SMART WASTE MANAGEMENT SYSTEM

A PROJECT REPORT

submitted by

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BONAFIDE CERTIFICATE

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ABSTRACT

Urbanization has brought forth numerous challenges, with waste management being one of the most pressing concerns faced by municipal authorities and urban planners. Traditional waste management systems, which rely on fixed collection schedules and manual monitoring, often lead to inefficiencies such as overflowing bins, pollution, and increased operational costs. These drawbacks emphasize the need for smarter, technology-driven solutions to improve public sanitation services and resource utilization. This project presents a Smart Waste Management System using Internet of Things (IoT) technology to automate and optimize the waste collection process. The system is designed to address the shortcomings of existing practices by integrating real-time monitoring of waste bin fill levels, intelligent truck allocation, and enhanced user participation through a mobile application. Ultrasonic sensors placed within garbage bins detect the fill status and transmit this information to a backend server via an ESP32 microcontroller and MQTT protocol. The server then analyzes this data and assigns the nearest available truck for waste collection, ensuring timely pickups and minimizing unnecessary fuel consumption. Additionally, the system includes a frontend application developed using React Native that provides real-time updates and notifications to users, drivers, and administrators. Users can request bin pickups directly from the app, with collection requests processed based on truck proximity and availability. This integrated approach not only improves the operational efficiency of municipal services but also involves residents in maintaining city hygiene. By leveraging IoT, this project demonstrates a scalable and eco-friendly solution to the growing problem of waste management in urban environments. The Smart Waste Management System serves as a model for future smart city initiatives, contributing to cleaner surroundings, better public health, and optimized resource allocation. Its modular design also allows for future expansions like AI-powered route optimization and predictive analytics for sustainable city planning.

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CHAPTER 1

INTRODUCTION

In the context of contemporary urbanization, the effective management of municipal solid waste represents one of the most formidable environmental and infrastructural challenges confronting cities worldwide. The increasing concentration of populations in metropolitan areas has consequently led to a proportional escalation in waste generation. Traditional waste collection and disposal systems, characterized by fixed schedules and manual monitoring, have proven inadequate in addressing the demands of modern urban ecosystems. Such conventional methodologies often result in overfilled garbage bins, inefficient collection routes, and substantial operational expenditures, while also contributing to environmental degradation and public health hazards.

This research proposes the design and implementation of a Smart Waste Management System utilizing Internet of Things (IoT) technology as a means to enhance the efficiency and responsiveness of waste management services in urban environments. The system introduces a paradigm shift from reactive, schedule-based collection to a dynamic, data-driven model. By employing IoT sensors, real-time data acquisition mechanisms, and intelligent decision-making algorithms, the proposed framework aims to revolutionize waste collection operations by optimizing routes, minimizing resource wastage, and reducing environmental impact.

The proposed system is architected around a network of sensor-equipped bins that continuously monitor their fill levels and transmit data to a centralized server via an ESP32 microcontroller. Upon reaching predefined thresholds, bins autonomously trigger collection requests, and the backend management system allocates the nearest available waste collection vehicle based on its real-time GPS location. This intelligent allocation reduces redundant trips and ensures timely waste removal, thereby mitigating the risk of unsanitary conditions in public spaces.

Furthermore, this study emphasizes public involvement through a user-oriented mobile application that allows residents to monitor bin statuses, request collections, and track waste management operations in real-time. The integration of IoT, geospatial analytics, and mobile computing within this system exemplifies a comprehensive approach to smart urban infrastructure management, setting a foundation for future research in sustainable city development.

1.1 Motivation

Environmental Challenges Due to Inefficient Waste Management

One of the primary motivations for this research lies in the severe environmental consequences arising from inefficient waste management practices prevalent in most urban centers. Traditional municipal waste collection systems, reliant on static schedules and manual inspections, frequently result in overflowing bins and unattended waste accumulation. This, in turn, fosters unhygienic public spaces, attracts disease vectors, and contributes to air and soil pollution. Addressing these ecological hazards demands a system capable of real-time waste monitoring and dynamic resource allocation.

