VIVEKANANDHA COLLEGE OF ENGINEERING FOR WOMEN

Department of Electronics and Communication Engineering

Smart Farmer-IOT Enabled Smart Farming Application

IBM NALAIYATHIRAN

PROJECT REPORT

TITLE	**Smart Farmer-IOT Enabled Smart Farming Application**
DOMAIN NAME	INTERNET OF THINGS
TEAM ID	PNT2022TMID23830
LEADER NAME	GOWSALYA L
TEAM MEMBER NAME	DEEPIKA BK MEGAVARSHINI G MONISHA N
MENTOR NAME	THIRUPPATHI M

ACKNOWLEDGEMENT

We would like to express our special thanks of gratitude to our **Faculty Mentor Mr.M. THIRUPPATHI, B.E., M.E.,** and **Industry Mentor MR. BHARADWAJ** for their support and guidance in completing our project on the Smart Farmer-IoT Enabled Smart Farming Application.

We would like to extend our gratitude to the **IBM** for **Nalaiya Thiran** project for providing us with all the facility that was required It was a great learning experience. We would like to take this opportunity to express our gratitude.

DATE: 19/11/2022

TEAM MEMBERS:
GOWSALYA L
DEEPIKA BK
MEGAVARSHINI G
MONISHA N

CONTENT

1.INTRODUCTION

IOT- Internet of Things:-

The Internet of things (IoT) is a trending Technology, which is a network of Physical Objects that are interconnected to other, able to communicate and transfer data within them over the internet without any Human intervention.

1.1. Project Overview

This project is based on Iot enabled smart farming application which rates to be retained and preferred to be conditional based full automation of the prospects and retained to reduce the work for the farmers who were considered as the backbone of our society. In order to achieve this, we use a trending technology named as Iot. Thus, it is applying the concept of Iot, ancient farming irrigation methods and using NodeMCU progressing the smart irrigation by making the smart automation this tends to be known as smart irrigation process.

1.2. Purpose

The main purpose of our project is to send a message to the corresponding user, when the temperature, humidity, moisture value is below or above the threshold value. Without human interference, the process of irrigation proceeds by turning on/Off the motor. Thus, irrigation becomes smart as well automated.

2.LITERATURE SURVEY

2.1. Existing problem

To incorporate the process of working and also elevate the smart farming using IOT enabled smart irrigation technique since the traditional irrigation technique which is very complex one.

2.2. References

https://ieeexplore.ieee.org/document/9432085

[1] Farooq,M.S.,Riaz,S.,Abid,A.,Abid,K.,& Naeem,M.A.(2019).A Survey on the Role of IoT in Agriculture for the Implementation of Smart Farming. IEEE Access, 7, 156237- 156271.

[2] Suma,V.(2021).Internet of Things (IoT) based Smart Agriculture in India. An Overview Journal of ISMAC,3(01),1-15.

[3] Dahane,A.,Benameur,R.,Kechar,B.,&Benyamina,A.(2020,October).AnIoT based smart farming system using machine learning. In 2020 International Symposium on Networks, Computers and Communications (ISNCC) (pp. 1-6). IEEE.

[4] Farooq,M.S.,Sohail,O.O.,Abid,A.,&Rasheed,S.(2022).Asurveyontheroleofioti n agriculture for the implementation of smart livestock environment. IEEE Access, 10, 9483- 9505.

