PROJECT REPORT

IOT BASED SMART CROP PROTECTION SYSTEM FOR AGRICULTURE

TEAM ID: PNT2022TMID32791

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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:

Smart farming systems reduce waste, improve productivity and enable management of a greater number of resources through remote sensing.In traditional farming methods, it was a mainstay for the farmer to be out in the field, constantly monitoring the land and condition of crops. Remote monitoring through smart farming systems enables production yields to increase because farmers have more time to attend to their farm's real issues.

2.LITERATURE SURVEY:

2.1. SURVEY:

The system presented by aims at adopting IoT in agriculture to exploit automation approach and protect the crops from animals. Monitoring environmental factors plays a vital role to increase the production of the efficient crops. Two most important natural factors are considered in this study namely temperature and humidity of the field. Humidity sensor sense the water in air. The proposed system consists of temperature (TMP007) & humidity (HDC1010) sensors and CC3200 single chip and ultrasonic sensor to detect animals. The CC3200 is a cheap and faster programmable Wi-Fi MCU that enables true, integrated IoT development. If sensor sense abnormal reading, it transmits field information about the temperature, humidity to famers. A camera is linked with this chip to take images and send to farmers via MMS and subsequently the farmer will take appropriate action.

Exploits the LM35 temperature sensor and soil moisture sensor that is deployed in field and used to monitor the water supplements. Proposed a system comprises of LM35 temperature sensor, moisture sensor, RPi 3 model B, IC 3208 converter, relay and a buzzer. A threshold value 2.4v is set for soil moisture; this may vary

from crop to crop. If the value is found less than the set threshold (2.4v in this case) the soil is classified as dry and signal is sent to turn on the water pump. Otherwise, Soil is classified as wet and motor will be turned OFF. The data acquire from sensors are ingested to the cloud and can be accessible to farmer via his/her mobile/PC. The system let the farmer when to turn ON/OFF the water pump. The aim of the investigation presented in is to decrease the loss of water, labour and improve the productivity and not allowing the animals to get inside the field. Moisture sensor is used to sense the content of moisture in soil and sends moisture sensor information to Arduino. Moisture sensor is used to detect moisture in the soil. It works on the principle of open and short circuit. When the soil is dry the circuit behaves like an open circuit and close if the soil is wet. Wi-Fi module is used for communication to transmit data from sensor layer to the cloud. Data collected from moisture sensor is fed into Arduino and Arduino upload this information or values on cloud by using Wi-Fi. Threshold value is set according to the crop's need. Moisture level checked with respect to predefined threshold value. The threshold value is different for different crops. If the moisture value is less than the reference value pump is ON otherwise remains OFF. This helps in reduction of water usage. [4] Proposed an innovative smart IoT based Stick equipped with temperature and moisture sensors, providing real time sensor data to famers on handheld device. The purpose of the study carried in [4] is to provide cost effective solution to increase the productivity. The stick equipped with Arduino Mega 2560 augmented with moisture sensor and temperature sensor to monitor temperature and moisture powered by solar panel as well as battery (2200mAh; 11.2V). The stick works as a plug and play manner, it starts transmitting live information to cloud through ESP8266 Wi-Fi module as it is placed into a field. The cloud data is accessible to a hand-held device like mobile cellular phone, tablet or laptop. The obtained data can easily be shared with some expert remotely via cloud. The arrangement assists famers by providing precise live feed of environmental temperature and soil moisture to increase the yield and take effective consideration of food production. The proposed system is tried on Live Agriculture fields giving high accuracy over 99% in data feeds.

2.2. References:

1. DAVIDE ADAMI, MIKE O. OJO and STEFANO GIORDANO, " Design, Development and Evaluation of an Intelligent Animal Repelling System for

Crop Protection Based on Embedded Edge-AI", September 6, 2021, accepted September 16, 2021, date of publication September 22, 2021, date of current version October 1, 2021.

2. UFERAH SHAFI, RAFIA MUMTAZ, NAVEED IQBAL, SYED MOHAMMAD HASSAN ZAIDI1, SYED ALI RAZA ZAIDI, IMTIAZ HUSSAIN3 and ZAHID MAHMOOD3, "A Multi-Modal approach for Crop Health", May 26, 2020, accepted June 8, 2020, date of publication June 16, 2020, date of current version June 29, 2020.

3. Ajay Prakash, Rahul Kumar, Prabhat Kumar Singh, Ankit Singh, Asst. Prof. Shahab Ahmed and Asst. Prof. Abhishek Jain, "A Review on IOT Based Water Irrigation and Farm Protection using Arduino", Issue 3, May-June-2021, ISSN (Online): 2395-566X.

4. Dr. Ayyasamy S, Eswaran S, Manikandan B, Mithun Solomon S P and Nirmal Kumar S, "IoT based Agri Soil Maintenance Through Micro-Nutrients and Protection of Crops from Excess Water", IEEE Xplore Part Number: CFP20K25-ART; ISBN:978-1-7281-4889-2.

5. Gogul Dev N S, Sreenesh K S and Binu P K, "IoT Based Automated Crop Protection System", 978-1-7281-0283-2/19/$31.00 ©2019 IEEE.

6. MUHAMMAD AYAZ, (Senior Member, IEEE), MOHAMMAD AMMAD-UDDIN, ZUBAIR SHARIF, ALI MANSOUR3 AND EL-HADI M. AGGOUNE,"Internet-ofThings (IoT)-Based Smart Agriculture: Toward Making the Fields Talk", July 7, 2019, accepted July 19, 2019, date of publication August 1, 2019, date of current version. September 23, 2019.

2.3. Problem statement definition:

Who does the problem affect?	Persons who do Agriculture.

