# MOBILE-BASED ONLINE QUEUE APPLICATION DEVELOPMENT AT GRIBIG PUBLIC HEALTH CENTER IN REALTIME

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## ABSTRACT

Puskesmas is one of the health service facilities that organizes community and individual health efforts at level one. Gribig Health Center is one of the health centers in the city of Malang, East Java, which has several health services. To get services from the Puskesmas, each patient is required to register and complete the required files for further processing by the administration. However, the imbalance between the number of patients and the availability of services is the cause of queues. This study aims to create a mobile-based queuing application at the Gribig Health Center in real-time. The ar-chitectural concept used in developing applications is client-server. The queuing method used in the system is a combination of FCFS (First Come First Served) and PS (priority service) methods. In system development, the development method used in this research is the waterfall method. For system testing, the author uses the Black Box Testing method to ensure that all application functionality is appropriate. The purpose of developing this application is to make it easier for pa-tients to get queue numbers for Gribig Health Center services anywhere and anytime, make it easier for patients to make registration bookings for other days in advance, exchange queue numbers, notifications when their turn is approaching, find out the estimated time to get service, and queue information. up-to-date for each service at the Puskesmas. The results of this study are successful in developing an online queuing application at the Gribig Health Center in real-time by utilizing the QR Code to verify the queue and there is also a notification feature as a patient reminder.

*Keywords*: Puskesmas, Mobile application, Queue, Realtime

# PENGEMBANGAN APLIKASI ANTRIAN ONLINE DI PUSKESMAS GRIBIG SECARA REALTIME BERBASIS MOBILE

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## ABSTRAK

Puskesmas merupakan salah satu fasilitas layanan kesehatan yang menyelenggarakan upaya kesehatan masyarakat dan perseorangan di tingkat satu. Puskesmas Gribig merupakan salah satu puskesmas yang berada di kota Malang, Jawa Timur yang memiliki beberapa layanan kesehatan. Untuk mendapatkan layanan dari puskesmas, setiap pasien diharuskan mendaftar dan melengkapi berkas yang dibutuhkan untuk selanjutnya diproses oleh pihak administrasi. Namun, Ketidakseimbangan antara jumlah pasien dengan ketersediaan layanan menjadi penyebab terjadinya antrian. Penelitian ini bertujuan untuk membuat sebuah aplikasi antrian di puskesmas Gribig secara realtime berbasis mobile. Konsep arsitektur yang digunakan dalam mengembangkan aplikasi adalah client-server. Metode antrian yang digunakan dalam sistem adalah kombinasi metode FCFS (First Come First Served) dan PS (priority service). Dalam pengembangan sistem, metode pengembangan yang digunakan dalam penelitian ini adalah metode waterfall. Untuk pengujian sistem, penulis menggunakan metode Black Box Testing untuk memastikan semua fungsionalitas aplikasi sudah sesuai. Tujuan dari pengembangan aplikasi ini adalah mempermudah pasien dalam mendapatkan nomor antrian pelayanan puskesmas Gribig dimana saja dan kapan saja, memudahkan pasien dalam melakukan booking pendaftaran untuk hari lain sebelumnya, menukarkan nomor antrian, notifikasi saat mendekati giliran, mengetahui estimasi waktu mendapatkan pelayanan, dan informasi antrian terkini tiap pelayanan di puskesmas. Hasil dari penelitian ini adlaah berhasil mengembangkan aplikasi antrian online di Puskesmas Gribig secara realtime dengan memanfaatkan QR Code untuk verifikasi antrian dan juga terdapat fitur notifikasi sebagai pengingat pasien.

*Kata Kunci*: Puskesmas, Aplikasi mobile, Antrian, Realtime

## I. INTRODUCTION

Puskesmas is a health service facility that organizes community health efforts and first-level individual health efforts [1]. Gribig Health Center is one of the many health centers located in Malang City. As a first-level health service provider, the puskesmas is crowded with patients seeking treatment. However, the ability of services at the puskesmas cannot serve the needs of all patients, causing queues. The queuing procedure used now is that the patient is required to put an identity card in a box which is differentiated based on the category of whether the patient is classified as elderly or not, then the officer calls one by one based on the pile of identity cards to go to the registration counter to complete the required registration form and also identify BPJS patients or the general public. The next process is paying for the service fee and after all is done, the patient waits to be called to the service.

