PROJECT REPORT

Team ID	PNT2022TMID23131
Project Name	Smart Farmer – IOT Enabled Smart FarmingApplication

DOMAIN: IoT (INTERNET OF THINGS)

Project Title: Smart Farmer– IOT Enabled Smart Farming Application

Team Members

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I)INTRODUCTION

1)PROJECT OVERVIEW:

Agriculture means production of foods and grains through farming. Farmers are the people who ensures that food is available for everyone. Production of crops mainly depends on soil condition therefore irrigation should be done with much care. Around 60% of water used for irrigation is wasted, poor irrigation systems are main cause of wastage of water. Alternate methods such as drip irrigation can be over-priced to be adapted. Agricultural operations have been highly enhanced after technology is combined with it. Smart Farming Using IoT enhances, automates and improves agricultural operations and processes. The system leads to increase in production with low cost and enables farmers with real time access to information. The objective of this system is to render a reliable, robust, efficient and intelligent farm controller app-based system which is smart enough to analyze distinct parameters of a field like moisture, temperature, humidity, etc. and provide a water delivering schedule in a targeted manner near the root zone of the crop to ensure all the crops get enough water for their healthy growth, thereby reducing manual intervention of farmer. The system analyses the soil quality to avoid soil erosion. The system gathers local weather information and suitable factors to grow crops so that the crops always receive the appropriate amount of water. This system incorporates the concept of IoT (Internet of Things),IBM Cloud and IBM Watson Services via mobile App and web app.

2)PURPOSE:

i)To avoid 24/7 hours monitoring.

ii) It will provide the field conditions regularly and farmers will not be in need to check the conditions by going directlly to the field.

iii)It can also stop the water wastage whenever there is excess water the system will indicate them.

iv)It also can reduce the stress of the farmers due to loss that occurs from crop damage.

II)LITERATURE SURVEY:

1)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 climate.

2)REFERENCES:

LITERATURE SURVEY

SI. No.	Title	Author	Abstract
1	Smart Farmer IOT	Zuraida Muhammad, Muhammad Azri Asyraf Mohd Hafez, Nor Adni MatLeh, Zakiah Mohd Yusoff , Shabinar Abd Hamid	The term "Internet of Things" refers to the connection of objects, equipment, vehicles, and other electronic devices to a network for the purpose of data exchange (IoT). The Internet of Things (IoT) is increasingly being utilised to connect objects and collect data. As a result, the Internet of Things' use in agriculture is crucial. The idea behind the project is to create a smart agriculture system that is connected to the internet of things. The technology is combined with an irrigation system t Malaysia's variable

			weather. This system's microcontroller is a Raspberry Pi 4 Model B. The temperature and humidity in the surrounding region, as well as the moisture level of the soil, are monitored using the DHT22 and soil moisture sensor. The data will be available on both a smartphone and a computer. As a result, Internet of Things (IoT) and Raspberry Pi-based Smart Agriculture Systems have a significant impact on how farmers work. It will have a good impact on agricultural productivity as well. In Malaysia, employing IoT-based irrigatio saves roughly 24.44 percent per year when compared to traditional systems. This would save money on labour expenditures while also preventing water waste in daily needs.
2	Smart Agriculture Monitoring	Divya J., Divya M., Janani V.	Agriculture is essential to India's economy and people's survival. The purpose of this project is to create an embedded-based soil monitoring and irrigation system that will reduce manual field monitoring and provide information via a mobile app. The method is intended to help farmers increase their agricultural output. A pH sensor, atemperature sensor, and a humidity sensor are among the tools used to examine the soil.Based on the findings, farmers may plant the best crop for the land. The sensor data is sent to the field manager through Wi-Fi, and the crop advice is created with the help of the mobile app. When the soil temperature is high, an automatic watering system is used. The crop image is gathered and forwarded to the field manager for pesticide advice.
3	Smart Agriculture Control using IOT	H.G.C.R. Laksiri, H.A.C. Dharmagunawardhana, J.V. Wijayakulasooriya	Development of an effective IoT-based smart irrigation system is also demand for farmers in the field of agriculture. This research develops a low-cost, weather-based smart watering system. To begin, an effective drip irrigation system must be devised that can automatically regulate water flow to plants basedon soil moisture levels. Then, to make this water-saving irrigation system even more efficient,an IoT-based communication feature is added, allowing a

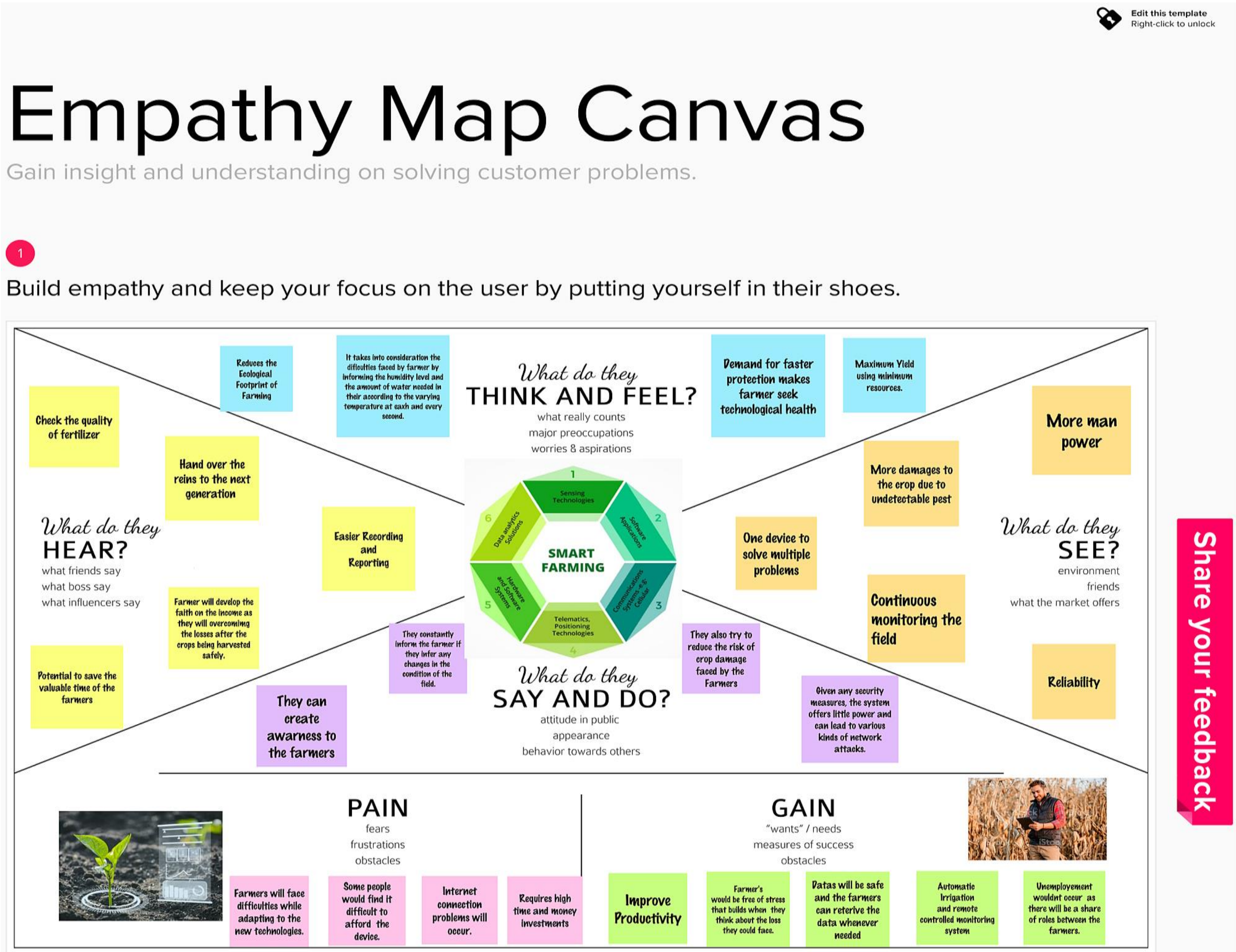
			remote user to monitor soil moisture conditions and manually adjust water flow. The system also includes temperature, humidity, and rain drop sensors, which have been updated to allow remote monitoring of these parameters through the internet. In real time, these fiel variables are stored in a remote database. Finally, based on the present weather conditions, a weather prediction algorithm is employed to manage water distribution. Farmers would be able to irrigate their crops more efficiently with the proposed smart irrigation system.

3)PROBLEM STATEMENT DEFINITION

Farmers needs a way to get altered when there is a change in the environmental conditions on their field. So, we are designing a device which indicates the farmer about the humidity level, temperature changes and the proper irrigation based upon the condition. People can operate in both a) Manual b) Automatic. So, when needed we can change the water level. All the updates will be given to the farmer through message and mail. So, they can stay updated by this device we can save the time and relieve the stress of the farmer.

