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UI/UX Design of Mobile Platform-Based Blood Donor Application Using User Centered Design Method

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ABSTRACT

Currently, there are many mobile-based blood donor applications available or various other platforms with the Indonesian Red Cross (PMI) as the center of the application, this is not in accordance with the situation in Sangihe Islands Regency where the blood transfusion process is still going directly to the hospital by searching for donors. through direct communication, via telephone, chat, or social media, for that, we need a UI/UX Design for a Mobile-Based Blood Donor Application in the form of an application prototype that adapts to the conditions and habits of users in the Sangihe Archipelago Regency. For this reason, it is necessary to design a mobile-based blood donor application that is right on target to be applied to users in Sangihe Islands Regency. This study aims to design a Mobile-Based Blood Donor Application with UI/UX Design in each stage of its manufacture involving users to get optimal results with the User Centered Design method.

1. Introduction

Blood is one of the most important components in the human body that has many functions. Platelets and blood plasma are blood components that have an important role as the first defense against diseases that enter the body. Blood transfusion is a part of health services that contains information on available blood stocks, and how to interrupt . Blood donation is the transfer of blood or a blood component from a healthy person (donor) to another sick person (recipient). The main purpose of blood donation is twofold. The first is to increase the amount of blood circulating in the body of a sick person whose blood is reduced for some reason. The second purpose is to increase the ability of the sick person's body to carry acid or O2 (Oxygen) (Rosove, 2024).

The delivery of blood donor information and services to the community is still done traditionally, as well as through social media and blood donor applications which are sometimes less effective due to various reasons. Many people who need blood or want to donate blood do not know information about blood stocks or recipients who need blood . With the development of technology that utilizes smartphones in various fields, it can help overcome blood stock deficits in various regions. In this research, a blood donor information system is proposed in a mobile application (Nurhidayatulah et al., 2019; Sudipa et al., 2020) . User interface (UI) is a form of graphical display that is directly related to the user. UI serves to connect users with the application so that users can use it easily (Fanani et al., 2024; Malik & Frimadani, 2022). UX is all aspects of how people use interactive products such as how when they use it, how well they understand how it works, how they feel about it while they use it, how well it serves their purpose, and how well it fits the context in which they use it so as to create

a broader relationship between the product and the user to investigate the individual's personal experience in its use.

There are many approaches to designing the UI/UX of a mobile application or other platform, one of which uses the User Centered Design (UCD) method which is a more focused and concise version of human-centered design, with a more in-depth analysis of the target user (Ahyati et al., 2024; Kwon et al., 2021; Virvou, 2023). Application development focuses on users running the application according to user habits, and some of the psychology that arises when users interact with the application . Currently, there are many blood donor applications available both mobile-based and various other platforms with the Indonesian Red Cross (PMI) as the center of the application, this is not in accordance with the situation in the Sangihe Islands Regency where the blood transfusion process is still directly to the Hospital by searching for donors through direct communication, via telephone, chat or social media, for this reason a Mobile-Based Blood Donor Application UI / UX Design is needed in the form of an application prototype that adapts to the circumstances and habits of users in the Sangihe Islands Regency.

2. Literature

The design of a mobile platform-based blood donor application utilizing the User-Centered Design (UCD) methodology is essential for enhancing user engagement and increasing blood donation rates. UCD emphasizes understanding the needs, preferences, and behaviors of users throughout the design process, ensuring that the final product is tailored to meet their expectations and improve usability.

Recent studies have highlighted the necessity of incorporating user feedback into the development of blood donation applications. For instance, Yuan et al. conducted an analysis of existing blood donation mobile apps, revealing that many do not adequately address the needs and preferences of potential donors (Yuan et al., 2018). This gap underscores the importance of UCD in designing applications that resonate with users. Furthermore, a systematic review by Li indicates that favorable perceptions of blood donation apps are influenced by demographic factors, suggesting that user-centered approaches must consider diverse user backgrounds to enhance engagement (Li, 2023).

Gamification has emerged as a promising strategy to motivate users (Aristana et al., 2024), particularly younger demographics, to participate in blood donation. Sari's research on the Gamified Blood Donation (G-BlooD) application illustrates how integrating gamification elements can significantly enhance user interaction and encourage routine donations (Sari, 2024). This aligns with findings from Potgieter and Rensleigh, who emphasize the need for features that resonate with user preferences, such as scheduling and social sharing capabilities. By employing UCD principles, developers can create engaging experiences that not only inform users but also motivate them to donate blood.

