DATE :	18-NOVEMBER-2022
TEAM ID :	PNT2022TMID51798
PROJECT NAME :	IoT Based Smart Crop Protection System For Agriculture

PROJECT REPORT

1.INTRODUCTION

1.1   PRJECT OVERVIEW

- **Internet of Things Smart technology enables new digital agriculture. Today technology has become a necessity to meet current challenges and several sectors are using the latest technologies to automate their tasks. Advanced agriculture, based on Internet of things technologies, is envisioned to enable producers and farmers to reduce waste and improve productivity by optimizing the usage of fertilizers to boost the efficiency of plants. It gives better control to the farmers for their livestock, growing cops, cutting costs, and resources.**

- **Despite the perception people may have regarding the agricultural process, the reality is that today's agriculture industry is data – centered, precise, and smarter than ever. The rapid emergence of the Internet of Things based technologies redesigned almost every industry including "smart agriculture" which moved the industry from statistical to quantitive approaches. Such revolutionary changes are shaking the existing agriculture methods and creating new opportunities along a range of challenges. Based on this thorough review, we identify current and future trends of IoT in agriculture and highlight potential research challenges.**

- **Challenge in agriculture is to cultivate the crops in the farm and to deliver the crop to the end consumer with the best possible price. Monitoring the environmental cause play a vital role, A traditional approach is measuring these factor manually by an individual and these manual measurements are being**

checked each and every day. In this project we use IOT sensor and Cloud to monitor the soil fertility, temperature, humidity for betterment of the agricultural yield. The combination of IoT and cloud has promoted the development of agriculture and made them to realize smart agriculture and effective way to solve the issue concerning agriculture

1.2   PURPOSE

- An intelligent crop protection system helps the farmers in   protecting the crop fromthe animals and birds which destroythe 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

- As new technologies has been introduced and utilized in modern world, there is a need to bring advancement in the field of agriculture also. Various Researches have been undergone to improve crop cultivation and have been widely used. In order to improve the crop productivity efficiently, it is necessary to monitor the environmental conditions in and around the field. The parameters that has to be properly monitored to enhance the yield are soil characteristics, weather conditions, moisture, temperature, etc. ,Internet of Things (IOT) is being used in several real time applications. The introduction of IOT along with the sensor network in agriculture refurbish the traditional way of farming. Online crop monitoring using IOT helps the farmers to stay connected to his field from anywhere and anytime. Various sensors are used to monitor and collect information about the field conditions. Collectively the about the farm condition is sent to the farmer through GSM technology.

- Presence of air pollutant and uncontrolled release of radioactivity to the environment due to human activities, leads us to consider how important are the environmental parameters monitoring to ensure public safety. To remotely monitor, in real time, the air quality and the ionizing radiation level of the surrounding environment, an IoTbased (Internet of Things) system which is composed of a set of interconnected equipment which is able to monitor and collect data from the environment, was designed and implemented at the Madagascar Institute for Nuclear Sciences and Technologies (INSTNMadagascar). The system consists of i) several sensing nodes based on esp8266 microcontroller equipped with sensors measuring environmental parameters i.e. air quality and ionizing radiation, ii) a central server for sensor data processing, event notification, real- time analytics and data storage and finally iii) a nearly real-time web and android applications that operate from remote computers and mobile phones for remote access. The system was designed to be easily scaled-up to measure as well other parameters of interest. In this paper, the overall description of the system's architecture and software components is shown and workability proved.

- Smart Agriculture now-a-days reducing various problems in farming. Farmers get required information and relative data to monitor the plants growth by the use of "INTERNET OF THINGS (IOT)", which connects the different sensors, actuators and other embedded devices. To provide quality crops based on soil nutrient level and its moisture content along with Ph. factor, also been maintained. Hence, in this project all those parameters are detected and controlled with the help of micro controller. Humidity sensor to detect the moisture content, where colour sensor is used to determine the percentage of soil nutrients (N2, P4 &K). It will analyse soil nutrient content present in soil at real time and Ph. sensor is used to determine the Ph value of the soil. Monitoring of these it provides the proper fertility to the soil depending upon the soil nutrients. GSM is used to display the information to the farmers. Thus it reduces the growing of husk in terms of wastage and thereby getting good quality and healthy crops.

2.2 <u>REFERENCES</u>

- G. Naveen Balaji, V. Nandhini, S. Mithra, N. Priya , R. Naveena (2018) - IOT Based Smart Crop Monitoring in Farm LanD
- Tambasafidy Francisco Pascal Elias, Ratongasoandrazana Jean Baptiste, Andrianiaina Hery, Rabesiranana Naivo, Rajaobelison Joel (2019) presents - Iot Based Environmental And Ionizing Radiation Monitoring System

