Usability Evaluation and Interface Design Improvement for the Maxim Application with User-Centered Design Approach

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Abstract

The research focused on the user interface of the Maxim application, a ride-hailing service in Indonesia facing usability challenges compared to its competitors, such as Gojek, Grab, and inDrive. The study aimed to identify user issues and propose alternative interface designs to enhance usability. The User-Centered Design (UCD) approach was adopted, involving two iterative phases that yielded high-fidelity designs. Through online surveys and interviews, 77 problem categories were identified, adhering to Usability Heuristic principles, and 93 design solutions were crafted based on Shneiderman's Eight Golden Rules of Interface Design. Subsequently, the design solutions were evaluated through moderated usability testing (UT) and the System Usability Scale (SUS) questionnaire distribution. The second iteration's UT results indicated improved success rates, reduced task completion times, higher SUS scores, and positive user feedback on ease of use. In conclusion, this research improved the application's usability and offered valuable recommendations for further enhancements and future investigations.

Keywords: Ride-hailing, usability, usability evaluation

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Introduction

Transportation is essential to Indonesian society, particularly in Jakarta Metropolitan Area which includes 5 cities: Jakarta, Bogor, Depok, Tangerang, and Bekasi (known locally as Jabodetabek area). There were 49.5 million trips per day in 2018 (Badan Pengelola Transportasi Jabodetabek 2019), which increased to 88 million in 2020 (Alhikam 2020) in the Jabodetabek area. Transportation growth in Indonesia has accelerated with the emergence of mobile app-based ride-hailing services. Currently, ride-hailing services, including motorcycles and cars, are the second most popular transportation choice for Indonesian people, at approximately 34% (Mutia 2022). According to Simarmata et al. (2019), people require safe, simple, fast, and affordable transportation, which has led to the continued growth of motorcycle ride-hailing services. Additionally, car-based ride-hailing services are favored for their safety and comfort (Nugroho et al. 2020).

Maxim is a ride-hailing service provider that entered Indonesia in 2018 (Maxim 2020). Despite being a relatively new application, by 2022, Maxim had placed third position in popularity after Gojek and Grab (Ahdiat 2022). Within its two years of operation, Maxim has experienced rapid growth, completing 16 million orders (Maxim 2020). However, despite this success, Maxim has faced some challenges. The application's version 3.14.6 received a moderate rating of 3.4/5 on the App Store and 4.3/5 on the Play Store, indicating mixed opinions among users. Criticism primarily revolves around concerns regarding the user interface and feature flow, contributing to an overall less positive sentiment. Users have found it challenging to navigate the app and perform specific activities due to these perceived shortcomings. To ensure a continued positive user experience and the smooth mobility of the Indonesian community, it is crucial for Maxim to conduct a thorough examination of these limitations and make necessary improvements to enhance the usability of its application.

Usability defined as the effectiveness, efficiency, and satisfaction with which a product can be used in a specific context (International Organization for Standardization 2019). Compared to Gojek and Grab, Maxim has lower usability ratings in the components of convenience, efficiency, ease of use, and user satisfaction (Sari and Rahmizal 2021). This could pose a limitation and disadvantage for Maxim, significantly since usability issues in the application can also negatively impact business performance (Markova and Aula 2007).

The high use of ride-hailing services has attracted researchers' attention to this topic in depth. Studies focusing on ride-hailing applications in Indonesia, such as Grab and Gojek, have been conducted to assess their usability. Sukmasetya and Shalahuddin (2019) examined the usability aspect of these applications, while Widyanti and Ainizzamani (2017) improved the interface design according to the usability evaluation. These two studies show that high usability in interface design factors can improve the application's experience. However, despite the growing popularity of Maxim among users, recent research by Sari and Rahmizal (2021) indicates that Maxim's usability remains subpar, resulting in only moderate user satisfaction. In addressing this issue, usability can be improved by redesigning the interface using a user-centered approach. Research conducted by (Zahib et al. 2022) serves as an example of using User-Centered Design (UCD) methodology to enhance the usability of the Grab ride-hailing application for individuals with visual impairments through the development of design solutions. However, this methodological approach has not been applied to the Maxim application. Hence, further research is necessary to evaluate Maxim's usability and develop interface design solutions that focus on user needs by implementing UCD.

The study aimed to investigate users' perceptions of the current Maxim application's usability in the context of ride-hailing services. Furthermore, this research also identified potential improvements by proposing alternative user interface designs aligned with Usability Heuristics (Da Costa et al. 2019) and Shneiderman's Eight Golden Rules of Interface Design (Shneiderman 1997). Subsequently, the alternative design outcomes were evaluated to determine their effectiveness in improving the usability features of the Maxim application. This approach was undertaken with the intention of providing valuable insights and practical recommendations for the optimization of Maxim's ride-hailing service, ensuring its competitiveness and user-centricity in the dynamic market landscape.

Literature Review

Ride-Hailing

Ride-hailing is a service that allows individuals to book vehicle rides to reach a destination through a mobile application (Malik et al. 2021). This service connects passengers with vehicle owners in real-time (Watanabe et al. 2016), providing a convenient solution for meeting mobility needs (Septiani et al. 2017). One notable advantage of ride-hailing is eliminating haggling between passengers and drivers. Additionally, it enhances safety by providing passengers with information about the driver and vehicle they are traveling with. These benefits contribute to the increasing popularity of ride-hailing services.

