IOT BASED SMART CROP PROTECTION SYSTEM FOR AGRICULTURE

PROJECT REPORT

TEAM ID: PNT2022TMID51806

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BONAFIDE CERTIFICATE

Certified that this project report **"IoT Based Smart Crop Protection System For Agriculture"** is the bonafide work of **"AJISHA K (961619205004), SUBITHA S (961619205016), AKASH MARGIN (961619205016)"** who carried out the project work under my supervision.

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Submitted for project Viva-Voce held on …….

INTERNAL EXAMINER **EXTERNAL EXAMINER**

ABSTRACT

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.IOT Based Crop Protection System against Birds and Wild Animal Attacks Smart crop protection system from wild animals using ArduinoSmart Crop Protection System from Animals and Fire using Arduino.Crops in farms are many times ravaged by local animals like buffaloes, cows, goats, birds, and fire etc. This leads to huge losses for the farmers. It is not possible for farmers to barricade entire fields or stay on field 24 hours and guard it. So here we propose automatic crop protection system from animals and fire. This is a arduino Uno based system using microcontroller. This system uses a motion sensor to detect wild animals approaching near the field and smoke sensor to detect the fire. In such a case the sensor signals the microcontroller to take action. The microcontroller now sounds an alarm to woo the animals away from the field as well as sends SMS to the farmer and makes call, so that farmer may know about the issue and come to the spot in case the animals don't turn away by the alarm. If there is a smoke, it immediately turns ON the motor. This ensures complete safety of crops from animals and from fire thus protecting the farmer's loss. This is a arduino Uno based system using microcontroller. This system uses a motion sensor to detect wild animals approaching near the field and smoke sensor to detect the fire. In such a case the sensor signals the microcontroller to take action.

ACKNOWLEDGEMENT

It gives us pleasure to acknowledgement our Indebtedness to all those who have helped us in completing this project.

First and fore most we would like to thank **GOD** almighty for the blessings he has showered upon us to complete this project successfully.

We wish to convey our immense gratitude and thanks to our respected Chairman **Prof. Dr. T. James Wilson, B.E., M.BA., M.I.Mar.Tech., Ph.D.,** and Vice Chairman **Er.F. Prince Vino,B.E.,** for providing us all facilities for the successful completion of the project.

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1.INTRODUCTION:

1.1 Project Overview

The Smart protection system defines that this project help to farmer for the protection of a farm. We have designed this project for the only secure from animals but we this project have the provision to secure from the human begins also. The SCPS work on the battery so that this project can be easily portable and also we are add solar panels and converter modules this can help the battery to charge from solar energy. The IOT device is used to indicate the farmer by a message while someone enter into the farm and we are used SD card module that helps to store a specified sound to fear the animals. This project is smart crop protection system for protect the farm from animals as well as unknown person. This projects contents ardiuno UNO, Node mcu, LCD display, PIR sensor, flame sensor, sd card module, solar panel, solar charges converter. This whole project is work on 12v dc supply from battery. We used solar panel to charge the battery. This project is based on Internet Of Things (IoT), that can measure soil moisture, Humidity and temperature conditions for agriculture and crop protection using Watson IoT services. IoT is network that connects physical objects or things embedded with electronics, software and sensors through network connectivity that collects and transfers data using cloud for communication. Data is transferred through internet without human to human or human to computer interaction. In this project we have not used any hardware. Instead of real soil moisture, Humidity and Temperature data obtained from sensors we make use of IBM IoT Simulator which can transmit these parameters as required.

2.2 . 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

● Agriculture is a field which forms the basis of our economy. Yet it faces a lot of problems in terms of availability of resources, Irrigation, increasing rate of Pesticides, Climatic disasters, Insects which ruin the crops and makes a huge loss this sector.

● In agriculture water is needed for the crops for their growth. If the Soil gets dry it is necessary to supply water. But sometime if the farmer doesn't visit the field it is not possible to know the condition of soil.

● Sometimes over supply of water or less supply of water affects the growth of crops.

● Sometimes if the weather/temperature changes suddenly it is necessary to take certain actions.

● Specific crops grow better in specific conditions, they may get damaged due to bad weather.

2.2 References

●https://smartinternz.com/assets/docs/Smart%20Home%20Automation%20using%20IBM%20cloud%20Service s%20(1).pdf

●https://smartinternz.com/assets/docs/Smart%20Home%20Automation%20using%20IBM%20cloud%20Service s%20(1).pdf

● https://openweathermap.org/

●https://smartinternz.com/assets/docs/Sending%20Http%20request%20to%20Open%20weather%20map%20 web site%20to%20get%20the%20weather%20forecast.pdf

● https://www.youtube.com/watch?v=cicTw4SEdxk

●https://smartinternz.com/assets/docs/Smart%20Home%20Automation%20using%20IBM%20cloud%20Service s%20(1).pdf

● https://github.com/rachuriharish23/ibmsubscribe

2.3 Problem Statement Definition

● Smart Crop Protection System based on IoT can monitor soil moisture and climatic conditions to grow and yield a good crop.

● The farmer can also get the real time weather forecasting data by using external platforms like Open Weather API.

● Farmer is provided a mobile app using which he can monitor the temperature, humidity and soil moisture parameters along with weather forecasting details.

