



Goal Directed Design Method Application on UI/UX of Dua Mata Mobile Apps

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Abstract

Purpose: Dua Mata is a mobile and website-based community service application intended for residents of South Kuta. Evaluation of existing designs is needed to assess whether the user interface design can provide user satisfaction. The aim of this paper is to evaluate the UI/UX of Dua Mata using the QUIM method.

Methods: Research, Modeling, requirement definition, Framework Definition, and Refinements are the steps of the GDD method. The QUIM method aims to prioritize indicators that need to be fixed in the old design: Resource Utilization, Minimal Memory Load, and Security. Modeling determined respondents who will do the second test and in the requirement definition stage scenarios are chosen. The selected scenario is registering, forgetting passwords, searching directories, ordering, and adding services. The framework definition and refinement is the stage of making a wireframe then prototype and tested

Result: The test results showed a big decrease in the scenario completion time by 39.41 seconds in the register scenario. The score on the Resource Utilization indicator has increased by 8 points, the Minimum Memory Load indicator is 9 points and the Security indicator is 6 points.

Novelty: The novelty is that the increasing of the Resource Utilization indicator indicates the new design has a higher level of user satisfaction than the old design.

Keywords: Goal Directed Design, Quality in Use Integrated Measurement, User Experience, User Interface

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INTRODUCTION

The need for mobile-based apps today is increasing along with the widespread use of smartphones in various circles and with various needs. As stated in [1], smartphone users in Indonesia ranked at the top with 93.9% internet access penetration of daily users. As stated by [2], internet user growth, especially mobile device users, reached 37,12% per year. This can be interpreted as people likely use mobile for internet access because it is easy to use. The fierce competition between mobile apps demands the apps to offer more features, attractive visual display, and simple to use. The purpose is to leave a good impression on the users and make them come back to use their application more. It isn't only about pleasing the eye, but a good user experience can bring economic benefits over competitors in the long term [3]. The way to know an app's user experience will fulfill the user's need and give a good experience is to evaluate the usability of the app [4]. Dua Mata is a mobile-based community service application intended for residents of South Kuta. This application helps community services in managing administrative documents, information about police stations, family welfare empowerment groups, schools, and other facilities within South Kuta. As an application that many people will use, a good display design is also needed by the Dua Mata so that users of the South Kuta can easily use this application. Evaluation is then needed to measure whether this application has an attractive and interactive design, assess the deficiencies, and improve the design that causes a bad impression. One method that can be used to evaluate UI design is the GDD method.

Research on user interface evaluation with Goal Directed Design has been carried out by [5] with improvements to the user interface design of the Jawa Timur Park Group website. The System Usability Scale (SUS) used to assess the design. The results obtained from the final evaluation are an average value of 82.75 and are included in the acceptable category in acceptability ranges, category B in the grade scale,

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the excellent category in the adjective rating, and getting grade A in the percentile rank results. With that the newly design website can be accepted and assessed by both stakeholders and general users.

Subsequent research conducted by [6] which discusses the improvement of the website at The Royale Krakatau Hotel Cilegon, which has several obstacles, namely Unattractive user interface design, complicated website flow, the main menu that hard to find, illegible text, too large image size, and inappropriate content placement. The results of the evaluation using the Quality in Use Integrated Measurement (QUIM) method show that problems with a high priority level of repair are found in the variables of effectiveness, satisfaction, and universality. The redesign was carried out using the Goal Directed Design (GDD) method with the steps of Research, Modeling, Requirement Definition, Framework Definition, and Refinement. The results of the final evaluation on the redesigned website carried out on respondents using the QUIM method. The average value obtained is 3.7 on the Likert scale, with the rating scale instrument form having a rating of 1 to 4, a value of 3 means it is quite good and there are no significant problems.

The method of implementing GDD with the QUIM questionnaire was then mostly taken from existing research. This paper will use GDD methods to fix the mobile user interface problems because there aren't any papers found yet by using this method with QUIM questionnaire on a community service mobile application. It mostly evaluates the UI of a particular website. The questionnaire with QUIM method will be used to find the problems in the old design. It is hoped that by evaluating the UI / UX of this application, users can use the application more easily thus attract the attention of other new users and it is because the Dua Mata's UI has never been evaluated before with any method, this paper will open a path to future researches using a different kind of method so the result can be compared to each other.

