SUNBEAM INFOTECH PRIVATE LIMITED

A

MAJOR PROJECT REPORT

ON

“THE RECYCLE-X”

PG-DMC

MOBILE COMPUTING

SUBMITTED BY

PATIL RAJVARDHAN BHARAT

Under the Guidance of

Dr. Mrs. Manjusha Nikam

Year

2024-2025

CERTIFICATE

This is to certify that the project report entitled

"THE RECYCLE_X"

Submitted To

SUNBEAM INFOTECH PRIVATE LIMITED, CENTRE FOR DEVLOPMENT OF ADVANCE COMPUTING, PUNE.

has been completed under my guidance and supervision. To the best of my knowledge and belief, the matter presented in this project report is original and has not been submitted elsewhere for any other purpose.

Submitted by

PATIL RAJVARDHAN BHARAT

Project Guide

&

Program Co-Ordinator

Dr. Mr. Yogesh Kolhe

Co-Ordinator (DMC), Sunbeam, CDAC

External Examiner(s) **Sign**

1. …… ……

2. …… ……

ACKNOWLEGEMENT

It is our foremost duty to express our deep sense of gratitude and respect to the guide **Dr. Mr. Yogesh Kolhe** for his uplifting tendency and inspiring us for taking up this project work successful.

We are also grateful to **Dr. Mr. Yogesh Kolhe** (Co-Ordinator of Mobile Computing) for providing all necessary facilities to carry out the project work and whose encouraging part has been a perpetual source of information.

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ABSTRACT

Introducing "Recycle X," an innovative mobile and web-based application dedicated to revolutionizing waste management through structured digital solutions. This comprehensive system bridges the gap between suppliers, consumers, and administrators, facilitating efficient waste collection, processing, and resale of recycled materials. Built using React, React Native, Node.js, Express.js, and MySQL, Recycle X ensures a seamless user experience across multiple platforms.

The Recycle X platform encompasses three primary roles:

- **Admin:** Manages system operations, monitors transactions, and ensures compliance.
- **Consumer:** Engages with waste management services, schedules pickups, and receives authentication through email OTP verification using the Node mailer library.
- **Supplier:** Collects and processes dry waste, metals, and other recyclable materials before supplying them for further processing.

The project follows the MVC architecture for backend development, ensuring maintainability and scalability. Additionally, file logging mechanisms have been implemented to track system activities efficiently. For secure authentication, MySQL is used with indexing and stored procedures to optimize database performance.

Key features of Recycle X include:

- **Multi-platform access:** React Native for mobile applications and React.js for web applications.
- **Secure consumer authentication:** Email OTP verification via Node mailer.
- **Expo for mobile application deployment and testing.**
- **Efficient waste processing and categorization.**
- **Sustainable waste management through a structured digital workflow.**

By integrating advanced technologies with sustainable practices, Recycle X aims to enhance waste management operations, promote environmental consciousness, and streamline interactions between stakeholders. Through its user-friendly interface and robust functionalities, Recycle X envisions a cleaner and more efficient waste recycling ecosystem.

Keywords: Recycle X, Waste Management, Sustainable Practices, Digital Platform, Consumer Authentication.

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OVERVIEW

In today's world, effective waste management has become a crucial challenge due to the increasing amount of waste generated by households, industries, and commercial establishments. Traditional waste management systems often struggle with inefficiencies, lack of proper segregation, and minimal incentives for recycling. Addressing these concerns, **Recycle X** emerges as an innovative waste management solution aimed at revolutionizing sustainable environmental practices through a comprehensive digital platform.

Recycle X is designed as a cutting-edge mobile and web application that seamlessly connects **consumers, suppliers, and administrators** within a unified ecosystem. The project's core objective is to optimize waste collection, processing, and repurposing through modern technological interventions. By leveraging digital platforms, automation, and secure authentication, Recycle X aims to bring efficiency, transparency, and ease to the waste recycling process.

This platform is equipped with features that streamline operations, including real-time tracking of waste collection, structured waste segregation methods, efficient supplier-consumer interactions, and an intuitive product-selling interface for recycled materials. The application integrates innovative solutions such as **automated OTP-based authentication using Node mailer**, secure transaction handling, and user activity logging to enhance overall system security and performance. Furthermore, **MySQL is utilized for structured data storage, implementing indexing and stored procedures** to improve database efficiency.

By providing a structured and efficient approach to waste management, **Recycle X** is committed to promoting sustainability, raising awareness about recycling, and reducing environmental impact. The project's digital transformation of waste handling serves as a benchmark for future waste management innovations, ultimately contributing to a cleaner and more environmentally conscious society.

1.2 Choice of Topic with Reasoning/Need for the Project

1.2.1 The Growing Waste Management Crisis

The rapid growth of urbanization, industrialization, and population has led to a significant increase in waste production. Current waste disposal methods are inefficient,

contributing to serious environmental and health hazards. The need for a more **structured, technology-driven waste management system** has never been more pressing.

Key challenges in existing waste management systems include:

1. Lack of structured waste collection and processing mechanisms.
2. Inefficient recycling practices leading to increased landfill waste.
3. Limited awareness and participation in sustainable waste management initiatives.
4. Absence of a digitalized, real-time tracking system for waste collection.
5. Unstructured supplier-consumer interaction in the recycling industry.
6. Minimal incentives for businesses and individuals to participate in recycling programs.
7.

Recycle X addresses these challenges by providing an **integrated, smart waste management solution** that enhances the recycling process, optimizes waste collection, and fosters a collaborative environment among consumers, suppliers, and administrators.

1.2 Problem Statement

The existing waste management system lacks efficiency, transparency, and structured recycling mechanisms. **Recycle X** aims to develop an integrated mobile and web application that facilitates efficient waste management through a seamless interaction platform for consumers, suppliers, and administrators. The primary goal is to enhance recycling processes, optimize waste collection, and promote environmental sustainability through digital transformation.

Key aspects addressed by Recycle X:

- A structured approach to waste collection and tracking.
- An intuitive digital marketplace for recycled products.
- Secure user authentication and real-time data logging.
- A technology-driven system for efficient waste processing.
- A collaborative platform encouraging active participation in recycling initiatives.

1.4 Objectives

The **Recycle X** project is designed to achieve the following key objectives:

- **Develop a user-friendly mobile and web application** for waste management.
- **Enable an efficient waste collection and processing system** for consumers and suppliers.
- **Implement a secure authentication mechanism** (OTP-based verification using Nodemailer).
- **Promote environmental awareness** and encourage sustainable recycling practices.
- **Facilitate seamless communication and transactions** between stakeholders.
- **Optimize database performance** using MySQL indexing and stored procedures.
- **Ensure a scalable and secure architecture** to support future expansions.
- **Enhance user experience** with intuitive UI/UX design principles.

By achieving these objectives, **Recycle X** sets a benchmark for an efficient and sustainable waste management system, transforming the way waste is handled at both individual and industrial levels.

2. LITERATURE REVIEW AND STUDY

2.1 Waste Management Technologies

Waste management has been a critical global challenge, with researchers and technologists continuously exploring new solutions to improve efficiency, sustainability, and environmental impact. Several studies have examined the evolution of waste management techniques, analysing existing waste disposal methods, recycling strategies, and the implementation of modern technologies in the field.

Analysis of Existing Waste Management Platforms

Numerous waste management platforms have emerged worldwide, aiming to enhance the efficiency of waste collection, sorting, and processing. Traditional waste management methods often suffer from inefficiencies due to manual sorting, improper disposal techniques, and inadequate tracking mechanisms. Several case studies highlight the effectiveness of digital platforms in improving waste management outcomes. For instance, studies on smart waste management systems indicate that integrating technology into the process leads to optimized collection routes, reduced costs, and higher recycling rates.

Review of Technological Interventions in Recycling Processes

Modern recycling processes leverage innovative technologies such as automated sorting, advanced material recovery, and bio-waste conversion techniques. Research highlights the adoption of mechanical and chemical recycling, where AI-driven sorting mechanisms significantly improve material recovery efficiency. Several pilot projects have demonstrated the benefits of robotics in sorting facilities, reducing contamination in recycling streams and increasing processing efficiency.

Study of User Engagement Strategies in Environmental Initiatives

User participation is a crucial aspect of successful waste management initiatives. Studies suggest that mobile applications and gamification techniques significantly increase public involvement in waste segregation and recycling programs. Research also highlights the role of government policies and incentive-based models in encouraging citizens to adopt

sustainable waste disposal practices. Many studies emphasize the need for awareness campaigns and educational initiatives to foster community participation.

2.4 Case Studies and Success Stories

Smart Waste Management in Singapore

Singapore has implemented an advanced waste management system leveraging AI, IoT, and data analytics. Research on the country's initiatives highlights the effectiveness of automated waste collection, smart bins, and digital tracking systems in achieving high recycling rates and reducing landfill waste.

Sweden’s Waste-to-Energy Model

Sweden is known for its successful waste-to-energy (WTE) initiatives, where non-recyclable waste is converted into energy for heating and electricity. Case studies demonstrate the environmental and economic benefits of WTE plants, showcasing Sweden's leadership in sustainable waste management.

Community-Driven Recycling Programs in India

Several grassroots initiatives in India focus on community participation in waste segregation and recycling. Studies on informal waste collection systems highlight the role of waste pickers and micro-entrepreneurs in managing urban waste effectively. Digital platforms connecting waste generators with recyclers have shown promising results in improving recycling rates and reducing landfill waste.

3. SOFTWARE REQUIREMENT SPECIFICATION

3.1 Software Requirements

3.1.1 Front-End Frameworks

Mobile Application:

- React Native: Enables cross-platform mobile development with a native-like experience.
- Expo Framework: Facilitates the development and deployment of React Native applications.

Web Application:

- React.js: Provides a component-based architecture for building user interfaces.

3.1.2 User Interface Design

- Adherence to responsive design principles for optimal usability across devices.
- Mobile-first approach to prioritize user experience on smaller screens.
- Intuitive user experience (UX) ensuring seamless navigation and interaction.
- Support for dark mode and accessibility features, including ARIA attributes for enhanced inclusivity.
- Component-based UI architecture using Chakra UI for consistency and efficiency.

3.1.3 Backend and Database

Backend Framework:

- Node.js: Lightweight and scalable JavaScript runtime for server-side development.
- Express.js: Minimalist backend framework facilitating RESTful API development.
- MVC Architecture: Ensures separation of concerns for maintainability and scalability.
- RESTful API Design: Provides a structured and standardized way to handle client-server communication.

Database:

- MySQL: Relational database management system (RDBMS) optimized for structured data storage.
- Indexing and Stored Procedures: Improve query performance and maintain data integrity.
- Normalization: Reduces redundancy and optimizes data organization for efficiency.

Authentication & Security:

- Nodemailer: Facilitates OTP-based authentication for secure user verification.
- Secure User Registration & Login: Enforces data encryption and validation mechanisms.
- JWT (JSON Web Token): Implements token-based authentication for session management.
- Role-Based Access Control (RBAC): Restricts access based on user roles and permissions.
- CORS Implementation: Ensures secure cross-origin resource sharing.

3.1.4 Additional Technologies

- File Logging: Backend tracking mechanism for debugging and auditing.
- WebSockets: Enables real-time communication for live updates and notifications.
- Cloud Storage: Securely manages documents and media files.
- Payment Gateway Integration: Supports online transactions using platforms like Stripe or PayPal.
- AI-Powered Recommendation Engine: Personalizes user experiences based on data analytics.
- Push Notification Service: Enhances user engagement with timely alerts.
- Geolocation Services: Enables real-time tracking and mapping functionalities.
- SMS & Email Notifications: Implements communication mechanisms for user updates.

3.2 System Architecture

User Roles:

- **Consumer:** Requests waste collection, views history, and interacts with the platform.

- **Supplier:** Collects and supplies waste materials for processing.
- **Administrator:** Manages users, processes, and system analytics.

Key Features:

- Waste collection scheduling with automated reminders.
- Real-time tracking for waste collection and processing.
- Waste processing management system for streamlined operations.
- Integrated product selling interface for recycled goods.
- Push notifications and alerts for important updates.
- Comprehensive analytics and reporting dashboard.
- Multi-language support for global accessibility.
- User feedback and review system for quality assurance.

3.3 Hardware Requirements

Mobile Devices:

- Minimum Android version: 8.0 (Oreo) or higher.
- Minimum 4GB RAM for smooth app performance.

Web Platform:

- Modern browsers with full HTML5 and JavaScript support.
- Minimum screen resolution: 1366x768 for optimal UI experience.

Server Requirements:

- Minimum 4-core processor for handling concurrent requests.
- 16GB RAM to support multiple user sessions effectively.
- 512GB SSD storage for fast data access and reliability.
- Cloud-based hosting solutions (AWS, Firebase, or DigitalOcean) for scalability and availability.
- Load balancer and caching mechanisms (Redis) for optimized performance.

SYSTEM DESIGN

4.1 Class Diagram

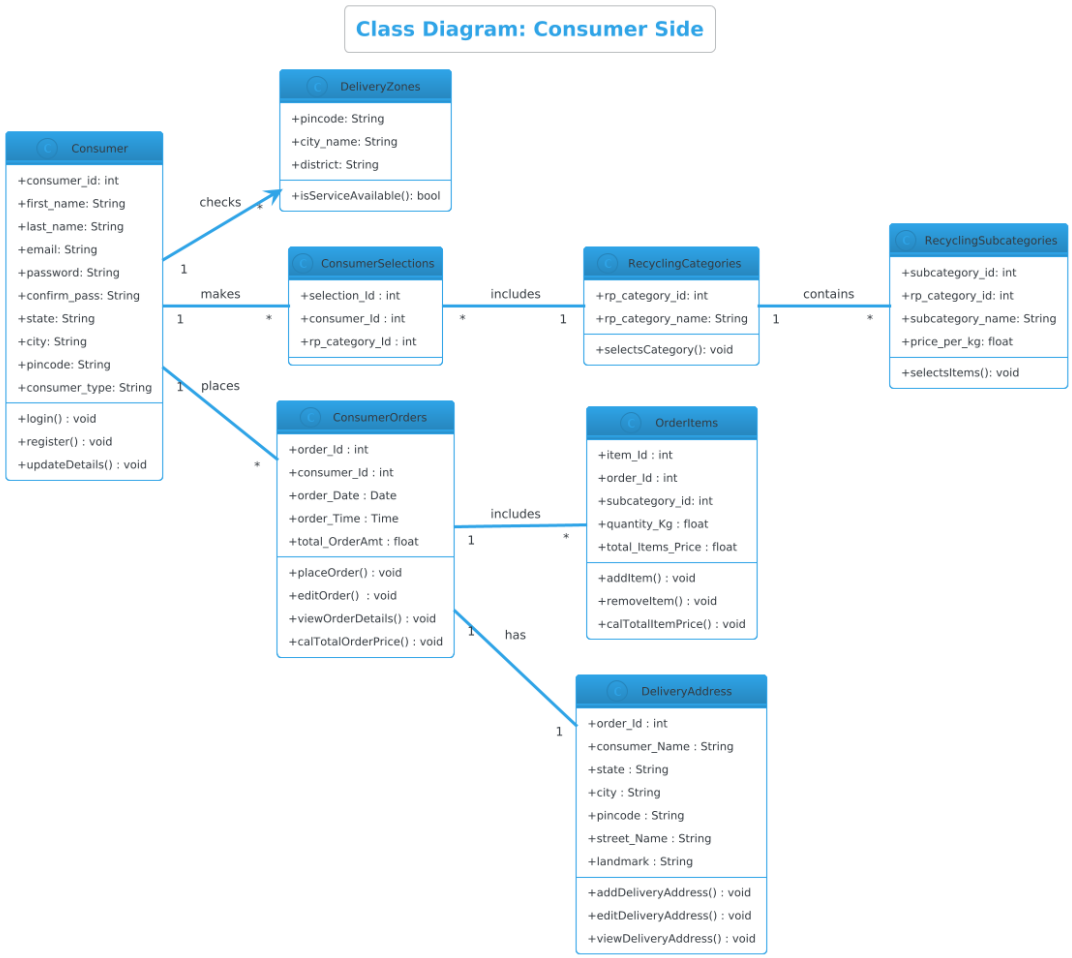


Fig: 4.1: Consumer Class Diagram

The class diagram represents the consumer side of the recycling management system, detailing the interaction between different entities involved in the order placement, selection of recycling categories, and delivery zones. The primary entities include consumers, orders, selections, and items, with relationships defining their interactions.

