iJRASET
International Journal For Research in Applied Science and Engineering Technology

INTERNATIONAL JOURNAL FOR RESEARCH

IN APPLIED SCIENCE & ENGINEERING TECHNOLOGY

Volume: 14 **Issue:** II **Month of publication:** February 2026

DOI: https://doi.org/10.22214/ijraset.2026.77506

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International Journal for Research in Applied Science & Engineering Technology (IJRASET)
ISSN: 2321-9653; IC Value: 45.98; SJ Impact Factor: 7.538
Volume 14 Issue II Feb 2026- Available at www.ijraset.com

Smart Waste Collection Management System Using Mobile and Web Technologies

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Abstract: ***The swift growth of urban areas and the rise in waste pro- duction have heightened difficulties in managing municipal waste. Con- ventional systems depend on fixed schedules and manual oversight, which frequently lead to inefficiencies. This study suggests a Smart Waste Col- lection Management System that combines web and mobile technologies to streamline and enhance waste collection processes. Test results show enhanced efficiency and shorter response times.***
Keywords: Smart Waste Management · Municipal Solid Waste · Mobile Application · Web-Based Monitoring System · Route Optimization

I. INTRODUCTION

The rapid growth of urban areas has led to a notable rise in solid waste gener- ation. Traditional waste collection methods often lack adaptability and clarity. Innovative technologies like cloud computing and mobile apps present new pos- sibilities for efficient service management.

II. RELATED WORK

Current studies emphasize IoT-connected smart bins, GPS tracking, and op- timizing routes. Nevertheless, there has been little focus on engagement from citizens and centralized oversight. The suggested system aims to fill these gaps.

III. PROPOSED SYSTEM ARCHITECTURE

The suggested system is structured around a three-tier architecture that includes the Presentation, Application, and Data layers, as illustrated in Fig. 1.
The layered structure improves scalability, maintainability, and security.

IV. SYSTEM WORKFLOW

The operational workflow of the proposed system is illustrated in Fig. 2.
This process guarantees immediate collaboration among users, collectors, and administrators.

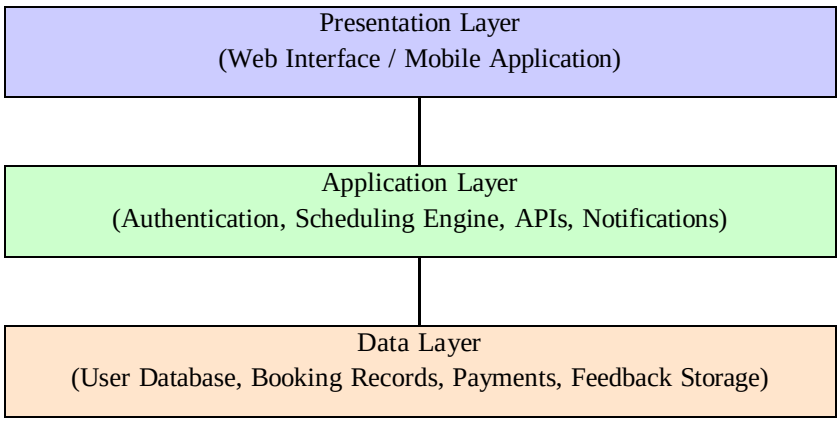

Fig. 1. Three-Layer Architecture of the Proposed System

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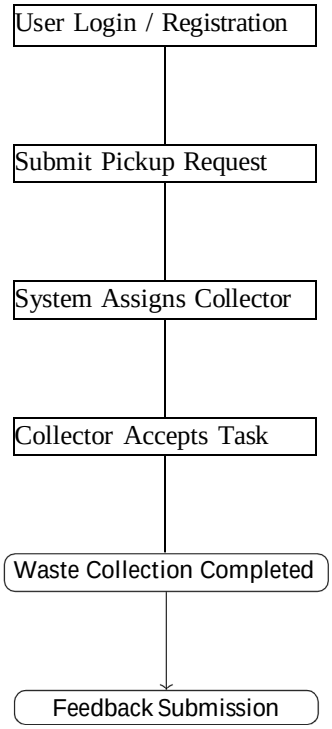

Fig. 2. Workflow of Smart Waste Collection Process

Smart Waste Collection Management System 3

V. DATABASE DESIGN

The diagram of the Entity Relationship (ER) model is illustrated in Fig. 3.

