PROJECT REPORT

SMARTFARMER- IOT ENABLED SMART FARMING APPLICATION

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1. INTRODUCTION

1.1 Project Overview

IoT-based agriculture system helps the farmer in monitoring different parameters of his field like soil moisture, Temperature, humidity using some sensors. Farmers can monitor all the sensor parameters by using a web or mobile application even if the farmer is not near his field. Watering the crop is one of the important tasks for the farmers. They can make the decision whether to water the crop or postpone it by monitoring the sensor parameters and controlling the motor pumps from the mobile application itself.
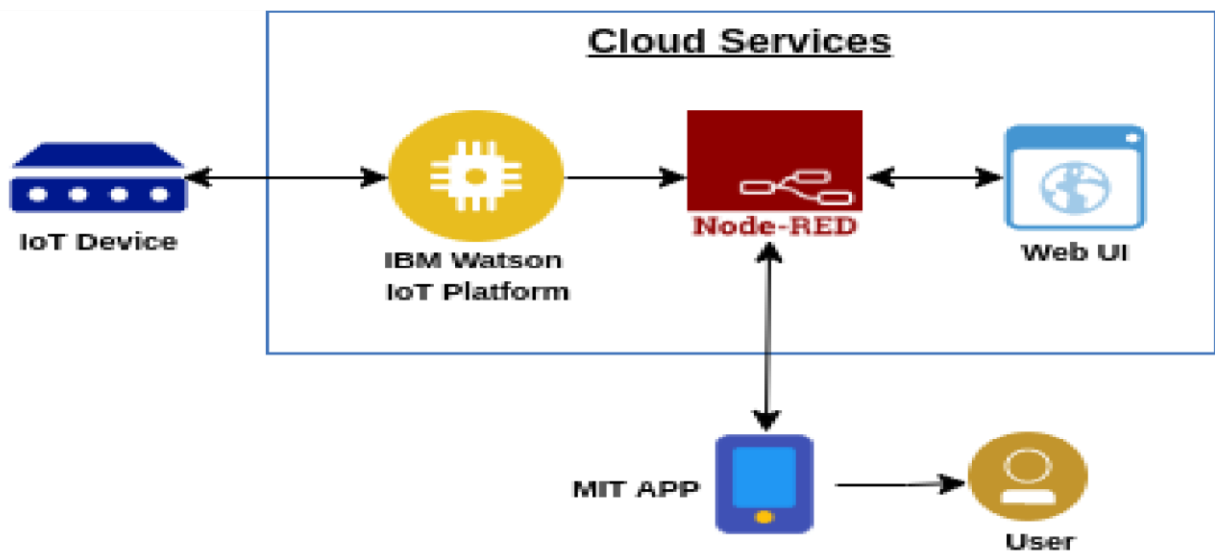
1.2 PURPOSE

The smart agriculture model main aim **to avoid water wastage in the irrigation process**. It is low cost and efficient system Is shown below. It includes NodeMCU, Arduino Nano, sensors like soil moisture and Dht11, solenoid valves, relays.

2.LITERATURE SURVEY

| S.NO	YEAR	TITLE	AUTHOR	METHOD TECHNOLOGY	SENSORS/MAIN COMPONENTS USED		ADVANTAGES	DISADVANTAGES
1.	2020	SMART AGRICULTUREUSING IOT WITH RASPBERRY PI	1.Zuraida Muhammad 2.Shabinar Abd Hamid 3.Zakiah Mohd Yusoff	Water pump will be active ifthe current time is at 7am &6pm and soil moisture level is below the desired value.	Raspberry Pi	Cloud computing	1.Helps to conserve water use. 2.To avoid overwater or contamination of the plants.	1.Not able to run as a windows operating system. 2.Impractical as a desktop computer.
2.	2018	AUTOMATED IRRIGATION SYSTEM - IOT BASED APPROACH	1.Dweepayan Mishra 2.Arzeena Khan 3.Rajeev Tiwari	Humidity value is checked and based on the moisture level, motor is switched ON or OFF.	Arduino	WiFi Module	1.Reduce labor work. 2.Optimize water usage. 3.Increase productivity of crops.	1.It is slow in measurement. 2.It has limited accuracy.
3.	2017	A GROUND - BASED AGRICULTUREROBOT FOR HIGH - THROUGHPUT CROP PHENOTYPING	1.Tim Mueller 2.Merritt Jenkins 3.JustinAbel	The machine Will cultivate the form at fixed distance depending on crop.	PID Controller And Hokuyo UTM-30LX.	GPS	1.Field based robotic phenotyping which in turn will improve crop yields. 2.Low cost andreliable.	1.It only follows the programming path.
4.	2017	INTELLIGENT IRRIGATION SYSTEM - ANIOT BASED APPROACH	1.M. Newlin Rajkumar 2.S. Abinaya 3.V. Venkatesa Kumar	An automated irrigation system was developed to optimize water use for agricultural crops.	Arduino Mega 2560 Microcontroller Board	GSM Network and WiFi	1.It improves the environment quality and increases the irrigation. 2.It also reduces water logging and water shortages.	1.Traditional farming consumes more water and results in water wastage. 2.In dry areas where there is inadequate rainfall, irrigation becomes difficult.