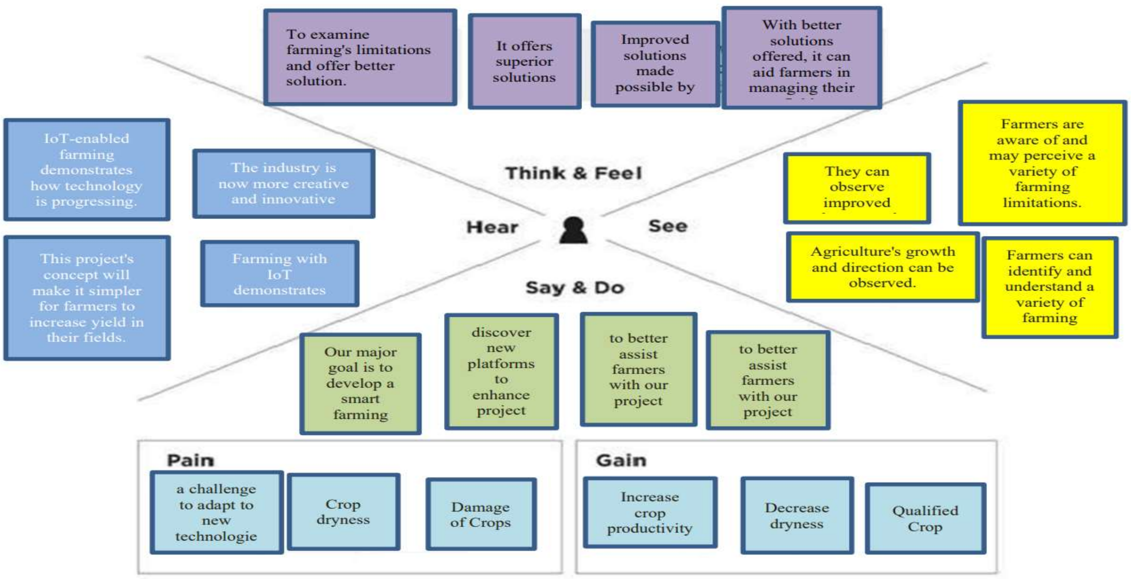
2.3. Problem Statement Definition

Problem Statement:

Problem Statement (PS)	I am (Customer)	I'm trying to	But	Because	Which makes me feel
PS-1	a Farmer	Increase my crop productivity.	I can't able to increase	of the correct supply of water to the crops	the damage in crops
PS-2	A Farmer	decrease the crop dryness	I can't able to decrease	of my out of station situation	decrease the crop productivity

3.IDEATION & PROPOSED SOLUTION

3.1. Empathy Map Canvas



3.2. Ideation & Brainstorming

TEAM IDEAS:

GOWSALYA L

- Automate irrigation using soil temperature measurement.
- Automate irrigation using soil moisture measurement.

DEEPIKA BK

- On sensing, we can use sensors.
- We can detect and set the moisture level.

MEGAVARSHINI G

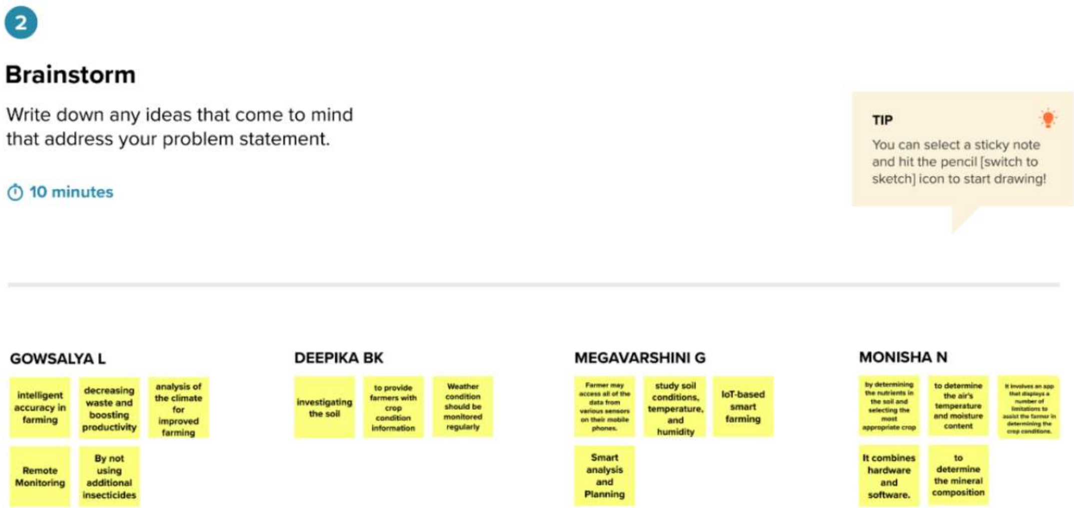
- The drip irrigation can be reduced to time-controlled irrigation.
- Automate irrigation with any available robots.

