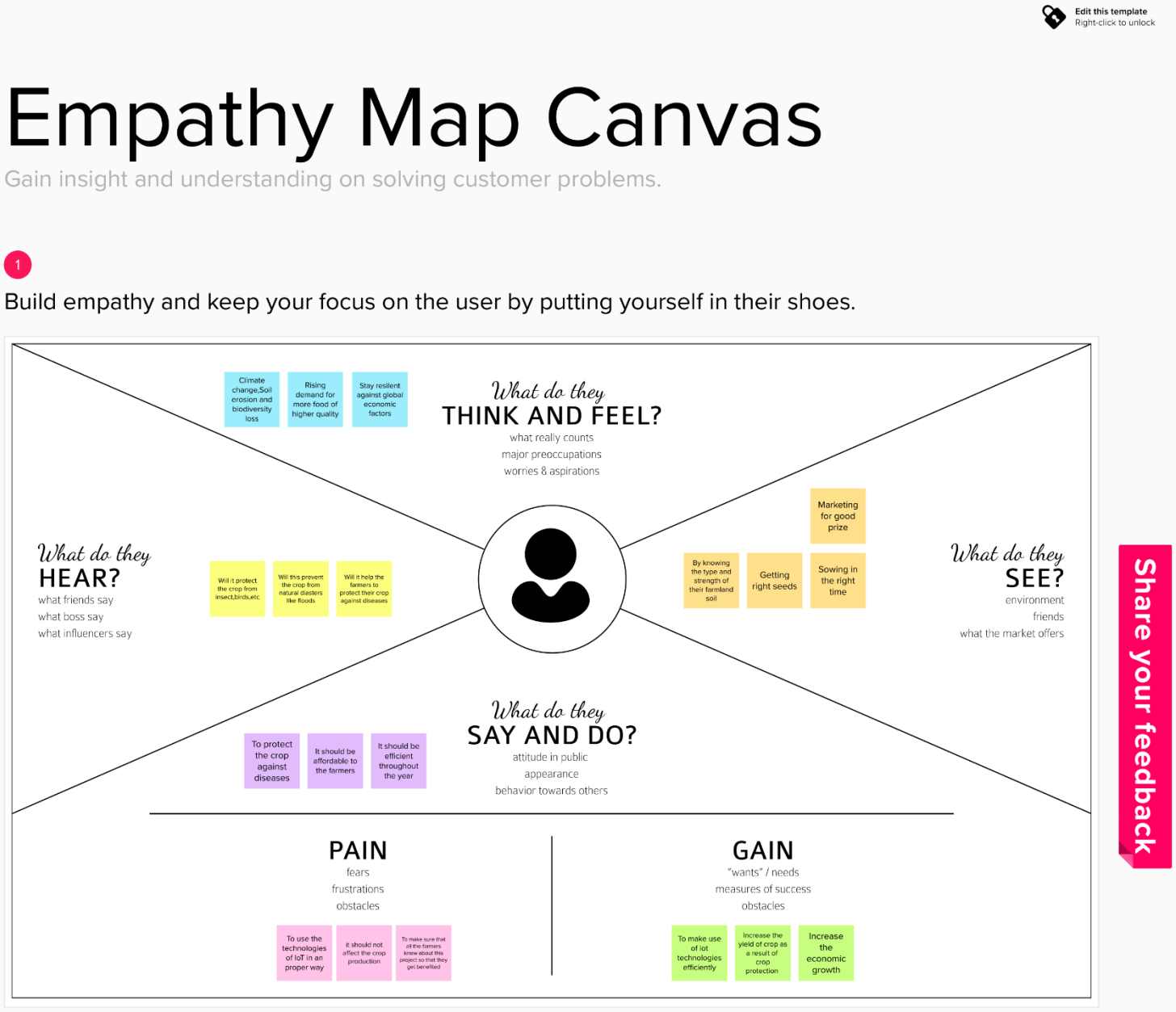
4. In this Project, Farm is going to get protected from humidity,Temperature and Animals with the help of IOT cloud module.

5. The Agricultural Farm is been monitored with the help of MIT appand then data will be collected and stored in it cloud.

6. It will monitor and sense the humidity level and movement ofanimals and will sent the message as notification to the user.

3. IDEATION & PROPOSED SOLUTION

3.1 Empathy Map Canvas



3.2 Ideation and Brainstorming

What do they think and feel?

As its name may imply, smart farming is the use of technology in animal agriculture, and its something that's been around since the Industrial Revolution. The biggest difference between then and now, though? "Motorized devices are being replaced with IOT".

What do they hear?

Smart farming is about using the new technologies whichhave arisen at the drawn of the Fourth Industrial Revolution in the area of Agriculture and cattle production to increase quality and quantity by making maximum use of resources and minimizing the environmental impact.

