



Implementation of QR Payment on Android-Based Waste Banks

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Abstract

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This research aims to implement a QR Payment system as an effort to increase attractiveness and encourage greater community participation in waste management at KSM BIMA, facilitating transactions, particularly the exchange of customer points for goods. The analytical method employed in this research is Design Thinking. The results demonstrate the successful implementation of the QR Payment system in the Android application of KSM BIMA waste bank. The prototype creation involved three stages: the first stage for developing an Android application prototype for customers and administrators, the second stage for QR Payment system development and creating Android applications for partners, and the final stage for adding several program features to the QR Payment system, setting an age limit for point redemption and generating reports for each application. Testing using the Black Box Testing method indicates that the implemented system functions effectively.

Keywords: waste bank, KSM BIMA, QR Payment, Design Thinking

Abstrak

Penelitian ini bertujuan mengimplementasikan sistem QR Payment sebagai upaya menambah daya tarik agar masyarakat lebih berpartisipasi dalam pengelolaan limbah sampah di KSM BIMA dan memudahkan transaksi, khususnya untuk tukar poin menjadi barang nasabah. Metode analisis yang digunakan dalam penelitian ini adalah Design Thinking. Hasil dari penelitian ini adalah berhasil menerapkan sistem QR Payment pada aplikasi android bank sampah KSM BIMA. Pembuatan prototype dilakukan melalui tiga tahapan, yaitu tahap pertama sebagai prototype aplikasi android untuk nasabah dan admin, tahap kedua adalah pengembangan sistem QR Payment dan pembuatan aplikasi android untuk mitra, dan tahap terakhir adalah penambahan beberapa fitur program pada sistem QR Payment, batas umur akun untuk pecairan poin dan pembuatan laporan untuk tiap aplikasi. Hasil pengujian menggunakan metode Black Box Testing menunjukkan bahwa sistem yang diimplementasikan dapat berjalan dengan baik dari sisi fungsionalitasnya.

Kata-kata kunci: Bank Sampah, KSM BIMA, QR Payment, Design Thinking,



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1. Introduction

Waste banks are one solution that can make a real contribution to efforts to manage household-scale waste [1] better. One of several waste bank community groups operating in the Banyumas area is the Bima Non-Community Group (KSM BIMA). KSM BIMA is a local community that actively participates in waste management, especially in parts of the Bay area [2]. The digitization process at the KSM BIMA [3] [4] [5] waste bank has been carried out before, there are several features in the first version of the waste bank application. These features include storing goods data, recording waste bank members, information about collected goods, information about waste exchange transactions, making reports and various other aspects. However, in its implementation, the first version of the application is not optimal due to several existing problems, such as there is no supporting waste bank information system [6] for customers, there is no attraction so that the public is more motivated to participate in waste management, transactions that have not been easy and transparent so that this first version of the application has not been used and is limited to internal testing. Solutions to the problems faced in the first version of the waste bank application can be implemented by implementing an Android-based QR Payment [7] system.

First, optimizing the waste bank information system to support customers is necessary. In this context, QR Payment can be a medium that facilitates and increases customer engagement [8] by providing instant and accurate transaction information. Furthermore, to increase the attractiveness of community participation, cooperation with MSME partners around the Bay Area is carried out, and special features in the QR payment system, such as point exchange strategies or other incentive programs, are integrated. The form of cooperation with MSME partners is to create a partner-specific Android application [9] to support the QR Payment system. In this study, QR Payment was used as a payment system to exchange customer points for goods from partners. QR Payment provides advantages in faster transaction efficiency because it uses QR codes [10]. The approach used in this study is the Design Thinking method. Design Thinking has several stages: Empathize, Define, Ideate, Prototype, and Test. This Design Thinking method [11] is used because it wants to prioritize user-center that is easy to use so that it can provide good functionality.

2. Method

Design Thinking is an innovative approach that emphasizes understanding human needs, adopted from the start of design, and combines several elements such as understanding user needs, technology potential, and requirements for business success [12]. Design Thinking is a collaborative method that combines diverse ideas with the goal of achieving innovative solutions. This approach emphasizes visual and emotional aspects and focuses on user experience. The Design Thinking method is also used to find the most effective and efficient solutions to complex problems. Applying this principle involves comprehensive thinking to formulate the right solution [13]. Design thinking this research is presented in **Figure 1**.