METHODS

This section will describe the research steps used to achieve the desired results. It will focus on discussing the initial steps of research in the form of evaluating old designs. The modeling stage until the refinement stage is discussed briefly and will be discussed in detail in the Results and Discussion.

Research Scenario

As Figure 1, this study will apply the Goal Directed Design method in improving the user interface in the Dua Mata mobile apps. Goal Directed Design's steps are varied from one research to another as stated in [3], [7] and [8], but mostly they consist of these 4 steps. The Research step is the use of questionnaires based on the QUIM criteria distributed to assess the user experience of running the existing UI and produce quantitative data processed using SPSS. Qualitative data is also obtained through interviews when the user performs the following scenarios. The modeling step is when the user personas are selected, also as a reference in selecting certain scenarios to be improved, and provides information needs for design purposes. The requirement definition stage is the selection of scenarios determined based on the results of the questionnaire, the completion time of the scenario, and the user persona. The framework definition step is where a wireframe is created based on the selected features of the selected scenario. There are three stages in, refinement step, first making a prototype, testing the prototype, and final evaluation with analyzing the test results. The second test then compares whether there are more problems related to the previous user interface. Improvement is considered successful if the post-improvement questionnaire score is better than the first test questionnaire score.

The research flow was showed in Figure 1.

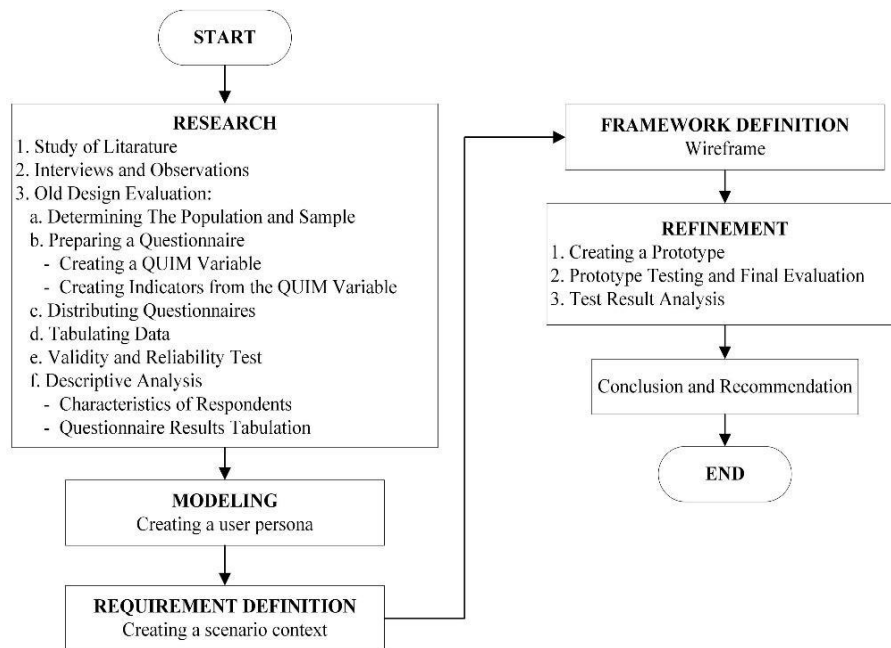


Figure 1. Research flow

Quality in Use Integrated Measurement

In the Goal Directed Design method, the QUIM (Quality in Use Integrated Measurement) standard is used as a consolidation model for usability. QUIM can describe a method to determine the quality requirements of a product [10]. As Table 1 shows, there are 10 assessment factors used in QUIM as described in the journal "User interface recommendations for the Telkom Freshman Selection (SMB) Mobile Application using the Goal Directed Design Method" conducted by [11].

