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Design of an Android Based Garbage Transport (Angkut's) Application

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ABSTRACT

The waste problem in urban areas, such as Belawan, Medan, is exacerbated by population growth and inadequate waste management systems, resulting in environmental degradation. To address this issue, "Angkut's," an Android-based waste transportation application, has been developed. The system aims to optimize waste management through the use of digital technology, allowing users to schedule and monitor waste collection efficiently. This application addresses inefficiencies in the existing waste transportation system by incorporating features like real-time order tracking and notifications for both users and administrators. The prototype for Angkut's was developed using prototyping methodology, which includes stages such as communication, quick planning, quick design modeling, prototype construction, and deployment feedback. The application includes various user-friendly interfaces, such as a splash screen, login, home, and order management pages. Administrators can monitor order statuses and provide updates on waste collection. The system also promotes community empowerment in waste management by using a structured approach to managing inorganic waste. After development, the prototype underwent testing to evaluate user responses and functionality. This application is expected to improve waste transportation efficiency, benefiting both the community and local governments.

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1. Introduction

Trash is a persistent issue that plagues all Indonesian cities, although it is particularly prevalent in large cities and provincial capitals like Medan City's Belawan subdistrict. The waste problem is growing as the population grows and trash production capacity rises without sufficient waste management capacity, leading to a constant buildup of waste [1][2]. The growth of a city's population will be directly correlated with the amount of waste produced. Without good waste management, the impact will be a decline in environmental quality. Waste management problems are common in large urban areas and developing cities [3]. There are many kinds of waste, such as wet waste, dry waste, ash and charcoal from burning, animal carcasses, rubbish or rubbish found on the side of the road, and waste resulting from industrial activities. (Suryani, 2014) [4]. In accordance with Law Number 18 of 2008 concerning Waste Management, this Law highlights the need to change waste management practices that prioritize waste reduction and handling [5].

Suryani (2014) suggests that waste reduction can be achieved through the use of strategies such as limiting waste accumulation, recycling activities and reuse [6]. The Waste Bank is a system for managing inorganic waste, especially that which comes from households, collectively and systematically. The aim is to provide benefits to both waste bank customers and waste sources. The amount of waste collected is measured in kilograms and the financial value is recorded in Rupiah [7], [8], [9]. The aim of the waste bank is to minimize community waste generation through an integrated approach in the inorganic waste cycle chain. The establishment of a waste bank will also help local governments empower the community to supervise waste management using digital technology, thereby reducing waste in final landfills. The waste bank program has introduced innovative waste processing methods aimed at increasing the income of the urban poor in lower middle class communities. (Elza et al., 2020 in Suleman, 2021) [10].

Medan Belawan, a sub-district in Medan City, faces challenges in waste management due to the poor condition of the waste transportation system. There is a large amount of waste that is not transported and accumulates, which has the potential to have a negative impact on environmental quality. Existing waste transportation procedures at the Environmental Service do not utilize information technology, which can simplify monitoring and reporting of waste volume data. Therefore, it is essential to implement improvements and advancements in the waste transportation process to provide a more efficient and effective approach. According to data from the Central Statistics Agency, the population of Medan Belawan in 2012 was 95,709 people. Then it experienced a growth rate of 0.59% and reached a population of 96,280 people in 2013. The population continues to increase every year. Population growth every year must be directly proportional to the expansion of city facilities, especially the provision of infrastructure and facilities that ensure the welfare and sustainability of urban residents. The author observes that the process of transporting waste to the TPA (Final Disposal Site) is hampered by problems in the waste transport system which are characterized by irregularities, negligence and inefficient use of transporting waste from the TPS or various locations to the TPA. Utilizing mobile-based media or application technology, such as Android, offers the right way to facilitate individuals in overcoming this problem. To address the waste transportation problem in Medan Belawan, the Android-based application "Angkut's" is designed as an integrated system that combines real-time tracking, user accessibility, and more efficient waste management. The application will provide an interface for the public to request waste transportation services, track collection progress, and communicate waste transportation schedules in real time. On the other hand, the backend server will manage user data, scheduling algorithms, and deliver notifications to ensure the process runs smoothly. With the support of GPS waste tracking, truck transporters can follow optimized routes, reducing transportation time and costs.

