Design a Waste Complaint Information System (Case Study in Babakan Ciparay District, Bandung City)

Mochamad Rizky Septian [1*], Idi Sumardi[2], Ina Siti Nurhasanah[3]

[1] Information System, Al-Ghifari University, Bandung, Indonesia.

[2] Informatic Engineering, Al-Ghifari University, Bandung, Indonesia.

*Email:

[1]214260009.mhs@stmikjabar.ac.id, [2]idis@unfari.ac.id, [3]ina@unfari.ac.id

Abstract. The background of this research is the increasing amount of waste in Bandung City. Littering is a serious problem that contributes to flooding, health problems, and pollution. This research aims to develop a waste complaint information system to address these negative impacts. This information system is based on the Waterfall model and the Unified Modeling Language (UML) method. This application was developed using the Python programming language and the MongoDB database. It is aims to facilitate the public's reporting of waste disposal locations to the authorities.

Keywords: Waste, Information Systems, UML.

Introduction

Waste accumulation is a challenge for most Indonesian cities, including Bandung. This problem not only spoils the view but also impacts public health and the environment (Gupta et al., 2023). Waste-related issues are continuously monitored as waste continues to accumulate due to increasingly sedentary lifestyles, and the public is continually urged not to litter but to dispose of waste properly. In January 2024, the amount of waste handled in Bandung City reached 29,105.02 tons. The amount of waste managed then experienced a significant increase in February, March, April, and May. The largest spike in the amount of waste handled in Bandung City occurred in March 2024, reaching 33,486.6 tons. The Bandung City Environmental Agency (DLH) noted an increase in waste volume during Ramadan. Salman Faruq, Head of Waste and Hazardous and Toxic Waste Management (PPL B3), stated that there was an increase of 68 tons of waste per day, with the majority being food waste. "According to the data, there has been a 7% increase in waste. Before Ramadan, Bandung City's average waste was 1,033 tons per day. As of today, it has reached 1,101 tons per day. This represents an increase of 68 tons per day," (Salman, 2024).

In Babakan Ciparay District, Bandung City has 6 sub-districts, namely Sukahaji, North Margahayu, Babakan, Babakan Ciparay, Margasuka, and Cirangrang, which have a total population of 136,963 people and have 2 TPS (Waste Disposal Sites), namely TPS Kopo and TPS Porib, which are located in North Margahayu and Cirangrang sub-districts. This occurs especially in Babakan Ciparay District, Bandung City, there are many appeals not to throw garbage in the gutter and throw garbage carelessly. However, in fact, people still throw garbage in the gutter and throw garbage carelessly not in the place. This reflects a lack of public awareness of the importance of cleanliness. So the most important thing to overcome this problem is to foster a sense of concern in the community. If the community remains indifferent to this problem, then the pile of garbage could increase. The impacts of this problem that commonly occur are flooding, impaired health, pollution and others (Kim et al., 2014).

Based on the existing problems, the solution provided is mapping the location of trash bins, making it easier for users (the public) to see where the trash bins are located. And adjustments from users (the public), where users (the public) can fill in the name, address, message and upload photos of trash (Padini et al., 2021). The author is interested in building an information system for trash bin locations in Bandung City, especially in Babakan Ciparay District, by conducting a study entitled "Design a Waste Complaint Information System."

This study aims to analyze the existing waste management system in Babakan Ciparay District and identify the necessary information system requirements. Furthermore, a website-based waste complaint information

system was designed and developed using the Waterfall methodology and Unified Modeling Language (UML) modeling (Kumar et al., 2014; Bhashitha et al., 2024). The effectiveness of the developed system was evaluated through functional testing using the Black Box Testing method (Zhang & Xia, 2014) and recommendations for further development of the waste management information system that can be adapted to other regions.

This research is expected to significantly benefit the community by providing an easily accessible platform for reporting waste problems and monitoring the status of their complaints (Aazam et al., 2016). For local governments, this research provides an efficient system for receiving, processing, and following up on public complaints related to waste. Academic contributions in the form of developing knowledge in the field of information systems, particularly in the application of technology to solve environmental problems and public services, are also an added value of this research.

