UI and UX Redesign for COVID-19 Response Mobile Application Using Usability ISO Model and Testing Tools

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Abstract

The aim of this study was to analyse the user-friendliness of the COVID-19 Response Mobile Application, namely PeduliLindungi. 107 respondents answered the questionnaire and concluded that the usability of the current version is 68%, which is categorised as 'terrible' on the system usability scale, indicating that the main concern of users is the accessibility of the application. The main objective is to redesign the UI and UX of the PeduliLindungi mobile application to improve the usability and accessibility of the application. The quantitative method was used as a research tool to obtain the responses of PeduliLindungi users and measure the attributes of the application based on the ISO 9241-11 metrics: Efficiency, Effectiveness and Satisfaction. A revised version of the PeduliLindungi mobile application received a 70% usability rating and was rated "good" on the system usability scale. The study also identified specific usability characteristics from the ISO usability model widely used in usability engineering. A guide was created for developers to include UX considerations in the development of mobile applications.

Keywords: *PeduliLindungi, COVID-19, User Experience, User Interface, Application*

1. Introduction

During the early 2020 to 2022 COVID-19 pandemic, many infected Indonesian people who died due to COVID-19 were not appropriately tracked by the health personnel because they were the only ones who lived in their place.

According to Alfred H. Knight, the number of confirmed cases in Indonesia has reached 26,121 as of February 7, 2022, with 4,542,601 and 4,191,604 recovered patient total [1]. During the initialization of Restrictions Towards Community

Activities (PPKM), people were allowed to visit the public area within several restrictions such as social distancing, takeaway food orders, and avoiding crowded places. This problem led to the development of COVID tracker applications, namely PeduliLindungi. As recorded by Office for the Coordination of Humanitarian Affairs (OCHA), almost 13.6 million of the community in Indonesia use the PeduliLindungi app as a tool for COVID-19 screening [2]. Mobile technology has advanced rapidly and consistently in parallel with user needs in terms of user interface (UI) and user experience (UX) in its development, especially in mobile applications. The usability model was introduced to measure the capability of the designed software if it fulfils the user goals or otherwise. There are many usability models such as International Organizational for Standardization (ISO) 9241-11, ISO 9126, and Eason that are mostly used these days by the UI and UX researcher [3].

The objectives of this research are:

i. to conduct a comparative analysis of existing COVID-19 applications.
ii. to evaluate the effectiveness, efficiency, and user satisfaction of the PeduliLindungi

This research uses the ISO 9214-11 usability model as a framework for design and testing to improve the user interface and usability of the PeduliLindungi application. The results will help to improve the UI and UX of the PeduliLindungi application and ultimately increase its overall impact in the fight against the pandemic.

2. Literature Review

Prior to the deployment of the COVID-19 tracing application, the Indonesian government required users to update their health status when entering public space through the application called electronic health alert card (e-HAC) until the application changed the functionality of frequent manual data entry to a Quick Response (QR) code. However, similar applications from other countries implement similar main functions, but the evaluations of the applications were quite different.

This study provides an overview of usability models that are suitable for measuring usability design [5]. The ergonomics of human-system interaction, also known as ISO 9241-11, provides a framework for understanding and applying the idea of usability in a variety of situations involving interactive systems. This framework provides a thorough method for improving the user experience in various domains and extends to systems involving physical environments, industrial and consumer goods, and technical and personal services.

2.1 User Experience (UX)

UX is about understanding the users, their requirements, values and talents as well as their limitations. It also takes into account the business goals of the project management team. UX best practises are committed to improving the quality of product interaction with connected services.

As cited by Nielsen [6], UX goes far beyond simply giving consumers what they think they want or providing a laundry list of goodies. To create a high-quality

UX for a company's offerings, various functions from engineering, marketing, graphics, industrial design and interface design must be seamlessly integrated. According to the study on website users, digital products are used by non-expert users who value important brief information. Users appreciate websites that contain digital resources on cultural heritage.

