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Donation Raising Application Using Rapid Application Development (RAD) Method Based on Mobile Application

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Abstract – Indonesia is one of the countries that has a high social spirit in doing gotong royong. Its people love to help and build social welfare. There are several activities that prioritize the principle of gotong royong in society, one of which is donation-raising activities. Many institutions still collect donations in a conventional way. This can be an obstacle for donors because not all institutions or communities that collect funds are in the same area and the reach is relatively small. Lack of public trust is also a reason because of the rampant fraud on behalf of institutions and foundations, so that it can hamper the raising of donations. To overcome these problems, a new system is needed that can be applied to the community. A fundraising platform is needed to make it easier for people to donate easily and efficiently. The Rapid Application Development (RAD) method is used in its development. System development uses the Kotlin programming language and uses a realtime Firebase database to manage the data. With this system, the mobile application can facilitate and provide access to the community in making donations online without collecting manually, raising donations can also provide a wider range of donations.

Keywords – Donation Fundraising, Kotlin, Firebase, Rapid Application Development (RAD)

I. INTRODUCTION

Donation activities have been going on for a long time in Indonesia and are carried out directly through religious activities, social services, arts and sports [1]. There are many organizations and foundations that organize donation activities. Many fundraisers are also willing to take to the streets and ask for donations from people around them. The concept of fundraising with the values of mutual cooperation gave birth to a site that acts as a donation platform in Indonesia. The rapid development of the internet has given birth to a variety of diverse platforms. This can increase the effectiveness of donation raising.

The problem that often occurs when raising donations is the narrow range that inhibits donors from making donations. Not all organizations or communities that collect funds are in the same area. Lack of public trust is also a reason because of the rampant fraud on behalf of institutions and foundations, which can hinder donation raising. Sometimes there is also a lack of coordination between the government and donors in distributing aid [2]. To overcome these problems, this research was conducted in order to provide the right solution to be applied.

Some previous research is used as a literature review in this study. In research conducted by Abdul Karim, analyzing and designing mobile applications used for donations using the React Native-based Hybrid method. The waterfall method is used to develop features that have donation categories such as natural disasters, houses of worship, education, orphanages and personal [3]. The next research was conducted by Rozaliana who made a donation information system using java. The application was developed using the waterfall method and produces donation features for cash, transfers, and donations of goods [4]. Further research was conducted by Fadhillah by designing a joint venture application using Agile and Scrum methods. The resulting application is a website that can manage transactions [5]. Muhammad Alfi also conducted research by creating an android-based fundraising application and SQL Lite. The application was developed using the waterfall method which is equipped with CRUD (Create, Read, Update, and Delete) features [6]. Then in research conducted by Erika Purba in designing a donation distribution system using the prototype method. The application features a login menu, dashboard, profile, student data, donor reports, student reports and logout [7].

The research conducted focuses on system design, use of techniques and tools, and system testing. The RAD (Rapid Application Design) method is used with the aim of creating software development quickly. Designing diagrams using UML (Unified Modeling Language) to find out the flow of the system being created. While the coding process uses the Kotlin programming language and the Firebase database to manage data in real time. The finished application will be tested using several scenarios created using the black box testing method.

II. RESEARCH METHODOLOGY

The system design starts with creating an architecture model. The architecture model provides an overview of the system's performance and what tools are applied to the system. The architecture model of this system can be seen in **Figure 1** as follows

Figure 1. Architecture Model

The user inputs the donation payment into the application then the application will send it via the internet, then the internet sends it to the database and the database stores the

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data, then the system will notify that the payment was successful.

A. Rapid Application Development (RAD) Method

Rapid Application Development (RAD) is a linear sequential software development process model that emphasizes very short development cycles. RAD can be used as a reference for developing an information system that excels in terms of speed, accuracy, and lower costs [8]. The RAD method emphasizes rapid design and iterative feedback to accelerate the creation of systems with good quality. The RAD method can be seen in **Figure 2** as follows

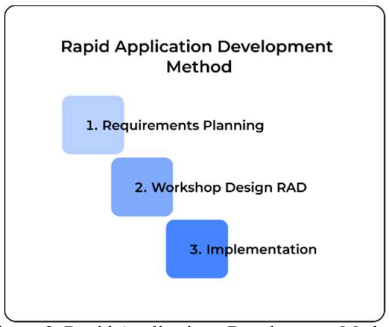

Figure 2. Rapid Applicatioon Development Method

At the Requirements Planning stage, literature data collection is carried out through literature studies. Then the RAD Design Workshop stage is carried out in the form of diagrams to determine system performance. After the application is completed, implementation is carried out.

