

USER-CENTERED DESIGN AND USABILITY EVALUATION OF THE SICITRA MOBILE APPLICATION

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Abstrak

SICITRA (Shared Circle Tracks) merupakan aplikasi mobile yang dirancang untuk membantu pengguna memantau lokasi perjalanan orang-orang terdekat, memperoleh informasi jadwal keberangkatan bus, dan mengakses berita terkini terkait transportasi. Perancangan user interface (UI) dan user experience (UX) menjadi aspek penting dalam pengembangan aplikasi untuk menghasilkan tingkat usability yang baik dan meningkatkan kepuasan pengguna. Penelitian ini bertujuan untuk merancang UI dan UX aplikasi SICITRA menggunakan pendekatan design thinking serta mengevaluasi usability aplikasi melalui task-based usability testing. Penelitian menerapkan lima tahapan design thinking, yaitu empathize, define, ideate, prototype, dan test, untuk mengidentifikasi kebutuhan pengguna dan menghasilkan rancangan yang berpusat pada pengguna. Tahap evaluasi melibatkan 50 partisipan berusia 13–27 tahun yang diminta menyelesaikan tujuh skenario tugas yang merepresentasikan fitur utama aplikasi. Hasil pengujian menunjukkan bahwa tingkat penyelesaian tugas tertinggi mencapai 82% pada fitur View the Current Trip of a Tracked Circle, yang mengindikasikan bahwa fitur tersebut memiliki visibilitas dan alur interaksi yang cukup intuitif. Persentase pengguna yang mengalami kendala terbesar ditemukan pada fitur Add and Remove a Circle sebesar 38%, sedangkan tingkat kegagalan tertinggi sebesar 10% terjadi pada fitur View Travel History. Temuan ini menunjukkan bahwa beberapa aspek, seperti visibilitas fitur, struktur navigasi, dan umpan balik sistem, masih memerlukan perbaikan. Secara keseluruhan, pendekatan design thinking mampu menghasilkan rancangan aplikasi yang lebih berpusat pada pengguna, sementara usability testing memberikan masukan yang bermanfaat untuk meningkatkan kualitas pengalaman pengguna dan kemudahan penggunaan aplikasi.

Kata kunci: *design thinking, user interface, user experience, usability testing, aplikasi mobile, SICITRA*

Abstract

SICITRA (Shared Circle Tracks) is a mobile application designed to help users monitor the travel locations of family members and close contacts, access bus departure schedules, and obtain up-to-date transportation news. User interface (UI) and user experience (UX) design are critical aspects of mobile application development, as they contribute to improving usability and increasing user acceptance. This study aimed to design the UI and UX of the SICITRA application using the Design Thinking approach and to evaluate its usability through task-based usability testing. The Design Thinking process consisted of five stages: empathize, define, ideate, prototype, and test, which were employed to identify user needs and develop a user-centered application design. The evaluation phase involved 50 participants aged 13–27 years who were asked to complete seven predefined task scenarios representing the application's core functionalities. The results revealed that the highest task completion rate was 82% for the “View the Current Trip of a Tracked Circle” feature, indicating good feature visibility and an intuitive interaction flow. The highest percentage of users who completed tasks with difficulties was observed in the “Add and Remove a Circle” feature (38%), while the highest task failure rate (10%) occurred in the “View Travel History” feature. These findings suggest that feature visibility, navigation structure, and system feedback mechanisms still require improvement. Overall, the Design Thinking approach successfully facilitated the development of a more user-centered application, while usability testing provided valuable insights for enhancing user experience and ease of use.

Keywords: *Design Thinking, user interface, user experience, usability testing, mobile application, SICITRA*

INTRODUCTION

The development of information technology in Indonesia is currently experiencing rapid growth and has a positive impact in various fields (Anggraini et al., 2022), one of which is transportation. Transportation, a tool used to move people and goods from one location to another, has an important role in people's lives (Atombo & Dzigbordi Wemegah, 2021). One mode of transportation that is widely used is the bus because it can carry many passengers at once (Vansteenwegen et al., 2022). Technology in transportation has been widely applied, primarily through applications that make it easier for people to get real-time information about schedules, routes, and bus locations (Aulia et al., 2024). One of the existing applications is GOBIS, created by the Surabaya City Government to monitor bus positions and stop locations, and offers various other features such as information on tourist attractions and SMEs (Ratnawati et al., 2024).

