ANNEXURE

A Project Report

On

SMART FARMING USING IOT TO ENHANCE CROP GROWTH

Submitted to

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY ANANTAPUR, ANANTHAPURAMU

In Partial Fulfillment of the Requirements for the Award of the degree of

BACHELOR OF TECHNOLOGY

In

COMPUTER SCIENCE & ENGINEERING (IOT)

Submitted By

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(UGC – AUTONOMOUS)

(Affiliated to JNTUA, Ananthapuramu)

Accredited by NBA, Approved by AICTE, New Delhi)

AN ISO 21001:2018 Certified Institution

P. B. No: 14, Angallu, Madanapalle – 517325

2023-2024

ANNEXURE 2

DEPARTMENT OF COMPUTER SCIENCE & ENGINEERING

BONAFIDE CERTIFICATE

This is to certify that the project work entitled **"SECURE SMART SHOPPING SYSTEM"** is a bonafide work carried out by

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Submitted in partial fulfillment of the requirements for the award of degree **Bachelor of Technology** in the stream of **Computer Science & Engineering** in **Madanapalle Institute of Technology & Science, Madanapalle,** affiliated to **Jawaharlal Nehru Technological University Anantapur, Ananthapuramu** during the academic year 2023-2024.

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Asst Professor,	Professor and Head,
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Submitted for the University examination held on:

Internal Examiner	**External Examiner**
Date:	**Date:**

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ACKNOWLEDGEMENT

We sincerely thank the **MANAGEMENT** of **Madanapalle Institute of Technology & Science** for providing excellent infrastructure and lab facilities that helped me to complete this project.

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We express our deep sense of gratitude to **Dr. R. Kalpana, M. Tech., Ph.D., Professor and Head of the Department of CSE** for her continuous support in making necessary arrangements for the successful completion of the Project.

We express our sincere thanks to the **Internship Coordinator**, **Dr. K. Sudhakar, Ph.D.,** for his tremendous support for the successful completion of the Project.

We express our deep sense gratitude to **Mrs. M. Bommy, M.E., Project Coordinator** for her guidance and encouragement that helped us to complete this project.

We express our deep gratitude to our guide **Mrs. Thripthi P Balakrishnan, PhD., Professor, Department of CSE** for her guidance and encouragement that helped us to complete this project.

We also wish to place on record our gratefulness to other **Faculty of CSE Department** and also to our friends and our parents for their help and cooperation during our project work.

ANNEXURE 4

DECLARATION

We hereby declare that the results embodied in this project **" SMART FARMING USING IOT-ENHANCING CROP GROWTH"** by us under the guidance of **Mrs. Thripthi P Balakrishnan, Assistant Professor, Dept. of CSE** in partial fulfillment of the award of **Bachelor of Technology** in **Computer Science & Engineering** from **Jawaharlal Nehru Technological University Anantapur, Ananthapuramu** and we have not submitted the same to any other University/institute for award of any other degree.

Date :

Place :

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I certify that above statement made by the students is correct to the best of my knowledge.

Date: **Guide**

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Abstract –

Farming is the main profession -for many people in many countries. However, the Farmers are going to benefit from the implementation of smart farming methods with IoT integration in agriculture like monitoring & automation of some works in the farm field. This work includes the integration of sensors like moisture sensors, temperature sensors, and humidity sensors (DHT11) to track farm conditions in real time, and we used Esp 8266 for real-time data monitoring. This project mainly consists of three functionalities, The first one is an automatic irrigation system, The second is the automatic application of a thin sheet to shield plants from excessive sunlight and The third is to monitor parameters like temperature, humidity, and moisture content.

Keywords: Temperature, Moisture, Smart watering,
Blynk IoT application, ESP3266 Wi-Fi Module, Remote Monitoring.

CHAPTER 1 INTRODUCTION

1.1 Motivation

Implementing smart farming using IoT (Internet of Things) technology provides several benefits and is a fascinating undertaking for several reasons:

1. Optimized Resource Utilization:
IoT devices incorporated into farming operations allow for exact monitoring and management of resources such as water, fertilizer, and pesticides. This leads to more efficient use, less waste, and lower overall operating costs.

2. Real-time monitoring and automation:
IoT sensors can frequently gather information about environmental factors like as soil moisture, temperature, humidity, and crop development. This data is analyzed in real time, allowing farmers to automate processes such as irrigation and crop protection based on current conditions rather than predeterminedplans.

3. Crop Quality and Yield Improvements:
With IoT-enabled monitoring, farmers may proactively identify concerns such as insect infestations or diseases, reducing crop damage and increasing overall quality. This can lead to bigger yields and better product.

4 .Remote Access and Control:
With IoT solutions, farmers may remotely monitor and manage their activities using smartphones or PCs. This versatility is especially useful for large-scale farms or those in distant areas. Smart farming encourages sustainable methods by lowering agriculture's environmental effect. Efficient resource management may help reduce water usage, chemical use, and greenhouse gas emissions.

1.2 Problem Definition

The issue statement for an IoT-based smart farming project, with an emphasis on modules such as smart irrigation and remote temperature monitoring via a WiFi module, tackles problems associated with traditional agricultural practices. Traditional agriculture frequently depends on human monitoring and intervention, resulting in inefficient resource usage and limited real-time information about crop health and environmental conditions. This causes problems such as over-irrigation, variable crop quality, and difficulty remotely monitoring farm conditions. The key goals of this project are to create a smart irrigation management system and enable remote temperature monitoring with IoT technologies. The smart irrigation system attempts to save water by monitoring soil moisture levels in real time and automating watering based on sensor data. The technology will manage irrigation valves to supply water precisely where and when it is required, eliminating water waste and enhancing crop health and output.

In addition to smart irrigation, the project will use IoT sensors to provide remote temperature monitoring over the agricultural area. These sensors will be strategically placed across the farm, delivering temperature data remotely via a WiFi module to a central monitoring system. Farmers will have access to real-time temperature analytics through a user-friendly online or mobile application, helping them to make educated decisions and respond quickly to temperature variances around the field. This project's implementation consists of many major phases. First, soil moisture and temperature sensors will be installed across the farm and calibrated to ensure reliable data collecting. Next, an IoT infrastructure will be built, using a WiFi network to provide seamless communication and data transmission between sensors and the central monitoring system. Algorithms will be created to interpret sensor data, automate irrigation scheduling, and give farmers with actionable insights via the user interface. This interface will enable farmers to remotely monitor soil moisture levels, alter irrigation settings, and get warnings for critical circumstances, therefore improving operational efficiency and crop management techniques.

1.3 Objectives of Project

The aims of a smart farming project that uses IoT technology with modules for smart irrigation and remote temperature monitoring via WiFi include:

1. Improve Water Management:
Create a smart irrigation system that regulates watering depending on real- time soil moisture levels. Reduce water waste by precise and focused irrigation, resulting in increased water usage efficiency in agriculture.

2. Improve Crop Yield and Quality:
Implement proactive monitoring of soil conditions to maximize crop growth factors such as moisture content. Improve crop health and output by supplying adequate water at the appropriate time, reducing stress and nutritional deficits.

3. Remote Monitoring and Control:
Using a web or smartphone app, farmers may remotely monitor and control agricultural variables such as soil moisture and temperature from anywhere. Real-time insights into field circumstances enable fast decision-making and responsive actions.