Location-based services are another critical aspect of modern blood donation applications. Iparraguirre-Villanueva et al. demonstrated that a location-based app could increase donor numbers by nearly 40% while significantly reducing the time required to find donors (Iparraguirre-Villanueva et al., 2022). This finding highlights the effectiveness of integrating practical features that address logistical challenges faced by both donors and blood banks. Such functionalities should be developed with user input to ensure they meet real-world needs.

Moreover, social media's role in enhancing donor engagement cannot be overlooked. Alanzi's study indicates that personal connections and social media interactions are key motivators for blood donation (Alanzi, 2023). By leveraging these platforms within the app, developers can create a community around blood donation, fostering a sense of belonging and encouraging repeat donations. This aligns with the findings of Alotaibi et al., who advocate for the integration of social media strategies to enhance donor recruitment and retention (AlOtaibi et al., 2021).

In summary, the design of a mobile blood donor application using UCD principles must prioritize user needs, incorporate gamification, utilize location-based services, and leverage social media. By synthesizing these elements, developers can create an effective platform that not only facilitates blood donation but also fosters a supportive community of donors.

3. Research Method

3.1. Materials and
Research Materials

The materials used in this study consisted of:
1) Blood Donation App Design
2) Illustration Design of Blood Donation Activity
3) Photo of Blood Donation Activity
4) Recipient Data
5) Donor Data
6) Standard Blood Donor Service in Hospital
7) User Response and Feedback as a Recipient
8) User Response and Feedback as a Donor

Research Tools

The tools used in this study consist of:
1) Figma app for prototyping and designing app UIs
2) User Experience Questionnaire (UEQ) for UX assessment

3.2. Research Procedure

The procedure in this research uses the User Centered Design (UCD) approach which consists of:
1) Understand Context of Use

This stage is carried out to understand the usefulness of the application, starting with analyzing and designing the initial things that become the main features in the Mobile-based Blood Donor application in accordance with the procedures for implementing blood transfusions in the hospital.
2) Specify User Requisites

This stage is carried out to detail the needs of End Users from the Donor side how to contact the recipient or his companion as well as the details and technical needs in blood donation. From the recipient's side, details are carried out on how to find a suitable donor and the needs that will be requested and how to communicate.
3) Design Solutions

This stage is done to create a design solution based on the previous two stages.
4) Evaluate against Requirements

This stage is carried out to evaluate the results of the design that has been made, evaluation and assessment are carried out on End Users both donors and recipients using UEQ. The UEQ results must be with optimal UX results, if it has not met the target then it must return to the previous stages.

4. Results and Discussions

This research uses the Human Centered Design (HDC) method with two development models, namely Understand Context of Use and Specify User Requirements, which are as follows.

4.1 Understand Context Of Use

The application to be built is able to provide data and communicate with each other between recipients / relatives of recipients and donors who are in the vicinity or who are able to reach the hospital or location of the donation site. The application must have features for finding the right donor with the recipient's blood type, detailing the number of blood bag needs, fulfilled blood bags, and unfulfilled blood bags.

4.2 Specify User Requirements

Detailing user needs is done by conducting a survey to 100 people using both fill-in forms and direct interviews. From the results of surveys and interviews, it was found that several things were missing in additional features such as:
1) Recipient data search for donor users who want to donate blood.
2) Donor search by relatives/siblings of the recipient
3) Gather information about donation activities from users
4) News related to blood donation activities
5) Validation of donation from the recipient
6) Willingness or permissibility to donate blood and donor privacy.

In addition, in terms of appearance, it must also adjust to be used in multi-platforms on mobile operating systems, designs with comfortable colors and designs that are easy to use, and easy to understand.

4.3 Design Solutios

At this stage there are 3 (three) parts consisting of information architecture, design and workflow or application workflow designed using Figma software or platform.

1. **Information Architecture (IA)**
   Information Architecture (IA) on the blood donor application is needed to ensure that this application meets the planning criteria that have been determined through initial surveys and interviews. IA is made to organize the information content in the application. at this stage it is divided into 6 (six) sections consisting of :
   a) Splash Screen and Login
   The splash screen contains initial information and the name of the application, the splash screen appears when the user opens the application and with the duration of the screen spash for 2 seconds or until the user connects to the application server. Screen splash can be seen in Figure 1.