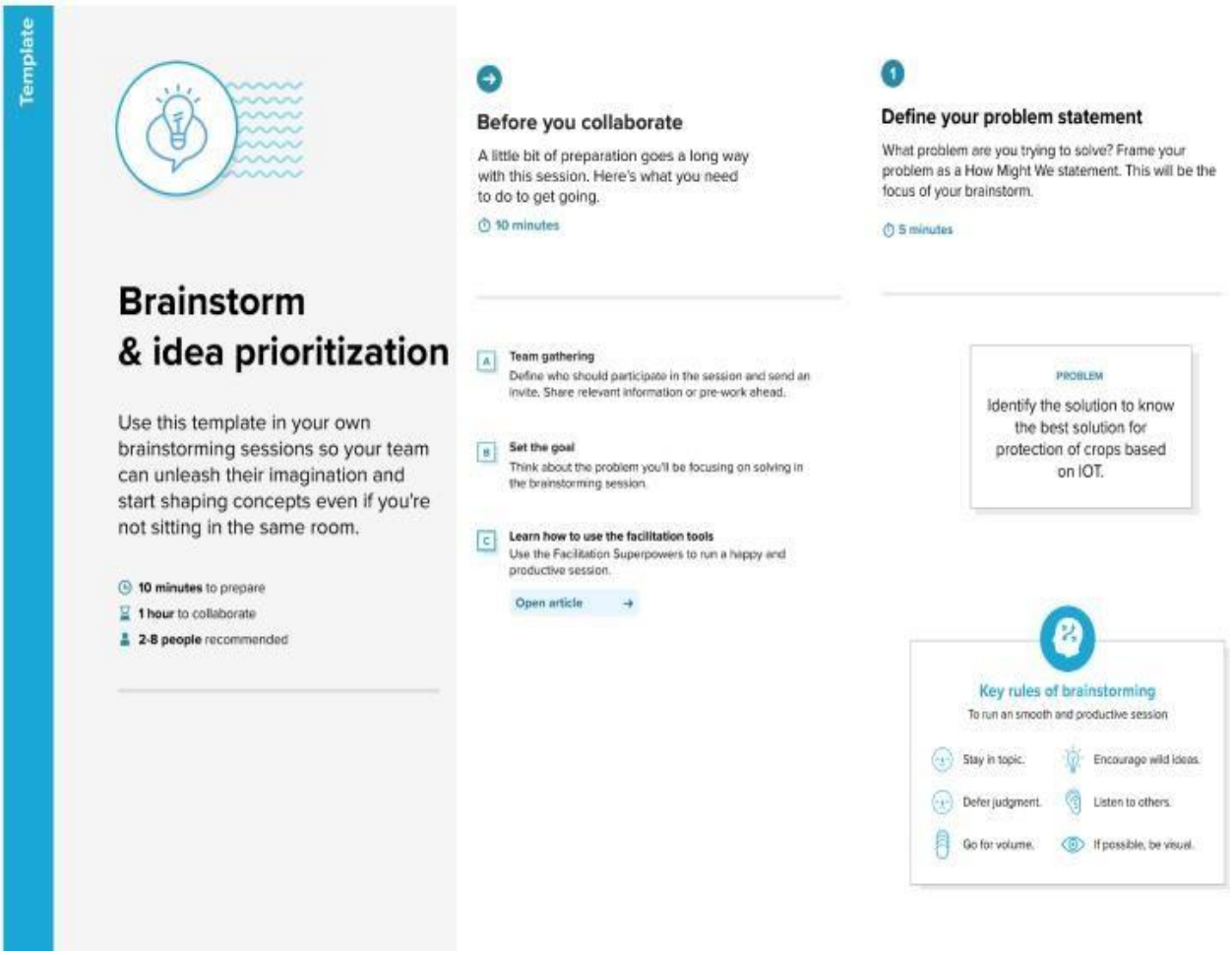
What do they see?

Smart farming is a management concept focused on providing the agriculture industry with the infrastructure to leverage advanced technology -including Big Data, the cloud and the Internet of Things(IOT)- for tracking, monitoring , Automating and Analysing operations.

What do they say and do?

The aim of this technology is to make The most of all the Data collected by various tools, by converting them into real sources if information in order to the define ways of simplifying agricultural work.It also allow for accurate and Predictive analysis of all situation that may affect the farms, Such as weather condition (temperature, humidity etc..) and sanitary .For Example: This makes it easier to organize the supply of energy ,water, livestock feed and fertilizer.

BRAINSTORM


Template
Brainstorm
& idea prioritization
Use this template in your own brainstorming sessions so your team can unleash their imagination and start shaping concepts even if you're not sitting in the same room.
10 minutes to prepare
1 hour to collaborate
2-8 people recommended
Before you collaborate
A little bit of preparation goes a long way with this session. Here's what you need to do to get going.
10 minutes
A Team gathering
Define who should participate in the session and send an invite. Share relevant information or pre-work ahead.
B Set the goal
Think about the problem you'll be focusing on solving in the brainstorming session.
C Learn how to use the facilitation tools
Use the Facilitation Superpowers to run a happy and productive session.
Open article
1
Define your problem statement
What problem are you trying to solve? Frame your problem as a How Might We statement. This will be the focus of your brainstorm.
5 minutes
PROBLEM
Identify the solution to know the best solution for protection of crops based on IOT.
Key rules of brainstorming
To run an smooth and productive session
Stay in topic.
Encourage wild ideas.
Defer judgment.
Listen to others.
Go for volume.
If possible, be visual.

2

Brainstorm

Write down any ideas that come to mind that address your problem statement.

10 minutes

TIP

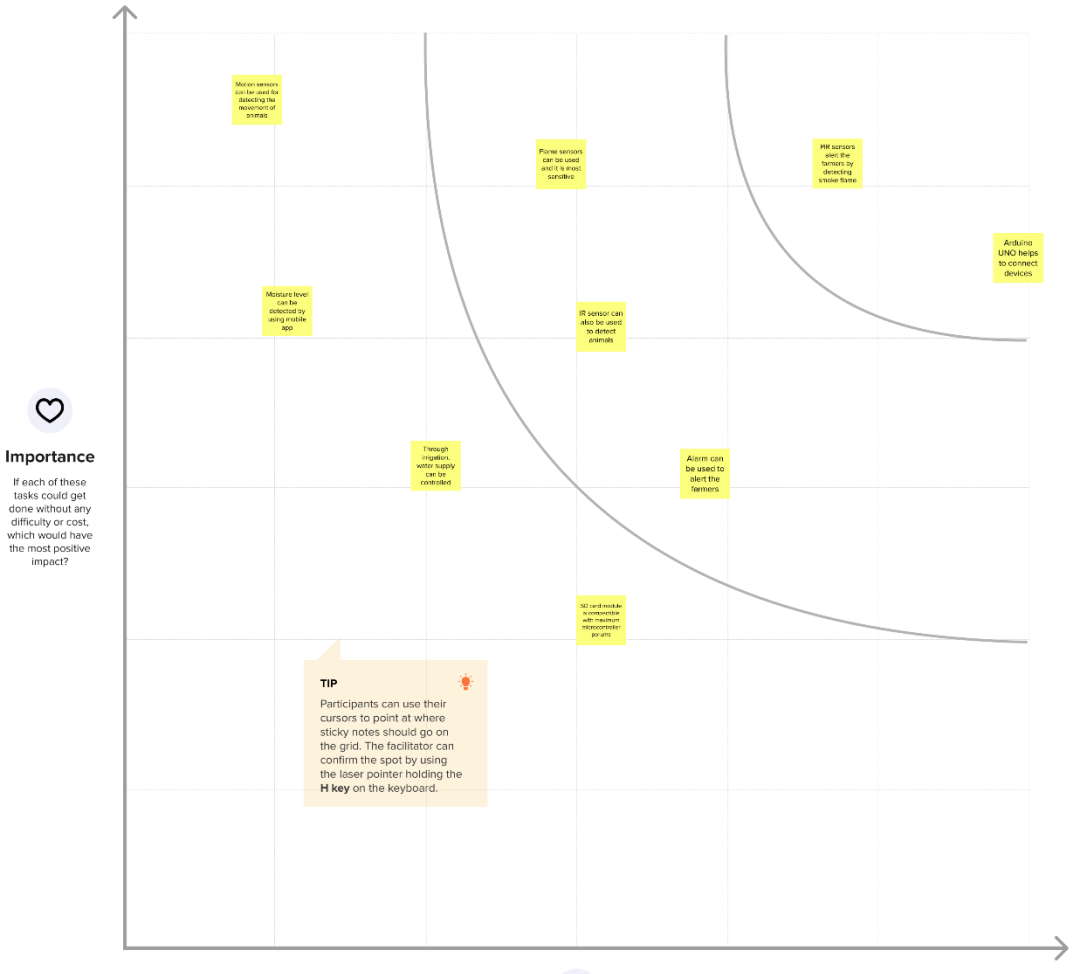
You can select a sticky note and hit the pencil [switch to sketch] icon to start drawing!

