

DEVELOPMENT OF MOBILE BASED APPLICATION FOR MEDICAL SERVICE RESERVATION AT PKU MUHAMMADIYAH KUTOARJO



**This Final Project Compiled as a Condition to Complete Bachelor Degree Program at the
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APPROVAL PAGE

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SCIENTIFIC PUBLICATION

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It has been maintained in front of the Board of Examiners
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On Saturday, 4 August 2018

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This scientific publication has been accepted as one of the requirements

To obtain a bachelor's degree

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I declare that this final project does not contain works that have been proposed to obtain a degree in college and throughout my knowledge also does not contain work or opinions that ever written or published by another person, except being referred to in the text and mention in the bibliography. If it is proven later that there is untruth in my statement above, I will be fully responsible.

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Abstrak

Masalah yang dihadapi oleh pasien untuk memperoleh pengobatan sesegera mungkin pada masa ini adalah banyaknya orang yang mengantri untuk berobat dan menyebabkan terbuangnya waktu istirahat pasien yang sedang sakit. Persoalan lainnya adalah lahan parkir yang dihadapi rumah sakit karena menumpuknya jumlah pelanggan yang mengantri untuk berobat. Berbagai macam persoalan inilah yang saat ini berusaha di pecahkan oleh Rumah Sakit PKU Muhammadiyah Kutoarjo dengan pengembangan aplikasi berbasis telepon genggam android. Tujuan utama dari penelitian ini adalah untuk mengembangkan aplikasi pemesanan jadwal berobat berbasis smartphone android dengan harapan pasien bisa datang pada waktu yang sudah ditentukan untuk berobat tanpa menunggu lama dan dapat segera kembali pulang agar dapat beristirahat untuk kesembuhan mereka, pada sisi lain kendaraan pasien tidak akan memenuhi lahan parkir rumah sakit. Pengembangan aplikasi dilakukan dengan menggunakan sebuah perangkat lunak pengembang aplikasi berbasis telepon genggam android dan didukung oleh basis data yang memiliki fitur pengolahan basis data serempak. Metode pengembangan perangkat lunak yang digunakan pada penelitian ini adalah waterfall model. Penelitian ini menghasilkan sebuah aplikasi berbasis telepon genggam android yang memberikan kemudahan bagi masyarakat untuk mendapatkan pelayanan kesehatan, aplikasi ini juga dapat menjadi sebuah cara bagi pihak rumah sakit untuk mempromosikan informasi kesehatan pada masyarakat agar hidup lebih sehat.

Kata Kunci: *aplikasi mobile, basis data serempak, pemesanan pelayanan kesehatan, PKU Muhammadiyah Kutoarjo.*

Abstract

The main problem faced by the patient to get immediate medical services nowadays is that there are a lot of people queuing to get medical services at the same time, it means many time is wasted and their rest time is loss. Moreover, parking lots problem is dealt by the hospital management because of many patients stuck in the queue to get their medical service. These problems are about to be solved by the hospital of PKU Muhammadiyah Kutoarjo with android based application. The main course from this research is to develop android-based application of medical service reservation with expectation that patients may come in the reserved time to get medical service immediately without being stuck in the queue and they could take their time to rest. On the other hand, patient's vehicles would not be crowding the parking lots of the hospital. The development is conducted using a software engine for developing mobile based application and is supported by a database that capable to maintenance realtime data processing. Methode that is used to develope the software in this reaserch is waterfall model. This reseach has developed a mobile based application that gives ease for people to get medical service, the application also can be a way for the hospital to promote medical information to people to live a healthier life.

Keywords: *medical service reservation, mobile application, PKU Muhammadiyah Kutoarjo, realtime databse.*

1. INTRODUCTION

Patient satisfaction is being the main thing that is awarded by any the hospital in the world including Hospital of PKU Muhammadiyah Kutoarjo, so we are trying to find a solution to any of the problems that can cause dissatisfaction of patients. a patient who is sick will feel uncomfortable of waiting too long for the sake of having medical treatment at the hospital while in particular term one thing that should be done by the sick is resting in order to recover their health immediately. Alongside with other problem patients come to the hospital with their own vehicle, when they wait too long in queue before they get the medical service they need, it means that they take spots in parking area for their vehicles, whereas another patient who needs medical treatment come, take another spot in parking area and joining the queue. In the end it will arise new issues need to be addressed, namely the shortage of parking area. When customers or patients had to struggle in this parking area will have an impact on customers satisfaction and they will consider to not coming back in the future or choose another hospital with wider parking area.