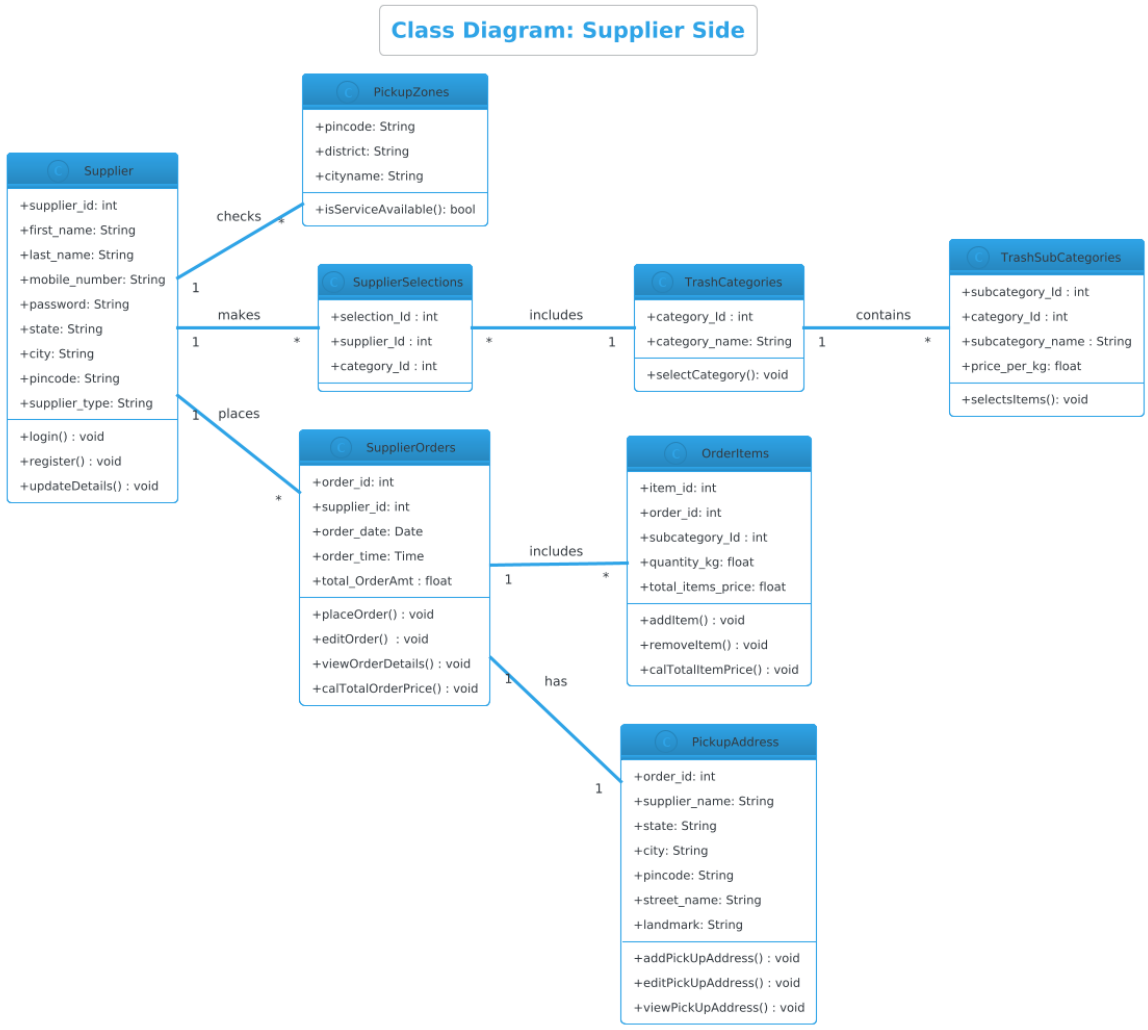


Fig: 4.2: Supplier Class Diagram

The supplier side of the recycling management system is responsible for handling suppliers who provide recyclable materials. The class diagram outlines the interaction between suppliers, their orders, pickup zones, and trash categories. It defines key entities and their relationships, ensuring smooth order placement, material selection, and pickup management.

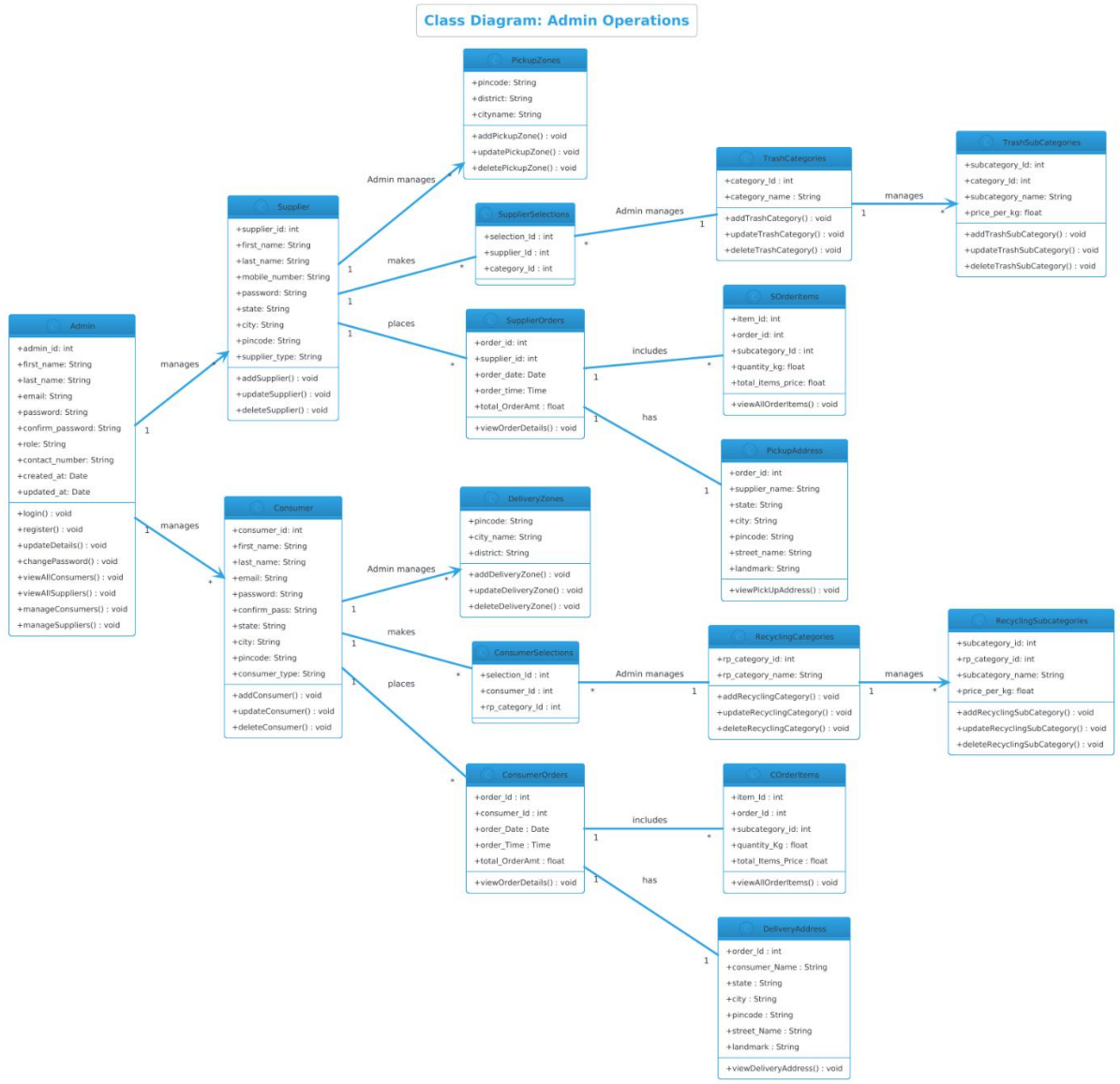


Fig: 4.3: Admin Class Diagram

The Admin Operations class diagram represents the system's administrative functionalities. The administrator manages suppliers, consumers, orders, pickup zones, and trash categories. The system ensures smooth interactions between suppliers and consumers Orders include Pickup or Delivery Addresses.