4

Prioritize

Your team should all be on the same page about what's important moving forward. Place your ideas on this grid to determine which ideas are important and which are feasible.

20 minutes

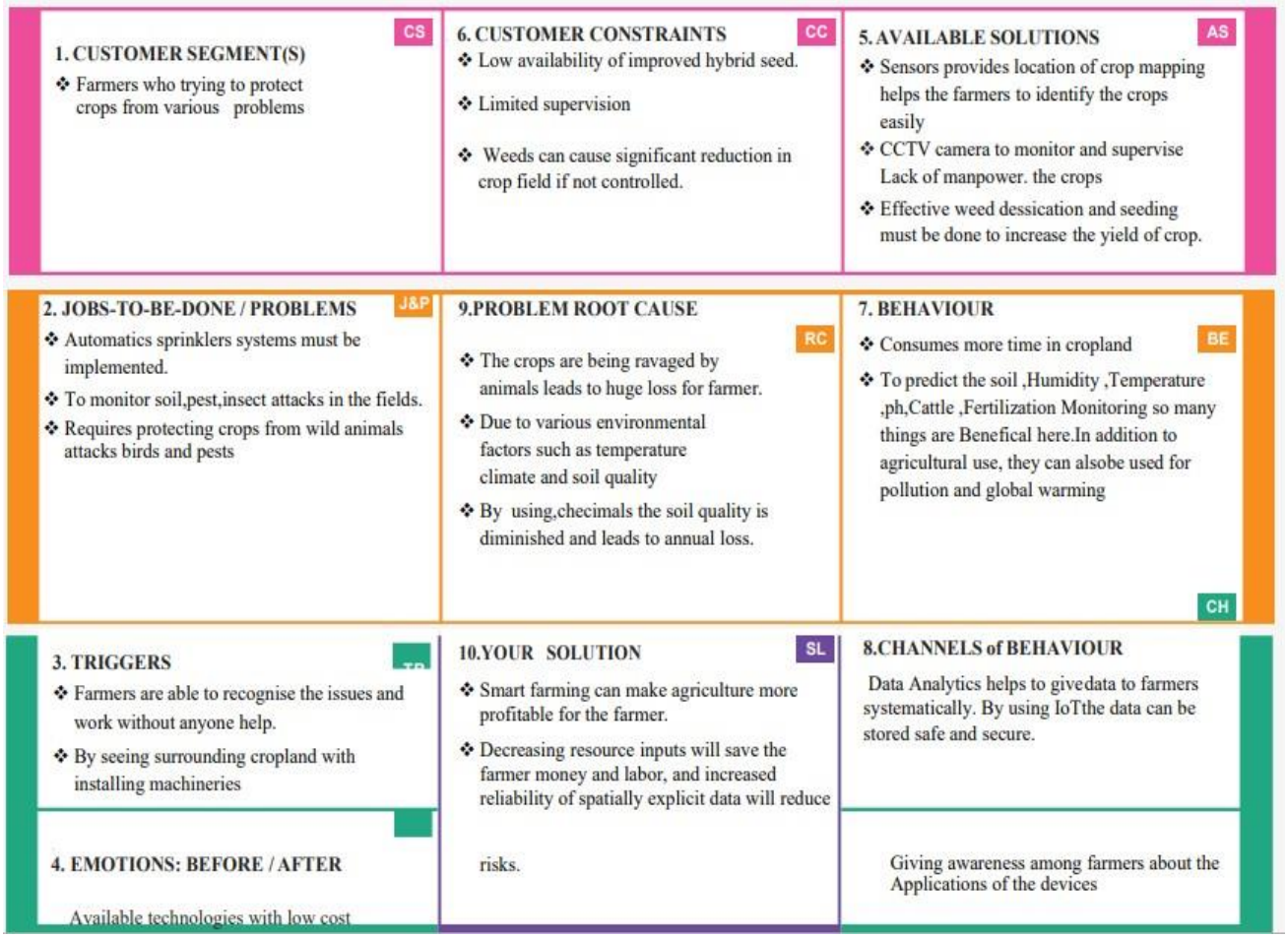


3.3 PROPOSED SOLUTION:

S.No.	Parameter	Description
1.	Problem Statement (Problem to be solved)	➢ Farm crops are frequently destroyed by neighbourhood animals including buffalo, cows, goats, birds, etc. ➢ The farmer suffers enormous losses as a result.
2.	Idea / Solution description	➢ Here, we suggest a mechanism for automatically protecting crops from animals. ➢ This microcontroller-based system uses a microcontroller from the PIC family. ➢ These systems employ a motion sensor to identify approaching wild animals close to the field.
3.	Novelty / Uniqueness	➢ Certain cultural techniques can stop or lessen crop damage caused by insects. ➢ These include where crop residues are placed, deep ploughing, crop rotation, fertiliser use, strip-cropping, irrigation, and planned planting activities.
4.	Social Impact / Customer Satisfaction	➢ The number of smartphone applications that can help farmers make better crop protection decisions is steadily rising. ➢ Despite the fact that recent studies have concentrated on smart phone adoption generally and farmers' willingness to pay for crop protection apps, none have concentrated on the initial adoption choice. ➢ Traditional farming practises relied heavily on the farmer being present in the field to continuously assess the state of the soil and the health of the crop.
5.	Business Model (Revenue Model)	➢ Smart crop protection system is the International Journal of Latest Engineering Science(IJLES) DOI:10.51386/25816659/ijles-v4i4101 E-ISSN:2581-6659 Volume:04 Issue:04
6.	Scalability of the Solution	➢ Utilizing crop leftovers for increased animal protection and manures for increased crop protection might be