Methods

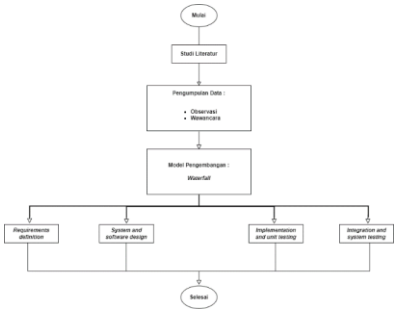


Figure 1. Research Flow

Literature study is a scientific compilation technique obtained from books, the internet and previous research that discusses the waste complaint information system. To obtain complete and accurate data, cooperation with related parties is needed. The steps taken for data collection are (1) Observation, review and research at the TPS locations in Babakan Ciparay sub-district to collect the required data or information; (2) Interviews, conducting questions and answers with sub-district employees regarding waste at the Babakan Ciparay sub-district office as well as the number of sub-districts and the number of residents in Babakan Ciparay sub-district. The system development model that we use is Waterfall, which is a systematic and sequential software development approach.

Result and Discussion

This system aims to facilitate the public in reporting waste-related issues quickly and efficiently to the district authorities. The system incorporates several key features including user authentication login, complaint submission forms, waste collection point (TPS) location mapping, and complaint status tracking functionality, enabling citizens to easily monitor the progress of their submitted complaints.

a. Use Case Diagram

The following presents the Use Case Diagram of the Waste Complaint Information System designed for Babakan Ciparay District

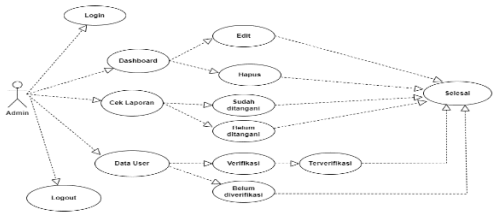


Figure 2. Use Case Admin

In Figure 2, the admin can access the system by logging in, then entering the Dashboard menu where the admin can edit or delete complaints. Then, in the Check Report menu, the admin ensures to verify whether the complaint has been handled or not. Then, in the User Data menu, the admin can see the name, email, and ID card of the user who created the new account. The admin will verify according to the area in Babakan

Ciparay District. If the area is not in Babakan Ciparay District, it will not be verified. When everything is complete, the admin can log out of the system.

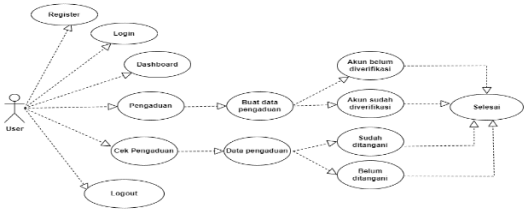


Figure 3. Use Case User

In Figure 3, in the Register menu, users must fill in and create a new account containing their name, email, password, and ID card to be able to log in. Once they have created a new account, they can log in and then be taken to the Dashboard menu. Users can make complaints in the Complaints menu. Fill in the form completely and clearly, but if the user account has not been verified, they cannot make a complaint. After completing the form, the user will be taken to the Check Complaints menu, where the user can see whether their complaint has been handled or not. Once everything is complete, the user can log out of the system.

Activity Diagram Pengaduan User

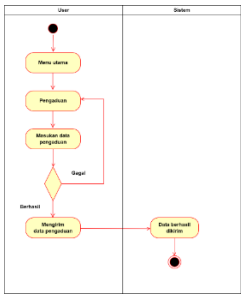


Figure 4. User Complaint Activity Diagram

In Figure 4, the user enters the complete complaint details. If the complaint details are incomplete, the user is returned to the complaint menu. However, if the complaint details are complete, the system processes them and sends them to the admin.

