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Enhancing User Experience in a Land Transportation Information Application: A Design Thinking Approach to the GOBIS Application

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ABSTRACT

GOBIS is a digital transportation application developed by the Surabaya City Government to facilitate public access to public transportation services. As a land transportation information system, GOBIS plays an important role in providing route, bus stop, and fleet information for urban mobility. However, user reviews and usability test results indicate that the current version of the application still has several shortcomings, particularly in interface design and user experience. The main issues include a difficult-to-interpret integrated map, the absence of an automatic route-search feature, and unclear information about bus stops and fleets. This study developed a redesigned GOBIS prototype through the five-stage Design Thinking process and evaluated the existing application and the redesigned prototype using the same task scenarios. Effectiveness was measured by task completion rate, efficiency by time-based efficiency, and perceived user experience by the User Experience Questionnaire (UEQ). The redesigned prototype increased task completion from 52% to 92%, representing a 40-percentage-point improvement, and increased time-based efficiency from 0.008 to 0.104 goals/sec. User satisfaction also improved after the redesign. Furthermore, assessment with the User Experience Questionnaire (UEQ) showed that all dimensions fell within the "excellent" category. These findings indicate that the redesigned interface successfully improves the overall quality of user interaction and enhances the user experience of GOBIS as a land transportation information system.

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1. INTRODUCTION

Traffic congestion in major Indonesian cities continues to increase as the number of motor vehicles grows. According to [1], Surabaya ranks 70th among the most congested cities in the world, with an average increase in travel time of 31% compared to normal conditions without congestion. In addition, data from the Central Statistics Agency shows that the number of motor vehicles in Indonesia increased from 141.99 million units in 2021 to 148.26 million units in 2022 [2]. This condition indicates that improving the quality and accessibility of public transportation is necessary to reduce dependence on private vehicles.

GOBIS (Golek Bis) is a mobile application developed by the Surabaya City Government to support public transportation services and reduce traffic congestion [3]. The application provides several key features, including route information, bus stop locations, and real-time tracking for public transportation services such as Surabaya Bus, Wirawiri, Teman Bus, and Trans Jatim. In addition, GOBIS also offers supporting features such as balance top-up, ticket purchasing, plastic bottle exchange locations, transaction history, and a reward point system.

However, a total of 2,526 user reviews available on the Google Play Store as of April 11, 2025, were examined to identify recurring usability issues. Each review was coded using predefined usability categories, including interface clarity, navigation, map visualization, route-search functionality, error notifications, and complaint features. Reviews mentioning at least one usability-related issue were classified accordingly. Based on this coding process, approximately 70% of the reviews contained comments related to difficulties with the interface or application navigation.

User interface (UI) and user experience (UX) play an important role in the success of digital applications. A well-designed interface can improve visual appeal and navigation, while a good user experience ensures that users can interact with the application easily and comfortably [4]. In addition, usability principles, such as Nielsen's heuristics, are often used as guidelines for identifying and solving user problems in interface design. However, a previous evaluation of GOBIS also identified usability problems related to information clarity, navigation, and interface design through heuristic evaluation [5]. These findings indicate that the redesign problem should be addressed through measurable user evidence rather than visual changes alone.

Recent studies have already evaluated or redesigned GOBIS using heuristic evaluation, Design Thinking, and User-Centered Design [5]-[7]. Similar user-centered redesigns have also been reported for other public transportation applications [8]-[9]. Therefore, this study is not the first to apply Design Thinking to GOBIS. Instead, this study focuses on an evidence-based and quantitatively validated redesign process in which baseline findings are explicitly translated into Design Thinking outputs and the existing interface and redesigned prototype are compared using the same task scenarios. The evaluation combines effectiveness, time-based efficiency, and the six UEQ dimensions to provide a detailed view of both observable task performance and perceived user experience.

