IoT Based Smart Crop Protection System for Agriculture

TEAM ID-PNT2022TMID19096

TEAM MEMBERS:

- ➤ SANCHANA C
- ➤ SWETHA J
- ➤ SWETHA S
- ➤ YAMUNA P

IOT BASED SMART CROP PROTECTION SYSTEM FOR AGRICULTURE

1.INTRODUCTION

1.1 PROJECT OVERVIEW

Smart farming frequently makes use of IoT trends to raise the bar for agriculture. Our productivity, however, continues to be incredibly low when compared to global averages. Because it is a successful business, pastoral societies move to urban locations where they are unable to think about crofting. In-depth, moderate smart irrigation systems are used to provide solutions for a variety of plants while also addressing moisture-related problems. To address the difficulty of frequently checking weather variables like temperature, humidity, and wetness manually, a new system based on the cloud of effects is developed. The need for wildlife overlaps with the needs of laypeople, costing the local population and agricultural land. Crop eminence is constantly destroyed by wild animals.The crop being destroyed by wild animals and the yield being destroyed by natural objects are the major causes of the low productivity. Due to unforeseen animal encounters, small species, bugs, certain dangerous snakes, and weather conditions, cultivators face several obstacles in their quest for increased productivity. In the current system, uncontrolled animals are prevented from attacking flora and killing animals by using electrical protection. Because of their size and flora of effort, small creatures, bugs, and snakes are difficult to observe and monitor. A well-known safety tip for wild animals that has been around for many years is fencing. Fences are frequently used as a train, though. Therefore, it is important to review local legislation laws before choosing an appropriate fence. Fencing's high quality is determined by its structure and material. Some permanent fences can endure up to 30 years, depending on how and what they are composed of. Prior to purchasing electrical fences, it is crucial to confirm that they may be used in the designated area and to protect endangered animal species. In order to prevent any possible human contact, it is advised that electrical fences be marked with a warning signal. Keep an eye on the temperature, humidity, and moisture are troublesome.

1.2 PURPOSE

The goal is to provide a crop safety monitoring device for animal outbreaks, environmental conditions, and environmental conditions. This helps to reduce the physical effort, which would otherwise be necessary if the farmers themselves had to use their ongoing physical labour to pay for crop protection. Wildlife frequently destroys eminence crops, which limits annual production of greenery and costs cultivators money. Farmer suicide is a major problem because of the poor harvest. This poor harvest is a result of two major factors, namely crop damage from wild animals and crop damage from weather conditions. The ranchers will enjoy these location-specific SMS messages. The main goal of this work is to provide an excellent response to this suffering.When a wild animal or species is recognised by a PIR sensor, the web camera is activated and a buzzer in the area is activated, alerting the farmer directly to the cloud. The sensor installed causes the water pumps to turn on when the moisture content falls below a scary threshold. This guarantees the complete safety of crops from both animals and the elements, preventing farmers.

2.LITERATURE SURVEY

2.1 EXISTING PROBLEM

Smart farming frequently makes use of IOT trends to raise the bar in agriculture. Agriculture is the foundation that holds up the overall commercial development of our nation. Our productivity, however, is incredibly poor by global standards. People from rural areas can't focus on agriculture since they drift to cities for other lucrative vocations.

The existing traditional agricultural practices have various drawbacks, including more expensive and labor-intensive field monitoring.

In particular, small-scale smart irrigation systems are used to address moisture-related problems while also providing a solution for a range of plants. It is challenging to manually check weather variables like temperature, humidity, and wetness frequently. Farmer suicide is becoming a significant issue as a result of low agricultural productivity. This lack of productivity is the result of two key factors: Crop destroyed by uncontrolled weather, uncontrolled animal attacks, small species, insects, certain dangerous snakes, and weather conditions.

2.2 REFERENCES

1.) Krunal Mahajan1, Riya Parate2, Ekta Zade3, Shubham Khante4, Shishir Bagal5," REVIEW PAPER ON SMART CROP PROTECTION SYSTEM", International Research Journal of Engineering and Technology (IRJET), Volume: 08, issue 02 Feb 2021.

2.) Dr.M. Chandra, Mohan Reddy, Keerthi Raju KamakshiKodi, BabithaAnapalliMounikaPulla, "SMART CROP PROTECTION SYSTEM FROM LIVING OBJECTS AND FIRE USING ARDUINO", Science, Technology and Development, Volume IX Issue IX, pg.no 261- 265, Sept 2020.

3.) Anjana, Sowmya, Charan Kumar, Monisha, Sahana, "Review on IoT in Agricultural Crop Protection and Power Generation", International Research Journal of Engineering and Technology (IRJET) , Volume 06, Issue 11 ,Nov 2019.

4.) G. NaveenBalaji, V. Nandhini, S. Mithra, N. Priya, R. Naveena, "IOT based smart crop monitoring in farmland", Imperial Journal of Interdisciplinary Research (IJIR), Volume 04, Issue 01, Nov 2018.

