DESIGN AND DEVELOPMENT OF "PLASTICARE" INFORMATION SYSTEM AS AN EFFORT TO SUPPORT SUSTAINABLE ENVIRONMENTAL MANAGEMENT

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Abstract

Plastic waste is a major environmental problem in Indonesia due to its large volume, long decomposition time, and low management rate. Bank Sampah Wonorejo provides a plastic waste pickup service to support recycling activities; however, the use of manual data recording has caused inefficiencies and increased the risk of data loss. This study aims to develop a web-based information system called PLASTICARE to support integrated management of plastic waste pickup activities. PLASTICARE was developed using the Waterfall method within the System Development Life Cycle (SDLC), which includes communication, planning, modelling, construction, and deployment stages. Data were collected through interviews and literature studies, while system design employed Unified Modeling Language (UML) such as use case diagram and activity diagram. The system was implemented using HTML, CSS, and PHP. The resulting system features plastic waste pickup submission, administrative approval, reporting, graphical visualization of daily plastic waste weight, and report downloads in PDF format. PLASTICARE improves efficiency, data accuracy, and transparency in waste management processes. The system is expected to increase community participation in plastic waste recycling and support sustainable environmental management

Keywords: information system, plastic waste, plastic waste pickup, Waterfall method, waste bank

1. INTRODUCTION

Plastic waste has become an urgent environmental problem in Indonesia. Recent data shows that in 2024, plastic waste in Indonesia is projected to reach around 13.98% of the total national waste generation with a volume of around 9.9 million tons, of which 33.5% of the total waste has not been properly managed (Lingga et al., 2024). Plastic takes hundreds to thousands of years to decompose and accounts for about 90% of the waste polluting the oceans (Aromi et al., 2024). In response to this problem, the concept of waste banks has emerged as a community-based solution that aims to manage waste through collection, sorting, and processing activities to give it economic value (Sirait et al., 2025).

Sustainable waste management is also an important part of achieving the Sustainable Development Goals (SDGs), specifically from goals 11 to 15 (Arifin et al., 2022), and in line with the Indonesia Clean Waste 2025 target, which aims to reduce waste by 30% and manage waste by 70% (Mauluddin & Isnainazzahra, 2024).

Bank Sampah Wonorejo is a local initiative that implements a program to collect plastic waste directly from residents' homes to facilitate the recycling process, raise public awareness, and provide economic incentives. However, Bank Sampah Wonorejo currently still uses a manual recording system through ledgers, making data management less effective, prone to data loss, and inefficient in terms of time and cost (Hikmatulloh et al., 2024).

Bank Sampah Wonorejo is a local initiative that implements a program to collect plastic waste directly from residents' homes to facilitate the recycling process, raise public awareness, and provide economic incentives. However, Bank Sampah Wonorejo currently still uses a manual recording system through ledgers, making data management less effective, prone to data loss, and inefficient in terms of time and cost (Hikmatulloh et al., 2024). Active community participation is very important in waste management efforts, and community initiatives such as waste banks can increase public awareness and participation in maintaining environmental cleanliness (Napu et al., 2025). The success of waste bank programs depends on active community participation, government policy support, and innovation in waste management systems (Wahfiuddin & Riyanto, 2024).

The use of website or application-based information systems has proven capable of improving the effectiveness of transaction management, data, and reporting in waste banks. Digitalization of waste banks can help facilitate public access and utilization of the nearest waste bank, as well as improve operational efficiency through automatic recording systems (Palahudin et al., 2024). Several studies show that waste bank information systems have been successfully developed and implemented with responsive displays and support operational needs (Rozaq et al., 2025; Dhuhita et al., 2025).

Based on these problems, an integrated information system is needed to support plastic waste management at Bank Sampah Wonorejo. The PLASTICARE system is designed to improve service quality, transparency, and data accountability, as well as encourage community participation. Through the utilization of information technology, this system is expected to be able to form sustainable waste management behavioral changes and become a model for other waste banks.

2. METHODOLOGY

The development of the PLASTICARE information system refers to the Waterfall method, which is included in the System Development Life Cycle (SDLC) model. The waterfall method is a method that is quite often used in the development of an information system (Andi et al., 2023).