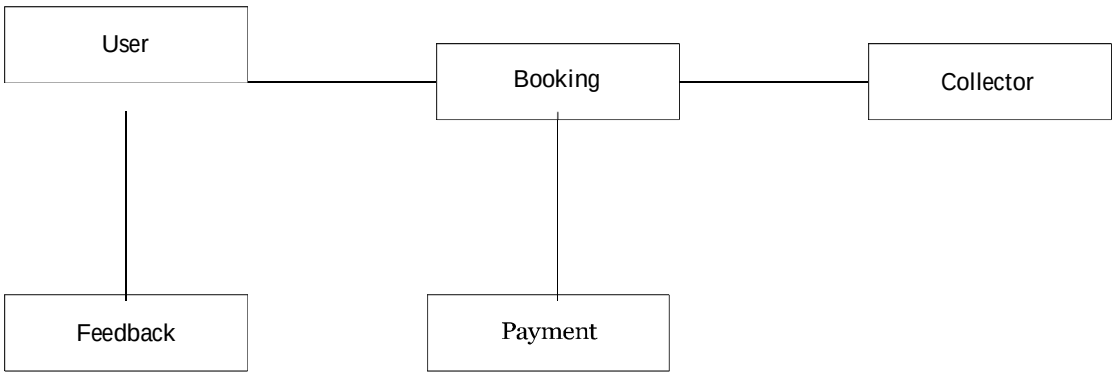

Fig. 3. Entity Relationship Diagram

VI. TECHNOLOGY STACK

Frontend technologies consist of HTML5, CSS3, JavaScript, and either React.js or Flutter. For backend services, Node.js or Django is utilized. Data storage is handled with MySQL or PostgreSQL, and deployment is facilitated by AWS or Google Cloud Platform.

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VII. PERFORMANCE EVALUATION

System performance comparison between traditional and proposed methods is presented in Fig. 4.
The results demonstrate a significant reduction in response time and im- proved operational efficiency.

VIII. CONCLUSION

The proposed Smart Waste Collection Management System enhances efficiency, transparency, and coordination through digital automation. The modular archi- tecture ensures scalability for smart city environments. Future enhancements include AI-based route optimization and IoT integration.