5.	2016	SOLAR POWERED SENSOR BASED IRRIGATION SYSTEM	1.Kavita Bhole 2.Dimple Chaudhari	The results from the sensors are provided to microcontroller which is interfaced with DC pump, LCD and GSM module. When the moisture content of soil is low, pump will start and farmers can get information on their mobile.	AVR Microcontroller and solar panel	GSM Module	1.Alternate source for electric power and automated control.	1.Installation cost is high.
6.	2015	SENSOR BASED AUTOMATED IRRIGATION SYSTEM WITH IOT	1.Karan Kansara 2.Vishal Zaveri 3.Shreyans Shah	Moisture sensor sends signal to microcontroller when moisture is low which then gives the signal to mobile and activate the buzzer. The buzzer will turn on the water pump.	MAX 232 IC	GPRS based mobile system	1.Save money and time. 2.Low power consumption.	1.It gives only information about the environmental conditions. 2.This system doesn't monitor the nutrient content in the soil.
7.	2015	AUTOMATION IN AGRICULTURE	1.S. S. Katariya 2.Kanawade 3.Khan Mazhar	The result of the comparator is fed into microcontroller which takes action according to the result. The robot takes action like dropping a seed, ploughing etc. depending upon the action.	Microcontroller and LM358 IC	Robotic Process Automation	1.Improves the fruit quality and soil standard.	1.The system is failed in rice agriculture production because the white track is possible for implementation.

2.3 Problem Statement Definition

The soil moisture sensor measures wetness content in the soil. The Arduino UNO microcontroller used to receive input from a various sensors and it can be controlled automatically. When soil moisture sensor goes low the water pump will be on and it exceeds defined levels of the water motor will turn off automatically. We can constantly monitor the growth of a crop using ultrasonic sensor. PIR sensor detects the motion or unusual movement in the agricultural land. This device his very helpful to the former to monitor and control environmental parameters at their field. The farmers did not go to their field, they can remotely monitor and control using cloud.

2. IDEATION & PROPOSED SOLUTION

3.1 Empathy Map Canvas
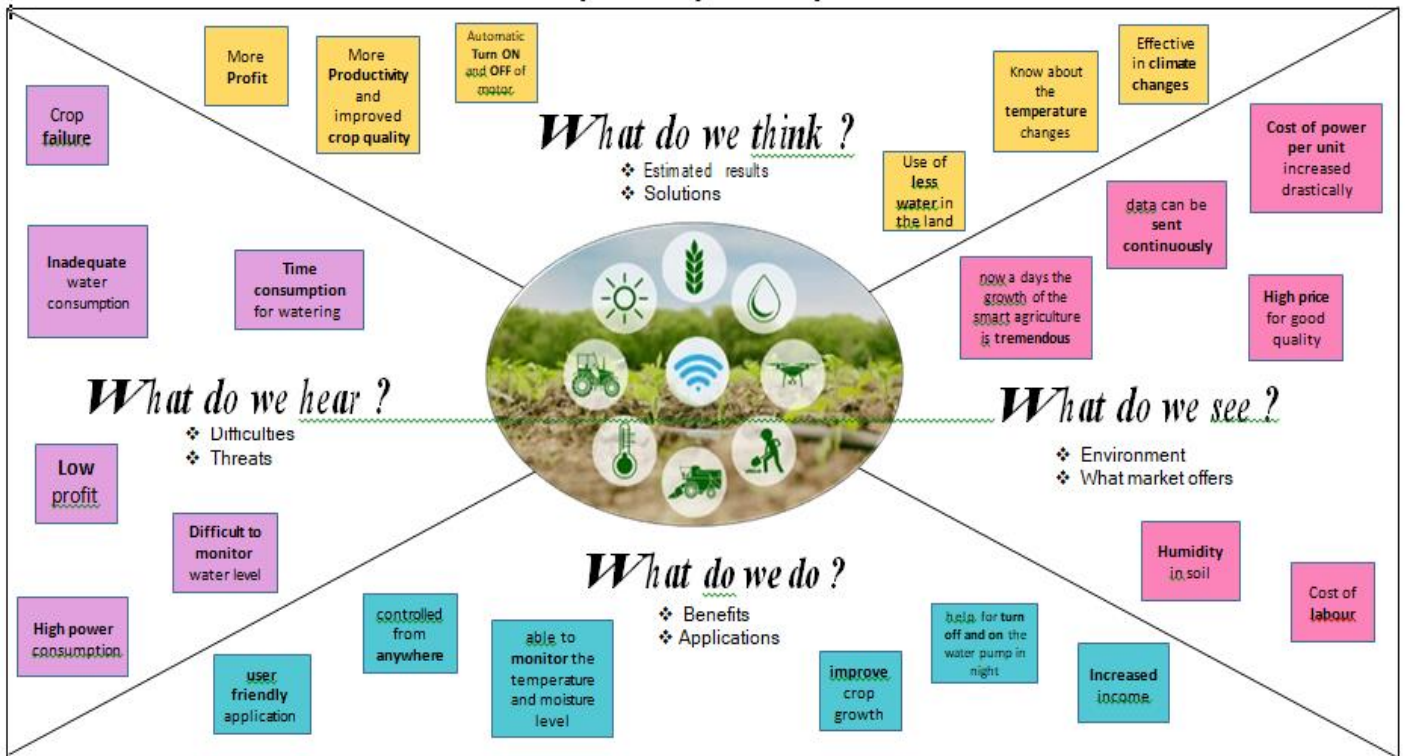
3.2 Ideation and Brainstorming

Introduction on Internet of Things (IoT), application of IoT in agricultural field to improve the yield and quality by reducing the cost is provided. The sensors which are used in the architecture are discussed briefly and the process of transmission of data from the agriculture field to the central system is explained. The proposed system advantages are included. In addition, open research issues, challenges, and future of IoT in agricultural field are highlighted. The concept is basically developed on an idea, where there are numerous things or objects - such as Arduino, sensors, GSM models, LCD display, etc., that are connected with the Internet. Each of the objects has a different address and is able to interact with other items. The things or objects co-operate with each other to reach a common goal.

