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Design of a Mobile-Based Systemic Lupus Erythematosus (SLE) Self-Management Application

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Abstract*— *Lupus is a chronic autoimmune disease characterized by unpredictable cycles of remission and flare-ups, making regular monitoring of symptoms essential. However, many people with lupus experience challenges in consistently tracking their health due to brain fog, fatigue, and the wide variation of symptoms, which often leads to missed medication schedules and incomplete symptom records. This study aims to develop a mobile self-management application designed to help individuals with lupus monitor their health, manage their medications, and increase awareness of self-care activities. The development process employed the DMAIC (Define–Measure–Analyze–Improve–Control) framework, with the initial application prototype created using Figma. The prototype was tested with 22 respondents who are people with lupus (ODAPUS) to gather user feedback. The results indicate that users evaluated the application positively and found it beneficial for daily health management. Nevertheless, they recommended simplifying the interface and user flow to enhance usability. These insights will guide further improvements in the next stage of development.

Keywords : *lupus, self-management, mobile application, DMAIC.*

I. INTRODUCTION

Systemic Lupus Erythematosus (SLE), or Lupus, is a chronic autoimmune disease that affects various organs of the body, including the skin, kidneys, joints, and nervous system [1]. Lupus has unpredictable periods of remission and relapse [18]. The management of this disease necessitates a long-term approach, involving regular symptom monitoring, adherence to prescribed medications, and modifications to lifestyle. Regular monitoring and tracking of symptoms are essential to assist medical professionals.

People living with lupus (ODAPUS) often experience brain fog, resulting in decreased memory and difficulty focusing. This can make it challenging for them to remember their medication schedules and to provide accurate information to medical professionals during appointments [17]. Another issue arises from this condition. Between 43% and 75% of lupus patients do not take their medicine as prescribed, according to several studies [19]. This lack of self-control lowers the patient's quality of life and raises the likelihood of recurrence.

Recent developments in digital technology, especially within mobile health (mHealth), have facilitated the management of chronic non-communicable diseases, including lupus [2]. mHealth applications enable patients to record their daily conditions, receive medication reminders, and access educational information relevant to their health status [3].

Research related to the development of digital systems and technologies to support self-management in SLE patients has been widely conducted in recent years. The study by Dantas et al. [1] discusses the use of mobile health (mHealth) technology in managing SLE. The study highlights that mobile applications can assist patients in monitoring symptoms, reminding them to take medications, and facilitating communication with healthcare providers, although challenges such as usability and long-term engagement remain to be addressed. Moulaei et al. [2] identified the role of Health Information Technology (HIT) in controlling and managing SLE. Their findings indicate that technology-based systems can improve the efficiency of disease management and patient engagement, particularly through systems that support condition tracking and digital interactions between patients and physicians.

Ramasamy et al. [3] conducted a critical assessment of various mHealth applications for SLE and lupus nephritis. The results showed that most available applications still have limitations in terms of features, clinical validity, and user involvement in the design process, thus emphasizing the need for user-centered design in developing new systems. Meanwhile, Guardino et al. [4] highlighted the importance of input from patients and caregivers in developing lupus applications, particularly for

pediatric patients. Their recommendations emphasized the inclusion of features such as daily condition tracking, medication logging, and symptom reporting, which are also relevant for the development of self-recording systems for adult lupus patients.

Canal-Pérez et al. [5] conducted a systematic review of e-health interventions aimed at improving health outcomes among SLE patients. The findings showed that digital app-based interventions have significant potential to enhance medication adherence, disease awareness, and patient autonomy in managing their health. In Bell et al. [6], an application was developed to collect Patient-Reported Outcomes (PROs) digitally. The study demonstrated that using such applications improved patient compliance in reporting their condition and could be integrated with medical systems for continuous monitoring.

Furthermore, Leung et al. [7] developed a digital toolkit to improve the quality of life of SLE patients. The toolkit included various modules, such as disease education, condition logging, and medication reminders, which were proven to support patient self-efficacy in managing their illness. Other studies, such as those by MacIver et al. [8] and Marques et al. [9], also provide conceptual foundations for system development, although their research focuses on rheumatoid arthritis and inflammatory arthritis. Nevertheless, these findings can serve as a basis for demonstrating that telehealth and digital application-based interventions can strengthen self-management strategies and improve the quality of life for patients with chronic diseases.