Based on the observations that have been made, several problems occur at the Gribig Health Center, namely the system that runs makes people crowd while waiting to get services. The impact of long queues creates problems, namely when waiting for the queue number to be called, there are sudden matters that cannot be left by the patient, this makes the patient have to complete the matter and return to the puskesmas with the risk that the queue number has been missed. But often the queue number has been missed from the call so it is no longer valid. From the results of observations for two days, at intervals of 08.00 - 09.00, it was found that 5 people had to cancel their queue due to sudden business. Long queues are also at risk of increasing the spread of disease to other people who are also waiting in the vicinity. Moreover, patients are required to be in an unfavorable condition for a long duration of time, according to the results of observations at the Puskesmas above 9 in the morning it takes around 30 to 40 minutes for patients to wait to get service at the destination poly. The long waiting time makes the patient uncomfortable. The problem of time is important because the time used by patients to wait would be better if it was used for other activities so that patients only have enough time to come and get service.

Calculation of the estimated waiting time in a service queue can shorten the waiting time during busy activities. To solve this problem, a queuing method is used which is a combination of First Come First Served (FCFS) and Priority Service (PS). FCFS is a method used to determine the turn in the queue, where the one who arrives first will be served first [2]. While Priority Service is a queuing method where service is given first to customers who have a higher priority than other customers [3]. With the FCFS method, it will also be possible to calculate the estimated waiting time and service time at the puskesmas. The combination of the FCFS and PS methods on the RS queuing system shows an increase in quality on the queue service side [4].

The need for technology is now starting to reach various aspects of life, making mobile applications more and more widely used. In 2022 mobile users in Indonesia will download 7.31 billion applications, which indicates more than 13 thousand applications are downloaded every 1 minute by mobile users in Indonesia [5]. The high use of mobile applications is inseparable from the factor where mobile applications can solve problems that are often found around. Of course, to be able to use mobile applications, a device is required to be installed so that it can be used. One of them is a smartphone that is used as a daily communication tool. Aside from being a communication tool, smartphones also provide several applications that can be installed to help human needs. In a smartphone, an operating system is needed to be able to run applications. One of these operating systems is Android which is open source so it helps in developing an application [6]. Devices with the Android operating system provide convenience and flexibility to their users so the use of applications on smartphones is getting higher. Moreover, the use of the internet has been implemented in many applications so that data exchange around the world can be done easily. Fast data exchange can be implemented in a realtime application. That way, it can minimize the occurrence of differences in data received on different devices.

From the problems mentioned above, it is necessary to have an application that allows BPJS patients at health facilities at the Gribig Health Center and general patients to queue online, therefore an online queuing application at the Gribig Health Center will be developed in realtime on a mobile basis to provide information about queues at puskesmas, list of services at puskesmas. as well as time estimation to estimate service time and waiting time, where data exchange is done in realtime.

## II. PREVIOUS RESEARCH

The Based on several studies related to the registration queue system at health facilities, developing or building a registration queue application can minimize the accumulation of patients in the waiting room it makes patients uncomfortable and also reduces the risk of spreading infectious diseases to other patients. In addition, the application can also improve patient time efficiency because patients can wait for their turn to arrive anywhere and can also continue their activities. The existence of an application can also replace the conventional queue recording process by recording patient arrivals one by one thereby reducing the risk of errors by officers and also overcoming

the problem of missing queues because queue information is not conveyed properly [7][8][9][10] [11][12].

This study utilized the QR Code feature to verify queue status and patient attendance status. The purpose of using the QR Code is to send and receive data information quickly [13]. Applications also use websocket technology which allows two-way communication from client to server or vice versa in realtime [14]. Realtime data exchange will be applied to queue information, both on patient queue tickets or queue information for each poly. To avoid missing queues, a notification feature is implemented as a reminder so that it can help someone give a warning so that it is easier to do time management [15] and also implements a new feature, namely queue exchange.

