VISVESVARAYA TECHNOLOGICAL UNIVERSITY

Jnana Sangama, Belagavi – 590014

A Mini Project Report

On

"Automated waste sorting bin"

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

BACHELOR OF ENGINEERING

By

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Project Completion Certificate

I, **Prajwal H K** (Roll No: 1AP21IS024), hereby declare that the material presented in the Project Report titled **" Automated waste sorting bin "** represents original work carried out by me in the **Department of Information science & Engineering** at the **APS college of Engineering, Bangalore** during the tenure **2 October, 2024 – 12, December, 2024**.

With My signature, I certify that:

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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.E. Internship Work.

Advisor's Name: **Prof Dr Shivamurthiah** Guide Name: **Akhil Sai**

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Project Completion Certificate

I, **Varma Balaji madiraju** (Roll No: 1AP21IS043), hereby declare that the material presented in the Project Report titled **" Automated waste sorting bin "** represents original work carried out by me in the **Department of Information Science & Engineering** at the **APS college of Engineering, Bangalore** during the tenure **2 October, 2024 – 12, December, 2024**.

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Advisor's Name: **Prof Dr Shivamurthiah** Guide Name: **Akhil Sai**

Advisor's Signature **Guide Signature**

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I, **Kallappa S Munavall** (Roll No: 1AP22EC403), hereby declare that the material presented in the Project Report titled **" Automated waste sorting bin "** represents original work carried out by me in the **Department of Electronic & communication Engineering** at the **APS college of Engineering, Bangalore** during the tenure **2 October, 2024 – 12, December, 2024**.

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Advisor's Name: **Dr. Prakash Jhadhav** Guide Name: **Akhil Sai**

Advisor's Signature **Guide Signature**

Evaluation Sheet

Title of the Project: **Automated waste sorting bin**

Name of the Students: Prajwal H K, Varma Balaji madiraju, Kallappa S Munavall

External Supervisor:

_____

Internal Supervisor:

_____

_____

Date:

Place:

ABSTRACT

Waste management is one of the biggest challenges facing modern cities, with improper sorting of waste contributing to environmental pollution and inefficiency in recycling processes. This report presents the design and development of an **Automated Waste Sorting Bin** that utilizes modern technology, such as an **ultrasonic sensor**, a **buzzer**, and a **stepper motor**, to automatically sort dry and wet waste. The system works by detecting moisture levels in waste, alerting users if the waste is wet, and then using a stepper motor to direct the waste into the correct bin. This solution aims to reduce manual labor, enhance recycling efforts, and promote sustainable waste management practices .

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CHAPTER 1

INTRODUCTION

With growing urbanization, the need for efficient waste management systems has become paramount. Traditional methods of waste segregation require significant human intervention, leading to errors, contamination, and increased costs. The automated waste sorting bin addresses this issue by employing sensors and motors to autonomously separate **dry waste** and **wet waste**. This system reduces human intervention, promotes proper recycling, and minimizes the environmental impact of waste.

1.1. Objective

To design a waste sorting bin that uses sensors and motors to automate the segregation of dry and wet waste.

To reduce the environmental impact of waste mismanagement by promoting correct waste segregation.

1.2 Problem Statement

- Improper segregation of waste leads to contamination and inefficiencies.
- Manual waste sorting is time-consuming and error-prone.
- There is an urgent need for automation to streamline the process of waste segregation

Chapter 2 APPLICATION

The **Automated Waste Sorting Bin** can be used in various sectors to improve waste management efficiency. Some key applications include:

1. **Residential Use**:
   - In homes, automated waste sorting bins can segregate waste, making it easier for households to dispose of dry and wet waste correctly.
2. **Commercial and Industrial Use**:
   - Offices, factories, and restaurants can benefit from automated waste sorting systems to reduce the time and cost associated with manual segregation.
3. **Public and Urban Areas**:
   - In public spaces like parks, airports, and malls, automated bins can reduce the risk of contamination and make waste management more efficient.
4. **Smart Cities**:
   - The system can be integrated into the infrastructure of smart cities, where waste bins are connected to central systems that monitor waste levels and manage the disposal process

CHAPTER 3

COMPONENTS

The Smart Parking System comprises the following major components :

- **Raspberry Pi** :

  The Raspberry Pi serves as the brain of the system, handling data from various sensors and peripherals. It processes input from ultrasonic sensors, communicates with the Flask server to update slot statuses, and controls the relay mechanism for the barrier. Its compact size, energy efficiency, and ability to interface with multiple devices make it an ideal choice for IoT applications.