- **Asadi Venkata Mutyalamma,Goplsetty Yoshitha,althi Dakshyani,Bachala Venkata Padmavathi (2020) presents - Smart Agriculture to Measure Humidity, Temperature, Moisture, Ph. and Nutrient Values of the Soil using IoT**
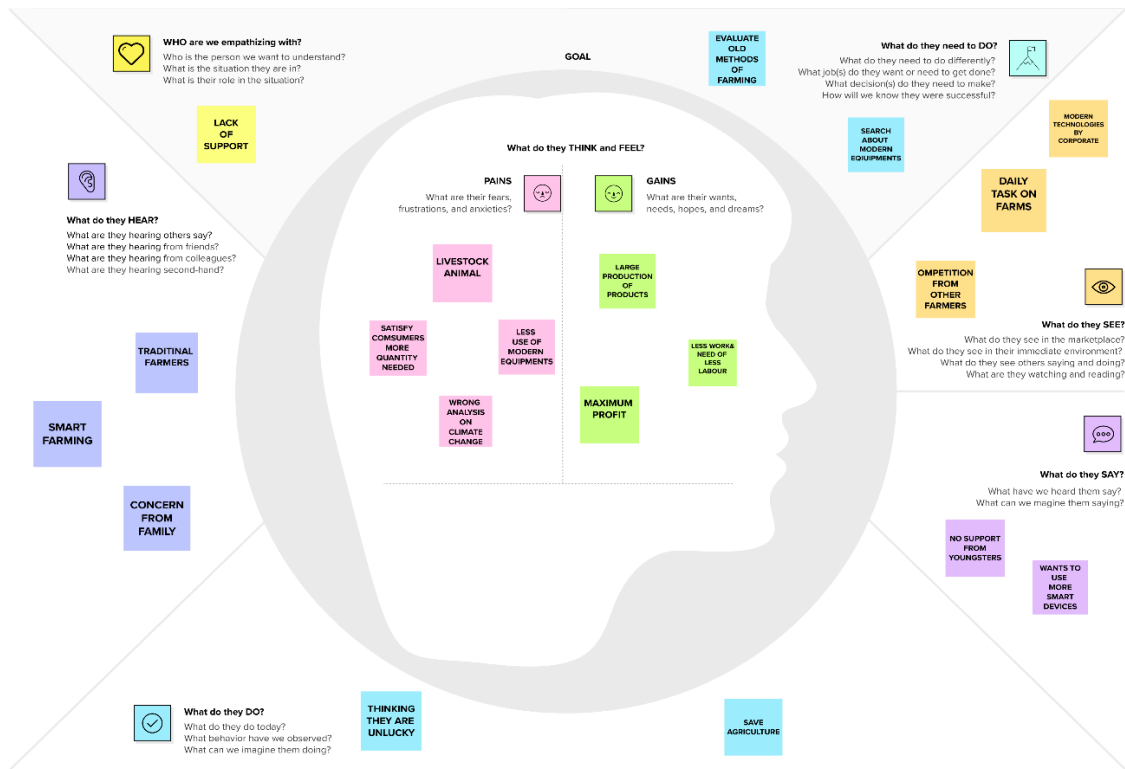
2.3 PROBLEM DEFINITION STATEMENT

- **Smart Crop Protection System based on IoT can monitor soil moisture and climaticconditions to grow and yield a good crop.**
- **The farmer can also get the realtimeweather forecasting data by using externalplatforms like Open WeatherAPI**
- **Farmer is provideda mobile app using whichhe can monitor the temperature,humidity and soil moistureparameters along with weather forecasting details.**
- **Based on all the parameters he can water his crop by controlling the motors usingthe mobile application.**
- **Even if the farmer is not present near his crop he can water his cropby controllingthe motors using the mobile application from anywhere.**
- **Here we are using theOnline IoT simulatorfor getting the Temperature, Humidityand Soil Moisture values.**

3.IDEATION & PROPOSED SOLUTION

3.1 EMPATHY MAP CANVAS

IOT BASED SMART CROP PROTECTION SYSTEM FOR AGRICULRURE

WHO are we empathizing with?
Who is the person we want to understand?
What is the situation they are in?
What is their role in the situation?

GOAL

EVALUATE OLD METHODS OF FARMING

What do they need to DO?
What do they need to do differently?
What job(s) do they want or need to get done?
What decision(s) do they need to make?
How will we know they were successful?

LACK OF SUPPORT

What do they HEAR?
What are they hearing others say?
What are they hearing from friends?
What are they hearing from colleagues?
What are they hearing second-hand?

SEARCH ABOUT MODERN EQUIPMENTS

MODERN TECHNOLOGIES BY CORPORATE

DAILY TASK ON FARMS

What do they THINK and FEEL?

PAINS
What are their fears, frustrations, and anxieties?

GAINS
What are their wants, needs, hopes, and dreams?

LIVESTOCK ANIMAL

LARGE PRODUCTION OF PRODUCTS

OMPETITION FROM OTHER FARMERS

What do they SEE?
What do they see in the marketplace?
What do they see in their immediate environment?
What do they see others saying and doing?
What are they watching and reading?

SATISFY COMSUMERS MORE QUANTITY NEEDED

LESS USE OF MODERN EQUIPMENTS

LESS WORK& NEED OF LESS LABOUR

TRADITINAL FARMERS

WRONG ANALYSIS ON CLIMATE CHANGE

MAXIMUM PROFIT

SMART FARMING

What do they SAY?
What have we heard them say?
What can we imagine them saying?

CONCERN FROM FAMILY

NO SUPPORT FROM YOUNGSTERS

WANTS TO USE MORE SMART DEVICES

What do they DO?
What do they do today?
What behavior have we observed?
What can we imagine them doing?

