DIGITAL REVOLUTION BASED WASTE MANAGEMENT TRACKING

Minor project-1 report submitted
in partial fulfillment of the requirement for award of the degree of

Bachelor of Technology
in
Computer Science & Engineering

By

PRIYANSU JAISWAL (21UECT0075) **(VTU19618)**
SALIM ROHMAN (21UECM0208) **(VTU19626)**

Under the guidance of
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DEPARTMENT OF COMPUTER SCIENCE & ENGINEERING
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VEL TECH RANGARAJAN DR. SAGUNTHALA R&D INSTITUTE OF SCIENCE & TECHNOLOGY

(Deemed to be University Estd u/s 3 of UGC Act, 1956)
Accredited by NAAC with A++ Grade
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CERTIFICATE

It is certified that the work contained in the project report titled ”DIGITAL REVOLUTION BASED WASTE MANAGEMENT TRACKING” by ”PRIYANSU JAISWAL (21UECT0075), SALIM ROHMAN (21UECM0208) has been carried out under my supervision and that this work has not been submitted elsewhere for a degree.

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January, 2024

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DECLARATION

We declare that this written submission represents our ideas in our own words and where others' ideas or words have been included, we have adequately cited and referenced the original sources. We also declare that we have adhered to all principles of academic honesty and integrity and have not misrepresented or fabricated or falsified any idea/data/fact/source in our submission. We understand that any violation of the above will be cause for disciplinary action by the Institute and can also evoke penal action from the sources which have thus not been properly cited or from whom proper permission has not been taken when needed.

PRIYANSU JAISWAL

Date: / /

SALIM ROHMAN

Date: / /

APPROVAL SHEET

This project report entitled ”DIGITAL REVOLUTION BASED WASTE MANAGEMENT TRACKING” by PRIYANSU JAISWAL (21UECT0075), SALIM ROHMAN (21UECM0208) is approved for the degree of B.Tech in Computer Science & Engineering.

Examiners **Supervisor**

Dr.A.UDAYAKUMAR, M.E, Ph.D.

Date: / /

Place:

ACKNOWLEDGEMENT

We express our deepest gratitude to our respected **Founder Chancellor and President Col. Prof. Dr. R. RANGARAJAN B.E. (EEE), B.E. (MECH), M.S (AUTO),D.Sc., Foundress President Dr. R. SAGUNTHALA RANGARAJAN M.B.B.S.** Chairperson Managing Trustee and Vice President.

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ABSTRACT

Effective waste management is critical for environmental sustainability and resource optimization. To address this need, our project offers a comprehensive software solution designed to streamline waste management processes across various location. This software amalgamates innovative technology with user-friendly interfaces to facilitate efficient waste tracking, monitoring, and optimization. Our project encompasses a range of functionalities, including waste generation data collection, real-time monitoring of disposal methods, analysis of waste composition, and compliance management with regulatory standards. Through intuitive dashboards and customizable reporting tools, users can visualize trends, identify areas for improvement, and make informed decisions to enhance waste reduction strategies. Overall, our project stands as a comprehensive and adaptable solution poised to revolutionize waste management practices, offering a sustainable approach towards a cleaner and more resource-efficient future.

Keywords:

Waste Management, Resource Optimization,Waste Tracking, Real-Time Monitoring, Waste Composition, Regulatory Standards.

LIST OF FIGURES

LIST OF ACRONYMS AND ABBREVIATIONS

AES	Advanced Encryption Standard
CSS	Cascading style Sheet
DFD	Data Flow Diagram
DNS	Domain Name Record
DPM	Data Processing Model
HTML	Hypertext Markup Language
IoT	Internet Of Things
PHP	Hypertext Preprocessor
UAT	User Acceptance Testing
UI	User Interface

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Chapter 1

INTRODUCTION

1.1 Introduction

In an era marked by a heightened global focus on environmental stewardship and sustainable practices, the pressing challenge of efficient waste management takes center stage. Acknowledging this critical imperative, our project emerges as a groundbreaking software solution poised to redefine the landscape of waste handling for organizations worldwide. Through the strategic integration of cutting-edge technology and an intuitively crafted design, our platform serves as a beacon of innovation, offering a comprehensive solution that transcends traditional waste management approaches. This revolutionary software is meticulously designed to empower organizations across diverse industries, providing them with the tools needed to seamlessly monitor, manage, and optimize their waste management processes.

At its core, our innovative software solution signifies a commitment to transforming waste handling methods. By harnessing state-of-the-art technology and incorporating a user-friendly interface, our project strives to usher in a new era where waste management becomes an intuitive and efficient process. This transformative platform caters to the unique needs of various industries and entities, enabling users to gain a profound understanding of their waste output, track its lifecycle, and manage it with unprecedented effectiveness. this project overarching with the vision of sustainability, efficiency, and adaptability. By emphasizing these key principles, our software promises to instigate a paradigm shift in waste management practices, inspiring organizations to embrace greener and more environmentally responsible approaches, thereby contributing to a sustainable and eco-friendly future. In essence, our project serves as a catalyst for positive change, paving the way towards a greener and more harmonious coexistence with our planet.

1.2 Aim of the Project

The primary aim of our project is to revolutionize waste management practices by introducing a cutting-edge software solution that aligns with the growing global emphasis on environmental sustainability. We aspire to empower organizations across diverse industries to transcend traditional waste handling methods by providing them with a comprehensive platform. Through strategic integration of state-of-the-art technology and a user-friendly design, our project aims to facilitate seamless monitoring, management, and optimization of waste processes. Our overarching goal is to instigate a transformative shift towards intuitive and efficient waste management, fostering a more sustainable future. By emphasizing principles of sustainability, efficiency, and adaptability, we aim to inspire organizations to embrace environmentally responsible practices, contributing to a harmonious coexistence with our planet. Ultimately, the aim of our project is to be a catalyst for positive change, spearheading innovation in waste management and paving the way for a greener and more ecologically conscious world.

1.3 Project Domain

Within the evolving landscape of waste management innovation, our project stands as a transformative force in the project domain. At the nexus of environmental stewardship and technological prowess, our software solution pioneers a paradigm shift in the way organizations navigate the challenges of waste handling. The project domain is characterized by a comprehensive approach that addresses the multifaceted complexities inherent in diverse industries and entities. By strategically integrating cutting-edge technology and an intuitively crafted design, our platform becomes a cornerstone within the project domain, offering indispensable tools for monitoring, managing, and optimizing waste processes. It serves as a beacon of innovation, facilitating a seamless transition from traditional waste management approaches to a sophisticated, user-friendly system that caters to the unique needs of modern organizations.

Embodying a commitment to sustainability, efficiency, and adaptability, our project domain represents more than just a technological solution—it encapsulates a vision for a greener and more responsible future. This domain signifies a departure from conventional waste management practices, as our platform empowers users to

gain profound insights into their waste output, track its lifecycle, and manage it with unprecedented effectiveness. As organizations embrace this transformative approach within the project domain, a ripple effect ensues, inspiring a collective shift towards greener and more environmentally responsible practices. In essence, our project domain becomes the epicenter of positive change, fostering a harmonious coexistence with our environment and exemplifying the progressive evolution of waste management practices.

1.4 Scope of the Project

The scope of our innovative waste management software project is extensive, encompassing a holistic approach to address the diverse needs of organizations across various industries. Firstly, the platform offers advanced monitoring capabilities, allowing users to track and analyze their waste generation in real-time. This functionality not only provides a comprehensive overview of waste output but also facilitates proactive decision-making by identifying patterns and trends. By leveraging cutting-edge technology such as sensors, IoT devices, and data analytics, our software ensures that organizations can gain valuable insights into their waste management processes, fostering informed and strategic decision-making.

Secondly, our project extends beyond mere monitoring to actively manage and optimize waste processes. The platform includes features for streamlined waste collection scheduling, route optimization for collection vehicles, and automated reporting. This not only enhances operational efficiency but also contributes significantly to cost reduction and resource optimization. The software's user-friendly interface empowers organizations to set tailored waste management goals, implement targeted strategies, and continuously refine their processes based on real-time data feedback. Furthermore, the adaptability of the platform allows seamless integration with existing waste management systems, ensuring a smooth transition for organizations seeking to upgrade their practices.

In conclusion, the scope of our project is multifaceted, aiming to revolutionize the waste management paradigm by providing advanced monitoring and management tools. With a focus on real-time insights, operational efficiency, and adaptability, our software aspires to be an indispensable asset for organizations committed to sustainable and effective waste handling practices.

Chapter 2

LITERATURE REVIEW

[1] M. Saad etal (2023) discussed the application of the Internet of Things (IoT) to address the critical issue of waste management, particularly in developing countries and urban areas where planning and resource availability pose significant challenges. The research proposes a state-of-the-art IoT-driven system for solid waste management, emphasizing the need for innovation in densely populated surroundings. The framework introduces a decentralized solution leveraging blockchain-enabled vehicular ad-hoc networks (VANETs) within the IoT domain. The study outlines step-by-step methods for implementing this blockchain-enabled VANET approach, offering a technologically advanced solution to enhance the efficiency and effectiveness of solid waste management in challenging urban environments.

[2] S. R. J. Ramson etal (2022) discussed about the persistent challenge of municipal solid waste management in urban areas, a concern with profound implications for health and the environment. Traditional trash bins, though widespread, often lead to environmental pollution and inconvenience due to overflowing. In response, a real-time remote monitoring system is proposed, aiming to alert municipalities or waste management companies about trash bin levels. The article introduces a self-powered, LoRaWAN Internet-of-Things (IoT)-enabled trash bin level monitoring system, employing end nodes known as trash bin level measurement units (TBLMUs). These units, installed in each monitored bin, measure fill levels and geographical locations, transmitting data to a LoRaWAN gateway at 915 MHz. The gateway acts as a concentrator, relaying data to an IoT server. Users can access a smart graphical interface to analyze and monitor the status and geolocation of each bin. The article reports on the system's accuracy, wireless range, current consumption, life expectancy, battery charging time, and cost, showcasing its potential for efficient municipal solid waste management.

[3] Ghahramani etal (2022) described about the integration of the Internet of Things (IoT) and Artificial Intelligence (AI) in addressing the challenges of waste

management in smart cities. The IoT paradigm, utilizing embedded sensors, facilitates the collection of diverse information and monitoring physical conditions such as waste bins' status. The paper addresses the increasing need for efficient waste management systems and proposes an intelligent approach to route recommendation within an IoT-enabled framework, considering spatial constraints. Through a comprehensive analysis employing AI-based methods, the study explores multiple-level decision-making processes based on bins' status and coordinates. The proposed solution offers insights into enhancing waste collection efficiency, providing a foundation for engineers to design sustainable infrastructure systems for smart cities.

[4] Boustani etal (2011) discussed about the growing significance of environmental sustainability and energy management and highlights the pivotal role of evolving tracking technologies in addressing these challenges. The focus is on how these technologies, particularly in waste removal infrastructures, can unveil hidden processes and patterns. By providing visibility into everyday activities, these technologies aim to influence personal behaviors toward environmental consciousness. The abstract introduces a tracking system, utilizing MIT-developed "trash tags" with GSM technology, designed to enhance waste management by offering both localization and active communication. The Trash Track project from MIT's SENSEable City Laboratory demonstrates the potential of pervasive monitoring to reveal, understand, and improve waste-management systems, contributing to the broader exploration of sensor technologies for urban transformation and understanding.

[5] M.A. Hannan (2021) discusses a comprehensive review explores technologies applied in solid waste monitoring and management systems, addressing associated issues and challenges. The article provides insights into the diverse landscape of technology usage, offering a critical ex-amination of current methodologies and highlighting key challenges within the field.

[6] Manasi Gokhale etal (2020) discussed about Internet of Things(IoT) based E-Tracking System for Waste Management, as published in IEEE in 2020. The research explores innovative solutions leveraging IoT technology to enhance waste management practices, offering insights into real-time tracking and optimization methods.

[7] Adi Suvarnamma (2020) dicussed about SmartBin system featuring waste tracking and sorting mechanisms employing Internet of Things (IoT) technology. The system aims to enhance waste management processes by integrating IoT for efficient monitoring and sorting of waste. His work contributes to the evolving landscape of smart waste solutions, addressing the challenges of waste management through innovative technological applications.