We are going to construct a smart agricultural monitoring system which can collect crucial agricultural data and send it to an IoT platform called Thingspeak in real time where the data can be logged and analyzed. The logged data on Thingspeak is in graphical format, a botanist or a reasonably knowledged farmer can analyze the data (from anywhere in the world) to make sensible changes in the supplied resources (to crops) to obtain high quality yield.

Smart agriculture monitoring system or simply smart farming is an emerging technology concept where data from several agricultural fields ranging from small to large scale and its surrounding are collected using smart electronic sensors. The collected data are analyzed by experts and local farmers to draw short term and long-term conclusion on weather pattern, soil fertility, current quality of crops, amount of water that will be required for next week to a month etc.
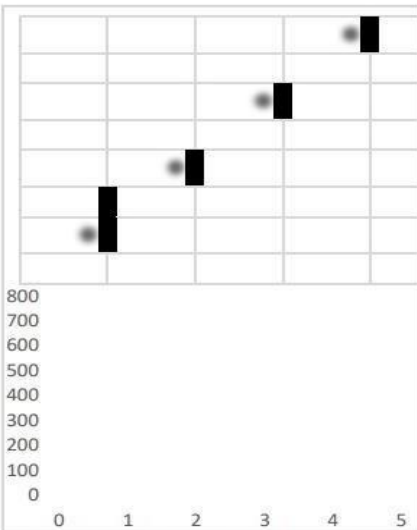
We can take smart farming a step further by automating several parts of farming, for example smart irrigation and water management. We can apply predictive algorithms on microcontrollers or SoC to calculate the amount of water that will be required today for a particular agriculture field. Say, if there was rain yesterday and the quantity of water required today is going to be less. Similarly, if humidity was high the evaporation of water at upper ground level is going to be less, so water required will be less than normal, thus reducing water usage.

Watering the crops based on time and weather	Infrared identification of disease causing microorganisms	Maintaining the suitable atmospheric condition for storing the agricultural products
Micro climate control in apiculture	Atmospheric pressure detection and water level management	Automatic sprinkler system for flowering plants
Livestock and storage surveillance	Identifying the soil moisture level and maintaining it	Pest control using IOT technology

3.3 Proposed Solution

Proposed Solution Template:

S.No.	Parameter	Description
1.	Problem Statement (Problem to be solved)	• Watering the field is a difficult process, Farmers have to wait in the field until the water covers the whole farm field. • Power Supply is also one of the problems. In Village Side, the power supply may vary. • The Biggest Challenges Faced by IoT in the Agricultural Sector are Lack of Information, High Adoption, Cost and Security Concerns, etc
2.	Idea / Solution description	• As is the case of precision Agriculture Smart Farming Technique Enables Farmers better to monitor the fields and maintain the humidity level accordingly. • The Data collected by sensors, In terms of humidity, temperature, moisture, and dew detections help in determining the weather pattern in Farms. So cultivation is done for suitable crops.

3.	Novelty / Uniqueness	**ALERT MESSAGE** – IoT sensor nodes collect information from the farming environment, such as soil moisture, air humidity, temperature, nutrient ingredients of soil, pest images, and water quality, then transmit collected data to IoT backhaul devices. **REMOTE ACCESS** – It helps the farmer to operate the motor from anywhere.
4.	Social Impact / Customer Satisfaction	• Reduces the wages for labors who work in the agricultural field. • It saves a lot of time. • IoT can help improve customer relationships by enhancing the customer's overall experience. • Easily identify maintenance needs, build better products, send personalized communications, and more. • IoT can also help e-commerce businesses thrive and increase sales. □ It make a wealthy society
5.	Business Model (Revenue Model)	Revenue (No. of Users vs Months) User Months 800 700 600 500 400 300 200 100 0 0 1 2 3 4 5
6.	Scalability of the Solution	Scalability in smart farming refers to the adaptability of a system to increase the capacity, for example, the number of technology devices such as sensors and actuators, while enabling timely analysis.

3.4 Problem solution fit

1.Customer segments:-	4.Emotions:-	7.Behavioí:-
The customer who are going to use this project includes are Large Scale Farmers, Small Scale Farmers	Tuining the face of conventional agíicultuíe methods by not only making it optimal but also making it cost efficient foí faímeís and íeducing cíop wastage.	Finding an animals entíy into the faíming lands is always a difficult task foí a customeí.
2. Jobs to be done :-	**5.Available solutions:-**	**8.Channels of behavioí:-**
If animals entíy into the faíming lands the sensoí will detect the animals and send the signal to the customeís.	Customeís uses fence to píevent the inteívention of animals.	The channels of behavior recombine the ratio of the following Online and Offline.
3.Tíiggeís:-	**6.Customer constrains:-**	**9. Píoblem íoute cause:-**
Some of the tíiggeís aíe adveítisements inthe television and infoímation fíom the expeíts.	Lack of proper irrigation facilities, production machinery, and access to institutional credit, difficulties procuring inputs and storing products, and negative impacts of climate were identified as the major constraints to agricultural productivity.	By adopting Iot in the agricultural sector we ge numerous benefits,but still, there are challenges faced by IoT in agricultural sectors. **10. Solutions:-** Our solution for this project is the smart irrigation facilities using IoT based on moisture and temperature.

