Application of Lean UX and System Usability Scale (SUS) Methods in Redesigning User Interface and User Experience on Adella Hospital Online Registration Website

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ABSTRACT
This research aims to evaluate user experience of a hospital online registration website. The SUS method will be used to accurately measure users' experience. Testing using SUS is carried out by distributing a questionnaire containing 10 SUS template questions and 13 general questions. After the questionnaire is distributed, the collected data will be processed using SUS assessment standards. In addition, several respondents will be interviewed in order to design a new website prototype. The prototype will be developed using Lean UX method. Testing design improvements using Lean UX method shows improvements compared to the old design.

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1. INTRODUCTION
The current development of information technology has had an influence in various fields, one of which is the health sector (Tjandrawinata, 2016). One of the application of the current technology in the field of hospital health services is online registration services. With this service, it is easier for people to register online remotely. Judging from the importance of online registration services on a hospital website, it is appropriate that online registration services have an easy access and a good level of usability.

Based on survey results using the SUS method, the average usability score is still below average. One of the causes is users' confusion and incomprehensibility when using the website. Therefore, it is important to redesign the design of Adella Hospital online registration service to increase the usability value. One effective way to measure the level of user experience of the hospital's online registration website is

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through the SUS (System Usability Scale) method which consists of a 10 question to measure user experience. This approach is able to determine whether the product has met user satisfaction based on the scale obtained through this evaluation method.

User interface is the part of the computer and software that can be seen, heard, touched and spoken to, and can be understood directly by humans (Galitz, 2007). An application design must apply user experience to produce the design that users want (Frederico et al., 2021). User experience is an aspect in which users interact with a company, its services and products (Norman & Nielsen, 1998). There are several methods that can be used to design user interfaces, including Lean UX method. In designing the UI/UX of an application, developers need to be innovative to create ideas and solutions that are focused on users' needs. The Lean UX method was chosen as the method used in designing user interface designs because this method is considered suitable for producing effective products and requires less time (Gothelf & Seiden, 2017).

2. THE PROPOSED METHOD

2.1 User Interface (UI)

User Interface (UI) can be defined as the elements on computers and softwares that can be seen visually, auditorily, haptically or through voice interaction, and can be understood directly by humans. User interface is very important because if a product does not have an attractive and comprehensible interface, it will have an undesired effect on the product demand and reduce users' interest in using the product. User Interface is not just colors and shapes, but also a bridge between the system and the users that provides them with the right information and tools to complete tasks or flows from a particular system (Rianingtyas & Wardani, 2018). User Interface is not limited to visible aesthetic elements, but User Interface must also be able to convey its function well (Rianingtyas & Wardani, 2018). User Interface also functions as a visual representation of the system or product being created. With an attractive User Interface design, the product will appeal to users.

2.2 User Experience (UX)

User Experience (UX) was introduced by Don Norman. User Experience can be defined as the aspect in which the end user interacts with the company, its services, and products. User Experience is totally needed since product developers must know that users are familiar with or very interested in the design or placement of a feature, therefore User Experience here is useful to determine the extent to which the design or placement of features can increase users' comfort when using a product (Hinderks et al., 2022). A good design is a design that is able to provide

benefits and comfort to users when using a product or system (Ferad Wawolumaja et al., 2021). User Experience has a direct impact on the level of user satisfaction which is often the main determinant to the success of a product. When the user feels satisfied and comfortable when using the product, it can be said that the poduct is successful, but if the user does not feel satisfied and feels that it is complicated or experiences difficulties when using the product, then the product can be declared as unsuccessful or that it does not meet the user criteria.

2.3 System Usability Scale (SUS)

System Usability Scale (SUS) is a questionnaire that refers to standard usability questionnaires which are known as a fast and simple evaluation method. The use of SUS questionnaire is carried out efficiently and the obtained data is reliable (Brooke, 1995). The process of SUS method involves distributing 10 questions in the form of a questionnaire to a predetermined number of users in which users are asked to rate each question with a predetermined rating scale. This method can provide a general overview of the system's usability level with fairly good efficiency. SUS is a usability measurement tool that is simple, efficient, and can provide a clear general picture of the extent to which the system is easy to use by users (Suyanto & Ependi, 2019).

