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Scientific Article

Design of the HealthyQue Mobile Application for Hospital Registration Based on Android Using the Design Thinking Approach and UML Modeling

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A B S T R A C T

The increasing number of patient visits to hospitals each year poses challenges in providing fast and efficient services, especially during the registration process. Conventional registration systems often cause long queues and patient discomfort. This study aims to design the HealthyQue mobile application as a digital solution for hospital registration based on the Android platform. The application development follows the Design Thinking approach through five stages: empathize, define, ideate, prototype, and test, to deeply explore user needs and behaviors. The results of this process are realized in the form of system modeling using Unified Modeling Language (UML), including use case diagrams, activity diagrams, sequence diagrams, and class diagrams to structurally depict the system's workflow and architecture. This application offers features such as online patient registration, doctor schedule checking, and real-time queue notifications. The implementation of HealthyQue is expected to improve hospital administrative efficiency, reduce patient waiting times, and enhance service quality. The design results demonstrate that the Design Thinking approach effectively produces solutions aligned with user needs, while UML modeling supports the system documentation in a technical and systematic manner.

INTRODUCTION

The healthcare sector in Indonesia, especially hospitals, faces significant challenges as the number of patients increases each year [1]. This increase is not only due to the growing population but also the rising public awareness of the importance of better healthcare services. This directly impacts the growing volume of patients requiring medical services, including administrative processes such as hospital registration [2].

The patient registration process, which is still carried out manually or conventionally with physical queues, causes several significant problems [3][4]. Long queues, overcrowding in waiting rooms, and uncertainty about waiting times not only reduce comfort but also affect time efficiency and the quality of medical services. Long waiting times increase patient stress, while this discomfort risks damaging the hospital's reputation and lowering patient satisfaction. For hospitals,[5] the high administrative burden also increases pressure on administrative staff, which can disrupt their focus on other more important medical service tasks[6].

Although information technology has developed rapidly[7], its implementation in hospital administrative systems, especially in patient registration, remains limited. Some hospitals have adopted technologies like online registration

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systems, but often existing applications do not fully accommodate user needs, both from patients and hospital staff. The main problems found are the inability of applications to integrate smoothly with existing hospital systems, unfriendly user interfaces, and a lack of features that facilitate patients' access to real-time health service information [8][9].

With the rapid development of mobile technology and the increasing penetration of Android users, mobile-based applications have become a potential solution to address these issues. The HealthyQue mobile application is designed to facilitate patients in registering for hospitals online, accessing doctor schedules, and receiving notifications about queue status. The application also aims to accelerate hospital administrative processes, improve service time efficiency, and reduce the workload of administrative staff [10][11].

To achieve optimal results, HealthyQue is developed using the Design Thinking approach, which focuses on deeply understanding user needs through five stages: empathize, define, ideate, prototype, and test. This approach ensures that the solutions developed are truly user-centered, providing an intuitive and effective experience for both patients and hospital staff. Furthermore, to systematically and structurally model the application system, Unified Modeling Language (UML) is used, including diagrams such as use case, activity, sequence, and class diagrams, to describe the application workflow and the relationships between system components[12][13].

It is expected that with the implementation of HealthyQue, the hospital registration process will be more efficient, patient waiting times minimized, and patient satisfaction with hospital services increased. In addition, the use of mobile technology in hospital registration has the potential to improve overall hospital service quality, both in queue management and in delivering fast and accurate information to patients.

LITERATURE REVIEW

1. Mobile Applications for Hospital Registration
   Mobile applications have increasingly been adopted in healthcare settings to improve patient experience and operational efficiency. Several studies highlight the benefits of mobile-based hospital registration systems, such as reducing waiting times, minimizing paperwork, and providing real-time updates to patients ([14]Android platforms are commonly used due to their widespread availability and flexibility for development [15].
2. Design Thinking Approach in Application Development
   The Design Thinking approach is a user-centered methodology that emphasizes empathy, ideation, prototyping, and testing to solve complex problems [16]. In mobile app development, especially for healthcare, Design Thinking ensures that applications meet real user needs and provide seamless experiences [17]. Studies demonstrate that apps developed with Design Thinking are more intuitive and better aligned with user workflows [18].
3. UML Modeling in Software Design
   Unified Modeling Language (UML) is a standardized way to visualize the design of software systems. UML diagrams—such as use case diagrams, class diagrams, and sequence diagrams—are critical tools for documenting system architecture and workflows [19]. In healthcare app development, UML aids in clarifying requirements and ensuring consistent communication between stakeholders and developers [20].
4. Integrating Design Thinking and UML for Healthcare Applications
   Combining Design Thinking with UML modeling provides a comprehensive approach to application design. While Design Thinking focuses on understanding user needs and iterative solution development, UML offers precise documentation and system structure [21]. This integration has been proven effective in designing complex healthcare applications that require both usability and technical robustness [22].

