B.M.S COLLEGE OF ENGINEERING BENGALURU
Autonomous Institute, Affiliated to VTU

OOMD Mini Project Report

WASTE MANAGEMENT SYSTEM

Submitted in partial fulfillment for the award of degree of

Bachelor of Engineering
in
Computer Science and Engineering

Submitted by:
VUNDAVALLI SUMA(1BM20CS192)
VALMIKA G(1BM20CS180)
V ASMA ANJUM(1BM20CS178)
VAISHALI KATHARIYA(1BM20CS179)

Department of Computer Science and Engineering
B.M.S College of Engineering
Bull Temple Road, Basavanagudi, Bangalore 560 019
2022-2023

B.M.S COLLEGE OF ENGINEERING

DEPARTMENT OF COMPUTER SCIENCE AND ENGINEERING

DECLARATION

We, Vundavalli Suma (1BM20CS192), Valmika G (1BM20CS180), V Asma Anjum (1BM20CS178) & Vaishali Kathariya (1BM20CS179) students of 6th Semester, B.E, Department of Computer Science and Engineering, BMS College of Engineering, Bangalore, hereby declare that, this OOMD Mini Project entitled "**WASTE MANAGEMENT SYSTEM**" has been carried out in Department of CSE, BMS College of Engineering, Bangalore during the academic semester March - July 2023. I also declare that to the best of our knowledge and belief, the OOMD mini Project report is not from part of any other report by any other students.

Signature of the Candidate

Vundavalli Suma(1BM20CS192)

Valmika G(1BM20CS180)

V Asma Anjum(1BM20CS178)

Vaishali Kathariya(1BM20CS179)

BMS COLLEGE OF ENGINEERING

DEPARTMENT OF COMPUTER SCIENCE AND ENGINEERING

CERTIFICATE

This is to certify that the OOMD Mini Project titled "**WASTE MANAGEMENT SYSTEM**" has been carried out by Vundavalli Suma (1BM20CS192), Valmika G (1BM20CS180), V Asma Anjum (1BM20CS178) & Vaishali Kathariya (1BM20CS179) during the academic year 2022-2023.

Signature of the Faculty in Charge

Signature of the Head of the Department

Table of Contents

Chapter 1: Problem Statement

Problem Statement:

Designing an Integrated Waste Management System to Address Inefficiencies and Promote Sustainability

Problem Description:

The current waste management system is plagued by numerous inefficiencies and lacks a holistic approach towards waste handling and disposal. This hampers the overall sustainability of the system and poses significant environmental and health risks. To address these challenges, there is a critical need to design and implement an integrated waste management system that optimizes waste handling processes, promotes recycling and reuse, reduces environmental impact, and enhances public health and sanitation.

Challenges:

Inefficient waste collection and disposal: The existing waste collection methods suffer from inefficiencies, resulting in irregular and inconsistent collection schedules, missed pickups, and accumulation of waste in public spaces. This not only contributes to unsightly litter but also poses health hazards and increases pollution levels.

Limited recycling and reuse practices: The current waste management system fails to effectively encourage and facilitate recycling and reuse. Inadequate infrastructure, insufficient awareness, and the absence of incentives hinder the diversion of recyclable materials from landfills, leading to the wasteful disposal of valuable resources.

Inadequate waste segregation at the source: Proper waste segregation at the point of generation is crucial for efficient waste management. However, there is a lack of awareness and convenient segregation methods, resulting in mixed waste streams that are difficult to handle and recycle. This further impedes the recycling and recovery of valuable materials.

Inefficient waste treatment facilities: The available waste treatment facilities, such as landfills and incinerators, often operate inefficiently and struggle to cope with the increasing waste volumes. This results in environmental pollution, emission of harmful gases, and contamination of groundwater. Additionally, the energy potential of waste is underutilized, contributing to energy scarcity.

Lack of public participation and awareness: Public engagement and awareness play a vital role in the success of any waste management system. However, there is a lack of widespread knowledge and active participation from the community. Insufficient education and outreach programs hinder the adoption of responsible waste disposal practices and inhibit behavioral changes required for sustainable waste management.

Objectives:

Develop an optimized waste collection system that ensures regular and efficient waste collection, minimizing litter and health risks in the community. This includes improving collection schedules, implementing modern tracking technologies, and streamlining waste pickup routes.

Design and implement a comprehensive recycling and reuse program, focusing on establishing adequate infrastructure, such as recycling centers and material recovery facilities. Implement education and incentive programs to promote recycling behavior among households, businesses, and industries.

Promote effective waste segregation at the source by raising awareness and providing accessible and user-friendly segregation methods. This includes distributing clear guidelines, providing proper waste bins, and conducting educational campaigns to emphasize the importance and benefits of waste segregation.

Establish advanced waste treatment facilities that minimize environmental impact and maximize resource recovery. Explore innovative techniques such as composting, anaerobic digestion, and waste-to-energy conversion to reduce waste volume, generate renewable energy, and recover valuable resources from waste.

Engage and educate the public through targeted awareness campaigns, community involvement programs, and educational initiatives. This includes conducting workshops, seminars, and public demonstrations to promote responsible waste management practices, emphasizing the importance of waste reduction, recycling, and responsible disposal.

Implement a robust monitoring and evaluation system to assess the performance of the waste management system. Utilize data-driven approaches to measure key performance indicators, identify areas for improvement, and optimize resource allocation and utilization.

By addressing these challenges and achieving the stated objectives, the aim is to design and implement an integrated waste management system that reduces waste generation, maximizes recycling and resource recovery, minimizes environmental impact, and fosters a culture of responsible waste management within the community.

These challenges collectively hinder the establishment of an efficient and sustainable waste management system. To address these issues, it is essential to design and implement a waste management system that integrates efficient waste collection methods, promotes recycling and reuse, enhances waste segregation practices, optimizes waste treatment facilities, and actively engages and educates the public. By tackling these challenges, the aim is to create a waste management system that minimizes waste generation, maximizes resource recovery, reduces environmental impact, and fosters a culture of responsible waste management.

Chapter 2: Software Requirements Specification

1. Introduction

1.1 Purpose

The purpose of this Software Requirements Specification (SRS) is to outline the functional and non-functional requirements of the Waste Management System. This system aims to provide an efficient and sustainable solution for waste handling, recycling, and disposal, addressing the challenges faced by the existing waste management practices.

1.2 Scope

The Waste Management System will encompass the entire waste management process, including waste collection, segregation, recycling, treatment, and disposal. It will target residential areas, commercial establishments, and public spaces, promoting waste reduction and encouraging public participation in sustainable waste management practices.

2. Functional Requirements

2.1 User Management

2.1.1 User Registration

- The system shall allow users to register by providing necessary information.

- Users can register as individuals, businesses, or waste management service providers.

2.1.2 User Authentication

- The system shall authenticate users based on their credentials before granting access.

2.2 Waste Collection

2.2.1 Waste Collection Scheduling

- The system shall allow users to view and request waste collection schedules for their respective locations.