2.4 Lean User Experience (Lean UX)

Lean UX is a method that brings realism to completing a product more quickly by collaborating so that it reduces comprehensive documentation activities, but focuses more on building or understanding together about the experience of the product being designed (Gothelf & Seiden, 2017). Lean UX has 4 stages, namely Declaring Assumption which is used as a starting point in designing a prototype, Creating an MVP which helps in testing assumptions so that the solution provided achieves the desired result and is used in research, Running on Experiment which is independent testing before testing on users, and lastly Feedback & Research, which includes testing on users and analyzing feedback to determine the success level the prototype. The feedback will be used as suggestions and consideration for further product development.

2.5 Hospital

According to Undang-Undang Nomor 44 Tahun (2009), a hospital can be defined as a service institution that provides complete health services for a person, providing such as outpatient, inpatient, and emergency care. Hospitals are grouped into 2 types based on the types of services, namely general hospitals and specialized hospitals. The difference lies in the services provided. General hospitals provide services and specialization in various fields to treat almost all types of diseases. While

specialized hospitals provide services focused on exclusive services in one particular area or type of disease.

3. METHOD

This research will use quantitative and qualitative approaches to measure the scale of user experience and determine what aspects need to be improved in the product. A quantitative approach was taken by distributing questionnaires to respondents who used the hospital online registration website. The qualitative process was carried out by conducting interviews and observing several respondents. The flow of research to be carried out can be seen in Figure 1.

To determine the number of samples that will be used, this research cites (Faulkner, 2003) as a reference for quantitative data samples, which states that using 5 participants will only get 55% of usability problems. Meanwhile to get 90% of usability problems, a minimum of 15 participants are needed. Based on the percentage of total known usability problems found in analysis of 100 samples table, the sample that will be used in this research as a quantitative data sample is 40 as to get 98% minimum usability problems and 99,6% average usability problems. Meanwhile, for the qualitative data samples, this research uses recommendations from (Jakob Nielsen, 2000) which states that using many samples for interviews will not make the obtained insights differ from the insights obtained through interviews with 5 participants. Therefore, there are 5 qualitative data samples in this research.

Collecting the data in this research is done by distributing SUS questionnaires using Google Forms designed according to research requirements. The link to the questionnaire is distributed via social media such as WhatsApp, Instagram, and Telegram intensively every day. After the data is collected, the data is the processed through the SUS calculation technique. At this stage, reliability and validity tests are also carried out. Lastly, the data processing result from the SUS calculation method are interpreted, the demographic result are analyzed, and the analysis results are defined to determine the average SUS value. After the average SUS score is obtained, it is matched on a comparison of adjective ratings, acceptance scores, and assessment scales (Brooke, 1995).

After the results of filling out the questionnaire were obtained, interviews were conducted with several respondents who had filled out the questionnaire to find out the problems that the users experienced. The results of this interview will then be used as a benchmark and source for solving problems through design ideas.