THINKING THEY ARE UNLUCKY

SAVE AGRICULTURE

3.2 IDEATION & BRAINSTORMING

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

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**
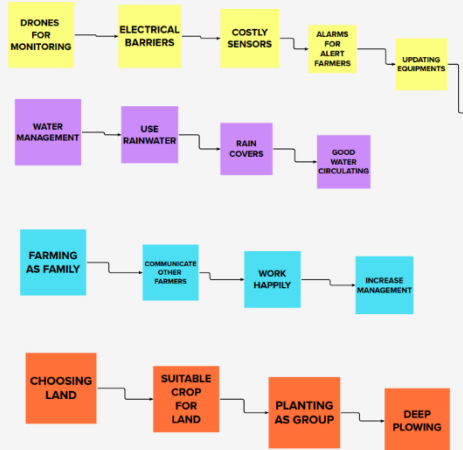Use the Facilitation Superpowers to run a happy and productive session.

Open article →

PROBLEM

ATTACK OF ANIMALS AND CHANGE IN TEMPERATURE,HUMIDTY AND CLIMATE

Key rules of brainstorming
To run a smooth and productive session

Stay in topic.
Defer judgment.
Go for volume.

Encourage wild ideas.
Listen to others.
If possible, be visual.

JENISH J

- DRONES FOR FERTILIZATION
- INCREASE MANPOWER
- UPDATING EQUIPMENTS
- CHOOSING LAND
- SUITABLE CROP FOR LAND
- COSTLY SENSORS

ISHFAN S

- MORE SENSORS
- TIME MANAGEMENT
- TRAIN ANIMALS TO SAVE CROPS
- GOOD WTER CIRCULATING
- SCARE ANIMALS

JEBALIN Y S

- FARMING AS FAMILY
- BIRD NETS
- CLEAR RESIDUES
- PROPER WATERING
- WORK HAPPILY

MANISHWARAN P

- WATER MANAGEMENT
- DRONES FOR MONITORING
- ELECTRICAL BARRIERS
- USE RAINWATER
- COMMUNICATE OTHER FARMERS

SHIVOLIN MOL G

- WATER QUALITY
- DEEP PLOWING
- RAIN COVERS
- PLANTING AS GROUP
- ALARMS FOR ALERT FORMER
- CLOUD SERVICES

DRONES FOR MONITORING → ELECTRICAL BARRIERS → COSTLY SENSORS → ALARMS FOR ALERT FARMERS → UPDATING EQUIPMENTS

WATER MANAGEMENT → USE RAINWATER → RAIN COVERS → GOOD WATER CIRCULATING

FARMING AS FAMILY → COMMUNICATE OTHER FARMERS → WORK HAPPILY → INCREASE MANAGEMENT

CHOOSING LAND → SUITABLE CROP FOR LAND → PLANTING AS GROUP → DEEP PLOWING

Importance

ch of these
s could get
without any
uity or cost,
would have
ost positive
mpact?

- WORK HAPPILY
- COMMUNICATE OTHER FARMERS
- ALARMS FOR ALERT FARMERS
- COSTLY SENSORS
- PLANTING AS GROUP
- DRONES FOR MONITORING
- CLOUD SERVICSE
- ELECTRICAL BARRIERS
- WATER MANAGEMENT
- USE RAINWATER
- SUITABLE CROP FOR LAND
- CHOOSING LAND

TIP
Participants can use their cursors to point at where sticky notes should go on the grid. The facilitator can confirm the spot by using

---

A Share the mural
Share a view link to the mural with stakeholders to keep them in the loop about the outcomes of the session.

B Export the mural
Export a copy of the mural as a PNG or PDF to attach to emails, include in slides, or save in your drive.

Keep moving forward

Strategy blueprint
Define the components of a new idea or strategy.
Open the template →

Customer experience journey map
Understand customer needs, motivations, and obstacles for an experience.
Open the template →

Strengths, weaknesses, opportunities & threats
Identify strengths, weaknesses, opportunities, and threats (SWOT) to develop a plan.
Open the template →

💬 Share template feedback

3.3 PROPOSED SOLUTION

S.No.	Parameter	Description
1.	Problem Statement(Problem to be solved)	Develop an efficient system & an application that can monitor and alert the users(farmers)
2.	Idea/Solution description	This product helps the field in monitoring the animals other disturbance. In several areas, the temperature sensors will be integrated to monitor the temperature & humidity.If in any area feel dry or wetless is detectedby admins, will be notified along with the location in the web application Access all the sensor remotely and change the sensors
3.	Novelty/Uniqueness	Fastest alerts to the farmers.The increasing demand for quality food.Providing good quality product forcustomer.Avoide all the unwanted products andanimals.
4.	Social Impact/Customer Satisfaction	Easy installation and provide efficientresultsthe optimisation of all the processes related to agriculture and livestock- rearing increases production rates.weather forecasts and sensors that measure soil moisture mean watering only when necessary and for the rightlength of time.
5.	Business Model(Revenue Model)	As the product usage can be understood by everyone, it is easy for them to use itproperly for their safest organizationThe product is advertised all over the platforms. Since it is economical, even helps small scale farming land from disasters.
6.	Scalability of the Solution	The role of crop protection in Integrated system is, additional to all the other methods, to efficiently control the residual harmful species, with minimal use of selected pesticide.