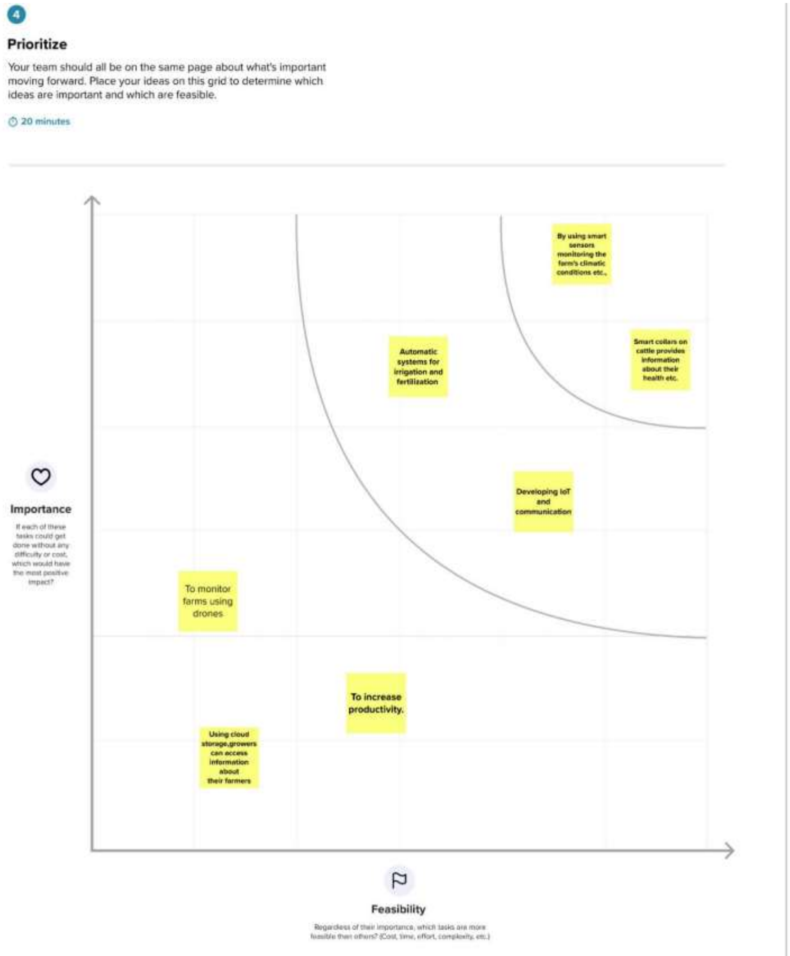
MONISHA N

- We are able to create and automate Arduino for programming.
- We are capable of making effective soil moisture and temperature design and programming.

BEST THREE IDEAS

- Automate irrigation using soil temperature measurement.
- We can detect and set the moisture level.
- Automate irrigation with any available robots.





3.3. Proposed Solution

S.No.	Parameter	Description
1.	Problem Statement (Problem to be solved)	Choosing a few agricultural challenges, overcoming them, and leveraging IOT to boost output quality and quantity in order to make farming easier.
2.	Idea / Solution description	Employing clever methods such as soil analysis, smart irrigation, and climate monitoring for farming.
3.	Novelty / Uniqueness	A smart irrigation system powered by solar energy enables you to use intelligent sensors to keep an eye on the temperature, moisture, and humidity.
4.	Social Impact / Customer Satisfaction	We can control soil erosion using this strategy, which is superior to the current modern irrigation system.

5.	Business Model (Revenue Model)	Customer happiness rises along with productivity, increasing demand for the application and, ultimately, the business's income.
6.	Scalability of the Solution	It is unquestionably scalable; if an issue emerges, we may tighten the limits.

3.4. Problem Solution fit

1.Customer Segments: Our clients are farmers.	**6.Customer Constraints:** There are various restrictions, including budget, network accessibility, and application knowledge.
2.Jobs-To-Be-Done/Problems: To quantitatively and easily facilitate farming. 1. Monitoring the weather at farms. 2. Automatic irrigation and fertilizing system 3. Examination of soil.	**7.Behaviour:** When a customer is unsure of how to evaluate the soil and upgrade the current irrigation system, they will contact us.
3.Triggers: To obtain accurate information about what should be done on the farm and to quantitatively generate more crops and livestock.	**8.Channels of Behaviour:** In order to make farming even simpler, we will contact the customer directly, enquire about their concerns, and, if those problems align with our application, offer appropriate solutions. I'll use advertisements to do digital marketing in an online setting.
4.Emotions: Before/After: Farmers will be happy once productivity increases. They won't be concerned about the loss. There will be improved irrigation efficiency	**9.Problem Root Cause** When there is uncertainty regarding the soil, it becomes difficult to determine what should be sown. Climate conditions are also important. understanding of how to properly water plants.
5.Available Solutions: The most popular irrigation method is drip irrigation, but one of its biggest drawbacks is that if the water is not adequately filtered, blockages will form and the tubes will be susceptible to damage. To get around this in smart farming, we can employ	**10.our Solution** Less weed growth, the most effective use of water, prevention of soil erosion, and maximum crop output will all be achieved.

