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# **INTRODUCTION**

## **1. INTRODUCTION**

### **1.1 PROJECT OVERVIEW**

**SMART CROP PROTECTION SYSTEM FOR AGRICULTURE** is an important method to protect the crops from danger. The crops in the field are damaged severely by pests, insects, wild animal attacks as well as the major issues due to the natural climate and the weather conditions. In order to overcome this problem the new technology has been raised which is named as IoT (Internet of Things). The smart crop protection system is done with the help of the Arduino system. The IoT can be used to measure the soil moisture, temperature and humidity conditions for agriculture and crop protection using IoT Watson service. IoT is a network that connects physical objects or things embedded with electronics, software and sensor through network connectivity that collects and transfers data using cloud for communication. Data is transferred through the internet without human to human or human to computer interaction.

### **1.2 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 the 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.

# **LITERATURE SURVEY**

## **2 LITERATURE SURVEY**

### **2.1 EXISTING PROBLEM**

- Agriculture is the backbone of the economy but because of animal interference in agricultural lands, there will be huge loss of crops. This article provides a comprehensive review of various methods adopted by farmers to protect their crops. The article also discusses the use of modern technology in agriculture. Finally, this article reviews smart crop protection systems using sensors, microcontrollers and GSM modules.

### **2.2 REFERENCES**

[1] Artur Frankiewicz; Rafał Cupek.” Smart Passive Infrared Sensor - Hardware Platform  
“Year: 2013 IECON 2013 - 39th Annual Conference of the IEEE Industrial Electronics Society Pages: 7543 – 7547

[2] Discant, A. Rogozan, C. Rusu and A. Bensrhair, “Sensors for Obstacle Detection” 2007 30th International Spring Seminar on Electronics Technology (ISSE), Cluj-Napoca, 2007, pp. 100-105. Doi: 10.1109/ISSE.2007.4432828 Volume:01 Pages:859-862, DOI:10.1109/ICCSNT.2015.7490876, IEEE Conference Publications.

### **2.3 PROBLEM STATEMENT DEFINITION**

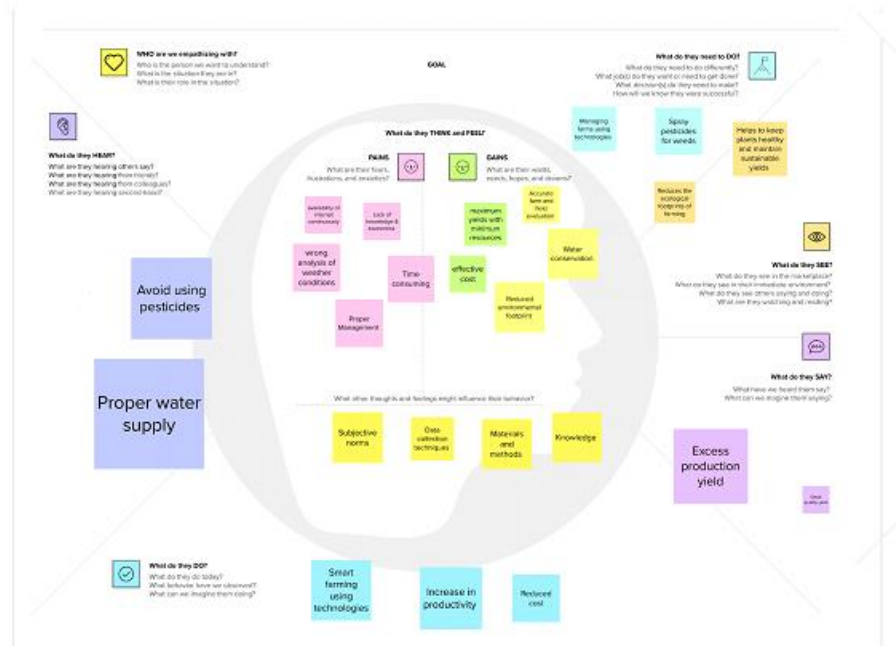
- Smart crop protection system based on IoT can monitor the soil moisture and climatic conditions to grow and yield a good crop.
- The farmer can also get real-time weather forecasting data by using external platforms like Open Weather API.
- Farmer can provide a mobile app using by which he can monitor 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.
- With the help of the humidity and temperature sensor the field can be fully monitored and controlled by the user.

## **IDEATION AND PROPOSED SOLUTION**

### 3. IDEATION AND PROPOSED SOLUTION

#### 3.1 EMPATHY MAP CANVAS

Empathy Map Canvas:



#### 3.2 IDEATION AND BRAINSTORMING

What do they think and feel?