4. Improving Sustainability:
Improve irrigation management to reduce water use and environmental effect.Adopting technology-driven precision agricultural solutions can help to reduce environmental impact.

5.Improving Data-Driven Insights:
Analyze soil moisture and temperature data to gain valuable insights for farm management. Use data analytics to spot patterns, forecast ideal watering schedules, and discover crop abnormalities.

1.4 Limitations of Project

The smart farming project incorporating IoT technology for smart irrigation and remote temperature monitoring through WiFi may encounter several limitations, which should be considered during the planning and implementation phases:

1. Initial Setup Costs:
Implementing IoT infrastructure, including sensors, actuators, WiFi modules, and a central monitoring system, can involve significant upfront costs. This may pose a barrier to adoption, particularly for small-scale or resource-constrained farmers.

2. Reliability of IoT Connectivity:
The performance and reliability of IoT devices, especially in remote agricultural locations, may be affected by factors such as network coverage, signal interference, and connectivity issues. This can impact the real-time monitoring and control capabilities of the system.

CHAPTER 2 LITERATURE REVIEW

2.1 GENERAL

The Internet of Things (IoT) will act as a foundation to smart computing in the future. "History" plays an important role in converting the home into an area of work that is "connected with other places". The Internet of Things (IoT) has begun to reach people everywhere. From the viewpoint of common individuals, the Internet of Things has become the basis for the development of many products, such as smart health, smart life, smart education, and electronic technology. [1] Food production has become an important issue in the 21st century because the population is increasing every year. It is estimated that by 2050, between 940 million and 10.1 billion people will depend on the world's biodiversity for their livelihoods, raising the demand for specialized sectors of food production. especially crops and livestock. [2]

disease, and pests. Artificial intelligence and Internet of Things are widely used in agriculture. They solve many problems like soil, weather, insect control, and deciding when to harvest. In addition, artificial intelligence and the Internet of Things include data such as temperature, humidity, pollution, water content, soil condition, and electricity. It provides the best care for real value. Smart agriculture improves precision through better agricultural management and timely decision-making based on received data. [3]

In 2019, M. A. Matin defined smart agriculture as the Internet of Things that can increase crop yields and reduce water consumption. farm management efficiency. The authors explain the developments in IoT-based smart agriculture, such as crop monitoring, insect proof of identity, and soil moisture measurement. This article indicates obstacles related to the deployment and usage of this technology, including data privacy and security issues, as well as future research for IoT-based smart agriculture.[5] - Big Data - Agriculture requires large resources for processing and storage. Add tasks that should start immediately. Therefore, the term "big data analytics" is used to describe new initiatives aimed at providing farmers with better information, access, and/or analysis, and organizations will benefit greatly from this. Since big data and smart farming are new concepts, it is clear that their implications for investment and research are not yet widely understood [6].

Unfortunately, due to a number of limitations such soil quality, geography, temperature, climate, and the like, not all areas of the earth's surface are suited to agriculture, and fact that the majority of arable land is not homogenous. In addition, each agricultural field has a variety of important traits, in particular soil type, irrigation flow rate, availability of nutrients, and insect resistance, all of which can be measured separately for a given crop in terms of both quality and quantity. Crop rotation and the yearly cycle of crop development require both spatial and temporal changes to optimize crop yield on the same land. Farmers who practice traditional farming visit their fields on a regular schedule throughout the crop's life cycle as part of ordinary farm labor to obtain a better grasp of the crop's circumstances. Farmers are able to determine current field operations without physically entering the field thanks to the accurate viewpoint offered by modern sensor and communication technology. Crops are monitored using wireless sensors.

more precisely and spot problems early on, increasing the use of smart equipment from crop sowing to harvest. [7]

Scientific developments have almost completely revolutionized agricultural operations, and the introduction of agricultural drones is disrupting this trend. Ground and aerial drones are used to assess suitability, examine crops, sow crops, spray crops, and assess fields. Drones equipped with thermal or multispectral sensors discover regions where irrigation adjustments are required. When the plants start growing, the sensors detect their health and calculate their plant index. Ultimately, smart drones reduce their impact on the environment effect. [8]

Farmers are able to determine current field operations without physically entering the field thanks to the accurate viewpoint offered by modern sensor and communication technology. Crops are monitored using wireless sensors. detects animal thefts using a variety of heuristics.

According to one such heuristic, an animal is considered "stolen" if it is found in a site that is "far" from its position and geographic surveillance fence. Finding an animal whose stated the location deviates substantially from the rest of the herd is another heuristic.. A reference described a similar technique incorporating wireless sensor networks and drones to track animals. [9] the current state of the field. Therefore, his regular visits to the field are essential to taking care of water requirements, chemical requirements, and other matters related to production. Thus, for early observation, automatic control over such parameters would alleviate the burden on each individual. Traditional cultivation methods such as hand plowing, two-part patterns, and old irrigation systems are mainly responsible for low agricultural productivity. The use of these old tools makes agriculture backward. A lack of proper understanding of the need to grow sustainable Crops will put farmers into a monetary trap.

High use of chemicals (fertilizers), poor water management, and low productivity and thus further debts for a fresh cycle. [10] Wi-Fi has been recognized as one of the most widely used and effective communication techniques because of its potential availability. Additionally, it was found that almost all of low-cost IoT devices available today support Wi-Fi. Considering its drawbacks (such as limited range and area coverage), this is seen to be a generally effective strategy. The GSM stands for Global System for Mobile Communications. has been recognized as an established wireless technology that offers long-distance communication; all that is required is a cellular plan from a service provider that functions and presents in that specific area. Recently, two further noteworthy technologies have been introduced: Message Queuing Telemetry Transport (MQTT) and Long Range (LoRa). [11]

With increasing issues regarding the role of agriculture in the surface association of groundwater quality, combined with increasing chemical costs, as well as theIn order to satisfy the predicted 50-70% Increasing global food demand with limited resources, agricultural systems have to be enhanced to become exceptionally efficient systems With productive area units. The main objective of enhancing the agricultural system is to determine stress levels and its causes. The stress level includes all aspects affecting plant health. Monitoring and identifying crop stress levels helps agrotech grow healthy crops and enhance productivity. Smart agriculture uses techniques and Technology to evaluate soil and crop variability in the field to optimize crop yield and agronomic inputs. [12]

Villacampa examined feature selection methodologiesExamples include knowledge acquisition, techniques for lowering the quantity of data pieces include mixed approaches, F-relief, wrapping, and correlation-based feature grouping. To assess the effectiveness of the methods, three general classification algorithms—Decision Trees, K-Nearest Neighbour, and Support Vector Machines—were employed as classifiers outlined above. Our results demonstrated that the relief-F system outscored every other method for feature selection.This approach comprised a comprehensive selection process in addition to a large feature set. SVR and RegTree, two regression models, were applied to combine the yield forecast with the results of many data sets. SVR and RegTree are two regression models that generated trials that varied significantly despite maintaining equivalent. However, both models produced intelligible and explainable functional scores, while additionally offering a fresh understanding of the datasets and their roles [13].

Implementing drip irrigation in our project has altered the way we handle watering, offering multiple benefits that significantly enhanced our operations. First, the system's accurate distribution of water straight to the root zone has resulted in major water savings by reducing evaporation and runoff, ensuring that every drop helps towards plant feeding. This efficiency not only conserves resources, but also reduces costs and strengthens our commitment to sustainable practices. In addition, drip irrigation's ongoing and targeted hydration has nourished healthier plants with stronger root systems, leading in higher yields and better crop quality.