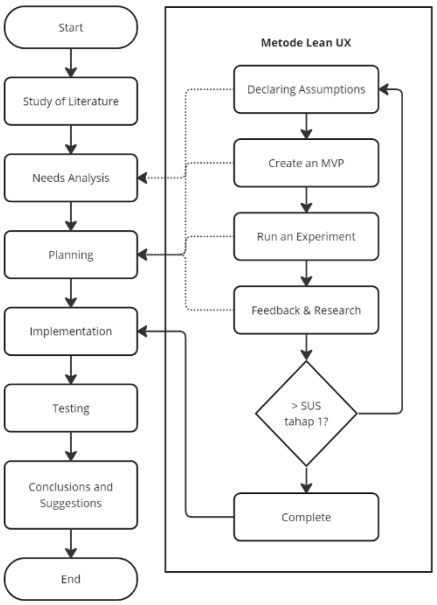

Figure 1. Research Flow Diagram

First, the Declaring Assumptions stage focuses on collecting data and understanding user needs. This process is expected to produce insights from the users after distributing the SUS questionnaire and interviews. SUS is used to obtain information on the average usability value of a product that can be said to be good or still requires assistance. After distributing the questionnaire, an interview stage was carried out to find out user problems more clearly and in detail. Second, the Creating an MVP stage aims to create an interactive prototype for the online registration website. Third, the Running on Experiment stage is the stage of independent testing of the prototype that has been created before testing it with users. Fourth, the Feedback and Research stage is the stage of testing the prototype with users to determine the usability value of the prototype design for the new hospital online registration website and analyzing the feedback received from the users. The test is carried by using the SUS method. Test results will be analyzed to validate whether the prototype design is successful or not in solving the users' problems.

4. RESULTS AND DISCUSSION

4.1 Usability Test Before Repair

Based on the data obtained from the website usability test before improvement, it produces a sus score as in Table 1.

Table 1. Usability Test Before Repair

Adjective Rating	Grade Scale	Acceptability Ranges
Poor	F	*Not Acceptable*

4.2 Lean UX Process

4.2.1 *Declaring Assumptions*

After understanding the overall problem that occurs, the next step is to present assumptions from various points of view in the business process from both the hospital and the users. The stages carried out are:

4.2.1.1 *Problem Statement*

In this stage, researcher will interpret the problems faced by users based on the data that has been collected. This problem statement was created through questionnaires and interviews with sources who conveyed the need for feature developments. The following are the results of the problem statement in Table 2.

Table 2. Problem Statements

No	Problem Statements
1	The Adella Slawi Hospital Online Registration Website is expected to provide a more attractive appearance to users with a design that is not monotonous, has distinctive characteristics and is user-friendly. Currently, respondents feel that their motivation to open website has decreased due to the website monotonous appearance and not being user-friendly. How to improve the appearance of the Adella Hospital Online Registration Website to make it more attractive, unique, and user-friendly?
2	The Adella Hospital Online Registration Website is expected to provide the information users need. Currently, respondents often feel confused about not knowing which doctor schedules are available and which are not, not informed about the current queue number, and are confused about the new and old patient types section. How do you create features that can make it easier for respondents to get informations?

3	The Adella Hospital Online Registration Website is expected to be able to help users when they experience difficulties or confusion in accessing the Adella Slawi Hospital Online Registration Website. Currently, respondents often face some difficulties when using the Adella Slawi Hospital Online Registration Website. How to create a feature that can make it easier for respondents to get answers to the difficulties or confusion they are experiencing?

4.2.1.2 *Assumptions Worksheet*

After generally understanding the existing problems, the next step is to present assumptions from various aspects of the business process, both from the hospital and the users' perspective. In Table 3, there is assumption worksheet.

Table 3. Assumption Worksheet

Assumptions Worksheet		
No	Business Worksheet	User Worksheet
1	I believe that users have the needs to…	Who of the users will use it?
2	My main customer is…	What the features are important?
3	I will make money with…	What will be a problem once the product is finished?
4	Users can obtain benefits…	When and how our product is used?
5	This need can be overcome with…	How is the appearance and impression of our product?

Business assumptions involve aspects such as explaining users' needs, addressing issues that arise from users' needs, and identifying potential risks. Meanwhile, user assumptions include identifying who will use the product, the problems they face, when and how the product will be used, as well as the main features of this product (Priyanto et al., 2022) The following are the results of the assumption worksheet stages which can be seen in Table 4 and Table 5.

Table 4. Business Assumptions

Business Assumptions	
Assumption 1	It is believed that users need the appearance of the Adella Hospital Online Registration Website to be more attractive with its own characteristics and user-friendly.