3.4 PROBLEM SOLUTION FIT

Define CS, fit into CL	1. CUSTOMER SEGMENT(S) **CS**	6. CUSTOMER LIMITATIONS EG. BUDGET, DEVICES **CL**	5. AVAILABLE SOLUTIONS PLUSES & MINUSES **AS**	Explore AS, differentiate
	• Farmers who trying to protect crops from various problems	• Limited supervision. • Limited financial constrains. • Lack of man power.	• Automation in irrigation. • CCTV camera to monitor and supervise the crops. • Alarm system to give alert while animals attacks the crops.	

Focus on PR, tap into BE, understand RC	2. PROBLEMS / PAINS + ITS FREQUENCY **PR**	9. PROBLEM ROOT / CAUSE **RC**	7. BEHAVIOR + ITS INTENSITY **BE**	Focus on PR, tap into BE, understand RC
	• Crops are not irrigated properly. • Improper maintenance of crops. • Lack of knowledge among farmers in usage of fertilizers and hence crops are affected. • Requires protecting crops from Wild animals attacks, birds and pests.	• Due to insufficient labour forces. • Due to various environmental factors such as temperature climate, topography and soil quality which results in crop destruction. • Due to high ammonia, urea, potassium and high PH level fertilizers. • Crops are damaged and it affects growth.	• Asks suggestions from surrounding peoples and implement the recent technologies. • Consumes more time in crop land. • Searching for an alternative solution for an existing solution.	

Identify strong TR & EM	3. TRIGGERS TO ACT **TR**	10. YOUR SOLUTION **SL**	8. CHANNELS of BEHAVIOR **CH**	Extract online & offline CH of BE
	• By seeing surrounding crop land with installing machineries. • Hearing about innovative technologies and effective solutions. **4. EMOTIONS** BEFORE / AFTER **EM** • Mental frustrations due to insufficient production of crops. • Felt smart enough to follow the available technologies with minimum cost.	Moisture sensor is interfaced with Arduino Microcontroller to measure the moisture level in soil and relay is used to turn ON and OFF the motor pump for managing the excess water level. It will be updated to authorities through IOT. Temperature sensor connected to microcontroller is used to monitor the temperature in the field. The optimum temperature required for crop cultivation is maintained using sprinklers. IOT based fertilizing methods are followed, to minimize the negative effects on growth of crops while using fertilizers. Image processing techniques with IOT is followed for crop protection against animal attacks.	ONLINE • Using different platforms /social media to describe the working and uses of smart crop protection device. OFFLINE • Giving awareness among farmers about the application of the device.	

4. REQUIREMENT ANALYSIS

4.1 FUNCTIONAL REQUIREMENTS

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 REQIREMENNTS

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 DIAGRAM
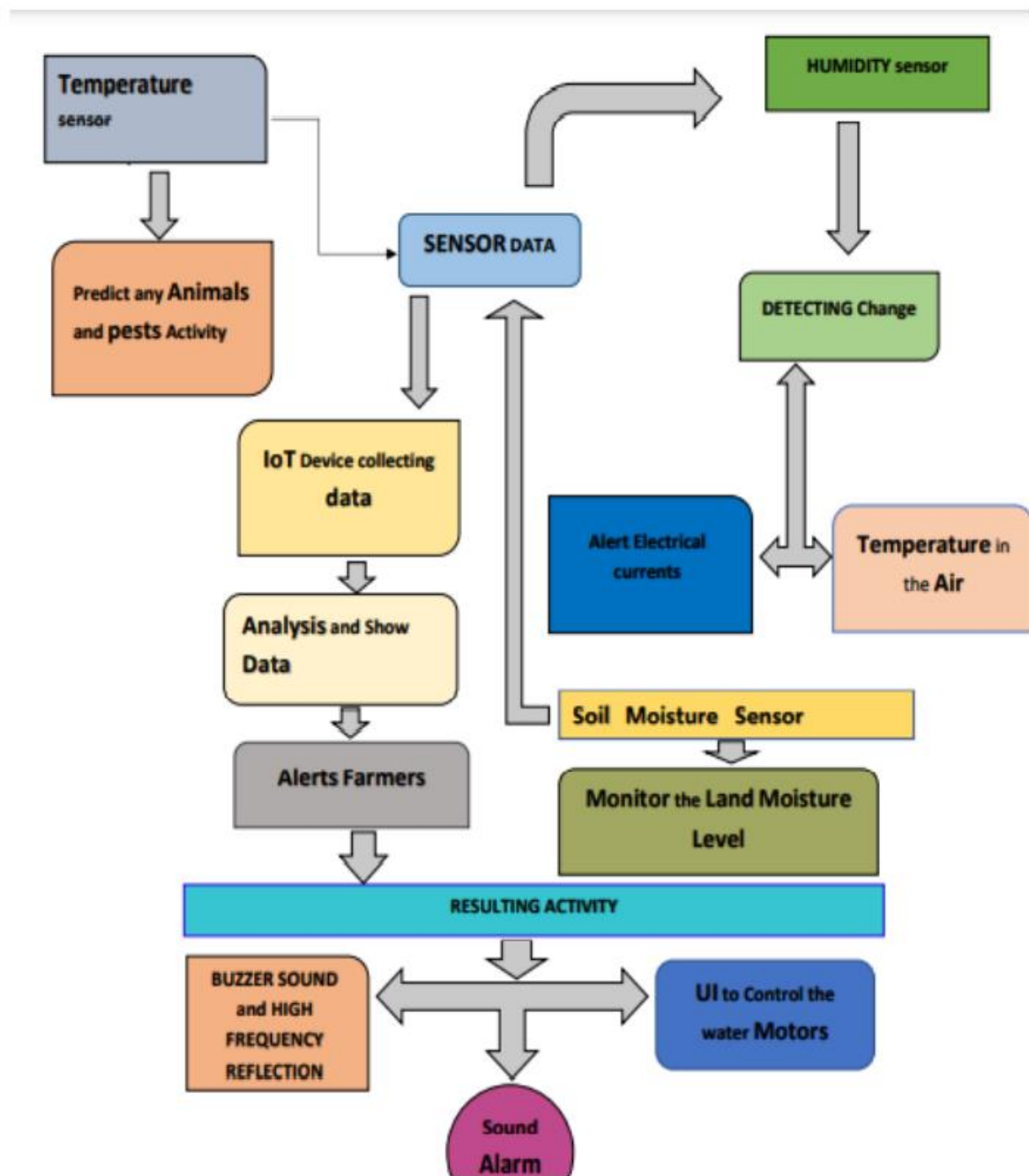
5.2 USER STORIES