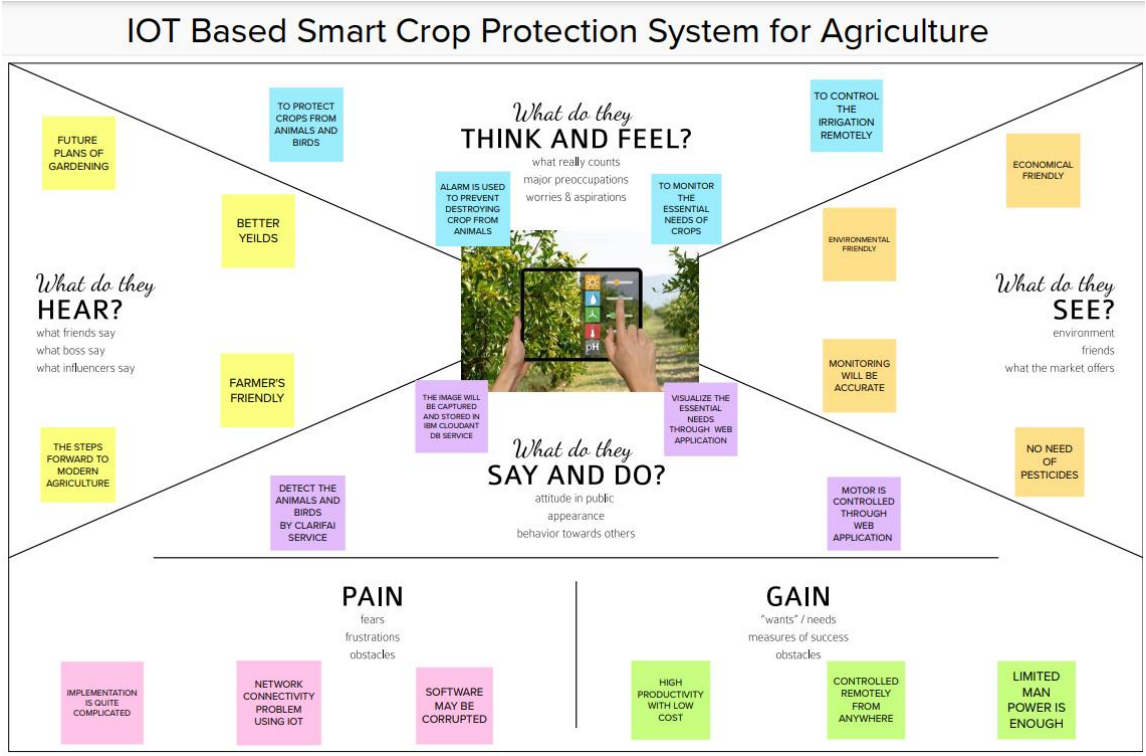
What are the boundaries of the problem?	People who Grow Crops and facing Issues of monitoring the irrigation and crops destroyed by animals and birds.
What is the issue?	If the crops provided with improper irrigation and destroyed by animals, this will damage the crops severely and then it brings the lots of loss to the farmers.
When does the issue occur?	Due to uncertain weather condition, it is difficult to decide whether irrigation is needed or not. When the crops are grown, then it can be destroyed by animals.

Where does the issue occur?	The issue occurs in agriculture practising areas, particularly in rural regions.

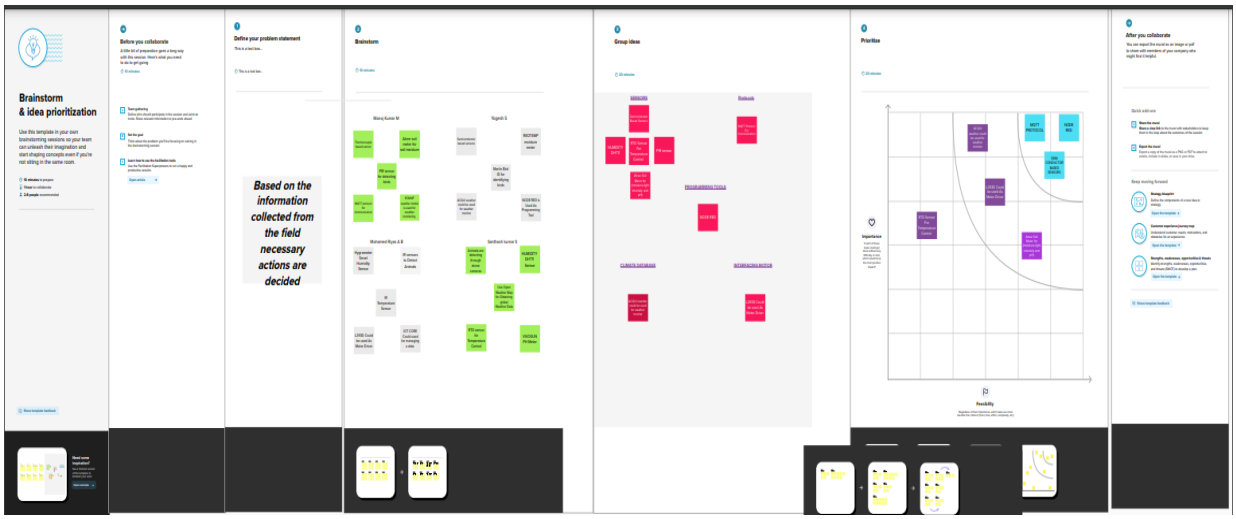
Why is it important that we fix the problem?	It is required for the growth of betterquality food products. It is important to maximise the crop yield.
What solution to solve this issue?	This issue could be solved by monitoring the soil parameters. It collects the data from the soil and made a decision whether the irrigation is needed or not. With the help of sensors, the animal's movement could be detected to prevent the crops from animals.
What methodology used to solve the issue?	Sensors, weather API and mobile application is used. Sensors are used detect the animals and birds' movement, and to detect the soil contents to make a decision whether to watering the plants or not.

3.IDEATION & PROPOSED SOLUTION

3.1Empathy Map Canvas:



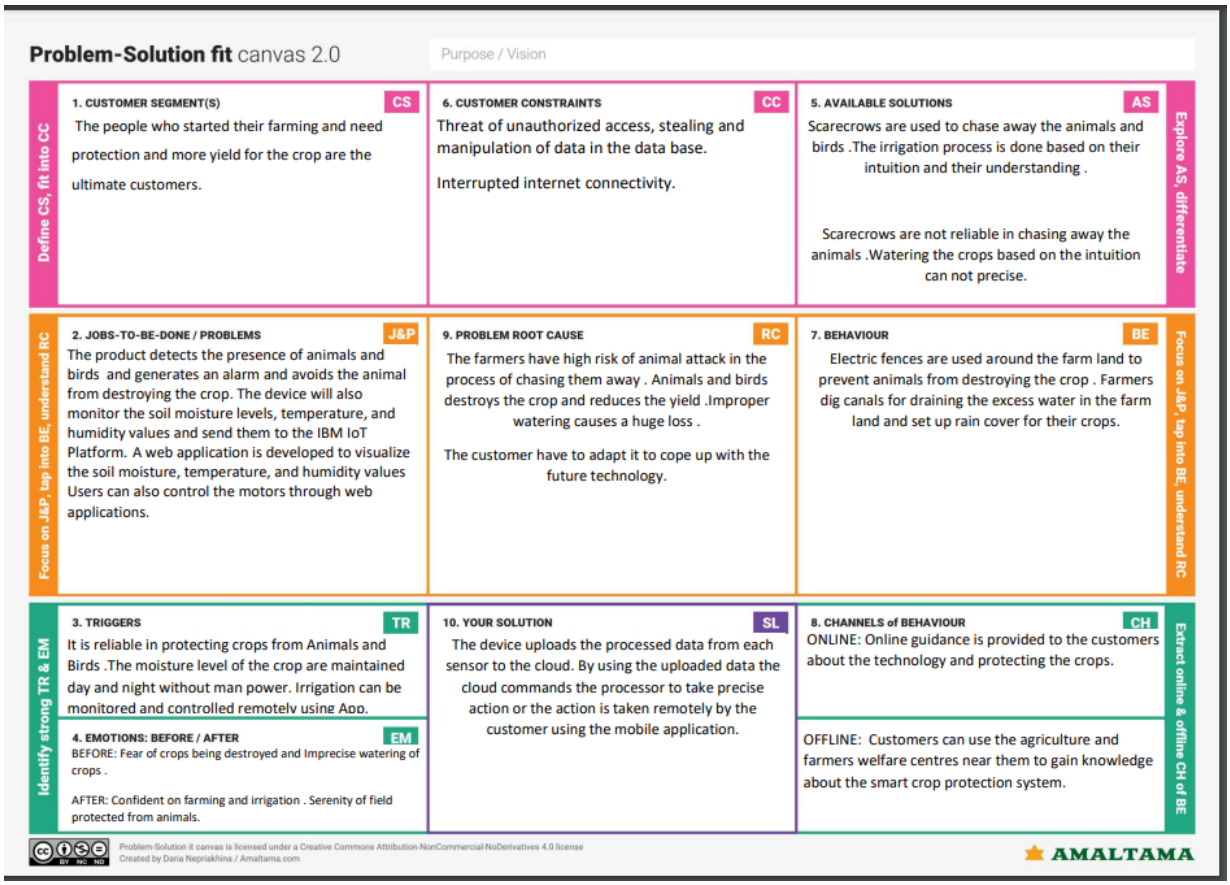
3.2. Ideation and brainstorming :