In application development, attention to User Interface (UI) and User Experience (UX) design is an important aspect that cannot be ignored (Goel et al., 2022). UI is part of the system as an intermediary between the user and the application (Jenny Ruiz & Snoeck, 2021). At the same time, UX includes the overall experience of the user when interacting with the system (Berni & Borgianni, 2021). A good UI/UX design can increase the comfort, satisfaction, and effectiveness of application use (Ramadhanti et al., 2023). Therefore, the design thinking method is applied in this study to ensure that the developed application is following user needs (Nasution & Nusa, 2021).

The design thinking method focuses on deeply understanding user needs through five stages: empathize, define, ideate, prototype, and test (Darmawan et al., 2022). This approach not only speeds up the design iteration process but also allows users to contribute directly through feedback provided on each prototype created (Yudhanto et al., 2022). Although it requires more time for the research and evaluation process, this method provides a more optimal solution for producing effective UI/UX designs (Setiyani & Tjandra, 2022).

GOBIS is the official app or digital service of the Surabaya City Transport Department. The app makes it easy for Surabaya citizens to access real-time public transport schedules, especially for the Suroboyo Bus and Wirawiri Suroboyo services. Key features include tracking, bus route and schedule information, and digital payments and tickets. However, while apps like GOBIS have many excellent features, there is still a lack of a solution to the need for users to share travel information with those closest to them. This is especially important to enhance the user's sense of security during travel. To address this need, the SICITRA (Shared Circle Tracks) app was designed with a key feature that allows users to share their current location with family or loved ones. The app's primary focus is to provide real-time location tracking, access to accurate bus schedules, and transport news updates for users. With its key location-sharing feature, SICITRA aims to minimize family anxiety and enhance a sense of security.

This research uses a design thinking approach to develop UI/UX design for the SICITRA application. In addition to contributing to the development of transportation applications, this research is also expected to be a reference for applying design thinking methods in UI/UX design. The expected benefits of this research are creating applications that are more responsive to user needs, improve travel comfort, and broaden insights into the importance of collaboration between users and developers in the design process.

METHOD

This study adopts a user-centered design approach. Design Thinking methods with Agile Scrum framework were used for the development process of an adaptive and responsive application. Quantitative data were analyzed descriptively in terms of task completion rates, whilst qualitative data were explored in greater depth through user feedback to identify the root causes of usability issues, such as cognitive barriers in the navigation structure and the clarity of feature terminology. In this study, Design Thinking is not merely a design process, but a holistic framework that integrates specific scopes, such as user personas, user scenarios, and customer journey maps, into the development cycle. By combining these two methods, the research aims to produce solutions that not only meet visual expectations but also address users' psychological need for a sense of social safety through intuitive and relevant features.

Design Thinking is a method and a holistic approach that includes processes, people, workspaces, and cross-disciplinary collaboration to create relevant and practical solutions (Gama et al., 2023). By putting the user at the center of attention, this approach ensures that the product developed meets the user's needs and expectations (Shankar et al., 2022). The Design Thinking process generally consists of five main stages: empathize, define, ideate, prototype, and test.



Figure 1. Research Method

Empathize is the first step that aims to understand the problems and needs of users in depth. Researchers focus on seeing, feeling, and understanding user perspectives through various methods such as observations, interviews, surveys, and questionnaires (Cuadros et al., 2021). In this research, the empathize stage is carried out by collecting data through an online interview with the user targeted. The data obtained at this stage will be used to create a pain points table, which helps summarize insights into what users feel, think, and needs of the application.

The second step is **Define**. After the data from the empathize stage is collected, the next stage is defined, clearly defining the problem and user needs. The information that has been collected is summarized into a more focused understanding to become the basis for product development. The results of this stage are user personas, user scenarios, and customer journey maps.

