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ANDROID-BASED GARBAGE MANAGEMENT APPLICATION USING K-MEANS ALGORITHM ON RT 03/02 KEL. KARAWACI BARU

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Abstract

Technological advances have brought significant changes in human life, one of which is the facilitation of access to information. Despite this, garbage management remains an important issue that requires serious attention. Without practical management efforts, the negative environmental impact will continue to increase. Therefore, the study aims to develop an Android-based waste management application using the Waterfall methodology approach and the K-means algorithm method to allow users to group the type of garbage according to its characteristics so that the waste management process can be done more systematically and efficiently. From the application design and testing results, it was concluded that this waste management application can serve as an effective tool in helping people manage their garbage more efficiently. With this digital platform, it is expected that public awareness of the importance of garbage management can be increased and contribute to the maintenance of hygiene and the health of the environment. Thus, the Android-based waste management application has great potential to be a relevant solution in dealing with the problem of waste management. With this digital approach, it is expected that people can be more effective in regulating and utilizing garbage and actively participate in efforts to maintain environmental sustainability for generations to come.

Keywords: *Garbage, Management, Society, Technology.*

1. INTRODUCTION

The evolution of the population, the change in consumption patterns, and the lifestyle of the people have increased the number of moons of garbage, the types, and the diversity of the trash[1]. The waste reduction activities in households as waste generators and at the municipal level are still around 5%, so the waste is thrown to the Final Processing Point (TPA) while the land of the TPA is minimal [2]. The United Nations Environment Programme – UNEP (2021) estimates that eight to ten percent of global greenhouse gas emissions are caused by unconsumed food [3]; by 2021, Indonesia is estimated to have 68.5 million tons of garbage. According to the information presented in the National Waste Management Information System (2020), the most significant composition of waste by type is food waste (about 40 percent) [4], whereas based on the source is dominated by households, it can potentially cause existing problems, ranging from health problems, problems in natural disasters such as floods, to disrupting the sustainable functioning of the environment, both settlements, forests, plains, rivers, and oceans. The increase in national garbage shows the importance of community management efforts in the community and small steps that people can take to help the government address the national household garbage problem.

This research will produce a program that is aimed at regulating digital waste management in the RT 03 community environment that is still using a manual waste management system; this Android-based waste management app is designed to meet needs such as being able to carry out non-cash waste payment transactions, view garbage pickup schedules, make special appointments for garbages pickup, review the performance of garment officers and report illegal garbage months to local sanitation services. The results of this research are expected to improve the waste management system in the neighborhood, raise public awareness of the waste they produce, and, most importantly, create a clean and healthy community environment on 03/02 RT.

2. RESEARCH METHOD

The type of research used in this study is qualitative, which is flexible, characteristically unstructured/non-numeric, emphasizes the critical role of subjects, explores a limited number of cases, and analyzes them verbally, not statistically. Qualitative research is also a form of social research whose research design is influenced by the data obtained [5].

2.1. Method of Collecting Data

2.1.1. Literature Review

Researchers use literature studies to understand theoretical foundations, gain a deeper understanding of previous research, and analyze previous findings published by studying various journals and searching for references from various Internet sources.

2.2. Field study

Field study is a data collection technique by conducting research and direct review of the problems taken[6]. In this research, field studies are conducted directly within the community, which includes:

2.2.1. Oberservation

Observation is a method of collecting data carried out directly in the field by determining what is needed and recording everything related to research.

2.2.2. Interviews

The interviews were conducted to obtain very accurate data because they came directly from the research owners.

2.3. System Design Methods

The method used for the development of waste management applications is the Waterfall method. According to Aceng (2020), the waterfall method is one of the SDLC models often used for information or software development [7]. This development model takes a systematic and sequential approach; this method is linear because, from the beginning of the development phase, which is a planning phase, to the final phase of the system development, it is a maintenance phase. The next phase will not be performed unless the previous phase has been completed and can not be returned or repeated at the previous stage. The waterfall model has several steps, namely the following [8]:

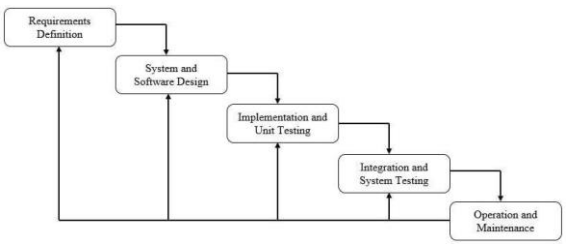

Figure 1. Waterfall Method Stage

1. Requirements Definition

The process of defining needs is carried out to determine the software needs so that users can understand the functionality of the software that the user needs. In this phase, data collection is carried out through observations and interviews conducted on RT 03/02.

