"SMART DUSTBIN"

Minor Project Report

Submitted for the partial fulfillment of the degree of

Bachelor of Technology
In
Internet of Things

Submitted By

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UNDER THE SUPERVISION AND GUIDANCE OF

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ABSTRACT

The main objective of the project is to design a smart dustbin which will help in keeping our environment clean and also eco friendly. We are inspired from Swaach Bharat Mission. Nowadays technologies are getting smarter day-by-day so, as to clean the environment we are designing a smart dustbin by using Arduino. This smart dustbin management system is built on the microcontroller based system having ultrasonic sensors on the dustbin. If dustbin is not maintained than these can cause an unhealthy environment and can cause pollute that affect our health. In this proposed technology we have designed a smart dustbin using ARDUINO UNO, along with ultrasonic sensor, servo motor, and battery jumper wire. After all hardware and software connection, now Smart Dustbin program will be run. Dustbin lid will when someone comes near at some range than wait for user to put garbage and close it. It's properly running or not. For social it will help toward health and hygiene, for business for we try to make it affordable to many as many possible. So that normal people to rich people can take benefit from it.

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ACKNOWLEDGEMENT

The full semester project has proved to be pivotal to my career. I am thankful to my institute, **Madhav Institute of Technology and Science** to allow me to continue my disciplinary /interdisciplinary project as a curriculum requirement, under the provisions of the Flexible Curriculum Scheme (based on the AICTE Model Curriculum 2018), approved by the Academic Council of the institute. I extend my gratitude to the Director of the institute, **Dr. R.K. Pandit** and Dean Academics, **Dr. Manjaree Pandit** for this.

I would sincerely like to thank my department, Department of Computer Science and Engineering, for allowing me to explore this project. I humbly thank **Dr. Praveen Bansal,** Professor and Co-ordinator, Department of Centre Of IOT, for his continued support during the course of this engagement, which eased the process and formalities involved.

I am sincerely thankful to my faculty mentors. I am grateful to the guidance of **Dr. Nookala Venu**, Assistant Professor, Department of Centre of IOT, for her continued support and guidance throughout the project. I am also very thankful to the faculty and staff Of the department.

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CONTENT

Table of Contents

ACRONYMS

- **IoT**: Internet of Things – A network of interconnected devices capable of collecting, sharing, and processing data in real-time.
- **Arduino**: An open-source microcontroller platform used to build electronic projects, serving as the control unit for various sensors and actuators.
- **Ultrasonic Sensor**: A sensor that uses ultrasonic waves to measure the distance to an object, aiding in waste detection and positioning.
- **Servo Motor**: A motor that provides precise control of angular position, directing waste to designated bins based on sorting commands.

LIST OF FIGURES

CHAPTER 1: INTRODUCTION

A smart dustbin is a waste bin that uses sensors, connectivity, and data analytics to improve waste management. Smart dustbins can help reduce the amount of waste that goes to landfills, and make the process of recycling and waste collection more efficient.
Here are some features of smart dustbins:

Waste level monitoring

Sensors monitor the amount of waste in the bin and send a message to the waste management system when the bin is full. This means that garbage collection only happens when it's needed, which can reduce operational costs and make better use of resources.

Challenges of Traditional Waste

Traditional waste sorting methods involve manual labor, where workers sort waste by hand. While this method ensures some accuracy, it is:

1. **Time-Consuming**: Sorting waste manually takes a lot of time and resources.
2. **Inconsistent**: Human error can result in improperly sorted waste, which contaminates recyclable materials.
3. **Costly**: Manual sorting requires a lot of work force and is not cost-effective, especially for large-scale operations.

The Need for Automated Solutions

To address these challenges, automation in waste sorting is becoming increasingly important. By incorporating technologies that reduce the need for manual intervention, waste sorting can be faster, more accurate, and safer. However, many existing automated systems are too large and expensive for residential or small-scale commercial use.