In Indonesia, ride-hailing services, both for motorcycles and cars, have become the second most preferred mode of transportation, accounting for approximately 34% of the population's mobility choices (Mutia 2022). Motorcycles are particularly popular due to their accessibility and affordability, leading to substantial growth (Soehodho 2017). Simarmata et al. (2019) note that the demand for safe, fast, and cost-effective transportation fuels the continuous growth of motorcycle ride-hailing. Furthermore, car ride-hailing services are chosen by individuals seeking comfort and security (Nugroho et al. 2020). The high demand for mobility in Indonesia creates significant opportunities for the growth of ride-hailing service providers. Several applications catering to this demand include Maxim, Grab, and Gojek.

Maxim

Maxim is a ride-hailing service application that has been present in Indonesia since 2018 (Maxim 2020). Maxim's mission is to enhance user interaction and assist many individuals on their day-to-day trips. Currently, Maxim serves more than 100 cities across Indonesia (Maxim 2023) and holds the top position for both vehicle and free application categories on the Play Store as of February 2023.

Maxim offers seven types of services, namely Maxim Bike (motorcycles), Maxim Car (cars), Maxim Food (food delivery), Maxim Delivery (parcel delivery), Maxim Cargo (freight services), Maxim Life (massage, spa, and cleanliness services), and Maxim Helper (workers for lifting goods). In Indonesia, Maxim Bike and Maxim Car services dominate the application, accounting for approximately 70% and 24.5% of Maxim's bookings, respectively (Maxim 2020). One of Maxim's strengths is its affordability compared to other competitors. Despite its low fares, user reviews on the Play Store indicate that Maxim continues to provide satisfactory services. This is supported by research conducted by Setyaningsih et al. (2020), which found high satisfaction levels in service responsiveness and cost variables.

Usability

According to Weichbroth (2020), the widely accepted definition of usability is developed by ISO 9241-11 (International Organization for Standardization 2018), which states "the extent to which specified users can use a product to achieve specific goals with effectiveness, efficiency and satisfaction in a specified context of use." In its application, usability has attributes for measuring the quality of an application (Huang and Benyoucef 2023). Weichbroth (2020) proposed usability attributes for mobile applications, which include: (1) efficiency; (2) satisfaction; (3) effectiveness; (4) learnability; (5) memorability; (6) cognitive load; (7) errors; (8) simplicity; and (9) ease of use. According to Huang and Benyoucef (2023), considering these aspects can enhance the utility of an application in delivering information and improving user performance when using the application.

Methods

This study adopted the User-Centered Design (UCD) that focuses on developing designs centered around users' needs to ensure that the user requirements are understood and the developed solutions will improve user utility and satisfaction (Zorzetti et al 2022). Compared to other user-centric approaches like Double Diamond and Lean UX, UCD places a more specific focus on digital processes and interfaces. Furthermore, the study will use the International Organization for Standardization (2019) approach by encompassing four key stages: (1) understanding context of use, (2) specifying user

requirements, (3) producing design solutions, and (4) evaluating against requirements. Qualitative methods, including surveys, interviews, and usability testing, were used to gain insights into user experiences, pinpoint challenges, and ensure design solutions aligned with user needs. On the other hand, quantitative methods involved surveys and the System Usability Scale (SUS) questionnaire (Brooke 2013), which has been adapted into Indonesian by Sharfina and Santoso (2016) to gain insights into application usage patterns and user experiences after adopting the newly developed alternative interface designs. The research was carried out in two iterations. In the first iteration, all four UCD stages were meticulously executed, and the evaluation results served as the foundation for proceeding to the second iteration. In the second iteration, the research commenced with stages that were tailored to address specific needs based on the evaluation results of the design (Mithun et al. 2018). Figure 1 shows the research stages, the methods used, and the outcomes produced from each stage of UCD.