2. System and Software Design

This phase changes the software needs from the previous design representation to be implemented as software later.

3. Implementation and Unit Testing

Design at the previous stage translated into software. Then, the result of this phase is a computer program based on the design made during the design phase.

4. System Integration and Testing (Integration and System Testing)

The primary function of the software is to run logically and functionally. It must be able to verify that all parts are tested. This is done to minimize errors and ensure that the resulting output meets the user's needs. This phase is submitted using blackbox testing.

5. Operation and Maintenance

At this stage, previously implemented and tested software is delivered to the user andined.

2.4. K-Means Algorithm

The k-means algorithm is one of the techniques in the category of centroid clustering models [9]. A centroid is the center or center of a cluster. A data is considered part of a cluster if it has the closest distance to the cluster's centroid. The stages in the k-means clustering algorithm can be seen in the illustration

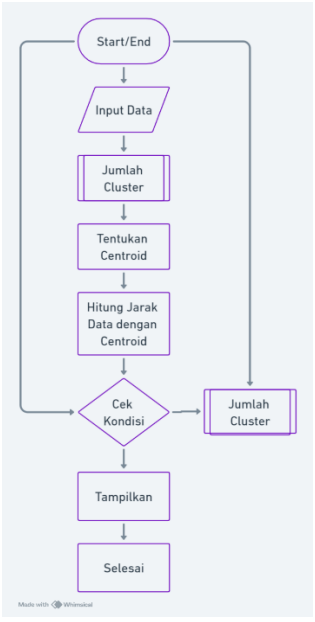

Figure 2. Flowchart of the k-means clustering algorithm

The steps in the k-means clustering algorithm are as follows:

1. Set the input data (n).
2. Set the number of clusters (k). The cluster number must be smaller than the amount of the data (k < n).

3. Identify the centroid for each cluster. Various methods, such as random selection from the source data, can be used to set up the initial centroid.
4. Calculate the distance between each data with a centroid.
5. Conduct a condition check; if the result of the distance calculation differs from the original data, then perform a calculation back with the same amount of cluster but using a new centroid from the data that has been calculated. If the result is equal to the initial data, display the calculations

In the context of a waste management application using the K-Means algorithm on RT 03/02 Kel. Karawaci Baru, such measures can be applied to group the waste data into several clusters based on their similarities. This can help identify patterns of garbage behavior in the region and plan more effective waste management strategies[10].

3. RESULTS

3.1. Requirements Data Analysis

3.1.1. User Application Implementation

Known in Figure 3-6, our latest user application development introduces innovative features designed to enhance the user experience. One of the main features is an intuitive and responsive homepage, which provides quick access to the application's key features. Updated authentication and profiling to enhance user safety and convenience