User Type	Functional requirement (Epic)	User Story number	User Story/Task	Acceptance criteria	Priority	Release
Customer (Mobil 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 email id and password	I can receive confirm email & click confirm	High	Sprint 1
	Login	USN-3	User can log into the application by entering email & password	I can login to my 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 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 given by the device	High	Sprint 3
Customer	Working	USN-1	User act according to the alert given by the device	I can get the data work according to it	High	Sprint 3
		USN-2	User turns ON the water motors/Buzzer/Sound Alarm when occur the disturbance on field.	I can get the data work according to it		Sprint 4
Customer care Executive	Action	USN-1	User solve the problem when some faces any usage issues	I can solve the issues when some one fails to understanding the procedure	High	Sprint 4
Administration	Administration	USN-1	User store every information	I can store the gained information	High	Sprint 4

6.PROJECT PLANNING AND 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.	25 September 2022
Prepare Empathy Map	Empathy Map is a visualization tool which can be used to get a better insight of the customer	19 September 2022
Ideation-Brainstorming	Brainstorming is a group problem solving session where ideas are shared, discussed and organized among the team members.	20 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.	17 September 2022
Problem Solution Fit	This helps us to understand the thoughts of the customer their likes, behaviour, emotions etc.	02 October 2022
Proposed Solution	Proposed solution shows the current solution and it helps is going towards the desired result until it is achieved.	18September 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.	29 September 2022
Customer Journey	It helps us to analyse from the perspective of a customer, who uses our project.	9 October 2022
Functional Requirement	Here functional and nonfunctional requirements are briefed. It has specific features like usability, security, reliability, performance, availability and scalability.	16 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.	14 October 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.	15 October 2022
Prepare Milestone & Activity List	It helps us to understand and evaluate our own progress and accuracy so far.	29 October 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.	In Progress

6.2 SPRINT DELIVERY PLAN

| Sprint	Functional Requirement (Epic)	User Story Number	User Story / Task	Story Points	Priority	Team Members
Sprint-1	CLARIFAI	USN-1	Sensors and wi-fi module with python code To create application in clarifai and run the python code	2	High	JENISH J ISHFAN S MANISHWARAN P JEBALIN Y S SHIVOLINMOL G
Sprint-2	SOFTWARE	USN-2	IBM watson iot platform , workflows for iot scenarios using node-red	2	High	JENISH J ISHFAN S MANISHWARAN P JEBALIN Y S SHIVOLINMOL G
Sprint-3	SOFTWARE	USN-3	Connecting iot device with object storage	2	high	JENISH J ISHFAN S MANISHWARAN P JEBALIN Y S SHIVOLINMOL G
Sprint-4	WEB UI	USN-4	To make the user to interact with software	2	high	JENISH J ISHFAN S MANISHWARAN P JEBALIN Y S SHIVOLINMOL G

