Jurnal Teknik Informatika Vol. 16 No. 2, October 2023 (112-122)
ISSN: p-ISSN 1979-9160 (Print)| e-ISSN 2549-7901 (Online)
DOI: https://doi.org/10.15408/jti.v16i2.27416

JURNAL TEKNIK INFORMATIKA

Homepage : http://journal.uinjkt.ac.id/index.php/ti

Implementation of Design Thinking Method in UI/UX Redesign of Public Complaint Application (Case Study: Go Siaga App)

Rafi Kurnia Pangestu[1], Muhamad Bahrul Ulum[2]

[1,2]Informatics Engineering Study Program, Faculty of Computer Science Esa Unggul University, Jakarta, Indonesia, 11510.

Article:
Accepted: September 01, 2023
Revised: July 03, 2023
Issued: October 28, 2023

***Correspondence Address:**
rafipangestu@student.esaunggul.ac.id

ABSTRACT

Go Siaga App is a mobile-based application by Tangerang Sub-district Police Office that provides special community services for the Tangerang sub-district community which provides features in the form of reports of disturbances in public security and reports of loss or damage. Since it is a new application released in March 2021 on Google Playstore, several things need to be considered to maintain the usability of the application. This research aims to redesign the user interface and user experience (UI/UX) of the Go Siaga application using Design Thinking Method in the design process. Quantitative measurements, including assessments of effectiveness, efficiency, usefulness, satisfaction, and learnability, were systematically applied during usability testing. The purpose behind utilizing these metrics was to objectively evaluate and assess the success of the UI/UX redesign of the Go Siaga application, establishing a sturdy foundation for measuring user satisfaction and comparing it against the previous version. The results indicated that the percentage values for all usability aspects in the redesigned version surpassed those of the current one, with effectiveness, efficiency, usefulness, satisfaction, and learnability registering at 80%, 80%, 80%, 86.67%, and 73.33%, respectively. Consequently, based on the research findings, Go Siaga's redesign was deemed more effective, efficient, useful, satisfying, and easier to learn.

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

Jurnal Teknik Informatika Vol. 16 No. 2, October 2023 (112-122)
ISSN: p-ISSN 1979-9160 (Print)| e-ISSN 2549-7901 (Online)
DOI: https://doi.org/10.15408/jti.v16i2.27416

1. INTRODUCTION

The research presented a notable contribution by implementing the Design Thinking Method in the UI/UX redesign of the public complaint application, specifically focusing on the Go Siaga App. The study addressed the challenge of the app's inactivity due to changes in employment, with the app's founder moving to the Central Jakarta Metro Police Office and suggesting a broader regional implementation. The importance of user interface (UI) and user experience (UX) in building sustainable applications was emphasized, revealing a gap in understanding, with only 20% of students demonstrating outstanding comprehension in a related study[1]. User experience encompasses the collective responses arising from the interaction between users and a product, involving their expectations, requirements, and emotions while the user interface is a visual representation that is completely visible to the user, starting with shapes, colors, graphic elements, etc.[2].

UI/UX was identified as a crucial factor in user engagement by the research, challenging misconceptions that it was solely involved in inserting components into the frame view. By emphasizing a user-centered approach, the study aligned with the principles of Design Thinking, comprising the phases of Empathize, Define, Ideate, Prototype, and Test[3]. The research underscored the human-centered, creative, iterative, and practical nature of UI/UX.

Previous research on this topic was conducted by Adiyasa & Yogasara in 2020 which gauged the job description based on ISCO-08 and the calculation of employee needs using the Interaction Design Method in the form of a web application high-fidelity prototype using Adobe XD. Assessment aspects such as effectiveness, efficiency, usefulness, satisfaction, and learnability were used in this research as a reinforcing determinant of the design result success[4]. The success of the prototype was influenced by those assessment aspects attributed to the research. In the preceding investigation, the standard maximum task completion time for other respondents was exclusively defined by only one person which was the researcher. In contrast, this research introduced a novel approach by concentrating on a single participant engaged in three consecutive days of testing to ascertain a more organic and user-oriented maximum completion time.

The results of this research included a high-fidelity prototype interactively based on a mobile phone view and the assessed usability level of the innovative design solution. Design iterations were subsequently conducted, considering feedback from relevant parties on the innovative solutions. As a result, it is anticipated that the research titled "Implementation of Design Thinking Method in UI/UX Redesign of Public Complaint Application (Case Study: Go Siaga App)" would be beneficial for the readers.