Figure 1.1 Raspberry Pi Kit(model 4)

- **Ultrasonic Sensor (HC-SR04)** :

  Measures the distance to the waste surface and determines moisture content based on the distance to the object. It helps identify whether the waste is dry or wet.

  - **Key Features** :
    - ✦ High accuracy for detecting objects within a range of 2 cm to 4 m.
    - ✦ Non-contact detection minimizes wear and tear.
    - ✦ **Functionality in the System** :
    - ✦ Detects waste presence in the dusbin.
    - ✦ Sends data to the Raspberry Pi for real-time updates.

Figure 2.1 Ultrasonic sensor

3. **Stepper Motor:**

Purpose: The stepper motor is responsible for physically sorting the waste into its designated bin (dry or wet). It powers the mechanical sorting mechanism, which ensures that the waste is directed into the correct compartment.

 The stepper motor is controlled by the microcontroller and receives signals to rotate in precise increments.
 Based on the moisture level detected by the soil moisture sensor, the stepper motor rotates the sorting mechanism in different directions:

- **Clockwise rotation**: If wet waste is detected, the motor turns clockwise to direct the waste to the wet waste compartment.
- **Anticlockwise rotation**: If dry waste is detected, the motor turns anticlockwise to direct the waste to the dry waste compartment.

Figure3.1 Stepper Motor

4. . Buzzer

Purpose: The buzzer serves as an alerting mechanism in the system. It is used to notify users when wet waste is detected, ensuring proper segregation of waste materials.

The ultrasonic sensor detects the moisture content in the waste. If the moisture content is below a certain threshold (e.g., 10%), indicating that the waste is wet, the system triggers the buzzer.

The buzzer then emits a sound to signal that the waste is wet, providing a visual and

- Operating Voltage: 5V DC.
- Sound Output: Loud enough to be audible in a public or private environment.

Figure 4.1 Buzzer

5.Soil Moisture Sensor

Purpose: The soil moisture sensor plays a critical role in detecting the moisture content of the waste. It helps determine whether the waste is dry or wet, which is essential for proper segregation.

 The **soil moisture sensor** works by measuring the amount of moisture present in the waste placed in the bin. The sensor consists of two probes that can detect the conductivity of the waste. Wet waste has higher conductivity than dry waste, allowing the sensor to differentiate between the two.

 When the sensor detects moisture levels below a certain threshold (indicating dry waste), the system will trigger the sorting mechanism to direct the waste to the dry bin. If the moisture content is above the threshold (wet waste), the system directs it to the wet waste bin and activates the buzzer.

 Operating Voltage: 3.3V - 5V DC.

 Detection Range: Can detect moisture levels ranging from dry to wet waste.

 Output: Analog or digital signal depending on the type of sensor used.

