iJRASET
International Journal For Research in Applied Science and Engineering Technology

INTERNATIONAL JOURNAL FOR RESEARCH

IN APPLIED SCIENCE & ENGINEERING TECHNOLOGY

Volume: 11 **Issue:** X **Month of publication:** October 2023

DOI: https://doi.org/10.22214/ijraset.2023.56345

www.ijraset.com

Call: 08813907089 | E-mail ID: ijraset@gmail.com

International Journal for Research in Applied Science & Engineering Technology (IJRASET)
ISSN: 2321-9653; IC Value: 45.98; SJ Impact Factor: 7.538
Volume 11 Issue X Oct 2023- Available at www.ijraset.com

Garbage Collection Android Application

Shubham Mangalure[1], Ganesh Misal[2], Sanket Shelke[3], Shrihari Waykule[4], Prof. Farheen Shaikh[5]
Computer Engineering, Sinhgad Academy Engineering College, Kondhwa, Pune

Abstract: ***The "Android Garbage Collection Application" stands as an innovative solution tailored for Android devices, with the objective of revolutionizing waste management in smart cities. Conventional waste collection methods frequently result in missed pickups, litter accumulation, and potential public health risks. This project harnesses seamless integration with Firebase to create a user-friendly Android app. It provides real-time notifications to residents as garbage collection trucks approach their locations. A central feature of this app is its live tracking system, enabling users to monitor the precise location of the garbage truck in real-time. Additionally, it offers estimated arrival times, effectively reducing waiting times for residents and optimizing the waste collection process. What truly sets this application apart is its focus on community engagement. By actively involving residents in the waste management process, it encourages shared responsibility and cooperation among city dwellers, fostering a cleaner environment and ensuring timely and efficient waste collection. Furthermore, this project serves as a testament to the transformative power of modern technology in enhancing traditional municipal services. It exemplifies how integrating cutting-edge technology can effectively address longstanding challenges and enhance the quality of life for residents in smart cities. The scalability and adaptability of this application make it a valuable asset for optimizing waste management in various urban settings. Its data analytics capabilities provide city officials with valuable insights, enabling more informed decision-making and a proactive approach to waste management.***

Keywords: Smart Cities, Android Application, Waste Management, Garbage Collection, Real-time Notification, Community Engagement, Data Analytics, Scalability

I. INTRODUCTION

In the realm of modern urban development, smart cities are on the rise, presenting innovative solutions to age-old urban challenges. One of these critical challenges is waste management. Conventional waste collection methods have often proven to be inefficient, resulting in missed pickups, unsightly litter, and significant public health concerns. The "Garbage Collection Android Application" discussed in this paper is a pioneering effort to address these issues by leveraging the power of mobile technology. The Android application has been meticulously designed to revolutionize waste management in smart cities, providing a user-friendly and efficient solution. Traditional waste collection processes are transformed through the incorporation of geofencing technology and seamless integration with Firebase. This dynamic application offers real-time notifications to residents, informing them of the approaching garbage collection trucks. The real-time tracking of these trucks, along with estimated arrival times, minimizes waiting times for residents and ensures the timely disposal of waste. Community participation is a key aspect of this application. By involving residents in the waste management process, it not only enhances user engagement but also optimizes the waste collection process. The "Garbage Collection Android Application" serves as a testament to the potential of modern technology to enhance traditional municipal services. The project's scalability, adaptability, and robust data analytics capabilities make it a valuable tool for optimizing waste management in the context of smart cities. This paper delves into the details of the application, shedding light on its architecture, functionality, and the benefits it brings to urban environments.

II. BACKGROUND

Waste Management in Smart Cities Smart cities are urban environments that leverage technology and data to improve the quality of life for residents while enhancing sustainability. Waste management is a crucial aspect of smart city development, as efficient waste collection and disposal systems are essential for maintaining clean and healthy urban spaces. Conventional waste management systems often suffer from inefficiencies, leading to missed pickups, litter accumulation, and related problems.