2.2 SCOPE AND OBJECTIVES

SCOPE:

Sensor Accuracy and Maintenance: The accuracy and reliability of soil moisture and temperature sensors might vary depending on environmental conditions and sensor calibration. Regular maintenance and calibration are required to maintain data accuracy and system performance.
Data Security and Privacy Concerns: IoT technologies create and send sensitive information about agricultural activities and environmental conditions. Ensuring data security, privacy, and protection from cyber attacks is critical, but it may be difficult, particularly with wireless data transfer.

In addition, the project intends to use data analytics methods to examine sensor data and extract useful information on temperature patterns, crop health, and soil moisture. Through the integration of IoT technologies with current farming techniques and infrastructure, the project aims to guarantee compatibility and promote farmer adoption. The implementation of training and capacity-building activities aims to enable farmers and agricultural workers to properly use IoT devices and comprehend data outputs for well-informed decision-making. In order to pinpoint areas in need of development and optimisation, a continuous performance evaluation will be used to evaluate the effects of IoT-enabled smart farming solutions on crop yields, resource efficiency, and overall farm productivity. Because the initiative will be scalable and replicable, it may be replicated in other regions or expanded to larger farms in the future.

OBJECTIVES:

1. **Create and Implement IoT Infrastructure:**
   Construct an adjustable and scalable IoT infrastructure that works well in agricultural settings.Install temperature and soil moisture sensors throughout the chosen farm regions.

2. **Install a Smart Irrigation System:**
   Create algorithms that use data on soil moisture to automatically adjust irrigation. Actuators are included to maximise water distribution and regulate irrigation valves.

3. **Turn on remote control and monitoring:**
   To send sensor data to a central monitoring system, establish WiFi connection.
   Provide an intuitive user interface (web or mobile application) so that farm conditions may be accessed from a distance.

4. **Enhance Utilisation of Resources:**
   To maximise water use and minimise water waste, apply real-time data insights. To increase agricultural output and resource efficiency, use precision irrigation techniques.

5. **Ensure System Reliability and Performance:**
   To guarantee system performance and dependability, thoroughly test and validate IoT components for accuracy and dependability.Resolve problems with connection and maximise system efficiency in a variety of environmental settings.

6. **Promote Sustainability and Environmental Stewardship:**
   Encourage environmental stewardship and sustainability in agricultural methods by reducing your farm's negative effects on the environment by managing your irrigation system well.

Utilise data-driven decision-making to lessen dependency on chemical inputs and to aid in the conservation of water.

7. **Empower Farmers with Technology:**

   Give farmers the guidance and assistance they need to use IoT-based products and technologies efficiently. Educate and raise awareness through campaigns to encourage user uptake and engagement.

8. **Determine Effect and Scalability:**

   Determine how the smart farming system will affect agricultural yields, resource conservation, and operational effectiveness.
   Based on project results, assess scalability and the possibility of expanding to more farms or areas.

CHAPTER 3 ANALYSIS

3.1 Introduction

The Internet of Things (IoT) powers smart farming, which transforms traditional farming practices by using modern technology to improve sustainability, efficiency, and production. Fundamentally, smart farming takes use of networked sensors, actuators, and other devices to collect, process, and respond to data in real-time, facilitating accurate and prompt decision-making in agricultural operations.Smart irrigation, which maximises water use by tracking crop water requirements, weather forecasts, and soil moisture levels, is a crucial part of smart farming. IoT-enabled sensors are positioned all over the field to continually gather information on temperature, humidity, soil moisture content, and other environmental parameters. The precise amount of water required by the crops is then ascertained by employing algorithms to analyse this data. Based on this data, farmers may automate irrigation systems to minimise water loss, enhance crop health, and eventually boost yields.

Furthermore, clever farming employs creative techniques to deal with problems like harsh weather. For example, during hot weather, a thin layer covering the crop acts as a protective barrier. This layer is often constructed of materials like shade cloth or specialised polymers. The thin layer is deployed to provide shade and lessen heat stress on the crops when the temperature increases beyond a certain threshold limit, which is detected by sensors. By taking preventative measures, you may preserve ideal growth conditions and protect crop health and production potential.Essentially, IoT-enabled smart farming provides a holistic approach to contemporary agriculture by merging automation, precision techniques, and data-driven insights to maximise resource efficiency, reduce environmental impact, and guarantee sustainable food production for an expanding world population.

3.2 Requirement Specification

To utilize the Arduino Uno software on your system seamlessly, you must ensure compatibility with the appropriate operating system. The Arduino IDE is versatile, supporting Windows, macOS, and Linux platforms. In terms of hardware, a modern processor capable of running your chosen operating system suffices. While there are no specific processor requirements for the Arduino IDE

3.2.1 Hardware Requirements

- Processor : Core i3/i5/i7
- RAM : 2-4GB
- HDD : 500 GB

3.2.2 Software Requirements

- **Platform : Windows Xp/7/8/10**
- **Coding Language : C++**
- **IDE : Arduino IDE**

