ENHANCING USER EXPERIENCE (UX) IN BUS TICKET BOOKING: A CASE STUDY OF REDBus APPLICATION

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Abstract—*In Indonesia, the number of buses has increased significantly, particularly in major cities. Along with the advancement of mobile technology, people can now purchase bus tickets online using mobile applications. One of the popular online bus ticket booking platforms is RedBus. As one of the widely used applications, it is crucial to focus on User Experience (UX) because it significantly influences user satisfaction, encouraging continued use of the application. However, usability testing of the current RedBus application revealed that users are experiencing several issues, including difficulties in using the app, which leads to low user motivation and dissatisfaction with RedBus services. As a result, a redesign was needed to improve the UX of the RedBus application. Therefore, this study aims to investigate how UX can be improved after a redesign of the application. The redesign process employed the Design Thinking method, which consists of five phases: Empathize, Define, Ideate, Prototype, and Test. UX was measured through usability testing, focusing on effectiveness, efficiency, and user satisfaction. The measurement results of the redesigned RedBus application showed a 44% increase in effectiveness, with efficiency reaching 0.079 goals per second. Additionally, user satisfaction improved by approximately 63% across all criteria. These findings provide practical insights for designers and developers looking to enhance UX in their applications. They underscore the importance of a user-centered approach and demonstrate the effectiveness of Design Thinking as a framework for successful redesigns. Moreover, this research offers a practical guideline on how to measure UX for digital products.*

Keywords: *design thinking, user experience, user interface, usability testing.*

Intisari— *Jumlah bus di Indonesia telah meningkat secara signifikan, terutama di daerah perkotaan. Seiring dengan kemajuan teknologi mobile, tiket bus telah bisa dibeli secara online melalui aplikasi mobile. Salah satu platform pemesanan tiket bus online yang populer adalah RedBus. Sebagai salah satu aplikasi yang banyak digunakan, sangat penting untuk memperhatikan User Experience (UX) dikarenakan secara signifikan mempengaruhi kepuasan pengguna untuk terus menggunakan aplikasi tersebut. Namun, pengujian terhadap aplikasi RedBus saat ini memperlihatkan bahwa pengguna Redbus mengalami beberapa masalah antara lain: kesulitan dalam penggunaan aplikasi yang mengakibatkan motivasi pengguna yang rendah serta ketidakpuasan terhadap layanan RedBus. Oleh karena itu, diperlukan desain ulang untuk meningkatkan UX aplikasi RedBus. Penelitian ini bertujuan untuk menginvestigasi bagaimana UX dapat meningkat setelah dilakukan desain ulang pada aplikasi RedBus. Proses desain ulang dilakukan dengan menggunakan metode design thinking yang terdiri dari lima fase: Empathize, Define, Ideate, Prototype, dan Test. Pengukuran UX dilakukan melalui usability testing, dengan fokus pada efektivitas, efisiensi, dan kepuasan pengguna. Hasil pengukuran pada aplikasi RedBus yang telah didesain ulang menunjukkan adanya peningkatan efektivitas sebesar 44% serta efisiensi menjadi 0.079 goals per second. Selain itu, kepuasan pengguna terhadap aplikasi RedBus meningkat sekitar 63% pada semua kriteria. Hasil penelitian ini memberikan wawasan praktis bagi desainer dan pengembang yang ingin meningkatkan pengalaman pengguna dalam aplikasi mereka. Penelitian ini menekankan pentingnya pendekatan berpusat pada pengguna dan menunjukkan efektivitas*

metode design thinking sebagai kerangka kerja untuk desain ulang yang sukses. Selain itu, penelitian ini juga menawarkan panduan praktis tentang cara mengukur UX pada sebuah produk digital.

Kata Kunci*: pemikiran desain, pengalaman pengguna, antarmuka pengguna, pengujian kegunaan.*

INTRODUCTION

According to [1], the number of buses in Indonesia increased by approximately 7,600 units from 2020 to 2022, with the largest growth seen in DKI Jakarta, East Java, Jambi, Central Java, and West Java. This growth reflects a growing recognition of bus transportation as an affordable option that supports mobility both within and between cities, offering consistently available departure schedules [2]. Additionally, people can now purchase bus tickets online using mobile applications on their smartphones, which have significantly altered how they book public transportation services and access travel information.

