UE22CS352B - Object Oriented Analysis & Design

Mini Project Report

Title : SMART WASTE MANAGEMENT SYSTEM

Submitted by:

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Semester Section

Facultly Name

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DEPARTMENT OF COMPUTER SCIENCE AND ENGINEERING
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PES UNIVERSITY
(Established under Karnataka Act No. 16 of 2013)

PROBLEM STATEMENT:

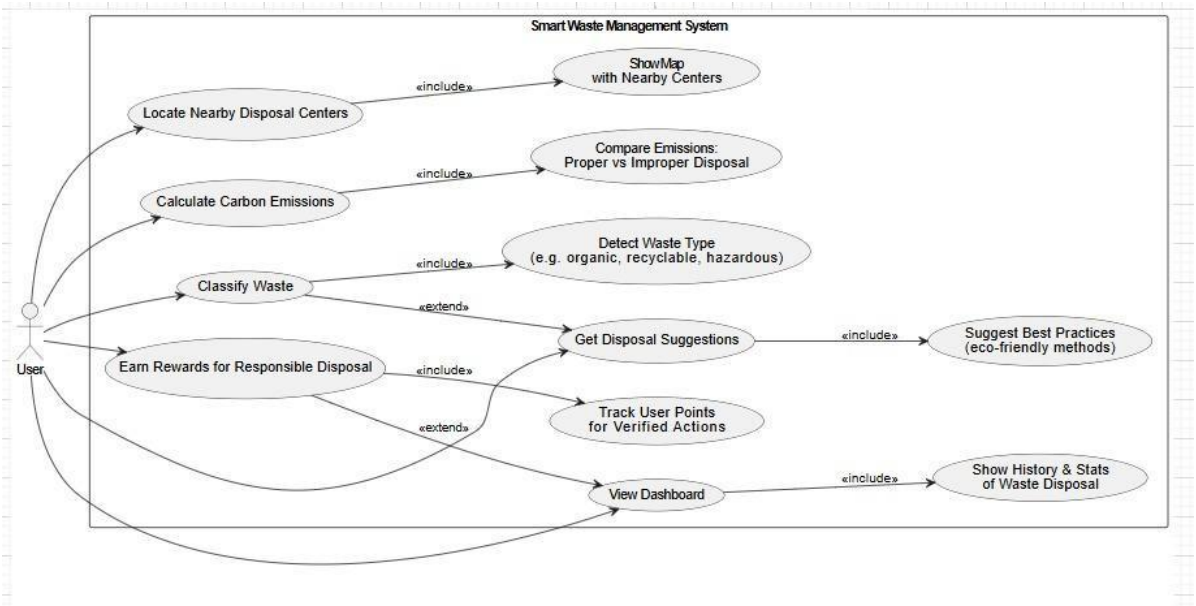
Improper waste disposal leads to environmental degradation and public health hazards. There is a lack of awareness, infrastructure, and incentives for proper waste segregation and disposal. This project aims to assist users in identifying, managing, and disposing of waste responsibly by leveraging technology, providing location-based services, and rewarding good practices.

KEY FEATURES:

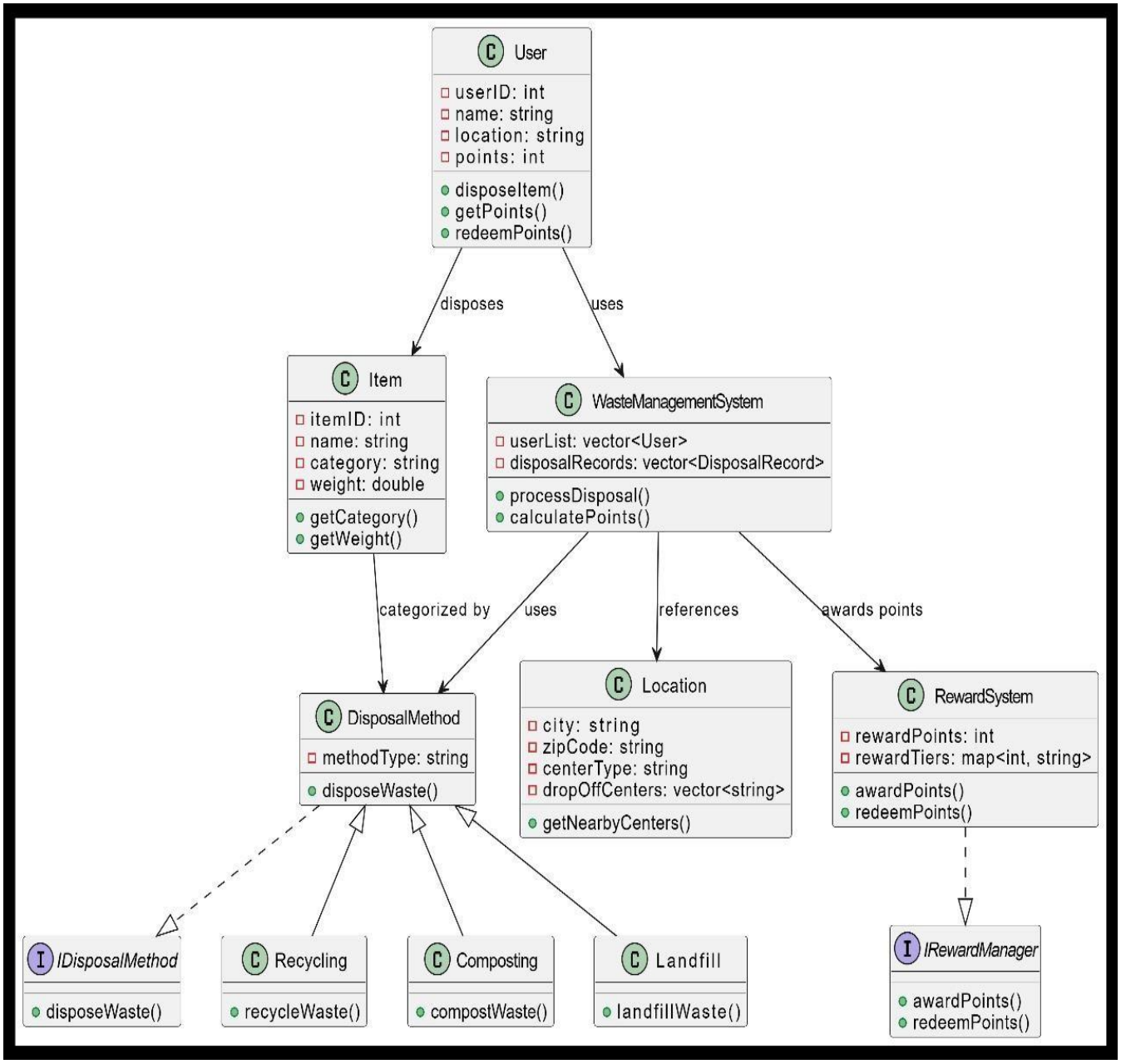
- Smart classification of waste into recyclable, organic, hazardous, or general.
- Suggestions for proper and eco-friendly disposal methods.
- Location-based discovery of nearby recycling and composting centers.
- Reward system granting points for verified responsible disposal.
- User dashboard to track personal disposal history and impact.
- Carbon Emission Calculator to estimate environmental benefit of proper waste management.

