Vineyard Monitoring System

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For the award of the Degree of

BACHELOR IN TECHNOLODGY
In
ELECTRONICS & TELECOMMUNICATION ENGINEERING

By

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2022-2023

CERTIFICATE

This is to certify that the dissertation entitled **"Vineyard Monitoring System"** has been completed successfully by **Mayuresh Pitale , Divesh Podar and Shruti Prabhu** under the guidance of for the award of **Semester 4 Mini Project** in **Electronics & Telecommunication Engineering** from **University of Mumbai**.

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MINI-PROJECT APPROVAL CERTIFICATE

This is to certify that the dissertation entitled **"Vineyard Monitoring system"** by **Mayuresh Pitale , Divesh Podar and Shruti Prabhu** is approved for the award of completing the project in **Electronics & Telecommunication Engineering** from **University of Mumbai**.

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

Seal of the Institute

Abstract

Monitoring soil moisture, temperature, and humidity is crucial for optimizing agricultural practices. However, existing monitoring systems often suffer from high costs and limited accessibility. The purpose of this study was to develop a bot, Vineyard monitoring system using Raspberry Pi 3B to track and analyze soil moisture, temperature, and humidity levels. The system aimed to provide real-time data and enable efficient monitoring of these environmental parameters in a cost-effective and accessible manner. Through the integration of sensors and Raspberry Pi 3B's capabilities, the developed system successfully captured and processed data, providing valuable insights for optimizing agricultural practices. Monitoring soil moisture, temperature, and humidity is crucial for optimizing agricultural practices. However, existing monitoring systems often suffer from high costs and limited accessibility.

Acknowledgement

I have great pleasure in presenting the report on **Vineyard Monitoring System**. I take this opportunity to express my sincere thanks towards my guide **Dr. Amol Deshpande**, Professor of Electronics & Telecommunication Engineering, S.P.I.T., Mumbai, for providing the technical guidelines and the suggestions regarding line of this work. I would like to express my gratitude towards their constant encouragement, support and guidance throughout the development of the project.

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Chapter 1

Introduction

The farm monitoring system using Raspberry Pi, moisture sensors, humidity, and temperature sensors is a project aimed at automating and enhancing the monitoring process in agricultural settings. The system utilizes the capabilities of Raspberry Pi, along with various sensors, to collect real-time data on soil moisture, humidity, and temperature.

The project involves deploying moisture sensors in the soil to measure the moisture content, humidity sensors to measure the atmospheric humidity, and temperature sensors to monitor the ambient temperature. The Raspberry Pi serves as the central control unit that collects, processes, and displays the sensor data.

The system's software, developed using Python programming language, interacts with the sensors through appropriate interfaces such as GPIO and SPI. The Raspberry Pi continuously reads the sensor data, applies calibration techniques, and presents the information in a user-friendly format. The data can be accessed remotely through a web-based interface or a dedicated mobile application, allowing farmers to monitor their fields and make informed decisions.

The farm monitoring system provides several benefits to farmers. By monitoring soil moisture levels, it helps optimize irrigation schedules, preventing overwatering or drought stress. The humidity and temperature sensors assist in assessing environmental conditions, enabling farmers to identify potential issues such as excessive humidity or extreme temperatures that can impact crop growth. Additionally, historical data analysis can provide insights for crop planning and yield optimization.

This project report covers the system architecture, hardware setup, software implementation, data visualization techniques, and the user interface. It also includes the calibration techniques used for accurate sensor measurements. The project demonstrates the feasibility and effectiveness of utilizing Raspberry Pi and sensor technologies to enhance farm monitoring and management practices.

Keywords: Raspberry Pi, moisture sensor, humidity sensor, temperature sensor, farm monitoring, irrigation, soil moisture, environmental monitoring.

