VISVESVARAYA TECHNOLOGICAL UNIVERSITY

Jnana Sangama, Belagavi – 590014.

Internship Report

On

"Smart Agriculture System Using AIOT"

Submitted in partial fulfillment of the requirement for the award of degree of

BACHELOR OF ENGINEERING

By

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Under the Guidance of:

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A P S COLLEGE OF ENGINEERING

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Evaluation Sheet

Title of the project : Smart Agriculture System

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2. Adeeba Fathima
3. Rohit Kumar

External Supervisor:

Internal Supervisor:

Date:

Place:

Project Completion Certificate

I, Neelu Far SA (1AP21CS031), hereby declare that the material presentedin the Project Report titled **"Smart Agriculture System using AIOT"** represents original work carried out by me in the department of Computer Science and Engineering at the **APS college of Engineering, Bangalore** during the tenure

2 October, 2024 – 12, December, 2024.

With My signature, I certify that:

- I have not manipulated any of the data or results.
- I have not committed any plagiarism of intellectual property and have clearly indicated and referenced the contributions of others.
- I have explicitly acknowledged all collaborative research and discussions.
- I understand that any false claim will result in severe disciplinary action.
- I understand that the work may be screened for any form of academic misconduct.

Date: **Student Signature:**

In my capacity as the supervisor of the above-mentioned work, I certify that the work presented in this report was carried out under my supervision and is worthy of consideration for the requirements of the B.Tech. Internship Work.

Advisor's Name: **Guide Name:**

Dr.Shivamurthaiah M Akhil Sai

Advisor's Signature **Guide Signature**

Project Completion Certificate

I, Adeeba Fathima (1AP21IS001), hereby declare that the material presentedin the Project Report titled **"Smart Agriculture System using AIOT"** represents original work carried out by me in the department of Information Science and Engineering at the **APS college of Engineering, Bangalore** during the tenure

2 October, 2024 – 12, December, 2024.

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Project Completion Certificate

I, Rohit Kumar (1AP21EC013), hereby declare that the material presentedin the Project Report titled **"Smart Agriculture System using AIOT"** represents original work carried out by me in the department of Electronics and Communication Engineering at the **APS college of Engineering, Bangalore** during the tenure

2 October, 2024 – 12, December, 2024.

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Advisor's Signature **Guide Signature**

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CHAPTER 1

ABSTRACT

Agriculture plays a vital role in sustaining economies and societies, yet it faces challenges like resource inefficiency, unpredictable climate changes, and labor shortages. This project aims to develop a Smart Agricultural System leveraging the Raspberry Pi as the core processing unit to improve farming efficiency, reduce costs, and increase productivity.

The system integrates Internet of Things (IoT) technology and sensors to monitor key agricultural parameters such as soil moisture, temperature, humidity, and light intensity. Data collected from these sensors is processed by the Raspberry Pi and made accessible through a user-friendly interface, enabling real-time decision-making. Automated irrigation control is implemented to ensure optimal water usage based on soil moisture levels, reducing wastage and conserving resources.

Additionally, the system incorporates weather prediction capabilities, pest detection, and crop growth monitoring through machine learning algorithms, enhancing the overall management of the farm. Remote access is enabled via a mobile or web application, allowing farmers to monitor and control the system from anywhere.

By combining IoT, machine learning, and real-time data analysis, this system offers an automated and efficient solution for farmers, promoting effective water management and improved crop productivity.

CHAPTER 2

INTRODUCTION

Smart agriculture refers to the integration of advanced technologies with traditional farming practices to enhance efficiency, productivity, and sustainability. Leveraging innovations such as the Internet of Things (IoT), Artificial Intelligence (AI), and cloud computing, smart systems enable real-time monitoring, data-driven decision-making, and automated management of agricultural activities.

In recent years, there has been a significant rise in the adoption of smart farming techniques, powered by IoT devices and cloud-based platforms. These technologies facilitate precise control over critical parameters such as irrigation, fertilization, pest management, and environmental monitoring. Among the most affordable and accessible platforms for building smart agricultural systems is the Raspberry Pi. This low-cost, credit-card-sized computer offers sufficient processing power and flexibility to handle a wide range of applications, making it a popular choice for farmers and researchers alike.

The Raspberry Pi serves as the central hub for connecting and processing data from various sensors and devices. These sensors measure essential environmental factors, including soil moisture, temperature, humidity, wind speed, and light intensity. The data collected is processed and analyzed in real-time, enabling timely interventions such as activating irrigation systems, adjusting greenhouse ventilation, or deploying pest control measures.

Additionally, the Raspberry Pi can be integrated with cloud services to store and analyze data over time, providing valuable insights into crop performance and environmental trends. Machine learning algorithms can be employed to predict weather patterns, optimize resource usage, and enhance yield forecasts. The system can also send alerts and notifications to farmers via mobile apps or SMS, ensuring they remain informed about critical changes in farm conditions even when they are offsite.