2.2 International Organizational for Standardization (ISO) 9241-11 Model

ISO is a non-governmental organisation that creates a standard to ensure the quality, safety and efficiency of products, services and systems. ISO is a certification that confirms that a management system, a manufacturing process, a service or a documentation technique fulfils all standardisation and quality assurance norms. ISO 9241-11:2018 is a framework for a usability model for understanding and applying the concept of usability to circumstances in which people use interactive systems and other types of systems, environments, goods and services. There are several studies on user experience that use ISO 9241-11 as a usability model. Usability refers to the ability of a product to be used to a certain extent. The model is not only used for mobile applications, but also for hardware, software and physical material [8]. Table 1 shows the characteristics of ISO 9241-11.

Table 1: ISO 9241-11 [9]

Characteristics	Sub-Characteristic
Effectiveness	Accuracy Completeness
Efficiency	Temporal/ Time Human Financial/ Economics
Satisfaction	Comfort Acceptance

The characteristic effectiveness of a product is measured by the accuracy with which the user completes a task specified by the tester, and completeness is a measure of the level the user has attained during the test. Efficiency is defined as a measure of the resources used by the user in completing a task, including time, emotional and financial resources. Satisfaction is defined as a measure of how the user accepts and feels about a particular task that relates to solving the user's problem. The framework is used by UX researchers in leading organisations for the development of their mobile and web applications and is suitable for investigating the accessibility and effectiveness of both the UI and UX of mobile applications.

2.3 Related Works

There are several countries which released COVID-19 tracker such as Australia with Service NSW, Malaysia with MySejahtera, Singapore with TraceTogether etc. However, these applications come in different occasions and function. Table 2 summarized similar works and contrast the difference among these applications.

Table 2: Comparison Between Similar COVID-19 Tracker Application

Application	Features	Weakness
Malaysia – MySejahtera [13]	Users will be redirected to the check-in interface instead of the home page to decrease user time to check in into public space. Daily health assessment will be provided for an individual in quarantine	The tracker of My Sejahtera may consume a lot of battery. There is no notification while entering a risky area
Indonesia – PeduliLindungi [10]	The tracer of the app makes the government able to track down and anticipate the individual who has the closest contact. The interface design is simple. User can make an appointment with a doctor and requesting a medicine which is useful during the quarantine	There is no health assessment for individual in quarantine. There is no notification while entering a risky area. The app is not friendly for foreigner user (e.g., only written in Indonesian language and doesn't accept foreign number)
Singapore - Trace Together	The tracer of the app makes the government able to track down and anticipate the individual who has the closest contact. The app request Bluetooth as a closes distance detector, in order user able to know if they have a COVID suspect around them, the phone will be vibrated if someone in under risk nearby parameter	The tracer app requires Bluetooth, and It may cause a great battery consumption. the QR scan performance sometimes inconsistent Users found it is quite frightening for the notification vibration if someone under risk nearby
Australia - Service NSW	The tracer of the app makes the government able to track down and anticipate the individual who has the closest contact. The app has a history of visited place by user and provide the risk status in means that user can anticipate whether they have visited a	Recent user reviews stated that the app was not able to change user password due to a loop bug. Users must log-in every time they open the app

	risky area	

The comparative study showed that the various features of a particular foreign COVID-19 application might be implemented into the prototype of PeduliLindungi. As conclusion the COVID-19 awareness test of MySejahtera and Risk Status from Service NSW can be implemented to the PeduliLindungi as it will fulfill the prototype accessibility for the purpose of the research.

3. Research Methodology

This study utilised a quantitative research approach using an online questionnaire as the primary method of data collection. According to John W. Creswell [11], quantitative is a method of evaluating hypotheses by examining the relationship between variables. Google Forms was used to create the survey and the link was distributed via various social media platforms. The survey was completed by 100 PeduliLindungi users in Indonesia. The questions in the survey are based on the ISO 9241-11 metric, which includes three key characteristics: Efficiency, Effectiveness and Satisfaction. The result will be used for the redesign of PeduliLindungi's UI and UX.