Design thinking is a user-centered approach that focuses on understanding user needs, identifying problems, and generating innovative solutions [10]. Previous studies have shown that this method can produce more innovative and effective solutions than traditional design approaches [11]. Accordingly, this study aims to redesign and evaluate the GOBIS application through an evidence-traceable Design Thinking process and to quantify the change in effectiveness, efficiency, and perceived user experience between the existing application and the redesigned prototype.

2. METHOD

This study employs a quantitative usability evaluation to compare the existing GOBIS interface with a redesigned prototype developed through the Design Thinking process. Figure 1 illustrates the overall research framework. The research process begins with usability testing of the current version of the GOBIS application to understand first-time users' experiences. In this stage, the usability evaluation focuses on three main aspects, namely effectiveness, efficiency, and user satisfaction.

To ensure traceability between evaluation evidence and design decisions, baseline findings are organized into a structured issue matrix. Each issue is linked to its evidence source, such as a Google Play review theme, a failed or slow task, or a weak UEQ dimension. The issue is then summarized as a user pain point, translated into a How Might We (HMW) statement during the Define stage, prioritized in the feature matrix during Ideate, and implemented through information architecture, user flows, wireframes, and a high-fidelity prototype. The redesigned prototype is then evaluated with the same five task scenarios and the same usability measures, enabling a direct descriptive before-and-after comparison.

The Google Play Store review dataset consisted of 2,526 reviews available as of April 11, 2025. One review served as one unit of analysis. Reviews were screened using predefined usability categories: interface clarity, navigation, map visualization, route-search functionality, error notifications, and complaint features. A review was counted once as usability-related when it contained at least one issue from these categories. The proportion of usability-related reviews was calculated as the number of reviews containing at least one usability issue divided by 2,526 and multiplied by 100%. The resulting themes were used as descriptive inputs to the Empathize and Define stages, while the before-and-after performance conclusions were based on task-based measures and UEQ results.

Figure 1. Research Methodology

2.1. User Interface and User Experience

User Interface (UI) refers to the visual elements that allow users to interact with an application. The UI includes components such as buttons, icons, menus, typography, colors, and images, arranged to present information clearly and efficiently to users [12]. A well-designed interface can improve visual appeal and help users navigate the application more easily.

User Experience (UX) refers to the overall experience users have when interacting with a product or system. UX includes functional aspects, emotional responses, and user perceptions during interaction with the application. The goal of UX design is to create interactions that are easy to understand, efficient, and comfortable for users [13]. In digital product development, UI and UX play an important role in determining user satisfaction. A well-designed interface can improve usability and encourage users to continue using the application.

2.2. Design Thinking

Design thinking is a human-centered approach for understanding user needs, defining problems, and developing innovative solutions. It emphasizes empathy for users and uses an iterative problem-solving process to produce relevant, practical solutions [10]. The design thinking process consists of five main stages: Empathize, Define, Ideate, Prototype, and Test.

The Empathize stage focuses on developing a deeper understanding of users' needs, experiences, behaviors, and challenges. In this stage, information is collected through methods such as observation, surveys, and direct interaction with users. The collected insights are then organized into an empathy map to capture users' perspectives across four dimensions: says, thinks, does, and feels. This stage provides a user-centered foundation for identifying the problems to address in the subsequent stages.

The Define stage focuses on analyzing and synthesizing the insights from the Empathize stage to identify the core problems users experience. In this study, user personas, user journey maps, and How Might We (HMW) statements supported this process. User personas represent the characteristics, needs, goals, and challenges of the target users, while user journey maps visualize their experiences and identify key pain points throughout their interactions. Based on these findings, HMW statements are formulated to transform the identified problems into clear design opportunities that guide the development of potential solutions.

The Ideate stage involves generating and exploring potential solutions to the problems identified in the Define stage. In this study, the ideation process was supported by information architecture, a feature matrix, and user flows. Information architecture organized the application's structure and content, while the feature matrix helped identify and prioritize features based on user needs. User flows were then developed to illustrate the sequence of interactions users follow when completing specific tasks. These outputs provide a structured foundation for translating solution ideas into prototype designs.