7.CODING & SOLUTIONING

7.1 FEATURE 1
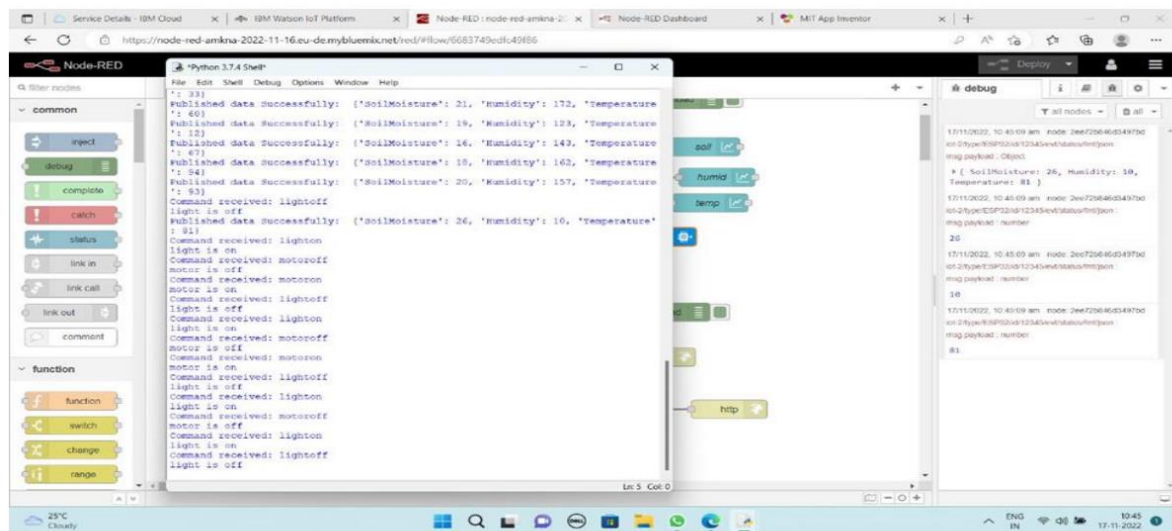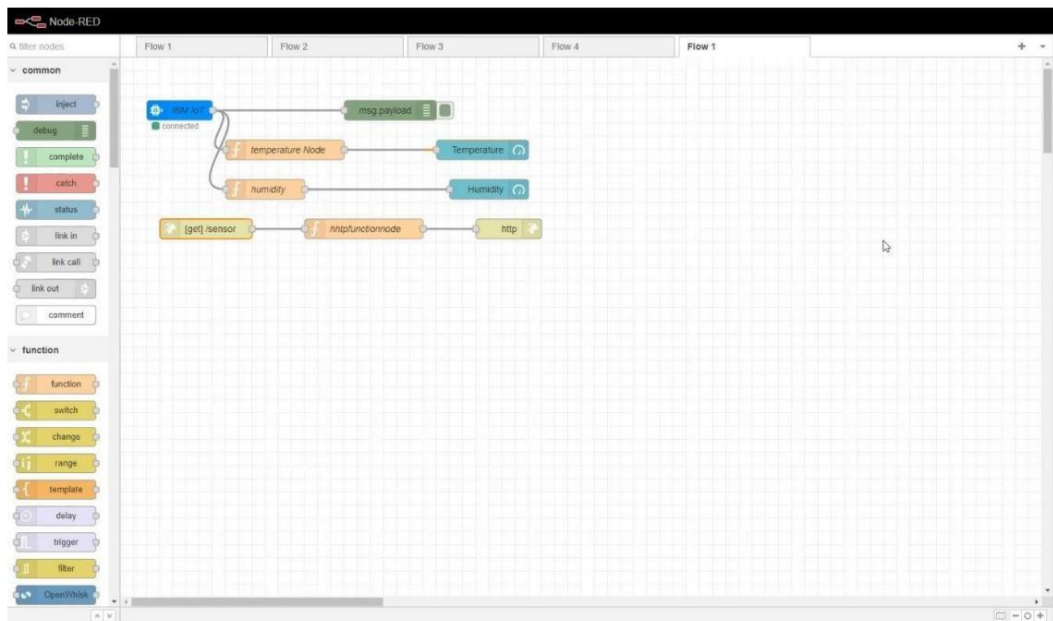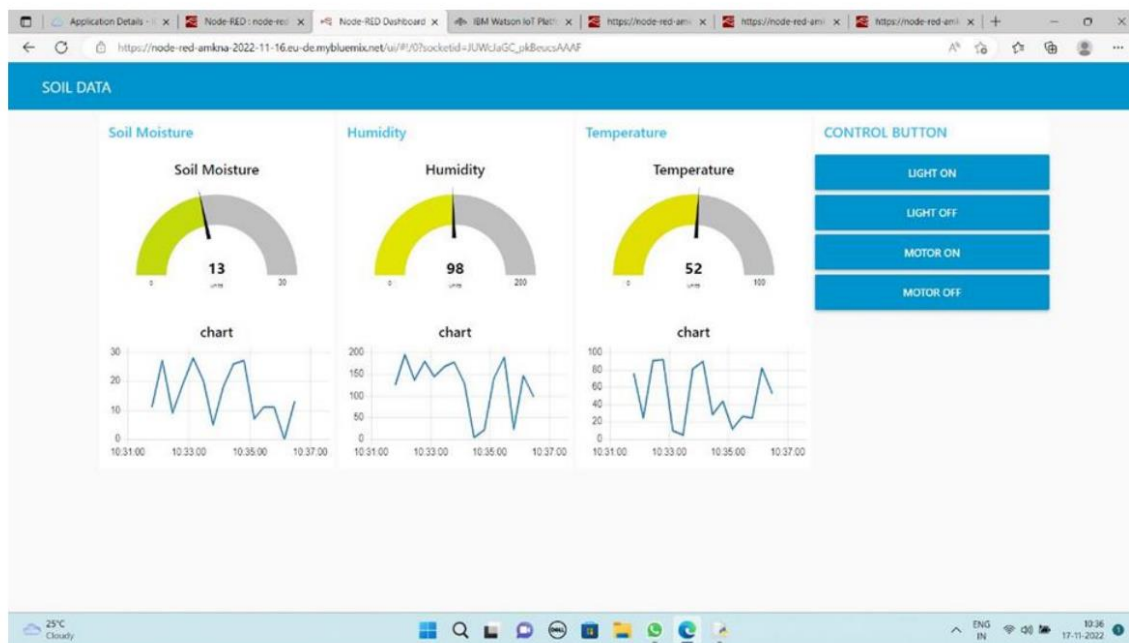