3.1 Questionnaire

According to Nielsen, surveys are a flexible tool for capturing respondents in a wide range. The questionnaire will consist of 17 questions. Section A contains 2 demographic questions, section B contains 5 questions on the effectiveness factors, section C contains 5 questions on the efficiency factor and section D contains 5 questions on the satisfaction factor. Table 3 shows the distribution of the questionnaire.

Table 3: Questionnaire Distribution

Section	Factor	No of Question
A	Demographic	2
B	Effectiveness	5
C	Efficiency	5
D	Satisfaction	5
	Total	17

3.2 Prototype

After the data from the questionnaire has been collected, a prototype of PeduliLindungi was created as a visualization, addressing the specific concerns raised by the users in the questionnaire. The prototype interface will be made using Figma and the prototype will be made using Maze. Figma is a powerful web-based design tool that can build various elements, including websites, applications, and

logos. While Maze is capable of performing remote usability testing, during the usability testing user will be told about the task to reach the user goal. Users will rate the prototype and the data collected will be using SUS method for data analysis of the research.

As for Maze, the system usability scale will be calculated using Mission Usability Score (MIUS) [12], which also combined with the screen usability score. MIUS method will be calculated using formula below:

$$MIUS = DSR + (IDSR / 2) – Avg (MC\_P) - Avg(DU\_P)$$

Which has these variables:

DSR = Direct Success Rate

IDSR = Indirect Success Rate

Avg = Average Mission

MC_P = mis click penalty = MCR * 0.5

DU_P = Duration penalty = (MIN(10,MAX(0,(AVGD - 5)/2)))

3.3 System Usability Scale

The System Usability Scale (SUS) is shown in Table 4 and was introduced by John Brooke in his research of Usability Testing. He stated that usability is not an absolute measure that can be explained in a certain context and in his journal, he stated that SUS methods is an efficient and low-cost usability scale in terms of quantitative surveying, especially in global assessments of an application [4].

The SUS method uses an ordinal format of each question which consists of 1-Strongly Disagree, 2-Disagree, 3-Neutral, 4-Agree and 5-Strongly Agree. To calculate a score, SUS differentiates two variables; X and Y. X is defined as a total sum point of odd numbered question, and Y is the total sum points of the even numbered question. Whilst the calculation is provided in the formula below:

$$X_0 = X – QO_0$$

$$Y_0 = (QE_0)5 - Y$$

Then the total SUS score of odd and even numbered question will be multiplied by 2.5:

$$SUS\ Score = (X_0 + Y_0) \times 2.5$$

X_0 = Total SUS score of Odd numbered question

Y_0 = Total SUS score of Even numbered question

X = Total point of Odd numbered question

Y = Total point of Even numbered question

QO_0 = Total Odd questions

QE_0 = Total Even questions

QE_0 = Total Odd questions

The average SUS score is 68 and indicates the usability, efficiency, and others metric of the application, it applies to all usability models including ISO, Eason, Shackle, etc. However, the interpretation of SUS is based on the table below:

Table 4: Interpretation of SUS

SUS Score	Grade	Adjectival Rating
> 80.3	A	Excellent
68 – 80.3	B	Good
68	C	Average
51 – 68	D	Awful
< 51	F	Poor

4. Analysis

Figure 1 shows most of the respondents were 18-25 years old (68.2%), followed by less than 18 years old (18.7%), 26-50 years old (10.3%), in the other range (0.9%) is 51-65 years old, and the 65 years old above was 1.9%. From the Occupation background, respondents were mostly from students (64.5%) followed by employee (12.1%), 6.5% respondents were academician, 3.7% identified themselves as businessman and freelance, 1.9% laborer, the medical frontliners (4.7%) of respondents, and unemployed were (2.8%) of respondents. The survey also screened vaccination status of each respondent and most of them already fully vaccinated with 55.1%, 40.2% partially vaccinated and only 4.7% of them only took the first dose. This numbers explained due to the situation in Indonesia whereas every individual are encouraged to take a booster and majority of its population are dominated with juvenile (Statistik, 2021).