This report outlines the development and application of a Smart Agricultural System using Raspberry Pi to monitor and manage farm conditions effectively. The system aims to improve agricultural productivity, reduce resource wastage, and contribute to sustainable farming practices. It explores key components, including sensor integration, data processing, communication modules, and user interfaces, while also discussing challenges, potential improvements, and future scalability.

2.1 Objectives:

The primary objective of the Smart Agricultural System is to:

- Monitor environmental and soil conditions in real-time.
- Provide automated systems for irrigation and climate control based on the data.
- Enhance decision-making in farming by providing accurate, real-time data on critical factors such as weather and soil health.
- Reduce resource waste (e.g., water, electricity) by automating processes based on real-time environmental data.

2.2 Problem statement:

- Water scarcity is a significant challenge in agriculture, especially in arid and semi-arid regions.
- Traditional irrigation methods lead to inefficient water use and wastage.
- Inefficient irrigation practices result in inconsistent crop health and reduced yields.
- Manual intervention in irrigation processes increases labor costs and is time-consuming.
- Lack of real-time monitoring makes it difficult to optimize water usage effectively.
- There is a need for a solution that conserves water, improves efficiency, and enhances crop productivity.

CHAPTER 3

APPLICATIONS

The project has a variety of real-world applications, such as:

- **Climate Monitoring**: Involves tracking environmental parameters such as temperature, humidity, rainfall, and wind speed to optimize agricultural practices and improve crop yields.
- **Crop Management**: Utilizes technology to monitor crop health, growth stages, and nutrient needs, ensuring better planning and higher productivity.
- **Greenhouse Automation**: Automates the control of conditions inside a greenhouse, such as temperature, lighting, and ventilation, to provide an optimal environment for plant growth.
- **Precision Farming**: Implements data-driven strategies for efficient resource use, including water, fertilizers, and pesticides, to maximize crop output and reduce environmental impact.
- **Irrigation Management**: Uses IoT-enabled systems to automate irrigation, conserve water, and ensure that crops receive adequate moisture based on real-time soil and weather data.

CHAPTER 4

COMPONENTS USED

Hardware Components:

- Raspberry Pi: Acts as the main controller to interface with sensors, display, and APIs.
- DHT11 Sensor: Measures local temperature and humidity.
- 16x2 LCD Display: Displays weather details such as temperature, humidity, rain, and wind speed.
- Relay: Controls the soil moisture level by turning On & Off.
- Jumper Wires: Used to connect various hardware components.

Software Components:

- Python: Programming language used for controlling the hardware and interfacing with APIs.
- Flask: Web framework used to build the user interface for weather input and display.
- OpenWeatherMap API: Provides real-time weather data for specific locations.
- Adafruit_DHT Library: Reads data from the DHT11 sensor.