		considered integration. ➢ Integration is a strategy for increasing outputs (family food, agricultural products for sale, etc.) while reducing input (purchase, labour).

3.4 PROBLEM SOLUTION FIT



4. REQUIREMENT ANALYSIS

4.1 Functional Requirements

F	Functional Requirement (Epic)	Sub Requirement (Story / Sub-Task)
FR	User Visibility	➢ Sensing animals near the crop field, the device sends the farmer an SMS and plays an alert to scare them away.
FR	User Reception	➢ Data such as sensor readings for temperature, humidity, and soil moisture are received by SMS.
FR	User Understanding	➢ Based on the sensor data value to get the information about present of farming land.
FR	User Action	➢ Actions that must be taken by the user include crop residue destruction, deep ploughing, crop rotation, fertiliser application, strip cropping, and scheduled planting operations.

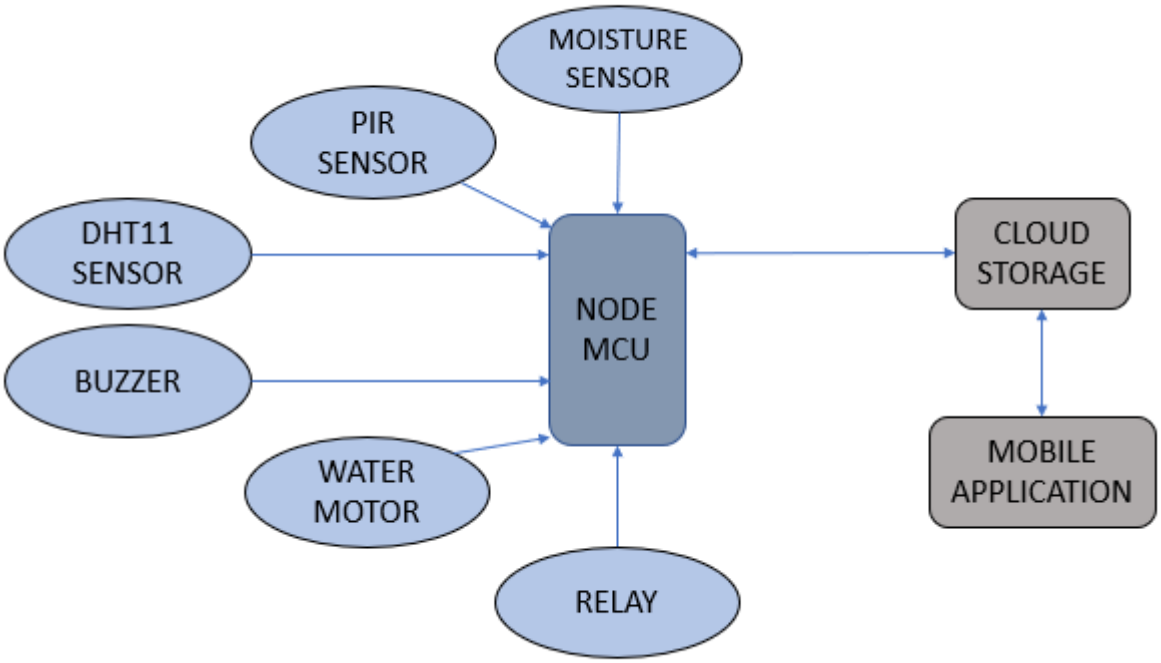
4.2 Non-Functional Requirements

FR No	ɔn-Functional equirement	scription
NFR-1	Usability	➢ Mobile assistance. Given the capabilities of mobile devices, users must be able to interact in the same roles and tasks on PCs and mobile devices when practicable.
NFR-2	Security	➢ Authorized users of the system who share information must be able to register and communicate securely on devices with data.

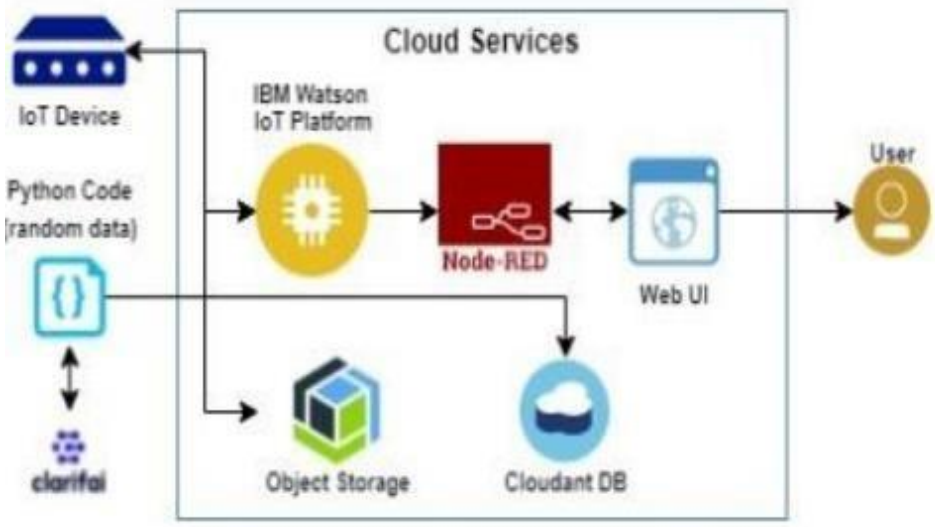
NFR-3	Reliability	➢ It has the ability to detect disturbances close to the field and doesn't issue an erroneous warning signal.
NFR-4	Performance	➢ Regardless of the amount of data that is saved and the background analytics, it must offer users acceptable response speeds. ➢ Communications that are bidirectional and nearly real-time must be supported. The necessity to support industrial and device protocols at the edge is connected to this requirement.
NFR-5	Availability	➢ For 24x7 operations, IOT solutions and domains require highly available systems. is not a vital production application, thus if the IoT solution goes down, neither operations nor production are affected.
NFR-6	Scalability	➢ System must manage increasing load and data retention requirements based on the scalability of the solution, such as additional buildings and manufacturing facilities.