The Need for Innovation The inefficiencies in traditional waste collection systems create significant challenges for urban authorities. These challenges include:

1) *Missed Pickups:* Traditional waste collection schedules can lead to missed pickups, resulting in overflowing bins and litter on the streets.
2) *Lack of Transparency:* Residents often lack information about the status of waste collection in their area, leading to uncertainty.

3) *Public Health Risks:* Accumulated waste can pose health risks, such as the spread of diseases and vermin infestations. To address these issues, innovative solutions are required to transform waste management in smart cities.
4) *The Role of Innovation in Smart City Waste Management:* In light of these challenges, innovation becomes imperative in transforming waste management in smart cities. Innovative solutions leverage technology and data to address these issues effectively:
5) *Scheduling Optimization:* Smart waste management systems can use real-time data to optimize collection routes, ensuring timely pickups and reducing the likelihood of missed collections.
6) *Environmental Sustainability:* Smart waste management systems can incorporate recycling and waste-to-energy initiatives, reducing the environmental impact of waste disposal.

III. EXISTING SYSTEM

The existing waste collection system in many municipalities involves manual waste collection, where a garbage collection truck is sent to each home to pick up garbage bags. However, this system has several shortcomings, including the lack of real-time communication with residents and inefficient collection routes. These shortcomings often result in delayed collections, residents throwing trash in open areas, and challenges in coordinating the efforts of municipal workers. The primary issues with the existing system are as follows:

1) *Lack of Timely Communication:* Residents do not have real-time information about the arrival of the garbage collection truck, leading to uncertainty and inconvenience.
2) *Inefficient Routes:* The routes taken by the collection trucks are not always optimized for efficiency, leading to wasted time and resources.
3) *Delayed Collections:* If the garbage collection truck is not on time, residents may not have their trash collected promptly, leading to uncollected waste.
4) *Related Work:* Several research papers and initiatives have explored smart waste management systems and mobile applications in the context of smart cities. These initiatives often focus on improving waste collection efficiency, communication, and engagement with residents. Some notable work includes:
5) *Singapore's Smart Waste Bins:* Singapore has implemented smart waste bins equipped with fill-level sensors that alert waste management teams when bins are full. This data-driven approach optimizes collection routes and reduces unnecessary trips.
6) *Barcelona's Smart City Project:* Barcelona's smart city project involves the use of technology and data-driven approaches for urban management, including waste management. Mobile applications and sensors are used to enhance waste collection and disposal

IV. WORKING

1) *User Registration and Login:* The user downloads and installs the Android application on their mobile device. Upon first use, the user registers an account with their personal details or logs in if they already have an account.

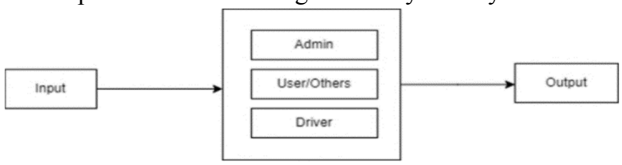


Fig. 1. Registration

2) *Live Tracking of Garbage Collection Trucks:* The application provides real-time tracking of municipal garbage collection trucks using GPS. Users can view the live location of nearby collection trucks on a map within the app.
3) *Notifications and Alerts:* Users receive notifications when a garbage collection truck is approaching their residential area. Notifications may include estimated arrival times and any specific instructions for disposal.
4) *Scheduling Garbage Disposal:* Users can schedule the disposal of their garbage when they receive a notification. This helps residents plan their waste disposal at a convenient time.
5) *User Feedback and Reporting:* Users can provide feedback on the collection process, report any issues, or request special pickups for bulky items or hazardous waste.

6) *Location Services:* The app can use GPS or location-based services to identify the user's location. Geocoding services can be used to translate addresses into coordinates.
7) *Waste Segregation and Guidelines:* Provide information and guidelines on waste segregation, disposal methods, and recycling practices.
8) *Greedy Algorithm:* The goal is to find the most efficient order in which to collect garbage from various locations to minimize travel distance and time.

While there are unvisited collection points:

a) For each vehicle, calculate the total distance if it were to visit the nearest unvisited collection point and then return to the depot.
b) Assign the nearest unvisited collection point to the vehicle that results in the shortest total distance.
c) Update the route and remove the assigned collection point from the unvisited list.