CHAPTER 4 DESIGN

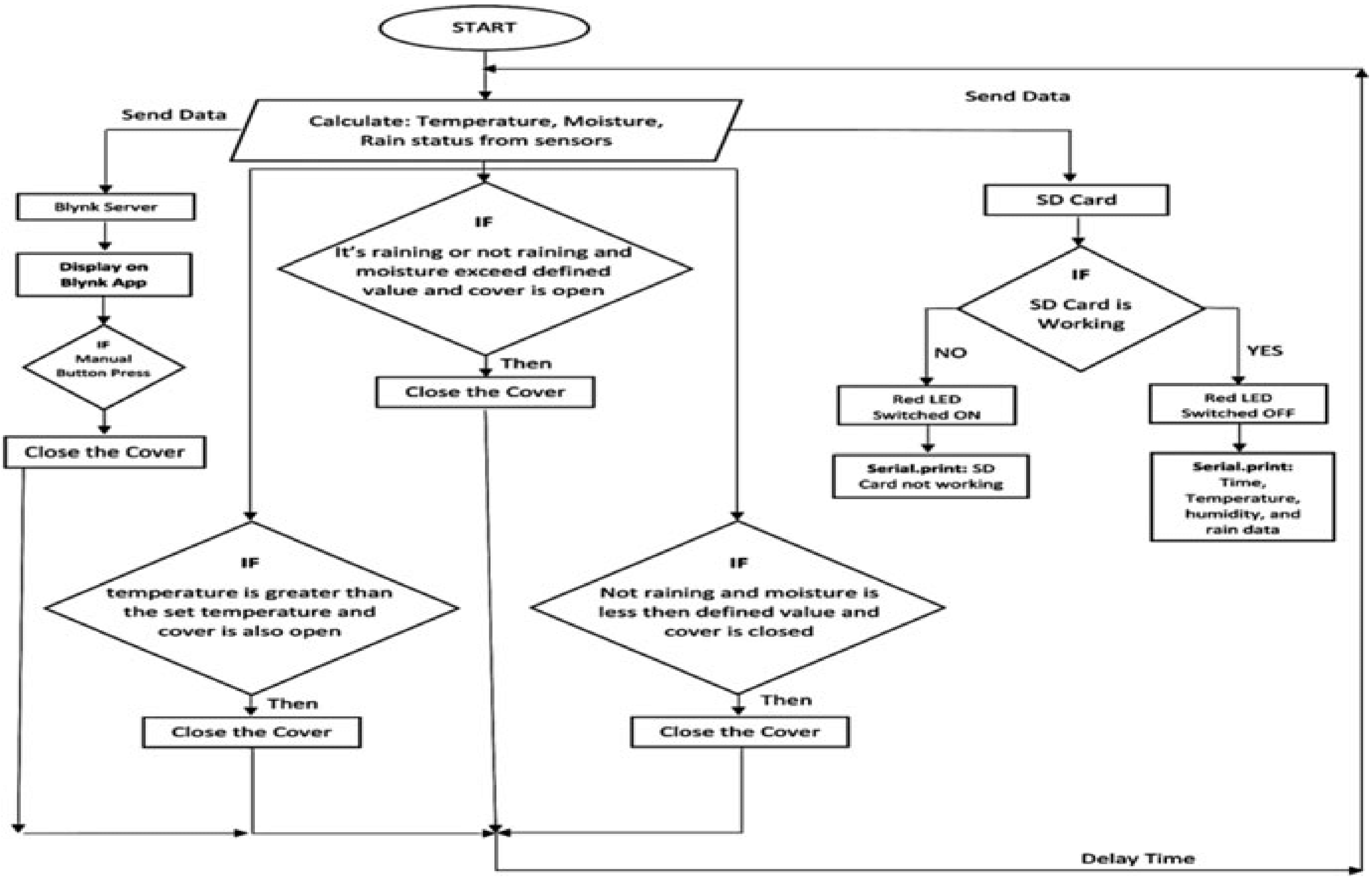
4.1 Introduction

Recent developments in Internet of Things (IoT) technology have made it possible to create smart agriculture systems, which have completely changed conventional farming methods. These systems use Internet of Things (IoT) devices, such sensors and actuators, to gather and evaluate data in real time on crop health and environmental conditions. This enables effective resource management and precision farming. In order to solve the major issues that contemporary farmers confront, this project focuses on the design and implementation of an Internet of Things (IoT)-based smart farming system that combines remote temperature monitoring with smart irrigation management.

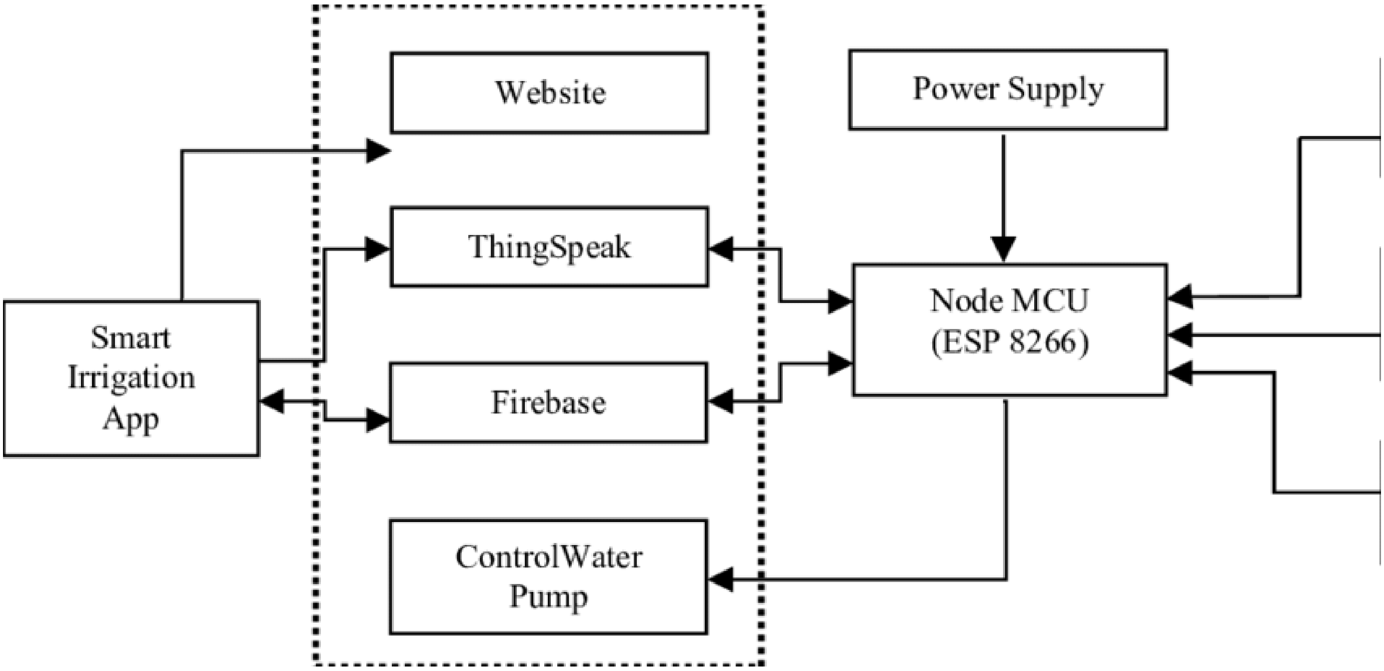
The first step in designing a smart farming system is determining which important variables to track and manage, such as field temperature and soil moisture content, which have a big influence on crop output and development. While temperature sensors track ambient temperatures to evaluate environmental conditions, soil moisture sensors will be positioned strategically throughout agricultural regions to gather data on soil moisture content. Via the use of WiFi connection, a strong Internet of Things architecture will link these sensors, enabling smooth data transfer to a cloud-based platform or central server.

The creation of clever algorithms and decision-making logic that automate irrigation procedures based on real-time sensor data forms the project's core. The technology will enable targeted and precise watering, optimising water distribution and reducing water waste by connecting actuators with irrigation valves. Farmers will be able to remotely monitor temperature fluctuations, irrigation status, and soil moisture levels thanks to an intuitive user interface that can be accessed by online or mobile applications. Farmers will be able to modify irrigation settings based on real-time data insights thanks to this interface, which will offer actionable insights.