## III.  METHODOLOGY

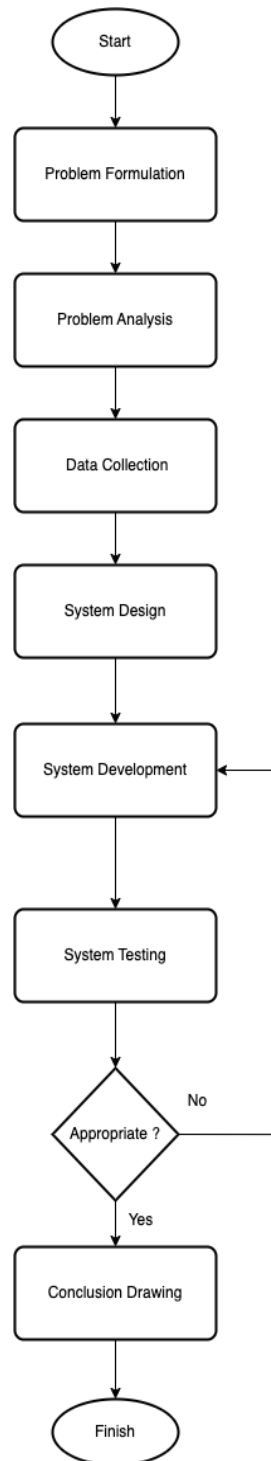In this study used in the development of the system consists of several stages.



Fig 1.  System Development Flow

## A. *Problem Formulation*

At this stage, interviews and observations were conducted to obtain information about the running system and the constraints that occurred so that researchers could formulate the problems that occurred..

## B. *Problem Analysis*

At this stage, the researcher analyzes the problems that occur, so that a solution is found that will be applied to the system to be developed..

## C. *Data Collection*

At this stage observations and interviews were carried out with the puskesmas to obtain data both documents and information needed in a queue registration at the Gribig Health Center which will later be used in system development. In addition, literature studies were also carried out to facilitate research.

## D. *System Design*

At this stage, from the results of problem analysis and data collection, a system design will be made with the aim that the developed system can run well and get the appropriate results.

## E. *System Development*

At this stage, the researcher develops the system according to the system design that has been made before. Later the application will be developed in the form of a mobile application with patient and officer roles, as well as a website with registration officer and administrator roles as supporters.

## F. *System Testing*

From the results of system development, researchers will conduct system testing to ensure all functionality is running and correct existing deficiencies to get results as planned.

## G. *Conclusion Drawing*

After the system testing phase is carried out and ensuring the system is running well, researchers can conclude.

## IV. SYSTEM PLANNING

In designing the system used data flow diagrams (DFD). DFD is a graphical representation that describes the flow of information and the transformation of information that is applied as data flowing from input and output [16].
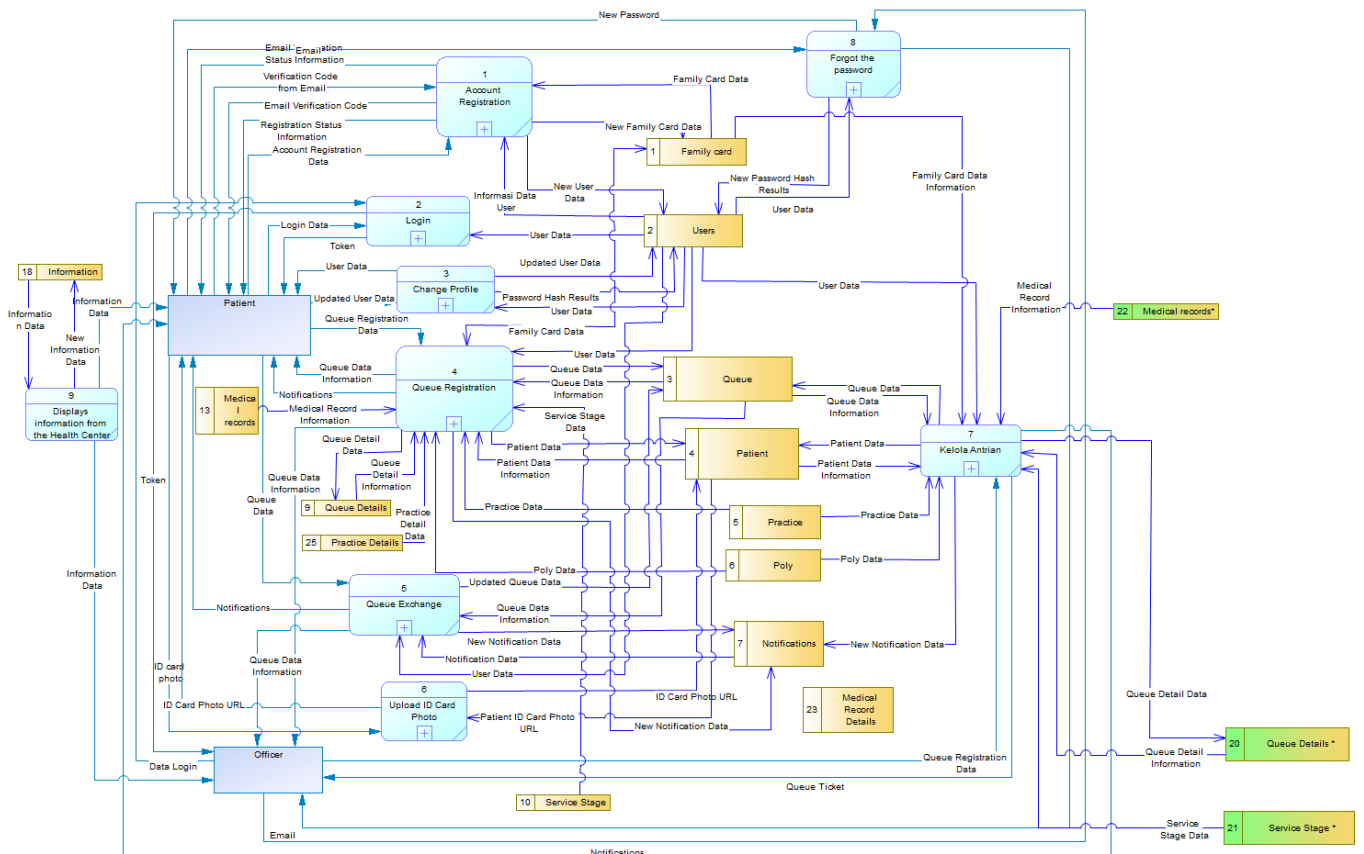