Figure 1. Methodology
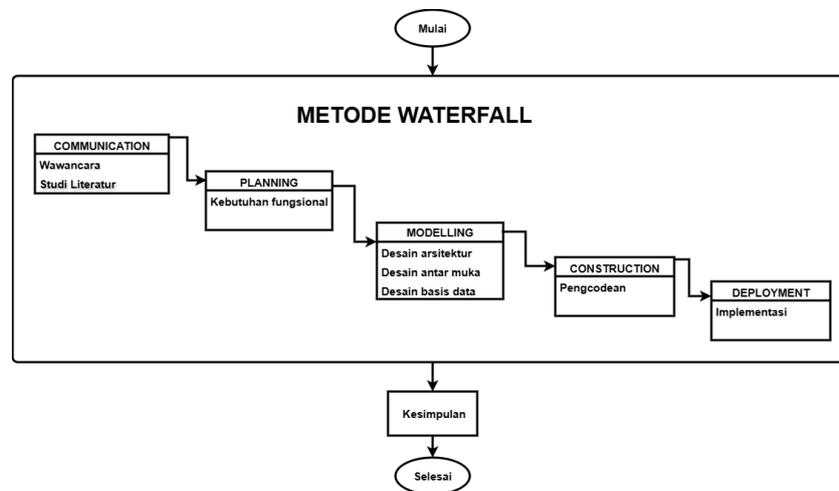
In the waterfall method, there are several stages as follows.

2.1 Communication

The stage of gathering and analyzing initial system requirements through communication with relevant parties and collecting the necessary data and information.

2.2 Planning

The stage of determining and formulating the functional requirements of the system as the basis for information system development.

2.3 Modelling

The system design phase involves modeling requirements and designs using Unified Modeling Language (UML).

2.4 Construction

The implementation stage of the system through the coding process based on the design results

2.5 Deployment

The final stage involves the implementation and handover of the system to users.

3. FINDINGS AND DISCUSSION

3.1 Communication
3.1.1 Interview

At this stage, data was collected through direct interviews with parties involved in the management of the Wonorejo Waste Bank.

3.1.2 Literature Review

At this stage, data collection is carried out by studying relevant literature and scientific references as a basis for supporting the research.

3.2 Planning

3.2.1 Functional Requirements

Functional requirements are requirements that describe the functions that must be possessed and performed by the system in accordance with user (Nuruzzaman et al., 2022), requirements on the PLASTICARE website.

Table 1. Functional Requirements

Number	Functional Requirements
1	Home
2	Login
3	Register
4	Plastic waste submission form for members
5	Member testimonial form
6	Confirmation of approval of plastic waste submission admin
7	Report on the approval of plastic waste submissions by administrators and leaders
8	Member testimonial report
9	Graph of daily plastic waste submissions
10	Download the plastic waste submission approval report

3.3   Modelling

3.3.1 Architectural Design

The use case diagram below illustrates a plastic waste collection information system involving four actors.

Figure 2. PLASTICARE Use case diagram
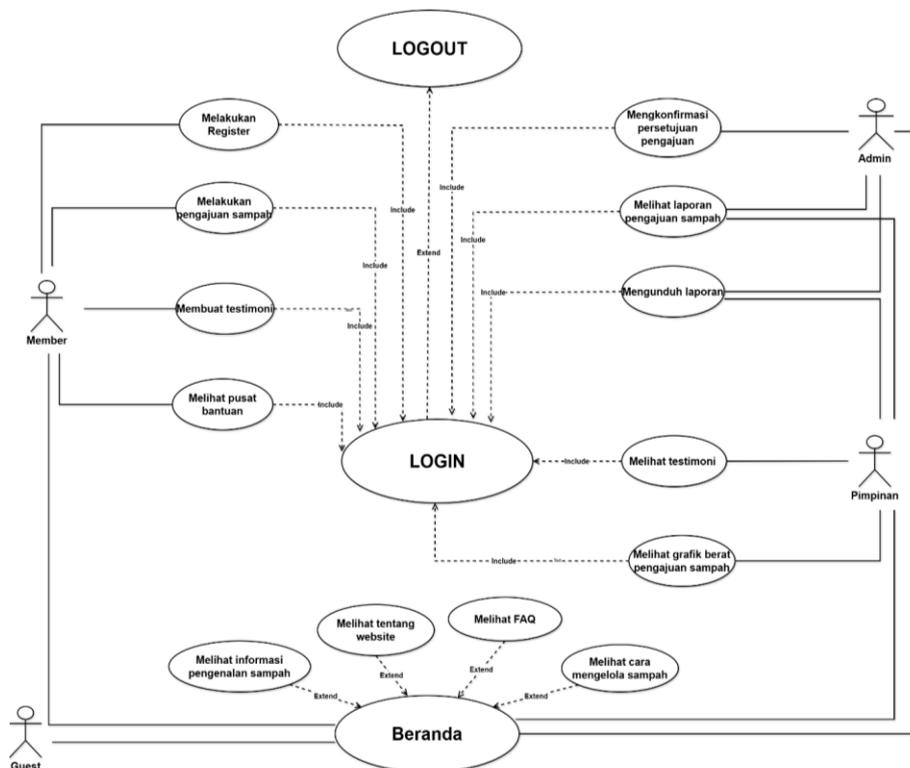
Guests can access the Home page to view general information. After logging in, members can submit waste, write testimonials, access the help center, and log out. Admins can confirm submissions and view and download reports. Managers can view submission reports, testimonials, and graphs of daily waste submissions for evaluation purposes.