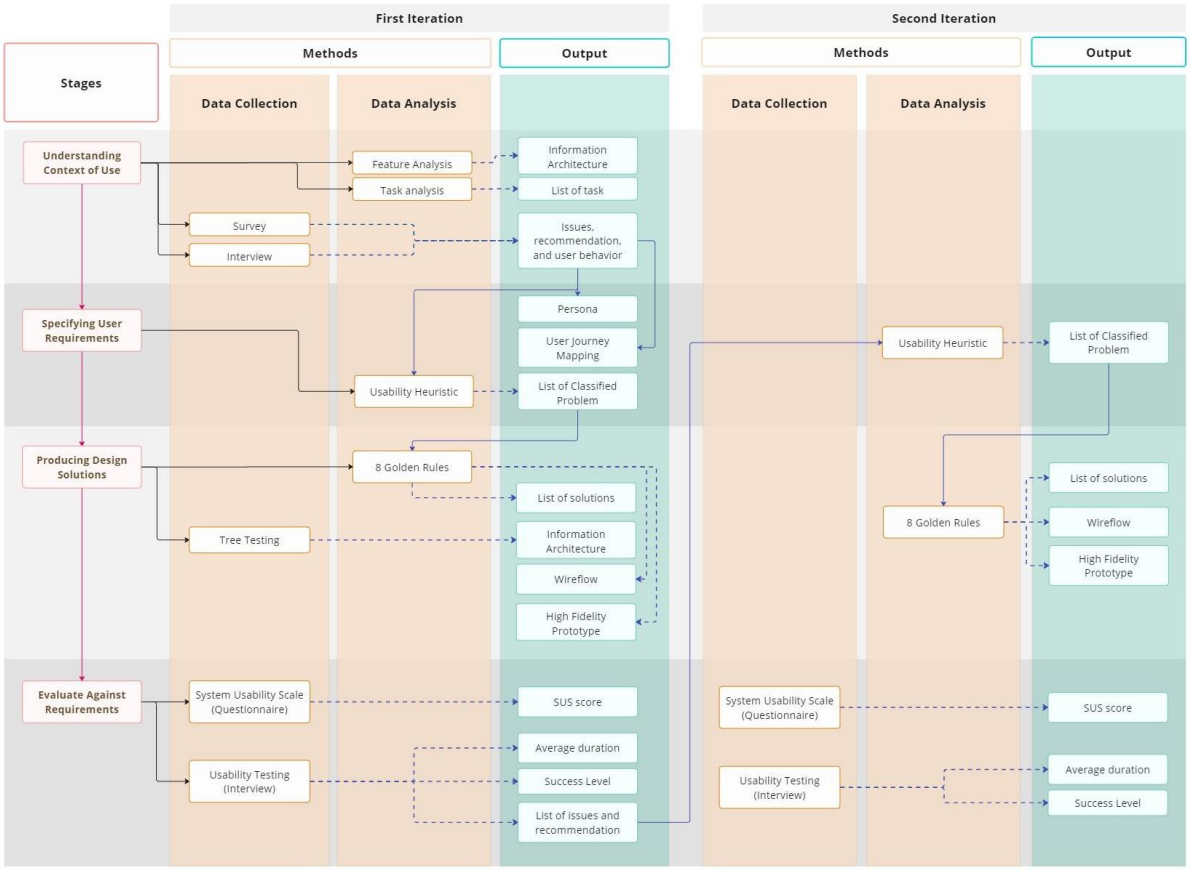

Figure 1. Two Iterative Phases of User-Centered Design Process Applied in This Study

The first stage of the User-Centered Design (UCD) development phase, known as understanding the context of use, was initiated through existing feature analysis and task analysis (Crystal & Ellington 2004) to identify the features and activities in the Maxim application. The results of this analysis were further developed into an information architecture (Ruzza et al. 2017) to facilitate understanding of feature categorization and placement. Subsequently, data collection took place through surveys (Arikunto 1992) and interviews (Badan Pusat Pengembangan dan Pembinaan Bahasa n.d.) to understand the characteristics and perceptions of Maxim's usage. The questions provided to respondents covered the entire process in Maxim application, particularly the ride-hailing services for both motorcycles and cars. The survey results were then further explored through online interviews via the Zoom application, with respondents selected from the survey participants.

In the second stage, specifying user requirements, user characteristics obtained from surveys and interviews are mapped into personas (Calde et al. 2002) and user journey mapping (Howard 2014). Subsequently, the identified issues are categorized according to 13 principles of Usability Heuristics for mobile applications, which was adapted from Nielsen (Da Costa et al. 2019)**.** Specific usability heuristics are important in evaluating mobile applications because they help quickly identify relevant

issues and ensure an ideal user experience (Othman et al. 2018). These principles include: (1) presenting the system status clearly; (2) aligning the application with real-world; (3) granting users control and freedom; (4) adhering to consistency and established standards; (5) incorporating measures for error prevention; (6) minimizing the user's memory load; (7) enabling customization and shortcuts; (8) optimizing efficiency of use and performance; (9) enabling aesthetic and minimalist design elements; (10) assisting users in recognizing, diagnosing, and recovering from errors; (11) providing help and documentation; (12) fostering pleasant and respectful interactions with the user; and (13) ensuring privacy. By leveraging these principles, designers can identify potential usability issues at an early design stage and make necessary adjustments to enhance the user experience (Saeed et al. 2019). These issues were grouped using deductive principles, a grouping based on a theory, literature, or research question (Kuckartz 2019).

Following the third stage, producing design solutions, started by systematically mapping improvement suggestions with the identified issues from the previous stage with a deductive approach guided by Shneiderman's Eight Golden Rules of Interface Design principle (Shneiderman 1997). This principle serves as guidelines for designing and improving interfaces, which consists of eight rules, such as: (1) aim for uniformity in design elements; (2) provide shortcuts for frequent users; (3) provide informative feedback to users; (4) design dialogues to result in closure; (5) implement straightforward error handling mechanisms; (6) allow for the easy reversal of actions; (7) support an internal locus of control for users; (8) minimize the cognitive load on short-term memory. Subsequently, all the identified areas for improvement were elaborated upon through the development of proposed information architecture, wireflows, and high-fidelity prototypes.

In the final stage, the interface design solutions were evaluated to validate the designs' alignment with user needs. Participants in this stage were previously involved in the understanding context of use phase. The evaluation began with usability testing (UT) to assess how effectively and satisfactorily a product can be used by users (Hertzum 2020). UT was carried out remotely using Maze (Maze n.d.) and Zoom (Zoom 2023) applications. Each research team member interacted with participants based on scenarios designed from the identified issues and needs in the specifying user requirement stages. Furthermore, the evaluation process continued with distributing a survey containing ten questions based on the System Usability Scale (SUS) through the Google Forms (Google Forms n.d.) platform. The questions were presented in the Indonesian translation by Sharfina and Santoso (2016). The SUS is adopted because it effectively supports a small sample approach for accurately assessing users' subjective perceptions of a system's usability (Vlachogianni and Tselios 2021).

Results

Understanding Context of Use (First Iteration)

The first stage began with feature analysis to understand the purpose of each Maxim feature. A total of 14 features were categorized into three groups: activities during booking, waiting for the driver's arrival, and post-journey activities accompanied by other supporting features. Subsequently, the results of the feature analysis were developed into an information architecture, as seen in Figure 2. To understand the user flow, task analysis was conducted, resulting in four activities that encompassed the entire set of features. These activities include booking a ride-hailing service, configuring travel orders, completing orders, and finding support.