Fig 2. DFD Level 0 Mobile Application

Figure 2 shows that there are two external entities, namely patients and officers. Besides that, there is also a process called "Gribig Health Center Online Queue Application" which has data flow or data flow. The storage used in DFD level 0 of the Gribig Health Center Online Queue Application is listed on Table I and the processes involved in the system is provided in Table II.

TABLE I
Storage or data store on DFD Level 0.

| Storage Name | Description |
|---|---|
| Queue | A database table to store queue data. |
| Family card | A database table to store family card data. |
| Notification | A database table to store notification data. |
| Patient | A database table to store patient data |
| Poly | A database table to store Poly data |
| Practice | A database table to store practice data. |
| Users | A database table to store users data. |
| Information | A database table to store information data. |
| Medical records | A database table to store medical records data. |
| Service stage | A database table to store service stage data. |
| Practice details | A database table to store practice details. |
| Queue details | A database table to store queue details |

TABLE II
Process on DFD Level 0.

| Process name | Input | Output | Description |
|---|---|---|---|
| Register | Account registration data, email verification code and account verification | Email verification status information, registration status information, user data and email verification code | To be able to use the application, the user is required to register first. Next, the administrator will verify the user account. |
| Login | Login data | Token | Before users can use the application, they are required to log in using an account that has been registered. |
| Change profile | Updated user data | User data | Patients can change their profile if there is a change in data including passwords. |
| Queue registration | Queue registration data | Queue data information and notifications | Patients can register the queue by filling out the form and determining when to seek treatment at the Puskesmas. |
| Queue Exchange | Queue data | Queue data notification and information | Patients as users can send queue exchange requests to other patients when suddenly there is an emergency. |
| Upload ID Card Photo | ID card photo | ID card photo URL | Patients are required to upload a photo of their identity card to speed up the process of filling out patient forms by officers. |
| Manage queues | Queue data | Queue ticket | The officer can register the queue or make changes to the status of the queue including canceling the patient queue. |
| Forgot the password | Email | New Password | When a patient or officer forgets the account password, they can enter their registered email, then the system will send a new password to that email. |
| Displays information from the Health Center | - | Information Data | Users who are patients or officers can see the information shared by the puskesmas in the application. |

## V. RESULT AND DISCUSSION

The results of the implementation of the application will describe the main features of the application, namely registration, QR Code scanning, cancellation, exchange of queues, ticket queues, notifications, information for each policy and uploading photo identity cards.
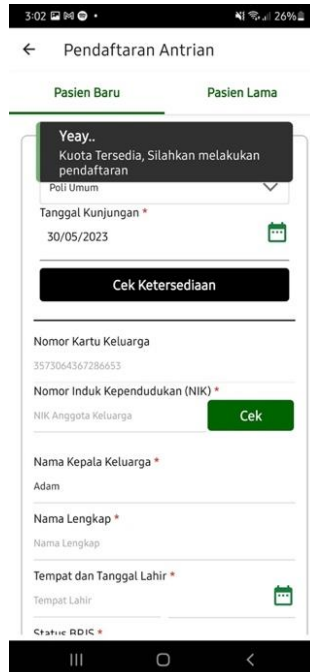


Fig 3. Register.