4. REQUIREMENT ANALYSIS

4.1. Functional requirement

Following are the functional requirements of the proposed solution.

FR No.	Functional Requirement (Epic)	Sub Requirement (Story / Sub-Task)
FR-1	IoT devices	Sensors and Wi-Fi module.
FR-2	Software	Web UI, Node-red, IBM Watson, MIT app

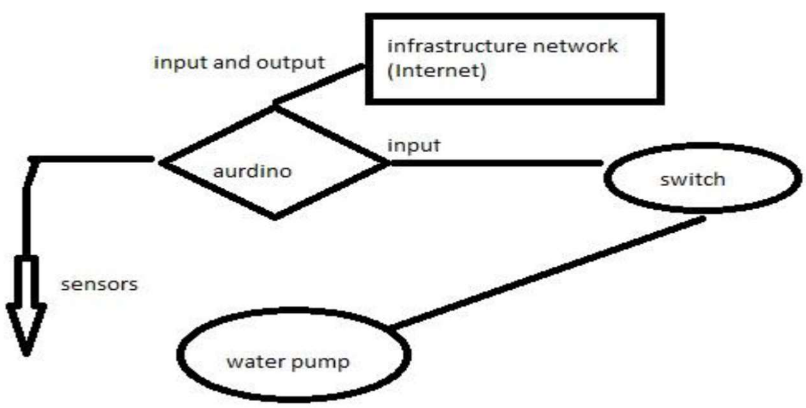
4.2. Non-Functional requirements

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

FR No.	Non-Functional Requirement	Description
NFR-1	**Usability**	Time is consumed more slowly, and productivity is higher.
NFR-2	**Security**	Due to the integration of sensor data, it has low-level security features.
NFR-3	**Reliability**	Data is reliable because of its accuracy.
NFR-4	**Performance**	High-level output is being produced.
NFR-5	**Availability**	The application is accessible with allowed network connectivity.
NFR-6	**Scalability**	It is completely scalable. There is plenty of room for new restrictions.

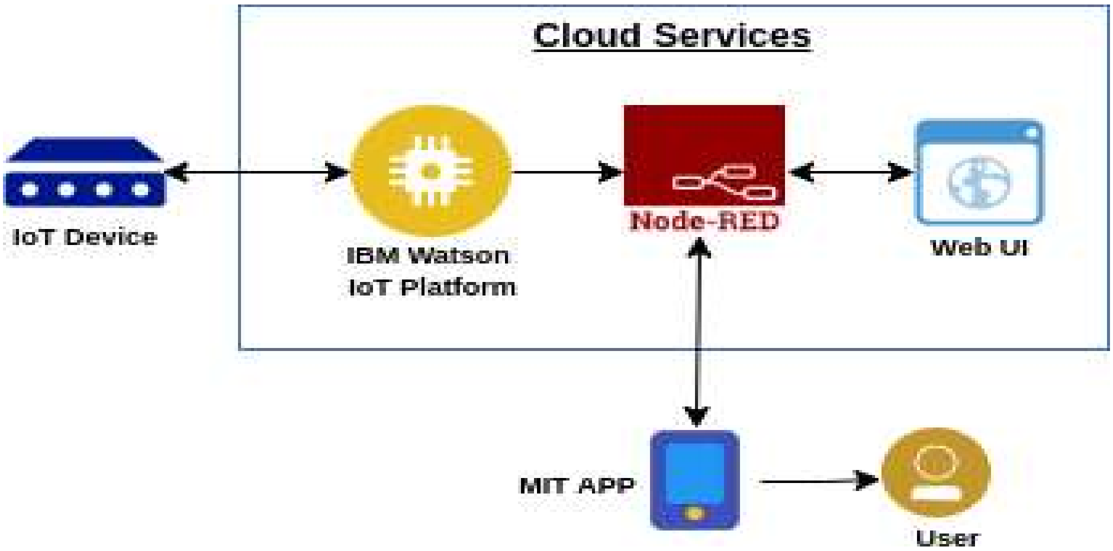
5. PROJECT DESIGN

5.1. Data Flow Diagram:



5.2. Solution & Technical Architecture

Technical Architecture:



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

Table-1: Components & Technologies:

S.No	Component	Description	Technology
1.	User Interface	How user interacts with application e.g.Web UI, Mobile App, Chatbot etc.	MIT app
2.	Application Logic-1	Logic for a process in the application	Node red/IBM Watson/MIT app
3.	Application Logic-2	Logic for a process in the application	Node red/IBM Watson/MIT app
4.	Application Logic-3	Logic for a process in the application	Node red/IBM Watson/MIT app
5.	Database	Data Type, Configurations etc.	MySQL, NoSQL, etc.
6.	Cloud Database	Database Service on Cloud	IBM cloud.
7.	Temperature sensor	Monitors the temperature of the crop	
8.	Humidity sensor	Monitors the humidity	
9.	Soil moisture sensor (Tensiometers)	Monitors the soil temperature	
10.	Weather sensor	Monitors the weather	.
11.	Solar panel		.
12.	RTC module	Date and time configuration	
13.	Relay	To get the soil moisture data	

Table-2: Application Characteristics:

S.No	Characteristics	Description	Technology
1.	Open-Source Frameworks	MIT app, Node-Red	Software
2.	Scalable Architecture	Drone technology, pesticide monitoring, Mineral identification in soil	Hardware

5.3. User Stories

Use the below template to list all the user stories for the product.

User Type	Functional Requirement (Epic)	User Story Number	User Story / Task	Acceptance criteria	Priority	Release
Customer	IoT devices	USN-1	Sensors and wi-fi module		High	Sprint-1
Customer	Software	USN-2	IBM Watson IoT platform, Workflows for IoT scenarios using Node-red		High	Sprint-1
Customer	MIT app	USN-3	To develop an application using MIT		Low	Sprint-2
Customer	Web UI	USN-4	To make the user to interact with the software.	User can access the app for the services.	Medium	Sprint-1
Customer	Login	USN-5	As a user, I can log into the application by entering email & password		High	Sprint-1
Customer	Web user	USN-4	Entering E-mail & Password		Medium	Sprint-1
Customer	Care Executive Administrator	USN-6			High	Sprint-1