B. Firebase

Firebase stores data online so to use firebase requires internet access. Firebase Database as a nonSQL database storage that allows for storing multiple types of data. Data in the Firebase database is stored as JSON tree objects. Unlike SQL databases, there are no tables and rows in non-SQL databases [9]. Firebase is realtime so data can be obtained quickly [10].

C. Unified Modelling Language (UML)

Unified Modeling Language (UML) is a software modeling used for visualization, specification, construction and documentation of some parts of the system. In this research, only a few types of diagrams are used such as Activity Diagram, Use Case Diagram, and Sequence Diagram [11].

D. Black Box Testing

The tests conducted focus on the functional specifications of the software [12]. Black Box testing checks every existing process whether it runs well as expected or not [13].

E. Kotlin

Kotlin was developed by JetBrains and is a functional programming language[14]. Various kinds of development can be done with kotlin, such as desktop, mobile, web, and even backend applications [15].

III. RESULTS AND DISCUSSION

A. Requirements Planning

The initial stage was carried out by identifying user needs by collecting information through interviews and surveys and literature studies. At this stage, problems were found along with application development solutions by collecting important features that must be present in the application. Documentation of the needs and solutions of these problems can be seen in the following research framework.

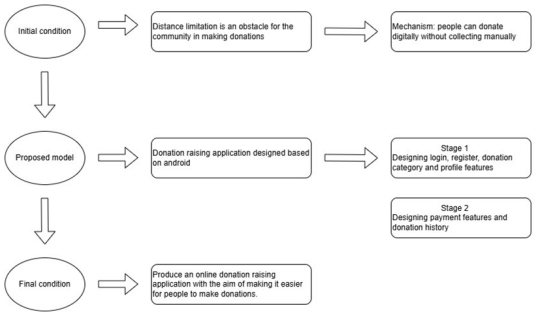

Figure 3. Requirements Planning

B. Workshop Design RAD

This stage is carried out modeling as a solution to existing problems Modeling the system using UML (Unified Modeling Language), namely use case diagrams, activity diagrams, and sequence diagrams. Use Case Diagram describes the process that occurs in the system. There is one actor, the user. Here is an image of the Use Case Diagram.

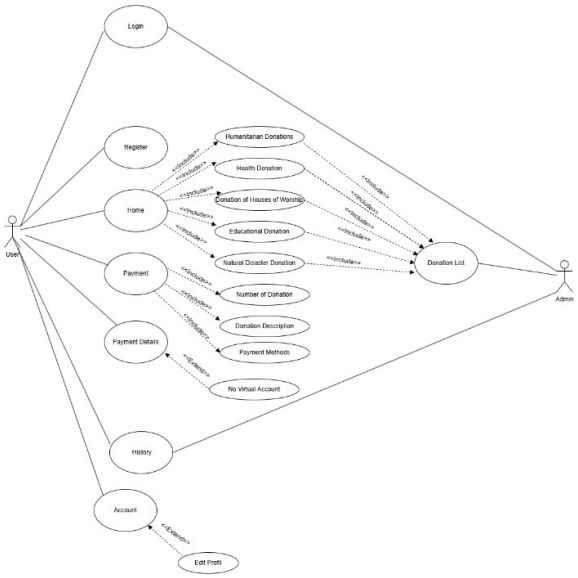

Figure 4. Use Case Diagram

Activity Diagram describes the flow of activities between users, systems and databases that have their own activities. The system as a link between the user and the database. In the login and register activity diagram, there are activities that start from the user being able to enter the application by logging in if they already have an account, but if not the user is required to register, after being validated by the system and checked by the database, the user can enter the application which displays the dashboard page. The following is an Activity Diagram **Figure 5** belows.

