



Hackathon Research Work

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Features of the application

User Registration & Profile Management

- Easy **sign-up/login** using **email, phone number, or social media**
- Users can **set their address, waste type preferences**.

Garbage collector Registration

- Easy **sign-up/login** using **email, phone number for ID verification**.
- Login credentials to access their dashboard.
- Assigned pickups & Route optimization - View a list of scheduled pickups for the day, GPS-based optimized routes for efficient collection.

User Interface & Experience Design

- **Elegant and intuitive UI** for easy navigation.
- **Clean layout** for an enhanced experience.

Subscription Plans

- Flexible plans: **Basic (weekly), Standard (twice a week), Premium (daily + on-demand)**
- **Pay-per-pickup** option for non-regular users

Garbage Collection Scheduling

- **Automated Scheduled Pickups** based on user subscription plan
- **Flexible Time Slots** allowing users to choose convenient pickup timings (Morning and Evening Timing)
- **Rescheduling Option** in case of unavailability and one day before the pickup they **delete** it as well.
- **Real-Time Notifications** for upcoming pickups and confirmations

Real-time Pickup Tracking

- **Estimated Time of Arrival (ETA)** updates for users.
- **Driver Updates** – View assigned driver information and current pickup status
- **Notification Alerts** – Receive updates when the vehicle is nearby or delayed.

Payment Integration

- **Secure Transactions** – Encrypted payments ensuring data safety
- **Multiple Payment Options** – UPI, Credit/Debit Cards, Mobile Wallets, Net Banking
- **Pay-Per-Pickup Option** – Flexible payment for occasional users

Reward System & Community Engagement

- **Billing History** – Users can track payments.

AI-Powered Chatbot System

- **24/7 Instant Support** – Users can get quick answers to their queries anytime
- **Subscription Assistance** – Helps with payment issues, plan details, and updates.
- **Pickup Scheduling Support** – Assists users in rescheduling pickups
- **Waste Segregation Guidance** – Provides information on proper waste disposal practices
- **Multi-Language Support** – Ensures accessibility for a diverse user base

Reward system

- Users earn **Eco-Points** for timely waste segregation. On 100 **Eco-Points** user will get a 25% discount.

Waste Segregation Guidelines

- **Category-Based Sorting** – Organic, Recyclable, Hazardous, and General Waste
- **Color-Coded Bins** – Follow app instructions for proper disposal
- **Mandatory Compliance** – Pickup may be refused for unsegregated waste
- **Reminder Alerts** – App notifies users to sort waste before collection
- **Educational Tips** – In-app guides to improve waste management practices

Enhanced Accessibility for People with Disabilities

- **Text-to-Speech (Read Aloud Option)** – Converts on-screen text into speech and helps provide audio assistance for visually impaired users to navigate the app.

How it works?

Database Design for User Management and Scheduling

1. User Side

- **Garbage Collected History:** Stores timestamps, waste categories (dry/wet/recyclable), and weights of disposed waste for each pickup, linked to the user's subscription ID.
- **Subscription Type:** Tracks active plans (monthly), payment status, start/end dates, and auto-renewal preferences.
- **Pickup Schedule Table:** Defines user-specific pickup days, times, and frequencies, synced with garbage collectors' schedules.
- **Eco Points:** Manages reward points earned for proper waste disposal, redeemable for discounts or perks.
- **Reports/Complaints:** in case the users find improper dispose of waste they may flag the issue by sending the picture and the location in the complaints

portal. The concerned collectors will reach there and collect it on time.

- **Chat History of the ChatBot:** Archives interactions with the AI chatbot, including queries about waste segregation, pickup delays, or payment issues.
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2. Garbage Collector Side

- **Pickup Location/Schedule Table:** Assigns daily routes with geocoded addresses, time slots, and task statuses (completed/pending) for each collector.
 - **User Data:** Stores collector profiles (name, contact, vehicle details) and work history (total pickups, attendance records).
 - **Reports:** Logs performance metrics (on-time pickups, user ratings) and operational issues (vehicle breakdowns, route delays).
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3. Payment Gateway Integration

The app integrates **Razorpay SDK** to support UPI, credit/debit cards, and net banking. Key steps include:

- **Plan Selection:** Users choose a subscription tier, triggering a payment request.
 - **Tokenization:** Sensitive card details are encrypted and tokenized to comply with PCI-DSS standards.
 - **Auto-Renewal:** Recurring payments are automated using subscription APIs, with reminders sent before deductions.
 - **Confirmation:** Successful transactions generate invoices stored in the Payment History Table.
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4. GPS Tracking Implementation

GPS Tracking Implementation

The application integrates **Google Maps SDK** and **Google Directions API** to enable real-time GPS tracking for garbage collection vehicles. Collectors access a dedicated driver app that displays their assigned pickup routes as geocoded

markers on an interactive map, dynamically updated every 30 seconds via coordinates stored in Firestore.

