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Design of a Car Rental Application User Interface Using Design Thinking and Kansei Engineering Approaches

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ABSTRACT

Transportation plays a crucial role in human development across social, cultural, and political domains, especially in the Industry 4.0 era. Cars are widely used for operational needs as they can carry multiple passengers efficiently and provide flexibility, particularly during the rainy season. With ongoing technological advancements, many businesses—including car rental services—use mobile applications to expand their customer reach. Mobile platforms are seen as practical and user-friendly. This research aims to design a car rental mobile app user interface that aligns with users' feelings and evaluate its usability. The methodology combines design thinking as a framework with Kansei engineering to capture user emotions, alongside the System Usability Scale (SUS) for usability testing. Based on partial component analysis, the study produced two user interface designs built on predefined design elements. Performance testing and SUS evaluation revealed that concept one delivered the best results, achieving 100% effectiveness. It also showed an efficiency time of 34.8 seconds for scenario one and 33.1 seconds for scenario two, with only one error recorded. The SUS score for this design was 90, indicating high usability. This approach demonstrates how integrating emotional design with practical usability testing can enhance user experience in car rental applications.

Keywords: transportation; car rental mobile apps, design thinking; kansei engineering.

INTRODUCTION

Transport is one of the needs in human life and development both social, cultural, political and as a means of population mobility (Lin & Cui, 2021; Makarova et al., 2017). Transport needs as a basic need of society to meet the needs of production, consumption and distribution activities must receive continuous attention (Barcik & Bylinko, 2018; Bengtsson et al., 2018). In Indonesia, during school holidays or collective leave as a celebration of holidays, the need for transportation for vehicles is certain to increase (Alcántara, 2022). The need for increased transportation can be seen in the majority of archipelago tourists travelling to various regions in Indonesia using private vehicles or renting vehicles (Hayakawa et al., 2020; Permana, 2025; Ricardianto et al., 2019). Based on a survey by the Central Statistics Agency (BPS) in 2020, people who drove during the holidays reached 64.08%, higher than in 2019, namely 59.4%. The BPS data shows that vehicle users as a tourist are high, exceeding 50% of users.

In the era of technological advancement, various business fields use applications to increase their user reach, including car rental service companies (Bayram, 2018; Tuyambaze et al., 2024). Companies that have mobile application platforms are considered more practical and flexible by users (Ahmad et al., 2018; Ehrenhard et al., 2017). One of the companies that provide car rental services is CV. Galaxy Sentosa Raya (Krisnayana, 2024). The company has been operating since 1 October 2001, but the company does not have an application to reach its users (Kapoor & Agarwal, 2017). In fact, mobile apps can increase user reach especially if it can fulfil user satisfaction and feelings (Al-Shamaileh & Sutcliffe, 2023; Dirin et al., 2023;

Durelli et al., 2018). To fulfil users' satisfaction and feelings, this research uses Kansei Engineering method to translate consumers' emotional needs into concrete design parameters through certain engineering techniques (Hartono, 2020; Luo et al., 2025; Sung & Isa, 2024). The emotional needs of consumers can be in the form of sight, touch, and sense of taste factors, which in this case are kansei parameters (Wu & Chen, 2021). Products designed based on customer emotions and feelings have benefits such as understanding user behaviour and desires, improving the usage experience, getting to know customers better, and increasing loyalty (Cachero-Martínez & Vázquez-Casielles, 2021; Felix & Rembulan, 2023; Yang et al., 2019).

Several studies have explored the development of car rental applications (Tuyambaze et al., 2024). Research by Wahyudi (2019) focused on developing an Android-based car rental system for CV. Amanah Kalimantan Rent, emphasizing technical functionality [10]. Another study by Manik et al. (2021) evaluated mobile application usability using the System Usability Scale (SUS) method. Meanwhile, Ramadhan (2018) implemented Kansei Engineering in university website design, demonstrating its effectiveness in translating emotional responses into design elements.

However, based on literature reviews from the last ten years, no research has been found that integrates Kansei Engineering within a Design Thinking framework specifically for designing car rental mobile application user interfaces based on user emotions. Previous studies tend to focus either on technical development aspects or usability evaluation separately, without comprehensively addressing users' emotional needs in the design process. This research aims to fill that gap by combining Design Thinking as a holistic design framework with Kansei Engineering systematically translating user emotions into concrete UI design specifications for car rental applications.