3.3. Proposed Solution:

S. No	Parameter	Description
1.	Problem Statement (Problem to be solved)	In agriculture, there are three major problems one is unpredictable climate change and another one is the yields of the crops that have been damaged by improper irrigation and another one is a crops are destroyed by animals and birds. Our project will give the solution to overcome these problems with help of IOT.
2.	Idea / Solution description	It collects the data from different types of sensors and it sends the value to the main server. The data from the sensor is used as parameter to protect the crop from animals ,birds and over watering of crops. The irrigation can also be done manually through mobile application.
3.	Novelty / Uniqueness	A cost-effective crop protection system is developed by proposing a system architecture and relevant solutions, we successfully integrate different modules related to sensing systems, communication, and data analytics into a whole system that not only monitors the farm environment but also performs remote automation and user control.
4.	Social Impact / Customer Satisfaction	The risk of animal attack for the farmers is reduced by using hardware and software technology. The customer can be remote and still monitor the crops through IoT.
5.	Business Model (Revenue Model)	Crop protection system reduces the loss due to the destructions caused by the animals and birds. The model also reduces the losses of crop due to over watering.

3.4 Problem Solution Fit:



4.REQUIREMENT ANALYSIS

4.1. Functional Requirements:

Non-Functional Requirements:

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

FR No.	Non-Functional Requirement	Description
NFR-1	Usability	End users can monitor and control their connected farm using IOT applications on their smartphones or tablets
NFR-2	Security	The software keeps the user's information more securely.
NFR-3	Reliability	The smart farm, embedded with IOT systems, could be called a connected farm, which can support a wide range of devices from diverse agricultural device manufactures.
NFR-4	Performance	It is a user-friendly software and have high performance.
NFR-5	Availability	Available for every user, visible for all users and farmer.
NFR-6	Scalability	The proposed precision farming structure allows the implementation of a flexible methodology that can be adopted to different types of crops.

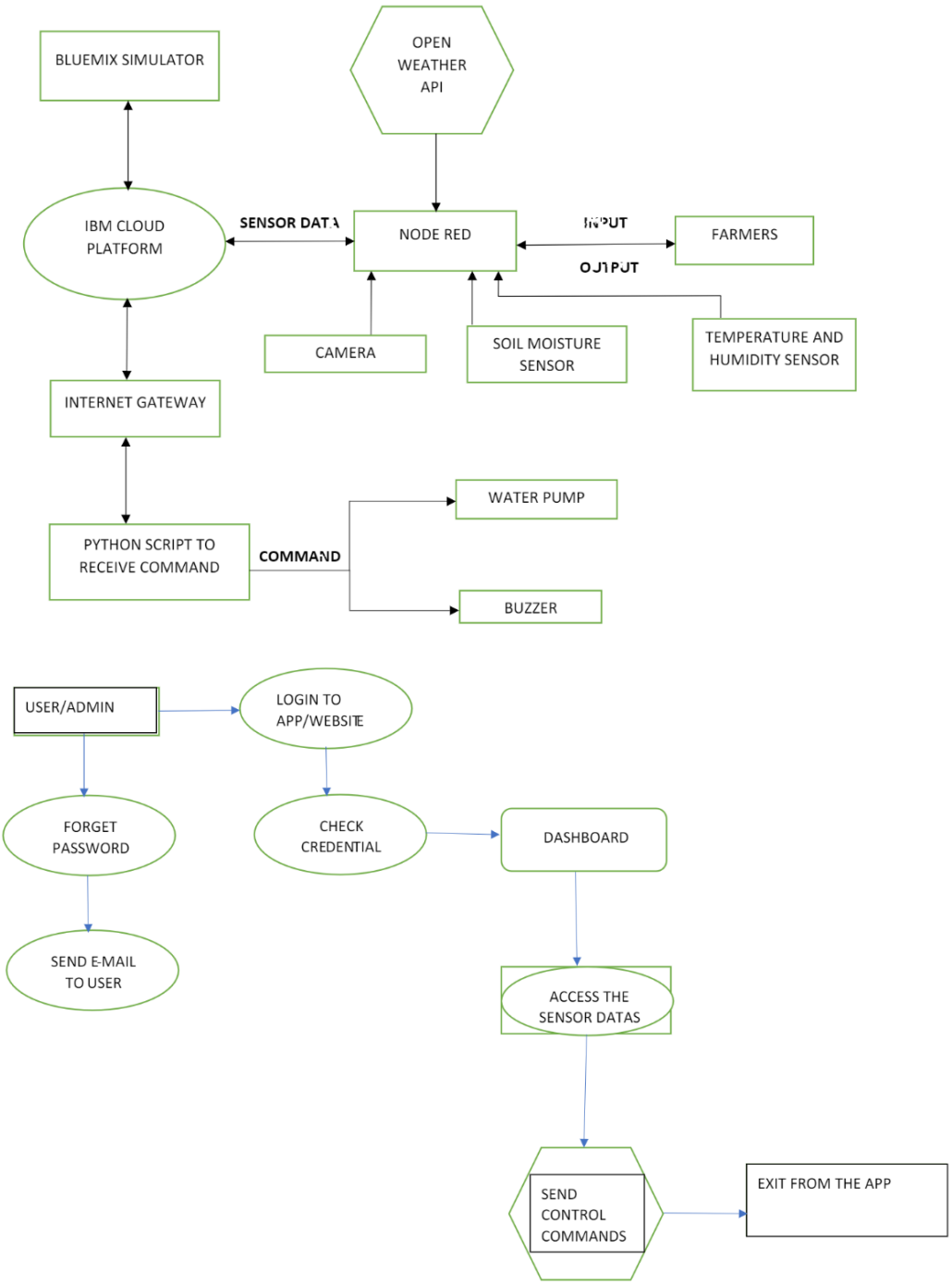
Functional Requirements:

Following are the functional requirements of the proposed solution

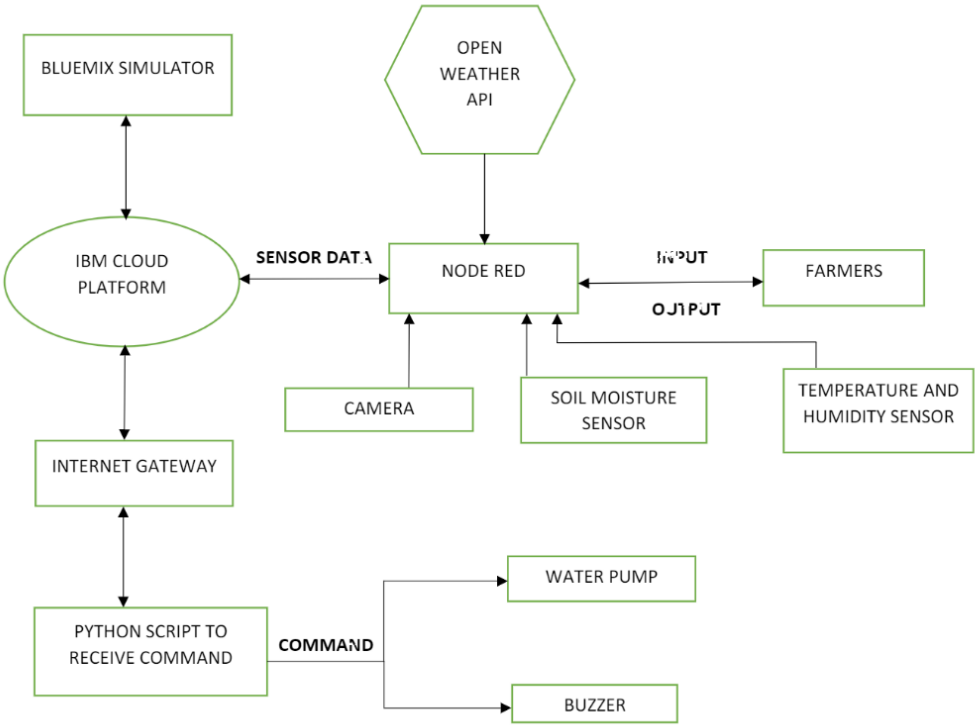
FR No.	Functional Requirement (Epic)	Sub Requirement (Story / Sub-Task)
FR-1	User Registration	Registration through Form Registration through Gmail Registration through Linked In
FR-2	User Confirmation	Confirmation via OTP
FR-3	User Profile	Log in Access the Profile
FR-4	Analyse	Data from smart sensors can be analysed for predictive analysis and automated decision- making.
FR-5	Recommend	Based on the farming the software recommends the automated irrigation practices.

5.PROJECT DESIGN

5.1 Data Flow Diagrams



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	As a user, I can register for the application by entering my email, password, and confirming my password.	I can access my account / dashboard	High	Sprint-1
	Login		As a user, I can log into the application by entering email & password	Log in to application.	High	Sprint-1
	Dashboard		By entering correct password, I could	Once logged in, User could the data.	Medium	Sprint-2

			access the dashboard			
	Forget password		As a user, if I forget my password, I could use this option to get a new password.		Low	Sprint-2
Customer (Web user)	Registration	USN-2	As a user, I can register for the application by entering my email, password, and confirming my password	I can access my account / dashboard	High	Sprint-1
	Login		As a user, I can log into the application by entering email & password	Log in to application	High	Sprint-1
	Dashboard		By entering correct password, I could access the dashboard	Once logged in, User could the data	Medium	Sprint-1
	Forget password		As a user, if I forget my password, I could use this option to get a new password		Low	Sprint-2

6.PROJECT PLANNING &SCHEDULING

6.1 Sprint Planning &Estimation

Sprint	Functional Requirement (Epic)	User Story Number	User Story / Task	Story Points	Priority	Team Members

