

Information System for Monitoring Waste Tonnage and Fleet Assignment at the Medan City Sanitary and Park Agency

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Abstract. The Medan City Sanitary and Parks Department has the responsibility of carrying out the waste transportation process from the source of waste to the location of the Sanitary Landfill. Every day, the waste transportation vehicle receives a Road Order Letter from the sub-agency located in the sub-district, which contains information on waste transportation information. After the transportation is complete, the letter is submitted to the landfill scale department for tonnage and origin data collection. However, at present, all waste transportation data collection activities are carried out manually, including the provision of assignment letters and data collection of waste tonnage and fleet routes at the landfill. This results in ineffectiveness in the data collection operations. This encourages researchers to design a monitoring and fleet assignment information system at the Medan City Sanitary and Parks Service. Data collection is done by observation and interviews. The system development model in this system uses SDLC (System Development Life Cycle) Waterfall and uses UML (Unified Modeling Language) as a method of describing the flow of the system by applying the Use Case Diagram, Activity Diagram and Sequence Diagram models. The system is designed to run on a website system and is built using the PHP programming language with MySQL as a database. With this system, it is hoped that it can help in facilitating fleet assignments and monitoring the amount of waste entering the Sanitary Landfill .

1. INTRODUCTION

Waste is solid waste left over from human activities that are no longer used, along with the rapid increase in human population, which has an impact on the increase in the amount of waste generated [1]. From the data collected from the website of the National Waste Management Information System of the Ministry of Environment of the Republic of Indonesia in 2022, in Medan City there are around 628,749.22 tons of waste generated. The waste comes from various sources, including 43% from households, 20% from markets, 11% from businesses, 9% from offices, and others. All of this waste is collected and transported by various waste transportation vehicle to the sanitary landfill [2]. Along with the times and the rapid development of the world of technology, especially in the field of information technology today, including in Indonesia, basically aims to make it easier for humans to carry out various things [3]. With information technology, information can be received quickly and help an organization in carrying out its operational activities, with the use of the development of information technology can affect life in any activity [4].

The Medan City Cleanliness and Landscape Service is one part of the local government that, based on Medan Mayor Regulation No. 54/2018, has the responsibility of assisting the mayor in carrying out tasks related to public works in the fields of cleanliness, waste management, and landscaping [5]. One of the authorities of the Cleanliness and Landscaping Service is to take care of the cleanliness of the city environment, especially in terms of the waste transportation process. Waste transportation activities are operational activities that involve the process of transporting waste from the location where the waste source is located and will be transported to the sanitary landfill [6]. With transport vehicles such as Trucks, Typer, Arm roll and other types of vehicles, used in transporting waste to the Terjun sanitary landfill located in the Terjun area, Medan Marelan.

In carrying out waste transportation activities every day the waste collection vehicles will get a Road Order given by the Sub-work of the Cleanliness and Parks Service in the Sub-district which functions as a warrant or road letter to carry out transportation tasks which contains transportation information such as the name of the driver, vehicle information and the location point of the waste collection that will be carried out by the waste collection vehicle, then the letter is given to the sanitary landfill in the scales section to collect data related to the weight of the tonnage of waste being

transported, Currently, in providing road orders, the sub-district sub-worker provides the letter still manually, namely by giving the letter directly to the driver and then the data collection activities of the waste tonnage and the transportation fleet's ritase at the landfill before the waste drop process, with this all operational activities of data collection and assignment of the waste transportation vehicle not taking place effectively and efficiently.

The application of information technology in managing waste volume data and good fleet assignments is one of the applications of e-government which is useful in the governance process to improve efficiency, effectiveness, transparency and accountability in the implementation of organizational operational activities [7]. Based on the problems expressed above, the researcher intends to conduct research with the title "Information System for Monitoring Waste Tonnage and vehicle Assignments at the Medan City Sanitary and Park Service".

This information system becomes a container that connects sub-agency work in the sub-district with the garbage collection vehicle and the management of the Medan Marelan Plunge sanitary landfill into an interconnected system that can monitor all activities so that all parties related to this get all information in a structured and well-organized manner. This information system for monitoring waste tonnage and fleet assignments at the Medan City Sanitary and Park Service is designed as a website-based system and designed to adjust the appearance when accessed on mobile devices, the system will be built using HTML and PHP programming languages and will use the Laravel framework and integrate with the MySQL database.

2. METHOD

Research Method

Researchers applied the Research and Development (R&D) method as a research methodology in this study, which with this method of research produced a certain product and and tested the effectiveness of the product [8]. In this study, researchers used data collection techniques related to the development of this system, among others:

- 1) Observation
Adding information by conducting a direct monitoring process in the research object by studying the existing work cycle and observing the obstacles that often occur in the research object.
- 2) Interview
Conducting question and answer sessions with the object of research to obtain information, in this study the question and answer process was carried out by researchers with the Sub-Working Unit of the Sanitary and Park Service of Medan Helvetia District and the management of the Terjun sanitary landfill area.
- 3) Literature Study
Conducted by observing previous research, by examining the sources of books, journals, theses and others as reference materials that can be related to the problems that researchers examine.