6.PROJECT PLANNING & SCHEDULING

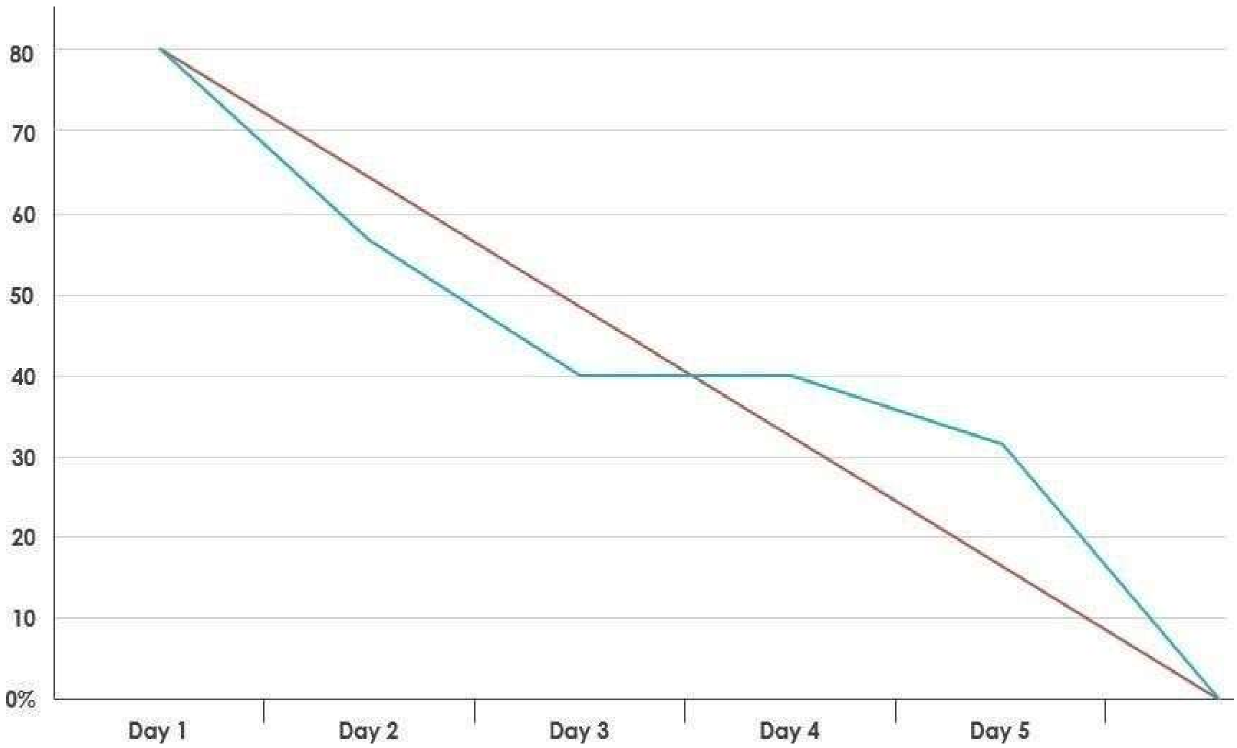
6.1. Sprint Planning & Estimation

Sprint	Functional Requirement (Epic)	User Story Number	User Story/Task	Story Points	Priority	Team Members
Sprint-I	Registration (Farmer Mobile User)	UNS-1	As a user, I can register for the application by entering my email, password, and confirming my password.	2	High	L. Gowsalya (Leader)
Sprint-I	Login	UNS-2	As a user, I will receive confirmation email once I have registered for the application.	1	High	B.K. Deepika (Member-1)
Sprint-II	User Interface	UNS-3	As a user, I can register for the application through Facebook.	3	Low	G.Megavarshini (Member-2)
Sprint-I	Data Visualization	UNS-4	As a user, I can register for the application through GMAIL.	2	Medium	N. Monisha (Member -3)
Sprint-III	Registration (Farmer-Web User)	USN-1	As a user I can login to the application by entering Email and Password.	3	High	L.Gowsalya (Leader)
Sprint-II	Login	USN-2	As a registered user, I need to easily login into my registered account via the web page in minimum time.	3	High	B.K. Deepika (Member-1)
Sprint-IV	Web UI	USN-3	As a user I need to have a friendly user interface to easily view and access the resources	3	Medium	G.Megavarshini (Member-2)
Sprint-I	Registration (Chemical Manufacturer -Web User)	USN-1	As a new user, I want to first register using my organization email and create a password for the account.	2	High	N. Monisha (Member-3)
Sprint-IV	Login	USN-2	As a registered user, I need to easily login using the registered account via the web page	3	High	L. Gowsalya (Leader)
Sprint-III	Web UI	USN-3	As a user, I need to have a user-friendly interface to easily view and access the resources.	3	Medium	B.K. Deepika (Member-1)
Sprint-I	Registration (Chemical Manufacturer -Mobile User)	USN-1	As a user, I want to first register using my Email and create a password for the account.	1	High	G. Megavarshini (Member-2)
Sprint-I	Login	USN-2	As a registered user, I need to easily login to the application.	2	Low	N. Monisha (Member -3)

6.2. 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	12	6 days	24 Oct 2022	29 Oct 2022	20	29 Oct 2022
Sprint-2	6	6 days	31 Oct 2022	05 Nov 2022	20	30 Oct 2022
Sprint-3	6	6 days	07 Nov 2022	12 Nov 2022	20	06 Nov 2022
Sprint-4	6	6 days	14 Nov 2022	19 Nov 2022	20	07 Nov 2022

6.3. Reports from JIRA



7.CODING & SOLUTIONING

Feature 1

```
//Arduino Code
//Code starts here
Int sensor pin=A0;//Soil sensor input at Analog pin A0
Int output value;
Void setup ()
{
        //put your setup code here, to run once:
        pinMode(4,OUTPUT);
        Serial.begin(9600);
        Serial.printIn("Reading from the Sensor");
        delay(2000);
}
//put your main code here, to run repeatedly:

Void loop()
{
        Output value=analogRead(sensor_pin);
        Output value=map(output_value,550,10,0,100);
        Serial.print("Moisture:");
        Serial.print(output_value);
        Serial.printIn("%");
        if(output_value<0)
                {
                 digitalWrite(4,HIGH);
                 }
        Else
                {
                 digitalWrite(4,LOW);
                }
        Delay(1000);
}
//Code ends here
```