III)IDEATION & PROPOSED SOLUTION

1)EMPATHY MAP



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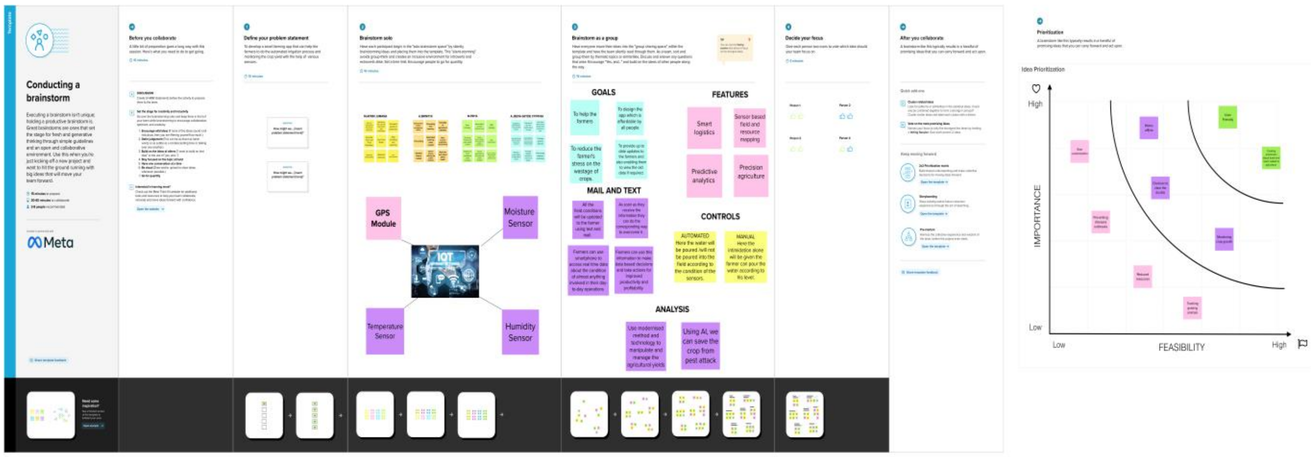
2)IDEATION & BRAINSTORMING



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3)PROPOSED SOLUTION:

Problem Statement:

This is the project from the motivation of the farmers working in the farm lands are solely dependent on the rains and bore wells for irrigation of their land. In recent times, the farmers have been using irrigation technique through the manual control in which the farmers irrigate the land at regular intervals by turning the water-pump ON/OFF when required. Moreover, for the power indication they are glowing a single bulb between any one of phase and neutral, meanwhile when there is any phase deduction occurs in other phases, the farmer cannot know their supply is low. If they Switch ON any of the motor, there will be the sudden defuse in motor circuit. They may have to travel so far for SWITCHING ON/OFF the motor. They may be suffering from hot Sun, rain and night time too. After reaching their farm, they found that there is no power, so they quietly disappointed to it!! Is there any solution for it??? Let’s check our solution.

Idea / Solution description:

This project presents proposed model for Smart Agriculture to develop real time monitoring system for soil properties like Temperature, Humidity and moisture, crop yield identification using SMS based Alerts. It will also be possible to control various operations of the field remotely from anywhere, anytime by mobile as well as web application. The IOT based agricultural monitoring system has been used to maximize the yield of crop by monitoring the environmental parameters and thus providing the required information to farmer remotely. This system can be implemented in any type of agricultural field with varying soils. The use of IOT over the other technology one aides for deploying it in any type of environment for monitoring, making it flexible and robust. The proposed system is developed for the goodwill of farmers. The system greatly reduces the human interaction, labour cost and wastage of water. Threshold values for climatic conditions like humidity, temperature, moisture can be fixed based on the environmental conditions of that particular region.This system generates irrigation schedule based on the sensed real time data from field and data from the weather repository. Using the water level sensor the water level in the tank can be calculated and based on the data from humidity and moisture sensor the land can be irrigated automatically and can detect the overflow in the water tank. Thus, smart irrigation system helps to improve the crop yield and thereby meet the demand. This project remotely measure and monitor water moisture levels in the soil to ensure that crops are getting optimal water resources and automatically trigger sprinkler systems to address low moisture levels in the soil to prevent crop damage or loss. This idea will improve the crop yield and manage them.

NOVELTY/ORIGINALITY OF THE STUDY:

Water being a precious resource must be utilized efficiently. Agriculture is one of those areas which consumes lot of water. Irrigation to the farm is a time consuming process and must be done on timely basis. As aimed, through this work an auto irrigation system measuring the moisture content, and the water level. Later harvesting the excess water from the cultivation field and recycled back to the tank.

SOCIAL IMPACT:

Third Green Revolution

Smart farming and IoT-driven agriculture are paving the way for what can be called a Third Green Revolution.Following the plant breeding and genetics revolutions, the Third Green Revolution is taking over agriculture. That revolution draws upon the combined application of data-driven analytics technologies, such as precision farming equipment, IoT, big data analytics, Unmanned Aerial Vehicles (UAVs or drones), robotics, etc.

In the future, this smart farming revolution depicts, pesticide and fertilizer use will drop while overall efficiency will rise. IoT technologies will enable better food traceability, which in turn will lead to increased food safety. It will also be beneficial for the environment, through, for example, more efficient use of water, or optimization of treatments and inputs.

Therefore, smart farming has a real potential to deliver a more productive and sustainable form of agricultural production, based on a more precise and resource-efficient approach. New farms will finally realize the eternal dream of mankind

BUSINESS MODEL/REVENUE MODEL:

Sensors,control systems, robots, autonomous vehicles ,motion detectors, button cameras, and wearable devices are all important components in this approach to farm management. This information can be used to track the overall state of the company, as well as employee performance and equipment efficiency. The ability to predict production output provides for improved product distribution planning.

I)**Agriculture Drones** are being utilised in agriculture to improve a variety of agricultural processes, including crop health assessment, irrigation, crop monitoring, crop spraying, planting, and soil and field analysis.

II) **Greenhouses with Intelligence** – A smart greenhouse built with IoT monitors and manages the climate intelligently, removing the need for manual intervention.

III)**Smart farming with predictive analytics**, Crop prediction is important because it aids the farmer in making future decisions about crop production, storage, marketing tactics, and risk management.

IV)**Artificial networks** are used to predict crop output rates using data received from farm sensors.

V)**A snowballing world population** means the agricultural industry will need to produce approximately 70 percent more food in 2050 than it did in 2006, according to the UN Food and

VI)**Agriculture Organization**. - To maximize crop yields and use of resources, farmers are utilizing smart agriculture technology to track progress, predict outcomes and drive decision-making.

VII)**Precision agriculture(Precision farming):** Weather forecasting accuracy and other dynamic data inputs can affects crop productivity to a great extent. The higher the level of accuracy, the lower the chances of crops being damaged; thus, more accurate weather forecasts can lead to higher profitability and productivity levels

SCALABILITY:

Scalability is another requirement that should be considered in a smart farming platform. Scalability refers to the ability to increase available resources and system capability without the need to go through a major system redesign or implementation. We can increase the capacity for data processing by increasing the cloud resources in the second layer and computation resources in the third layer. The challenges related to scalability in smart farming fall into two categories: i)Capacity

ii)Performance

Scaling capacity refers to the ability to add new nodes or resources to the system. Scaling performance is the ability to improve performance or to keep the performance identical while expanding capacity. The fundamental bottleneck that may affect system performance may be caused by different deployment configurations of various components. Other challenges of scalability are identity management and access control, security, privacy , governance, and fault tolerance . Since farming data generation is rapidly increasing every day, such data are too large to be stored on a single node. A fundamental solution to address this need is distributing data collection mechanisms across multiple nodes. For instance, Zhou et al employed Hadoop to process and store 1.44 million data records for daily temperature monitoring. Since most smart farming data are small files that lead to many small files, Hadoop cannot be effective without a distributed system equipped with a high-performance computing system. To address this problem, the Hadoop Distributed File System (HDFS) has been designed to process large (and small size) datasets. Using cloud computing technology in a smart farming platform is another solution that can address scalability challenges related to capacity due to flexible and robust data collection, management, and processing capabilities [83]. Cloud computing provides a high level of flexibility by providing remote services for monitoring and managing farm data. Moreover, these services can provide on-demand storage and computation resources with no need for on-farm hardware installation. The data stored in the cloud systems are usually distributed in the data storage platforms supported by backup mechanisms. The data-driven services are finally offered by web services accessible through diverse tools, including laptops, tablets, and smartphones in the last stage of smart farming tasks. Smart Farm Net is an example of a scalable platform that utilizes cloud computing technology to provide a scalable solution for smart farming.

4)PROBLEM SOLUTION FIT:

Problem-Solution Fit

Define CS, fit into

1. CUSTOMER SEGMENT(S) CS

The main customer for our project are:
i)Farmers who wants to improve the yield of their crops.
ii)Farmers who wants to know the condition of their crops and it's environmental conditions so they could take the necessary methods immediately.

6. CUSTOMER CC

Network connectivity would be the main constraint as we use Wi-Fi which has major limitations like in coverage, scalability, and power consumption.

5. AVAILABLE SOLUTIONS AS

For smart farming, lot of iot based solutions are there. But one huge disadvantage of smart farming is that it requires an unlimited or continuous internet connection to be successful. This means that in rural communities, especially in the developing countries where we have mass crop production, it is completely impossible to operate this farming method. In places where internet connections are frustratingly slow, smart farming will be an impossibility.

Explore AS,

Focus on J&P, tap into BE, understand

2. JOBS-TO-BE-DONE / PROBLEMS J&P

1)The farmers will initially find it hard to use the device as they have to get familiar with the technologies.
ii)They must be with their phone/laptop always so that they would be alarmed when they get the message/mail.
iii)Our main job would be making the technologies feasible for the farmers by bridging the gap.

9. PROBLEM ROOT CAUSE RC

Technologies keep developing but still the farmers are not able to achieve their goals(i.e.) receiving the expected profit due to various reasons like the presence of excess water in the field, varying climatic conditions etc which affects the crop. So in order to avoid this there is a need for smart farming which helps to improve the time efficiency,crop monitoring,soil management etc.

7. BEHAVIOUR BE

IoT applications help farmers to collect data regarding the location, well-being, and health of their crops.
Weather stations equipped with smart sensors can collect weather data and send useful information to a farmer.
As in the case of weather condition monitoring, sensors for crop monitoring also collect all information like crop health, humidity, precipitation, temperature, and other parameters.

Focus on J&P, tap into BE, understand

Identify strong TR & EM

3. TRIGGERS TR

Customers get triggered mainly because to save their crops and to prevent them from the damage as they feel depressed when they face the losses and it indirectly affects their family too. This device is also a budget friendly device.