User access management is also arranged according to each role: residents can arrange transportation and unify its status, transport officers have access to optimized routes, and admins and local authorities can connect and manage schedules with waste collection data analytics. Through the use of data and machine learning, the application is also able to adjust routes and schedules based on collection patterns, thereby minimizing inefficiencies in the transportation process. The author aims to produce a solution to the problems above. "Designing an Android-Based Garbage Transport (Angkut's) Application" as a means of optimizing the existing transport system. Adiguna et al. (2018) emphasized that design is a definition process that uses various methodologies. Additionally, it highlights the specifics of the architecture and components, as well as the challenges faced during the project. (Syabania & Rosmawarni, 2021) [11], [12].

Implementation comes from the word "application" which means "to use". Ready-to-use instruments that are designed to perform tasks for other users or applications and can be used by appropriate individuals are referred to as applications. (Azis, 2018).

Android is a type of operating system created to work on smartphones and computers. The Android system is based on Linux, on which the Android operating system is built [13]. Angkut's is a smartphone application designed to help the public handle and control both domestic and industrial waste efficiently. The app allows users to easily organize waste collection, monitor transportation progress, and guarantee that waste is handled appropriately according to recycling and sustainability standards. Use case diagram is a model that describes the behavior of the information system to be developed [14], [15]. After creating a use case diagram, an activity diagram is produced to determine the sequence of actions that will be utilized by users of the Angkut program [16], [17].

2. Research Method

2.1 Data Collection Techniques

2.1.1 Observation

The data collection technique is by directly observing the activities carried out. This was done through interviews with people in Belawan City [18].

2.1.2 Literature review

The aim is to collect many reference sources, theories related to the problem posed in this research.

2.2 System Development Methods

This program was created using a prototype methodology. The prototype technique "Designing an Android-Based Garbage Transport (Angkut's) Application" was implemented in five different stages. Pressman (2012:50) states that the prototyping method can be applied in designing a system for which a prototype will be made [19], [20].

3. Result and Discussion

In A prototype is an unfinished product that requires re-evaluation and modification (Aditya et al., 2021a) [21]. The prototyping process consists of several stages:

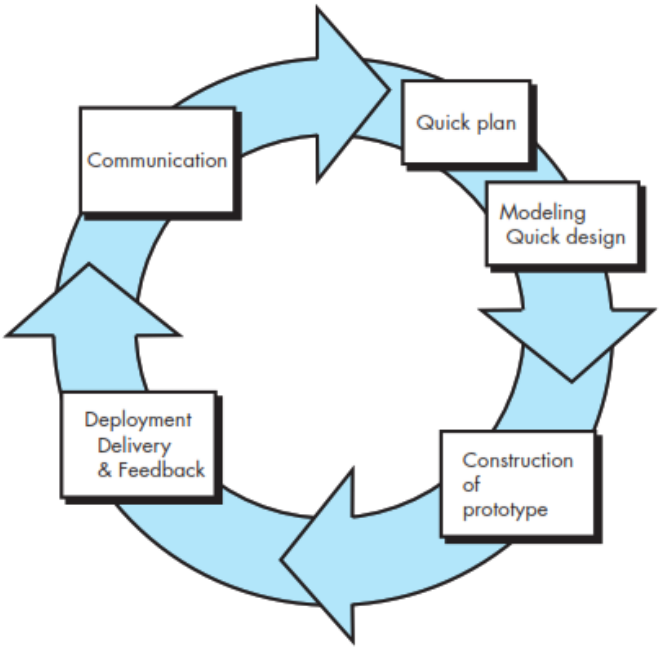

Figure 1. Prototype Method

This diagram is often used to describe the prototype model in software engineering. Here is an explanation of each stage in the cycle:

3.1. Communication

Therefore, the author conducted direct interviews with people in Belawan. During this conversation, the author examines the methods currently used in waste transportation [22].