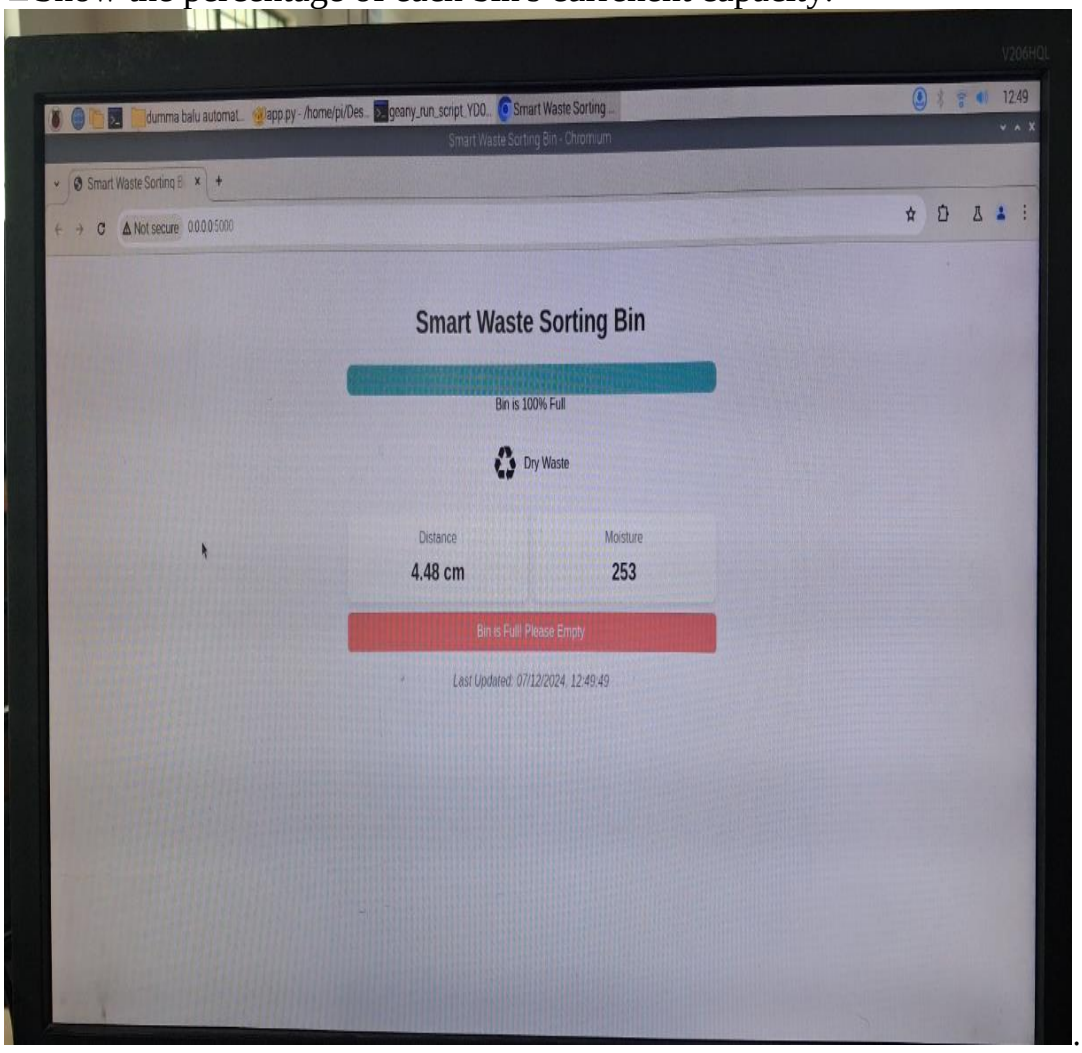
Figure 5.1 Soil moisture sensor

Web App : The web app provides a user-friendly interface for managing waste bin.
Key Features :

- Display the status of the waste sorting system (dry or wet waste detected).
- Show real-time data on moisture levels detected by the soil moisture sensor.
- Notify the user if the waste is **dry** or **wet**.
- Alert the user when the **buzzer** is activated due to wet waste detection

. o **Functionality in the System** :

- Monitor the levels of waste in both bins (dry and wet).
- Show the percentage of each bin's currenent capacity.



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Flask Framework :

Flask serves as the backend framework for the system, handling API requests and processing data.

- **Key Features** :
  - ✦ Lightweight and easy to set up.
  - ✦ Supports restful APIs for seamless communication.
- **Functionality in the System**:
  - ✦ Manages slot booking requests and updates from the web app.
  - ✦ Handles sensor data and updates the slot status in real-time.

HTML, CSS, JavaScript :

These technologies are used to build the web app interface:

- **HTML** : Structures the content of the web app.
- **CSS** : Styles the interface to ensure a clean and professional appearance. ○**JavaScript** : Enables dynamic updates, such as real-time slot availability.
- **Functionality in the System** :
  - ✦ Provides an intuitive and visually appealing interface for end-users.
  - ✦ Supports interactive features like slot status updates and booking options.

