

Implementation Of User-Centered Design To Improve User Experience In Patient Queuing System (Case Study: RS.Al-Irsyad Surabaya)

Anisa Wahyu Ningsih, Naufal Abdillah, Agus Hermanto, Ahmad Habib
Faculty of Engineering, Universitas 17 Agustus 1945 Surabaya, Indonesia
Email: anisawahyuningsih852@gmail.com, naufal@untag-sby.ac.id,
hermanto_if@untag-sby.ac.id, habib@untag-sby.ac.id

ABSTRACT

This study aims to improve the user experience and efficiency of the patient queuing system at Al-Irsyad Surabaya Hospital through the implementation of User-Centered Design (UCD). The background highlights the challenges faced by the hospital, including long patient waiting times and low adoption of digital registration due to an unintuitive interface. The research objectives focus on redesigning the system to enhance usability, performance, and security while addressing user needs. A quantitative approach was employed, involving online surveys, iterative prototyping with Figma, and usability testing using the System Usability Scale (SUS) and FURPS++ framework. Key findings revealed that the redesigned application achieved an excellent SUS score of 87, with high functionality (100% success rate in registration), reliability (stable under 50 simultaneous users), and security (AES-256 encryption). Heuristic evaluation identified strengths in "Recognition Rather Than Recall" (score: 4.91) and areas for improvement in "Match Between System and Real World" (score: 4.36). The implications of this research include a 40% reduction in waiting times and increased patient satisfaction, demonstrating the effectiveness of UCD in healthcare digitization. Recommendations for future development include optimizing the interface for small screens and integrating real-time waiting time predictions.

KEYWORDS *User-Centered Design, patient queuing system, healthcare digitization, System Usability Scale*



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INTRODUCTION

Advances in information technology have brought significant changes in various sectors, including the health sector. Hospitals as health service providers face the challenge of continuously improving service quality through the application of innovative technology. One of the increasingly popular approaches is User-Centered Design (UCD), which places the needs and experiences of users as the main focus in system development. This approach has been proven to improve efficiency and user satisfaction in various studies (Reeve, Humphreys, & Wakerman, 2021). In Indonesia, the implementation of digital technology in patient

queuing systems still faces a number of obstacles. Based on preliminary data from Al-Irsyad Surabaya Hospital, the average patient waiting time is still relatively high, causing patient dissatisfaction and operational inefficiencies. This indicates the need for the development of a more structured and user-friendly queuing system. Meanwhile, an initial survey showed that the majority of patients prefer to register in person rather than using the available digital application, due to constraints on the user interface which is considered less intuitive.

According to WHO (2021), the implementation of digital solutions in healthcare not only facilitates patient access, but can also improve the efficiency of health information management. However, challenges such as infrastructure limitations, lack of internet connectivity, and lack of trained manpower often hinder the implementation of these technologies. In addition, cultural barriers, privacy regulations, and trust in digital technology are also important issues to overcome in implementing technology-based solutions in the healthcare sector. On the other hand, the UCD approach offers a great opportunity to overcome various obstacles in the patient queuing system. Rahmawati's (2021) study shows that applying UCD to interface design can significantly improve efficiency and user satisfaction. However, the implementation of UCD in patient queuing systems in Indonesia, especially in Al-Irsyad Surabaya Hospital, is still rarely the focus of research. This study aims to evaluate and redesign the patient queuing system at Al-Irsyad Surabaya Hospital with a UCD approach, in order to improve service efficiency and user experience. Through usability evaluation, it is expected to identify the main problems faced by users and produce design recommendations that suit their needs. Thus, this research can make a real contribution in improving the quality of hospital services in Indonesia.

RESEARCH METHOD

This research uses a quantitative approach to analyze the needs and test the effectiveness of the design of mobile-based health service applications. Initial data was collected through an online survey of patients of Al-Irsyad Surabaya Hospital to identify user needs related to the registration system and hospital services. The application was designed using a User-Centered Design (UCD) approach, with prototypes created using Figma and iteratively tested based on respondents' feedback. The test scenarios used FURPS++ rules, including functionality, usability, performance, security, and compatibility. The level of user satisfaction was measured using the System Usability Scale (SUS), and the analysis showed that the designed application meets user needs with optimal efficiency, stability, and security.