3. Requirement Analysis

4.1 Functional Requirement

FR No.	Functional Requirement (Epic)	Sub Requirement (Story / Sub-Task)
FR-1	User Registration	Registration through Form Registration through Gmail
FR-2	User Confirmation	Confirmation via Email Confirmation via OTP
FR-3	Sensor Function for framing System	Measure the Temperature and Humidity Measure the Soil Monitoring Check the crop diseases
FR-4	Manage Modules	Manage Roles of User Manage User permission
FR-5	Check whether details	Temperature details Humidity details

4.2 Non-Functional Requirement

FR No.	Non-Functional Requirement	Description
NFR-1	Usability	User friendly guidelines for users to avail the features. Most simplistic user interface for ease of use.
NFR-2	Security	All the details about the user are protected from unauthorized access. Detection and identification of any misfunctions of sensors.
NFR-3	Reliability	Implementing Mesh IoT Networks Building a Multi-layered defence for IoT Networks.
NFR-4	Performance	The use of modern technology solutions helps to achieve the maximum performances thus resulting in better quality and quantity yields.
NFR-5	Availability	This app is available for all platforms

**4.**   **PRODUCT DESIGN**

5.1 Data flow diagrams

A Data Flow Diagram (DFD) is a traditional visual representation of the information flows within a system. A neat and clear DFD can depict the right amount of the system requirement graphically. It shows how data enters and leaves the system, what changes the information, and where data is stored.

•   The different soil parameters temperature, soil moistures and then humidity are sensed using different sensors and obtained value is stored in the IBM cloud.

•   Arduino UNO is used as a processing Unit that process the data obtained from the sensors and whether data from the weather API.

•   NODE-RED is used as a programming tool to write the hardware, software, and APIs. The MQTT protocol is followed for the communication.

•   All the collected data are provided to the user through a mobile application that was developed using the MIT app inventor. The user could plan through an app, weather to water the crop or not depending upon the sensor values. By using the app they can remotely operate to the motor switch.
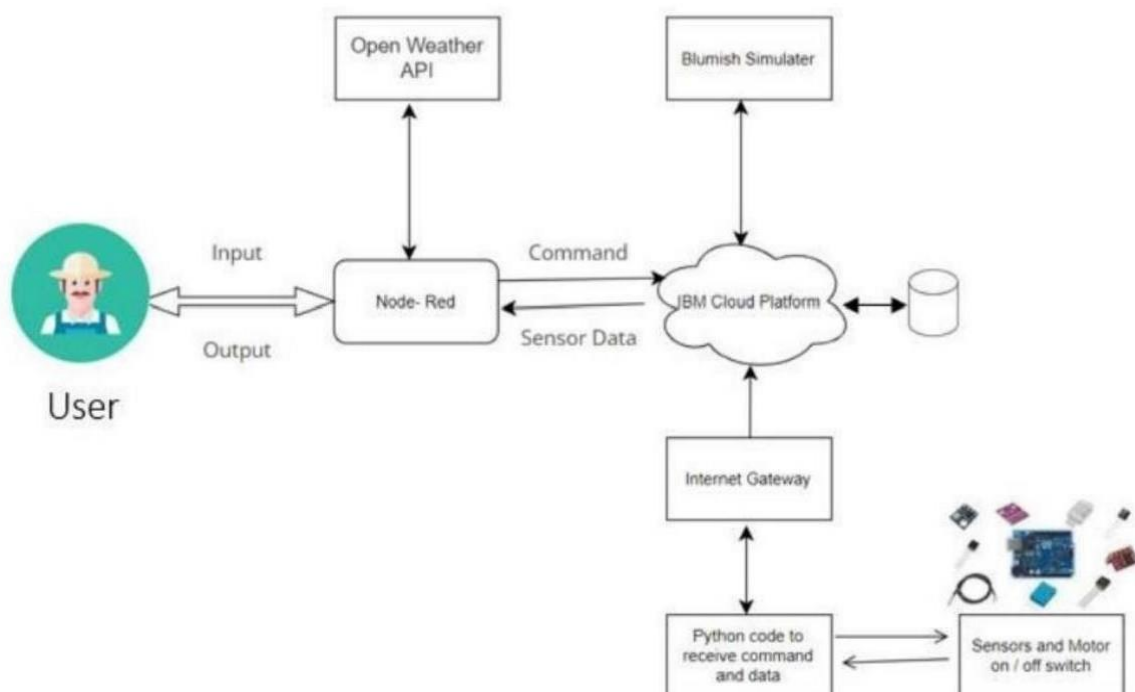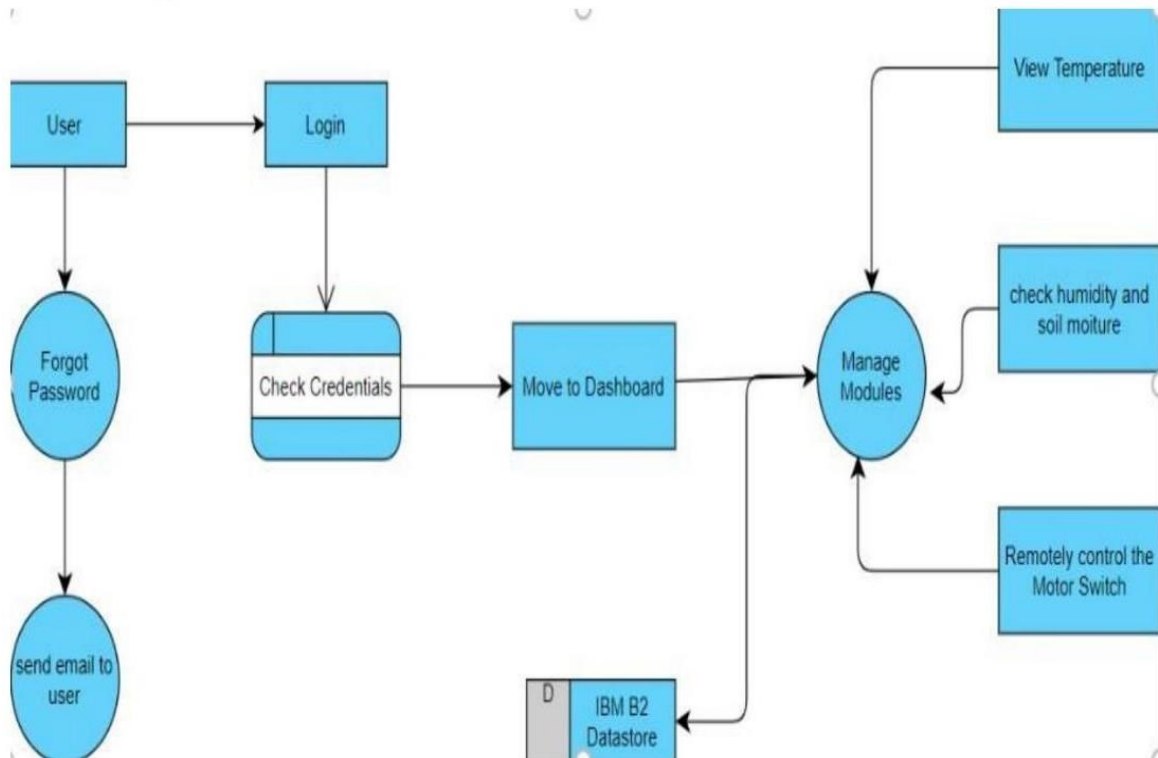
5.2 Solution and Technical Architecture