The Prototype stage transforms the selected solution ideas into visual and interactive representations of the proposed application. Prototypes can be developed at different levels of fidelity depending on the purpose of the design process. Low-fidelity prototypes, such as wireframes, are used to explore the initial layout, structure, and functionality efficiently. These initial designs are then developed into high-fidelity prototypes that provide more detailed, interactive representations of the interface and closely resemble the intended final application. The prototype serves as a tangible representation of the proposed solution that users can evaluate.

Finally, the Test stage evaluates the developed prototype through direct user involvement. Participants interact with the prototype by performing predefined tasks, allowing the researchers to assess its usability and identify potential difficulties during interaction. User feedback and testing results are then analyzed to determine whether the proposed design effectively addresses the problems identified in the earlier stages. The findings from this stage can also be used to refine the prototype iteratively, ensuring that the final design better meets user needs and provides an improved user experience.

2.3. Usability Evaluation

A usability evaluation measures how well users interact with the application [14]. Usability can be assessed through three main aspects: effectiveness, efficiency, and user satisfaction [15]. Effectiveness measures users' success rate in completing tasks using the application. This metric is commonly calculated as the completion rate. It represents the percentage of successfully completed tasks compared to the total number of tasks. Formula (1) shows how to calculate effectiveness. A completion rate of around 78% is generally considered acceptable in usability testing [16].

$$E = \frac{Num\ of\ task\ completed}{Num\ of\ task} x100\% \tag{1}$$

Efficiency refers to the time users need to complete a task. In usability testing, efficiency is commonly measured using time-based efficiency. This metric calculates how quickly users can complete tasks based on the number of successful attempts and the time spent on each task [17]. Formula (2) shows how efficiency is calculated.

$$P_t = \frac{\sum_{j=1}^{R} \sum_{i=1}^{N} \frac{n_{ij}}{t_{ij}}}{NR} \tag{2}$$

Where:
N = Total number of tasks performed by users
R = Total number of users
t_{ij} = The recorded time for user j while performing task i; for incomplete tasks, the measurement ends when the user quits
n_{ij} = Task completion result for task i performed by user j (1 = successful, 0 = unsuccessful).

Satisfaction reflects users' perceptions and feelings when interacting with the application. This aspect measures how comfortable and satisfied users feel while completing tasks using the application. In this study, satisfaction was measured using the User Experience Questionnaire (UEQ), which evaluates users' experience across several dimensions of interaction quality.

2.4. User Experience Questionnaire (UEQ)

To measure user satisfaction with the redesigned interface, this study uses the User Experience Questionnaire (UEQ). UEQ is a widely used evaluation instrument designed to measure user experience quickly and reliably. UEQ not only assesses usability aspects, such as ease of use and efficiency, but also evaluates users' emotional responses while interacting with an application. Therefore, the UEQ provides a more comprehensive measure of user experience. UEQ measures six main dimensions of user experience [18]: attractiveness, perspicuity, efficiency, dependability, stimulation, and novelty.

Attractiveness reflects users' overall impression of the application, particularly whether they perceive it positively or negatively. Perspicuity evaluates how easy the application is to understand and learn, while efficiency measures how quickly and effectively users can complete their tasks. Dependability refers to users' perception of control, predictability, and security when interacting with the application. Stimulation assesses how enjoyable and motivating the application is to use, whereas novelty evaluates its creativity, originality, and innovativeness. Together, these six dimensions provide a comprehensive assessment of users' perceptions and experiences when interacting with the application.

Among these dimensions, perspicuity, efficiency, and dependability primarily focus on the application's functional quality. In contrast, stimulation and novelty are related to the product's emotional appeal and attractiveness. Meanwhile, attractiveness reflects users' overall perception and experience of the application. By combining pragmatic and hedonic aspects, UEQ provides a more comprehensive understanding of user experience than traditional usability evaluation methods.