METHOD

This study employs a design and development method focused on creating a mobile application as a digital solution for the hospital registration process based on the Android platform. The methods used in this research consist of two main approaches: Design Thinking and Unified Modeling Language (UML). The following are the detailed methods applied in this study:

1. Design Thinking Approach
   The Design Thinking approach is used to design the HealthyQue mobile application by focusing on a deep understanding of user needs (patients and hospital staff). This approach involves five stages, as follows:

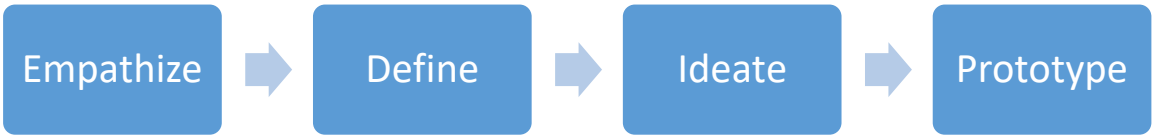

Figure 1. Design Thinking Approach Method [23][24]

   a. Empathize
      At this stage, the researcher collects data and information related to the hospital registration issues faced by patients and hospital staff. Data is gathered through interviews with patients, hospital administrative officers, and direct observations of the existing registration process [19].
   b. Define
      Based on the data obtained during the empathize stage, the researcher identifies the main problems to be solved, namely delays and patient discomfort during the registration process. At this stage, the researcher defines user personas and the functional requirements of the application[25].
   c. Ideate
      After defining the problems, the researcher generates ideas for solutions and application features to be developed. These ideas are discussed in brainstorming sessions, and feature priorities are determined based on their importance to the users.
   d. Prototype
      At this stage, the researcher creates an initial prototype of the application that includes main features such as online registration, doctor schedule checking, and queue notifications. This prototype is developed using interface design tools [26].

2. System Modeling with Unified Modeling Language (UML)
   System Modeling with Unified Modeling Language (UML) is used to describe the detailed structure and workflow of the application. The diagrams utilized in this study include:
   a. Use Case Diagram
      To illustrate the interactions between users and the application system, as well as the functions accessible to users [27][28].
   b. Activity Diagram
      To depict the overall flow of the patient registration process, from start to finish, including interactions with the hospital system.
   c. Sequence Diagram
      To show the sequence of interactions between objects within the system, such as the patient registration flow, doctor schedule checking, and queue notification delivery [29][30].
   d. Class Diagram
      To represent the data structure within the application, including the classes in the system and the relationships between them [31].

3. Application Development
   After the design and modeling stages, the HealthyQue mobile application was developed using programming languages compatible with the Android platform, such as Java or Kotlin. The application development followed the design principles established during the Design Thinking phase and adhered to the structure and workflows modeled using UML.

   The testing of the HealthyQue Mobile Application for Hospital Registration will be conducted through a combination of functional testing and usability testing to ensure the app meets its design objectives and user requirements. Functional testing will verify that all features—such as patient registration, queue management,

and notification systems—operate correctly according to the UML-based system design. Usability testing, grounded in the Design Thinking approach, will involve real users interacting with the app to assess ease of use, navigation flow, and overall user experience. Feedback gathered during testing will be analyzed and used to iteratively improve the application, ensuring it effectively supports hospital registration processes on the Android platform.

RESULTS AND DISCUSSION

Results

1. Design Thinking Approach

   The Design Thinking approach is a user-centered methodology used to develop solutions by deeply understanding users' needs and challenges. This approach involves five main stages: empathize, define, ideate, prototype, and test. In the empathize stage, the focus is on gathering insights about users through interviews, observations, and other research methods to understand their experiences and pain points. Next, in the define stage, the collected data is analyzed to identify core problems and to clearly articulate the problem statement. During the ideate stage, a wide range of ideas and potential solutions are brainstormed. The prototype stage involves creating early models of the solution, which can be tested and refined. Finally, in the test stage, prototypes are evaluated by users, and feedback is used to improve the solution iteratively. This approach ensures that the final product is tailored to meet real user needs effectively and innovatively.