The findings from these studies indicate that application development for people with lupus must consider factors such as interface design, usability, and user needs to ensure that the application genuinely assists them in monitoring their daily conditions. However, previous studies have not extensively explored design approaches that are specifically developed through direct feedback from ODAPUS, particularly in simplifying the interface and self-recording features.

Therefore, this research aims to fill this gap by designing and evaluating a prototype-based mHealth application for ODAPUS, developed based on direct feedback from adult lupus patients. The application is designed to function as a digital self-management tool to help ODAPUS record, monitor, and manage their health independently, while also increasing disease awareness, improving medication adherence, and supporting remote monitoring by healthcare professionals. These studies use the DMAIC (Define-Measure-Analyze-Improve-Control) paradigm to interface development. This framework, adopted from Six Sigma, provides a systematic procedure for defining user demands, measuring design performance, analyzing usability concerns, implementing targeted changes, and ensuring ongoing quality control [20].

The main objective of this research is to create a mobile application design that is in line with user requirements and includes essential functions such daily condition tracking, medication reminders, symptom monitoring, and health education. This study uses the DMAIC paradigm to describe the process of designing mobile applications for lupus self-management.

II. RESEARCH METHODS

A. Research Subjects

The research subjects consisted of 23 ODAPUS users who were asked to complete a questionnaire to determine user needs using a 1–5 Likert scale and to provide an assessment of the initial design.

B. Research Focus

The focus of the research was on users aged 18 years and over, as defined by Government Regulation No. 17 of 2025, who are deemed capable of self-managing and operating a smartphone without the assistance or supervision of a parent/guardian [16].

C. Prototype Development Method

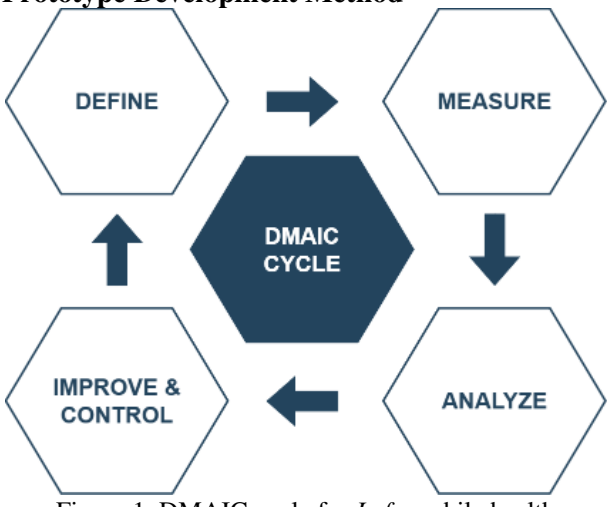

Figure 1. DMAIC cycle for *Lufy* mobile health application

The system development in this study adopts the Six Sigma process model using the DMAIC method. The development stages included:

1. **Define**
   Define the scope, platform, tools, and user needs for the development of the *Lufy* mobile-based m-health application, which functions as a digital self-management tool for individuals with SLE (ODAPUS) through the implementation of key features designed according to user needs.
2. **Measure**
   Collecting data on the needs of individuals with SLE (ODAPUS) regarding the presence of an m-health application using a questionnaire technique.

Table 1. The Questionnaire Statement in Measure Step

No.	Questionnaire Statement
1.	"I usually record my daily health condition."
2.	"I usually record my condition on my phone, such as in a note-taking app."
3.	"I have felt forgetful or found it difficult to recall the symptoms I experienced."
4.	"I feel that daily health recording helps me recognize lupus symptoms faster."
5.	"I often forget my medication schedule or doctor appointments."
6.	"I feel comfortable using phone alarms or notifications to remind me of health activities."
7.	"I feel disturbed by alarm sounds that appear frequently."
8.	"I can distinguish between mild symptoms and flare-up symptoms."
9.	"When I experience a flare-up, I know what to do."
10.	"I have used a health application before."
11.	"How long have you been diagnosed with lupus?"

3. **Analyze**
   Analyze the questionnaire results from the previous stage to identify the functionalities required by users. Next, create a visualization of this functionality. Finally, create an interface design using Figma.

4. **Improve and Control**
   Improving the previous design by gathering feedback from ODAPUS users through a Focus Group Discussion (FGD) and questionnaires.

Table 2. The Questionnaire Statement in Improve Step

No	Questionnaire Statement
1.	"I prefer applications with a simple and uncluttered interface."
2.	"I feel more comfortable when the application uses easily understandable language."
3.	"I like it when the application displays graphs or visuals, as they help me understand my condition more easily."
4.	"I feel comfortable using an application with clear and easily accessible menus."