- User persona represents the user based on demographic data, behavior, motivation, and challenges faced (Barus et al., 2022).
- User scenario describes how the user will interact with the product in a particular scenario (Bartolotta & Bourelle, 2024).
- The customer journey map visualizes the user experience journey from start to finish when using the application (Bradley et al., 2021).

The ideate stage is a phase where various solution ideas are gathered through a brainstorming process based on the understanding gained from the define stage. At this stage, ideas are organized and evaluated to produce a solution concept that can be implemented. The products of this stage are user flow or sitemap. User flow is a diagram that describes the flow of user interaction with the system (Oliveira et al., 2023). The sitemap shows the hierarchical structure of the features and pages to be designed (Ge et al., 2024).

Once ideas have been developed, the next stage is to create a prototype as an early representation of the product. These prototypes can be both low-fidelity wireframes and high-fidelity wireframes. Low-fidelity wireframes are simple sketches to convey the basic features and layout of the application without complex visual details (Drzyzga & Harder, 2024). High-fidelity wireframes are more detailed prototypes with visual elements such as icons, typography, and illustrations. At this stage, a simulation of the app is created to give a more tangible idea of how the product will look and function before further testing (Kim Soo Yun and Lee, 2020).

The final stage in the Design Thinking process is **testing**. Testing evaluates the quality and usability of the prototype from the user's perspective. Users are asked to try out the prototype and provide feedback that will be used for product improvement. This testing provides insight into what needs to be improved and ensures that the resulting product fits the user's needs. This stage is critical because developers can get direct input to fix the prototype's shortcomings before proceeding to the complete product implementation stage.

The research involved 50 participants aged 13 to 27, representing the key demographic of mobile technology users. During development, the team used the Agile Scrum methodology. This approach keeps the product adaptable through short sprint cycles, allowing the team to respond quickly to user feedback and technical challenges during development. The Design Thinking approach helps ensure the resulting solution is innovative, relevant, and valuable to users. This iterative process allows for continuous customization and refinement of the product based on user needs and experiences. In addition, this research also applies the Agile Scrum method to project management (Resmi Rachmawati et al., 2023). Agile Scrum allows teams to work collaboratively through short, focused sprints so that product development can be done more adaptively and responsively to changing needs or challenges that arise during the development process (Kaur et al., 2021). Combining Design Thinking and Agile Scrum provides a robust framework for producing optimal solutions (Wardani et al., 2023).

This research integrates Design Thinking and Agile Scrum to bridge the gap between user needs and technical implementation. Design Thinking plays a role in the exploration (Discovery) phase through the Empathize and Define stages, during which user problems are identified and converted into a Product Backlog. Subsequently, Agile Scrum plays a role in the execution (Delivery) phase. Each feature designed during the Ideate and Prototype stages is developed within short, focused Sprint cycles. This enables the team to remain responsive to emerging challenges; the test results from one sprint form the basis for evaluation and improvement in the next sprint (Resmi Rachmawati et al., 2023). This synergy ensures that the SICITRA application is not only technically functional but also provides relevant and valuable solutions for users.

RESULT AND DISCUSSION

Empathize Stage

The purpose of the empathize stage is to be able to understand, feel, and define what is experienced and needed by users. The criteria for potential users considered for the SICITRA application are:

Table 1. Potential Users

No.	Criteria	Qualification
1	Sex and Age	1. Men and Women 2. Teenagers (12-17 years old) 3. Adults (18-55 years old) 4. Elderly (56-70 years old)
2	Geography	The location is accessible by bus transportation
3	Application Requirements	1. Bus passengers who want to know bus departure information. 2. Families who want to track the journey of bus passengers.
4	Level of Technological Understanding	1. Users with a basic understanding of technology (who use smartphones but are less familiar with applications). 2. Users with a high understanding of technology (who use smartphones and are familiar with applications).

One of the outputs of this stage is the pain points felt by public transportation users. This study conducted interviews with three prospective SICITRA users and obtained the pain points shown in Table 2.

