

Evaluation of User Interface and User Experience on Solo Destination App using System Usability Scale and Human-centered Design Methods

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ABSTRACT

User interface (UI) and user experience (UX) play a crucial role in determining a system's usability. Although designed for widespread use, the Solo Destination app has not been assessed for its usability. This study evaluates the app using the System Usability Scale (SUS) and Human-Centered Design (HCD) methods. The sample size was determined using Slovin's formula, resulting in 50 participants, with 5 chosen for in-depth interviews to gain deeper insights. The initial evaluation showed that the app scored 55.55 on the SUS, placing it in the marginal low category within the acceptability range. This score corresponds to a grade scale of D and an "OK" adjective rating. Interviews conducted during the inspiration phase provided detailed data for the subsequent ideation phase, where brainstorming identified seven main issues: features, reminders, event updates, information delivery, color, layout, and hierarchy. In the implementation phase, solutions to these issues were developed into a prototype using Figma. The improved prototype was then retested using the same methods. The retest showed a significant improvement, with the SUS score rising to 82.05. This places the app in the acceptable category, with a grade scale of B and a "good" adjective rating. This research highlights the importance of continuous usability evaluation and user focused design. Addressing identified issues significantly enhanced the app's usability, ensuring better user acceptance and satisfaction.

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1. INTRODUCTION

The evolution of user interface and user experience has become crucial in digital product design during the era of the Fourth Industrial Revolution (Sembiring et al., 2019). By leveraging good user interface and user experience, companies can introduce products to the public, attract consumers, and compete in a competitive market (Widharma, 2020). Both complement each other in the digital product design process and play equally important roles. Therefore, user interface and user experience play a crucial role in achieving company goals, such as increasing sales and scaling the business.

The user interface plays a crucial role in developing information systems. It refers to the interface that users will interact with to use the information system, and the quality of the user interface can significantly impact the user experience (Sidhawara, 2022). Some roles of the user interface in developing information systems include enhancing user satisfaction, facilitating navigation, improving efficiency, and reducing user errors (Fitriana et al., 2022). To achieve success, the development of information systems requires a combination of good user interface and user experience. Understanding user needs and preferences is the key to creating a good information system and achieving high usability.

User experience is an essential part of the information system development process that needs to be considered and emphasized (Knight, 2019). Designing user experience is crucial because systems with good user experience can leave a positive impression on users when they use the system. Moreover, good user experience can create a pleasant experience for users and enhance system efficiency (Isadora et al., 2021). Conversely, systems with poor user experience can cause discomfort for users when using the system (Sukarsa et al., 2022). When discussing user experience, usability and user interface are inevitable topics. These aspects are primary factors in user experience (Sujito et al., 2019).

Usability refers to the extent to which the user interface and user experience of a product or application meet certain criteria that make it easier to use, efficient, and satisfying for users. In this context, usability measures how well users can interact with the product or interface, to what extent the product meets user needs, and how much it provides a positive experience. Usability in user interface and user experience is crucial because satisfied users tend to use the product continuously, reduce frustration and errors, and enhance the product's image.

Usability analysis can employ various methods available. Methods commonly used to analyze usability include expert review, heuristic evaluation, and System Usability Scale (SUS). The choice of method for analyzing usability depends on the research objectives, budget, and available resources. Some studies also combine

several methods to gain a more comprehensive understanding of usability. Expert review involves a usability and interface design expert reviewing the product to identify potential issues and provide recommendations for improvement, while heuristic evaluation is similar to expert review but involves multiple experts or a team. In contrast to expert review and heuristic evaluation, System Usability Scale (SUS) has several advantages. It involves actual users of the product in usability testing, produces quantitative scores that can be used to directly compare the usability of products with others, and is easy to implement and quick to conduct.

There have been numerous studies examining the ease of use of a system. The methods used to investigate usability levels are diverse. Research conducted by Maramba et al. (2019) utilized heuristic evaluation to test the usability of a healthcare application. Another study employed the Usability Metric for User Experience (UMUX) to evaluate user satisfaction with the user interface of Coursera and Open Education applications (Holmes et al., 2019). Additionally, there are studies that utilize user experience questionnaires to identify usability issues within a system (Korableva et al., 2019). The aforementioned research, employing various methods such as heuristic evaluation, UMUX, and user experience questionnaires, successfully addressed issues within the examined objects. Further research on usability can progress through the improvement stage. Continuation studies for usability improvement may involve systems or applications, which can be approached through design methodologies.