3.2. Quick Plan

System interface design planning is implemented during this phase. The functionality requested by stakeholders is efficiently incorporated into this design, and the specifications for each function to be integrated into the system are clearly delineated [23], [24].

3.3. Modelling Quick Design

Following a thorough analysis of existing business protocols. Initially, the authors used simulations to reproduce the characteristics and requirements that users of their programs would experience. The author uses use case diagrams and activity diagrams as modeling tools [25].

This image is a Use Case Diagram for the "Angkut's" application, designed for a waste transportation system. The diagram shows the actors, namely User and Admin, as well as the actions (use cases) they can perform within the application.

Here is a more detailed explanation of the diagram:

a. User:
   1. Login and Register: The user can log in or register to access the application. Both are part of the authentication feature, simplified in this diagram as a generalization of the app's authentication feature.
   2. Order Waste Package: The user can order a waste collection service through the "Order Waste Package" feature. In this process, the user will enter an address, make a payment, upload a payment receipt, and save the order data for delivery.
   3. View History: The user can view the history of their previous orders.
   4. View Profile: The user can view their profile.
   5. View Notifications: The user receives notifications about their order status.

b. Admin:
   1. Login: The admin also has access to log into the system.
   2. Order Confirmation: The admin manages orders, including confirming accepted orders or rejecting orders if there are issues.
   3. View Order Data: The admin can view all order data in the system.
   4. Monitor Waste Transportation Status: The admin can monitor the status of waste transportation for various orders.