The novelty of this research lies in the integrated approach of Design Thinking and Kansei Engineering methodologies to create emotionally-responsive user interface designs specifically for car rental mobile applications. This integration allows for a more comprehensive understanding of user needs, from functional requirements to emotional satisfaction, resulting in UI designs that are not only usable but also emotionally appealing.

Based on the last ten years of research, research designing the user interface of car rental mobile apps has never been done based on user emotions in the design thinking framework. Therefore, this research aims to design the user interface of car rental mobile apps based on users' emotions. This research will use Kansei Engineering to translate user emotions into product specifications, and the design thinking framework is used to complete the user interface design of car rental mobile apps. For usability testing, the author uses the system usability scale (SUS) and performance metrics that focus on the level of effectiveness, efficiency, and user satisfaction with the prototype results of the user interface design. The practical benefits of this research include providing CV. Galaxy Sentosa Raya with an optimized mobile application UI design that enhances user experience and satisfaction. For the academic field, this research contributes methodologically by demonstrating the effective integration of Design Thinking and Kansei Engineering in UI/UX design. For the wider community, this research can serve as a reference for developing emotionally intelligent applications in the transportation service industry.

METHOD

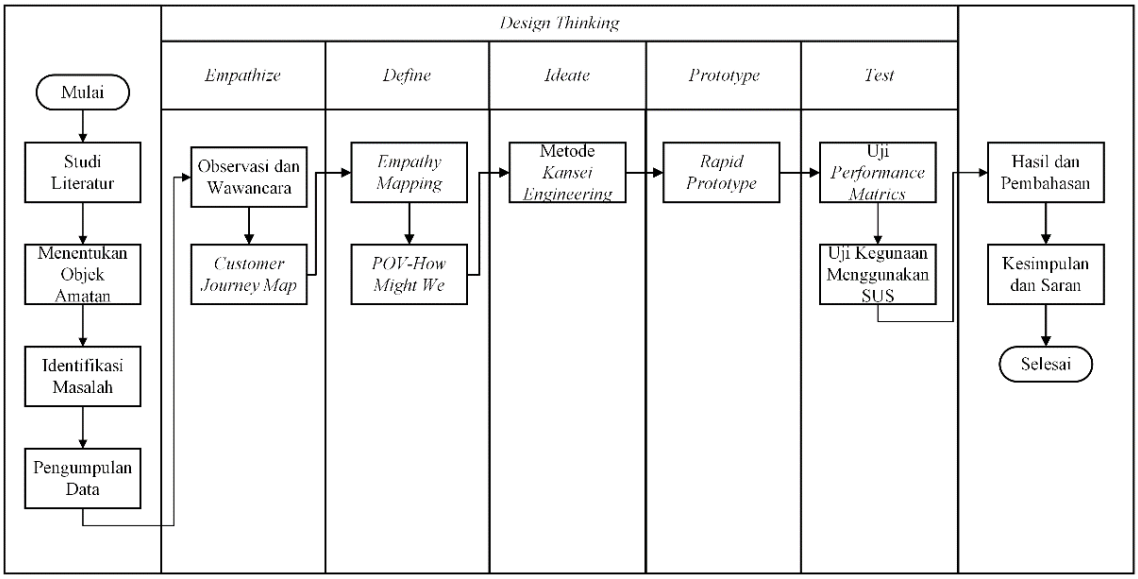

Figure 1 Flowchart Research Systematics

Based on Figure 1 shows the data processing process. Starting with a literature study to find relevant information and theories, followed by observing the car rental website and finding the problem that there is no mobile-based car rental application. The next stage is to create a customer journey map obtained from interviews with five users of CV. Galaxy Setosa Raya as well as two experts who are experts in UI/UX design and experts in product development by making customer journey maps. At the empathy mapping stage, it is made based on surveys or observations. Then, the How Might We statement is made to expand the point of view in solving the problem. Then using Kansei Engineering method to process Kansei Word data starts with collecting Kansei words from 201 respondents, then validated with semantic differential one. Then, benchmarking products were collected and semantic differential questionnaire two was distributed to 156 respondents. Then in the prototype stage based on the design concept that has been made with the rapid prototype approach, this approach allows the author to make early progress while focusing on the most important goals in product development. At the test stage, testing will be carried out to determine the level of user performance using performance metrics. For usability testing using the system usability scale (SUS). System usability scale is a simple system usability test that uses a scale of one to five to provide a comprehensive evaluation of usability goals.