The UEQ instrument uses 26 pairs of opposite statements, each rated on a 7-point Likert scale. Figure 2 presents the complete list of paired statements included in the UEQ instrument. Through these paired statements, users can more effectively express their perceptions of both the application's functional performance and its emotional aspects.

	1	2	3	4	5	6	7		
annoying								enjoyable	1
not understandable								understandable	2
creative								dull	3
easy to learn								difficult to learn	4
valuable								inferior	5
boring								exciting	6
not interesting								interesting	7
unpredictable								predictable	8
fast								slow	9
inventive								conventional	10
obstructive								supportive	11
good								bad	12
complicated								easy	13
unlikable								pleasing	14
usual								leading edge	15
unpleasant								pleasant	16
secure								not secure	17
motivating								demotivating	18
meets expectations								does not meet expectations	19
inefficient								efficient	20
clear								confusing	21
impractical								practical	22
organized								cluttered	23
attractive								unattractive	24
friendly								unfriendly	25
conservative								innovative	26

Figure 2. Measurement Items of UEQ

Figure 3 presents the interpretation criteria for each User Experience Questionnaire (UEQ) category: Attractiveness, Perspicuity, Efficiency, Dependability, Stimulation, and Novelty [19]. The benchmark values are divided into five interpretation levels: Excellent, Good, Above Average, Below Average, and Bad. A higher score indicates a better user experience evaluation for a particular category.

Scores categorized as Excellent indicate that the application performs very well compared to benchmark data from previous studies. Meanwhile, categories such as Good and Above Average reflect positive user perceptions and a satisfactory user experience. In contrast, scores classified as Below Average and Bad suggest that the application still has usability or user experience issues that require further improvement. These interpretation ranges help provide a more objective understanding of the quality level of each UEQ dimension and facilitate comparison between evaluation results

	Attractiveness	Perspicuity	Efficiency	Dependability	Stimulation	Novelty
Excellent	≥1,75	≥1,9	≥1,78	≥1,65	≥1,55	≥1,4
Good	≥ 1,52 < 1,75	≥ 1,56 < 1,9	≥ 1,47 < 1,78	≥ 1,48 < 1,65	≥ 1,31 < 1,55	≥ 1,05 < 1,4
Above Average	≥ 1,17 < 1,52	≥ 1,08 < 1,56	≥ 0,98 < 1,47	≥ 1,14 < 1,48	≥ 0,99 < 1,31	≥ 0,71 < 1,05
Below Average	≥ 0,7 < 1,17	≥ 0,64 < 1,08	≥ 0,54 < 0,98	≥ 0,78 < 1,14	≥ 0,5 < 0,99	≥ 0,3 < 0,71
Bad	< 0,7	< 0,64	< 0,54	< 0,78	<0,5	< 0,3

Figure 3. Interpretation of UEQ Score

3. RESULTS AND DISCUSSION

This section presents the findings from implementing the research methodology. First, usability testing was performed on the current GOBIS application to identify existing usability issues and establish baseline usability measures. Second, based on the findings from the initial evaluation, the GOBIS application was redesigned using the Design Thinking approach to address the identified user needs and usability problems. Third, usability testing was conducted on the redesigned GOBIS application using the same evaluation measures to assess its usability performance and user experience. Finally, the results obtained before and after the redesign were analyzed and compared to determine the improvements achieved through the proposed redesign.

3.1. Usability Testing of GOBIS Application

Initial usability testing was conducted to assess the current GOBIS application's usability before the redesign stage. The evaluation focused on three usability metrics: effectiveness, efficiency, and user satisfaction. The testing session involved five participants and followed the guidelines in [20]. All respondents completed task scenarios that represent common activities in the application. Users performed five common tasks in the GOBIS application. Table 1 presents the tasks.

Table 1. Tasks List

No.	Task
1	Create a new account in the GOBIS application
2	Search for a route from Klampis Bus Stop to Ciputra World
3	Search for a route from Surabaya Zoo to Taman Flora using Wirawiri service
4	Perform a balance top-up of IDR 5,000
5	Purchase a ticket and prepare the QR ticket

The effectiveness testing resulted in an overall completion rate of 52%, as shown in Table 2. This result indicates that many participants were unable to complete several tasks in the application successfully.