Table 1. QUIM assessment variable

No.	Assessment Components	Description
1.	Efficiency	The extent to which the user feels that the application can help in the job.
2.	Effectiveness	Allows the user to achieve specific tasks with accuracy and completeness.
3.	Satisfaction	Refers to subjective responses from users about how they feel when using the Dua Mata app.
4.	Productivity	Focusing the amount of useful output obtained from user interaction with the application.
5.	Learnability	A measure of user satisfaction by how easy the application is mastered or how easy it is for new facilities in the application to be learned.
6.	Safety	Regarding whether the application limits the risk of harm to people or other resources, such as hardware or stored information/error prevention.
7.	Trustfulness	Refers to information provided in the application are trustworthy or not.
8.	Accessibility	Refers to the ability of an application whether it can be used by people with physical limitations.
9.	Universality	Concerns whether the application accommodates the user's diversity with different behavior and cultural backgrounds.
10.	Usefulness	Refers to whether the application is useful in dealing with problems received by the user and how practically the application supports the user's task.

The factors are attributes or characteristics of the user interface that users see and understand when assessing a product. The user defines the quality of a software product in their language and is not easy to measure and see specifically. A factor can then be formulated into sub-factors or criteria. Like other models, criteria are sub-factors or sub-characteristics of a software product. The criteria are specified and defined in the language of the software developer, so it is quite difficult for general users to understand the technical terms covered in the description. The following is the relationship between the QUIM factors and indicators, as shown in Figures 2 [12] and [13].

Criteria	Factors									
	Efficiency	Effectiveness	Satisfaction	Productivity	Learnability	Safety	Trustfulness	Accessibility	Universality	Usefulness
Time behavior	+			+						
Resource utilization	+			+						+
Attractiveness			+						+	
Likeability			+							
Flexibility		+	+					+	+	+
Minimal action	+		+		+			+		
Minimal memory load	+		+		+			+	+	+
Operability	+		+				+	+		+
User guidance			+		+			+	+	
Consistency		+			+	+		+	+	
Self-descriptiveness					+		+	+	+	
Feedback	+	+							+	+
Accuracy		+				+				+
Completeness		+				+				
Fault-tolerance						+	+			+
Resource safety						+				
Readability								+	+	
Controllability							+	+	+	+
Navigability	+	+					+	+	+	
Simplicity					+			+	+	
Privacy							+		+	+
Security						+	+			+
Insurance						+	+			
Familiarity					+		+			
Loading time	+			+					+	+

Figure 2. Relationship the factors and indicators QUIM

Old Design Evaluation

Evaluation of the old design was carried out using a questionnaire, therefore the number of samples had to be determined in advance. Based on [14] recommendations, the number of samples is determined by 5 users per user group. There are three types of user groups in total, for the regular user groups there are millennials and elderly, then the second group is the business/community admin group. The regular user groups and business/community admins need to be separated because the features used by each group are different. The separation of regular user groups into millennials and elderly is because the problems that occur and the time used to complete the scenarios are different based on these age groups. In the analysis, it needs to be reviewed separately.

The questionnaire was prepared with 10 variables contained in the QUIM standard [10]. The total indicators on the 10 variables are 25 indicators [9] arranged into 25 questions. To conduct an assessment, the researcher uses a 5 point scale with a Likert scale model. Each point consists of strongly agree, agree, neutral, disagree, and strongly disagree. In addition to the QUIM questionnaire, there are also scenarios form that contains tasks that the user needs to do, the steps the user needs to complete the task, and records the user's completion time. This scenario form will be used as a reference for users in conducting the test and helps select the scenario that needs improvement. This form is also differentiated by regular users and business or community admin users. The tabulated questionnaire's data was then tested for its validity and reliability using IBM SPSS software [15].

RESULT AND DISCUSSION

This section will explain the results of Dua Mata's old design evaluation, which features were fixed, and how these features were improved. The explanation will immediately discuss the conclusions of each GDD step.