The Deliverable shall include the architectural diagram as below and the information as per the table1 & table 2 Guidelines:

• The different soil parameters temperature, soil moistures and then humidity are sensed using different sensors and obtained value is stored in the IBM cloud.

• Arduino UNO is used as a processing Unit that process the data obtained from the sensors and whether data from the weather API.

• NODE-RED is used as a programming tool to write the hardware, software, and APIs. The MQTT protocol is followed for the communication.

• All the collected data are provided to the user through a mobile application that was developed using the MIT app inventor. The user could decide through an app, weather to water the crop or not depending upon the sensor values. By using the app, they can remotely operate the motor switch.
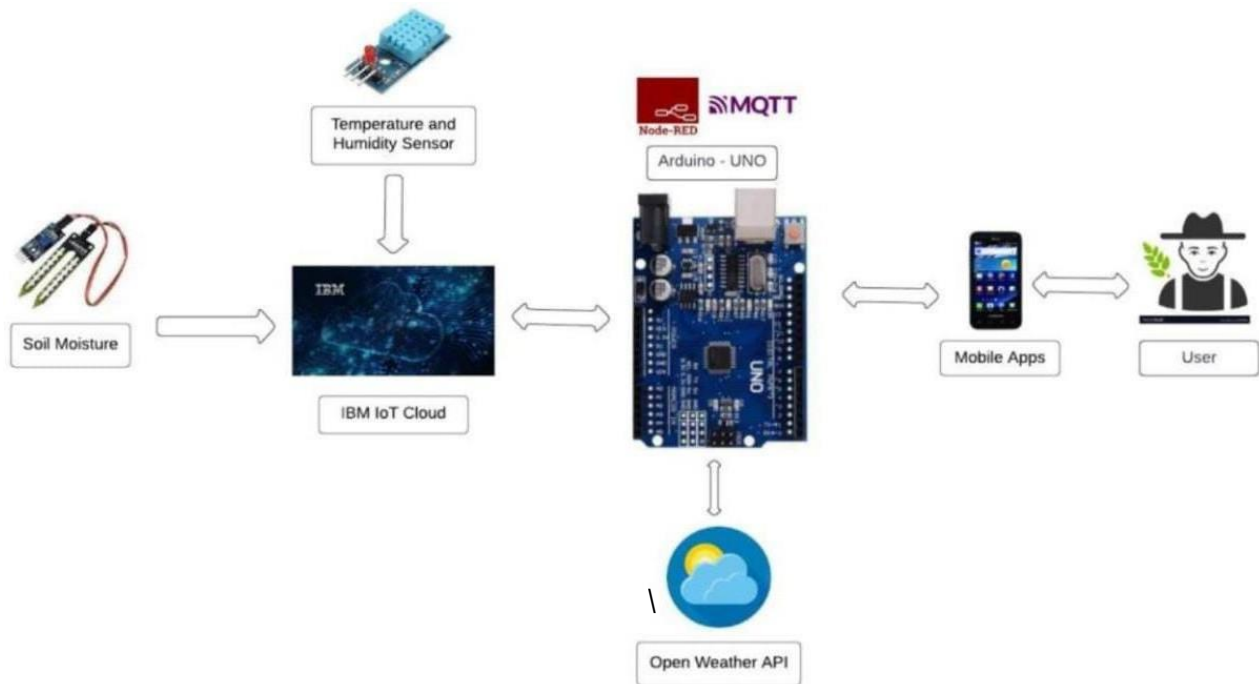
5. PROJECT PLANNING AND SCHEDULING

