

BAB I

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1.1 Project Background

With the growing urbanization and rapid population increase, waste management has become a significant challenge for cities worldwide. Traditional waste management systems, relying on human labor and fixed schedules, are often inefficient, leading to overflowing trash cans, improper waste disposal, and increased environmental pollution. In recent years, the advancement of Internet of Things (IoT) technology has opened new possibilities in enhancing waste management systems. IoT-based solutions can provide real-time monitoring and management of waste, leading to more efficient, responsive, and environmentally friendly systems.

A smart trash can equipped with IoT sensors can monitor waste levels, track the status of waste disposal, and even communicate with waste management authorities for timely collection. This solution can improve waste collection efficiency, reduce operational costs, and ensure a cleaner and more sustainable urban environment. The goal of this project is to develop a smart trash can system that integrates IoT sensors for real-time monitoring of waste levels, offering a cost-effective solution to modernize waste management in urban areas.

1.2 Problem Statement

The current waste management systems in urban areas face several challenges, as follow:

- i. overflowing trash bins
- ii. a lack of real-time monitoring.

These problems lead to environmental pollution, unsightly waste accumulation, and unnecessary resource expenditure by waste management

services. Traditional methods are reactive and do not address the real-time needs of waste management, leading to inefficiencies in the process.

The key problem this project aims to address is the lack of intelligent waste management solutions that allow for the dynamic tracking and management of waste levels. By implementing IoT technology in trash cans, it is possible to create an intelligent, responsive waste management system that can monitor the status of trash bins, optimize collection schedules, and minimize environmental impact.

1.3 Project Objectives

The main objectives of this project are:

- i. **Develop an IoT-based Smart Waste Monitoring System:** Implement IoT technology in trash bins to enable real-time tracking of waste levels, providing actionable data for efficient waste management.
- ii. **Minimize Environmental Impact and Resource Waste:** Create a responsive waste management solution that reduces pollution, prevents waste accumulation, and ensures the efficient use of resources, contributing to a cleaner and more sustainable urban environment.

1.4 Project Scope

This project focuses on the development of a prototype smart trash can using IoT technology. The scope of the project includes:

- i. **Hardware Development:** The design and creation of a trash can embedded with IoT sensors that can monitor waste levels and send data to a central system. Sensors such as ultrasonic or capacitive sensors will be used for waste level detection.
- ii. **Smart Trash Can System:** The development of a interface that allows the trash can to transmit data to a cloud server or mobile application. This will enable waste management authorities to track waste levels in real-time.

- iii. **Software Development:** The creation of an application or dashboard that receives and analyzes the data, presenting waste levels and suggesting optimal collection times.

The project will not cover large-scale city-wide implementation, but will instead focus on developing and testing a functional prototype.

1.5 Project Significance

This project is significant for multiple stakeholders:

- i. **Urban Residents:** The smart trash can will contribute to cleaner and more efficient waste management in urban areas, reducing the environmental impact of overflowing trash bins and unsightly waste accumulation.
- ii. **Waste Management Companies:** By using IoT-based systems, waste management services can optimize their routes and schedules, saving time, fuel, and operational costs. This increases efficiency and reduces the carbon footprint of waste collection.
- iii. **Local Authorities:** For city planners and local government authorities, implementing a smart trash management system offers a solution to the growing problem of waste in urban environments. It can also provide valuable data on waste generation patterns for future planning and resource allocation.
- iv. **Environmental Sustainability:** The project will help reduce waste-related pollution, as the smart system will ensure that trash cans are emptied before they overflow, preventing environmental contamination.
- v. **Technology and Innovation:** The project promotes the use of IoT in public services and offers an innovative approach to addressing one of the most pressing urban management challenges.

1.6 Chapter Summary

Chapter 1 introduced the background, problem statement, objectives, scope, significance, and overall framework of the Development of a Smart Trash Can Using IoT project. The project aims to address inefficiencies in traditional waste management systems, particularly in urban areas, by developing a smart trash can that utilizes IoT technology for real-time monitoring and management of waste levels.

- i. Section 1.1 provided the project background, emphasizing the challenges faced by conventional waste management systems, including overflowing bins and ineffective collection schedules. The introduction of IoT technology offers a solution by allowing for smarter, real-time waste monitoring and management.
- ii. Section 1.2 highlighted the problem of inefficient waste collection and the lack of intelligent monitoring systems, which lead to unnecessary resource expenditure and environmental pollution. The need for a more responsive and data-driven waste management approach was established as the core problem.
- iii. Section 1.3 outlined the key objectives of the project, including the development of a smart trash can prototype, implementing a communication system for data transmission, optimizing waste collection schedules, and evaluating the system's performance in real-world conditions.
- iv. Section 1.4 defined the scope of the project, which includes the design of the hardware (smart trash can with IoT sensors), development of communication and software systems, and pilot testing in a small-scale environment to validate the system's functionality.
- v. Section 1.5 emphasized the significance of the project for urban residents, waste management companies, local authorities, and the environment. The use of IoT technology in waste management can

lead to more efficient, cost-effective, and sustainable systems, benefiting multiple stakeholders.