- Users shall be able to select collection frequency (daily, weekly, etc.) based on their requirements.

2.2.2 Collection Route Optimization

- The system shall optimize waste collection routes to ensure efficient and timely collection.

- It shall consider factors like geographical location, waste quantity, and real-time traffic information.

2.3 Waste Segregation

2.3.1 Segregation Guidelines

- The system shall provide users with clear guidelines for waste segregation at the source.

- It shall specify the types of waste to be segregated (recyclable, organic, hazardous, etc.) and the appropriate containers for each waste type.

2.3.2 Segregation Assistance

- The system shall provide users with visual aids, labels, or color coding to facilitate proper waste segregation.

- It may include features like image recognition to assist users in identifying and segregating waste correctly.

2.4 Recycling and Reuse

2.4.1 Recycling Information

- The system shall provide users with information on recycling centers, drop-off points, and recycling guidelines.

- Users shall be able to search for nearby recycling facilities based on their location.

2.4.2 Recycling Notifications

- The system shall send notifications or reminders to users about recycling events, campaigns, or initiatives.

- It shall provide updates on the impact of recycling efforts and encourage continued participation.

2.5 Waste Treatment

2.5.1 Treatment Facility Information

- The system shall provide information about waste treatment facilities, including their locations, services offered, and operating hours.

- Users shall be able to search for appropriate treatment facilities based on waste type and proximity.

2.5.2 Advanced Treatment Techniques

- The system may include features that promote advanced waste treatment techniques such as composting, anaerobic digestion, or waste-to-energy conversion.

- It shall provide guidelines and resources for users interested in adopting these techniques.

2.6 Reporting and Analytics

2.6.1 Waste Generation Reports

- The system shall generate reports on waste generation patterns, quantities, and trends.

- It shall provide insights into waste management effectiveness and identify areas for improvement.

2.6.2 Performance Metrics

- The system shall measure and track key performance indicators, such as waste diversion rates, recycling rates, and energy recovery rates.

- It shall present performance metrics in a visually appealing and understandable format.

3. Non-functional Requirements

3.1 Usability

- The system shall have a user-friendly interface that is easy to navigate and understand.

- It shall provide clear instructions and guidance for users at each stage of the waste management process.

3.2 Performance

- The system shall be capable of

handling a large volume of user requests and data processing efficiently.

- It shall have minimal response times for waste collection scheduling, route optimization, and other critical functionalities.

3.3 Security

- The system shall ensure the confidentiality and integrity of user data, including personal and location information.

- It shall implement appropriate security measures, such as encryption and access controls, to protect against unauthorized access or data breaches.

3.4 Scalability

- The system should be designed to accommodate future expansion and increased user demand.

- It should have the capability to handle additional waste management features, accommodate more users, and integrate with external systems or APIs.

3.5 Reliability

- The system shall be reliable and available for use during scheduled service hours.

- It should have backup and recovery mechanisms to minimize downtime and data loss.

4. Constraints

- The Waste Management System should be compatible with various devices and platforms, including web browsers and mobile applications.

- It should adhere to local waste management regulations and guidelines.

- The development of the system should consider budgetary constraints and available resources.

5. Conclusion

This Software Requirements Specification outlines the functional and non-functional requirements for the Waste Management System. By addressing these requirements, the system aims to provide an efficient and sustainable solution for waste management, promoting waste reduction, recycling, and responsible disposal practices.

Chapter 3: Class Modeling

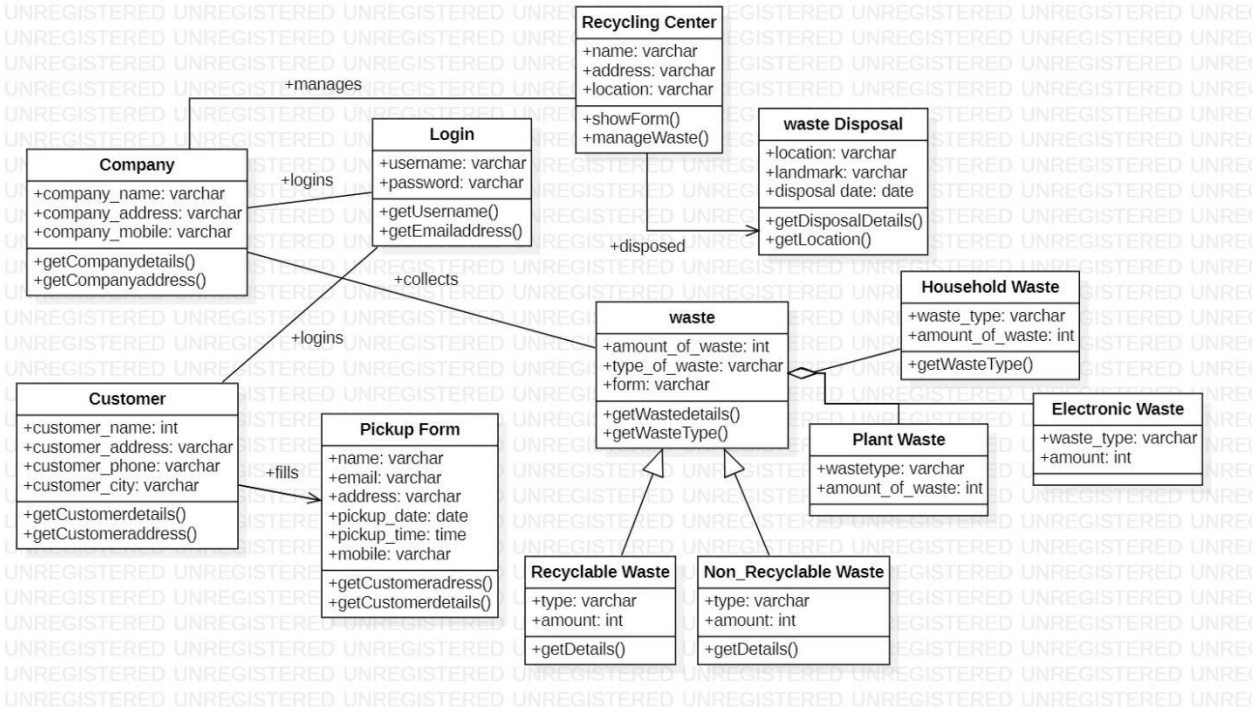

Fig 3.1: Class Diagram

A class diagram is a type of UML (Unified Modeling Language) diagram that provides a visual representation of the structure and relationships of the classes in a system. It is commonly used in software development to design, visualize, and document the static structure of an application.

This class diagram provides a view of the system's architecture, showcasing the classes, their attributes, and their behaviors. It also shows the associations or connections between classes, such as "has-a" or "uses-a" relationships.

Additionally, this class diagram illustrates inheritance, where one class inherits properties and behaviors from another. Inheritance is shown by an arrow pointing to the superclass or parent class. It also illustrates generalization.

