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Development and Design A Queue Service System Banyumudal Health Center Using the Waterfall Method

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ABSTRACT

Puskesmas Banyumudal is a health care facility in Pemalang Regency, located at KM 1, Banyumudal, Jalan Raya Moga-Karangsari, Moga District, Central Java. This health center aims to improve the standard and equity of health services for all levels of society. one of the main obstacles that is often faced is the lack of management of patient queues that still use manual systems, causing long and irregular queues resulting in inefficient and ineffective patient waiting times. this research was conducted to build a more efficient and effective Banyumudal Health Center queue service system. by using the waterfall method, through this system, it is hoped that service efficiency will increase by reducing the duration of patient queues and improving better service quality. This method involves clear stages, starting from analyzing needs, designing designs, and testing. The results of the study show that the application of the waterfall method in the development of the Banyumudal health center queuing service system is able to improve queue management efficiently and effectively and provide information to patients regarding queue status, as well as facilitate health center officers and doctors in monitoring the queuing process. blackbox testing results show that all systems function properly according to predetermined specifications. thus, the queuing system designed is expected to have a positive impact on improving the quality of queuing services at the Banyumudal Health Center.

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1. INTRODUCTION

Banyumudal Community Health Center is a health care facility in Pemalang Regency, Central Java. The motto of the Banyumudal Health Center is “Healthy people, Happy people” with the intention of improving the quality and equitable distribution of health services so that it can be felt by all levels of society. in order to improve public services, all state institutions are required to build websites in accordance with Presidential Instruction Number 07 of 2003 establishing national policies and plans for building E-Government. therefore the quality of health services is needed to be better for an effective and efficient service system [1]. one of the main challenges faced by Puskesmas is patient queue management, which can affect the efficiency and quality of services provided.

Queues are conditions in which several people or objects are in a certain order to wait for their turn and people often experience queues in public places such as banks and hospitals, as well as other places where they can get public services [2]. queues occur because the capacity of facilities and services exceeds the demand for services, so there will be queues. queuing situations are conditions that occur as part of random operational activities within a service facility. In addition, many health centers still use

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manual methods in recording patient visits that come on that day, which has an impact on the performance and efficiency of the health center and reduces services to patients [4]. manual queues can cause inconvenience to patients seeking treatment. therefore, it is necessary to design and require a queuing system that can be organized and managed to be organized and comfortable [5].

At the Banyumudal Health Center, there is a problem in managing patient queues that still use a manual system, causing long and irregular queues that can result in inefficient and ineffective patient waiting times. the manual system also results in a lack of queue information so that patients do not know the order number that has been called, so patients have to stay around the registration area to make sure they don't miss their turn in the queue. thus, based on these conditions, there is a need for a solution that is more efficient and effective in managing the patient queue [6]. The website-based queuing system is expected to be an alternative solution to overcome the queuing problem at the Banyumudal Health Center, so as to improve service efficiency by reducing patient waiting time and providing a better experience for patients as a whole [7]. with this system, patients can register practically through the website, avoid long physical queues and allow them to get queue numbers digitally.

Based on the above background, the purpose of this study is to design and build a system to improve the queuing service of Banyumudal Health Center which is more efficient and effective. the Waterfall method was chosen because it provides a structured and systematic framework. this method involves clear stages, starting from initial needs analysis, system planning, implementation, testing and maintenance. each step must be completed before going to the next step, to ensure every aspect of development gets enough attention. thus it is hoped that through this research, it can reduce patient waiting time, improve patient experience, and help Puskesmas officers manage queues better.