The use of digital products must balance both user interface (UI) and user experience (UX). In developing digital products, it is not sufficient for them to be merely functional and easy to understand; they must also provide happiness, beauty, and satisfaction [3]. The quality and user satisfaction of digital products are heavily influenced by their UI and UX [4]. These principles can be applied to optimize the online bus ticket booking process.

RedBus is an online bus ticket booking application from India that operates in the travel industry. It currently serves multiple countries, including India, Indonesia, Thailand, Colombia, Peru, Malaysia, and Singapore. The service allows users to select departure routes, schedules, bus operators, seats, and various payment methods. RedBus continuously innovates to enhance user satisfaction.

Based on interviews conducted with users of the RedBus application, several issues have been identified: inconsistent UI displays, excessive information, and confusing layouts that slow down the booking process. These problems negatively affect the UX, rendering the service ineffective. Due to these appearance and experience issues, users question the credibility and quality of the RedBus service, leading them to abandon their orders.

Credibility is a key factor that consistently influences user experience (UX) [5]. To create a digital product that aligns with user goals, the first step is to redesign the UI/UX before development [6]. An empathic understanding of user needs in the UI/UX redesign process can enhance trust in the RedBus application.

In the process of redesigning the user interface (UI) and user experience (UX), an iterative approach is essential to comprehend users' needs and desires. One effective method for this is design thinking [7]. This approach emphasizes focusing on users, encouraging critical thinking from a positive perspective to solve problems, and generating innovative ideas that can be realized through prototyping [8]. Implementing the design thinking method in UI/UX redesign has been shown to enhance user engagement with a website application [9].

Design thinking is a valuable approach for improving UI/UX, driving innovation by prioritizing the user experience [8]. By focusing on empathy, ideation, and prototyping, it enables a deeper understanding of user pain points, fostering tailored solutions that directly improve usability [7]. The novelty of this research lies in integrating usability testing within the testing phase of design thinking, specifically measuring the effectiveness, efficiency, and user satisfaction of the prototype. Usability testing was conducted using task analysis to assess user performance on specific tasks, alongside the Post-Study System Usability Questionnaire (PSSUQ), an area that has rarely been explored in past studies.

Therefore, the objectives of this study are twofold: (1) to determine whether redesigning the RedBus application using a design thinking approach can improve user satisfaction and overall UX; (2) to measure the usability of the prototype developed using the design thinking method in terms of effectiveness, efficiency, and user satisfaction. Most of prior research has focused primarily on applying design thinking methodologies in the design process without integrating usability testing to evaluate user experience. This gap is particularly evident in studies involving mobile applications for public transportation booking. The results of this research can be used as guidance for decision-makers and application developers to increase user satisfaction and experience and maintain user trust.

MATERIALS AND METHODS

This research employs a quantitative approach. The methodology, illustrated in Figure 1, involves several steps. Initially, the first-time user experience (UX) of the current RedBus application

will be assessed through usability testing. Subsequently, the RedBus application will be redesigned in a prototype format using the design thinking method. The resulting prototype will then undergo evaluation via usability testing. Finally, an analysis will be conducted comparing the results of the two usability tests. The number of respondents in both the first and second usability tests is in accordance with the guidelines from [10].
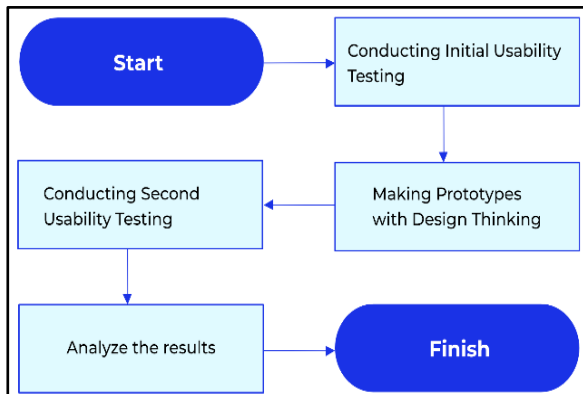
Source: (Research Results, 2024)
Figure 1. Research Methodology

A. Design Thinking

Design thinking is known as the process of solving a problem by producing innovative ideas and implementing them into viable products and testing them [4]. The design thinking process can help solve the most complex problems that cannot be solved with ordinary approaches because it focuses on user-centricity, innovation, and creativity.