Fig.1. Splash Screen and Login

   b) Home
   This stage explains the initial navigation on the application home page. Navigation contains the main menu and additional features that can be seen in Figure 2.

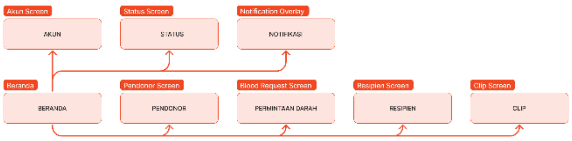

Fig.2. Home

   c) Donor Search
   This stage explains the navigation that can be done if the user is on the donor screen. Navigation contains the main menu and additional features that can be seen in Figure 3.

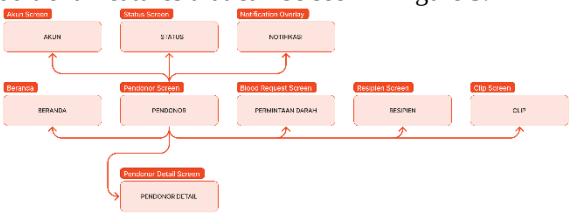

Fig.3. Donor Search

   d) Blood Demand
   This stage explains the navigation that can be done when the user is on the blood request screen. The one-way navigation is shown in Figure 4.

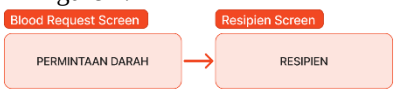

Fig.4. Blood Demand

   e) Recipient Search
   This stage explains the navigation that can be done when the user is on the recipient screen. The navigation contains the main menu and additional features which can be seen in Figure 5.

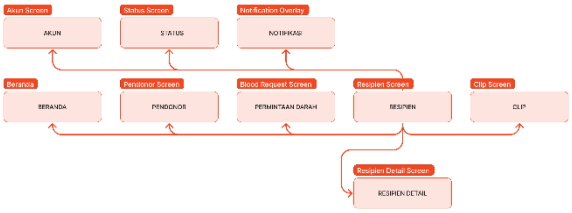

Fig.5. Recipient Search

f) Donor Validation
This stage explains the navigation that can be done if the user to validate the donor. The navigation is focused and ended on the user screen clip which can be seen in Figure 6.

Fig.6. Donor Validation

2. Design
After the IA is complete, proceed with making a screen design as a real picture of the application to be made.
a) Screen Splash

The splash screen contains initial information and the name of the application, the splash screen appears when the user opens the application and with the duration of the screen spash for 2 seconds or until the user connects to the application server. Screen splash can be seen in Figure 7.

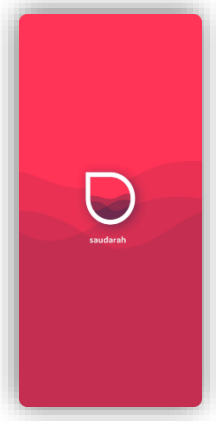

Fig.7. Screen Splash

b) Login Screen
The login screen is done to enter the account of the user, so that users do not need to register, the use of login uses a login with a Google account which can be seen in Figure 8.

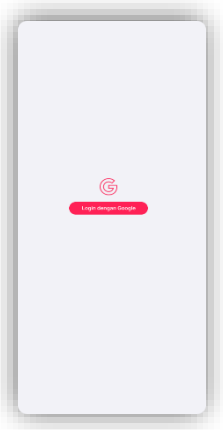

Fig.8. Login Screen

c) Screen Home

The home screen is the main page or homepage of the application, the home screen contains navigation for account settings, donor status settings, notifications, news or news, the latest recipients who need donors, the latest donors who have just donated and the main menus of the application, namely the homepage, donor search, blood requests, recipient search, and clips that summarize user activities seen in Figure 9.

