



## Plastrack - A Community – Driven Plastic Waste Collection and Redemption Platform

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**ABSTRACT:** This project is a Java-based web application that promotes plastic recycling through Public, Recycle Center, and Admin modules. Users can upload plastic waste details, locate nearby recycling centers, track submissions, and earn reward points redeemable for eco-friendly products. Recycling centers manage waste requests, schedule collections, and update statuses after admin approval. Admins oversee registrations, monitor activities, manage products, and ensure transparency. The system includes a community dashboard showing total waste collected and location-based ratings. By combining technology with incentives, the platform encourages public participation and builds a sustainable, collaborative ecosystem for effective plastic waste management and environmental awareness.

**KEYWORDS:** A Java-based web application for plastic waste management that enables users to upload waste details, connect with nearby recycling centers, track submissions, and earn rewards. It promotes sustainability through gamification, community participation, transparent monitoring, and efficient recycling processes.

### I. INTRODUCTION

Plastic waste is a major environmental issue, with large amounts polluting land, water, and ecosystems. Non-biodegradable plastics harm marine life and break into microplastics, posing risks to human health. Current waste management systems lack efficiency, transparency, and public involvement, leading to poor recycling rates. This project proposes a Java-based web application connecting users, recycling centers, and administrators. Users can upload waste details, find nearby centers, and track submissions. A gamified reward system encourages participation by offering points redeemable for eco-friendly products. The platform improves coordination, transparency, and engagement, promoting sustainable plastic waste management and active community involvement.

### II. LITERATURE SURVEY

Alejandro Mendoza Barrionuevo et al. proposed an intelligent plastic waste collection system using heterogeneous autonomous surface vehicles combined with deep reinforcement learning. This system improves waste collection efficiency by enabling cooperation between multiple autonomous agents, reducing energy consumption and operational time. However, the approach faces challenges such as high computational requirements and real-world implementation difficulties.

Saumya Hegde et al. introduced a smart waste management framework that integrates carbon emission analysis with machine learning-based object detection. The system identifies different types of waste materials and evaluates their environmental impact, helping in decision-making for sustainable waste handling. Despite its advantages, the model depends heavily on data quality and requires high computational resources.

Sirajam Munira et al. developed an intelligent recycling bin using image processing and embedded systems to automatically detect plastic bottles and reward users for recycling. This system promotes environmental awareness and improves recycling efficiency. However, limitations include high installation cost, maintenance requirements, and dependency on continuous power supply.



Yanhong He et al. proposed an intelligent supervision system for waste collection and transportation using an improved YOLOv3 deep learning model. The system enhances detection accuracy and enables real-time monitoring of waste management activities. Nevertheless, it requires powerful hardware and may face performance issues under adverse environmental conditions.

Robert Procházka et al. presented a hybrid waste sorting system combining automated and manual methods to improve plastic waste separation. The integration of both methods increases sorting accuracy and efficiency. However, the system involves higher operational costs and complexity in implementation.

### III. THEORETICAL BACKGROUND

#### PROBLEM IDENTIFICATION

Plastic waste management has become a serious environmental issue due to the increasing use of non-biodegradable materials and improper disposal, leading to pollution and harm to ecosystems and human health. Existing systems are inefficient, lack transparency, and rely heavily on manual administrative processes, causing delays and reducing overall effectiveness. Additionally, these systems depend on stable internet connectivity and hardware components, which may not be reliable in all areas, and they often suffer from security vulnerabilities that affect data protection. Limited public awareness and the absence of incentive-based mechanisms further reduce user participation in recycling activities, resulting in low recycling rates. These challenges highlight the need for a secure, efficient, and user-friendly platform that improves transparency, enhances coordination between stakeholders, motivates users through rewards, and ensures effective and sustainable plastic waste management.

#### PROBLEM SOLVING

The proposed system solves the challenges of plastic waste management by providing a secure, efficient, and user-friendly Java-based web application that connects users, recycling centers, and administrators on a single platform. It allows users to upload waste details, find nearby recycling centers using location-based services, and track their submissions in real time, thereby improving transparency and reducing delays caused by manual processes. To increase user participation, the system includes a reward-based mechanism where users earn credit points for contributing plastic waste, which can be redeemed for eco-friendly products. The platform also ensures better security through authentication and data validation. Recycling centers can manage requests, schedule pickups, and update statuses efficiently, while the admin monitors the entire system for smooth operation. Overall, the system enhances coordination, transparency, and user engagement, providing a sustainable and scalable solution for effective plastic waste management.