2. RESEARCH METHOD

This research involves several stages that must be passed. The following is a research flow chart that describes the research process for compiling this report. can be seen in Figure 1

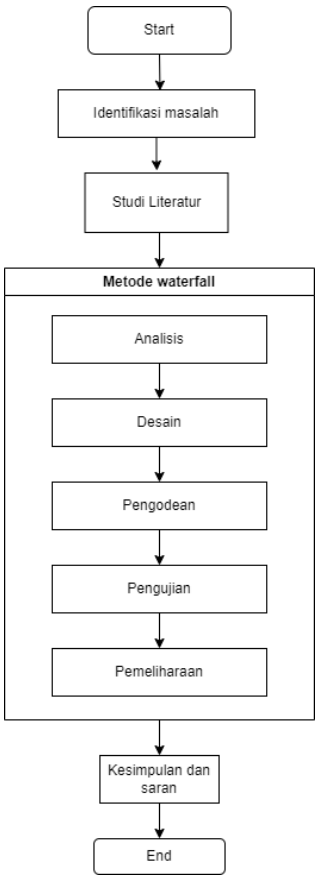

Figure 1. Research Flow Diagram

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2.1. Problem Identification

This stage is a step to identify problems that aim to identify obstacles in the queuing service used at the Banyumudal Health Center. This activity is carried out to analyze existing problems in depth, so that the designed solution can provide an improvement in the quality of queuing services at the Banyumudal Health Center.

2.2. Literature Review

At this stage, it is necessary to conduct a theoretical basis and references related to the design of information systems obtained from various sources, including previous books and journals. This literature study aims to add to the understanding of the concepts and theories needed for this research.

2.3. Analysis

In the analysis stage, data collection and evaluation are carried out to identify user needs and the required system. in this analysis stage includes identifying the process of collecting data to obtain information from user needs. the data collection method used in this analysis stage is through observation, and direct interviews with the Banyumudal Health Center.

2.4. Design

After analyzing the necessary requirements, the next step is the design stage which is the design stage in which the software structure is designed based on the previously identified requirements specifications. at this design stage, some important elements that will be explained include *Use case diagrams*, *Activity diagrams*, and basic user interface (UI) designs. these elements are designed to ensure each element of user requirements and functionality is met.

2.5. Coding

After the design step, the next stage is coding, at this stage, PHP will be used as a programming language and MySQL as a database management system. the coding stage will be implemented into a web-based system program that will be used by patients, doctors and Puskesmas admins.

2.6. Testing

In this step to ensure that the solution that has been created can operate effectively and provide the best results, testing is needed. at this stage, the method used is *Black Box* Testing. *Black Box* Testing is a test used to describe a system or element designed to perform testing, without the need to examine the details of the program implementation in it. As for testing the actors involved in this system, namely admin, doctor, and patient.

Table 1. User Testing

No	User	Description
1.	Admin	Admin is a user who has full access to the queue service system. his duties include data management and system settings,
2.	Doctor	Doctors are users who have access to view the patient queue list as a whole. In addition, doctors can see the status of the queue being handled.
3.	Patient	Patients are users who can register queues independently through the system. In addition, patients can also see the available service schedule and see the history of previous queues.

2.7. Maintenance

At the maintenance stage is a system that has been developed. The main focus is to ensure the system continues to function properly, perform regular updates, and fix errors.

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3. RESULTS AND DISCUSSION

3.1 Analysis

The analysis stage was carried out after conducting direct observations and interviews with Banyumudal Health Center officers. This process aims to understand real user needs and identify the main problems that occur in the current queuing system. Based on the results of data collection in the field, it was found that patient queue management was still done manually. Patients must come directly to the health center and register by showing an identity card, which often causes long lines and inefficient waiting times. These findings are the main basis for the need to develop a website-based queuing system. the proposed system offers a more effective and efficient solution, allowing patients to register and collect queue numbers online without having to come directly to the service location.

This research applies a systematic approach in exploring user needs through direct interaction in the field, as well as designing digital technology solutions specifically aimed at solving problems at the Banyumudal Health Center. therefore, the development of this system is an innovative step that is expected to improve the quality of public health services at Puskesmas Banyumudal. With the implementation of this system, patients are expected to no longer experience long physical queues, so that the service process becomes efficient and organized. Based on these conclusions, the analysis of the needs required in the development of the queuing system for the banyumudal puskesmas is as follows:

Table 2. Functional requirements

Actor	System Requirements
Patient	- Patients can create a new queue through the system - Patients can view information about queue numbers, queue status, and estimated waiting time. - Patients can view the service schedule - Patients can view queue history
Doctor	- Doctors can view a list of patients who are queuing. - Doctors can access detailed information on the queue of patients being treated.
Admin	- Admin have access to the dashboard to manage the system. - Admin can see the list of patients who are queuing. - Admin can provide information to patients regarding their queue status. - Admin can add new entries for admin, and doctor data into the system. - Admin can edit existing information for admin, patient, and doctor data. - Admin have the ability to delete entries that are no longer required from admin, patient, and doctor data. - Admin can access reports or history of completed patient queues.