5. PROJECT DESIGN

5.1 Data flow Diagram



5.2 Solution & Technical Architecture



5.3 USER STORIES

User Type	Functional Requirement (Epic)	User Story number	User Story/Task	Acceptance Criteria	Priority	Release
Customer (Mobile user)	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 e-mail 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 log into my account	High	Sprint1
	Dashboard	USN-4	User can view thetemperature	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
Customer (Web user)	Usage	USN-1	User can view the web page and get the information	I can view the data givenby the device	High	Sprint 3
Customer	Working	USN-1	User acts according to The alert given by the device	I can get the data work according to it	High	Sprint 3

6.PROJECT PLANNING AND SCHEDULING

TITLE	DESCRIPTION	DATE
Literature Survey on TheSelected Project and Information Gathering	A Literature Survey is a compilation summary of research done previouslyin the given topic. Literature survey can be taken from books, research paper online or from any source.	13 September 2022
Prepare **Empathy Map**	Empathy Map is a visualization toolwhich can be used to get a better insight of the customer	14 September 2022
Ideation-**Brainstorming**	Brainstorming is a group problemsolving session where ideas are shared, discussed and organized among the team members.	19 September 2022
Define **Problem Statement**	A Problem Statement is a concise description of the problem or issues aproject seeks to address. The problemstatement identifies the current state, the desired future state and any gaps between the two.	19 September 2022
Problem Solution Fit	This helps us to understand the thoughts of the customer their likes,behaviour, emotions etc.	19 September 2022
Proposed Solution	Proposed solution shows the current solution and it helps is going towards the desired result until it is achieved.	19 September 2022
Solution Architecture	Solution Architecture is a very complex process that it has a lot of subprocesses and branches. It helps inunderstanding the components and features to complete our project.	19 September 2022
Customer Journey	It helps us to analyze from the perspective of a customer, who usesour project.	03 October 2022

Functional Requirements	Here functional and nonfunctionalrequirements are briefed. It has specific features like usability, security, reliability, performance, availability and scalability.	03 October 2022
Data Flow Diagrams	Data Flow Diagram is a graphical or visual representation using a standardized set of symbols and notations to describe a business's operations through data movement.	21 October 2022
Technology Architecture	Technology Architecture is a more well defined version of solution architecture. It helps us analyze and understand various technologies thatneeds to be implemented in the project.	03 October 2022
Prepare Milestone & ActivityList	It helps us to understand and evaluate our own progress andaccuracy so far.	18 October 2022
Spring Delivery Plan	Sprint planning is an event in scrum that kicks off the sprint. The purposeof sprint planning is to define what can be delivered in the sprint and how that work will be achieved.	In Progress

6.1 Sprint Planning and Estimation

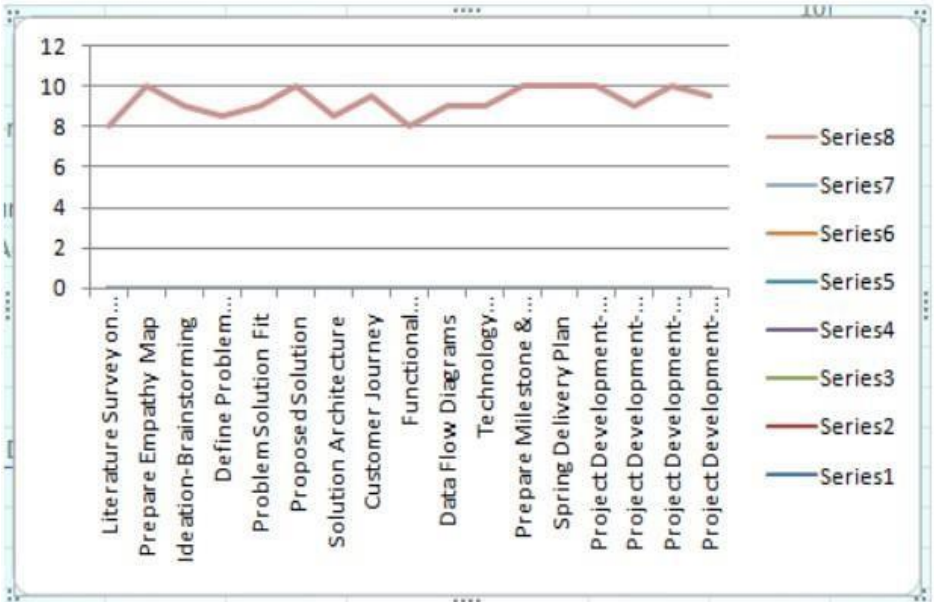
Sprint	Functional Requirement (Epic)	User Story Number	User Story / Task	Story Points	Priority	Team Members
Sprint-1		US-1	Create the IBM Cloud services which are being used in this project.	6	High	Kowsalya
Sprint-1		US-2	Configure the IBM Cloud services which are being used in completing this project.	4	High	Myvizhli
Sprint-2		US-3	IBM Watson IoT platform acts as the mediator to connect the web application to IoT devices, so create the IBM Watson IoT platform.	5	High	Mounesh
Sprint-2		US-4	In order to connect the IoT device to the IBM cloud, create a device in the IBM Watson IoT platform and get the device credentials.	5	High	Kasiram