• Repeat this process until all collection points have been visited

9) *Convolutional Neural Networks:* It is a sub-field of deep learning and specialized deep neural networks used for the recognition and classification of images. CNN is used to process the data, which is represented as 2D matrix-like images.

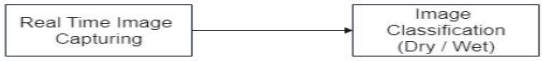


Fig. 2. CNN

V. ARCHITECTURE

The application's architecture is designed to provide a robust and scalable platform for waste management in smart cities. It consists of the following components:

1) *Mobile Application:* The mobile application is the user-facing component of the system. It is available for Android devices and can be easily downloaded and installed from the Google Play Store.

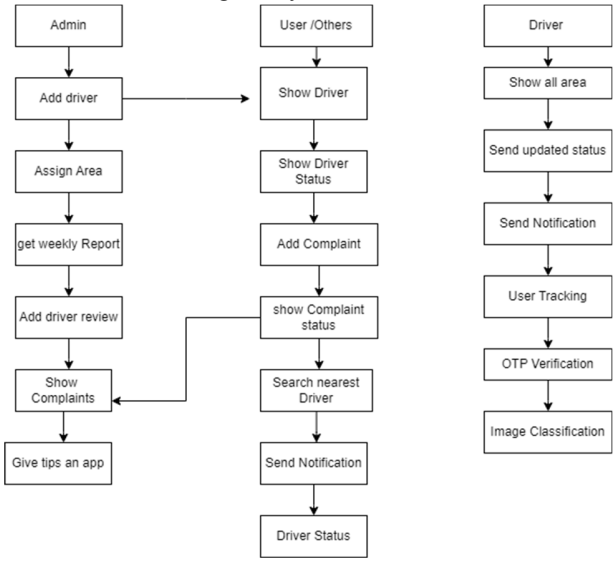


Fig. 3. Architecture of Project

2) *Server Backend:* The application's server backend is hosted on cloud infrastructure and is responsible for processing real-time data, managing notifications, and handling user requests. It also stores and manages data related to waste collection schedules and routes.
3) *Firebase Integration:* The application is seamlessly integrated with Firebase, Google's mobile and web application development platform. Firebase provides authentication, real-time database functionality, and cloud storage, which are crucial for the application's real-time capabilities.
4) *Collection Crew Interface:* Android or web-based interface for collection crews to receive and update pickup assignments.

5) *Functionality:* The "Garbage Collection Android Application" offers a seamless user experience while providing efficient waste management solutions. The typical user flow involves the following steps:

a) *Installation:* Users download and install the application from the Google Play Store.

b) *Registration:* New users are required to create an account, providing essential details such as name, address, and contact information.

c) *Notifications:* Once registered, users receive real-time notifications when garbage collection trucks approach their area. These notifications include estimated arrival times, allowing residents to prepare their waste for pickup.

d) *Reporting:* Users can report issues, such as missed pickups or overflowing bins, directly through the application. This feedback is sent to the responsible authorities for prompt action

e) *Community Engagement:* By actively involving residents in the waste management process, the application promotes a sense of community participation and responsibility.

f) *Notifications Service:* Responsible for sending push notifications to users and collection crews.

g) *Reporting and Analytics:* Collects and analyzes data for optimizing waste collection operations and improving user experience.

h) *Data Analytics:* The system collects data on waste collection activities, resident feedback, and route optimization. This data is analyzed to improve waste management strategies and resource allocation.

VI. ALGORITHM

Greedy Algorithm for Route Optimization:

```
def greedy_garbage_collection_route(locations, starting_location):
    unvisited_locations = locations.copy()
    current_location = starting_location
    route = [current_location]
    while unvisited_locations:
        shortest_distance = float('inf')
        next_location = None
        for location in unvisited_locations:
            distance = calculate_distance(current_location, location)
            if distance < shortest_distance:
                shortest_distance = distance
                next_location = location
        if next_location is not None:
            route.append(next_location)
            current_location = next_location
            unvisited_locations.remove(next_location)
    route.append(starting_location)
    return route
```

VII. CONCLUSION

The development and implementation of an intelligent garbage collection Android application for smart cities represent a significant leap forward in addressing the challenges and inefficiencies plaguing traditional waste management systems. This project, fueled by the convergence of cutting-edge technology and the urgent need for improved urban waste management, introduces a cost-effective, user-friendly, and highly efficient solution.