Table 2. Result of Effectiveness

Task	Completion Rate (%)
Task 1	40
Task 2	20
Task 3	20
Task 4	100
Task 5	80
Effectiveness	**52**

Efficiency testing produced an average value of 0.008 goals/sec, as shown in Table 3. This result indicates that users required a relatively long time to complete the tasks in the application.

Table 3. Result of Efficiency

Task	Completion Rate (%)
Task 1	0.004
Task 2	0.001
Task 3	0.001
Task 4	0.015
Task 5	0.018
Time-Based Efficiency	**0.008**

The UEQ evaluation results indicate that the average scores across the six assessed dimensions were still classified as neutral or bad. Table 4 presents the detailed results. This result indicates that user satisfaction with the GOBIS application remains relatively low. Furthermore, Figure 4 shows the UEQ evaluation results diagram of the GOBIS application.

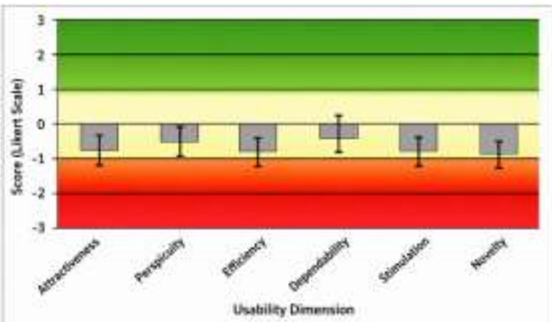

Figure 4. UEQ Diagram

Overall, the usability testing results indicate that the GOBIS application's user experience still requires significant improvement. Therefore, redesigning the application interface is necessary to enhance usability and improve the overall user experience.

3.2. Redesign of GOBIS Application

This redesign process applies the Design Thinking method to develop improvements for the GOBIS application based on the usability evaluation results [21][22]. The empathize stage aims to understand user

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experiences when using the GOBIS application. Data were collected through application observation, analysis of user reviews on the Google Play Store, usability testing, and online questionnaires using UEQ. An online survey was also conducted to gather additional feedback. The findings were summarized using an empathy map to identify what users say, think, do, and feel when interacting with the application.

In this stage, the collected data were analyzed to identify the main usability problems in the application. A user persona was created to represent typical users and their needs. A User Journey Map was then developed to illustrate the user interaction process and identify key pain points. These problems were formulated into How Might We questions to guide solution development. The identified pain points were summarized along with proposed solutions based on Nielsen's Ten Usability Heuristics.

During the ideation stage, solutions are developed based on problems identified in the empathize and define stages. The solutions are structured using Information Architecture to organize features and information flow. Next, a Feature Matrix is used to prioritize features based on user impact and development effort. Figure 5 depicts the Feature Matrix created during this stage. Finally, User Flow is designed to illustrate key interactions in the application, such as accessing the app, searching routes, topping up balance, and purchasing tickets.

Figure 5. Feature Matrix

The prototype stage transforms the ideas from the ideation phase into visual designs. The process begins with developing a design application to ensure consistency in elements such as typography, colors, icons, buttons, and input fields. Next, a low-fidelity wireframe is created to define the interface's basic layout and structure, as shown in Figure 6. Finally, a high-fidelity prototype is developed to present a more complete and interactive design of the redesigned GOBIS application. Figure 7 presents the screens before and after the redesign process. The test stage evaluates the high-fidelity prototype.

Figure 6. Low-Fidelity Prototype

Figure 7. Screens Before and After Redesign

3.3. Usability Testing of GOBIS Application (After Redesign)

The study conducted usability testing of the redesigned GOBIS application prototype. A total of five participants with different backgrounds were involved in the testing process. The testing was conducted remotely and unmoderated via Google Meet, with participants asked to share their screens while completing the tasks. Table 1 presents the five common tasks performed by GOBIS users. The usability evaluation focused on three main metrics: effectiveness, efficiency, and user satisfaction using the UEQ method.