Feature 2

```
#include "Arduino.h"
#include "dht.h"
#include "Soil Moisture.h"
#define dht_apin A0
const int sensor pin_Al://soil moisture
int pin_out=9,
dht DHT:
int c-0:
void setup()
{
```

```
   pinMode(2, INPUT); //Pin 2 as INPUT
   pinMode(3, OUTPUT); //PIN 3 as OUTPUT
   pinMode(9, OUTPUT);//output for pump
}

void loop()

{

  if (digitalRead(2) == HIGH)

  {

     digitalWrite(3, HIGH);// turn the LED/Buzz ON

      delay(10000); // wait for 100 msecond

     digitalWrite(3, LOW); // turn the LED/Buzz OFF

     delay(100);

   }

   Serial.begin(9600)

   delay(1000);

   DHT.read11(dht_apin);//temperature

   float h=DHT.humidity;

   float t=DHT.temperature;

   delay(5000);

   Serial.begin(9600);

   float moisture_percentage;

   int sensor_analog;

   sensor_analog=analogRead(sensor_pin);

   moisture_percentage = ( 100 - ( (sensor_analog/1023.00) * 100 ) );

   float m=moisture_percentage;

   delay(1000);

   if(m=0)

  {

    mySerial.begin(9600);

    delay(15000);

    Serial.begin(9600);

    delay(1000);
```

```
    Serial.print("\r");
    delay(1000);
    Serial.print((String)"update>"+(String)"Temprature="+t+(String)"Humidity="+h+(String)"Moisture="+m);
    delay(1000);
  }
}
```

8.TESTING

8.1. Test Cases

INTERFACING OF SENSOR AND AURDINO AND INSTALLATION IN SOIL

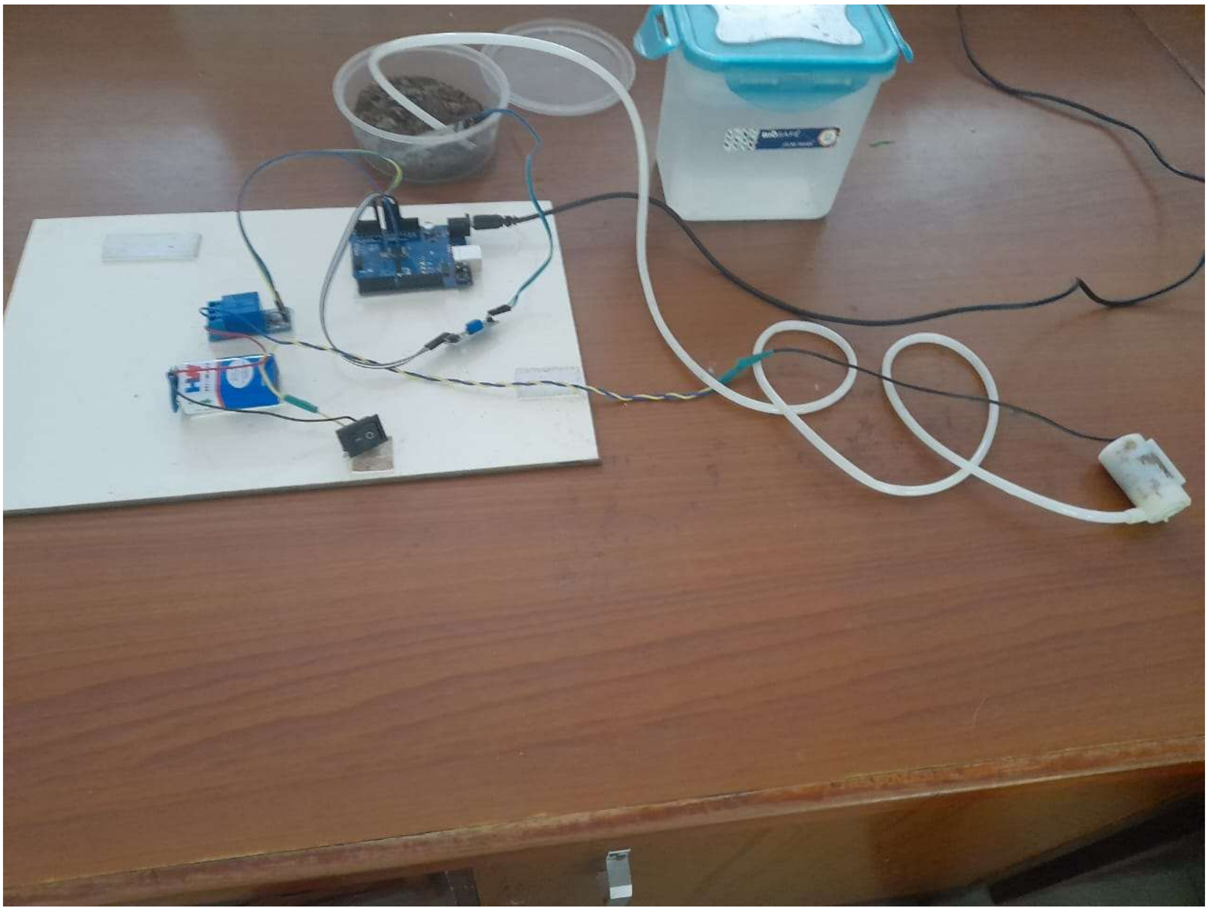
According to our project we are improving an automated irrigation system which works in the soil in accordance to the humidity conditions in order to reduce human interference in the process of irrigation

This sprint three is the progression phase of the project in which we feed the code which has been developed for arduino and we install moisture sensor to the arduino UNO by that we interface both in a successful manner then we install that into the real soil and test in the real time conditions.