RESULTS AND DISCUSSION

Empathize

At the empathise stage, this research conducted interviews with five CV customers. Galaxy Sentosa Raya who have subscribed and rented a car more than five times. This number of respondents is sufficient to fulfil the research needs.

Customer Journey Map

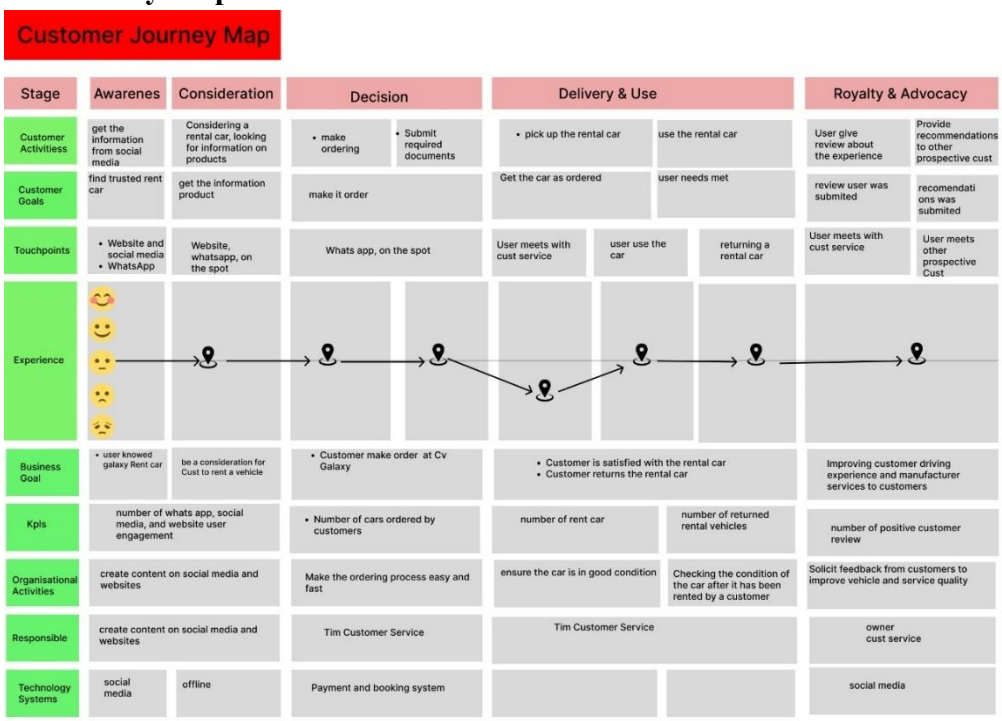

Figure 2 Customer Journey Map

Source: Research Analysis Results (2024)

Figure 2 presents the user journey map that has been created based on this research. This user journey map illustrates the customer's journey in using the car rental service of CV. Galaxy Sentosa Raya, starting from the initial stage of awareness to the final stage of royalty.

Define

After knowing the journey of using the product using the User journey map, the stage is continued by knowing the problems that exist in the product by providing empathy to the user, an empathy map is made and to understand the user's point of view using the empathy map. point of view how might we

a. Empathy map

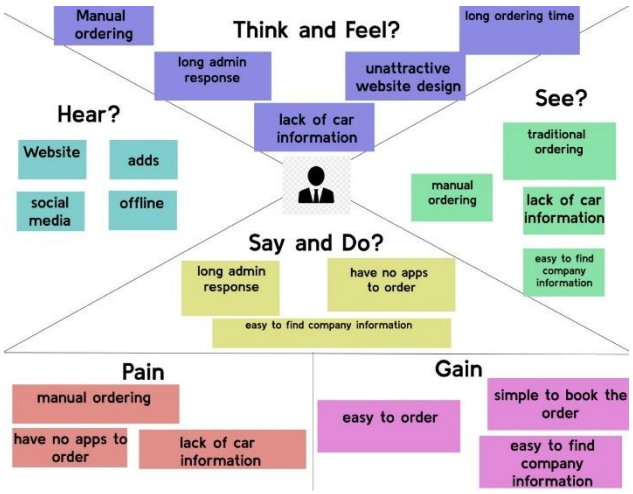

Figure 3 Empathy map

Source: Research Analysis Results (2024)