Chapter 3

PROJECT DESCRIPTION

3.1 Existing System

The existing waste management tracking systems, while serving a crucial role in monitoring waste, are not without their shortcomings. One significant disadvantage lies in their often outdated and disparate technologies, leading to fragmented data collection and inefficient communication between different stages of the waste management process. This lack of integration can result in data silos, hindering the seamless flow of information critical for making informed decisions. Additionally, many current systems may not adequately leverage emerging technologies such as Internet of Things (IoT) devices and real-time sensors, limiting their ability to provide accurate and up-to-date insights into waste generation and collection.

Moreover, the user interfaces of existing waste management tracking systems are frequently criticized for being complex and unintuitive. This poses a challenge for operators and administrators who may struggle with the systems' navigation and functionality. The learning curve associated with these interfaces can lead to errors in data input and retrieval, compromising the overall reliability of the tracking system. This usability issue can impede the adoption of more sustainable waste management practices, as operators may find it challenging to maximize the potential benefits of the system due to its less-than-optimal user experience. Addressing these disadvantages is crucial for the successful evolution of waste management tracking systems towards more effective, integrated, and user-friendly solutions.

3.2 Proposed System

Our innovative waste management software project presents a significant leap forward in comparison to existing waste management tracking systems, offering a multitude of advantages that enhance operational efficiency, sustainability, and adaptability. Unlike traditional systems that may rely on manual data entry or outdated

technologies, our platform leverages cutting-edge technology such as sensors, IoT devices, and data analytics. This results in real-time monitoring capabilities, providing organizations with instant insights into their waste generation patterns, allowing for proactive decision-making and timely interventions. The dynamic nature of our software ensures a more accurate and up-to-date understanding of waste metrics, facilitating a responsive and agile approach to waste management.

Furthermore, our project stands out for its comprehensive approach to waste management. While some existing systems may focus solely on monitoring, our software goes beyond by incorporating features for active management and optimization of waste processes. The platform includes functionalities for intelligent waste collection scheduling, route optimization for collection vehicles, and automated reporting. This not only streamlines daily operations but also minimizes costs and maximizes resource utilization. The user-friendly interface ensures that organizations can easily set and customize waste management goals, enabling a more tailored and efficient approach. In essence, our project offers a holistic and technologically advanced solution that outshines conventional waste management tracking systems, providing a more sophisticated, user-friendly, and sustainable approach to waste handling.

3.3 Feasibility Study

3.3.1 Economic Feasibility

The economic feasibility of our innovative waste management software project is rooted in its potential to generate substantial cost savings for organizations while simultaneously fostering environmental sustainability. By streamlining waste management processes through cutting-edge technology, our platform minimizes operational inefficiencies and reduces the overall costs associated with waste disposal. The intuitive design enhances user productivity, ensuring that personnel can efficiently allocate resources, track waste output, and implement optimized disposal strategies. As organizations transition towards more eco-friendly practices, our software aligns with the global shift towards sustainable business operations, potentially enhancing market competitiveness.

Moreover, the long-term economic benefits extend beyond immediate cost savings. Our project's emphasis on sustainability and adaptability positions organizations favorably in an evolving business landscape where environmental conscious-

ness is a key driver of consumer and investor choices. The software's ability to provide insightful analytics further aids strategic decision-making, enabling organizations to identify opportunities for process improvements and resource optimization. In essence, the economic feasibility of our project not only addresses the immediate need for cost-effective waste management but also positions organizations for long-term financial resilience in a world increasingly valuing environmentally responsible practices.

3.3.2 Technical Feasibility

The technical feasibility of our waste management software project is underpinned by a robust foundation of cutting-edge technology and a meticulously designed architecture. Leveraging state-of-the-art advancements, the platform ensures seamless integration with existing organizational systems, facilitating a smooth transition to more efficient waste management practices. The scalable nature of our software accommodates the diverse needs of various industries, allowing for customization and adaptability to specific waste management requirements.

The implementation of advanced data analytics and artificial intelligence algorithms empowers our software to provide real-time insights into waste generation, disposal patterns, and environmental impact. The intuitive user interface facilitates ease of use, ensuring that organizations can harness the full potential of the platform without the need for extensive training. Furthermore, the platform is designed with cybersecurity measures to safeguard sensitive waste management data, adhering to industry standards and regulations. The technical feasibility of our project is not only a testament to its innovation but also positions it as a practical and viable solution for organizations seeking to embrace sustainable waste management practices in an increasingly digitalized world.

3.3.3 Social Feasibility

The social feasibility of our innovative waste management software project is rooted in its capacity to bring about positive change and foster a collective commitment to environmental responsibility. By offering a user-friendly interface and intuitive design, the platform ensures accessibility for a diverse user base, transcending technical barriers and facilitating widespread adoption. This inclusivity promotes community engagement and empowers individuals, businesses, and organizations to

actively participate in sustainable waste management practices.

Furthermore, our project aligns with societal values by placing a strong emphasis on sustainability. Through its comprehensive approach to waste monitoring and management, the software not only educates users about their waste output but also encourages environmentally conscious decision-making. This educational aspect contributes to a broader societal awareness of the environmental impact of waste, fostering a culture of responsibility and stewardship. As our project strives to instigate a paradigm shift in waste management practices, its social feasibility lies in its potential to inspire a collective movement towards greener and more sustainable living, creating a ripple effect that positively impacts communities and society at large.

3.4 System Specification

3.4.1 Hardware Specification

- Inductive proximity sensor
- DC motor
- Arduino UNO r3
  - Microcontroller ATmega328 ATmega328
  - Operating Voltage 5V 5V
  - Input Voltage(recommended) 7–12V
  - Input Voltage(limits) 6–20V
  - Digital I/O Pins 14
  - Analog Input Pins 6
  - DC Current per I/O Pin 40 mA
  - DC Current for 3.3V Pin 50 mA
  - Flash Memory 32 KB
  - SRAM 2 KB (ATmega328)
  - EEPROM 1 KB (ATmega328)
  - Clock Speed 16 MHz
- Software Methodology
- Implementation

3.4.2 Software Specification

- Web Servers : Microsoft Internet Information Services (IIS) , Apache
- Web Hosting Platforms : Amazon Web Services , Microsoft Azure

3.4.3 Standards and Policies

Visual Studio

Visual Studio Visual Studio is the primary integrated development environment for building web applications using ASP.NET Core. It provides a rich set of tools, debugging capabilities, and integrated Git support for efficient development.By aligning the system specifications with your development environment, you can enhance the efficiency and performance of your web development project.

PHP (Hypertext Preprocessor)

An extremely popular scripting language that is used to create dynamic Web pages. Combining syntax from the C, Java and Perl languages, PHP code is embedded within HTML pages for server side execution. It is commonly used to extract data out of a database on the Web server and present it on the Web page. Originally known as ”Personal Home Page,” PHP is supported by all Web servers and widely used with the MySQL database.

Chapter 4

METHODOLOGY

4.1 General Architecture

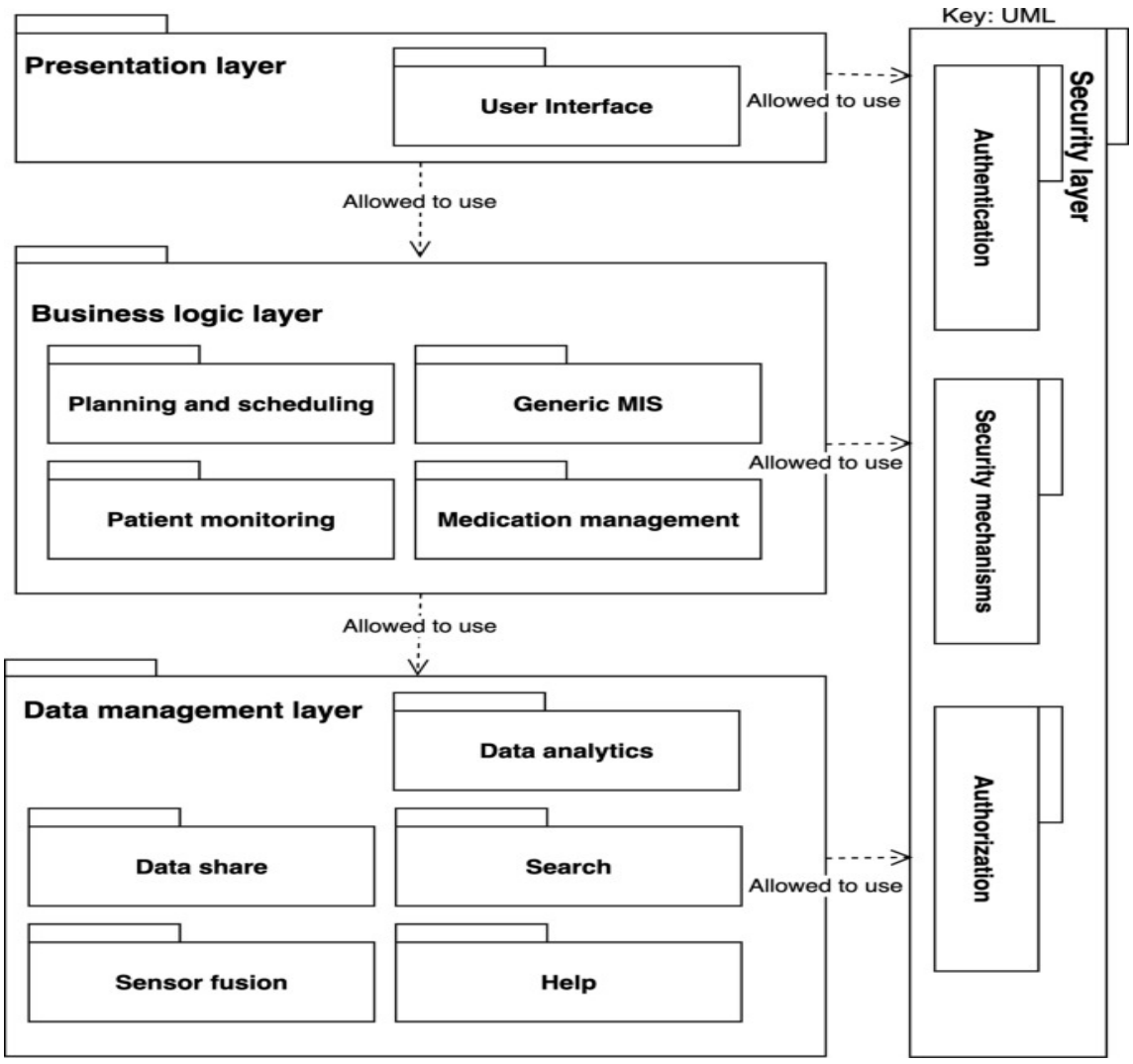

Figure 4.1: **Architecture Diagram for Waste Management Tracking**

In the given figure our waste management software system features a modular and scalable architecture, comprising three key layers: presentation, application, and data. The presentation layer offers an intuitive user interface accessible through web or mobile platforms, prioritizing user-friendly design for efficient navigation and

interaction.

At the system's core, the application layer integrates advanced algorithms and business logic to handle diverse waste management processes. This layer includes real-time monitoring, predictive analytics, and optimization tools, enabling organizations to streamline their waste-related activities. It also facilitates seamless integration with other software systems for enhanced interoperability within existing organizational frameworks.

The data layer is dedicated to storing and retrieving vast amounts of data generated by waste management processes. Employing robust database management systems, this layer ensures data security, integrity, and accessibility. Cloud-based solutions enhance system performance, providing scalability and cost-effectiveness, while adhering to industry-standard security protocols ensures compliance with data protection regulations.

In essence, waste management software system boasts an organized and adaptable architecture that combines an intuitive user interface, a powerful application layer, and robust data management. This approach revolutionizes how organizations approach waste handling, emphasizing efficiency, sustainability, and technological innovation.