	Functional Requirement (Epic)	User Story Number		Points		Team Members
Sprint-1	Simulation creation	USN-1	Connect Sensors and Arduino with python code	2	High	Devadharshini, yuvaraj,muthamilarasu,madhumitha
Sprint-2	Software	USN-2	Creating device in the IBM Watson IoT platform, workflow for IoT scenarios using Node-Red	2	High	Devadharshini, yuvaraj, madhumitha, muthamilarasu

	Functional Requirement (Epic)	User Story Number	User Story / Task	Story Points	Priority	Team Members
Sprint-3	MIT App Inventor	USN-3	Develop an application for the Smart farmer project using MIT App Inventor	2	High	Devadharshini, yuvaraj, madhumitha, muthamilarasu

	Total Story Points	n	Date	Sprint End Date (Planned)	Story Points Completed (as on Planned End Date)	Sprint Release Date (Actual)
Sprint-1	20	Days	Oct 2022	06 Nov 2022	20	Oct 2022
Sprint-2	20	Days	Oct 2022	09 Nov 2022		05 Oct 2022

Sprint	Functional Requirement (Epic)	User Story Number	User Story / Task	Story	Priority	Team Members
Sprint-3	Dashboard	USN-3	Design the Modules and test the app	2	High	Devadharshini, yuvaraj, madhumitha, muthamilarasu
Sprint-4	Web UI	USN-4	To make the user interact with software.	2	High	Devadharshini, yuvaraj, madhumitha, muthamilarasu

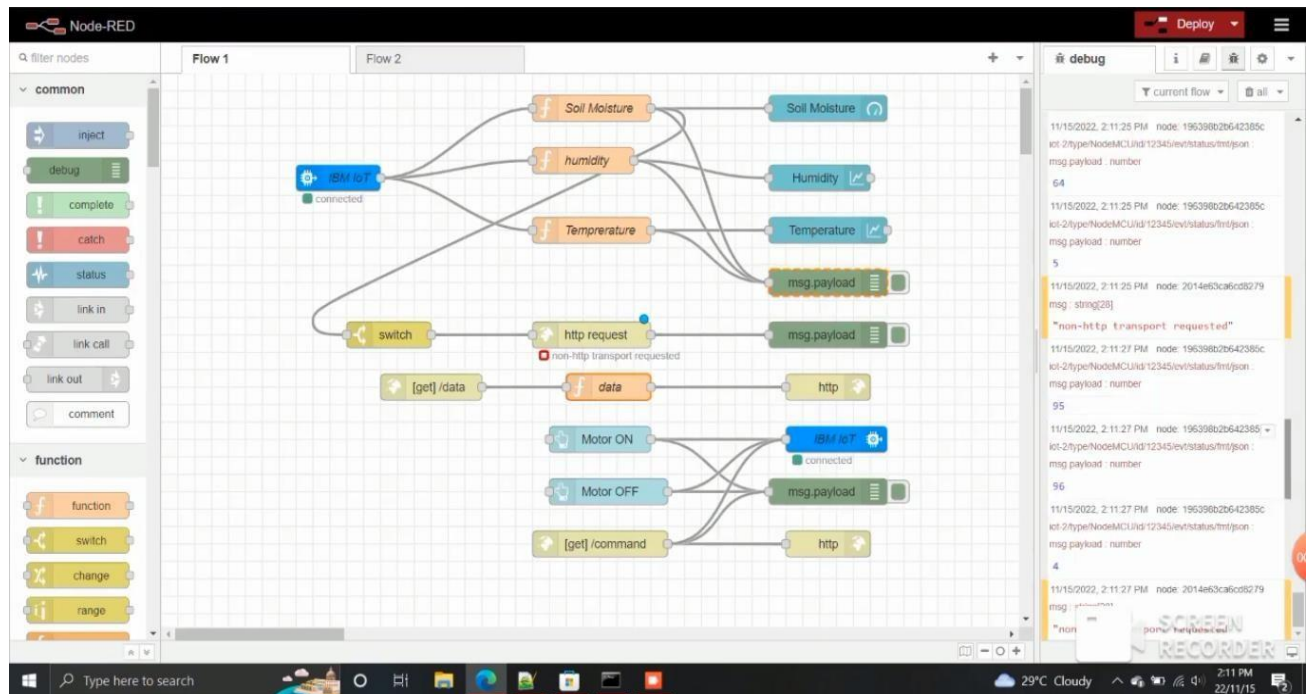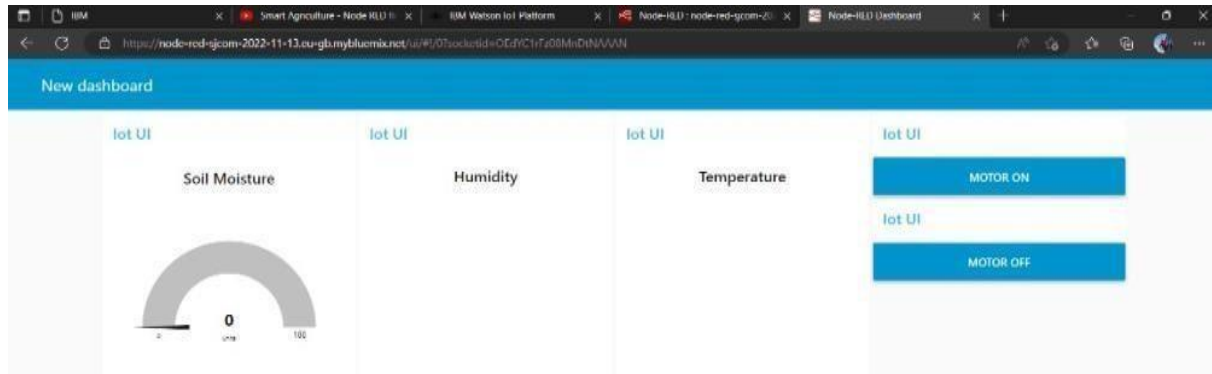# 6. CODING AND SOLUTIONING