System Development Method

In system development, researchers apply one of the SDLC models, which is a method used in the development of an information system [9]. Development is carried out using a structured model from the beginning to the end of the information system development process, because using a structured model causes SDLC to have very detailed stages so that it will reduce the occurrence of software crises [10]. Researchers use the SDLC Waterfall model where this model is used because the work of a system is carried out in a systematic sequence starting from the initial stage of preparation to system maintenance [11]. Which consists of 5 phases, each phase has a different purpose that describes the software life cycle [12].

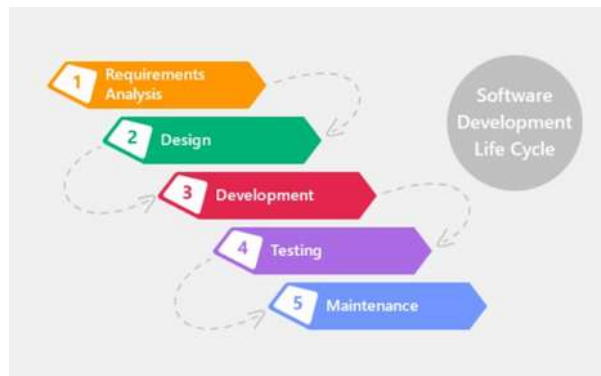


Figure 1. SDLC Waterfall Model

Explanations of the SDLC Waterfall model include:

- 1) Requirement Analysis
The first step is to collect data and information related to the fleet assignment process, the waste tonnage data collection process and the waste transportation fleet route.
- 2) Design
This stage involves designing a system that is tailored to the needs of research objects such as the Office, Sub-district Office and sanitary landfill department. At this stage, design is carried out using the UML method, such as making Use Case Diagrams, Activity Diagrams and Sequence Diagrams.
- 3) Development
At this stage, the system design that has been planned previously will be converted into program code. Researchers will use HTML, PHP and Laravel Framework. In addition, the system will be integrated with MySQL database.
- 4) Testing
At this stage, the verification process is carried out by testing the effectiveness of the system and ensuring that each function on the system runs well and runs properly according to the system design. Researchers use the black-box testing method to test the effectiveness of system functions.
- 5) Maintenance
This stage is the stage where the process of repairing system errors that are not found in the stage before maintenance is carried out.

3. RESULTS AND DISCUSSION

Needs Analysis Stage

This stage is the initial stage that will be carried out in the system design process [13], used in order to find out the needs of everything from the system to be built and must be adjusted to the needs of the system.

System Design State

This stage is the stage where development is allocated to designing the proposed system requirements including hardware and software requirements used in forming an overview of the entire system. The design in designing the proposed system is to use UML diagrams, which are visual modeling tools used to design object-oriented software [14]. therefore UML is the basis for building information systems [15]. System depiction using UML models Use Case Diagram, Activity Diagram and Sequence Diagram.

1) Use Case Diagram

Use Case Diagram is a description in the form of a diagram that models the interaction between actors and the system, this diagram describes system activities in order where admins, drivers, landfill scales officers and leaders function as actors and carry out tasks based on the actor's access rights.



Figure 5: User Login Page

2) Dashboard Page

This page is the first page directed by the system after the user has successfully logged in according to the access rights entered, if the user uses admin access rights, the page will contain a dashboard that contains various menus that can be accessed by admin users such as the driver data management menu, transportation fleet, transportation routes and road orders. different from the access rights of drivers and sanitary landfill officers. The driver dashboard contains transportation information and transportation history while the sanitary landfill officer can access the transportation status dashboard which contains an input form for the process of collecting data on the volume of waste from the waste transportation fleet.



Figure 6. Admin Dashboard Page

3) Add Driver Page

This page is one of the menus from the admin dashboard which functions to add new data information about drivers to the system.

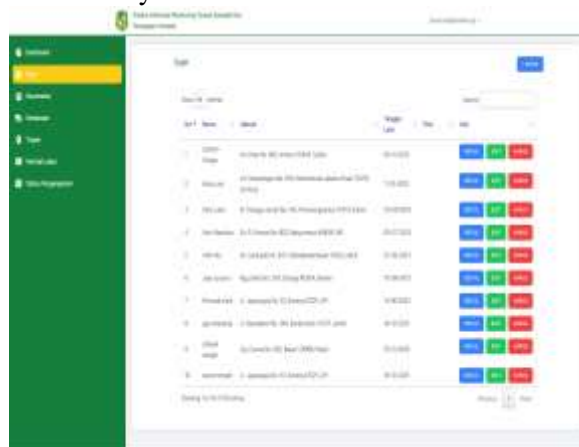


Figure 7: Add Driver Page

4) Add Transportation Fleet Page

This page aims to add new data information about the waste transportation fleet to the system. Such as vehicle type, license plate, year of production and others.