2. METHODS

The methodology used in this study is design thinking which is a process that infuses a human-centered design ethos throughout the entire range of innovative activities with its non-linear stages[5].

Design thinking may be seen as the intellectual fruit of a thorough user-centered approach to innovation (Illustrated in Figure 1).

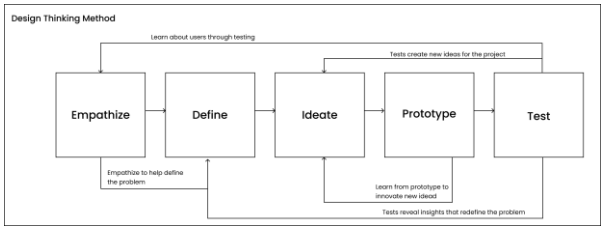

Figure 1.Design thinking method

2.1. Empathize

The initial step involves Empathize, a deliberate effort to comprehend individuals within the context of our design challenge. To achieve this, various techniques are employed, such as interviews, observations, and participant involvement through assigned activities. The aim is to capture firsthand insights into how individuals feel when interacting with the product. In line with the practical approach, we target an optimal number of five respondents, ensuring a focused and detailed exploration during interviews to gather in-depth information.

The optimal number of respondents is five people to be approached to obtain detailed and in-depth information from the interview[6].

Jurnal Teknik Informatika Vol. 16 No. 2, October 2023 (112-122)
ISSN: p-ISSN 1979-9160 (Print)| e-ISSN 2549-7901 (Online)
DOI: https://doi.org/10.15408/jti.v16i2.27416

2.2. Define

The define stage is a process of analyzing and comprehending various insights obtained through empathy, with the aim of determining the problem statement as a point of view or primary focus in research[7]. The define stage focuses on providing clarity about all the data we receive from users while also identifying which data points, expressed as pain points, are relevant to the issue at hand. In order to begin establishing connections, we must first move all of our information out of our heads and onto a wall—post pictures of our users, notes with quotes on them, maps of trips or experiences—anything that encapsulates their impressions and facts.

2.3. Ideate

Essentially, ideation involves formulating hypotheses for potential solutions to a problem or user needs[8]. It is more important to generate as many ideas as you can using techniques like brainstorming, mind mapping, and drawing.

2.4. Prototype

Prototype is an iterative tool for enhancing collaboration, encouraging learning, and supporting decision-making at any level of the design process, which can be a physical or digital representation of important design elements[9]. Wireframe (a low-fidelity prototype) and UI design (a high-fidelity prototype) are two examples of UI/UX.

2.5. Test

Testing is carried out to determine how closely the prototypes have matched the needs.

Usability testing is a term used in the testing phase to assess the utility of a product under development. Usability testing places a strong emphasis on performance metrics, such as how long it takes and how many mistakes are made when carrying out a series of specified tasks[3].

There some aspects in measuring the usability testing for the design that has been innovated[10].

a. Effectiveness

Effectiveness is a component of usability testing that assesses whether the respondents complete the tasks that are given.

Table 1.Example of the measurement recap of the effectiveness aspect

Task	Respondent					Task Error	Task Effectiveness
	1	2	3	4	5		
1						2	80%
2						0	100%
3						1	90%
Efficiency Average (∑Task Effectiveness / N Task)							90%

Description:
- Green Highlighted Box = Time spent by respondents <= MCT
- Red Highlighted Box = Time spent by respondents > MCT
- N Task = Number of tasks

The green highlighter shows that the task was completed successfully and without any faults, whereas the red highlighter denotes either incomplete or failed completion of the work. To measure the total score of the effectiveness, the formula in the Equation (1) can be used.

$$Effectiveness = 100\% - \left(\frac{\sum Task\ Error}{\sum Respondent} \times 100\%\right) \quad (1)$$

b. Efficiency

The efficiency factor reveals if the respondent's task completion time is shorter, equal to, or even longer than the standard time that has been calculated in the past using particular techniques (Provided in Table 2).