Table 2. Pain Points

Pain Points	How	Might
Bus departure schedule information	How can users get information on bus departure schedules?	By creating a real-time bus departure schedule table
Bus departure schedule information	How do users not miss the bus departure schedule information?	By creating a bus departure schedule and notification feature
Trip history information	How can users know their trip history? Families who want to track the journey of bus passengers.	By creating a trip history feature for users and people close to users
Share location information with the user's close people (contact)	How do users categorize the people closest to them?	By creating a 'circles' feature that has the same functionality as user contacts
Share location information with the user's close people (contact)	How can users share their location information with those close to them?	By creating a shared location activation feature for the user's 'Circles' (contacts)
Know the nearest bus shelter	How can users quickly find the nearest bus shelter?	By displaying the nearest bus shelter map feature and equipped with a bus shelter location search
Get transportation news	How can users get news about transportation and real-time traffic flow?	By creating a news-update feature and traffic flow information as long as the user activates the GPS function

Ideate Stage

From the ideate stage, a customer journey describes the features users will encounter while running the application and explains the application's workflow. The application workflow shows the interaction between the user and the system, as well as the user flow when using the application. The SICITRA application workflow is shown in Picture 2. When first accessing the application, users will go to the login page. If the user does not have an account, the user will be directed to the signup page. Next, the user will go to the home page. There are other pages that users can access that complement the needs of the SICITRA application features, namely the Circles, Make a Trip, Trip History, and Profile pages.



Figure 2. SICITRA Application Workflow

Prototype Stage

The next stage is prototyping. At this stage, workflows and features are implemented according to user needs. Picture 3 are the results of the prototype design based on the results of the ideate stage and the previous stages.