4.1 Efficiency

The results show 15.9% of the respondents disagreed with the notion itself. Most of the respondents did not have any opinion about whether they were aware of their surroundings (i.e., if they can view COVID-19 suspects nearby). Moreover, it shows that 33.6% of the majority agreed with the notion and almost 17.7% of the respondents do not align with the question. In conclusion, most users are concerned about the QR Code efficiency, and the risk awareness presented by the application.

4.2 Effectiveness

The results show that 40.2% of the respondents were able to navigate to the vaccination certificate page when asked by security at the gate. Additionally, 43.8% of the total respondents agreed that their QR code sometimes did not work when scanning through the gate. In contrast, the remaining respondents had a different experience, possibly due to mobile data performance issues. Furthermore, the respondents pointed out that they were able to identify the places they had visited after scanning through the app. The effectiveness metric of the PeduliLindungi app highlights the need for a valid recognition of risk status as an alternative to the vaccine certificate for user validation.

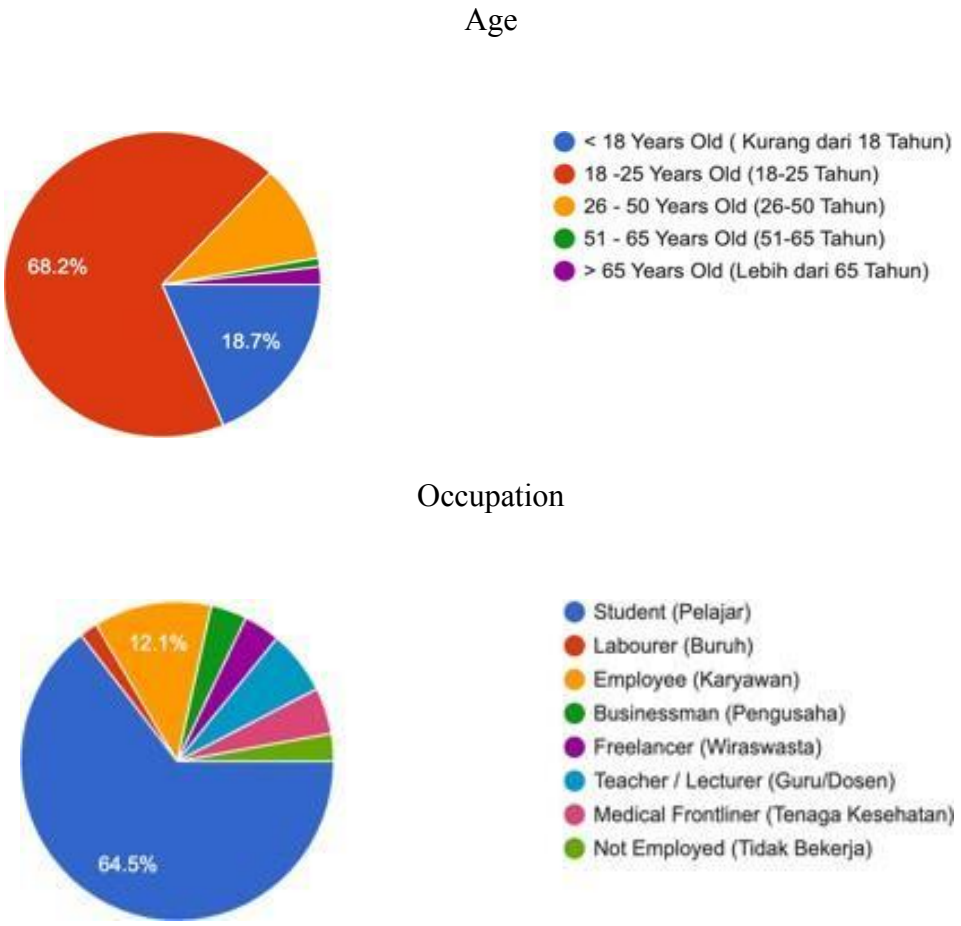

Figure 1: Demographic Overview

4.3 Satisfaction

The results show that most respondents (79.5%) were able to understand the PeduliLindungi app, while the remaining respondents felt neutral towards this notion. Furthermore, 51.4% of respondents agreed that the help center in PeduliLindungi was useful when they experienced errors or had queries. Additionally, 61.7% of respondents agreed that the interface of PeduliLindungi was easy to understand and remember. Lastly, 76.6% of the respondents believed that the icons used in the PeduliLindungi app were simple and user-friendly. Consistent with the UI trend, most users agreed on the admirable design implemented in PeduliLindungi for better recognition.

4.4 Usability Result

The average System Usability Score (SUS) obtained from 107 respondents was 63, indicating an "Awful" level of usability based on the range of 51-68 as referenced in Table 3. This finding underscores the need for significant improvements in the usability of the current PeduliLindungi application.

5. Prototype and Result

The results of the Usability Testing are applied to the proposed prototype

using Figma. Potential testers are categorized into five groups based on the User Personas created. As documented in the Maze Prototype, 38 participants who had previously taken part in the survey successfully completed the tasks, while 2 participants abandoned the assignment midway. The proposed prototype received a usability score of 70%, which is higher than the present version of PeduliLindungi, which received a score of 63%. This outcome signifies an improvement in the overall usability of the proposed prototype.

5.1 Hierarchical Task Analysis

Hierarchical Task Analysis (HTA) provides a systematic approach to identify the goals, subgoals, operations, plans, and interactions involved in completing a task, allowing for a detailed examination of task performance and potential areas for improvement. It is commonly used in fields such as usability engineering, and user-centered design to inform the design and evaluation of systems, interfaces, and workflows. Figure 3 to 5 shows the HTA for this research.