III. RESULT AND ANALYSIS

A. Define

At this stage, the scope of system development was determined, namely the creation of the *Lufy* mobile-based m-health application for Android and iOS platforms. This application is designed as a digital self-management tool for individuals with SLE (ODAPUS) to record, monitor, and manage their daily health conditions independently.

In addition, the main tool used in this stage is Figma, which serves as the medium for user interface (UI) design. The development focuses on the core functionalities of the application, including daily condition recording, flare-up monitoring, medication reminders, and routine check-up reminders. The primary users of this system are adult individuals with SLE (aged ≥18 years) who are capable of recording their health data independently, in accordance with Government Regulation No. 17 of 2025 [16].

B. Measure

Figure 2. User Needs Scale Diagram

Table 3. The Result of Questionnaire Statement in Measure Step

No.	Questionnaire Statement	Conclusion
1.	"I usually record my daily health condition."	50% of respondents agreed (scale 4–5), indicating that most respondents record their daily condition.
2.	"I usually record my condition on my phone, such as in a note-taking app."	63% agreed; the majority use their phones for health recording.
3.	"I have felt forgetful or found it difficult to recall the symptoms I experienced."	63% agreed; most respondents struggle to remember their symptoms.
4.	"I feel that daily health recording helps me recognize lupus symptoms faster."	77% agreed; the majority believe that daily recording helps them identify symptoms earlier.
5.	"I often forget my medication schedule or doctor appointments."	54% agreed; many find it hard to remember medication and check-up schedules.
6.	"I feel comfortable using phone alarms or notifications to remind me of health activities."	72% agreed; most feel comfortable using alarms as reminders.
7.	"I feel disturbed by alarm sounds that appear frequently."	45% disagreed (scale 1–2); many respondents dislike excessive notifications.
8.	"I can distinguish between mild symptoms and flare-up symptoms."	72% agreed, 13.6% neutral, 13.6% disagreed; most can differentiate between symptom types.
9.	"When I experience a flare-up, I know what to do."	72% agreed, 22.7% neutral, 4.5% disagreed; most respondents know what actions to take during a flare.
10.	"I have used a health application before."	54% disagreed (scale 1–2); many have never used a health app before.
11.	"How long have you been diagnosed with lupus?"	13.6% <1 year, 40.9% 1–3 years, 27.3% 4–6 years, 18.2% 7–10 years; the majority have been diagnosed for 1–3 years (as of 2025).

This stage aimed to collect user requirement data from individuals with SLE (ODAPUS) through a questionnaire distributed to 22 respondents. The results showed an average score of 4.2 on a 1–5 scale, indicating a high level of interest in an application that assists in monitoring and recording health conditions.

Half of the respondents (50%) reported being accustomed to recording their health conditions, and 63% do so via their phones. However, 54% had never used a health application, suggesting that while digital device usage is common, the adoption of health applications remains low.

Furthermore, 77% stated that daily recording helps them recognize lupus symptoms faster, 63% often forget their symptoms, and 54% find it difficult to remember medication or check-up schedules. Meanwhile, 72% feel comfortable using phone alarms for health reminders, though 45% expressed discomfort with frequent notifications.

These results emphasize the need for a simple, flexible recording system equipped with customizable reminder features that can accommodate users' preferences.

C. Analyze

At this stage, the questionnaire results were analyzed to determine the main functionalities needed by users. Based on the findings, three key user requirements were identified:

1. Daily condition recording, to help users recognize symptom patterns independently.
2. Medication and routine check-up reminders, to assist users who often forget their treatment schedules, with customizable notifications that do not disrupt daily activities.
3. Flare-up monitoring, designed in an easily understandable visual format.

The results of this requirement analysis were then visualized through user interaction flow diagrams and initial interface designs using Figma. The first prototype highlighted the main features of the application, including the following screens:

Flare-Up Screening Interface

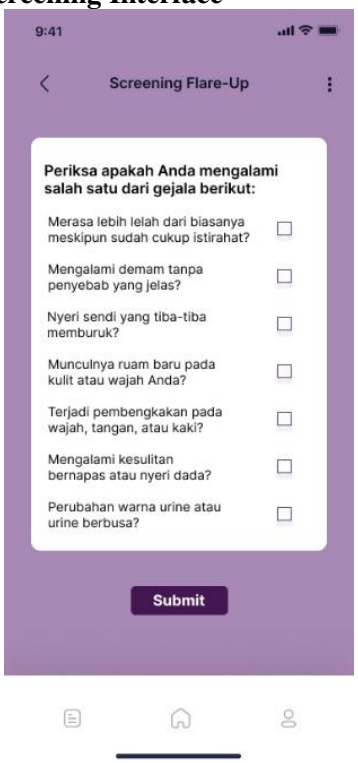

Figure 3. Flare-Up Screening

The Flare-Up Screening page allows users to conduct a self-assessment of the flare symptoms they are experiencing, enabling them to understand the current stage or severity of their flare.

