IoT Team Number -4

Title : IoT-Based Smart Dustbin Management System

1. Introduction

The IoT-Based Dustbin Management System is designed to streamline waste collection by optimizing the monitoring and collection of garbage bins. This project introduces a smart solution to efficiently manage garbage disposal by providing real-time monitoring of dustbin fill levels. The system's purpose is to reduce unnecessary visits to dustbins that are not yet full and to ensure timely waste disposal for bins that are over 60% full.

2. Project Objectives

- To monitor the fill level of dustbins remotely.

- To set a threshold for garbage collection (60% fill level) and send alerts when this threshold is exceeded.

- To implement an optimized route for waste collection using the Travelling Salesman Algorithm, displaying both the shortest path and the minimum travel cost.

- To facilitate better planning for waste management and reduce operational costs.

3. System Components

1. NodeMCU: A microcontroller used to collect data from sensors and communicate it to the backend system via Wi-Fi.

2. Ultrasonic Sensor: Used to measure the fill level of each dustbin by calculating the distance between the sensor and the garbage. This measurement allows us to determine if the bin is more than 60% full.

3. Wiring and Connectivity: Basic wiring is set up to connect the NodeMCU with the ultrasonic sensors, ensuring a steady data flow from each dustbin.

4. System Workflow

1. Threshold Setting: Each dustbin is assigned a threshold fill level of 60%. When the sensor detects that the fill level has surpassed this limit, it sends a signal to the backend system.

2. Data Collection: NodeMCU gathers real-time data from each dustbin and sends it to the backend system.

3. Backend Processing: A custom backend code processes this data and determines which bins need immediate collection based on the threshold condition.

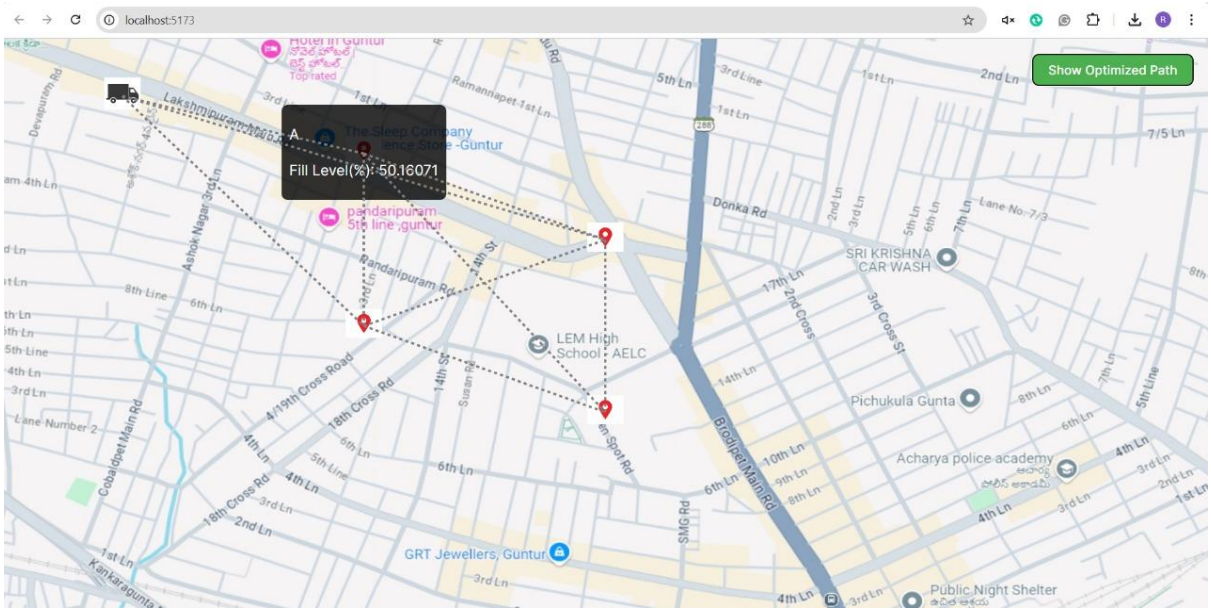
4. Route Optimization: Using the Travelling Salesman Algorithm, the backend calculates the shortest route for visiting each filled dustbin. This calculation minimizes travel cost and enhances efficiency in waste collection.