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

What do they hear?

Smart farming is about using the new technologies which have arisen at the dawn of the Fourth Industrial Revolution in the areas of agriculture and cattle production to increase production quantity and quality, by making maximum use of resources and minimizing the environmental impact .

What do they see?

Smart farming is a management concept focused on providing the agricultural industry with the infrastructure to leverage advanced technology – including big data, the cloud and the internet of things (IoT) – for tracking, monitoring, automating and analyzing operations.

What do they say and do?



The aim of this technology is to make the most of all the data collected by various tools, by converting them into real sources of information to then define ways of simplifying agricultural work. It also allows for accurate and predictive analysis of all situations that may affect the farms, such as weather conditions (temperature, humidity, etc.) and sanitary or economic situations, for example. This makes it easier to organize the supply of energy, water, livestock feed and fertilizer.

In its most advanced form, smart farming facilitates the exchange of information between different farms, creating a real network of connected farms accessible from a smartphone.

### 3.3 PROPOSED SOLUTIONS

S.No	Parameters	Description
1	Problem Statement (Problem to be solved)	Agriculture is the backbone of a country. Approx 58% people depend on agriculture and the GDP of the Indian economy contributed by agriculture is about 38%. It depends on the monsoon and rainfall. Due to overpopulation deforestation occurs and therefore agricultural land becomes reduced, and the rate of crop production is decreased. Similarly, the crops that are damaged by pests and other microorganisms. On the other hand, the crops in the fields that are also damaged by wild animals such as buffalo, elephants and reptiles such as rats, snakes. etc. Inorder to overcome this and to protect the crops, we need to invent a modern smart crop protection system. Smart crop protection wants to help the farmers from the endanger.
2	Idea / Solution description	Inorder to overcome the issues facing in crop protection a new smart crop protection should be made. To overcome this challenge, we have proposed smart crop protection in agriculture. This system can help the farmers to protect the crops from crop damage. By using the different sensors and microcontrollers the signals are transmitted to the cloud which in turn can detect the hazards causing to the crops. Thus, the system will help to protect the crops from the hazardless
3	Novelty / Uniqueness	<ul style="list-style-type: none"> <li>❖ Due to the crop monitoring with the help of IoT which helps to increase the productivity.</li> <li>❖ The sensors used in the IoT system which can helps to detect the crops real-time.</li> <li>❖ The GPS which can helps to track the location and the area of the fields full time.</li> <li>❖ The motion sensors used in the system which will helps the farmers to detect whether the animals are entered or not.</li> <li>❖ The buzzers used in the system which will helps to make sure that any smoke exists due to any fire.</li> </ul>

<b>4</b>	Social Impact / Customer Satisfaction	<ul style="list-style-type: none"> <li>❖ It helps the farmers to maximize the productivity of crops.</li> <li>❖ Remote management provides transparency and real-time crop monitoring.</li> <li>❖ With the help of sensors, it collects vital information like crop health, temperature etc.</li> <li>❖ It helps the farmers for thorough marketing and business development.</li> <li>❖ The smart crop protection system may minimize the human work and effort.</li> </ul>
<b>5</b>	Business Model (Revenue Model)	<ul style="list-style-type: none"> <li>❖ Agriculture is the main income of the economy.</li> <li>❖ The smart crop protection system which can be controlled and monitored by the websites and the internet facility.</li> <li>❖ The agricultural products that are exported from the country which may be based upon the commissions involved.</li> </ul>
<b>6</b>	Scalability of the Solution	<ul style="list-style-type: none"> <li>❖ The method focuses on the sensors used in the system.</li> <li>❖ It increases the number of connected devices,users,applications and analytical capabilities</li> </ul>