6.2 Sprint Delivery Schedule

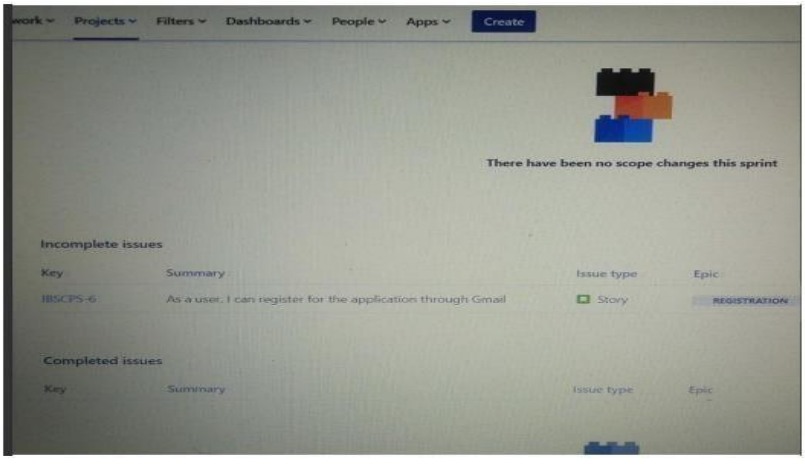
Sprint	Total Story Points	Duration	Sprint StartDate	Sprint End Date(Planned)	Story Points Completed (ason Planned End Date)	Sprint Release Date (Actual)
Sprint-1	20	6 Days	24 Oct 2022	29 Oct 2022	20	29 oct 2022
Sprint-2	20	6 Days	31 Oct 2022	05 Nov 2022	30	30 oct 2022
Sprint-3	20	6 Days	07 Nov 2022	12 Nov 2022	49	6 nov 2022
Sprint-4	20	6 Days	14 Nov 2022	19 Nov 2022	50	7 nov 2022

Burn down Chart:

A burn down chart is a graphical representation of work left to do versus time. It is often used in agile software development methodologies such as Scrum. However, burn down charts can be applied to any project containing measurable progress overtime.



6.3 Reports From JIRA



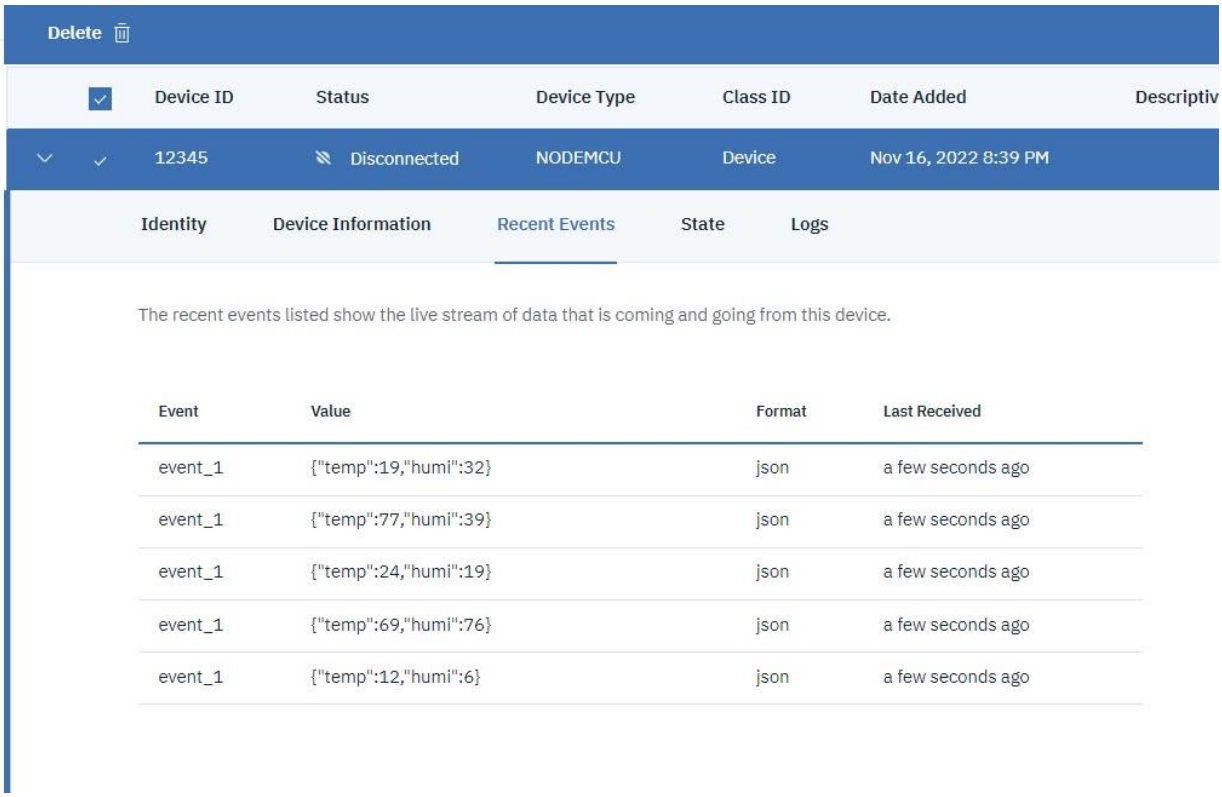
7. CODING AND SOLUTIONING

7.1 Feature 1

```
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()
```



Features

Output: Digital pulse high (3V) when triggered (motion detected) digital lowwhen idle (no motion detected). Pulse lengths are determined by resistors and capacitors on the PCB and differ from sensor to sensor. Power supply: 5V-12V input voltage for most modules (they have a 3.3V regulator),but 5Vis ideal in case the regulator has different specs.

BUZZER

Specifications

- RatedVoltage : 6V DC
- Operating Voltage : 4 to 8V DC
- Rated Current*: ≤30mA
- SoundOutput at 10cm* : ≥85dB

Most modern ones are civil defense or air- raid sirens, tornado sirens, or the sirens on emergency service vehicles such as ambulances, police cars and firetrucks.

There are two general types, pneumatic and electronic.

7.2 FEATURE 2

Good sensitivity to Combustible gas in wide range .

High sensitivity to LPG, Propane and Hydrogen .

Long life and low cost.