4.2 Design Phase

4.2.1 Data Flow Diagram

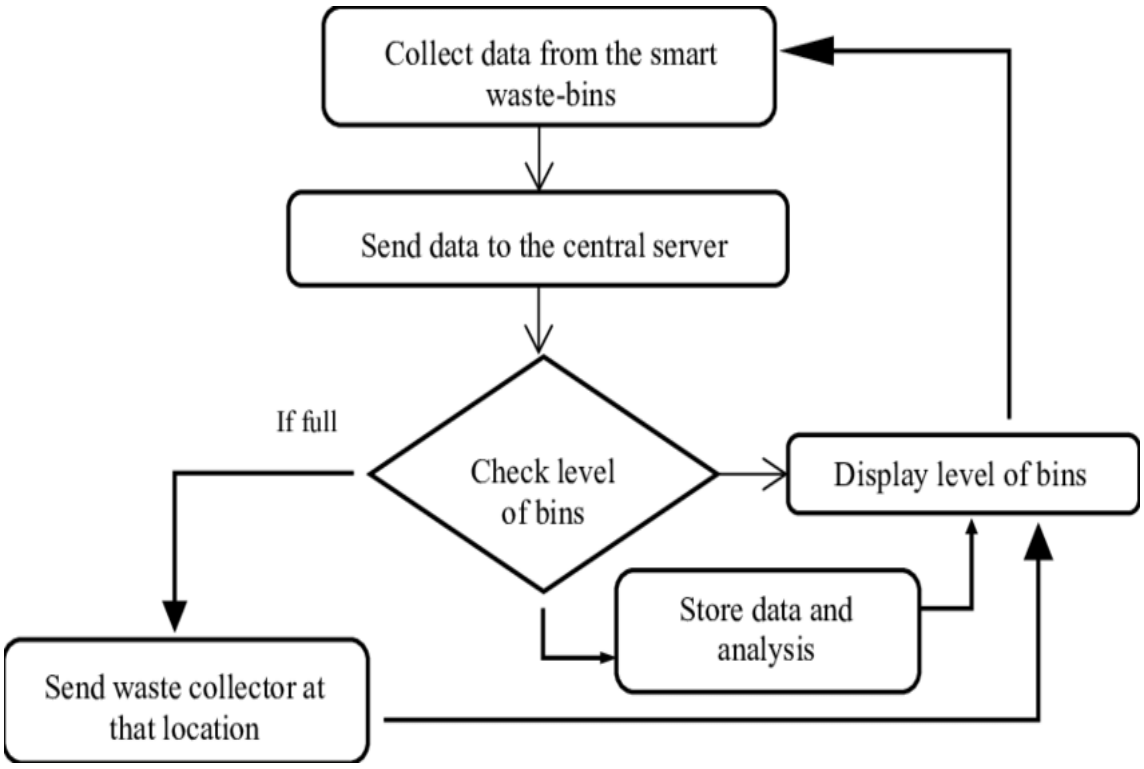

Figure 4.2: **Data Flow Diagram For the Software**

In the above given Data Flow Diagram (DFD) for our innovative waste management software project illustrates a dynamic system where users interact with external entities through a user-friendly interface. The primary external entities are the users who input data into the system, providing crucial information about waste generation, disposal methods, and other relevant parameters. This data is then processed through various key processes within the system.

The initial data input and processing phase involves the utilization of cutting-edge technology to analyze and categorize the provided information effectively. Subsequently, the system engages in continuous monitoring and optimization processes, analyzing trends, tracking the lifecycle of waste, and offering valuable insights to users for better decision-making. As a result of this processing, comprehensive reports are generated, providing users with a detailed understanding of their waste output and the effectiveness of their current management strategies.

To facilitate these processes, the system relies on two main data stores: the Waste Database and User Profiles. The Waste Database serves as a repository for information on various types of waste, their quantities, and characteristics, enabling historical data analysis and trend identification. User Profiles store individual or organizational-specific information, preferences, and historical data, allowing the system to tailor its insights and recommendations. The data flows within the system encompass input data flows from users to the system, conveying details about waste generation, and output data flows transmitting analyzed and processed information back to users in the form of reports, recommendations, and visualizations. Additionally, a continuous feedback loop ensures that the system adapts to evolving waste management needs, making this DFD a comprehensive representation of a technologically advanced and user-centric waste management solution.

4.2.2 Use Case Diagram

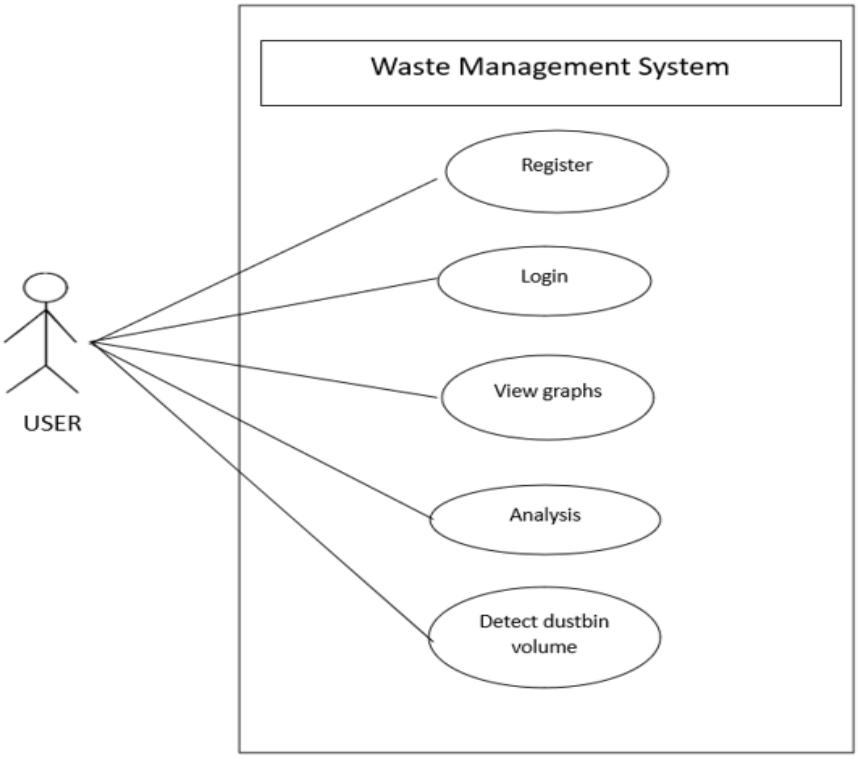

Figure 4.3: **Use Case Diagram For the Software**

In the above given use case diagram for our waste management software project, we envision three primary actors: the Administrator, User (Organization), and End User. The Administrator holds a central role, equipped with the authority to configure system settings, manage user roles, and oversee the overall functionality of

the waste management software. On the organizational side, the User actor represents businesses and entities utilizing the software to efficiently monitor, manage, and optimize their waste management processes. The End User, on the other hand, signifies individual users within organizations who interact with the software to input waste data, track its lifecycle, and engage with various features for effective waste management.

Within this dynamic framework, essential use cases emerge to encapsulate the system's functionality. These include standard processes such as Login/Logout for both administrators and users to ensure secure access. The Administrator, possessing the capability to Configure System Settings, plays a crucial role in tailoring the software to the specific needs of the organization. Users, in turn, engage in pivotal activities like Monitoring Waste Output, Managing Waste Lifecycle, and Optimizing Processes, utilizing the software to identify areas for improvement aligned with sustainability goals. Additionally, both administrators and users can Generate Reports, providing comprehensive insights into waste management metrics for informed decision-making and compliance. The use case diagram serves as a visual representation of these interactions, illustrating how the waste management software facilitates collaboration between administrators, organizations, and individual users to achieve efficient and sustainable waste management practices.

4.2.3 Class Diagram

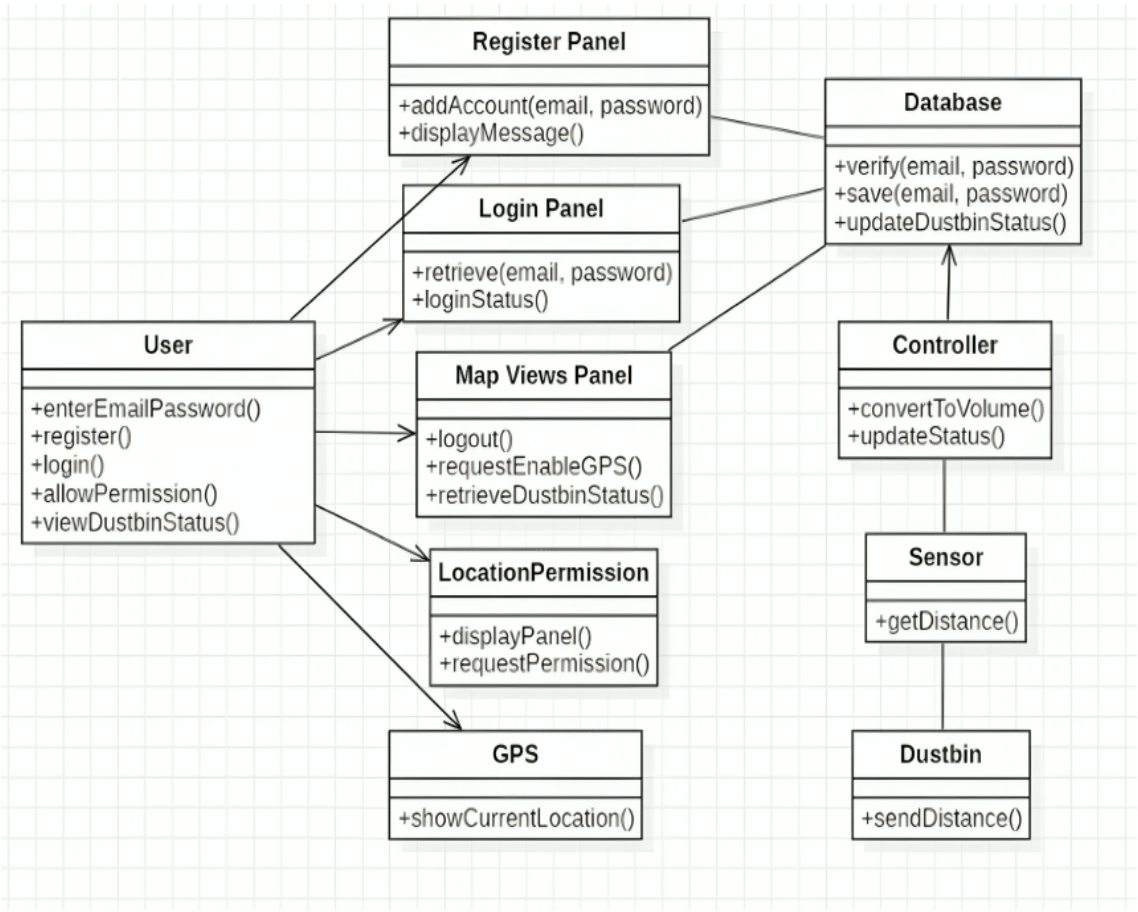

Figure 4.4: **Class Diagram For Database**

In the above given figure, the class diagram for our innovative waste management software project encapsulates the essential entities and their interactions within the system. At the core is the User Class, representing the diverse user base including individuals, businesses, and organizations engaging with the software. This class incorporates attributes such as UserID, UserName, UserType, and methods like AuthenticateUser() to ensure secure and personalized interactions. The WasteManagementSystem Class serves as the orchestrator, overseeing the entire system with attributes like SystemID and SystemName. The WasteBin Class embodies the physical waste containers, featuring attributes such as BinID and BinLocation, and methods like UpdateFillLevel() for real-time monitoring. The WasteCategory Class defines different waste categories with attributes like CategoryID and CategoryName, fostering systematic classification.

The system's monitoring and tracking functionalities are encapsulated in the MonitoringPlatform Class, detailing attributes like MonitoringID and SensorType. The ReportingSystem Class manages report generation with attributes such as ReportID and ReportType, enabling users to access insightful waste management statistics. The SustainabilityModule Class underscores the system's commitment to sustainability, featuring attributes like EcoScore and Recommendations. These classes interact through associations, compositions, and potentially inheritance, forming a comprehensive class diagram that mirrors the intricate relationships and functionalities within our forward-thinking waste management software.