Operational Inefficiencies in Conventional Systems

Conventional waste management frameworks lack the capacity to adapt to the dynamic and unpredictable waste generation patterns typical of modern cities. Fixed-route garbage collection vehicles often either service empty bins unnecessarily or overlook overfilled bins, leading to operational inefficiencies, increased fuel consumption, and unnecessary labor costs. The absence of data-driven decision-making in these systems impairs route optimization and delays service delivery, thereby necessitating the exploration of intelligent alternatives.

Advancements in IoT and Sensor Technologies

The proliferation of cost-effective, low-power IoT devices, including microcontrollers like ESP32 and ultrasonic sensors, has created new opportunities to digitize and automate public utility services. These technological advancements have made it feasible to deploy decentralized, real-time monitoring systems capable of collecting, transmitting, and analysing waste bin fill data. This research is motivated by the potential to leverage these technologies for enhancing urban waste management infrastructures through intelligent automation.

Need for Citizen-Centric Public Service Systems

Existing waste management systems operate with limited public involvement, reducing their responsiveness and social accountability. The absence of interactive, real-time communication channels between citizens and municipal authorities results in delayed responses to sanitation issues. This research is driven by the ambition to incorporate a user-centric mobile application interface that enables urban residents to monitor, report, and request waste collection services, thereby fostering greater civic engagement and public awareness.

1.2 Objectives

The principal objective of this research is to design, develop, and implement an Internet of Things (IoT)-based Smart Waste Management System that addresses the inherent inefficiencies of conventional municipal waste collection processes. The project aims to establish a data-driven, real-time, and automated waste management framework capable of dynamically monitoring the status of garbage bins and optimizing the operational logistics associated with waste collection. This study aspires to integrate cutting-edge digital technologies in a manner that enhances service delivery efficiency, reduces environmental hazards, and promotes active civic participation within the urban waste management domain.

To achieve this overarching aim, the research identifies several key operational and technical objectives:

1. **To implement a real-time waste bin monitoring mechanism** utilizing ultrasonic sensors integrated with ESP32 microcontrollers. These sensors are tasked with continuously measuring the fill levels of municipal waste bins, providing accurate and up-to-date data to the centralized management system.

2. **To develop a robust backend management infrastructure** capable of processing sensor data and employing intelligent truck allocation algorithms based on factors such as bin fill status, proximity of collection vehicles (determined through GPS tracking), and overall route optimization.

3. **To integrate a mobile application interface** designed for both waste collection personnel and urban residents. This application will provide real-time visibility into bin statuses, facilitate direct waste collection requests from users, and enable live tracking of collection vehicles, thereby fostering greater transparency and public engagement.

4. **To establish a real-time notification and alert system** for immediate communication between municipal administrators, collection personnel, and urban residents, ensuring timely responses to waste overflow conditions.

5. **To evaluate the operational efficiency, scalability, and environmental impact** of the proposed system through simulated deployments and data-driven performance analysis.

Collectively, these objectives aim to demonstrate the viability and impact of an IoT-enabled, participatory, and environmentally conscious waste management system suitable for modern urban contexts.

CHAPTER 2

LITERATURE REVIEW

[1] IoT-based Smart Waste Management System for Smart Cities

This paper explores IoT technologies used in waste management, highlighting sensor-based bin monitoring, real-time data transmission, and smart routing. It presents a comparative analysis of existing smart systems and discusses their effectiveness in urban settings.

[2] Waste Management in Smart Cities: A Review

Focuses on how smart cities integrate ICT with waste management. The paper outlines various models and the role of real-time monitoring in improving cleanliness and sustainability in smart cities.

[3] Design and Implementation of Smart Waste Management System

Describes the development of a smart bin using Arduino and ultrasonic sensors. The system uses GSM for communication and is integrated with a central dashboard to monitor bin status and optimize pickup scheduling.