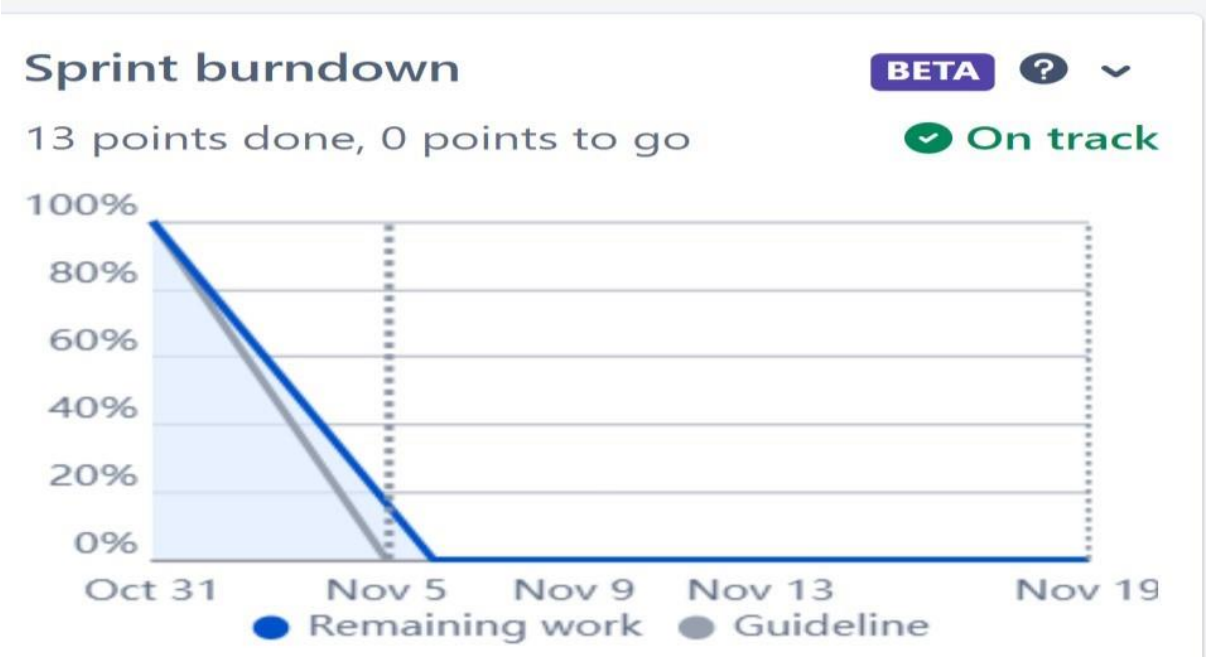
Sprint-1	Registration (Mobile user)	USN-1	I can register for the application by entering my Username, password, and confirming my password as a user.	1	Low	M.SANTOSH KUMAR, M.MANOJ KUMAR
Sprint-1	Login (Mobile user)	USN-2	I can log into the application by entering User name & password as a user.	3	High	A.B. MOHAMED RIYAS, S. YOGESH
Sprint-2	Dashboard (Mobile user)	USN-3	I could access the dashboard by entering correct password.	13	Medium	M.SANTOSH KUMAR
Sprint-3	Alert message (Mobile user)	USN-4	I could receive alert message regarding the field parameters as a user.	13	High	M.SANTOSH KUMAR, M.MANOJ KUMAR
Sprint-4	Data Storage (Mobile user)	USN-5	I will be able to store parameter values as a user.	2	High	M.SANTOSH KUMAR, M.MANOJ KUMAR
Sprint-4	Decision (Mobile user)	USN-6	I can operate motor remotely using the mobile application as a user.	8	High	A.B. MOHAMED RIYAS, S. YOGESH
Sprint-1	Login (web user)	USN-7	I can log in to the application as a user.	13	High	M.SANTOSH KUMAR, M.MANOJ KUMAR
Sprint-1	Dashboard (web user)	USN-8	I could access the dashboard as a user.	3	Medium	A.B. MOHAMED RIYAS, S. YOGESH
Sprint-3	Alert message (web user)	USN-9	I receive alert message regarding the field parameters as a user.	5	High	M.SANTOSH KUMAR, M.MANOJ KUMAR
Sprint-4	Data Storage (web user)	USN-10	I will be able to store parameter values as a user.	2	High	M.SANTOSH KUMAR, M.MANOJ KUMAR
Sprint-4	Decision (web user)	USN-11	I can operate motor remotely using the mobile application as a user.	8	High	A.B. MOHAMED RIYAS, S. YOGESH

6.2. Sprint Delivery Schedule

Sprint	Total Story Points	Duration	Sprint Start Date	Sprint End Date (Planned)	Sprint Release Date (Actual)
Sprint-1	20	6 Days	24 Oct 2022	29 Oct 2022	29 Oct 2022
Sprint-2	20	6 Days	31 Oct 2022	05 Nov 2022	
Sprint-3	20	6 Days	07 Nov 2022	12 Nov 2022	
Sprint-4	20	6 Days	14 Nov 2022	19 Nov 2022	

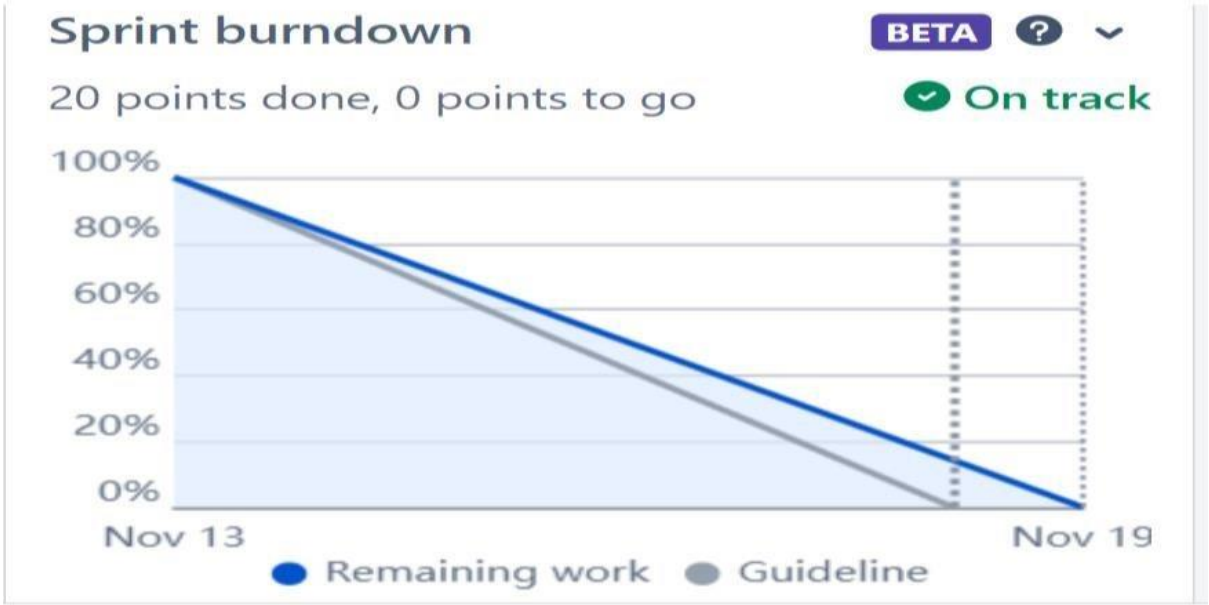
6.3. Reports from JIRA:

Sprint 2



Sprint 3

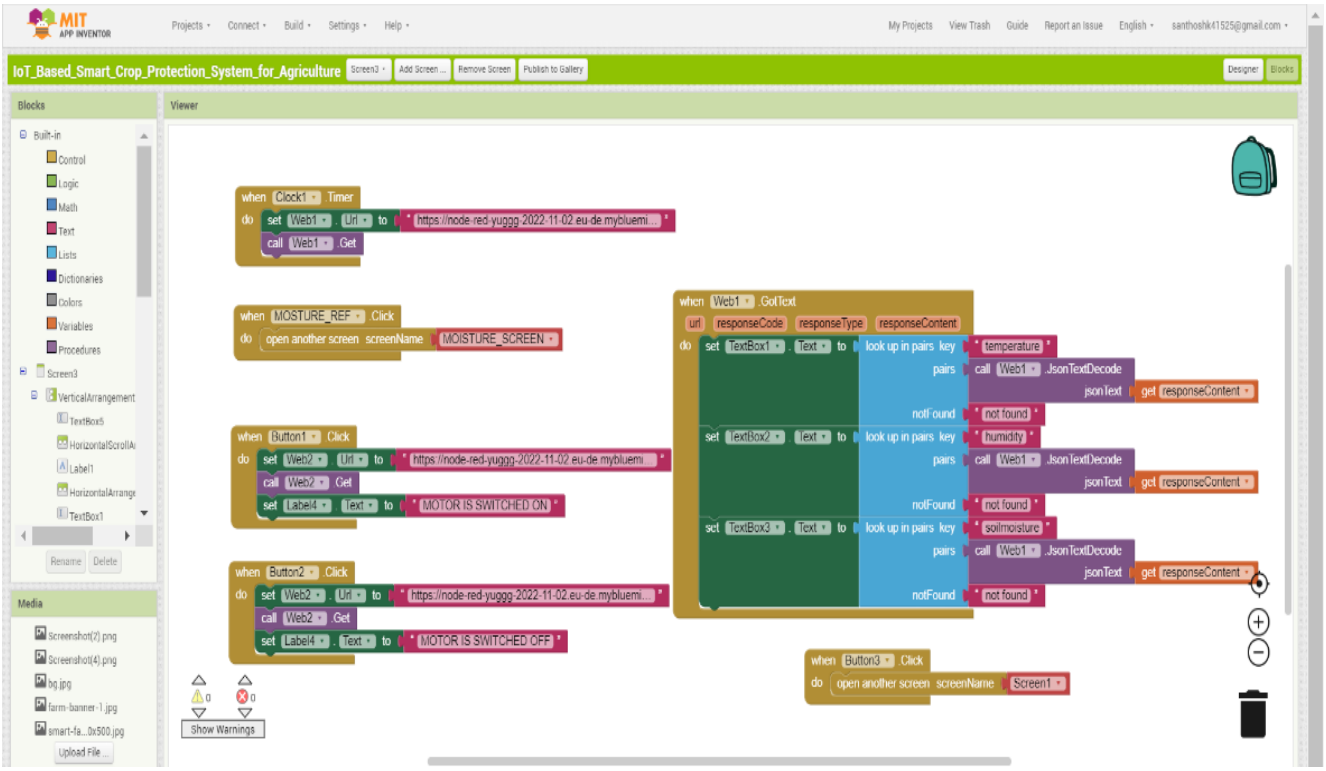
Sprint 4



7.CODING & SOLUTIONING

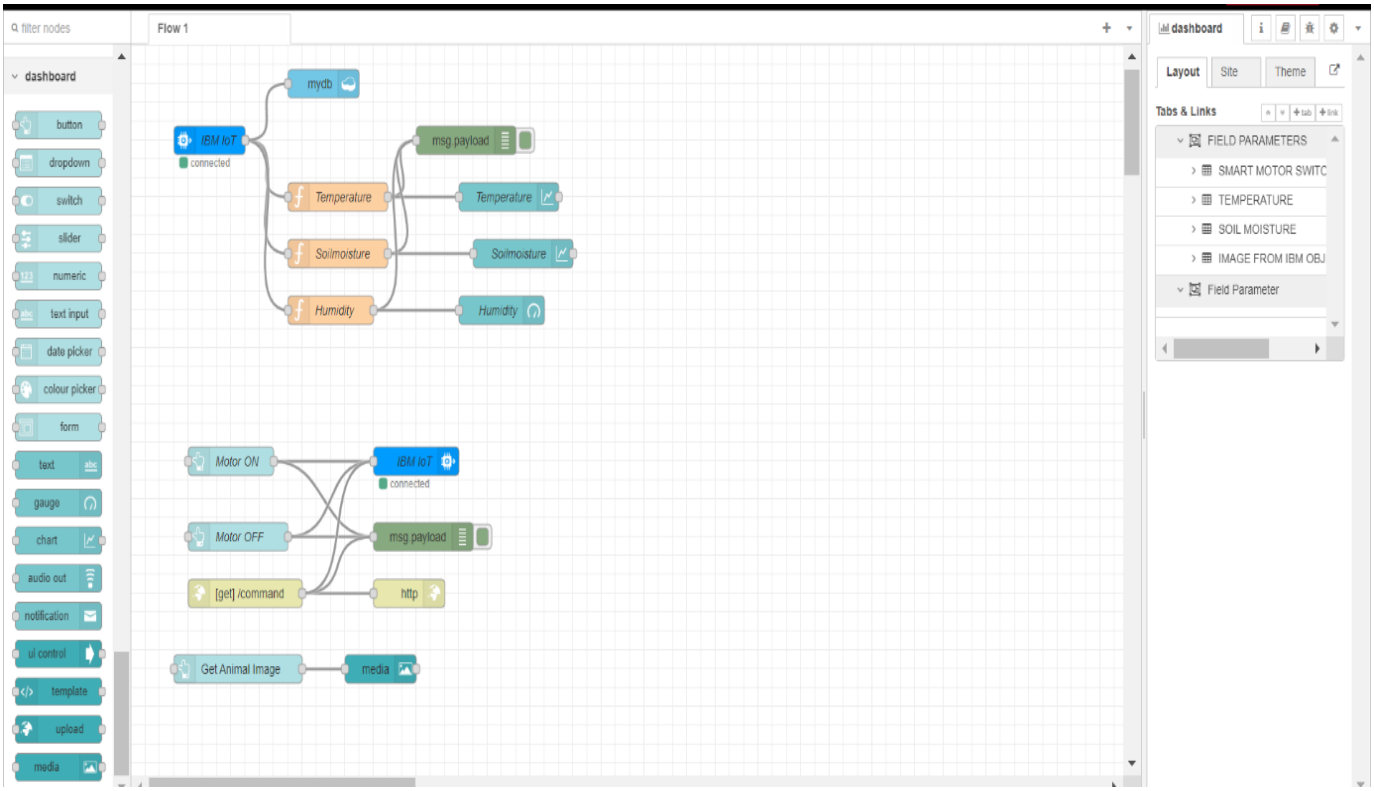
7.1 MIT app inventor

A mobile app is designed using MIT app inventor. The new user can register with app and the old users can login to access to view the field parameters. The authentication is done using firebase. The field parameters are given to the app by using node red platform . The user can view and store the data in cloundantDB. The user can remotely switch on and off the water motor using the app.