	This need can be overcome by improving the appearance of the website which can appeal to the eyes of the users with its own characteristics and is user friendly.
	The risk of improving this display is if users find the website display difficult to understand and users are not very familiar with technology, they must make adjustments first before using the website.
Assumption 2	It is believed that users need the doctor's schedule information features.
	This need can be addressed by creating a feature in the online website that can facilitate users to get informed on doctor's schedule as to know who are available and who are not.
	The risk in this feature is the case where users feel that it is not helpful in viewing available and unavailable doctor's schedule information.
Assumption 3	It is believed that users need a feature to find out the queue number currently running at each services.
	This need can be overcome by creating a feature that can facilitate users to find out the queue number currently running at each services.
	The risk in this feature is the users who feel that it is not helpful to see the current queue number and prefers to go to the hospital to find out directly.
Assumption 4	It is believed that users need to make the distinction between old patients and new patients easier.
	This need can be addressed by creating features that can facilitate users to easily understand the type of patient they should choose.
	The risk in this feature is if users feel that they are not helped in understanding the flow of the old and new patient type selection section and prefer to register in person or by phone call.

Table 5. User Assumptions

User Assumptions	
Who are the users?	Prospective Adella Slawi Hospital patients.
What features are important?	Online registration feature and information courtesy of Adella Slawi Hospital.

What problems can this product solve?	Prospective patients can feel uncomfortable, registering directly at the hospital or by phone call, and prospective patients feel that their motivation to use the website has decreased because the website is too monotonous, has no distinctive features and is not user-friendly.
When and how is this product used?	When a prospective patient or someone else is sick and needs a medical examination immediately or wants to make a doctor's appointment, they can register online via the hospital website.
How should this product look and behave?	The appearance and flow of the hospital website must give the impression of being non-monotonous, attractive, distinctive, easy to understand and self-explanatory.

4.2.1.3 *Prioritizing Assumptions*

This stage is carried out with the aim of helping researchers to be more focused and directed in feature development, taking into account the level of risk. Assumptions are grouped based on the risks involved and the benefits that will be experienced by the user. The results of determining the priority of assumptions can be found in Figure 2.

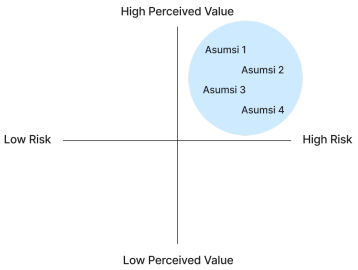

Figure 2. Prioritizing Assumptions

4.2.1.4 *Hypotheses*

Previously collected assumptions are converted into hypotheses to make designing website features easier. The following are the hypotheses that have been noted in Table 6.

Table 6. Hypotheses

No	*Hypotheses*
1	It is believed that a more attractive appearance of the Adella Slawi Hospital online registration website with its own characteristics and user-friendliness is needed so that users can enjoy the appearance of the website and understand the contents of the website without having to feel that their reason to use the website has decreased and prefer to register directly at the hospital or by phone call. It is said to be true if the users think that the appearance of the website increase the user's motivation or mood in using the website to register when they want to seek treatment.
2	It is believed that the doctor's schedule information feature is needed so that users can find out whether the doctor's schedule is available or not at each clinic. It is true that users find the doctor's schedule information to be helpful when they uses the Adella Slawi Hospital online registration website.
3	It is believed that a feature to find out the running queue number is needed so that users can see the running queue online. It is said to be true if users think that it’s helpful to have the queue number information that is currently running on the Adella Slawi Hospital online registration website.
4	It is believed that a feature to differentiate patient types is needed so that users can understand more easily and be able to select patient types according to each users’ patient type. It is said to be correct if the users find it helpful to know the differences between the types of the patients.

4.2.1.5 *User Persona*

User Persona is a brief description of a users’ goals, personality, and pain points (Kurniasari et al., 2022). User persona includes biography, users’ needs, users’ desires, and problems users face when using the Adella Slawi Hospital online registration website. The User Persona that has been created can be seen in Figure 3.