   a. Define

      In the Define stage, data from interviews and observations were analyzed to identify key problems such as long queues, slow manual registration processes, and lack of doctor schedule information. The main problem was formulated as: "The manual registration process causes long queues, patient discomfort, and decreased service efficiency." A user persona was created, including Dewi, a 30-year-old office worker who needs fast and easy registration via mobile phone. Based on this analysis, the HealthyQue app must provide online registration, doctor schedule checking, and real-time queue notifications. A user journey map was developed to ensure an optimal and user-centered application flow.

   b. Ideate

      During the Ideate stage, brainstorming generated various solution ideas based on the Define findings. The focus was on easy access, fast service, and intuitive user experience. Proposed key features include online patient registration, doctor schedule checking, real-time queue notifications, and patient visit history. The interface design (UI) was planned to be simple and user-friendly, including for elderly patients. The most relevant and technically feasible ideas were selected for further development into a prototype.

   c. Prototype

      At the Prototype stage, selected ideas were transformed into an initial design of the HealthyQue application. The prototype visualizes main features such as online registration, doctor schedule checking, queue notifications, and visit history. The goal is to create an early version that users can test to identify strengths and weaknesses at an early stage.

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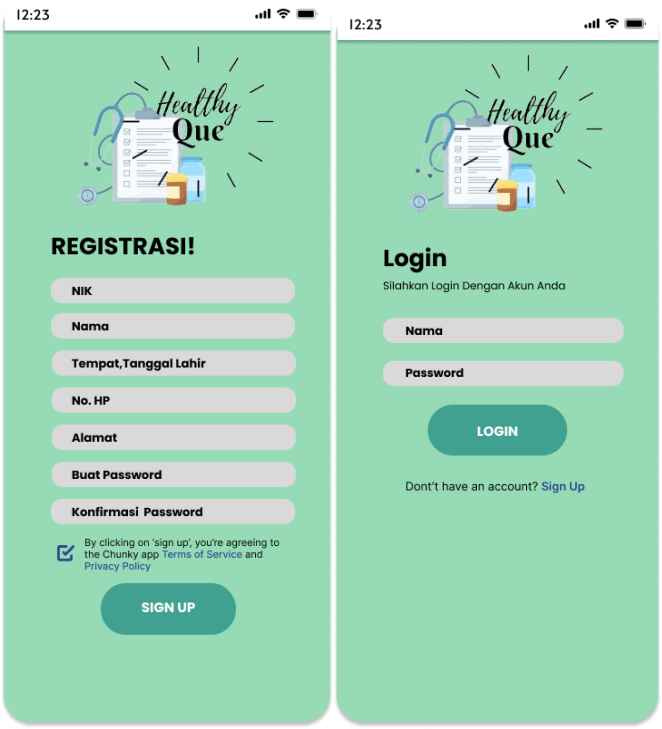

Figure 1. HealthyQue Prototype 1

Figure 2. HealthyQue Prototype 2

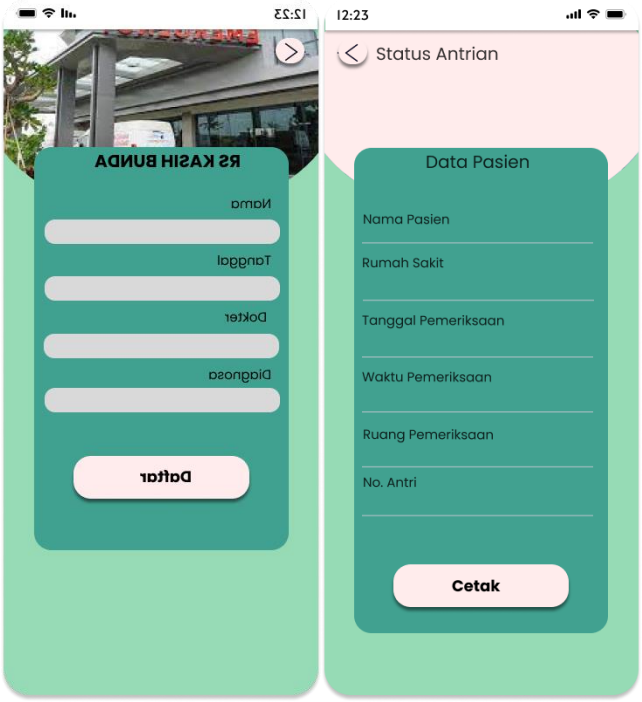

Figure 3. HealthyQue Prototype 3

The image shows the user interface (UI) of the Profile page in a mobile application. At the top of the screen, the user's name "Siti Fatimah" is displayed along with a profile picture. This page presents several main menu options under the Account category, each displayed as a button with an icon and label. These menu options include Account Settings to manage account information, Privacy Policy to view policies related to user data, Help which likely contains guides or a help center, and a Logout button to sign out of the account. The interface design uses soft pastel colors with a simple and easy-to-understand layout, making it user-friendly and allowing users to easily access important features related to their account.