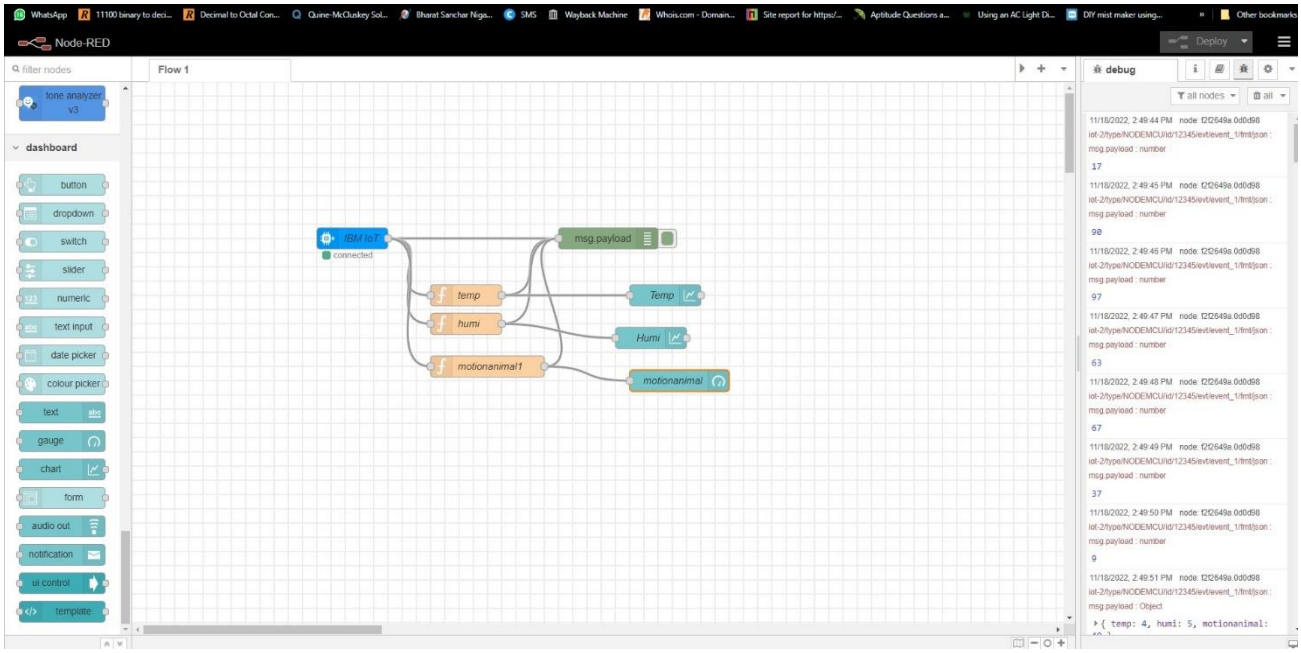
Simple drive circuit.