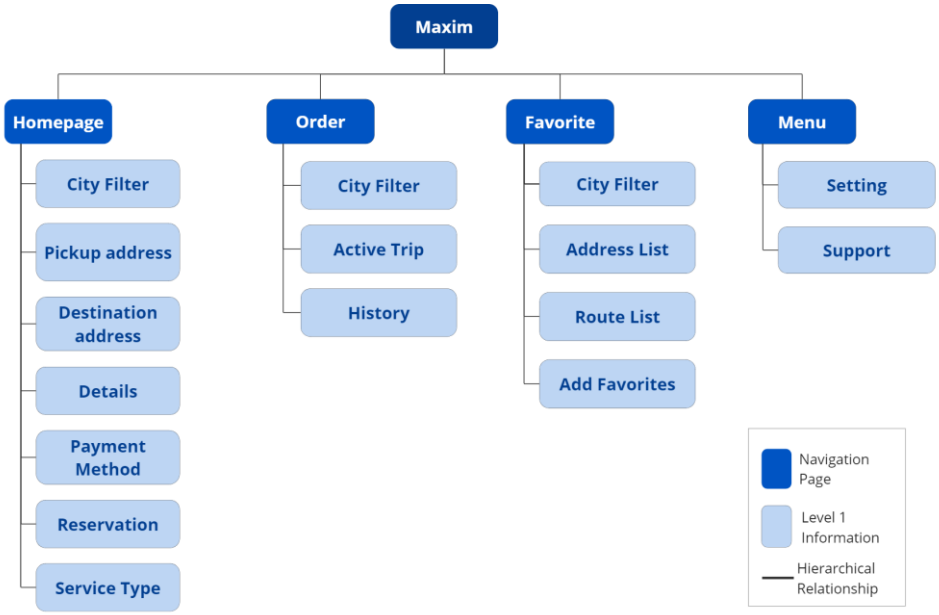

Figure 2. Existing Architecture Information of Maxim

Data collection through an online questionnaire survey was conducted from February 17, 2023, to March 18, 2023, resulting in 132 valid responses. Most of the respondents came from the 18-25 age group (82.6%), followed by those aged 26-35 (7.6%). The motorbike service emerged as the most frequently used service on the Maxim application, accounting for 90.9% of users. Respondents' motivation for booking Maxim services generally stemmed from routine needs (n = 69) and the desire for quick arrivals (n = 61). Additionally, the survey highlighted that the activity of selecting a location received the lowest ease-of-use rating, scoring 2.84 on a 1-5 scale. This low rating was attributed to challenges such as struggles to pinpoint the correct location, especially when multiple places share similar names. Through this survey, the research team gains insights into the diverse usage patterns, satisfaction levels associated with each feature, and the difficulties respondents face while using Maxim.

Furthermore, interviews were conducted online with 10 respondents to delve deeper into the survey findings, with 9 female respondents and 1 male respondent. The interviewees were selected from the survey respondents within the age range of 18-25 years, aligning with the distribution of most respondents. The respondents were categorized based on their application usage characteristics: regular users (3-5 days every week), occasional users (1-2 days every week), and novice users (less than 4 days every month). The interview results, covering respondents' habits, difficulties, and suggestions, showed consistent trends with the survey results.

Specifying User Requirements (First Iteration)

Based on the survey and interview findings, three distinct user groups were identified, differentiated by their frequency of use, specific needs, the types of features they utilize, and the challenges they encounter when using Maxim. These groupings were further developed into personas, with each persona relying on a core set of 12 features such as “Location Selection,” “Payment,” and “Safety Support.” Each persona also exhibits preferences for additional features that cater to their needs. Detailed profiles of each persona can be found in Table 1.

Table 1. List of Personas

Name	Age (years)	Application Usage Characteristics	Goal	Specific Used Features
Tiara	25	Regular	Arrive at work on time every day	Speed Up (*percepat*), Return Route (*rute kembali*)
Naya	20	Occasional	Arrive at destinations with unknown routes or without public transportation	Image Messaging (*pesan gambar*), Share Order Information (*bagikan informasi pesanan*)
Xavier	24	Novice	Discover cheaper transportation alternatives	Favorite (*favorit*)

Furthermore, Usability Heuristics served as a guide in categorizing the issues identified by respondents through the survey and interviews. The identified issues were assigned unique codes, which were then used to map them onto the proposed design improvement solutions provided by the respondents. Based on the 13 principles of Usability Heuristics, 121 issues were identified, with the three principles that appeared most frequently being correspondence between the application and the real world (n = 24), help and documentation (n = 16), and minimizing the user's memory load (n = 15). The results of this categorization and mapping served as the basis for determining needs and problems, as well as for developing design improvements. Table 2 shows certain major application features and examples of detected concerns. However, the evaluation method considers every feature and its related issues.

Table 2. List of Problems Based on Surveys and Interviews Categorized by Usability Heuristics

Feature	Rating (easiness)	Problem Code	Problem Description	Heuristics
Location Selection (*Pemilihan Lokasi*)	2.8	KLO1	Address not found	Help users recognize, diagnose, and recover from errors
		KLO2	Insufficient details regarding a specific location and its exact coordinates.	Minimize User's Memory Load
		KLO4	In a location with multiple pick-up points, the points are hard to distinguish as they are presented smaller than the main point	Minimize User's Memory Load, Consistency and standards
		KLO5	Recommendations for addresses are overly long, obstructing the map view	Aesthetic and minimalist design