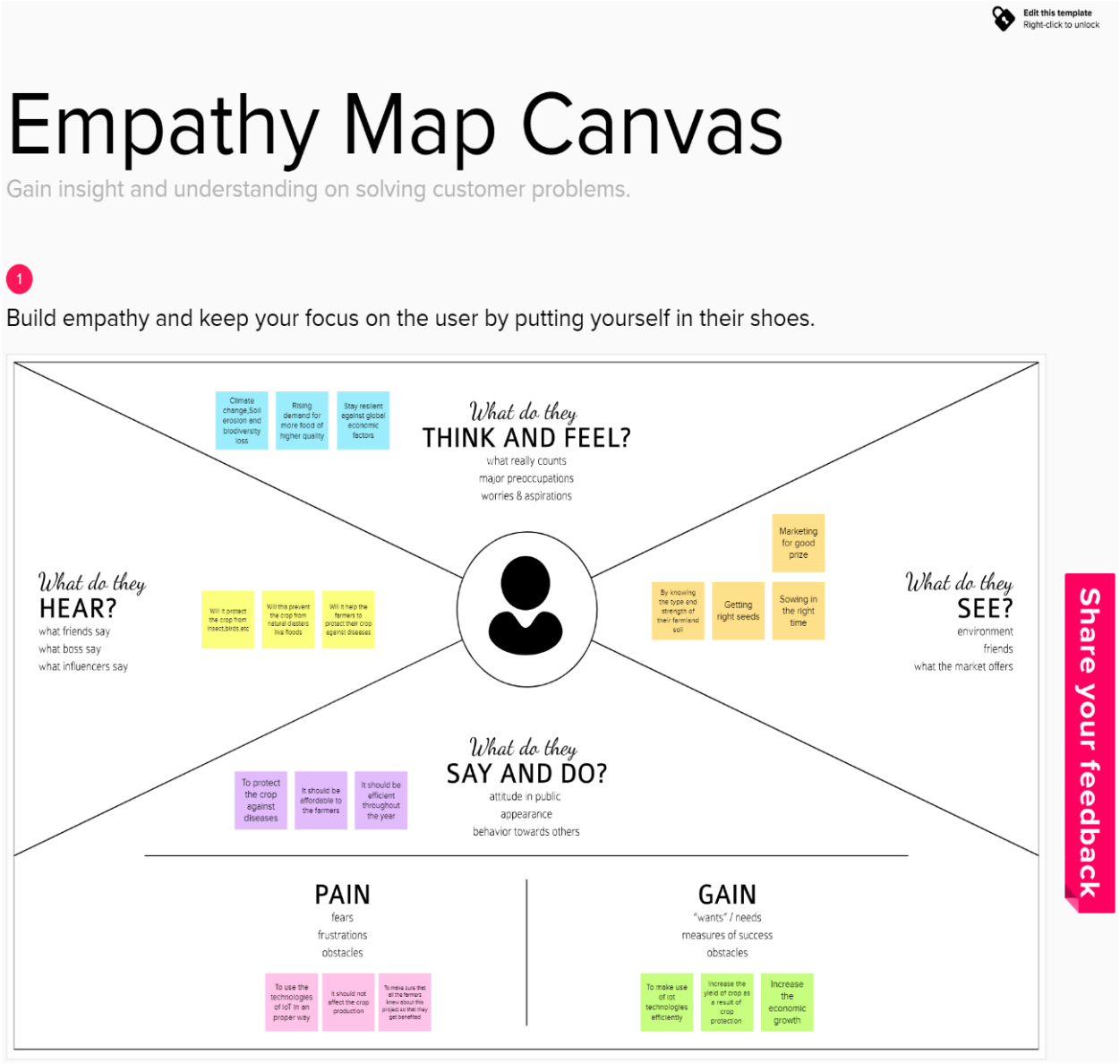
● Based on all the parameters he can water his crop by controlling the motors using the mobile application.

● Even if the farmer is not present near his crop he can water his crop by controlling the motors using the mobile application from anywhere.

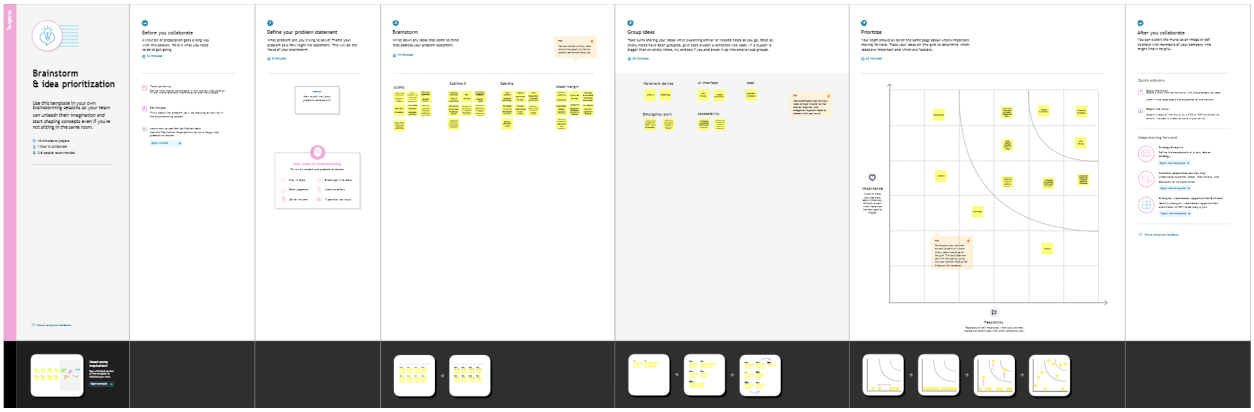
● Here we are using theOnline IoT simulator for getting the Temperature, Humidity and Soil Moisture values.