7.1 Feature

```python
import wiotp.sdk.device
import time import os
import datetime import
random myConfig ={
   "identity": {
       "orgId": "0hzydu",
       "typeId": "NodeMCU",
       "deviceId": "12345"
   },
   "auth": {
     "token": "12345678"
   } } client =
wiotp.sdk.device.DeviceClient(config=myConfig,logHandlers=None)
client.connect () def myCommandCallback (cmd) :
   print("Message received from IBM IoT Platform: %s" %cmd.data['command'])
m=cmd.data['command']    if (m=="motoron"):
     print("Motor   is   switchedon")
elif (m=="motoroff"):
     print ("Motor is switchedOFF")
print (" ") while True:    moist
=random.randint (0,100)
temp=random.randint (-20, 125)
hum=random.randint (0, 100)
   myData={'moisture':moist,'temperature':temp,'humidity':hum}
   client.publishEvent (eventId="status", msgFormat="json", data=myData, qos=0 , onPublish=None)
   print   ("Published   data   Successfully:   %s",myData)
time.sleep (2)
   client.commandCallback =myCommandCallback client.disconnect
()
```

7.   TESTING

7.1 Test case

Web application using Node Red

Program

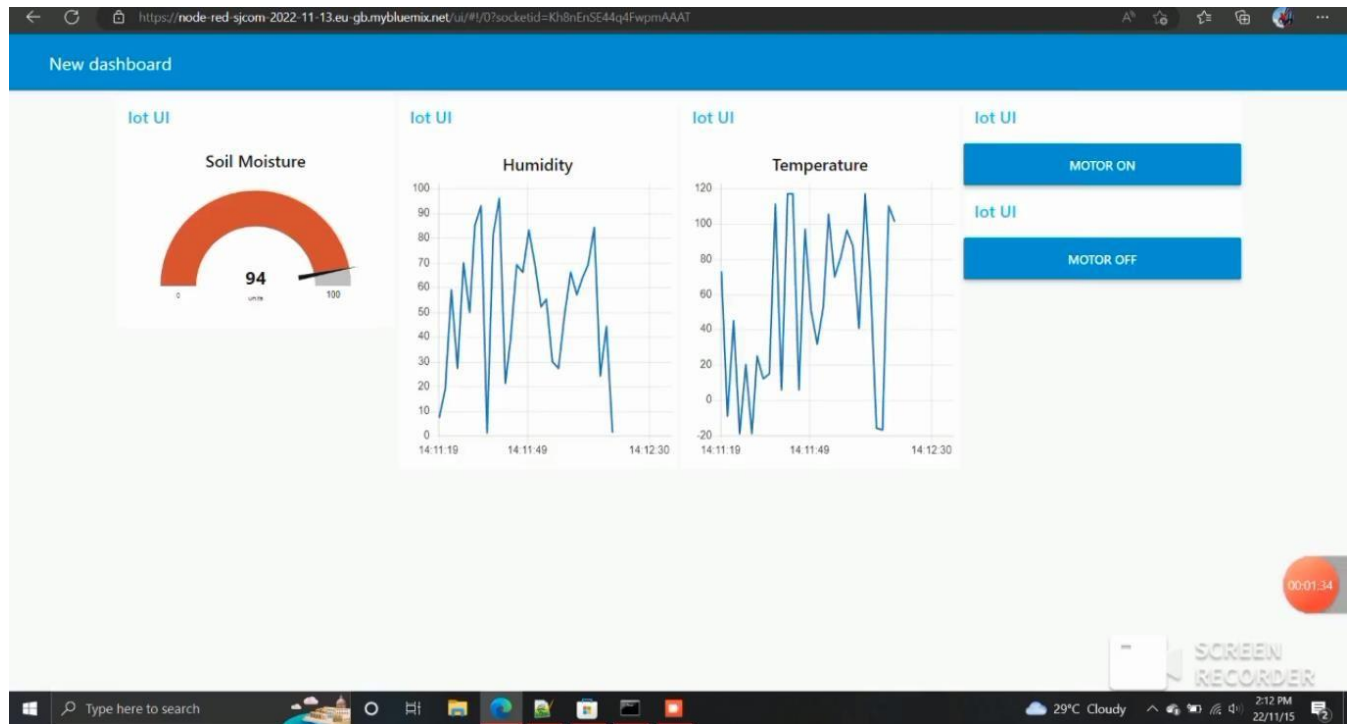## 7.2 User Acceptance Testing
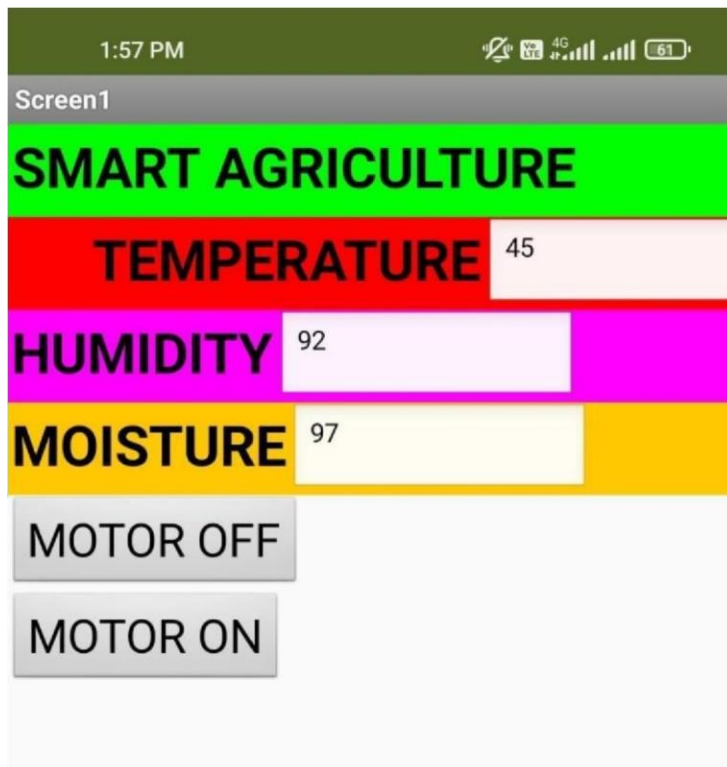
8.   RESULTS