5 P.Rekha, T.Saranya, P.Preethi, L.Saraswathi, G.Shobana, "Smart AGRO Using ARDUINO and GSM", International Journal of Emerging Technologies in Engineering Research (IJETER) Volume 5, Issue 3, March 2017

2.3 PROBLEM STATEMENT DEFINITION

In the current method, electrical fencing is utilised to stop wild animals from attacking agricultural plants and killing animals. The main goal is to offer an excellent solution to this issue, minimising losses while giving farmers a precise estimate of crop yield. The two main causes of this low production are crop damage caused by natural objects and crop destruction by wild animals. The major goal of this project is to provide an excellent solution to this issue in order to reduce the financial losses caused by supporting our farmers and obtain an accurate crop outputThis guarantees complete protection of the vegetation from animals and guards against farmer loss. PIR sensor, web camera, ultrasonic sensor, LDR sensor, temperature sensor, humidity sensor, moisture sensor, buzzer, and monitor are employed in the suggested system. This area of the work is still focused on monitoring the crop security system in confrontation with subconscious occurrences and weather conditions. As the system is automated, the water pumps are turned on when the moisture content falls below a critical level that is determined by the sensor installed in the fields. This completely protects the crops from both animals and the elements, preventing losses for the farmers.

3.IDEATION & PROPOSED SOLUTION

3.1 EMPATHY MAP CANVAS

Our nation's economy relies heavily on agriculture, which accounts for 45% of GDP and is the driving force behind economic growth. The goal of this IOT-based crop protection system is to create an integrated module to boost the effectiveness of the current agricultural modules. Smart agriculture is a clever technique to automate the farming process.

One of the most well-known uses of IoT in the agricultural industry is precision agriculture, and many companies are making use of this strategy globally. It is possible to eliminate hazards to the crops by establishing an automated system and minimising human participation. The main focus will be on creating a favourable environment for plants.These automated agricultural systems will support the management and upkeep of a secure environment, particularly in agricultural areas. in-the-moment environment. Smart farming involves a lot of monitoring. The hardware system will be controlled by software with a graphical user interface, and it will be completely isolated with sensors like temperature and humidity sensors installed. A master station that communicates with the human interactive software will control the I controllers.

3.2 IDEATION & BRAINSTORMING

Sanchana

The smart protection system defines that this project help to Farmer for the protection of a farm.

The IOT device is used so 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 whole project is work on 12V dc supply from battery. We used solar panel to charge the battery

This project contents Arduino UNO,node mcu,LCD display,Flame sensor,PIR sensor,SD card module,solar panel(solar charge converter)Boost converter).

Swetha.J

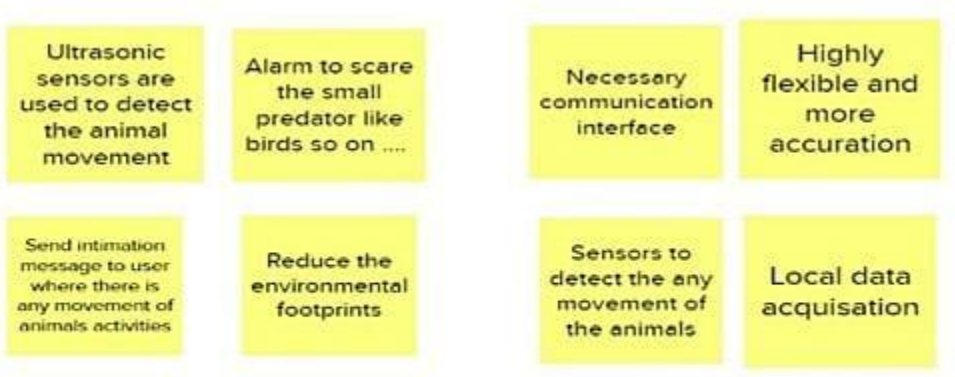
Sensors to detect if there is any disease