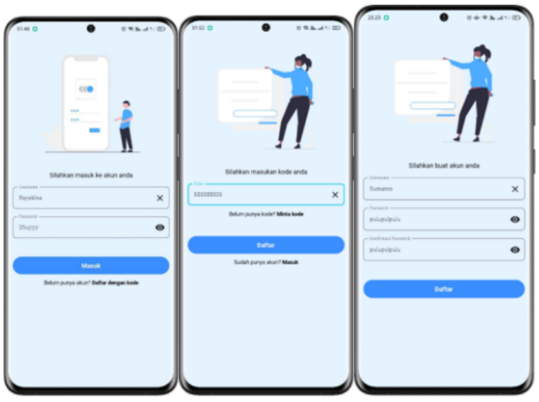

Figure 3. User Authentication

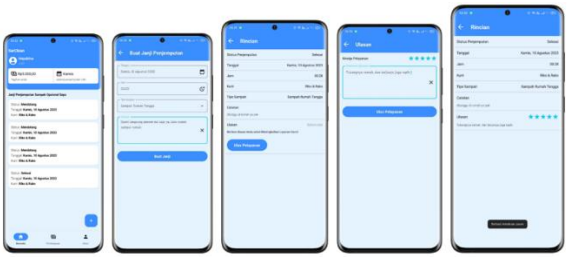

Figure 4. Home Screen

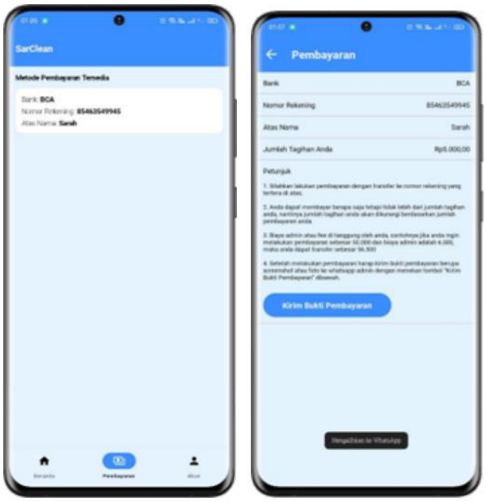

Figure 5. User Payments

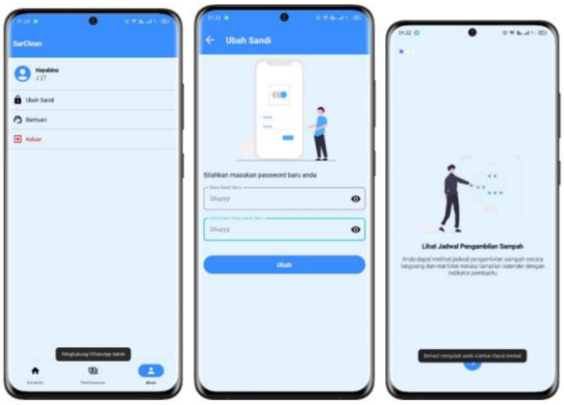

Figure 6. Profile User

With this new set of features, we aim to provide a more smooth, integrated, and rewarding user experience, strengthening the relationship between users and our applications.

3.2. Flowchart

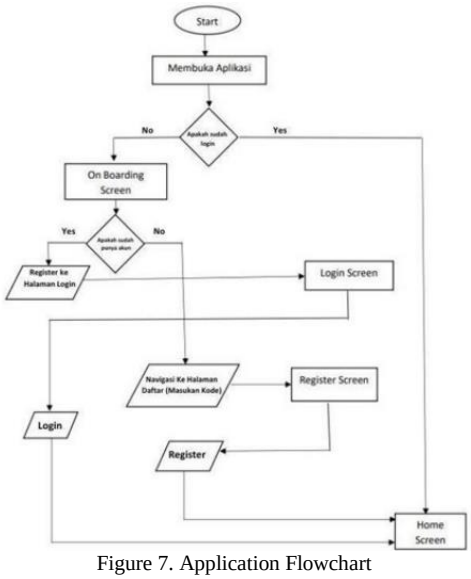

Figure 7. Application Flowchart

Based on the application created, it needs a Flowchart that aims to describe a workflow as well as

the process of a program. The process begins by opening the application, after which the system shows the state “Is it already logged in?” which shows two possibilities: if yes, then the system invites the user to enter the home screen (first page) then on the codification NO user will be met with onboarding screen. The one where the onboarding screen also has a decision “Do you already have an account?” and if YA, the system will invite the user to the login page to proceed to the home screen then if NO, the system will guide the user to the registry page the systems would invite users to enter to the home screens. So, after performing authentication with some conditions, the user would be sent and invited to go to the original page. (home screen)..

3.3. Unified Modeling Language

3.3.1. Usecase

Based on the application created, it needs a Usecase, to know what functions are in a system and who is entitled to use those functions.