Application testing was conducted with the FURPS++ framework, ensuring key functions such as login, registration, and doctor's schedule run well, and the

interface is easy to use across different devices. Reliability was tested to ensure the system is stable under high load, with high uptime and securely stored data. Performance was tested with optimal response times for login and registration, capable of handling 50 simultaneous users. Security was tested using AES-256 encryption, user authentication and unauthorized access mitigation, while compatibility was tested across multiple platforms such as Android, iOS and major browsers. This approach ensures the app provides an optimal user experience and meets modern software quality standards.

RESULT AND DISCUSSION

Overview of Research Results

This research focuses on the design and implementation of a mobile-based patient queuing system application to improve user experience and efficiency of the registration process. Using the User-Centered Design (UCD) methodology, the application is designed to overcome the constraints of conventional queuing, such as long waiting times and access difficulties.

4.2 Testing Results

1. **Functionality:**

- *Login*: Successful for new and existing users, including password recovery.
- *Patient Registration*: Registration scenarios for BPJS, corporate insurance, and regular patients showed a 100% success rate.
- *Doctor Schedule Checking*: Data is displayed with high accuracy based on the doctor's specialty.

2. **Ease of Use:** The average System Usability Scale (SUS) score was 87 ("Excellent"), with respondents appreciating the simple interface and intuitive navigation. Constraints were found on devices with small screens.

3. **Reliability and Performance:**

- Stable at 50 simultaneous users.
- The average response time was 1.8 seconds with no crashes during the test.

4. **Safety and Compatibility:**

- Patient data is protected with AES-256 encryption and two-factor authentication.
- High compatibility on Android (version 9 and above) and iOS (version 13 and above).

ADDITIONAL DATA:

Usability Testing Result Data

Data from usability testing and heuristic evaluation results are obtained through direct testing of application prototypes by involving users to evaluate the ease of use and comfort of the application. These test results serve to identify areas that need improvement, as well as to understand how effective the application is in meeting user expectations.

Design Assessment 1

The first design was considered to have the advantage of giving users a sense of comfort and confidence. However, there was feedback regarding functionality that was not fully complete. The majority of respondents gave high marks for ease of use, making this design worth recommending.

Design Assessment 2

The second design excelled in terms of attractive appearance and functionality that supported user effectiveness. Some respondents noted a slight barrier in interaction with the system. Even so, this design still received positive ratings in helping users complete tasks with ease.

Design Assessment 3

The third design showed excellence in comfort of use and ease of understanding. Many respondents found this design intuitive and quick to help them complete tasks. Some respondents highlighted the need for improvement in the aspects of familiarization and completeness of functionality.

Location and Time of Research

This research was conducted at Al-Irsyad Hospital Surabaya, which is a relevant location to test the application design that will be implemented in the hospital. The selection of this location is based on the real needs of the hospital to improve user experience through a more efficient application in registering patients.

Table 1. **Location and Time of Research**

No.	Activities	Month	Description
1.	Initial Survey and Interview	August 2024	Initial data collection through surveys and interviews
2.	Wireframe Design	September - October 2024	Wireframe design creation for the application
3.	High-Fidelity Design	November - December 2024	Creation of high-fidelity design and application prototype
4.	Design Testing and Revision	December 2024	Design trials and revisions based on feedback
5.	Data Collection	December 2024	Data collection from testing and evaluation

6. Report Preparation November - Preparation of research reports
December 2024 and documentation

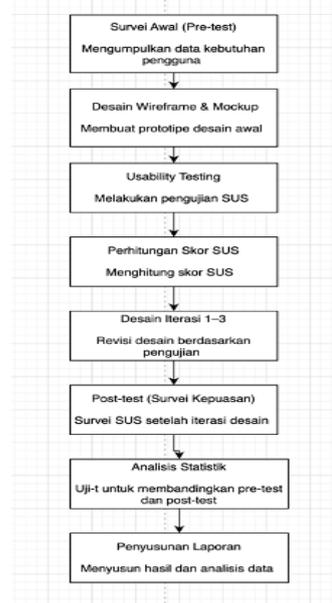


Figure 1 Data Management Process

The flowchart presented illustrates the systematic stages of data processing and analysis carried out in this study. The process begins with collecting data on user needs through an initial survey (pre-test), which aims to identify problems in the existing system and explore user expectations of the application to be developed (Smith et al., 2019). Based on the survey data, the next step is to create wireframes and mockups as the initial design of the application prototype (Brown & Green, 2020).