4. EMOTIONS: BEFORE / AFTER EM

Before:
Depressed, loss of time ,Facing more losses
After:
Confident , Gets chance to spend time efficiently,95%

10. YOUR SOLUTION SL

To provide an alternate (i.e) to avoid the network problems we are also going to introduce the manual mode where the farmers can stop the water flow /provide limited amount of water flow into the field., Make it more user friendly(like appoint the help center team to guide them whenever they are facing any trouble with our app),..
Additional features like create an awareness about where to get agricultural loans, government agriculture schemes and get the feedback of every farmers on every monthend and if its related to government, then make it to reach the government. It also ensures whether the crops are well nourished and watered without human intervention. It helps in increasing farming productivity and quality, reducing labour costs and maintaining the sustainability of the entire value chain.

8. CHANNELS of BEHAVIOUR CH

Offline:
The IoT-based smart farming not only helps in modernizing the conventional farming methods but also targets other agriculture methods like organic farming, family farming (complex or small spaces, particular cattle and/or cultures, preservation of particular or high-quality varieties, etc.), and enhances highly transparent farming.
Online:
IoT-based smart farming is also beneficial in terms of environmental issues. It can help the farmers to efficiently use water, optimize the inputs and treatments

Extract online & offline CH of BE

IV)REQUIREMENT ANALYSIS:

1)FUNCTIONAL REQUIREMENT

FR No.	Functional Requirement	Sub Requirement
FR-1	User Registration	Registration through form Registration through gmail
FR-2	User Confirmation	Confirmation via Email Confirmation via OTP
FR-3	System Login	Check username and password Check multifactor enrollment Check accessthrough a different device Check wrong credentials

FR-4	Data Management	Manage the data of weather conditions Manage the data of crop conditions Manage the data of livestock conditions
FR-5	Manage Modules	Manages system admins Manage Roles of access Manage user permission

2)NON FUNCTIONAL REQUIREMENT

FR No.	**Non-Functional Requirement**	**Description**
NFR-1	**Usability**	The proposed system uses robots, drones, remote sensors,analytical tools, and the whole system is monitored and managed through an app on a smartphone. This makes thesystem userfriendly and the usage of this product doesn't require any prior learning.
NFR-2	**Security**	The proposed system includes Data anonymization whichis aprocess in which any information that can enable personal identification, including name, address, geographic identifiers, are removedfrom data andAccess control which helps in privacy-preserving and security.

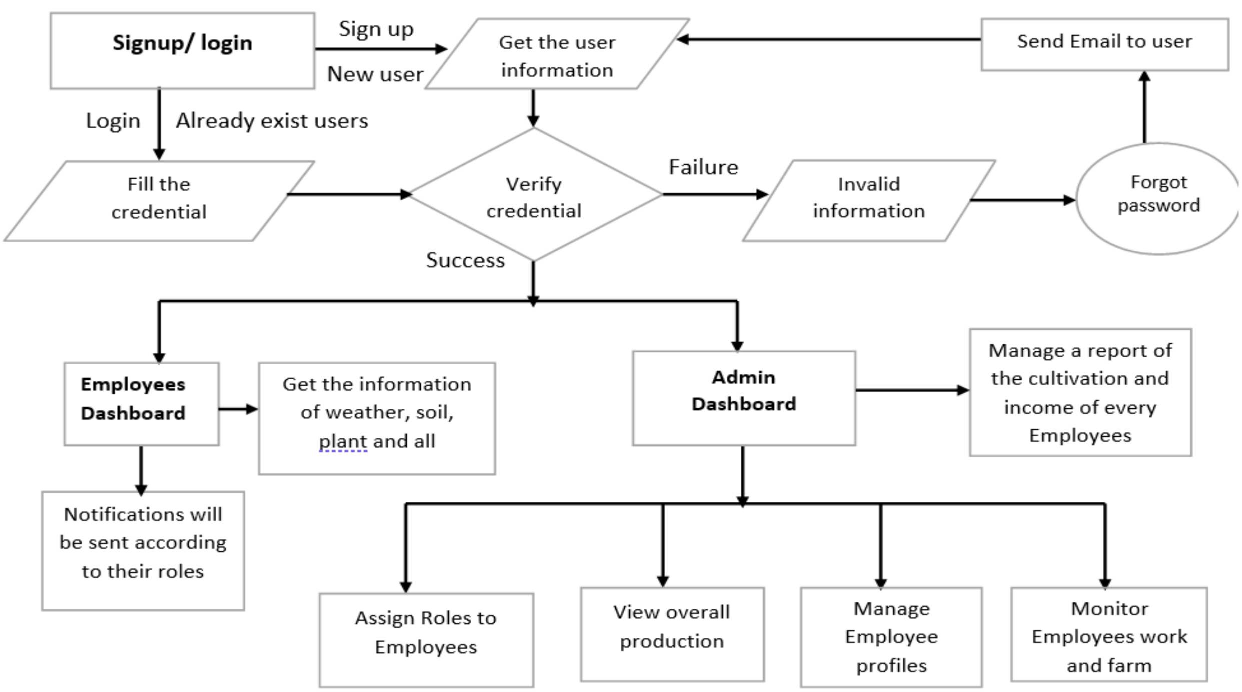
NFR-3	**Reliability**	The use of sensors, specialized software IOT platform andenhanced uninterrupted internet connectivity withstand severe weather events and open space conditions. The system provides an accurate measurement of data, and it can have a longerlifespan.
NFR-4	**Performance**	The use of modern technological solutions helps to bridge the gap between production and quality and quantity yield.Data Ingested by obtaining and importing information fromthe multiple sensors for real time use or storage in a database ensuresswift action and less damage to the crops increasing the overall performance of the system.
NFR-5	**Availability**	The present system can be improved easily by integratingnew components with enhanced features. Automatic adjustment of farming equipment made possible by linkinginformation likecrops/weather and equipment to auto adjust temperature and humidity.
NFR-6	**Scalability**	The proposed system uses Cloud database deployment which can be visualized as the intermediate medium between hardware system and user's mobile application.

		With increased production, lowered operation costs and with accurate farm and fieldevaluation, proposed systemis scalable.

V)PROJECT DESIGN

1)DATA FLOW DIAGRAMS

A data flow diagram (DFD) maps out the flow of information for any process or system. It uses defined symbols like rectangles, circles and arrows, plus short text labels, to show data inputs, outputs, storage points and the routes between each destination.



2)SOLUTION& TECHNICAL ARCHITECTURE:

SOLUTION ARCHITECTURE:

SMART FARMER-IOT ENABLED SMART FARMING APPLICATION

The proposed solution will assist farmers by getting live data (Temperature, humidity, soil moisture) from the farmland to take necessary steps to enable them to do smart farming by also increasing their crop yields and saving resources (water, fertilizers).

The architecture of proposed system consists of various blocks:

SENSORS

The soil moisture sensor senses the moisture level in the soil. The humidity and temperature sensor gives the humidity and temperature values of the atmosphere which determine whether the crop is suitable for growth. The soil moisture sensor, humidity and temperature sensor continuously monitors the soil and environmental conditions, sends the live data to mobile.

ARDUINO UNO

Arduino Uno is the heart of the system. The facts gathered with the aid of the sensors is sent to the Arduino UNO.The gathered information may be displayed in a Arduino IDE.

SOIL MOISTURE SENSOR

A soil moisture sensor *empowers agriculturalists to estimate the water levels without the need* to be physically present in the field.

TEMPERATURE SENSOR

The temperature sensor senses the surrounding temperature of the farm

in different farm conditions.

HUMIDITY SENSOR

Humidity sensors are electronic devices that measure and report the moisture and air temperature of the surrounding environment.

IBM CLOUD

Used to connect the device Node-Red with the IBM Watson Platform.

Technology Architecture:

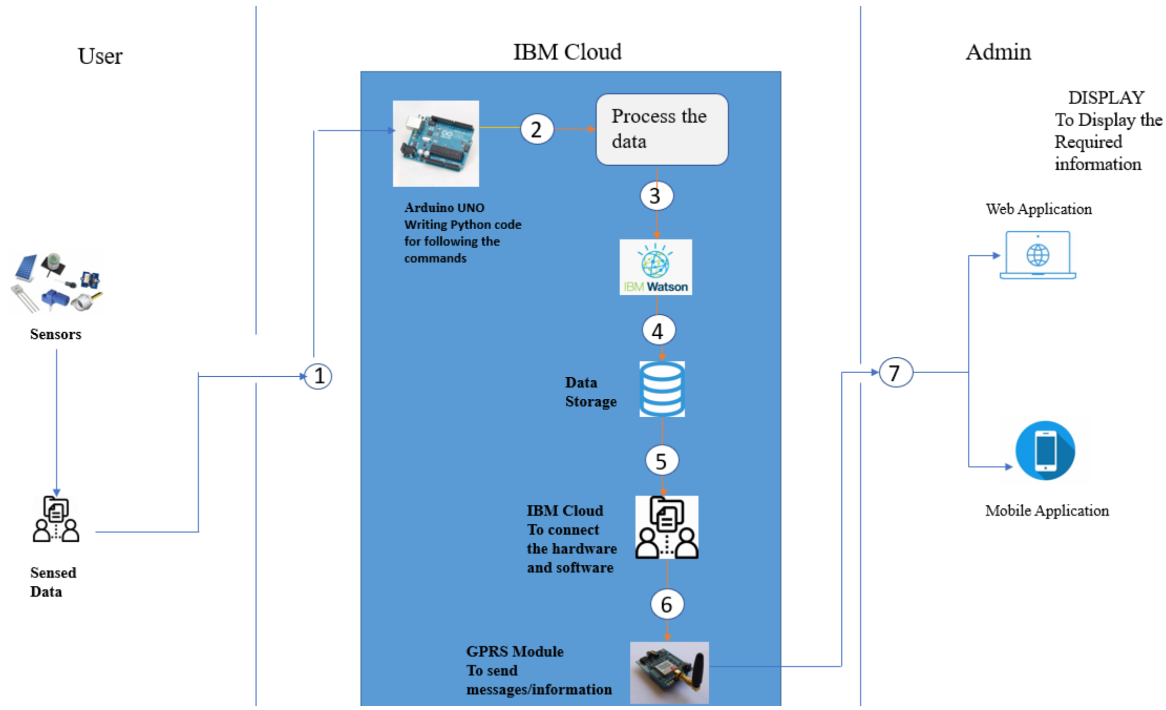


Table-1 : Components & Technologies:

S.No	Component	Description	Technology
1.	User Interface	Through Mobile app or Web Application the information processed will be sent to the user through message or mail.	HTML, CSS, JavaScript / Angular Js / React Js etc.
2.	Application Logic-1	The code will include certain conditions like based on the humidity condition the water flow will be controlled, based on the moisture content the water flow will be controlled and if the temperature exceeds certain level it will also be intimated through message and mail.	Java / Python

3.	Application Logic-2	Here we can develop the software process like creating a device and then adding Node RED to form as an interface.	IBM Watson STT service
4.	Application Logic-3	Here the sensed data and the conditions can be checked and the final result can be obtained.	IBM Watson Assistant
5.	Database	We can save all the data in SQL or any other database so that the user can retrieve data whenever required.	MySQL, NoSQL, etc.
6.	Cloud Database	The database we created and the predefined data's like weather from external API can be combined here and can be stored safely with security for future purpose.	IBM DB2, IBM Cloudant etc.
1.	File Storage	File storage requirements	IBM Block Storage or Other Storage Service or Local Filesystem
1.	External API-1	With the help of external API only we can know the weather condition and compare with our sensed inputs.	IBM Weather API, etc.
1.	External API-2	Purpose of External API used in the application	Aadhar API, etc.

Table-2: Application Characteristics:

S.No	Characteristics	Description	Technology
1.	Open-Source Frameworks	MIT App Inventor, Python, Weather App API.	Technology of Opensource framework
2.	Security Implementations	Here we are using IBM Cloud and it is the very secured place where we can store the data and retrieve the information whenever needed.	IBM Cloud, MIT App Invertor , IBM Watson Assistant
3,	Scalable Architecture	Cloud-based IoT is becoming an increasingly popular and desirable solution. This work presents a specially designed architecture based on IBM Cloud services for monitoring livestock using Internet of things (IoT) equipment and a wide range of cloud native services. Used services in IBM a stress test to prove the ability of the developed architecture for data processing was completed	IBM Cloud
4.	Availability	Many important features are available in this application instead of wasting time by staying in the farm and monitoring the conditions we have the moisture, humidity and temperature which will denote the corresponding quantities and we have both automatic and manual mode so once the certain conditions are met pump will be on/off and messages will be sent when needed so the farmer just have to check	Sensor Networks , IBM Watson IoT , IBM Cloud , Weather API'S , Analytics

		the message in their phone and can take decisions accordingly.	
5.	Performance	**Excelled efficiency**: Today's agriculture is in a race. Farmers have to grow more products in deteriorating soil, declining land availability and increasing weather fluctuation. IoT-enabled agriculture allows farmers to monitor their product and conditions in real-time. They get insights fast, can predict issues before they happen and make informed decisions on how to avoid them. Additionally, IoT solutions in agriculture introduce automation, for example, demand-based irrigation, fertilizing and robot harvesting. **Expansion:-**By the time we have 9 billion people on the planet, 70% of them will live in urban areas. IoT-based greenhouses and hydroponic systems enable short food supply chains and should be able to feed the people. Smart closed-cycle agricultural systems allow growing food basically everywhere—in supermarkets, on skyscrapers' walls and rooftops, in shipping containers and, of course, in the comfort of everyone's home. **Reduced resources:** Plenty of agriculture IoT solutions are focused on optimizing the use of resources—water, energy, land. Precision farming using IoT relies on the data collected	

		from diverse sensors in the field which helps farmers accurately allocate just enough resources to within one plant. **<u>Cleaner process</u>**: Not only do IoT-based systems for precision farming help producers save water and energy and, thus, make farming greener, but also significantly scale down on the use of pesticides and fertilizer. This approach allows getting a cleaner and more organic final product compared to traditional agricultural methods. **<u>Agility:</u>** One of the benefits of using IoT in agriculture is the increased agility of the processes. In the conditions of extreme weather changes, new capabilities help agriculture professionals save the crops. **<u>Improved product quality:</u>** Data-driven agriculture helps both grow more and better products. Using soil and crop sensors, aerial drone monitoring and farm mapping, farmers better understand detailed dependencies between the conditions and the quality of the crops. Using connected systems, they can recreate the best conditions and increase the nutritional value of the products. As a result, all of these factors can eventually lead to higher revenue.	

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3)USER STORIES:

User Type	Functional Requirement(Epic)	User Story Number	User Story/Task	Acceptance criteria	Priority	Release
Employee dashboard	Registration	USN-1	As an employee, I can register for the application by entering my email, password, and confirming my password	I can access my account/ dashboard	High	Sprint-1
	Login	USN-2	As an employee, I can login to the application by	I can access my account/ dashboard	High	Sprint-1

			entering correct email andpassword			
	Dashboard	USN-3	As an employee, accordingto my role, I will get notification about my task	I get the information about whatI have to doin monsoons	High	Sprint-1
	Forgot Passwor d	USN-4	As an employee, I can resetmy password by this option incase I forgot myold password	I get access to my account again	Medium	Sprint-2
	Know more	USN-5	As an employee, I will be guided by expertise through online session oncein a week about howto take care of the plant and all	Know something more	Low	Sprint-3

	Help me	USN-6	As an employee, I can postmy problems and will get Solution from expertise	I can ask my query and all	High	Sprint-1
	Feedback	USN-7	As a user , if I face any problem while using the app or want to give some suggestion about the app..ThatI can do by posting my issuesin feedback	I can tell my problems	Medium	Sprint-2

User Type	**Functional Requirement (Epic)**	**User StoryNumber**	**User Story/Task**	**Acceptance criteria**	**Priority**	**Release**
Admin dashboard	Login	USN-1	As an admin, I can login to the application by	I can access my account/ dashboard	High	Sprint-1

			entering correct email and password			
	Dashboard	USN-2	As an admin, I can see theperformance of the employees	I get the information employees work	High	Sprint-1
	Forgot Password	USN-3	As an admin, I can reset my password by this option incase I forgot myold password	I get accessto my account again	Medium	Sprint-2
	Role Assignment	USN-4	As an admin, I can assignroles to employees	I can assign roles to employees	High	Sprint-1
	Production view	USN-5	As an admin, I can view the overall production of everymonth	I get the information of cultivation	High	Sprint-1

	Note Book	USN-6	As an admin, I can make a note of expenditure of myfarm and all	I can use note book also	Low	Sprint-3

VI) PROJECT PLANNING & SCHEDULING:

1)SPRINT PLANNING & ESTIMATION:

Sprint	Functional Requirement (Epic)	User Story Number	User Story / Task	Story Points	Priority	Team Members
Sprint-1	Hardware	USN-1	Sensors and wi-fi module with python code	2	High	Jeeva GetzieCynthia A, Srinithi A, Priya M, Afrin Jumana M
Sprint-2	Software	USN-2	IBM Watson IoT platform, Workflows for IoT scenarios usingNode-red	2	High	Jeeva GetzieCynthia A, Srinithi A, Priya M, Afrin Jumana M
Sprint-3	MIT app	USN-3	To develop an mobileapplication using MIT	2	High	Jeeva GetzieCynthia A, Srinithi A, Priya M, Afrin Jumana M
Sprint-4	Web UI	USN-4	To make the userto interact withsoftware.	2	High	Jeeva GetzieCynthia A, Srinithi A, Priya M, Afrin Jumana M

2)SPRINT DELIVERY SCHEDULE:

Sprint	Total Story Points	Duration	Sprint Start Date	Sprint End Date (Planned)	Story Points Completed (as on Planned End Date)	Sprint Release Date (Actual)
Sprint-1	20	6 Days	24 Oct 2022	29 Oct 2022		29 Oct 2022
Sprint-2	20	6 Days	31 Oct 2022	05 Nov 2022		5 Nov 2022
Sprint-3	20	6 Days	07 Nov 2022	12 Nov 2022		12 Nov 2022
Sprint-4	20	6 Days	14 Nov 2022	19 Nov 2022		19 Nov 2022