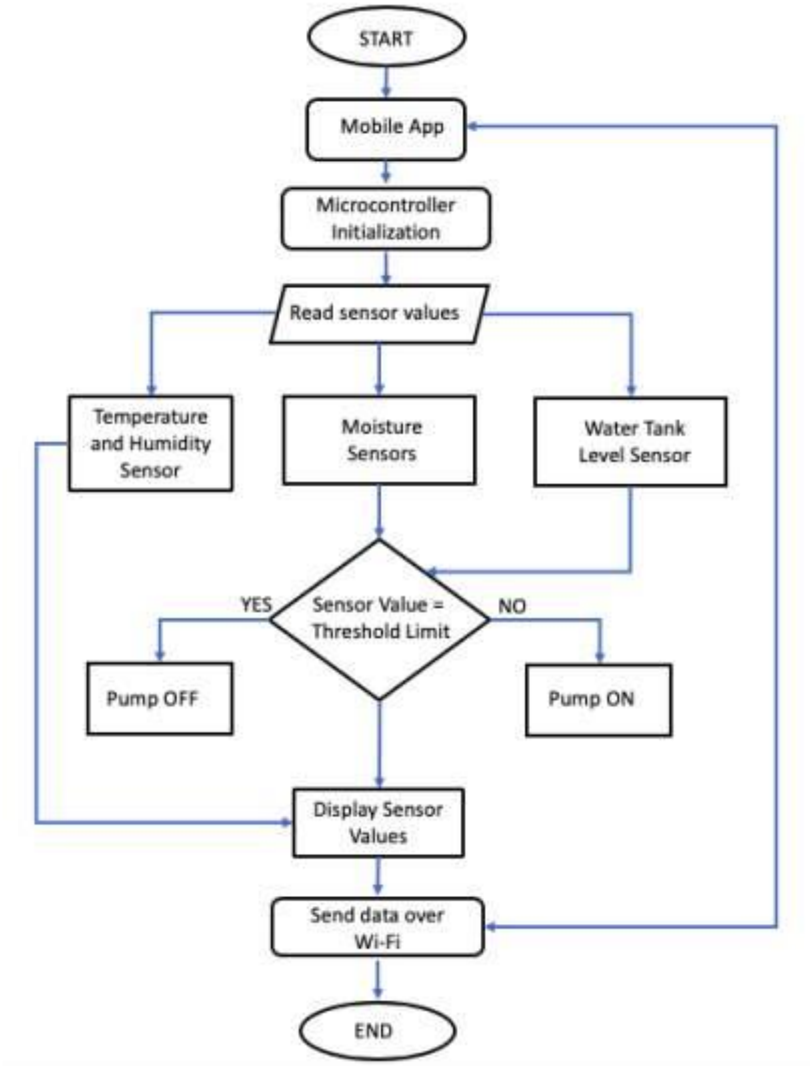
Additionally, scalability and flexibility are prioritised in the project design to guarantee compatibility with the current farm infrastructure and to allow for future development to suit larger farms or alternative crop varieties. Sensor data will be analysed, trends found, and predictive models created using data analytics techniques in order to improve agricultural operations and raise crop output and quality. With an emphasis on sustainability, the project will be planned to encourage effective resource use, lessen its negative effects on the environment, and provide farmers with technology-enabled tools for precision agriculture.



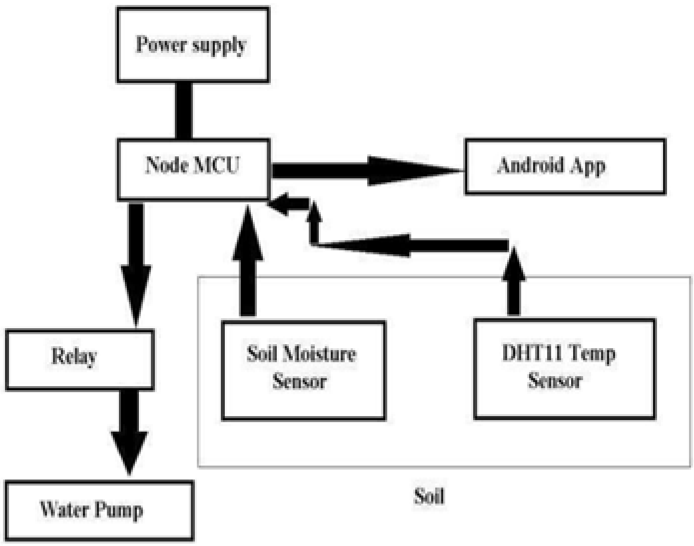
USE CASE DIAGRAM



SEQUENCE DIAGRAM



DATA FLOW DIAGRAM



CLASS DIAGRAM

4.3 CONCLUSION

To sum up, this smart farming project's design, which makes use of IoT technology to monitor temperature remotely and control irrigation, is a revolutionary way to approach contemporary agriculture. The project attempts to solve major issues that farmers confront, such as ineffective resource management, unstable environmental conditions, and a lack of real-time insights into crop health, by merging IoT devices, data analytics, and automation.

The foundation of the project is the creation of a strong Internet of Things infrastructure, which includes temperature sensors, actuators, soil moisture sensors, and WiFi connection. Accurate data gathering is made possible by the strategic deployment and calibration of these sensors, which also enable proactive monitoring of field conditions and precise irrigation control. Using clever algorithms to automate irrigation control guarantees efficient use of water, reducing waste and raising crop yields.

Farmers are empowered with remote monitoring and control capabilities by the easily navigable interface that can be accessed by online or mobile applications. It offers real-time insights into temperature fluctuations, irrigation status, and soil moisture levels. Farmers may use this interface as a decision support tool to help them make well-informed decisions based on insight gathered from data.

In addition, the project design places a strong emphasis on sustainability, flexibility, and scalability. The system constantly optimises farming processes by utilising data analytics techniques, which helps to promote resource conservation, environmental stewardship, and long-term agricultural sustainability. The project's emphasis on capacity building, education, and training guarantees that farmers adopt and use IoT technologies effectively, promoting an innovative and technology-driven agricultural culture.

CHAPTER 5 IMPLEMENTATION AND RESULTS

5.1 IMPLEMENTATION OF KEY FUNCTIONS

A number of crucial procedures and elements must be included in order to implement the main features of a smart farming project, which include smart irrigation, real-time temperature monitoring, and an instant alarm system. Below is a thorough implementation strategy for every function:

1. Intelligent Watering System:

1.1 Sensor Deployment:

To gather data on soil moisture levels in real time, strategically place soil moisture sensors across the farm's various parts.
Actuator Integration: To provide automated control based on sensor data, integrate actuators with irrigation valves.

1.2 IoT Connectivity:

To facilitate communication between actuators, sensors, and a central control system, set up WiFi connectivity.

1.3 Developing Algorithms:

Create algorithms to evaluate soil moisture information and calculate irrigation demands based on crop water requirements and predetermined thresholds.

1.4 Automation:

To maximise water use and reduce waste, use automated irrigation scheduling and control logic.

1.5 User Interface:

Create an intuitive dashboard or mobile application that enables farmers to remotely monitor and adjust irrigation parameters.

2. Real-time Monitoring of Temperature:

2.1 Temperature Sensor Deployment:

Install temperature sensors across the farm to keep an eye on the current temperature.

2.2 Data Transmission:

Using WiFi or other communication protocols, make sure temperature sensors are continuously sending data to the central monitoring system.

2.3 Data analysis:

Use algorithms for data analysis to handle temperature data and find abnormalities or variations.

2.4 Visualisation:

Give farmers immediate access to field temperature data by displaying real-time temperature measurements on the user interface.

3. **Quick Alert Mechanism:**

3.1 Threshold monitoring:
Establish soil moisture and temperature thresholds to set off alarms according to crop needs.

3.2 warn Generation:
Provide a system for creating alerts that will warn farmers by text message, email, or app when circumstances stray from ideal ranges or when crucial thresholds are surpassed.

3.3 Real-Time Notifications:
Make sure farmers receive information in a timely manner so they may act promptly and take remedial action.

5.2 METHOD OF IMPLEMENTATION

1. **Hardware Setup:** Purchase and install temperature sensors, actuators, IoT connection modules, and soil moisture sensors around the farm.

2. **Software Development:** Create and include central control system, actuator, and sensor firmware. Put algorithms into practice for alert creation, irrigation management, and data analysis.

3. **Testing and Calibration:** To guarantee precision and dependability in data gathering and irrigation management, thoroughly test and calibrate sensors and actuators. Establish seamless communication and integration between the central control system, sensors, actuators, and Internet of Things devices.

4. **User Interface Development:** Create an intuitive user interface (web or mobile app) that enables farmers to monitor farm conditions, communicate with the system, and get notifications.