3.2 System Design

System design is an important stage in the software development process, which aims to design the structure, workflow, and main components of the system so that it can run as needed. In this study, system design was carried out with a focus on developing a website-based queuing system that was tailored to the conditions and needs at the Banyumudal Health Center.

This design process includes three main aspects, namely the design of Use Case Diagrams, Activity Diagrams, and Interface Design (Wireframe). These three elements are used to illustrate how the system will interact with users, as well as how the flow of the queue registration process takes place online.

1. Use Case Diagram

Use Case Diagram explains the intertwined relationship between users and the Banyumudal Health Center queuing service system. This diagram is a system analysis and design process, because it helps visualize the main functions and interactions that occur in system development. The following is a Use Case Diagram that is applied to the Banyumudal Health Center Queuing Service System.

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Figure 2. *Use Case* Diagram *User* Pasien, Doctor and Admin

2. Activity Diagram

Activity Diagram, also known as Activity Diagram, is a visual representation used to show and explain the stages in a process that takes place in a system. The following is an activity diagram applied to the Banyumudal Health Center Queuing Service System.

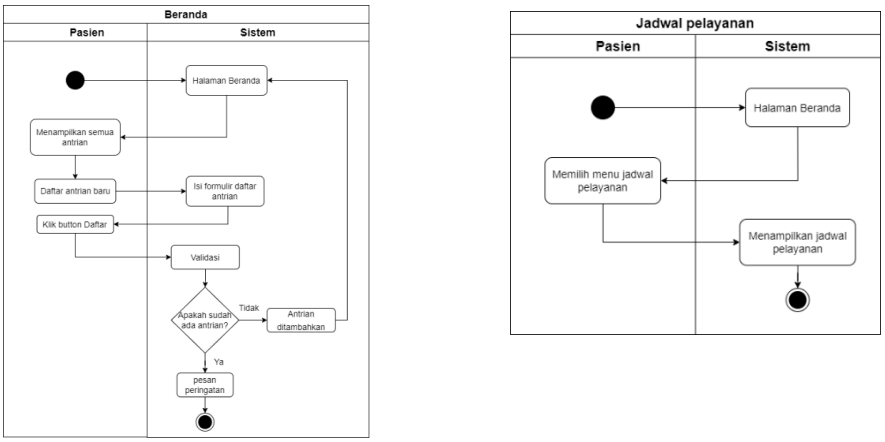

Figure 3. *Activity* Diagram *User* Pasien

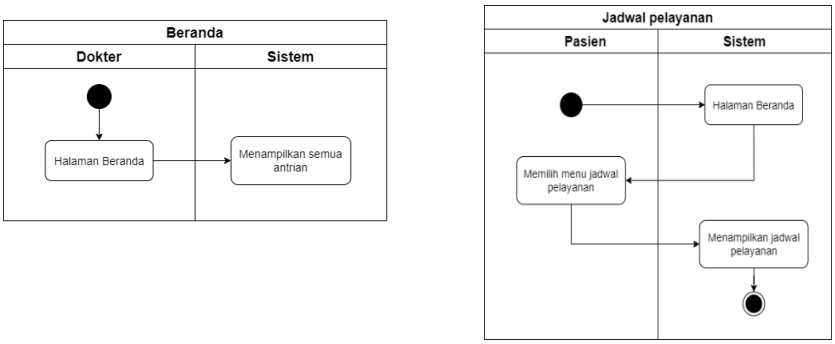

Figure 4. *Activity* Diagram *User* Doctor

JURNAL ECOTIPE
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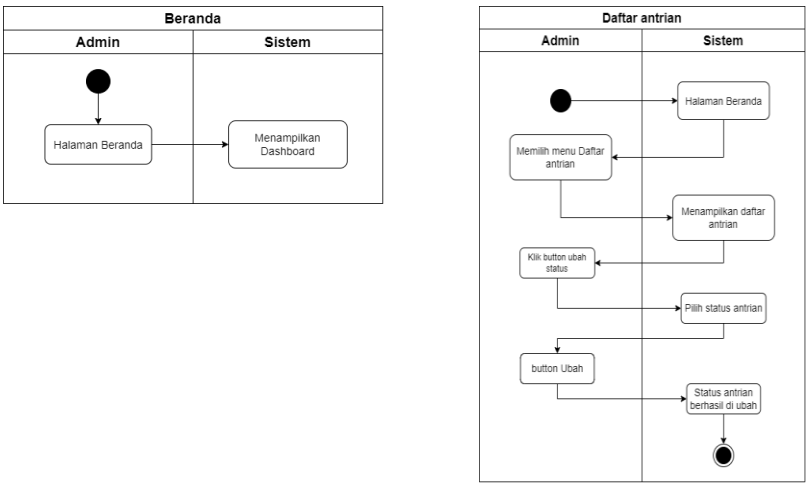

Figure 5. *Activity* Diagram *User* Admin

3. Design Interface (*Wireframe*)

The following are some pages in the basic design interface for the Banyumudal Health Center queuing system:

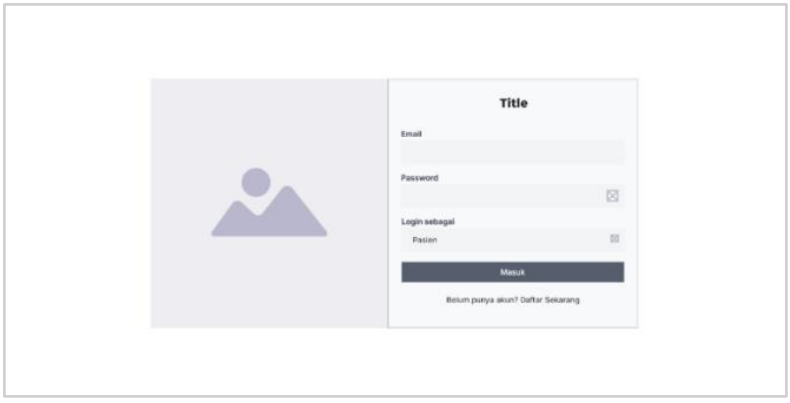

Figure 6. *Design Interface* Patient, Doctor and Admin Login

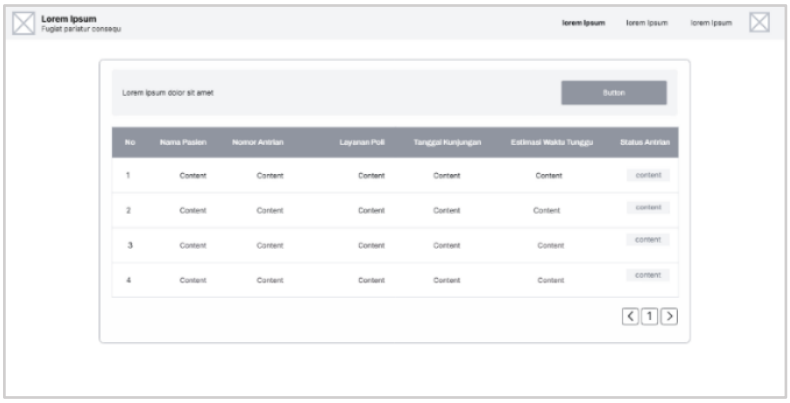

Figure 7. *Design Interface* Patient User Home Page

JURNAL ECOTIPE
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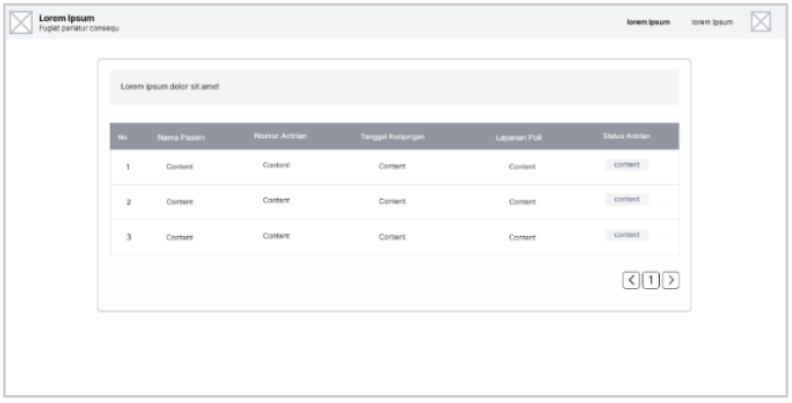

Figure 8. *Design Interface* Doctor User Home Page

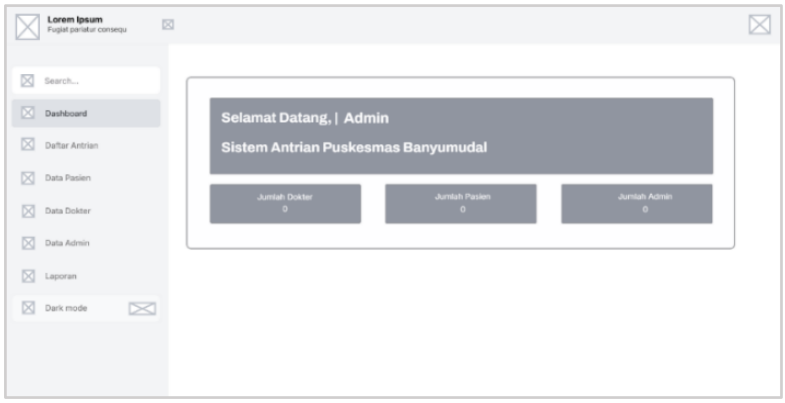

Figure 9. *Design Interface* Halaman dashboard Admin

3.3 Results of the Health Center Queuing Service System Website

The following is a view of the website of the queuing service system for puskesmas banyumudal.