Feature	**Rating (easiness)**	**Problem Code**	**Problem Description**	**Heuristics**
		KLO7	The order of history and saved addresses does not match in address recommendations	Consistency and standards
		KLO12	No shortcut for saving addresses	Customization and Shortcuts
Details **(Perincian)**	3.65	KR2	The naming and positioning of features do not accurately reflect their functions.	Correspondence between application and the real world
		KR8	Hard to understand the difference between the "Additional Information" and "Nearest Pickup Point" fields	Correspondence between application and the real world, Efficiency of use and performance
Payment (*Pembayaran*)	3.67	KBY1	There are no clear details of allocation and payment terms for each payment method	Minimize User's Memory Load
		KBY5	The presentation of information regarding payment method options is not clear	Minimize User's Memory Load
Speed Up (*Percepat*)	3.9	KC1	The costing of the “Speed Up” feature is not flexible	Customization and Shortcuts
		KC2	Hard to understand the terms of use of the "Speed Up" feature	Help and documentation
Edit Order (*Ubah Pesanan*)	3.4	KU2	There is no confirmation when changing an order	Help users recognize, diagnose, and recover from errors
		KU5	Not aware of any cost adjustments that occur	Visibility of system status

In summary, users hold positive perceptions of certain features due to their ease of use. However, these positive impressions were counterbalanced by numerous negative perceptions, primarily associated with unfamiliar and unengaging designs, complex information structures, and using terms and information uncommon to respondents. The majority of the feedback from respondents emphasized the development of clean, intuitive, and fresh design solutions, aiming to create a user interface that facilitated the utilization of Maxim's features.

Producing Design Solutions and Evaluation Design (First Iteration)

After understanding the user context and needs, the research proceeded with developing solutions to enhance the usability aspects of the application, followed by an evaluation process to assess the effectiveness of these enhancements. In the first iteration, the identified issues and solutions were developed into the proposed information architecture, which involved organizing feature layouts, adjusting feature names, and adding shortcuts. The information architecture was then validated using Tree Testing, which resulted in an 88% correct completion rate. The development of design solutions continued with the creation of wireflows (a combination of wireframes and flowcharts) and a high-fidelity prototype based on user feedback, which was then incorporated with all of Shneiderman's Eight Golden Rules of Interface Design. A total of 94 proposed design solutions were formulated, with the "Location Selection" feature standing out as the one with the most improvements. Table 3 elaborates on the findings about issues and design solutions for the "Location Selection" feature, which is critical because it is a main feature used by users.

Table 3. Design Solution of "Location Selection" Feature (First Iteration)

Problem Code	Problem Description	Design Code	Design Proposal	Design Principal
KLO1	Address not found	DLO1	Displaying error messages	*Offer informative feedback*
KLO2	Insufficient details regarding a specific location and its exact coordinates.	DLO2	Presenting the place name, specific area, and its distance from the current location	*Reduce short-term memory load*
KLO4	In a location with multiple pick-up points, the points are hard to distinguish as they are presented smaller than the main point	DLO4	Grouping pick-up points within the main address with easily readable color selection	*Strive for consistency*
KLO5	Recommendations for addresses are overly long, obstructing the map view	DLO5	Showing complete address recommendations on a single page, with the map appearing upon user address selection	*Reduce short-term memory load*
KLO7	The order of history and saved addresses does not match in address recommendations	DLO7	Separately presenting address history and saved addresses	*Strive for consistency*
KLO12	No shortcut for saving addresses	DLO12	Providing shortcuts for inputting booking addresses	*Enable frequent users to use shortcuts*

The design proposals in Table 3 were implemented as a high-fidelity prototype accessible through the link https://ristek.link/maxim-iteration1. Design codes were used to specify the design enhancements.

An example of the high-fidelity “Address Search” page within the “Location Selection” feature can be observed in Figure 3.