#### SYSTEM ARCHITECTURE

The plastic waste recycling web application is designed using a scalable, secure, and efficient three-tier architecture consisting of the presentation layer, business logic layer, and database layer to ensure smooth coordination between public users, recycling centres, and administrators. The presentation layer serves as the user interface accessible through web browsers, allowing public users to register, upload plastic waste details, schedule pickups, track request status, and redeem credit points for eco-friendly products, while recycling centres manage collection requests and update statuses, and administrators monitor overall system operations through a centralized dashboard. The business logic layer functions as the core processing unit, handling request management, validation, credit point calculation based on waste type and quantity, approval workflows, eco-friendly product transactions, and enforcement of system policies to ensure secure and accurate communication among all stakeholders. The database layer securely stores structured information including user profiles, recycling centre data, waste request records, credit point balances, transaction histories, and product inventories, ensuring data integrity and efficient retrieval. In addition, the system integrates a location-based service module that matches users with nearby recycling centres to optimize collection efficiency and reduce transportation time, along with a community module that provides dashboards displaying total plastic waste collected, regional participation statistics, and performance ratings to promote transparency and user engagement. Overall, this layered architecture enhances modularity, security, scalability, and efficient management of the entire recycling ecosystem while supporting sustainable environmental practices.



## IV. SYSTEM IMPLEMENTATION

### MODULES:

1. User Login
2. Administrative Login
3. Recycle Centre
4. Community

#### 1. User Login

The public module is designed to engage ordinary users in the plastic recycling process. Users can register and log in to the system to upload images and details of the plastic waste they wish to recycle. Based on their geographic location, they are guided to nearby registered recycling centres for submission. The module allows users to track the status of their waste requests, ensuring transparency in collection and processing. Additionally, it incorporates a gamified system where users earn credit points for the quantity of plastic waste they contribute. These points can be redeemed for discounts on eco-friendly products, motivating individuals to participate actively in recycling initiatives. This module serves as the primary interface connecting citizens to recycling centres and promoting environmentally responsible behaviour.

#### 2. Administrative Login

The admin module provides centralized control and oversight for the entire system. Administrators can log in to approve recycling center registrations, manage user and center lists, monitor plastic waste collection details, and upload eco-friendly products to the marketplace. They also oversee transaction histories and waste exchange details to ensure transparency, accountability, and smooth operation of the platform. The admin module acts as the backbone of the system, managing all critical operations and ensuring compliance with established processes.

#### 3. Recycle Centre

The recycle center module facilitates the management of registered recycling facilities within the system. Recycling centers can register by providing their center details and location, which requires approval from the admin to ensure



authenticity. Once approved, centers gain access to public waste requests in their vicinity, allowing them to accept requests, schedule pickups, and update the status of collected materials. Verified waste quantities submitted by the center result in credit points being awarded to the respective public users. This module ensures efficient coordination between waste generators and recycling facilities while maintaining accurate tracking of the collection process.

#### 4. Community

The Community Module plays a vital role in promoting environmental awareness and encouraging active participation in plastic waste recycling initiatives. It provides a comprehensive and collective view of recycling activities by displaying the total amount of plastic waste collected in kilograms across different regions. This transparent presentation of data helps users understand the broader environmental impact of their contributions. One of the key features of this module is the location-wise rating system, which evaluates and ranks regions based on their recycling performance and level of participation. This ranking mechanism motivates users and communities to improve their efforts and increase their contributions.

By highlighting regional achievements and showcasing top-performing areas, the module fosters healthy competition among users and communities. At the same time, it promotes collaboration by encouraging individuals to work together toward common sustainability goals. The visual representation of progress, such as cumulative waste collection metrics and performance indicators, enhances user engagement and awareness. Overall, the Community Module strengthens public responsibility, boosts motivation, and emphasizes the positive environmental impact achieved through collective recycling efforts and active community involvement.

#### V. RESULT



Fig.2 Home Page

This fig.2 shows the EcoCycle homepage with navigation options for users, recycling centers, and admin. It includes a welcome message, system purpose, and a “Get Started” button for easy access.