Daily Recording Interface

Figure 4. Daily Recording

The Daily Recording page enables users to log their daily symptoms, including the option to add photos—such as rashes or other visible symptoms—to assist during routine medical check-ups.

Medication Reminder Alarm Interface

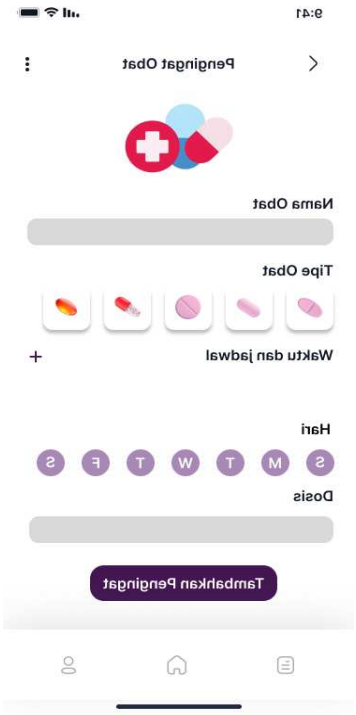

Figure 5. Medication Reminder Alarm

This page manages medication schedules, allowing users to input the name, type, dosage, and time for each medication to ensure consistent adherence.

Routine Check-Up Reminder Alarm Interface

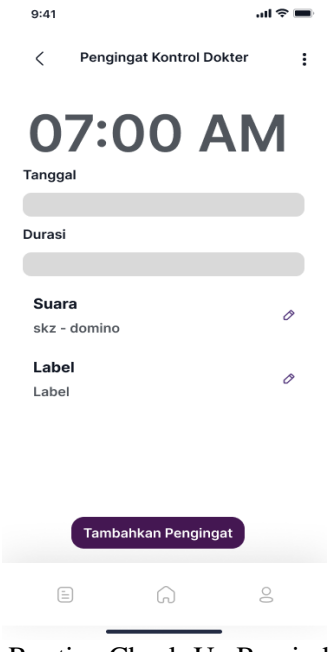

Figure 6. Routine Check-Up Reminder Alarm

This page allows users to manage their regular check-up schedules by setting the date, time, and notification sound for upcoming appointments.

D. Improve and Control

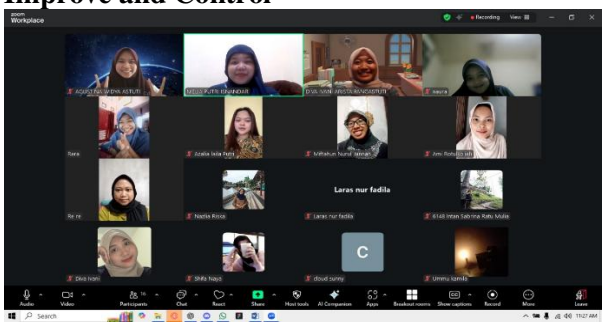

Figure 7. Zoom Documentation with ODAPUS

Table 4. The Result of Questionnaire Statement in Improve Step

No	Questionnaire Statement	Conclusion
1.	"I prefer applications with a simple and uncluttered interface."	Based on the questionnaire results, 81% of respondents (scale 4–5) agreed with the statement. Respondents prefer applications with a clean and uncluttered design.
2.	"I feel more comfortable when the application uses easily understandable language."	Based on the questionnaire results, 86% of respondents (scale 4–5) agreed with the statement. The majority of respondents prefer applications that use simple and easily understood language.
3.	"I like it when the application displays graphs or visuals, as they help me understand my condition more easily."	Based on the questionnaire results, 90% of respondents (scale 4–5) agreed with the statement. Respondents like applications that display visual images and graphs to help them better understand their condition.
4.	"I feel comfortable using an application with clear and easily accessible menus."	Based on the questionnaire results, 90% of respondents (scale 4–5) agreed with the statement. Respondents prefer applications with clear and easily accessible menus.