**Figure 3. Waste Submission by Members**
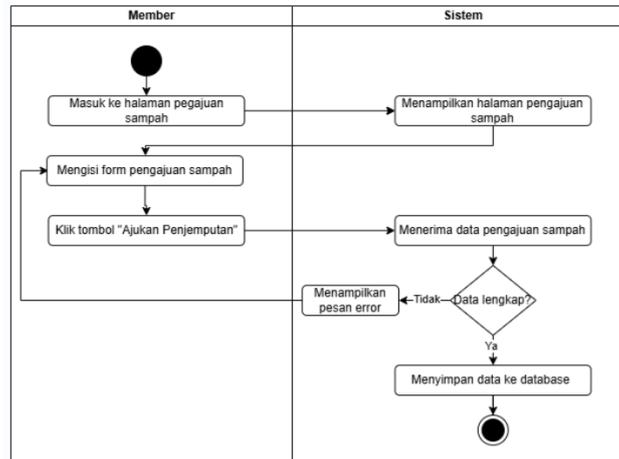
This activity diagram illustrates the process of requesting waste collection by members, starting from filling out the request form to the system validating the data, where valid data will be stored in the database and incomplete data will be rejected with an error message displayed.

**Figure 4. Testimonials by Members**
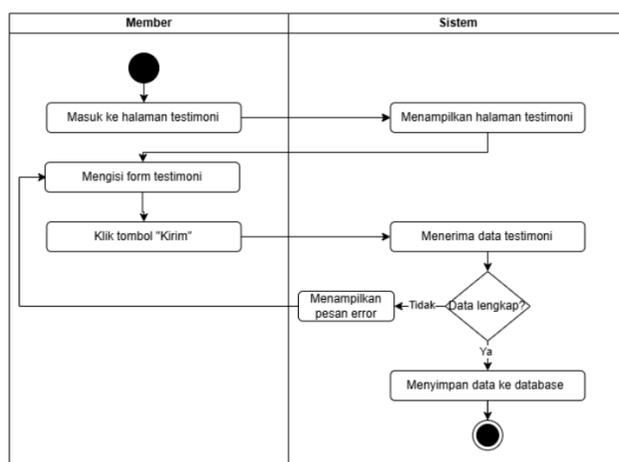
This activity diagram illustrates the process of providing testimonials by members, starting from filling out and submitting the testimonial form to the system validating the data. If the data is complete, the testimonial is saved to the database; if not, the system displays an error message.

**Figure 5. Proses Konfirmasi Pengajuan oleh Admi**
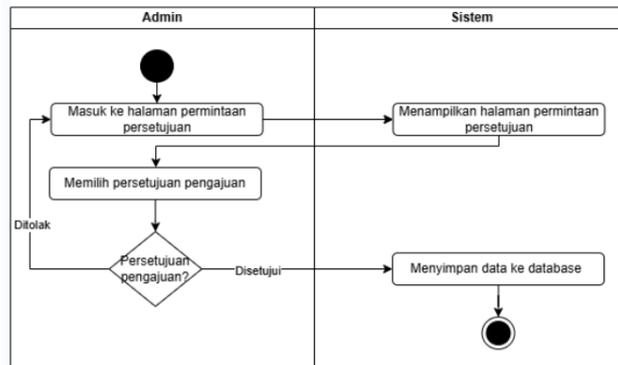
The activity diagram for the admin confirmation process illustrates the approval flow, which begins with the admin accessing the approval request page and selecting requests to approve or reject. Approved requests are saved to the database, while rejected requests return to the selection process.