4.2 ER Diagram

1. Supplier

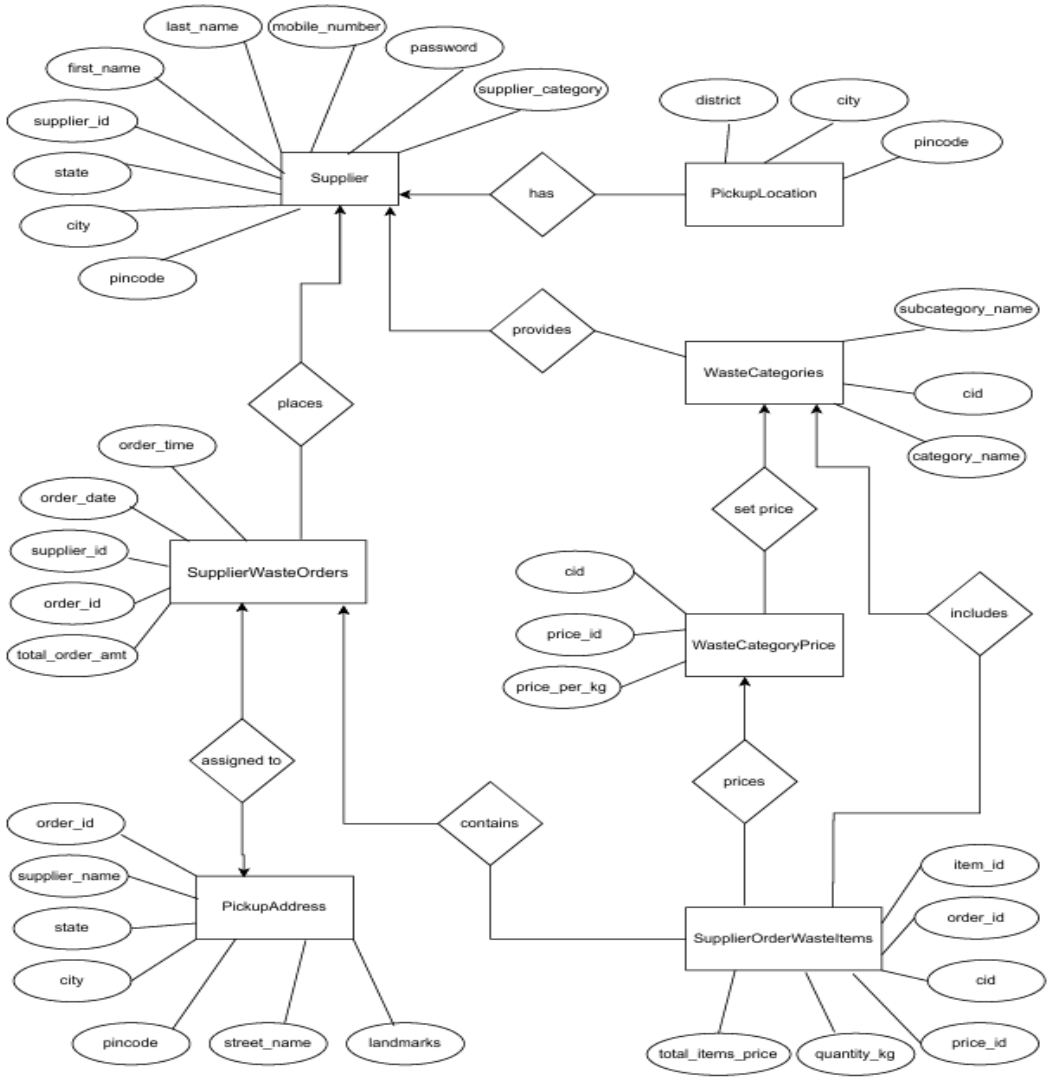


Fig: 4.4: Supplier Diagram

2. Consumer

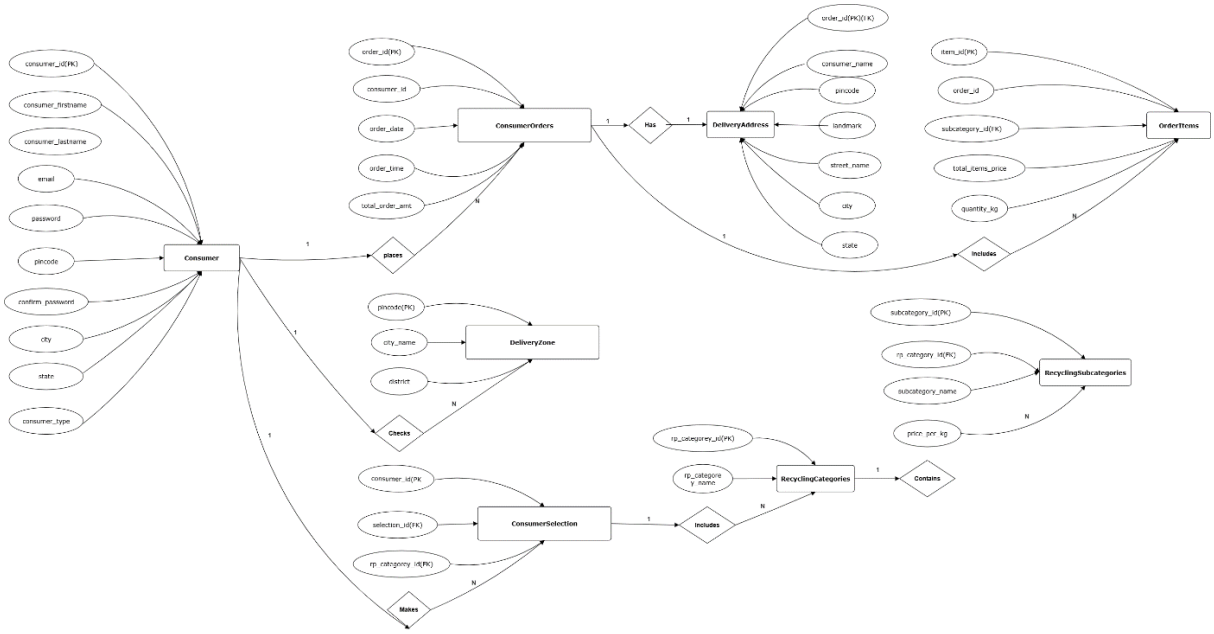


Fig: 4.4: Consumer Diagram

4.4 Use Case Diagram

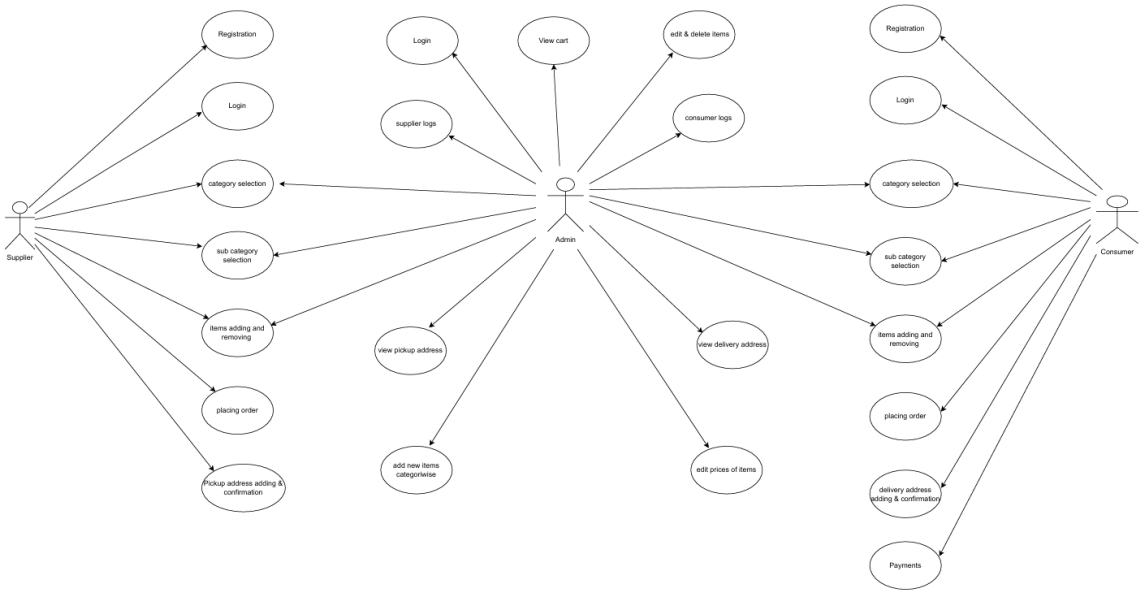


Fig. 4.3 Use Case Diagram

The use case diagram shows how user will interact with the system. In the above use case diagram, there are multiple use case where user can interact to perform specific task like user can login to the system, sent messages etc.

4. DATABASE DESIGN

4.1 The following table structures depict the database design

ADMIN

```
CREATE TABLE admin (
   admin_id INT NOT NULL AUTO_INCREMENT,
   first_name VARCHAR(100) NOT NULL,
   last_name VARCHAR(100) NOT NULL,
   email VARCHAR(255) NOT NULL UNIQUE,
   password VARCHAR(255) NOT NULL,
   is_active TINYINT(1) DEFAULT 1,
   PRIMARY KEY (admin_id)
   created_at TIMESTAMP DEFAULT CURRENT_TIMESTAMP,
   updated_at TIMESTAMP DEFAULT CURRENT_TIMESTAMP ON UPDATE CURRENT_TIMESTAMP );
```

SUPPLIER

```
CREATE TABLE supplier (
   supplier_id INT PRIMARY KEY AUTO_INCREMENT,
   first_name VARCHAR(50) NOT NULL,
   last_name VARCHAR(50) NOT NULL,
   mobile_number VARCHAR(15) NOT NULL UNIQUE,
   password VARCHAR(255) NOT NULL,
   state VARCHAR(50) NOT NULL,
   city VARCHAR(50) NOT NULL,
   imageName VARCHAR(50) DEFAULT 'default.jpg',
   pincode CHAR(6) NOT NULL,
   supplier_type ENUM('Individual', 'Organization', 'Government') NOT NULL DEFAULT 'Individual',
   supplier_status ENUM('Active', 'InActive') NOT NULL DEFAULT 'Active',
```

```
    registered_at TIMESTAMP DEFAULT CURRENT_TIMESTAMP INVISIBLE,
    last_modified_at TIMESTAMP DEFAULT CURRENT_TIMESTAMP ON UPDATE
CURRENT_TIMESTAMP INVISIBLE,
    last_modified_by VARCHAR(255) DEFAULT (CURRENT_USER) INVISIBLE,
    extra_col1 VARCHAR(255) DEFAULT NULL INVISIBLE,
    extra_col2 VARCHAR(255) DEFAULT NULL INVISIBLE,
    extra_col3 VARCHAR(255) DEFAULT NULL INVISIBLE,
    extra_col4 VARCHAR(255) DEFAULT NULL INVISIBLE,
    extra_col5 VARCHAR(255) DEFAULT NULL INVISIBLE
);

CREATE INDEX idx_supplier_first_name ON supplier (first_name);


CREATE TABLE serviceZones (
    pincode VARCHAR(10) PRIMARY KEY,
    state VARCHAR(100) NOT NULL,
    city VARCHAR(100) NOT NULL,
    district VARCHAR(100) NOT NULL,
    service_type ENUM('Delivery', 'Pickup', 'Both') NOT NULL,
    extra_col1 VARCHAR(255) DEFAULT NULL INVISIBLE,
    extra_col2 VARCHAR(255) DEFAULT NULL INVISIBLE,
    extra_col3 VARCHAR(255) DEFAULT NULL INVISIBLE,
    extra_col4 VARCHAR(255) DEFAULT NULL INVISIBLE,
    extra_col5 VARCHAR(255) DEFAULT NULL INVISIBLE
);

CREATE TABLE trashCategories (
    category_id INT PRIMARY KEY AUTO_INCREMENT,
    category_name VARCHAR(255) NOT NULL UNIQUE,
```

```
    category_image VARCHAR(50) NOT NULL,

    category_description TEXT NOT NULL,

    created_at TIMESTAMP DEFAULT CURRENT_TIMESTAMP INVISIBLE,

    last_modified_at TIMESTAMP DEFAULT CURRENT_TIMESTAMP ON UPDATE
CURRENT_TIMESTAMP INVISIBLE,

    last_modified_by VARCHAR(255) NOT NULL DEFAULT (CURRENT_USER)
INVISIBLE,

    extra_col1 VARCHAR(255) DEFAULT NULL INVISIBLE,

    extra_col2 VARCHAR(255) DEFAULT NULL INVISIBLE,

    extra_col3 VARCHAR(255) DEFAULT NULL INVISIBLE,

    extra_col4 VARCHAR(255) DEFAULT NULL INVISIBLE,

    extra_col5 VARCHAR(255) DEFAULT NULL INVISIBLE

);
```

CONSUMER

```
CREATE TABLE consumer (

    consumer_id INT PRIMARY KEY AUTO_INCREMENT,

    first_name VARCHAR(255) NOT NULL,

    last_name VARCHAR(255) NOT NULL,

    email VARCHAR(255) NOT NULL UNIQUE,

    mobile_number VARCHAR(15) NOT NULL,

    password VARCHAR(255) NOT NULL,

    state VARCHAR(255) NOT NULL,

    city VARCHAR(255) NOT NULL,

    imageName VARCHAR(50) DEFAULT 'default.jpg',

    pincode VARCHAR(20) NOT NULL,

    consumer_type ENUM('Individual', 'Organization', 'Government') NOT NULL
DEFAULT 'Individual',

    consumer_status ENUM('Active','InActive') NOT NULL DEFAULT 'Active',

    registered_at TIMESTAMP DEFAULT CURRENT_TIMESTAMP INVISIBLE,
```

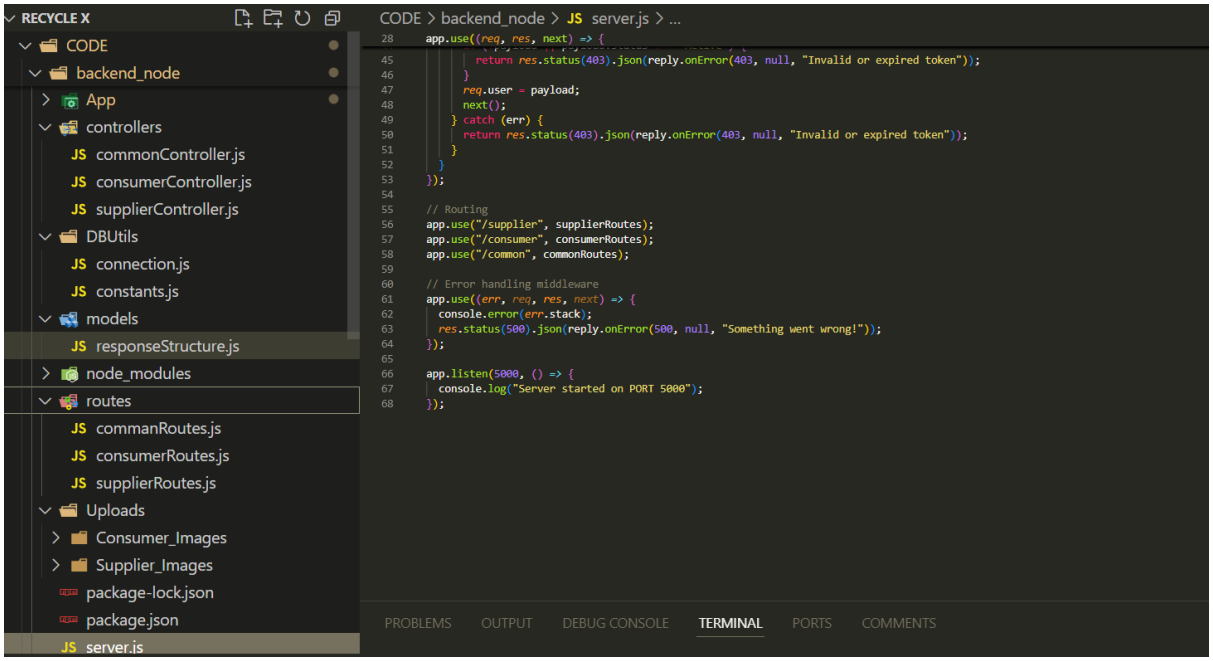
```
    last_modified_at TIMESTAMP DEFAULT CURRENT_TIMESTAMP ON UPDATE
CURRENT_TIMESTAMP INVISIBLE,
    last_modified_by VARCHAR(255) DEFAULT (CURRENT_USER) INVISIBLE,
    extra_col1 VARCHAR(255) DEFAULT NULL INVISIBLE,
    extra_col2 VARCHAR(255) DEFAULT NULL INVISIBLE,
    extra_col3 VARCHAR(255) DEFAULT NULL INVISIBLE,
    extra_col4 VARCHAR(255) DEFAULT NULL INVISIBLE,
    extra_col5 VARCHAR(255) DEFAULT NULL INVISIBLE
);

CREATE INDEX idx_consumer_first_name ON consumer (first_name);

CREATE TABLE recyclingCategories (
    rp_category_id INT PRIMARY KEY AUTO_INCREMENT,
    rp_category_name VARCHAR(255) NOT NULL UNIQUE,
    rp_category_image VARCHAR(50) NOT NULL,
    category_description TEXT NOT NULL,
    created_at TIMESTAMP DEFAULT CURRENT_TIMESTAMP INVISIBLE,
    last_modified_at TIMESTAMP DEFAULT CURRENT_TIMESTAMP ON UPDATE
CURRENT_TIMESTAMP INVISIBLE,
    last_modified_by VARCHAR(255) NOT NULL DEFAULT (CURRENT_USER)
INVISIBLE,
    extra_col1 VARCHAR(255) DEFAULT NULL INVISIBLE,
    extra_col2 VARCHAR(255) DEFAULT NULL INVISIBLE,
    extra_col3 VARCHAR(255) DEFAULT NULL INVISIBLE,
    extra_col4 VARCHAR(255) DEFAULT NULL INVISIBLE,
    extra_col5 VARCHAR(255) DEFAULT NULL INVISIBLE
);
```

```
CREATE TABLE recyclingSubcategories (
   subcategory_id INT AUTO_INCREMENT PRIMARY KEY,
   rp_category_id INT,
   subcategory_name VARCHAR(255) NOT NULL UNIQUE,
   subcategory_image VARCHAR(50) NOT NULL,
   price_per_kg FLOAT NOT NULL CHECK (price_per_kg >=1),
   category_description TEXT NOT NULL,
   created_at TIMESTAMP DEFAULT CURRENT_TIMESTAMP INVISIBLE,
   updated_at TIMESTAMP DEFAULT CURRENT_TIMESTAMP ON UPDATE
CURRENT_TIMESTAMP INVISIBLE,
   last_modified_by VARCHAR(255) NOT NULL DEFAULT (CURRENT_USER)
INVISIBLE,
   extra_col1 VARCHAR(255) DEFAULT NULL INVISIBLE,
   extra_col2 VARCHAR(255) DEFAULT NULL INVISIBLE,
   extra_col3 VARCHAR(255) DEFAULT NULL INVISIBLE,
   extra_col4 VARCHAR(255) DEFAULT NULL INVISIBLE,
   extra_col5 VARCHAR(255) DEFAULT NULL INVISIBLE,
   FOREIGN KEY (rp_category_id) REFERENCES
recyclingCategories(rp_category_id) ON DELETE SET NULL
);
```

5. CODING TECHNIQUES AND IMPLEMENTATION DETAILS

```jsx
import React from "react";
import { BrowserRouter as Router, Routes, Route, Link } from "react-router-dom";
import UserTypeSelection from "./components/UserTypeSelection";
import SupplierLogin from "./components/supplier/SupplierLogin";
import ConsumerLogin from "./components/consumer/ConsumerLogin";
import SupplierRegistration from "./components/supplier/SupplierRegister";
import ConsumerRegister from "./components/consumer/ConsumerRegister";
import OtpVerification from "./components/consumer/OtpVerification";
import SupplierHomePage from "./components/supplier/SupplierHomePage";
import AboutUsPage from "./components/AboutUsPage";
import SupplierProfile from "./components/supplier/SupplierProfile";
import ContactPage from "./components/ContactPage";
import SupplierCart from "./components/supplier/SupplierCart";
import SupplierOrderSummary from "./components/supplier/SupplierOrderSummary";
import OrderSuccess from "./components/OrderSuccess";
import ConsumerHomePage from "./components/consumer/ConsumerHomePage";
import ConsumerProfile from "./components/consumer/ConsumerProfile";
import ConsumerCart from "./components/consumer/ConsumerCart";
import ConsumerOrderSummary from "./components/consumer/ConsumerOrderSummary";

const App = () => {
  return (
    <Router>
      <Routes>
        <Route path="/" element={<UserTypeSelection />} />
        <Route path="/supplier/login" element={<SupplierLogin />} />
        <Route path="/supplier/register" element={<SupplierRegistration />} /> {/* Correct component */}
        <Route path="/supplier/dashboard" element={<SupplierHomePage />} />
        <Route path="/supplier/profile" element={<SupplierProfile />} />
        <Route path="/supplier/cart" element={<SupplierCart />} />
        <Route path="/supplier/summary" element={<SupplierOrderSummary />} />
        <Route path="/about" element={<AboutUsPage />} />
        <Route path="/contact" element={<ContactPage />} />
        <Route path="/consumer/login" element={<ConsumerLogin />} />
        <Route path="/consumer/register" element={<ConsumerRegister />} />
        <Route path="/consumer/dashboard" element={<ConsumerHomePage />} />
        <Route path="/consumer/profile" element={<ConsumerProfile />} />
        <Route path="/consumer/cart" element={<ConsumerCart />} />
```

```
app.use(cors(corsOptions));
app.options("*", cors(corsOptions));
app.use(appendFileLogs);
app.use(express.json());
app.use(express.urlencoded({ extended: true }));
// Serve static files from Uploads folder
app.use("/uploads", express.static(path.join(__dirname, "Uploads")));

app.use((req, res, next) => {
  const excludedPaths = ["/supplier/signin", "/supplier/signup", "/supplier/verifyEmail", "/consumer/signin", "/consumer/signup", "/consumer/verifyEmail",

  if (excludedPaths.includes(req.path)) {
    next();
  } else {
    const authHeader = req.headers.authorization;

    if (!authHeader || !authHeader.startsWith("Bearer ")) {
      return res.status(403).json(reply.onError(403, null, "Bearer token required"));
    }

    const token = authHeader.split(" ")[1];

    try {
      const payload = jwt.verify(token, config.SECRET_KEY);
      if (!payload || payload.status !== "Active") {
        return res.status(403).json(reply.onError(403, null, "Invalid or expired token"));
      }
      req.user = payload;
      next();
    } catch (err) {
      return res.status(403).json(reply.onError(403, null, "Invalid or expired token"));
    }
  }
});
```