4.2.4 Sequence Diagram

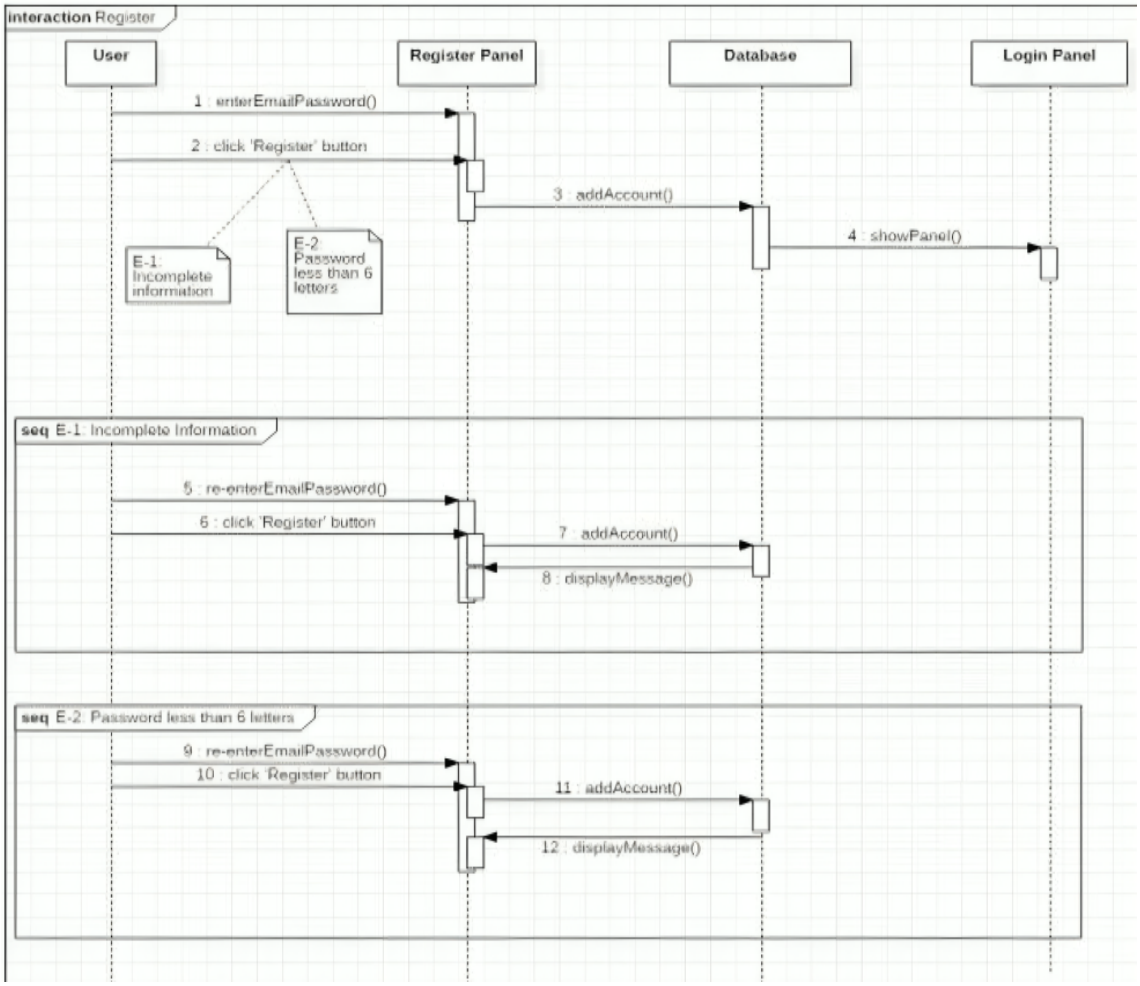

Figure 4.5: **Sequence Diagram For Waste Management Tracking**

In the above given figure, the sequence diagram illustrates a dynamic view of the interactions between different components during the waste management process. The sequence begins with a user initiating an action, such as logging into the

platform. Upon authentication, the system responds by presenting the user with an intuitive interface for waste monitoring and management.

As the user interacts with the system, making inputs such as waste data, the sequence diagram reflects the smooth flow of information to the backend processing module. This module, powered by cutting-edge technology, processes the inputted data and updates the waste management database accordingly. Simultaneously, the system triggers real-time monitoring functionalities, enabling users to track their waste lifecycle seamlessly.

The sequence diagram further captures the system's adaptability by showcasing interactions with external entities, such as waste disposal services or recycling facilities. Upon user requests for waste disposal, the system communicates with these external entities to facilitate the eco-friendly handling of waste. Throughout the entire process, the software prioritizes sustainability, reflecting the overarching vision of the project. The sequence diagram serves as a visual representation of the dynamic and efficient interactions within the waste management software, depicting its user-centric design and commitment to revolutionizing waste handling practices.

4.2.5 Collaboration Diagram

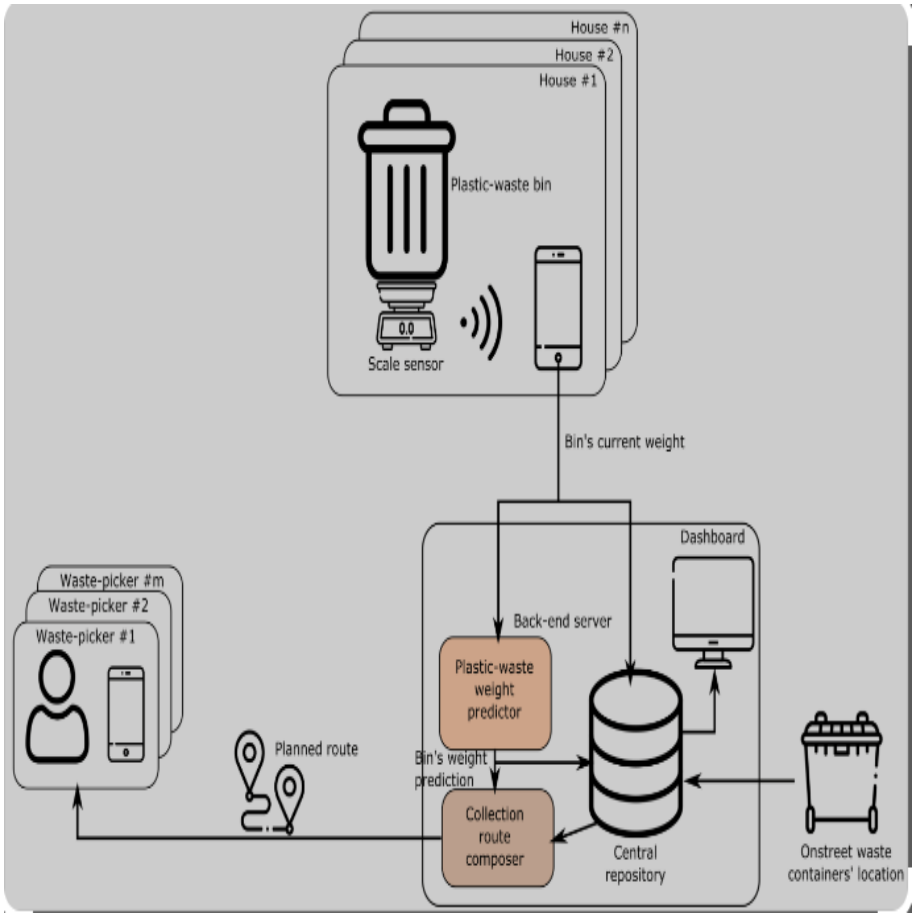

Figure 4.6: **Collaboration Diagram of Website**

In the above given collaboration diagram for our innovative waste management software system vividly illustrates the seamless interaction and synergy among the various components that constitute the platform. At the center of this collaborative ecosystem is the user interface, intelligently designed for user-friendly engagement. Users, represented in the diagram, initiate interactions with the system by inputting data related to their waste management needs and preferences. This input triggers a cascade of collaborative processes, with the software leveraging cutting-edge technology to process and analyze the information.

The collaboration extends to the internal components of the system, including the waste monitoring and optimization modules, symbolizing a dynamic exchange of data and commands. These components work in tandem to deliver real-time insights to users, allowing them to make informed decisions about waste management. Additionally, the collaboration diagram highlights the interoperability with external

entities such as waste disposal services and regulatory bodies. This ensures that the software seamlessly integrates with existing waste management infrastructure and complies with environmental regulations.

In essence, the collaboration diagram encapsulates the intricate dance of information exchange and cooperation between users, internal system modules, and external stakeholders, portraying a holistic view of how our innovative software facilitates a collaborative and efficient approach to waste management.

4.2.6 Activity Diagram

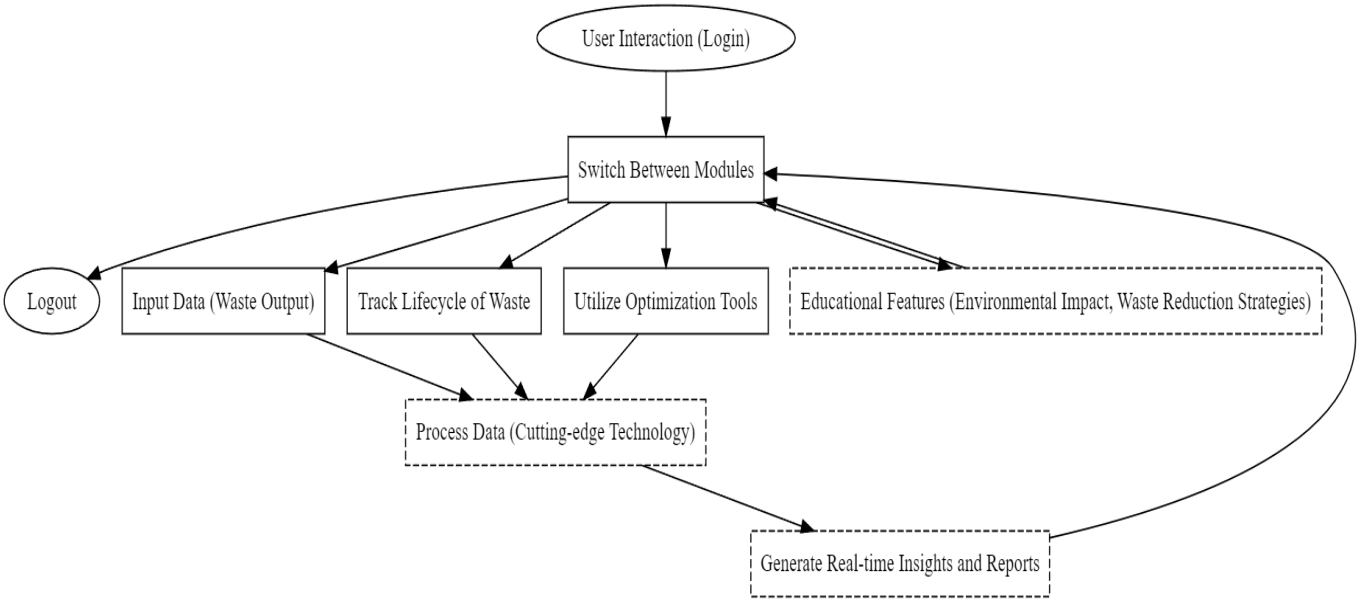

Figure 4.7: **Activity Diagram of the Software**

In the above given activity diagram for our innovative waste management software system depicts a dynamic and efficient workflow that encapsulates the core functionalities of the platform. Initiated by user interactions, the diagram illustrates the seamless navigation through the software's user-friendly interface. Upon logging in, users are directed to a dashboard where they can access various modules for waste monitoring, management, and optimization.
The diagram captures the essence of the software's capabilities as users engage in activities such as inputting data regarding their waste output, tracking the lifecycle of waste, and utilizing optimization tools to enhance their waste management processes. The system intelligently processes this information, leveraging cutting-edge

technology to generate real-time insights and reports. Users can seamlessly transition between different modules, reflecting the intuitive design that underpins the software's user interface.

Crucially, the activity diagram emphasizes the platform's educational component, illustrating features that promote user awareness of sustainable waste management practices. This includes features that provide information about environmental impact, waste reduction strategies, and best practices. The dynamic flow of activities within the diagram encapsulates the holistic approach of our project, which not only streamlines waste management processes but also educates and empowers users to make environmentally responsible decisions.

4.3 Algorithm & Pseudo Code

4.3.1 Algorithm

1. User Authentication and Dashboard Initialization:

- Algorithm:

1. Validate user credentials.
2. If valid, authenticate the user.
3. Display the dashboard with modules for waste monitoring, management, and optimization.

2. Waste Input and Tracking:

- Input: Type of waste, quantity, location
- Output: Updated waste tracking information
- Algorithm:

1. User selects the "Input Waste" module.
2. Input type, quantity, and location of waste.
3. Store the information in the system's database.
4. Update the waste tracking records.

3. Optimization Tools:

- Input: Waste data, optimization preferences
- Output: Optimized waste management plan
- Algorithm:

1. User selects the "Optimization Tools" module.
2. Input preferences (e.g., cost efficiency, environmental impact).

3. Utilize algorithms to analyze waste data and generate optimization suggestions.
4. Display the optimized waste management plan.

4. Real-time Monitoring and Reporting:

- Input: Continuous data from sensors, user requests
- Output: Real-time monitoring updates, generated reports
- Algorithm:

1. Continuously collect data from sensors and other sources.
2. Update real-time monitoring displays.
3. Allow users to request specific reports (e.g., monthly waste summaries).
4. Generate and display requested reports.