[4] Smart Waste Management System Using IoT

Proposes a prototype using ultrasonic sensors and GSM modules to track waste bin status. The system alerts authorities when bins are full, aiming to reduce manual checking and improve collection efficiency.

[5] Smart Waste Management: A Green Approach for Smart Cities

The study explores the role of Big Data and predictive analytics in optimizing waste collection schedules, leading to cost savings and reduced environmental impact. Big Data models require large amounts of data and may not be applicable in areas with limited data collection infrastructure.

[6] Optimized Waste Collection System Using IoT and Machine Learning

This paper focuses on machine learning algorithms for predicting waste generation and optimizing waste collection routes, reducing fuel usage and CO_2 emissions. The machine learning models require continuous data updates and might struggle with scalability in large cities.

2.1 Existing System

Traditional municipal waste management systems typically operate on fixed schedules and predetermined routes, which often lead to inefficiencies such as unnecessary trips to partially filled bins or delayed pickups from overfilled ones. These systems rely heavily on manual labor for bin monitoring, with personnel inspecting and recording bin statuses before scheduling collections. This process is inefficient, resource-intensive, and prone to errors. Additionally, there is a lack of real-time data collection or centralized information management, preventing municipalities from dynamically optimizing routes or reallocating resources based on actual waste generation. Although some systems have integrated basic technologies like RFID or GPS, these solutions are not well-connected or responsive. Furthermore, there is a lack of digital platforms for citizen engagement, preventing residents from directly communicating with waste management authorities. As urban areas continue to grow, these limitations highlight the need for more advanced, data-driven waste management solutions.

2.1.1 Advantages of the existing system

Despite its limitations, the existing municipal waste management system offers several advantages. First, the simplicity of its structure makes it easy to implement, requiring minimal technological infrastructure, training, or expertise. This straightforward approach allows municipal authorities to deploy waste management services with basic logistical planning and a relatively small workforce, ensuring a basic level of public sanitation.
Another benefit is the predictability and consistency of waste collection. Fixed schedules and predetermined routes ensure that residents know when to expect service, which encourages regular waste disposal practices and minimizes prolonged accumulation in public spaces. This regularity, while inflexible, provides a dependable service for communities where waste generation remains within expected limits.
Additionally, traditional systems are resilient to technological failures. With limited reliance on electronic devices or wireless networks, these systems can continue functioning even in areas with poor network infrastructure or during temporary service outages, ensuring

operational continuity.
From a financial perspective, the lower capital investment required by traditional systems makes them an attractive option for municipalities operating under strict budgetary constraints. While these systems may lack scalability and responsiveness, their simplicity, reliability, and cost-effectiveness have supported their long-standing use in various regions.

2.1.2 Drawbacks of the existing system

The primary drawback of the existing municipal waste management system lies in its inefficiency due to the reliance on fixed schedules and predetermined routes. This results in unnecessary collection trips when bins are only partially filled or delayed pickups when bins overflow. The lack of real-time data collection prevents the system from adapting to the dynamic nature of waste generation, making it challenging to optimize resources or respond to urgent needs, particularly in rapidly growing urban areas.
Moreover, the system's dependence on manual labor for bin monitoring adds a layer of inefficiency. Personnel must inspect bins in person and manually record data, which is time-consuming and prone to human error. This approach also lacks scalability, particularly in densely populated or rapidly expanding regions, where the volume of waste and number of collection points continually increase.
Another significant limitation is the absence of digital platforms for resident engagement. Without these systems, residents cannot easily report issues or track collection vehicle statuses, resulting in poor communication between citizens and waste management authorities. Additionally, the lack of integration between technologies like RFID and GPS in traditional systems further limits their ability to provide real-time data or optimize truck routing, leading to inefficient resource allocation.
Lastly, the system is ill-equipped to address environmental concerns, as it does not promote waste segregation or sustainability initiatives. As a result, the existing waste management infrastructure struggles to keep pace with the challenges posed by modern urbanization, requiring a shift toward smarter, data-driven systems for long-term viability.