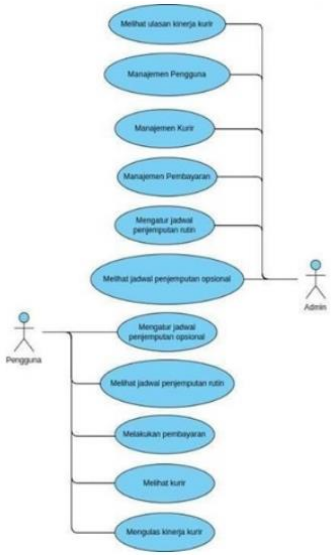

Figure 8. Usecase

3.3.2. Activity Diagram

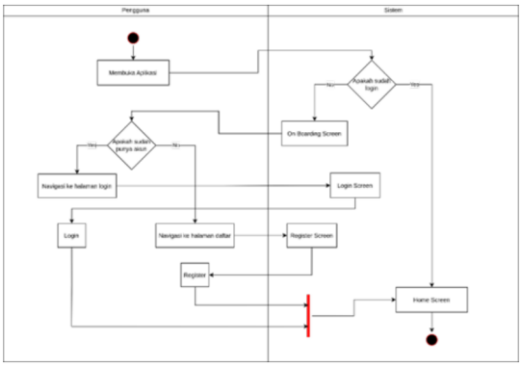

Figure 9. Activity Diagram

On the user authentication activity diagram, the first thing the user does is open the application; if the user is already logged in, then the system immediately displays the home page; when the user has not logged on, then the system will direct to the page onboarding screen first, then the user will be given the option if they already have an account then users are directed to the login page. Users will be directed to the register page if they have no account. The user authentication Activity Diagram can be seen in the image below.

3.3.3. Class Diagram

Based on the application he created, he needed a Class Diagram to show a system's structure clearly. It also improves understanding of a program's general overview or scheme. Figure 4.4 shows that the application has a class, namely admin entity with action create and delete user, CRUD payment method (creates, edits, deletes the payment method), changes the desired courier (edit courier), and also edits the routine garbage collection schedule. Then, on user entities with the authentication action (login, register, and logout) and changing the password, payment entities by action CRUD, option pickup entity by action make the garbage collection and the review on the Review entity. All of these entities are interconnected to form a class diagram.

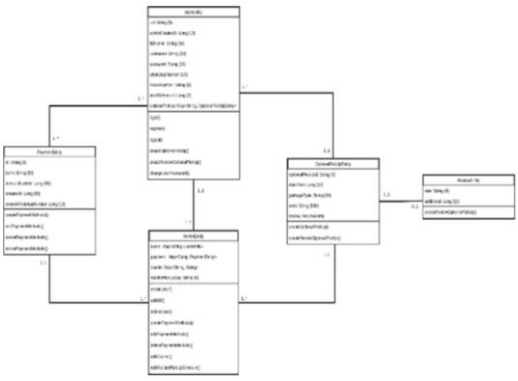

Figure 10. Class Diagram

3.4. Interface Design

At this stage the author designs the User Interface design.

3.4.1. Login Screen

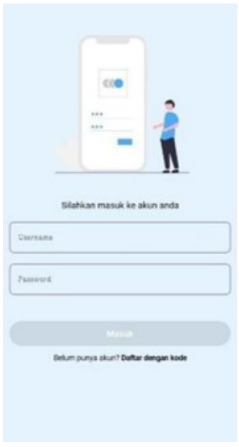

Figure 11. Login Screen Design

Design a user interface where users can authenticate or log into the application using the user account they have registered.

3.4.2. Registrarion Code Screen

User interface design where users can register by entering the code first.

Figure 12. Registration Code Screen Design

3.4.3. Register Screen

User interface design where, after entering the code, the user can proceed with the registration process by creating a username and password.

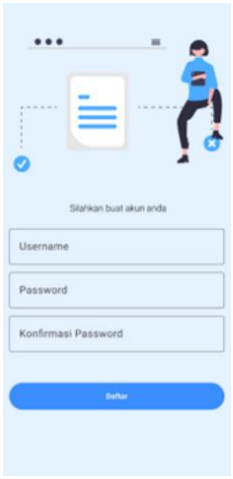

Figure 13. User Registration Screen

3.4.4. Home Screen

Designing a user interface where users can create optional garbage pickup schedules, make payments, view a profile homepage, see optional trash pickup details, look at fee bills, and give ratings and reviews.

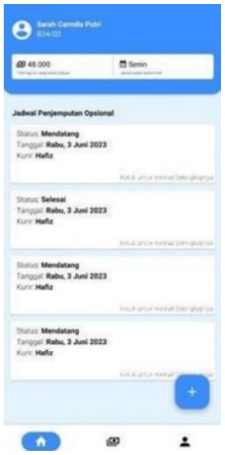

Figure 14 Home Screen

3.4.5. Garbage Pickup Schedule Screen

Designing a user interface where users can make optional pickup promises.