The intelligent garbage collection Android application for smart cities stands as a pivotal tool in the transformation of waste management.

It not only enriches the lives of residents by providing real-time information and convenience but also contributes to the creation of cleaner, more sustainable, and healthier urban environments.

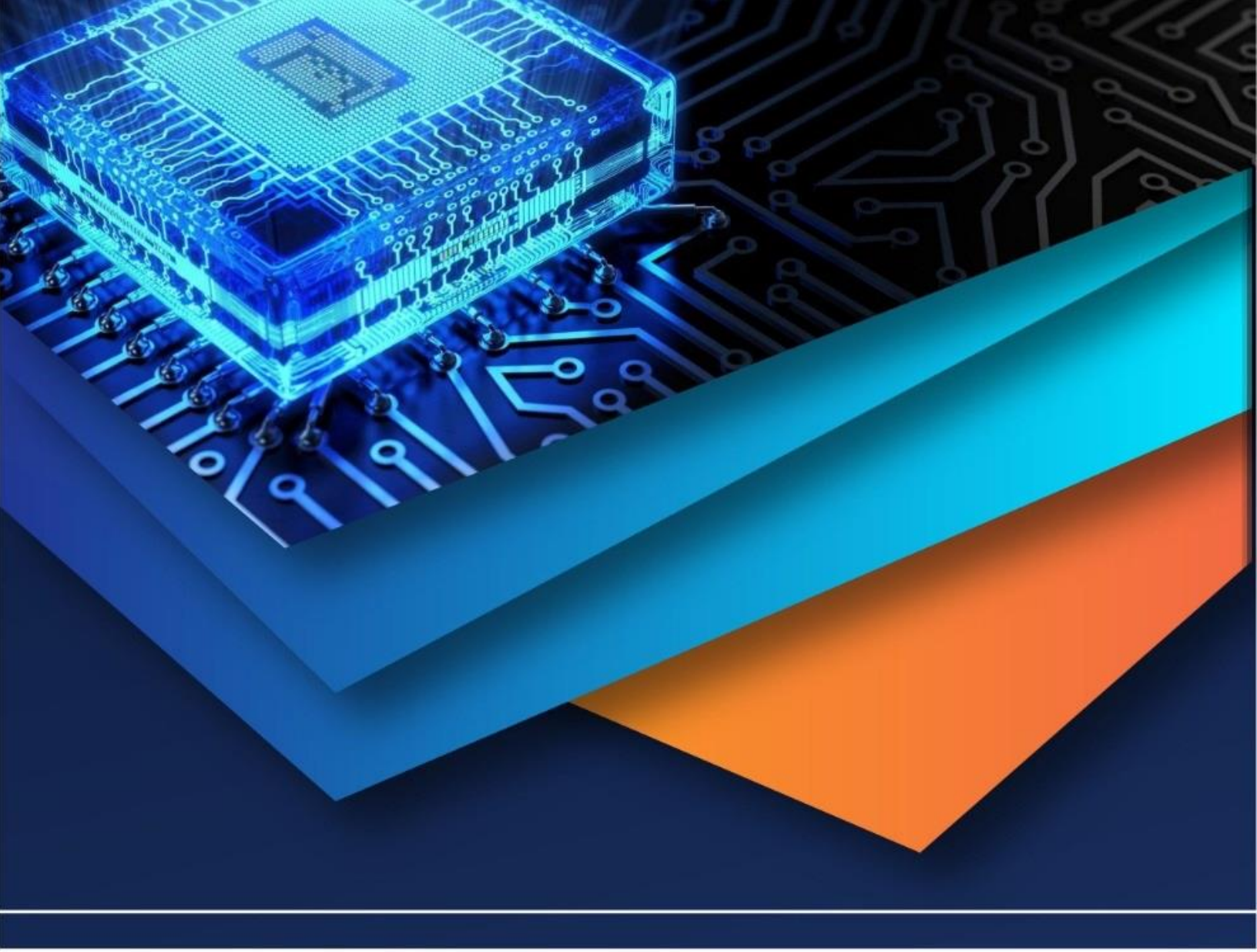
By harnessing the latest technological advancements, this project serves as a blueprint for the future of waste management in rapidly expanding urban areas, where efficiency, user engagement, and environmental responsibility take precedence. This application marks a significant stride toward the development of smarter, more interconnected, and cleaner cities.