3.IDEATION & PROPOSED SOLUTION:

3.1 Empathy Map Canvas



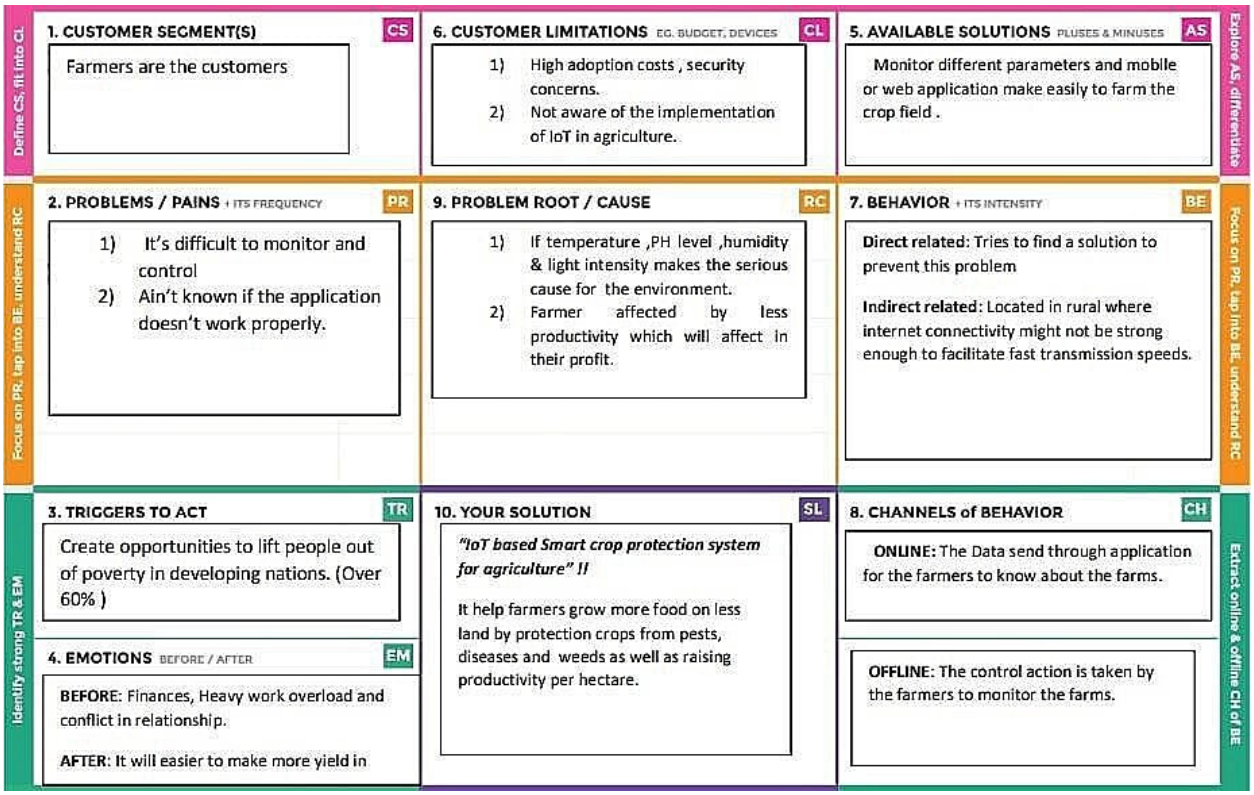
3.2 Ideation & Brain Storming



3.3.Proposed Solution

S.No.	Parameter	Description
1.	Problem Statement (Problem to be solved)	Crops in farms are many times ravaged by local animals like buffaloes, cows, goats, birds, and fire etc. This leads to huge losses for the farmers. It is not possible for farmers to barricade entire fields or stay on field 24 hours and guard it.
2.	Idea / Solution description	Here we propose an automatic crop protection system from animals and fire. This is an arduino Uno based system using microcontroller. This system uses a motion sensor to detect wild animals approaching near the field and smoke sensor to detect the fire.
3.	Novelty / Uniqueness	Fastest alert to the farmers through SMS.
4.	Social Impact / Customer Satisfaction	Real time data and production insight. Remote monitoring.
5.	Business Model (Revenue Model)	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.
6.	Scalability of the Solution	Alerts the farmers immediately through an SMS.

3.4 . Problem Solution Fit



4.REQUIREMENT ANALYSIS:

4.1 Functional Requirements

- **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	Install the app. Signing up with Gmail or phone numbers. Creating a new profile. Understand the guidelines which we given
FR-2	User Confirmation	Email or phone number verification required via OTP.
FR-3	Accessing datasets	The data like values of temperature, data sensor, humidity, soil moisture are received by alert SMS.
FR-4	Interface sensor	Connect the sensor and the application When animals enter the field, the alarm is generated.
FR-5	User action	The user needs to take action like detecting through crop rotation, fertilizer, strip cropping.

4.2 Non Functional Requirements

NFR-2	**Security**	It was created to protect the crops from animals.
NFR-3	**Reliability**	Farmers are able to safeguard their lands by help of this technology. They get some good benefits from higher crop yields.
NFR-4	**Performance**	When animals attempt to enter the crop field, IOT devices and sensors alert the farmer via message and maintain good yields.
NFR-5	**Availability**	Agriculture fences are quite an effective wild animal protection system.
NFR-6	**Scalability**	The develop system will not harmful and injurious to animals as well as human beings through the system.