The design approach method has been utilized in numerous studies to create solutions for user problems and needs. Some design approach methods used include those conducted by Bakar et al. (2022), who employed user-centered design to create spatial designs in public buildings. Additionally, design thinking was used in education and craftsmanship at universities and schools (Briede et al., 2020), and human-centered design was utilized by Holeman & Kane (2020) in the development of technology-based healthcare systems. The aforementioned methods, whether user-centered design, design thinking, or human-centered design, have proven effective in addressing existing issues.

Research methods for assessing usability can be used in conjunction with design approaches to achieve the best results. Problem data obtained from usability analysis techniques can be used when designing or improving systems to find the best solutions. Previous studies have combined usability testing methods with design approaches. There are studies that combine usability and design approaches, including research that uses the System Usability Scale and Task-Centered System Design by Kusumah (2022) to redesign the academic information system application of Universitas Siliwangi. Research conducted by Lestari Siahaan & Syafrianto (2023) combines the System Usability Scale and User-Centered Design to design an

inventory website. Studies that use a combination of usability and design approaches have yielded good results. Therefore, the researcher uses the System Usability Scale to evaluate the usability level of the designated objects. However, according to Sauro (2013) cited by Vlachogianni & Tselios (2022), although the System Usability Scale can provide valuable information about the usability of a system, it should be combined with other measuring tools, depending on the type of system being evaluated. Here, the researcher combines the System Usability Scale with a human-centered design approach because this approach ensures that the products and services developed are based on user needs, preferences, and experiences (Philips, 2018).

The objects used in the mentioned studies share some similarities, namely being software or information systems. In this research, the object to be used is a tourism information service application in Surakarta or Solo, namely the Solo Destination application. The Solo Destination application is a tourist guide application in Surakarta with features that facilitate users in exploring the city (Rustam, 2022). The Solo Destination application can be accessed by downloading it from the Google Play Store or App Store. As a tourist guide application accessed by both local and non-local residents of Surakarta, it should provide informative information and good usability. However, based on assumptions and personal experiences, the researcher feels that the Solo Destination application does not yet have good usability, as there are features that should not be included in a tourist guide application.

This research will focus on analyzing the usability level of the Solo Destination app. The study will take place in Surakarta, with the population for this research being Surakarta residents who use the Solo Destination app. The research will use the System Usability Scale method, consisting of 10 Likert-scale questions incorporated into a questionnaire to gather data on how Surakarta residents perceive the Solo Destination app. The results from the questionnaire distribution will be analyzed and used for evaluating the usability level of the Solo Destination app's user interface and user experience. The evaluation results will be utilized for improvement purposes to create a new prototype of the Solo Destination app, implementing the human-centered design method, which will be retested using the System Usability Scale method.

2. RESEARCH DESIGN

This study falls under the research and development (R&D) category. According to Sugiyono (2022), research and development are conducted to produce specific products and evaluate their effectiveness. Meanwhile, according to (Firouz et al. 2021) research and development is an activity aimed at generating new knowledge

useful for companies or society, as well as producing better and innovative products or services. Research and development involve the process of discovering, developing, and implementing creative ideas that can be applied in various fields, such as technology, products, and knowledge. The research design flow in this study can be seen in Figure 1.