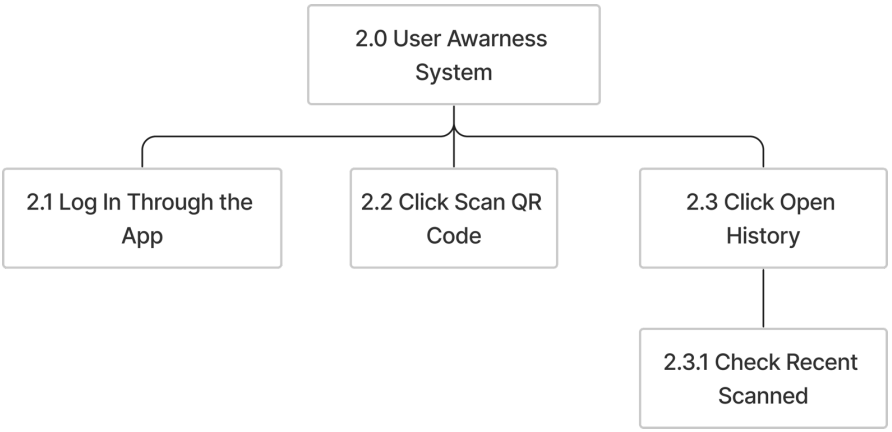

Figure 2: User Awareness System

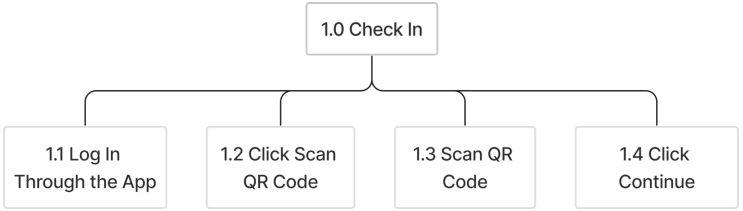

Figure 3: Check in System

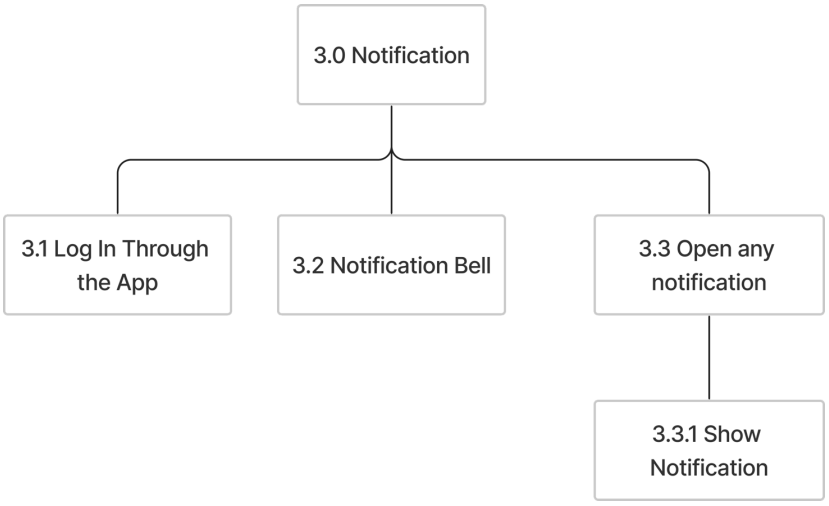

Figure 4: Notification

5.2 QR Code

In the proposed prototype (Figure 5), the design has been improved for the accessibility of the color-blind user. This is due to the regulations of the color status by the health ministry of Indonesia, as the green color represent full vaccinated and allowed to enter public area, yellow color for those who partially vaccinated and restricted to enter public area, red color for those who only took 1 vaccine or contacted with COVID-19 suspects and not allowed to enter public area, and the black status are not allowed to enter public area as those who unvaccinated. However, these color statuses only represent the vaccination status. In the current version, the color status is only labelled with the user's name and the color status around the label, however this is limited to the color-blind user who might be not able to perceive the color information. Therefore, we decided to replace the name label with the color status label. For additional information, the QR code prototype will be included with accordion component for the color status information, for instance that user is exempted from checking out after checking in from the gate. Moreover, the proposed application offered user status, will be determined by the other user color status e.g., if black status person scanned to the public area, then the green status person will be updated to yellow status.