Chapter 2

Literature Review

1. **Smart Farming Systems for Precision Agriculture** Smart farming systems that incorporate sensor technologies and data analysis techniques have been extensively researched. These systems provide farmers with crucial information for optimized resource management, crop growth monitoring, and yield prediction. Studies have highlighted the importance of integrating moisture sensors, humidity sensors, and temperature sensors to capture comprehensive environmental data and provide actionable insights.
2. **Raspberry Pi in Agricultural Applications** The Raspberry Pi, with its compact size, low power consumption, and GPIO capabilities, has emerged as a popular platform for agricultural applications. Researchers have utilized Raspberry Pi boards to build farm monitoring systems, integrating various sensors for environmental data collection. These systems enable remote monitoring and control, facilitating precision agriculture practices.
3. **Moisture Sensors for Soil Moisture Monitoring** Soil moisture sensors are widely employed in farm monitoring systems. They measure the water content in the soil and help optimize irrigation practices. Literature suggests the use of different types of moisture sensors, such as resistive, capacitive, and TDR-based sensors, to accurately measure soil moisture and prevent water stress or excessive irrigation.
4. **Humidity and Temperature Sensors for Environmental Monitoring** Humidity and temperature sensors are crucial components in farm monitoring systems. They provide valuable information about the ambient conditions, including air moisture content and temperature. Researchers have explored the integration of humidity and temperature sensors with Raspberry Pi platforms to monitor climate conditions, detect anomalies, and optimize crop growth.
5. **Data Analysis Techniques for Farm Monitoring** The collected data from moisture sensors, humidity sensors, and temperature sensors require analysis for actionable insights. Researchers have employed various data analysis techniques, such as statistical analysis, machine learning, and data visualization, to process the sensor data and provide meaningful information to farmers. These techniques enable the identification of patterns, prediction of crop health, and decision support for optimized agricultural practices.
6. **Wireless Communication and Remote Monitoring** Several studies have focused on wireless communication protocols and remote monitoring capabilities in farm monitoring systems. The integration of Wi-Fi or other wireless technologies enables real-time data transmission, remote access, and control of the monitoring system. This allows farmers to monitor their fields from anywhere, enhancing convenience and efficiency.

Chapter 3

Project Objectives

- The project will provide accurate and real-time data on soil moisture, nutrients, pH, temperature, and humidity, and automate the watering process based on this data.

- The App will provide users with easy access to the data and the ability to control the system remotely.

- The system will avoid plant damage from excess water, chemical fertilizers and harmful pesticides and suggest remedies to users through App.

- The system will help to manage all required parameters for grapes to grow and maximize the yield.

Fig 1 :Grape Vineyard

Chapter 4

Theory

Why do we need a Vineyard monitoring system?

Plants requires 17 nutrients to grow among which

- Nitrogen
- Phosphorus
- Potassium are essential one's as well as they are the main components in most of the fertilizers.

Overusing these fertilisers can have a variety of negative effects on plants and the soil, which can significantly reduce the soil's fertility.Grapes need a certain amount of nutrients to flourish, thus they need to be constantly monitored.

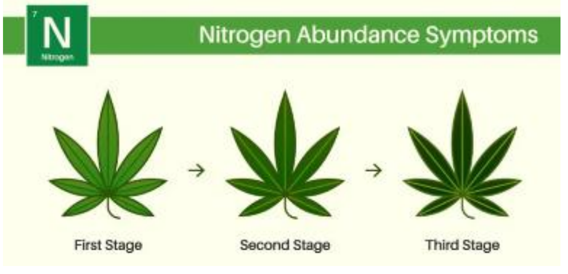
Nitrogen and Phosphorus are significant in increasing wine grape berry set and weight.

- Strong vine canopies can lead to excessive nitrogen and potassium uptake, which increases grapes and wine pH.

Standards for Grape Petiole Analysis			
Element	Low	Normal	High
N (%)	<0.5	0.8 - 1.3	>2
P (%)	<0.1	0.16 - 0.3	>0.5
K (%)	<1	1.5 - 2.5	>4

Table 1

Adverse effect on plants



EXCESS :

- Too leafy
- No Fruit or Flowers
- Weak Structure

DEFICIENT :