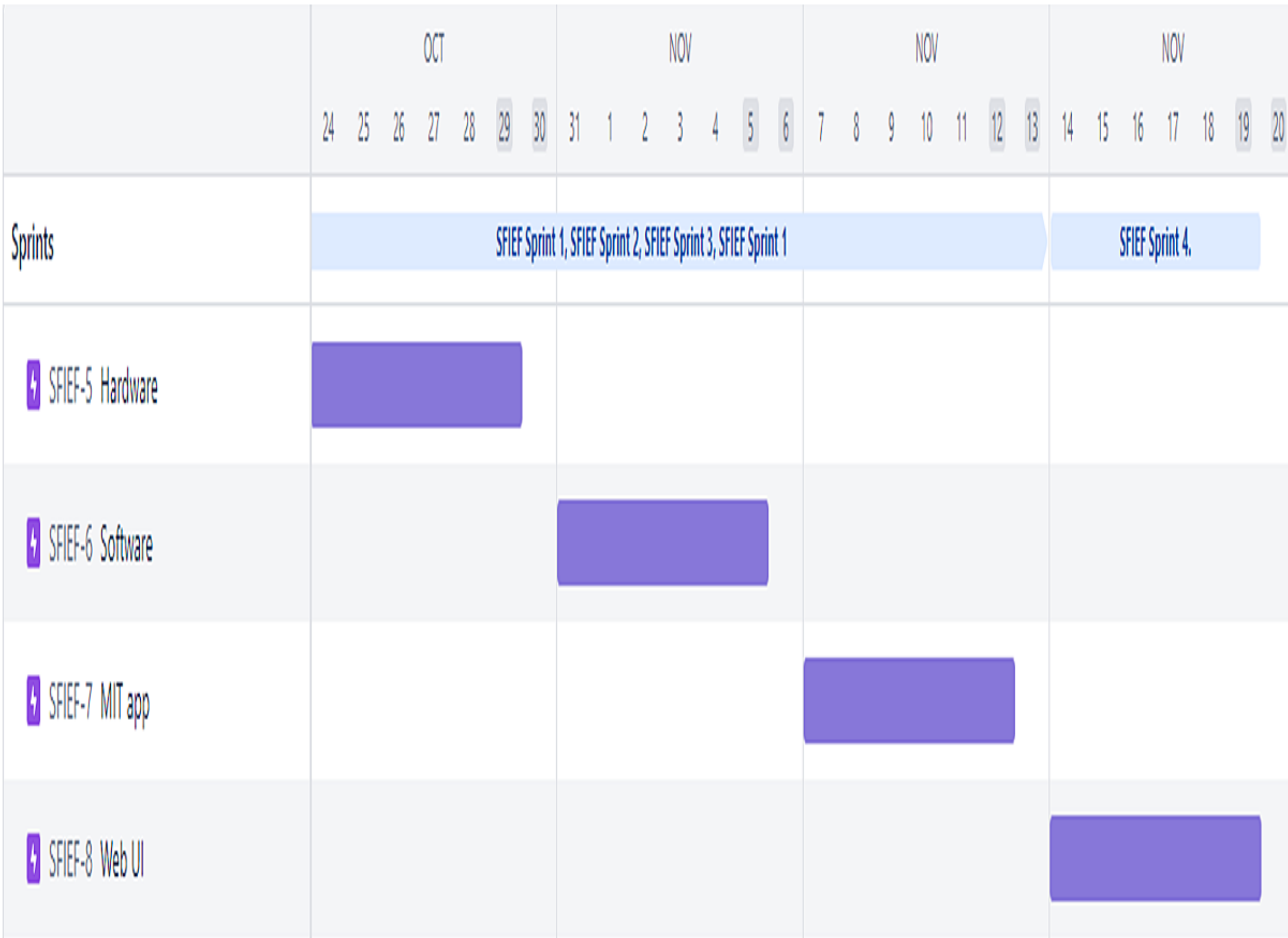
3)REPORTS FROM JIRA:

Velocity:

Imagine we have a 10-daysprint duration, and the velocityof the team is 20 (pointsper sprint). Let’s calculate the team’s averagevelocity (AV) per iteration unit (story points per day)

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

3)REPORTS FROM JIRA:



VII) CODING & SOLUTIONING:

FEATURE 1 WEB APP: PYTHON CODE

We have created a web app which will show the values of the monitored field conditions continuously (i.e.) Humidity,Pressure and Moisture and we also have included two buttons (i.e.,) MOTOR ON and MOTOR

OFF .Based on the displayed conditions the farmers can control the motor from the place they are present with the help o Python CODE,IBM WATSON and NODE - RED(DEVICE)

PYTHON CODE:

```
import time

import sys

import ibmiotf.application

import ibmiotf.device

import random



#Provide your IBM Watson Device Credentials

organization = "ewf12x"

deviceType = "Raspberrypi"

deviceId = "123459"

authMethod = "token"

authToken = "123456789"


# Initialize GPIO
```

```
def myCommandCallback(cmd):

    print("Command received: %s" % cmd.data['command'])

    status=cmd.data['command']

    if status=="motoron":

        print ("MOTOR is ON")

    else :

        print ("MOTOR is OFF")



    #print(cmd)








try:

        deviceOptions = {"org": organization, "type": deviceType, "id": deviceId, "auth-method": authMethod,
"auth-token": authToken}
```

```
    deviceCli = ibmiotf.device.Client(deviceOptions)

    #..............................................


except Exception as e:

    print("Caught exception connecting device: %s" % str(e))

    sys.exit()


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

deviceCli.connect()


while True:

    #Get Sensor Data from DHT11


    temp=random.randint(60,100)

    hum=random.randint(90,110)

    moist=random.randint(0,100)
```

```
        data = { 'temp' : temp, 'hum': hum, 'moist': moist }

        #print data

        def myOnPublishCallback():

            print ("Published Temperature = %s C" % temp, "Humidity = %s %%" % hum, "Moisture = %s %%"
%moist, "to IBM Watson")


        success = deviceCli.publishEvent("IoTSensor", "json", data, qos=0, on_publish=myOnPublishCallback)

        if not success:

            print("Not connected to IoTF")

        time.sleep(5)


        deviceCli.commandCallback = myCommandCallback

# Disconnect the device and application from the cloud

deviceCli.disconnect()
```

FEATURE 2 : MOBILE APP

Now with the help of MIT App Inventor and the datas from NODE - RED Device we have created the mobile app using which the Farmer can know the same field conditions (Humidity , Moisture and Temperature) and also the MOTOR ON and MOTOR OFF Buttons .It is more feasible than web application as the values will be directly displayed instead of charts.

LINK:http://ai2.appinventor.mit.edu/#5557081697288192

FEATURE 3: SMS

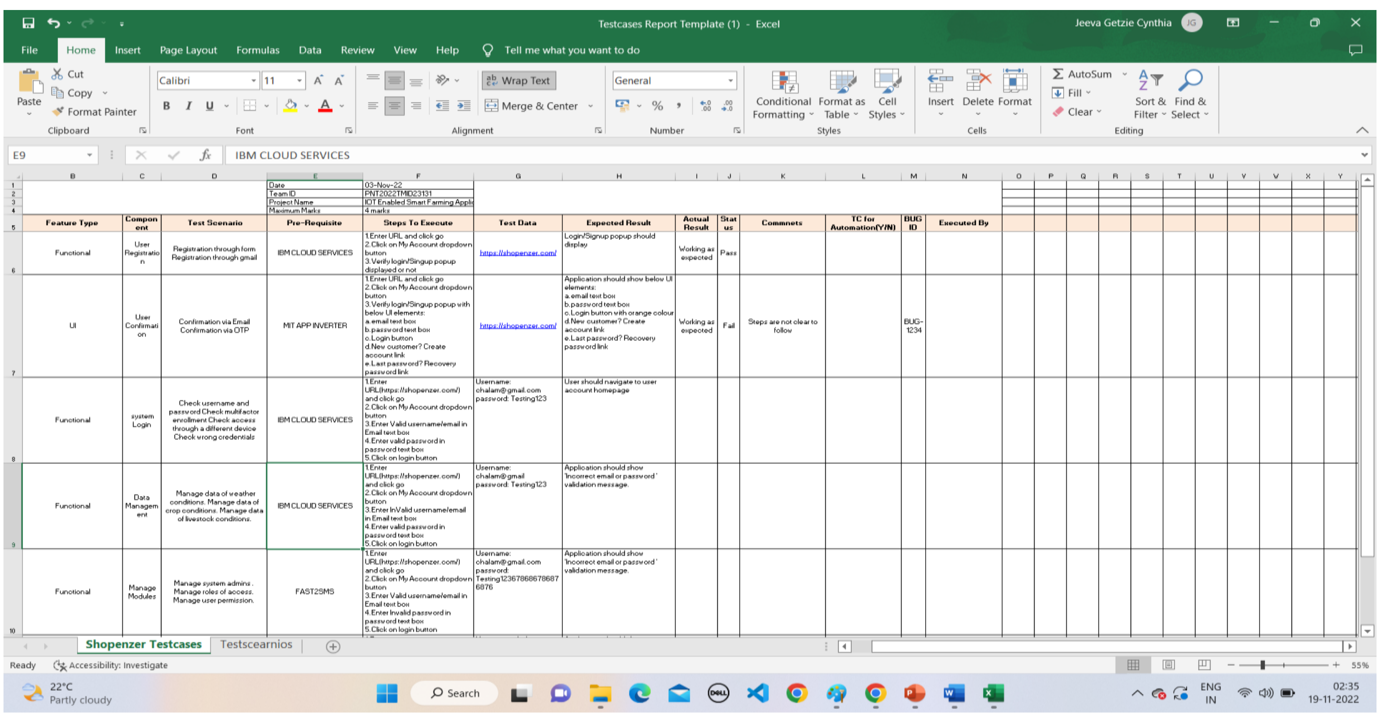
Finally we have included the SMS feature which indicates the farmer whenever the moisture is less than 20 using FAST2SMS .

