INTERNET OF THINGS

AI-Powered Trash Can for Smart Waste Manangement

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Introduction

- Global Waste Crisis: The world is expected to produce 3.4 billion tons of waste annually by 2050. Efficient waste management systems are crucial to address this issue. This project automates waste sorting, reducing human error and increasing recycling rates.
- Technological Advancements: AI and IoT have revolutionized waste management. Smart bins with sensors and AI can improve sorting efficiency. This project uses these technologies to create an intelligent system that classifies waste into organic and inorganic categories.
- Environmental Impact: Proper waste segregation is essential for recycling and reducing landfill waste, helping mitigate pollution and conserve resources. This project promotes sustainability by ensuring accurate and efficient waste sorting, supporting global efforts for a cleaner planet.

Purpose of the Project

- Enhance Waste Management Efficiency: The project aims to streamline the waste segregation process using AI and IoT technologies, reducing human effort and errors in waste sorting.
- Promote Sustainability: By accurately classifying waste into organic and inorganic categories, the project supports recycling efforts and minimizes landfill usage, contributing to environmental conservation.
- Leverage Technology: The project demonstrates the practical application of AI and IoT in solving real-world problems, showcasing the potential of smart technologies in creating sustainable waste management solutions.

Existing Methods

1

Manual Sorting

Traditionally, waste segregation is performed manually by workers, which is labor-intensive, time-consuming, and prone to human error, leading to inefficient sorting and recycling processes.

2

Conventional Waste Bins

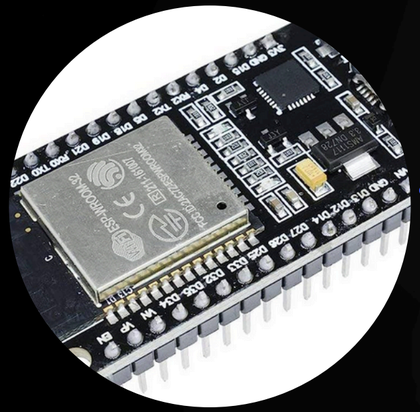
Standard waste bins without smart features require regular manual checks for collection, often resulting in overflow, inefficient collection routes, and increased operational costs.

3

Basic Sensor Systems

Some existing systems use basic sensors to detect waste levels in bins, but lack advanced classification capabilities and integration with AI, limiting their effectiveness in accurately sorting waste into different categories.

Components Used



01

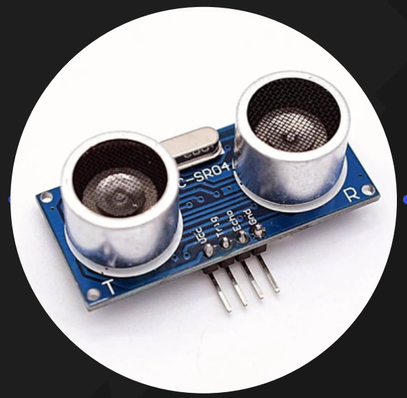
ESP32

A versatile microcontroller used for managing sensors and communication with the server, enabling the automated waste classification system.

02

Servo Motor

Provides precise movement to open and close the bin lid, controlling access to the dustbin based on waste classification.



03

Ultra Sonic Sensor

Detects the presence of waste by measuring distance, triggering the waste classification process.