7.2 Web Dashboard using Node-red

A web dashboard is created using the node red service to monitor the field parameters graphically in the web using the node-red service. The node red gets the field parameters from the python code. The node red is also connected with the IBM cloud so that it receives animal image from the IBM object bucket. Animal image which is stored in the cloud by Clarifai by detecting the motion of animals in the field. The image is displayed in the web dash board.


filter nodes
Flow 1
dashboard
button
dropdown
switch
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numeric
text input
date picker
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form
text
gauge
chart
audio out
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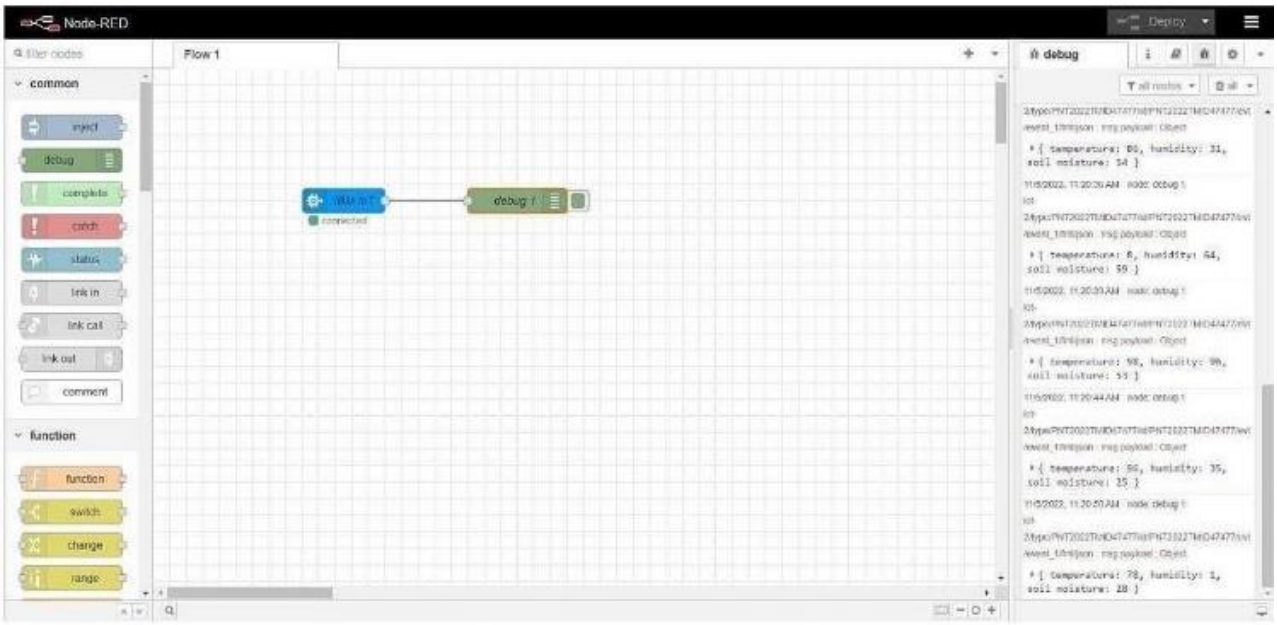
ui control
template
upload
media
mydb
IBM IoT
connected
msg.payload
Temperature
Temperature
Soilmoisture
Soilmoisture
Humidity
Humidity
Motor ON
IBM IoT
connected
Motor OFF
msg.payload
[get] /command
http
Get Animal Image
media
dashboard
Layout
Site
Theme
Tabs & Links
FIELD PARAMETERS
SMART MOTOR SWITC
TEMPERATURE
SOIL MOISTURE
IMAGE FROM IBM OBJ
Field Parameter

8.TESTING


LTS
Recommended For Most Users
Current
Latest Features
Windows Installer
macOS Installer
Source Code
Windows Installer (.msi)
32-bit
64-bit
Windows Binary (.zip)
32-bit
64-bit
macOS Installer (.pkg)
64-bit / ARM64
macOS Binary (.tar.gz)
64-bit
ARM64
Linux Binaries (x64)
64-bit


Node-RED
Deploy
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link call
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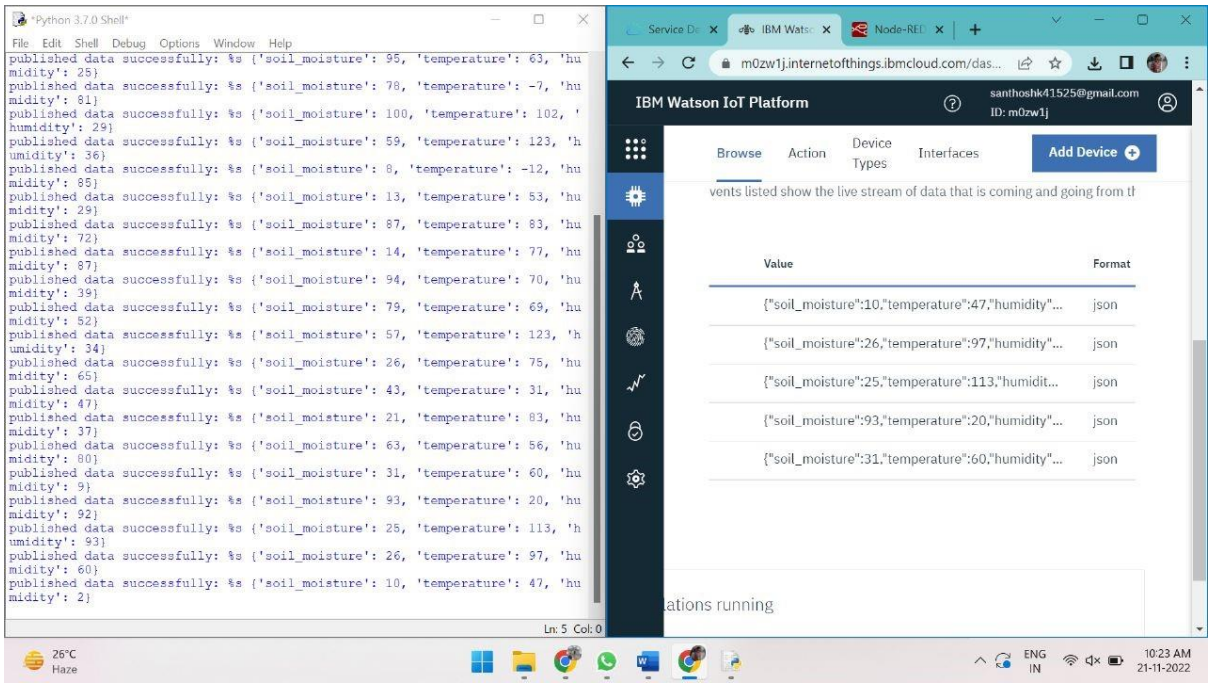
Python 3.7.0 Shell
File Edit Shell Debug Options Window Help
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IBM Watson IoT Platform
santhoshk41525@gmail.com
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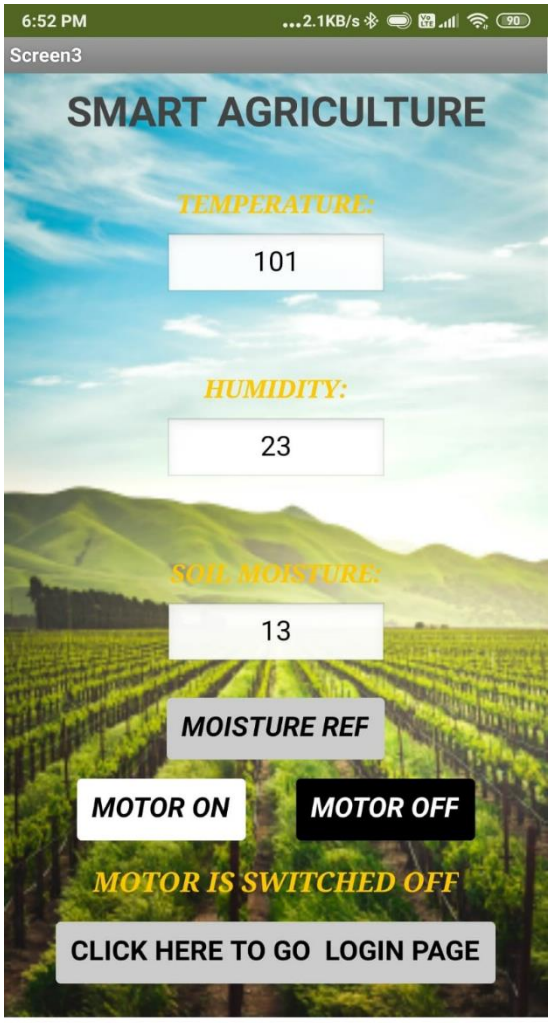