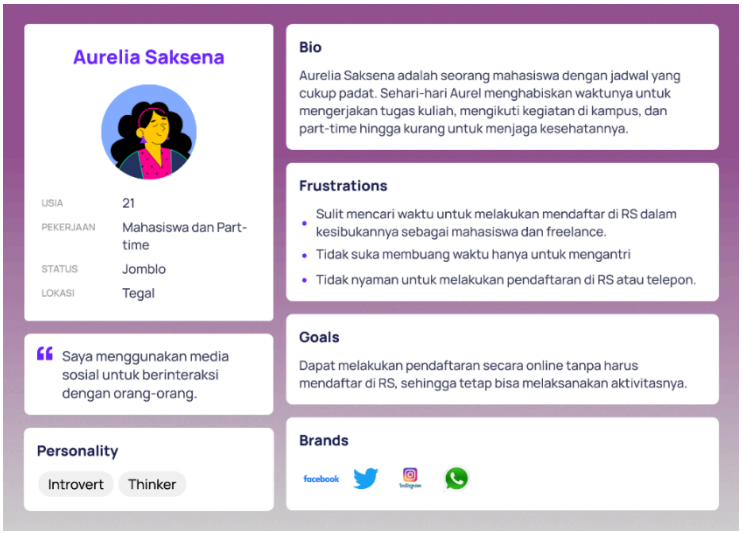

Figure 3. User Persona

4.2.2 ***Create an MVP***

At the Creating an MVP stages there are 2 procedures for design, namely:

4.2.2.1 *User Flow*

Generated user flow for the indicated hospital website online registration flow can be seen in Figure 4.

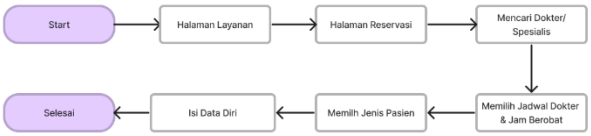

Figure 4. User Flow

4.2.2.2 *Wireframe*

This stage provides a framework for the layout and describes existing contents and features.

4.2.2.3 *Design System*

Design Systems are used to create uniformity in the use of components or design elements and to optimize the time needed to design efficiently. In this research, several design systems were created, such as typography, colors and icons.

4.2.2.4 *High Fidelity Design*

At this stage a high fidelity is created to be carried out later when the test on each prototype is conducted. The following is the display of high fidelity:

1) Services page

When accessing the website, the users will get displayed the following image as shown in Figure 5.

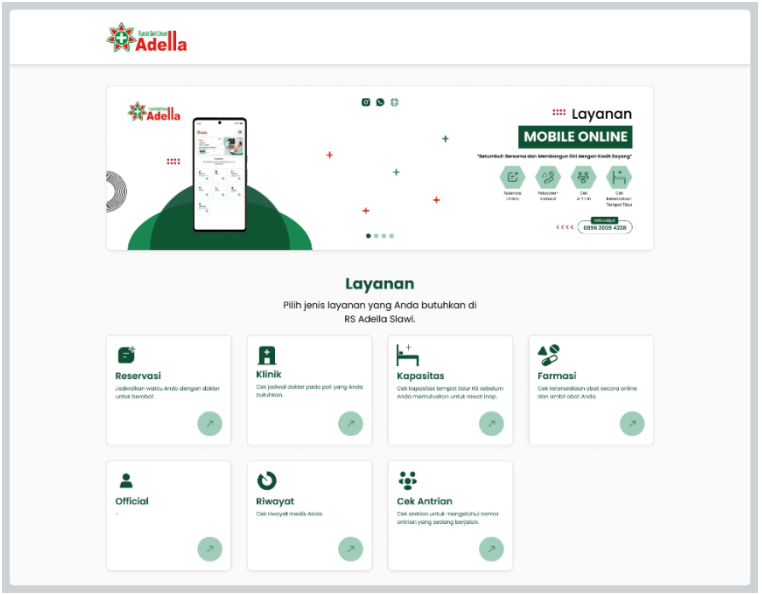

Figure 5. Services Page

2) Doctor search page

After users click on the reservation, users will be shown the search for a doctor page as displayed in Figure 6.