Table 2.Example of the measurement recap of the efficiency aspect

Task	Time spent by respondents in completing tasks (seconds)					MCT (seconds)	Task Effectiveness
	Respondent						
	1	2	3	4	5		
1	25	22	26	27	29	25	40%
2	20	20	35	18	26	26.4	60%
Efficiency Average (∑Task Efficiency / N Task)							50%

Description:
- MCT = Maximum Completion Time.
- Green Highlighted Box = Time spent by respondents <= MCT
- Red Highlighted Box = Time spent by respondents > MCT
- N Task = Number of tasks

Jurnal Teknik Informatika Vol. 16 No. 2, October 2023 (112-122)
ISSN: p-ISSN 1979-9160 (Print)| e-ISSN 2549-7901 (Online)
DOI: https://doi.org/10.15408/jti.v16i2.27416

c. Usefulness

Usefulness evaluates the user willingness to use the product at all and the extent to which a product aids users in achieving their objectives.

d. Satisfaction

The term "satisfaction" is determined from the customer's perceptions, emotions, and opinions on the product, which are frequently elicited through both oral and written inquiries.

e. Learnability

As a part of effectiveness, learnability refers to a user's capacity to utilize a system with a specific level of competence after receiving a specific amount and duration of training (which may be no time at all).

The System Usability Scale (SUS) was used for calculating the usability and it also conceived the calculation of aspects of usefulness, satisfaction, and learnability[11]. The Example of the SUS Calculation is provided in Table 3 while the SUS Items and Its Aspects is provided in Table 4.

Table 3.Example of the SUS calculation

No	Respondent				
	1	2	3	4	…
Odd Numbered Item (N)					
1	4	4	4	3	…
3	4	4	4	4	…
5	4	4	4	4	…
7	4	4	4	3	…
9	4	4	4	4	…
Even Numbered Item (N)					
2	3	4	3	4	…
4	4	3	4	4	…
6	4	2	4	4	…
8	3	3	4	3	…
10	2	2	4	4	…
Total Score (∑SUS Calculation)	36	36	39	37	…
Final Score = Total Score × 2.5	90	90	97.5	92.5	…
SUS Average (SAV) = Score/Total Respondent				92.5	

Table 3 continued…

No	Respondent				
	1	2	3	4	…
SUS Average Value Percentage (SAV × 100%)			92.5%		
Description: • Odd Numbered Item = N – 1 • Even Numbered Item = 5 – N • Final Score = Total Score × 2.5					

Table 4.SUS statement and its aspects

Item	SUS Statement	Aspect
1	I think that I would like to use this system frequently.	Usefulness
2	I found the system unnecessarily complex.	Satisfaction
3	I thought the system was easy to use.	Satisfaction
4	I think that I would need the support of a technical person to be able to use this system.	Learnability
5	I found the various functions in this system were well integrated.	Satisfaction
6	I thought there was too much inconsistency in this system.	Satisfaction
7	I would imagine that most people would learn to use this system very quickly.	Learnability
8	I found the system very cumbersome to use.	Satisfaction
9	I felt very confident using the system.	Satisfaction
10	I needed to learn a lot of things before I could get going with this system.	Learnability

(Brooke, 1986) then explained that the calculation of the SUS score.

Based on the obtained data; the minimum score of SUS at 68 is a precise average (Lewis & Sauro). The Curved Grading Scale Interpretation of the SUS Scores as calculated by Sauro and Lewis is shown in Table 4.

Jurnal Teknik Informatika Vol. 16 No. 2, October 2023 (112-122)
ISSN: p-ISSN 1979-9160 (Print)| e-ISSN 2549-7901 (Online)
DOI: https://doi.org/10.15408/jti.v16i2.27416

Table 5.Curved grading scale interpretation of SUS scores

SUS Score Range	Grade
84.1–100	A+
80.8–84.0	A
78.9–80.7	A-
77.2–78.8	B+
74.1–77.1	B
72.6–74.0	B-
71.1–72.5	C+
65.0 –71.0	C
62.7–64.9	C-
51.7–62.6	D
0.0–51.6	F

3. RESULTS AND DISCUSSION

3.1. Empathize

The empathize phase was conducted by using an observation and also interview with users who have used the Go Siaga App. These two ways of collecting data were used to accommodate lots of pain points from the users.

The observation was carried out by paying attention to some of the comments in the Go Siaga App review column on Google Playstore and through the Instagram page of Go Siaga which then some of the required respondents were then reached out to be involved in research interviews.

Given the redesign focus, the ongoing system of Go Siaga, including information architecture (Figure 2), user interfaces (Figure 3), and unified model language (Figure 4), was analyzed.