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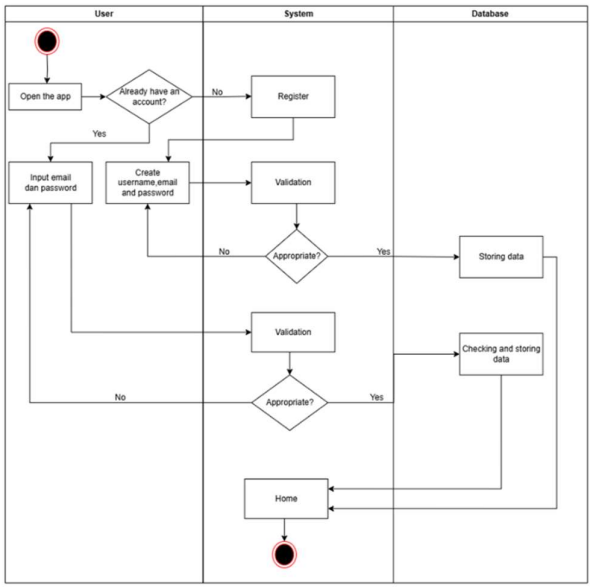
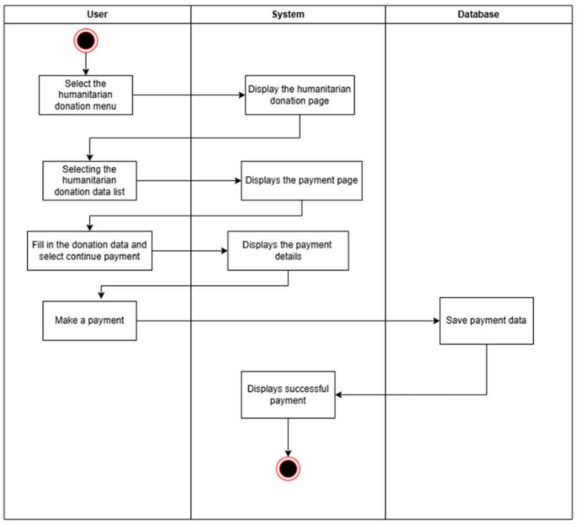


Figure 5. Login and Registration Activity Diagram

Furthermore, in the donation payment activity diagram, there are activities that start from the user selecting the donation category menu as an example of a humanitarian donation payment, the system displays the humanitarian donation page, then the user selects the humanitarian donation category, the system displays the humanitarian category, then the user selects the humanitarian donation data list and then will enter the payment page, the system displays the payment page, the user inputs the donation amount and chooses the payment method if the user has clicked the continue payment button, the system displays payment details in the form of a virtual account number if the payment is through mbanking, the user can copy the virtual account number and make a payment, then the database saves and the system displays a successful payment.



Fgure 6. Donation Payment Activity Diagram

Furthermore, in the history and delete history activity diagram, there are activities that start from the user selecting the history menu, the system displays the history menu, then the user deletes the donation history and the system confirms if yes then the database will save and delete the history otherwise it will return to the history menu.

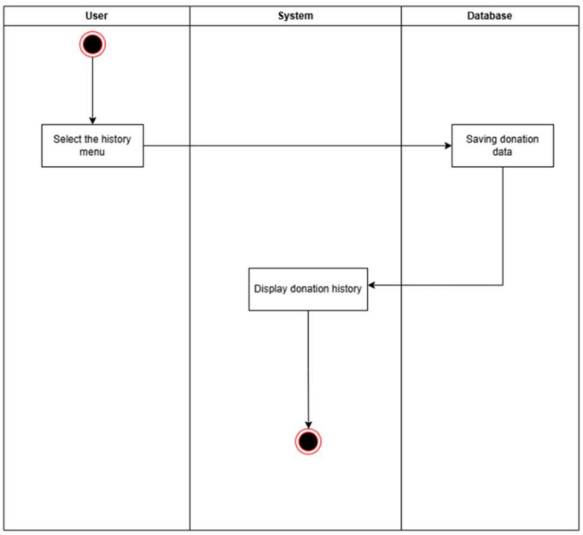


Figure 7. Activity Diagram History dan Hapus History

Activity Diagram Profile and Edit Profile starts the activity by selecting the profile menu then the system displays it, the user inputs the data that you want to change then the system will validate if yes then the database will save and update the profile, otherwise it will return to the profile menu.

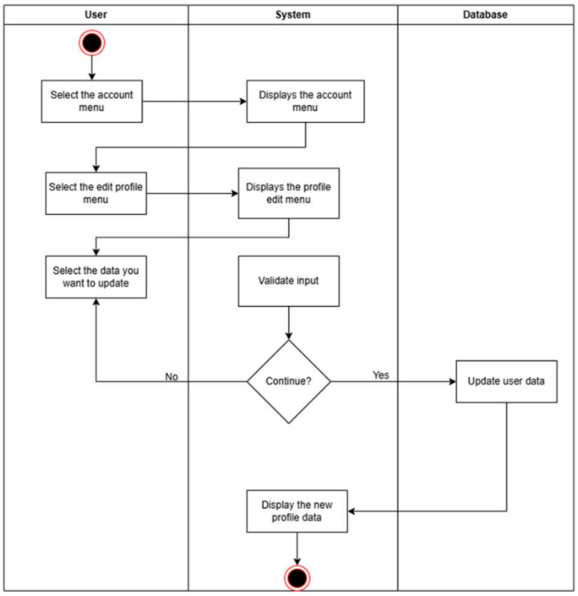


Figure 8. Activity Diagram Profile and Edit Profile

Activity Diagram Login Admin starts the activity when the admin opens the application by logging in first to be able to enter the dashboard page by entering email and password.