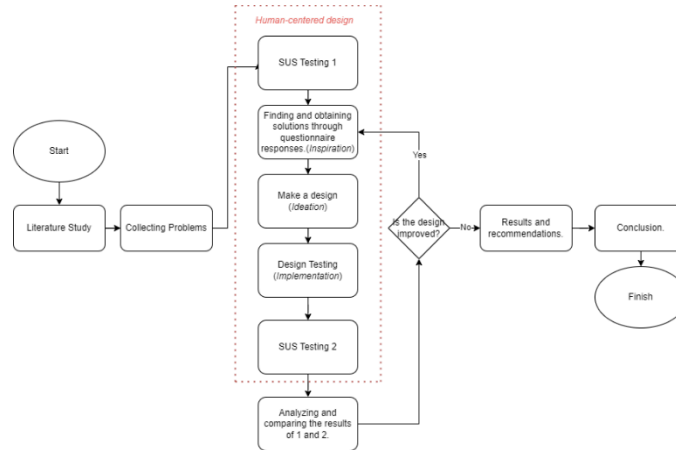


Figure 1. Research Design

This research began with testing the Solo Destination application using the System Usability Scale questionnaire. The System Usability Scale questionnaire itself addresses the usability of a system. Research by Sharfina and Santoso (2016), as cited by Susilo (2019), elaborated on the questions. Based on this research, the researchers successfully formulated ten questions regarding the application under study. The following are the ten questions in the SUS questionnaire as presented in Table 1.

Table 1. SUS Questionnaire

Variable	Code	Construct
1 Efficiency	Q1	I feel that I can use this application quickly.
	Q2	I feel that this application requires too many steps to accomplish something.
2 Learnability	Q3	I am confident that most people would learn to use this application quickly.
	Q4	I find this application difficult to use.
3 Memorability	Q5	I feel I would easily remember how to use this application.
	Q6	I find it difficult to remember how to use this application.
4 Satisfaction	Q7	I enjoy using this application.
	Q8	I feel there are too many inconsistencies in this application.

Variable	Code	Construct
5 Error	Q9	I feel the functions in this application are well-integrated.
	Q10	I feel I would need technical assistance to use this application.

The obtained data were then processed to obtain initial values for the usability level of the Solo Destination application. The next stage involved implementing the human-centered design method, which consists of three stages, including:

1. Inspiration

In this stage, the aim is to obtain insights into the needs of users by conducting detailed observations, analysis, and identification related to the Solo Destination application. The process or activities carried out in this stage involve distributing questionnaires and conducting interviews with several informants based on pre-determined criteria and samples. The questions used in this stage can be seen in the table 2.

Table 2. Inspiration Instrument

Code	Questions
I1	How often do you access the Solo Destination app?
I2	What comes to mind when you hear about the Solo Destination app?
I3	What do you usually use or access the Solo Destination app for?
I4	Do you think the features provided by the Solo Destination app are optimal and help you get to know Surakarta city?
I5	Do you have any complaints or issues when using the Solo Destination app?
I6	Can you mention positive aspects of the Solo Destination app?
I7	Can you mention negative aspects of the Solo Destination app?
I8	Are there any needs that should be available but are not yet provided in the Solo Destination app?
I9	What do you expect from the Solo Destination app?
I10	How do you find the current interface of the Solo Destination app?
I11	Do you think the Solo Destination app is user-friendly?
I12	Please provide your suggestions and recommendations for improving the Solo Destination app.

2. Ideation

The ideation stage is a phase where brainstorming is conducted to gather ideas or solutions to previously identified problems (Prabowo, 2022). This is done to facilitate the selection of ideas that can be realized according to the needs and desires of

users. Before conducting brainstorming, a user journey map is created to understand what users do and feel. In addition to brainstorming, this stage involves creating user interface designs and evaluating these designs. The user interface created is in the form of a prototype. The evaluation process in this stage involves feedback or input provided by respondents. The designs that have been created will be given feedback by the respondents.

3. Implementation

The implementation stage is the final stage of human-centered design. In this stage, user interface solutions are created after testing or evaluation (Prabowo, 2022). Subsequently, improvements are made to the previous user interface design based on evaluations to produce a user interface design that meets the needs and desires of users. This enables users to experience a more tangible system. Therefore, at this stage, a design has been produced that can effectively meet the experiences and usage of users.

3. RESEARCH METHODS

3.1 Sample

This study defines the sample into several parts, which are used according to the stages of the research.

3.1.1 Testing Sample

The testing sample is the sample that will be used to conduct the usability testing process. This sample will fill out the SUS questionnaire and generate quantitative data. To determine the sample in usability testing, a sampling technique is needed. In this research, the Slovin formula or formula is used to determine the number of samples to be tested. The population size to be studied is approximately 50,000 users, taken from the number of application downloads on the Play Store, with a margin of error of 15% to yield data accuracy of 85%. When calculated using the Slovin formula with a margin of error of 15%, the value obtained is 44.4 samples, rounded up to 50 sample participants. Respondent recruitment for this study is conducted by distributing pamphlets containing recruitment information. Interested users will be directed straight to a WhatsApp group, which serves as the platform for gathering respondents and sharing information related to the study.