- Decreased chlorophyll content
- Pale yellow colour leaves
- Stunted growth

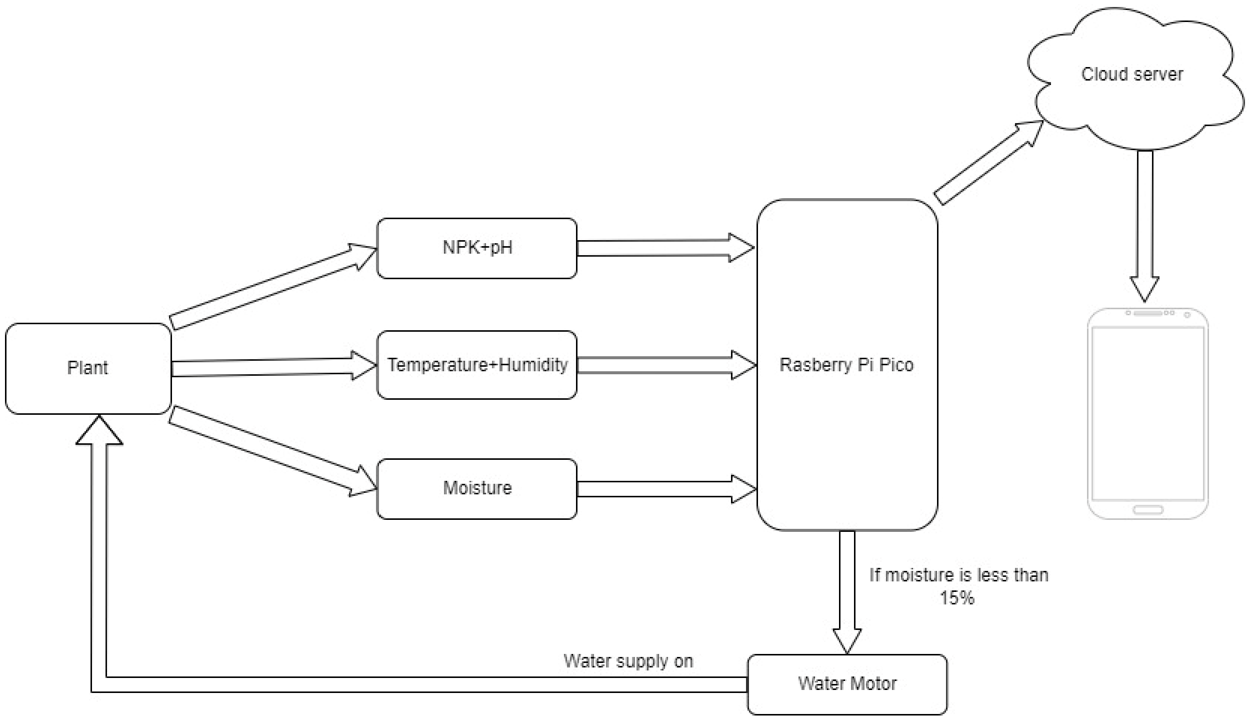
Chapter 5

System Design

The Bluetooth-controlled farm monitoring robot is designed to provide remote control and monitoring capabilities for agricultural settings. It utilizes a Raspberry Pi along with moisture sensors, humidity sensors, temperature sensors, a servo motor for dipping the moisture sensor, an L293D motor driver IC, an MCP3008 ADC for the moisture sensor, and two DC motors for movement. The system architecture and components are described below:

The system operates as follows:

1. The Raspberry Pi establishes a Bluetooth connection with a paired device (e.g., smartphone) to receive control commands.
2. The user sends a command through the Bluetooth interface to initiate the dipping of the moisture sensor.
3. Upon receiving the command, the Raspberry Pi activates the servo motor, adjusting its position to lower the moisture sensor into the soil.
4. The Raspberry Pi reads data from the moisture sensors, humidity sensors, and temperature sensors through their respective interfaces.
5. The analog output from the moisture sensors is converted to digital values using the MCP3008 ADC.
6. The Raspberry Pi processes the sensor data, performs calibration if necessary, and transmits the data wirelessly to the paired device for remote monitoring.
7. The Raspberry Pi controls the DC motors via the L293D motor driver IC to navigate the farm monitoring robot in different directions and locations.
8. The humidity and temperature sensors continuously monitor the environmental conditions and provide real-time data to the Raspberry Pi for analysis and decision-making.
9. The data collected are uploaded on Cloud which can be accessed to app or web



SR No.	Components
1.	Raspberry Pi 3B
2.	DC motors
3.	Humidity+ temperature sensor
4.	Moisture sensor
5.	Servo Motor
6.	IC MCP3008 (ADC)
7.	IC L293D (Motor Driver)