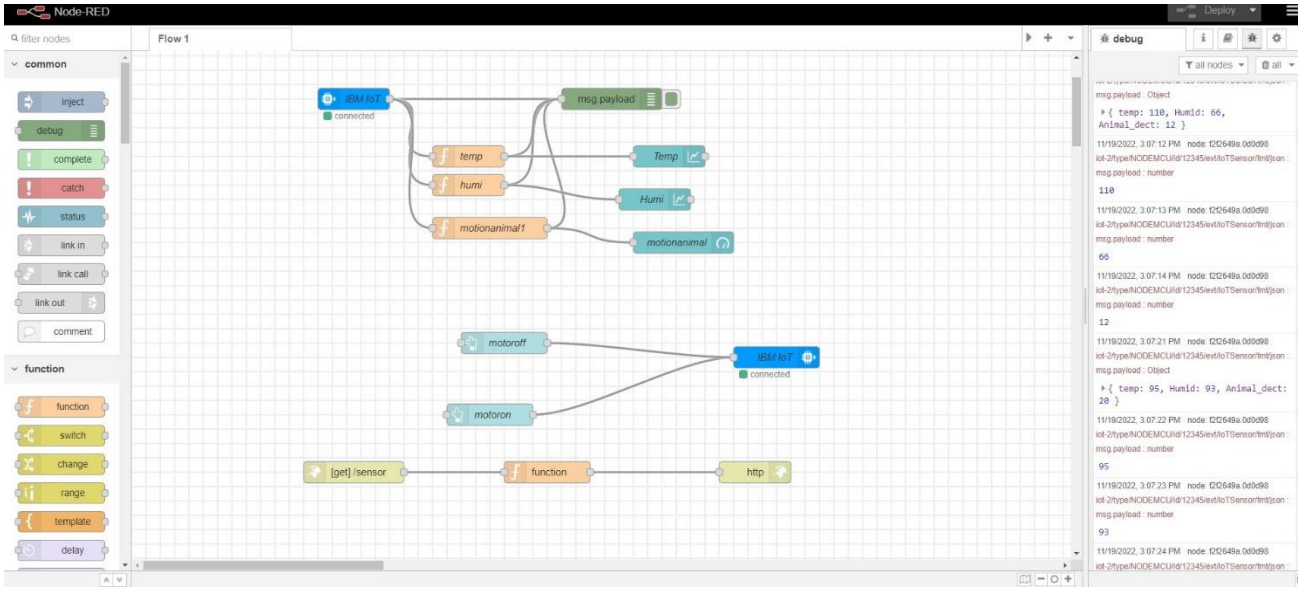
8. TESTING

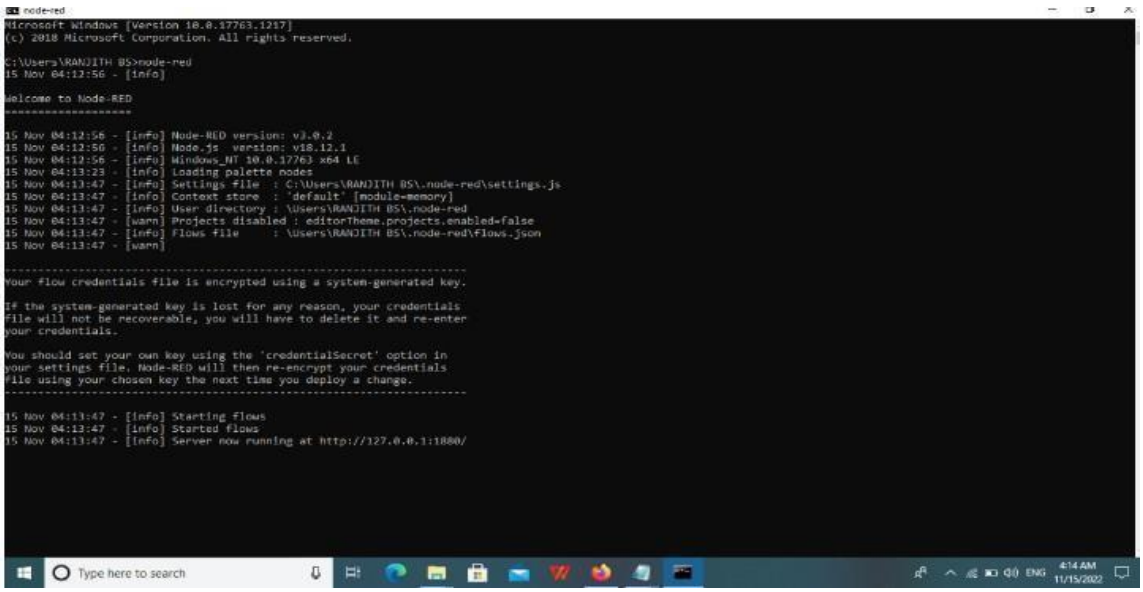
8.1 TEST CASES

sno	parameter	Values	Screenshot
1	Model summary	-	
2	accuracy	Training accuracy-95% Validation accuracy-72%	
3	Confidence score	Class detected-80% Confidence score-80%	

8.2USER ACCEPTANCE TESTING:




Node-RED
Deploy
Flow 1
common
inject
debug
complete
catch
status
link in
link call
link out
comment
function
function
switch
change
range
template
delay
IBM IoT
connected
msg.payload
temp
humi
motionanimal1
Temp
Humi
motionanimal
motoroff
motoron
IBM IoT
connected
[get] /sensor
function
http
debug
all nodes
all
msg.payload : Object
{ temp: 110, Humid: 66, Animal_dect: 12 }
11/19/2022, 3:07:12 PM node: f2f2649a.0d0d98
iot-2/type/NODEMCUId/12345/evt/IoTSensor/fmt/json : msg.payload : number
110
11/19/2022, 3:07:13 PM node: f2f2649a.0d0d98
iot-2/type/NODEMCUId/12345/evt/IoTSensor/fmt/json : msg.payload : number
66
11/19/2022, 3:07:14 PM node: f2f2649a.0d0d98
iot-2/type/NODEMCUId/12345/evt/IoTSensor/fmt/json : msg.payload : number
12
11/19/2022, 3:07:21 PM node: f2f2649a.0d0d98
iot-2/type/NODEMCUId/12345/evt/IoTSensor/fmt/json : msg.payload : Object
{ temp: 95, Humid: 93, Animal_dect: 20 }
11/19/2022, 3:07:22 PM node: f2f2649a.0d0d98
iot-2/type/NODEMCUId/12345/evt/IoTSensor/fmt/json : msg.payload : number
95
11/19/2022, 3:07:23 PM node: f2f2649a.0d0d98
iot-2/type/NODEMCUId/12345/evt/IoTSensor/fmt/json : msg.payload : number
93
11/19/2022, 3:07:24 PM node: f2f2649a.0d0d98
iot-2/type/NODEMCUId/12345/evt/IoTSensor/fmt/json :


node-red
Microsoft Windows [Version 10.0.17763.1217]
(c) 2018 Microsoft Corporation. All rights reserved.
C:\Users\RANJITH BS>node-red
15 Nov 04:12:56 - [info]
Welcome to Node-RED
15 Nov 04:12:56 - [info] Node-RED version: v3.0.2
15 Nov 04:12:56 - [info] Node.js version: v18.12.1
15 Nov 04:12:56 - [info] Windows_NT 10.0.17763 x64 LE
15 Nov 04:13:23 - [info] Loading palette nodes
15 Nov 04:13:47 - [info] Settings file : C:\Users\RANJITH BS\.node-red\settings.js
15 Nov 04:13:47 - [info] Context store : 'default' [module=memory]
15 Nov 04:13:47 - [info] User directory : \Users\RANJITH BS\.node-red
15 Nov 04:13:47 - [warn] Projects disabled : editorTheme.projects.enabled=false
15 Nov 04:13:47 - [info] Flows file : \Users\RANJITH BS\.node-red\flows.json
15 Nov 04:13:47 - [warn]
Your flow credentials file is encrypted using a system-generated key.
If the system-generated key is lost for any reason, your credentials
file will not be recoverable, you will have to delete it and re-enter
your credentials.
You should set your own key using the 'credentialSecret' option in
your settings file. Node-RED will then re-encrypt your credentials
file using your chosen key the next time you deploy a change.
15 Nov 04:13:47 - [info] Starting flows
15 Nov 04:13:47 - [info] Started flows
15 Nov 04:13:47 - [info] Server now running at http://127.0.0.1:1880/
Type here to search
ENG
4:14 AM
11/15/2022

9. RESULTS

1. The problem of crop vandalization by wild animals and firehas become a major social problem in current time.

2.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 cropyields thus leading to their economic wellbeing.

10. ADVANTAGES AND DISADVANTAGES

Advantage:

Controllable food supply. you might have droughts or floods, but if you are growing the crops and breeding them to be hardier, youhave a better chance of not straving. It allows farmers to maximize yields using minimum resources such as water, fertilizers.

Disadvantage:

The main disadvantage is the time it can take to process the information.in order to keep feeding people as the population growsyou have to radically change the environment of the planet.

11. CONCLUSION

A IoT Web Application is built for smart agricultural system usingWatson IoT platform, Watson simulator, IBM cloud and Node-RED.

12. FUTURE SCOPE

In the future, there will be very large scope, this project can be madebased on Image processing in which wild animal and fire can be detected bycameras and if it comes towards farm then system will be directly activated through wireless networks. Wild animals can also be detected by using wireless networks such as laser wireless sensors and by sensing this laser orsensor's security system will be activated.

11.APPENDIX

Github : https://github.com/IBM-EPBL/IBM-Project-22440-1659852031