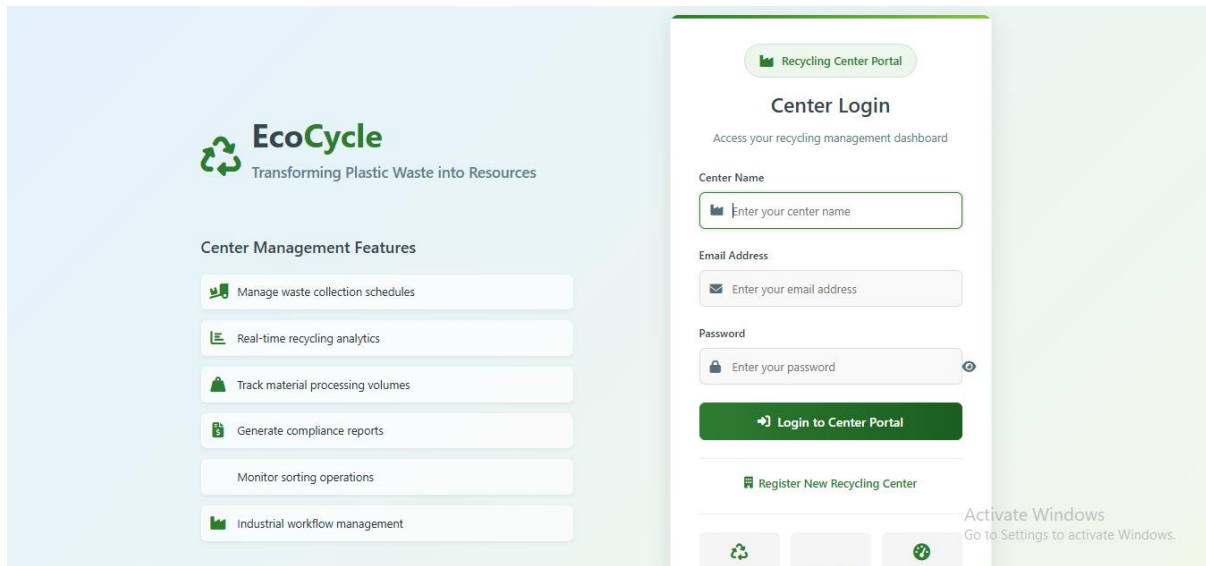


Fig.3 Center Login Page

This fig.3 shows the EcoCycle Recycling Center login page with fields for center name, email, and password, along with features like waste tracking, analytics, scheduling, and industrial workflow management.

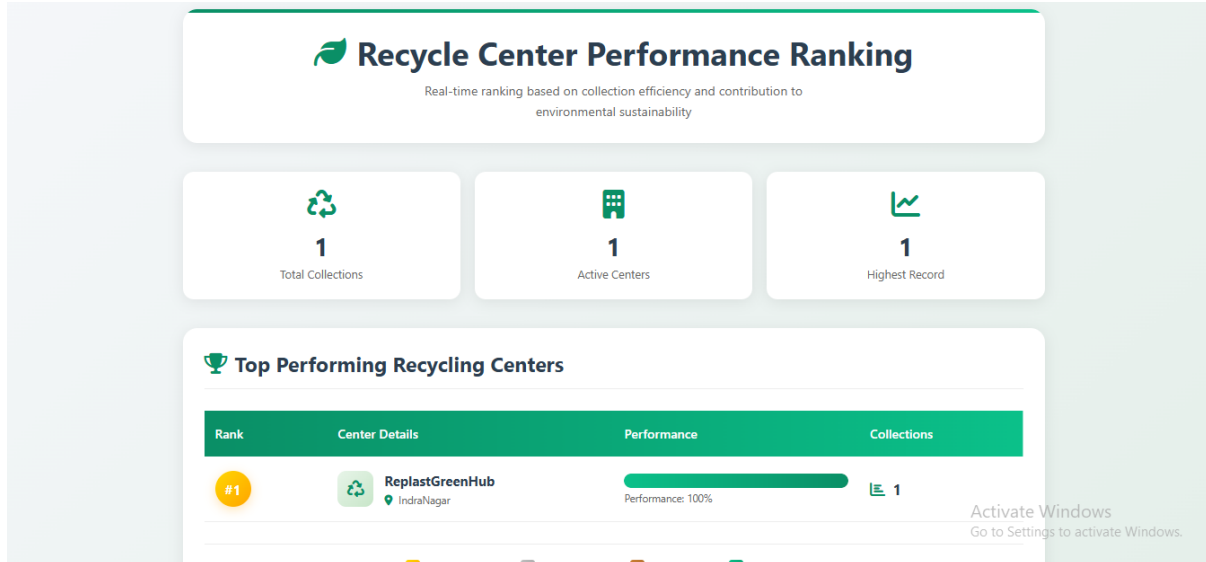


Fig.4. Recycle Center Performance Ranking

This fig.4 shows the recycling center performance ranking dashboard, displaying total collections, active centers, highest records, and a leaderboard of top-performing centers based on efficiency and contributions to sustainability.