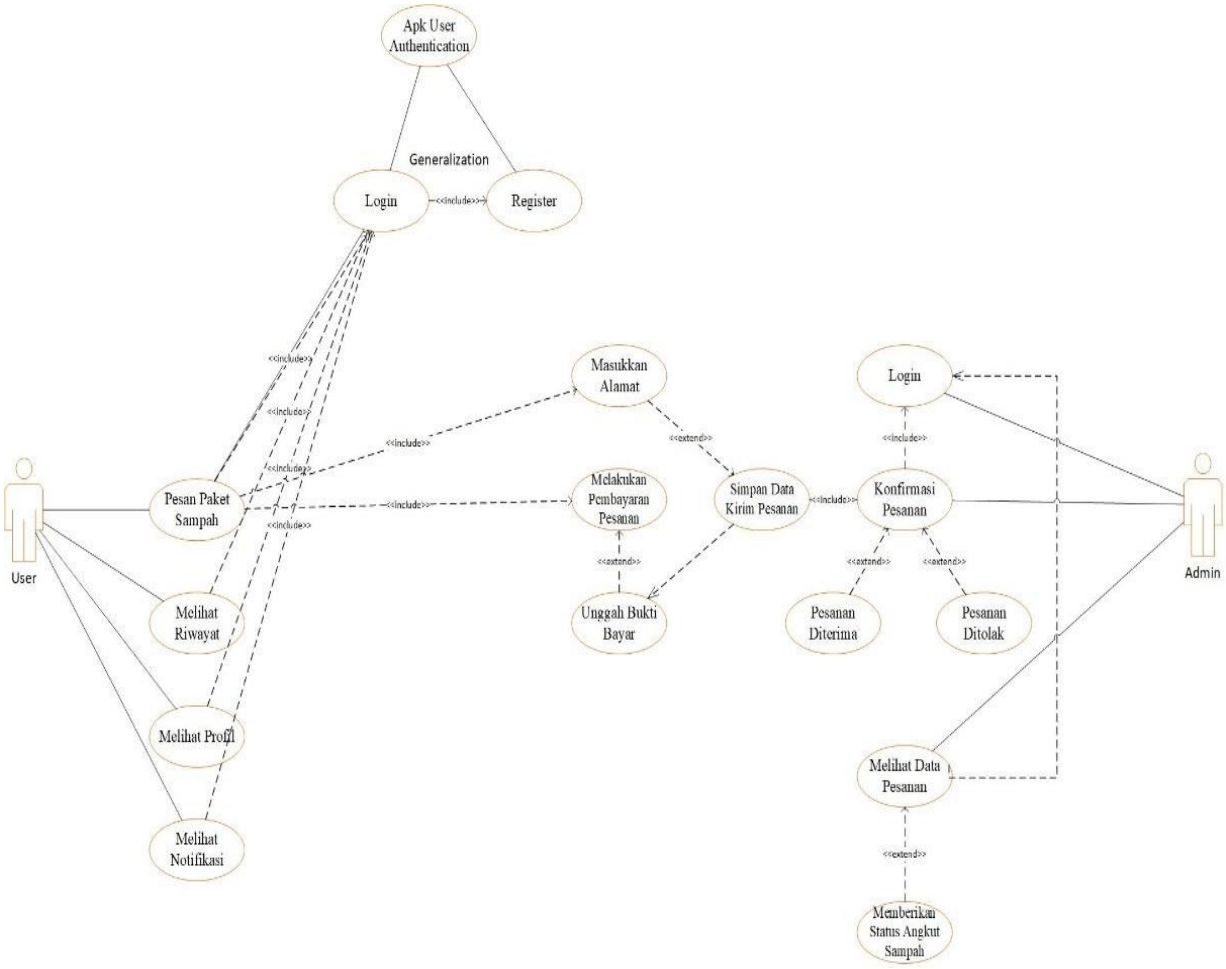

Figure 2. Use Case Diagram of Angkut's Application

This diagram helps the development team and stakeholders understand the system requirements from the perspective of the user and administrator. By understanding these interactions, the system can be designed to optimally meet the needs of both actors.