The image shows the user interface of the Print page in a mobile application used by a user named Siti Fatimah. At the center of the screen, there is a large QR code with the instruction text "Scan here" displayed above it. This QR code is likely used for verification purposes, data printing, or accessing certain services quickly and conveniently without manual input. The interface design uses a combination of pastel green and pink colors, consistent with the previous profile page, creating a soft and user-friendly impression. A back icon in the top-left corner allows the user to easily exit the page. This display indicates that the application offers digital features that support efficiency and convenience in the process of printing or validating information.

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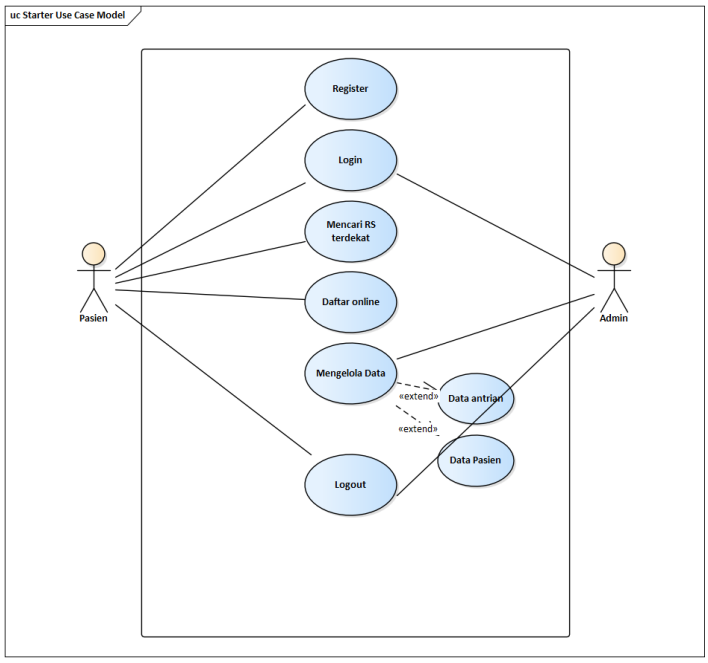
Figure 4. HealthyQue Prototype 4

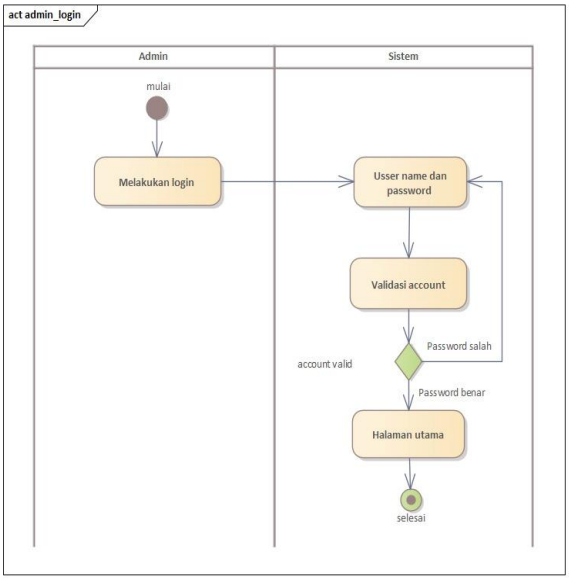
2. System Modeling with Unified Modeling Language (UML)
   a. Use Case Diagram

   The image represents a Use Case diagram of a hospital information system involving two main actors: Patient and Admin. In this diagram, the patient can perform several activities such as Register, Login, Search for the nearest hospital, Online registration, Manage Data, and Logout. The "Manage Data" feature has two extensions: Queue Data and Patient Data, which means these features can be executed as part of data management when needed. On the other hand, the Admin has access to features like Login, Manage Data, Queue Data, and Patient Data, indicating that the admin plays a role in managing patient and queue data. This diagram provides an initial overview of how the system will interact with users (patients and admins) and the main functions available in the system.