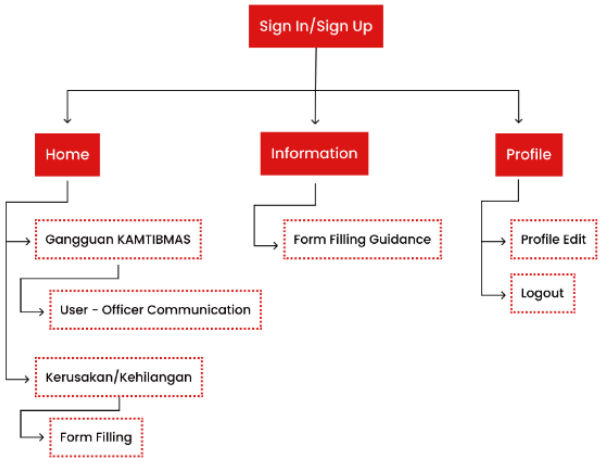

Figure 2.Go Siaga's information architecture

Figure 2 is the Go Siaga App's current information architecture, which encompasses all of its features.

Figure 3.Go Siaga's user interfaces

Figure 3 depicts the UI of Go Siaga as it appeared during its initial launch or before undergoing redesign.

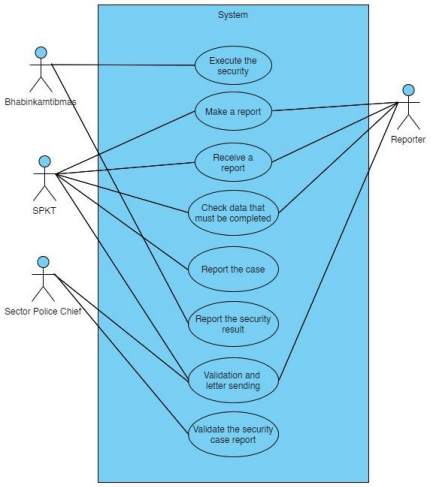

Figure 4.Go Siaga's use case diagram

The use case diagram (Figure 4) illustrates the functionalities of each role in the active system. The three actors include Reporters, Bhabinkamtibmas, SPKT, and the Sector Police Chief.

The next empathizing technique utilized a questionnaire created through a Google Form for efficient data collection, considering time and location constraints. Subsequently, a select group of willing respondents, chosen from the survey participants, underwent a second round of interviews for additional in-depth questions. The questionnaire was completed by five participants.

The last empathize method involved conducting interviews to gather insights on the Go Siaga App and identify potential improvements. Approximately one in five respondents participated in Google Meet interviews.

Jurnal Teknik Informatika Vol. 16 No. 2, October 2023 (112-122)
ISSN: p-ISSN 1979-9160 (Print)| e-ISSN 2549-7901 (Online)
DOI: https://doi.org/10.15408/jti.v16i2.27416

3.2. Define

The define stage was carried out to gather what users really need. The pain points were transformed into user personas include environmental factors, relationships, background, trends, and user needs[12].

With this knowledge, the latent user needs were able to be known[13].

Four user personas were created, and one of them is illustrated in Figure 5.

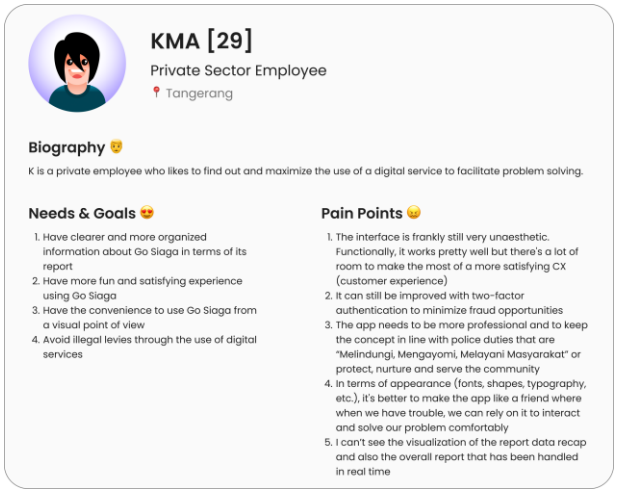

Figure 5.User persona

After transforming pain points into user personas, the "How Might We" stage was conducted as a method to generate potential solutions aimed at addressing the identified user issues.

In the “How Might We” stage, every assertion made about the pain points is transformed into a line-up of "how" on whether the issues identified may be improved.

One of the "How Might We" ideas was "Provide any new features and other updates on the Go Siaga App that are from user's suggestions." This encompassed a broad spectrum of modifications, beginning with visual design and progressing through the user flow to align with feedback.

3.3. Ideate

Following the How Might We, lists of features via solution ideas, the mapping through affinity maps, the work priority through prioritization ideas, the flow through user flows, and the guidance in terms of keeping the consistency through the UI style guidelines were all innovated.