5. Frontend Visualization: The frontend displays a map showing the locations of all dustbins and the base station (start location). Once the shortest path is calculated, it is displayed on the map as a series of lines connecting the relevant dustbins in an optimal sequence.

5. Technical Specifications

- Backend Code: Processes the fill-level data and calculates the optimal route for collection.

- Frontend Interface: Visualizes dustbin locations on a map, showing both the shortest route and associated minimum cost of collection.



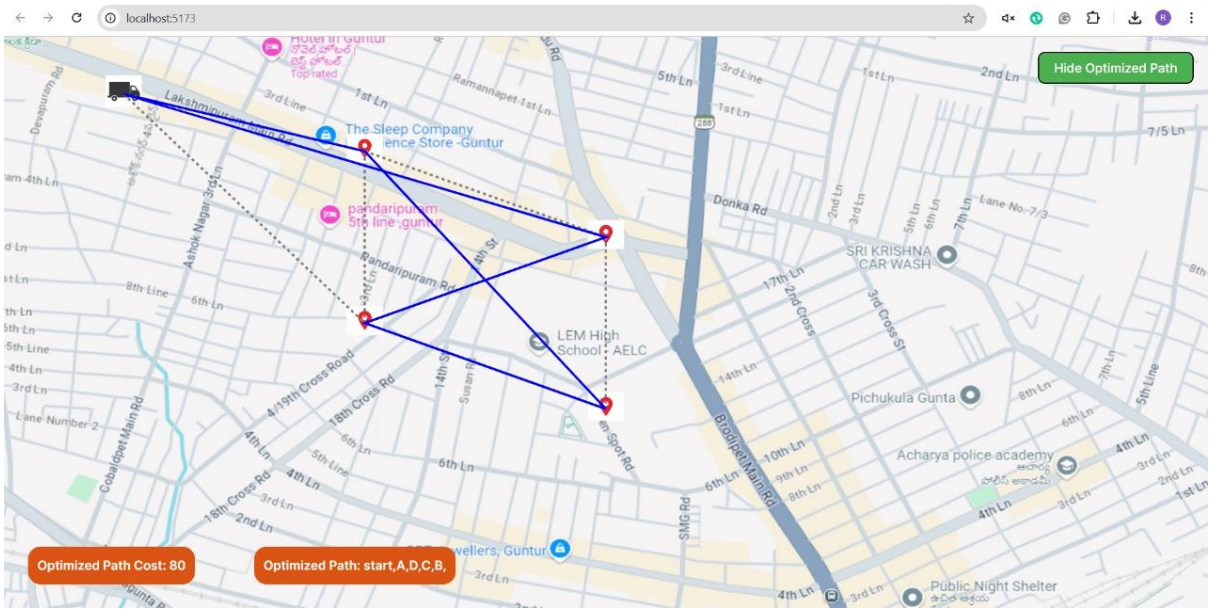
6. Benefits of the System

-Operational Efficiency: Enables targeted waste collection only when dustbins are near capacity, reducing unnecessary travel.

- Cost Reduction: Minimizes fuel and manpower costs by providing an optimized route for collection.

- Environmental Impact: By promoting efficient waste collection, the system helps in reducing emissions from waste collection vehicles.

- Route optimization Algorithm: Employed to ensure efficient route planning by identifying the shortest path, thus reducing operational time and cost (Recursive BFS).



7. Future Scope

In the future, this system can be scaled to include more dustbins, incorporate predictive data analytics, for waste generation patterns and automate alerts for municipal waste management systems.

8. Conclusion

The IoT-Based Dustbin Management System offers a practical, scalable solution for waste management in urban areas. By leveraging IoT and route optimization algorithms, the project ensures efficient waste collection, ultimately contributing to cleaner surroundings and sustainable urban management.