Based on Figure 3 above, it can be concluded that e-learning users have diverse needs and desires. Users want a learning experience that is interesting, easy to understand, and in accordance with user needs..

b. Point of View How Might We

The results of the empathy map obtained from the user's point of view from CV. Galaxy Sentosa Raya which is formed in the questions below.

1. How can CV. Galaxy Sentosa Raya can provide services to place orders online?
2. How is the mobile application suitable for customers of CV. Galaxy Sentosa Raya?
3. How does the mobile application design look like for users of CV. Galaxy Sentosa Raya?
4. How can the mobile application provide clear information?
5. How does CV. Galaxy Sentosa Raya make ordering easy and fast?
6. How does the simple design look on the mobile application that has been created?
7. How does the mobile application design look neat and easy to understand?

3.3. Ideate

a. Result Kansei Word

In the previous stage, the problems and point of view of the users were known. The next stage is the ideate stage where this stage uses kansei engineering. In collecting Kansei words using semantic differential one with 201 respondents, Kansei words are obtained based on user opinions from the results of empathy mapping which are compared with kansei word terms based on journal literature. The number of kansei words used was 10 kansei words. After getting 12 kansei words, a semantic differential one was conducted to determine whether the kansei word was needed in designing the user interface of mobile apps, with a scale of one meaning "disagree" to five meaning "strongly agree" to design the user interface of mobile apps.

Table 1. Kansei Word

No	*Kansei Word*	Description
1	Modern	Gives the impression of keeping up with the times
2	Creative	provides new inventiveness in design
3	Comfortable	provides a comfortable state
4	Simple	Gives the impression of easy use
5	Flexible	Provides ease of access anywhere
6	Functional	Provides functions that can be carried out properly
7	Informative	Provides clear, complete, and relevant information
8	Interesting	Affects or arouses a desire to pay attention.
9	Provides	a statement that is easy to understand
10	Neat	gives the impression of being appropriate and organised
11	Balanced	Provides a balanced and appropriate appearance
12	Efficient	Gives the right impression of doing something

Source: Research Data Processing Results (2024)

Table 2 Validity and reliability test

No	Kansei Word	Rcount (Reliability)	Rhitung (Validity)	Rtable	Description
1	Modern	0,681	0,412	0,1384	Reliable and Valid
2	Creative	0,697	0,335	0,1384	Reliable and Valid
3	Comfortable	0,661	0,544	0,1384	Reliable and Valid
4	Simple	0,65	0,61	0,1384	Reliable and Valid
5	Flexible	0,691	0,347	0,1384	Reliable and Valid
6	Functional	0,697	0,36	0,1384	Reliable and Valid
7	Informative	0,685	0,393	0,1384	Reliable and Valid
8	Interesting	0,664	0,523	0,1384	Reliable and Valid
9	Provides	0,644	0,644	0,1384	Reliable and Valid
10	Neat	0,674	0,495	0,1384	Reliable and Valid
11	Balanced	0,685	0,636	0,1384	Reliable and Valid
12	Efficient	0,645	1	0,1384	Reliable and Valid

Source: SPSS Data Processing Results (2024)

b. Product Benchmarking

The next step is to determine the bencmarking product based on the most downloaded and highest rated mobile app. The selected mobile apps are movic, track, and trevo. The 12 kansei words were tested using product benchmarking and a semantic differential questionnaire in the form of a Likert scale, with the lowest value representing a negative kansei word and the highest value being positive. The criteria for benchmarking products in this study include similar products, and having a theme according to the colour of different company logos. Two semantic differential questionnaires were distributed to 156 respondents to calculate the average value for each Kansei word from the three benchmarking products shown in Table 3.