5. Educational Component:

- Input: User engagement, preferences
- Output: Educational content, tips, and recommendations
- Algorithm:

1. Track user interactions and engagement.
2. Identify opportunities to provide educational content.
3. Display educational materials on sustainable waste management.
4. Personalize recommendations based on user preferences.

4.3.2 Pseudo Code

```
class WasteManagementSystem:
    def  init (self):
        self.waste_data =
    def input_waste_data(self, user_id, waste_type,quantity, timestamp):
        if user_id not in self.waste_data:
            self.waste_data[user_id] = []
        self.waste_data[user_id].append(
            'waste_type': waste_type,
            'quantity': quantity,
            'timestamp': timestamp
        )
    def calculate_environmental_impact(self, user_id):
waste_system = WasteManagementSystem()
waste_system.input_waste_data(user_id='123', waste_type='Plastic', quantity=5, timestamp='2024-01-10
    T12:00:00')
impact_value = waste_system.calculate_environmental_impact(user_id='123')
print("Environmental Impact for User 123:", impact_value)
```

4.4 Module Description

4.4.1 User Interface Module

The User Interface Module is the gateway for users to interact with the waste management system, prioritizing a user-friendly experience. It features an intuitive dashboard, user-friendly input forms, and powerful data visualizations, ensuring easy navigation and clear representation of waste-related data. User profiles and personalized settings enhance the user experience, while reporting and analytics functionalities provide valuable insights into waste generation patterns. Notifications and alerts keep users informed, and educational resources promote environmental awareness. In essence, this module is designed to streamline data entry, encourage user engagement, and empower users with actionable insights for effective waste management.

4.4.2 Data Processing Module

The Data Processing Module is a crucial component in the waste management system, responsible for validating and analyzing collected waste data to extract meaningful insights. It ensures the accuracy and reliability of the data through robust validation mechanisms and performs real-time calculations to generate key metrics such as total waste quantities and environmental impact scores. The module collaborates with other system modules, such as Waste Monitoring and User Interface, to facilitate a seamless flow of information. Through comprehensive reporting and visualization, it provides users with clear insights into their waste management performance, highlighting trends and offering optimization recommendations. In essence, the Data Processing Module acts as the analytical powerhouse, transforming raw data into actionable information for informed decision-making in sustainable waste management practices.

4.5 Steps to execute/run/implement the Project

4.5.1 Project Planning

- Define project goals, objectives, and scope.
- Create a detailed project plan with tasks, timelines, and resource allocation.

4.5.2 System Design

- Develop the system architecture, outlining components and their interactions.
- Design the database schema to efficiently store and retrieve waste-related data.
- Create wireframes and design the user interface to align with user preferences.

4.5.3 Development

- Write code for each module of the waste management system based on the design.
- Implement features for waste data monitoring, user interface, data processing, and optimization.
- Ensure coding standards, security, and scalability are adhered to during development.

4.5.4 Testing and Deployment

- Conduct unit testing to verify the functionality of individual modules.
- Perform integration testing to ensure seamless communication between different system components.
- Conduct system testing to validate the software against the defined requirements.
- Prepare the system for deployment by configuring servers and databases.
- Deploy the waste management software on the targeted infrastructure or cloud platform.
- Monitor deployment to address any issues that may arise during the process.

Chapter 5

IMPLEMENTATION AND TESTING

5.1 Testing

Testing is a critical phase in the implementation of a waste management software project, ensuring the system's reliability, functionality, and performance. During this phase, the software undergoes rigorous scrutiny through various testing methods, starting with unit testing to verify the correctness of individual modules. Integration testing follows, focusing on assessing the seamless interaction between different components of the system. System testing is conducted to validate the software against the defined requirements, simulating real-world scenarios to identify and rectify any potential issues. User Acceptance Testing (UAT) is imperative, allowing end-users to evaluate the system's usability and functionality, providing valuable feedback before the official launch. This comprehensive testing process aims to detect and resolve bugs, ensure data accuracy, and guarantee a robust and user-friendly waste management solution. Successful testing not only validates the quality of the software but also instills confidence in its reliability and effectiveness, laying the foundation for a successful and seamless implementation.

5.2 Types of Testing

5.2.1 Unit testing

Input

```
<!-- ======= Skills Section ======= -->
    <section id="skills" class="skills">
      <div class="container" data-aos="fade-up">

        <div class="row">
          <div class="col-lg-6 d-flex align-items-center" data-aos="fade-right" data-aos-delay="100"
              >
            <img src="assets/img/recycling5.png" class="img-fluid" alt="">
          </div>
```

```
          <div class="col-lg-6 pt-4 pt-lg-0 content" data-aos="fade-left" data-aos-delay="100">
            <h3>Composition and Percentage of Waste Generation</h3>
            <p class="fst-italic">
              Management of Municipal Solid Wastes: A Case Study in Limpopo Province, South Africa

            </p>

            <div class="skills-content">

              <div class="progress">
                <span class="skill">Plastics <i class="val">35%</i></span>
                <div class="progress-bar-wrap">
                  <div class="progress-bar" role="progressbar" aria-valuenow="100" aria-valuemin="0"
                       aria-valuemax="100"></div>
                </div>
              </div>

              <div class="progress">
                <span class="skill">Paper and Glass <i class="val">25%</i></span>
                <div class="progress-bar-wrap">
                  <div class="progress-bar" role="progressbar" aria-valuenow="90" aria-valuemin="0"
                      aria-valuemax="100"></div>
                </div>
              </div>

              <div class="progress">
                <span class="skill">Food Waste  <i class="val">25%</i></span>
                <div class="progress-bar-wrap">
                  <div class="progress-bar" role="progressbar" aria-valuenow="75" aria-valuemin="0"
                      aria-valuemax="100"></div>
                </div>
              </div>

              <div class="progress">
                <span class="skill">Garden Waste<i class="val">15%</i></span>
                <div class="progress-bar-wrap">
                  <div class="progress-bar" role="progressbar" aria-valuenow="55" aria-valuemin="0"
                      aria-valuemax="100"></div>
                </div>
              </div>

            </div>

          </div>
        </div>

      </div>
    </section><!-- End Skills Section -->
```

5.2.2 Test Result

Figure 5.1: **Test Image Of the Website**

In the above given figure 5.1 it shows the test image of the website which was generated after the testing code for the website was run, the image shows the type of waste generated and the amount generated for it.

Chapter 6

RESULTS AND DISCUSSIONS

6.1 Efficiency of the Proposed System

The proposed waste management software promises a revolution in efficiency, tackling environmental, resource, and financial challenges head-on. By harnessing real-time data and innovative tech, it streamlines operations and empowers informed decision-making.

Imagine optimized collection routes that cut fuel consumption and unnecessary trips. Real-time bin monitoring prevents overflow and optimizes equipment deployment. Additionally, precise waste composition analysis empowers efficient sorting, boosting recycling and reducing landfill burden. This translates to environmental wins, minimized resource consumption, and reduced reliance on virgin materials.

Financially, the system shines. Optimized operations and reduced downtime from equipment breakdowns deliver significant cost savings. Accurate compliance monitoring minimizes fines and penalties, while potential revenue streams emerge from increased recycling and attracting environmentally conscious clients.

Overall, this software unlocks a future of efficient, sustainable waste management. It empowers informed decision-making, optimizes resource utilization, and drives financial savings, all while contributing to a cleaner and healthier planet.

6.2 Comparison of Existing and Proposed System

Existing system:

Traditional waste management resembles a chaotic battlefield, overrun by overflowing bins, inefficient routes, and unsorted mountains of landfill waste. These systems, shrouded in inefficiency, pose environmental and economic dangers. Blind spots of missing data lead to haphazard schedules, wasted fuel, and missed pick-

ups. Resource mismanagement sends valuables straight to landfills, while manual compliance processes invite errors and penalties. In the end, the drain on finances from malfunctioning machines, inefficient operations, and regulatory woes leaves everyone worse off. It's time to abandon this wasteland and embrace a smarter, cleaner future.

Proposed system:

The current landscape of waste management, characterized by operational inefficiencies and environmental challenges, necessitates a transformative approach. Emerging from this landscape, the proposed software stands as a beacon of hope, poised to revolutionize the very way we handle waste.

Leveraging the power of real-time data and state-of-the-art technology, this system promises to orchestrate a seamless dance of efficiency and sustainability. Imagine meticulously optimized collection routes, dynamically adjusted based on bin levels and waste composition, minimizing fuel consumption and maximizing operational effectiveness. Precise sorting, empowered by accurate data, will rescue valuable recyclables and compostables from their landfill fate, fostering resource conservation and environmental stewardship. Compliance, once a burdensome process, becomes a streamlined endeavor with automated data collection and reporting, erasing the specter of fines and penalties.

And finally, the sweet reward: a symphony of cost savings. Optimized operations, reduced equipment downtime, and efficient resource allocation will resonate in the wallets of corporations, municipalities, and individuals alike. This futuristic vision is not a distant prospect, but a mere click away. By embracing this revolutionary software, we stand on the precipice of transforming waste management from a mere necessity into a beacon of environmental and economic prosperity.

6.3 Sample Code

```
<!DOCTYPE html>
<html lang="en">

<head>
  <meta charset="utf-8">
  <meta content="width=device-width, initial-scale=1.0" name="viewport">

```

```
  <title>Wms - Home</title>
  <meta content="" name="description">
  <meta content="" name="keywords">

  <!-- Favicons -->
  <link href="assets/img/clients/Capture.PNG" rel="icon">
  <link href="assets/img/clients/Capture.PNG" rel="apple-touch-icon">

  <!-- Google Fonts -->
  <link href="https://fonts.googleapis.com/css?family=Open+Sans:300,300i,400,400i,600,600i,700,700i|
      Jost:300,300i,400,400i,500,500i,600,600i,700,700i|Poppins:300,300i,400,400i,500,500i,600,600i
      ,700,700i" rel="stylesheet">

  <!-- Vendor CSS Files -->
  <link href="assets/vendor/aos/aos.css" rel="stylesheet">
  <link href="assets/vendor/bootstrap/css/bootstrap.min.css" rel="stylesheet">
  <link href="assets/vendor/bootstrap-icons/bootstrap-icons.css" rel="stylesheet">
  <link href="assets/vendor/boxicons/css/boxicons.min.css" rel="stylesheet">
  <link href="assets/vendor/glightbox/css/glightbox.min.css" rel="stylesheet">
  <link href="assets/vendor/remixicon/remixicon.css" rel="stylesheet">
  <link href="assets/vendor/swiper/swiper-bundle.min.css" rel="stylesheet">

  <!-- Template Main CSS File -->
  <link href="assets/css/style.css" rel="stylesheet">

    <!-- cdn for awesome fonts icons -->
    <link rel="stylesheet" href="https://cdnjs.cloudflare.com/ajax/libs/font-awesome/4.7.0/css/font-
        awesome.min.css">

     <!-- Google Fonts -->
  <link rel="stylesheet" href="https://cdnjs.cloudflare.com/ajax/libs/font-awesome/5.8.2/css/all.min
      .css" crossorigin="anonymous" />

</head>

<body>

  <!-- ======= Header ======= -->
  <header id="header" class="fixed-top ">
    <div class="container d-flex align-items-center">

      <h1 class="logo me-auto"><a href="index.html">Waste Management System</a></h1>
      <!-- Uncomment below if you prefer to use an image logo -->
      <!-- <a href="index.html" class="logo me-auto"><img src="assets/img/logo.png" alt="" class="
          img-fluid"></a> -->
```