MODELS:

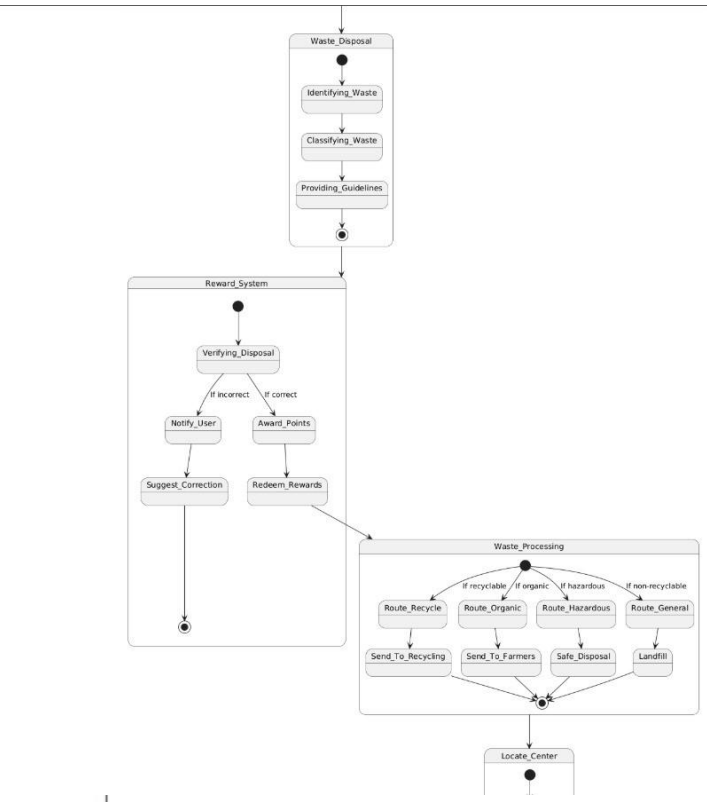
USE-CASE DIAGRAM:

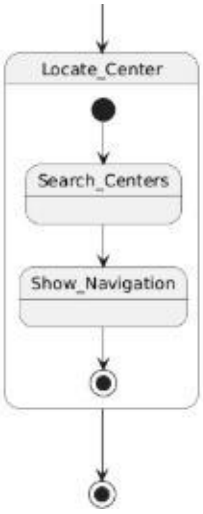


CLASS DIAGRAM:



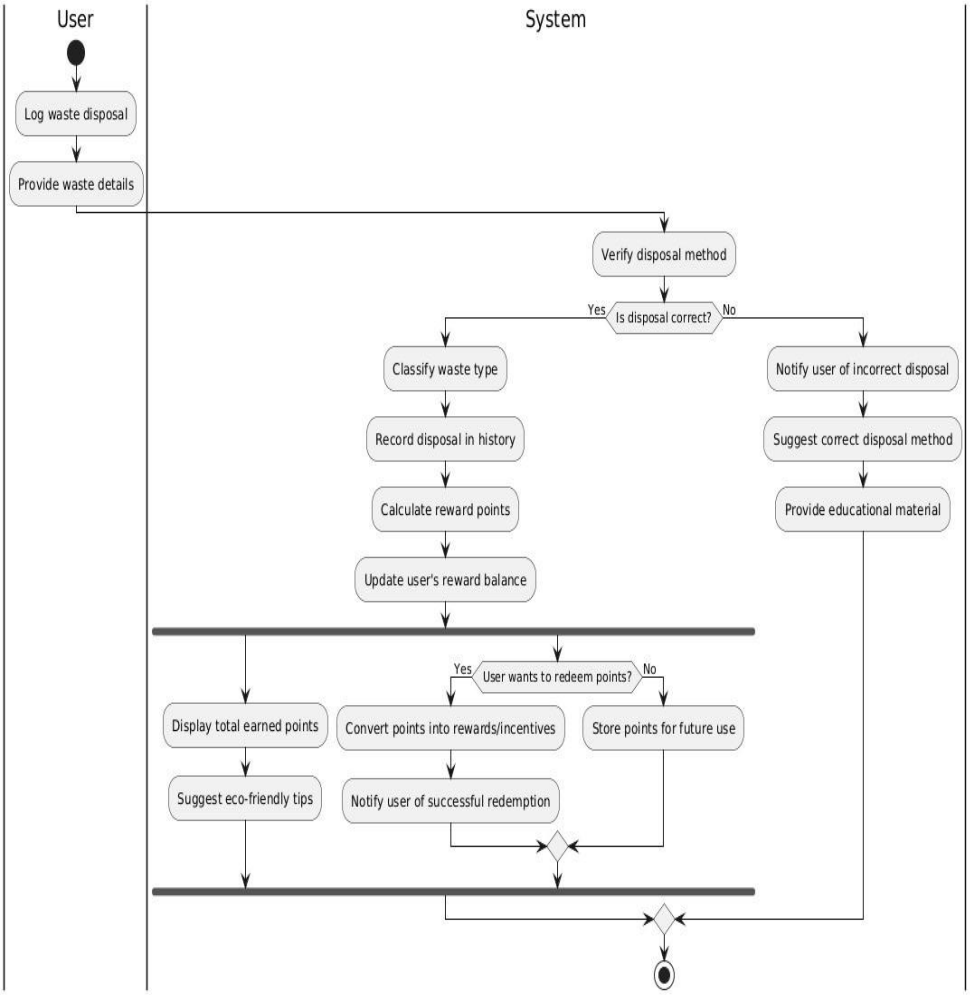
STATE DIAGRAM:



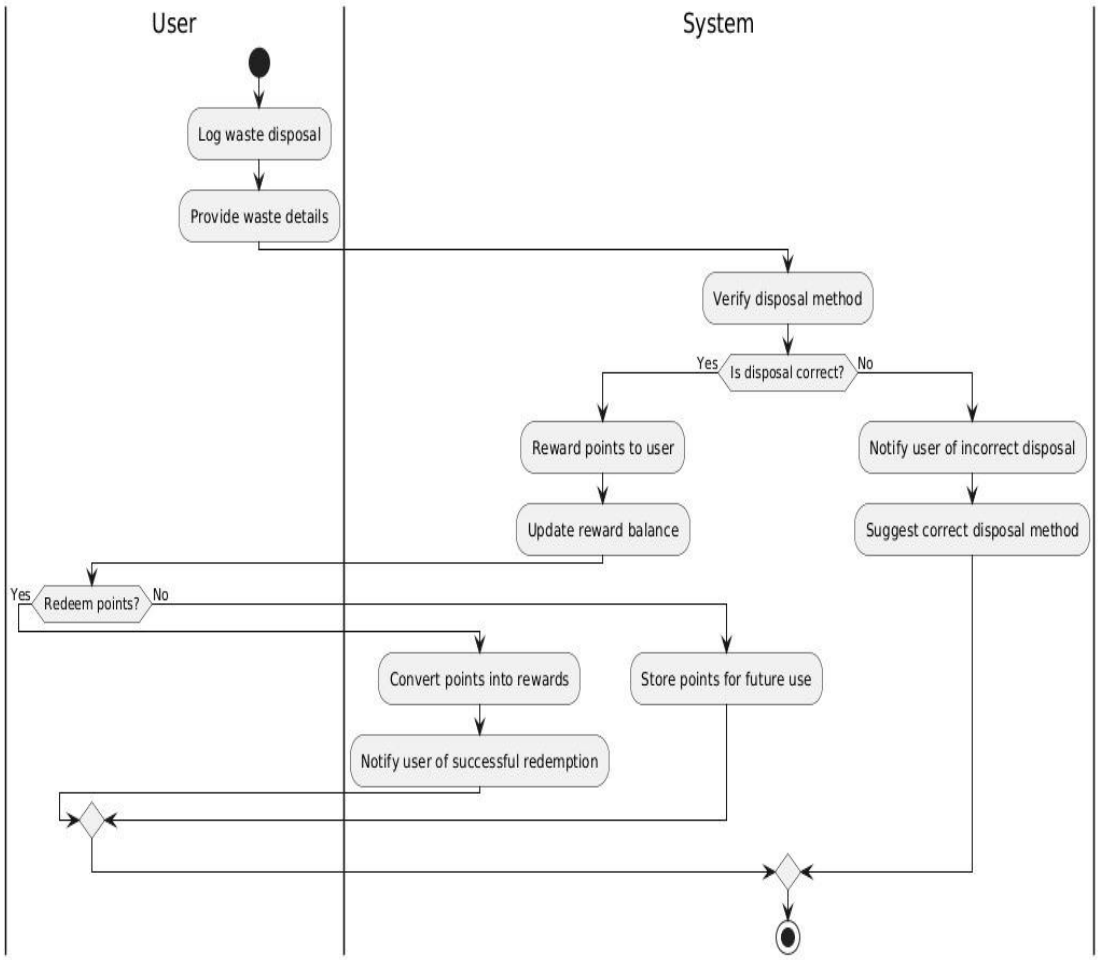


ACTIVITY DIAGRAM:

1. MAJOR USE-CASE:



2. MINOR USE-CASE:



Architecture Patterns, Design Principles & Design Patterns:

Architecture Pattern: Model–View–Controller (MVC)

Model:

- Represents data layer.
- E.g., WastePickup entity, connected via Spring Data JPA (WastePickupRepository).

View:

- UI elements (e.g., Thymeleaf templates) for data presentation and input capture.

Controller:

- Handles HTTP requests and maps them to services.
- E.g., WastePickupCreateController, WastePickupViewController.

Service Layer:

- Acts as intermediary applying business logic.