The system auto-generates optimized routes to minimize travel time between pickup points, providing turn-by-turn navigation guidance. Geofencing triggers proximity alerts when vehicles approach a pickup location (within 500 meters), notifying both collectors and users. Offline functionality ensures route data and maps remain accessible during connectivity gaps, with cached GPS coordinates syncing to Firestore once restored. All location data is encrypted (AES-256) during transmission and storage, maintaining privacy while enhancing operational efficiency and transparency.

5. Push Notification System

Firebase Cloud Messaging (FCM) delivers timely alerts:

- **Scheduled Reminders:** Users receive notifications when the pickup slot starts. For example, If some Books the morning slot then They will receive notification 15min before the slot begins.
- **Payment Alerts:** Automated reminders for upcoming subscription renewals.
- **Emergency Updates:** Instant alerts confirm emergency pickup requests or delays.

Technical Approach

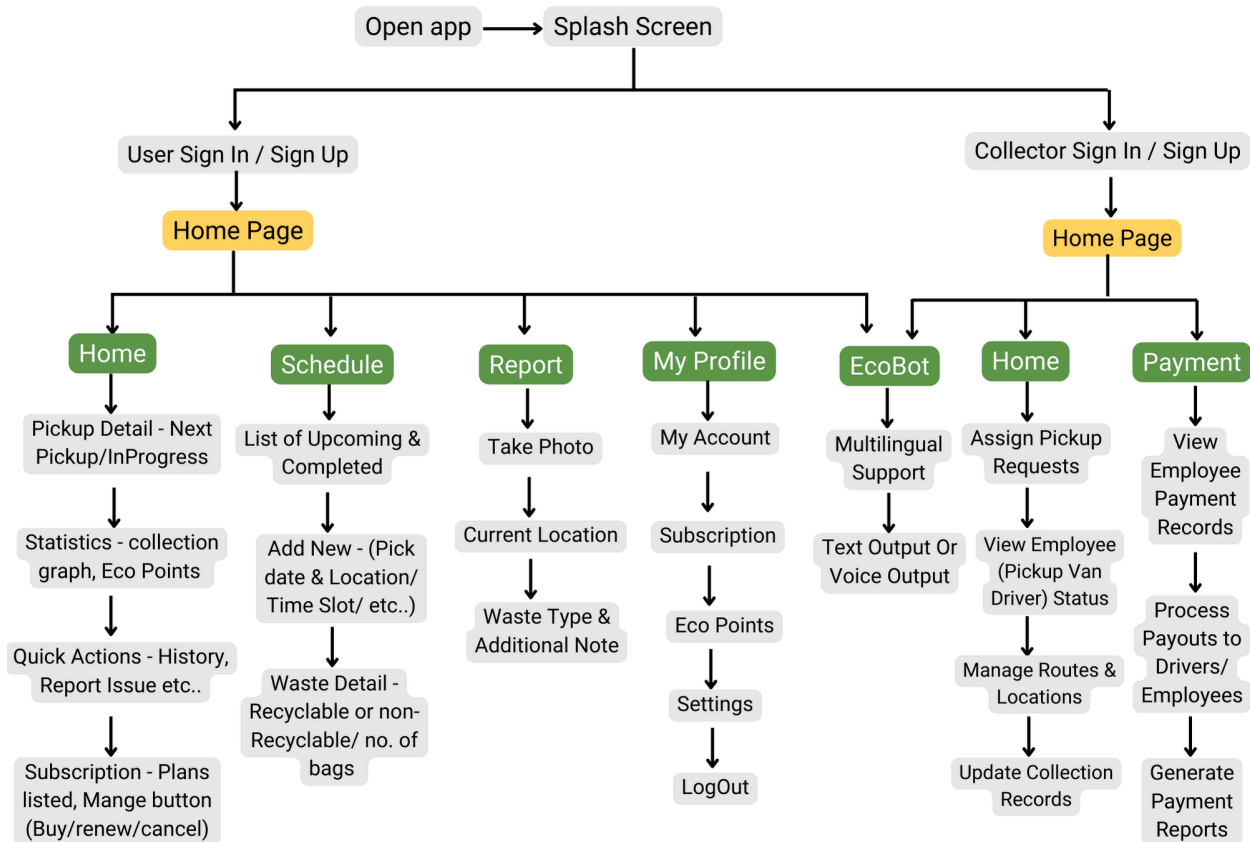
Tech Stack

Programing Language: Python

Database: Firebase

Library/frameworks: Flutter, Flask API, Razorpay, Google Map API, ChatGPT API

Flowchart



Viability

Market Demand

Urban Waste Challenges

- **Rapid Urbanization:** The growing urban population has led to a significant increase in waste generation, necessitating efficient and sustainable waste management solutions.

Consumer Behavior Trends

- **Demand for Convenience:** Consumers increasingly prefer reliable and convenient waste management services, highlighting the need for innovative solutions.