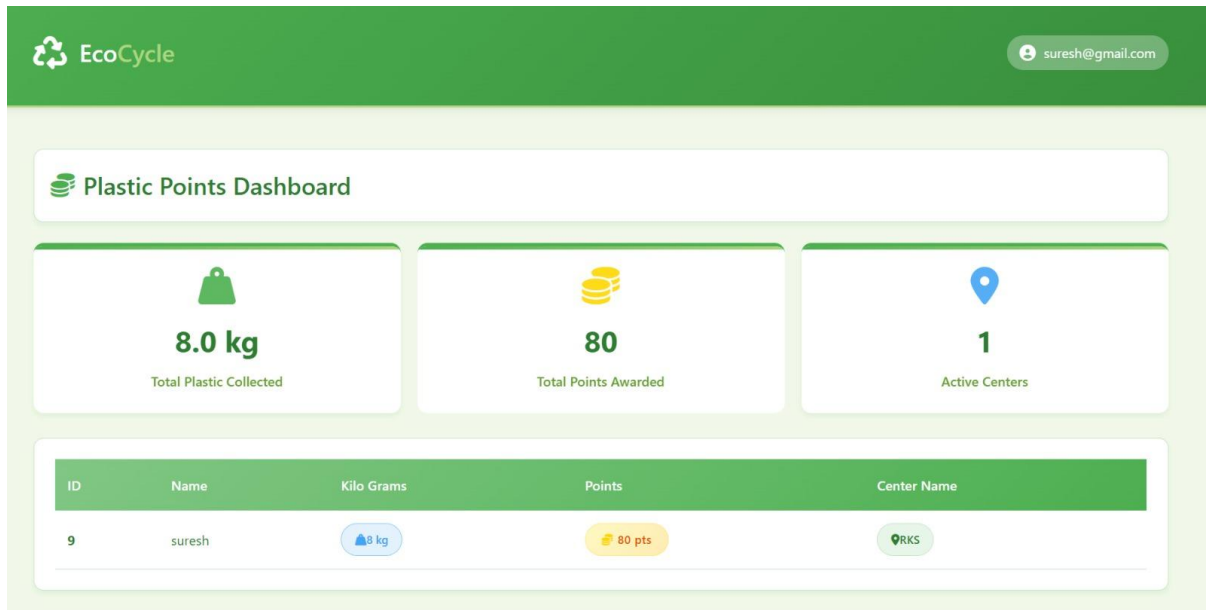


Fig.5. Plastic Points Dashboard

This fig.5 shows the Plastic Points Dashboard displaying total plastic collected, points earned, and active centers, along with user contribution details including kilograms submitted, points received, and assigned recycling center.