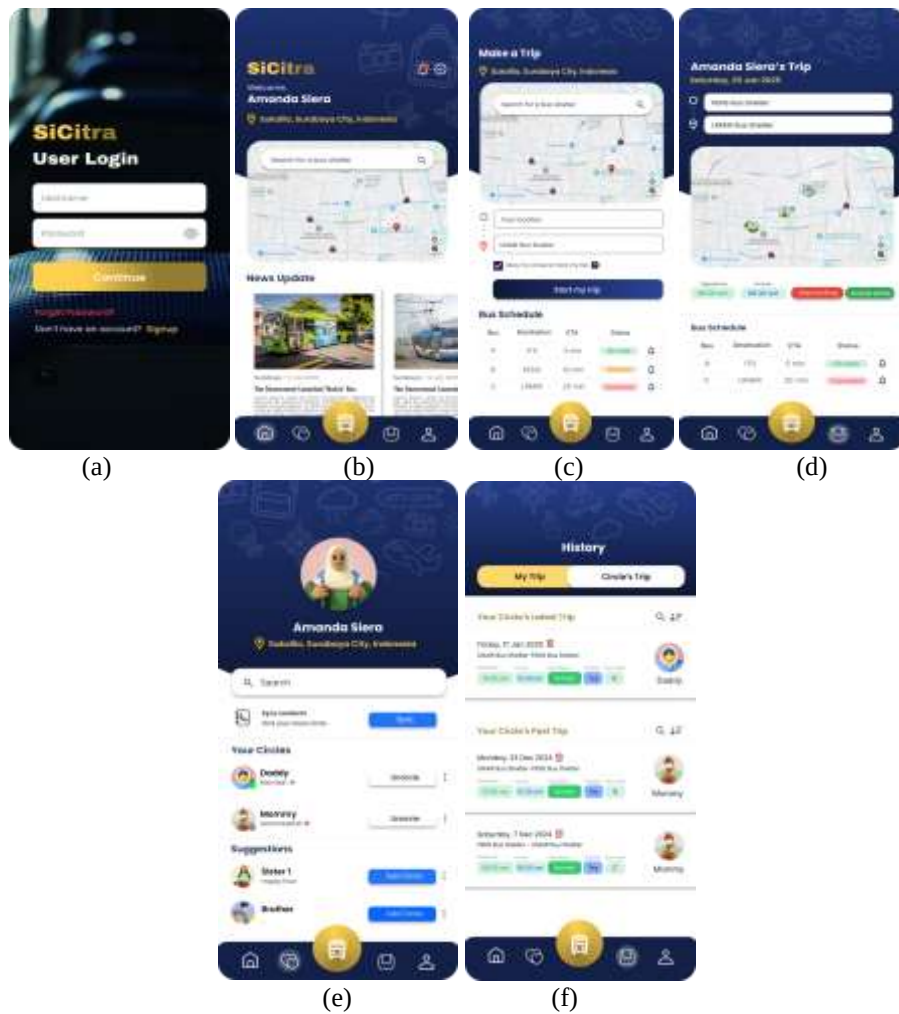


Figure 3. SICITRA Prototype

The prototype Picture 3 shows the features the SICITRA application provides, such as the (a) Login, (b) Home, (c) Make a Trip, and (d) Tracking page. On the home page, users can discover the location of the nearest bus stop, read the latest transportation news, and read notifications related to track “Circles”. Users can start their trip on the Make a Trip page and set whether their circle can also track it. In addition, users can view the bus arrival schedule and activate the notification or alarm feature if the bus is about to arrive. Picture 3 also shows the (e) Circle, (f) Trip History page. On the Circle page, users can add or delete their circles. The circle is a recommendation from the app based on synchronization with the user's phone book. The Trip History page shows the user's trip history and the user's circle that they have tracked.

User Testing Stage

The testing stages are carried out to determine whether the designed prototype meets the user's needs. The validation process serves as feedback for the SICITRA application design before proceeding to the development phase. This ensures that any necessary improvements or adjustments can be made to enhance the application's functionality and user experience. This study employed a task-based usability testing approach using predefined task scenarios to assess users' task completion performance and identify usability issues encountered during their interaction with the application. Table 3 shown the task-based user usability testing scenario.

Table 3. User Usability Testing Scenario

Task Code	Task	Scenario	Usability Objective
US-1	Launch the Application and Perform Login/Sign-Up	Participants were instructed to open the application and complete the login or sign-up process. During this task, participants were asked to observe the initial interface, including the loading screen, splash screen, and navigation flow.	To evaluate the ease of initial use and the efficiency of accessing the application for the first time.
US-2	Locate and Review the Notification Feature	Participants were instructed to explore and access the notification feature and examine the information provided through notifications.	To assess the ease of locating and accessing notification-related information within the application.
US-3	Add and Remove a Circle	Participants were instructed to explore the functionality for adding a new Circle and removing an existing Circle.	To evaluate the ease of adding and removing a Circle within the application.
US-4	Enable and Disable Circle Tracking	Participants were instructed to explore the tracking settings and perform both activation and deactivation of Circle tracking.	To assess the ease of activating and deactivating the Circle tracking feature.
US-5	View the Current Trip of a Tracked Circle	Participants were instructed to select “Daddy” from the “Your Circles” section and then access the “Show Current Trip” feature to view the ongoing trip information.	To evaluate the accessibility and visibility of current trip information associated with a tracked Circle.
US-6	Start a New Trip (Make a Trip)	Participants were instructed to explore the “Make a Trip” feature, including granting tracking permissions to Circles, stopping tracking, confirming safe arrival, and enabling bus departure schedule notifications.	To assess the accessibility and visibility of the “Make a Trip” feature and its related functions.
US-7	View Travel History	Participants were instructed to explore trip history records, including both personal trip history and Circle trip history, and to perform a trip history deletion task.	To evaluate the accessibility and visibility of the travel history feature.

Usability testing was conducted using seven task scenarios to evaluate users' interactions with the application's main features. User performance was categorized into three outcomes: Completed, Completed with Difficulties, and Failed. A total of 50 participants were recruited to participate in the task-based usability testing conducted in this study. The participants were predominantly aged between 13 and 27 years old, reflecting the application's primary user demographic. During the testing session, participants were instructed to complete a set of predefined task scenarios representing the application's main functionalities. Their performance and the challenges encountered throughout the interaction process were then observed and documented to identify potential usability issues and opportunities for improving the user experience. Table 4 described the results of the task-based user usability testing.