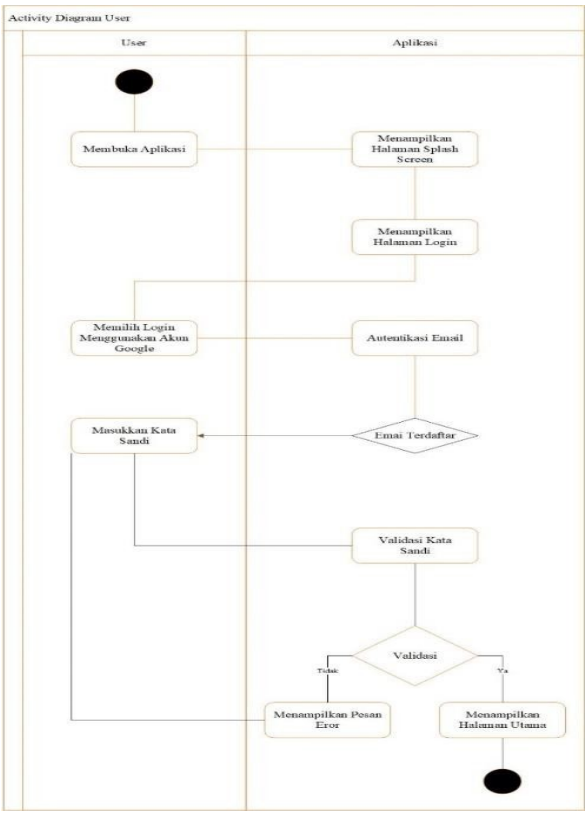

Figure 3. User Activity Diagrams in the Angkut's Application

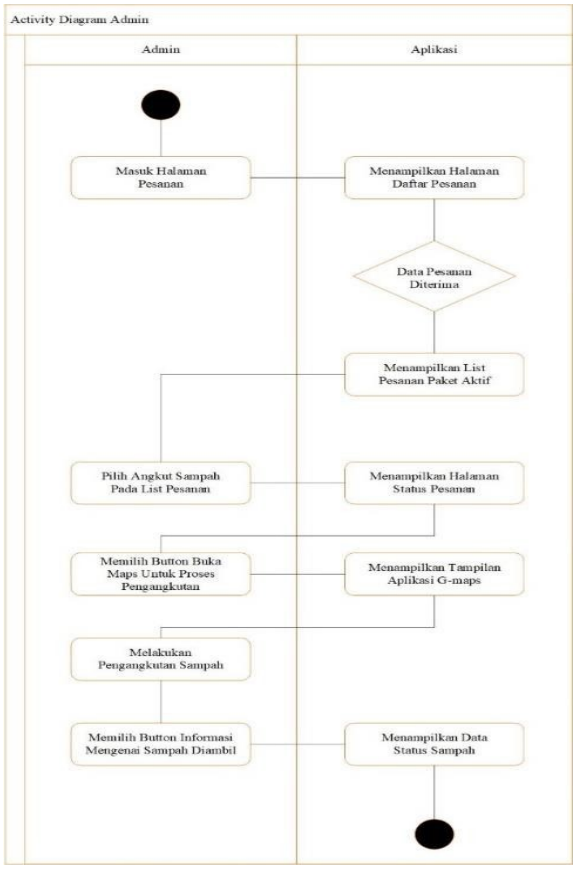

Figure 4. Admin Activity Diagrams on the Angkut's Application

3.4 Construction of Prototype

After the analysis and design stages are completed, a prototype is developed to implement the system design. The following is the system implementation.

3.4.1 User

a. Spalash Screen and Login page display

When launching the application, the user is initially presented with a splash screen page, which is then redirected to the login page. Users have the option to select the “Sign in with Google” button on the login page. This page is depicted in Figure 5.

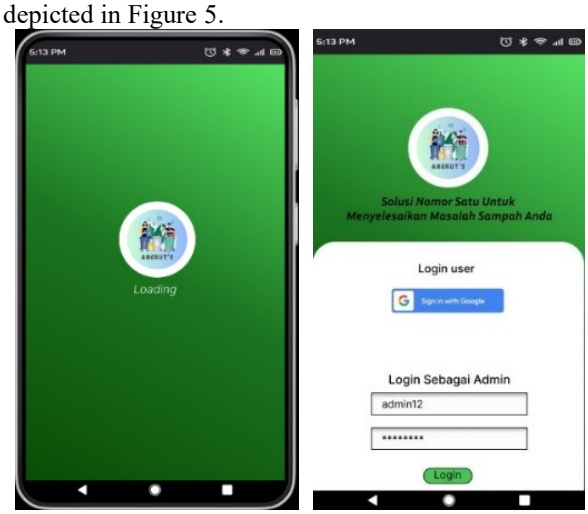

Figure 5. Splash Screen and Login Page on Angkut's Application

When the application is launched, users are first presented with a splash screen, which serves as an introductory image designed to engage users and create a branded experience. This screen might include the app's logo or a visual element representing the application's purpose. After the splash screen, users are redirected to the login page, which features another image, possibly as a background or banner, designed to create a welcoming and professional atmosphere. This image may include branding elements or emphasize themes like security and accessibility. On the login page, users can select the "Sign in with Google" button, which typically displays the recognizable multicolored Google "G" logo in a simple, minimalist design, ensuring easy recognition and functionality for users logging in with their Google accounts.

b. Home Page View

After successful authentication, the user will be redirected to the homepage, which includes features such as Home, History, and Account. This page is depicted in Figure 6.