Design Principles:

1. **Single Responsibility Principle (SRP)**
   Each controller handles one task (Create, Delete, Edit, View).
2. **Open/Closed Principle (OCP)**
   FilteredWastePickupServiceImpl uses Factory Pattern to support easy extension.
3. **Liskov Substitution Principle (LSP)**
   Interfaces ensure interchangeable service implementations.
4. **Interface-Based Dependency**
   Abstractions are used for loose coupling and better testability.

Design Patterns:

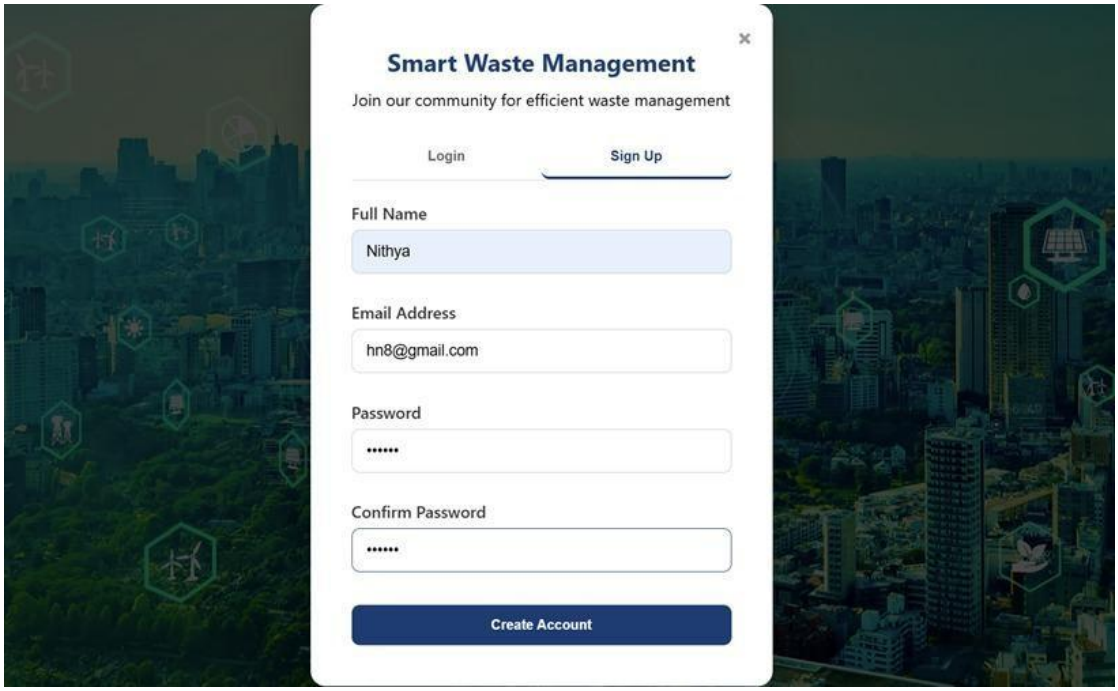
1. **Strategy Pattern**
    - Applied in FilteredWastePickupServiceImpl for dynamic filtering (e.g., by type, status).
    - Supports future extension via FilterStrategy interface.
2. **Factory Pattern**
    - FilterStrategyFactory selects appropriate strategy.
    - Simplifies strategy object creation and promotes encapsulation.
3. **Singleton Pattern**
    - Used in LoggerService for centralized logging.
    - Ensures single instance with thread-safe access.
4. **Observer Pattern**
    - Implemented in WastePickupNotifier.
    - AdminObserver gets real-time updates when new waste pickups occur.

Github link to codebase:

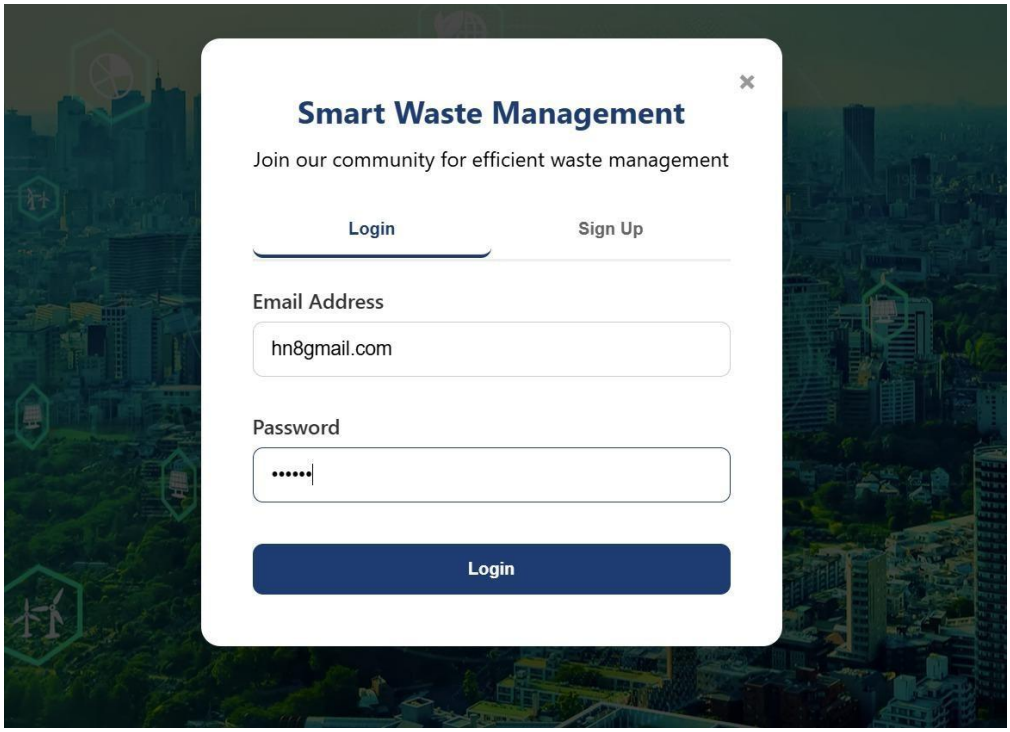
https://github.com/Nithyahn/OOAD_Project