The design thinking approach method has several stages starting from gathering information, understanding the problem, creating creative solutions, implementing predetermined solutions, and testing the results to get feedback [9]. This process is carried out repeatedly or iteratively and non-linearly to always update the product according to user needs. In its preparation, there are 5 stages of design thinking, namely [11]:

1) *Empathize*: The first stage in exploring the problem is to carry out research that focuses on users and is empathetic. The research was conducted to produce an in-depth understanding, of experiences, and user motivations. Empathy is important to problem-solving because it produces real insight into user needs. Overall, the empathize stage provides the best understanding of the needs and problems experienced by users to develop the product to be designed.

2) *Define*: The second stage is the process of defining the problems that have been obtained from the previous stage. It starts by processing the data obtained and then analyzes problems related to user-focused obstacles. Through the define stage, we can provide broader insight and group topics that are core problems.

3) *Ideate*: The third stage begins with the development of innovative ideas from the core problems obtained previously. By combining various thoughts, it is hoped that the ideas will be as broad as possible and unlimited. Testing and feedback will determine the right ideas and solutions.

4) *Prototype*: The fourth stage involves implementing the best solution in prototype form. This stage aims to identify the best possible solution to each problem defined in the previous three stages. Through prototypes, you can build mindsets, solve problems, carry out targeted communication with users, create dummy products at affordable costs, and test possibilities.

5) *Test*: The final stage is testing the prototype as the best solution produced. This stage is feedback provided by potential users on the prototype that has been designed. Tests are carried out to determine usage behavior patterns and ways of thinking about the products used. The final result obtained is an in-depth understanding and refinement of the solution by iterating to the previous stage as needed.

B. Usability Testing

To find out the user experience (UX) that users get when using an application, an attribute called usability is needed [12]. Usability determines whether a digital product is well received by users or not. Usability testing is carried out on certain selected users to find out the process of interacting with the digital product that has been designed [13]. The usability testing process to find out the design problems of a product can be given to a minimum of 3 or 5 users in each persona to test it [14]. According to ISO 9241-11, the results obtained through usability testing are the level of functionality based on effectiveness, efficiency, and satisfaction [15][16].

1) *Effectiveness*: The success rate focuses on the percentage of users completing each task. The calculation is carried out by giving a value of '1'

if you complete the task and '0' if not. Based on research conducted on more than 1,100 usability tasks, shows that the minimum average completion rate is 78% [17]. Effectiveness can be represented with the following calculation:

$$Effectiveness = \frac{Num\ of\ task\ completed}{Num\ of\ task} x100\% \quad (1)$$

2) *Efficiency*:   Efficiency is defined as the time required to complete a task. The analysis for calculating efficiency uses a time-based efficiency measure, which is represented by the following calculation:

$$Time\ based\ efficiency = \frac{\sum_{j=1}^{R}\ \sum_{i=1}^{N}\ \frac{n_{ij}}{t_{ij}}}{NR} \quad (2)$$

Where:
R = Number of users
N = Total number of tasks (goals)
t_{ij} = Time spent by user j on task i (if the task is not completed, time is recorded until the user quits)
n_{ij} = Outcome of task i by user j (1 if successful, 0 if not).

3) *Satisfaction*: The level of user satisfaction refers to the user's feelings towards the product. The level of satisfaction needs to be measured using a satisfaction questionnaire after a functionality test to determine the impression of the overall ease of the task. The method used to measure satisfaction is the Post-Study System Usability Questionnaire (PSSUQ).

C.   Post-Study System Usability Questionnaire (PSSUQ)

PSSUQ is a research instrument that consists of 16 items and can be used to measure user satisfaction based on four criteria, namely system usefulness (SYSUSE), information quality (INFOQUAL), interface quality (INTERQUAL), and overall satisfaction [18]. The 3rd version of the PSSUQ questionnaire has 16 statements with eight answer choice scales, from 1 (strongly agree) to 7 (strongly disagree), and 1 NA option (not applicable). Table 1 shows a list of questions from the PSSUQ, following the guidelines from [18].