Realtime crop monitoring

Effective accuration and adaptive

Imroved livestock farming

Swetha.S **Yamuna.P**

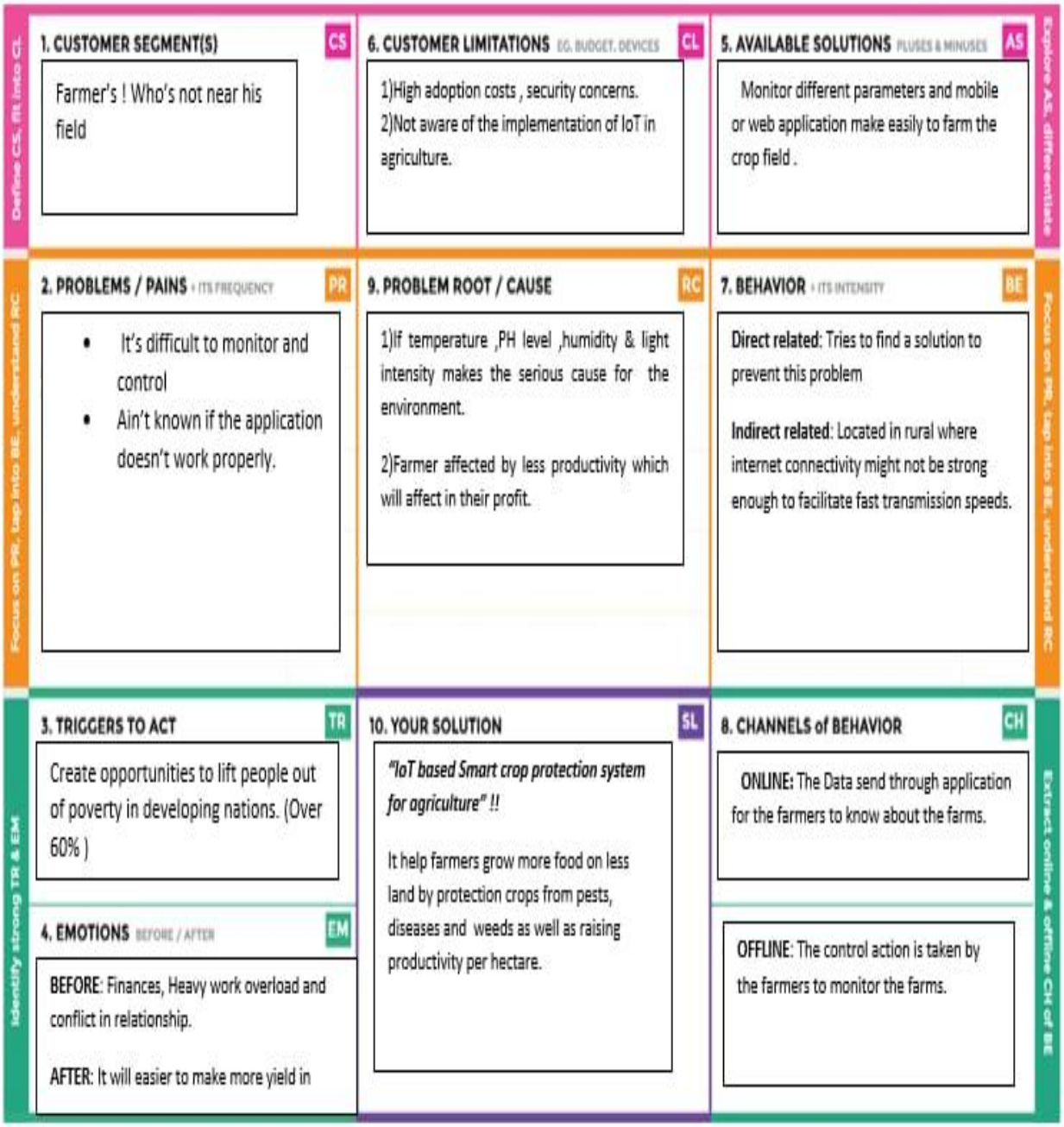


- Implementation of water level sensor
- Using Solar panels to generate energy
- Usage of organic fertilizers to increase yield
- Usage of IR sensors to detect wild animals
- Selecting good quality seeds

3.3 PROPOSED SOLUTION

S.No.	Parameter	Description
1.	Problem Statement (Problem to be solved)	Protecting crops from insects , animals and other factors using pest sprayer , sound system and automatic drip irrigation.
2.	Idea / Solution description	Using moisture meter ,automatic sprayer of pesticide ,automatic DC motor and sensors are placed for protect crops.
3.	Novelty / Uniqueness	Water stagnation and scarcity is maintained every movement in field and growth of plants are monitored with mobile phone.
4.	Social Impact / Customer Satisfaction	Improved and high yield crops are obtained , Farmers work is reduced with automation.
5.	Business Model (Revenue Model)	This makes agriculture easier and profit is attained more by using this technique.
6.	Scalability of the Solution	This solution will gives high performance for proper maintenance.