Introducing the Intelligent Waste

The **Intelligent Waste** uses IoT technology to automate the sorting process, efficiently separating dry and wet waste. This compact and cost-effective solution offers several advantages:

- **Precision**: The robot uses sensors to accurately detect and differentiate waste based on moisture content.
- **Efficiency**: Automated sorting reduces time and labour costs, making it ideal for smaller applications.
- **Sustainability**: By ensuring proper waste segregation, it promotes recycling and reduces environmental impact.

This report explores the key components and functionality of the Intelligent Waste, highlighting its potential to revolutionize waste management, especially in household and small-scale commercial settings. Through automation, this robot helps achieve more efficient waste sorting, supporting a more sustainable and eco-friendly approach to waste management.

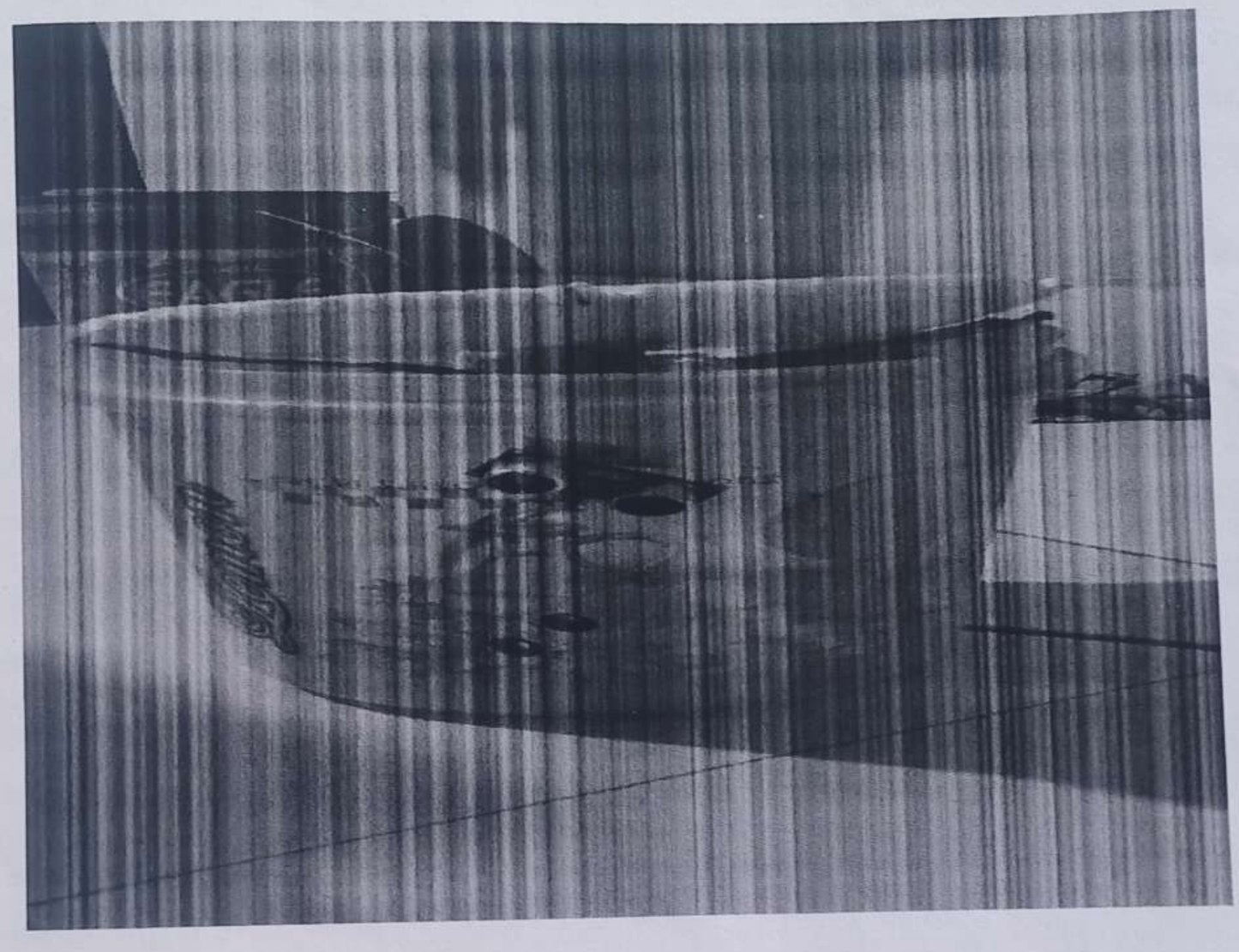

Fig: Smart dustbin

CHAPTER 2: LITERATURE SURVEY

The Internet of Things (IoT) has revolutionized various industries, including waste management. IoT enables real-time data collection and automation, allowing systems to perform tasks independently with precision. This technology reduces human intervention, enhances accuracy, and improves efficiency in waste sorting, paving the way for more sustainable waste management solutions.

How IoT Enhances Smart dustbin Efficiency

1. **Real-Time Monitoring**: IoT sensors collect data on waste characteristics like moisture, weight, and composition, enabling real-time analysis and decision-making.