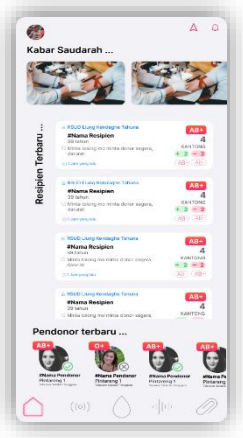

Fig.9. Home Screen

d) Screen Donor

The donor screen is a page to search for donors based on the required blood type. There are donors with the appropriate blood type and rhesus and alternatives. The donor screen also contains navigation for account settings, donor status settings, notifications, news or news, the latest recipients who need donors, the latest donors who have just donated and the main menus of the application, namely the homepage, donor search, blood requests, recipient search, and clips that summarize user activities seen in Figure 10.

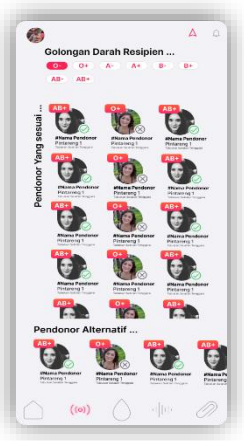

Fig.10. Donor Screen

e) Screen Blood Request
The blood request screen is a screen for making blood requests that contains the hospital where the blood is transfused, the recipient's profile, contact person, recipient's blood type, alternative blood type, the number of blood bags needed, the number of blood bags fulfilled, the number of blood bags that are still lacking and a message to the donors seen in Figure 11.

Fig.11. Blood Request Screen

f) Screen Recipient
The recipient screen is a page to search for recipients based on the blood type of the donor. There are recipients with the appropriate blood type and rhesus and alternatives. The recipient screen also contains navigation for account settings, donor status settings, notifications, news or news, the latest recipients who need donors, the latest donors who have just donated and the main menus of the application, namely the homepage, donor search, blood requests, recipient search, and clips that summarize user activities seen in Figure 12.

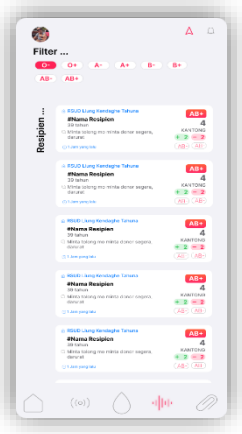

Fig.12. Recipient Screen

g) Screen Clip

Screen clip is a page that summarizes user activities in the application that records the number of donations, ranking, number of blood requests, validation requests, donor validation, donations to recipients that have been made, blood requests that have been made. The screen clip also contains navigation for account settings, donor status settings, notifications, news or news, the latest recipients who need donors, the latest donors who have just donated and the main menus of the application, namely the homepage, donor search, blood requests, recipient search, and clips that summarize user activities seen in Figure 13.

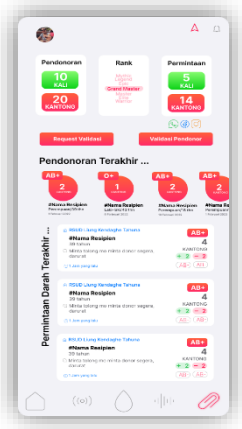

Fig. 13. Screen Clip

h) Screen Status

The status screen is a setting whether the user is able and willing to donate blood at that time, as well as hospitals that can be reached to donate blood and messages to recipients as shown in Figure 14.

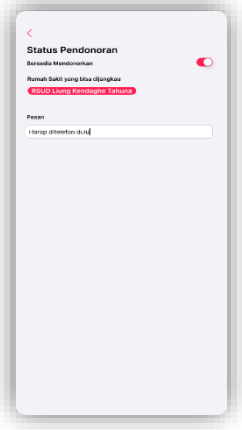

Fig. 14. Status Screen

i) Account Screen

The account screen contains the account settings of the application user which contains the user's profile, contacts, and blood type which can be seen in Figure 15.

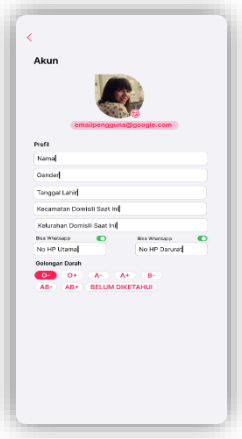

Fig.15. Account Screen

j) Screen Blood Request Detail

The blood request detail screen is a screen to view the details of the blood request which contains the hospital where the blood is transfused, the recipient's profile, contact person, recipient's blood type, alternative blood type, the number of blood bags needed, the number of blood bags fulfilled, the number of blood bags that are still lacking and a message to the donors as shown in Figure 16.