CHAPTER 5

FLOW CHART

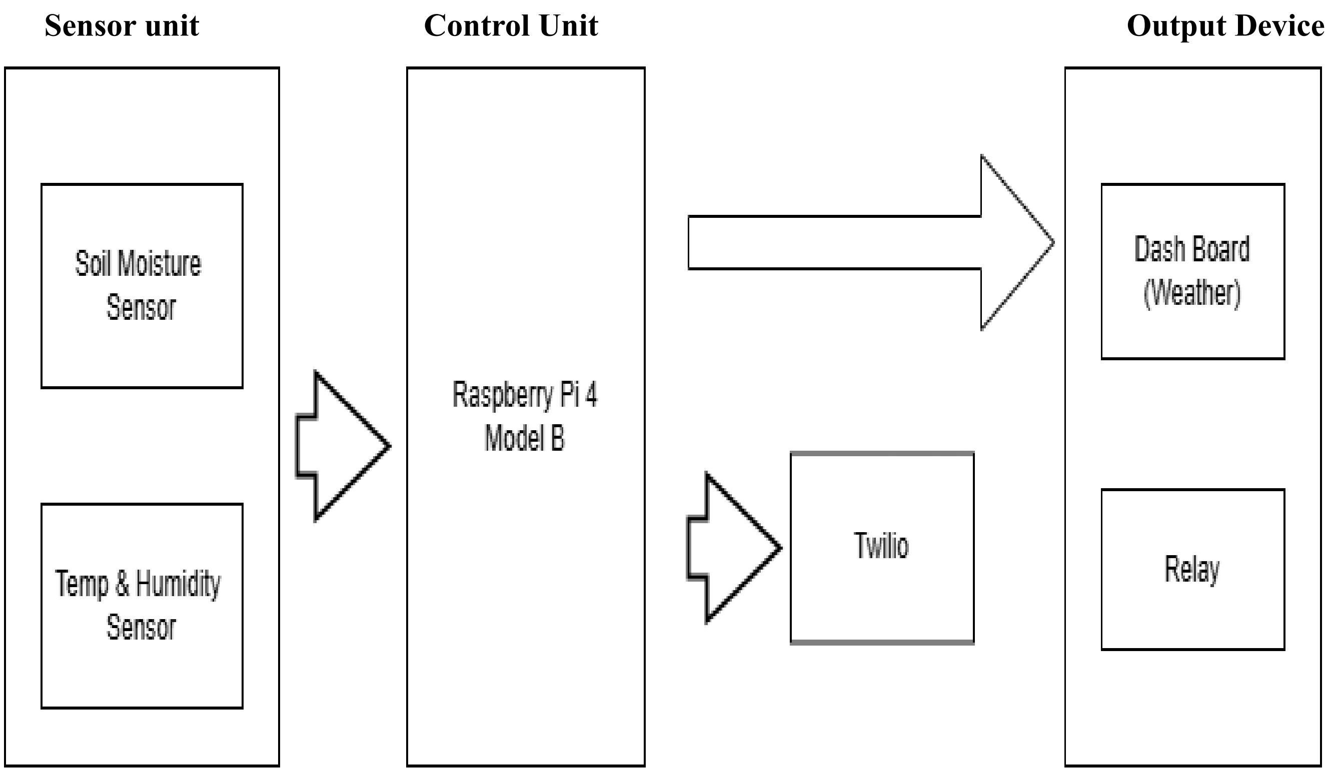

Figure 5.1 Flow Chart

The brief explanation of the components in the figure 5.1 which is the flowchart of the project is as follows

- **Sensor Unit**

  Soil Moisture Sensor: Monitors soil moisture levels.

  Temp & Humidity Sensor: Tracks ambient temperature and humidity**.**

- **Control Unit**

  Raspberry Pi 4: Processes sensor data.

- **Output Devices**

  Relay: Turns On & Off according to Soil Moisture levels.

  Dashboard: Displays temperature and system status in Monitor Screen.

CHAPTER 6

CONCLUSION

The use of Raspberry Pi in smart agriculture systems offers a cost-effective and scalable solution for improving farm productivity. Through the collection of real-time data and the automation of key processes, farmers can make informed decisions that lead to better resource management and higher crop yields. By integrating various sensors, actuators, and cloud platforms, Raspberry Pi provides a flexible platform for developing advanced agricultural systems that can be customized to meet the needs of different types of farms.

As agricultural technology continues to evolve, systems based on affordable hardware like Raspberry Pi will play a crucial role in transforming traditional farming practices, ensuring sustainability, and improving food security.

CHAPTER 7

FUTURE WORK

To further improve the Smart Agricultural System, the following enhancements can be considered:

- **AI Integration**: Using machine learning to predict crop diseases, yield forecasts, or optimal harvest times.
- **Energy Efficiency**: Implementing solar panels and energy-efficient systems to reduce operational costs.
- **Advanced Sensors**: Integrating more advanced sensors for monitoring soil health, pH levels, and crop-specific requirements.
- **Blockchain for Traceability**: Integrating blockchain technology to ensure the traceability and transparency of agricultural products from farm to table.

This holistic approach can further optimize agriculture, leading to more sustainable and profitable farming practices in the future.

CHAPTER 8

APPENDIX

8.1Pseudo Code

1. **Initialization**
   - Setup GPIO
     - Configure GPIO pins for LCD, Relay, and sensors.
     - Initialize LCD for display.
     - Setup relay and define motor step sequence.
   - Setup ADC (MCP3008)
     - Initialize SPI for ADC communication to read soil moisture levels.
   - Initialize Flask and WebSocket
     - Create a Flask app for the user interface.
     - Enable WebSocket for real-time communication with the interface.

2. **Functions**
   - LCD Functions
     - Initialize the LCD and display messages.
     - Toggle the enable pin for sending commands and data to the LCD.
   - Relay Functions
     - Configure GPIO pins for the relay module and control its activation to manage the water pump or irrigation system.
     - Turn the relay ON/OFF based on soil moisture levels, providing real-time feedback on its status.
   - Sensor Reading Functions
     - **Soil Moisture**: Read analog data from ADC (MCP3008).
     - **Temperature & Humidity**: Read data from the DHT sensor.

3. **Flask Application**
   - Route
     - Serve the HTML page for the user interface.
   - WebSocket Emission
     - Emit sensor data (soil moisture, temperature, humidity, and system status) to the web interface every 5 seconds.

4. **Background Thread**
   - Continuously perform the following tasks:
     - Read soil moisture, temperature, and humidity data.
     - Determine the system's status (Dry/Normal/Wet).
     - Emit real-time sensor data to WebSocket for display on the user interface.
     - Activate the relay motor if soil moisture drops below the threshold.

5. **Main Server**
   - Setup GPIO pins and initialize all components.
   - Start the Flask server with WebSocket for real-time data handling.
   - Handle cleanup operations:
     - Reset GPIO pins.
     - Close SPI communication during script termination.

6. **Execution**
   - Start the Flask server automatically when the script is executed.

CHAPTER 9

REFERENCES

- OpenWeatherMap API Documentation: https://openweathermap.org/api
- Raspberry Pi GPIO Library Documentation: https://gpiozero.readthedocs.io
- Flask Web Framework: https://flask.palletsprojects.com/