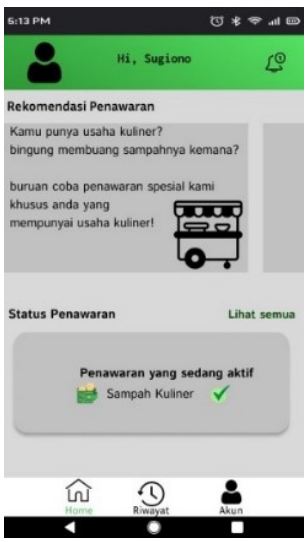

Figure 6. Home page of the Angkut's application

After successful authentication, the user is redirected to the homepage, which features key navigational elements such as Home, History, and Account. The Home icon is typically represented by an image of a house, symbolizing the main page or starting point of the platform. The History icon often takes the form of a clock or timeline, signifying access to the user's past actions or activities on the site. Lastly, the Account icon is usually depicted as a silhouette or user profile image, guiding users to their account settings and personal information. These icons are designed to be visually intuitive, allowing for easy navigation and a seamless user experience.

c. Notification Page Display

Users can see notifications about completed orders and waste disposed of. The content on this page is depicted in Figure 7.

Figure 7. Notification page on the Angkut's application

Figure 7 likely contains images that visually represent notifications about completed orders and waste disposal. The image for completed orders might feature a symbol such as a checkmark inside a box or a clipboard with a green tick, indicating that an order has been successfully processed and fulfilled. For waste disposal, the image could depict a trash can icon, possibly with an arrow or motion lines to indicate that waste has been successfully removed. These images are designed to be simple and intuitive, making it easy for users to understand the status of their orders and waste management.

d. Package and Order Page View

Users start the process by clicking on the “choose plan” option displayed on the main website. They are then directed to the package page where they can select and purchase a package. Finally, they proceed to the order page. There is a waste sorting function at this location. This page is depicted in Figure 8.

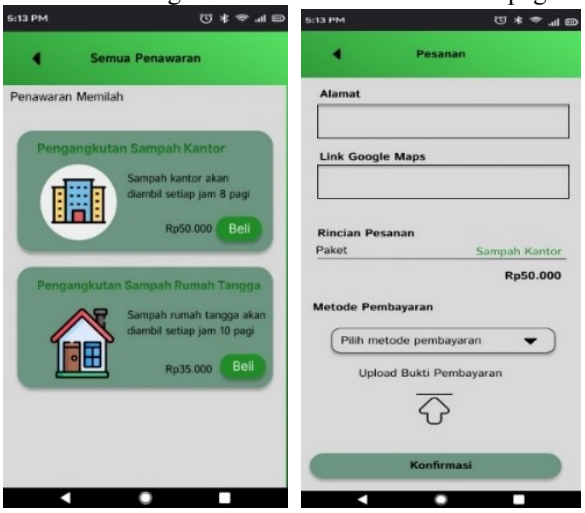

Figure 8. Package and Order page on the Angkut's application

The process begins on the main website with a prominent “Choose Plan” option, likely highlighted with clear visuals like buttons or icons to guide users. After selecting, users are taken to the package page, where they can view various packages, each presented in its own section with details like name, price, and features, along with icons representing different tiers. Finally, on the order page, users complete their purchase. This page also features a waste sorting function, which may include visuals like bins or icons for different types of waste (recycling, compost, trash) to help users sort correctly.

e. Address Page Display

People who click the "Add Address" button on the order page will go to the address page and fill in their information. When the user is finished, they click the “Add” button and are taken back to the order page with the new information (Figure 9).

Figure 9. Address page on Angkut's application

In the first image (Figure 9), the order page is displayed, showcasing details of the user’s selected items, total price, and the option to click the "Add Address" button. This takes the user to the second image, which represents the address input page. Here, users can fill in their personal and shipping information, such as name, phone number, and postal code, with a button labeled “Add” or “Save” at the bottom to submit the details. The third image shows the updated order page, where the newly entered address information is now visible in the order summary, confirming that the user has successfully added their address and can proceed with their purchase.

f. Completed Payment Page Display

After completing payment, users are redirected to the main site where they wait for confirmation from the waste hauler. Figure 10 shows the page.