Admin User Interfaces

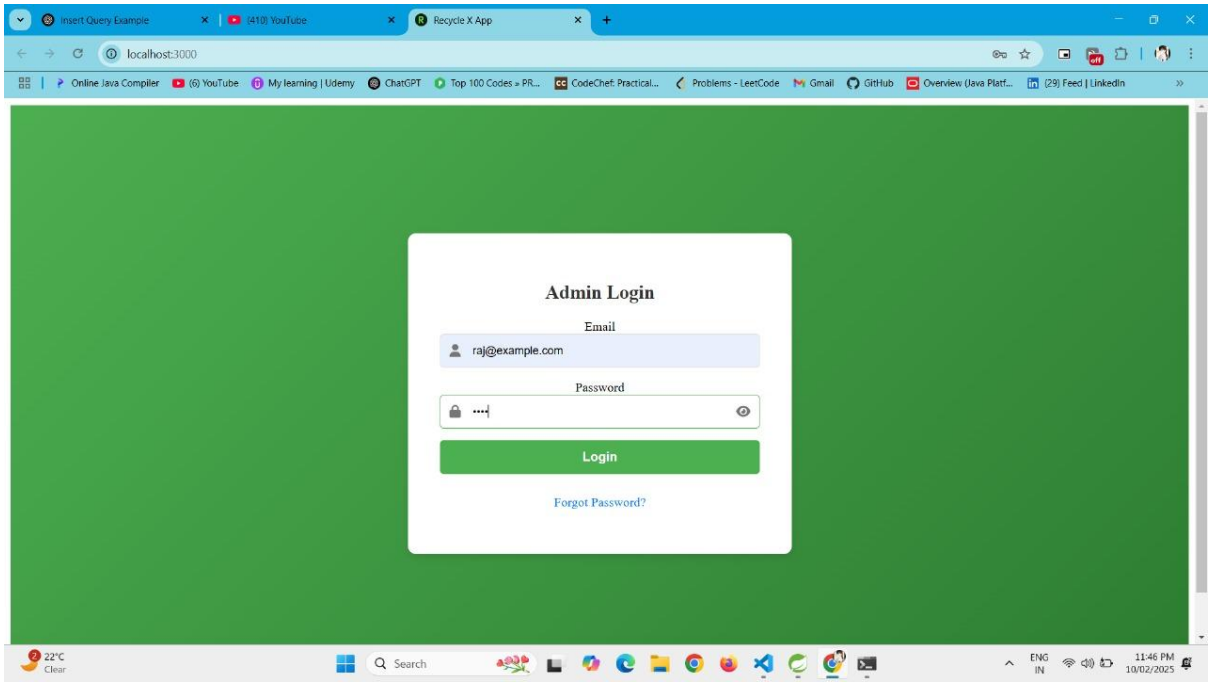
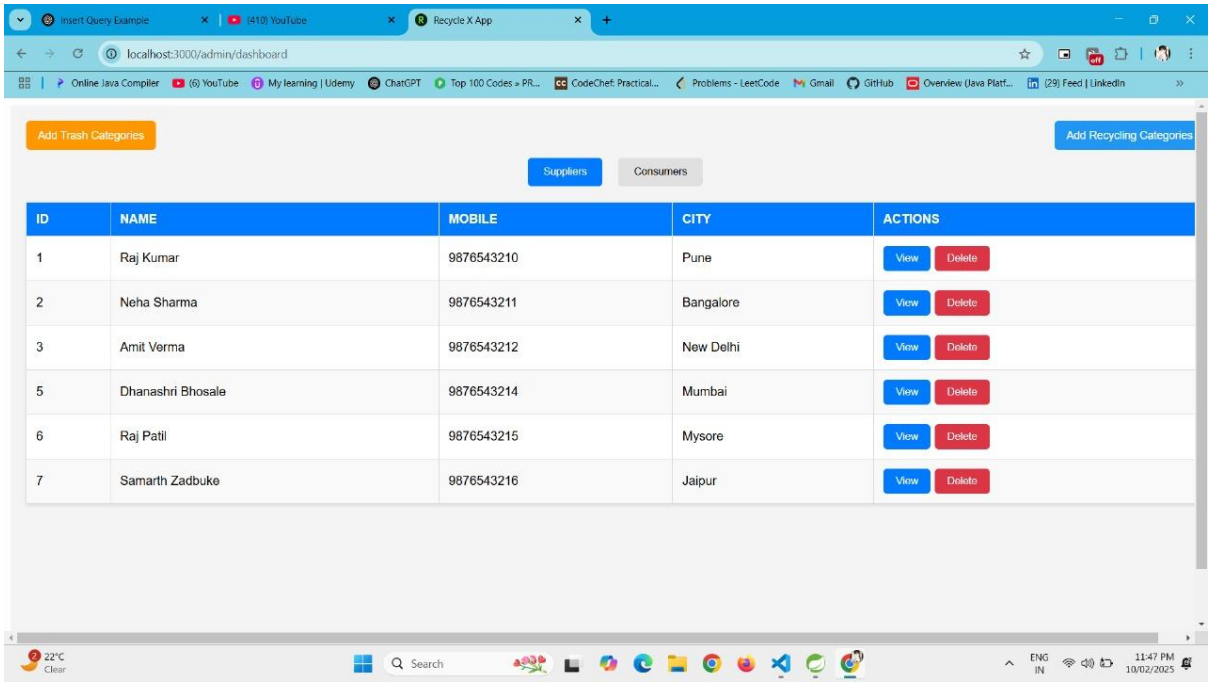


Fig. 5.2.1 Home page



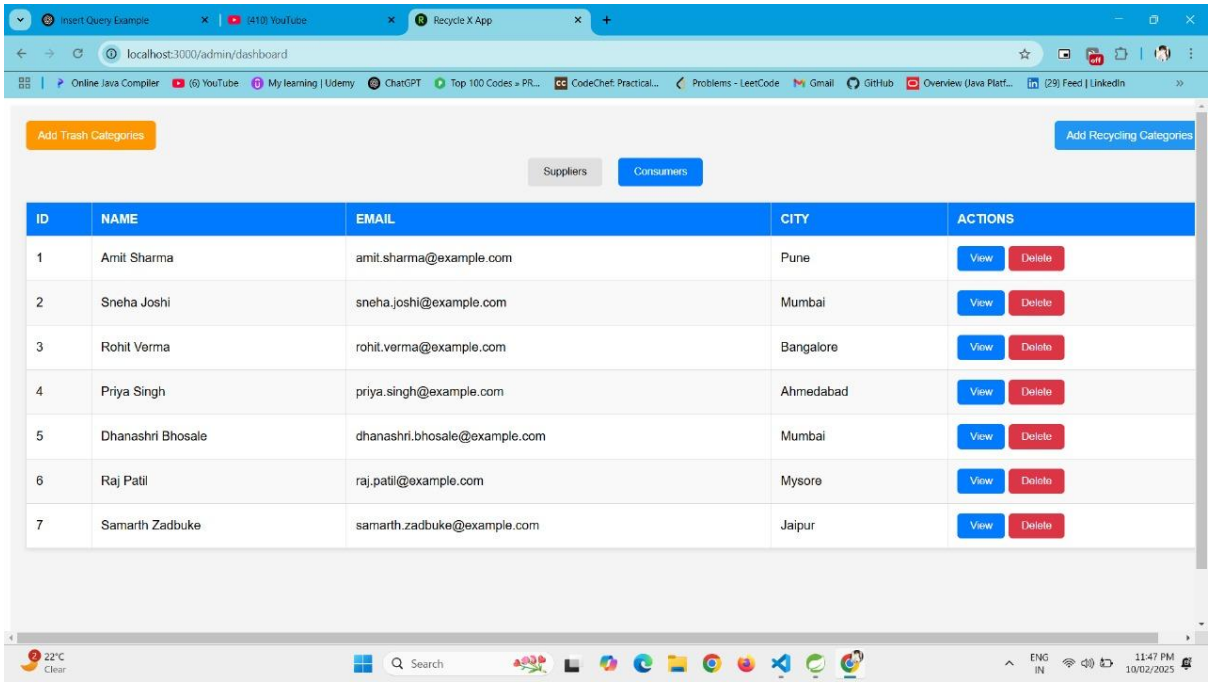


Fig. 5.2.2 Add Trash Category

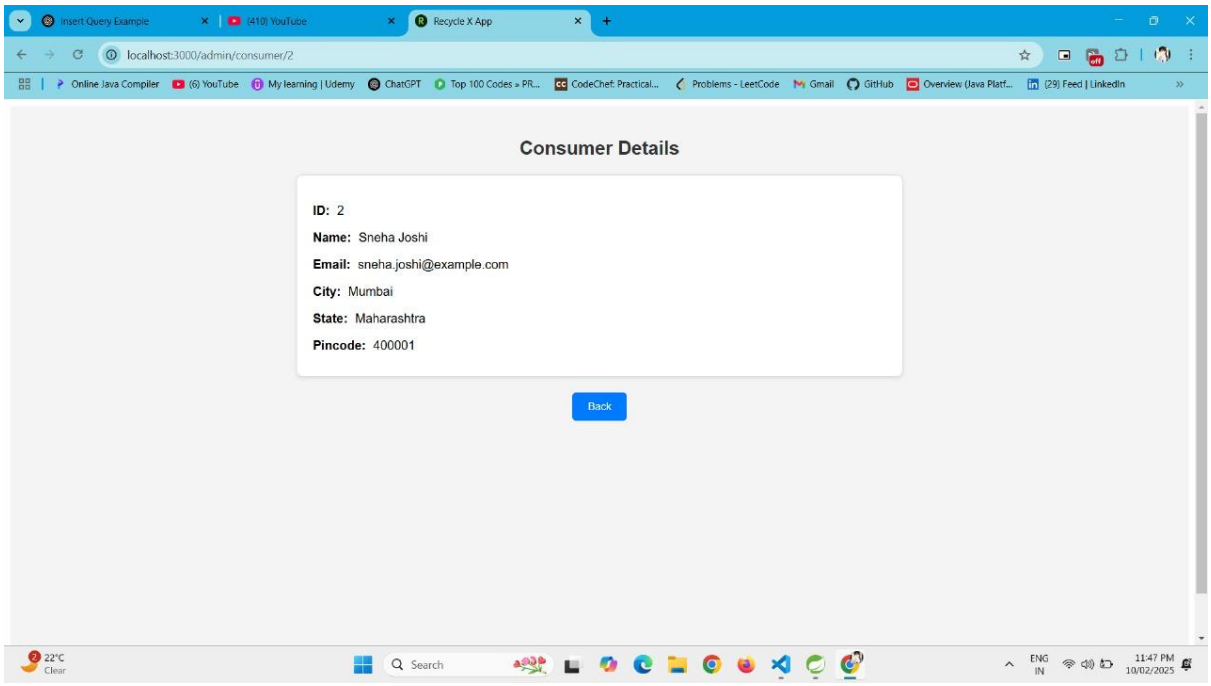
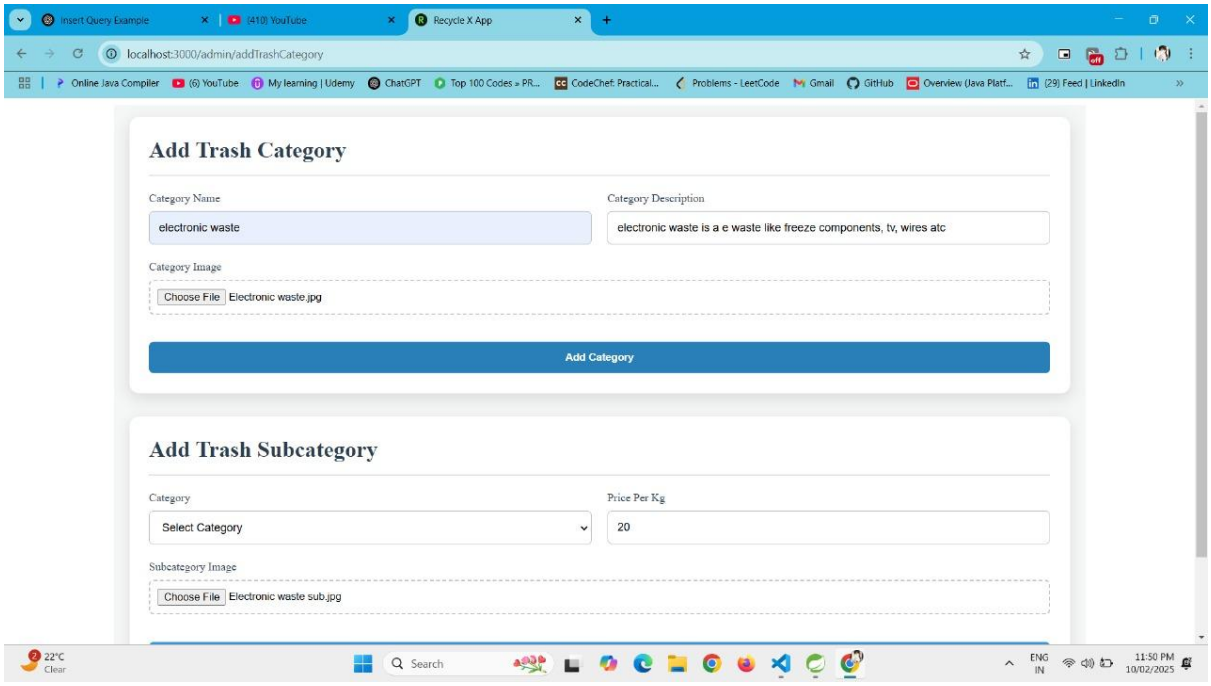