User Complaint Sequence Diagram

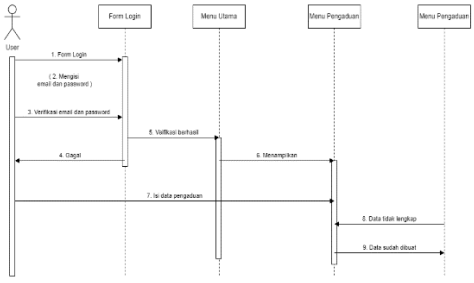
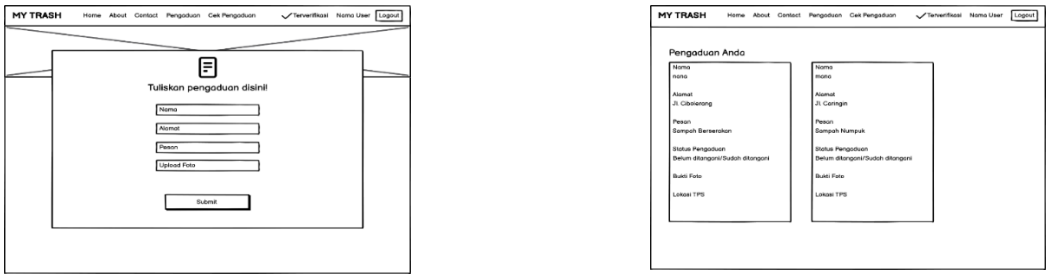


Figure 5. User Complaint Sequence Diagram

In Figure 5, the user enters the complete complaint details. If the complaint details are incomplete, they will be returned to the complaint menu. However, if the complaint details are complete, the system will process them and create the data.

Interface

Interface design is the process used to create the appearance of software, focusing on appearance and style. The following is the interface design for a waste complaint information system:

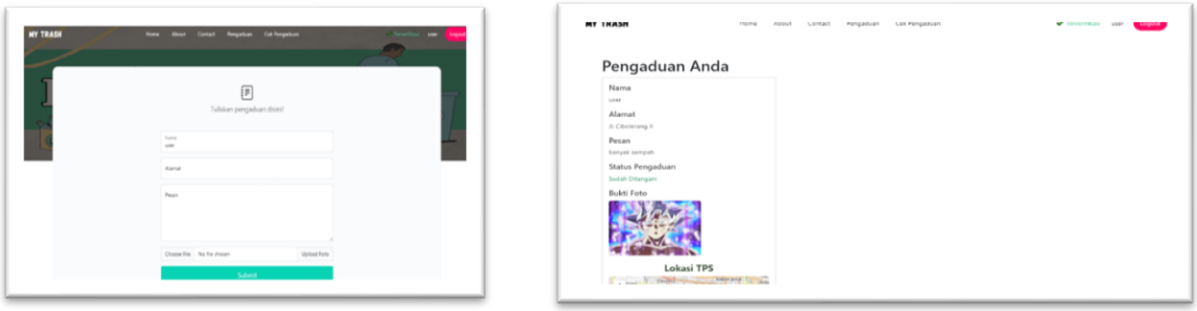


(a) (b)

Figure 6. Interface User Complaint and Check

Program Development

This program development stage is the stage where the software designed in the system design stage is created. At this stage, the system is ready for use.



(a) (b)

Figure 7. User Complaints Page

In Figure 10, in this menu, users can submit complaints about waste. Fill in the provided information completely and clearly, then click Submit. In this menu, users can check their complaints and see their status, whether they have been handled or not.

System Testing

This system is tested using the Black Box Testing system as follows:

Table 1. User Complaint and Check

No.	Testing	Expected results	The results obtained	Conclusion
1	Filling in incomplete data.	Stay on the complaint menu and a message will appear stating that *the form* must be filled in.	Stay on the complaint menu and a message will appear stating that *the form* must be filled in.	In accordance
2	Fill in the complete data.	Go to the complaint check menu.	Go to the complaint check menu.	In accordance
3	Check *User Complaints*	Complaint data, verification status and TPS locations appear on *the map* .	Complaint data, verification status and TPS locations appear on *the map* .	In accordance

From the results of the system testing above, it can be concluded that this system testing is in accordance with the expected results, where all the tables above have appropriate conclusions, so it can be stated that the percentage of 100% success for this system testing.

Conclusion

Based on the test results and discussions obtained during the research, it can be concluded that the design of this website-based waste complaint system is an appropriate solution for waste management in Babakan Ciparay District. This information system can facilitate and assist users in minimizing waste. This waste complaint system can provide information quickly and efficiently, and can also identify waste collection points (TPS) to prevent users from littering. However, it is recognized that the information system developed still has several shortcomings. Therefore, further development is recommended:

This waste complaint information system is also expected to utilize an IoT system for greater automation, with sensors connecting incoming waste to a database.

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