Output

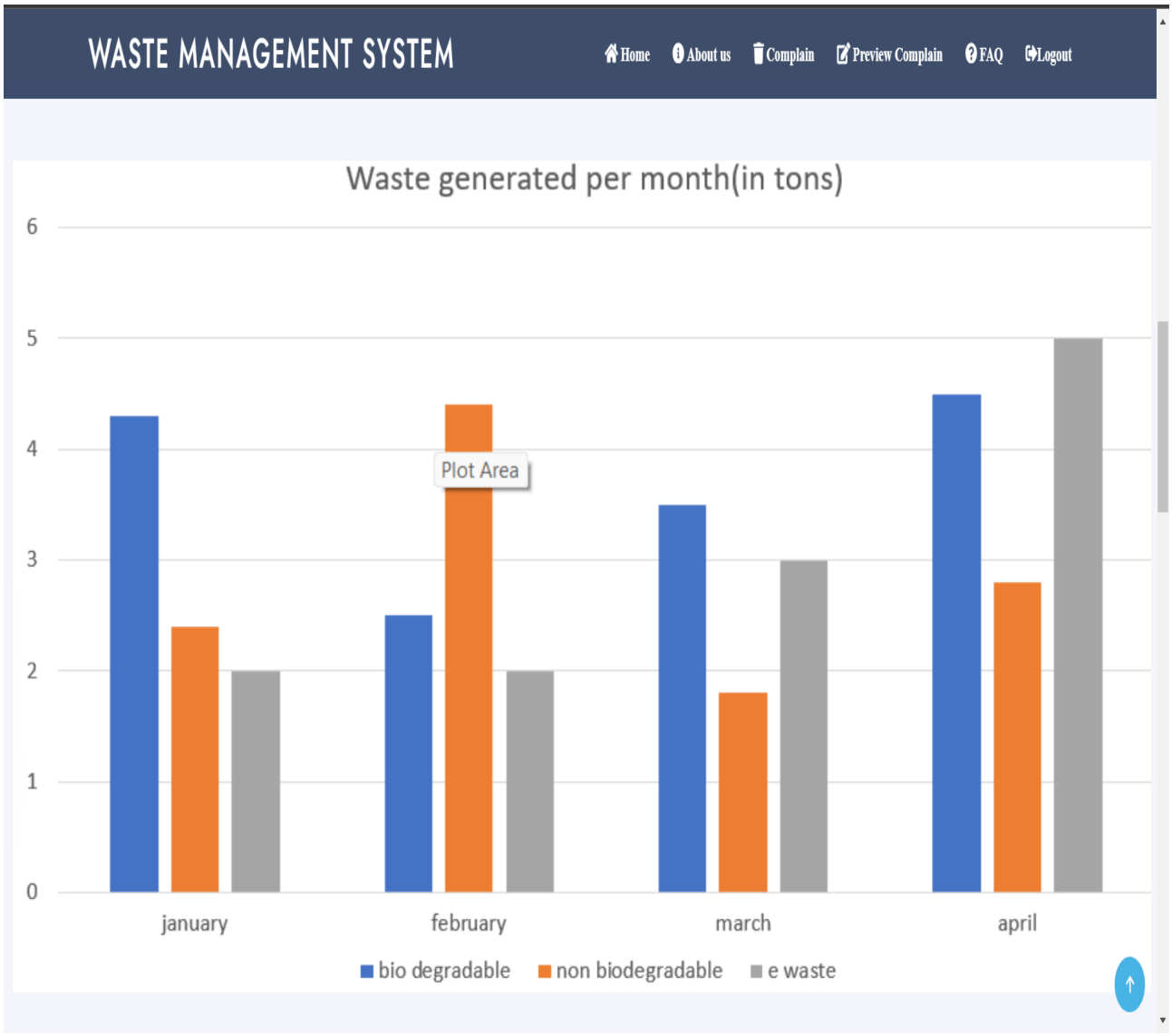

Figure 6.1: **Output for the Graph**

The above given figure 6.1 shows the output of the graph in the website that will show the waste generated in a month in the area. So, the municipal corporation can keep a better track of the waste generated and help in better waste management.

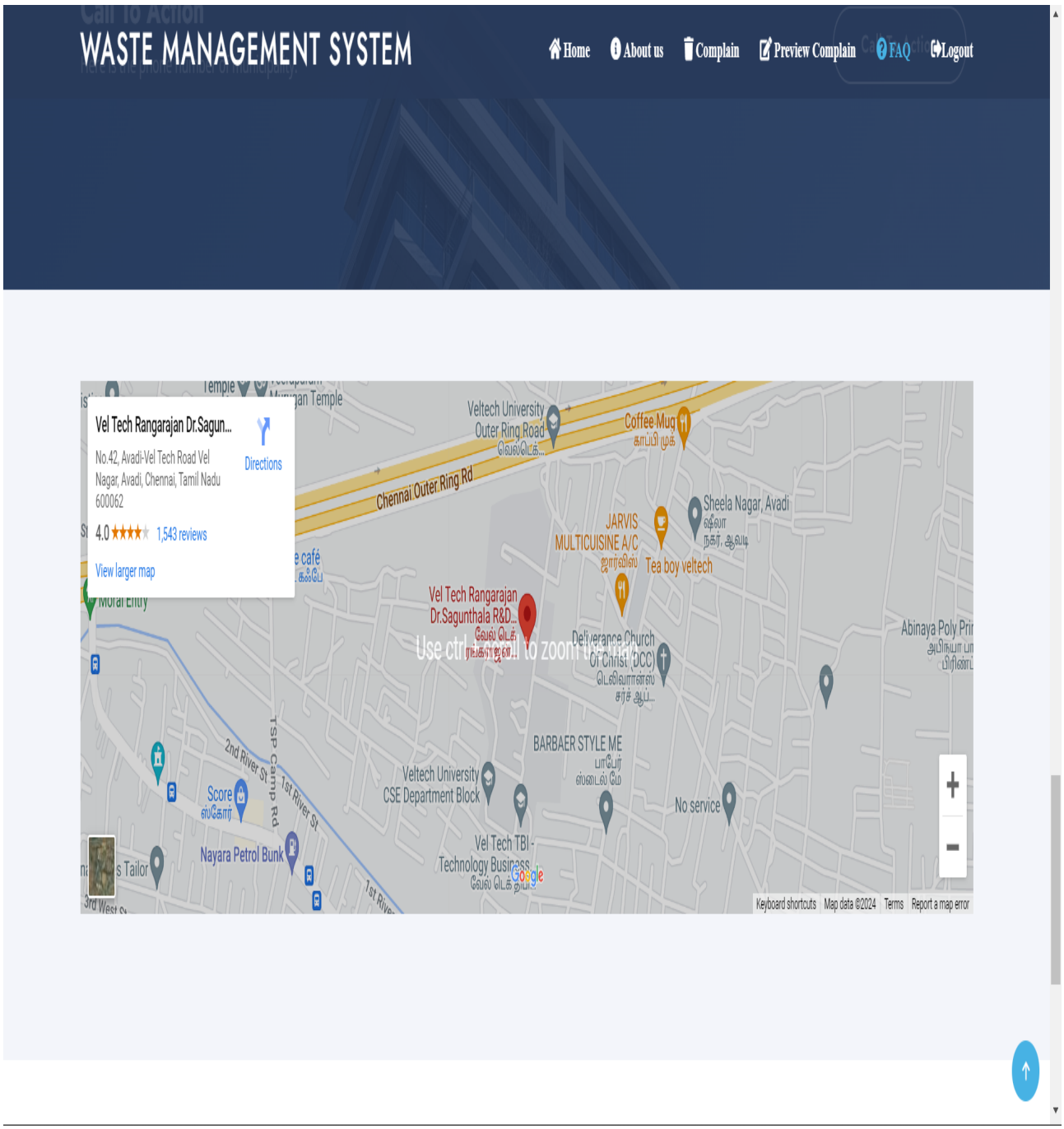

Figure 6.2: **Output for Map**

The above figure 6.2 shows the output of the map in the website that will display the location of the sensors placed in the dustbins in the local area.

Chapter 7

CONCLUSION AND FUTURE ENHANCEMENTS

7.1 Conclusion

The landscape of waste management, long marred by inefficiencies and environmental burdens, stands poised for a transformative reimagining. The proposed software emerges not as a mere technological improvement, but as a paradigm shift, a bold pivot towards a future where waste itself becomes a catalyst for positive change.

Imagine a meticulously orchestrated dance of efficiency, where collection routes dynamically adapt to the ebb and flow of waste generation, minimizing fuel consumption and maximizing operational effectiveness. Precise sorting, empowered by the potent language of real-time data, breathes new life into recyclables and compostables, rescuing them from the dusty abyss of landfills and ushering them back into the virtuous cycle of the circular economy. Compliance, once a bureaucratic labyrinth, is transformed into a seamless waltz of automated data collection and reporting, banishing the specter of fines and penalties to the forgotten realms of operational headaches. And the grand finale? A symphony of cost savings resonates across the economic landscape, harmonizing the needs of businesses, municipalities, and individuals through optimized operations, reduced downtime, and resource allocation so meticulous it benefits all. This vision of a sustainable future is not a distant utopia; it beckons from the horizon, awaiting our resolute embrace.

By implementing this innovative software, we rewrite the narrative of waste, transforming it from a cumbersome burden into a valuable resource. We forge a path where environmental health and economic prosperity intertwine, where clean air whispers through optimized routes and vibrant ecosystems flourish on the bedrock of diverted resources. The road to this brighter tomorrow is paved with collaboration

and innovation. Together, we can unlock the immense potential of waste management, wielding it as a tool to fuel our economy, nurture our planet, and build a sustainable legacy for generations to come. Let us not hesitate, but boldly stride into this new era, where waste is not an obstacle, but an opportunity, and where efficient waste management becomes the lifeblood of a thriving, resilient world.

7.2 Future Enhancements

1. Artificial Intelligence and Machine Learning:

Predictive Analytics for Enhanced Efficiency: Leveraging the power of AI, predictive analytics can revolutionize waste management by accurately forecasting waste generation patterns. By considering variables such as weather conditions, holidays, and local events, AI systems can predict the volume of waste, enabling optimized collection routes and efficient resource allocation for a more responsive waste management system.

Automated Waste Identification for Streamlined Processes: Integrating AI-powered cameras onto waste collection vehicles introduces automated waste identification capabilities. This innovative technology enables real-time identification and classification of various waste types, facilitating a seamless sorting process. By automating this crucial aspect of waste management, the system enhances operational efficiency, reduces manual labor, and ensures accurate categorization for improved recycling efforts.

Adaptive Algorithms: Machine learning plays a pivotal role in waste management through the implementation of adaptive algorithms. These algorithms continuously analyze data from various sources, learning and evolving over time. As the system processes more information, it refines its algorithms, leading to improved decision-making, resource optimization, and overall effectiveness. The adaptive nature of these algorithms ensures that the waste management system becomes increasingly adept at handling dynamic and evolving waste management challenges.

2. Internet of Things (IoT) Integration:

Smart Bins: Sensor-equipped bins could send real-time data on fill levels, allowing for dynamic route adjustments and preventing overflows.
Connected Equipment: Waste collection vehicles and processing facilities could communicate with each other, optimizing operations and resource utilization.
Citizen Engagement: IoT-enabled apps could connect residents with the software, encouraging waste reduction and responsible disposal practices.

3. Blockchain Technology:

Waste Tracking and Transparency: Blockchain can create a secure and transparent record of waste movement, ensuring responsible disposal.
Incentivized Recycling: Blockchain-based reward systems could incentivize individuals and businesses to participate in recycling and composting programs. Circular Economy Optimization: Blockchain can track the flow of materials throughout the circular economy, facilitating resource recovery and maximizing efficiency.

4. Advanced Robotics and Automation:

Autonomous Collection Vehicles: Self-driving waste collection vehicles could further optimize routes and reduce reliance on human labor.
Automated Sorting and Processing Facilities: Robotic systems could automate waste sorting and processing, improving accuracy and efficiency.
Waste-to-Energy Conversion: Advanced technologies could convert certain types of waste into renewable energy sources, reducing reliance on fossil fuels.