LINK:

https://www.fast2sms.com/dev/bulkV2?authorization=mo3KRCt2gEwpxSZnuQWTMAHBOa4YFDJ9NVscvdjUGeizlhX75qDeUvh7JMtLzcQij89dyOYb1Bk4WG3C&route=q&message=Less%20moisture%20detected&language=english&flash=0&numbers=9315864297

VIII)TESTING

1)TEST CASES



Date	03-Nov-22
Team ID	PNT2022TMID23131
Project Name	IOT Enabled Smart Farming Applic
Maximum Marks	4 marks

Feature Type	Component	Test Scenario	Pre-Requisite	Steps To Execute	Test Data	Expected Result	Actual Result	Status	Commnets	TC for Automation(Y/N)	BUG ID	Executed By
Functional	User Registration	Registration through form Registration through gmail	IBM CLOUD SERVICES	1.Enter URL and click go 2.Click on My Account dropdown button 3.Verify login/Singup popup displayed or not	https://shopenzer.com/	Login/Signup popup should display	Working as expected	Pass				
UI	User Confirmation	Confirmation via Email Confirmation via OTP	MIT APP INVERTER	1.Enter URL and click go 2.Click on My Account dropdown button 3.Verify login/Singup popup with below UI elements: a.email text box b.password text box c.Login button d.New customer? Create account link e.Last password? Recovery password link	https://shopenzer.com/	Application should show below UI elements: a.email text box b.password text box c.Login button with orange colour d.New customer? Create account link e.Last password? Recovery password link	Working as expected	Fail	Steps are not clear to follow		BUG-1234	
Functional	system Login	Check username and password Check multifactor enrollment Check access through a different device Check wrong credentials	IBM CLOUD SERVICES	1.Enter URL(https://shopenzer.com/) and click go 2.Click on My Account dropdown button 3.Enter Valid username/email in Email text box 4.Enter valid password in password text box 5.Click on login button	Username: chalam@gmail.com password: Testing123	User should navigate to user account homepage						
Functional	Data Management	Manage data of weather conditions. Manage data of crop conditions. Manage data of livestock conditions.	IBM CLOUD SERVICES	1.Enter URL(https://shopenzer.com/) and click go 2.Click on My Account dropdown button 3.Enter InValid username/email in Email text box 4.Enter valid password in password text box 5.Click on login button	Username: chalam@gmail password: Testing123	Application should show 'Incorrect email or password ' validation message.						
Functional	Manage Modules	Manage system admins . Manage roles of access. Manage user permission.	FAST2SMS	1.Enter URL(https://shopenzer.com/) and click go 2.Click on My Account dropdown button 3.Enter Valid username/email in Email text box 4.Enter Invalid password in password text box 5.Click on login button	Username: chalam@gmail.com password: Testing123678686786876876	Application should show 'Incorrect email or password ' validation message.						

2)USER ACCEPTANCE TESTING:

1. Purpose of Document

The purpose of this document is to briefly explain the test coverage and open issues of the [ProductName] project at the time of the release to User Acceptance Testing (UAT). Acceptance Testing (UAT) Weather plays a very significant role when it comes to the Agriculture sector. In agriculture, there is almost everything dependable upon the climate condition. In smart Farming, temperature humidity, and soil moisture can be monitored through various sensors. These are again used by the reactive system to trigger alerts or automate the process such as water and air control. Farmers usually use a sampling method to calculate soil fertility, moisture content. Fortunately, this sampling doesn't give accurate results as chemical decomposition varies from location to location. Meanwhile, this not much helpful. To resolve this thing, it plays an essential role in Farming. Sensors can be installed at a uniform distance across the length and breadth of the farmland to collect the accurate soil data, which can be further used in the dashboard or mobile application for the farm monitoring. 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 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.

2. 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	8	3	2	3	16
Duplicate	1	0	2	0	3
External	2	3	0	1	6
Fixed	10	2	3	18	33
Not Reproduced	0	0	1	0	1
Skipped	0	0	1	1	2
Won't Fix	0	4	2	1	7
Totals	21	12	11	24	68

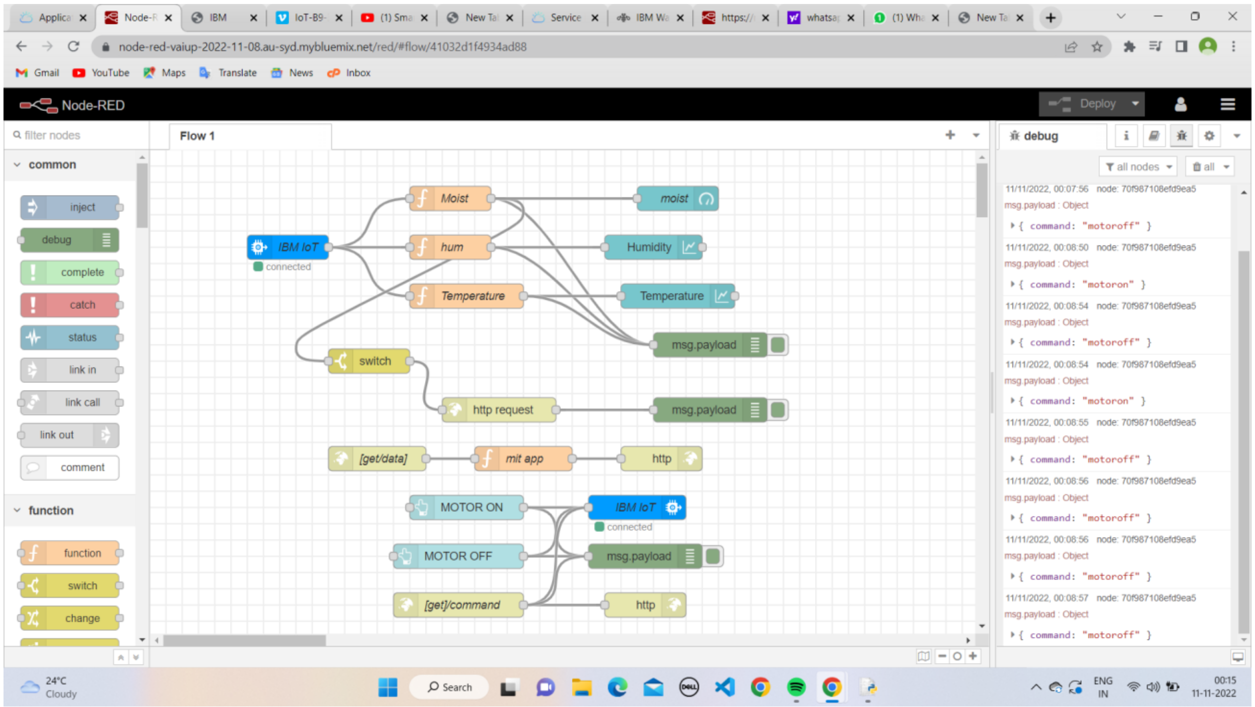
3. Test Case Analysis This report shows the number of test cases that have passed, failed, and untested