In the creation of fresh solutions, diverse ideas generated by extensive stakeholder groups are harnessed, utilizing a blend of analysis and intuition[14].

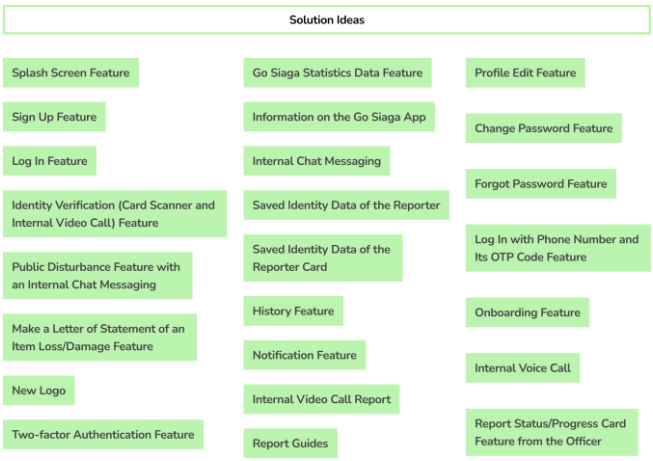

Figure 6.Solution ideas

Figure 6 contain what features would be available in the redesign of the Go Siaga App.

To organize any enhancements or changes in the Go App according to their appropriate parent features, affinity diagrams were made (Illustrated in Figure 7).

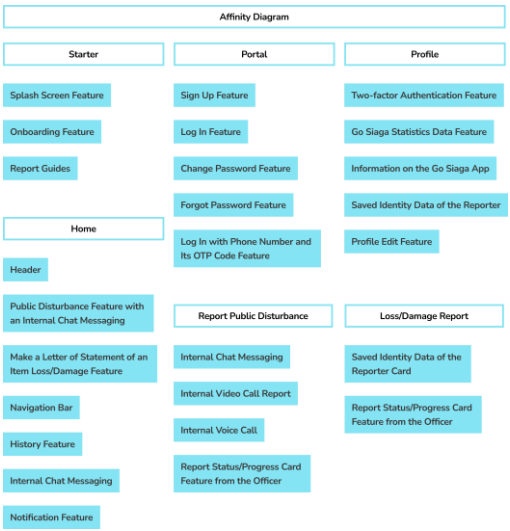

Figure 7.Affinity diagram

Furthermore, the prioritization idea was formulated to categorize upcoming features in the redesign of Go Siaga based on their priority, considering both the value and effort involved (illustrated in Figure 8).

Jurnal Teknik Informatika Vol. 16 No. 2, October 2023 (112-122)
ISSN: p-ISSN 1979-9160 (Print)| e-ISSN 2549-7901 (Online)
DOI: https://doi.org/10.15408/jti.v16i2.27416

Figure 8.Prioritization idea

Following the establishment of the prioritization idea, a user flow was developed to streamline the implementation of each idea for the redesign of Go Siaga features. Figure 9 illustrates the user flow for reporting public disturbances.

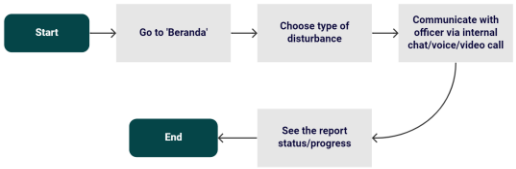

Figure 9.Reporting public disturbance user flow

The last step for the ideate stage was to make the UI style guide that addressed several topics, including color, typography, iconography, buttons, and other Go Siaga components, in order to preserve design consistency. The UI style guide can be seen in Figure 10.

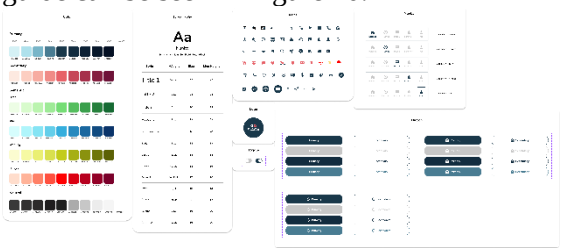

Figure 10.UI style guide

3.4. Prototype

Prototypes encompass a broad spectrum, ranging from simple sketches on a napkin to engaging in role-playing scenarios. In essence, they represent anything that enables the transformation of abstract ideas into tangible, testable forms[15].