VIII. ACKNOWLEDGMENTS

The authors would like to express their gratitude to the faculty at Sinhgad Academy of Engineering for their guidance and support throughout the development of this application. They would also like to thank the residents who participated in the pilot program and provided valuable feedback for system improvement.

REFERENCES

[1] Fadi Aloul and Mamoun Al-Mardini, "A Smart City Application: A Fully Controlled Garbage System," IEEE/RSJ International Conference on Intelligent Robots and Systems (IROS), 2017.
[2] Bin Guo et al., "Design of a Smart Waste Collection System for Smart Cities," IEEE Transactions on Industrial Informatics, 2011.
[3] Dave Hecker and Derek May, "Smart Cities and Their Impact on the Future of E-Waste," IEEE International Symposium on Sustainable Systems and Technology (ISSST), 2017.
[4] Sandra Bruegger and Mohammed Mubarak, "A Smart City Approach for Improved Waste Collection and Waste Management in European Cities," Proceedings of the 2017 Smart City 360° Conference.
[5] Sandeep Nair and Anuradha Daptardar, "Smart Garbage Monitoring and Segregation System for Efficient Recyclable Waste Collection," International Conference on Data Science and Management of Data (ICDSMD), 2019.
[6] Isra'a Alqasem and Seifedine Kadry, "Smart Solid Waste Management System for Smart Cities," IEEE/ACS 15th International Conference on Computer Systems and Applications (AICCSA), 2018
[7] Guo, B., et al. “Design of a Smart Waste Collection System for Smart Cities”. IEEE Transactions on Industrial Informatics, 2011.
[8] Hecker, D., & May, D. “Smart Cities and Their Impact on the Future of E-Waste”. IEEE International Symposium on Sustainable Systems and Technology (ISSST), 2017.
[9] Bruegger, S., & Mubarak, M. “A Smart City Approach for Improved Waste Collection and Waste Management in European Cities”. Proceedings of the 2017 Smart City 360° Conference.
[10] Nair, S., & Daptardar, A. “Smart Garbage Monitoring and Segregation System for Efficient Recyclable Waste Collection”. International Conference on Data Science and Management of Data (ICDSMD), 2019.
[11] Alqasem, I., & Kadry, S. “Smart Solid Waste Management System for Smart Cities”. IEEE/ACS 15th International Conference on Computer Systems and Applications (AICCSA), 2018.
[12] Irfanullah, I. R., & Islam. “A Smart Mobile Application for Solid Waste Management in Smart Cities”. IEEE Region 10 Symposium (TENSYMP), 2018.
[13] Abu-Mahfouz, A. M., & Bajoudah, A. B. “Towards an Intelligent Wireless Sensor Network for Monitoring of Urban Waste Bins”. Sensors, 2015.
[14] Xiao, Y., & Li, X. A “Smart Garbage Collection System for Sustainable Waste Management in Smart Cities”. Sustainability, 11(21), 5953.
[15] Zia, T. A., & Yadav, A. (2016). “A Framework for a Smart City Waste Management System”. Procedia Computer Science, 89, 298-303.
[16] Iraj R. Irfanullah and Mohammad Zahidul Islam, "A Smart Mobile Application for Solid Waste Management in Smart Cities," IEEE Region 10 Symposium (TENSYMP), 20



10.22214/IJRASET

45.98

IMPACT FACTOR: 7.129

IMPACT FACTOR: 7.429

INTERNATIONAL JOURNAL FOR RESEARCH

IN APPLIED SCIENCE & ENGINEERING TECHNOLOGY