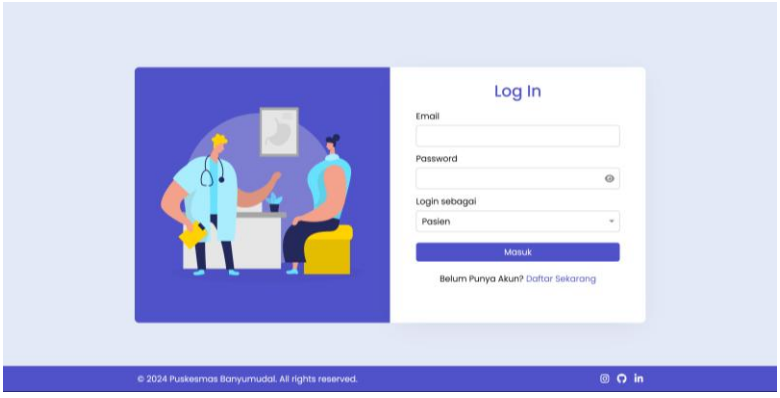

Figure 10. Page Login Patient, Doctor and Admin

In Figure 5 is the login page for patients, doctors and admins to enter the puskesmas queuing system. on this page, User patients, doctors and admins are asked to enter email, password, and select a role. If the data entered is valid, the system will direct the patient to the home page.

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Figure 11. Home Page User Patient

In Figure 11 is a patient home page that displays a list of all existing queues. on this page, there is a button to register a new queue.