SCREENSHOTS: UI

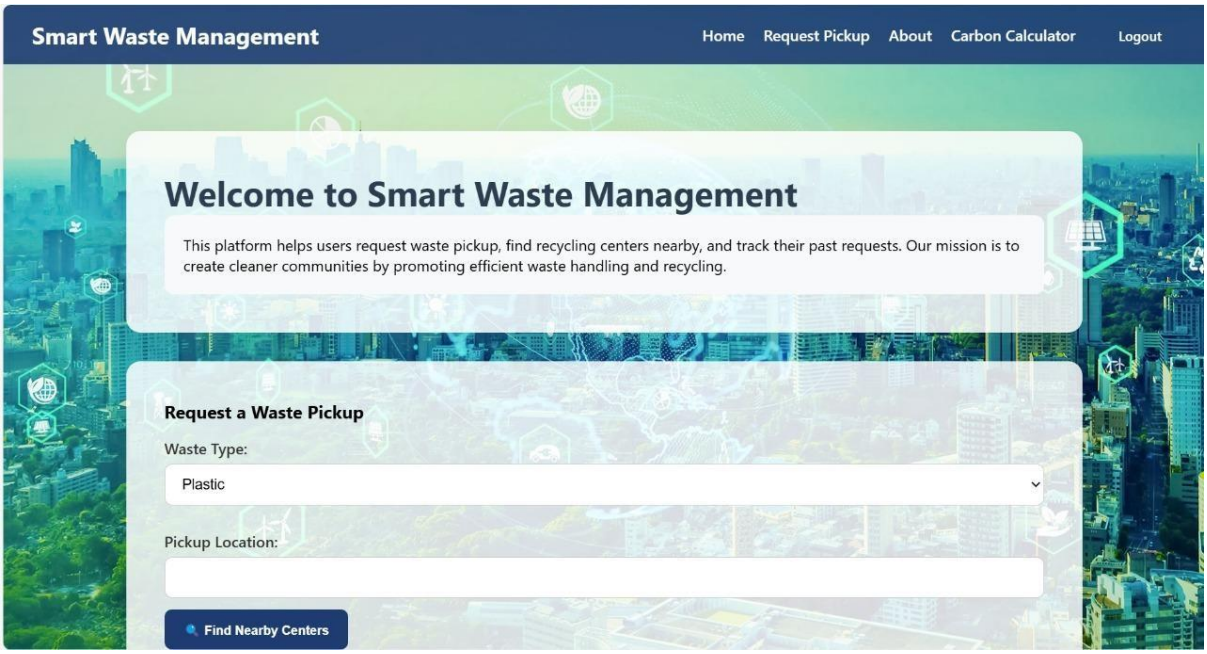
Sign Up:



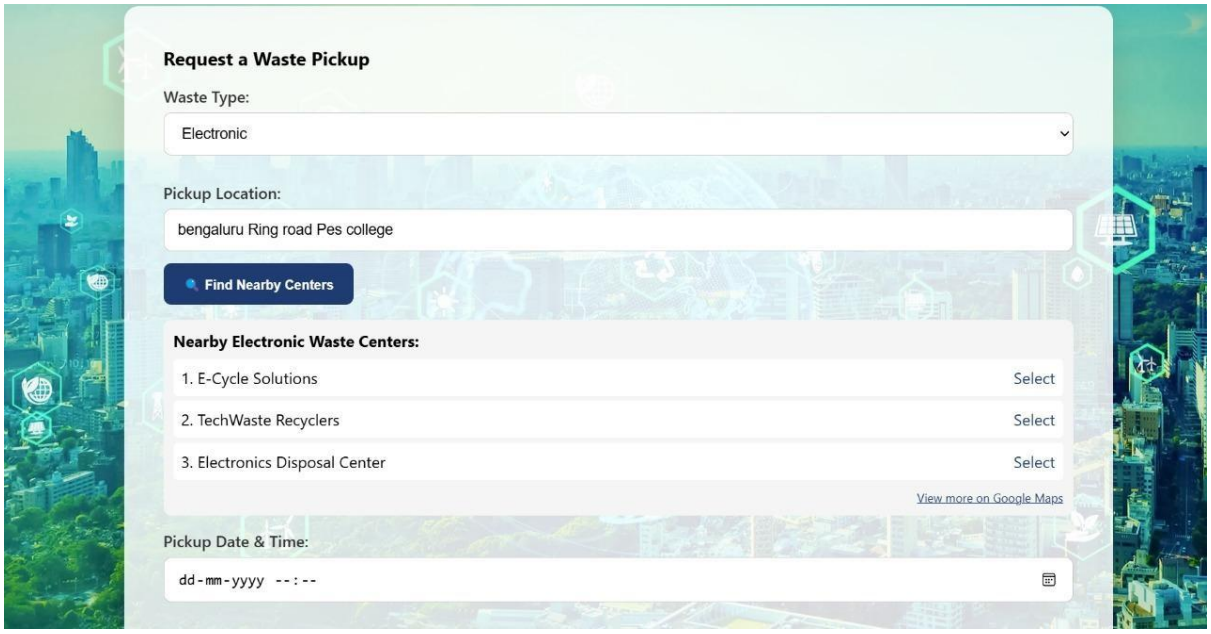
Login :