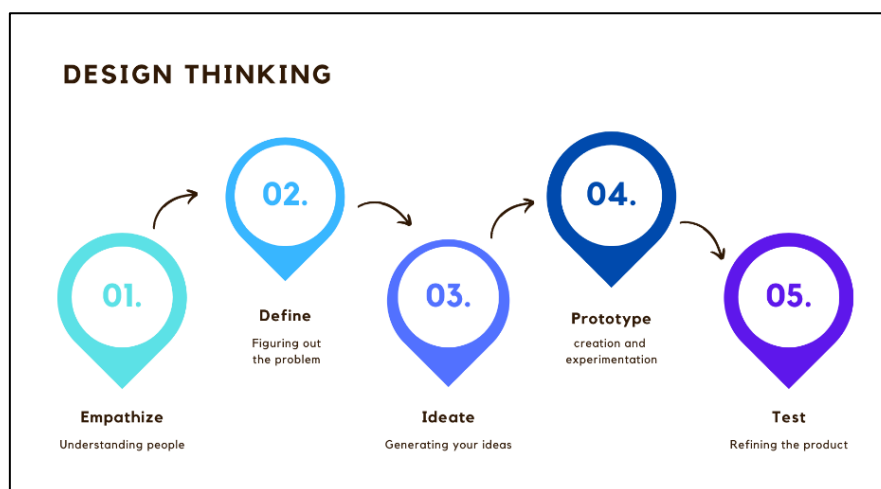


Figure 1. Design Thinking

The Design Thinking method has several stages, namely *Empathize*, *Define*, *Ideate*, *Prototype*, *Test*. The following is an explanation of the stages of the *Design Thinking method* [14].

1. Empathize

The empathize stage is carried out with the aim of digging deep into information and gaining a deeper understanding of the experiences and views felt by potential users. Through this interaction, researchers seek to empathically feel and understand the perspectives that are being experienced by potential users to detail and identify the needs and challenges that they may be facing. The technique that is often used is interviewing and observing related parties.

2. Define

At the *Define* stage, researchers conduct a careful and comprehensive analysis with the aim of identifying and detailing problems that may arise in related parties involved in the research [14] In this process, researchers try to understand in depth the various aspects related to the

problem at hand, with the aim that the problem can be well identified and become a solid understanding basis for the next steps in the research.

3. Ideate

In the *Idea* stage, researchers actively strive to formulate various creative solutions that can be used as an effort to overcome problems that have been identified in the previous stage [14]. After conducting an in-depth analysis, the results of the analysis are used as a foundation to form a system structure. The system includes a system design detailing user needs and system structure in the form of diagrams, obtained based on the understanding that has been developed in the requirements analysis stage.

4. Prototype

In the *Prototype* stage, researchers focus on making a *Prototype* which is an initial representation of the system that has been designed in the previous stage [12]). *This prototype* serves as a visualization tool that allows related parties to test, evaluate, and experience firsthand how the system will operate. The design process is carried out using the *Prototype for empathy method*. *Prototype for empathy* is a design method that considers users when interacting with the *application* prototype [15]. The steps of designing a *prototype* start from designing the system flow, making *low fidelity wireframing* and *high-fidelity wireframing*, to making programs or coding prototypes.

5. Test

In the Test stage, *the Prototype* is tested by prospective users to ensure that the application is appropriate and easy to use by potential users [14]. At this stage *the Prototype* will be tested with the *Black Box method*.

3. Results and Discussion

Researchers digitizing waste banks have been noted in previous literature, such as E-Pulung [16], Trash-mate [14], and Trash bank [12]. These applications include features such as garbage pickup, junk coins, junk data, customer data, admin data, withdraw balances or coins, and so on. There are several system concepts proposed as solutions for transactions that facilitate and increase the attractiveness of waste bank member participation, namely *Point of sales*, *QRIS*, and *QR Payment*. In addition to the system concept, there are also proposed strategy concepts, such as the waste points strategy, and cooperation with BIMA KSM partners. These partners can be MSME stalls, nearby pharmacies, and others.

The idea adopted for the system concept emphasizes the fusion of *point of sales (POS)* and *QR Code*, which is often referred to as *QR Payment*. This concept embraces ease of transaction using *QR Codes* in *point of sales* systems. The chosen strategy to support this concept includes the implementation of waste points, where waste bank members can accumulate points as an incentive for their active participation. In addition, another strategy implemented is cooperation with nearby partners, which aims to expand networks and community involvement in waste bank activities. With this combination, it is expected to create an efficient, attractive, and sustainable system. The solution idea is poured into a diagram form as a reference in making a *Prototype*

a. Trash Swap

An overview of when customers make a waste exchange schedule. The first step is to ensure that the customer and admin have logged in to the application. Next, the customer inputs the schedule details, including the waste list and weight. After the schedule data is input and sent, the admin validates the schedule, prints a special scale note, and sends a collector to weigh it. After the weighing session is complete, the customer must photograph the special scale note and send it for admin validation. The last step is for the customer to wait for the validation of the scale and garbage notes from the admin side. The points will automatically be added to the customer's account if the admin has validated. **Figure 2** is a use case garbage swap diagram.