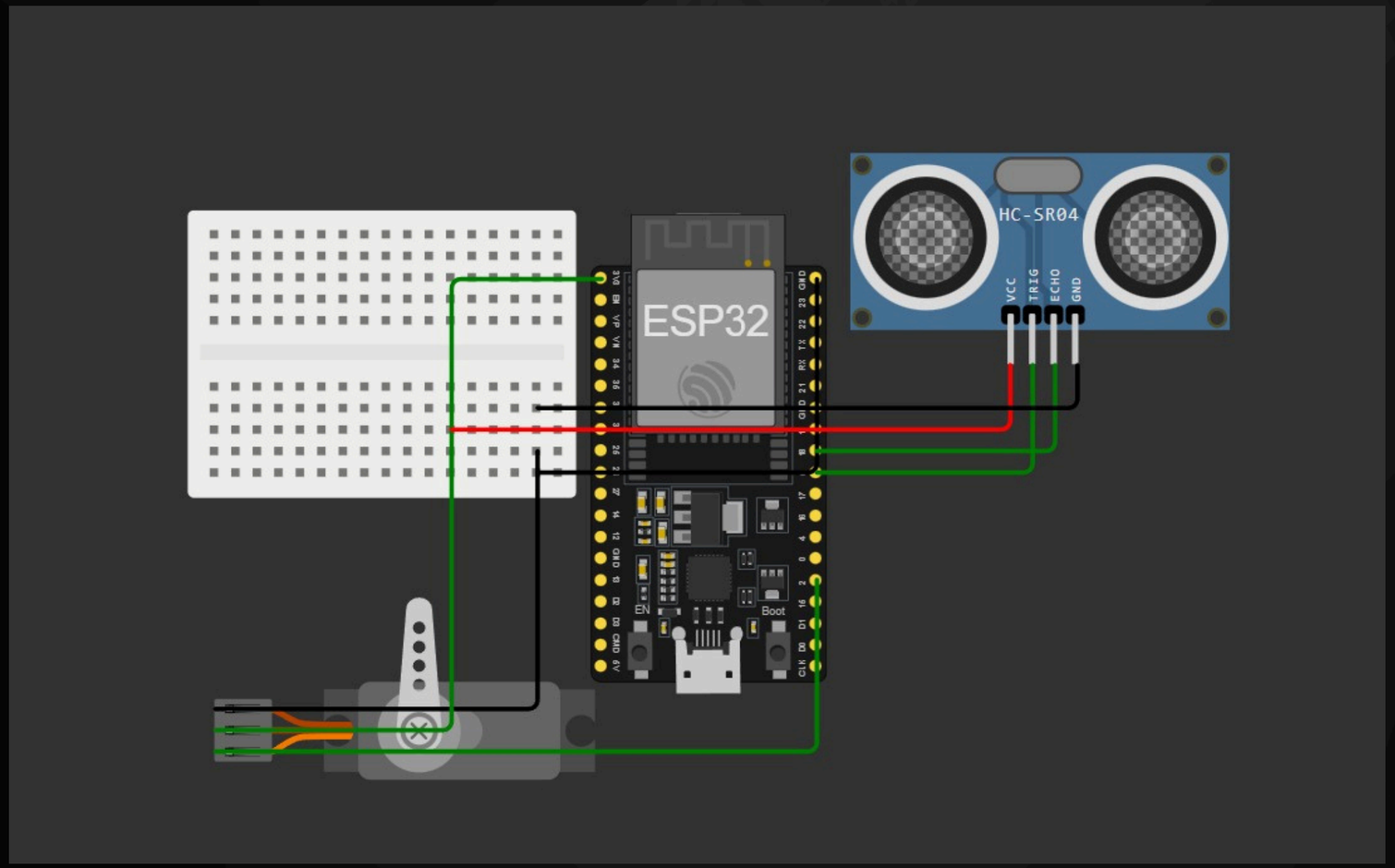
04

Cardboard Dustbin

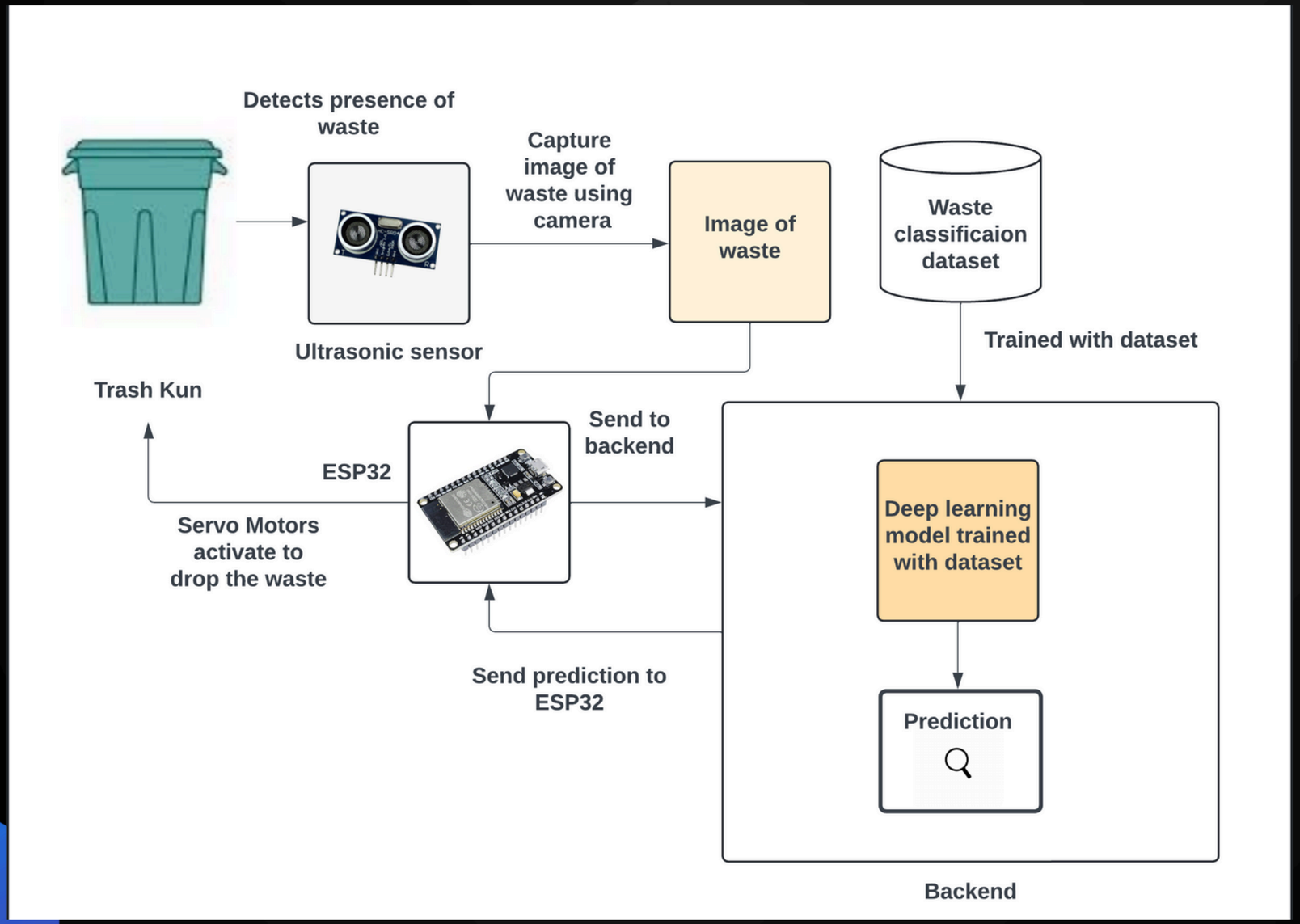
Acts as the physical container for waste, integrating with the system to demonstrate the classification and sorting process.