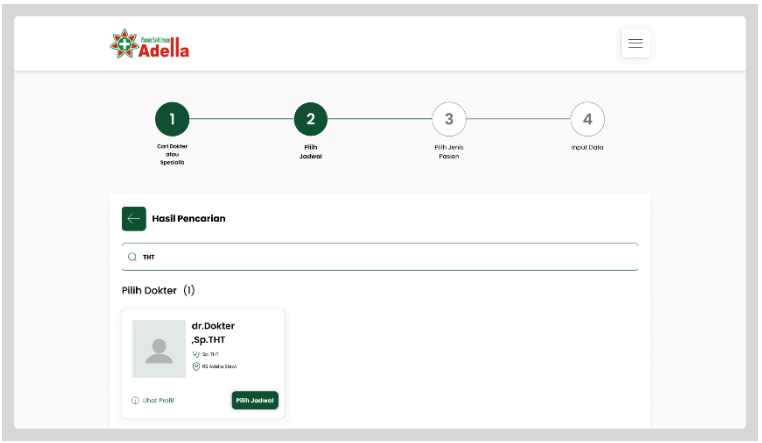

Figure 6. Doctor search page

3) Select doctor's schedule page

After selecting a doctor, users will be directed to select a schedule, such as the date and time as shown in Figure 7.

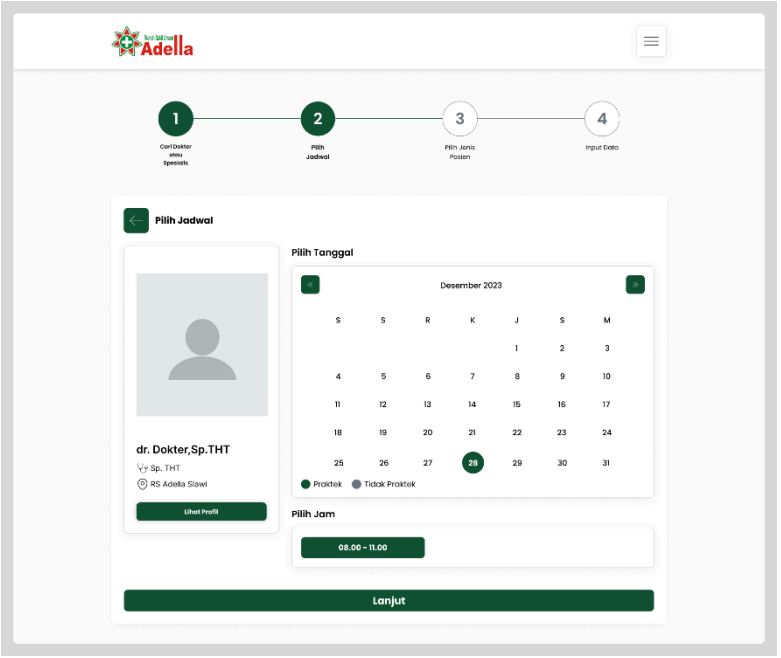

Figure 7. Select Doctor's Schedule Page

4) Select patient type page

After selecting a doctor's schedule, the patient will be directed to select the type of patient as shown in Figure 8.

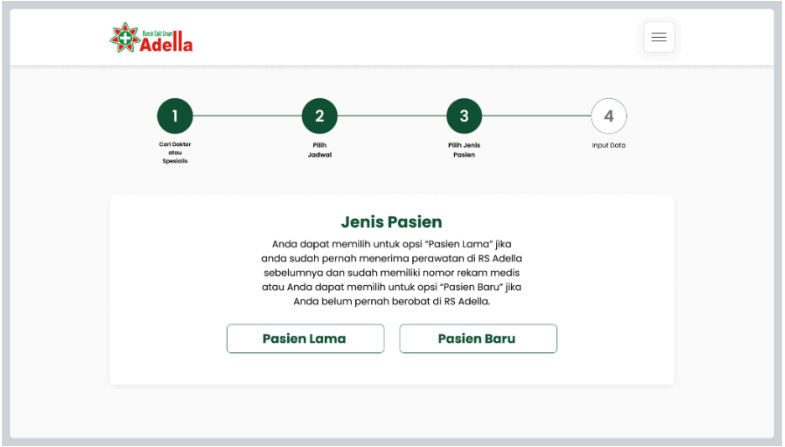

Figure 8. Select Patient Type Page

5) Old patient data input page

When the patient selects the old patient type the display will be as shown in Figure 9.