5. PROJECT DESIGN:

5.1 Data Flow Diagram

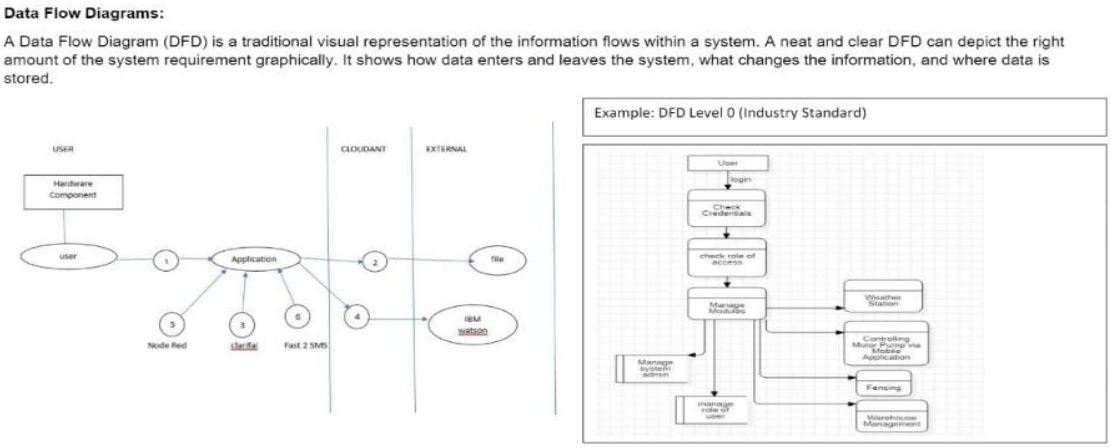


Fig:5.1

5.2. Solution &Technical Architecture

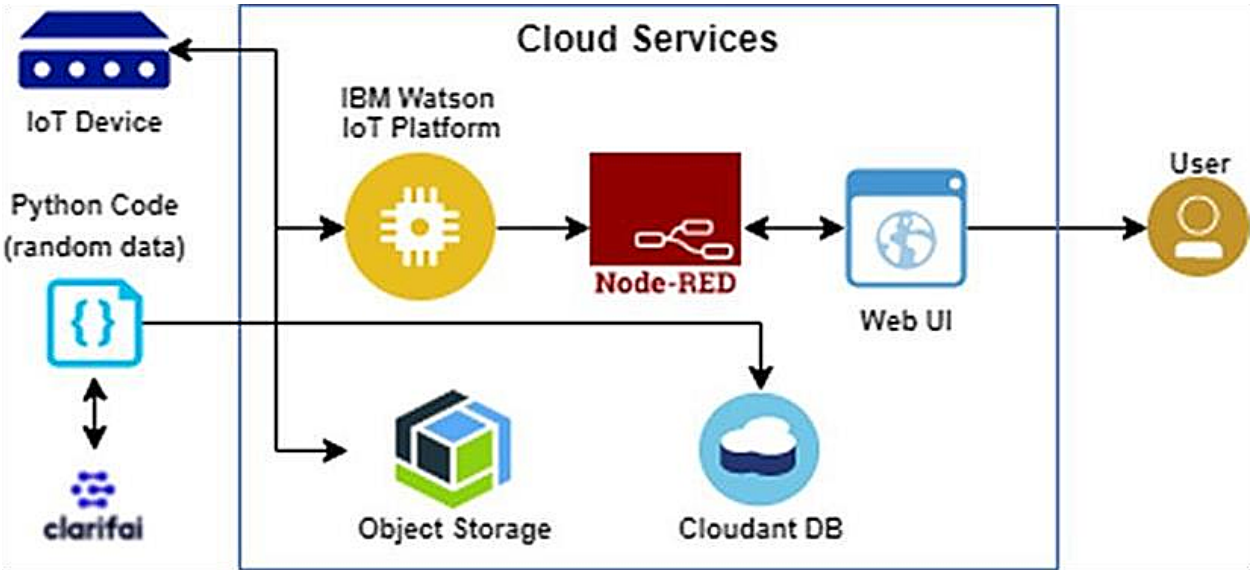


Fig:5.2

5.3. User Stories

User Type	Functional requirement(Epic)	User Story number	User Story/Task	Acceptancecriteria	Priority	Release
Customer (Mobil user)	Registration	USN-1	User can enter into the web application	I can accessmy account /dashboard	High	Sprint 1
		USN-2	User can register their credentials likeemail id and password	I can receive confirmation email & click confirm	High	Sprint 1
	Login	USN-3	User can log into theapplication by entering email & password	I can login tomy account	High	Sprint 1
	Dashboard	USN-4	User can view the temperature	I can view the data given by the device	High	Sprint 2
		USN-5	User can view thelevel 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 theinformation	I can view the data given by the device	High	Sprint 3
Customer	Working	USN-1	User act according to the alert given by thedevice	I can get thedata work according to it	High	Sprint 3

6. PROJECT PLANNING & SCHEDULING

6.1.Sprint Planning & Estimation

TITLE	DESCRIPTION	DATE
Literature Survey on The Selected Project and Information Gathering	A Literature Survey is a compilation summary of research done previously in the given topic. Literature survey can be taken from books, research paper online or from any source.	20 September 2022
Prepare Empathy Map	Empathy Map is a visualization tool which can be used to get a better insight of the customer	22 September 2022
Ideation-Brainstorming	Brainstorming is a group problem solving session where ideas are shared, discussed and organized among the team members.	28 September 2022
Define Problem Statement	A Problem Statement is a concise description of the problem or issues a project seeks to address. The problem statement identifies the current state, the desired future state and any gaps between the two.	20 September 2022
Problem Solution Fit	This helps us to understand the thoughts of the customer their likes, behaviour, emotions etc.	01 October 2022
Proposed Solution	Proposed solution shows the current solution and it helps is going towards the desired result until it is achieved.	18 October 2022
Solution Architecture	Solution Architecture is a very complex process I.e it has a lot of sub-processes and branches. It helps in understanding the components and features to complete our project.	18 October 2022
Customer Journey	It helps us to analyse from the perspective of a customer, who uses our project.	01 November 2022
Functional Requirement	Here functional and nonfunctional requirements are briefed. It has specific features like usability, security, reliability, performance, availability and scalability.	01 November 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.	03 November 2022
Technology Architecture	Technology Architecture is a more well defined version of solution architecture. It helps us analyze and understand various technologies that needs to be implemented in the project.	03 November 2022
Prepare Milestone & Activity List	It helps us to understand and evaluate our own progress and accuracy so far.	06 November 2022
Spring Delivery Plan	Sprint planning is an event in scrum that kicks off the sprint. The purpose of sprint planning is to define what can be delivered in the sprint and how that work will be achieved.	06 November 2022