In simple terms, a class diagram is like a family tree that shows how different classes in a program are related to each other. Each class is represented by a box, and the relationships between classes are depicted by lines connecting them.

Chapter 4: State Modeling

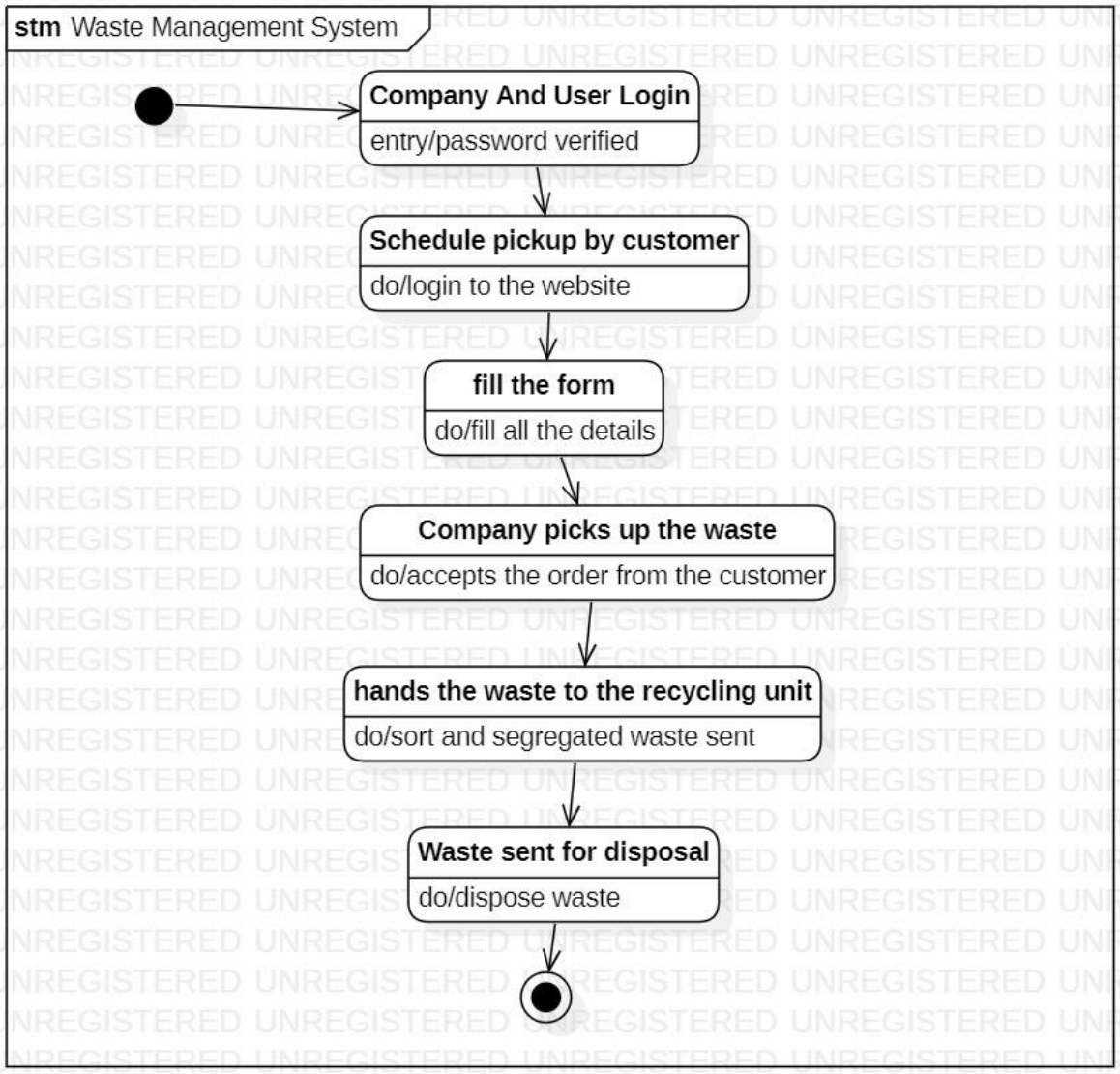

Fig 4.1: State Diagram

A state model represents the various states that an object can be in and how it transitions between those states. It describes the behavior of an object over time and captures the changes in its internal state.

The state model consists of states, events, and transitions. A state represents a specific condition or situation of an object. Events are the triggers or actions that cause an object to transition from one state to another. Transitions represent the paths or routes that an object takes when moving from one state to another in response to an event.

Chapter 5: Interaction Modeling

5.1 Use Case Diagram

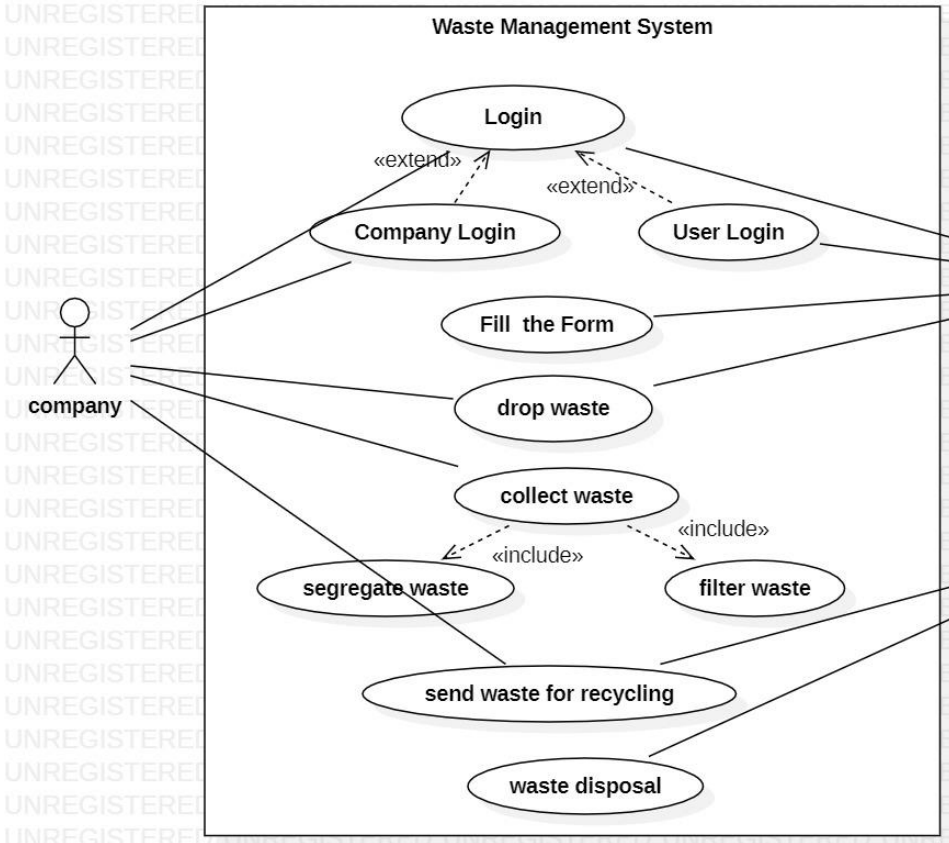

Fig 5.1.1: Use Case Diagram

A use case diagram in object-oriented modeling and design is a visual representation of the interactions between actors (users or external systems) and a system. It illustrates the different ways in which actors interact with the system to achieve specific goals or perform tasks.