The registration data input process is carried out on the queue registration page. The user chooses whether the patient is old or new and also fills out the registration form. For old patients, users can select family members or themselves in the dropdown list, and for new patients, fill out the entire registration form. Starting from choosing the date of the visit and poly destination, then filling out the registration form completely. Once completed, the system will process the registration and the patient will receive registration information consisting of queue number, poly destination, estimated time served, estimated hours served, QR Code, and other supporting information.



Fig 4. Scan QR Code.

The user goes to the active queue page and selects the queue whose status will be changed. Then the user will be directed to the scanner page to scan the QR Code and the system will process it. Figure 7 shows when the user chooses to cancel the queue on the queue page. The poly detail page provides the feature of exchanging with other patient queues. The user selects his queue number to be exchanged, then selects the destination queue and writes the reason for the exchange. Next will be processed by the system.
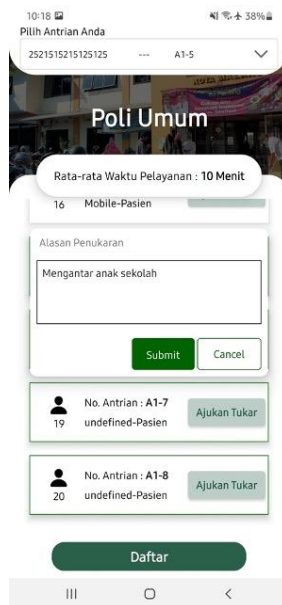
Fig 5. Cancellation.



Fig 6. Submission of Queue Exchange.



Fig 7. Notifications.

The notification page, shown in Fig. 8, provides notification regarding the status of the queue and also when there is a queue exchange request. The user is on the identity card page. On this page (Fig. 9) the user can choose to upload photos via the camera or gallery which will then be processed by the system. The user is on the queue page and can see queue tickets that have been registered for each patient registered through the same account. The information provided includes poly destination, check date, queue status, remaining queue, estimated queue time, queue number and QR Code which is used to verify attendance and verify queue status. Figure 10 and Figure 11 show the user is on the home page and detail poly to see the latest queue information.
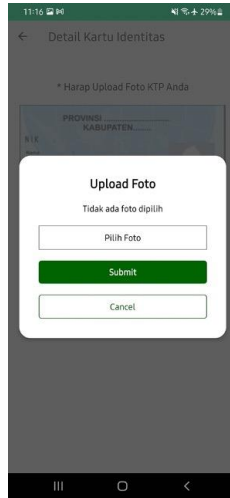


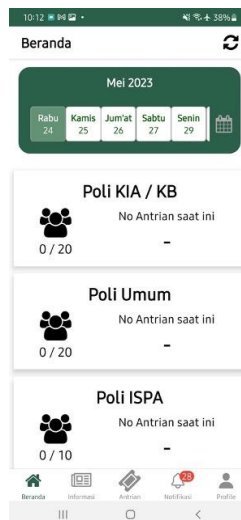Fig 8. *Upload ID Card Photo*.



Fig 9. Queue Ticket



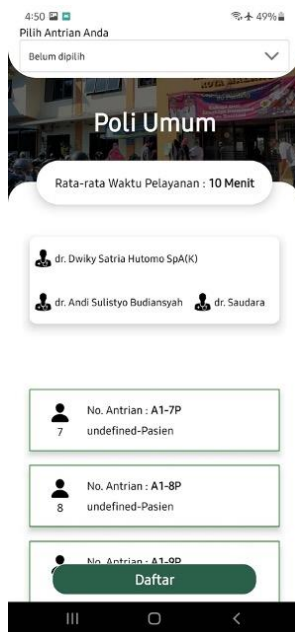Fig 10. Queuing Information for Each Poly.

Fig 11. Poly details.

## VI. SYSTEM TESTING

Testing the functionality of the program includes all input and output functions from login, register, forgot password, email verification, change profile, queue registration, queue exchange, upload ID card photos, managing queues, managing queue registration data, and display information. from the health center. The purpose of doing this test is to ensure the program runs properly. If during the testing phase, an error or bug is found, repairs and updates are made to resolve the errors or bugs that appear. The following is a table that shows scenarios up to the application testing status.