Figure 6. Monitoring of Waste Submission Weight Charts by Management
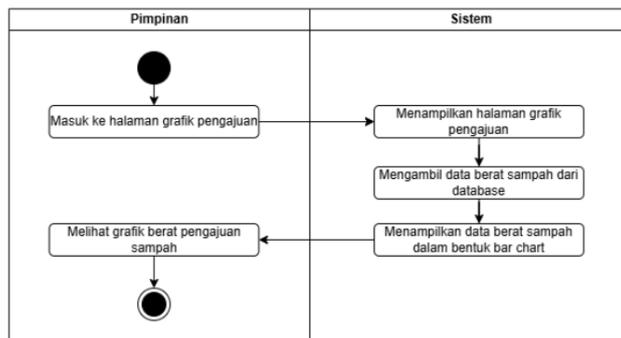
This activity diagram illustrates the flow of leaders accessing the waste submission chart, starting from opening the chart page to the system retrieving data from the database and displaying it in chart form.

Figure 7. Download the report
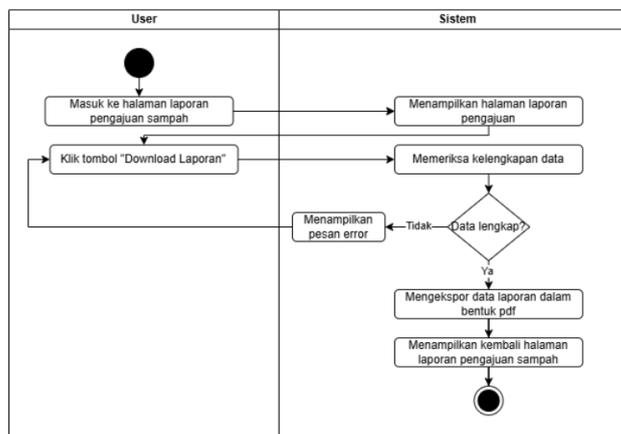
This activity diagram illustrates the user flow for downloading waste disposal reports, from opening the report page to the system exporting the report in PDF format or displaying an error message if the data is incomplete.

3.3.2 Database Design

Database design begins with the preparation of a Conceptual Data Model (CDM) to map data requirements and relationships between entities in order to align with business processes (Fadillah et al., 2025). This is followed by a Physical Data Model (PDM) as a technical design of the database structure prior to the implementation stage (Irwanda et al., 2022).

Figure 8. Conceptual Data Model
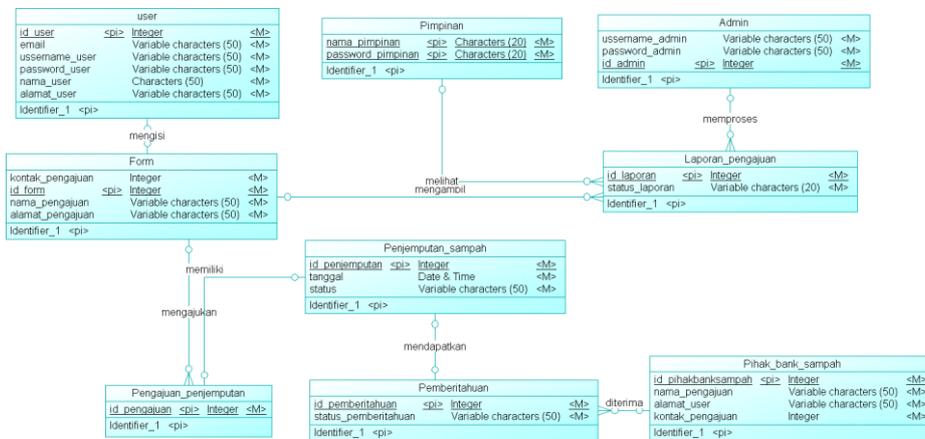
The Conceptual Data Model (CDM) describes the business concept of the system without technical details, where users submit waste collection requests through a form that is processed into **Penjemputan_sampah**, generating a notification to the **Pihak_bank_sampah**, then managed by the admin into a **Laporan_pengajuan** that is used by management as a basis for decision making.