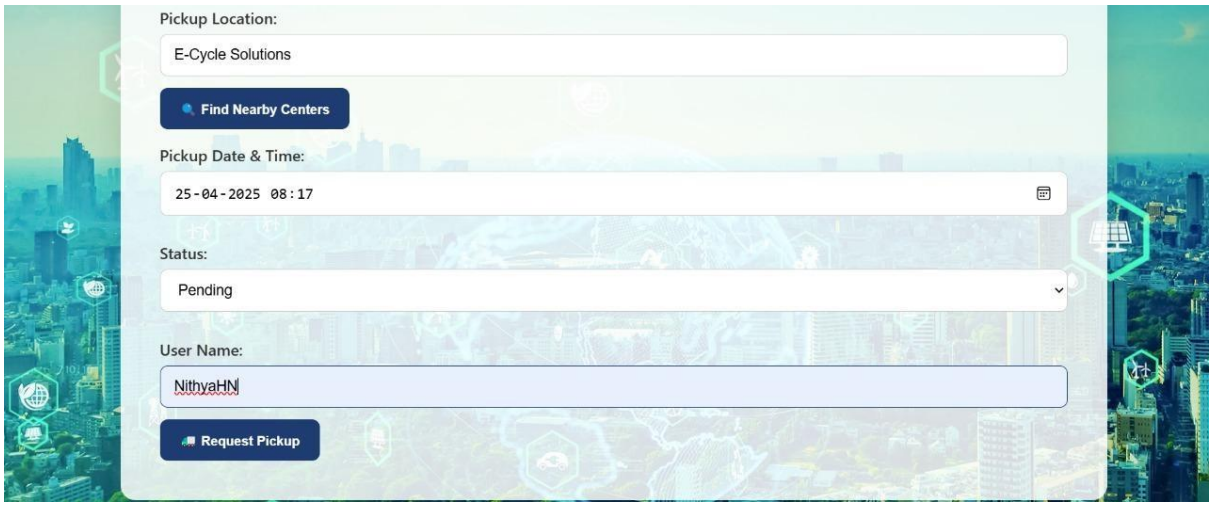
Home :



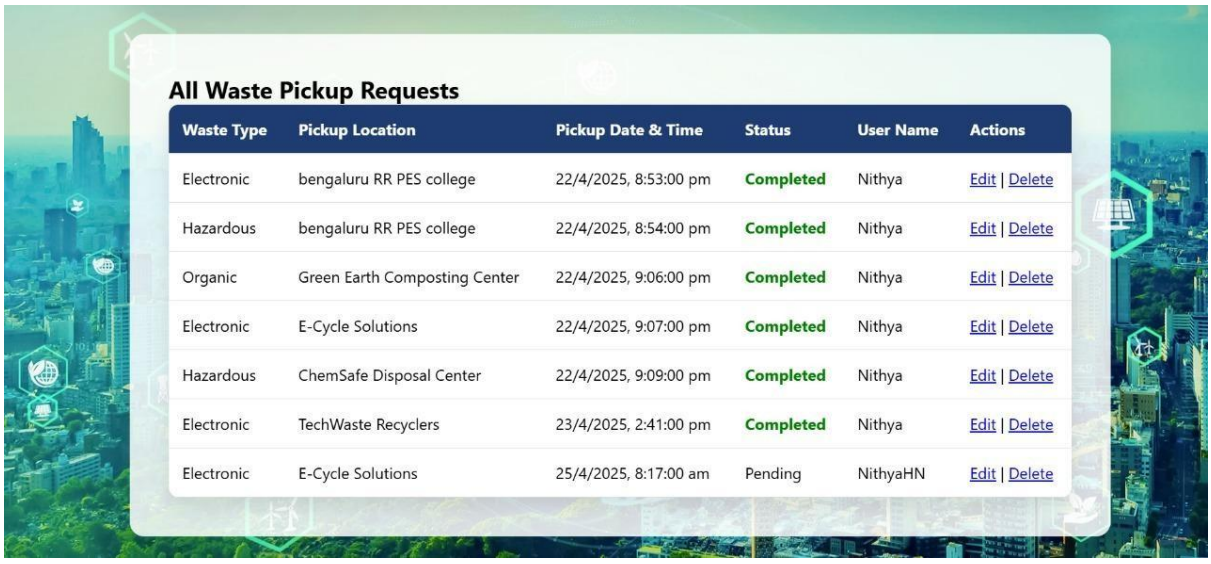
Request waste Pickup



Pickup Location :



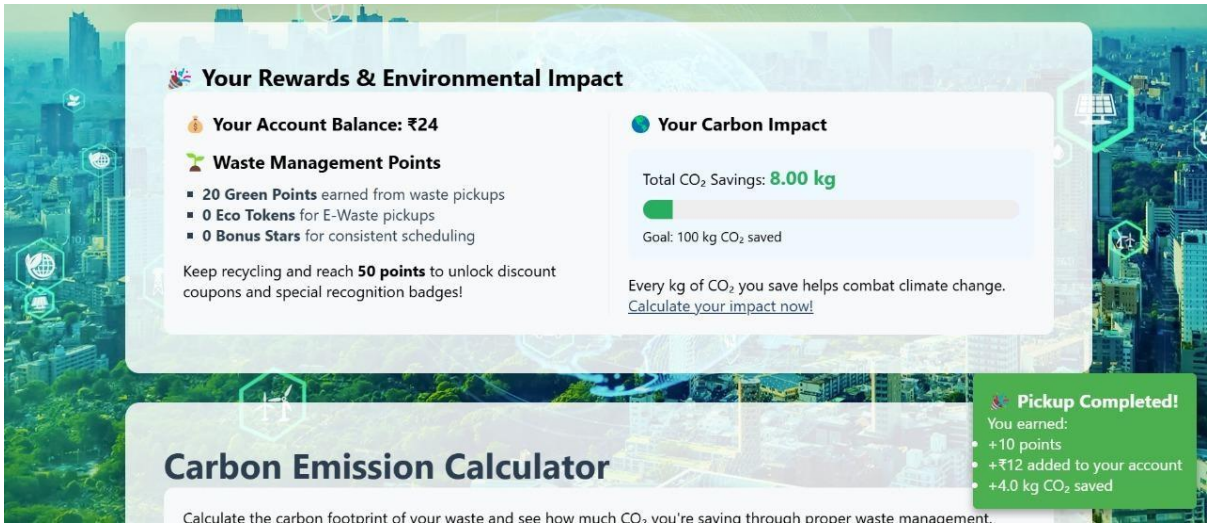
Waste Pickup completed :