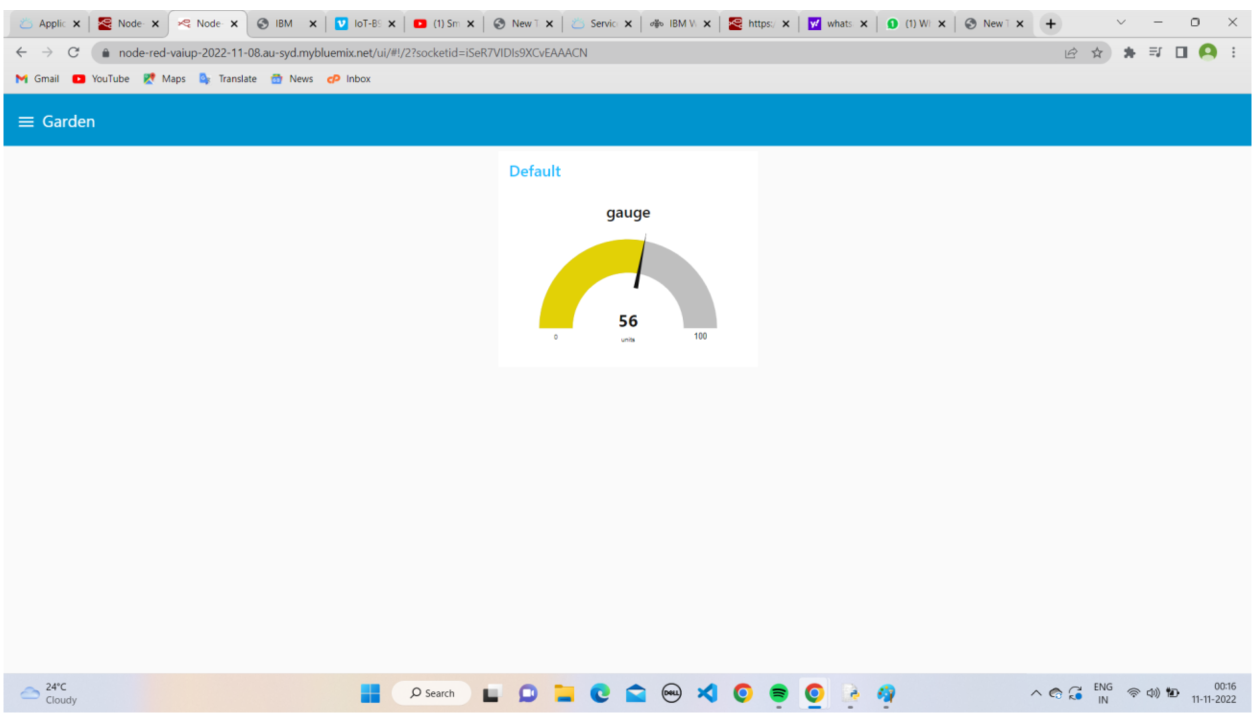
3. Test Case Analysis

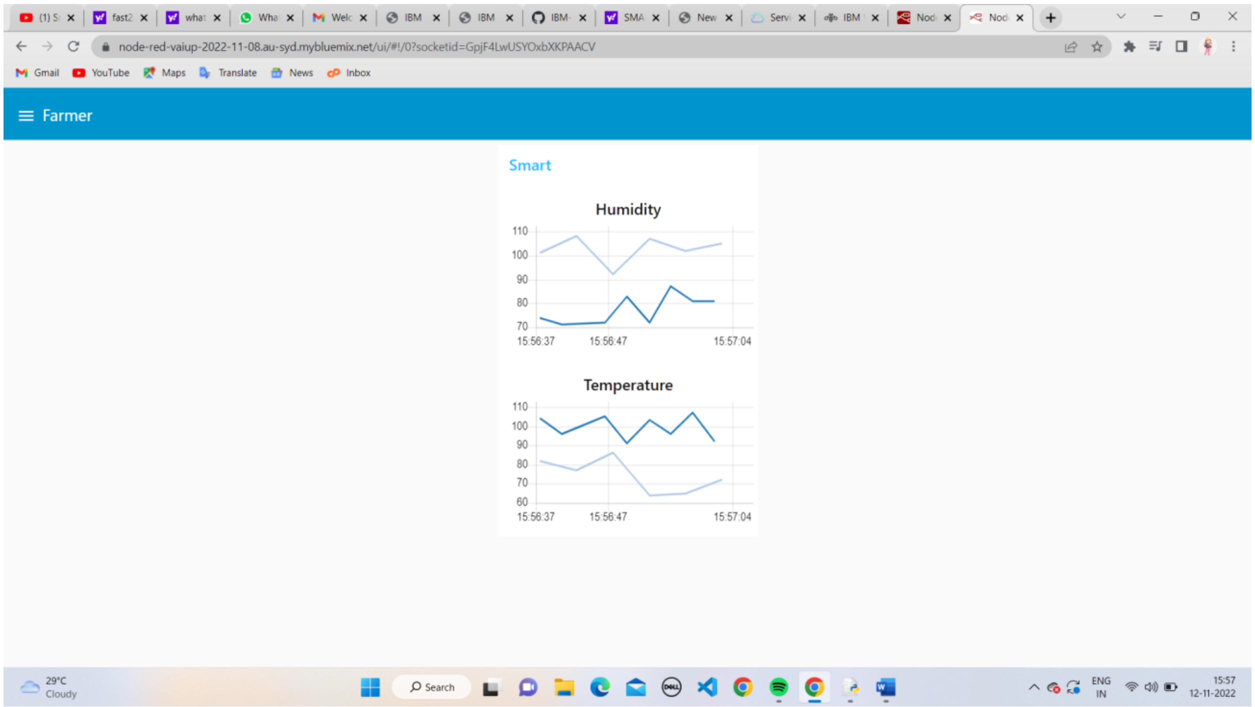
This report shows the number of test cases that have passed, failed, and untested

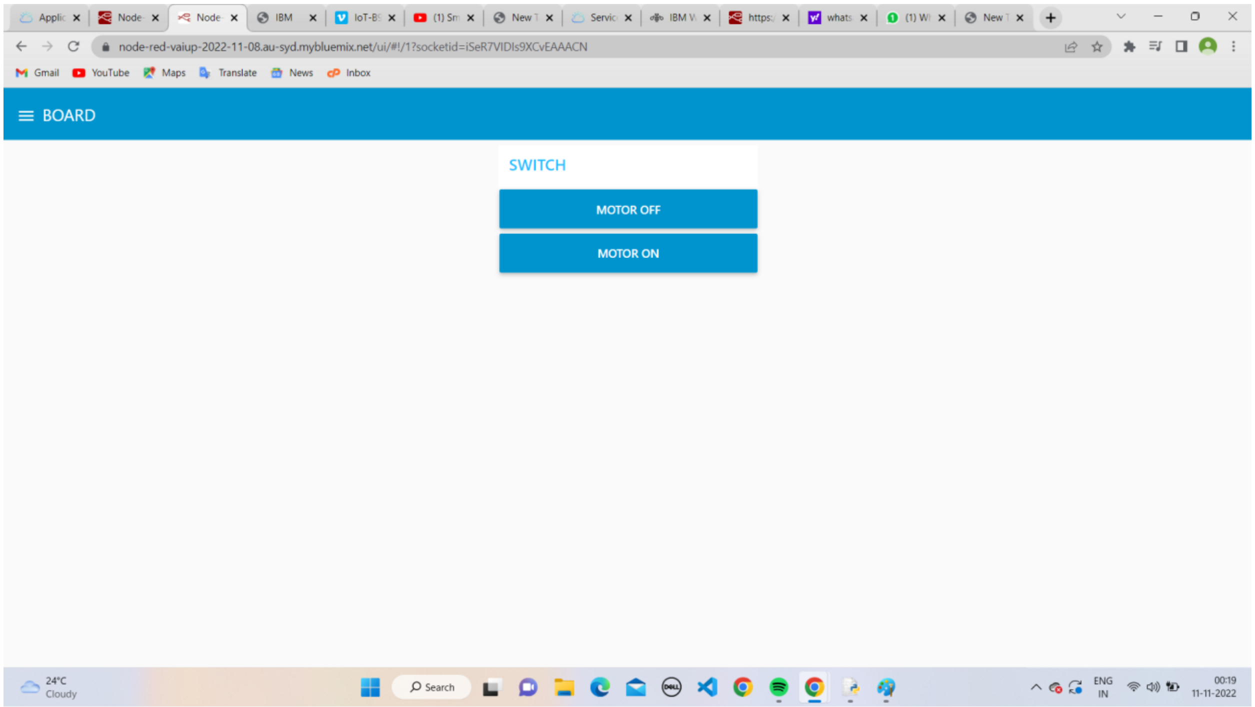
Section	Total Cases	Not Tested	Fail	Pass
Print Engine	6	0	0	6
Client Application	45	0	0	45
Security	2	0	0	2
Outsource Shipping	3	0	0	3
Exception Reporting	9	0	0	9
Final Report Output	4	0	0	4
Version Control	2	0	0	2

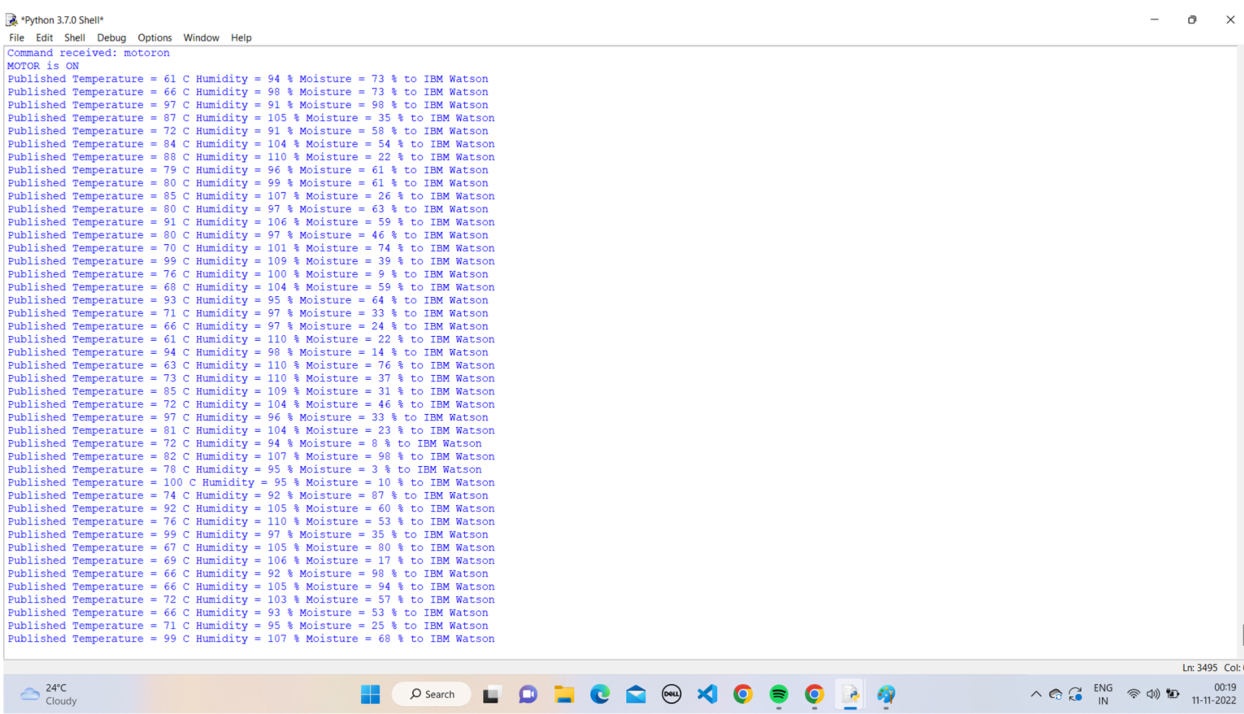
IX)RESULTS:WEB APP:


node-red-vaiup-2022-11-08.au-syd.mybluemix.net/red/#flow/41032d1f4934ad88
Node-RED
Deploy
Flow 1
debug
common
inject
debug
complete
catch
status
link in
link call
link out
comment
function
function
switch
change
IBM IoT
connected
Moist
hum
Temperature
moist
Humidity
Temperature
msg.payload
switch
http request
msg.payload
[get/data]
mit app
http
MOTOR ON
MOTOR OFF
[get]/command
IBM IoT
connected
msg.payload
http
11/11/2022, 00:07:56 node: 70f987108efd9ea5
msg.payload : Object
{ command: "motoroff" }
11/11/2022, 00:08:50 node: 70f987108efd9ea5
msg.payload : Object
{ command: "motoron" }
11/11/2022, 00:08:54 node: 70f987108efd9ea5
msg.payload : Object
{ command: "motoroff" }
11/11/2022, 00:08:54 node: 70f987108efd9ea5
msg.payload : Object
{ command: "motoron" }
11/11/2022, 00:08:55 node: 70f987108efd9ea5
msg.payload : Object
{ command: "motoroff" }
11/11/2022, 00:08:56 node: 70f987108efd9ea5
msg.payload : Object
{ command: "motoroff" }
11/11/2022, 00:08:56 node: 70f987108efd9ea5
msg.payload : Object
{ command: "motoroff" }
11/11/2022, 00:08:57 node: 70f987108efd9ea5
msg.payload : Object
{ command: "motoroff" }
24°C
Cloudy
00:15
11-11-2022

