

FINAL PROJECT REPORT

TEAM ID : PNT2022TMID46534

PROJECT NAME : IOT BASED SMART CROP PROTECTION SYSTEM FOR AGRICULTURE

1. INTRODUCTION:

PROJECT OVERVIEW:

- 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.

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:

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.

REFERENCES:

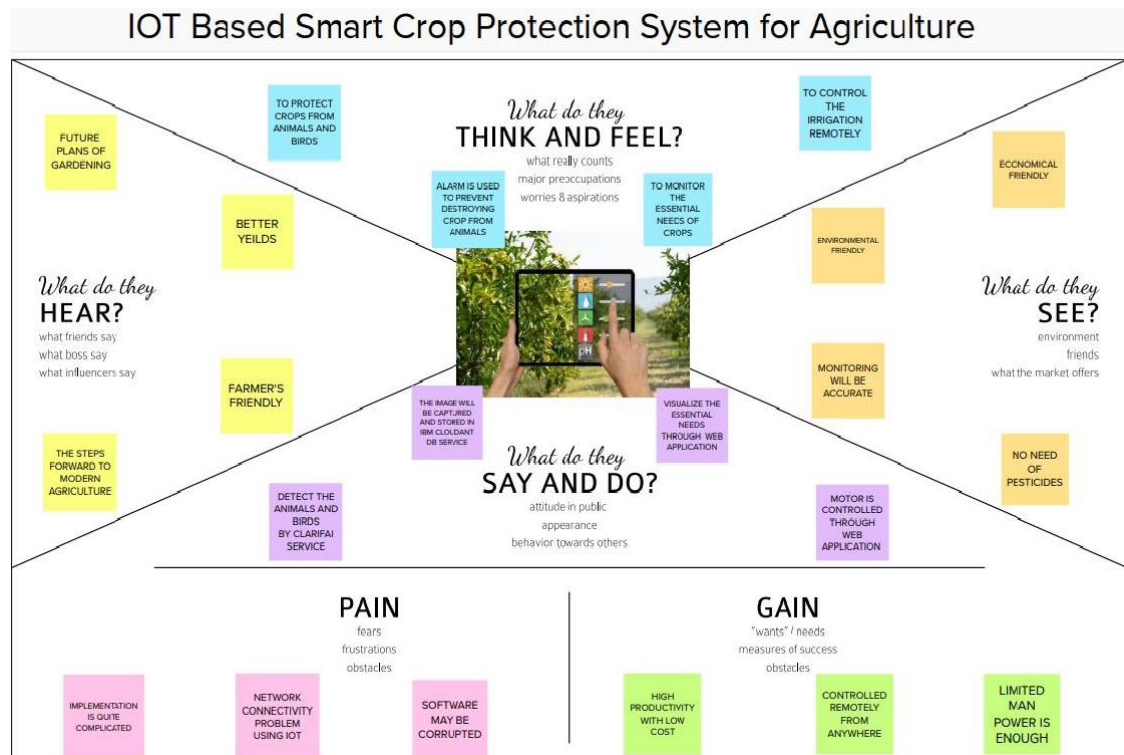
- [https://smartinternz.com/assets/docs/Smart%20Home%20Automation%20using%20IBM%20cloud%20Service s%20\(1\).pdf](https://smartinternz.com/assets/docs/Smart%20Home%20Automation%20using%20IBM%20cloud%20Service%20s%20(1).pdf)
- [https://smartinternz.com/assets/docs/Smart%20Home%20Automation%20using%20IBM%20cloud%20Service 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%20web 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://smartinternz.com/assets/docs/Smart%20Home%20Automation%20using%20IBM%20cloud%20Service s%20(1).pdf)
- <https://github.com/rachuriharish23/ibmsubscribe>

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 realtime 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 the Online IoT simulator for getting the Temperature, Humidity and Soil Moisture values.

3. IDEATION & PROPOSED SOLUTION:

Empathy Map Canvas



Brain Storming & Ideation

Idea 1:

Crops in the farms are many times devastated by the wild as well as domestic animals and low productivity of crops is one of the reasons for this. It is not possible to stay 24 hours in the farm to sentinel the crops. So to surmount this issue an automated perspicacious crop aegis system is proposed utilizing Internet of Things (IOT). The system consists of esp8266 (nodeMCU), soil moisture sensor, dihydrogen monoxide sensor, GPRS and GSM module, servo motor, dihydrogen monoxide pump, etc. to obtain the required output. As soon as any kineticism is detected the system will engender an alarm to be taken and the lights will glow up implemented at every corner of the farm. This will not harm any animal and the crops will stay forfended.