5. **Training and Deployment:** Educate farmers on the proper use of the smart farming technology. Install the system on the farm and carry out preliminary testing to confirm its functioning and efficiency.

6. **Constant Monitoring and Optimisation:** Put in place a plan for tracking system performance, getting user input, and continually refining algorithms and configurations in light of user experience and real-world data.

5.3 CODES

ESP 8266 FUNCTIONALITY CODE

```
#define BLYNK_TEMPLATE_ID "TMPL3OxwiQO1S"
#define BLYNK_TEMPLATE_NAME "Temp Hum Moisture"
#define BLYNK_AUTH_TOKEN "JZKJLyCegLdweofausCFG0Sc4bPoK1A1"

#define BLYNK_PRINT Serial
#include <ESP8266WiFi.h>
#include <BlynkSimpleEsp8266.h>

#include <DHT.h>
```

```
char auth[] = BLYNK_AUTH_TOKEN;

char ssid[] = "Mohan";      // type your wifi name
char pass[] = "123456789";  // type your wifi password


BlynkTimer timer;


#define DHTPIN 4 //Connect Out pin to D2 in NODE MCU

#define DHTTYPE DHT11
DHT dht(DHTPIN, DHTTYPE);

int led2=2;
void sendSensor()
{
  /*int soilmoisturevalue = analogRead(A0);
   soilmoisturevalue = map(soilmoisturevalue, 0, 1023, 0, 100);*/
   int value = analogRead(A0);
  value = map(value,400,1023,100,0);
  float h = dht.readHumidity();
  float t = dht.readTemperature();
  float f=dht.readTemperature(true); // or dht.readTemperature(true) for Fahrenheit

  if (isnan(h) || isnan(t)) {
    Serial.println("Failed to read from DHT sensor!");
    return;
  }
  // You can send any value at any time.
  // Please don't send more that 10 values per second.
    Blynk.virtualWrite(V0, value);
    Blynk.virtualWrite(V1, t);
    Blynk.virtualWrite(V2, h);
    Blynk.virtualWrite(V3, f);
    Serial.print("Soil Moisture : ");
    Serial.print(value);
    Serial.print("Temperature : ");
    Serial.print(t);
    Serial.print("    Humidity : ");
    Serial.println(h);
}
void setup()
{

  Serial.begin(115200);

pinMode(2,OUTPUT);
  Blynk.begin(auth, ssid, pass);
  dht.begin();
  timer.setInterval(100L, sendSensor);
```

```
  }

void loop()
{
digitalWrite(2,LOW);
delay(100);
digitalWrite(2,HIGH);
delay(100);
  Blynk.run();
  timer.run();
 }
```

ESP 8266 CONFIGURATION

```
#include <ESP8266WiFi.h>
#include <ESP8266HTTPClient.h>
#include <ESP8266WebServer.h>
#include <EEPROM.h>

//Variables
int i = 0;
int statusCode;
const char* ssid = "text";
const char* passphrase = "text";
String st;
String content;


//Function Decalration
bool testWifi(void);
void launchWeb(void);
void setupAP(void);

//Establishing Local server at port 80 whenever required
ESP8266WebServer server(80);

void setup()
{

  Serial.begin(115200); //Initialising if(DEBUG)Serial Monitor
  Serial.println();
  Serial.println("Disconnecting previously connected WiFi");
  WiFi.disconnect();
  EEPROM.begin(512); //Initialasing EEPROM
  delay(10);
  pinMode(LED_BUILTIN, OUTPUT);
  Serial.println();
  Serial.println();
  Serial.println("Startup");

  //---------------------------------------- Read eeprom for ssid and pass
  Serial.println("Reading EEPROM ssid");
```

```
  String esid;
  for (int i = 0; i < 32; ++i)
  {
    esid += char(EEPROM.read(i));
  }
  Serial.println();
  Serial.print("SSID: ");
  Serial.println(esid);
  Serial.println("Reading EEPROM pass");

  String epass = "";
  for (int i = 32; i < 96; ++i)
  {
    epass += char(EEPROM.read(i));
  }
  Serial.print("PASS: ");
  Serial.println(epass);


  WiFi.begin(esid.c_str(), epass.c_str());
  if (testWifi())
  {
    Serial.println("Succesfully Connected!!!");
    return;
  }
  else
  {
    Serial.println("Turning the HotSpot On");
    launchWeb();
    setupAP();// Setup HotSpot
  }

  Serial.println();
  Serial.println("Waiting.");

  while ((WiFi.status() != WL_CONNECTED))
  {
    Serial.print(".");
    delay(100);
    server.handleClient();
  }

}
void loop() {
  if ((WiFi.status() == WL_CONNECTED))
  {

    for (int i = 0; i < 10; i++)
    {
      digitalWrite(LED_BUILTIN, HIGH);
      delay(1000);
      digitalWrite(LED_BUILTIN, LOW);
      delay(1000);
```

```
    }

  }
  else
  {
  }

}


//--------------------------------------------- Fuctions used for WiFi credentials saving and connecting to it which you do not need to change
bool testWifi(void)
{
  int c = 0;
  Serial.println("Waiting for Wifi to connect");
  while ( c < 20 ) {
    if (WiFi.status() == WL_CONNECTED)
    {
      return true;
    }
    delay(500);
    Serial.print("*");
    c++;
  }
  Serial.println("");
  Serial.println("Connect timed out, opening AP");
  return false;
}

void launchWeb()
{
  Serial.println("");
  if (WiFi.status() == WL_CONNECTED)
    Serial.println("WiFi connected");
  Serial.print("Local IP: ");
  Serial.println(WiFi.localIP());
  Serial.print("SoftAP IP: ");
  Serial.println(WiFi.softAPIP());
  createWebServer();
  // Start the server
  server.begin();
  Serial.println("Server started");
}

void setupAP(void)
{
  WiFi.mode(WIFI_STA);
  WiFi.disconnect();
  delay(100);
  int n = WiFi.scanNetworks();
  Serial.println("scan done");
  if (n == 0)
```

```
    Serial.println("no networks found");
  else
  {
    Serial.print(n);
    Serial.println(" networks found");
    for (int i = 0; i < n; ++i)
    {
      // Print SSID and RSSI for each network found
      Serial.print(i + 1);
      Serial.print(": ");
      Serial.print(WiFi.SSID(i));
      Serial.print(" (");
      Serial.print(WiFi.RSSI(i));
      Serial.print(")");
      Serial.println((WiFi.encryptionType(i) == ENC_TYPE_NONE) ? " " : "*");
      delay(10);
    }
  }
  Serial.println("");
  st = "<ol>";
  for (int i = 0; i < n; ++i)
  {
    // Print SSID and RSSI for each network found
    st += "<li>";
    st += WiFi.SSID(i);
    st += " (";
    st += WiFi.RSSI(i);

    st += ")";
    st += (WiFi.encryptionType(i) == ENC_TYPE_NONE) ? " " : "*";
    st += "</li>";
  }
  st += "</ol>";
  delay(100);
  WiFi.softAP("techiesms", "");
  Serial.println("softap");
  launchWeb();
  Serial.println("over");
}

void createWebServer()
{
 {
    server.on("/", []() {

      IPAddress ip = WiFi.softAPIP();
      String ipStr = String(ip[0]) + '.' + String(ip[1]) + '.' + String(ip[2]) + '.' + String(ip[3]);
      content = "<!DOCTYPE HTML>\r\n<html>Hello from ESP8266 at ";
      content += "<form action=\"/scan\" method=\"POST\"><input type=\"submit\"
value=\"scan\"></form>";
      content += ipStr;
      content += "<p>";
      content += st;
```

```
    content += "</p><form method='get' action='setting'><label>SSID: </label><input name='ssid' length=32><input name='pass' length=64><input type='submit'></form>";
    content += "</html>";
    server.send(200, "text/html", content);
  });
  server.on("/scan", []() {
    //setupAP();
    IPAddress ip = WiFi.softAPIP();
    String ipStr = String(ip[0]) + '.' + String(ip[1]) + '.' + String(ip[2]) + '.' + String(ip[3]);

    content = "<!DOCTYPE HTML>\r\n<html>go back";
    server.send(200, "text/html", content);
  });

  server.on("/setting", []() {
    String qsid = server.arg("ssid");
    String qpass = server.arg("pass");
    if (qsid.length() > 0 && qpass.length() > 0) {
      Serial.println("clearing eeprom");
      for (int i = 0; i < 96; ++i) {
        EEPROM.write(i, 0);
      }
      Serial.println(qsid);
      Serial.println("");
      Serial.println(qpass);
      Serial.println("");

      Serial.println("writing eeprom ssid:");
      for (int i = 0; i < qsid.length(); ++i)
      {
        EEPROM.write(i, qsid[i]);
        Serial.print("Wrote: ");
        Serial.println(qsid[i]);
      }
      Serial.println("writing eeprom pass:");
      for (int i = 0; i < qpass.length(); ++i)
      {
        EEPROM.write(32 + i, qpass[i]);
        Serial.print("Wrote: ");
        Serial.println(qpass[i]);
      }
      EEPROM.commit();

      content = "{\"Success\":\"saved to eeprom... reset to boot into new wifi\"}";
      statusCode = 200;
      ESP.reset();
    } else {
      content = "{\"Error\":\"404 not found\"}";
      statusCode = 404;
      Serial.println("Sending 404");
    }
    server.sendHeader("Access-Control-Allow-Origin", "*");
    server.send(statusCode, "application/json", content);
```

```
  });
 }
}
```