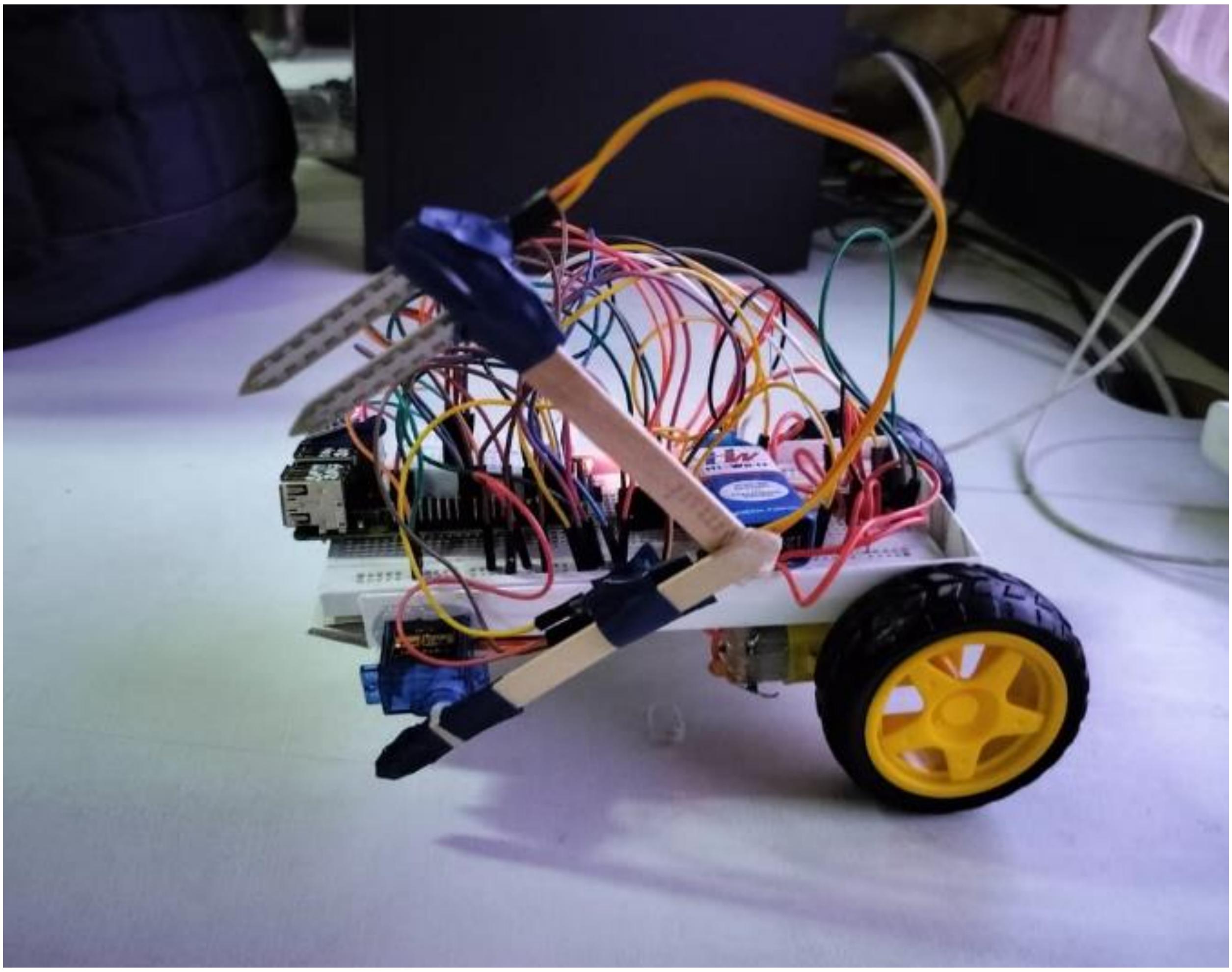
Chapter 6

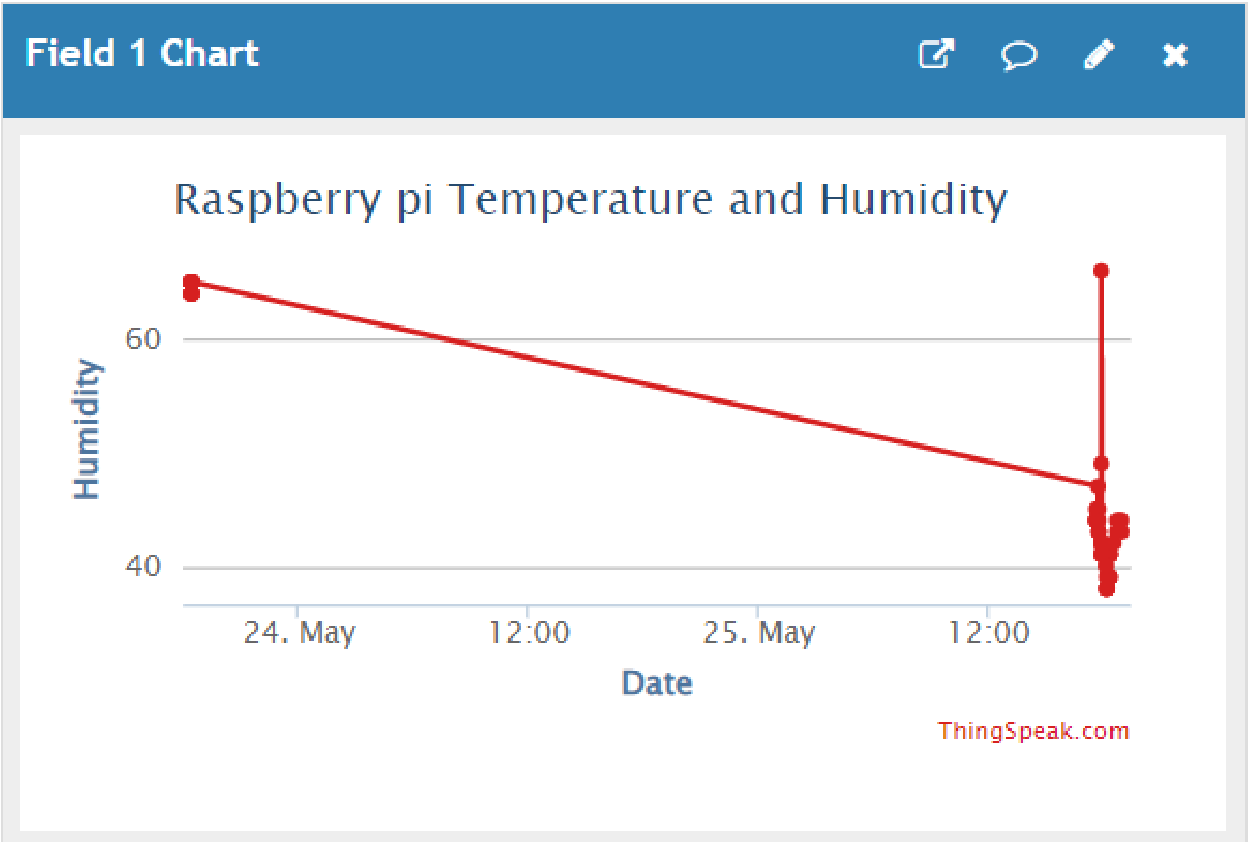
Softwares

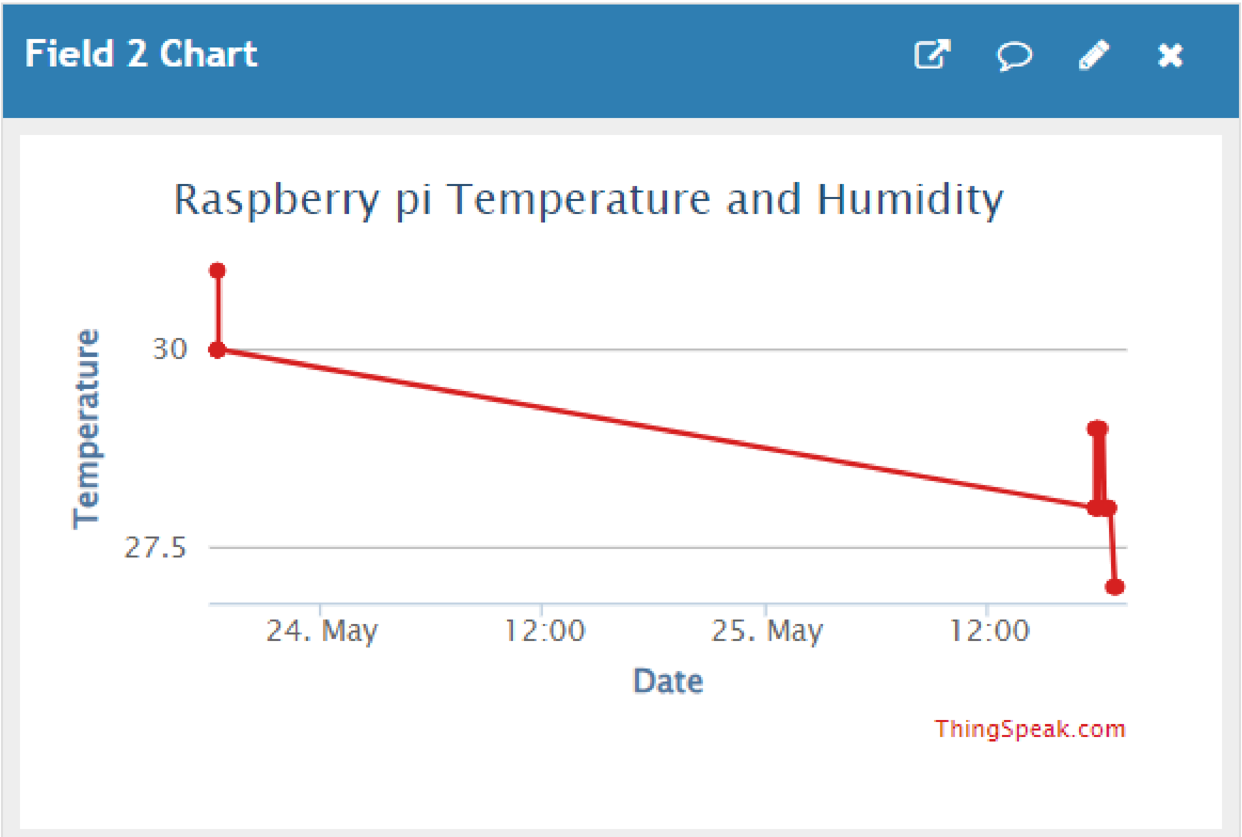
Using the **Thonny IDE,** create a new Python script to control the farm monitoring robot and collect sensor data. The code will include functions to read data from the moisture sensors, humidity sensors, and temperature sensors, control the servo motor for dipping the moisture sensor, and control the DC motors for robot movement. Additionally, you will need to include code to establish an internet connection and send the sensor data to the ThingSpeak cloud. establish an HTTP connection with the **ThingSpeak API** and send the sensor data to your created ThingSpeak channel. Use the appropriate API endpoints and parameters to ensure that the data is stored correctly in the respective fields of the channel.

Chapter 7

Simulation & Experimental Results




Field 1 Chart
Raspberry pi Temperature and Humidity
Humidity
60
40
24. May
12:00
25. May
12:00
Date
ThingSpeak.com


Field 2 Chart
Raspberry pi Temperature and Humidity
Temperature
30
27.5
24. May
12:00
25. May
12:00
Date
ThingSpeak.com

Chapter 8

Conclusions

The developed Vineyard monitoring system successfully captured and monitored soil moisture, temperature, and humidity levels in real time. The collected data allowed for comprehensive analysis, enabling users to make informed decisions regarding irrigation schedules, crop health, and overall environmental conditions. The system demonstrated reliable and accurate measurements, facilitating efficient agricultural management.

The Vineyard monitoring system using Raspberry Pi 3B proved to be an effective and affordable solution for monitoring soil moisture, temperature, and humidity. By combining sensor integration, data acquisition, and analysis, the system provided real-time insights that can optimize agricultural practices. Future work may involve expanding the system's capabilities, incorporating additional sensors, and integrating wireless communication for remote monitoring and control.

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