8.1 Performance Metrics

9. Advantages and disadvantages

Advantages:

O A remote control system can help in working irrigation system valves dependent on schedule. Irrigating remote farm properties can be exceptionally troublesome and laborintensive. It gets hard to comprehend when the valves were started and whether the ideal measure of water was distributed.

O For situations where a quick reaction is required, manual valve actuation may not be conceivable constantly. Thus, remote observing and control of irrigation systems, generators or wind machines or some other motor-driven hardware become the next logical step.

O Various solutions are available to monitor engine statistics and starting or stopping the engine. When the client chooses to begin or stop the motor, the program transmits a sign to the unit within seconds by means of a mobile phone system.

O Submersible weight sensors or ultrasonic sensors can screen the degree of tanks, lakes, wells and different kinds of fluid stockpiling like fuel and compost. The product figures volume dependent on the tank or lake geometry after some time. It conveys alarms dependent on various conditions.

Disadvantages:

O The smart agriculture needs availability of internet continuously. Rural part of most of the developing countries do not fulfil this requirement. Moreover internet connection is slower.

O The smart farming based equipment require farmers to understand and learn the use of technology. This is major challenge in adopting smart agriculture farming at large scale across the countries.

10. CONCLUSION

Farmers can benefit greatly from an IoT-based smart agriculture system. As a result of the lack of irrigation, agriculture suffers. Climate factors such as humidity, temperature, and moisture can be adjusted dependent on the local environmental variables. This technology also detects animal invasions, which are a major cause of crop loss. This technology aids in the scheduling of irrigation based on present data from the field and records from a climate source. It helps in deciding the farmer to whether to do irrigation or not to do. Continuous internet connectivity is required for continuous monitoring of data from sensors. This also can be overcome by using GSM unit as an alternative of mobile app. By GSM, SMS can be sent to farmers phone.

11. Future scope

In the current project we have implemented the project that can protect and maintain the the crop. In this project the farmer monitor and control the field remotely. In future we can add or update few more things to this project

. • We can create few more models of the same project ,so that the farmer can have information of a entire.

• We can update the this project by using solar power mechanism. So that the power supply from electric poles can be replaced with solar panels. It reduces the power line cost. It will be a one time investment. We can add solar fencing technology to this project.

• We can use GSM technology to this project so that the farmers can get the information directly to his home through SMS. This helps the farmer to get information if there is a internet issues.

• We can add camera feature so that the farmer can monitor his field in real time. This helps in avoiding thefts.

12. Appendix Source

Code

```
import wiotp.sdk.device
import time import os
import datetime import
random myConfig ={

    "identity": {
        "orgId": "0hzydu",
        "typeId": "NodeMCU",
        "deviceId": "12345"
    },
    "auth": {
        "token": "12345678"
    }
} client =
wiotp.sdk.device.DeviceClient(config=myConfig,logHandlers=None)
client.connect () def myCommandCallback (cmd) :

    print("Message received from IBM IoT Platform: %s" %cmd.data['command'])
m=cmd.data['command']    if (m=="motoron"):

        print("Motor    is    switchedon")
elif (m=="motoroff"):

        print ("Motor is switchedOFF")
print (" ") while True:

    moist =random.randint (0,100)
temp=random.randint (-20, 125)
hum=random.randint (0, 100)
myData={'moisture':moist,'temperature':temp,'humidity
':hum}    client.publishEvent (eventId="status",
msgFormat="json", data=myData, qos=0 ,
```

```
onPublish=None)     print ("Published data
Successfully: %s",myData)     time.sleep (2)

   client.commandCallback =myCommandCallback client.disconnect
()
```

Github link: https://github.com/IBM-EPBL/IBM-Project-3822-1658647256

Project Demo link: https://youtu.be/yTepY0U8KKU