The use case diagram consists of actors, use cases, and the relationships between them. Actors represent the users or external systems that interact with the system. Use cases represent the specific tasks or actions that actors can perform within the system.

The relationships between actors and use cases are depicted by lines connecting them. These relationships define how actors are involved in specific use cases. For example, an actor may be the primary user of a particular use case or play a supporting role.

5.2 Sequence Diagram

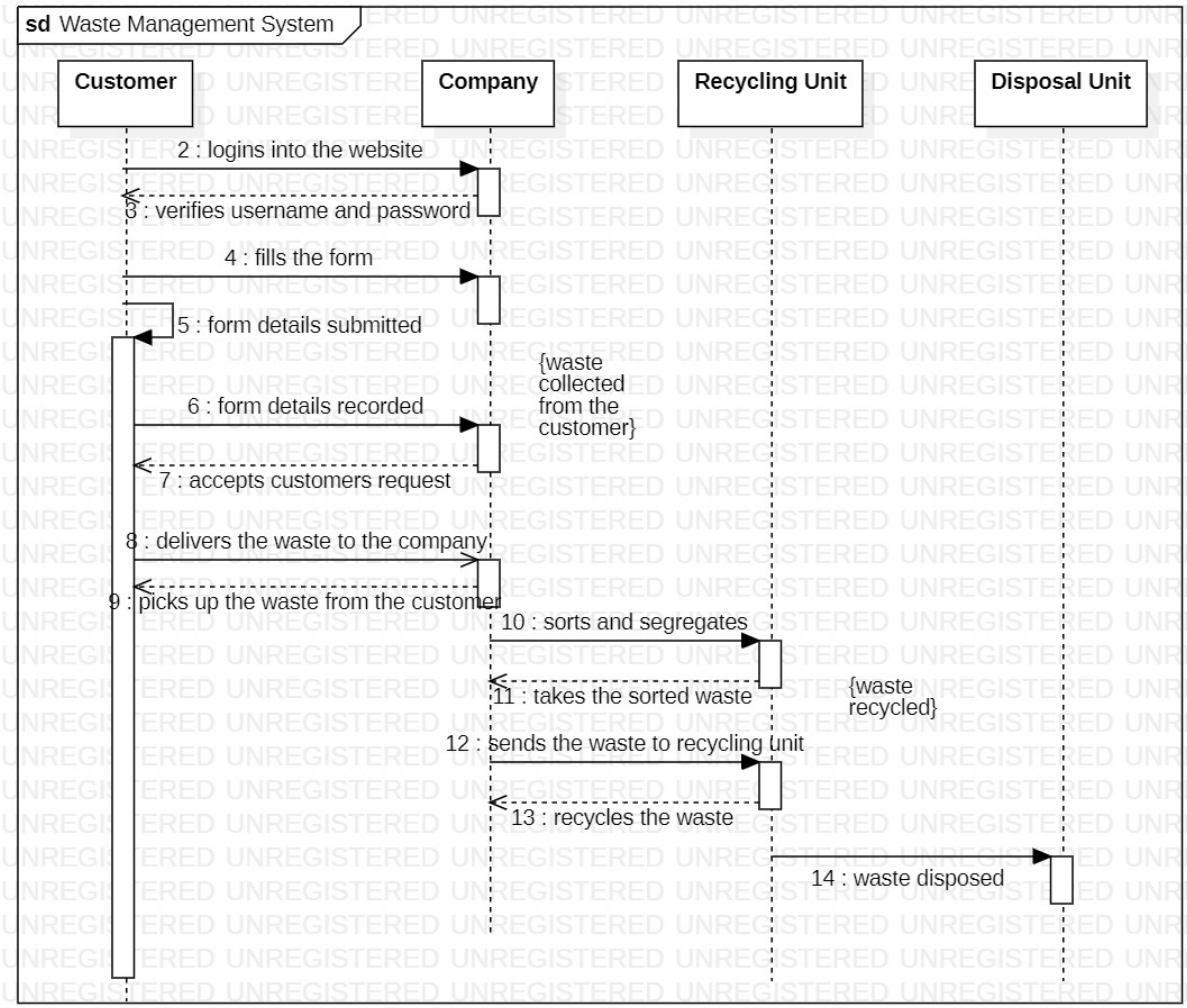

Fig 5.2.1: Sequence Diagram

A sequence diagram in object-oriented modeling and design is a visual representation of the interactions between objects over time. It shows the chronological order of messages exchanged between objects to achieve a specific task or behavior.

The diagram is laid out horizontally, with time progressing from left to right. Each object is represented by a vertical line called an "object lifeline." The messages between objects are shown as arrows or dashed lines, indicating the flow of communication.

By following the sequence of messages, the diagram illustrates the order in which objects interact, the methods or operations being called, and the flow of data between objects. It helps in understanding the dynamic behavior of the system and the collaboration between different objects.