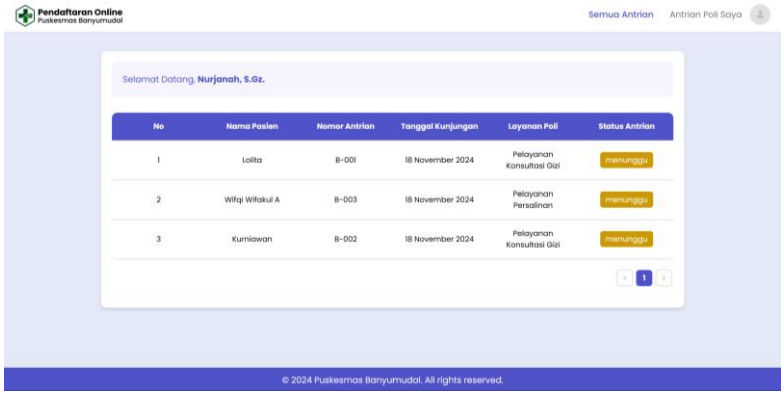

Figure 12. Home Page User Doctor

In Figure 12 is a doctor's home page that displays a list of all existing queues. on this page, doctors can see information about patients who are queuing.

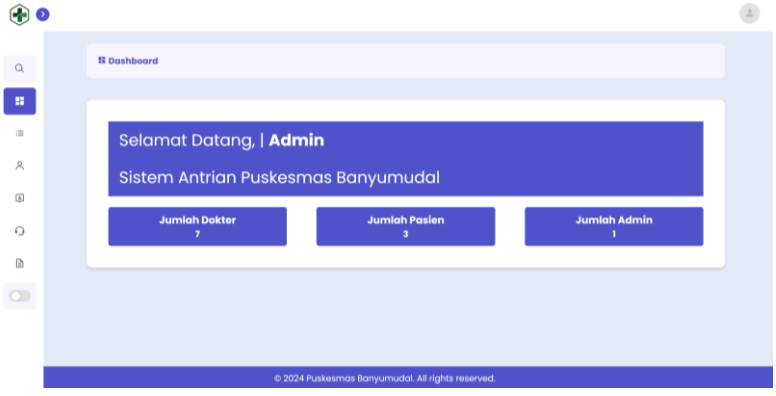

Figure 13. Admin User Dashboard Page

In Figure 13 is the admin dashboard home page that displays information on the number of doctors, patients, and admins. on this page provides a summary of data that is easily accessible by the admin to see the total number of registered doctors, the number of registered patients, and the number of admins in the system.

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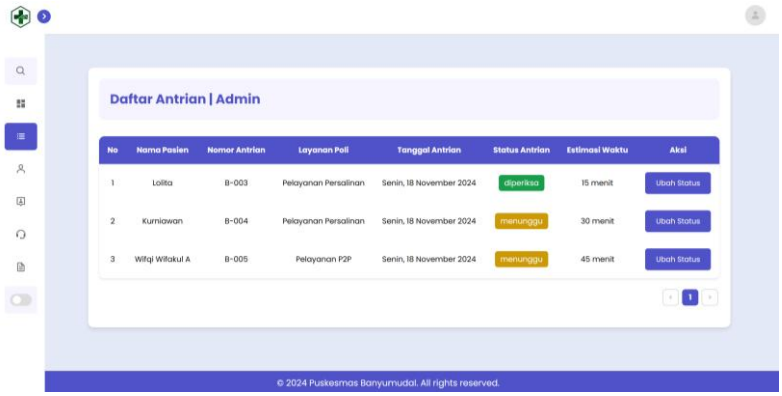

Figure 14. Admin User Queue List Management Page

In Figure 4.113 is the User admin queue list page that displays all patient queue lists. on this page displays all active patient queues, with related information such as queue number and patient status. admins can view the list to monitor ongoing patient queues.

3.4 Blackbox System Testing

After the system development stage is complete, a testing process is carried out to ensure that all system functions run as they should. Testing is carried out using the Blackbox Testing method, which is a test focused on observing system outputs based on certain inputs, without examining internal code.

This method is used to identify logic errors, input-output flow errors, and ensure that key features such as registration, queue number retrieval, and login access run correctly. at this stage, structured and thorough test documentation is carried out on the puskesmas banyumudal queuing system, This process also ensures that the system is ready to be used directly by users.