The results show that all participants successfully completed the assigned tasks. As shown in Table 5, the overall completion rate across the five tasks reached 92%, representing a substantial improvement from the 52% completion rate observed before the redesign. This increase suggests that the redesigned interface improved task completion and enabled participants to perform the tasks more successfully.

Table 5. Result of Effectiveness (After Redesign)

Task	Completion Rate (%)
Task 1	100
Task 2	80
Task 3	100
Task 4	100
Task 5	80
Effectiveness	**92**

Efficiency was calculated using time-based efficiency in goals per second. Based on the results presented in Table 6, the average efficiency during prototype testing was 0.104 goals/sec, representing a substantial improvement from 0.008 goals/sec before the redesign. This increase indicates that the redesigned interface enabled participants to complete the assigned tasks more efficiently.

Table 6. Result of Efficiency (After Redesign)

Task	Completion Rate (%)
Task 1	0.063
Task 2	0.071
Task 3	0.096
Task 4	0.183
Task 5	0.109
Time-Based Efficiency	**0.104**

The UEQ evaluation results in Table 7 indicate that the redesigned GOBIS application provides an excellent user experience. All evaluated dimensions achieved mean scores above 1.5 and were mostly categorized as excellent according to the UEQ benchmark (see Figure 8). Overall, the redesign significantly improved the user experience across all UEQ dimensions compared to the previous version, particularly in attractiveness, perspicuity, and efficiency.

Table 7. Result of Satisfaction (UEQ) (After Redesign)

Dimension	Average	Interpretation
Attractiveness	2,150	**Excellent**

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Perspicuity	2,161	**Excellent**
Efficiency	2,157	**Excellent**
Dependability	1,982	**Excellent**
Stimulation	1,989	**Excellent**
Novelty	1,589	**Excellent**

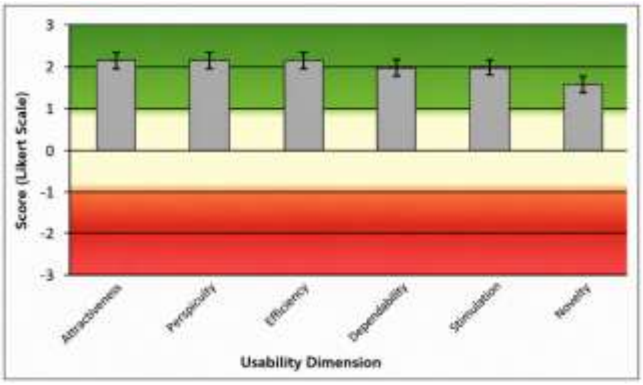

Figure 8. UEQ Diagram (After Redesign)

The measurement results showed that the redesigned prototype achieved significant improvements in effectiveness, efficiency, and user satisfaction. These improvements indicate that the Design Thinking approach successfully addressed the main usability issues in the GOBIS application. Therefore, the redesign enhanced usability and improved the overall user experience.

4. CONCLUSION

This study used all five Design Thinking stages - Empathize, Define, Ideate, Prototype, and Test - to redesign GOBIS based on baseline evidence from app reviews, task-based usability testing, and UEQ. The usability testing results showed clear improvements. Effectiveness increased from 52% to 92%, representing a 40-percentage-point improvement. This means that most participants were able to complete the given tasks successfully. Efficiency also improved, as time-based efficiency increased from 0.008 goals/sec to 0.104 goals/sec. This result shows that users completed tasks faster after the redesign. In addition, user satisfaction also improved, as indicated by the UEQ results. All UEQ dimensions obtained average scores above 1.5, indicating that all dimensions were categorized as excellent based on the UEQ benchmark. Overall, the redesigned interface provides clearer navigation, faster task completion, and a more comfortable experience for GOBIS users.

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