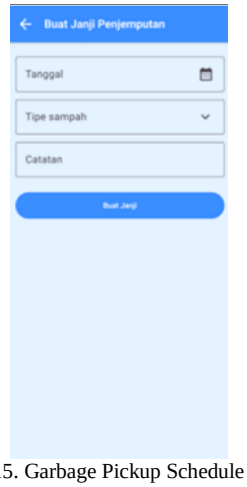

Figure 15. Garbage Pickup Schedule Screen

3.4.6. Detail Garbage Pickup Schedule Screen

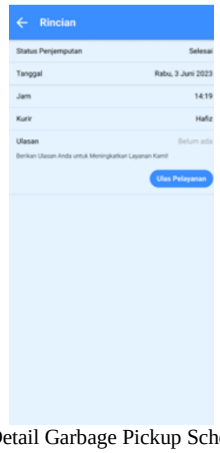

Figure 16. Detail Garbage Pickup Schedule Screen

User interface design where users can see details of upcoming optional garbage pickup appointments

3.4.7. Rating Screen

User interface where users can give ratings and reviews on the performance of garbage officers.

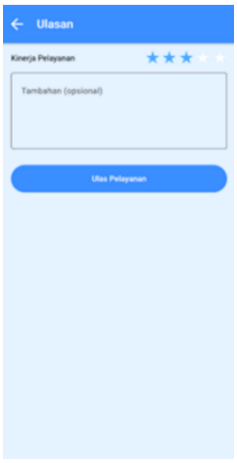

Figure 17. Rating Screen

3.4.8. Payment Detail Screen

User interface design where users can see the trash payment methods already specified by the admin.

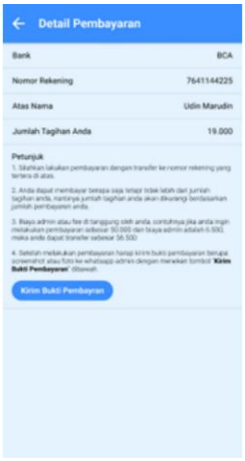

Figure 18. Payment Detail Screen

3.4.9. Payment Method Screen

User interface design where users can view payment details as well as send proof of payment directly to the admin.

Figure 19. Payment Method Screen

3.4.10. User Profile Screen

User interface design where users can change their passwords, search for help information and log out of their own accounts.

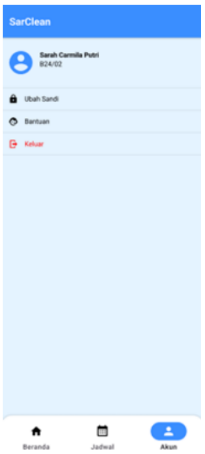

Figure 20. User Profile Screen

3.4.11. Password Change Screen

User interface design where users can perform password replacement activities by entering a new password.

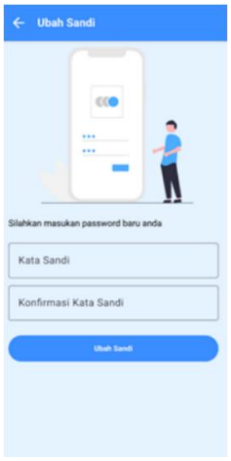

Figure 21. Password Change Screen

3.5. Testing

	fikasi	Input	Output	
	n	ın kode	ılid	
	r	ıta	register	
		ın tombol *register*		
	n *Login*	ın akun yang telah kan sebelumnya	l masuk	
		ın tombol *login*		
	n Utama	ın tagihan	n metode pembayaran	
		ın jadwal penjemputan rutin	anggal penjemputan	
		Menekan list jadwal opsional	Halaman rincianjadwal opsional	*Valid*
		Menekan tombol "+"	Halaman buat janji penjemputan opsional	
4.	*Halaman Pembayaran*	Menekan list metodepembayaran	Halaman detail pembayaran	
		Menekan tombol kirimbukti pembayaran	Halaman *WatsApp*	*Valid*

Figure 22. Blackbox Test Results

After the application is completed, the next step is to carry out the test phase. The first test is an alpha test with the Black box method, which focuses on the functionality aspect so that the application can be specified for use by the user.

4. DISCUSSION

Arya Yoga et all conducted the study in 2021, which is the subject Android-based Garbage Transportation Services (SANGKUTS) in the Kabupaten Kudus. This research is related to garbage transportation services treated as goods worth selling; this system is an attempt to utilize the waste into goods that can be sold back and use technology to facilitate the transportation system. The concern for the surrounding community is that it has no interest in saving the garbage because there are limited facilities to pick up the trash rather than waiting for the arrival of the pickers and pickers selected for the creative industries without self-processing. So, we built a garbage collection system with an Android-based application[11].