Old Design Evaluation

After the validity test was conducted as shown in Table 2, the 7 statement points were declared valid by the SPSS results, they were statement number 2, 4, 17, 20, 21, 23, and 24. The r_{xy} value of the statement was greater than the value of the r table product-moment, 0.514. The r_{xy} values were, 0.534, 0.588, 0.543, 0.739, 0.589, 0.570, and 0.723. Based on the reliability test results obtained through the SPSS, the Cronbach alpha value was 0.79, which fulfilled the requirements for Cronbach's Alpha value that need to be greater than 0.6. It can be said that the valid question points are reliable.

Table 2. Total valid statements frequency

No	Questionnaire Number	Score (Person)					Total Frequency
		1	2	3	4	5	
1	2		7	2	5	1	45
2	4	1	3	6	5		45
3	17		4	3	8		49
4	20		6	3	5	1	46
5	21		5	6	4		44
6	23		4	4	4	3	51
7	24		4	2	7	2	52

Table 2 shows the value of each statement item, 45 for statement number 2, 45 for statement number 4, 49 for statement number 17, 46 for statement number 20, 44 for statement number 21, 51 for statement number 23, and 52 for statement number 24. The priority for improvement was then determined based on the smallest total frequency of the seven statement items. Based on the Table 2, the smallest total frequency is statement items number 2, 4, and 21, so the three statement items will then become improvements priority in this study. The three statement items were,

1. The apps can process existing resources or newly input resources (Resource Utilization).
2. Users do not need to remember a lot of information at each step when using the application (Minimal Memory Load).
3. The application guarantees that users can search for information and make transactions through the application (Security).

Modeling

At the modeling stage, the user persona or user model is selected. User personas are selected based on the characteristics of users who represent each group of respondents, users who give the smallest questionnaire point on the selected indicators, and who have difficulty working on the average context scenario (seen from the time behavior results). The behavior of the selected user persona is then used as a reference in determining the selected scenario which is corrected as well as the user persona being the respondent in the second stage of the test. There are two user personas chosen per user group, to avoid the bias that occurs when only one respondent is used.

Table 3. Priority Statement Improvement Tabulation

Respondents	Questionnaire Statement		
	2	4	21
A01	2	2	2
A04	2	3	2
UM03	2	4	3
UM04	3	3	2
U02	2	1	3
U03	4	2	3

Based on Table 3, the selected users were A01 and 04, UM 03 and 04, lastly U02 and U03. The reason for selecting each user persona can be seen based on the results of the QUIM questionnaire, where the six respondents gave low average scores on the three priority statements for improvement. Besides being based on the questionnaire statements, the selection of user personas must also be seen based on the user's time in completing the scenario.

The results obtained from the time records as Table 4 – Table 6 shows, for user persona A01, 13 scenarios were performed faster than the average time, 7 on average and 8 scenarios were longer than average time completion. For user persona A04, 7 scenarios were performed faster than the average time, 16 on average, and 5 longer than average. For user persona UM03, 1 scenario was performed faster than the average time, 7 on average, and 8 longer than average. For user persona UM04, 3 scenarios were performed faster than the average time, 9 on average, and 4 are longer than the average. For user persona U02, 6 scenarios were performed faster than the average time, 4 on average and 6 longer than average. Last, for user persona U03 7 scenarios were performed faster than the average, 4 on average, and 5 are longer than average. Red in the table symbolizing longer than average, yellow means average, and green means faster than average.

Table 4. User persona's completion time (general tasks)

No	User Scenario Task	A01	A04	UM03	UM04	U02	U03
1	Registering	52,18 s	132 s	71 s	68 s	113 s	200 s
2	Log in	6,02 s	12,97 s	14,20 s	12,03 s	18,65 s	24,52 s
3	Log out	16,95 s	11,14 s	13,42 s	08,49 s	6,8 s	11,72 s
4	Forgetting Passwords	21,98 s	43,02 s	46,97 s	30,12 s	54 s	79 s
5	Edit Profile	15,44 s	23,03 s	28,14 s	23,33 s	47,17 s	44,73 s

Table 5. User persona's completion time (user member tasks)