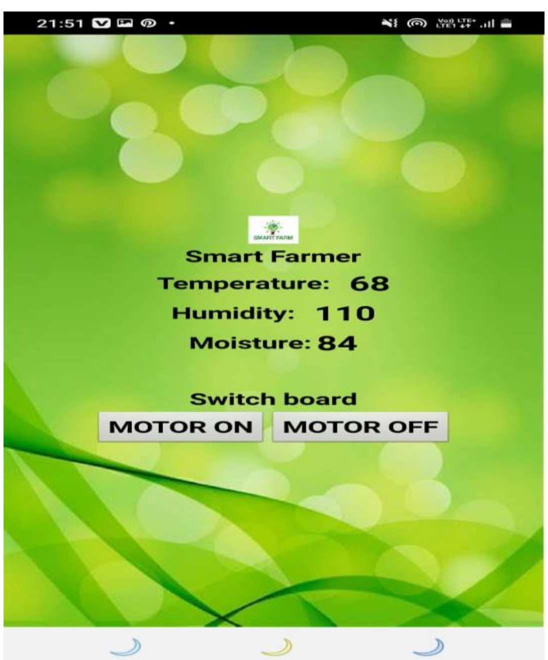

node-red-vaiup-2022-11-08.au-syd.mybluemix.net/ui/#!/2?socketid=iSeR7VIDIs9XCvEAAACN
Garden
Default
gauge
56
0
100
24°C
Cloudy
00:16
11-11-2022


node-red-vaiup-2022-11-08.au-syd.mybluemix.net/ui/#!/0?socketid=GpjF4LwUSYOxbXKPAACV
Gmail
YouTube
Maps
Translate
News
Inbox
Farmer
Smart
Humidity
110
100
90
80
70
15:56:37
15:56:47
15:57:04
Temperature
110
100
90
80
70
60
15:56:37
15:56:47
15:57:04
29°C
Cloudy
Search
ENG
IN
15:57
12-11-2022


node-red-vaiup-2022-11-08.au-syd.mybluemix.net/ui/#!/1?socketid=iSeR7VIDIs9XCvEAAACN
BOARD
SWITCH
MOTOR OFF
MOTOR ON
24°C
Cloudy
00:19
11-11-2022


Python 3.7.0 Shell
File Edit Shell Debug Options Window Help
Command received: motoron
MOTOR is ON
Published Temperature = 61 C Humidity = 94 % Moisture = 73 % to IBM Watson
Published Temperature = 66 C Humidity = 98 % Moisture = 73 % to IBM Watson
Published Temperature = 97 C Humidity = 91 % Moisture = 98 % to IBM Watson
Published Temperature = 87 C Humidity = 105 % Moisture = 35 % to IBM Watson
Published Temperature = 72 C Humidity = 91 % Moisture = 58 % to IBM Watson
Published Temperature = 84 C Humidity = 104 % Moisture = 54 % to IBM Watson
Published Temperature = 88 C Humidity = 110 % Moisture = 22 % to IBM Watson
Published Temperature = 79 C Humidity = 96 % Moisture = 61 % to IBM Watson
Published Temperature = 80 C Humidity = 99 % Moisture = 61 % to IBM Watson
Published Temperature = 85 C Humidity = 107 % Moisture = 26 % to IBM Watson
Published Temperature = 80 C Humidity = 97 % Moisture = 63 % to IBM Watson
Published Temperature = 91 C Humidity = 106 % Moisture = 59 % to IBM Watson
Published Temperature = 80 C Humidity = 97 % Moisture = 46 % to IBM Watson
Published Temperature = 70 C Humidity = 101 % Moisture = 74 % to IBM Watson
Published Temperature = 99 C Humidity = 109 % Moisture = 39 % to IBM Watson
Published Temperature = 76 C Humidity = 100 % Moisture = 9 % to IBM Watson
Published Temperature = 68 C Humidity = 104 % Moisture = 59 % to IBM Watson
Published Temperature = 93 C Humidity = 95 % Moisture = 64 % to IBM Watson
Published Temperature = 71 C Humidity = 97 % Moisture = 33 % to IBM Watson
Published Temperature = 66 C Humidity = 97 % Moisture = 24 % to IBM Watson
Published Temperature = 61 C Humidity = 110 % Moisture = 22 % to IBM Watson
Published Temperature = 94 C Humidity = 98 % Moisture = 14 % to IBM Watson
Published Temperature = 63 C Humidity = 110 % Moisture = 76 % to IBM Watson
Published Temperature = 73 C Humidity = 110 % Moisture = 37 % to IBM Watson
Published Temperature = 85 C Humidity = 109 % Moisture = 31 % to IBM Watson
Published Temperature = 72 C Humidity = 104 % Moisture = 46 % to IBM Watson
Published Temperature = 97 C Humidity = 96 % Moisture = 33 % to IBM Watson
Published Temperature = 81 C Humidity = 104 % Moisture = 23 % to IBM Watson
Published Temperature = 72 C Humidity = 94 % Moisture = 8 % to IBM Watson
Published Temperature = 82 C Humidity = 107 % Moisture = 98 % to IBM Watson
Published Temperature = 78 C Humidity = 95 % Moisture = 3 % to IBM Watson
Published Temperature = 100 C Humidity = 95 % Moisture = 10 % to IBM Watson
Published Temperature = 74 C Humidity = 92 % Moisture = 87 % to IBM Watson
Published Temperature = 92 C Humidity = 105 % Moisture = 60 % to IBM Watson
Published Temperature = 76 C Humidity = 110 % Moisture = 53 % to IBM Watson
Published Temperature = 99 C Humidity = 97 % Moisture = 35 % to IBM Watson
Published Temperature = 67 C Humidity = 105 % Moisture = 80 % to IBM Watson
Published Temperature = 69 C Humidity = 106 % Moisture = 17 % to IBM Watson
Published Temperature = 66 C Humidity = 92 % Moisture = 98 % to IBM Watson
Published Temperature = 66 C Humidity = 105 % Moisture = 94 % to IBM Watson
Published Temperature = 72 C Humidity = 103 % Moisture = 57 % to IBM Watson
Published Temperature = 66 C Humidity = 93 % Moisture = 53 % to IBM Watson
Published Temperature = 71 C Humidity = 95 % Moisture = 25 % to IBM Watson
Published Temperature = 99 C Humidity = 107 % Moisture = 68 % to IBM Watson
Ln: 3495 Col: 0
24°C
Cloudy
00:19
11-11-2022

<u>MOBILE APP:</u>



X) ADVANTAGES:

- One of the really good things about this branch of farming is that it allows for Soil Sensing. This aspect of smart farming gives room for you as a farmer to test your soil for information and also measure it for a wide range of important and nutritious constituents necessary in securing the good health of your farm produce.
- Soil sensing is also employe to appropriately control the application of real-time variable rate equipment. This allows you to understand the scale of your grounds, making you also, in this process, device effective ways of conserving necessary farming resources like water, fertilizer and so on. So, with this, you only have to apply fertilizers and pesticides where you need to apply them so as not to negatively affect your plants. You also get to conserve seeds, fertilizer, water, etc., and still even maximize yields at the end of the day.
- You also get to get important information about the amount of air and the levels of air, sound, humidity, and temperature of your environment.
- Smart farming is a wonderful option if you want to save the cost of electricity. It allows for the use of solar-powered tools like pumps that save your expenditure. It is cost-effective as it somewhat reduces the spending usually generated by farmers in maintaining their capital-intensive techs.
- Smart agriculture makes use of AI to improve the process of wireless monitoring, regulation and data collection. With these inputs on your farm, all thanks to smart farming, you can be sure of high-quality crop production and delivery.

DISADVANTAGES:

- One huge disadvantage of smart farming is that it requires an unlimited or continuous internet connection to be successful. This means that in rural communities, especially in the developing countries where we have mass crop production, it is completely impossible to operate this farming method. In places where internet connections are frustratingly slow, smart farming will be an impossibility.
- As pointed out earlier, smart farming makes use of high techs that require technical skill and precision to make it a success. It requires an understanding of robotics and ICT. However, many farmers do not have these

skills. Even finding someone with this technical ability is difficult or even expensive to come by, at most. And, this can be a discouraging factor hindering a lot of promising farmers from adopting it.

XI)CONCLUSION:

A system to monitor temperature, humidity, moisture levels in the soil was designed and the project provides an opportunity to study the existing systems, along with their features and drawbacks. Agriculture is one of the most water-consuming activities. The proposed system can be used to switch the motor (on/off) depending on the favorable condition of plants i.e. sensor values, thereby automating the process of irrigation, which is one of the most time efficient activities in farming, which helps to prevent over-irrigation or under irrigation of soil thereby avoiding crop damage. The farm owner can monitor the process online through an Android App. Though this project can be concluded that there can be considerable development in farming with the use of IOT and automation.

XII)FUTURE SCOPE:

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.

XIII)APPENDIX:

SOURCE CODE:

NODE-RED Flow: https://github.com/IBM-EPBL/IBM-Project-31353-1660199773/blob/main/Project%20Objectives/Create%20and%20Configure%20IBM%20Cloud%20Services/NODE%20RED%20FLOW.json

PYTHON CODE: https://github.com/IBM-EPBL/IBM-Project-31353-1660199773/blob/main/Project%20Objectives/Create%20and%20Configure%20IBM%20Cloud%20Services/Python%20Script/Smartfarmer.py

GITHUB LINK : https://github.com/IBM-EPBL/IBM-Project-31353-1660199773

PROJECT DEMO LINK: https://github.com/IBM-EPBL/IBM-Project-31353-1660199773/tree/main/Final%20Deliverables/Demo%20Video