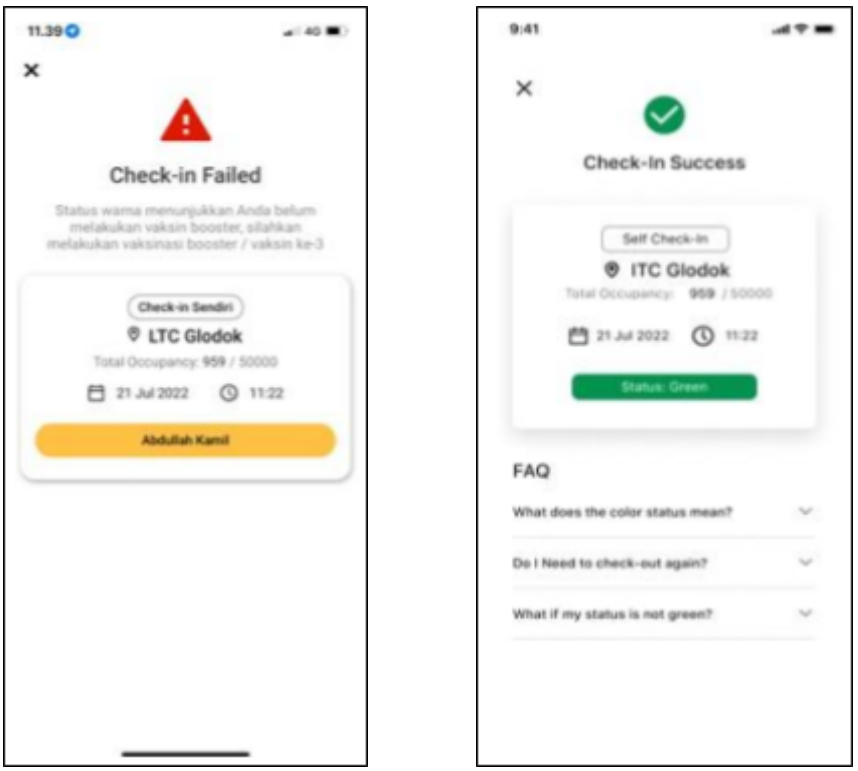

Figure 5: QR Code Scan Improvement -Left Current Version, Right Proposed Version

The statistics show that most users completed 76.3% of the overall task given for the QR Code, however users recorded 29% of mis-click rate and spent 28 seconds on completing the task. This is resulted to the variety of the user background and the ability to complete such tasks. Moreover, users spent 5.4 seconds spent on screen in this task. According to the framework, this task has recorded 67 usability score. The limitations were due to the prototype tools used for the testing including device, network and path used in Figma.

5.3 Information / Inbox

The current version application has a notification page; however, user did not often receive any notification from the system administrator. For instance, in the health status or user registration