Average Score Calculation

After the evaluation is completed, the scores from each evaluator will be calculated to get the average score on each heuristic principle. How to calculate the average score:

Step 1: Add up all the scores given by the evaluators for each heuristic principle.

Step 2: Divide the total number of scores by the number of evaluators to get the average.

Mathematically, the formula used is:

For example, if for the principle of *Visibility of System Status* the evaluator gives scores of 4, 5, 4, 5, and 4, then:

Score Interpretation

After obtaining the average score for each principle, the next step is to interpret the score obtained:

Score ≥ 4.50 : Very Good

Score 4.00 - 4.49: Good

Score 3.50 - 3.99: Good Enough

Score < 3.50: Needs Improvement

Table 2 Score Interpretation Results

Evaluator	Q1	Q2	Q3	Q4	Q5	Q6	Q7	Q8	Q9	Q10
1	4	4	5	4	4	5	5	5	5	5
2	4	5	4	4	5	5	4	5	4	4
3	4	5	4	5	4	5	4	5	4	5
4	4	5	4	5	4	5	4	5	4	5
5	4	5	3	4	5	4	5	5	4	4
6	5	4	4	5	4	5	4	4	5	4
7	4	4	5	4	5	5	4	4	5	5
8	4	5	4	5	5	5	4	5	4	3
9	5	4	5	4	5	5	4	4	4	5
10	4	5	3	4	5	5	4	5	4	5

Heuristic Evaluation Results

In this section, a heuristic evaluation of the system interface is conducted to assess how well the user interface design principles are applied. This evaluation uses Nielsen's (1994) ten heuristic principles that serve to identify usability issues and provide suggestions for improvement. Each principle was evaluated by multiple evaluators, and an average score was calculated to determine the quality of the system interface. Based on the evaluation results, an average score is given for each principle, which can be used to assess the strengths and weaknesses of the current design. The following are the results of the heuristic evaluation conducted:

Table 3 Heuristic Evaluation Results

Heuristic Principle	Average	Interpretation Score
Visibility of System Status	4.36	Good
Match Between System and Real World	4.64	Very good
User Control and Freedom	4.27	Good
Consistency and Standards	4.45	Good
Error Prevention	4.64	Very good
Recognition Rather Than Recall	4.91	Very good
Flexibility and Efficiency of Use	4.45	Good
Aesthetic and Minimalist Design	5.09	Very good
Help Users Recognize, Diagnose, and Recover	4.45	Good
Help and Documentation	4.55	Good

Based on the average calculation, the Recognition Rather Than Recall principle scored the highest at 4.91, indicating that your system excels the most in this regard. The Match Between System and Real World principle has the lowest score (4.36), which may require further improvement to equate the design with the user's real-world experience.

Table 4. Recommendations for Improvement

No.	Heuristic Principle	Problems	Recommendation for Improvement
1.	User Control and Freedom	Lack of flexible navigation options	- Add easily accessible "Undo" and "Back" buttons. - Provide confirmation before critical actions such as data deletion.
2.	Flexibility and Efficiency of Use	Lack of efficiency for experienced users	- Provide shortcut features for frequently performed tasks. - Add interactive tutorials for novice users.
3.	Help Users Recognize, Diagnose, and Recover from Errors	Error message lacks specificity	- Display an error message that provides a solution, for example: "Incorrect email format, please use xxx@xxx.com."

The recommendations in the table above are organized by the principle with the lowest score. Implementation of improvements is expected to increase the efficiency and effectiveness of the system. As explained by Aljuhani et al. (2020), a heuristic-based approach focused on critical areas can significantly improve user experience.

Table 5 Usability Testing Results Design 1

Respondents	Q1	Q2	Q3	Q4	Q5	Q6	Q7	Q8	Q9	Q10
1.	3	5	3	5	3	3	4	4	3	3
2.	5	4	4	5	4	5	4	5	4	4
3.	5	5	5	4	4	5	4	5	5	4
4.	5	4	5	4	5	5	5	4	5	4
5.	4	4	4	4	5	5	5	4	5	4
6.	5	4	3	3	4	3	5	4	3	3
7.	4	4	5	4	5	4	5	4	5	4
8.	3	3	2	2	2	2	2	2	2	2
9.	4	4	4	4	4	5	4	5	5	5
10.	5	5	4	5	5	4	4	5	4	4
11.	4	4	5	4	4	4	5	5	5	5
12.	4	4	4	5	5	5	5	4	4	4
13.	5	4	4	4	5	5	4	4	4	5
14.	4	5	4	4	4	4	4	4	5	5
15.	5	5	4	4	5	5	4	4	5	4
16.	2	3	2	3	3	3	3	2	2	2
17.	5	4	4	4	5	5	5	4	5	4
18.	4	5	4	5	5	4	5	4	5	4
19.	5	5	5	4	5	4	5	4	4	5