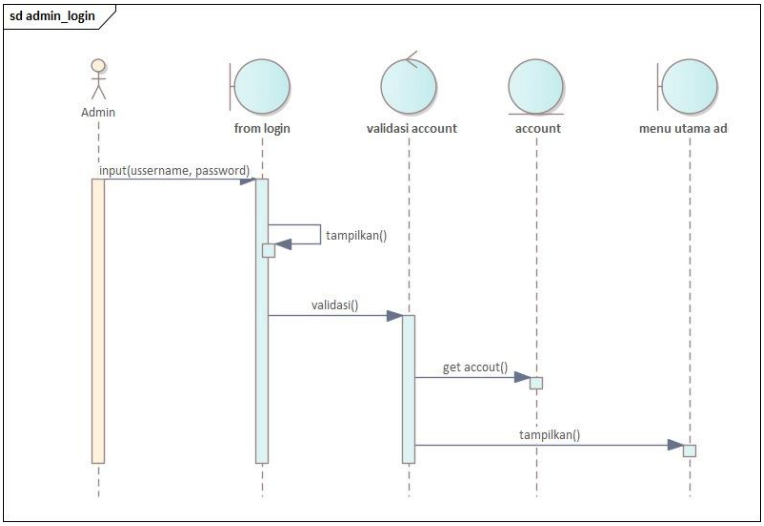
b. Activity Diagram

The image represents an activity diagram of the login process for the Admin actor within the system. The process begins when the admin chooses to log in. After that, the system prompts for a username and password, then proceeds to the account validation stage. If the entered data is incorrect (especially the password), the system redirects back to the username and password input stage. However, if the entered data is correct and the account is valid, the system directs the admin to the main page. The process then ends at the finish point. This diagram clearly and structurally illustrates the logical flow and interaction between the admin and the system during the login process. It is also worth noting that the misspelling of "Usser name" should be corrected to "Username" to adhere to proper writing conventions.



c. Squence diagram

The image represents a sequence diagram for the admin login process in the system. This diagram shows the interaction between the Admin actor and several system objects, namely from login, account validation, account, and admin main menu. The process begins when the admin inputs a username and password. This data is sent to the from login object, which then calls the tampilkan() (display) method to show the login form. Next, the validasi() (validate) process is carried out by the account validation object, which calls the get account() method on the account object to match the data. If the data is valid and matches, the system then calls the tampilkan() method again to display the admin main menu. This diagram helps illustrate the detailed sequence of communication flow between objects in the login process, although there is a typo in the label "ussername" which should be corrected to "username."



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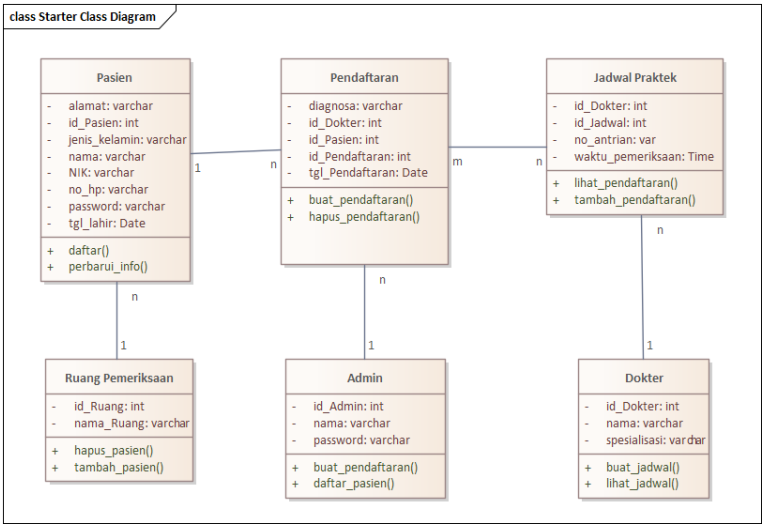
d. Class Diagram

The image shows a class diagram that represents a patient registration management system in a healthcare facility. This diagram consists of several main classes: Patient, Registration, Practice Schedule, Examination Room, Admin, and Doctor. The Patient class stores personal information such as name, address, gender, and contact number. The Registration class functions to record information related to patient registration, including diagnosis, patient ID, doctor ID, and registration date. The relationship between the Patient and Registration classes is one-to-many, meaning one patient can have multiple registrations. The Practice Schedule class contains doctor schedule data such as doctor ID, queue number, and examination time, which is associated with the Doctor and Registration classes. Meanwhile, the Examination Room class manages room data and the patients being treated, while the Admin class is responsible for handling registrations and managing patient data. Finally, the Doctor class stores information about doctors and their practice schedules, which can be viewed or added. Each class has attributes and methods (functions) that align with its responsibilities in the system, forming an integrated information system structure.