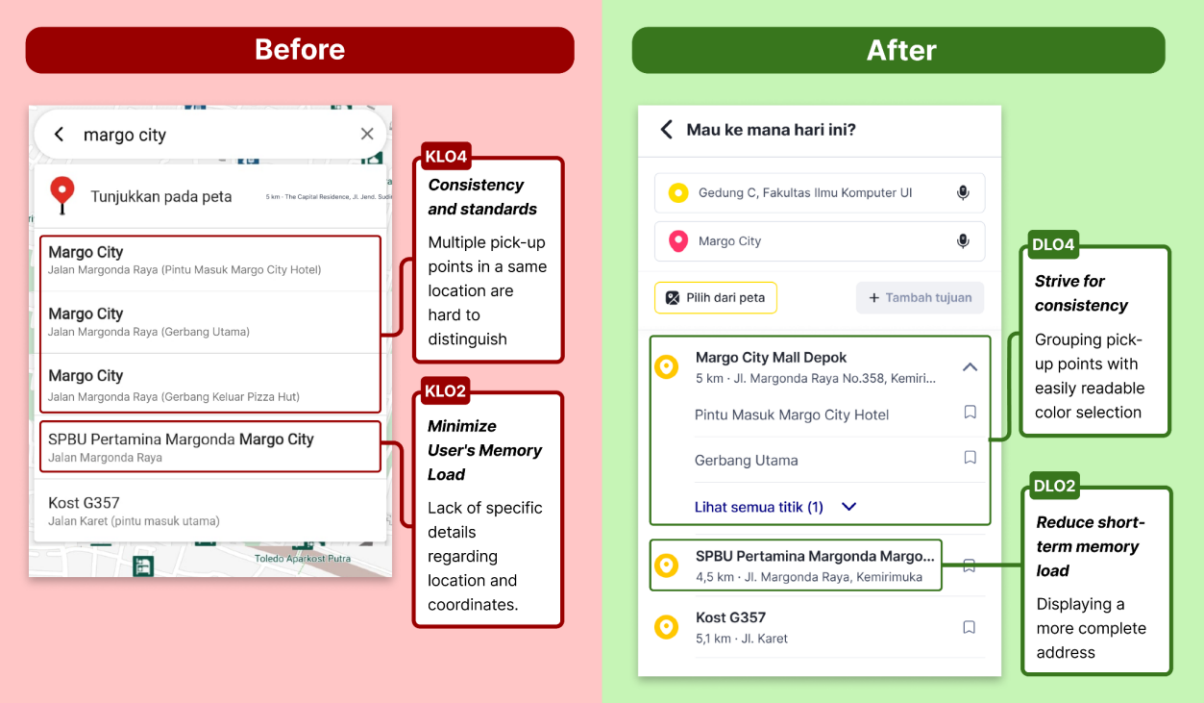

Figure 3. High-fidelity of “Location Selection” Feature (First Iteration)

Figure 3 compares two design enhancements on the location selection page after users input the destination address, contrasting the initial design (highlighted in red) and the first iteration (highlighted in green). Each identified issue and its respective solution is denoted by codes corresponding to Table 4. As an illustration, KLO4 addresses users' challenges in distinguishing multiple locations within the same area, adhering to the usability heuristic principle of consistency and standards. This concern is effectively tackled through an alternative design labelled DLO4, which involves grouping destinations in the same area with distinct colors for better differentiation. This adjustment aligns with the "strive for consistency" principle, as it consistently applies color hierarchy and components across each design.

After the design solutions were developed, the process proceeded to the evaluation stage using UT and SUS surveys. Fifteen participants, who had previously undergone the "understand the context of use" stage, took part in the UT. A total of 22 scenarios were crafted based on previously identified issues and tailored to match the characteristics of each persona. For instance, building upon the "Location Selection" feature, three scenarios were designed for participants representing each persona, as illustrated in Table 4.

The evaluation results from the first iteration of design solutions development indicated that the design had achieved a high level of usability. This was evidenced by the success rates in the UT results, which generally leaned towards “complete success” (64.24%) and “success with minor issues” (25.15%). Additionally, respondent assessments gathered from 33 participants in the SUS survey supported the positive usability findings with a score of 76. This score falls within the “good” and “acceptable” categories, according to (Brooke 2013).

However, this high level of usability was not consistently achieved in every scenario or perceived by every respondent. Some scenarios in the UT were found to either fail to be completed (1.21%) or completed with significant issues (9.39%). The UT also revealed varying completion times due to respondent anxiety and exploration. The average completion duration of all scenarios was 41.25 seconds, with completion times ranging from 11.3 seconds to 109.5 seconds. Additionally, the SUS scores have the potential for improvement, especially regarding respondents’ need to familiarize themselves before using the system. Therefore, the research continued to the second iteration for specific features that need improvement following the issues and suggestions provided by respondents.

This second iteration development aims to increase the success rate, reduce the scenarios' completion duration, and enhance respondent assessments of the final Maxim application design outcomes.

Table 4. Usability Testing Scenario of "Location Selection" Feature

No	Scenario	Success Indicators	Follow-up Questions
1	You want to select the destination location to the Main Gate of Margo City Mall. How do you do it?	Type in the destination location column.	What is your opinion after completing this task?
2	Next, you want to add the second destination address to Stasiun Pondok Cina in the recommended address history. How do you do it?	Locate the "Add Destination" button; and Select the saved address or history address through the recommended address suggestions.	Is the arrangement of information and display of saved addresses or history of addresses easier to understand?
3	You work at Venus Karaoke & Billiards, located near Margo City. You want to find the closest pickup point at Margo City to your office and decide to save that address for future use. How do you do it?	Choose the nearest location from Venus Karaoke & Billiard; and Click the shortcut button for saving the address.	Is the display informative enough when the address is not found?; and Are the differences in pickup points easier to understand?

Specifying User Requirements (Second Iteration)

The development of design solutions continues in the second iteration based on the results of the design evaluation and potential improvements from the first iteration's evaluation. To enhance the usability of the Maxim application, a second iteration was conducted based on the identified issues and recommendations provided in the first iteration. The insights gathered were then mapped into Usability Heuristics, as illustrated in Table 5.

Table 5. List of Problems Found in The Second Iteration

Feature	Success Rate (Iteration 1)	Problem Code	Problem Description	Heuristics
Location Selection (*Pemilihan Lokasi*)	51.5%	MULO1	Difficult to discern the active column.	*Visibility of system status*
		MULO2	Challenging to select points on the map due to insufficiently contrasting point colors.	*Aesthetic and minimalist design*
		MULO3	The shortcut for saving addresses is not clearly visible.	*Minimize User's Memory Load*
Details (*Perincian*)	73.3%	MUR1	The feature "Add Another Contact" is less familiar to beginners.	*Correspondence between*

Feature	Success Rate (Iteration 1)	Problem Code	Problem Description	Heuristics
				application and the real world
		MUR2	Locating the “Cash Split” (*pecahan uang tunai*) feature proves challenging due to the absence of guidance	*Help and documentation*
Payment (*Pembayaran*)	40.0%	MUBY1	Filtering payment method options are difficult due to the dense information provided	*Aesthetic and minimalist design*
		MUBY2	The placement of Maxipay is somewhat overshadowed by the “Cash Split” feature.	*Aesthetic and minimalist design*
Speed Up (*Percepat*)	50%	MUC1	Sempat sulit menemukan ikon "Percepat" akibat warnanya yang kurang kontras	*Consistency and standards*
Edit Order (*Ubah Pesanan*)	66.7%	MUU1	The text on the "Edit Order" button is challenging to discern.	*Consistency and standards*
		MUU3	Assuming direct access to the "Edit Order" page from each information column on the "Order Details."	*Pleasant and respectful interaction with the user*

Based on the findings of the Usability Testing, user perceptions were generally positive, with a decrease in the number of usability issues for the first iteration’s design. However, some challenges persist for users when locating information and features. The conducted mapping revealed that most user difficulties in terms of usability are related to the principle of minimizing user memory load (n = 11). These usability problems will then be used as input for producing design solutions.