6.2 Sprint Delivery Schedule

Sprint	Functional Requirement (Epic)	User Story Number	User Story / Task	Story Points	Priority	Team Members
Sprint-1	Registration	USN-1	As a user, I can register for the application by entering my email, password, and confirming my password.	4	High	Ajisha K
Sprint-1	Registration	USN-2	As a user, I will receive confirmation email once I have registered for the application	3	High	Subitha S
Sprint-1	Login page	USN-3	As a user, enter the username and password which is already existing	3	Medium	Akash Margin
Sprint-1	Forecasting the weather	USN-4	As a user, we can monitor he weather conditions like humidity , temperature etc...	12	High	Ajisha K
Sprint-2	Sensing moisture condition of the soil	USN-5	As a user, we can know about soil moisture condition , controlling the motor pump for water flow by using mobile application.	10	High	Akash Margin
Sprint-3	Detecting the motion in certain range	USN-6	Fencing system are helpful in providing security against animals and birds.	12	High	Subitha S
Sprint-4	Checking the crops conditions.	USN-7	Here farmer needs to update the condition of crops.	9	High	Ajisha K

6.3 Reports from JIRA

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	22	29 Oct 2022
Sprint-2	1	6 Days	31 Oct 2022	05 Nov 2022	10	05 Nov 2022
Sprint-3	2	6 Days	07 Nov 2022	12 Nov 2022	12	12 Nov 2022
Sprint-4	1	6 Days	14 Nov 2022	19 Nov 2022	9	19 Nov 2022

Velocity:

Imagine we have a 10-day sprint duration, and the velocity of the team is 20 (points per sprint). Let's calculate the team's average velocity (AV) per iteration unit (story points per day)