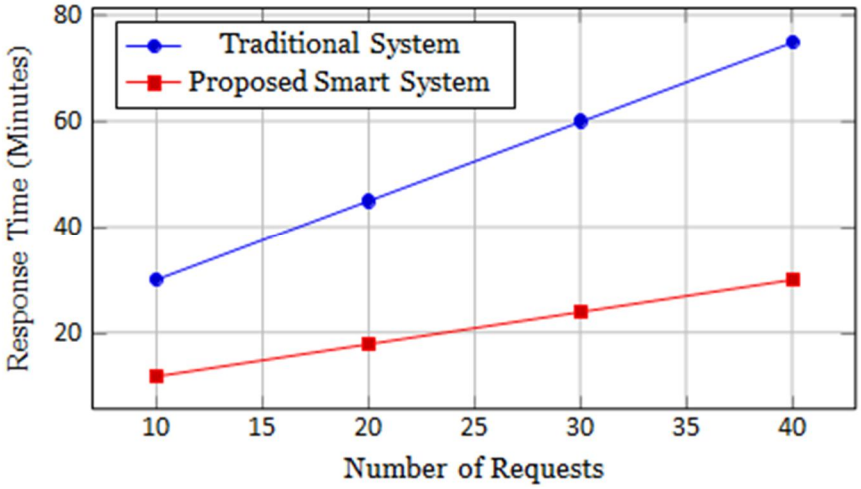

Fig. 4. Performance Comparison Between Traditional and Proposed System

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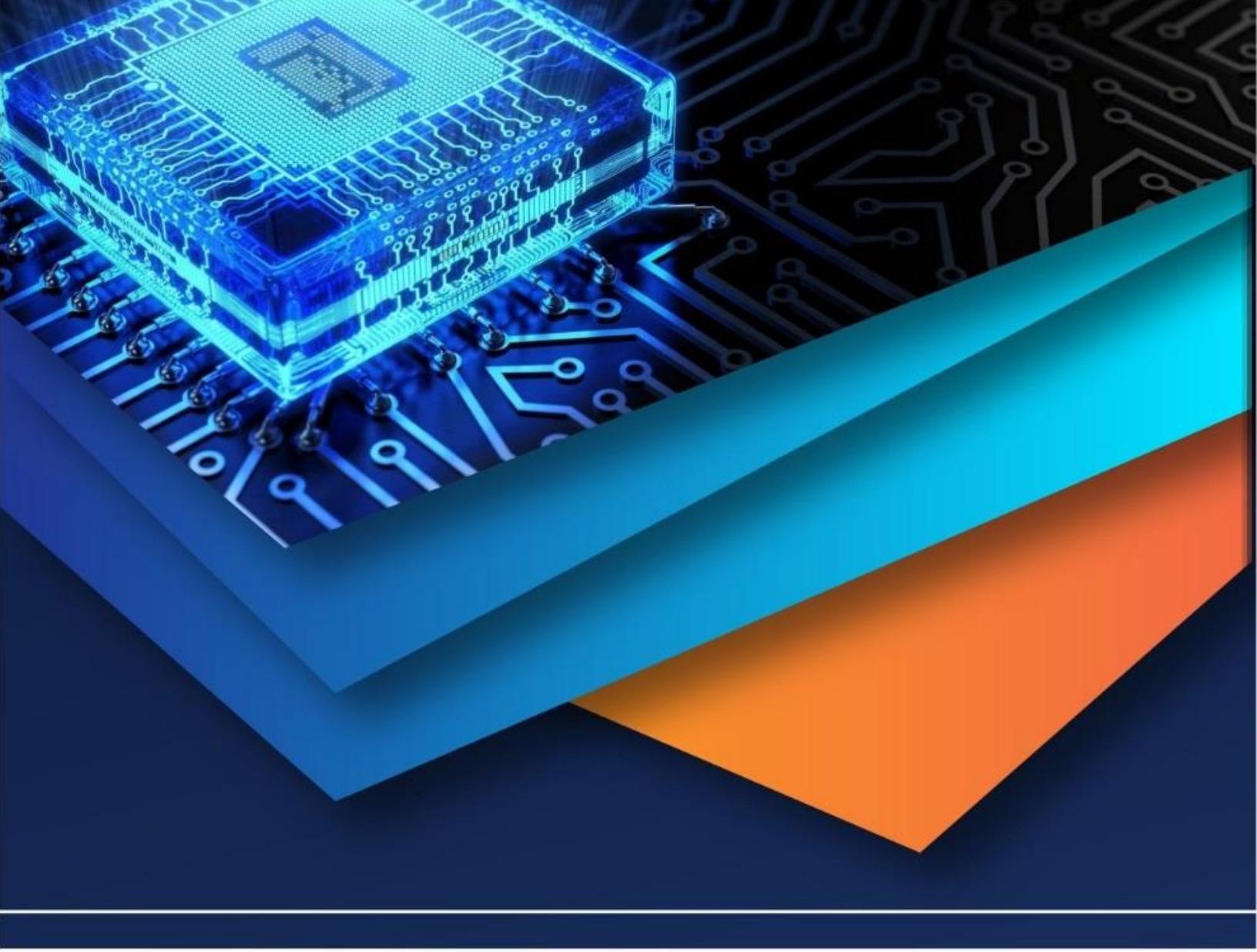

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