				Date	12 November 2022								
				Team ID	PNT2022TMID32791								
				Project Name	IoT Based Smart Crop Protection System for								
				Maximum Marks	4 marks								
Test case ID	Feature Type	Component	Component	Pre-Requisite	Steps To Execute	Test Data	Expected Result	Actual Result	Status	Commnets	TC for Automation(Y/N)	BUG ID	Executed By
LoginPage_TC_OO1	Functional	Registration Page	As a new user, I want to first register using my username and create a password for the account.	wifi connection, Laptop/Mobile	1.Install the application 2.Register using sign up button	username:Manoj password:Kumar	I can register for the application by entering my Username, password, and confirming my password as a user.	Working as expected	Pass	Steps are all clear to follow	yes	Nil	Manoj Kumar.M
Loginpage_TC_OO2	Functional	Login page	As a user, I can log into the application by entering username and password	wifi connection, Laptop/Mobile	1.Login in to the app using the credentials	user name:Kumar password:Santhosh	Application should show "Incorrect email or password" validation message if credentials given wrong	Working as expected	Pass	Steps are all clear to follow	yes	Nil	Santhosh Kumar.M
Dashboard_TC_003	UI	Dashboard	As a user,I could access the dasboard	wifi connection, Laptop/Mobile	1.enter correct login details 2.get values from cloud	Sensor Values generated by python code	Sensor values to be displayed to the user	Working as expected	pass	Steps are all clear to follow	yes	Nil	Yogesh.S
Log Off_TC_004	UI	Home page	As a user, I could log off	wifi connection, Laptop/Mobile	Click on log off button	click on log log button	The app should return to login page	Working as expected	pass	Steps are all clear to follow	yes	Nil	Yogesh.S
Sms_TC_005	Functional	message	A user will receive message when the moisture value is less	wifi connection, Laptop/Mobile	1.enter correct login details 2.get values from cloud	user name:sherin password:begum	the user must receive message when the moisture level is less	Working as expected	pass	Steps are all clear to follow	yes	Nil	Santhosh Kumar.M
Dashboard_TC_006	UI	Dashboard(WEB)	As a user,I could access the dasboard	wifi connection, Laptop/Mobile	1.Get the values from cloud and modered	sensor values generated by python code	Sensor values to be displayed to the user	Working as expected	pass	Steps are all clear to follow	yes	Nil	Mohamed Riyas.A.B
Dashboard_TC_007	UI	Dashboard(WEB)	As a user,I could switch on or off the motor through web	wifi connection, Laptop/Mobile	1.Get the values from cloud and modered	sensor values generated by python code	User could be able to access the motor	Working as expected	pass	Steps are all clear to follow	yes	Nil	Manoj Kumar.M
Dashboard_TC_008	UI	Dashboard	As a user,I could switch on or off the motor through web	wifi connection, Laptop/Mobile	1.enter correct login details 2.get values from cloud	user name:sherin password:begum	User could be able to access the motor	Working as expected	pass	Steps are all clear to follow	yes	Nil	Mohamed Riyas.A.B

9.RESULT

The problem of crop vandalization by wild animals 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 wellbeing.

10.ADVANTAGES AND DISADVANTAGES

Advantages:

- Farms can be monitored and controlled remotely.
- Increase in convenience to farmers. Less Manpower.
- Better standards of living.

Disadvantages:

- Lack of internet/connectivity issues.
- Added cost of internet and internet gateway infrastructure.
- Farmers wanted to adapt the use of WebApp.

11.CONCLUSION

This system focuses on developing devices and tool to manage, display and alert the users using the advantages of a wireless sensor network system. It aims at making agriculture smart using automation and IoT. The cloud computing devices are used at the end of the system that can create a whole computing system from sensors to tools that observe data from agriculture field. It proposes a novel methodology for smart farming by including a smart sensing system and smart irrigator system

through wireless communication technology. Thus, the objective of the project to implement an IoT system in order to help farmers to control and monitor their farms has been implemented successfully.

12.FUTURE SCOPE

In the future, there will be very large scope, this project is made based on Image processing in which wild animal can be detected by cameras and if it comes towards the 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 or sensor’s security system will be activated.

13.APPENDIX

Source code

```
import wiotp.sdk.device
import time
import os
import datetime
import random
myConfig = {
   "identity":{
      "orgId":"m0zw1j",
       "typeId": "raspberry",
      "deviceId": "8138191060"
      },
    "auth":{
      "token": "d525!T5ZUiwPeMf5u*"
      }
   }
client=wiotp.sdk.device.DeviceClient(config=myConfig,logHandlers=Non
e)
client.connect()

def myCommandCallback(cmd):
```

```
    print("message received from ibm iot platform: %s"
%cmd.data['command'])
    m=cmd.data['command']
    if(m=="motoron"):
        print("motor is switched on")
    elif(m=="motoroff"):
        print("motor is switched off")
    print(" ")

while True:
    soil=random.randint(0,100)
    temp=random.randint(-20,125)
    hum=random.randint(0,100)
    myData={'soil_moisture':soil,'temperature':temp,'humidity':hum}
    client.publishEvent(eventId="status",msgFormat="json",data=myData,
qos=0,onPublish=None)
    print("published data successfully: %s", myData)
    time.sleep(2)
    client.commandCallback = myCommandCallback
client.disconnect()
```

GitHub Link:
https://github.com/IBM-EPBL/IBM-Project-16481-1659615518.git

Demo Link:
https://youtu.be/iAseLSKoSdw