and in the notification page, it displayed a blank page rather than the current state of the information which violated the usability heuristics. In the proposed prototype (Figure 6) we added a visibility of system status while allowing the user to receive notification.

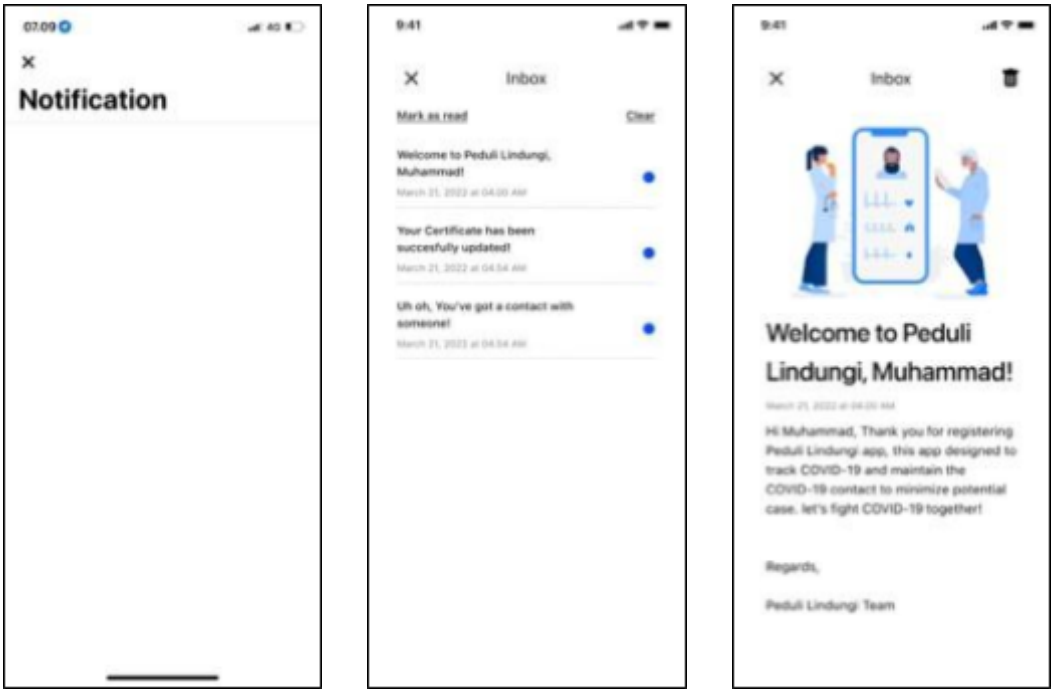

Figure 6: Notification Page -Left, the current version. Second column to the right, the Proposed Version

The statistics show that most users completed (80.6%) of the overall task given for the Information and Notification page, yet few users recorded (18%) of mis-click rate and spent 8 seconds completing the task. The average time spent on screen was 2.7 seconds which was considered outstanding. In the end of the usability testing, average users believed that the notification state was interactive, and the task received 80 of usability score from Maze.