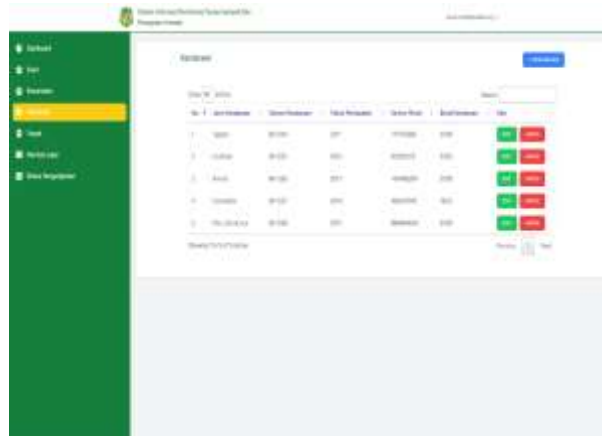


Figure 8: Add transportation fleet page

5) Add Transportation Route Page

This page is a page where admin users can add new information regarding the route or point of waste transportation that will be carried out by the transportation fleet.

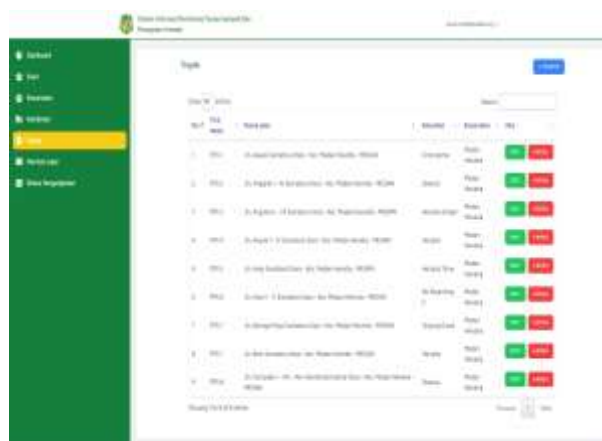


Figure 9: Add transportation route page

6) Fleet Assignment Page

This page is a page where admin users from sub-agency work in the sub-district make new assignments to drivers in the form of Road Orders where letters are made based on input information in previous menus such as the manage driver menu, fleet and transportation routes stored in the database.

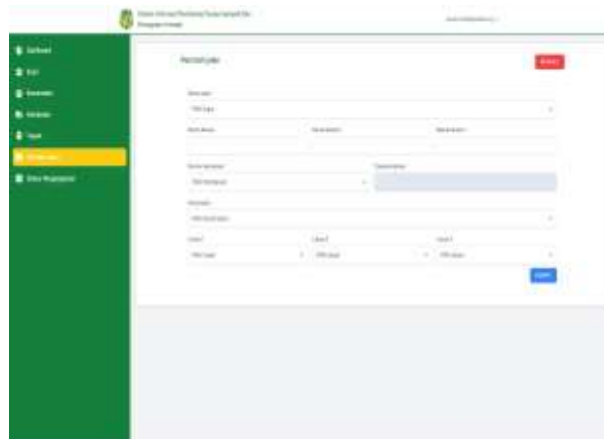


Figure 10: Add Fleet Assignment Page

7) **Print Assignment**

From the menu on the road order dashboard, a successfully created Road Order will produce a document that can be saved and printed.



Figure 11. Print Assignment Page

8) **Driver Assignment Page**

The driver gets information about the assignment against him, the new assignment information appears on the initial dashboard after the driver has successfully logged in, this page contains an information box containing assignment information and there is a Road Order that can be displayed.



Figure 12. Driver Transportation Status Page

9) Driver Assignment Notification

The driver will get a notification regarding his/her waste collection assignment.



Figure 13. Driver's New Task Notification

10) Transportation Status Page

This page is a page where the admin can display the status of each transportation fleet assignment, the admin can monitor the work in progress or completed.