$$AV = \frac{sprint\ duration}{velocity} = \frac{20}{10} = 2$$

$$AV = \frac{sprint\ duration}{velocity}$$

=6/13.25

=0.45

7. CODING & SOLUTIONING

7.1. Feature1

Screenshot:1

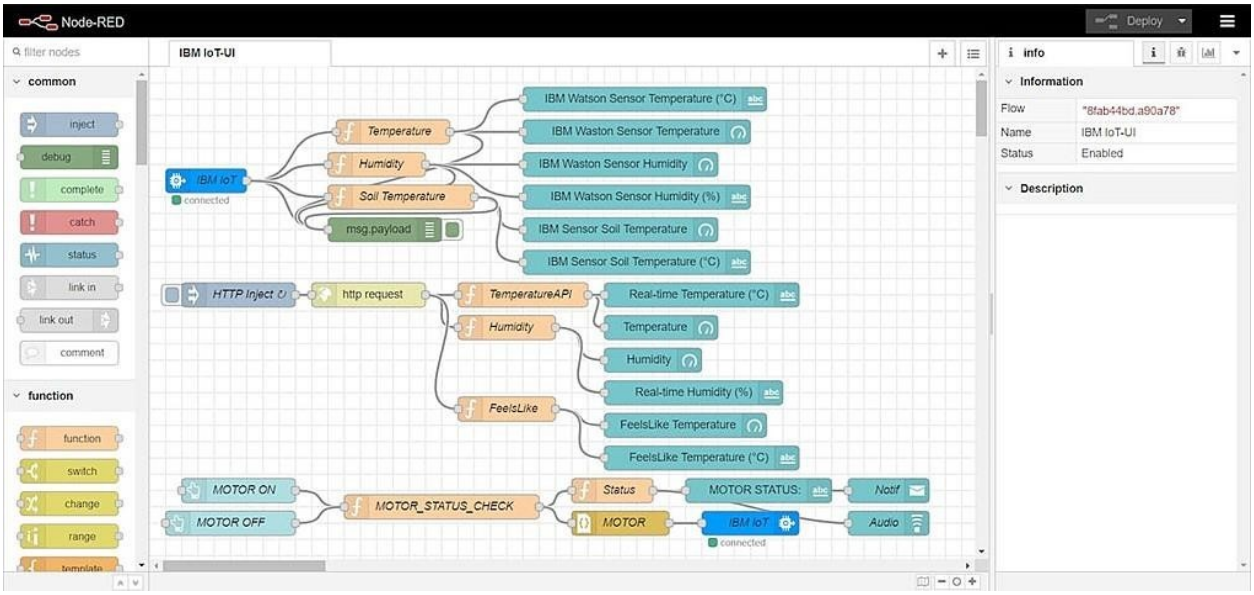


Fig:7.1

Screenshot:2

Fig:7.2

Screenshot:3

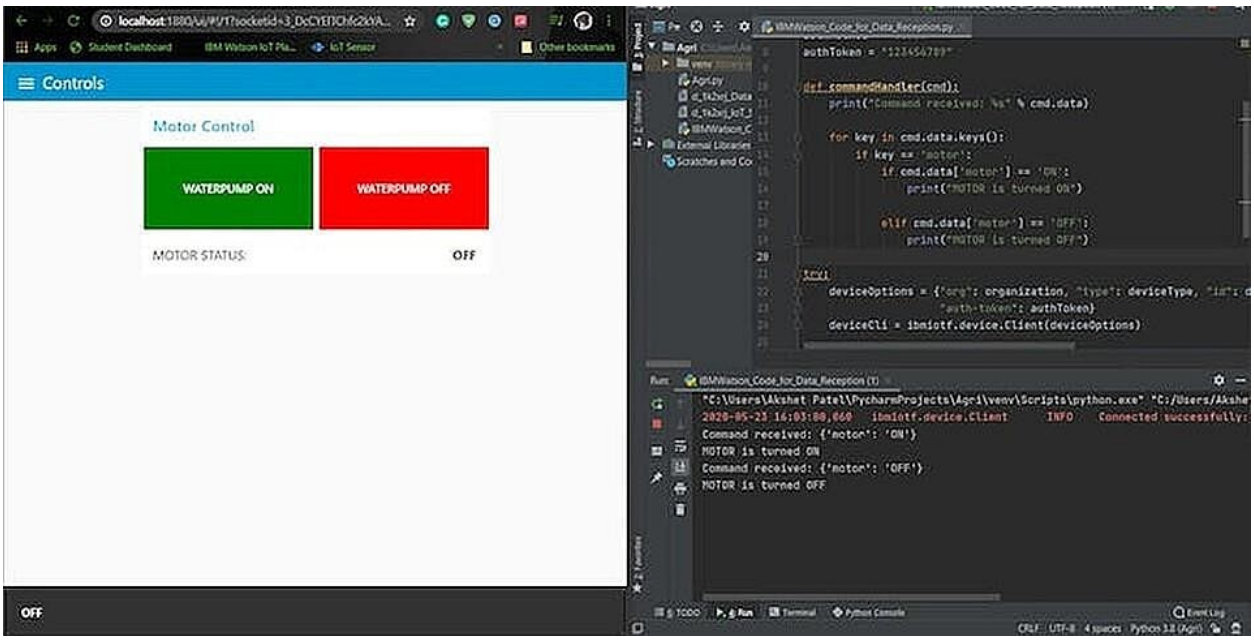


Fig:7.3

Screenshot:4

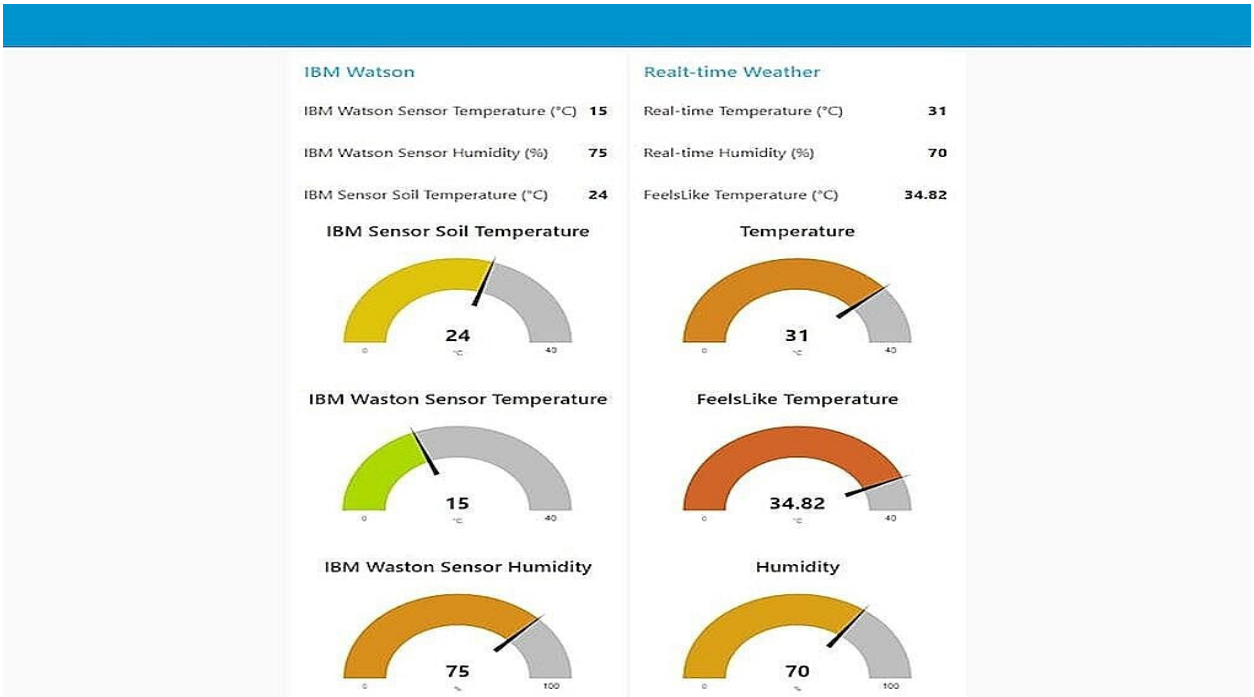


Fig:7.4

7.2. Feature2

MIT APP inventor to design the APP

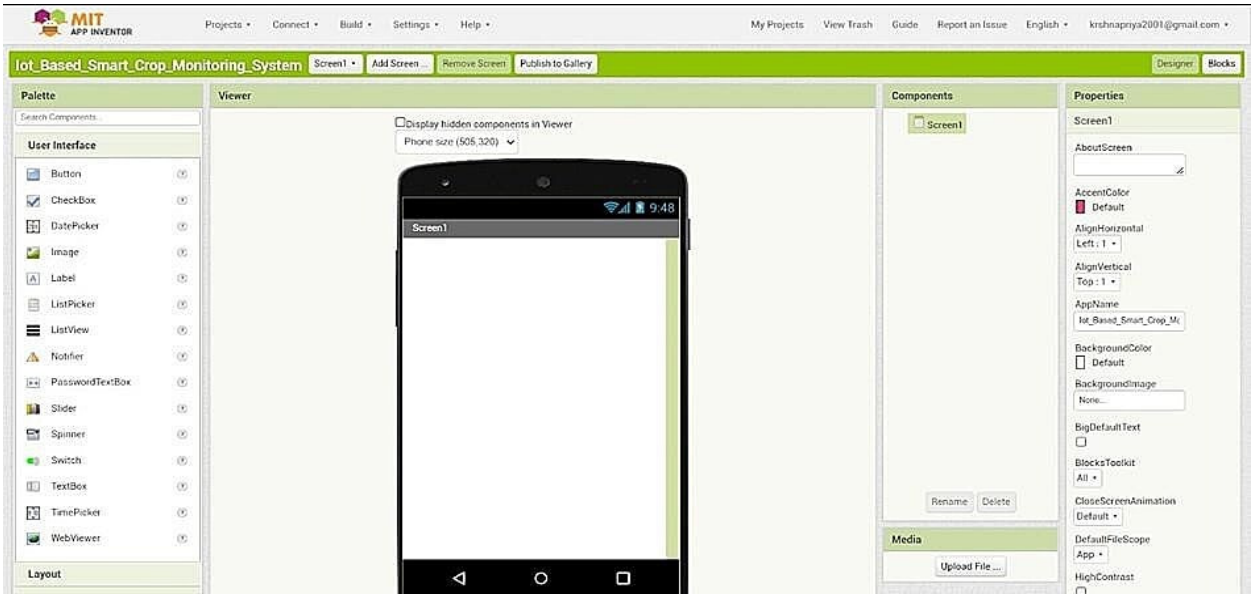


Fig:7.5

Customize the Appointer face to Display the Values

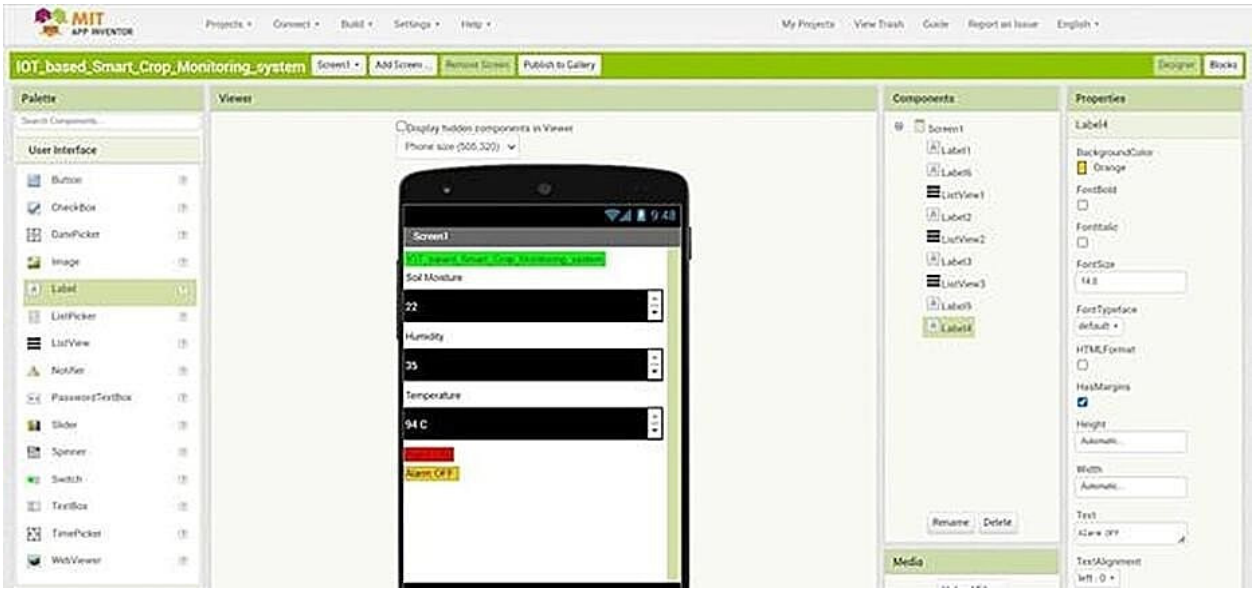


Fig:7.6

8. TESTING

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	11	4	2	2	19
Duplicate	1	1	2	0	4
External	2	3	0	1	6
Fixed	10	2	3	20	35
Not Reproduced	0	0	2	0	2
Skipped	0	0	2	1	3
Won't Fix	0	5	2	1	8
Totals	24	15	13	25	77

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	5	0	1	4
Client Application	47	0	2	45
Security	3	0	0	3
Outsource Shipping	2	0	0	2
Exception Reporting	11	0	2	9
Final Report Output	5	0	0	5
Version Control	3	0	1	2

9.RESULT:

We have successfully built an IOT Based Smart Crop Protection System for Agriculture and integrated all the services using Node-RED.

10. ADVANTAGES & DISADVANTAGES

a. Advantages

- All the data like climatic conditions and changes in the soil or crop conditions can be easily monitored
- Risk of crop damage can be lowered to a greater extent
- Many difficult challenges can be avoided by making the process automated and the quality of crops can be maintained
- The process included in farming can be controlled using the web application from anywhere anytime.

b.Disadvantages

- Smart Crop Protection requires internet connectivity continuously but,rural parts cannot fulfil the requirement.
- Any faults in the sensors can cause great loss in the agriculture, due to wrong record and the actions of automated processes.
- IOT devices need much money to implement.

11.CONCLUSION:

IoT based smart Crop Monitoring System for Agriculture for Live Monitoring of Temperature and Soil Moisture and to control motor and light remotely has been proposed using Node Red and IBM Cloud Platform. The System has high efficiency and accuracy in fetching the live data of temperature and soil moisture. The IOT based smart crop protection System for agriculture being proposed via this project will assist farmers in increasing the agriculture yield and take efficient care of food production as the system will always provide helping hand to farmers for getting accurate live feed of environmental temperature and soil moisture with more than 99% accurate results. Therefore, the project proposes a thought of consolidating the most recent innovation into the agrarian field to turn the customary techniques for water system to current strategies in this way making simple profitable and temperate trimming.

12. FUTURE SCOPE:

In future due to more demand of goods and more farming in less time, for betterment of the crops and reducing the usage of extra source like electricity and water IOT can be implemented in most of the places.