2. **Automation**: The system automatically sorts waste based on sensor data, reducing manual labour and speeding up the process.
3. **Remote Control**: Operators can monitor and manage the system remotely, making adjustments as needed for optimal performance.
4. **Cost Reduction**: IoT reduces labour costs by automating the sorting process and minimizing human error.
5. **Accuracy**: IoT-based systems provide precise sorting by using sensors that consistently identify waste types, ensuring proper disposal.

CHAPTER 3: IOT SENSORS USED IN THE WASTE SORTING ROBOT

The *Intelligent Waste Sorting Robot* relies on multiple sensors to detect, analyze, and sort waste materials. Here's a closer look at each component:

- **Arduino Uno**

The Arduino Uno acts as the brain of the entire system, coordinating the sensors and actuators. It processes data from the ultrasonic and soil moisture sensors, controls the servo motor, and executes sorting commands based on predefined logic. As an open-source microcontroller, it's easy to program and widely used in IoT projects.

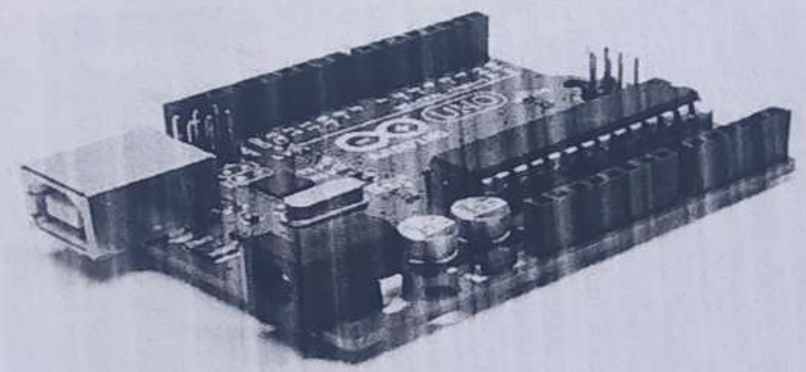

Fig: Arduino Uno

- **Ultrasonic Sensor**

The ultrasonic sensor is a critical component in distance measurement. It emits ultrasonic waves and calculates the time taken for the waves to bounce back from the object, which in this case is the waste. This sensor is instrumental in detecting the size and distance of the waste material, allowing the robot to appropriately position it for sorting.