Idea 2:

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 this project have the provision to secure from the human begins also. This can be achieved by the help of IOT device. The SCPS work on the battery so that this project can be easily portable and also we are added 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.

Idea 3:

A centralizing method in the area of IIoT (Industrial Internet of Things) contrived for understanding agriculture which is preceding the arrangements low-power devices . This project yields a monitoring procedure for farm safety against animal attacks and climate change conditions. IIoT advances are frequently used in smart farming to emphasize the standard of agriculture. It contains types of sensors, controllers. On behalf of WSN, the ARM Cortex-A board which consumes 3W is the foremost essence of the procedure . Different sensors like DHT 11 Humidity & Temperature Sensor, PIR Sensor, LDR sensor, HC-SR04 Ultrasonic Sensor, and camera are mounted on the ARM Cortex-A board. The PIR goes high on noticing the movement within the scope, the camera starts to record, and the data will be reserved onboard and in the IoT cloud, instantaneously information will be generated automatically towards the recorded quantity using a SIM900A unit to notify about the interference with the information of the weather conditions attained by DHT11. If a variance happens, the announcement of the threshold rate will be sent to the cell number or to the website. The result will be generated on a catalog of the mobile of the person to take the necessary action.

Brainstorming

2 Brainstorm

Write down any ideas that come to mind that address your problem statement.

10 minutes

TIP
You can select a sticky note and hit the pencil icon to select it. Then to start drawing!

Harish Rajagendran	Arun kumar	Kamalanathan	Karthick
(1) Locase of emergency the system should play an egective role (2) cost must be affordable (3) The waste should be discarded perfectly	(1) Interface should be easy to understand (2) Eco-Friendly (3) solar panels can be used for back up power	(1) Motors can be connected with this devices whci can be controlled from anywhere (2) More pictroal represents should be use than words	(1) Final outcomes should be user friendly (2) Aidsuins device can be used. (3) Battery power back is important.

Mohamed Sulaiman

(1) The whole system should be water resistant
(2) Operate with also both Solar and electrical sources
(3) solar panels will be included in advanced devices

3 Group ideas

Take turns sharing your ideas while clustering similar or related notes as you go. Once all sticky notes have been grouped, give each cluster a sentence-like label. If a cluster is bigger than six sticky notes, try and see if you can break it up into smaller sub-groups.

20 minutes

TIP
Add customer tags to sticky notes to make it easier to find, browse, organize, and categorize important ideas as themes within your mind.

4

Prioritize

Your team should all be on the same page about what's important moving forward. Place your ideas on this grid to determine which ideas are important and which are feasible.

20 minutes



After you collaborate

You can export the mural as an image or pdf to share with members of your company who might find it helpful.

Quick add-ons

- 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](#)

• 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.

• Problem Solution Fit

Define CS, fit into CL	1. CUSTOMER SEGMENT(S) CS Farmers are the customers	6. CUSTOMER LIMITATIONS <small>EG. BUDGET, DEVICES</small> CL 1) High adoption costs , security concerns. 2) Not aware of the implementation of IoT in agriculture.	5. AVAILABLE SOLUTIONS <small>PLUSES & MINUSES</small> AS Monitor different parameters and mobile or web application make easily to farm the crop field .	Explore AS, differentiate
	2. PROBLEMS / PAINS <small>+ ITS FREQUENCY</small> PR 1) It's difficult to monitor and control 2) Ain't known if the application doesn't work properly.	9. PROBLEM ROOT / CAUSE RC 1) If temperature ,PH level ,humidity & light intensity makes the serious cause for the environment. 2) Farmer affected by less productivity which will affect in their profit.	7. BEHAVIOR <small>+ ITS INTENSITY</small> BE Direct related: Tries to find a solution to prevent this problem Indirect related: Located in rural where internet connectivity might not be strong enough to facilitate fast transmission speeds.	
Focus on PR, tap into BE, understand RC	3. TRIGGERS TO ACT TR Create opportunities to lift people out of poverty in developing nations. (Over 60%)	10. YOUR SOLUTION SL <i>"IoT based Smart crop protection system for agriculture" !!</i> It help farmers grow more food on less land by protection crops from pests, diseases and weeds as well as raising productivity per hectare.	8. CHANNELS of BEHAVIOR CH ONLINE: The Data send through application for the farmers to know about the farms.	Extract online & offline CH of BE
	4. EMOTIONS <small>BEFORE / AFTER</small> EM BEFORE: Finances, Heavy work overload and conflict in relationship. AFTER: It will easier to make more yield in		OFFLINE: The control action is taken by the farmers to monitor the farms.	