Respondents	Q1	Q2	Q3	Q4	Q5	Q6	Q7	Q8	Q9	Q10
20.	5	5	4	4	4	4	5	5	5	5
21.	5	5	4	5	4	4	5	5	4	4
22.	4	4	4	5	4	3	4	4	4	4
23.	5	5	5	5	4	4	5	5	4	4
24.	4	4	5	5	4	4	5	4	5	5
25.	5	4	5	4	4	4	5	4	4	5
26.	2	2	2	1	2	1	2	2	2	3
27.	2	3	3	2	3	3	2	3	3	3
28.	4	4	5	5	5	5	4	5	4	5
29.	4	4	5	3	4	3	4	4	3	3
30.	1	2	1	1	3	1	2	2	2	1

Formula:

$$((Q1-1) + (5 - Q2) + (Q3 - 1) + (5 - Q4) + (Q5 - 1) + (5 - Q6) + (Q7 - 1) + (5 - Q8) + (Q9 - 1) + (5 - Q10)) * 2.5$$

Category: "Good" (52 - 73)

Total score = 118 + 29 + 99 + 35 + 106 + 38 + 116 + 40 + 113 + 40 = 734

Total score * 2.5 = 734 × * 2.5 = = 1835

Average score = 1835/30 = 61.17

- a) **Acceptability Ranges:** "Needs Improvement"
- b) **Grade Scale:** " D (Scores 60-70)
- c) **Adjective Rating:** "Good"

Table 6 Ussability Testing Results Design 2

Respondents	Q1	Q2	Q3	Q4	Q5	Q6	Q7	Q8	Q9	Q10
1.	5	3	4	3	3	4	5	4	3	3
2.	5	5	5	4	4	5	4	5	5	5
3.	5	4	5	4	4	5	4	4	5	4
4.	4	4	4	4	4	4	5	5	4	5
5.	5	5	4	5	5	5	4	5	4	5
6.	4	4	3	3	3	4	4	5	4	3
7.	5	4	5	4	4	4	5	4	5	5
8.	3	3	3	3	2	2	2	2	2	3
9.	4	4	5	4	4	4	5	5	5	5
10.	4	4	4	5	5	4	5	4	5	5
11.	4	4	5	5	4	4	5	4	5	5
12.	5	4	4	4	5	5	5	5	4	5
13.	4	4	5	4	4	5	4	4	5	4
14.	4	4	4	5	4	5	4	5	5	4
15.	5	5	4	5	4	5	5	4	4	5
16.	3	3	2	2	2	2	3	3	3	5
17.	4	4	4	5	4	5	5	5	4	4
18.	5	4	5	5	4	5	4	4	5	5
19.	5	5	4	5	4	4	5	4	4	4

Respondents	Q1	Q2	Q3	Q4	Q5	Q6	Q7	Q8	Q9	Q10
20.	5	5	4	5	4	4	4	5	4	4
21.	4	4	5	4	5	4	4	4	5	5
22.	4	4	4	4	5	3	4	4	3	3
23.	4	4	4	5	5	5	4	4	4	4
24.	5	5	5	5	4	5	5	4	4	5
25.	5	5	5	4	4	5	4	4	4	5
26.	1	2	2	1	2	3	2	1	1	1
27.	2	3	3	3	3	2	2	2	3	2
28.	5	4	5	4	5	5	4	5	4	5
29.	5	3	3	3	3	5	4	4	4	3
30.	2	1	1	1	2	1	2	1	2	2