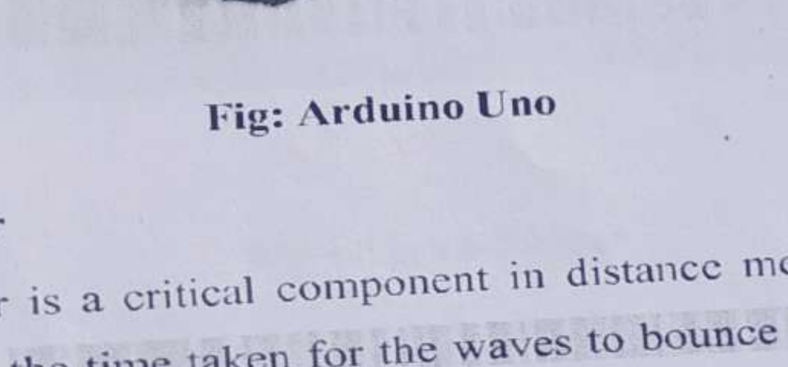

Fig: Ultrasonic sensor

- **Servo 9g Motor**

The servo motor controls the physical movement of waste items. When the Arduino signals a decision, the servo motor rotates to direct the waste to the appropriate bin. Its precision and responsiveness ensure the accurate placement of waste based on moisture readings.

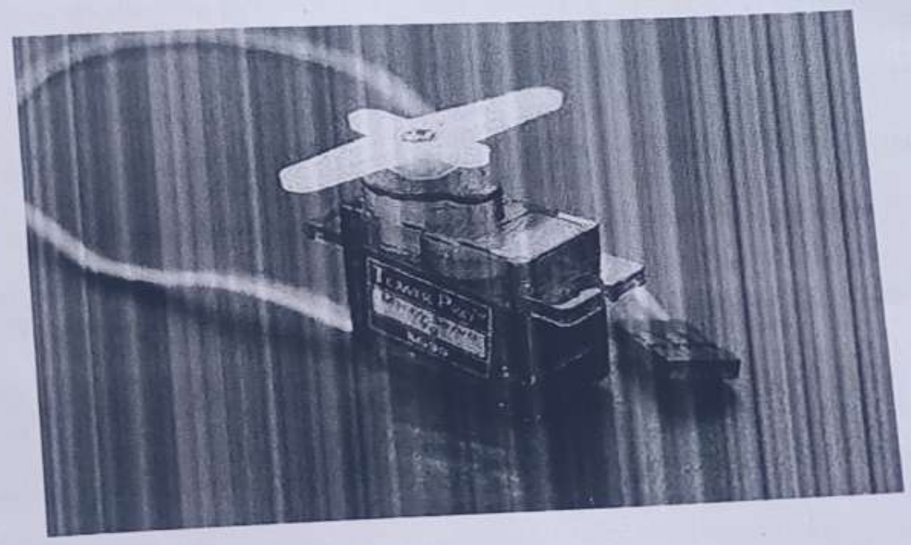

Fig : Servo Motor

Chapter 4: Current Waste Sorting Techniques

Waste sorting today primarily relies on manual and semi-automated processes, especially in residential and small-scale commercial environments. These methods vary in efficiency, cost, and scalability. Here's a closer look:

Manual Sorting

Manual sorting involves workers physically separating waste by hand.

- **Advantages**: High flexibility and accuracy for diverse waste types.
- **Disadvantages**: Time-consuming, costly, inconsistent, and exposes workers to health risks like hazardous materials and infections.

Though common, manual sorting struggles to meet the demands of modern waste management due to its inefficiency and health concerns.

Semi-Automated Sorting

Semi-automated systems combine human effort with basic machinery like conveyor belts and compactors.

- **Advantages**: Faster than manual sorting and less physically demanding.
- **Disadvantages**: Still labour-intensive, less effective for complex waste streams, and requires significant setup costs.

This method offers incremental improvements but is limited in scalability and precision.

Fully Automated Sorting in Industrial Settings

Larger facilities employ advanced technologies, including conveyor belts, optical sensors, and magnetic separators, to sort waste with minimal human involvement.

- **Advantages**: High speed, consistency, and capacity for large volumes.

- **Disadvantages**: High setup costs, significant space requirements, and limited accessibility for smaller-scale applications.

While effective for large-scale operations, these systems are impractical for residential or smaller environments due to cost and space needs.