5.3 Activity Diagram

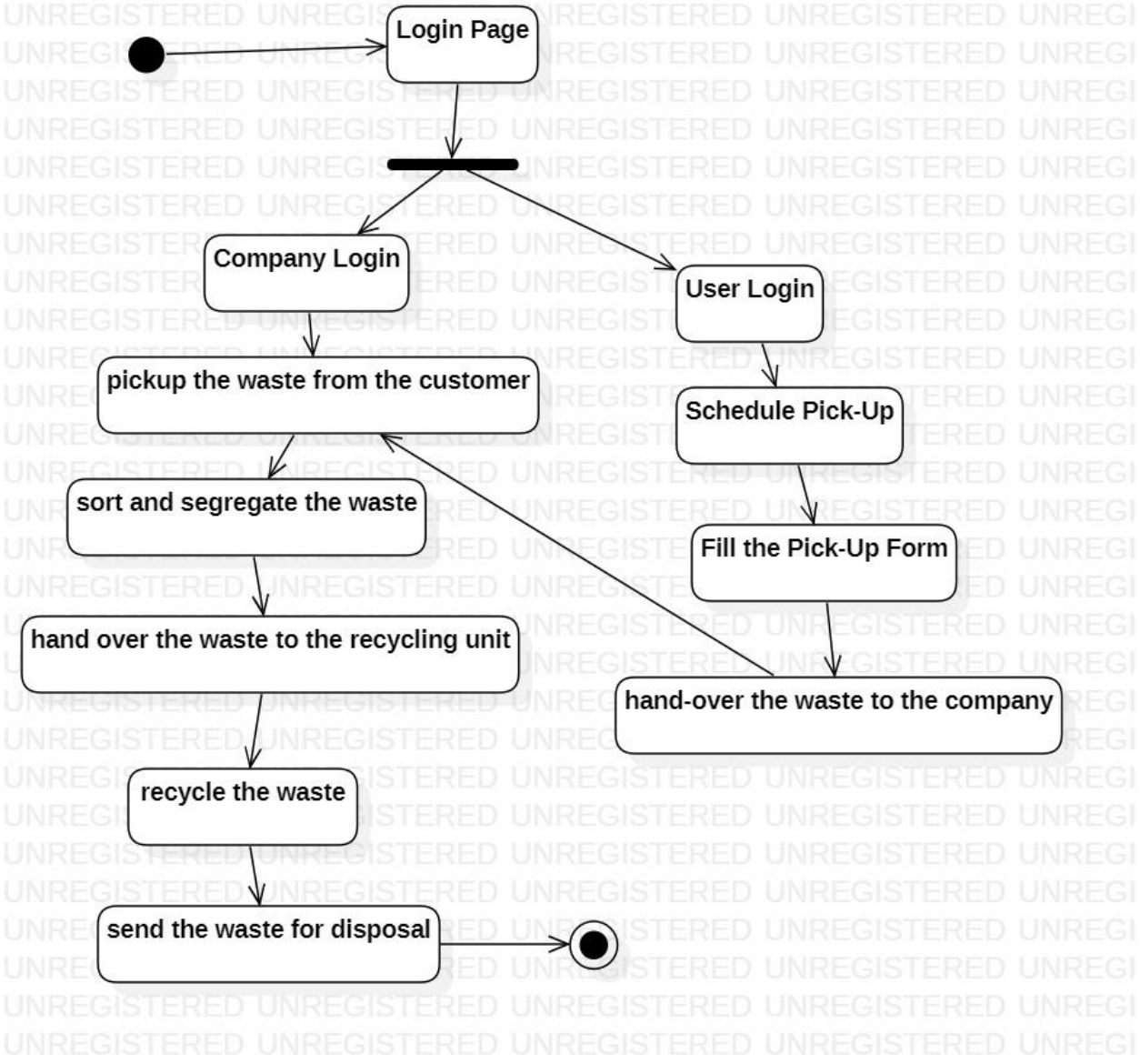

Fig 5.3.1: Activity Diagram

An activity diagram in object-oriented modeling and design is a visual representation of the flow of activities or tasks within a system. It illustrates the sequential and parallel steps involved in achieving a specific goal or process.

The diagram starts with an initial node, indicating the beginning of the activity. Each activity is represented by a rectangle, and the arrows connecting the rectangles represent the transitions or the flow of control from one activity to another. Decision points are shown using diamond-shaped nodes, which indicate a branching path based on a condition or decision. The final node marks the end of the activity.