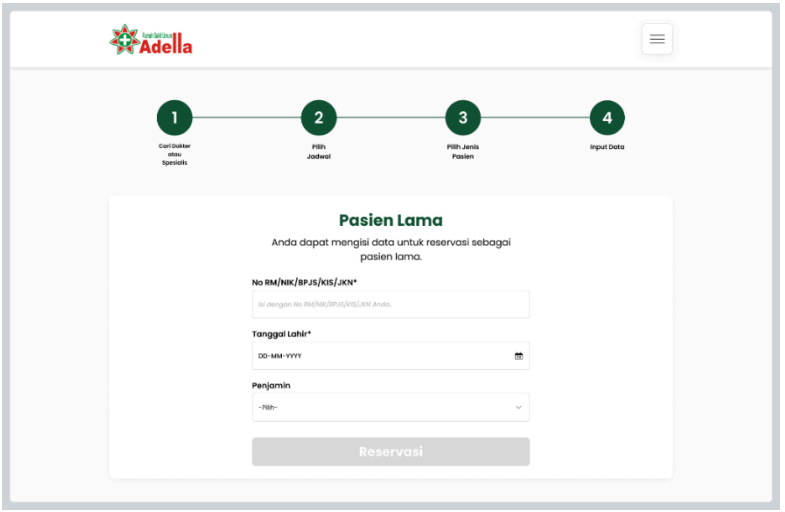

Figure 9. Old Patient Data Input Page

6) New patient data input page

If the patient selects the new patient type the page will be as shown in Figure 10.

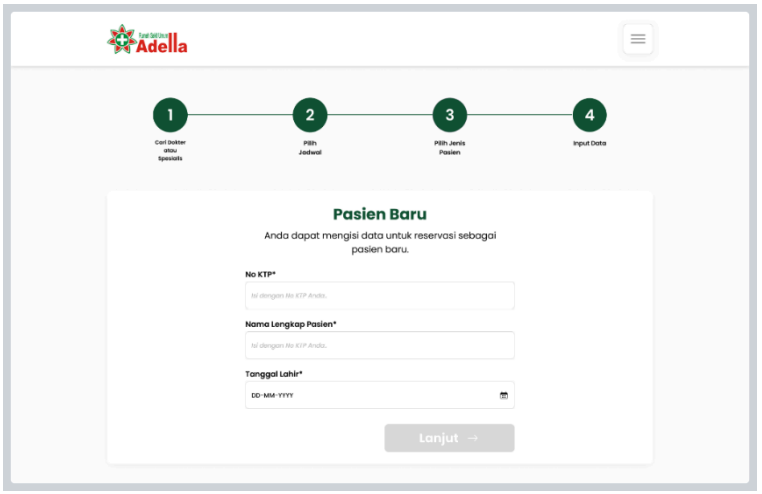

Figure 10. New Patient Data Input Page

7) Queue check page

The page used to check the queue number on hospital in real time is shown in Figure 11.