This stage was carried out by refining the interface design based on feedback from ODAPUS, which was obtained through a Focus Group Discussion (FGD) with the *Sahabat Cempluk* Community in Yogyakarta, as well as through follow-up evaluations. The initial testing revealed that some design elements still appeared complex and caused users to feel fatigued, particularly when recording symptoms or responding to lengthy flare-up questionnaires. The results of the prototype testing and user feedback showed that most respondents were satisfied with the ease of use and the application's interface design. Based on the questionnaire results, 81% of respondents agreed that they preferred an application with a simple and uncluttered design. Furthermore, 86% of respondents preferred applications that use easily understandable language, while 90% stated that visual displays and graphs helped them better understand their health conditions. Additionally, 90% of respondents felt comfortable using applications with clear and easily accessible menus.

These insights served as the foundation for improving the user interface (UI) to make it more intuitive, enhancing the user experience (UX), and clarifying navigation and menu structure. The use of simple language and informative data visualization will be maintained and further improved to help ODAPUS better understand their health conditions. As a follow-up, several design refinements and quality control measures were carried out, including:

1. Flare-up screening feature: changed from a long checklist format to an interactive visual display using simple icons (e.g., fever, joint pain, extreme fatigue) with short descriptive labels for easier comprehension.

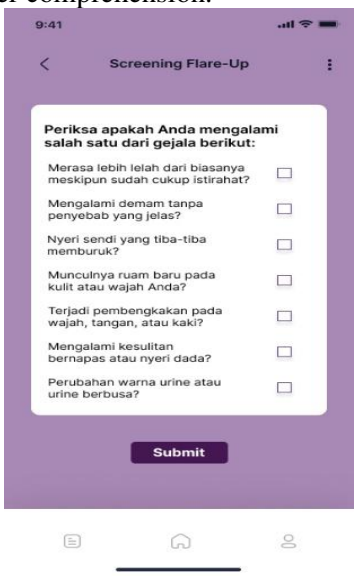

Figure 8. Initial Flare-Up Screening Design

Figure 9. Final Flare-Up Screening Design

2. Daily recording feature: simplified by replacing open-ended questions with illustrated options, making data entry faster and less tedious. An "Other" option was retained to maintain user flexibility.

Figure 10. Initial Daily Recording Design

Figure 11. Final Daily Recording Design

3. Routine check-up reminder feature: integrated directly into the daily recording page, eliminating the need for users to navigate a separate menu. The system now displays a reminder card showing the nearest check-up schedule whenever the user opens the recording page.

Figure 12. Initial Check-Up Reminder Design

Figure 13. Integrated Check-Up Reminder Design with Daily Recording Feature

4. Medication reminder feature retained as an independent module due to its higher frequency of use and the need for flexible time management.

The Control phase ensures that all implemented improvements remain consistent and aligned with user needs. Continuous monitoring was conducted through a feedback loop between researchers and users until a final design was achieved that is effective, user-friendly, and supports the main goal of the application — serving as a digital self-management tool for individuals with SLE (ODAPUS) to monitor and manage their health independently.

VI. CONCLUSION

The interface design of the mobile application, a system for recording health conditions aimed at offering self-management assistance for adults with lupus (ODAPUS), was effectively created as a consequence of this study, according to the findings and discussion that took place. From the questionnaire responses of 22 participants, an average score of 4.2 out of 5 was obtained, indicating a high level of interest in the development of an application that can assist them in monitoring and recording their daily health conditions. The majority of respondents have been living with lupus for more than one year and already have a habit of recording their health independently. However, they still face several challenges, such as forgetting to record symptoms, difficulty remembering medication and doctor appointment schedules, and unfamiliarity with using health applications regularly.

These findings reinforce the urgency of developing an application that is easy to use, intuitive, and responsive to user needs. Based on the initial evaluation results, several interface improvements were made to ensure simplicity and efficiency through the following:

1. Simplifying layouts and interactions by converting long text-based questions into interactive visual elements that are faster to respond to.
2. Integrating features, such as merging the check-up reminder with the daily recording feature, so that users no longer need to switch between pages.
3. Providing flexible reminders that can be customized according to user preferences without causing disturbance from excessive notifications.
4. Enhancing user experience through engaging visuals and lightweight input options to accommodate ODAPUS' limited concentration and fatigue levels.

The improved interface design demonstrates that the final version is more adaptive to the real needs of ODAPUS, supporting daily symptom recording, flare-up monitoring, and adherence to medication and routine check-up schedules.

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