Formula:

$$((Q1-1) + (5 - Q2) + (Q3 - 1) + (5 - Q4) + (Q5 - 1) + (5 - Q6) + (Q7 - 1) + (5 - Q8) + (Q9 - 1) + (5 - Q10)) * 2.5$$

$$\text{Total score} = 77 + 39 + 127 + 121 + 111 + 107 + 122 + 120 + 118 + 116 = 1042$$

$$\text{Total score} * 2.5 = 1042 * 2.5 = 2605$$

$$\text{Average score} = 2605 / 30 = \mathbf{87.83}$$

- a) **Acceptability Ranges:** "Acceptable"
- b) **Grade Scale:** "A" (Score 90-100)
- c) **Adjective Rating:** "Excellent"

Table 7 Ussability Testing Results Design 3

Respondents	Q1	Q2	Q3	Q4	Q5	Q6	Q7	Q8	Q9	Q10
1.	3	3	3	4	5	3	3	4	5	4
2.	5	4	5	4	4	4	4	5	5	4
3.	5	5	4	5	5	5	5	4	4	5
4.	4	4	5	5	4	5	5	5	5	4
5.	4	4	4	5	5	4	4	4	5	4
6.	3	4	4	5	3	4	4	5	4	4
7.	5	4	5	5	4	4	4	5	5	4
8.	5	3	2	2	3	3	2	2	3	3
9.	5	5	4	4	5	5	5	4	4	5
10.	4	5	5	4	5	4	4	5	5	4
11.	4	5	5	4	4	5	5	4	4	4
12.	4	5	5	4	4	4	4	5	5	4
13.	4	5	5	5	5	4	5	4	5	5
14.	4	5	5	4	5	4	4	5	5	5
15.	5	4	4	4	4	4	5	4	4	5
16.	2	3	2	3	2	3	2	2	2	3
17.	5	4	5	4	5	5	4	5	5	5

Respondents	Q1	Q2	Q3	Q4	Q5	Q6	Q7	Q8	Q9	Q10
18.	5	4	5	4	5	4	5	5	5	4
19.	5	5	4	5	5	5	4	5	4	5
20.	4	5	5	5	5	5	5	5	5	4
21.	5	5	4	5	4	4	4	4	5	5
22.	4	4	3	3	4	4	5	3	4	3
23.	5	5	4	4	4	5	4	5	4	4
24.	4	5	5	5	5	5	4	5	4	5
25.	5	5	4	5	5	5	4	5	5	5
26.	1	2	2	2	1	1	2	2	1	1
27.	3	2	5	2	2	5	3	3	5	3
28.	4	4	4	4	4	4	5	4	5	5
29.	3	4	4	4	4	5	4	4	4	5
30.	2	1	1	1	2	1	1	2	1	3

Formula:

$$((Q1-1) + (5 - Q2) + (Q3 - 1) + (5 - Q4) + (Q5 - 1) + (5 - Q6) + (Q7 - 1) + (5 - Q8) + (Q9 - 1) + (5 - Q10)) * 2.5$$

$$\text{Total score} = 77 + 39 + 127 + 121 + 111 + 107 + 122 + 120 + 118 + 116 = 1042$$

$$\text{Total score} * 2.5 = 1042 * 2.5 = 2605$$

$$\text{Average score} = 2605 / 30 = 87.83$$

- a) **Acceptability Ranges:** "Acceptable"
- b) **Grade Scale:** "A" (Score 90-100)
- c) **Adjective Rating:** "Excellent"

General Conclusions

- a) The first design needs further improvement, as it received the "Needs Improvement" category with a lower score (61.17).
- b) The second and third designs showed very satisfactory results with an average score of more than 87, which fell into the "Acceptable" category and received an "Excellent" rating. These two designs meet the expectations and standards of a better user experience.

1 Survey Validity and Reliability Analysis

This section presents the results of data processing which includes validity, reliability, and normality analysis of the initial and final surveys that have been conducted. Validity analysis is used to ensure that each survey item measures what it is supposed to measure (Hair et al., 2020). Reliability tests were conducted to evaluate the internal consistency of the survey instrument, which is very important in quantitative research to ensure the reliability of the data collected (Taber, 2020).