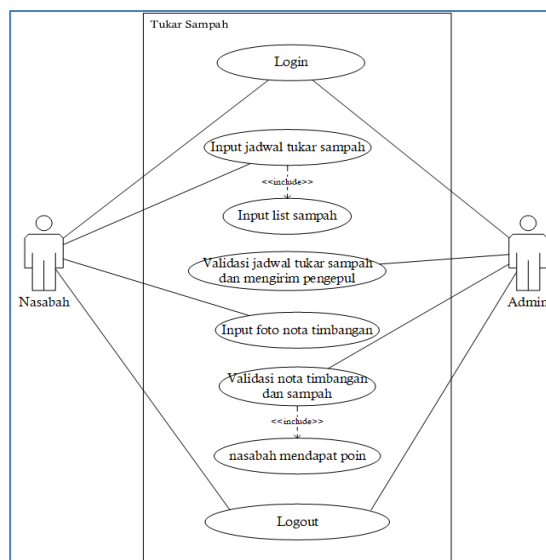


Figure 2. Use case garbage swap diagram

Figure 2 illustrates when the customer makes a waste exchange schedule. The first step is to ensure that the customer and admin have *logged in to* the application. Next, the customer

inputs the schedule details including *the waste list* and weight. After the schedule data is input and sent, then the admin validates the schedule, *prints* a special scale note and sends a collector to do the weighing. After the weighing session is complete, the customer must photograph the special scale note and send it for admin validation. The last step is for the customer to wait for the validation of the scale and garbage notes from the admin side. If the admin has validated, the points will automatically be added to the customer's account.

b. Swap Point Trash

This is an overview if the customer wants to convert points into cash. **Figure 3** is a use-case diagram of converting points into customer cash.

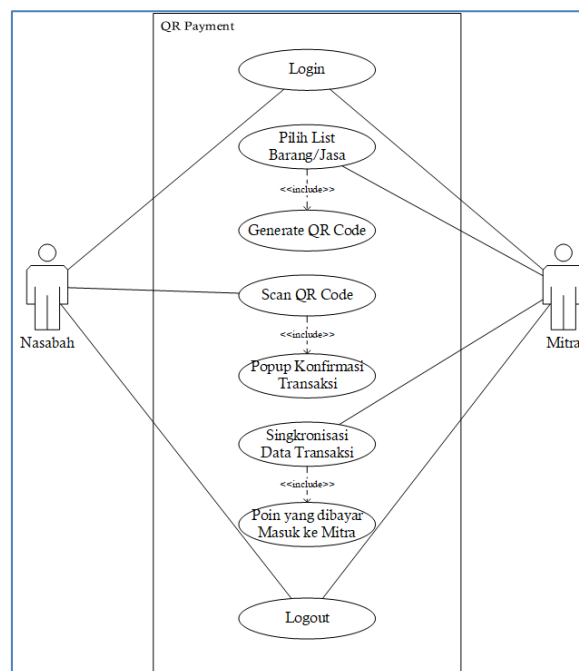


Figure 3. Use Case Diagram of Converting Points into Customer Cash.

The customer and admin have logged in. Furthermore, customers can input point exchange requests. This request can be done anywhere, but it will be easier if you come to the KSM BIM A office first. Then the admin waits for the customer to get to the office, the admin validates the point exchange request and gives the results of the point exchange in the form of cash

c. QR Payment

Overview of customers and partners use the QR Payment system to exchange points for goods. Use case diagram QR payment is presented in **Figure 4**.