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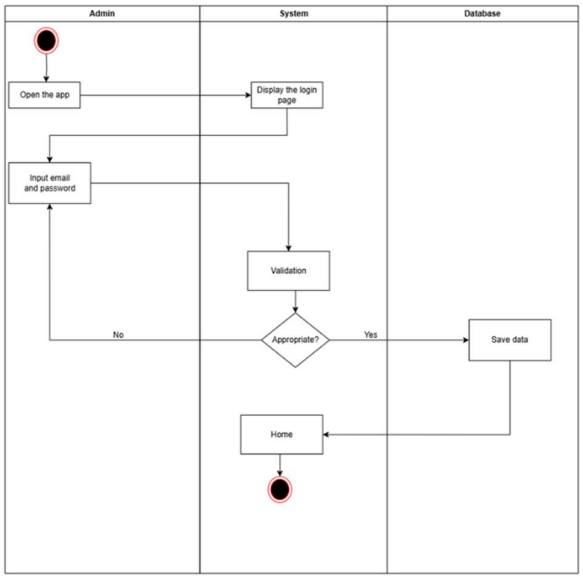

Figure 9. Activity Diagram Login Admin

Next Activity Delete Donation Data List. The activity starts when the admin chooses the donation category, the system will display it, the admin can delete the donation list data if yes then the database will delete the data, otherwise it will return to the donation data list page.

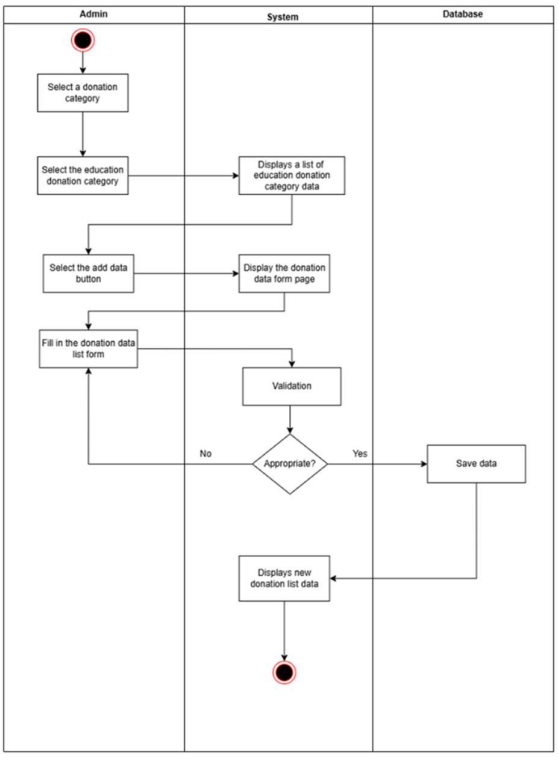

Figure 10. Activity Delete Donation Data List

Activity Diagram of Monitoring and Deleting User Donation History, starting from the admin selecting the history menu, the system displays the history menu, then the admin deletes the donation history and the system confirms if yes then the database will save and delete the history otherwise it will return to the history menu.

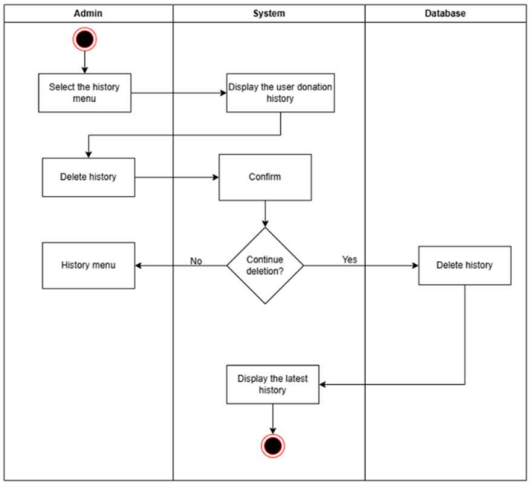

Figure 11. Activity Diagram of Monitoring and Deleting User Donation History

Sequence diagram is a diagram used to explain and display interactions between objects in a system in detail. The User Login Diagram Sequence starts when the user opens the application by logging in first to be able to enter the dashboard page by entering email and password.