Challenges with Current Methods

Manual and semi-automated sorting lack precision and consistency, while industrial systems are expensive and unsuitable for small-scale use. These limitations emphasize the need for compact, affordable, and efficient solutions, such as the **Intelligent Waste Sorting Robot**, which integrates automation and IoT to address these gaps effectively.

CHAPTER 5: HOW THE SMART DUSTBIN WORKS

The *Intelligent Waste Sorting Robot* operates through a series of coordinated steps, using sensors and motors controlled by an Arduino microcontroller. Here's a breakdown of each step, showing how the system detects, identifies, and sorts waste based on its moisture content.

1. Fill Level Monitoring with Sensors

Smart dustbins are equipped with sensors, such as ultrasonic or weight sensors, to monitor how full the bin is. **Ultrasonic sensors** emit sound waves and measure the time it takes for them to bounce back from the waste inside. This gives an accurate read of the fill level. **Weight sensors** measure the weight of the waste to detect when the bin is full. These sensors provide real-time data on the bin's status and send it to a central system, which can be accessed remotely.

2. Automated open box

Some advanced smart dustbins are designed with the ability to **automatically sort waste**. These bins use technologies like **optical sensors** or AI-driven algorithms to differentiate between various types of waste (e.g., plastics, metals, paper). This sorting capability may be accompanied by mechanical systems, like **conveyor belts** or **robotic arms**, which physically separate the waste into different compartments. This helps with recycling efforts and promotes efficient waste management.

3. IoT Connectivity and Alerts

Smart dustbins are connected through the **Internet of Things (IoT)**, which allows them to communicate with waste management systems or municipal platforms. When a bin reaches a certain fill level, it automatically sends an alert to the waste collection team. This data helps optimize waste collection routes, ensuring that bins are emptied before they overflow and reducing unnecessary collection trips. The alerts can be accessed via mobile apps, emails, or integrated city systems, providing a more efficient waste management process.

4. System Reset

- After sorting each item, the Arduino resets the sensors to detect the next waste item.
- The system then waits for the ultrasonic sensor to detect the presence of new waste, and the process begins again.

This automated sequence allows the robot to identify and sort waste continuously without requiring manual intervention, enhancing efficiency and accuracy in waste management.