4. REQUIREMENT ANALYSIS:

- **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 <u>required</u> 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 <u>generated</u> .
FR-5	User action	The user needs to take action like detecting through crop rotation, fertilizer, strip <u>cropping</u> .

- **Non Functional Requirements**

▣ **Non-functional Requirements:**

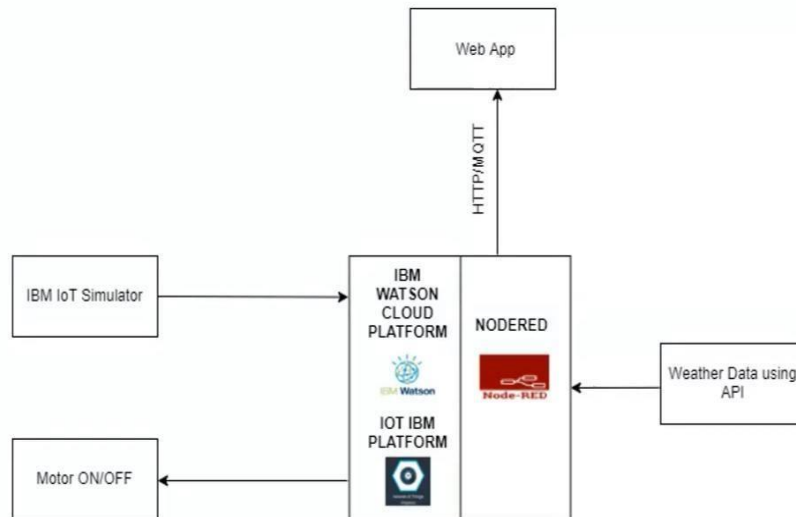
Following are the non-functional requirements of the proposed solution.

FR No.	Non-Functional Requirement	Description
NFR-1	Usability	This project's contributors to the farm protection through the smart protection system and use new technologies and also increase the quality of its crop.

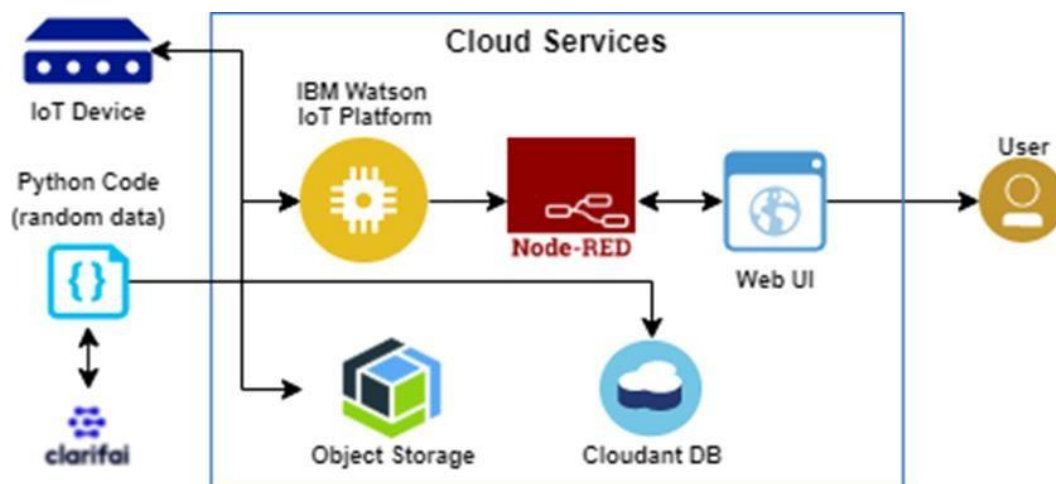
NFR-2	Security	It was created to protect the crops from animals.
NFR-3	Reliability	Farmers are able to safeguard their lands by help of this technology. They get some good benefits from higher crop <u>yields</u> .
NFR-4	Performance	When animals attempt to enter the crop field, IOT devices and sensors alert the <u>farmer</u> 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 <u>beings</u> through the system.