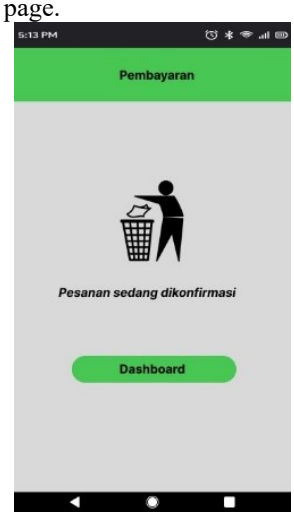

Figure 10. Completed Payment Page on Angkut's Application

To provide a description of each image, I need to understand what the images look like. Could you describe them, or if you have any specific details or context about them, let me know! For example, I would describe images based on the layout, color scheme, and elements visible on the page.

g. View History Page
Users can view the status of order history and waste collection through the history feature. Just press the history button in the navbar, then select order history or trash history as in Figure 11.

Figure 11. History page on the Angkut's application

3.4.2. Admin

a. Order Confirmation Display
Admin can accept or reject orders from users. If there are no orders, the order confirmation screen will be blank. If there is an order, order information will appear. An image of the order receipt can be seen below (Figure 12).

Figure 12. Order Confirmation Page on Angkut's Application

b. Order List View
Administrators can view the list of approved orders from users. If there are no orders yet, a blank page will appear. Once the order is confirmed, the order information will appear on the order list page. The order list page in Figure 13 is shown below.

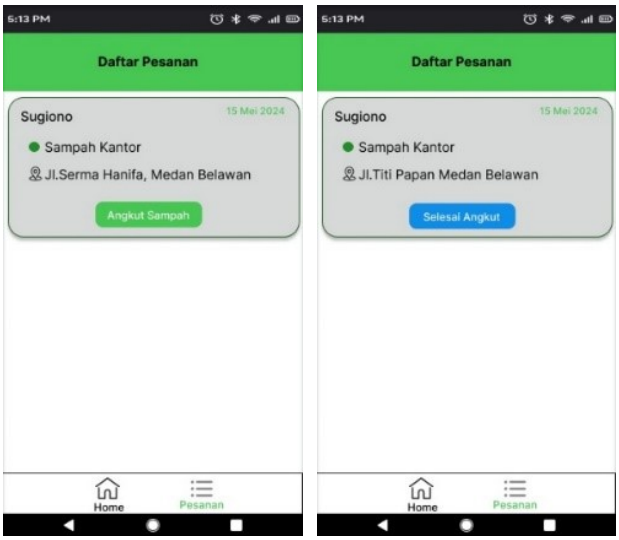

Figure 13. Order List Page on the Angkut's Application

c. Order Status Display

With the buttons on the order status page display, people can see information on the progress of their orders and get updates on their waste transportation for one month. Figure 14.

Figure 14. Order Status Page on the Angkut's Application

3.5 Deployement Delivery Feddback

In this phase, ideas and prototypes developed in the previous stage undergo testing. The aim of this stage is to evaluate Angkut's target market reaction to the start-up. Ideas and prototypes will undergo internal and external testing stages. Internally, testing will be carried out by Angkut team members who act as developers. Externally, testing will involve Angkut's target market.

4. Conclusion

Medan Belawan has problems in waste management because the city's population is growing faster than its management capacity. This causes waste to accumulate and environmental quality to deteriorate. The current method of moving waste is not good and does not function well.

The Waste Bank and the mobile application "Angkut" are intended to increase the efficiency of waste management. The Waste Bank facilitates the reduction of waste in landfills and empowers communities, while "Angkut" provides pickup scheduling, status tracking, and waste management and recycling principles.

The creation of “Angkut’s” uses a prototyping approach that includes communication, rapid planning, rapid design, prototype construction, and feedback during implementation. This process includes interviews, interface design planning, use case modeling, activity diagrams, and evaluating concepts and

prototypes through testing. This program is designed to increase the efficiency of waste transportation by combining the functions of login, notification, package selection, address input, order history and order confirmation by the administrator.

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