3.1.2 Inspiration Sample

This study does not utilize a large sample size for interviews. Instead, it employs 5 samples representing the duration of Solo Destination app usage, categorized based on a 1 to 5 scale in the questionnaire. It is hoped that the duration of Solo Destination app usage can influence respondents' answers regarding the Solo Destination app.

3.2 Outer Model

3.2.1 Techniques for Quantitative Data Validity

Quantitative validity testing in this study is conducted by testing the research instruments used to determine whether the designed instruments can be used or not, so that the resulting data can be justified. In this research, validity testing and reliability testing are used.

Validity testing is used to demonstrate the extent to which a measurement tool can measure what it is intended to measure, while reliability testing assesses the extent to which measurements with the same object will produce consistent data (Rahayu et al., 2018).

3.2.2 Techniques for Qualitative Data Validity

The validity testing of qualitative data in this research is conducted during the midpoint of the study, specifically during the inspiration phase where data has been obtained and analyzed during the ideation phase. The identified issues are then validated by several research samples to ensure the validity and reliability of the generated data. In validating the data, this study utilizes reference materials and membercheck.

3.3 Inner Model

3.3.1 Quantitative Data Analysis Techniques

In analyzing quantitative data, this study employs the technique of descriptive statistical data analysis. Descriptive analysis is a method used to analyze data by describing it without intending to draw generalizing conclusions (Sugiyono, 2022).

3.3.2 Qualitative Data Analysis Techniques

In this study, the data analysis technique utilized is the Miles and Huberman (1984) model, which consists of three steps: data reduction, data display, and conclusion drawing.

4. RESULTS AND DISCUSSION

4.1 Data Collection

In the initial usability testing phase, data was collected from 50 respondents using the System Usability Scale (SUS) method, which includes 10 usability questions. Additional optional questions were included in the questionnaire to gather feedback and recommendations from participants regarding their experience with the Solo Destination application.

Table 3 displays the calculated scale ratings provided by respondents when filling out the evaluation questionnaire for the Solo Destination app. The obtained values from the questionnaire distribution are then processed using the standard SUS calculation to determine the usability score of the Solo Destination app.

Table 3. Calculation results of SUS for each instrument

Instrume nt	Instrument Score	SUS Score
Q1	165	2,3
Q2	137	2,26
Q3	159	2,18
Q4	128	2,44
Q5	145	1,9
Q6	118	2,64
Q7	153	2,06
Q8	151	1,98
Q9	161	2,22
Q10	138	2,24

The usability score of the Solo Destination application through the calculation process is 55.55. Translated into the usability valuation theory by Tullis and Stetson (2004), the Solo Destination application receives an "ok" rating in the adjective rating category, and a "marginal low" rating in the acceptability ranges category. These scores and ratings indicate that the Solo Destination application falls below usability standards and requires evaluation and improvement.

4.2 Inspiration

In the inspiration phase, detailed data sampling was conducted through descriptive questionnaires and interviews with selected participants to gain deeper insights into issues with the Solo Destination app. Table 4 contains the summarized results of the questionnaire distribution and interviews, categorized based on the inspiration research instrument.

Table 4. Inspiration Questionnaire Results

Cod e	The Questionnaire Results.
I1	The results of questionnaire instrument I1 indicate that users tend to use the Solo Destination application less frequently.
I2	The results of instrument I2 indicate that the majority of respondents believe that the Solo Destination application is useful for assisting users.
I3	The results obtained from instrument I3 indicate that the majority of respondents use the Solo Destination application to search for tourist attractions in Surakarta City.
I4	The responses to instrument I4 are predominantly indicating that the features available in the Solo Destination application are helpful enough. However, respondents also express confusion due to features