Circuit Diagram

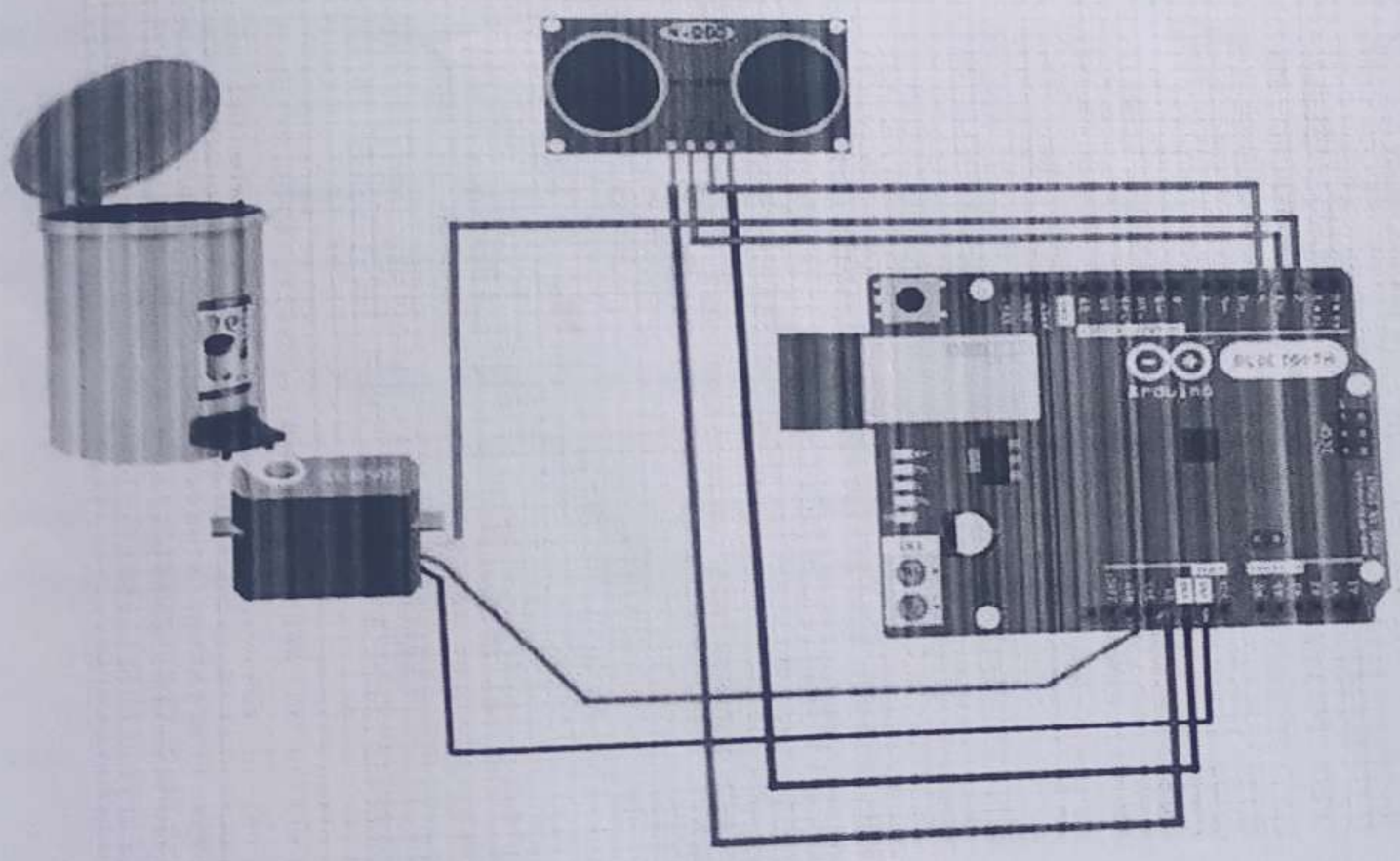

Fig 6:Circuit Diagram of Intelligent Waste Sorting Robot

CHAPTER 6: ADVANTAGES OF THE WASTE SORTING ROBOT

The robot brings several benefits to waste management systems:

- **Time Efficiency:** Automated sorting significantly reduces the time required for waste separation.
- **Consistency and Accuracy:** Unlike manual sorting, which can vary in precision, this robot offers consistent accuracy in distinguishing between dry and wet waste.
- **Enhanced Sustainability:** By reducing human labor and sorting errors, the robot promotes recycling and efficient waste disposal.

Real-World Applications

The Intelligent Waste Sorting Robot has versatile applications:

- **Household Waste Management:** Home users can install the robot to manage waste efficiently, reducing sorting time and improving recycling rates.
- **Commercial or Industrial Waste Management:** Small businesses, offices, and industries can benefit from the robot to ensure quick and efficient waste separation.
- **Why Our Model is Optimal in Current Times**

  With increasing waste production and limited landfill space, efficient sorting at the source is crucial. This robot addresses modern waste management challenges by ensuring accurate and consistent sorting, which promotes recycling, saves space, and reduces waste disposal costs.

CHAPTER 7: PROJECT COST ANALYSIS AND FUTURE ENHANCEMENTS

Project Cost Analysis and Feasibility

The primary components—Arduino, sensors, and servo motor—are relatively affordable, making the project feasible for both small and large-scale implementations. Its cost-effectiveness and ease of setup make it a viable solution for households, small businesses, and communities focused on waste management.

Future Enhancements and Upgrades

The Intelligent Waste Sorting Robot has room for growth:

- AI Integration: Artificial intelligence could improve the robot's ability to sort complex waste types.
- Scaling for Large-Scale Industrial Use: The project can be expanded for use in large-scale settings with more advanced components and higher processing power.

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