Figure 9. Physical Data Model
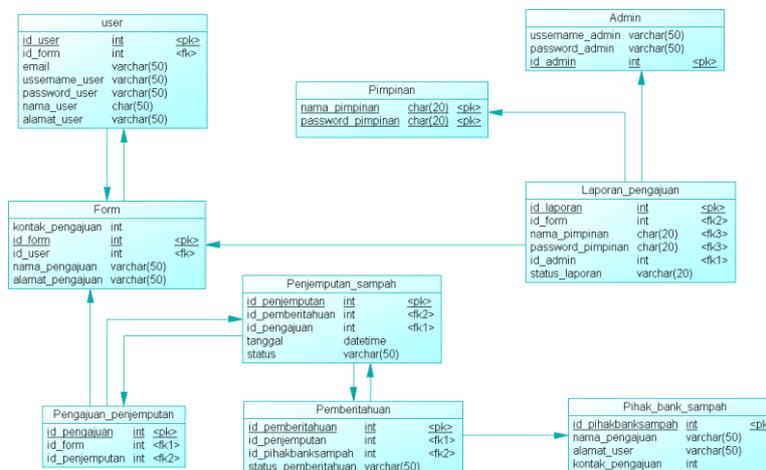
The Physical Data Model (PDM) describes the technical structure of data in a database, including tables, attributes, data types, primary keys, and foreign keys. In the PDM, garbage collection request data is stored in the **penjemputan_sampah**

table, connected to the users, **bank_sampah**, and admin tables, and generates a **laporan_pengajuan** table that is used to view and print reports.

3.4 Construction

The construction phase involves the implementation of the PLASTICARE system based on the previously designed models. In this stage, the system is developed using HTML to define the basic structure of the web pages, CSS to manage layout and visual appearance, and PHP to implement application logic and dynamic functionalities. This phase translates the design into a functional system that can be operated by users. The following section presents screenshots of the main pages implemented in the PLASTICARE system.

Figure 10. Home page

The home page displays a welcome message from the head of the waste bank and the latest environmental articles, complete with a sidebar containing an information menu and Admin and Management Login buttons in the header section.

Figure 11. Page on how to manage plastic waste

The page on how to manage plastic waste contains practical guidelines to raise public awareness on proper plastic waste management and encourage sorting and recycling.

Figure 12. About the PLASTICARE website
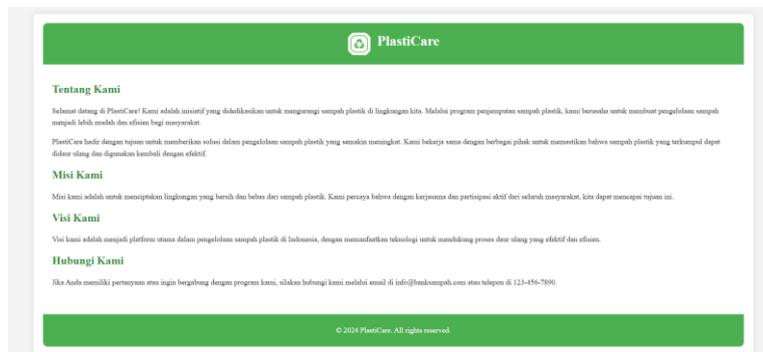
The PLASTICARE website page contains general information about PLASTICARE, its vision and mission, and contact details.

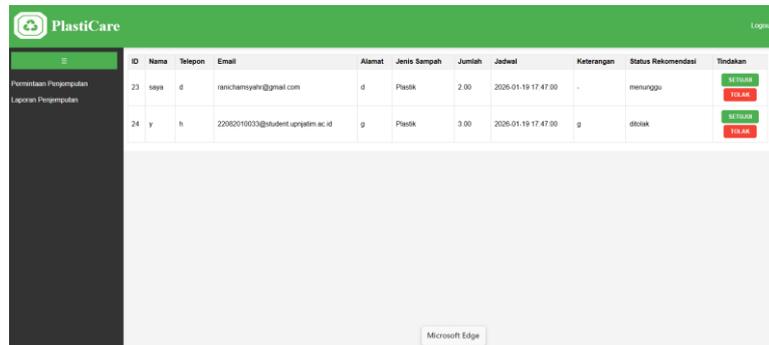**Figure 13. Plastic waste submission page for members**