Table 3. Patient User Testing Table

No	Scenario Testing	Test Case	Expected results	Results	Conclusion
1.	Patient home page	Patient home page displayed after successful login	The system will display the patient's name, the “New Queue List” button, and display the list of active patient queues.	Passed	Valid
2.	New queue list	Click the Register New Queue button	The system will display a pop up modal form for queue registration	Passed	Valid
3.	Service Schedule Menu	Click on the service schedule menu	The system will display the service schedule page	Passed	Valid
4.	Menu Riwayat Antrian	Click on the queue history menu	The system will display the queue history page	Passed	Valid
5.	View queue history details	Click or select the details button	The system will display the queue history detail page	Passed	Valid

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Table 4. Doctor User Testing Table

No	Scenario Testing	Test Case	Expected results	Results	Conclusion
1.	Doctor Home Page	The doctor's home page is displayed after a successful login	The system will display all active patient queue lists.	Passed	Valid
2.	My poly queue menu	Click on My poly queue menu	The system will display my poly queue page	Passed	Valid
3.	Menu View patient queue data details	Click or select the details button	The system will display a pop up of patient queue data details	Passed	Valid

Table 5. Admin User Testing Table

No	Scenario Testing	Test Case	Expected results	Results	Conclusion
1.	Admin Dashboard Page	Admin Dashboard page displayed after successful login	The system will display data on the number of doctors, number of patients, and number of admins	Passed	Valid
2.	Queue list menu to see the queue list page display	Click the queue list menu	The system will display the queue list page	Passed	Valid
3.	Patient data menu to display the patient data management page	Click the patient data menu	The system will display the patient data management page	Passed	Valid
4.	Doctor data menu to display the doctor data management page	Click the doctor data menu	The system will display the doctor data management page	Passed	Valid
5.	Admin data menu to display the admin data management page	Click the admin data menu	The system will display the admin data management page	Passed	Valid
6.	Report menu to display the Report page	Click the report menu	The system will display the completed queue report page	Passed	Valid

Based on the results of tests that have been carried out on each user, accurate data and conclusions are obtained. This indicates that the system functions properly and in accordance with predetermined needs.

3.5 Maintenance of the System

At this stage, system maintenance is carried out to ensure that the system continues to run optimally and can adapt to changes or obstacles that may arise during use. The following are the maintenance steps that will be carried out regularly, including solutions to problems that may arise, such as errors on the login page, popups that do not appear, or home pages that cannot be clicked.

Conduct periodic system evaluations to ensure that the Banyumudal Health Center queuing service system still meets user needs and meets the desired performance standards. This evaluation includes:

a) Daily Evaluation:

Volume 12, Issue 1, April 2025, pp. 31-42
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Checking whether there are problems such as login errors or problems not being able to access the main page.

b) Weekly Evaluation:
Evaluate the performance of the queuing system so that it runs optimally and meets user needs.

c) Monthly Evaluation:
Evaluating user feedback and analyzing the overall performance of the system.

Perform regular data backups by copying and storing data to a secure location. The goal is to prevent data loss or data corruption that can occur due to system failure The following is a backup schedule:

a) Daily Backup:
Stores constantly changing data, such as patient information and queue schedules, to avoid data loss due to technical difficulties.

b) Weekly Backup:
Performs a more complete backup that covers the entire system, including login settings and user data.

c) Monthly Backup:

d) Perform a full backup of the entire system and database to protect data from damage or loss.

4. CONCLUSION

Based on the results of the discussion related to the development of the banyumudal puskesmas queuing service system, the researchers concluded as follows:

1. The queuing service system was successfully developed using the Waterfall method which is applied by going through the stages of needs analysis, design, and testing. Each stage is carried out sequentially to ensure that the system developed is in accordance with user needs. The queuing service system that has been designed is able to improve queue management, provide information to patients regarding queue status, and make it easier for Puskesmas officers and doctors to monitor the queuing process.
2. Testing the system with a Black Box Testing approach shows that all functions in the system operate in accordance with predetermined specifications. This test involves the role of patients, doctors, and Puskesmas officers, where the results prove that each component of the system provides outputs that match expectations and function properly.

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