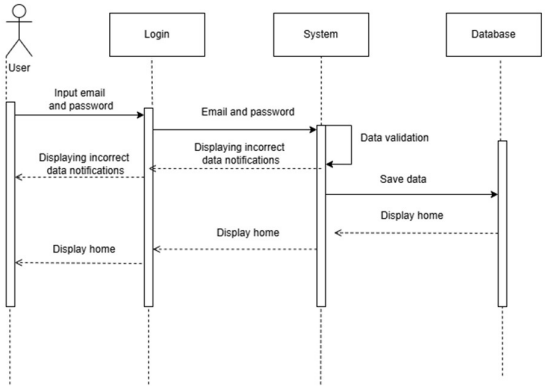

Figure 12. Sequence Diagram Login User

Furthermore, the user register sequence diagram starts from the user can enter the application by registering, by filling in the username, email and password after being validated by the system and checked by the database, then the user can enter the application which displays the dashboard page.

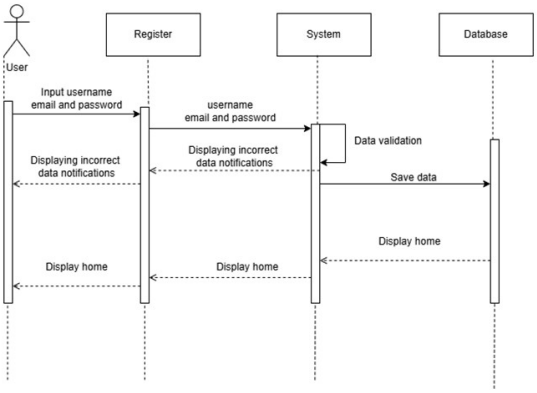

Figure 13. Sequence Diagram User Register

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Sequence Diagram History starts from the user selecting the donation category menu, then the user selects the donation category, then the user selects the donation data list, then it will enter the payment page, the user inputs the donation amount and chooses the payment method if the user has clicked the continue payment button, the system displays payment details in the form of a virtual account number if payment via mbanking can copy the virtual account number and make a payment, then the database saves and the system displays a successful payment.

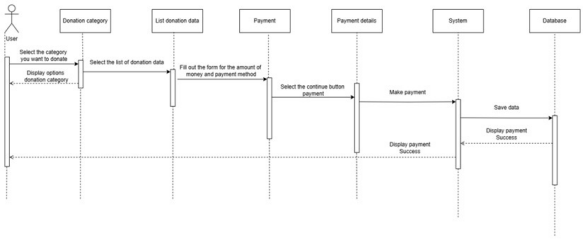

Figure 14. Sequence Diagram Payment

The User History Sequence Diagram starts when the user selects the history menu, the database will store and send the history data, then the system will display the history data.

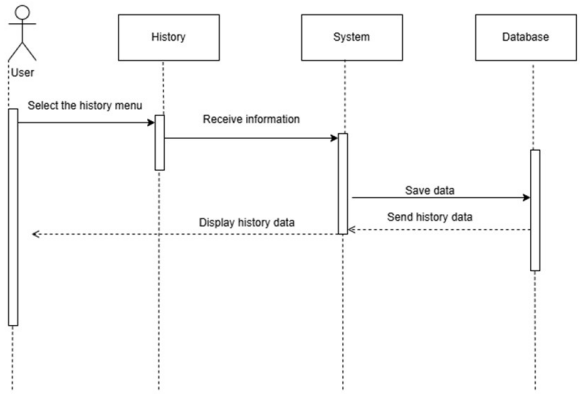

Figure 15. Sequence Diagram User History

The sequence diagram starts when the user selects the profile menu then the user inputs the data that he wants to change then the system will validate, if yes the database will save and update the profile, otherwise it will return to the profile menu.