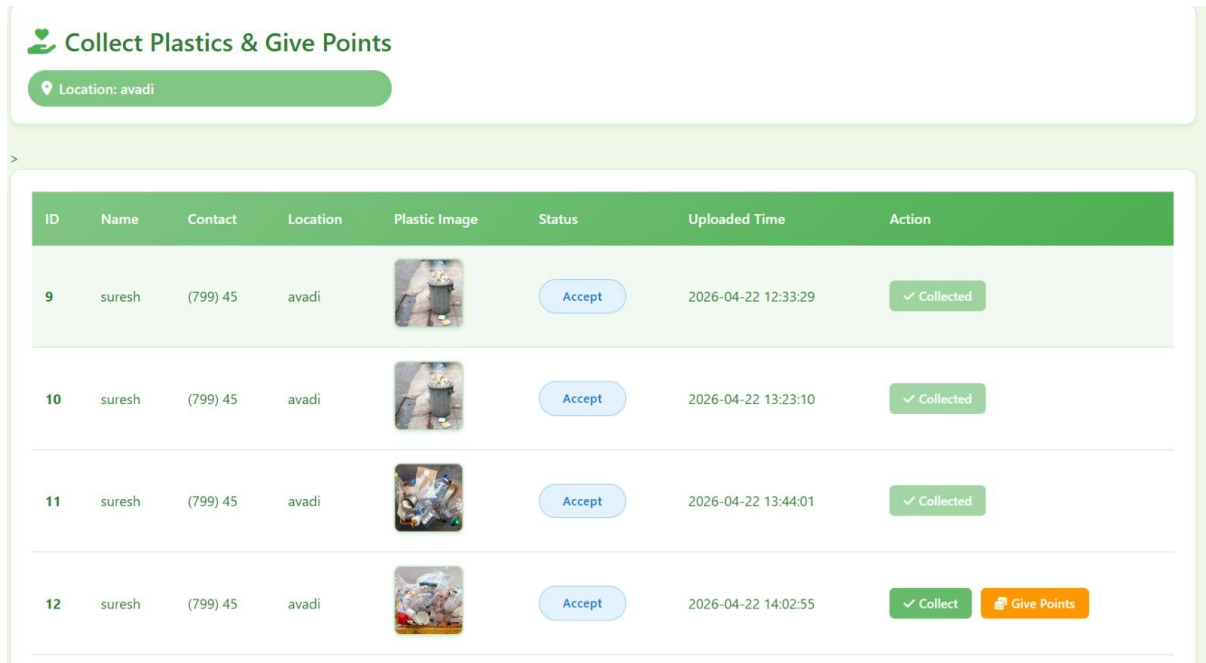


Fig.6. Collect Plastics & Give Points

This fig.6 shows the plastic collection management interface where recycling centers view user submissions, accept requests, track status, verify waste images, and update actions like collection and reward point allocation.

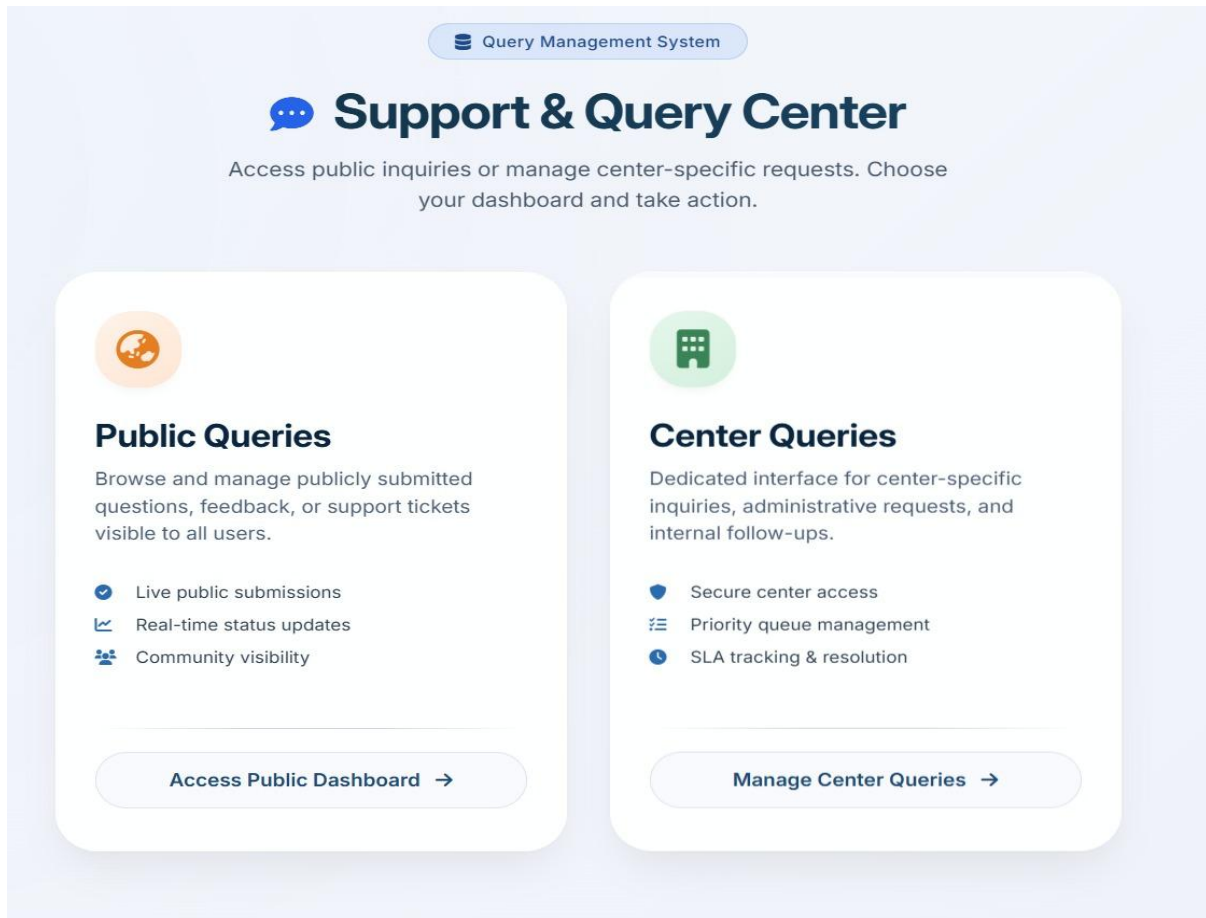


Fig.7. Support and Query Center

This fig.7 shows the Support & Query Center interface, providing options to manage public queries and center-specific requests, enabling users and recycling centers to track issues, updates, and support activities efficiently.