Government Initiatives

- **Policy Support:** Programs like *Swachh Bharat Abhiyan* and stringent environmental regulations are driving the adoption of innovative waste disposal solutions¹².

Competitive Analysis

Market Gap Identification

- **Unaddressed Needs:** Current quick-commerce platforms do not directly cater to household waste management, leaving a gap in the market for specialized services.

Unique Selling Proposition (USP)

- **Emergency Pickups:** The app differentiates itself by offering on-demand emergency waste pickups, addressing an unmet consumer need.

Revenue Model

Subscription-Based Income

- **Monthly Plans:** Tiered pricing options provide predictable revenue streams while catering to different customer needs.

Add-On Services

- **Emergency Pickups:** Monetization opportunities arise from offering premium services like on-demand pickups.

Corporate Partnerships

- **Bulk Subscriptions:** Collaborating with residential societies can lead to large-scale adoption and increased revenue.

Cost Structure

Operational Expenses

- **Key Costs:** Recurring expenses include salaries, fuel, vehicle maintenance, and customer service infrastructure.

Scalability

Regional Expansion Strategy

- **Phased Growth:** Initial focus on Tier 1 cities with expansion guided by demand analytics ensures efficient scaling.

Cross-Sector Collaboration

- **NGO Partnerships:** Collaborations with NGOs can amplify reach, enhance credibility, and support community-driven initiatives.
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Subscription Plans:

Plan Name	Pick Ups (per week)	Price/month
Gold	7	199
Silver	4	119
Bronze	2	59

Feasibility

Urban Waste Challenges

- Rapid urbanization increases waste generation, creating demand for efficient solutions.
- Consumers prefer convenient and reliable services, which the app can deliver.

Government Support

- Aligns with initiatives like Swachh Bharat Abhiyan, gaining credibility and support.
- Encourages adoption through alignment with cleanliness programs.

Market Positioning

- Fills gaps left by quick-commerce platforms by focusing on household waste.
- Emergency pickups differentiate the app from competitors.

Revenue Streams

- Subscription plans ensure predictable income with tiered options.
- Add-on services like emergency pickups provide extra revenue opportunities.

Scalability

- Start in Tier 1 cities and expand based on demand analytics.
- Partner with NGOs and governments to amplify reach and credibility.

Job Creation

- Creates jobs for low-skilled workers (e.g., collection assistants, customer support).
- Engages communities through educational campaigns on waste disposal.

Social Impact

- Promotes sustainable waste habits, contributing to environmental conservation.
 - Empowers informal workers by formalizing their roles in waste management.
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Impacts & Benefits

Impact & Benefits

Environmental Impact

- **Reduction in Landfill Overflow:** Proper segregation can divert up to 40% of waste from landfills, significantly reducing the pressure on these sites.
- **Cleaner Urban Ecosystems:** Scheduled pickups help minimize littering and pollution in public spaces, leading to healthier urban environments.
- **Carbon Footprint Mitigation:** Optimized collection routes lower greenhouse gas emissions associated with waste management, contributing to climate change mitigation.

Community Health

- **Disease Prevention:** Proper waste disposal practices minimize breeding grounds for disease-carrying pests, enhancing public health.
- **Improved Air Quality:** Reducing open dumping curbs harmful emissions, which in turn enhances respiratory health for community members.

Economic Benefits

- **Job Creation Across Sectors:** The implementation of this app generates employment opportunities in various roles within the waste management sector, boosting local economies.
- **Savings for Municipal Bodies:** Efficient private-sector involvement reduces the burden on municipal resources, allowing for better allocation of funds.
- **Circular Economy Promotion:** Encouraging recycling supports industries that rely on recycled materials, fostering sustainable economic practices.

Social Engagement

- **Behavioral Change Among Residents:** Regular reminders and notifications instill long-term waste segregation habits among residents, promoting a culture of sustainability.
- **Community Collaboration Opportunities:** The app fosters partnerships among households and local authorities, enhancing community efforts towards cleanliness and environmental stewardship.

Educational Opportunities

- **Awareness Campaigns via App Features:** Interactive tutorials within the app educate users about sustainable practices and the importance of waste management.
- **Youth Engagement Programs:** Collaborations with schools promote eco-consciousness through app-driven initiatives, inspiring the next generation to adopt sustainable habits.

Technological Advancement

- **Data Analytics for Policy Making:** Real-time data collected through the app informs government policies for better resource allocation and waste management strategies.
- **Integration with Smart City Frameworks:** The app aligns with smart city initiatives by utilizing IoT devices for efficient urban waste management.

Long-Term Societal Impact

- **Enhanced Civic Pride:** A cleaner city fosters pride among residents, which can attract tourism and investment, further benefiting the local economy.
- **Environmental Legacy Creation:** By embedding sustainability into daily life, we contribute to a greener future for generations to come, ensuring a lasting positive impact on the environment.