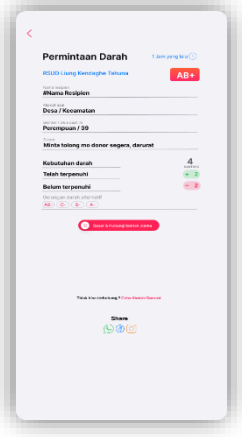

Fig.16. Screen Blood Request Detail

k) Validation Request Screen

The validation request screen is a page that contains features for donors to request validation to the recipient or relatives of the recipient after donating. This page contains information from the patient who has been donated and generates a validation code which will later be sent to the account that made the blood request which can be seen in Figure 17.

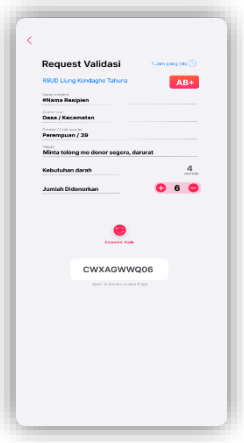

Fig.17. Validation Request Screen

l) Donor Validation Screen

The validation screen is a page that contains features for recipients or their relatives to validate the donor who has donated. This page contains information from the patient who has been donated and enters the validation token that has been sent by the donor to the account that made the blood request which can be seen in Figure 18.

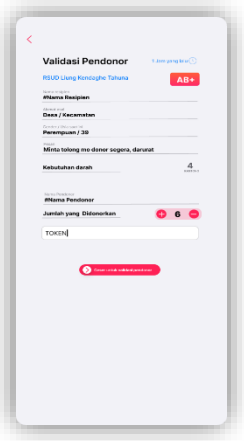

Fig.18. Donor Validation Screen

m) Donor Details Screen

The donor details screen contains donor detail data along with the status of the donor about the location of the hospital that can be reached and the message from the donor which can be seen in Figure 19.

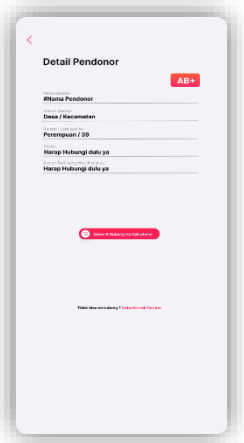

Fig.19. Donor Details Screen

n) Notification Overlay
The notification overlay is a display that appears on the screen that contains a notification if there is a donation request that matches or alternates with the donor's blood type which can be seen in Figure 20.

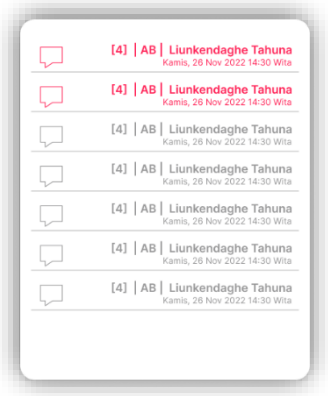

Fig.20. Notification Overlay

3. Workflow

The workflow of the application explains how all the information flow and functions of the application work. Workflow explains the navigation function of each application item that is clicked and will lead to a specific screen or overlay. Details of the workflow can be seen in Figure 21.