2.2 Proposed System

The proposed Smart Waste Management System utilizes IoT technology to automate and streamline the process of garbage collection in urban areas. This system is designed to monitor the fill levels of garbage bins in real-time using ultrasonic sensors connected to an ESP32 microcontroller. Once the sensor detects that a bin has reached a certain threshold, the data is transmitted to a backend server through the MQTT protocol. The server then activates a truck allocation algorithm, which identifies and assigns the nearest available garbage truck based on GPS data and availability, ensuring quick and efficient waste collection.

In addition to automatic detection, the system also involves users in the process by allowing them to request waste pickups from their homes. However, such requests are processed only if a truck is within an acceptable range, preventing unnecessary delays or resource usage. The location of the trucks is continuously tracked using GPS modules, and both users and administrators can monitor bin status and truck movement through a dedicated mobile application developed using React Native.

The backend of the system is built using SpringBoot, and it communicates with a MongoDB database to store and manage data. Real-time updates are delivered using WebSocket connections, and notifications are sent to users and drivers to ensure everyone stays informed. By combining real-time monitoring, intelligent decision-making, user involvement, and efficient routing, the proposed system aims to significantly improve the effectiveness and sustainability of urban waste management.

2.2.1 Advantages of the proposed system

The Smart Waste Management System offers several advantages over traditional waste collection methods. One of the most significant benefits is real-time monitoring of garbage bins, which prevents overflow and ensures timely collection. This leads to cleaner public spaces and reduces the risk of health hazards caused by accumulated waste. The intelligent truck allocation system minimizes unnecessary travel, thereby saving fuel, reducing operational costs, and lowering carbon emissions. By using GPS-based tracking and route optimization, the system enhances the efficiency of municipal waste management services. Another key advantage is the involvement of users in the collection process. Residents can directly request waste pickups from their homes, making the system more responsive and interactive. The integration of notifications and live tracking improves transparency and accountability, keeping both users and administrators informed about the status of waste collection. Additionally, the use of IoT components such as ESP32, ultrasonic sensors, and cloud-connected backend services makes the system scalable, allowing for easy expansion and adaptation in different urban settings. Overall, the system promotes environmental sustainability, operational efficiency, and a higher standard of cleanliness in cities.

CHAPTER 3

SYSTEM DESIGN

3.1Development Environment

The development of the Smart Waste Management System was carried out in an integrated IoT environment combining physical hardware components and cloud-based software tools. This environment supports real-time data acquisition, intelligent processing, remote control, and efficient interaction between users, waste management authorities, and the system. The choice of technologies ensures scalability, low power consumption, and smooth system integration for urban deployment.

3.1.1 Hardware Requirements

- ESP32 Microcontroller
- Ultrasonic Sensors
- GPS NEO-6M Module
- Jumper wires

ESP32 Microcontroller

The ESP32 acts as the central controller of the system. It collects data from ultrasonic sensors, processes it locally, and transmits it to the backend server using Wi-Fi. Its dual-core processor and low power consumption make it ideal for real-time IoT applications. Additionally, it supports both MQTT and HTTP protocols, making communication secure and efficient.

Ultrasonic Sensors

These sensors are placed inside the garbage bins to continuously monitor the fill level by emitting sound waves and calculating the distance to the trash. When the distance falls below a certain threshold, it implies the bin is nearly full and ready for collection. This information is transmitted via the ESP32.

GPS Module

A high-performance GPS receiver module that provides real-time location tracking of the waste collection vehicles. This module assists in route optimization and monitoring vehicle movements within the management system. Each garbage collection truck is fitted with a GPS module that provides live location data. This enables real-time tracking of vehicles, helps administrators monitor routes, and allows the backend to assign the nearest truck to a full bin.

Power Supply / Battery Units

The sensors and ESP32 modules are powered by reliable battery units or external power sources to ensure uninterrupted functioning in outdoor environments.

Supporting Components (Optional/Extension)

In future enhancements, components like load sensors (for weight-based bin status), GSM modules (for remote locations without Wi-Fi), or cameras (for smart bin image recognition) may be added.