Producing Design Solutions and Evaluation Design (Second Iteration)

After identifying and categorizing the issue of the last iteration, the development progressed to enhancing the usability of interface design. The solutions are devised according to mapped issues and recommendations for improvements with Shneiderman’s Eight Golden Rules of Interface Design. For example, the results of issue mapping and improvement for the “Location Selection” feature can be seen in Table 6.

Table 6. Design Solution of "Location Selection" Feature (Second Iteration)

Problem Code	Design Code	Design Proposal	Design Principal
MULO1	D2LO1	Providing distinct icons for pick-up and drop-off points by using different colors for the active column	Strive for consistency
MULO2	D2LO2	Applying color to the main address area and using more contrasting colors for points	Strive for consistency
MULO3	D2LO3	Including tooltips with bookmark function information	Reduce short-term memory load

Table 6, shows that the problems found were related to readability, consistency and color selection. Therefore, improvements were made to the "Address Recommendation," "Add More Destinations," and map display pages by applying Shneiderman's Eight Golden Rules of Interface Design. Furthermore, the proposed design in Table 6 is implemented as a high-fidelity prototype, which can be accessed via the link https://s.id/maxim-iterasi2. A design comparison of this feature can be seen in Figure 4.

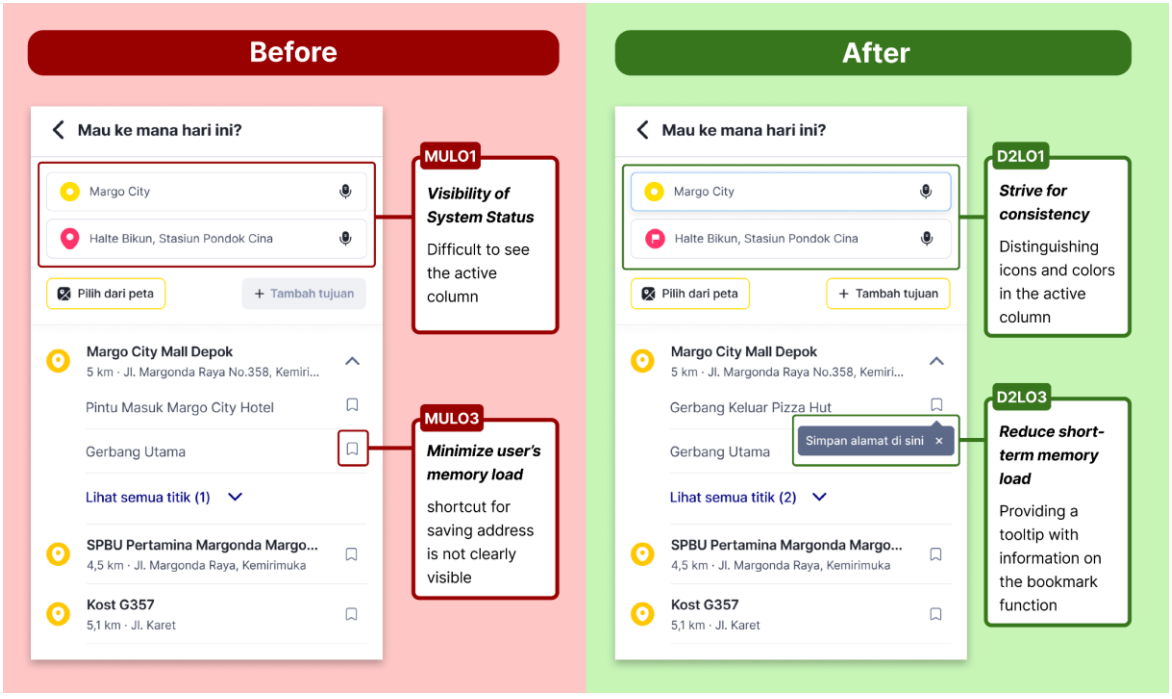

Figure 4. High-fidelity of "Location Selection" Feature (Second Iteration)

In Figure 4, a comparison of two design improvements on the location selection page after the user has entered the destination address is depicted between the first iteration (highlighted in red) and the second iteration (highlighted in green). Each problem and solution refer to codes corresponding to Table 6. For example, MUL01 represents an issue related to users having difficulty distinguishing the active column, in line with the Usability Heuristic principle of visibility of system status. This issue is addressed through an alternative design with the code D2LO1, involving the differentiation of icons and colors for the active column, aligning with the strive for consistency principle in Shneiderman's Eight Golden Rules of Interface Design.

The improvements in the second design iteration were evaluated using the same methods and tools as the first iteration. The evaluation process began with usability testing (UT) involving 15 respondents with scenarios design as in the first iteration. However, only 14 scenarios were included in the second UT, specifically those with low success levels or significant issues identified in the previous testing phase that required improvement. Based on the results of the UT implementation, most participants could complete scenarios without any problems, achieving "complete success" (90.48%). Furthermore, the average time required by respondents to complete scenarios decreased to 26.69 seconds. These results were supported by the SUS score obtained from 34 respondents, which increased to 88.97, equivalent to an "excellent" and "acceptable" satisfaction level based on research by Brooke (2013). These positive evaluation results indicated that the development had successfully enhanced the user experience for Maxim application users in utilizing the features related to ride-hailing services. Additionally, mapping improvement recommendations and solutions derived from identified issues could serve as a reference for future research concerning the development of the Maxim application design. Moreover, mapping the improvement recommendations and solutions derived from identified issues could serve as a reference for further research regarding the development of the Maxim application design.