### 3.4 PROBLEM SOLUTION FIT

Define CS, fit into C	<b>1. CUSTOMER SEGMENT(S)</b> Farmers and common people are the customers. <b>CS</b>	<b>6. CUSTOMER CONSTRAINTS</b> The crop protection methods which consists of the constraints such as the method of cultivation, increase in crop attacks, improper climate changes, irrigation system, cost investment. <b>CC</b>	<b>5. AVAILABLE SOLUTIONS</b> Smart crop protection to protect the crops, smart irrigation system, smart pest control and geo fencing for crop protection system. <b>AS</b>	Explore AS, differe
	<b>2. JOBS-TO-BE-DONE / PROBLEMS</b> <b>J&amp;P</b> <ul style="list-style-type: none"> <li>One of the major problem faced by the farmers is that the crops that are damaged by the wild animals.</li> <li>Due to the diseases and the pest attacks which will reduce the crop yield and increases the need of food production.</li> </ul>	<b>9. PROBLEM ROOT CAUSE</b> <b>RC</b> The major problem faced by the farmers and the common people is that the damages caused to crops due to the sudden change in climatic conditions and the efficiency of the soil is decreased. The productivity of the crop is reduced.	<b>7. BEHAVIOUR</b> <b>BE</b> <ul style="list-style-type: none"> <li>The smart crop protection system should be introduced by which the crop can be protected.</li> <li>The sensors used in the crop protection system will help to know about the source of damage and thus the crops can be protected from damage.</li> <li>The buzzer in the smart crop protection system which can be used to detect whether any attacks of animals happened in the crop field.</li> <li>Using the smart crop protection system the farmers and the people can work in the real time.</li> </ul>	

<b>3. TRIGGERS</b> Farmers and the people are able to identify the attack against the crops and can clear the problem with the help of the smart protection technology to protect the crops. <b>TR</b>	<b>10. YOUR SOLUTION</b> <b>SL</b> Inorder to overcome the issues we need to propose a crop protecting and monitoring app with the modern technology.	<b>8. CHANNELS of BEHAVIOUR</b> <b>CH</b> <b>8.1 ONLINE</b> People and wellwishers share the posts through social media and spread awareness by forwarding messages about smart crop protection to protect the crops from danger.  <b>8.2 OFFLINE</b>
<b>4. EMOTIONS: BEFORE / AFTER</b> <b>EM</b> Before the system the farmers were highly depressed and worried due to the loss of crops and reduction in crop yield. After using the system the farmers and the customers were happy and highly satisfied by increasing the productivity rate.		Spreading awareness about the system by giving proper training and other programs in order to help farmers and the society.

## 4. REQUIREMENT ANALYSIS

### 4.1 FUNCTIONAL REQUIREMENT

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 Sign up with gmail or mobile number Create a username and password Create a profile.
FR-2	User Confirmation	Accept the user agreement Verify the mail id by entering the mail id.
FR-3	Accessing datasets	The data that are stored in the cloud
FR-4	Interface sensor	The sensors in the field that helps to detect whether the animals entered the field
FR-5	Mobile application	The mobile application which may be used to control and detect the protection of crops.
FR-6	Software used	The software used in the system which may be used to analyse the monitoring of the process.

## 4.2 Non- Functional requirement

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

FR No.	Non-Functional Requirement	Description
NFR-1	Usability	The project is supposed to protect the farm and field from danger.
NFR-2	Security	The security provided in the crop protection is highly protected.
NFR-3	Reliability	The farmers in the field are able to safeguard their lands with the help of technology.
NFR-4	Performance	The performance on the system is more sensitive and better than the system.
NFR-5	Availability	The crops can be protected from danger which may yield high crop production in the real time.
NFR-6	Scalability	The system which uses a high scalability with more efficient to increase the production.

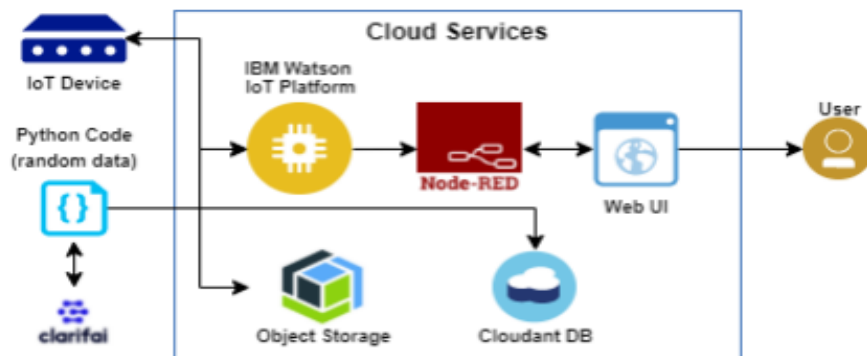
# 5. PROJECT DESIGN

## 5.1 Data flow diagram



## 5.2 SOLUTION AND TECHNICAL ARCHITECTURE

### Technical Architecture:



## 5.3 USER STORIES

Sensors	Passive Infrared Sensor
Display	LCD Display
Perception	sensor nodes, GPS, etc.
Power supply	Rated voltage 6V DC
Sound output	10 cm at 85dB
Tone	Micro controller, Buzzer, Rheostat(10K), GSM based SIM900A, PIEZO Buzzer
Operating Voltage	8V DC
LCD Display	(16*2) (JHD162A)