Table 1. PSSUQ Questions

No	Statements
1	Overall, I am satisfied with how easy it is to use this system.
2	It is very easy to use this system.

No	Statements
3	I can complete tasks quickly using this system.
4	I feel comfortable using this system.
5	It's easy to learn to use this system.
6	I'm sure I can become productive quickly using this system.
7	The system provides clear error messages on how to fix the problem.
8	Whenever I made a mistake using the system, I was able to recover easily and quickly.
9	This system provides clear information (online help, on-screen messages, and other documentation).
10	It is easy to find the information I need.
11	This information was effective in helping me complete the task.
12	The arrangement of information on the system screen is clear.
13	The system's interface is pleasant.
14	I love using this system interface.
15	This system has all the functions and capabilities I expected.
16	Overall, I am satisfied with this system.

Source: (Vlachogianni and Tselios, 2023)

The PSSUQ score is then calculated according to the following rules:
1. System usefulness (SYSUSE): calculates the average of questions 1 to 6.
2. Information quality (INFOQUAL): calculates the average of questions 7 to 12.
3. Interface quality (INTERQUAL): calculates the average of questions 13 to 15.
4. Overall: calculate the average of questions number 1 to 16.

Next, the interpretation of the obtained average values can be seen in Table 2. The interpretation used will refer to the median values [18].

Table 2. PSSUQ Interpretation

Criteria	Lower Bound	Median	Upper Bound
SYSUSE	2,57	2,8	3,62
INFOQUAL	2,79	3,02	3,24
INTERQUAL	2,28	2,49	2,71
Overall	2,62	2,82	3,02

Source: (Research Results, 2024)

RESULTS AND DISCUSSION

A. Initial Usability Testing

At the initial stage, usability testing was conducted on the current redBus application. Five respondents were invited to participate using both moderate and remote methods. Effectiveness and efficiency were assessed through task analysis, which included 10 tasks. Satisfaction levels were measured using the PSSUQ method.

1) *Task Development*: The first step in task analysis involves developing a scenario or tasks for respondents to complete during the trial. This

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approach facilitates the respondents' participation in the testing. The task list is provided in Table 3.

Table 3. List of Tasks

No	Task
1	Log in using your existing account.
2	Look for bus availability from Surabaya to Malang tomorrow.
3	Filter your search for buses arriving at 21.00 using the Kalisari bus type.
4	Book bus tickets at the lowest prices, then go to the initial voucher selection page.
5	Select and apply the voucher code.
6	Select the payment method with a BCA virtual account.
7	Visit redBus admin help regarding money-back guarantee.
8	Book a Bus Pass from Dipati Ukur to Blok M, then make payment.
9	Search bus ticket booking history.
10	Make changes to the account details on the phone number.

Source: (Research Results, 2024)

2) *Effectiveness Measurement*: Table 4 presents the results of the completion rate calculations. The overall percentage for the level of effectiveness achieved is 66%.

Table 4. Effectiveness Result

Task	Completion Rate (%)
1	80
2	80
3	100
4	40
5	20
6	100
7	40
8	20
9	100
10	80
Overall Completion Rate	66

Source: (Research Results, 2024)

3) *Efficiency Measurement*: According to the efficiency calculations using the time-based efficiency category, the overall result was 0.027 goals per second. Detailed calculations are provided in Table 5.

Table 5. Efficiency Result

Task	Goals/sec
1	0,027
2	0,056
3	0,035
4	0,005
5	0,009
6	0,046
7	0,019
8	0,003
9	0,048
10	0,024
Total	0,027

Source: (Research Results, 2024)

4) *Satisfaction Measurement*: Satisfaction testing employed the Post-Study System Usability Questionnaire (PSSUQ) method, assessing four criteria. The overall result of 5.63 indicates that user satisfaction remains low according to the guidelines from [19], as shown in Table 6.

Table 6. Satisfaction (PSSUQ) Result

Criteria	Average
SYSUSE	5,53
INFOQUAL	5,53
INTERQUAL	5,73
Overall	5,63

Source: (Research Results, 2024)

The test results across the three usability criteria reveal that the user experience (UX) of the redBus application is still lacking [19]. Consequently, a redesign is necessary to enhance the UX of the redBus application.