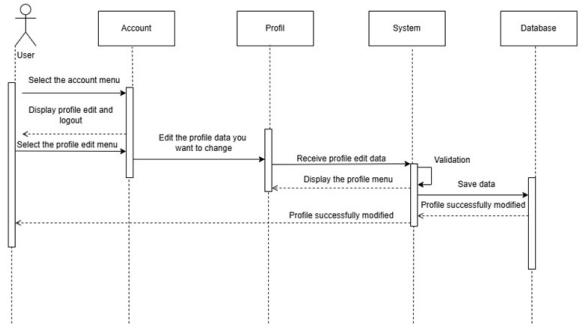

Figure 16. Account and Edit Profile Sequence Diagram

The Admin Login Diagram Sequence starts when the admin opens the application by logging in first to be able to enter the dashboard page by entering email and password.

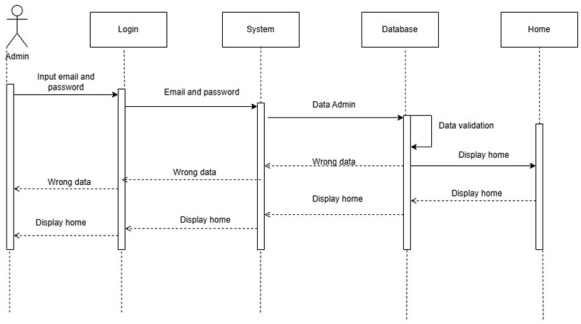

Figure 17. Sequence Diagram Admin Login

Sequence Diagram Delete Donation Data List starts when the admin enters the donation category page, then selects the list of data to be deleted, the system will validate if yes then the database will save the payment data and the system displays the data successfully deleted, otherwise it will return to the donation data list page.

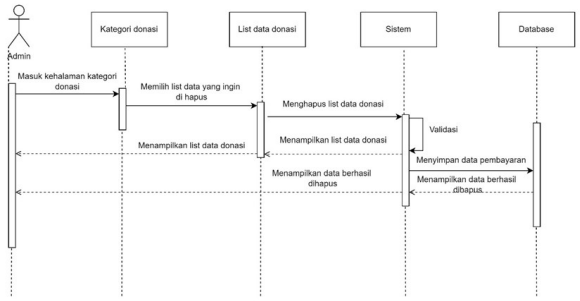

Figure 18. Sequence Diagram Delete Donation Data List

The Add Donation List Data Sequence starts when the admin enters the donation category page, then clicks the add list data button, then the admin fills in the list data form, the system will validate if yes then the database will save the payment and the system displays the data successfully deleted, otherwise it will enter the donation data form page.

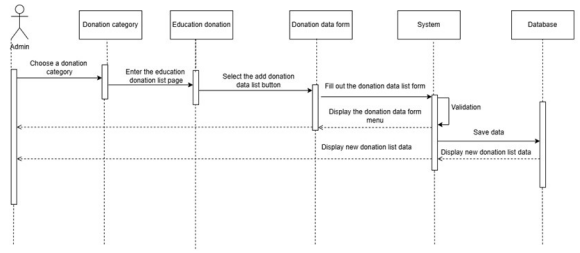

Figure 19. Sequence Diagram Add Donation List Data

Sequence diagram for Monitoring and Deleting User Donation History starts when the admin selects the history menu and deletes the user's donation history, the system will confirm the delete if yes then the database will delete and display the successful deletion, otherwise it will return to display the history menu.

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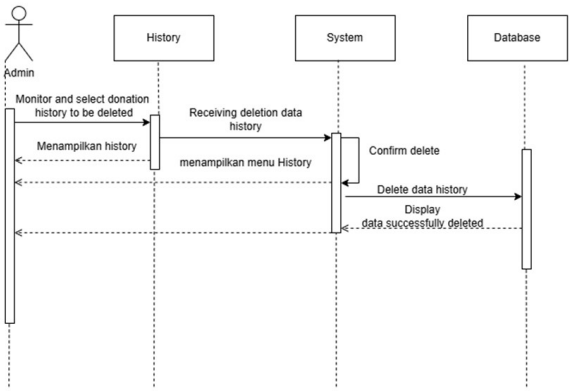

Figure 20. Sequence diagram for Monitoring and Deleting User Donation History

C. Implementation

The system created is then implemented in a mobile-based application by coding first. The implementation of the system interface can be seen as follows. Login page to log in first before entering the dashboard page. If the user does not have an account, it will be directed to register an account first.