Fig. 5.2.3 Customer Details



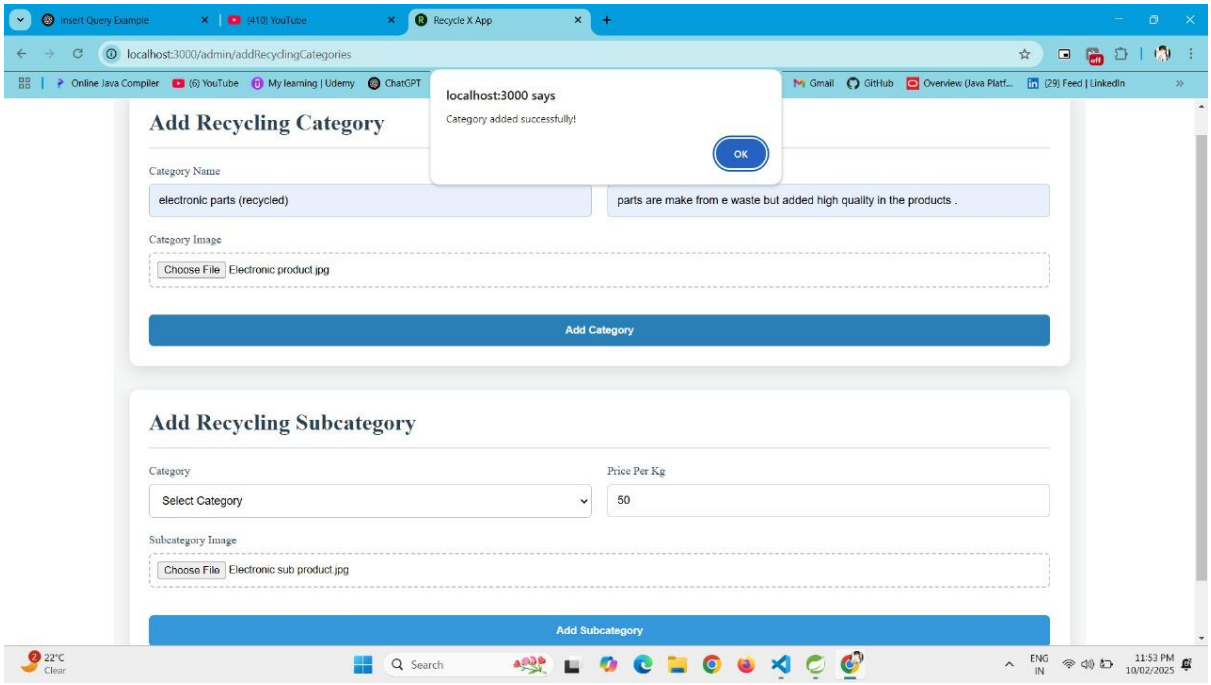


Fig. 5.2.4 Add Recycling Category

Supplier User Interfaces

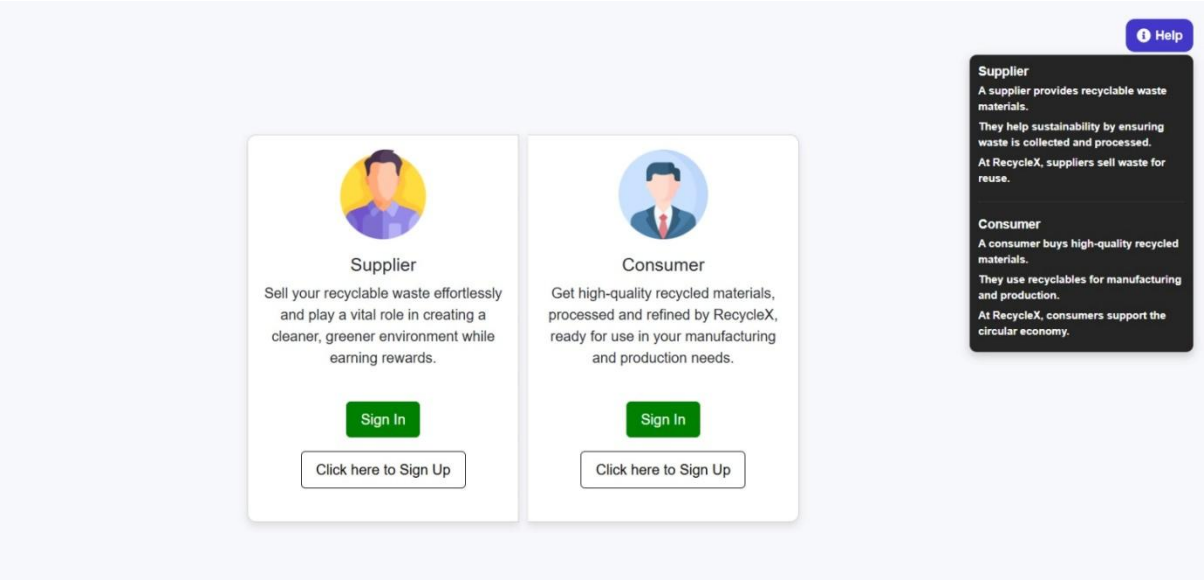


Fig. 5.3.1 Home Welcome

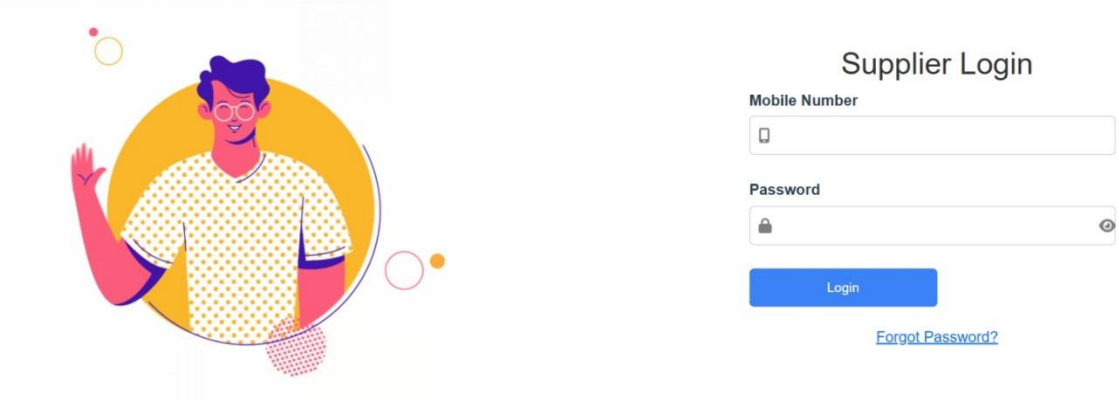


Fig. 5.3.2 Supplier Login

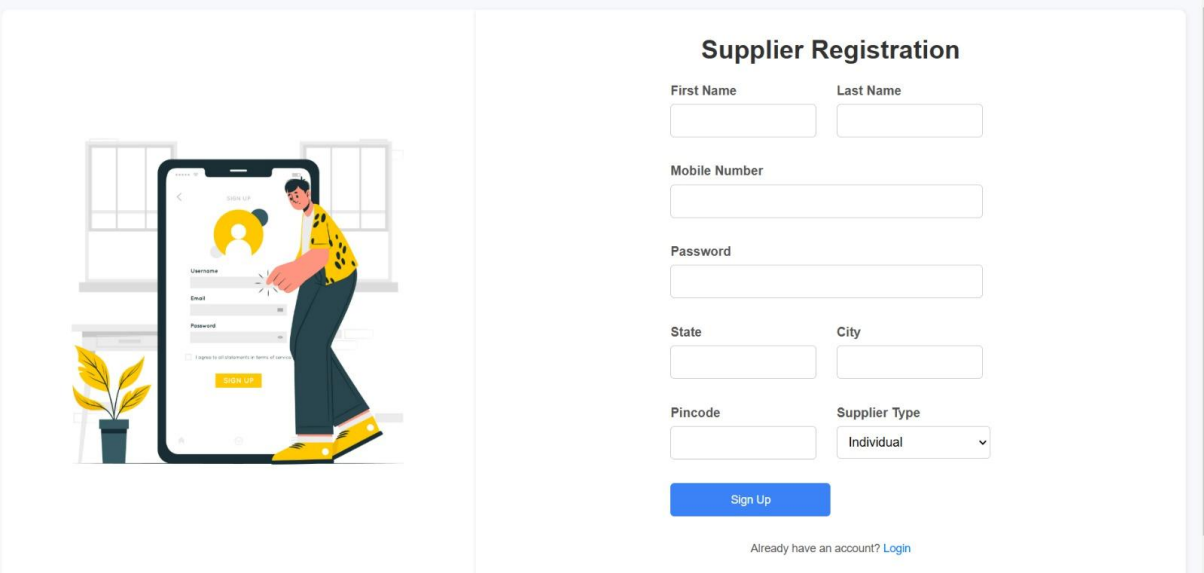


Fig. 5.3.3 Supplier Registration

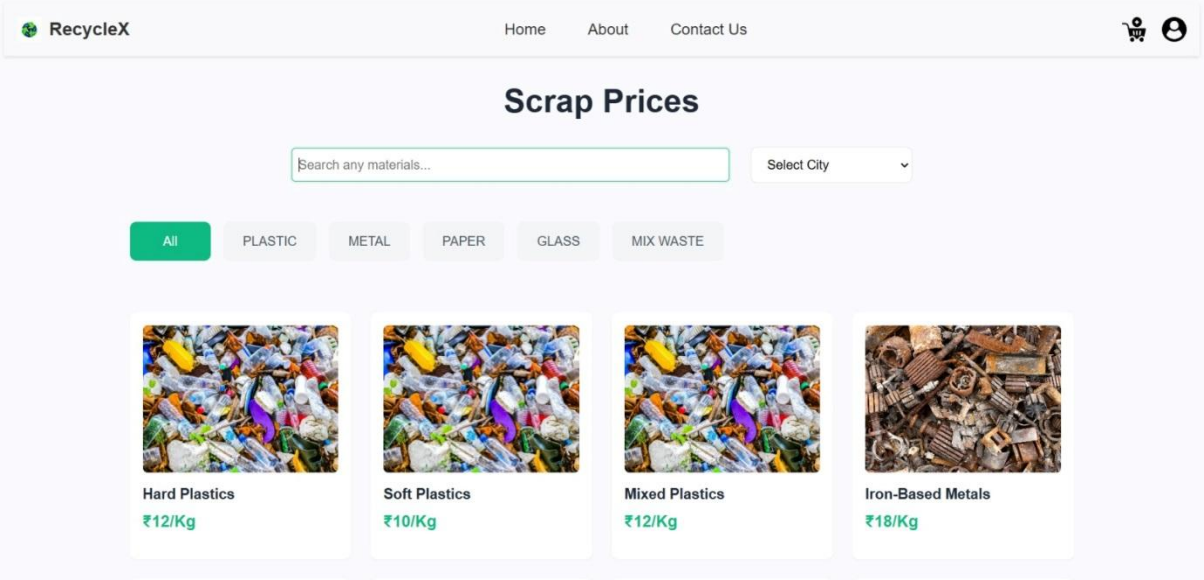


Fig. 5.3.4 Supplier Home

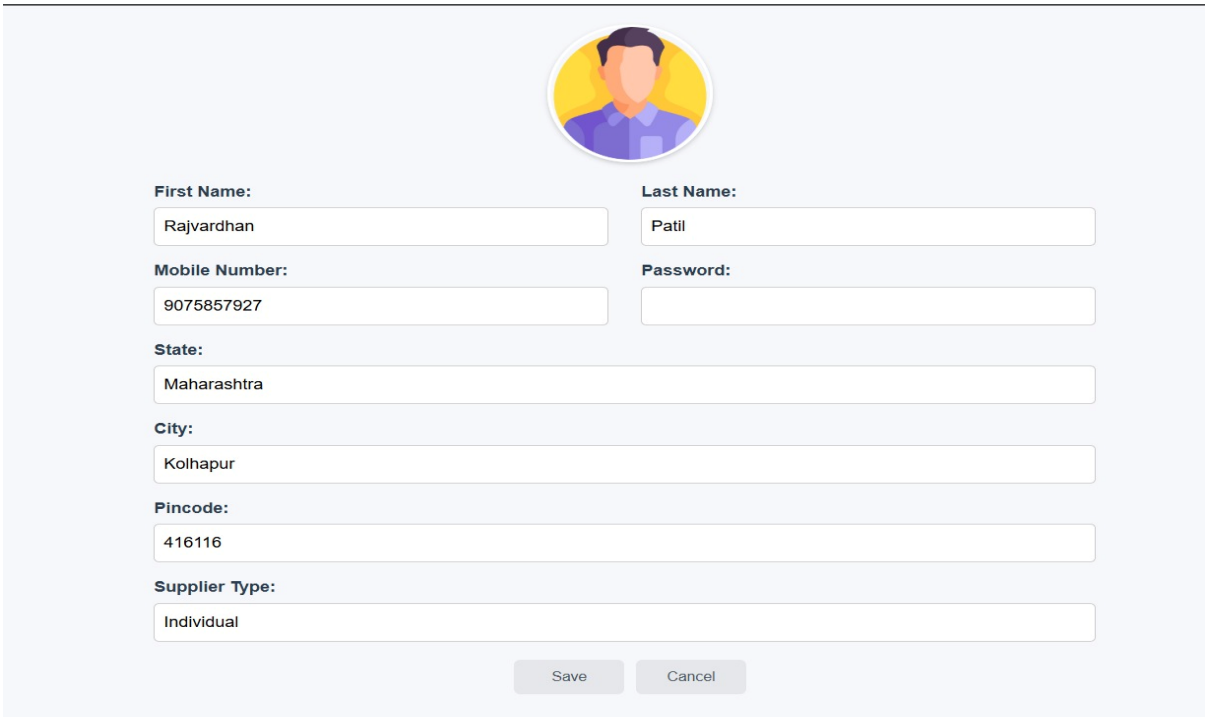


Fig. 5.3.5 Supplier Profile

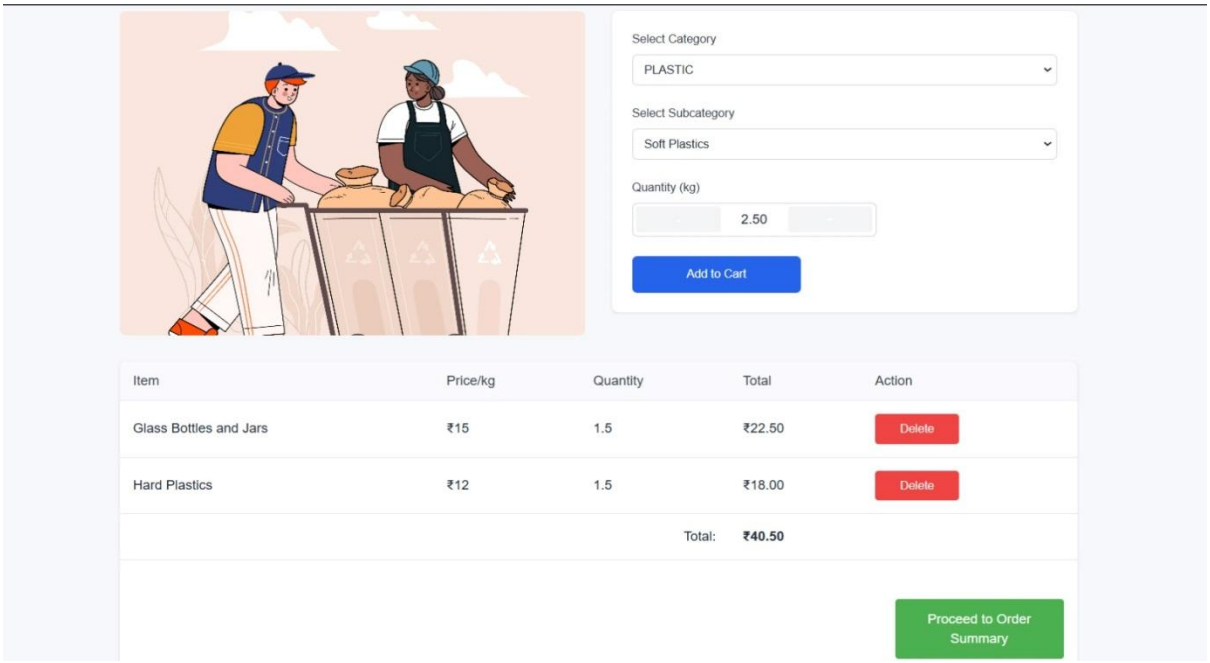


Fig. 5.3.6 Supplier Add Cart

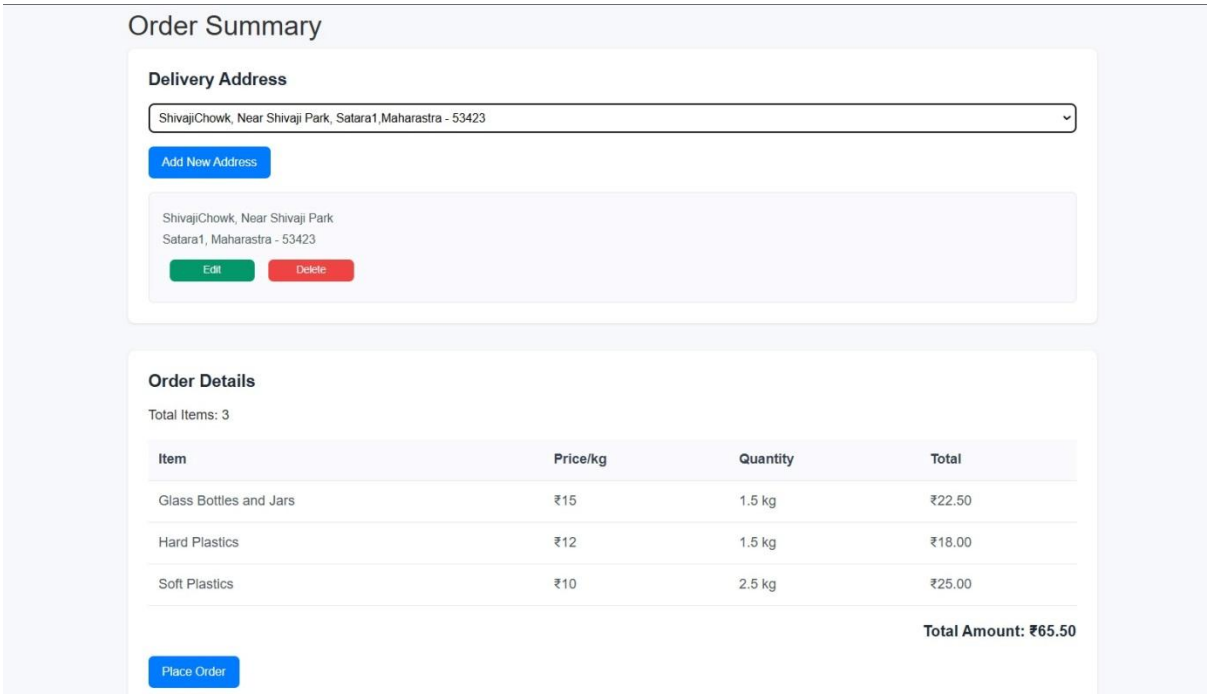


Fig. 5.3.7 Supplier Order Summary

Consumer User Interfaces

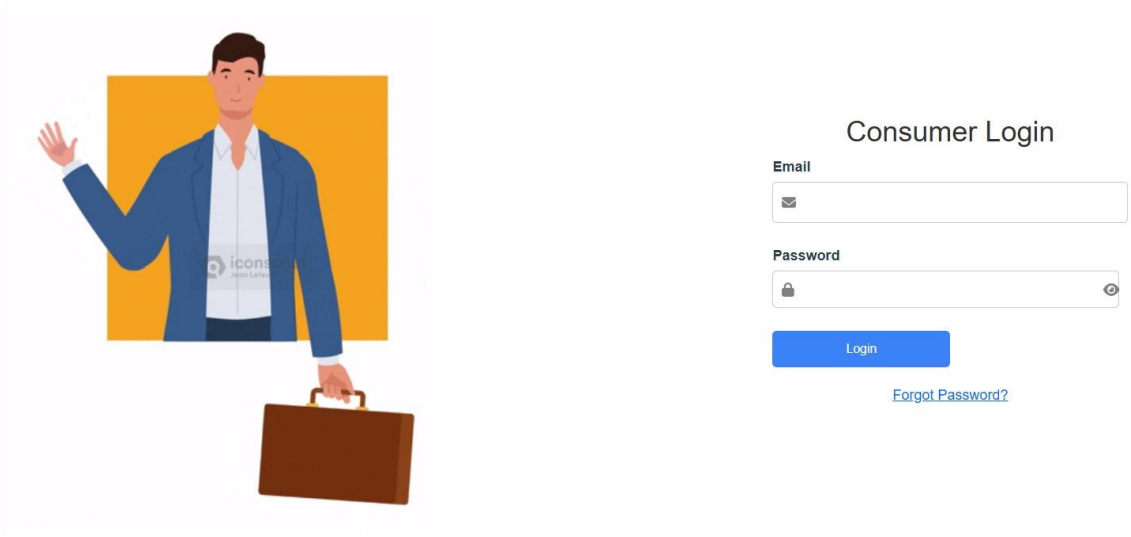


Fig. 5.4.1 Consumer Login

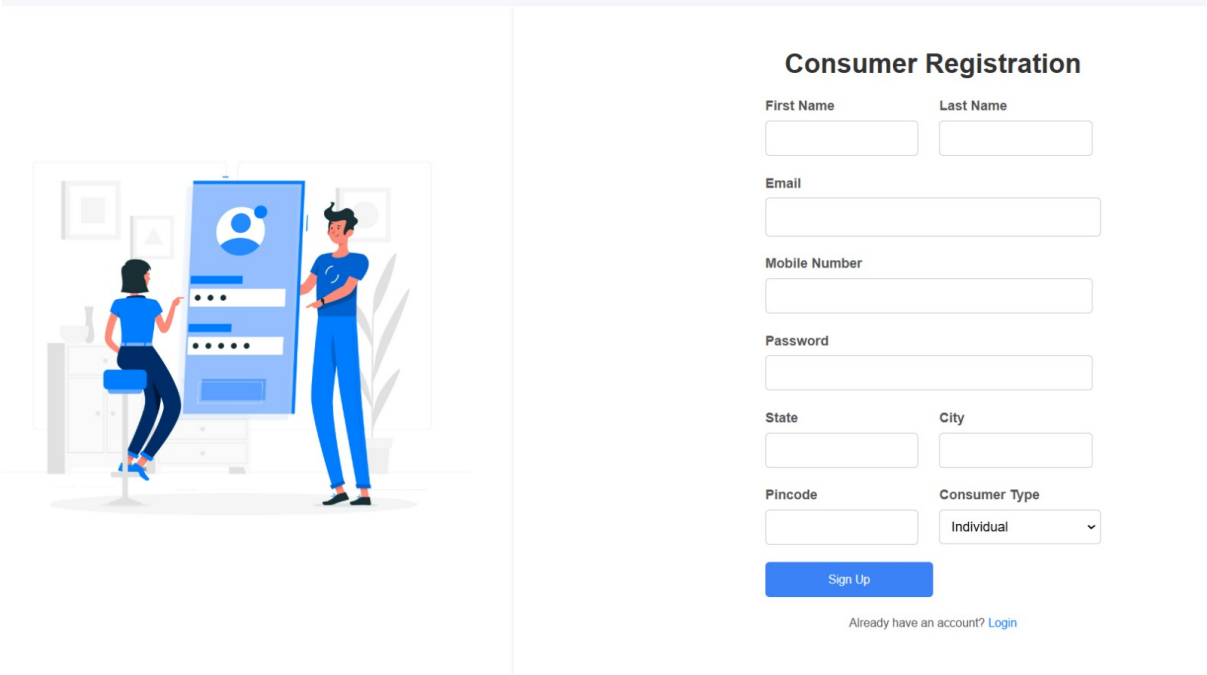


Fig. 5.4.2 Consumer Registration

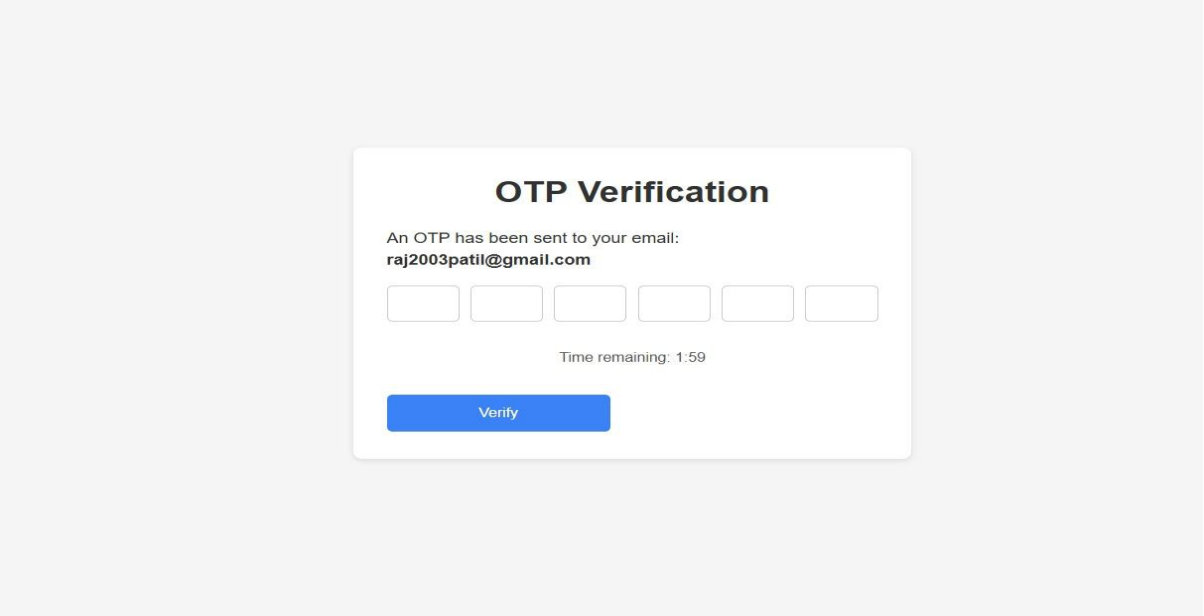


Fig. 5.4.3 OTP Verification

5.4.4 Consumer Email OTP Code:

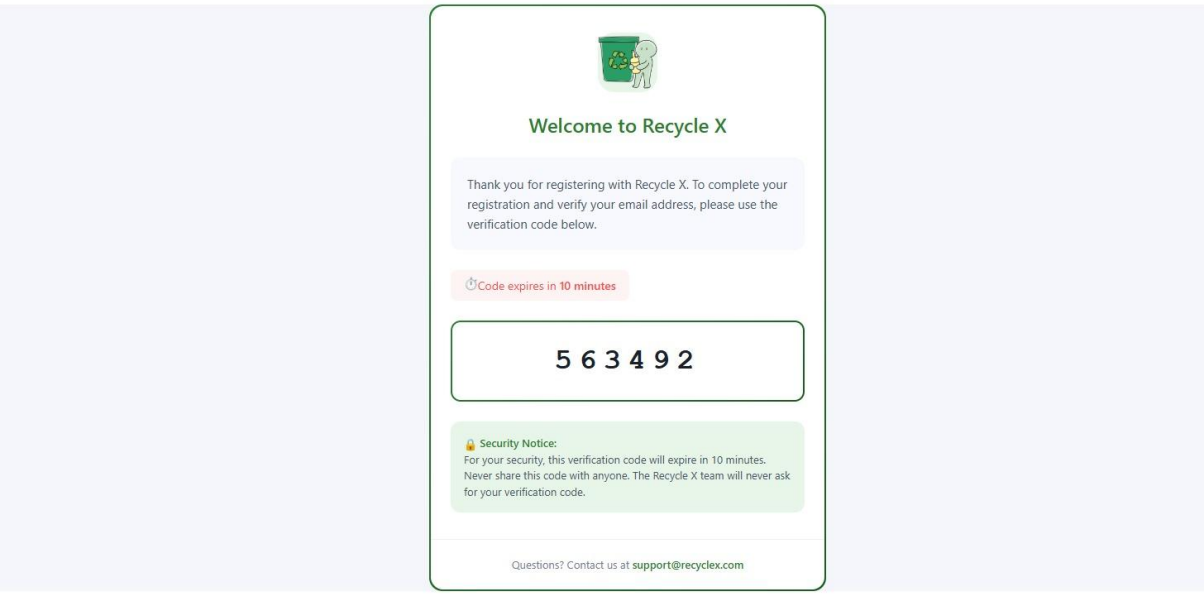


Fig. 5.4.4 Consumer Email OTP

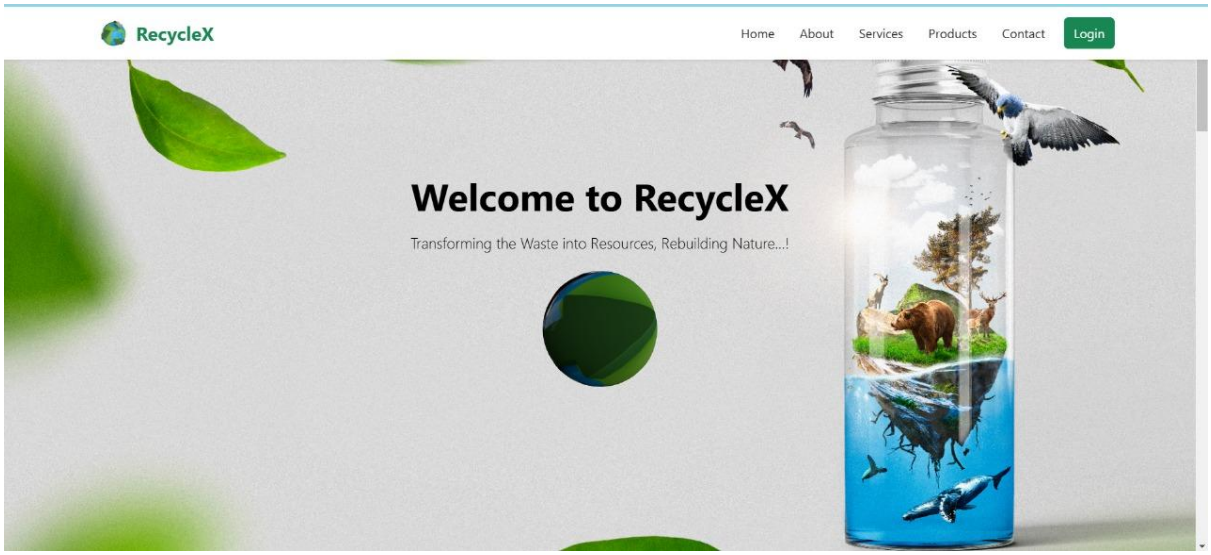


Fig. 5.4.5 Consumer Welcome

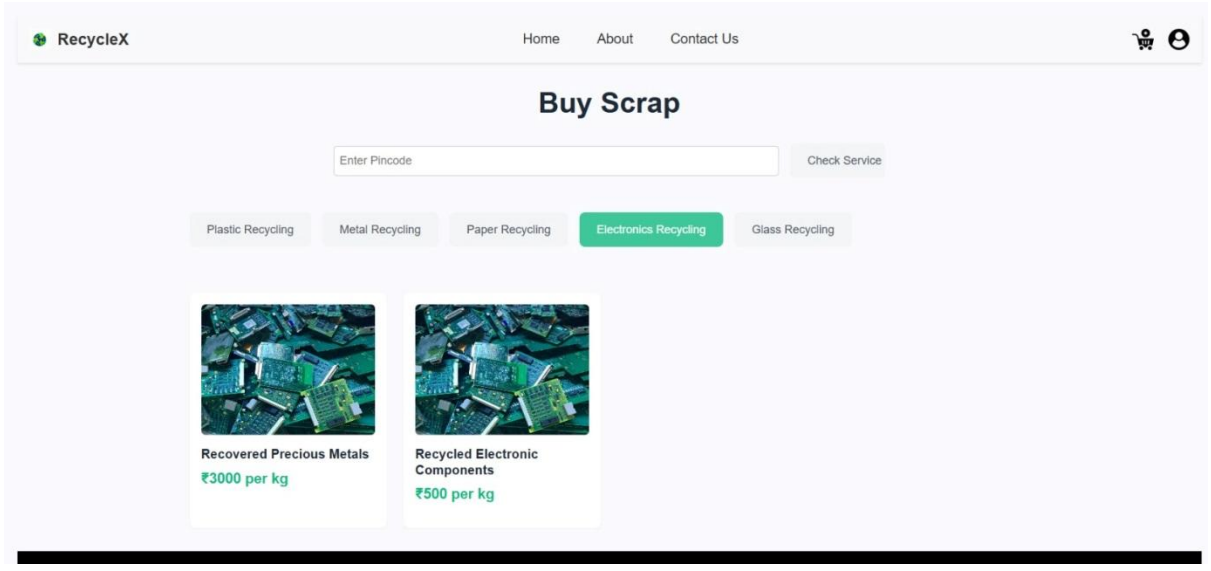


Fig. 5.4.6 Consumer Home

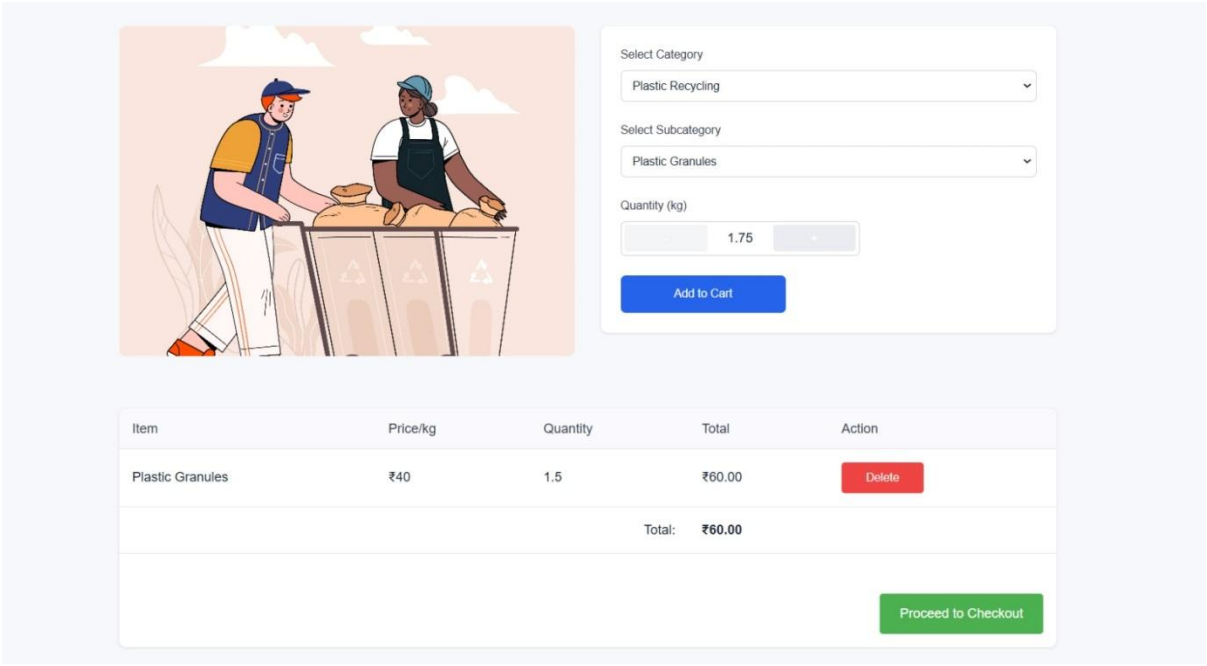


Fig. 5.4.7 Consumer Add Cart

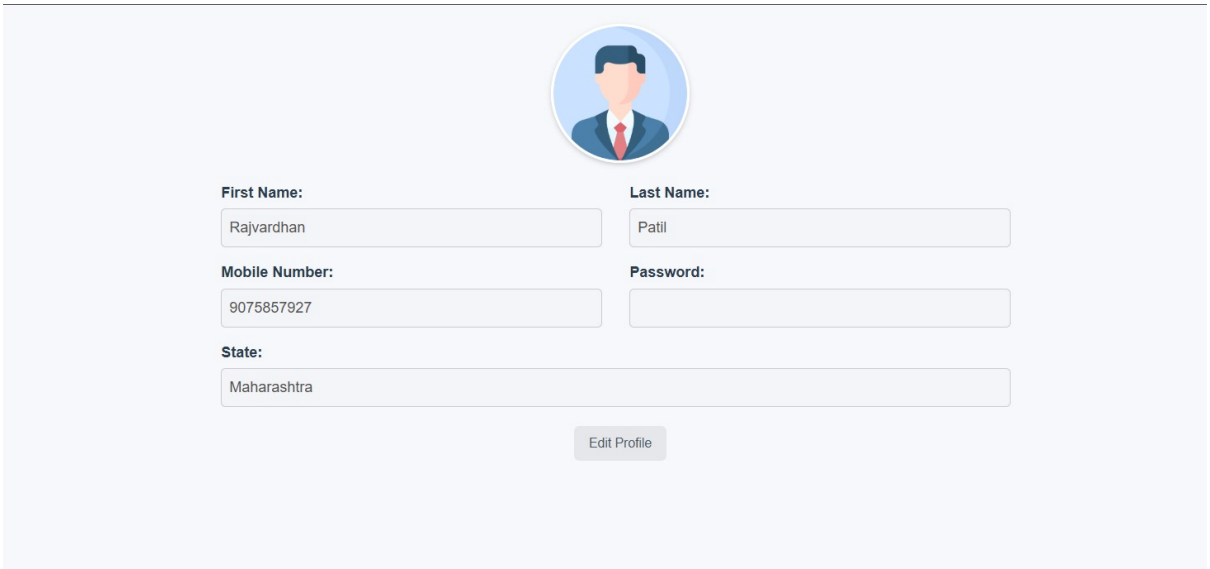


Fig. 5.4.8 Consumer Profile

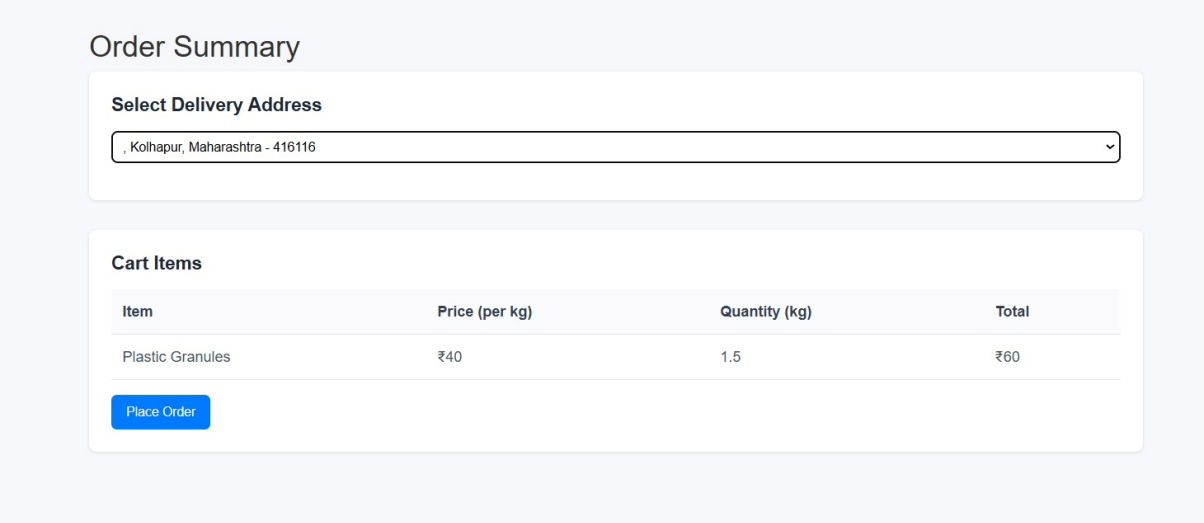


Fig. 5.4.9 Consumer Order Summary

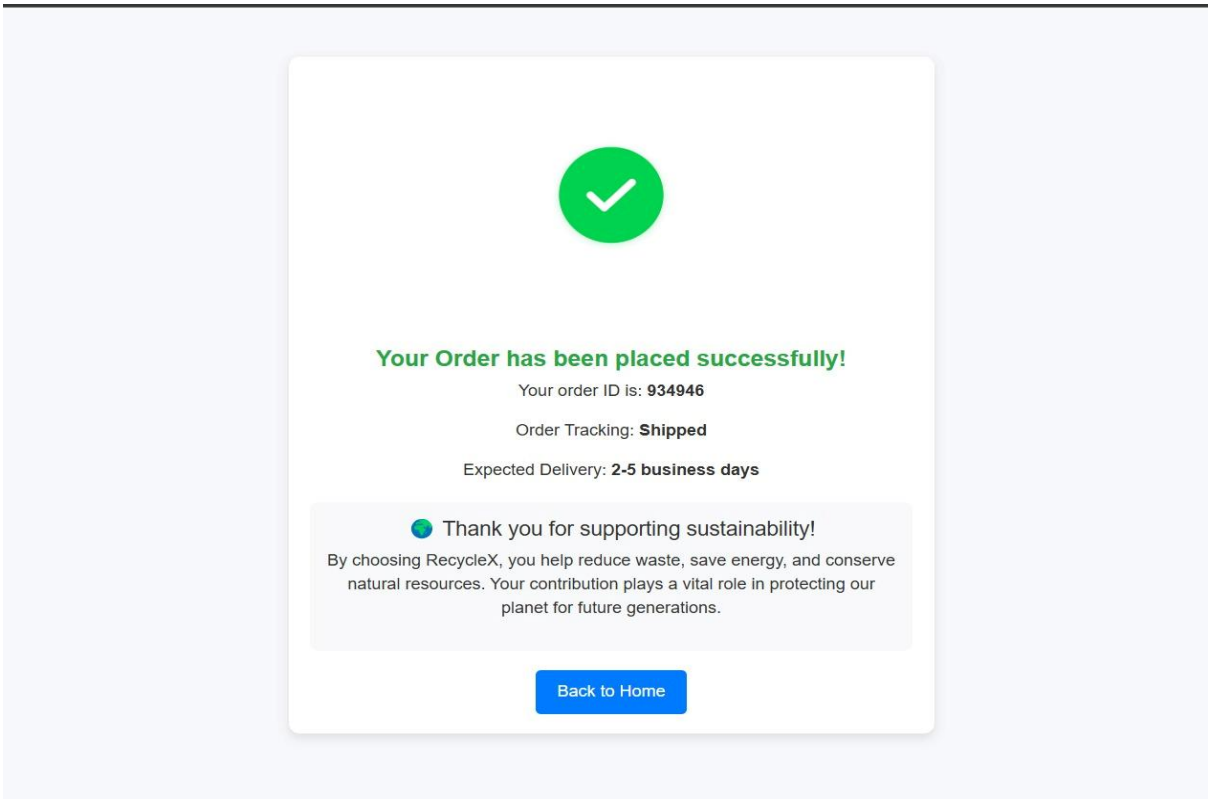


Fig. 5.4.10 Consumer & Supplier Order Placed

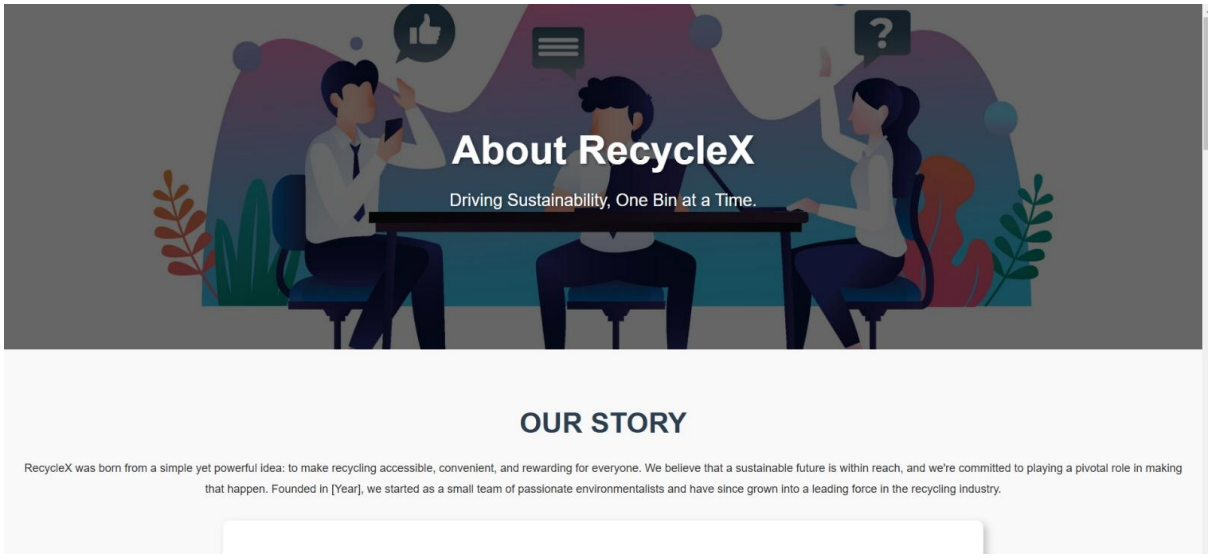


Fig. 5.4.11 About Us

5.4.12 Contact US:

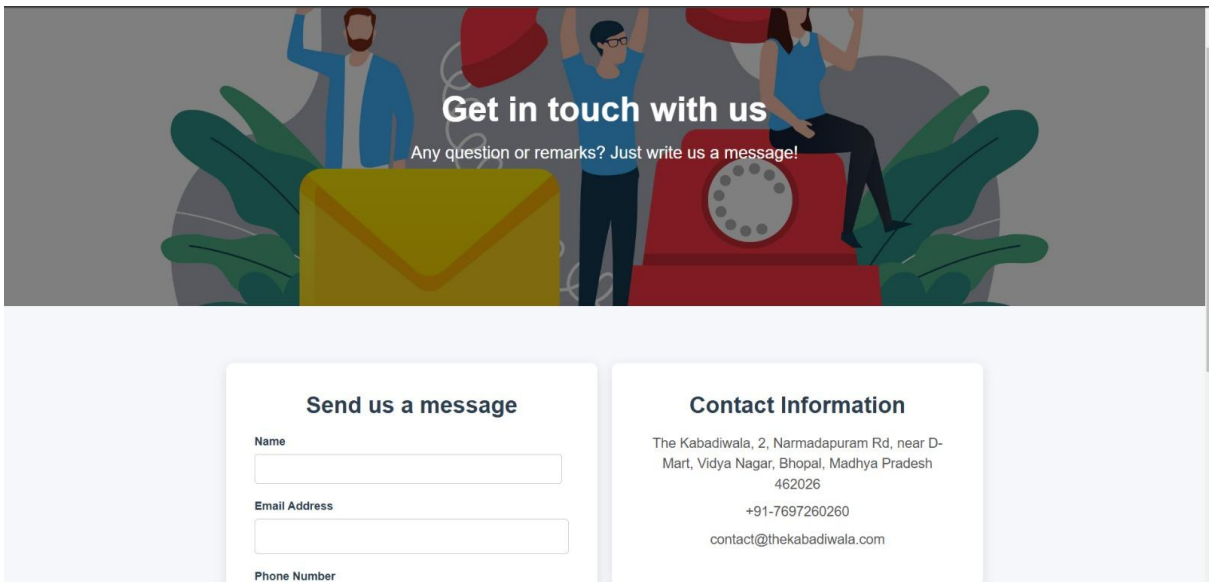


Fig. 5.4.12 Contact Us

5.5. Mobile Consumer & Supplier Interfaces

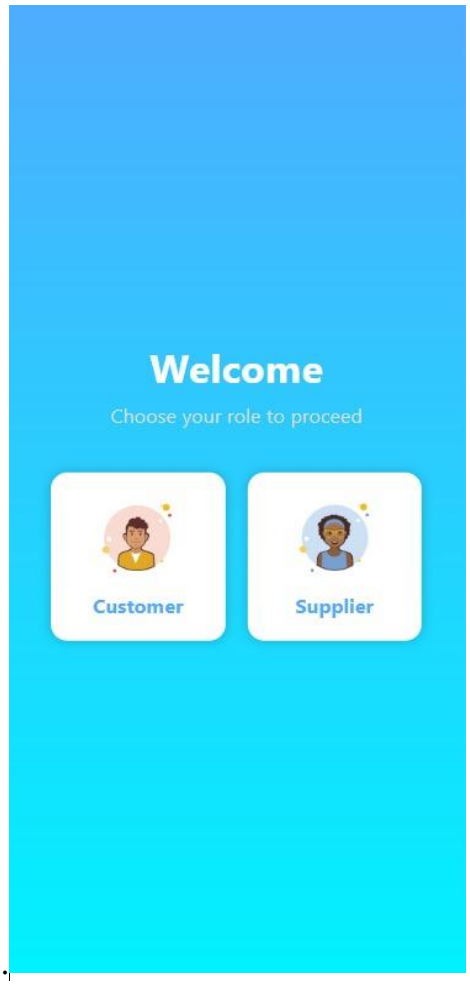


Fig. 5.5.1 Home Welcome

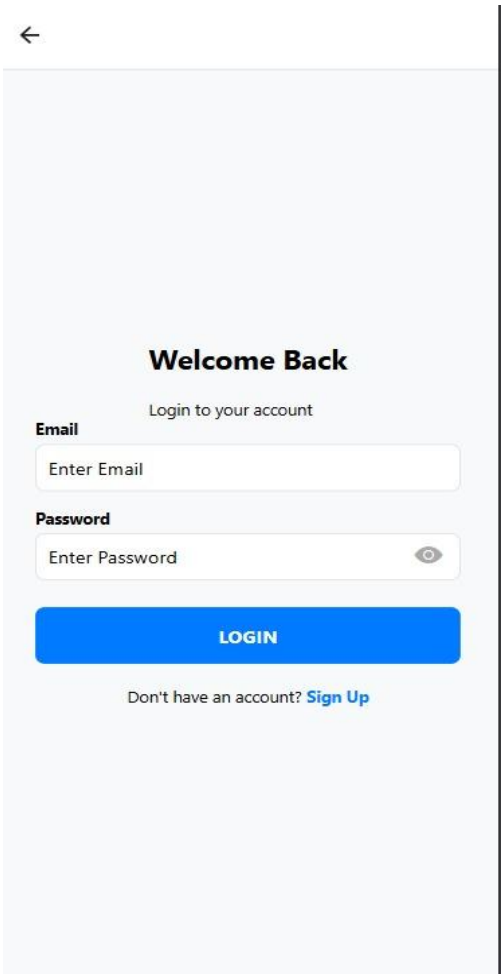


Fig. 5.5.2 Consumer Login

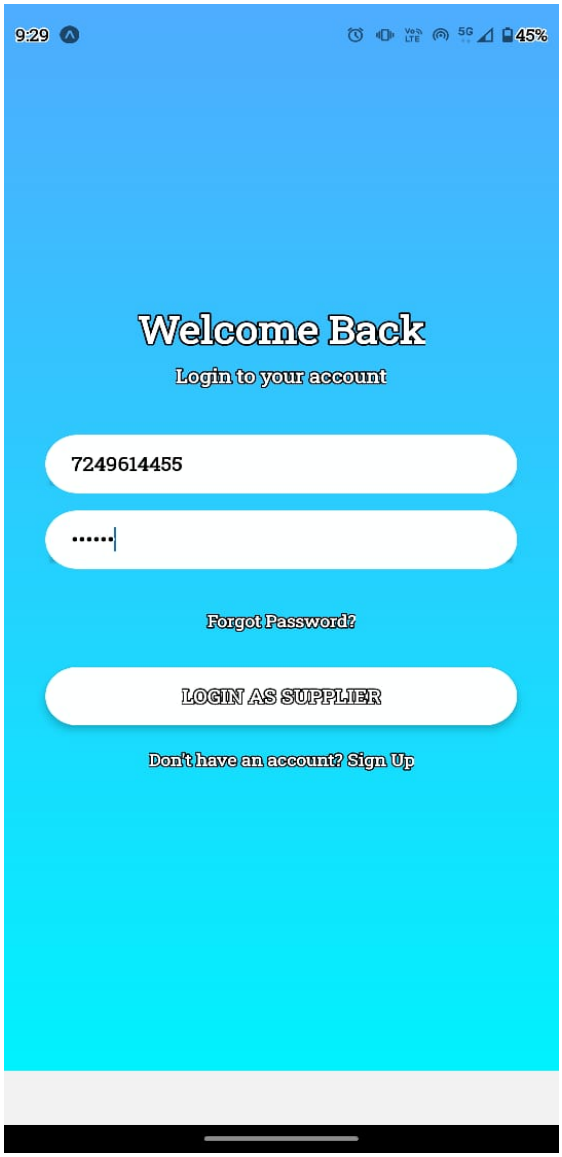


Fig. 5.6.1 Login Page

Fig. 5.6.2 Supplier Sell Product

Fig. 5.6.3 Supplier Add Cart