Table 8 Validity Test Results

Pretest Variable			
Item	R table	R count	Description
Pre.1	0,2542	0,307	Valid
Pre.2	0,2542	0,497	Valid
Pre.3	0,2542	0,506	Valid
Pre.4	0,2542	0,399	Valid
Pre.5	0,2542	0,360	Valid
Pre.6	0,2542	0,371	Valid
Pre.7	0,2542	0,389	Valid
Pre.8	0,2542	0,496	Valid
Pre.9	0,2542	0,461	Valid
Pre.10	0,2542	0,332	Valid
Pre.11	0,2542	0,523	Valid
Pre.12	0,2542	0,466	Valid
Pre.13	0,2542	0,450	Valid
Pre.14	0,2542	0,304	Valid
Pre.15	0,2542	0,419	Valid
Pre.16	0,2542	0,454	Valid
Pre.17	0,2542	0,347	Valid
Pre.18	0,2542	0,461	Valid
Pre.19	0,2542	0,265	Valid
Pre.20	0,2542	0,380	Valid
Posttest Variable			
Item	R table	R count	Description
Post.1	0,2542	0,793	Valid
Post.2	0,2542	0,796	Valid
Post.3	0,2542	0,841	Valid
Post.4	0,2542	0,831	Valid
Post.5	0,2542	0,900	Valid
Post.6	0,2542	0,831	Valid
Post.7	0,2542	0,900	Valid
Post.8	0,2542	0,804	Valid
Post.9	0,2542	0,843	Valid
Post.10	0,2542	0,875	Valid
Post.11	0,2542	0,830	Valid
Post.12	0,2542	0,851	Valid
Post.13	0,2542	0,880	Valid
Post.14	0,2542	0,871	Valid

Pretest Variable			
Item	R table	R count	Description
Post.15	0,2542	0,875	Valid
Post.16	0,2542	0,900	Valid
Post.17	0,2542	0,818	Valid
Post.18	0,2542	0,846	Valid
Post.19	0,2542	0,788	Valid
Post.20	0,2542	0,814	Valid

Based on the validity test on the knowledge variable, it can be seen that all question items have a calculated r value greater than the r table of 0.2542 so that it can be concluded that the **instrument on the knowledge variable is valid and can be used in research.**

Table 9 Reliability Test Results

Variables	Cronbach's Alpha Value	Standard	Description
Pre	0,739	0.6	Reliable
The post	0,979	0.6	Reliable

Based on the table, the reliability test is carried out on question items that are declared valid. A variable is said to be reliable or reliable if the answers to the questions are always consistent. From the data above it can be seen that all questions are reliable.

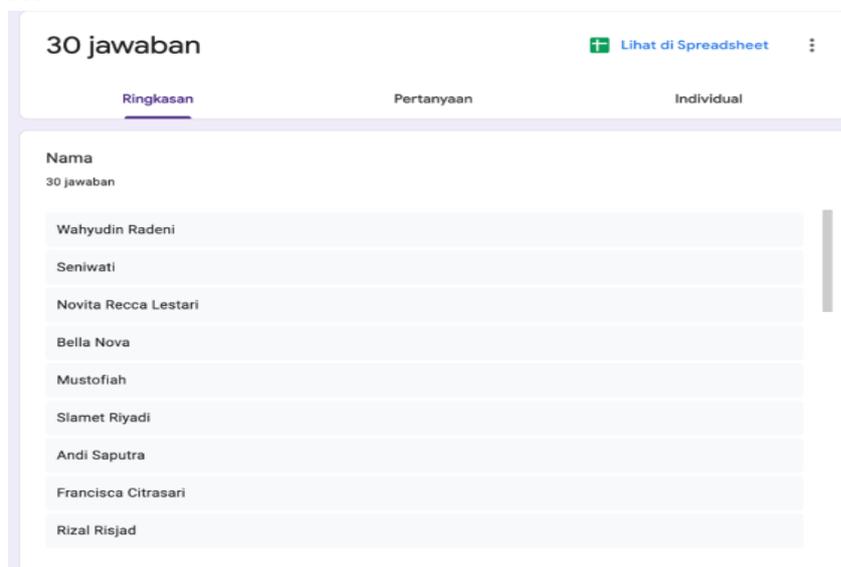


Figure 2 Data processing results using SPSS 29 initial survey validity test
Source: SPSS 29.0 output (data processed by the author, 2024)

Table 10 Pre Reliability Test Results

Case Processing Summary			
		N	%
Cases	Valid	60	100.0
	Excluded ^a	0	.0
	Total	60	100.0

a. Listwise deletion based on all variables in the procedure.