Table 3. Semantic Differential dua

Kansei word	Rcount (Reliability)	Rcount (Validity)	Rtable	Description
Modern	0,958	0,654	0,1572	Reliable and Valid
Creative	0,956	0,597	0,1572	Reliable and Valid
Comfortable	0,955	0,724	0,1572	Reliable and Valid
Simple	0,956	0,626	0,1572	Reliable and Valid
Flexible	0,955	0,696	0,1572	Reliable and Valid
Functional	0,955	0,7	0,1572	Reliable and Valid
Informative	0,955	0,717	0,1572	Reliable and Valid
Interesting	0,955	0,684	0,1572	Reliable and Valid
Provides	0,955	0,716	0,1572	Reliable and Valid
Neat	0,957	0,683	0,1572	Reliable and Valid
Balanced	0,957	0,68	0,1572	Reliable and Valid
Efficient	0,955	1	0,1572	Reliable and Valid

Source: Semantic Differential Questionnaire Results (2024)

c. Principal Component Analysis

Principal component analysis aims to identify the most significant Kansei words that have the greatest impact on users' emotions when using mobile apps. This analysis was performed

by analysing the relationship between specimens to reduce the Kansei word variables and ending with varimax rotation of the Kansei word. The average recapitulated data of participants was used for principal component analysis using IBM SPSS Statistic V.26. Several factors, known as principal components, can be generated based on the principal component analysis calculation, as shown in Table 4.

Table 4. Principal Component Analysis

Rotated Component Matrix		
Kansei Word	**Component**	
	Concept 1	**Concept 2**
Modern	0,125	0,438
Creative	0,229	0,734
Comfortable	0,048	0,794
Simple	0,353	0,390
Flexible	0,576	0,169
Functional	0,147	0,850
Informative	0,726	0,267
Interesting	0,731	0,276
Provides	0,794	0,116
Neat	0,793	0,102
Balanced	0,434	0,611
Efficient	0,375	0,433

Source: SPSS Analysis Results (2024)

d. Design Elements and Partial Least Square

Determination of design elements will be done through google materials to get a category in making a user interface for web-based e-learning user interface. Table 6 shows the results of partial least square (PLS) categories obtained from two design concepts based on the results of the correlation between Kansei Word and design elements obtained from google materials that have been evaluated. The main purpose of this partial least square (PLS) analysis is to find out the design elements that strongly influence user emotions. The results of this process will serve as a reference for the recommendation of which design elements are in accordance with the Kansei word chosen by the user. Thus, the resulting mobile apps user interface design is expected to provide an optimal and enjoyable learning experience for users.

Table 5. Design Concept Results and partial least square

Sub Category	**Concept 1**		**Concept 2**	
	Average	**0,007**	***Average***	**0,017**
	Range		***Range***	
Top App Bar color purple #800080	0,007	*Significant*	0,02	*Significant*
Call center	0,003	NS	0,005	NS
Voucher menu	0,009	*Significant*	0,023	*Significant*
My Cart Menu	0,009	*Significant*	0,023	*Significant*
Top bar search location	0,009	*Significant*	0,023	*Significant*
Body font style - Noyh R SemiLight	0,007	*Significant*	0,02	*Significant*
Experience menu	0,003	NS	0,005	NS
Recommended *Trips*	0,003	NS	0,005	NS

Sub Category	Concept 1		Concept 2	
	Average	**0,007**	*Average*	**0,017**
	Range		***Range***	
Bottom App bar - Inbox	0,009	NS	0,023	NS
Bottom App bar - Host	0,006	NS	0,018	*Significant*
Loading Page - Type - logo	0,009	*Significant*	0,023	*Significant*

Source: PLS Analysis Results (2024)

Prototype

Concept 1 Concept 2

After knowing what design elements are significant and not significant, a prototype design is formed which is divided into two, namely concept one and concept two. The following in Figure 4 is the result of two prototypes that have design differences as concept one and concept two designs.