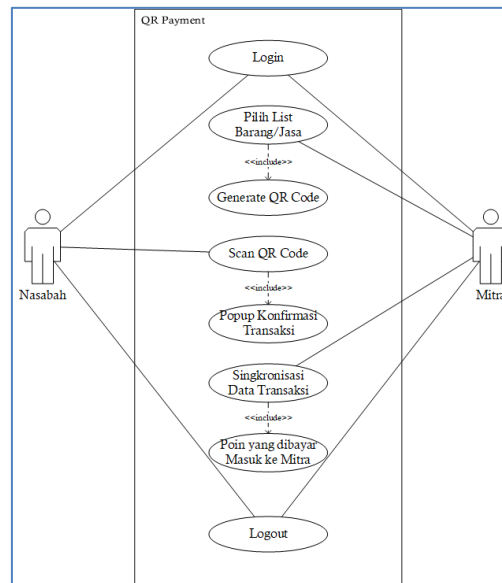


Figure 4. Use case diagram QR Payment

At the initial stage, customers and partners *log into* their respective applications. Next, the customer selects the item you want to exchange and the partner inputs the item into the application. If the customer has chosen the item, the partner will create a *QR Code*. The customer will scan the QR Code to make payments. Next, a transaction/payment confirmation *popup* will appear. If successful, then the partner must synchronize, and the customer's points will be moved to the partner.

d. Prototyping

The big picture of the entire BIMA KSM application is based on *android*. The *prototype* is divided into 2 applications; it is used according to the grouping of users, namely customers and admins of KSM BIMA.

1) Customer

a) Customer login activity in the system

Overview of *login* and *registration* activities as a Bima KSM customer.

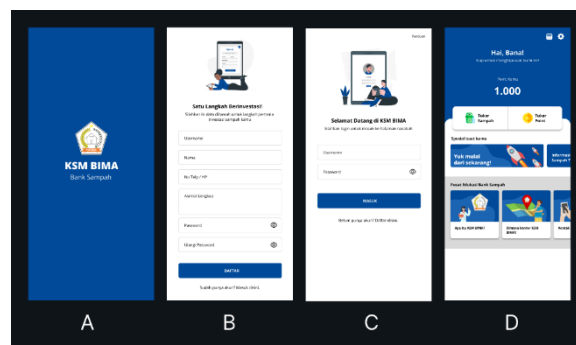


Figure 5. High-fidelity Wireframing Login and Register Customer

The image uses colour selection in accordance with the identity of KSM BIMA; there are several images to attract the public as well. Figure 5 (A) illustrates when the application was first opened. Figure 5 (B) displays the list form to become a customer. Figure 5 (C) displays the customer's login form. Figure 5 (D) is the customer's home view.

b) Exchange customer waste

Figure 6 (A) is a guide to exchanging customer waste. Figure 6 (B) is a junk or garbage swap schedule creation page. Figure 6 (C) is a *popup display* for adding to the trash list. Figure 6 (D) is a display of selecting a pick-up point. Figure 6 (E) displays when the customer has successfully created a waste exchange schedule. Figure 6 (F) is a garbage swap schedule detail page. Figure 6 (G) is a photo *input page* of the proof of the scale note. Figure 6 (H) is a page showing if the customer has successfully sent a photo of proof of the scale note.

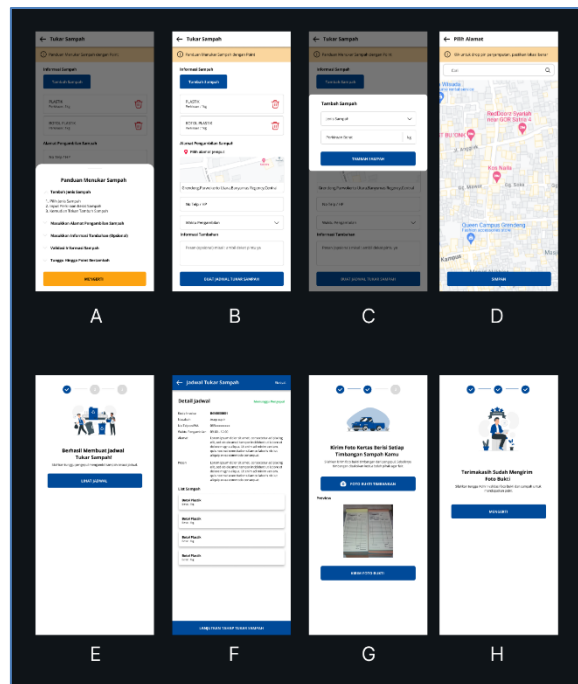


Figure 6. High-fidelity Wireframing Exchange Customer Trash

c) Redeem customer points

Overview of customer point exchange flow version 1. First, the customer goes to the point exchange form page from the point exchange menu. The customer inputs the points they want to exchange, then enters the *point exchange request* process. In this process, points will be checked whether they are enough. If it is not enough, a notification appears that you cannot redeem points. If so, then enter the process of saving data. This process will save the exchange point data to the *database server*. If successful, the customer will be directed to the point

exchange request page. The next step is for customers to come directly to the BIMA KSM office to get money from point exchange and validation.