TABLE III
Black box Testing.

| Feature | Testing Scenario | Test Cases | Results Obtained | Status |
|---|---|---|---|---|
| Register | Fill in all the fields then press the register button | Fill in all fields and hit the register button | The message "Successful Account Creation" appears and the data is successfully m-pan. Then redirected to the secure email verification page | Valid |
| Login | Enter the appropriate NIK/User ID and password and the email and account verification status has been verified | User ID / NIK : 3333333333333333 Password: admin123 | The message "Successful Login" appears and is redirected to the home page | Valid |
| Email Verification | Fill in the appropriate verification code field then press the submit button | Verification code : 372452 | A warning "Email verification successful" appears and redirects to the login page | Valid |
| Forgot Password | Fill in the appropriate email then press the submit button | Email: dwikysahut@gmail.com | The message "New Password Has Been Sent to Your Email" appears and a new password is | Valid |

| | | | sent via email | |
|---|---|---|---|---|
| Change Data Profile | Fill in all the fields and replace the data then press the save button | Family head name: Asep | The message "Successfully Changing Data" appears | Valid |
| Queue Registration | Fill in all the fields correctly then press the button | All fields are filled | Temporary queue ticket information appears. | Valid |
| | Pressing the Submit button on the temporary queue ticket that appears after all fields are filled in and clicking the submit button | Pressing the Submit button | The message "Registration succeeded" appears. | Valid |
| Queue Exchange | Reject queue exchange requests | Select the exchange request and click the reject button | The message "The queue exchange request has been rejected" appears. | Valid |
| | The message "The queue exchange request has been rejected" appears. Receive a queue exchange request | Select the exchange request and click the accept button | The message "The queue exchange request has been received appears" | Valid |
| Fetch Latest Data Queue | Displays queue registration ticket information | Open the queue page and select one of the queue data | Displays detailed queue information | Valid |
| | Queue status information changes automatically when changes occur | Open the scanner menu then scan the QR Code. | Queue status changes automatically | Valid |
| Displays Queue Information for Each Poly | Selecting poly on the home menu | Displays the queue on the selected poly | Displays the queue on the selected poly | Valid |
| Upload ID Card Photo | Opening the identity card menu, then selecting a family member and pressing the replace button. After that choose a photo to upload (upload) and press the submit button | Photo selected from gallery. | Displays the message "Photo successfully uploaded and saved" | Valid |
| Notification | Displays a notification when queue status changes | Queue status changed to "Processing" | The notification is successfully displayed on the mobile device | Valid |
| Queue Cancellation | Selecting the next queue menu selects the queue to be canceled | Selects the canceled queue | Displays a notification with the message "Your current queue status is 'canceled'" | Valid |
| Queue Registration (Officers) | Choose the queue ticket menu and fill in all the fields after | All fields have been filled | Displays the message "Queue regis- | Valid |

| | | | | |
|---|---|---|---|---|
| | that pressing the submit button | | tration was successful" and a ticket appears ready to be printed | |
| | Pressing the print ticket button on a queue ticket that has been successfully generated | The print ticket button is selected | Thermal printer prints queue tickets | Valid |
| Scan QR Code (officer) | Selecting the queue ticket menu then selecting the queue scan and scanning the QR Code on the queue ticket for patients who have completed administration | Selecting the queue ticket menu then selecting the queue scan and scanning the QR Code on the queue ticket for patients who have completed administration" | Displays the message "Status in the queue has been successfully changed" and the patient's queue status changes to "is being served in poly" | Valid |

## VII. CONCLUSION

Based on the results of the research conducted, the following conclusions can be drawn:

- This research succeeded in developing a mobile-based online queuing application at the Gribig Malang Health Center with name of the application, EQ-Puskesmas. This application was developed using the React Native programming language, using a web service developed using Javascript with the Express JS framework. As for the database using MySQL. The application successfully utilizes the QR Code feature to make it easier to verify queue status and attendance status. Applications also utilize WebSocket to exchange data in real-time. And for application notifications, it was successfully developed using FCM.

- In this study the researcher obtained the results of the black box test, it shows that all functions are running well.

- With the Online Queuing Application at the Gribig Health Center in Realtime Mobile Based it makes it easier for people to register queues online when they want to seek treatment at the puskesmas.

- Admins or puskesmas officers can easily manage data, application users, registration queue data, and other data regarding registration.

- Health center staff can easily call patients, as well as make it easier to verify attendance and verify queue status.

- Patients get information and notifications sent through their devices regarding queues and when their turn will arrive easily. Patients can also exchange queues if there is an emergency.

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