Chapter 6: UI Design with Screenshots

6.1 Login Page

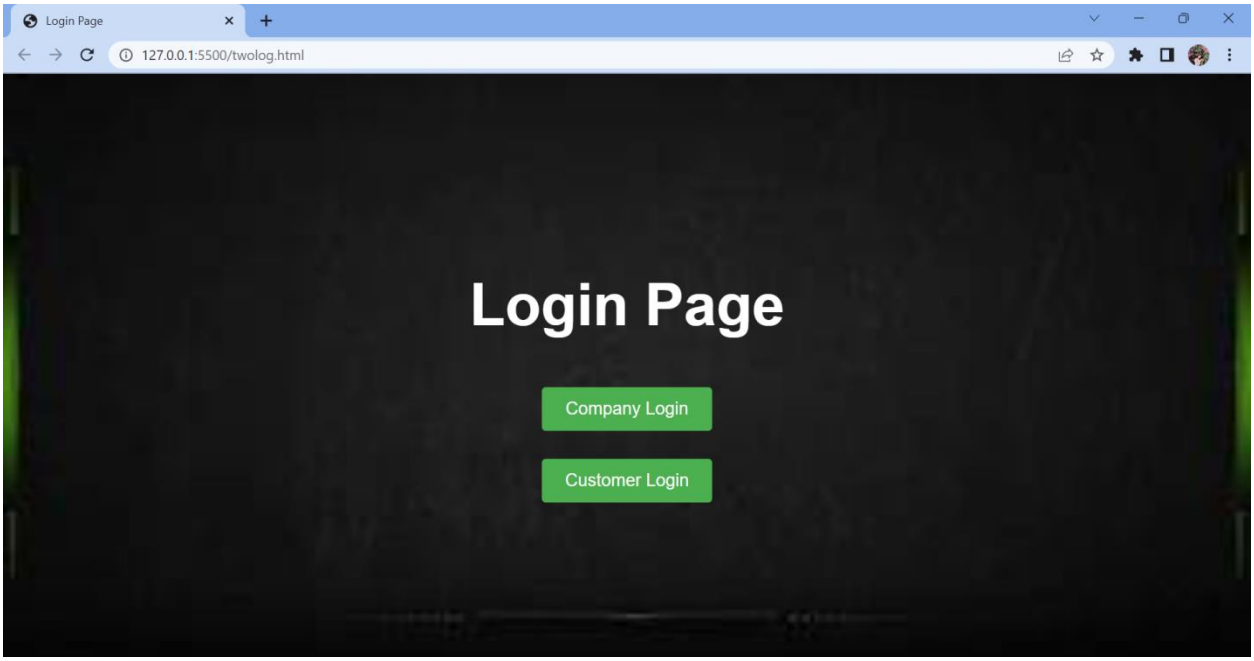

Fig 6.1.1: Login Page

6.2 Customer Login Page

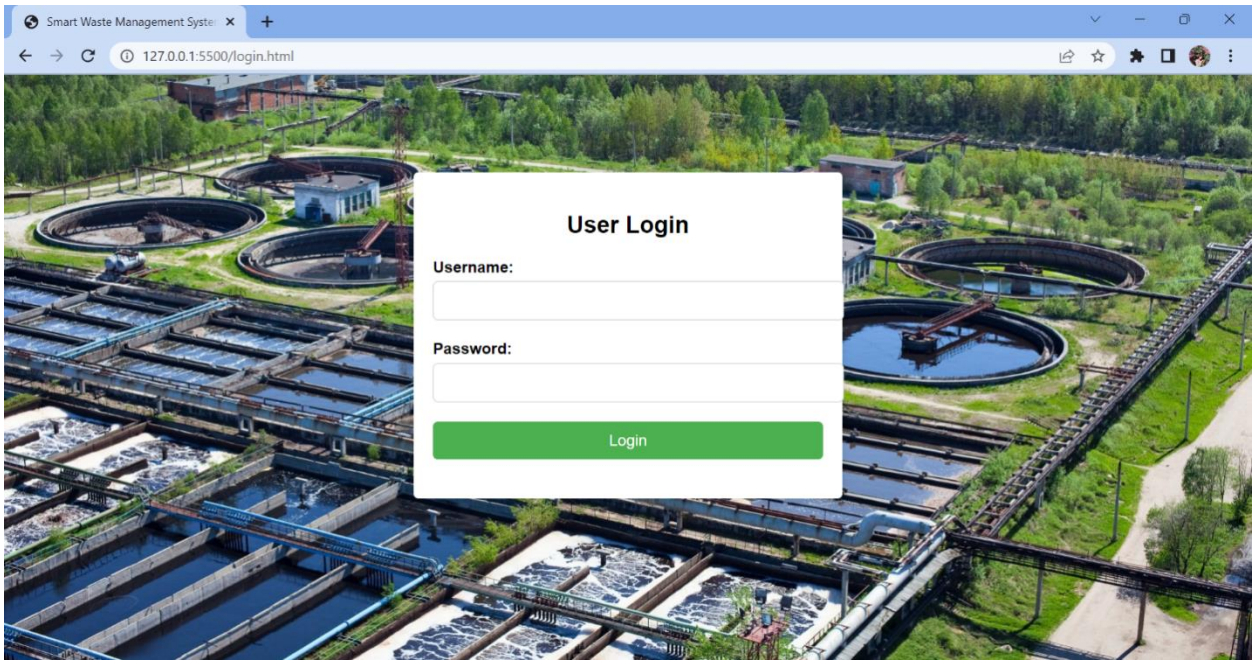

Fig 6.2.1: Customer Login Page

6.3 Schedule-Pickup

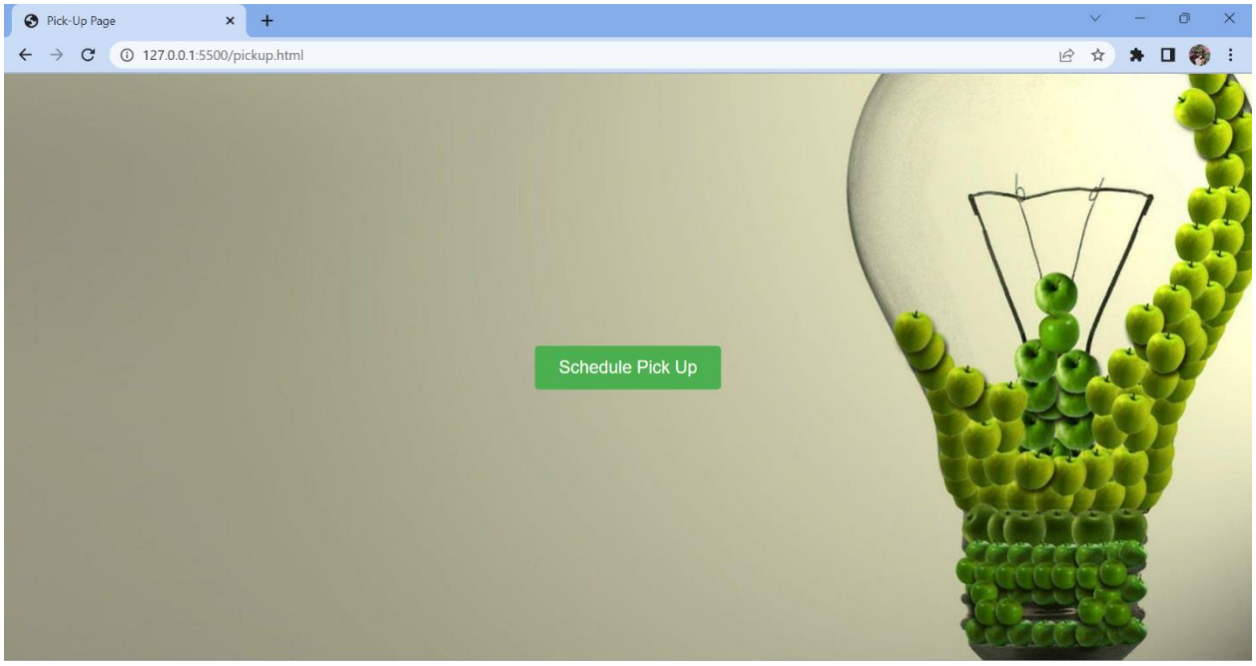

Fig 6.3.1 Schedule Pick-Up Page

6.4 Pickup-Form

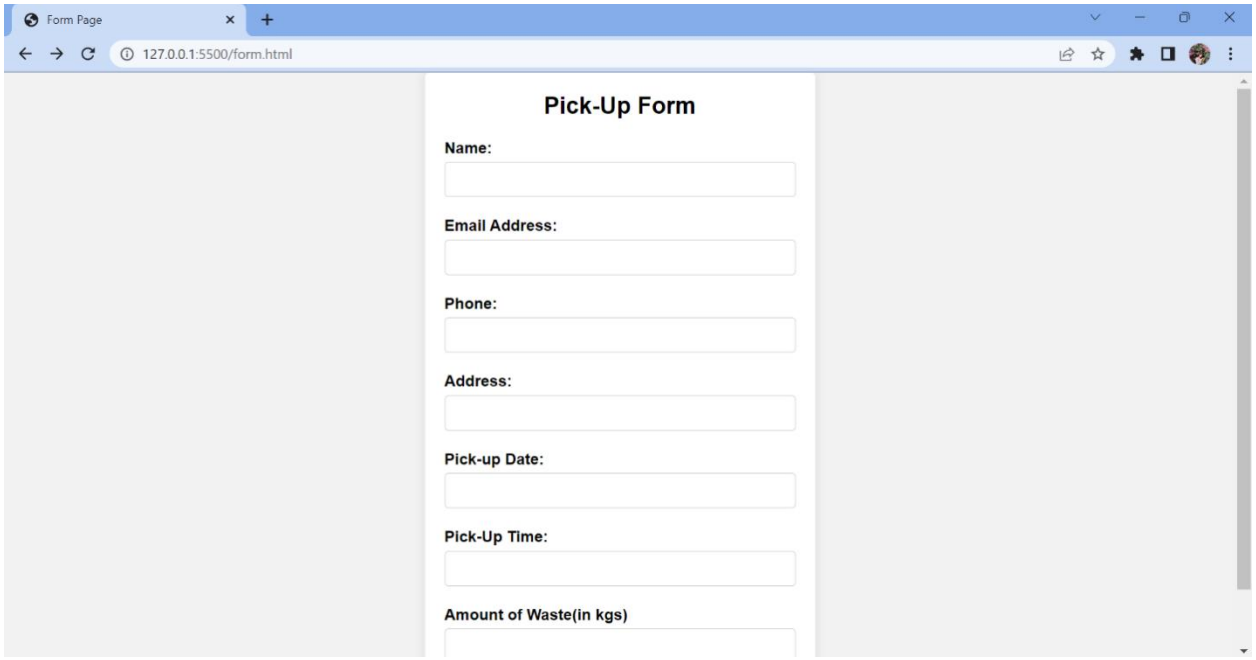

Fig 6.4.1: Pick-up Form

6.5 Final Submit Page

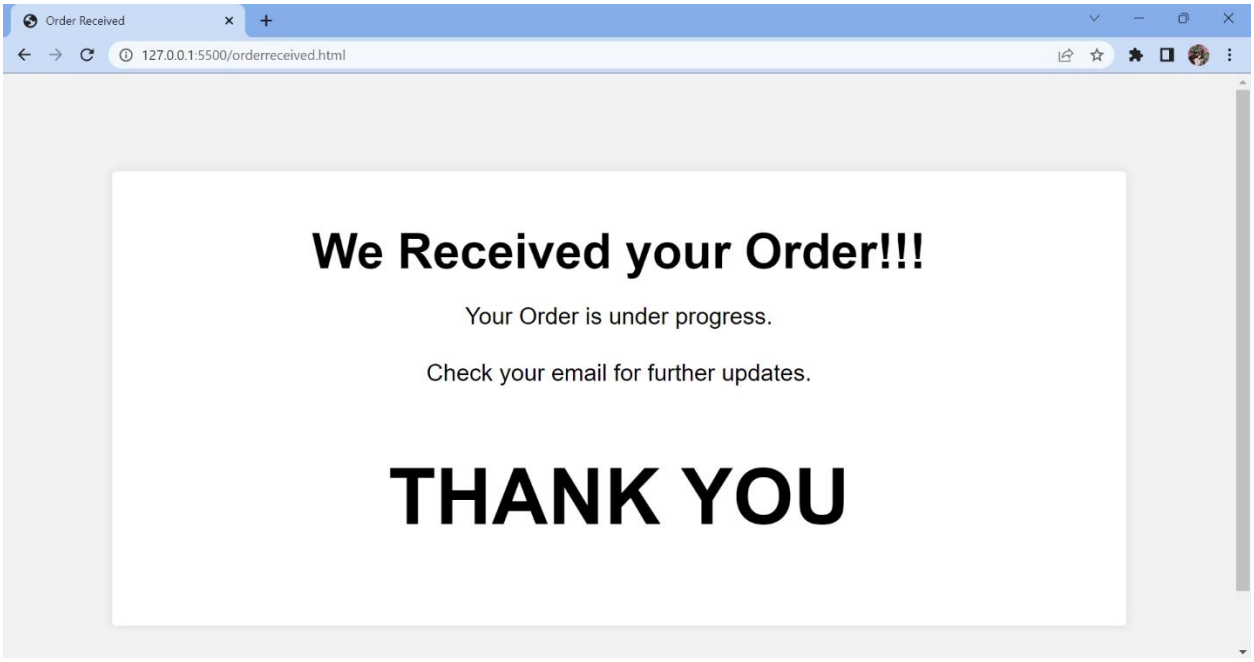

Fig 6.5.1: Order-Received Page

6.6 Company Login Page

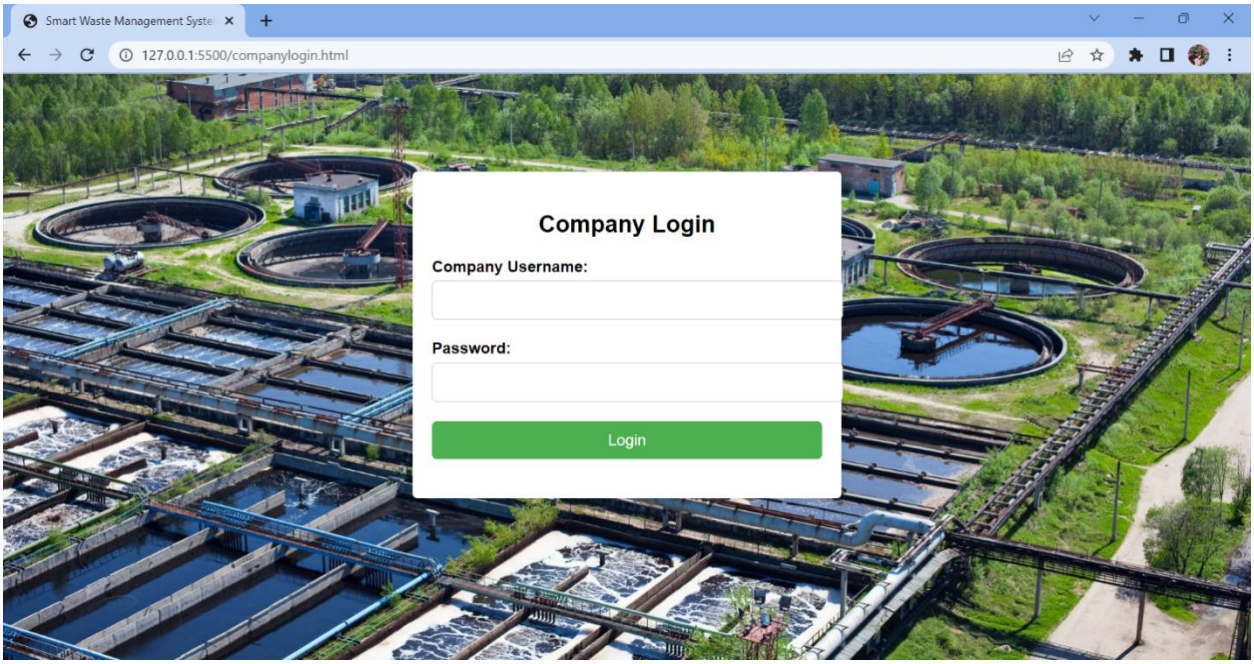

Fig 6.6.1: Company Login Page

6.7 Orders Page

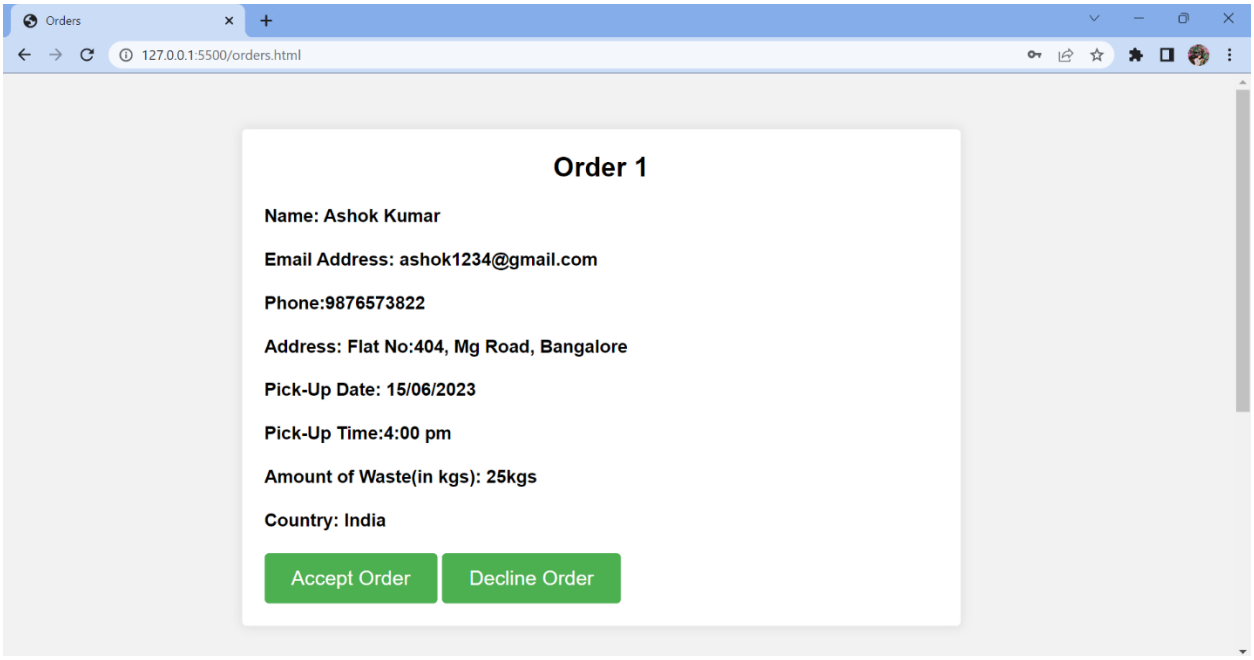

Fig 6.6.1: Orders Page

6.8 Final Page

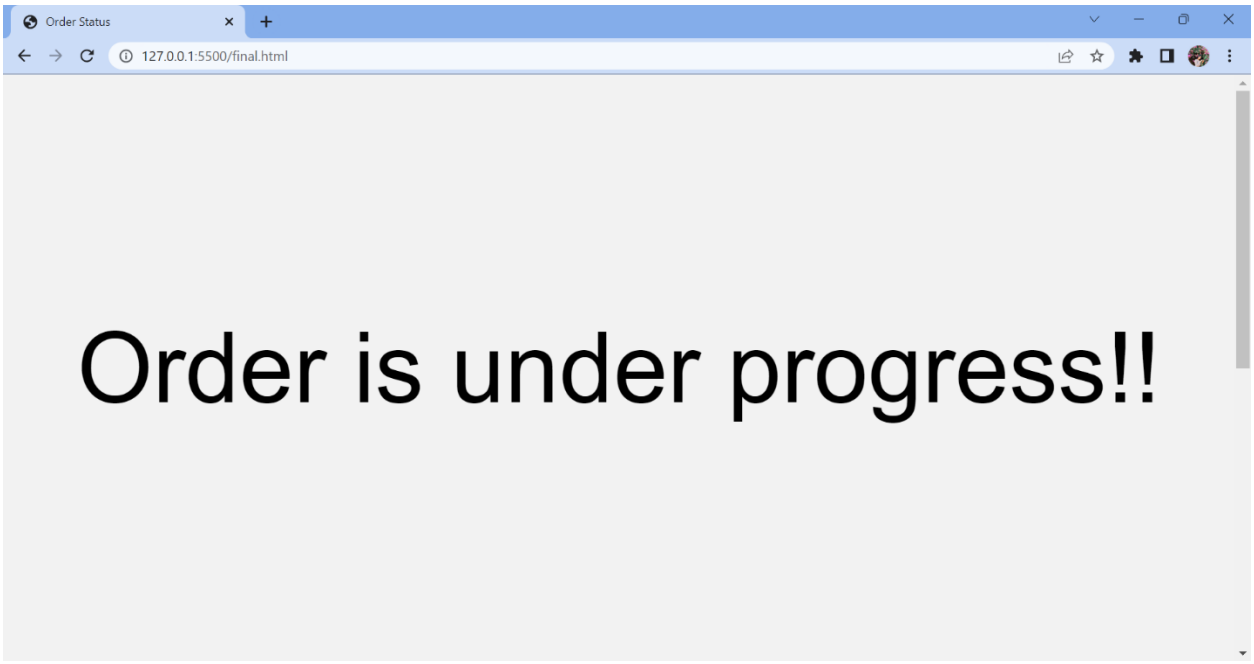

Fig 6.8.1: Final Page

Chapter 7: Conclusion

A well-implemented waste management system is crucial for ensuring the sustainable and efficient handling of waste. Such a system not only promotes environmental protection but also contributes to public health and economic benefits. By adopting proper waste management practices, we can reduce pollution, conserve resources, and mitigate the negative impacts of waste on our ecosystems.

An effective waste management system involves several key elements, including waste reduction and prevention, recycling and composting, proper disposal methods, and public education and awareness. By prioritizing waste reduction strategies such as source separation, reuse, and recycling, we can significantly decrease the amount of waste generated and conserve valuable resources.