5. PROJECT DESIGN:

- **Data Flow Diagram**



- **Solution & Technical Architecture**



- User Stories

User Type	Functional requirement(Epic)	User Story number	User Story/Task	Acceptance criteria	Priority	Release
Customer (Mobile 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 confirmation 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 Buzzer/Sound Alarm when the disturbance will occur on field.	I can get the data work according to it		Sprint 4
Administration	Administration	USN-1	User store every information	I can store the gained information	High	Sprint 4

6. PROJECT PLANNING & SCHEDULING:

- **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, <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>ie</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

□

• Sprint Delivery Schedule

Product Backlog, Sprint Schedule, and Estimation

Use the below template to create product backlog and sprint schedule

Sprint	Functional Requirement (Epic)	User Story Number	User Story / Task	Story Points	Priority
Sprint-1	Simulation Creation	USN-1	Registering IBM Cloud and IBM WATSON IOT PLATFORM	6	High
Sprint-1	Software	USN-2	Developing IBM Cloud Storage and IBM WATSON	10	High
Sprint-2	Software and Hardware	USN-3	Registering NODE-RED & Connect IBM IOT	6	Medium
Sprint-2	Software	USN-4	Editing gauge node & Developing Python Code	10	High
Sprint-3	Software	USN-5	Establishing Node-Red connection	8	Medium
Sprint-3	Software	USN-6	Connecting application with Node-Red and further application development	8	High
Sprint-4	Testing	USN-7	Create & Develop the MIT App and Customized Interface to Display	16	High

Project Tracker, Velocity & Burndown Chart:

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	16	5 Days	25 Oct 2022	29 Oct 2022	16	30 Oct 2022
Sprint-2	16	8 Days	31 Oct 2022	07 Nov 2022	16	08 Nov 2022
Sprint-3	16	6 Days	09 Nov 2022	13 Nov 2022	16	14 Nov 2022
Sprint-4	8	6 Days	15 Nov 2022	17 Nov 2022	8	17 Nov 2022 – 18 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)