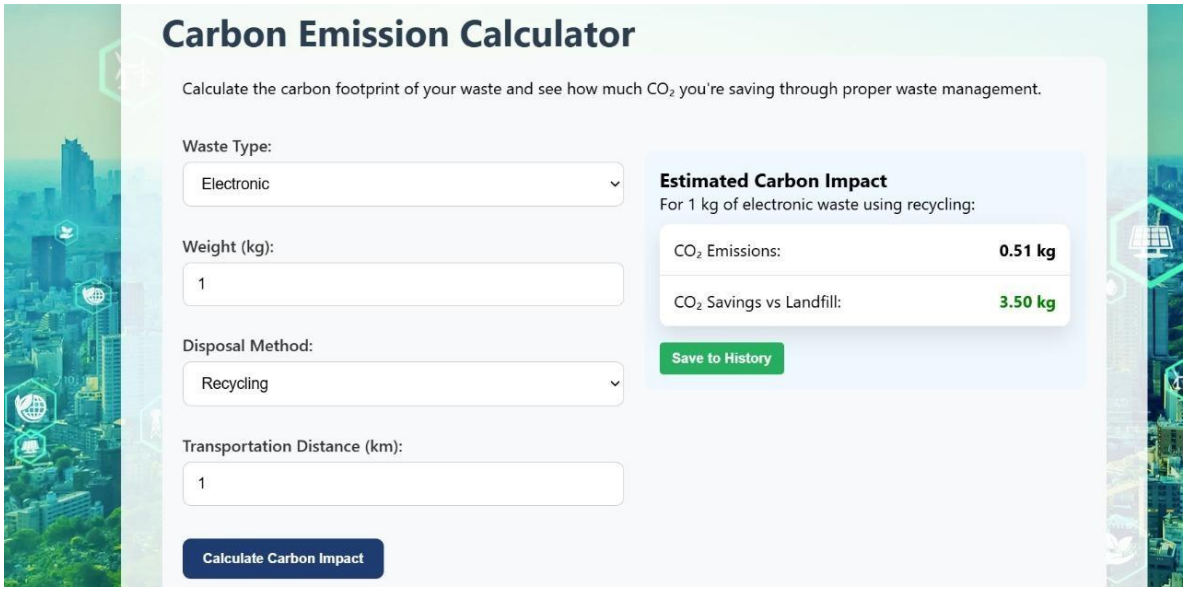
All Waste Pickup Requests

Waste Type	Pickup Location	Pickup Date & Time	Status	User Name	Actions
Electronic	bengaluru RR PES college	22/4/2025, 8:53:00 pm	Completed	Nithya	Edit | Delete
Hazardous	bengaluru RR PES college	22/4/2025, 8:54:00 pm	Completed	Nithya	Edit | Delete
Organic	Green Earth Composting Center	22/4/2025, 9:06:00 pm	Completed	Nithya	Edit | Delete
Electronic	E-Cycle Solutions	22/4/2025, 9:07:00 pm	Completed	Nithya	Edit | Delete
Hazardous	ChemSafe Disposal Center	22/4/2025, 9:09:00 pm	Completed	Nithya	Edit | Delete
Electronic	TechWaste Recyclers	23/4/2025, 2:41:00 pm	Completed	Nithya	Edit | Delete
Electronic	E-Cycle Solutions	25/4/2025, 8:17:00 am	Pending	NithyaHN	Edit | Delete

Reward System :