3.4 PROBLEM SOLUTION FIT



4. REQUIREMENT ANALYSIS

4.1 FUNCTIONAL REQUIREMENT

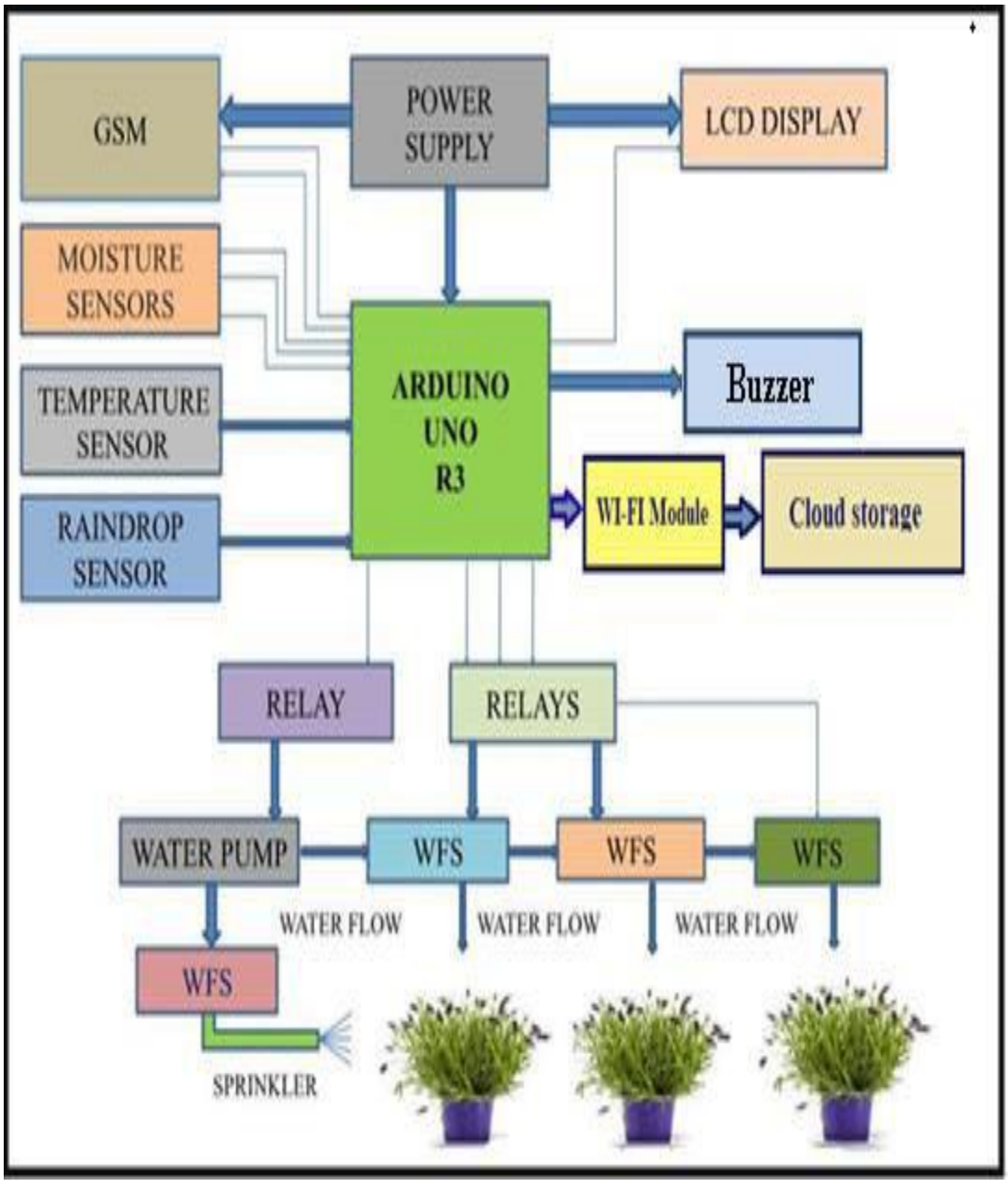
FR-NO	FUNCTIONAL REQUIREMENTS	SUB-REQUIREMENTS
FR-1	Fertilizing frame service	Documentation requirements and assisting information
FR-2	Economical service	Assisting information
FR-3	Technology assessment service	Selecting fertilizing features
FR-4	Feature assessment service	Updated technical information and machinery selection
FR-5	Information acquisition service	Assisting information about fertilizing rules
FR-6	Farm and field customizing service	Potential data acquisition service
FR-7	Field inspection	Spatial field information
FR-8	Field observation service	Analysed risks
FR-9	Assisting remote controlling	Inspecting and controlling fertilizing task
FR-10	Assisting "operational performance service"	Economical analysis of current technology

4.2 NON-FUNCTIONAL REQUIREMENT

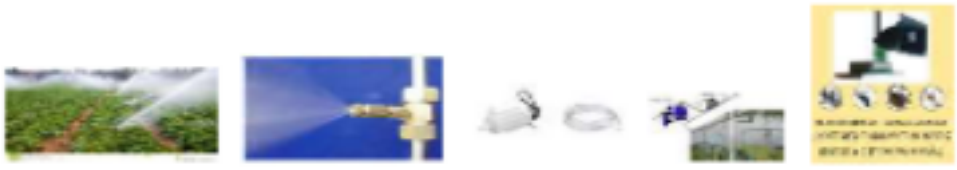
NRF.NO	NON FUNCTIONAL REQUIREMENTS	DESCRIPTION
NRF-1	Usability	To use new technologies and increase the quantity and quality
NRF-2	Security	Protect the field from animals.
NRF-3	Reliability	Increasing the demand for food with minimum resources
NRF-4	Performance	Maintain good yield and provide sustainable quantity
NRF-5	Availability	Agricultural fences are quite an effective wild animal protection
NRF-6	Scalability	The develop system will not harmful and injurious to animals as well as human beings.