13.APPENDIX:

```
import random
import  ibmiotf.device from time
import sleep
 import sys
 #IBM Watson Device Credentials.
 organization = "op701j"
deviceType = "SubiAji"
deviceId = "SubiAji89"
authMethod = "token"
authToken = "1223334444"
def myCommandCallback(cmd):
print("Command received: %s" % cmd.data['command'])
status=cmd.data['command']
if status=="sprinkler_on":
print ("sprinkler is ON")
else :
print ("sprinkler is OFF")
 #print(cmd)

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()
 #Connecting to IBM watson.
deviceCli.connect()
while True:

 #Getting values from sensors.

temp_sensor = round( random.uniform(0,80),2)
```

```
PH_sensor = round(random.uniform(1,14),3)

 camera = ["Detected","NotDetected","NotDetected","NotDetected","Not
  Detected","Not Detected",]
  camera_reading = random.choice(camera)
flame = ["Detected","NotDetected","NotDetected","NotDetected","Not
  Detected","Not Detected",]
  flame_reading = random.choice(flame)
  moist_level = round(random.uniform(0,100),2)
water_level = round(random.uniform(0,30),2)


  #storing the sensor data to send in json format to cloud.


  temp_data = { 'Temperature' : temp_sensor }
  PH_data = { 'PH Level' : PH_sensor }
  camera_data = { 'Animal attack' : camera_reading}
  flame_data = { 'Flame' : flame_reading }
  moist_data = { 'Moisture Level' : moist_level}
  water_data = { 'Water Level' : water_level}



   # publishing Sensor data to IBM Watson for every 5-10 seconds.  success =
  deviceCli.publishEvent("Temperature sensor", "json", temp_data,
qos=0)

  sleep(1)
   if success:
                print (" .....publish ok..... ")
                print ("Published Temperature = %s C" % temp_sensor, "to IBM Watson")


                    success = deviceCli.publishEvent("PH sensor", "json", PH_data, qos=0)
  sleep(1)
```

```
  if success:
                print ("Published PH Level = %s" % PH_sensor, "to IBM Watson")


                success = deviceCli.publishEvent("camera", "json", camera_data, qos=0)
 sleep(1)
 if success:
print ("Published Animal attack %s " % camera_reading, "to IBM Watson")
success = deviceCli.publishEvent("Flame sensor", "json", flame_data, qos=0)  sleep(1)
 if success:
                    print ("Published Flame %s " % flame_reading, "to IBM Watson")


                success = deviceCli.publishEvent("Moisture sensor", "json", moist_data,
qos=0)
 sleep(1)
  if success:
print ("Published Moisture Level = %s " % moist_level, "to IBMWatson")


                success = deviceCli.publishEvent("Water sensor", "json", water_data,
qos=0)
 sleep(1)
 if success:
            print ("Published Water Level = %s cm" % water_level, "to IBM Watson")
                print ("")
                #Automation to control sprinklers by present temperature an to send alert
                message to IBM Watson.


if (temp_sensor> 35):
print("sprinkler-1 is ON")
                success = deviceCli.publishEvent("Alert1", "json",{ 'alert1' :
              "Temperature(%s) is high, sprinkerlers are turned ON" %temp_sensor }  , qos=0)
sleep(1)
 if success:
```

```
                    print( 'Published alert1 : ', "Temperature(%s) is high, sprinkerlers are
                    turned ON" %temp_sensor,"to IBM Watson")
  print("")
   else:
  print("sprinkler-1 is OFF")
                    print("")

                     #To send alert message if farmer uses the unsafe fertilizer
  if (PH_sensor> 7.5 or PH_sensor< 5.5):
                       success = deviceCli.publishEvent("Alert2", "json",{ 'alert2' : "Fertilizer PH
                    level(%s) is not safe,use other fertilizer" %PH_sensor } , qos=0)
sleep(1)
if success:
print('Published alert2 : ' ,
"Fertilizer PH level(%s) is
not safe,use other

    fertilizer" %PH_sensor,"to IBM Watson")
print("")


    #To send alert message to farmer that animal attack on crops.

if (camera_reading == "Detected"):
                       success = deviceCli.publishEvent("Alert3", "json", { 'alert3' : "Animal
                    attack on crops detected" }, qos=0)
sleep(1)
          if success:
                    print('Published alert3 : ' , "Animal attack on crops detected","to IBM
  Watson","to IBM Watson")
  print("")
                     #To send alert message if flame detected on crop land and turn ON the
splinters to take immediate action.
if (flame_reading == "Detected"):
```

```
print("sprinkler-2 is ON")
                    success = deviceCli.publishEvent("Alert4", "json", { 'alert4' : "Flame is
                    detected crops are in danger,sprinklers turned ON" }, qos=0)
sleep(1)
if success:
                    print( 'Published alert4 : ' , "Flame is detected crops are in
danger,sprinklers turned ON","to IBM Watson")


                    #To send alert message if Moisture level is LOW and to Turn ON Motor-1
 if (moist_level< 20):
                    print("Motor-1 is ON")
                    success = deviceCli.publishEvent("Alert5", "json", { 'alert5' : "Moisture
  level(%s) is low, Irrigation started" %moist_level }, qos=0)
 sleep(1)
  if success:
                    print('Published alert5 : ' , "Moisture level(%s) is low, Irrigation started"
                    %moist_level,"to IBM Watson" )
print("")
 #To send alert message if Water level is HIGH and to Turn ON Motor-2 to take water out.  if
                    (water_level> 20):
                    print("Motor-2 is ON")
                    success = deviceCli.publishEvent("Alert6", "json", { 'alert6' : "Water
                    level(%s) is high, so motor is ON to take water out "
                    %water_level }, qos=0)
 sleep(1)
          if success:
                    print('Published alert6 : ' , "water level(%s) is high, so motor is ON to take
        water out " %water_level,"to IBM Watson" )
 print("")
  #command received by farmer  deviceCli.commandCallback =
myCommandCallback
                    # Disconnect the device and application from the cloud deviceCli.disconnect()
```

GitHub Link:

https://github.com/IBM-EPBL/IBM-Project-5381-1658761312

Demo Link:

https://drive.google.com/file/d/1T4B9_TuwokWKUxS6yXc2IrVOdGjv-tJK/view?usp=drivesdk