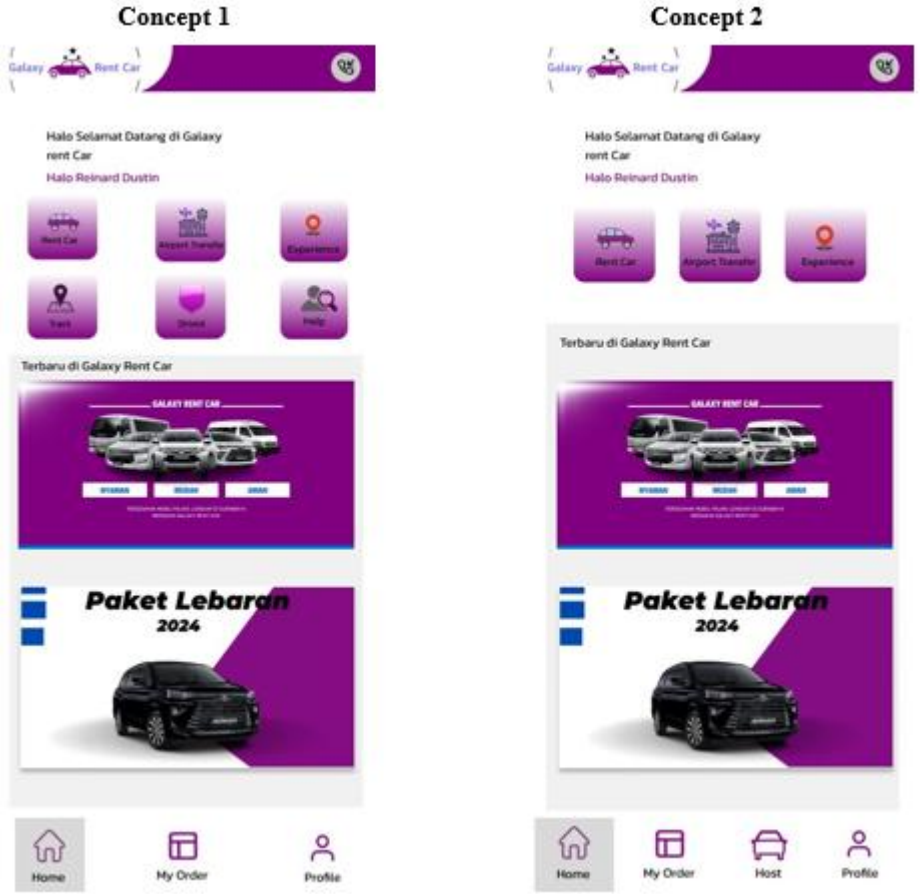

Figure 4 second mobile apps design concept

Source: Researcher's Personal Documents (2024)

Test

At the testing stage begins with making a test scenario in the form of a flowchart. After that, using the performance matrix where testing is carried out by distributing questionnaires to respondents who have ordered a car at CV. Galaxy Sentosa Raya.

a. Performance Metrics

The performance matric test will be tested using 3 stages, namely effectiveness, error and efficiency. In effectiveness based on the test results obtained has a success rate of 100% in

table 6, this proves that the design concept that has been made is effective for users of CV. Galaxy Sentosa Raya. After the effectiveness test is carried out, an efficiency test is carried out, namely a test to see which time is faster between concept one and concept two that has been made.

Table 6 Effectiveness

Design Concept	Effectiveness Test Results
Concept 1	100%
Concept 2	100%

Source: Performance Test Results (2024)

After the effectiveness test, the efficiency test is carried out to see which time is faster between concept one and concept two that has been made. In the bar chart in Figure 5, concept one has an average time of 34.8 seconds to complete scenario one, namely placing a vehicle order. Concept two has an average time of 41.5 seconds to complete it. Then, in scenario two, concept one has an average time of 33.1 seconds to complete scenario two, namely placing a vehicle order. Concept two has an average time of 39.3 seconds to complete it.

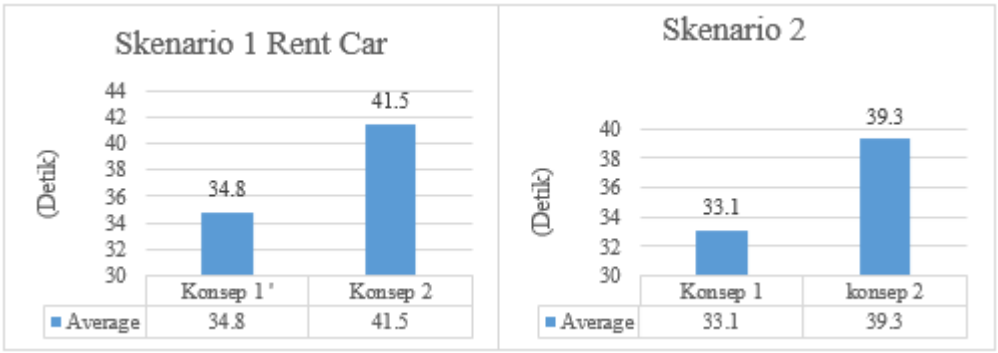

Figure 5 Efficiency

Source: Performance Test Results (2024)