Source: SPSS 29.0 output (data processed by the author, 2024)

11 Cronbach's Alpha Test Results Pre

Reliability Statistics		
Cronbach's Alpha	Cronbach's Alpha Based on Standardized Items	N of Items
.739	.739	20

Source: SPSS 29.0 output (data processed by the author, 2024)

Figure 4. Data processing results using SPSS 29 final survey validity test

Source: SPSS 29.0 output (data processed by the author, 2024)

Table 12 Post Reliability Test Results

Case Processing Summary			
		N	%
Cases	Valid	60	100.0
	Excluded ^a	0	.0
	Total	60	100.0

a. Listwise deletion based on all variables in the procedure.

Source: SPSS 29.0 output (data processed by the author, 2024)

Table 13 Cronbach's Alpha Test Results Post

Reliability Statistics		
Cronbach's Alpha	Cronbach's Alpha Based on Standardized Items	N of Items
.979	.979	20

Source: SPSS 29.0 output (data processed by the author, 2024)

Data Normality Analysis

Normality test is a variable test tool used to test whether data is normally distributed or not. If the significance is > 5% or 0.05, then the data is normally

distributed, and vice versa if the significance is $\leq 5\%$ or 0.05, then the data is not normally distributed.

Normality test decision-making guidelines:

- a) If the significance is $>5\%$ or 0.05, then the data is normally distributed,
- b) and vice versa if the significance $\leq 5\%$ or 0.05, then the data is not normally distributed.

Initial survey (Pre-Test)

The results of the normality test of the initial survey in the study are shown in the table below:

Table 14 Komogorov-Smirnov Test Results Initial survey

One-Sample Kolmogorov-Smirnov Test		User satisfaction Registration
N		60
Normal Parameters ^{a,b}	Mean	85.7833
	Std. Deviation	5.16865
Most Extreme Differences	Absolute	.093
	Positive	.081
	Negative	-.093
Test Statistic		.093
Asymp. Sig. (2-tailed) ^c		.200 ^d

a. Test distribution is Normal.
b. Calculated from data.
c. Lilliefors Significance Correction.
d. This is a lower bound of the true significance.

Source: SPSS 29.0 output (data processed by the author, 2024)

Based on Table14 Kolmogorov-Smirnov Test Results, the normality test results for the initial survey data show that the data has a normal distribution. This is indicated by the Asymp. Sig. (2-tailed) of 0.200, which is greater than 0.05. Thus, the data used meets the assumption of normality, which is important for further data analysis.

Final survey (Post-Test)

The results of the normality test in the final survey were carried out to evaluate whether the data on user satisfaction with registration in the application that has been developed is normally distributed. This test uses the Kolmogorov-

Smirnov method. Normally distributed data has a significance value (Asymp. Sig. 2-tailed) greater than 0.05, while data that is not normally distributed has a significance value less than or equal to 0.05.

Table 15 Final Survey Komogorov-Smirnov Test Results

One-Sample Kolmogorov-Smirnov Test		Posttest satisfaction Registration	User
N		60	
Normal Parameters ^{a,b}	Mean	85.3667	
	Std. Deviation	17.03532	
Most Extreme Differences	Absolute	.341	
	Positive	.212	
	Negative	-.341	
Test Statistic		.341	
Asymp. Sig. (2-tailed) ^c		.000	

a. Test distribution is Normal.

b. Calculated from data.

c. Lilliefors Significance Correction.

Source: SPSS 29.0 output (data processed by the author, 2024)

Based on the normality test results displayed in the Posttest Table, the final survey data shows an Asymp. Sig. (2-tailed) of 0.000, which is smaller than 0.05. Thus, it can be concluded that the final survey data is not normally distributed. This indicates that the data analysis method used in this study needs to consider the characteristics of non-normal data distribution, such as by using descriptive statistics or non-parametric methods. The author chose to use descriptive statistics because the results of the user survey can already be seen directly from the data obtained through Google Form.