The final UI design was developed following the guidelines outlined in the style guide, concluding all preparations made during the ideate stage. The prototype comprises both the wireframe (low fidelity) and the UI design (high fidelity). Figure 11 displays some of the entire wireframes.

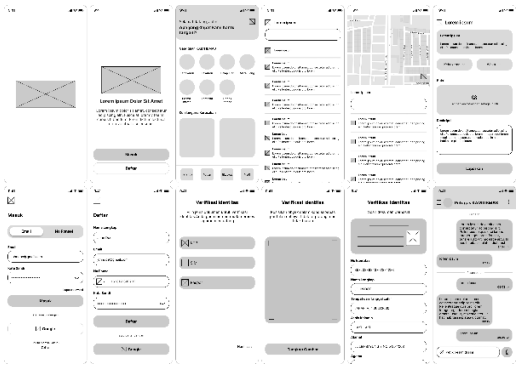

Figure 11.The wireframe of the main redesigned features

Whilst the presentation of one of the UI redesign results can be seen in Figure 12.

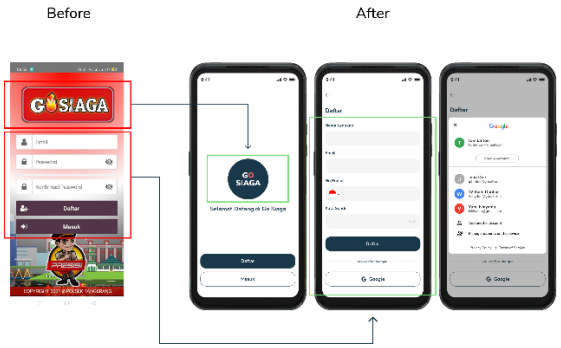

Figure 12.The UI of before and after being redesigned

3.5. Test

During the testing stage, the ideas and assumptions that were previously developed and selected are transformed into prototypes[16]. These prototypes are then subjected to iterative experiments, involving repetitive testing with additional adjustments until the optimal solution is identified. Various metrics, including job completion, think-aloud, maximum completion time, and the System Usability Scale, were employed. The calculation of the aspects of effectiveness, efficiency, usefulness, satisfaction, and learnability are also described. Table 6 is the tasks that respondents must experience to evaluate the redesigned version of Go Siaga in form of prototype.

The previous testing of the current version of Go Siaga obtained 80% of effectiveness, 68% of efficiency, 60% of usefulness, 56.6% of satisfaction, and 60% of learnability.

Jurnal Teknik Informatika Vol. 16 No. 2, October 2023 (112-122)
ISSN: p-ISSN 1979-9160 (Print)| e-ISSN 2549-7901 (Online)
DOI: https://doi.org/10.15408/jti.v16i2.27416

After the calculation results of the current design usability were obtained, the redesigned version was implemented on the redesigned UIs to assess whether an increase in the percentage of each tested aspect occurred or not (as provided in Table 7, Table 8, Table 9, Table 10, Table 11, and Table 12).

Table 6.Task completion

No	Task Completion
1	Experience the Splash Screen and Onboarding
2	Sign Up
3	Fill Out the Identity Verification
4	Sign In
5	Report a Public Disturbance
6	Make a Letter of Statement of an Item Loss/Damage
7	Set Up the Two-factor Authentication
8	See the Go Siaga Statistics Data
9	See the Information
10	Experience Forgot Password
6	Make a Letter of Statement of an Item Loss/Damage
7	Set Up the Two-factor Authentication

The calculation of the effectiveness aspect was obtained by looking at whether the respondent could do the task in order or not. The recapitulation of the effectiveness aspect is provided in Table 7.

Table 7.Recapitulation of the effectiveness aspect calculation

Task	Respondent					Task Error	Task Effectiveness
	1	2	3	4	5		
1						0	100%
2						0	100%
3						2	60%
4						0	100%
5						1	80%
6						3	40%
7						2	60%
8						2	60%
9						0	100%
10						0	100%
Efficiency Average (∑Task Effectiveness / N Task)							80%

Description:
- Green Highlighted Box = Time spent by respondents <= MCT
- Red Highlighted Box = Time spent by respondents > MCT
- N Task = Number of tasks

After going through task completion to calculate the effectiveness, task completion to calculate efficiency was done by respondents with the time benchmark called maximum completion time (MCT) as the determination of how efficient the task would be. The recapitulation of the efficiency aspect calculation is provided in Table 8.