No	User Scenario Task	UM03	UM04	U02	U03
1	Searching Directories	13,69 s	14,55 s	28,30 s	21,26 s
2	Joining Directories	11,33 s	14,80 s	14,58 s	09,86 s
3	Leaving Directories	03,13 s	26,10 s	08,45 s	8 s
4	Ordering	33,97 s	31,15 s	66 s	43,77 s
5	Checking Previous Transactions	11,63 s	05,92 s	09,52 s	05,96 s
6	Ordering Services	34,76 s	28,41 s	63 s	57,63 s
7	Filed Complaint About a Services	26,56 s	23,70 s	29,43 s	20,40 s
8	Validating The Services (Service Validation Admin)	13,7 s	17,52 s	12,42 s	15,57 s
9	Reply To Complaints (Complaint Admin)	27,3 s	13,42 s	31,72 s	28,82 s
10	Accessing news & agenda (directory)	29,99 s	17,79 s	31,74 s	29,43 s
11	Accessing news & agenda (public)	25,71 s	10,59 s	29,64 s	25,61 s

Table 6. User persona's completion time (admin directories tasks)

No	User Scenario Task	A01	A04
1	Register a directory	27,42 s	70 s
2	Change directory profile	20,08 s	30,97 s
3	Set a directory close date	20,09 s	26,29 s
4	Approving Member Joining directory (1 person)	31,22 s	13,99 s
5	Making Member as Admin (1 person)	5,23 s	13,33 s
6	Adding the Product (1 product)	50,26 s	65 s
7	Adding Product Order Status (1 status)	17,05 s	15,70 s
8	Processing Product Orders (1 transaction)	16,93 s	16,15 s
9	View Product Sales Results (filter)	20,17 s	15 s
10	Adding Services (1 service)	39,54 s	50,38 s
11	Adding Service Form (1 service)	43,76 s	28,93 s
12	Adding Other Types of Terms (1 type)	35,63 s	41,02 s
13	Adding an Admin or Other User as a Validator (1 user)	24,13 s	15,38 s
14	Submitting Service Orders (1 service)	52,76 s	17,55 s
15	Processing Service Orders (1 service)	16,09 s	14,43 s
16	Seeing the Results of Services That Have Been Running	6,93 s	06,89 s
17	Making Complaints (1 type)	10,60 s	11,83 s
18	Appoint Admin or User to Serve Complaints (1 user)	10,38 s	07,09 s
19	Reply to User Complaints (1 complaint)	12,85 s	14,65 s
20	Posting News (1 news)	23,69 s	48,83 s
21	Editing News (1 news)	9,23 s	19,96 s
22	Posting Agenda (1 agenda)	47,60 s	40,93 s
23	Editing Agenda (1 agenda)	11,76 s	11,90 s

Requirement Definition

The selected scenarios in the general category were, register / create an account and forget password. These two scenarios were chosen because more than two users had scenario time completion records above the average. Minimal Memory Load and Security indicator aspects were influenced. The chosen ordinary user scenario were looking for a business/community and ordering services. These scenarios were chosen because more than two users had completion scenarios time above the average and Resources Utilization and Minimal Memory Load indicators were affected. The selected admin user scenario is all steps in adding a service. The consideration of this selection is because it affects the indicators of Resources Utilization and Minimal Memory Load, besides that this scenario has a fairly large time difference for A04 users. This scenario was chosen because adding services with separate features can be combined into one feature, making it simpler, especially for older users.

Framework Definition

The framework definition stage is the stage where a wireframe is produced based on all the information that has been previously collected. This stage also determines the type and size of the font and color scheme used in the new design. The type of font used for the improved design is the same as the type used in the existing design, Poppins. The font size used is 30, 20, 16, 15, 13 and 12. The unchanged font was decided because the user did not have problems with the clarity of the letters per letter of the existing font, only what needs to be improved is the font size or thickness of the font so that elderly users can read it better. The color scheme was decided to remain the same because the existing color scheme was considered good by the users who participated in the test, it's just that the placement of colors in some parts had to be changed/moved because it could affect the clarity of the font that was located above it. The wireframe can then be arranged as shown in Figure 3 until Figure 7. The prototype is arranged based on a wireframe, as shown in Figure 3 until Figure 7. After the prototype is finished, the second test can be started.