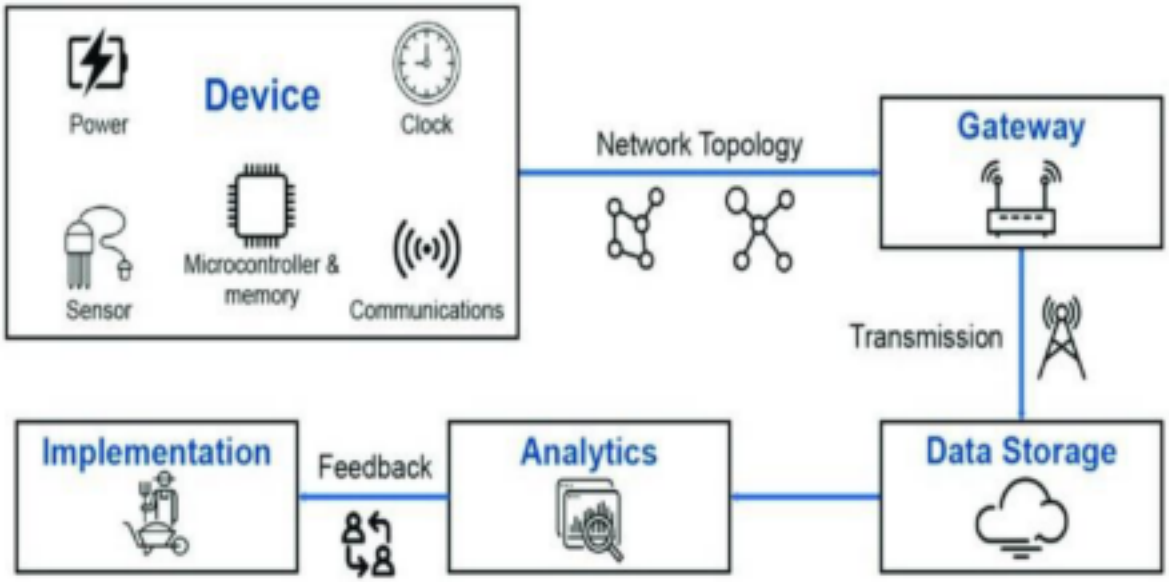
5.PROJECT DESIGN

5.1 DATA FLOW DIAGRAMS



5.2 SOLUTIONS & TECHNICAL ARCHITECTURE





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5.3 USER STORIES

User Type	Functional Requirement (Epic)	User Story Number	User Story / Task	Acceptance criteria	Priority	Release
Customer (Farmer)	Maintaining Fields	USN-1	As a user, I can monitor the growth of crops and protect the crops against animals	I can maintain the fields with less labor	High	Sprint-1
	Analyzing Problems	USN-2	As a user, I collect the required information about the problems on agriculture fields	I can ask my field owner directly.	Low	Sprint-2
		USN-3	As a user, I can monitor the moisture level in soil and solve the problems by using Smart IOT System	I can take remedial action immediately	High	Sprint-1
Project Designers	Identifying the problem and provide solutions	USN-4	As a user, I can sense the water level and flame in the field using sensor and monitor using IOT	I can perform this actions via IoT.	Medium	Sprint-1
		USN-5	As a user, I can make services for Irrigation, pesticides, Fertilization, and Soil preparation	I can solve this problem using IOT	High	Sprint-1
			As a user, I can monitor the field against animal attacks using a camera interface module and appropriate actions can be taken	I can monitor the field continuously.	Medium	Sprint-2
Customer (Field Maintainer)	Problem solutions	USN-6	As a user, areas can be monitored from a remote place	Checking Process	Medium	Sprint-3
	Application	USN-7	As a user, I can respond to the problems in the fields immediately	Continuous monitoring and remedial actions.	Medium	Sprint-3
	Final Process	USN-8	This proposed smart IOT-based crop protection device is found to be cost-effective and efficient	I can take necessary action if required.	Medium	Sprint-4

6.PROJECT PLANNING & SCHEDULING

Sprint	User Story Number	User Story / Task	Story Points	Priority	Team Members
Sprint-1	USN-1	As an Administrator, Develop applications with APIs and SDKs for integration with the open, IoT-enabled EcoStruxure architecture and platform.	20	High	Swetha J
Sprint-2	USN-2	An ecosystem of experts in industrial automation and energy management, potential business partners, and qualified leads on an open business platform.	20	High	Swetha S
Sprint-3	USN-3	As a Team member, we have to implement the developed app's and the further process.	20	High	Sanchana C
Sprint-4	USN-4	As a additional member in our team , we have to do all the work in pour team with the following work that we have to do.	20	High	Yamuna P

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	20	6 Days	24 Oct 2022	29 Oct 2022	20	29 Oct 2022
Sprint-2	20	6 Days	31 Oct 2022	05 Nov 2022	20	05 Nov 2022
Sprint-3	20	6 Days	07 Nov 2022	12 Nov 2022	20	12 Nov 2022
Sprint-4	20	6 Days	14 Nov 2022	19 Nov 2022	20	19 Nov 2022

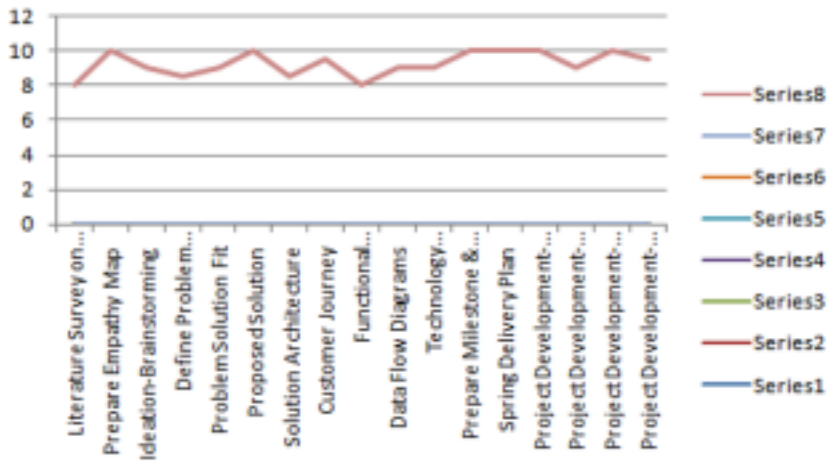
VELOCITY:

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

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

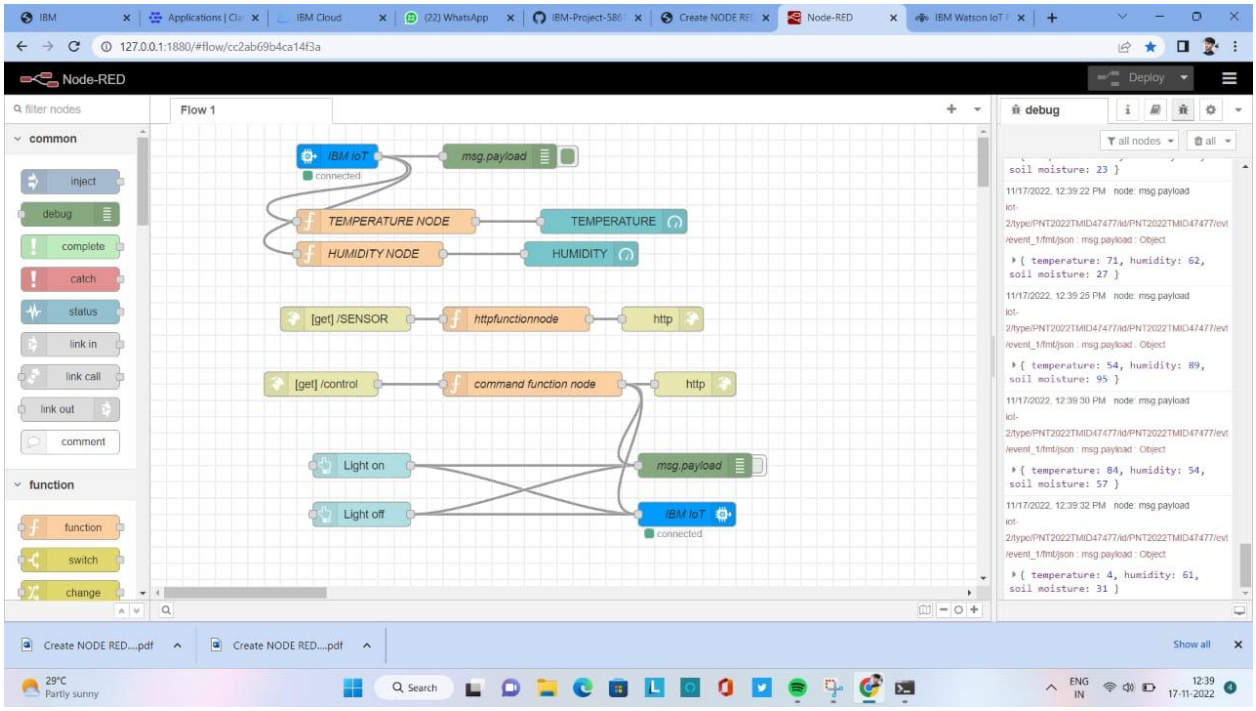
BURNDOWN CHART:

A burndown 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, burndown charts can be applied to any project containing measurable progress overtime



7.CODING & SOLUTIONING (EXPLAINATION OF PROJECT ALONG WITH CODE)