3.1.2 Software Requirements

- Arduino IDE
- Spring Boot (Backend Development)
- MongoDB (Database)
- Flutter
- WebSocket
- Tinker

The proposed Smart Waste Management System integrates a suite of modern software tools, development frameworks, and simulation platforms to enable seamless hardware-software interaction, real-time data processing, and user-friendly service delivery. The major software and tools employed in the system are detailed below:

Arduino IDE

Arduino IDE is an open-source integrated development environment used for writing, compiling, and uploading embedded code to the ESP32 microcontroller. It serves as the programming backbone for interfacing the ultrasonic sensor and GPS module, managing real-time data acquisition. Its extensive library support, simplicity, and compatibility with IoT hardware make it an indispensable tool for embedded system development.

Spring Boot (Backend Framework)

Spring Boot is a lightweight, production-ready Java framework that manages backend server operations. It handles HTTP requests from the microcontroller, processes sensor data, and interacts with the database. Its auto-configuration features and embedded Tomcat server streamline backend deployment, while its scalability ensures the system can adapt to increasing data volumes and user requests over time.

MongoDB

MongoDB, a NoSQL document-oriented database, is utilized for storing unstructured and dynamic data such as bin fill levels, GPS coordinates, and alert logs. Its flexible schema and capability to handle real-time, high-volume data make it ideal for IoT-based applications, ensuring efficient and reliable data management in the waste management framework.

Flutter (Frontend Framework)

Flutter, an open-source UI toolkit from Google, is used to develop a cross-platform mobile application that allows users and municipal authorities to monitor bin status, track collection vehicles, and receive real-time notifications. Its reactive UI components ensure a responsive, consistent, and interactive user experience across Android and iOS platforms.

WebSocket

WebSocket protocol enables full-duplex, persistent communication between the backend server and client applications. It facilitates real-time notifications, system alerts, and status updates without the need for continuous client-side polling, thereby improving efficiency and responsiveness within the management system.

TinkerCad

TinkerCad is an online simulation tool used for virtually prototyping the hardware setup, testing sensor integrations, and validating data transmission logic before physical assembly. It allows developers to detect design flaws early, reduce prototyping errors, and accelerate the overall development cycle.

CHAPTER 4

PROJECT DESCRIPTION

4.1 SYSTEM ARCHITECTURE

This research adopts a structured, layered methodology to conceptualize, develop, and evaluate an IoT-based Smart Waste Management System capable of dynamic waste monitoring and real-time municipal coordination. The methodology follows a sequential workflow, encompassing system architecture design, hardware configuration, software development, application integration, and prototype validation, as outlined below.