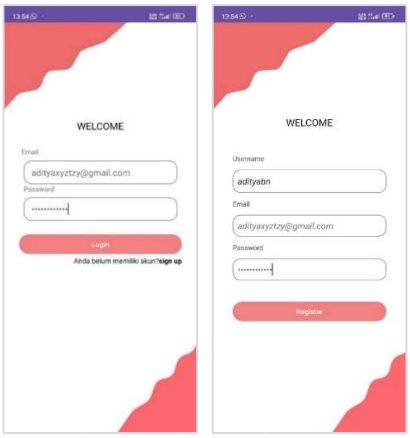

Figure 21. Login & Register Page

After successfully logging in, users can select the category to be donated. There are five donation categories, namely health donations, natural disasters, houses of worship, humanitarian, and education.

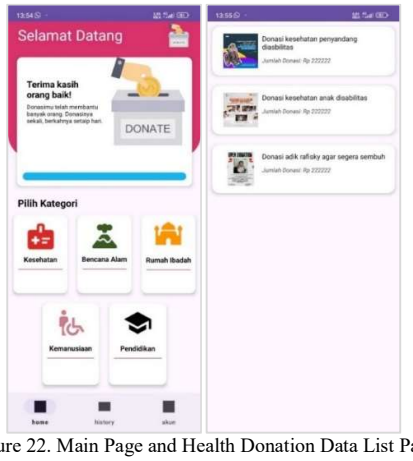

Figure 22. Main Page and Health Donation Data List Page

The next page lists the donation data. For example, from the natural disaster donation category. There is an add button that is useful for adding a list of data from natural disaster donations.

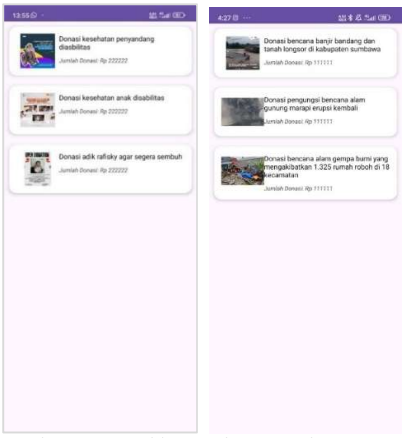

Figure 23. Health Donation Data List Page

The next is the implementation of the page of Worship Donation Data List Page and the Humanitarian Donation Data List Page.

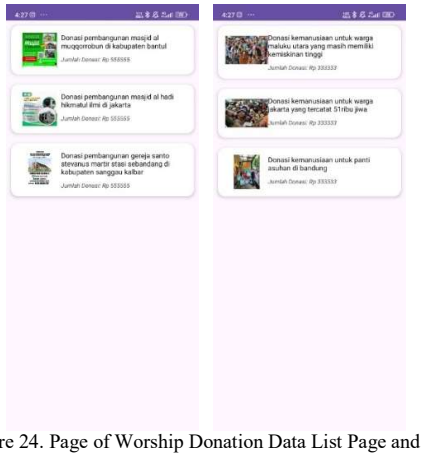

Figure 24. Page of Worship Donation Data List Page and the Humanitarian Donation Data List Page.

Next, donation page implementation and donation history page display

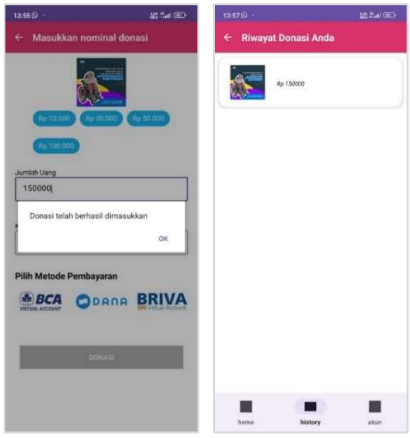

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Figure 25. Donation & Donation History Page

The account page is also equipped with a personal data editing feature.

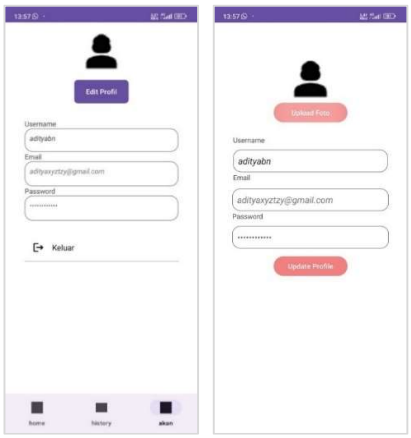

Figure 25. Account Page & Edit Page

Photo upload page with validation after photo is successfully updated.