Chapter 8

PLAGIARISM REPORT

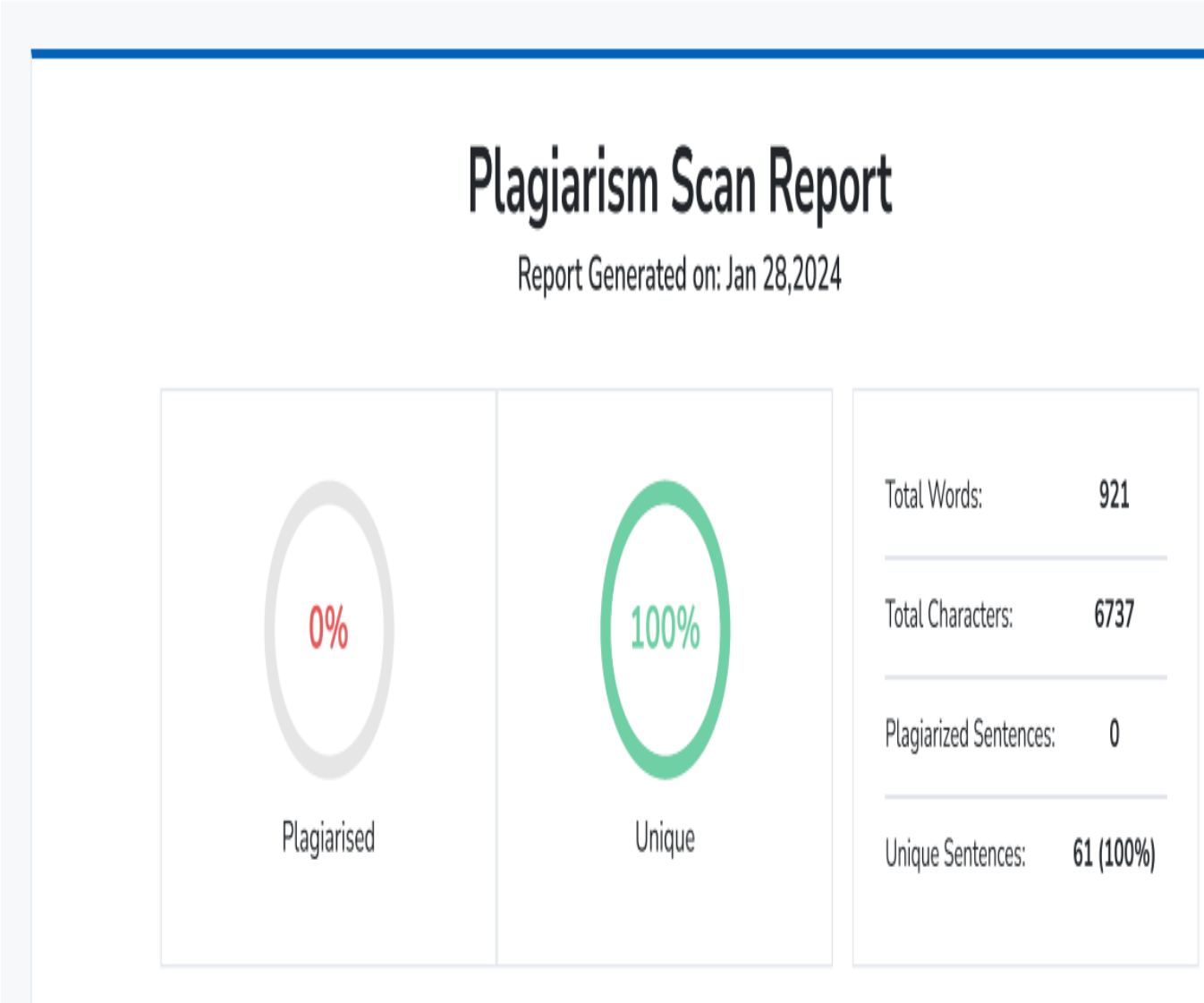

Figure 8.1: **Plagarism Summary**

Chapter 9

SOURCE CODE & POSTER PRESENTATION

9.1 Source Code

```
<!DOCTYPE html>
<html lang="en">

<head>
  <meta charset="utf-8">
  <meta content="width=device-width, initial-scale=1.0" name="viewport">

  <title>Wms - Home</title>
  <meta content="" name="description">
  <meta content="" name="keywords">

  <!-- Favicons -->
  <link href="assets/img/clients/Capture.PNG" rel="icon">
  <link href="assets/img/clients/Capture.PNG" rel="apple-touch-icon">

  <!-- Google Fonts -->
  <link href="https://fonts.googleapis.com/css?family=Open+Sans:300,300i,400,400i,600,600i,700,700i|
      Jost:300,300i,400,400i,500,500i,600,600i,700,700i|Poppins:300,300i,400,400i,500,500i,600,600i
      ,700,700i" rel="stylesheet">

  <!-- Vendor CSS Files -->
  <link href="assets/vendor/aos/aos.css" rel="stylesheet">
  <link href="assets/vendor/bootstrap/css/bootstrap.min.css" rel="stylesheet">
  <link href="assets/vendor/bootstrap-icons/bootstrap-icons.css" rel="stylesheet">
  <link href="assets/vendor/boxicons/css/boxicons.min.css" rel="stylesheet">
  <link href="assets/vendor/glightbox/css/glightbox.min.css" rel="stylesheet">
  <link href="assets/vendor/remixicon/remixicon.css" rel="stylesheet">
  <link href="assets/vendor/swiper/swiper-bundle.min.css" rel="stylesheet">

  <!-- Template Main CSS File -->
  <link href="assets/css/style.css" rel="stylesheet">

    <!-- cdn for awesome fonts icons -->
    <link rel="stylesheet" href="https://cdnjs.cloudflare.com/ajax/libs/font-awesome/4.7.0/css/font-
        awesome.min.css">
```

```
33
34      <!-- Google Fonts -->
35  <link rel="stylesheet" href="https://cdnjs.cloudflare.com/ajax/libs/font-awesome/5.8.2/css/all.min
        .css" crossorigin="anonymous" />
36
37 </head>
38
39 <body>
40
41   <!-- ======= Header ======= -->
42   <header id="header" class="fixed-top ">
43     <div class="container d-flex align-items-center">
44
45       <h1 class="logo me-auto"><a href="index.html">Waste Management System</a></h1>
46       <!-- Uncomment below if you prefer to use an image logo -->
47       <!-- <a href="index.html" class="logo me-auto"><img src="assets/img/logo.png" alt="" class="
             img-fluid"></a> -->
48
49       <nav id="navbar" class="navbar">
50         <ul>
51           <li><a class="nav-link scrollto active" href="#hero"><span class="fa fa-home"> Home </span
                 ></a></li>
52           <li><a class="nav-link scrollto" href="#about"><span class="fa fa-info-circle" aria-hidden
                 ="true"> About us</span></a></li>
53           <li><a class="nav-link scrollto" href="phpGmailSMTP/trash.php"><span class="fa fa-trash">
                 Complain</span></a></li>
54           <li><a class="nav-link scrollto"  href="adminlogin/welcome.php"><span class="fa fa-edit">
                 Preview Complain </span></a></li>
55           <!-- <li><a class="nav-link scrollto" href="#contact">Contact</a></li> -->
56           <li><a class="nav-link scrollto" href="#faq"><span class="fa fa-question-circle"> FAQ</
                 span></a></li>
57           <li><a class="nav-link scrollto" href="logout-user.php"><span class="fas fa-sign-out-alt">
                 Logout</span></a></li>
58         </ul>
59         <i class="bi bi-list mobile-nav-toggle"></i>
60       </nav><!-- .navbar -->
61
62     </div>
63   </header><!-- End Header -->
64
65   <!-- ======= Hero Section ======= -->
66   <section id="hero" class="d-flex align-items-center">
67
68     <div class="container">
69       <div class="row">
70         <div class="col-lg-6 d-flex flex-column justify-content-center pt-4 pt-lg-0 order-2 order-lg
               -1" data-aos="fade-up" data-aos-delay="200">
71           <h1>Better Solutions For The Waste Around You!</h1>
72           <h2>Keep our Environment Healthy</h2>
73
```

```
          <div class="d-flex justify-content-center justify-content-lg-start">
            <a href="#about" class="btn-get-started scrollto">Get Started</a>
            <a href="https://youtu.be/mQ93IcGCag4" class="glightbox btn-watch-video"><i class="bi bi-play-circle"></i><span>Watch Video</span></a>
          </div>
        </div>
        <div class="col-lg-6 order-1 order-lg-2 hero-img" data-aos="zoom-in" data-aos-delay="200">
          <img src="assets/img/recycling.jpeg" class="img-fluid animated" alt="">
        </div>
      </div>
    </div>
  </section><!-- End Hero -->
  <main id="main">

    <!-- ======= Cliens Section ======= -->
    <section id="cliens" class="cliens section-bg">
      <div class="container">

        <div class="row" data-aos="zoom-in">

          <div class="col-lg-2 col-md-4 col-6 d-flex align-items-center justify-content-center">
            <img src="assets/img/clients/images.png" class="img-fluid" alt="">
          </div>

          <div class="col-lg-2 col-md-4 col-6 d-flex align-items-center justify-content-center">
            <img src="assets/img/clients/images (1).png" class="img-fluid" alt="">
          </div>

          <div class="col-lg-2 col-md-4 col-6 d-flex align-items-center justify-content-center">
            <img src="assets/img/clients/Capture.PNG" class="img-fluid" alt="">
          </div>

          <div class="col-lg-2 col-md-4 col-6 d-flex align-items-center justify-content-center">
            <img src="assets/img/clients/download (2).jfif" class="img-fluid" alt="">
          </div>

          <div class="col-lg-2 col-md-4 col-6 d-flex align-items-center justify-content-center">
            <img src="assets/img/clients/download (1).jfif" class="img-fluid" alt="">
          </div>

          <div class="col-lg-2 col-md-4 col-6 d-flex align-items-center justify-content-center">
            <img src="assets/img/clients/download (3).jfif" class="img-fluid" alt="">
          </div>

        </div>

      </div>
    </section><!-- End Cliens Section -->

    <!-- ======= About Us Section ======= -->
```

```
123     <section id="about" class="about">
124       <div class="container" data-aos="fade-up">
125
126         <div class="section-title">
127           <h2>About Us</h2>
128         </div>
129
130         <div class="row content">
131           <div class="col-lg-6">
132             <p>
133
134  The  WASTE  MANAGEMENT SYSTEM
135 is a web application aimed to provide a digital way for companies and municipality to look after
        the waste management.
136
137
138             </p>
139             <ul>
140               <li><i class="ri-check-double-line"></i> Complaining about waste or garbage problems
                      near their locality. </li>
141               <li><i class="ri-check-double-line"></i> See thier complain Report and check if the
                      work is done! or not. </li>
142               <li><i class="ri-check-double-line"></i> people can take different ideas regarding
                      recycling of waste through this website. </li>
143             </ul>
144           </div>
145           <div class="col-lg-6 pt-4 pt-lg-0">
146             <p>
147               Complaining about the waste problem encountered everyday to municipality is hefty
                      process and waste management
148                aims to make this process easier. With a simple handheld device with access to
                       internet, user can use this platform complain
149                their concerns to municipality . The automated system will redirect the complains .
                       The municipality admins at the receiving side can acknowledge
150                 the reports which lets the users whether their complain is adddressed or not.
151             </p>
152             <a href="#" class="btn-learn-more">Learn More</a>
153           </div>
154         </div>
155
156       </div>
157     </section><!-- End About Us Section -->
158
159     <!-- ======= Why Us Section ======= -->
160     <section id="why-us" class="why-us section-bg">
161       <div class="container-fluid" data-aos="fade-up">
162
163         <div class="row">
164
```

```
165           <div class="col-lg-7 d-flex flex-column justify-content-center align-items-stretch  order
                  -2 order-lg-1">
166
167             <img src="C:\Users\Priyansu\Pictures\Screenshots\Screenshot 2024-01-10 220728.png" alt="
                    Girl in a jacket" width="1500" height="600">
168
169
170             </div>
171
172           </div>
173
174
175         </div>
176
177       </div>
178     </section><!-- End Why Us Section -->
179
180     <!-- ======= Skills Section ======= -->
181     <section id="skills" class="skills">
182       <div class="container" data-aos="fade-up">
183
184         <div class="row">
185           <div class="col-lg-6 d-flex align-items-center" data-aos="fade-right" data-aos-delay="100"
                  >
186             <img src="assets/img/recycling5.png" class="img-fluid" alt="">
187           </div>
188           <div class="col-lg-6 pt-4 pt-lg-0 content" data-aos="fade-left" data-aos-delay="100">
189             <h3>Composition and Percentage of Waste Generation</h3>
190             <p class="fst-italic">
191               Management of Municipal Solid Wastes: A Case Study in Limpopo Province, South Africa
192
193             </p>
194
195             <div class="skills-content">
196
197               <div class="progress">
198                 <span class="skill">Plastics <i class="val">35%</i></span>
199                 <div class="progress-bar-wrap">
200                   <div class="progress-bar" role="progressbar" aria-valuenow="100" aria-valuemin="0"
                          aria-valuemax="100"></div>
201                 </div>
202               </div>
203
204               <div class="progress">
205                 <span class="skill">Paper and Glass <i class="val">25%</i></span>
206                 <div class="progress-bar-wrap">
207                   <div class="progress-bar" role="progressbar" aria-valuenow="90" aria-valuemin="0"
                        aria-valuemax="100"></div>
208                 </div>
209               </div>
```

```
210
211             <div class="progress">
212               <span class="skill">Food Waste  <i class="val">25%</i></span>
213               <div class="progress-bar-wrap">
214                 <div class="progress-bar" role="progressbar" aria-valuenow="75" aria-valuemin="0"
                        aria-valuemax="100"></div>
215               </div>
216             </div>
217
218             <div class="progress">
219               <span class="skill">Garden Waste<i class="val">15%</i></span>
220               <div class="progress-bar-wrap">
221                 <div class="progress-bar" role="progressbar" aria-valuenow="55" aria-valuemin="0"
                        aria-valuemax="100"></div>
222               </div>
223             </div>
224
225           </div>
226
227         </div>
228       </div>
229
230     </div>
231   </section><!-- End Skills Section -->
232
233   <!-- ======= Cta Section ======= -->
234   <section id="cta" class="cta">
235     <div class="container" data-aos="zoom-in">
236
237       <div class="row">
238         <div class="col-lg-9 text-center text-lg-start">
239           <h3>Call To Action</h3>
240           <p> Here is the phone number of municipality.</p>
241         </div>
242         <div class="col-lg-3 cta-btn-container text-center">
243           <a class="cta-btn align-middle" href="tel:+97716609952111">Call To Action</a>
244         </div>
245       </div>
246
247     </div>
248   </section><!-- End Cta Section -->
249
250   <!-- ======= Frequently Asked Questions Section ======= -->
251   <section id="faq" class="faq section-bg">
252     <div class="container" data-aos="fade-up">
253
254       <div class="section-title">
255
256
```

```
257           <iframe style="border:0; width: 100%; height: 350px;" src="https://www.google.com/maps/
                  embed?pb=!1m18!1m12!1m3!1d3884.781694010417!2d80.09568487454968!3d13.17616001036153 7!2
                  m3!1f0!2f0!3f0!3m2!1i1024!2i768!4f13.1!3m3!1m2!1s0x3a525d82ff11a9cf%3
                  A0x3304dc9aed0f444a!2sVel%20Tech%20Rangarajan%20Dr.Sagunthala%20R%26D%20Institute%20of
                  %20Science%20and%20Technology!5e0!3m2!1sen!2sin!4v1704901599569!5m2!1sen!2sin"
                  frameborder="0" allowfullscreen></iframe>
258         </div>
259
260       </div>
261     </section><!-- End Frequently Asked Questions Section -->
262   </main><!-- End #main -->
263
264   <!-- ======= Footer ======= -->
265   <footer id="footer">
266
267
268     <div class="footer-top">
269       <div class="container">
270         <div class="row">
271
272           <div class="col-lg-3 col-md-6 footer-contact">
273             <h3><img src="assets/img/clients/Capture.PNG" style="width:80px;height:60px;"></h3>
274             <p>
275               Mahendranagar <br>
276               kanchanpur, sudurpacchhim state<br>
277               Nepal <br><br>
278               <strong>Phone:</strong> +977 16609952111<br>
279               <strong>Email:</strong> <a href="mailto:info@bheemdattamun.gov.np bmuncipality@gmail.
                      com">info@bheemdattamun.gov.np bmuncipality@gmail.com<br></a>
280             </p>
281           </div>
282
283           <div class="col-lg-3 col-md-6 footer-links">
284             <h4>Useful Links</h4>
285             <ul>
286               <li><i class="bx bx-chevron-right"></i> <a href="#">Home</a></li>
287               <li><i class="bx bx-chevron-right"></i> <a href="#about">About us</a></li>
288               <li><i class="bx bx-chevron-right"></i> <a href="#faq">FAQ</a></li>
289               <li><i class="bx bx-chevron-right"></i> <a href="#">Terms of service</a></li>
290               <li><i class="bx bx-chevron-right"></i> <a href="#">Privacy policy</a></li>
291             </ul>
292           </div>
293
294           <div class="col-lg-3 col-md-6 footer-links">
295             <h4>Our Services</h4>
296             <ul>
297               <li><i class="bx bx-chevron-right"></i> <a href="#">Waste Pick up </a></li>
298               <li><i class="bx bx-chevron-right"></i> <a href="#">E- managementwaste</a></li>
299               <li><i class="bx bx-chevron-right"></i> <a href="#">Garbage Management</a></li>
300               <li><i class="bx bx-chevron-right"></i> <a href="#">Awareness program</a></li>
```

```
            <li><i class="bx bx-chevron-right"></i> <a href="#">Complain Hnadling </a></li>
          </ul>
        </div>

        <div class="col-lg-3 col-md-6 footer-links">
          <h4>Our Social Networks</h4>
          <p>Follow us in our social media to stay updated about community waste management.</p>
          <div class="social-links mt-3">
            <a href="#" class="twitter"><i class="bx bxl-twitter"></i></a>
            <a href="#" class="facebook"><i class="bx bxl-facebook"></i></a>
            <a href="#" class="instagram"><i class="bx bxl-instagram"></i></a>
            <a href="#" class="google-plus"><i class="bx bxl-skype"></i></a>
            <a href="#" class="linkedin"><i class="bx bxl-linkedin"></i></a>
          </div>
        </div>

      </div>
    </div>
  </div>

  <div class="container footer-bottom clearfix">
    <div class="copyright">
      &copy; Copyright <strong><span>WMS</span></strong>. All Rights Reserved
    </div>
    <div class="credits">
     Designed by <a href="">Janak Bista </a> and <a href="">Image Kunwar </a>
    </div>
  </div>
</footer><!-- End Footer -->

<div id="preloader"></div>
<a href="#" class="back-to-top d-flex align-items-center justify-content-center"><i class="bi bi-arrow-up-short"></i></a>

<!-- Vendor JS Files -->
<script src="assets/vendor/aos/aos.js"></script>
<script src="assets/vendor/bootstrap/js/bootstrap.bundle.min.js"></script>
<script src="assets/vendor/glightbox/js/glightbox.min.js"></script>
<script src="assets/vendor/isotope-layout/isotope.pkgd.min.js"></script>
<script src="assets/vendor/php-email-form/validate.js"></script>
<script src="assets/vendor/swiper/swiper-bundle.min.js"></script>
<script src="assets/vendor/waypoints/noframework.waypoints.js"></script>

<!-- Template Main JS File -->
<script src="assets/js/main.js"></script>
</body>
</html>
```