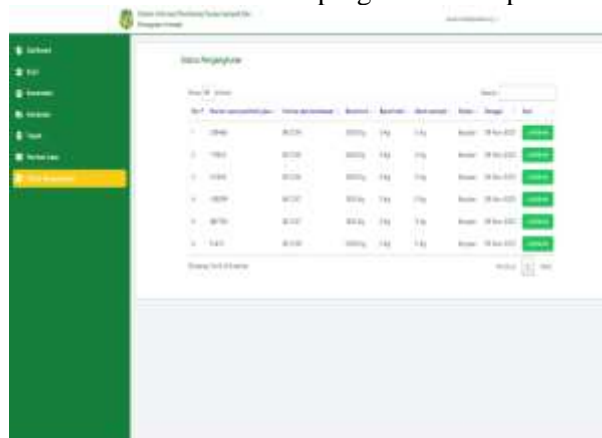


Figure 14. Transportation Status Page

11) Tonnage Input Page

On this page, the user of the landfill scale officer will input the amount of waste tonnage generated by the transportation fleet, the waste tonnage input process is based on assignment information derived from road orders made by the sub-agency admin user in the sub-district in Figure 10.

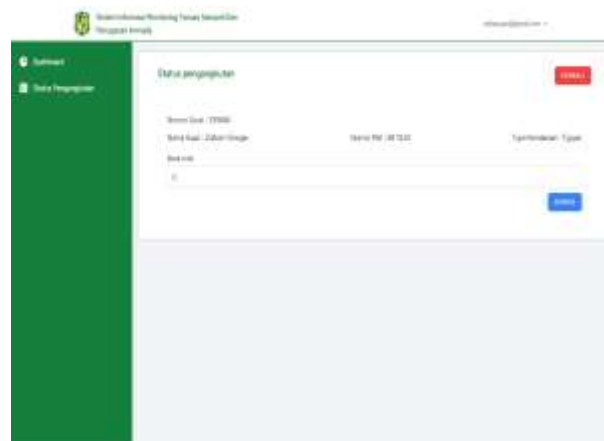


Figure 15. Waste Tonnage Input Page

12) Monitoring Result Page

This page is the page where the system shows the monitoring results of the waste transportation process and the ritase monitoring of the transportation fleet.

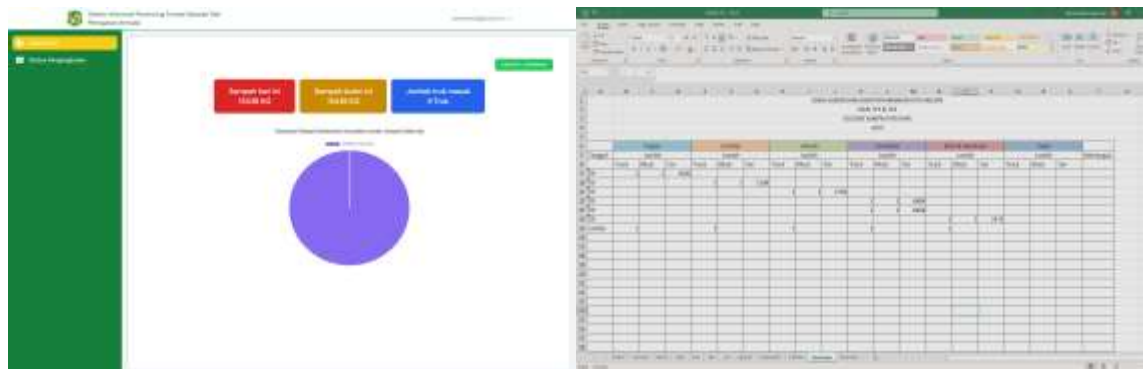


Figure 16. Monitoring Results Page

On the monitoring results page there is an export report button that has a function to convert reports from data into a *spreadsheet* format table

System Testing

The verification process of the system aims to ensure the effectiveness of each function that runs, showing that the system runs well as its function in accordance with the design in the previous stage. Researchers use black-box testing as a method used to test the system without paying attention to the details in the system [18].

Table 1. Black-Box Testing Results

No	Scenario	Testing Result	Validation
1	User log in with correct email and password	User successfully logs in and enters the dashboard menu	Success
2	User logs in with wrong email and password	The user receives a notification of incorrect data entered and is redirected back to the login menu.	Success
3	Admin fills in the form to add driver, Fleet, Route	Driver, fleet and route data saved successfully	Success
4	Admin adds Road Order	Admin successfully creates assignment based on driver fleet and route form inputs.	Success
5	Driver receives assignment	Driver receives the assignment and gets a new task notification	Success
6	Landfill officers input waste tonnage	Waste tonnage input is successfully saved to the database system	Success

4. CONCLUSION

Based on the results of the research, it can be concluded that the existence of this information system makes it easier for the sub-agency in the sub-district to manage information on the assignment of the garbage collection fleet, both information about drivers, transportation routes, garbage collection fleets and road orders. Make it easy for drivers to receive information on Road Warrant, Make it easy for the manager of the sanitary landfill to input waste tonnage and make it easier for the leadership of the relevant agencies to monitor the implementation of waste transportation and monitor the tonnage of waste and the ritase of the waste transportation fleet entering the sanitary landfill area.

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