Table 4. Task-based Usability Testing Results			
Task Code	Completed	Completed with Difficulties	Not Completed
US-1	78%	18%	2%
US-2	78%	18%	2%
US-3	56%	38%	4%
US-4	76%	18%	4%
US-5	82%	14%	2%
US-6	78%	16%	4%
US-7	74%	14%	10%

Based on the results of the task-based usability testing, users demonstrated varying levels of performance across the seven predefined task scenarios. The highest task completion rate was observed in task code US-5 (82%), namely “View the Current Trip of a Tracked Circle”, indicating that participants were generally able to access and retrieve current trip information with minimal difficulty. This finding suggests that the feature has a relatively intuitive interface and adequate information visibility, enabling users to accomplish the task successfully.

Meanwhile, the highest proportion of users who completed a task with difficulties was found in task code US-3, “Add and Remove a Circle”, accounting for 38% of participants. Although users were ultimately able to complete the task, the high percentage of encountered difficulties indicates potential usability issues related to feature discoverability, terminology, or the interaction flow required to manage Circle members. This suggests that users may require additional cognitive effort to understand and perform the available actions.

The highest task failure rate was identified in task code US-7, “View Travel History”, with 10% of participants being unable to complete the task. This finding indicates that the history feature may have limitations in terms of navigation structure, information architecture, or menu differentiation, making it difficult for some users to locate and access the desired information. Although the failure rate was relatively low, the presence of unsuccessful task completion highlights opportunities for improving the interface design and enhancing the accessibility of historical travel information. Overall, the findings indicate that while most users were able to complete the assigned tasks, several features still present usability challenges. Therefore, future improvements should focus on enhancing feature visibility, simplifying interaction workflows, and providing clearer system feedback to improve users' overall experience and task performance.

User reviews were qualitatively analyzed to identify recurring usability issues. The user feedback analysis revealed that most participants expressed positive perceptions of the application's visual aspects, particularly its color scheme, modern and minimalist design, and the tracking feature, which was considered beneficial for enhancing users' and their family members' sense of safety while using public transportation. In addition, the integration of the Circle feature and the map interface emerged as some of the most appreciated aspects of the application.

Nevertheless, several usability issues were still identified. The most frequently reported problems were related to interface responsiveness, including application lag, unresponsive scrolling functionality, and buttons that were difficult to interact with. Users also experienced difficulties understanding certain icons and features due to the lack of usage guidance, particularly for the Circle, History, and tracking activation features. Furthermore, the use of English as the primary language and the placement of certain interface elements, such as the map overlapping other content, negatively affected users' overall experience and comfort while using the application.

Based on users' feedback, several improvements are recommended, including the addition of a brief onboarding tutorial for new users, the provision of an Indonesian language option, optimization of interface performance, the inclusion of labels for icons, refinement of the home page layout, and improvements to button sensitivity and scrolling functionality. These findings indicate that feature visibility, navigation, and system feedback remain key priorities for the further development of the SICITRA application.

CONCLUSION

This study demonstrated that the Design Thinking approach can effectively support the development of a user-centered design, user interface (UI), and user experience (UX) for the SICITRA (Shared Circle Tracks) mobile application. Through the five stages of Design Thinking—empathize, define, ideate, prototype, and test—the application was designed based on users' needs and interaction patterns related to public transportation monitoring.

The results of the task-based usability testing involving 50 participants aged 13–27 years indicated that most users were able to complete the predefined tasks successfully. The highest task completion rate (82%) was achieved for the “View the Current Trip of a Tracked Circle” feature, suggesting that this feature provides good

visibility and an intuitive interaction flow. However, several usability issues were identified, particularly in the “Add and Remove a Circle” feature, where 38% of participants experienced difficulties, and the “View Travel History” feature, which recorded the highest task failure rate (10%).

User feedback further revealed issues related to interface responsiveness, navigation complexity, insufficient guidance for new users, and limited system feedback. Therefore, future improvements should prioritize enhancing feature visibility, simplifying navigation structures, optimizing interface performance, and providing clearer onboarding instructions and visual cues. Overall, the findings indicate that integrating Design Thinking with usability testing offers valuable insights for developing mobile applications that are more accessible, intuitive, and aligned with users' expectations.

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