9.2 Poster Presentation

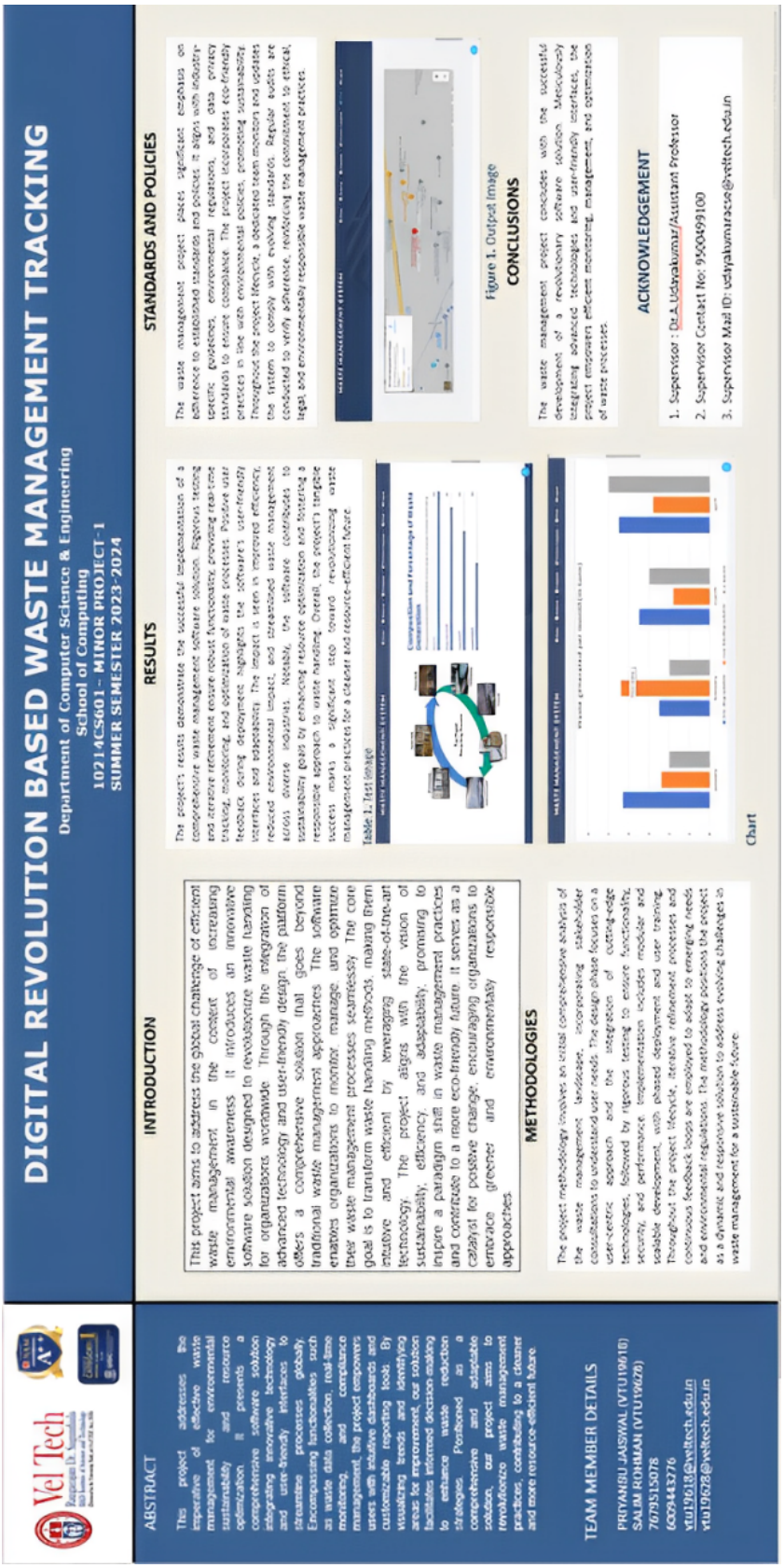

Figure 9.1: **Poster For the Project**

References

[1] M. Saad, M. B. Ahmad, M. Asif, M. K. Khan, T. Mahmood and M. T. Mahmood, ”Blockchain-Enabled VANET for Smart Solid Waste Management,” in IEEE Access, vol. 11, pp. 5679-5700, 2023. This study explores the application of the Internet of Things (IoT) to address the critical issue of waste management,particularly in developing countries and urban areas where planning and resource availability pose significant challenges.

[2] S. R. J. Ramson, S. Vishnu, A. A. Kirubaraj, T. Anagnostopoulos and A.M. Abu-Mahfouz, ”A LoRaWAN IoT-Enabled Trash Bin Level Monitoring System,” in IEEE Transactions on Industrial Informatics, vol. 18, no. 2, pp. 786-795,Feb. 2022. This article discussed about the persistent challenge of municipal solid waste management in urban areas, a concern with profound implications for health and the environment.

[3] Ghahramani, M. Zhou, A. Molter and F. Pilla, ”IoT-Based Route Recommendation for an Intelligent Waste Management System,” in IEEE Internet of Things Journal, vol. 9, no. 14, pp. 11883-11892, 15 July15, 2022 talked about the integration of the Internet of Things (IoT) and Artificial Intelligence (AI) in addressing the challenges of waste management in smart cities.

[4] Boustani et al., ”Investigation of the waste-removal chain through pervasive computing,” in IBM Journal of Research and Development, vol. 55, no. 1.2,pp. 11:1-11:11, Jan.-March 2011 discussed about the growing significance of environmental sustainability and energy management and highlights the pivotal role of evolving tracking technologies in addressing these challenges

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[6] Manasi Gokhale, Rushikesh Wagh, Pallavi Chaudhari. ”IOT Based E-Tracking System for Waste Management”. This article review discusses Internet of Things (IoT) based E-Tracking System for Waste Management, as published in IEEE in 2020. The research explores innovative solutions leveraging IoT technology to enhance waste management practices, offering insights into real-time tracking and optimization methods.IEEE. 2020

[7] Adi Suvarnamma. ”SmartBin system with waste tracking and sorting mechanism using IoT”. This review article explores a SmartBin system featuring waste tracking and sorting mechanisms employing Internet of Things (IoT) technology. The system aims to enhance waste management processes by integrating IoT for efficient monitoring and sorting of waste. His work contributes to the evolving landscape of smart waste solutions, addressing the challenges of waste management through innovative technological applications.2020