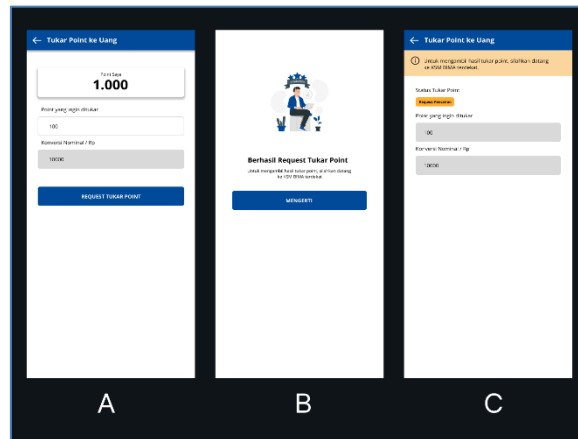


Figure 7. High-fidelity wireframing Redeem Customer Points

Customer Points Exchange Feature. Figure 7 (A) is a real picture of the point exchange menu. Figure 7 (B) is a real picture of the points to cash exchange page. On that page, the customer fills in the points they want to exchange. Figure 7 (C) is the page where the customer successfully made a request. Figure 7 (D) is a details page for converting points to cash.

2) Admin Bima KSM

a) Login Admin KSM Bima

Admin enters the splash screen, in the splash screen will retrieve login history data that has been stored on the database.

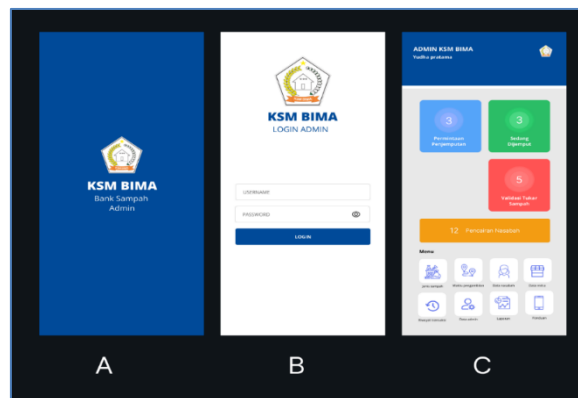


Figure 8. High-fidelity Wireframing Login Admin

Figure 8(A) shows the page where the admin first logged in to the application. Figure 8 (B) shows the admin login page. Figure 8 (C) shows the admin home page.

b) Trash Pickup

Overview of the garbage pickup flow for admins. This flow is the answer to customer waste exchange. First, the admin goes to the garbage swap menu. Before entering the junk

exchange schedule list page, the system will retrieve the schedule data first. Furthermore, the data is checked to determine whether there is a schedule that needs to be taken. If not, then go to the schedule details page. If so, the admin waits for the collector to weigh and bring the garbage and the scale note. On the system side, the admin enters the photo validation form of proof of the scale note. The admin validates the note, and the customer's points are automatically accrued.