ARDUINO CODE

```
int sensor_pin= A0;
int output_value;
int celcius=0;

void setup(){
  pinMode(12, OUTPUT);
  pinMode(2,OUTPUT);
  pinMode(3,OUTPUT);
  Serial.begin(9600);


}

void loop()
{
  output_value= analogRead (sensor_pin);
  output_value= map (output_value,550,10,0,100);
  celcius=map(((analogRead(A1))),0,1023,30,70);
  Serial.print("Moisture:");
  Serial.print(output_value);
  Serial.println("%");
  if(celcius<30){
    digitalWrite(2,LOW);
    delay(1000);
    digitalWrite(3,HIGH);
    delay(1000);

  }
  else{
    digitalWrite(3,LOW);
    delay(1000);
    digitalWrite(2,HIGH);
    delay(1000);
  }

  if (output_value<20)
  {
    delay(1000);
    digitalWrite(12, LOW);
  }

  else
  {
    delay(1000);
    digitalWrite (12,HIGH);
```

```
  }

  delay (1000);
}
```

5.4 OUTPUTS

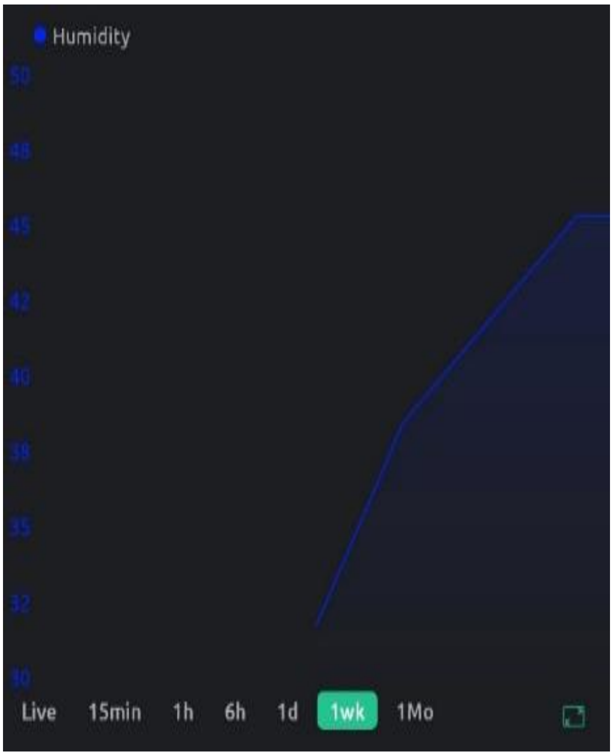


FIG 1.Humidity Live Visualization

FIG 2.Live Data Monitoring

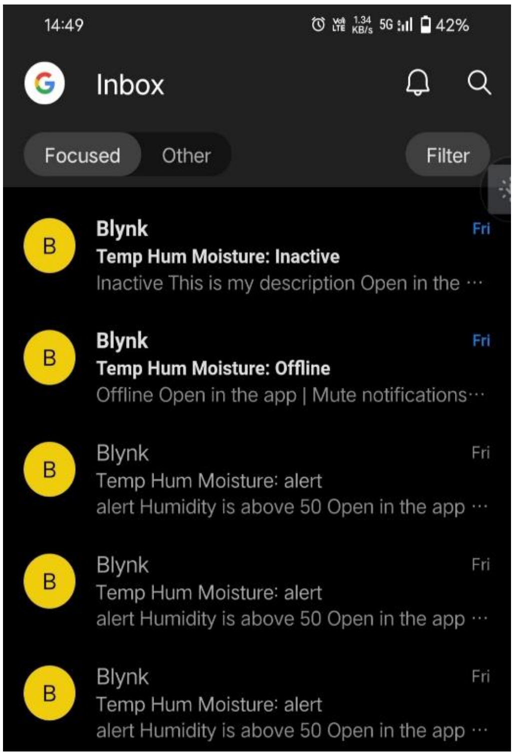


FIG 3.Alerting through Mail

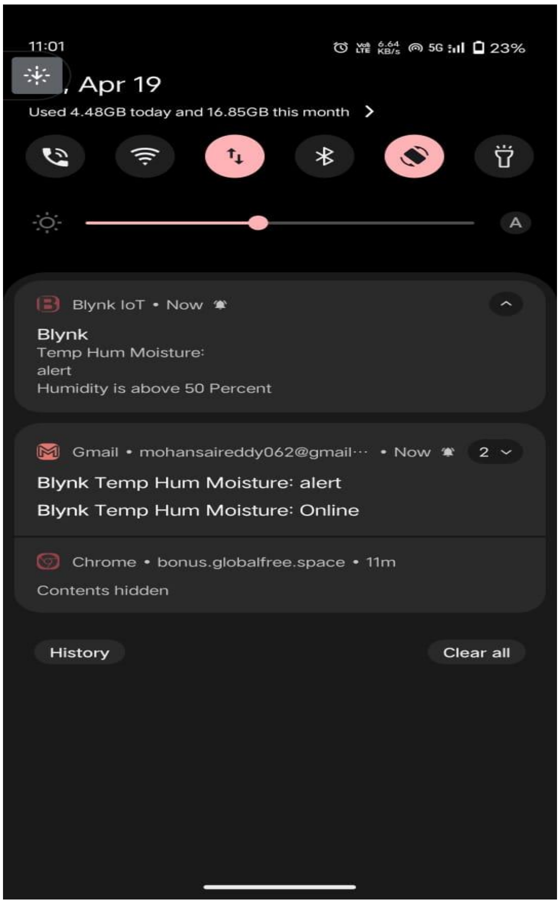


FIG 5.Notifying Through Mobile Notification pannel

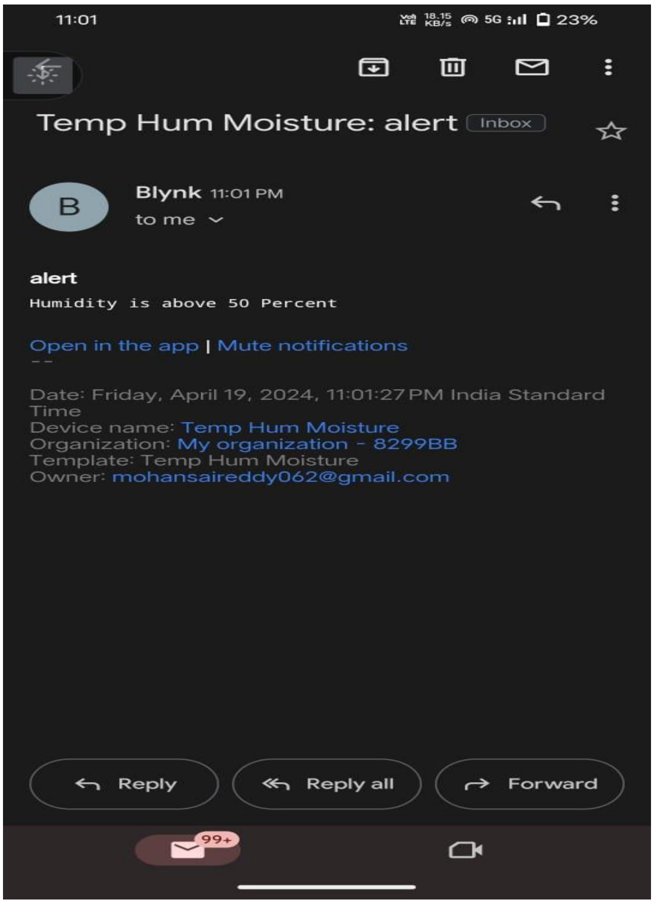


FIG 6.INFO about HUMIDITY through MAIL

CHAPTER 5 TESTING AND VALIDATION

6.1 INTRODUCTION

A smart farming project that uses IoT technology for remote temperature monitoring and smart watering must go through a critical testing phase. This stage makes sure the system works as intended, satisfies requirements, and performs dependably in a range of scenarios. The significance of testing, major goals and crucial techniques for testing a project of this kind are described in the introduction that follows:

Importance of Testing

Thorough testing is necessary in the context of a smart farming project to confirm the IoT-enabled system's operation, performance, and dependability. Testing lowers the risk of operational failures and ensures optimal performance in actual farm situations by assisting in the early identification and correction of possible problems or flaws early in the development lifecycle. Developers may optimise resource use and improve system quality by carrying out comprehensive testing.

6.2 DESIGN OF TEST CASES AND SCENARIOS

Creating test cases and scenarios for a smart farming project that uses IoT technology for remote temperature monitoring and smart irrigation entails figuring out precise features, inputs, and expected results in order to guarantee comprehensive system testing. Here are some instances of scenarios and test cases that address important project components:

6.2.1. Functionality Testing:

Test Case 1: Gathering Sensor Data

Situation: Verify that temperature and soil moisture sensors reliably gather and send data.
Sensor data simulations (temperature readings, moisture content) are the inputs.
Anticipated Result: The central monitoring system successfully receives and displays data.
Automated Irrigation Control in Test Case Two

Scenario: Using sensor data, confirm autonomous watering.
inputs: Irrigation triggered by simulated soil moisture levels.
Anticipated Result: Water control valves open and close in accordance with preset criteria.

Test Case 2: Automated Irrigation Control

Scenario: Using sensor data, confirm autonomous watering.
inputs: Irrigation triggered by simulated soil moisture levels.
Anticipated Result: Water control valves open and close in accordance with preset criteria.

6.2.2. RELIABILITY AND STABILITY TESTING

Test Case 3 : System Load Testing

Scenario: Evaluate system stability in the event of a peak load.
Inputs: User requests and a sizable amount of sensor data were simulated.
Anticipated Result: The system continues to operate without any crashes or slowdowns.

Case 4: Network Accessibility

Scenario: Confirm system functionality with different network configurations.

Inputs: Network delay or sporadic WiFi access.