The member waste submission page is used to request plastic waste collection by filling out a form with personal details and waste information.
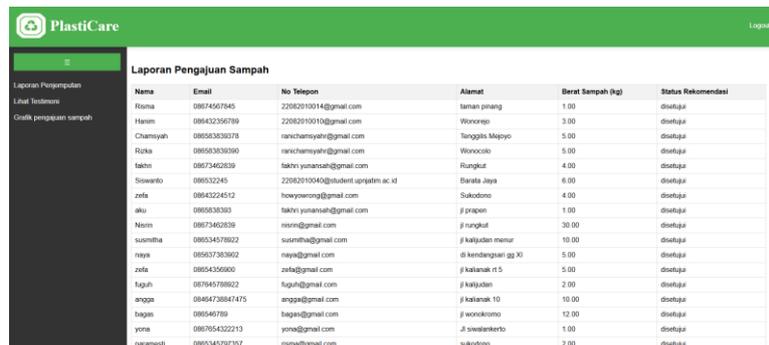
Figure 14. Member testimonials page
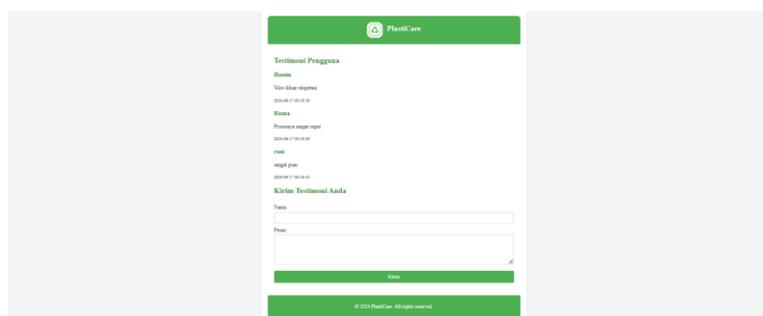
The member testimonial page displays the names and messages of users who have submitted plastic waste.

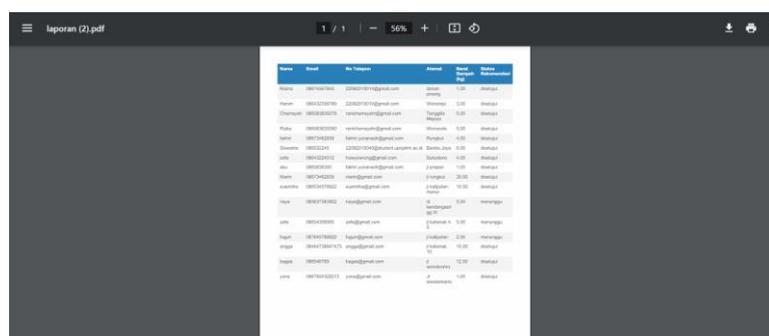**Figure 15. Admin approval confirmation page**

The admin approval confirmation page is used to approve or reject plastic waste collection requests.

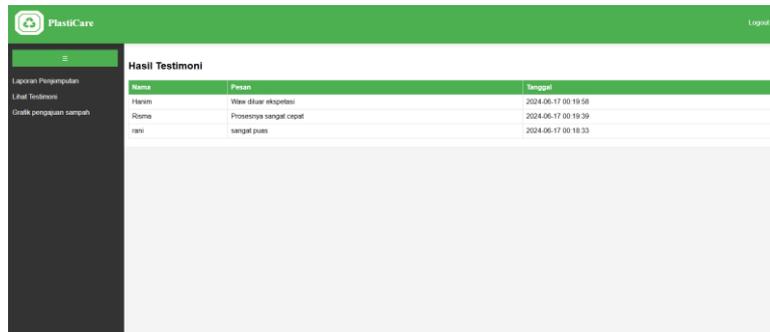**Figure 16. Plastic waste submission approval report page**

The plastic waste submission approval report page displays pickup submission data along with its approval status.

Figure 17. Printed Report Results

The waste collection request report can be printed in PDF format when the user clicks the Print Report button.

Figure 18. Testimonial page

The testimonial report page is used to display and monitor testimonials submitted by users through the website.

Figure 19. Daily waste weight submission chart page

The submission graph can only be accessed by managers to view the weight of plastic waste submissions made by users each day.

4. CONCLUSION

This research resulted in the PLASTICARE information system, which was designed using the Waterfall method to support the management of plastic waste collection at the Wonorejo Waste Bank. This system integrates features for pickup requests, approvals, reporting, and graphical presentations, thereby improving the efficiency and accuracy of data management. Through the ease of online pickup scheduling, PLASTICARE is expected to increase community participation in plastic waste management and recycling and support sustainable environmental conservation efforts.

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