B. Redesign of Application

This redesign process employs the design thinking method.

1) *Empathize*: At this stage, user understanding is achieved by distributing online questionnaires via Google Forms to gather users' opinions and issues related to the appearance and experience of using the redBus application. In addition to the questionnaires, interviews were conducted to gain insights into the problems users encounter. The conclusions from these interviews are categorized into four quadrants of the empathy map: says, does, thinks, and feels.

2) *Define*: At this stage, the issues and user needs are categorized using the 'How Might We' method. Furthermore, problems and corresponding solutions are also identified.

3) *Ideate*: During the ideation stage, innovation serves as a guide for generating ideas that effectively address user problems. To foster innovative ideas, techniques such as solution mapping and the solution matrix are utilized. Solution mapping organizes innovative solutions into three categories: improvements, innovative features, and user involvement. The solution matrix is developed by positioning each feature idea according to its complexity and effectiveness, facilitating the application development process.

4) *Prototype*: The prototyping stage starts with developing a low-fidelity prototype, which is a wireframe, taking into account the solution matrix from the ideation stage. This is followed

by designing assets and components to ensure consistency across all pages. These components include the color system, typography, icons, buttons, input fields, and illustrations. Subsequently, a high-fidelity prototype is created using these assets and components.

C. Second Usability Testing (Prototype)

Testing of the new design of the redBus application is conducted using the usability testing method. A total of 10 respondents who had used the redBus application participated, with an equal distribution of 5 male and 5 female respondents, following the guidelines from [10]. Effectiveness and efficiency testing is carried out using task analysis which consists of 21 tasks. Meanwhile, measuring the level of satisfaction uses the PSSUQ method.

1) *Task Development*: There are 21 tasks developed to evaluate prototype. Table 7 presents all tasks.

Table 7. Tasks List

No	Task
1	Change the language setting to Indonesian.
2	Log in using your email account. If this is your first time entering a telephone number, please change it and adjust it to use your email.
3	Choose a trip by regular bus, claim the promo code with the highest discount and look for bus availability for the next day's return trip.
4	Perform filtering by finding the bus that has the latest arrival time.
5	Add the bus with the lowest price to your favorites list.
6	Make bus reservations with round trips at the lowest prices. Select the outbound and return seat numbers.
7	Create a pin for your payment process to make it more secure.
8	Fill in passenger data, insurance first, and apply the promo code to get more cashback.
9	Make payment with a virtual account first and then change the payment method.
10	Perform live tracking on Surabaya-Malang travel ticket orders and chat or call with the driver.
11	Find a service for purchasing ticket packages in large quantities at once using Aeron Trans for 8 trips, the most economical price, and confirm manual payment due to system problems and activate e-ticket 2 by adjusting your travel time.
12	Find the top departure schedule and make a booking by adding your friend's passenger data.
13	Find a service to contact the admin directly regarding refunds.
14	Find promo vouchers and deals that can be exchanged using redPoin.
15	Fill in the blank data first then change the email address using verification via telephone number.
16	Activate dark mode for comfortable use of the redBus application.
17	Delete bus items that fall into the favorite category.
18	Find out information regarding bus partners working with redBus, one of which is the Kalisari bus which you want to choose as travel transportation.
19	Find interesting video content from creators related to bus transportation.
20	Find communities that provide the most popular information.
21	Find out related information articles and new knowledge about tips for riding the bus safely & comfortably.

Source: (Research Results, 2024)

2) *Effectiveness Measurement*: Table 8 displays the results of the completion rate calculations. The effectiveness level for all tasks is 95%, indicating a 44% improvement over the initial test results, which were 66%.

Table 8. Effectiveness Result (Prototype)

Task	Completion Rate (%)	Task	Completion Rate (%)
1	100	12	100
2	100	13	100
3	100	14	100
4	100	15	100
5	100	16	90
6	100	17	100
7	100	18	100
8	100	19	100
9	100	20	100
10	100	21	100
11	100	-	-
Percentage of Completion Rate			95

Source: (Research Results, 2024)

3) *Efficiency Measurement*: The efficiency of the redesigned application is assessed through time-based efficiency calculations. Table 9 reveals that the redBus application's redesign is efficient, with users completing the overall task in under 1 goal per second, specifically 0.079 goals per second.