## 6 PROJECT PLANNING AND SCHEDULING

### 6.1 Sprint Planning and 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, <u>behaviour</u> , 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 <u>i.e</u> 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 <u>analyse</u> from the perspective of a customer, who uses our project.	01 November 2022
Functional Requirement	Here functional and nonfunctional requirements are briefed. It has	01 November 2022

	specific features like usability, security, reliability, performance, availability and scalability.	
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 <u>more well</u> 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

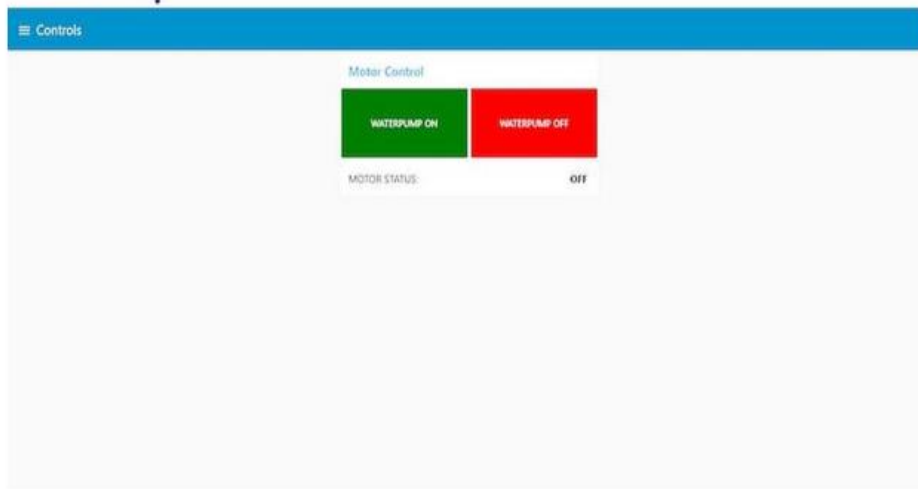
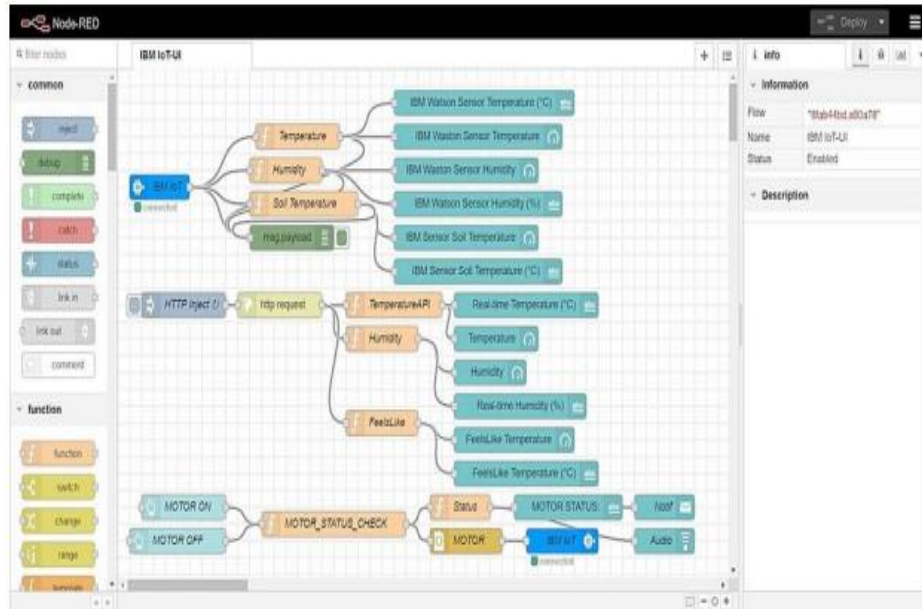
## 6.2 Sprint Delivery Schedule

Sprint	Functional Requirement (Epic)	User Story Number	User Story / Task	Story Points	Priority	Team Members
Sprint -1	Simulation Creation	USN-1	Connect sensors, Arduino and esp8266	2	High	Sharmini, Nanthini, Aiswarya, Thusleema
Sprint -1	Software	USN-2	Develop an application with MIT App inventor (Login page with firebase)	2	High	Sharmini, Nanthini, Aiswarya, Thusleema
Sprint -2	Software and Hardware	USN-3	Connect the hardware with IBM Cloud and API Integration	2	Medium	Sharmini, Nanthini, Thusleema
Sprint -2	Software	USN-4	Application development for project	2	High	Sharmini, Nanthini, Aiswarya
Sprint -3	Software	USN-5	Establishing Node-Red connection	2	Medium	Sharmini, Aiswarya
Sprint -3	Software	USN-6	Connecting application with Node-Red and further	2	High	Sharmini, Nanthini, Aiswarya