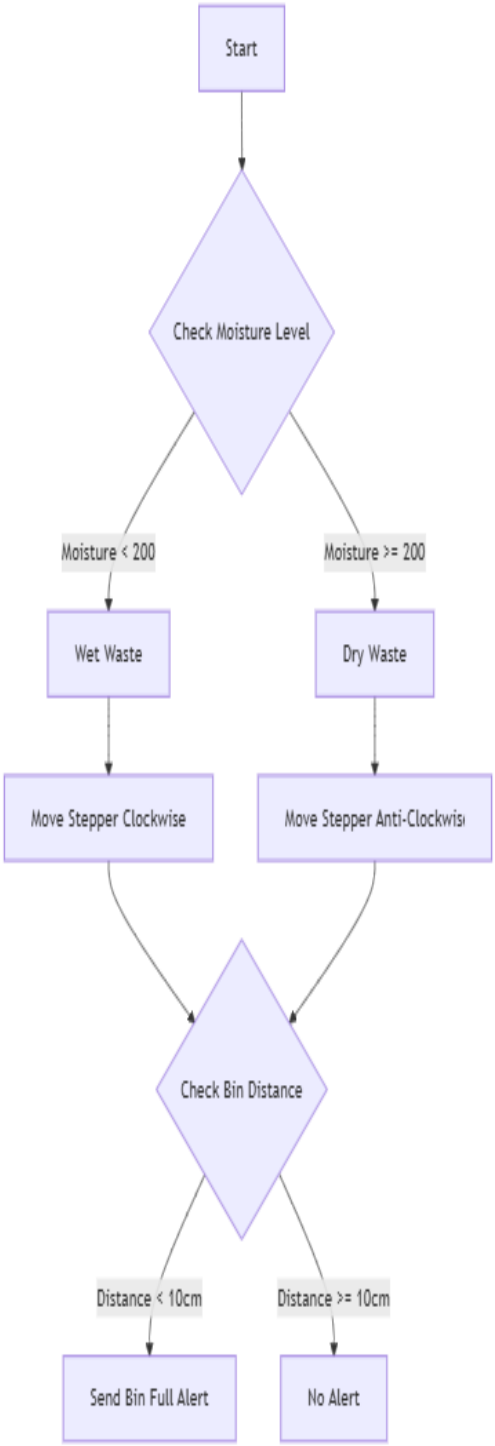
- **Power Supply** :

The power supply ensures that all components, including the Raspberry Pi, sensors, and relay module, function without interruption.

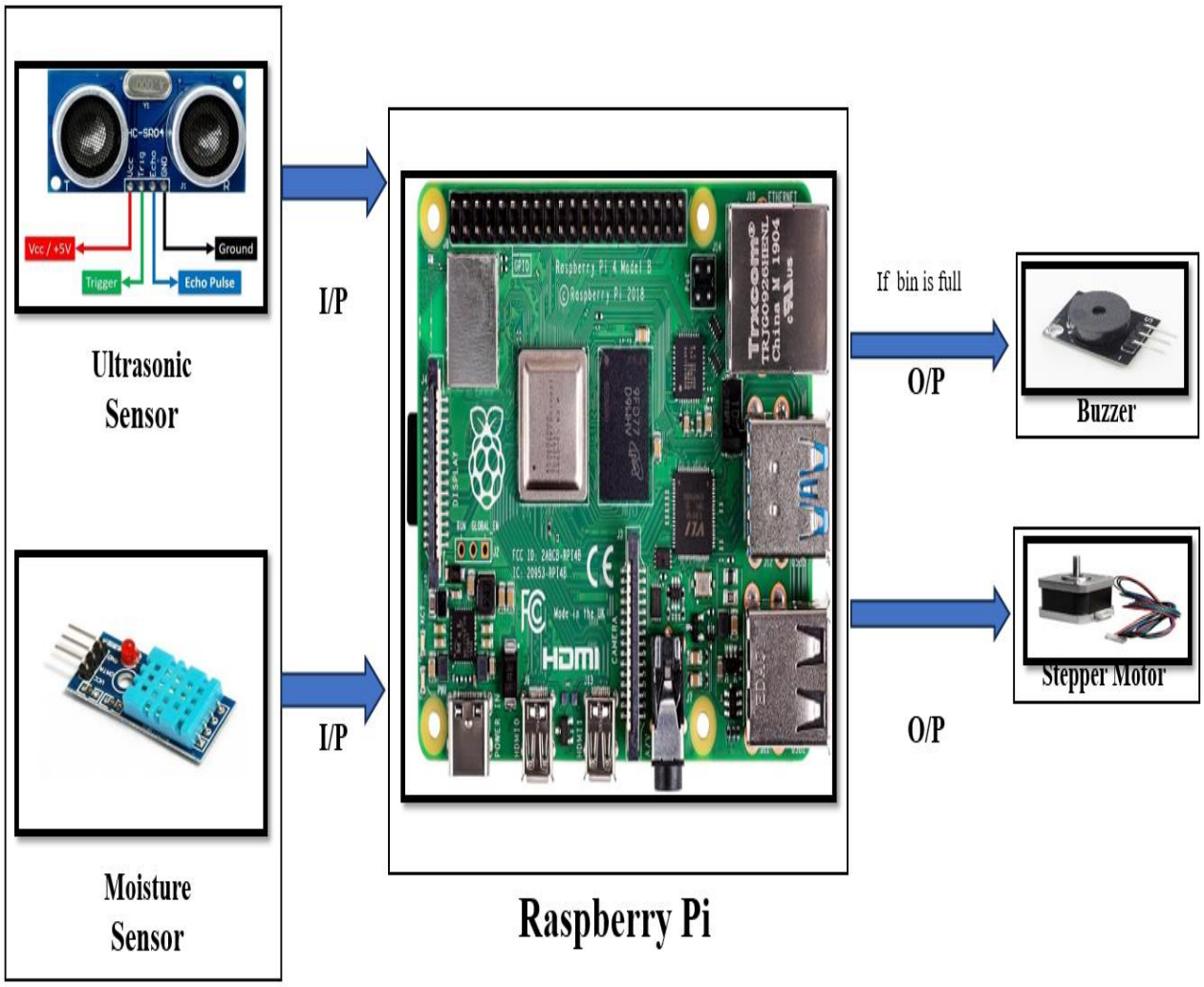
- **Key Features** :
  - ✦ Stable output voltage to prevent damage to sensitive components.
  - ✦ Compatible with Raspberry Pi and peripheral devices.
  - ✦ ○ **Functionality in the System** :
  - ✦ Supplies continuous power for reliable operation.
  - ✦ Protects the system from power fluctuations and interruptions.