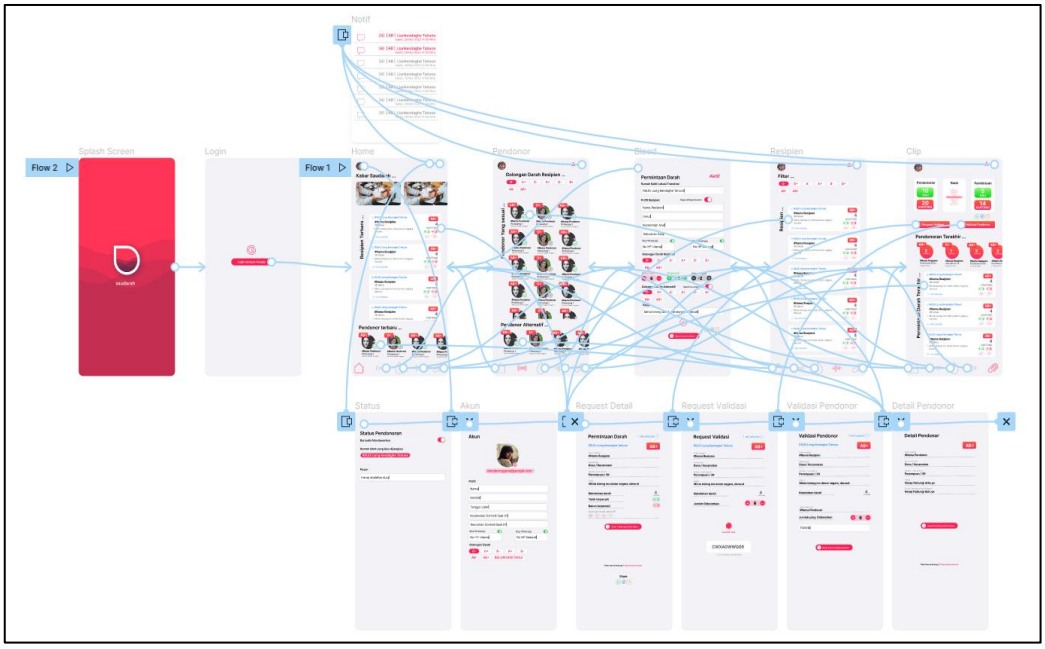

Fig.21. Workflow

4.4 Evaluate Against Requirements

Testing was conducted on 50 participants. Testing uses Figma for Android to run the prototype. The scenario is divided into 3 (three) parts, namely Login and Account Scenario, Main Feature Scenario, and Additional Feature Scenario. In this test, the average time in seconds, error rate and success rate are measured.

1. Login and Account Scenario

Testing of the login scenario was obtained without errors for all features with 100% success and with an average time for Login of 10 seconds, Account Setting 7.1 seconds, and Status Setting 8.14 seconds. These details can be seen in Table 1.

Table 1 . Account Login Scenario

	Login	Account Settings	Setting Status

	Second	Wrong	Second	Wrong	Second	Wrong
1	9	0	10	0	12	0
2	5	0	8	0	4	0
3	12	0	4	0	7	0
4	14	0	6	0	4	0
5	8	0	6	0	8	0
6	14	0	10	0	8	0
7	4	0	6	0	12	0
8	7	0	7	0	7	0
9	14	0	7	0	4	0
10	10	0	6	0	4	0
11	11	0	9	0	10	0
12	13	0	9	0	6	0
13	15	0	7	0	12	0
14	8	0	9	0	5	0
15	15	0	6	0	12	0
16	11	0	7	0	4	0
17	12	0	7	0	6	0
18	14	0	5	0	7	0
19	8	0	10	0	11	0
20	4	0	9	0	12	0
21	15	0	8	0	8	0
22	5	0	6	0	8	0
23	15	0	8	0	6	0
24	7	0	10	0	5	0
25	14	0	6	0	4	0
26	13	0	8	0	7	0
27	15	0	9	0	12	0
28	9	0	5	0	7	0
29	9	0	6	0	10	0
30	5	0	5	0	5	0
31	6	0	6	0	5	0
32	4	0	4	0	12	0
33	15	0	9	0	11	0
34	10	0	6	0	8	0
35	14	0	7	0	4	0
36	11	0	10	0	7	0
37	4	0	10	0	8	0
38	9	0	9	0	11	0
39	9	0	9	0	11	0
40	8	0	7	0	11	0
41	13	0	5	0	6	0
42	9	0	4	0	12	0
43	8	0	5	0	10	0
44	8	0	4	0	8	0
45	14	0	5	0	10	0
46	7	0	10	0	12	0
47	4	0	8	0	12	0
48	13	0	6	0	4	0
49	6	0	8	0	12	0
50	8	0	4	0	5	0
	R Time	10	R Time	7,1	R Time	8,14
	T Failed	0	T Failed	0	T Failed	0
	T Successful	50	T Successful	50	T Successful	50

2. Main Feature Scenario

Tests on the main feature scenarios were obtained without errors for all features with 100% success and with an average time for Donor Search 9.54 which is 10 seconds, Blood Request 7.26 seconds, and Recipient Search 8.44 seconds. These details can be seen in Table 2.