Cod e	The Questionnaire Results.
	such as e-tax, permits/MPP, and food prices, which they feel should not be included in a tourism information application.
I5	The results of instrument I5 indicate that respondents perceive some difficulties, such as the lack of updated news about tourist attractions or events.
I6	The results of instrument I6 is Solo Destination app has positive impact, aiding residents and tourists in discovering Surakarta attractions.
I7	Instrument I7 findings majority of respondents express that Solo Destination app features are too numerous and complex, particularly for users from outside Surakarta.
I8	In Instrument I8, respondents mention that there are certain needs that should be fulfilled by the Solo Destination app, yet these features are not available in the application.
I9	In Instrument I9, respondents express their hope that the application can assist many people, both local and non-local visitors, when they are planning to visit a place in Surakarta City.
I10	The data from Instrument I10 indicates that the interface of the Solo Destination application is already quite good.
I11	The results from Instrument I11 indicate that most respondents feel fairly comfortable with the available features, although issues often arise.
I12	Instrument I12 consists of suggestions and recommendations from respondents who are users of the Solo Destination application.

4.3 Ideation

The Ideation stage is a phase where brainstorming is conducted to generate ideas or solutions to the problems identified in the previous stage. This is done to facilitate the selection of ideas that are feasible to be implemented according to the needs and desires of the users.

The UI design process for the Solo Destination app follows the human-centered design method, focusing on user psychology and natural characteristics. The researcher assumes the user's perspective to gather ideas. After collecting ideas to solve potential user problems, the next step is to prioritize these ideas. This is done to facilitate their implementation and determine which tasks should be tackled first. After that, an analysis is conducted to identify the problems experienced by users and the needs they have from the Solo Destination application. The issues with the Solo Destination application have been summarized.

1. Feature – M1

The issue of features emerges as a primary concern for the Solo Destination application, frequently complained about by respondents. The excessive features for a tourism information application raise numerous questions regarding the utility of the existing features.

2. Reminder/Notification – M2

The lack of reminders or notifications about upcoming events leaves respondents feeling uninformed about the activities taking place or scheduled to take place in Surakarta City.

3. Event Update – M3

The existence of the agenda feature in the Solo Destination application is currently quite helpful, but the lack of updates about upcoming events makes respondents feel less inclined to frequently open the Solo Destination application.

4. Information Delivery – M4

Information is one of the most crucial aspects to consider in UX. Some respondents feel that the information provided in the Solo Destination application is not yet comprehensive and not effectively conveyed.

5. Color – M5

The Solo Destination application has a monotonous color scheme, predominantly white, which makes the app appear dull and causes discomfort to the eyes if used for extended periods.

6. Layouting – M6

Arranging elements is crucial when designing a user experience. It not only adds aesthetic value but also enhances the user experience.

7. Hierarchy – M7

Hierarchy is a key component of user experience, as it relates to the prioritization and placement of elements so that users can easily find important or prioritized information.

To determine the validity of the defined issues, a validity test is necessary. In this study, the validity test of the issues is conducted using the member-check technique, which involves directly asking a few sample participants about the identified issues. The member-check results indicate that most identified issues are valid except for M6 and M7. Participants did not perceive layouting issues (M6), finding the current layout satisfactory. Regarding hierarchy (M7), while many noted small icons, only a few considered it a primary concern, with most accepting the current arrangement.

4.4 Implementation

In this phase, validated ideas and prepared solutions will be implemented. The implementation phase ensures that ideas and solutions are directly adopted for improvement. Ideas, classified by priority, will be utilized to create a prototype.

The user interface design is created one by one, and each designed page is connected using a prototype in Figma to make it interactive and enjoyable. The list of improvements made to address the usability issues identified in the previous subsection is provided. The problem fixes are tailored to meet user needs.

8. Feature – M1

One way to address this issue is by reducing features such as e-tax, MPP, and others.

9. Reminder/Notification – M2

The researcher added a notification tab and reminders in the form of advertisements that appear on the homepage.

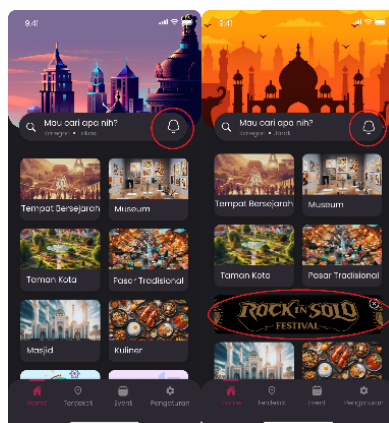


Figure 2. M2

10. Event Update – M3

The researcher added a separate tab for events and grouped them according to event types.