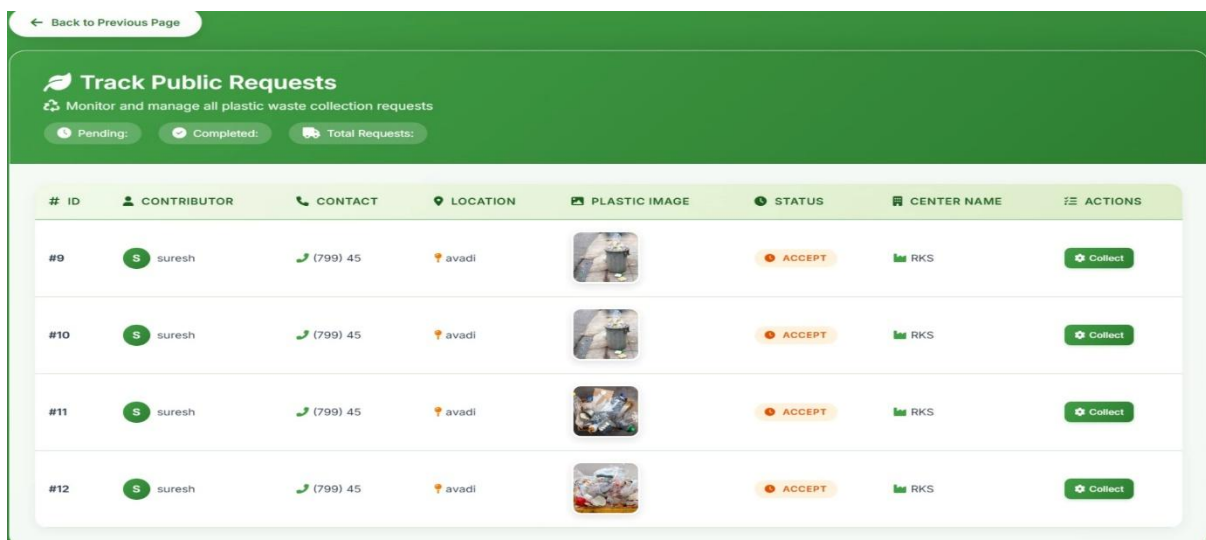


Fig.8.Track Public Requests



This fig.8 shows the public request tracking dashboard where recycling centers monitor user submissions, view details like contact, location, and images, track status, and perform actions such as accepting and collecting waste.

## VI. CONCLUSION & FUTURE ENHANCEMENT

The Plastitrack system offers an innovative solution to plastic waste management by integrating modern web technologies with community participation. It connects users, recycling centers, and administrators on a unified platform, enabling users to register, upload waste details, and locate nearby recycling centers easily. A reward-based system encourages active participation by offering credit points redeemable for eco-friendly products. The platform ensures transparency through real-time tracking and administrative monitoring, improving accountability. Built using technologies like Java, JSP, and database systems, it provides a scalable and efficient solution. Modules such as public, recycle center, admin, and community ensure organized operations and clear responsibilities. Features like waste tracking, collection management, and community dashboards promote awareness and collective responsibility. Its flexible design allows future enhancements and expansion. Overall, Plastitrack simplifies recycling, promotes environmental consciousness, supports sustainable development, and contributes to a cleaner, greener, and more responsible society.

The system can be further enhanced by integrating advanced technologies such as artificial intelligence and machine learning for automatic plastic waste classification and image-based detection, improving accuracy and efficiency. A mobile application version can be developed to increase accessibility and user engagement. Real-time GPS tracking can be added for efficient waste collection and route optimization. The platform can also be expanded to support multiple types of waste such as e-waste and organic waste. Additionally, implementing stronger security features, cloud integration for scalability, and IoT-based smart bins can improve performance and automation. These enhancements will make the system more intelligent, scalable, and suitable for smart city applications.

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