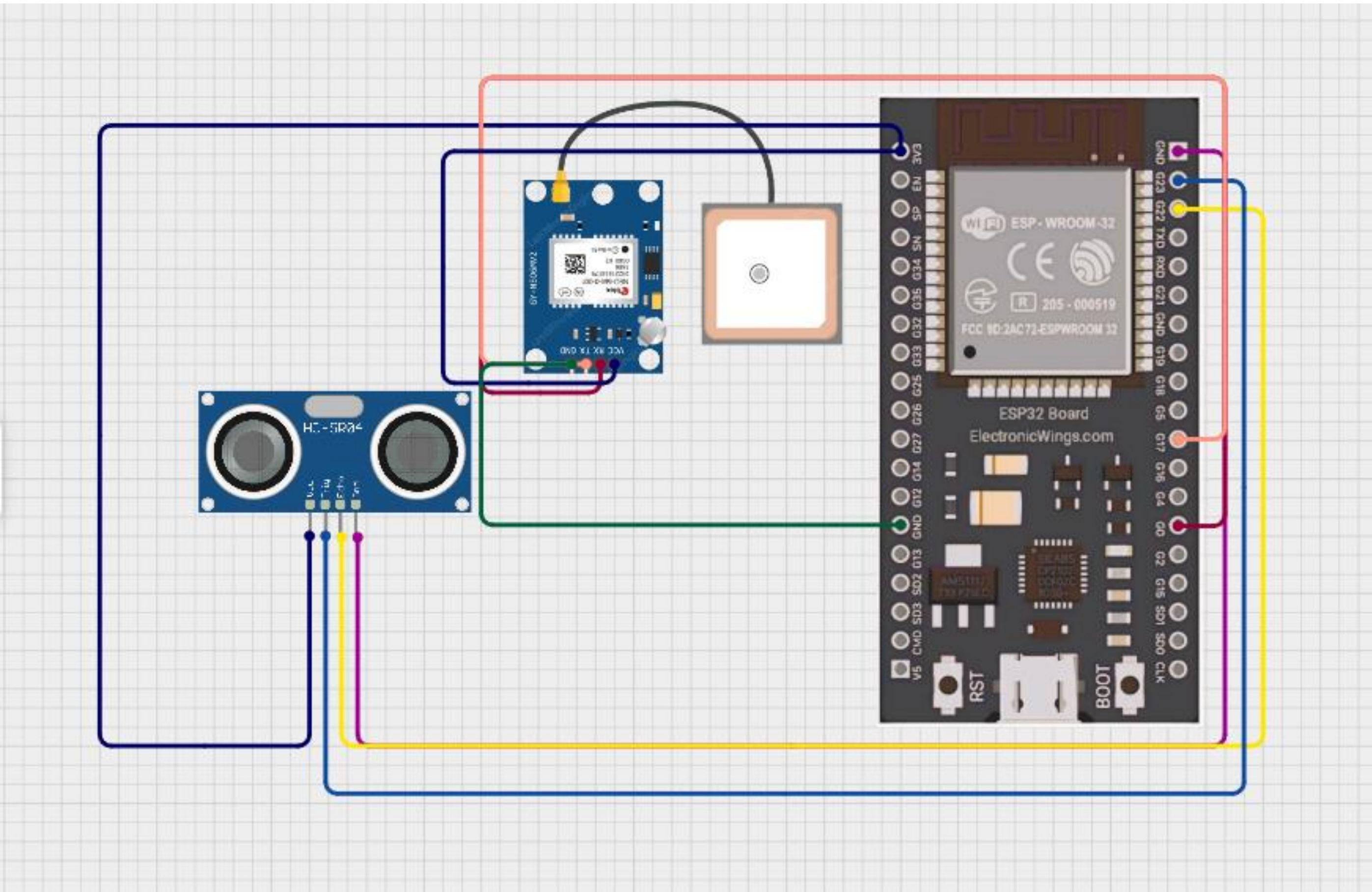


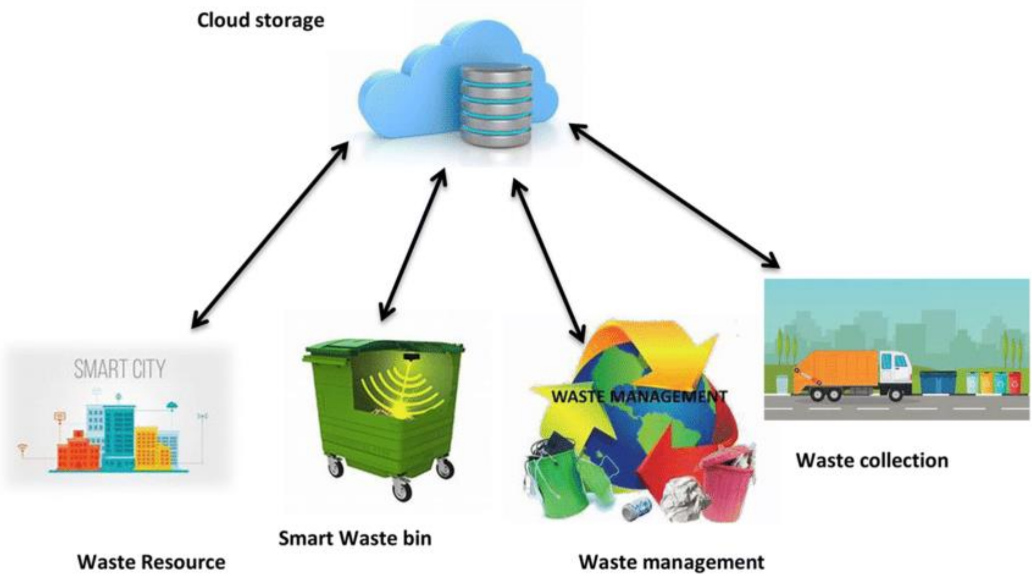
Fig 4.1 System Architecture

4.2 METHODOLOGY

This research adopts a structured, layered methodology to conceptualize, develop, and evaluate an IoT-based Smart Waste Management System capable of dynamic waste monitoring and real-time municipal coordination. The methodology follows a sequential workflow, encompassing system architecture design, hardware configuration, software development, application integration, and prototype validation, as outlined below.

System Architecture Design

The proposed system architecture is categorized into three primary layers: **hardware sensing layer**, **data management layer**, and **application interface layer**. The sensing layer comprises ultrasonic sensors for detecting waste bin fill levels and a GPS module for identifying the location of collection vehicles. An ESP32 microcontroller manages sensor data acquisition and transmission. The data management layer consists of a Spring Boot-based backend server interfaced with a MongoDB database for real-time data storage and analytics. The application interface layer is realized through a Flutter-based mobile application, enabling end-users to receive instant bin status updates and collection notifications. WebSocket protocol is employed to ensure persistent, low-latency, bidirectional communication between the hardware and the backend server.



Hardware Configuration

In this phase, **HC-SR04 ultrasonic sensors** are mounted on garbage bins to measure the distance between the sensor and the waste material. The fill level is inferred by comparing this reading with the bin's height. Simultaneously, a **NEO-6M GPS module** retrieves the vehicle’s real-time location coordinates. The **ESP32**

microcontroller reads these inputs and prepares structured data packets for wireless transmission. Initial configurations, component behavior, and circuit connectivity are simulated using **TinkerCad**, ensuring design reliability prior to physical prototyping on breadboards and jumper wires.

Software Development