Following the efficiency test, user errors were analyzed. Error rates indicate design usability. Figure 6 shows Concept 1 has fewer errors (1) than Concept 2 (2) when booking a vehicle. Similarly, in scenario two (host menu), Concept 1 has zero errors compared to Concept 2's two errors.

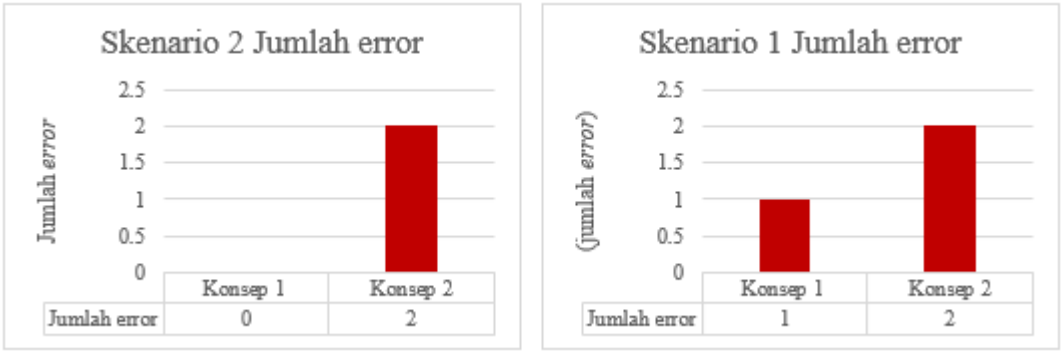

Figure 6 Error

Source: Performance Test Results (2024)

b. System Usability Scale

After conducting the performance matrics test, the next step is to conduct a system usability scale test. system usability scale test aims to help measure the overall level of usability of mobile applications. In Figure 7 ystem usability scale, concept one has a usability value of 90.0 which means it is greater than concept two which has 89.8. The SUS value affects the level of user satisfaction, concluding that concept one has better customer satisfaction than concept two.

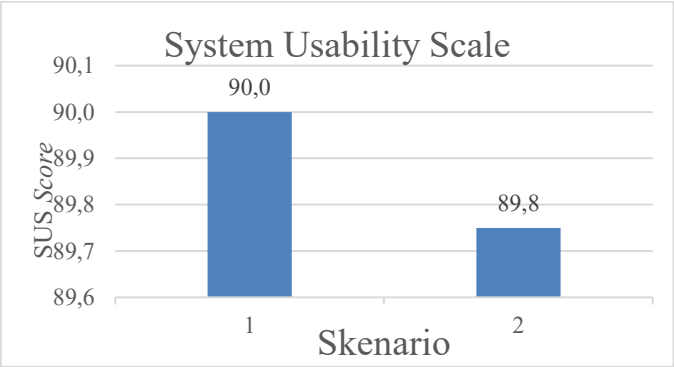

Figure 7 System Usability Scale

Source: SUS Test Results (2024)

CONCLUSION

This research focused on designing a modern, creative, and user-friendly mobile app UI for car rental company CV. Galaxy Sentosa Raya, emphasizing attributes such as simplicity, flexibility, functionality, and clarity. Using a qualitative approach with 12 Kansei words analyzed through Partial Least Squares (PLS) and System Usability Scale (SUS) tests, two UI design concepts were developed. Concept 1 outperformed concept 2 with 100% effectiveness, average task times of 34.8 and 33.1 seconds in two scenarios, only one error, and a high SUS score of 90.0. Consequently, concept 1 was selected for implementation due to its superior effectiveness, efficiency, and usability. Future research could explore integrating real-time user feedback and adaptive UI elements to further enhance the user experience and personalization of car rental apps.

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