Furthermore, implementing appropriate disposal methods, such as landfilling and incineration with energy recovery, while ensuring proper containment and treatment, helps minimize the environmental and health risks associated with waste disposal. Additionally, promoting the use of advanced technologies and innovative solutions can further enhance waste management practices, including waste-to-energy systems and the development of circular economy models.

Education and awareness play a vital role in waste management, as they empower individuals and communities to make informed decisions and actively participate in waste reduction and recycling initiatives. Public outreach campaigns, educational programs, and community engagement initiatives can help foster a culture of responsible waste management, encouraging behavioral changes and promoting sustainable habits.

Overall, a well-designed waste management system should be comprehensive, integrated, and adaptable to meet the evolving needs of society. By embracing sustainable waste management practices, we can minimize environmental impacts, conserve resources, and create a cleaner and healthier future for generations to come.

Chapter 8: References and Annexures

United Nations Environment Programme (UNEP): Waste Management: https://www.unep.org/resources/waste-management

This UNEP resource offers insights into waste management practices, policies, and global initiatives.

World Bank: What a Waste 2.0: A Global Snapshot of Solid Waste Management to 2050: https://openknowledge.worldbank.org/handle/10986/30317

This report by the World Bank provides an overview of global waste management trends, challenges, and potential solutions.

Environmental Protection Agency (EPA): Waste Management: https://www.epa.gov/smm/waste-management

The EPA's waste management webpage offers comprehensive information on waste management strategies, regulations, and resources in the United States.

Waste Management World: https://waste-management-world.com/

Waste Management World is an online publication that covers various aspects of waste management, including technologies, case studies, and industry news.

European Environment Agency (EEA): Waste: https://www.eea.europa.eu/themes/waste

The EEA's waste webpage provides insights into waste management practices, policies, and data specific to Europe.

The International Solid Waste Association (ISWA): https://www.iswa.org/

ISWA is a global association that focuses on promoting sustainable and professional waste management practices. Their website offers resources, reports, and publications on waste management.

Waste Management and Research Journal: https://journals.sagepub.com/home/wmr