IS 4110 - Capstone Project Proposal

EcoBin-Smart Garbage Management System

Group 23

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Approval of Capstone Project

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Suggestions If Any :

Table of Contents

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Mentor: Mr. N Priyasad

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Internal Supervisor: Mr. P Vigneshwaran

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We are truly grateful for their contributions and commitment to promoting recycling practices and environmental sustainability.

Group 23
Team Members

Introduction & Objectives

Introduction

EcoBin Smart Garbage Management System (IoT) is an innovative solution aimed at revolutionizing waste management practices. EcoBin mainly provides real-time monitoring of garbage bin fill levels, optimizing waste collection routes and reducing operational costs. Reduce operational costs by up to 30% with optimized routes based on real-time fill level data.

EcoBin minimizes unnecessary pickups, saving fuel and manpower. The proposed system accessible via a mobile app and website, allowing municipalities and businesses to efficiently manage waste disposal. EcoBin uses intelligent alerts to notify authorities and users when bin capacity is reached, ensuring timely and optimal waste removal.

This system will provide a comprehensive solution for efficient and active garbage management.

Here are some major problems we identified that led in the development of this system.

- Limited data: Lack of real-time data of the bin fill levels makes it difficult to optimize routes and allocate resources effectively.
- Inefficient routes: Collection trucks frequently operate on fixed schedules, regardless of the actual bin fill levels, leading to unnecessary fuel consumption and missed bins.
- High operational costs: Waste management costs are mostly fuel, labor and vehicle maintenance.
- Unreliable service: Uncollected waste (Missed collections) or overflowing bins can cause to sanitary problems and dissatisfaction of people.
- Environmental impact: Impact on the environment: Pollution and greenhouse gas emissions are caused by inefficient routes and overflowing garbage bins.

Objectives

By addressing these identified problems and implementing the proposed solution approach, this real-time waste monitoring and management system will improve the efficiency of waste management practices. The proposed system will empower municipalities and businesses to monitor effectively fill bin levels, prevent unnecessary pickups and ensure continuous service.

Accordingly, the followings are the objectives that we hope to achieve through this project.

- Optimized routes: Collection trucks move intelligently through the city, and picking up trash and garbage only when the bins are truly full. Sensors in the bins provide real-time fill level data to the system, by allowing dynamic route planning and eliminating unnecessary pickups.
- Improved Service: Timely alerts ensure bins are emptied before overflowing, improving sanitation and citizen satisfaction. this proposed system can benefit for citizens with mobile app notifications informing them when their bins will be emptied, promoting responsible waste disposal habits.
- Reducing Operational Cost: Optimized routes lead to fuel savings and require fewer trucks, reduce manpower needed.
- Data - Driven insights: Real-time data enables analysis of waste management campaigns across different areas, identifying peak waste generating times this will leading to better resource allocation and planning.
- Environmental Benefits: Reduced fuel consumption and optimized routes contribute to reduced greenhouse gas emissions and a smaller environmental footprint.

Analysis

Feasibility Study

Technical Feasibility

Economic Feasibility

Operational Feasibility

Legal & Regulatory Feasibility

Social & Environmental Feasibility

DFD Diagrams

ER Diagrams

Hardware & Software Requirements

Hardware Requirements

- Intel(R) Core™ i5 – 6200U CPU @ 2.3GHz Processor
- 8.00 GB RAM
- Internet Connection
- Wires
- Mobile Device (Android or iOS)
- Uno Board

Software Requirements

- Visual Studio Code
- Web Browsing Software (Google Chrome / Microsoft Edge / Mozilla Firefox)
- Flutter
- Arduino

Tables & Structure

Number of Modules

Details of Modules

Data Structure

Proposed System

The purpose of the EcoBin-Smart Garbage Management System is an IoT based system which used to facilitate the separation of recyclables from general waste. The system, which consists of Arduino sensors and sophisticated algorithms, automatically identifies and classifies various recyclable materials, including metal, glass, paper and plastic. Each type of recyclable material bin has its own compartment, ensuring effective and efficient waste management.

In our EcoBin system, there is a main bin to collect waste dropped by the people. After waste is put on the main bin, it will be separated into different bins in order to complete garbage separation process after the detection by the sensors. By simply putting their waste in the bin, users encourage recycling habits and support environmental sustainability as the system handles sorting.

Accordingly, the followings are the basic components of the proposed system of the EcoBin.

- Bin: A garbage container divided into sections for recyclables and general waste.
- Ultrasonic Sensor: Recognizes the distance between the garbage and the main bin.
- Uno Board: Connects all components together.
- Digital Display: Monitors the progress of the process states.

Functional Requirements

- User Login
- Automated Sorting: Automatically identifying and sorting various recyclable materials.
- Sensor Integration: Use sensors to identify materials such as papers, metals, and plastics.
- Compartmentalization: Divide the bin into separate compartments for different recyclables.
- Sorting Mechanism: Implement a system that allows sorted materials to be moved to appropriate compartments.
- User Interface (UI): Make the bin interface as easy to use as possible for users to interact with, including instructions on where to put waste.
- Feedback System: Use audio-visual or visual cues to let users know when a compartment needs to be emptied or when the bin is full.
- Remote monitoring: Allow remote monitoring of bin status and fill levels via an online interface or smartphone app.
- Data logging: For analytical and reporting purposes, keep track of the types and amounts of materials placed in the bin.
- User Logout

Non-Functional Requirements

- Accuracy: To minimize pollution, the system's ability to identify and sort recyclables must be highly accurate.
- Dependability: Verify that the system operates reliably across a range of handling scenarios and environmental conditions.
- Scalability: Create a system that can be easily expanded to handle different bin sizes and types.
- Power efficiency: If the system is connected to a power source, optimize power consumption to extend battery life or reduce energy costs.
- Security: Implement security measures to stop unauthorized users from modifying or accessing system data or functionality.
- Maintenance: Build the system with access to spare parts for maintenance and repair.
- Compatibility: Ensure compatibility with existing standards and waste management infrastructure.
- Cost-Effectiveness: To promote widespread adoption, aim for a cost-effective design that strikes a balance between affordability and performance.
- Accessibility: Consider features such as tactile indicators or audible cues to accommodate users with disabilities.
- Environmental Impact: Reducing the environmental impact of the system by using sustainable materials and operating it efficiently.

Methodology

Modules Split-Up & Gantt Chart References

Cost Analysis

Conclusion

References