Table 9. Efficiency Result (Prototype)

Task	goals/sec	Task	goals/sec
1	0,106	12	0,017
2	0,061	13	0,023
3	0,023	14	0,234
4	0,114	15	0,022
5	0,281	16	0,282
6	0,038	17	0,057
7	0,071	18	0,162
8	0,025	19	0,248
9	0,033	20	0,359
10	0,04	21	0,158
11	0,012	-	-
	Total		0,079

Source: (Research Results, 2024)

4) *Satisfaction Measurement*: The satisfaction test on the redesign of the RedBus application was carried out using the Post-Study System

Usability Questionnaire (PSSUQ) which measures based on 4 criteria. The measurement results show that the average value of all these criteria is between 1 and 2 and the comparison value before and after redesign can be seen in Table 10. The results show that the level of user satisfaction increased by 63%. The lower the score obtained, the more satisfied the user feels with the application they are using [19].

Table 10. Satisfaction (PSSUQ) Result Comparison

Criteria	Average (before redesign)	Average (after redesign)
SYSUSE	5,53	1,32
INFOQUAL	5,53	1,33
INTERQUAL	5,73	1,33
Overall	5,63	1,23

Source: (Research Results, 2024)

Usability testing results reveal a significant improvement in the user experience of the Redbus application following its redesign using the design thinking method. This finding aligns with the study of [7], who also found that design thinking enhanced user engagement by focusing on user needs and streamlining the UI/UX for service companies. Similarly, other researchers [8] highlighted the effectiveness of design thinking in the development of user-centered systems, specifically in university information management, further supporting our study's approach. A study by [9] also reported a similar improvement in user interest and usability when applying design thinking to redesign a website interface.

An additional analysis of the improvement in the user experience of the redesigned RedBus application reveals significant advancements. In the initial usability testing, only 10 tasks were included, whereas the usability testing of the prototype involved 21 tasks, providing a more detailed assessment of the user journey. Furthermore, the number of respondents in the initial usability testing and the prototype testing also differed, which contributed to a more comprehensive evaluation. The changes in both task quantity and respondent number highlight that the redesign led to a notable improvement in the user experience compared to the previous version.

These results further emphasize the broader benefits of design thinking in UX design. By integrating user feedback throughout the design process, as demonstrated in our study and supported by prior research, Design thinking promotes innovation, enhances user satisfaction, and leads to more intuitive, effective designs. This iterative approach ensures that user experience is continuously improved, leading to better product-market fit and increased user retention across various applications.

Practically, these findings provide valuable insights for designers and developers looking to enhance user experience in their applications. They emphasize the importance of adopting a user-centered approach and highlight the effectiveness of design thinking as a framework for achieving successful redesigns. Additionally, this research provides a practical contribution by outlining a guideline for testing prototypes, specifically using task analysis and the PSSUQ. By applying PSSUQ, practitioners can systematically measure user satisfaction, effectiveness, and efficiency, ensuring that usability goals are met.

CONCLUSION

Based on the results of usability testing, it can be concluded that applying design thinking in redesigning the redBus application has been proven to improve the user experience (UX) of users. This improvement can be seen in three aspects, namely effectiveness, efficiency, and user satisfaction. The effectiveness and efficiency of the new redBus application design show an increase of 44% and % respectively compared to before. Apart from that, the level of user satisfaction with the RedBus application also increased by around 63% on all criteria. Users feel comfortable using the redBus application with the new design because it has an attractive appearance, better visuals, and consistent design elements.

This research has several limitations. UX improvements were made only to the Android version of the RedBus application, and further research is needed for the iOS version and website. Additionally, future studies should assess user loyalty and long-term engagement with the app. To measure user satisfaction more comprehensively, methods beyond the Post-Study System Usability Questionnaire (PSSUQ) can be used, such as the System Usability Scale (SUS) and User Experience Questionnaire (UEQ). These tools provide a broader view of usability, user satisfaction, and emotional responses, offering valuable insights for refining the UX in future iterations.

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