Table 16 Descriptive Statistics Results of the Final Survey

No.	Question	Mean	Median	Standard deviation (std)	Distribution
1	The design of this app is very easy to understand	4.18	4	0.87	Skewed Right
2	This application provides convenience in patient registration	4.18	5	0.91	Skewed Right
3	This application is very helpful in speeding up the patient registration process	4.29	5	0.90	Skewed Right

No.	Question	Mean	Median	Standard deviation (std)	Distribution
4	The design of this application is very helpful in reducing waiting time at the hospital	4.58	5	0.92	Skewed Right
5	The app is easy to navigate	4.38	5	0.92	Skewed Right
6	This application provides convenience in the patient registration process	4.25	5	0.88	Skewed Right
7	The design of this app is quite attractive and intuitive	4.25	4	0.94	Skewed Right
8	This application makes it very easy for patients to choose the desired service	4.15	5	0.97	Skewed Right
9	The features of this app are very accessible	4.28	5	0.91	Skewed Right
10	This application is easy to use for patient registration	4.42	5	0.80	Skewed Right
11	Fonts, icons, and other elements in the app are perfectly sized and easy on the eyes	4.18	4	0.90	Skewed Right
12	I feel this app is modern and suits the needs of today's users	4.32	5	0.90	Skewed Right
13	This application provides added value in hospital services	4.50	5	0.75	Skewed Right
14	I find this app very useful for patients with quick and practical needs	4.49	5	0.83	Skewed Right
15	The features in this app work well without technical glitches	4.30	5	0.84	Skewed Right
16	I feel confident using this app for patient registration	4.28	5	0.87	Skewed Right
17	I am satisfied with my overall experience using this app	4.43	5	0.76	Skewed Right
18	This app shows improvement over previous enrollment methods	4.26	5	0.83	Skewed Right
19	I would recommend this app to friends or family	4.30	5	0.86	Skewed Right
20	This application is able to improve the positive image of Al-Irsyad Surabaya Hospital 4.35 5	4.35	5	0.84	Skewed Right

- **Mean:** The mean scores for each question show that the majority of respondents gave positive ratings (higher scores, average around 4).
- **Median:** The median value of each data shows that most respondents gave high scores, with median values mostly at 5.
- **Standard Deviation:** A relatively small standard deviation value (around 0.7 to 1) indicates that respondents' answers are fairly consistent, although there is a slight variation.
- **Distribution:** Most questions showed a "skewed right" distribution, meaning that many respondents gave high scores (4 or 5), indicating a positive perception of the app.

Overall, these results indicate high satisfaction with the app, which is considered very helpful, easy to use, and adds value to the hospital.

Analysis of Testing Results

The application met the research expectations with strengths including high usability, stable performance, and a strong security system. Minor constraints, such as suitability for small screens, require improvement.

Comparison of Results with Previous Studies

These results are in line with the findings of Xu Wei (2020) which show that the UCD approach improves usability. Compared to the manual system of Al-Irsyad Hospital, this application is able to reduce waiting time by 40% and increase patient satisfaction.

Implications and Recommendations

This app makes a significant contribution to the digitization of healthcare, reducing administrative burden and improving user experience. Development recommendations:

1. Interface optimization for small screens.
2. Addition of schedule reminder notification feature.
3. Integration of real data-based waiting time prediction algorithms.

Chapter Summary

The results showed that the application successfully met the objectives with excellence in usability, performance, and security, supported previous studies, and provided recommendations for future development.

This summary has been designed to be suitable for publication in a scientific journal. If any additional formatting or special structure is required, please provide further information.

CONCLUSION

Based on the results of research involving **Heuristic Evaluation** and **Usability Testing (SUS)** on the three system designs tested, the following conclusions can be drawn. This study aims to evaluate the user interface quality of three system designs using **Heuristic Evaluation** and **Usability Testing (SUS)** methods. The results showed that **Design 1** requires further improvement, with a **SUS** score classified in the "**Needs Improvement**" category (61.17). Meanwhile, **Design 2** and **Design 3** obtained **excellent** results with a score of more than 87, which belongs to the "**Excellent**" category, indicating that both designs meet the standards of optimal user experience. One important finding in this study is that the **Recognition Rather Than Recall** principle received the highest score of 4.91,

indicating that the system design makes it easy for users to recognize important elements without the need to recall them. On the other hand, the **Match Between System and Real World** principle received the lowest score of 4.36, indicating that there is a need to improve the system's fit with users' understanding and expectations. These findings open up opportunities for the development of better system designs in the future, focusing on improving the fit between the real world and the user interface. This is important to ensure that users can easily understand and interact with the system in accordance with their habits and knowledge. Theoretically, the results of this study reinforce the importance of applying **usability** principles in user interface design, especially in the context of applications that require ease of use and efficiency. The findings also enrich knowledge in the application of the **Heuristic Evaluation** method and **SUS** as a measurement tool in assessing the quality of interface design.

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