PHOTO OF THE INTERFACED AURDINO AND SOIL TESTING CONDITION AFTER INTERFACING: -

8.2. User Acceptance Testing

IMAGE OF FINAL TESTING:



9.RESULTS

9.1. Performance Metrics: -

PERFORMANCE MATRICES	CONDITION OUTPUT
Human interference cut down	good
Reduction of wastage	good
Economic efficiency	better
reliability	excellent

10. ADVANTAGES & DISADVANTAGES

Advantage: -

- The user can be remote at any time
- The user interference is not required
- Reduces over irrigation
- Reliability is high
- Enhances the process of irrigation
- Reduce wastage of resources
- Improves lifestyle of farmers
- Makes the progression to be easy
- Improves ground water level in a periodical manner
- Improved yield for farmers.
- Attracts most of the people to involve in agriculture
- Since the agriculture improves, human life also improves

Disadvantages: -

- Work for the people is reduced
- Sensors and the components should be maintained
- There may be a threat of damaging sensors by animals present in the field

11. CONCLUSION

To incorporate the process of working and also elevate the smart farming using IOT enabled smart irrigation technique since the traditional irrigation technique which is very complex one.

IOT plays a major role in agricultural field This paper is mainly applied to agricultural field Smart irrigation and farming can help farmers to grow healthy plants. The existing system only checks the soil water stress and automates the process of watering. The paper is about IOT based smart farming and irrigation system. The ultimate agenda of this paper is to automate the process of watering to plants. This work helps us to know the values of various parameters such as humidity, moisture and temperature of plants and water them accordingly. The system consists of three sensors which sense the values of humidity, moisture and temperature of plants. If any of the values decreases the motor automatically turns on the water for plants. This is done using Arduino board, voltage regulator and relay which controls the motor. WIFI module is used to inform the user about the exact field condition. The various sensors send the values to the Arduino board which has been coded with if else conditions will further pass the commands to the relay which turns on or off the motor according to the conditions given. If the sensor values are decreased, it turns on the motor else it turns off the motor. The ultimate significance of this paper is that most of the manual work is reduced and watering process is automated with the help of devices as a result of which healthy plants can be grown, Water and electricity usage are saved by this paper. Even elderly people can easily do farming. The paper has been used to grow a tomato plant and it was successfully grown by automatic process. This methodology with the use of IOT technology had made us achieve a healthy farming. Increase in agriculture also helps us to increase the economical state of the country.

Thus, the above problem statement has been addressed and the perfect technology that could solve the above real-world problem has been developed, tested and presented on this esteem forum.

12. FUTURE SCOPE

We hope that this project is able to tackle the problems present in the real and could be developed further more in the process of automation on feeding pest killer, insect killer sprays, and feeding fertilizer for the land, etc.,

13. APPENDIX

Source Code

```
import time
import sys
import ibmiotf.application
import ibmiotf.device
import random


#Provide your IBM Watson Device Credentials
organization = "kua3hx"
deviceType = "NodeMcu123"
deviceId = "12345"
```

```
authMethod = "token"
authToken = "1234567890"

#Initialize GPIO

def myCommandCallback(cmd):
    print("Command received: %s" % cmd.data['command'])
    status=cmd.data['command']
    if status=="Motor ON":
        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(0,100)
```

```
        Humid=random.randint(0,100)
        Moist=random.randint(0,100)

        data = { 'temperature' : temp, 'humidity': Humid , 'moisture': Moist}
        #print data
        def myOnPublishCallback():
          print ("Published Temperature = %s C" % temp, "Humidity = %s %%" % Humid, "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(1)

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

LINKS:

GitHub Link: https://github.com/IBM-EPBL/IBM-Project-36829-1660298122

Project Demo Link:
https://github.com/IBM-EPBL/IBM-Project-36829-1660298122/blob/main/Final%20Deliverables/Final%20deliverables-%20Demo%20Video/Demo%20Video.mp4

YouTube Link: https://youtu.be/8V_x-3ipXS0