5.4 COVID-19 Awareness

In regards of MySejahtera COVID-19 assessment, users were required to fill in an assessment form for those who had contact with COVID-19 suspect. In the current PeduliLindungi version, this feature was not included. Therefore, we suggested this feature be included in the prototype, hence it fulfills the user requirements as shown in Figure 7.

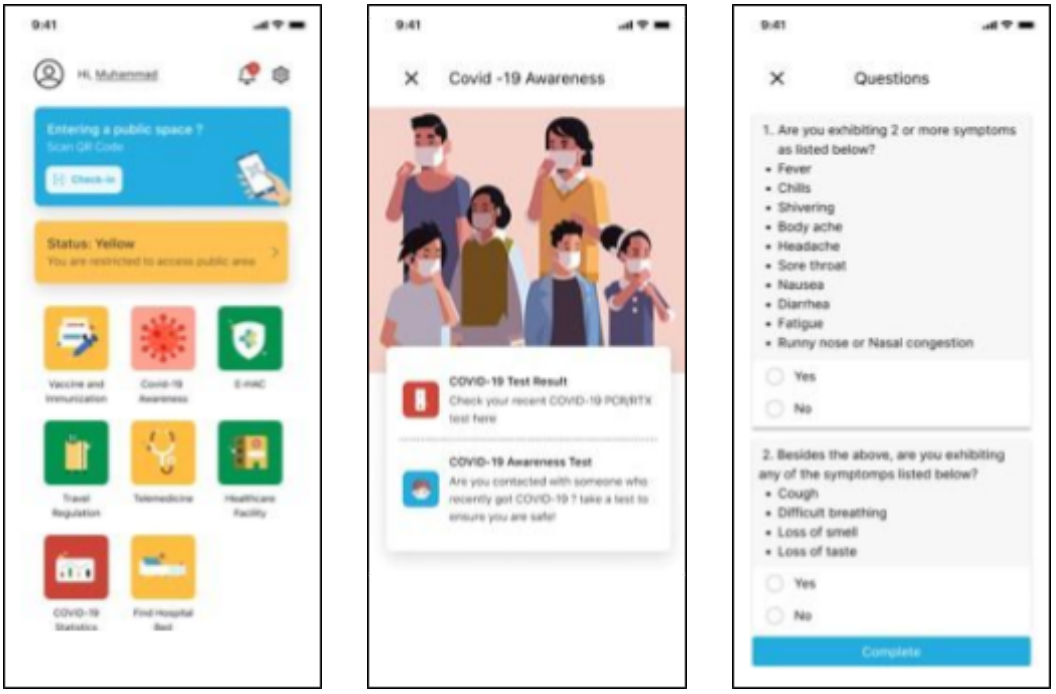

Figure 7: Covid-19 Awareness Test

The statistics show that most users completed (52.8%) the overall task given for the Covid-19 Awareness page, few users recorded (16.8%) of mis-click rate and spent 14 seconds on completing the task. The statistics contradict the later task. Although users spend 2.9 seconds on the screen, this task has been assessed by Maze with 63 usability score. This score depended on the user background variety and devices that the tester was using during the completion of the task.

6. Conclusion

To summarise, this research highlights the areas of importance to users in the current version of PeduliLindungi, including efficiency, effectiveness and satisfaction. The system usability score shows that the current version of PeduliLindungi has a "terrible" level of usability, which emphasises the need for significant improvements. The proposed prototype developed using Figma achieved a higher usability score of 70% compared to the current version's score of 63%, indicating an overall improvement in usability. These findings have contributed to the development of the proposed prototype and further improvements can be made to address user concerns and ensure a more user-friendly experience with PeduliLindungi.

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