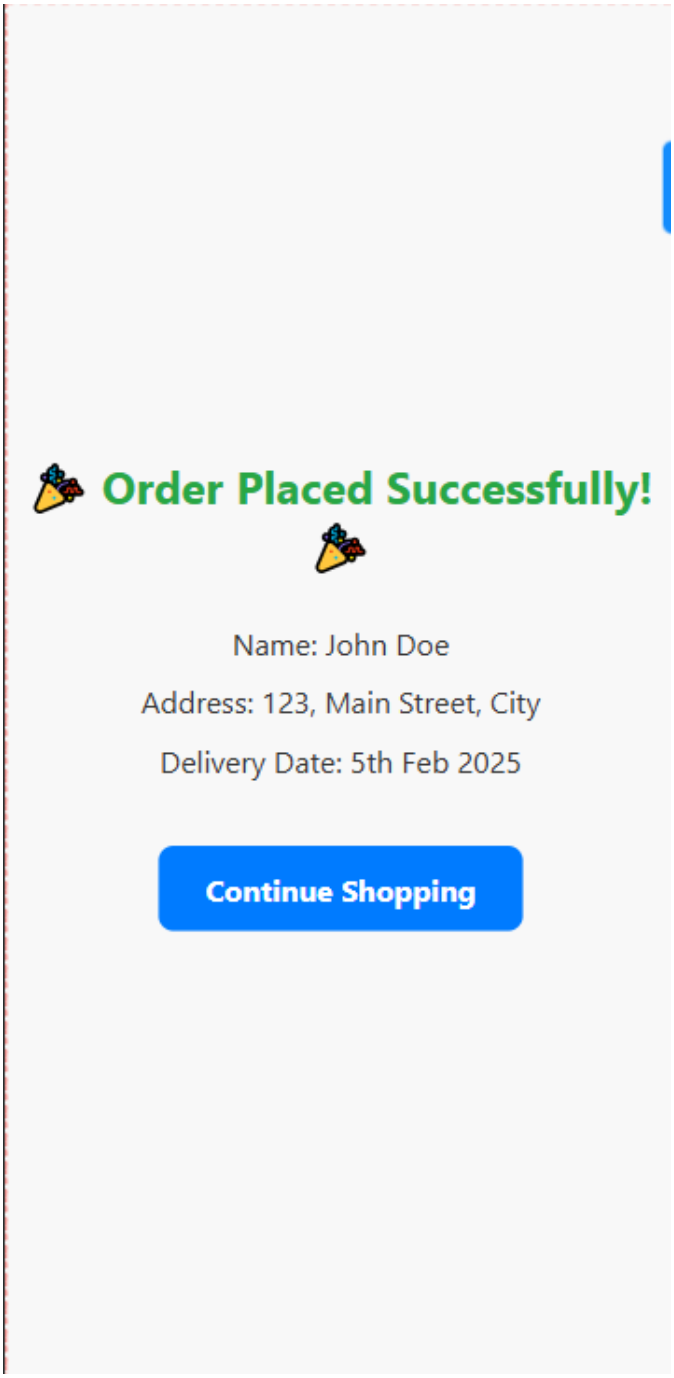


Fig. 5.6.5 Consumer & Supplier Order Placed

5.2Testing

5.3.1 TESTING METHODOLOGIES

Black box Testing

It is the testing process in which tester can perform testing on an application without having any internal structural knowledge of application. Usually Test Engineers are involved in the black box testing.

White box Testing

It is the testing process in which tester can perform testing on an application with having internal structural knowledge. Usually, The Developers are involved in white box testing.

Example for GUI Test cases

Table 5.2 GUI Test Cases

T.C. No	Description	Expected value	Actual value	Result
1	Checking whether all the components are properly arranged or not	The GUI must contain all the components properly arranged	Arranged properly	Pass
2	Checking the alignment of components placed	The alignment should be in proper way	Alignment should be correct	Pass

Positive Test Cases:

- The positive flow of the functionality must be considered.
- Valid inputs must be used for testing.
- Must have the positive perception to verify whether the requirements are justified.
- Verify that the system maintains data integrity and consistency when processing valid inputs.
- Ensure that positive test cases cover all user roles and permissions, verifying that each user type can successfully perform their intended actions.
- Ensure that the system provides appropriate feedback to the user for successful operations, such as success messages or confirmation dialogs.

Table 5.1 Positive Test Cases

Sr. No.	Test Case	Expected Result	Actual Result	Status
1	Check User is logged in or not	If user is logged in and authenticated redirect to home page else redirect to landing page.	User is redirecting properly on the basis of login status	Pass
2	Registration: Successful registration	User account created successfully, redirected to the home page	User account created successfully, redirected to the home page	Pass