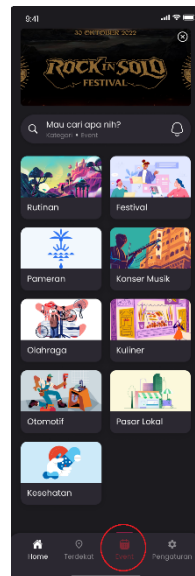


Figure 3. M3

11. Information Delivery – M4

The researcher provided comprehensive information for each tourist destination in the Solo Destination application.

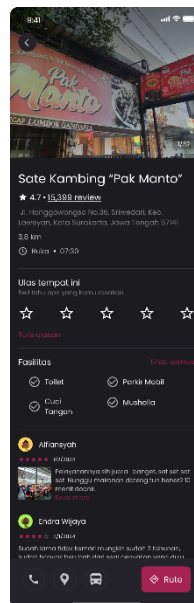


Figure 4. M4

12. Color – M5

The researcher implemented a dark mode theme to prevent users from experiencing eye strain when using the application for extended periods.

13. Layouting – M6

The issue M6 was not significantly noted by users, who felt that the layout of the Solo Destination application was already satisfactory. However, the researcher made slight

adjustments and set standards between elements to ensure a neater and more consistent interface.

14. Hierarchy – M7

The researcher addressed this by enlarging the icons and adding thumbnail images to provide a brief explanation of the features.

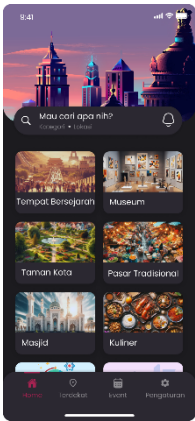


Figure 5. M7

4.5 Usability Testing After Improvements

In this stage, the prototype that has been successfully created is then tested again to determine whether the prototype designed as a solution has addressed the main problems experienced by the users. Table 5 shows the summary of responses from 50 respondents in completing the assessment questionnaire grouped based on the given scale of responses.

Table 5. The results of SUS stage 2 calculation for each instrument

Instrument	Instrument Score	SUS Score
Q1	225	3,5
Q2	91	3,18
Q3	220	3,4
Q4	78	3,44
Q5	215	3,3
Q6	99	3,02
Q7	225	3,5
Q8	72	3,56
Q9	209	3,18
Q10	113	2,74

After calculating the SUS valuation, it can be observed from the table that the Solo Destination application prototype obtained an average SUS score of 82.05. This result places the Solo Destination application prototype in the "good" category in

terms of adjective rating, "B" category in the grade scale, and receives the "acceptable" predicate in the acceptability range category.

5. CONCLUSION

The current version of the Solo Destination application was tested for its usability using the System Usability Scale and obtained a score of 55.55. When translated using the usability valuation theory, it received a grade scale rating of D, an "ok" rating in the adjective rating category, and fell into the category of marginal low in the acceptability range.

To evaluate the usability level using human-centered design, it needs to start with the initial testing of the application, which in this study uses the System Usability Scale. After obtaining the initial usability score, it proceeds to the inspiration phase to gather detailed information about the needs and difficulties experienced by users. The data obtained from the previous phase is then processed and analyzed to determine the main problems perceived by users through the ideation phase; in this study, the output received in the ideation process is the result of brainstorming. From the identified problems, the search for the best solutions to solve these problems is conducted. In this study, there are 7 main problems validated by users: issues with features, reminders/notifications, event updates, information delivery, color, layout, and hierarchy. From these problems, a solution is then designed in the form of a prototype to address the existing issues, and it is tested again to draw conclusions.

After undergoing improvement processes following the principles of human-centered design, a prototype of the Solo Destination application was developed. This prototype was then tested using the SUS, resulting in a score of 82.05. This indicates a significant improvement, placing the designed prototype of the Solo Destination application in the B category on the grade scale, with a "good" rating in the adjective rating category. It also falls within the acceptable range, indicating that the application design is acceptable and suitable for use by users.

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