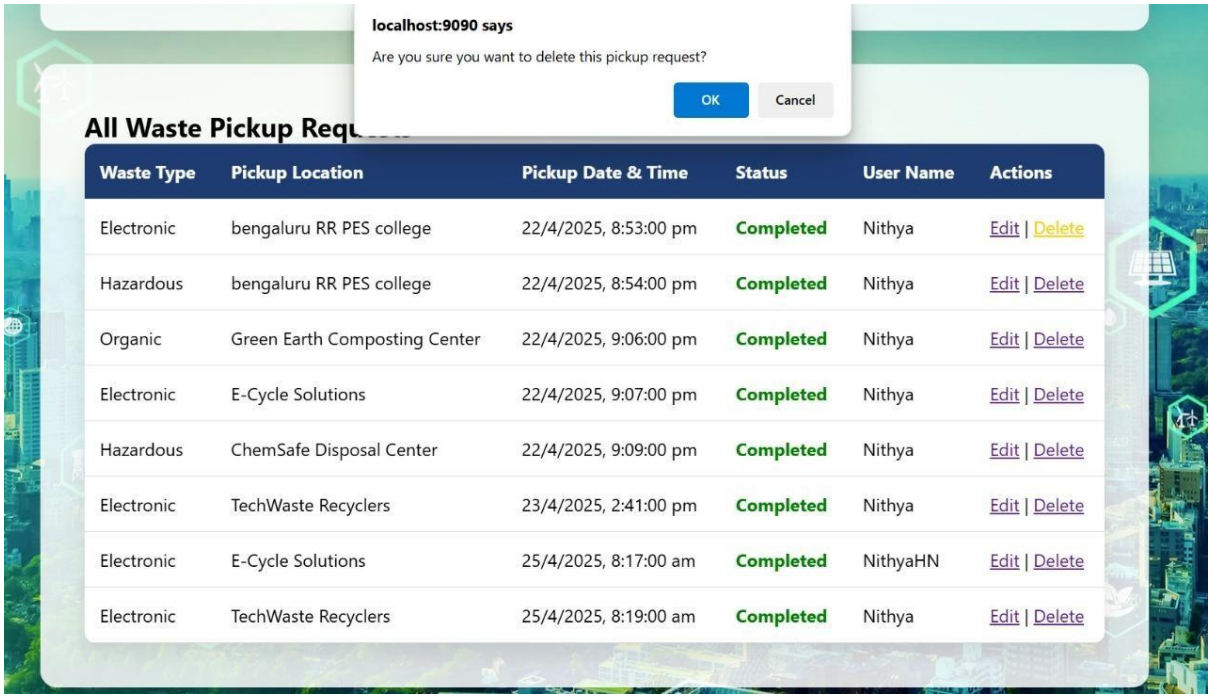


Carbon emission Calculator :

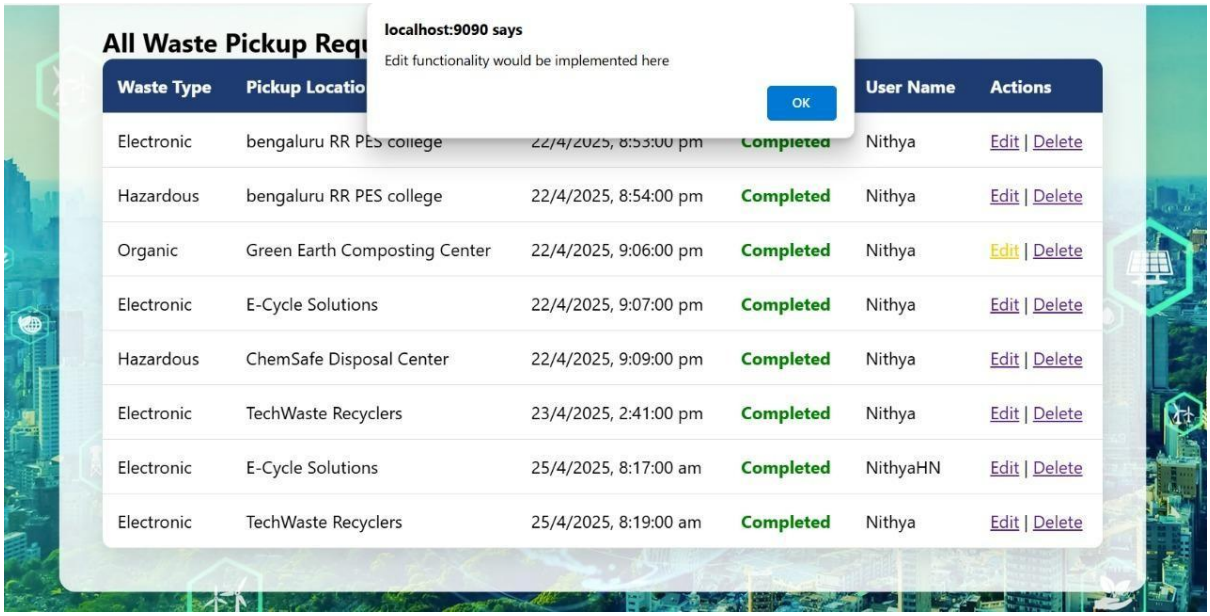


Carbon emission history:

Delete WastePickup :



Edit WastePickup :



Data storing in the mysql Database :

```
mysql> show tables;
+-------------------------+
| Tables_in_wastepickupdb |
+-------------------------+
| waste_pickup            |
| waste_pickup_user       |
+-------------------------+
2 rows in set (0.01 sec)

mysql> select * from waste_pickup
    -> ^Z^C
mysql> select * from waste_pickup;
+----+---------------------------+--------------------------+-----------+-----------------+------------+
| id | pickup_date_time          | pickup_location          | status    | user_name       | waste_type |
+----+---------------------------+--------------------------+-----------+-----------------+------------+
| 10 | 2025-03-07 06:00:00.000000 | Bengaluru electronic city | Completed | Nithya HN CS400 | Organic    |
| 11 | 2025-03-12 09:53:00.000000 | bengaluru PES college     | Pending   | NithyaHN        | Organic    |
| 13 | 2025-04-19 22:53:00.000000 | mysore                    | Pending   | NithyaHN        | Electronic |
| 14 | 2025-04-18 19:31:00.000000 | bengaluru                 | Scheduled | Ni              | Electronic |
| 16 | 2025-04-03 20:40:00.000000 | bengaluru PES college     | Pending   | kakjas          | Hazardous  |
| 17 | 2025-05-05 10:29:00.000000 | bengaluru PES college     | Scheduled | pavpo           | Organic    |
| 18 | 2025-04-22 19:20:00.000000 | bengaluru RR PES college  | Pending   | ni              | Organic    |
| 19 | 2025-04-22 20:00:00.000000 | bengaluru RR PES college  | Pending   | Nithya          | Plastic    |
+----+---------------------------+--------------------------+-----------+-----------------+------------+
8 rows in set (0.00 sec)

mysql>
```

Individual contributions of team members:

NAME	MODULE WORKED ON
NITHYA H.N.	View, Liskov and Factory pattern
PALLAVI. M. PATIL	Model, Open/closed principle and Strategy pattern
PAVITRA. M. GABIGOL	Model ,Interface Dependency principle and Singleton pattern
POOJA ANGADI	Controller, SRP and absorber pattern