Table 8.Recapitulation of the efficiency aspect calculation

Task	Time spent by respondents in completing tasks (seconds)					MCT (seconds)	Task Efficiency
	Respondent						
	1	2	3	4	5		
1	6	10	32	18	21	27.33	80%
2	7	28	24	36	43	29.33	60%
3	18	32	12	20	27	27.67	80%
4	5	24	15	18	105	28	100%
5	79	85	73	80	94	80.67	60%
6	147	156	155	110	151	152	60%
7	19	11	15	12	19	28.67	100%
8	17	28	19	21	32	24	60%
9	4	8	6	7	6	12	100%
10	33	37	30	35	40	46.67	100%
Efficiency Average (∑Task Efficiency / N Task)							80%

Description:
- MCT = Maximum Completion Time.
- Green Highlighted Box = Time spent by respondents <= MCT
- Red Highlighted Box = Time spent by respondents > MCT
- N Task = Number of tasks

The calculation for the SUS was described in Table 9.

Table 9.Recapitulation of the system usability scale calculation on the redesign

No	Respondent				
	1	2	3	4	5
Odd	SUS Calculation				
1	2	3	4	3	3
3	3	4	3	4	3
5	2	4	3	4	3
7	4	3	3	4	2
9	3	3	3	4	2

Jurnal Teknik Informatika Vol. 16 No. 2, October 2023 (112-122)
ISSN: p-ISSN 1979-9160 (Print)| e-ISSN 2549-7901 (Online)
DOI: https://doi.org/10.15408/jti.v16i2.27416

Table 9 continued…

No	Respondent				
	1	2	3	4	5
Even	SUS Calculation				
2	4	3	3	4	3
4	3	2	4	3	3
6	4	3	3	3	3
8	0	3	3	3	3
10	3	3	3	3	1
SUS Total	28	31	32	35	26
Final Score	70	77.5	80	87.5	65
Average Respondent	380/5 = 76				
Score in Percent	76%				

The total score of SUS of redesign of Go Siaga was 76%.

Furthermore, the calculation of the aspects of usefulness, satisfaction, and learnability were described in Table 10, Table 11, and Table 12. The determination of the results was obtained by how many people agreed or disagreed with the SUS statements based on where each aspect laid on.

Table 10.Recapitulation of the calculation of the usefulness aspect on the redesigned

Item	SUS Statement	Result
1	I think that I would like to use this system frequently.	80% of respondents agreed

The total percentage of the usefulness aspect obtained 80%.

Table 11.Recapitulation of the calculation of the satisfaction aspect on the redesigned

Item	SUS Statement	Result
2	I found the system unnecessarily complex.	80% of respondents disagreed
3	I thought the system was easy to use.	80% of respondents agreed
5	I found the various functions in this system were well integrated.	100% of respondents agreed

Table 11 continued…

Item	SUS Statement	Result
6	I thought there was too much inconsistency in this system.	100% of respondents disagreed
8	I found the system very cumbersome to use.	80% of respondents disagreed
9	I felt very confident using the system.	80% of respondents agreed

The percentage average of satisfaction aspect obtained 86.67%.

Table 12.Recapitulation of the calculation of the learnability aspect

Item	SUS Statement	Result
4	I think that I would need the support of a technical person to be able to use this system.	80% of respondents disagreed.
7	I would imagine that most people would learn to use this system very quickly.	60% of respondents agreed
10	I needed to learn a lot of things before I could get going with this system.	80% of respondents disagreed

The percentage average of learnability aspect obtained 73.33%.

Upon the completion of testing, feedback from all respondents regarding the design choices was documented for further consideration in the design iteration phase. Figure 12 represents one of the redesigned user interfaces.

Figure 13.UI modification of the status/progress card sent by the officer

ISSN: p-ISSN 1979-9160 (Print)| e-ISSN 2549-7901 (Online)
DOI: https://doi.org/10.15408/jti.v16i2.27416

CONCLUSION

Drawing upon the findings and subsequent discussion, it is observed that the redesign of the Go Siaga application has been successfully executed through the application of the Design Thinking Method, which includes testing. This success is evidenced by a notable percentage increase in each of the tested usability aspects, achieving 80% effectiveness, 80% efficiency, 80% usefulness, 86.67% satisfaction, and 73.33% learnability. The SUS calculation for the redesigned version of Go Siaga yielded a fulfillment of 76% (Grade B). The revamped Go Siaga has undergone significant enhancements to boost its effectiveness, efficiency, utility, satisfaction, and user-friendliness. Notably, the UI/UX redesign reflects a community-centric approach, marked by substantial input from users spanning the empathetic phase to rigorous testing.