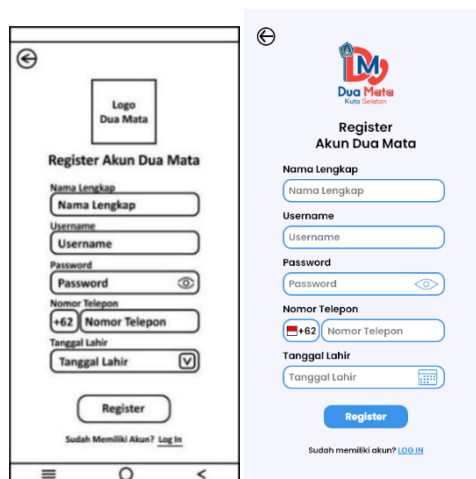


Figure 3. Example of register wireframe and prototype

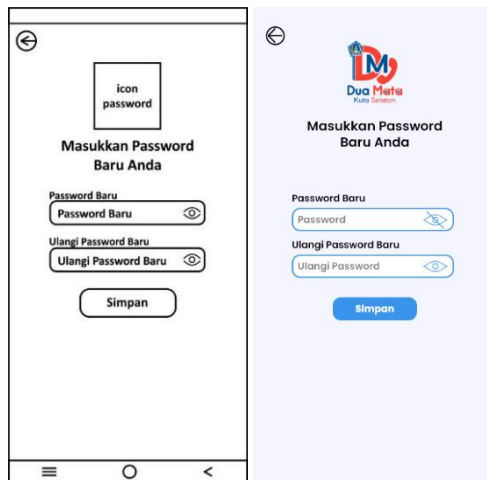


Figure 4. Example of forgetting password wireframe and prototype

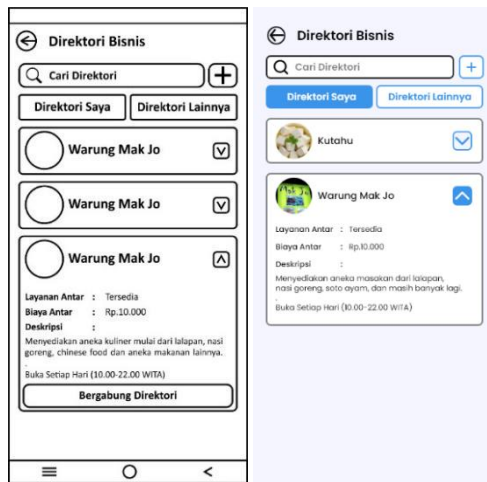


Figure 5. Example of searching directories wireframe and prototype

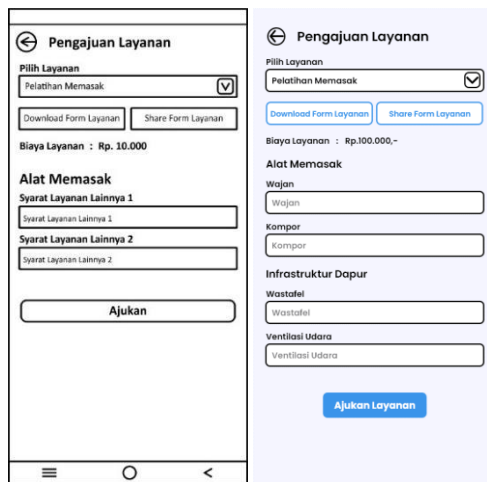


Figure 6. Example of ordering services wireframe and prototype

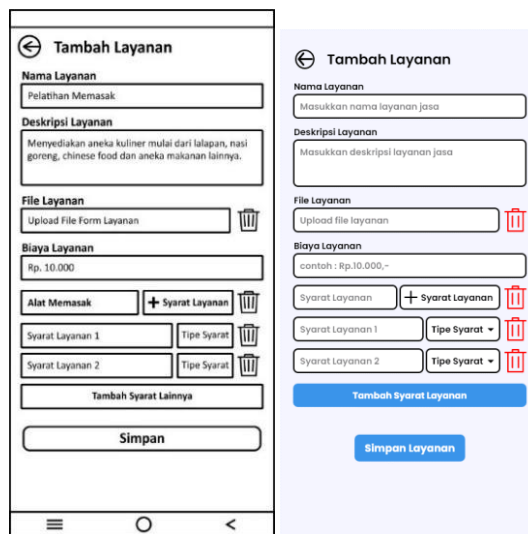


Figure 7. Example of adding services wireframe and prototype

Refinement

The second test results can be seen in Table 7 presenting the questionnaire score given by the user persona in the second test. There was an increase in the score of the selected indicator, in addition to the selected indicator, the increase in score also occurred in other valid indicators.

Table 7. Second test questionnaire result recapitulation

Respondents	Statement		
	2	4	21
A01	4	4	3
A04	4	4	3
UM03	4	4	4
UM04	4	4	3
U02	3	4	4
U03	4	4	4

Not only in the score but also improvement came from the completion time for the selected scenarios. Table 8 presents the time required by the user persona to complete each scenario according to the user persona category. The biggest time reduction occurs in adding a service scenario in the admin user persona. The time reduction that occurs in the adding service scenario occurs up to 45 seconds. The biggest reduction in time for elderly user persona's occurred in the Register scenario, which reached 35 seconds. In the younger age user personas in the forgot password scenario, the time decreased to 20 seconds.

Table 8. User persona second testing time recap

No	User Persona	Registering (sec)	Forgetting Passwords (sec)	Searching Directories (sec)	Ordering Services (sec)	Adding Services (sec)
1	A01	56,33	47,22	49,03	26,05	-
2	A04	55,92	46,5	40,08	37,36	-
3	UM03	55,81	43,95	51,26	30,32	22,73
4	UM04	59,96	41,91	39,72	27,85	14,35
5	U02	98	58,59	75	40,83	21,45
6	U03	77	57,9	58,57	49,19	19,09

Table 9. Comparison of the total value of the selected indicators

No	ID	Statements	Indicator	Questionnaire Score		Note
				Before Redesign	After Redesign	
1	2	Applications can process existing resources and that you input properly.	Resource Utilization	15	23	Increase
2	4	Users do not need to remember a lot of information at each step when using the application.	Minimal Memory Load	15	24	Increase
3	21	Application ensures that users are safe in searching for information and making transactions through the application.	Security	15	21	Increase