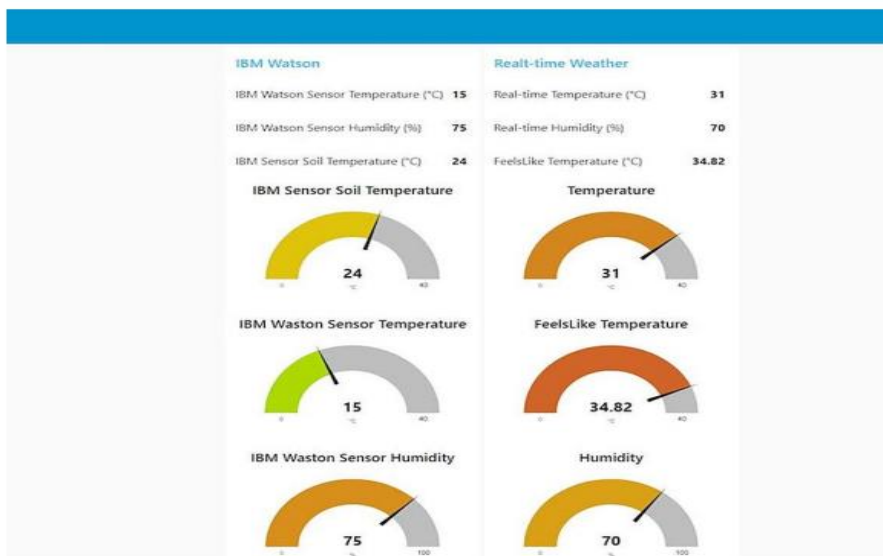
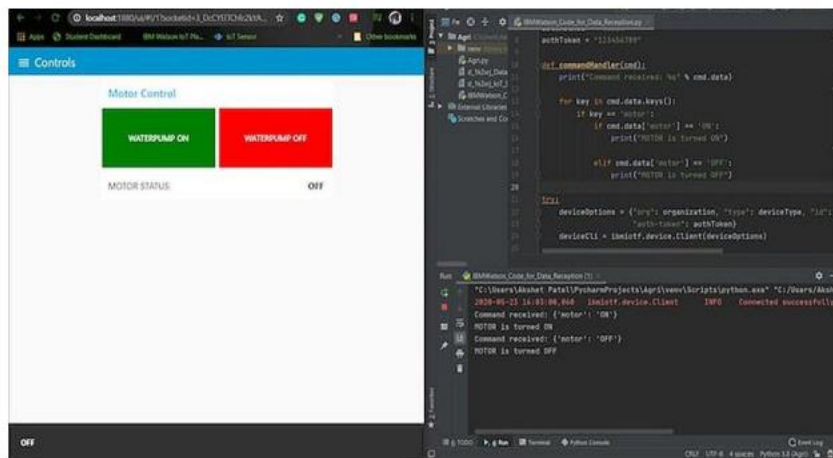
			application development			
Sprint -4	Testing	USN-7	Testing developed application and working model of hardware	2	High	Sharmini, Nanthini, Aiswarya, Thusleema

## 7. CODING AND SOLUTIONING

## 7.1 Feature 1







## 7.2 Feature 2

## Customize the App interface to Display the Values



## 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:

### 10.1 Advantages

- ◆ All the data like climatic conditions and changes in them, or crop conditions can be easily monitored.
- ◆ The 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 web applications from anywhere, anytime.

### 10.2 Disadvantages

- ◆ Smart Crop Protection requires internet connectivity continuously, but rural parts cannot fulfill this requirement.
- 1. Any faults in the sensors can cause great loss in agriculture, due to wrong records and the actions of automated processes.
- 2. 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 CloudPlatform. The System has 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 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 for goods and more farming in less time, for betterment of the crops and reducing the usage of extravagant resources like electricity and water IoT can be implemented in most of the places.

## 13. APPENDIX:

GITHUB LINK: <https://github.com/IBM-EPBL/IBM-Project-48117-1660804654>

SOURCE CODE: <https://github.com/IBM-EPBL/IBM-Project-48117-1660804654/blob/main/FINAL%20DELIVERABLES/Final%20project%20code.pdf>