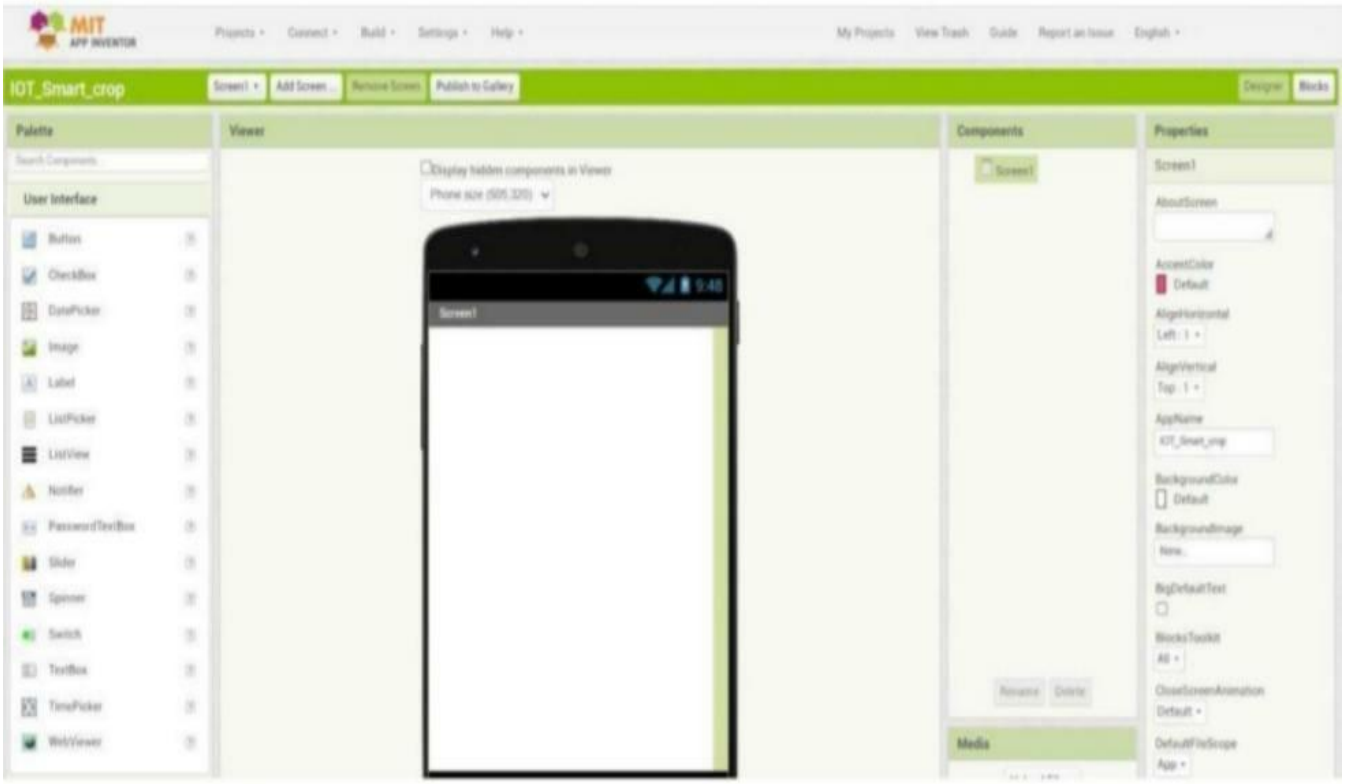
7.1 FEATURE 1



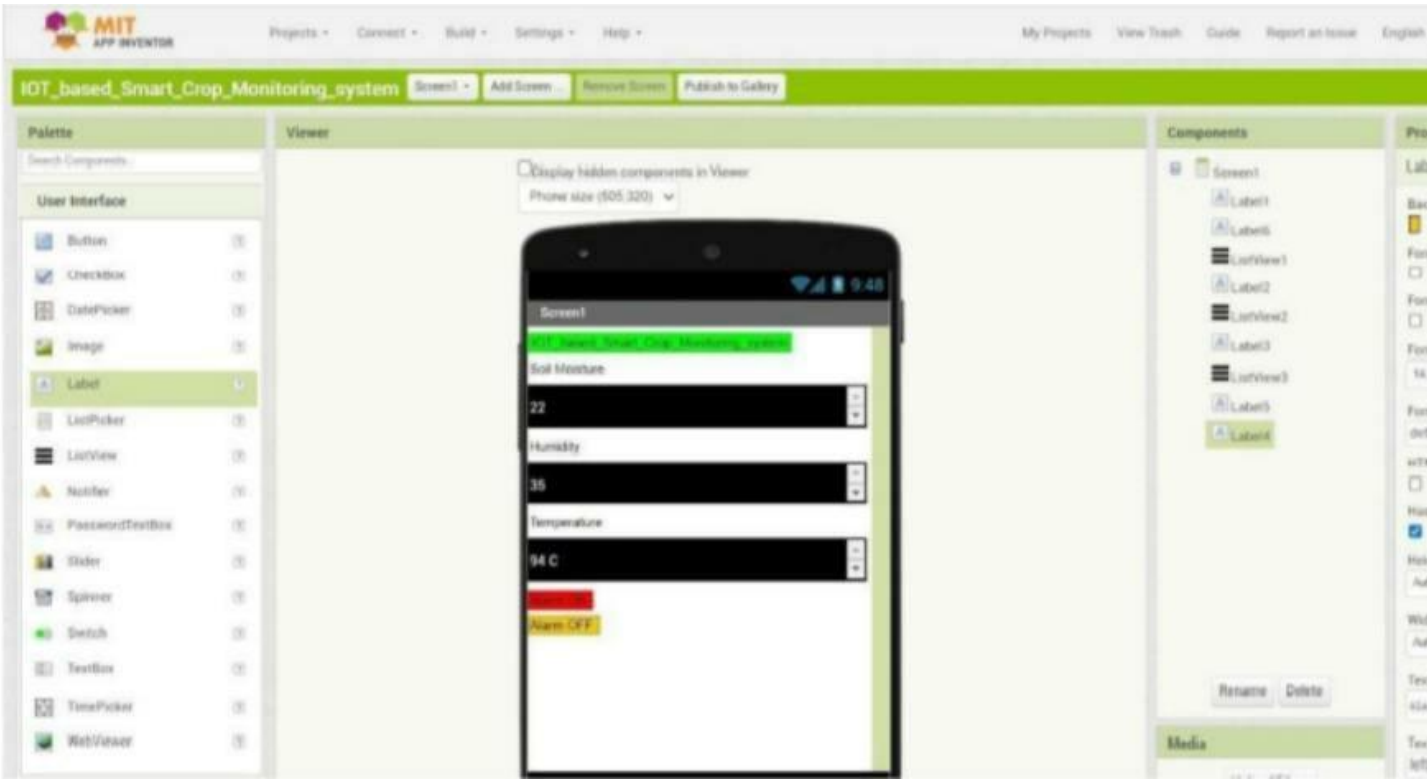

Python 3.7.0 Shell
File Edit Shell Debug Options Window Help
Python 3.7.0 (v3.7.0:1bf9cc5093, Jun 27 2018, 04:59:51) [MSC v.1914 64 bit (AMD64)] on win32
Type "copyright", "credits" or "license()" for more information.
>>>
== RESTART: C:/Users/Latha/AppData/Local/Programs/Python/Python37/ibmiot.py ==
2022-11-13 22:01:48,939 ibmiotf.device.Client INFO Connected successfully: d:8osflk:cropprotection99:cropprotection99
Published Temperature=9 C Humidity=50 % to IBMWatson
Published Temperature=37 C Humidity=55 % to IBMWatson
Published Temperature=96 C Humidity=60 % to IBMWatson
Published Temperature=4 C Humidity=11 % to IBMWatson
Published Temperature=67 C Humidity=49 % to IBMWatson
Published Temperature=79 C Humidity=13 % to IBMWatson
Published Temperature=83 C Humidity=7 % to IBMWatson
Published Temperature=68 C Humidity=70 % to IBMWatson
Published Temperature=69 C Humidity=68 % to IBMWatson
Published Temperature=61 C Humidity=36 % to IBMWatson
Published Temperature=20 C Humidity=76 % to IBMWatson
Published Temperature=3 C Humidity=93 % to IBMWatson
Published Temperature=41 C Humidity=98 % to IBMWatson
Published Temperature=31 C Humidity=96 % to IBMWatson
Published Temperature=78 C Humidity=22 % to IBMWatson
Published Temperature=65 C Humidity=75 % to IBMWatson
Published Temperature=16 C Humidity=89 % to IBMWatson
Published Temperature=87 C Humidity=95 % to IBMWatson
Published Temperature=7 C Humidity=35 % to IBMWatson
Published Temperature=17 C Humidity=85 % to IBMWatson
Published Temperature=32 C Humidity=74 % to IBMWatson
Ln: 26 Col: 0

7.2 FEATURE 2

MIT APP INVENTOR TO DESIGN THE APP



CUSTOMIZING THE APP INTERFACE TO DISPLAY THE VALUES:



8. TESTING

8.1.TEST CASES

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.RESULTS

Thus the IOT based Smart Crop Protection has been build successfully with the help of MIT app, Node.Js, and node red. And the output has been tested and verified using MIT app.

The problem of crop vandalization by wild animals and fire has become a major social problem in currenttime.

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.

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, you have a better chance of not starving. 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 grows you have to radically change the environment of the planet.

11.CONCLUSION:

The aim of this project is to make the life and work of the farmer much easier. This can be achieved using the technique - Precision Farming, this involves autonomous monitoring of crops and other environmental

parameters which has an effect on the crop, these environmental conditions are:

1. Environmental Humidity
2. Environmental Temperature.
3. Soil Moisture.
4. Rain Sensing.

Above mentioned are some of the conditions monitored autonomously, threshold parameters for various crops are automatically set upon user input of crop variety to be monitored. By this system one could achieve a good yield and better nutritional crops in their agricultural produce.

12. FUTURE SCOPE:

Future scope of our project relies on the farmers and their feedbacks, in future we are planning to add the following features: 1. One device one farm - Cover the entire farm area with a single device.

2. Pest monitoring system.
3. Estimated yield calculator.
4. Estimated time of cultivation.
5. Individual cloud management dashboard.

13.APPENDIX SOURCE CODE MOTOR.PYTHON

```
Imp or time

import sys

import ibmiotf.application # to install pip
install ibm iotf import ibmiotf.device


    # Provide your IBM Watson Device
    Credentials organization = "63004g"
    # replace the ORG ID
    deviceType = "MainDevice" # replace the
    Device type deviceId = "9344022806" # replace
    Device ID
    authMethod = "token"
```

```
authToken = "a-63004g-86womzydrf" # Replace the

authtoken def myCommandCallback(cmd): # function for

   Callback if cmd.data['command'] ==

   'motoron':

      print("MOTOR ON IS RECEIVED")

   elif cmd.data['command'] ==
      'motoroff': print("MOTOR
      OFF IS RECEIVED")
   if cmd.command ==

      "setInterval": if

      'interval' not in

      cmd.data:

         print("Error - command is missing required information:
      'interval'") else:
         interval =
   cmd.data['interval'] elif
   cmd.command ==
   "print":
      if 'message' not in cmd.data:
 print("Error - command is missing required information: 'message'")

      else:
```

```
            output =
            cmd.data['message
            '] print(output)


    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:
       deviceCli.commandCallback = myCommandCallback


    # Disconnect the device and application from the
    cloud deviceCli.disconnect()
```

SENSOR.PY

```
 import time
 import sys
 import ibmiotf.application
 import ibmiotf.device
```

```
import random

#Provide your IBM Watson Device Credentials
organization = "63004g"
    deviceType =
    "MainDevice"
    deviceId =
    "9344022806"
    authMethod = "token"
    authToken =
    "9944611970"


    # Initialize GPIO
    def myCommandCallback(cmd):
        print("Command received: %s" % cmd.data['command'])
        status=cmd.data['command']
        if status ==
            "motoron":
            print ("motor
            is on")
        elif status ==
            "motoroff":
            print ("motor
            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
       animal=random.uniform(0.
       1, 0.99)
       moisture=random.randint(0
       ,110)
       temperature=random.randin
       t(-20,125)
       Humid=random.randint(0,1
```

```
        00)
        data = {'animal':animal,'moisture': moisture, 'temperature' :
 temperature, 'Humid': Humid }
        #print data
        def myOnPublishCallback():
            print ("Published Soil Moisture = %s %%"
 %moisture,"Temperature = %s C" % temperature, "Humidity = %s %%"
 % Humid,'animal = %s'%animal, "to IBM Watson")
            if
                animal>
                0.98:
                print("
                Alert")
        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()
```

GitHub Link

IBM-EPBL/IBM-Project-26364-1660025592: IoT Based Smart Crop Protection System for Agriculture (github.com)

PROJECT DEMO VIDEO LINK

https://drive.google.com/file/d/1uvXQruvCkL7VyCSF9UOxLOn_TK7OpqAD/view?usp=drivesdk