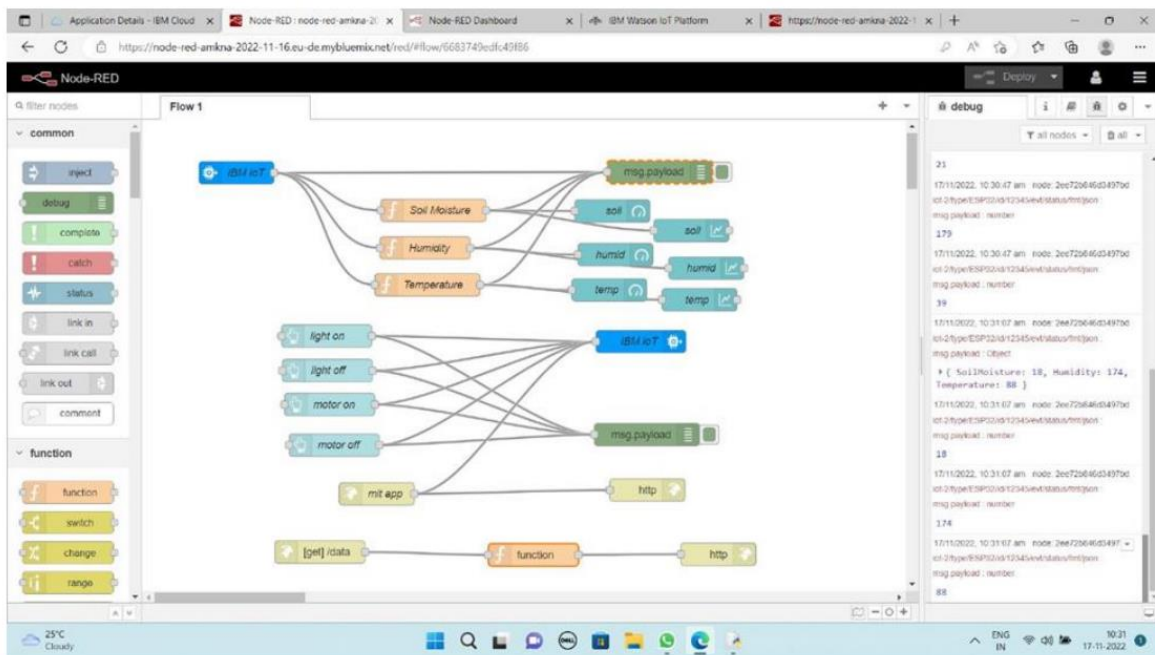
7.2 FEATURE 2
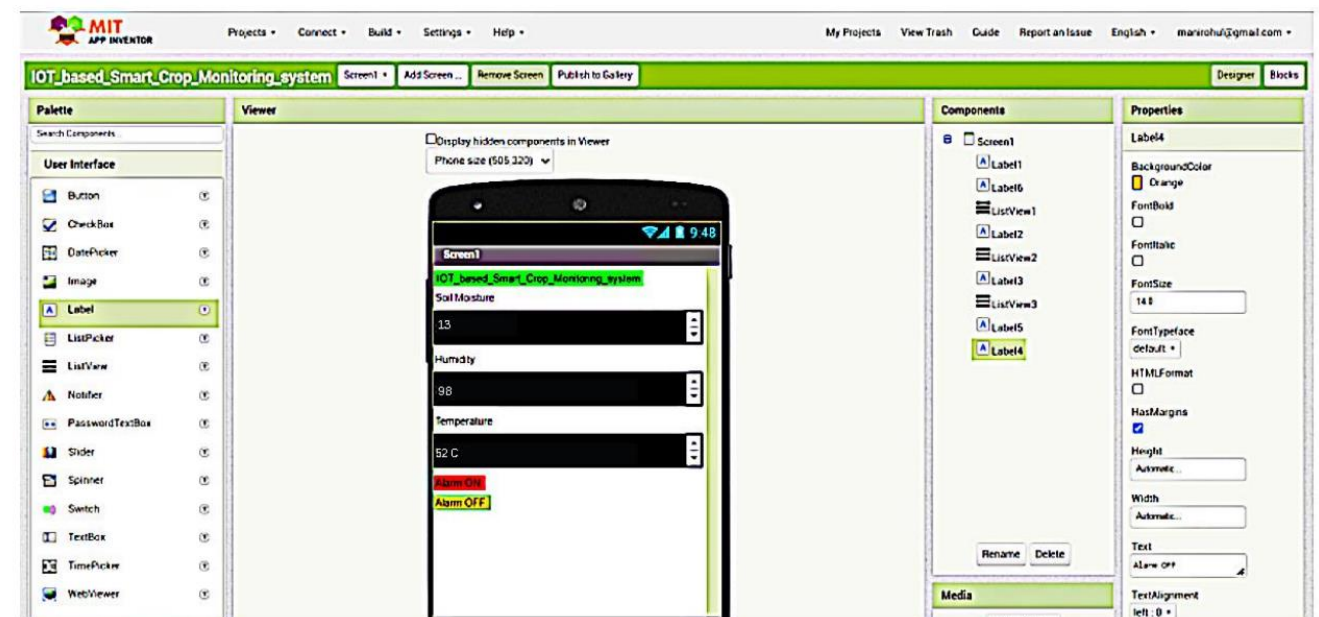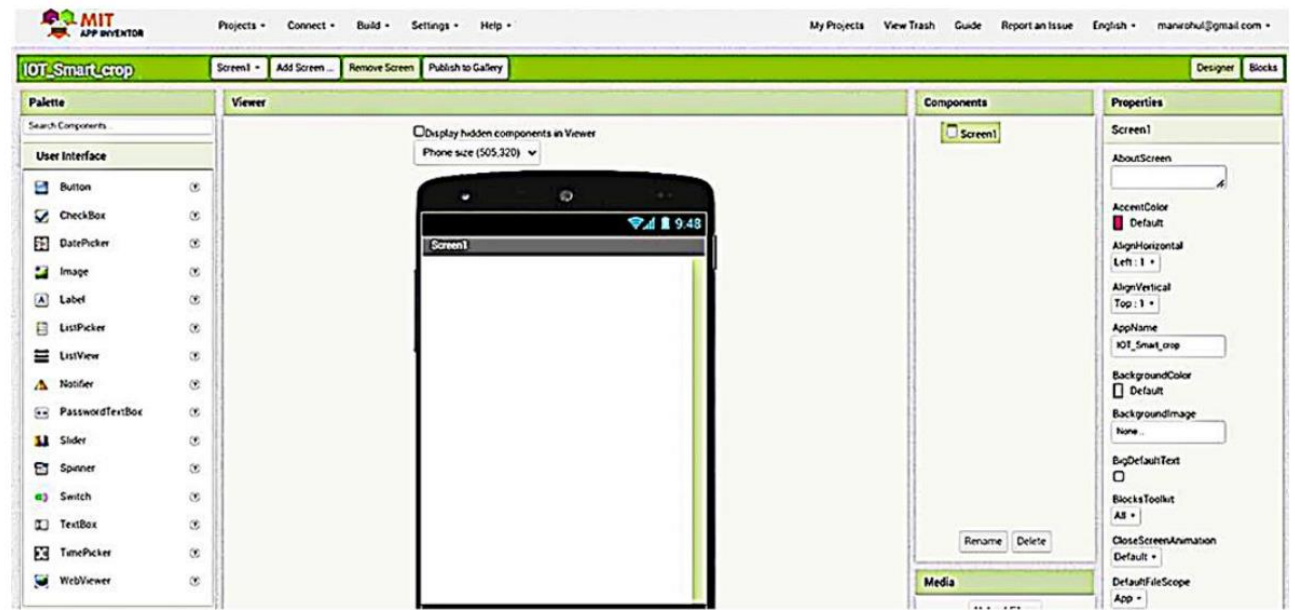
8.TESTING