3	Registration: Existing email	Error message displayed indicating the email is already in use	Error message displayed indicating the email is already in use	Pass
4	Login: Successful login	User logged in successfully, redirected to the home page	User logged in successfully, redirected to the home page	Pass
5	Login: Invalid credentials	Error message displayed indicating invalid credentials	Error message displayed indicating invalid credentials	Pass
6	When creator profile is available	Avatar, username, and time ago displayed	[Avatar], [Username], [Time Ago] displayed	Pass
7	When creator profile is not available	Skeleton avatar and username displayed	Skeleton avatar and username displayed	Pass
8	When follow status is 'Following'	Follow button displays 'Unfollow'	Follow button displays 'Unfollow'	Pass
9	When follow status is 'Not Following'	Follow button displays 'Follow'	Follow button displays 'Follow'	Pass
10	When follow status is being updated	Follow button displays loading indicator	Follow button displays loading indicator	Pass
11	Posts: Display posts	Posts are displayed on the home page	Posts are displayed on the home page	Pass

APPLICATIONS

 Professional Networking:

Recycle X offers a dedicated professional networking platform for users within the waste management sector. Consumers, suppliers, and admins can create personalized profiles, showcasing their expertise and career aspirations in sustainable waste management. By making posts, answering queries, and interacting with others in the system, users can build a professional presence. This feature not only helps individuals showcase their academic achievements but also allows them to connect with others in the recycling and environmental sectors, facilitating career growth and knowledge sharing. The platform offers opportunities to discuss industry trends, advancements, and best practices in waste management, enabling users to expand their professional network.