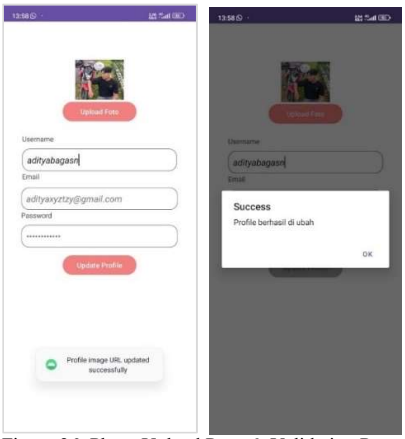

Figure 26. Photo Upload Page & Validation Page

The next stage is system testing using several scenarios created using the black box testing method. The test can be seen in the following table.

Table 1. Black Box Testing

No	Scenario	Expected Result	Status
1	Register yourself by filling in your username, email, and password, then click register.	The system will save the user data into the firebase realtime database, then the page will move to the main page.	[√]
2	Log in by filling in the correct email and password, then press login.	The system will save the user data into the firebase realtime database, then the page will move to the main page.	[√]
3	Log in by filling in the wrong email and password, then press login.	The system will refuse to enter the main page.	[√]
4	Log in without filling in your email and password, then press login.	The system will refuse to enter the main page.	[√]
5	Click the logout button.	The page will move to the login page and the user is asked to login again if they want to enter the application.	[√]
6	Select the health donation category	The page will move to the health donation data list and display the health donation data.	[√]
7	Select the natural disaster donation category	The page will move to the natural disaster donation data list and display the natural disaster donation data.	[√]
8	Select the house of worship donation category	The page will move to the list of donation data for houses of worship and display the donation data for houses of worship.	[√]
9	Select the humanitarian donation category	The page will move to the list of humanitarian donation data and display the humanitarian donation data.	[√]
10	Select the education donation category	The page will move to the education donation data list and display the education donation data.	[√]
11	The list of health donations can be entered on the payment page.	The page will move to the payment page according to the selected health donation list.	[√]
12	List data from natural disaster donations can enter the payment page	The page will move to the payment page according to the selected health donation list.	[√]
13	List data from donations to houses of worship can be entered into the payment page	The page will move to the payment page according to the selected health donation list.	[√]

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14	List data from humanitarian donations can enter the payment page	The page will move to the payment page according to the selected health donation list.	[√]
15	List data from education donations can enter the payment page	The page will move to the payment page according to the selected health donation list.	[√]
16	Click the button to select the amount of money to donate	When you click on the donation amount option, you can enter the form to fill in the amount of money.	[√]
17	Fill in the donation amount with a minimum of Rp. 10,000 and click the donate button	Firebase realtime database will save the donation data and then send it to the donation history and when clicking the donation button a pop up will appear "donation has been successfully entered".	[√]
18	Select a payment method and click the continue payment button on the payment page.	The payment method has a spinner to select the payment method and the page will move to the transaction details.	[X]
19	Click the "<" button on the transaction details page	Return to the payment menu.	[X]
20	Click the "<" button on the payment page	Return to the donation data list menu.	[√]
21	Click the "<" button on the donation data list page	Return to the dashboard menu .	[√]
22	Click the history button and display the donation history	The page will switch to donation history and the system will display the donation history.	[√]
23	Click the account button and display the account menu	The page will move to the account page and the firebase realtime database will save the register data then the system displays the username, email and password on the account page.	[√]
24	Click the edit profile button	The page will move to the profile edit page	[√]
25	Click the photo upload button and edit the username	The page will display a choice of image sources from the camera or gallery and can upload photos and can fill in the username form.	[√]
26	Click the profile upload button	The page will issue a pop up "profile successfully changed" and move to the account page. Thedatabase will save and update the data by changing the account photo and username.	[√]
27	Click the "<" button on the profile edit page	The page will move to the account.	[√]

Based on the scenarios that have been tested, it can be seen that there are 27 scenarios tested with the results of 25 successes and 2 failures. So it can be stated that the percentage of applications running smoothly is 92.5%.

IV. CONCLUSION

This research was conducted to overcome problems related to donation money. Problems that are the reason for this research such as the lack of a trusted donation platform and to streamline donation time. To overcome this problem, a system was developed using the Rapid Application Development method which prioritizes rapid system development. Kotlin and Firebase were used in the development of the system. This research produces an application that has several excellent features. Supporting features needed are top up features that make it easy for users to make donations without opening third-party applications, the appearance of the application also affects the user experience that is more attractive and payments through virtual accounts or e-wallets that make it easier for users to donate. The system can also select institutions or foundations that have a good reputation in providing donations to people in need.

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