The following recommendations are made as there are still numerous topics in this study warranting further investigation, particularly in the information gathering during the empathy stage. It is suggested to employ alternative techniques, such as competition analysis with comparable applications, to generate more inventive ideas for solutions. Additionally, the efficiency element can be assessed by having more than one responder examine the maximum completion time over a period longer than three days to obtain more comprehensive findings.

REFERENCE

[1] H. Joo, "A study on understanding of UI and UX, and understanding of design according to user interface change," *Int. J. Appl. Eng. Res.*, vol. 12, no. 20, pp. 9931–9935, 2017.

[2] R. Hartson and P. Pyla, *What Are UX and UX Design?*, 2nd ed. Elsevier Inc., 2019.

[3] H. Plattner, "An introduction to Design Thinking," *Iinstitute Des. Stanford*, p. 6, 2018, [Online]. Available: https://dschool-old.stanford.edu/sandbox/groups/designresources/wiki/36873/attachments/74b3d/ModeGuideBOOTCAMP2010L.pdf.

[4] A. A. Adiyasa and T. Yogasara, "Perancangan Website Deskripsi Pekerjaan Berdasarkan ISCO-08 dan Perhitungan Kebutuhan Pegawai," 2020, [Online]. Available: http://repository.unpar.ac.id/handle/123456789/12419.

[5] T. Brown, "Design Thinking," *2008 HARVARD BUSINESS SCHOOL PUBLISHING CORPORATION*, vol. 37, no. 2, pp. 21–24, 2008.

[6] J. Nielsen, *Usability Engineering*. Mountain View, California: Academic Press, 1993.

[7] A. A. Razi, I. R. Mutiaz, and P. Setiawan, "Penerapan Metode Design Thinking Pada Model Perancangan Ui/Ux Aplikasi Penanganan Laporan Kehilangan Dan Temuan Barang Tercecer," *Desain Komun. Vis. Manaj. Desain dan Periklanan*, vol. 3, no. 02, p. 219, 2018, doi: 10.25124/demandia.v3i02.1549.

[8] J. Liedtka, "'Putting technology in its place: design thinking's social technology at work,'" vol. 62, no. 2, pp. 58–83, 2020, doi: 10.1177/0008125619897391.

[9] C. A. Lauff, D. Kotys-Schwartz, and M. E. Rentschler, "What is a prototype? what are the roles of prototypes in companies?," *J. Mech. Des. Trans. ASME*, vol. 140, no. 6, 2018, doi: 10.1115/1.4039340.

[10] J. Rubin and D. Chisnell, *Handbook of Usability Testing: How To Conduct Effective Test, 2nd Edition*, Second Edi. Indianapolis, Indiana: Wiley Publishing Inc., 2008.

[11] Z. Halim, "Desain Aplikasi Mobile untuk Menunjang Perawatan Mobil," 2017, [Online]. Available: https://repository.unpar.ac.id/handle/123456789/4867.

[12] M. Holloway, "How tangible is your strategy? How design thinking can turn your strategy into reality," *J. Bus. Strategy*, vol. 30, no. 2–3, pp. 50–56, 2009, doi: 10.1108/02756660910942463.

[13] J. Liedtka, "Perspective: Linking Design Thinking with Innovation Outcomes through Cognitive Bias Reduction," vol. 32, no. 6, pp. 925–938, 2015, doi: 10.1111/jpim.12163.

ISSN: p-ISSN 1979-9160 (Print)| e-ISSN 2549-7901 (Online)
DOI: https://doi.org/10.15408/jti.v16i2.27416

[14] V. Nagaraj, N. Berente, K. Lyytinen, and J. Gaskin, "Team Design Thinking, Product Innovativeness, and the Moderating Role of Problem Unfamiliarity," *J. Prod. Innov. Manag.*, vol. 37, no. 4, pp. 297–323, 2020, doi: 10.1111/jpim.12528.

[15] R. F. Dam and T. Yu, "Design Thinking: Get Started with Prototyping," *Creat. Condence Unleashing Creat. Within Us All*, pp. 1–8, 2013, [Online]. Available: https://library.parenthelp.eu/wp-content/uploads/2021/03/www.interaction-design.org_.pdf.

[16] C. Lisa, R. Ingo, and E. Maria, "Framing Design Thinking: The Concept in Idea and Enactment," vol. 25, no. 2, pp. 306–306, 2016, doi: 10.1111/caim.12153.