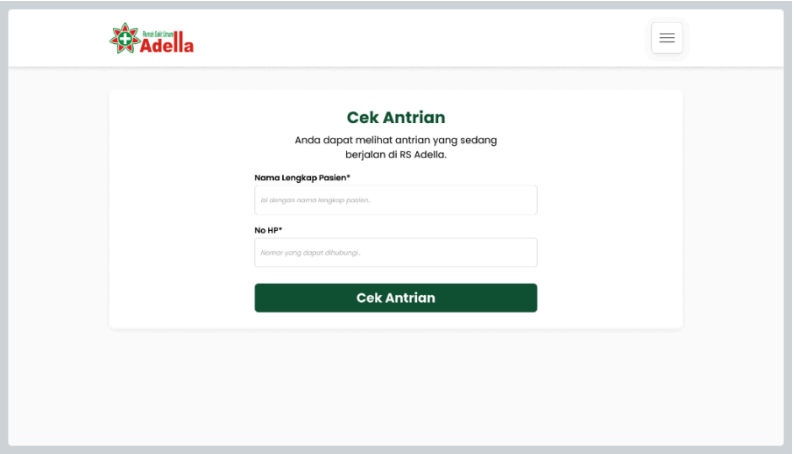

Figure 11. Queue Check Page

4.2.3 *Run an Experiment*

In this stage, trials are conducted based on the MVP design that had been created independently before testing it on users.

4.2.4 *Feedback & Research*

In this stage, prototype testing is carried out by distributing the prototype with an assessment questionnaire altogether to respondents. In this prototype test, respondents were given the freedom to explore the prototype without any time limit. Apart from the assessment questionnaire in the form of an SUS assessment, respondents will also be asked to provide validation of the design to ensure that the design has been designed according to the users' needs. The table of calculation result for the SUS method test on Table 7 and Table 8 is the result of design validation.

Table 7. SUS Score Results and Final SUS Score After Improvement

Respondents	SUS Score	Final SUS Score
R1	35	87,5
R2	35	87,5
R3	32	80
R4	33	82,5
R5	33	82,5
R6	33	82,5
R7	34	85

R8	33	82,5
R9	34	85
R10	34	85
R11	32	80
R12	33	82,5
R13	34	85
R14	36	90
R15	29	72,5
R16	29	72,5
R17	32	80
R18	36	90
R19	35	87,5
R20	35	87,5
R21	34	85
R22	33	82,5
R23	30	75
R24	32	80
R25	35	87,5
R26	32	80
R27	33	82,5
R28	33	82,5
R29	34	85
R30	32	80
R31	27	67,5

R32	29	72,5
R33	33	82,5
R34	33	82,5
R35	32	80
R36	32	80
R37	33	82,5
R38	31	77,5
R39	32	80
R40	31	77,5
Average	**32,7**	**81,75**

Based on the comparison of adjective ratings, acceptance scores, and rating scales with the average score of the System Usability Scale (SUS) by (Brooke, 1995), the average usability score after improvements are made is included in the Good group in the adjective rating category, getting B value in grade scale category and receiving the Acceptable predicate in the acceptability ranges category. This value shows that the prototype of the Adella Slawi Hospital online registration website is good and can be accepted by users.

Table 8. Validation Design

No	Questions	Evaluation				
		STS	**TS**	**N**	**S**	**SS**
1	Does the prototype design have interesting design interactions?	-	-	-	23	17
2	In your opinion, is the design in the prototype difficult to understand?	18	22	-	-	-
3.	In your opinion, does the design suit the users' needs?	-	-	-	18	22

Based on this table, it can be concluded that most users think that the design in the prototype already has interesting design interactions, is not difficult to understand, and has been designed according to users' needs.

4.3 Comparison of Usability Test Result

Table 9 is a comparison table of usability test results before and after improvements.

Table 9. Comparison of Usability Test Result

Value Category	Before Improvement	After Improvement
SUS *Score*	-	81,75
Adjective Rating	*Poor*	*Good*
Grade Scale	F	B
Acceptability Range	*Not Acceptable*	*Acceptable*

Table 8 shows that there is an increase in usability test results before improvements compared to usability test results after improvements in all value categories. The increase in usability value is influenced by a design appearance that is not monotonous, fresh, attractive, easy to understand, while also has the completion of features such as the queue checking feature that users need.

5. CONCLUSION

Based on the findings of this research, there are several conclusions that can be drawn. This research resulted in the user experience of the hospital's online registration website using the SUS method and obtained a score below average. The usability value of the online registration website required improvements to its appearance, in which were carried out in this research using the Lean UX method. After redesigning the design, the prototype was tested again using the SUS method and obtained a score of 81.75, which indicates that there was an increase in the usability value after improvements were made and the design was acceptable to users.

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