This reduced time can be caused by the reduction in the scenario completion steps on the indicators that affect the design changes of all selected scenarios, besides that it is also caused by almost all selected scenarios related to the Minimal Memory Load indicator, therefore it can be concluded that the scenario of ordering services, adding services, searching Directory, registers, and forgot password can be said to have increased in terms of Minimal Memory Load indicator. During the interview, the admin user persona also felt that in their new design it was easier to do the task on the available menu, therefore it can be concluded that the scenarios of adding services, ordering services, and searching for directories have increased in terms of resource utilization. The slight increase in the score on security can be caused because the new design being tested as only a design, so it is difficult to measure the level of security of an application. The increase in the score still occurs due to the addition of an eye icon. This icon functions as a feature to see the password entered by the user. The user feels safer and more certain because he can confirm whether the entered password is correct or if the characters are incorrectly typed. The use of the eye icon is used by users in the register and forget password scenario. It can be concluded that the register and forget password scenario has increased from a security perspective. All these assumptions can be proved by comparing each indicator's score after and before redesign as stated in Table 9. As shown in Table 9, all indicators score improved which means the redesign of the mobile app was successfully improved user experience in those indicators.

CONCLUSION

The results showed that in the second test, there was a significant increase in questionnaire score and a significant decrease in scenario completion time on the new design compared to the old design by user persona. The Minimal Memory Load has increased by 9 points, Resources Utilization by 8 points and 6 points on the Security indicator. The reduced completion time in the selected scenarios also confirms the assumption that user satisfaction has increased. The biggest reduction in time for elderly user personas occurred in the Register scenario which reached 35 seconds and in the younger age user personas by 20 seconds in the forgotten password scenario. Other completion times of the scenarios have also decreased between 1-15 seconds.

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