DEFECT ANALYSIS

Resoulution	Severity 1	Severity 2	Severity 3	Severity 4	Sub total
By design					
Duplicate					
External					
Fixed					
Not reported					
skipped					
Won't Fix					
TOTAL					

TEST CASE ANALYSIS

section	Total cases	Not tested	Fail	Pass
Print Engine	5	0	1	4
Security	3	0	2	3
Outsource Shipping	4	0	0	4
Exception Reporting	2	0	0	2
Final Report Output	5	0	2	3
Client Application	46	0	2	44
Version Control	3	0	1	2

9.RESULT

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

10.ADVANTAGES & DISADVANTAGES

10.1 ADVANTAGES

* All the data like climatic conditions and changes in them, soil or cropconditions everything can be easily monitored

* Risk of crop damage can be lowered to a greater extent

* Many difficult challenges can be avoidedmaking the processautomated and thequality of crops can be maintained

* The process included in farming can be controlled using the web applicationsfrom anywhere, anytime.

10.2 DISADVANTAGES

- **Smart Crop Protection requiresinternet connectivity continuously, but rural partscan not fulfill this requirement**.
- **Any faults in the sensors can cause great loss in the agriculture, due to wrong recordsand 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 usingNode Red and IBM CloudPlatform. The Systemhas high efficiency and accuracy in fetching the live data of temperature and soil moisture.The IoT based smart farming System being proposed via this project will assist farmers in increasing theagriculture yield and take efficient care of food production as the System will always provide helpinghand to farmers for gettingaccurate live feed of environmental temperature and soil moisture with more than 99% accurate results. Therefore, the project proposesa thought of consolidating the most recentinnovation 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 good and more farming in less time, for betterment of the crops and reducingthe usage of extravagant resourceslike electricity and water IoT can be implemented in most of the places

13.APPENDIX

GITHUB LINK : IBM-Project-4335-1658728789/Brainstorm &Idea Prioritization.pdf at main · IBM-EPBL/IBM-Project-4335-1658728789 (github.com)

SOURCE CODE : IBM-Project-4335-1658728789/final submisssion at main · IBM-EPBL/IBM-Project-4335-1658728789 (github.com)