CHAPTER 4

Flow Diagram



BLOCK DIAGRAM



CHAPTER 5

CONCLUSION

The **Automated Waste Sorting Bin** is a promising solution for enhancing waste management processes. By automating the segregation of dry and wet waste, it reduces human labor and minimizes errors associated with manual sorting. The integration of sensors and a stepper motor ensures accurate waste identification and sorting. This system not only makes waste disposal more efficient but also promotes sustainability by improving recycling and reducing contamination. The automated system offers great potential for smart cities, residential areas, and commercial spaces to adopt more efficient waste management practices

CHAPTER 6

FUTURE WORK

While the current system works efficiently, there are several areas for improvement and further research:

1. **Integration with IoT**:
   - Future versions of the system could be integrated with IoT technology to enable remote monitoring and control of waste bins.
2. **AI-based Waste Classification**:
   - Machine learning algorithms could be implemented to better classify different types of waste (e.g., plastics, metals) beyond just wet or dry.
3. **Energy Efficiency**:
   - Solar panels or other renewable energy sources could be integrated into the system to reduce energy consumption and make it more sustainable.
4. **User Feedback and Interface**:
   - Adding a user interface or mobile app for real-time feedback on the status of waste bins can improve user interaction.

CHAPTER 7

APPENDIX

8.1 GPIO Pin Configuration

- **TRIG (19)** : Sends a trigger pulse to the ultrasonic sensor.
- **ECHO (26)** : Receives the reflected signal from the sensor.
- **BUZZER_PIN (20)** : Controls the BUZZER to send a bin full alert.
- **STEPPER_PIN (13,4,6,5)** : control stepper motor.

8.2 APIs

- **GET /get_data** : Retrieves the bin fill level.

  Response:

  Json :

  {
  Distance
  Moisture value
  Waste type
  }

8.1 Pseudo Code

```
MainApp(Host, Port)
   repeat till Termination
      Run Flask App on Host and Port
      if (Termination)
         GPIO.cleanup()

ReadMoisture(Channel)
   return MCP3008.read_adc(Channel)

MeasureDistance()
   Set TRIG = LOW
   Sleep for Sensor Stability

   Send Trigger Pulse to TRIG

   repeat till ECHO == HIGH or Timeout
      Record PulseStart

   repeat till ECHO == LOW or Timeout
      Record PulseEnd

   Calculate Distance = PulseDuration * SpeedOfSound

   if (Distance > 400)
      Set Distance = 400

   return Distance

MoveStepper(Steps, Direction)
   repeat for each Step in Steps
      Activate GPIO Pins for Current Step
      Update StepCounter Based on Direction
      Sleep for Step Delay

BinFullAlert()
   Set BUZZER = HIGH
   Sleep for 1 Second
   Set BUZZER = LOW

Route: /
   Render index.html

Route: /get_data
   Call MeasureDistance() to get Distance
```

```
Call ReadMoisture(Channel=0) to get MoistureValue

if (MoistureValue < WET_THRESHOLD)
   Set WasteType = "Wet"
   Call MoveStepper(Steps, Direction=Forward)

else
   Set WasteType = "Dry"
   Call MoveStepper(Steps, Direction=Backward)

if (Distance < 10)
   Call BinFullAlert()

Return JSON Data (Distance, MoistureValue, WasteType)
```