WORKING

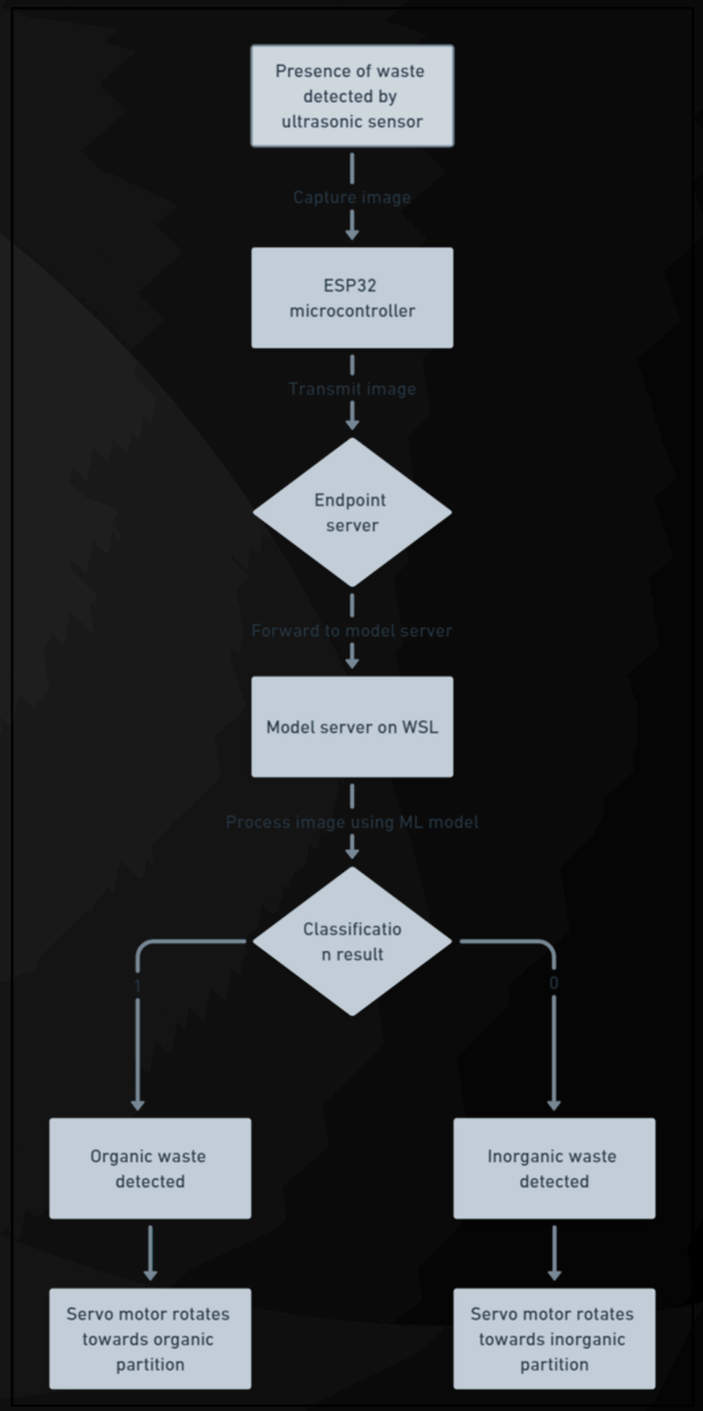
Circuit Diagram



Architecture



System Flow Diagram



Results

- High Classification Accuracy: Achieved 92% accuracy in classifying organic and inorganic waste, indicating reliable model performance in real-world scenarios.
- Efficient System Integration: ESP32 and ultrasonic sensor effectively detected waste presence, while the servo motor accurately controlled the bin lid based on classification results.
- Responsive Server Performance: Flask server demonstrated an average response time of 0.2 seconds, processing 95% of requests from the ESP32 correctly, ensuring quick and reliable waste classification.

Conclusion and Future Enhancement

- The project successfully integrated AI and IoT for waste management, achieving high accuracy in waste classification and efficient hardware-software interaction. This demonstrates the potential of smart systems in enhancing environmental sustainability.
- Future improvements could include adding more waste categories to the classification model for broader applicability, integrating solar power for sustainable operation, and developing a mobile app for real-time monitoring and alerts to improve user interaction and system oversight.

THANK YOU