Total Sprint = 4

Total Sprint Points = 56

Average Velocity = $56/4 = 14$

6. CODING & SOLUTIONING:

```
import time
import sys
import ibmiotf.application # to install pip install ibmiotf
import ibmiotf.device

#Provide your IBM Watson Device Credentials
organization = "hrodmj" #replace the ORG ID
deviceType = "NODEMCU1" #replace the Device type wi
deviceId = "12345" #replace Device ID
authMethod = "token"
authToken = "kp1234" #Replace the authtoken

def myCommandCallback(cmd): # function for Callback
    print("Command received: %s" % cmd.data)
    if cmd.data['command']=='motoron':
        print("Motor On IS RECEIVED")

    elif cmd.data['command']=='motoroff':
        print("Motor Off IS RECEIVED")

    if cmd.command == "setInterval":

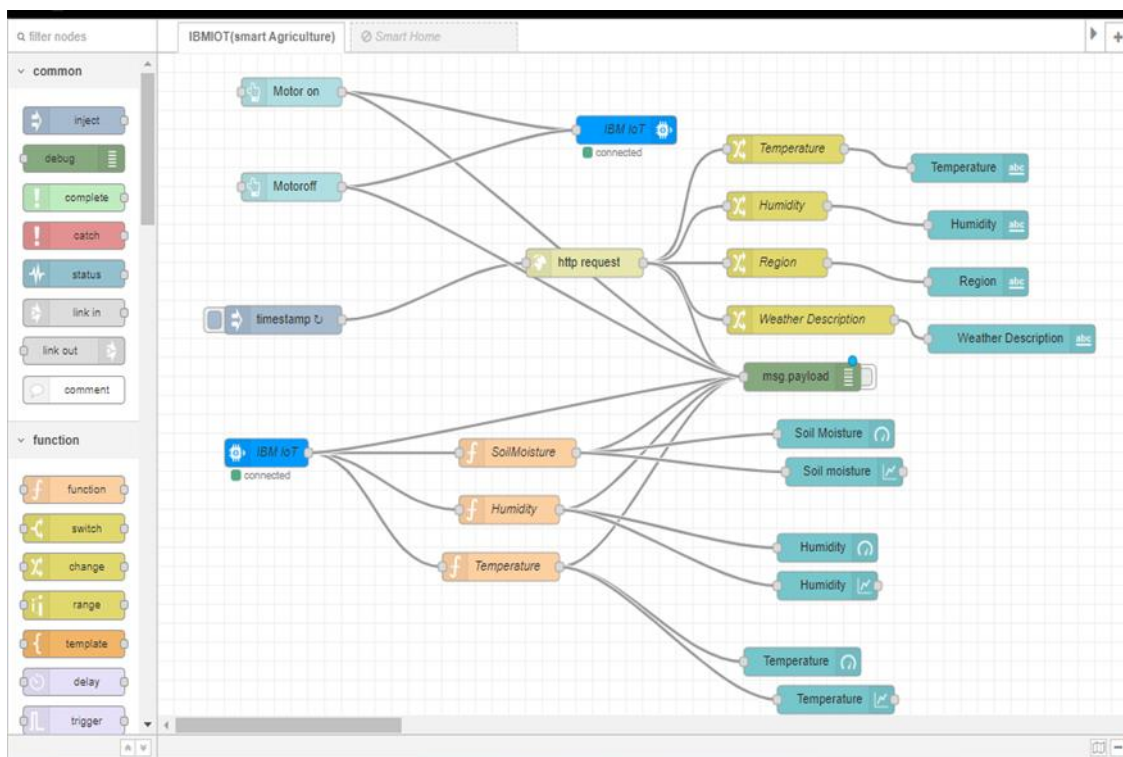
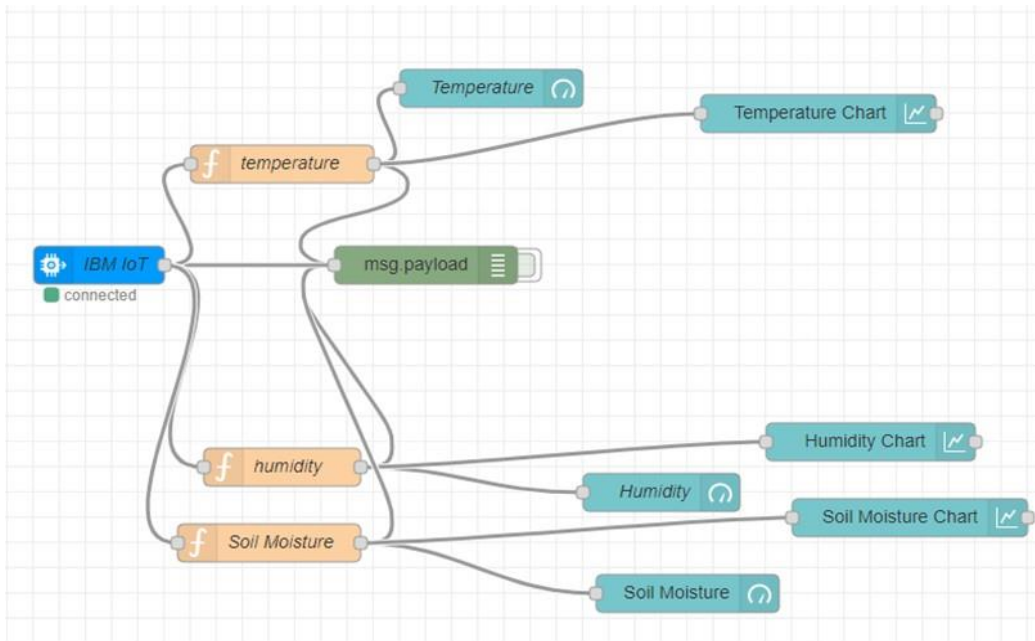
        if 'interval' not in cmd.data:
            print("Error - command is missing required information: 'interval'")
        else:
            interval = cmd.data['interval']
    elif cmd.command == "print":
        if 'message' not in cmd.data:
            print("Error - command is missing required information: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

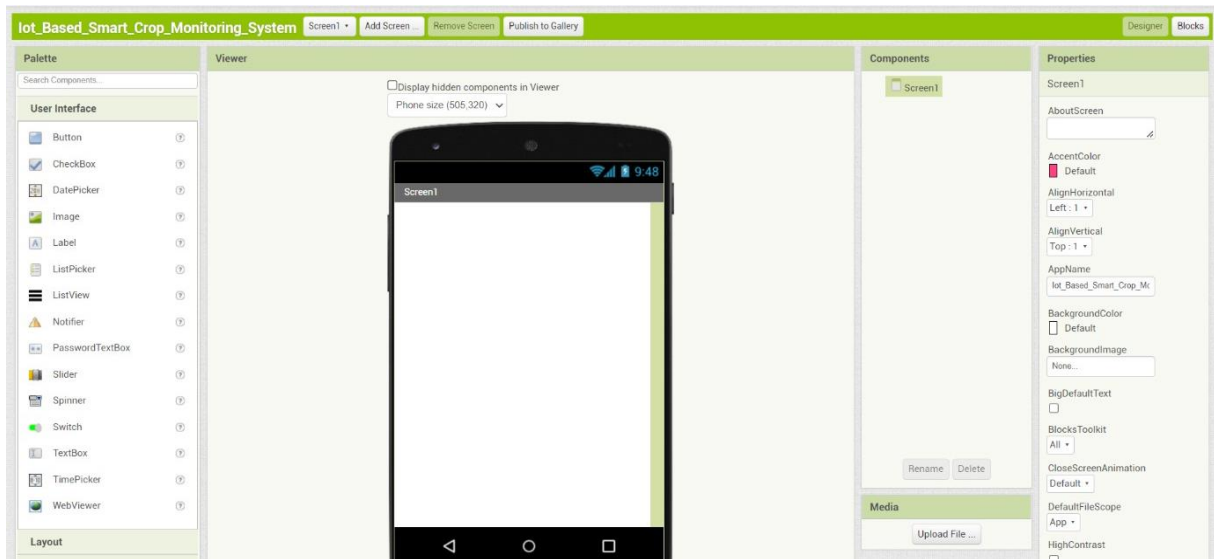
# Connect and send a datapoint "hello" with value "world" into the cloud as an event of type
"greeting" 10 times

deviceCli.connect()
while True:
    deviceCli.commandCallback = myCommandCallback
    # Disconnect the device and application from the cloud
    deviceCli.disconnect()
```