Discussion

In the first iteration, 121 issues were identified and grouped into 77 problems based on their similarities. These problem groups were mapped to the principles of mobile usability heuristics, with the "correspondence between application and the real world" principle being the most commonly encountered problem (n = 24). Subsequently, these identified issues were addressed by developing solutions based on user feedback and Shneiderman's Eight Golden Rules of Interface Design principle. A total of 92 proposed design solutions were then evaluated to ensure their effectiveness in improving the usability aspects of the application using usability testing (UT) and the distribution of the SUS survey. Some scenarios in UT were successfully finished with "complete success" (64.24%) and "success with minor issues" (25.15%). However, these results were not consistently achieved in every scenario or perceived by every respondent. Additionally, the obtained SUS score of 76 (good and acceptable) indicated potential for improvement, particularly regarding respondents' need to familiarize themselves before using the system. Therefore, the research proceeded to the second iteration to address specific features that needed improvement.

The second iteration evaluation results of 43 design solutions that were developed to address 42 issues demonstrated a significant improvement, with 90.48% of UT scenarios finished perfectly and an enhanced SUS score of 88.97 (excellent and acceptable to users). Moreover, the increase in positive feedback and the absence of previously identified negative sentiments, as observed in the first iteration and the current application, indicate an improvement and enhancement in the usability aspect of the design in the second iteration.

Design Implications

Previous studies by Widyanti and Ainizzamani (2017), Sukmasetya and Shalahuddin (2020), Sari and Rahmizal (2021), and Astuti et al. (2021), highlighted various aspects of usability and user satisfaction in the context of ride-hailing apps. However, none of these studies specifically delved into the systematic development of alternative user interface designs and their impact on the app's usability for Maxim Application using user-centered design (UCD) methodology. This study applies to each UCD stage, involving respondents at each step and utilizing several techniques of data collection (survey, interview), data analysis (feature analysis, task analysis, Usability Heuristics, & Shneiderman's Eight Golden Rules of Interface Design), and evaluation (SUS & UT). Additionally, the study is conducted through two iterations, making it more comprehensive and ensuring the best results from the Maxim application design development process.

This research implied that user interface development using user-centered design (UCD) could substantially enhance the Maxim ride-hailing app's usability. The application of the Usability Heuristic, a key principle in the study, has proven effective in identifying usability issues and improving the

overall user experience. This aligned with the principles of the Usability Heuristic as presented by Salazar et al. (2013) and Saeed et al. (2019), as well as its utilization in research (Widyanti and Ainizzamani 2017). In addition, the positive impact on the app's usability through iterative design development is in line with the findings of Sukmasetya and Shalahuddin (2020).

In practical terms, these findings will offer valuable implications for Maxim company and future research in the realms of interface design and the usability of the Maxim application. Maxim can leverage these findings by integrating UCD methodologies into their development processes to enhance overall usability, guided by the identified usability issues and the success of iterative design changes. This study provides actionable guidance for Maxim, providing specific recommendations based on identified usability issues and iterative design improvements. Furthermore, the research suggests future endeavors should expand the geographical scope of studies, ensuring usability improvements cater to diverse user needs. Additionally, competitor analysis is recommended to gain strategic insights for enhancing the overall user experience.

Conclusion

This research was conducted to identify user issues and develop alternative interface designs to enhance the usability aspects of the Maxim application using UCD. The identification of context and user needs through surveys and interviews revealed both positive and negative perceptions regarding the utilized features. However, these positive impressions were counterbalanced by numerous negative perceptions. In total, 121 issues were identified and grouped into 77 problems based on their similarities. These problem groups were then mapped to the principles of mobile Usability Heuristic, with the "correspondence between application and the real world" principle being the most commonly encountered problem (n = 24).

After two development iterations, the “complete success” rate significantly increased to 90.48%, a marked improvement from the initial 64.24%. Respondents demonstrated a reduced average completion time of 26.69 seconds in the second iteration, compared to the varied durations ranging from 11.3 to 109.5 seconds observed in the first iteration. Moreover, the SUS score ascended from 76 to 88.97 in the second iteration, indicating an “excellent” and “acceptable” satisfaction level. The refinement process was guided by Shneiderman’s Eight Golden Rules of Interface Design principles, ensuring effective user need fulfillment. Finally, improvement and enhancement in the usability aspect of the second iteration are evident, as reflected by the rise in positive feedback and the absence of previously identified negative sentiments observed both in the initial phase and the current application.

In summary, the insights obtained from these findings are expected to provide valuable information for Maxim company and future research in interface design and Maxim application usability. Nevertheless, it is crucial to recognize the study's limitations, as it focused exclusively on the Jakarta Metropolitan Area, potentially restricting the generalizability of the results to other geographical areas. To address this limitation in future research, it is advisable to broaden the scope of Maxim application development by investigating a more diverse user demographic and enhancing user experience through additional aspects or methodologies, such as competitor analysis.

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How to cite:

Saksono R. D., Sulistyorini, D., Sagita, S.R., Kasiyah, Sadita, L. 2024. "Usability Evaluation and Interface Design Improvement for the Maxim Application with User-Centered Design Approach," *Jurnal Sistem Informasi (Journal of Information System)* (20:1), pp. 23–40.