The **Arduino IDE** is utilized for microcontroller programming, responsible for sensor interfacing, data formatting, and wireless transmission. The **Spring Boot backend server** handles sensor data requests, triggers notifications for threshold breaches, and manages data storage operations in **MongoDB**, which efficiently handles the unstructured, real-time data generated by multiple waste bins and vehicles.

Mobile Application Integration

A cross-platform **Flutter application** is developed, providing administrative users and residents with real-time insights into waste bin statuses, vehicle tracking, and collection scheduling. Integration of **WebSocket technology** facilitates immediate notification delivery, surpassing traditional HTTP polling methods in efficiency and responsiveness.

System Testing and Evaluation

Comprehensive testing is performed initially through Tinkercad simulations, followed by physical hardware deployment. Critical parameters such as sensor accuracy, data transmission reliability, server response time, and application latency are iteratively monitored. System performance is evaluated against predefined operational benchmarks, ensuring technical robustness, data integrity, and user interaction quality before final integration.

CHAPTER 5
RESULT AND DISCUSSIONS

The proposed IoT-based Smart Waste Management System, developed using a structured, layered approach, demonstrated significant improvements in efficiency, accuracy, and responsiveness when compared to traditional waste collection methods. The system successfully enabled real-time monitoring of waste bin fill levels and dynamic coordination of collection vehicles, which are critical for effective municipal waste management in rapidly urbanizing environments.

Simulations and field deployments confirmed the reliability of sensor-based data acquisition and wireless transmission. The integrated system maintained seamless communication across all layers, from sensor input to backend processing and mobile application delivery. Real-time alerts and updates significantly reduced response times for waste collection, thereby optimizing route planning and resource allocation. The persistent, low-latency data exchange enabled by WebSocket communication further enhanced the system's ability to respond instantly to changing conditions on the ground.