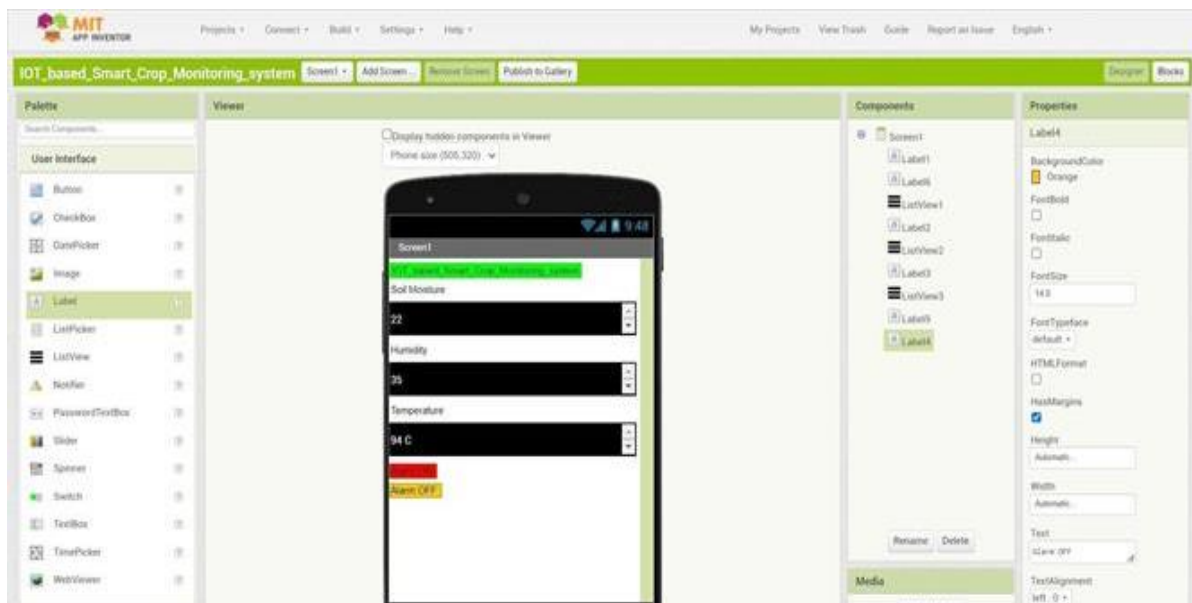
- Node Red flow to get simulated data



- MIT APP inventor to design the APP



- Customize the App interface to Display the Values



7. TESTING:



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



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

8. RESULT:

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

9. ADVANTAGES & DISADVANTAGES:

Advantages

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

Disadvantages

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

10. 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 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.

11. FUTURE SCOPE:

In future due to more demand of good 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.

12. APPENDIX:

GITHUB LINK:

<https://github.com/IBM-EPBL/IBM-Project-11513-1668781180>

VIDEO LINK:

<https://youtu.be/vrychJMfYeE>

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