 Community Engagement:

The community engagement feature of Recycle X provides an inclusive, collaborative space for users to interact, share ideas, and contribute to meaningful discussions about sustainability, recycling processes, and waste management practices. Through this section, users can participate in forums that cover a wide range of topics, from reducing waste to implementing effective recycling systems. Recycle X breaks down geographical barriers, enabling individuals from different parts of the world to collaborate and learn from each other, regardless of location. This diverse community encourages interdisciplinary discussions and enhances the overall user experience, promoting a sense of collective responsibility for the environment and sustainability.

6. CONCLUSION

Recycle X is an innovative waste management platform that integrates **React**, **React Native**, **Node.js**, and **MySQL** to provide an efficient, scalable solution. Using **MVC architecture**, the system ensures a clean and organized structure for easy maintenance and development. **Email OTP authentication** secures the platform, while **backend logging** ensures transparency and allows for easy monitoring of activities. With **MySQL** for data storage, the system handles user and waste management data efficiently using **indexing** and **stored procedures** for optimized queries. The platform supports three main roles: **Admin**, **Consumer**, and **Supplier**, each contributing to the seamless flow of waste collection, recycling, and material distribution. Recycle X's main goals are to promote **sustainable waste management**, increase **recycling awareness**, and contribute positively to the environment, making it a vital tool in addressing waste management challenges.