Anticipated Result: The system resumes regular operations after handling network disruptions with grace.

6.3 CONCLUSION

In conclusion, creating and carrying out thorough test cases and scenarios is essential to guaranteeing the system's usability, dependability, and functioning in actual agricultural settings for a smart farming project utilising IoT technology. The project's many components sensor data collecting, automated irrigation management, system stability, data correctness, interoperability, security, and user experience are assessed through methodical testing. Developers may minimise risks and maximise system performance by addressing any problems or vulnerabilities in the system early in the development lifecycle by using an organised approach to testing. Targeting distinct functionality and needs, each test case and scenario enables comprehensive validation of crucial elements including data integrity, network connection, sensor accuracy, and user interface usability.

To evaluate how the system behaves in both typical and unusual situations, test cases are executed by imitating various scenarios, inputs, and conditions. Verifying the system's interoperability with various devices, browsers, and network conditions is another aspect of testing that guarantees smooth functioning and accessibility for end users.

CHAPTER 5 CONCLUSION

7.1 Summary of Work

The smart farming project is an innovative endeavour that uses the Internet of Things (IoT) to revolutionise traditional agricultural methods. The project's main goal is to develop an intelligent farming system that can enhance crop health, maximise resource use, and provide farmers never-before-seen levels of monitoring and control over their operations. Through the use of Internet of Things devices including sensors, actuators, and data analytics tools, the project aims to solve major issues facing contemporary agriculture and pave the way for effective and sustainable agricultural methods.

7.2 Scope for Future Work

Using machine learning (ML) algorithms to forecast climate conditions using sensor data presents a viable path forward for the smart farming project. By enabling farmers with predictive skills that improve decision-making and optimise agricultural practices, this expansion seeks to empower farmers. The integration of machine learning encompasses several crucial elements and goals in order to provide precise and useful climate projections.

First and foremost, the goal is to use past sensor data such as soil moisture content, temperature, humidity, and maybe other environmental factors to create machine learning models that can forecast future weather patterns. Farmers will be able to plan ahead for weather patterns, schedule irrigation efficiently, and make well-informed decisions on crop management strategies because to this predictive capabilities.Expanding data gathering efforts to incorporate a wider variety of environmental characteristics important for climate prediction is part of the scope. In order to effectively train machine learning models, sensor data must be cleaned, transformed, and prepared using improved data pretreatment approaches. Regression, time series forecasting, and neural networks are a few examples of suitable machine learning techniques. Their research and selection will be essential to precisely modelling and projecting future climatic conditions using the gathered sensor data.

For smooth real-time prediction and decision assistance, integration with the smart farming system's current IoT infrastructure is essential. In order to guarantee timely forecasts and updates, ML models must be implemented and connected into the system architecture, allowing automatic data flow from sensors to the ML models.

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