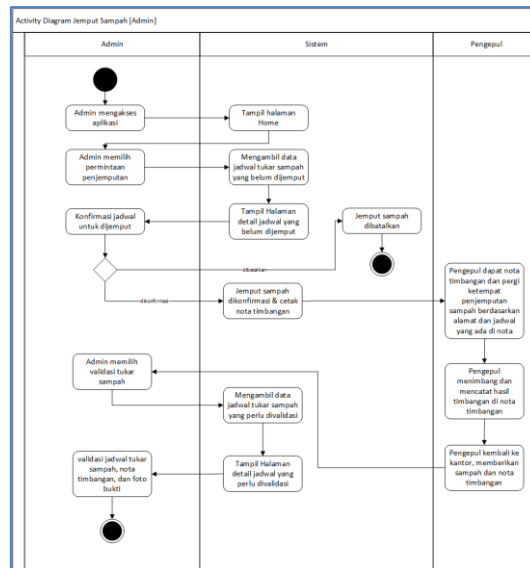


Figure 9. Activity Diagram Admin Garbage Pickup

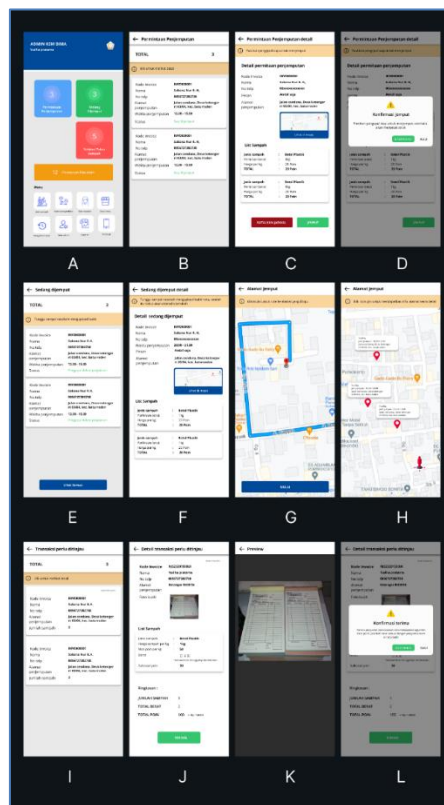


Figure 10. High-fidelity Wireframing Admin Garbage Pickup

Figure 10 (A) is a real picture of the admin home page, which has a pick-up, being picked up and garbage swap validation menu. **Figure 10 (B)** is a real picture of the schedule list page that needs to be picked up and has not been validated. **Figure 10 (C)** is a real picture of the schedule list detail page that has not been validated. **Figure 10 (D)** is a real-life representation of the page displaying the pick-up confirmation popup. **Figure 10 (E)** is a real picture of the schedule list page that is/needs to be picked up. **Figure 10 (F)** is a real picture of the schedule detail page that needs to be picked up. **Figure 10 (G)** is a real picture of the pick-up route page. **Figure 10 (H)** is a real picture of the pick-up point page. **Figure 10 (I)** is a real picture of the garbage exchange schedule list page that needs to be validated. **Figure 10 (J)** is a real-life overview of the schedule detail page that needs to be validated. **Figure 10 (K)** is a real picture of the *photo preview* page of the scale note that the customer has sent. **Figure 10 (L)** is a real picture of a page displaying a *confirmation popup* for validation of having implemented a garbage swap schedule.

c) Disbursement Point garbage.

This is an overview of the flow of customer point disbursement by the admin. First, the admin goes to the list page of customers who want to exchange points.

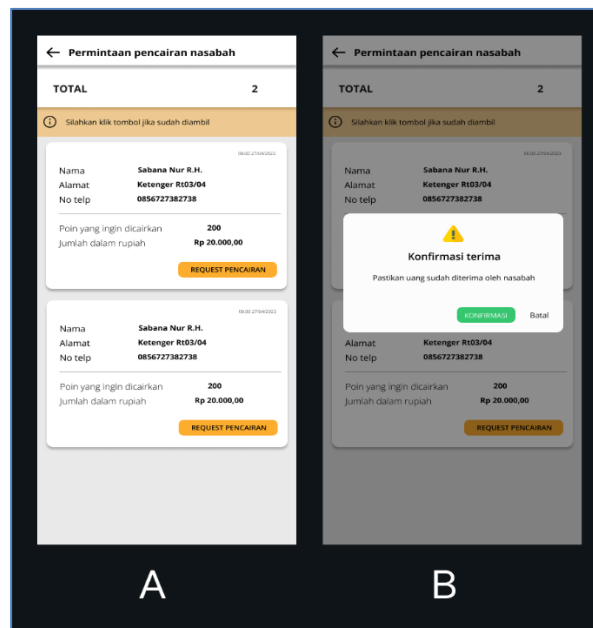


Figure 11. High-fidelity wireframing Disbursement of Customer Points into Cash

Figure 11 (A) is a real picture of the *list* page of customers who want to exchange points for cash. **Figure 11 (B)** is a real picture of the *confirmation popup* to validate the customer's cash exchange points.

4. Conclusion

This research successfully implemented a *QR Payment* system on KSM BIMA's digital waste bank. A *prototype* is made in 3 stages, namely the first stage as an *android* application *prototype* for customers and admins, the second stage of developing a *QR Payment system* and prototyping partner applications, and finally, the addition of several program features to the *QR Payment system*, account age limits for point disbursement and report generation for each app. The test results using the *Black Box Testing* method show that the implemented system can run well in terms of functionality. As a continuation, this system has been uploaded on the *Play Store* under the name KSM BIMA Waste Bank application for the community/waste bank members, KSM BIMA Mitra for partners, and KSM BIMA Admin for KSM BIMA admins.

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