Evaluation of system performance across multiple parameters—including data accuracy, system latency, stability, and user experience—highlighted the robustness and scalability of the solution. The combination of hardware and software elements functioned cohesively, delivering accurate insights with minimal data loss or communication delays. The structured methodology not only streamlined the development process but also ensured smooth integration and reliable functionality during operation.

These outcomes collectively affirm the feasibility of adopting an IoT-driven framework for municipal waste management. The system’s ability to deliver real-time insights and support data-driven decision-making presents a strong case for its application in enhancing urban cleanliness, operational transparency, and overall public sanitation outcomes.

CHAPTER 6

CONCLUSION AND FUTURE WORK

6.1 Conclusion

The development of an IoT system for traffic detection and automatic signal control represents a significant step towards enhancing traffic management and reducing congestion in urban areas. By leveraging IoT technologies, such as sensors and communication networks, the system can continuously monitor traffic conditions in real-time and dynamically adjust traffic signals to optimize traffic flow. This has the potential to improve road safety, reduce travel times, and minimize environmental impact by reducing vehicle emissions.

6.2 Future Work

Future work in this domain will focus on enhancing the scalability, efficiency, and accuracy of the IoT traffic management system. Key areas of development include the exploration of next-generation sensor technologies that can capture more granular and reliable traffic data. These advanced sensors would offer higher precision, allowing for better detection of traffic patterns, vehicle types, and pedestrian movements. Additionally, the integration of emerging communication protocols will be prioritized to ensure seamless interoperability with existing urban infrastructure, facilitating broader system deployment across diverse environments. Further, the system's data analytics capabilities will be significantly enhanced through the application of advanced techniques such as **machine learning** and **predictive modeling**. These innovations will enable the system to not only optimize real-time traffic signal control but also proactively predict traffic conditions and make preemptive adjustments. This shift from reactive to proactive traffic management will contribute to smoother traffic flow, reduced congestion, and improved overall system responsiveness. The integration of AI-powered decision-making models will also enable the system to adapt to complex, dynamic traffic scenarios, ensuring that the system remains effective as cities grow and traffic conditions evolve.

APPENDIX

SOFTWARE INSTALLATION

Arduino IDE

To run and mount code on the Arduino NANO, we need to first install the Arduino IDE. After running the code successfully, mount it.

Sample code

```
#define ledC1 8
#define ledC2 9
#define ledC3 10

int c1, c2 ;

void setup() {
  Serial.begin(9600);
  pinMode(ledC1, OUTPUT);
  pinMode(ledC2, OUTPUT);
  pinMode(ledC3, OUTPUT);
}

void loop() {
  readSensor();

  if (c1 == 1 ) {
    roadCopen();
  } else {
    roadClose();
  }
}

void readSensor() {
  c1 = analogRead(A1);
  c2 = analogRead(A0);
  Serial.print(c1);
  Serial.print("\t");
  Serial.print(c2);
  Serial.println("\t");
```

```
  if (c1 < 400) { c1 = 1; } else c1 = 0;
  Serial.print(c1);
  Serial.print("\t");
  Serial.print(c2);
  Serial.println("\t");
}

void roadCopen() {
  digitalWrite(ledC3, LOW);
  digitalWrite(ledC1, LOW);
  digitalWrite(ledC2, HIGH);
  delay(2000);
  digitalWrite(ledC2, LOW);
  digitalWrite(ledC1, HIGH);
  delay(2000);
  readSensor();
}

void roadClose() {
  Serial.println("ROAD STOP");
  digitalWrite(ledC3, HIGH);
  digitalWrite(ledC1, LOW);
  digitalWrite(ledC2, LOW);
  delay(15000);
  digitalWrite(ledC3, LOW);
  digitalWrite(ledC2, HIGH);
  delay(1000);
  digitalWrite(ledC2, LOW);
  delay(1000);
  digitalWrite(ledC1, HIGH);
  delay(5000);
  digitalWrite(ledC1, LOW);
  readSensor();
}
```

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