Akhmad Faisal and Ade Oktarino conducted the study in 2021, which is the subject of Clean Jambiku Application with Modeling Using UML. This journal explains that problems occurring in the field include the timetable of garbage transportation, supervision of officers on the field, and transparency in the delivery of information. The research was conducted to model a community application to obtain information about the location of the garbage disposal site[12].

Research conducted by Tesar Firstyaji Pramudya in 2023 entitled "Development of Garbage Transportation Applications Using Prototyping Methods." This research refers to the problem of garbage that exists in Yogyakarta, which is still not fully realized because there are still many communities that are not aware of the long-term impact of waste disposal in the wild and left to accumulate followed by an increasing population and increasingly varied waste caused by the community, thereby causing negative impacts such as new environmental damage, waste pollution, and obstructing groundwater processes. The result of the research was the development of a system of transportation of garbage in the area of Yogyakarta in the form of an Android-based application that can be accessed with smartphone devices as an alternative solution to reduce the accumulation of waste in the community, as a means of optimizing the transport of waste by utilizing the mode of transport owned by the waste disposer and optimizing environmental hygiene efforts[13].

According to a study by Abdul Aziz and Soni Fajar in 2018 entitled Design of Functional Application Management Administration and Business Management of Garbage Bank in Indonesia. This research explains that the administration of the garbage bank has different formats of recording methods and different methods of disposal of garbage, as well as the non-existence of a standard reference price for the purchase of trash to the customer of the waste bank. From the customer side, all access to information about savings transactions and balances can be limited to the physical savings book or visit the trash bank to get the latest information about the administration and management of garbage. Other obstacles are also felt by garbage banks and customers who use scheduled garbage pickup methods. The problem is that changeable pickup schedule information cannot be accessed by customers quickly, and the scheduling process is not flexible about the readiness of customers to be picked up. Moreover, some other problems have caused the productivity of the garbage bank business to be less than maximum. Then, from that guy and information from the garbage bank quickly and in real-time. To develop an application system that can help the business needs of the trash bank both from the side of the administration of the garbage bank, methods of collection with the system of scheduling and access of information by the customer, then a general plan is needed features of the management of the application of administration and business of the waste bank by looking at the problems and conditions of the bank in Indonesia. The design features of the application to be studied are based on the results of observations and field studies on several garbage banks. This research will produce a general design of application features such as design functionality features and display user interface applications as a basis for developing the system of the waste bank's application management administration and business[14].

The research conducted by Santi Cahyati and Yudi Ramadhani in 2021 is entitled Android Smart Dumping Monitoring App based on the Internet of Things. This study explains that the garbage that exists around today is still in mixed condition and has not been automatically picked up, so it becomes a problem when it is recycled. To be more efficient, waste management is carried out by creating brilliant garbage sites, one of the alternatives for accumulating waste. With such problems, there is a need for an intelligent waste site design; this bright waste place aims to detect and sort metal and non-metallic types of waste so that the waste can be recycled more easily. In addition, this waste site can detect if the waste site is complete and can notify the sanitary officer where the waste is placed using the Android User Interface[15].

A study by Mardhiah Fadhli and Risma Amelia Putri in 2022 entitled Planning of Building a Map-based Application for Complaining of Illegal Dumping Places. This study explains that the large amounts of garbage disposed of in illegal places and still the lack of means and supplies owned by the Government in the management of waste causes the problem of dumping to be dealt with and well

managed by the Government, the occurrence of illegal dumping due to factors such as land type, road type, and population density. The waste disposal process often involves soil and groundwater pollution because garbage is improperly managed. Based on the conditions, then it is necessary to build a compliant application on the location of illegal disposal based on Map; through this application calculate the coordinates of the point of location of legal disposal, the DLHK administrator can see the complaints data and change the status of the report to immediately be picked up based on the point location of complaining[16].

5. CONCLUSIONS

From the results of the application design and testing (blackbox), it can be concluded that this waste management application can be used as a container to regulate waste management. The presence of this application is expected to help the community seek more effective and efficient waste management in the form of digitalis. One of the techniques used in this application is the k-means clustering algorithm to group types of garbage according to their characteristics, thus making it easier for users to identify and manage garbage more structured.

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