Table 2. Main Feature Scenario

	Login	Account Settings	Setting Status

	Second	Wrong	Second	Wrong	Second	Wrong
1	6	0	10	0	11	0
2	11	0	7	0	6	0
3	15	0	10	0	9	0
4	10	0	9	0	11	0
5	5	0	5	0	6	0
6	4	0	9	0	12	0
7	8	0	7	0	11	0
8	13	0	8	0	9	0
9	6	0	10	0	7	0
10	5	0	4	0	5	0
11	6	0	7	0	8	0
12	13	0	8	0	6	0
13	9	0	9	0	9	0
14	12	0	10	0	12	0
Participan ts	**Login**		**Account Settings**		**Setting Status**	
	Second	**Wrong**	**Second**		**Second**	**Wrong**
15	11	0	8	0	11	0
16	12	0	7	0	7	0
17	10	0	10	0	7	0
18	9	0	8	0	8	0
19	15	0	7	0	8	0
20	6	0	9	0	7	0
21	6	0	6	0	11	0
22	5	0	7	0	4	0
23	11	0	5	0	11	0
24	5	0	6	0	9	0
25	10	0	7	0	7	0
26	11	0	6	0	8	0
27	6	0	6	0	9	0
28	9	0	5	0	6	0
29	12	0	5	0	5	0
30	14	0	6	0	11	0
31	11	0	9	0	4	0
32	8	0	7	0	10	0
33	8	0	7	0	6	0
34	14	0	5	0	12	0
35	14	0	8	0	8	0
36	15	0	10	0	10	0
37	8	0	9	0	4	0
38	10	0	10	0	11	0
39	8	0	8	0	5	0
40	6	0	4	0	5	0
41	14	0	4	0	9	0
42	4	0	5	0	12	0
43	14	0	10	0	10	0
44	10	0	9	0	10	0
45	10	0	9	0	7	0
46	13	0	5	0	9	0
47	11	0	4	0	6	0
48	8	0	4	0	10	0
49	12	0	10	0	11	0
50	4	0	5	0	12	0
	R Time	9,54	R Time	7,26	R Time	8,44
	T Failed	0	T Failed	0	T Failed	0
	T Successful	50	T Successful	50	T Successful	50

3. Additional Feature Scenarios

Testing of additional feature scenarios is obtained without errors for all features with 100% success and with an average time for Clip of 9.2 seconds, Request Validation 7.08 seconds, Donor Validation 8.12 seconds, and Notification 5.3 seconds. These details can be seen in Table 3.

Table 3. Additional Feature Scenario

Fe a	**Login**	**Account Settings**	**Setting Status**

	Second	Wrong	Second	Wrong	Second	Wrong
1	13	0	8	0	8	0
2	6	0	8	0	12	0
3	6	0	4	0	5	0
4	4	0	10	0	10	0
5	6	0	6	0	5	0
6	10	0	8	0	4	0
7	12	0	7	0	8	0
8	4	0	6	0	4	0
9	15	0	9	0	12	0
10	10	0	5	0	9	0
11	14	0	7	0	8	0
12	14	0	6	0	8	0
13	13	0	10	0	11	0
14	10	0	7	0	9	0
15	4	0	8	0	6	0
16	9	0	4	0	10	0
17	11	0	4	0	5	0
18	5	0	8	0	6	0
19	12	0	10	0	8	0
20	4	0	6	0	7	0
21	13	0	5	0	11	0
22	5	0	8	0	7	0
23	15	0	7	0	5	0
24	4	0	4	0	12	0
25	7	0	9	0	5	0
26	8	0	7	0	12	0
27	13	0	8	0	7	0
28	15	0	9	0	9	0
29	9	0	5	0	10	0
30	5	0	10	0	7	0
31	4	0	7	0	6	0
32	15	0	6	0	5	0
33	10	0	8	0	9	0
34	15	0	6	0	9	0
35	5	0	4	0	10	0
36	5	0	9	0	4	0
37	12	0	7	0	10	0

5. Conclusion

The conclusion obtained from the results of this study is that the design made is in accordance with user needs and without errors that occur during the prototype testing process, each - each feature of this application design takes time starting from the fastest, which is 5.3 seconds, and the longest with a duration of 10 seconds, with an average access time of 7.85 seconds for users who have just seen this prototype with 1 trial at the beginning and a brief explanation of the icon of the main menu.

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