Discussion

Based on the research conducted, the HealthyQue mobile application was successfully designed using the Design Thinking approach, focusing on understanding user needs, along with system modeling using Unified Modeling Language (UML). Testing revealed that the application provides key features such as online registration, doctor schedule checking, and real-time queue status notifications. Prototype testing results showed that the application can improve efficiency in the hospital registration process, reduce patient waiting time, and provide a better experience for both patients and administrative staff.

The application also proved to facilitate the registration process for patients, reduce long queues in waiting rooms, and accelerate hospital administrative workflows. User testing (patients and hospital staff) indicated that the HealthyQue application is easy to use, functional, and offers an effective solution to the queue problems in hospitals.

The increasing number of patients visiting hospitals every year has made the need for a fast, efficient, and comfortable service system crucial. The manual registration process often results in long queues and extended waiting times, leading to patient discomfort and a decline in the quality of healthcare services. In addition, the administrative workload increases, potentially lowering the effectiveness of hospital management. Therefore, the development of a mobile application like HealthyQue, which leverages digital technology and a user-centered approach, is urgently needed to improve administrative efficiency, reduce patient waiting times, and enhance patient satisfaction. This urgency forms a strong foundation for this research to design innovative solutions that can support digital transformation in the healthcare sector, especially in the hospital registration process.

Although several hospitals in Indonesia have begun implementing online registration systems, many hospitals still rely on manual registration methods, leading to long queues and discomfort for patients. Moreover, the current hospital registration applications often fail to fully meet the needs of both patients and hospital staff. Some of the existing online registration applications face issues with integration into existing hospital systems, user interfaces that are not user-

friendly, and a lack of features that help patients access real-time medical information.

The research gap lies in the lack of solutions that effectively integrate digital technology with the needs of hospital users, particularly in improving patient registration efficiency and queue management. Many previous studies have focused on the overall development of hospital information systems, but there has not been a sufficiently in-depth solution that specializes in streamlining the hospital registration process by leveraging mobile technology that addresses the needs of both patients and hospital staff.

Therefore, this research focuses on developing the HealthyQue mobile application, designed with a Design Thinking approach to meet specific user needs, while optimizing the registration process flow using Unified Modeling Language (UML) for a more structured and clear system modeling. This study also aims to introduce a digital solution that is not only effective in reducing patient wait times but also improving the overall hospital registration experience.

CONCLUSIONS AND SUGGESTIONS

Conclusions

Based on the results of the research and testing conducted, it can be concluded that: The Design Thinking approach is proven effective in designing a mobile application that meets user needs. This approach enables a deep understanding of the problems faced by patients and hospitals, resulting in solutions that are more relevant and user-experience focused. Modeling using UML provides a clear and organized structure in describing the application's workflow and components, which greatly assists in the systematic development of the application system. The HealthyQue application designed is capable of reducing long queues, accelerating the registration process, and improving hospital administrative efficiency. Features such as online registration, doctor schedule checking, and real-time queue notifications significantly enhance patient experience and optimize hospital management. Application testing results show that the app is user-friendly, effective, and well-accepted by users, including both patients and hospital staff. Therefore, this application can serve as a practical and efficient solution to improve healthcare services in hospitals.

Suggestions

Based on the results of this study, several recommendations for further development are proposed:

1. To increase effectiveness, the HealthyQue application should be integrated with existing hospital management systems (e.g., Hospital Information System or HIS). This will ensure that patient data, doctor schedules, and queue statuses can be managed in real-time and more accurately.
2. As further development, HealthyQue can be equipped with additional features such as online registration payments, online doctor consultations, and reminders for regular health check-ups. These features can further enhance patient convenience and experience when using the application.
3. Considering that this application handles sensitive patient data, improvements in data security and user privacy protection are necessary. The use of strong encryption and authentication technologies must be prioritized in future development.
4. To optimize the application, it is recommended to conduct further testing in several hospitals with different scales and types of services. This aims to ensure that the application can be adapted to various hospital types and the diverse digital literacy levels of patients.

Although the application has been designed with a user-friendly interface, developing a more modern and attractive interface design that considers the preferences of users from various demographics (including the elderly) will further enhance user comfort in accessing the application.

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