Facing two problems is becoming the cornerstone of any such activities to grow the online booking application queue-based android besides to struggle in parking area and take a long time to wait in queue to get medical service. This application does not only deal with patients who want medical treatment with a physician of the cities but also with medical specialist. This application will be an alternative option so that the patients do not have to wait long since they can order or set an appointment-like feature from the specified schedule for certain medical treatment provided by hospital. An additional advantage from the application is that when patients get their medical treatment immediately as they come in time as the scheduled time of their booking, they will not take parking space too long while they are waiting to get their treatment, in other words the chance of overloaded parking space will be decreased. In order to serve the society more the application will be embedded a chat like feature to have online consultation about health with medical staff from the hospital. According to the hospital management, the more health information obtained by the society they believe that the society will be aware of their health and more often to check and maintenance their health.

Looking at the good outcomes that may be happened in the future and with a view that there will be more people aware about healthiness the hospital management believe it will increase the number of people who came to visit the hospital, and these outcomes are because of the effect of this application. From this outcome the hospital management would consider giving discounts to the patients who utilize the application to get their medical service. By doing such of scheme, it can increase people's interest to use the application, and come to the hospital to medical treatment, become healthier.

In previous research, there was development of android-based healthcare by Erika Ramadhani (2016) titled e-helath design: integrasi e-appointment berbasis android dan website, but the application only handles special appointment with certain problems to meet the doctor. Sukma Bahrul Aziz and other from Telkom University (2015) has also been carrying out similar research entitled design and implementation queue system application for patient of general practitioner using android sms gateway. The research that they have done is very good with the support of many features. The differences with our research lies in the online consultation service with a medical staffs from the hospital to provide solutions of medical problems faced by society to create healthier society. There will be another feature to give information about health to the customers with medical articles section in the application.

The needs of the solution about the problems makes the development of android-based medical service reservation is necessary, providing two main parts, which the first part is that patients as customers who want to get medical services can choose a specific time that is already listed for particular service provided by the hospital. The second part is the consultation feature where customers can get actual solution for their health problem for the hospital staffs, in this case is the doctors. The additional feature is medical article that can improve the awareness of the customer about healthiness and another feature to promote the hospital.

2.METHOD

This paper use waterfall model as software development cycle to follow. It is considered as the most basic software development life cycle model and is a linear and sequential approach to developing software (Kannan and other, 2014).

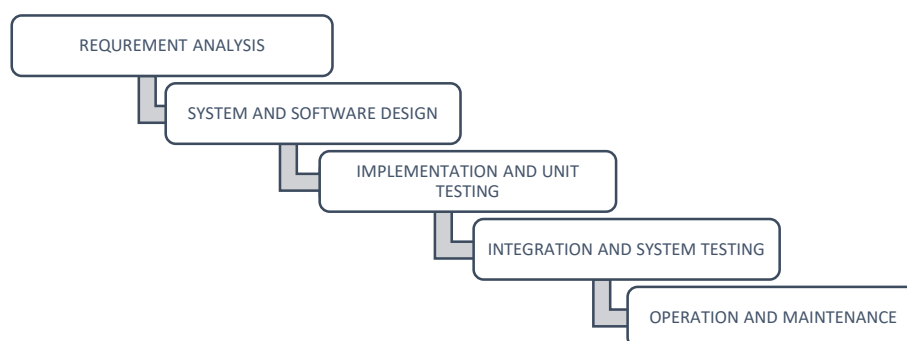


Figure 1. Waterfall model

2.1 Requirements Analysis

In the process of collecting data the author collects information about what categories of practitioners or specialist of doctors in the hospital, catering schedule of each doctor and the resources that can be used for the development process.

The next is analyzing the needs and preparing the material. Based on the data provided the author prepared the material: application android studio version 2.2.3 as the primary tool used to develop android-based applications, development is supported with notebook (Intel Core i3-2348M, 2.2 GHz Processor, 500 GB HDD capacity, 4 GB of RAM), smartphone with gingerbread android operating system as minimum, the MySQL database, Firebase database, self-developed simple REST API and the sms gateway. Due to many systems, application domains, and user's needs, data is different but the mechanism how to expose and access it could be standardized via API (Application Program Interface). API as itself can be designed in many ways and technologies but in the context of web applications we need to work over HTTP protocol and under a mechanism which is easy to implement, maintain and standardized. This is where REST comes (Hradil and Sklenak, 2017).

2.2 System and Software Design

Author creates the Use Cases the activities that can be done by all parties who will be involved in the implementation of the application. Other diagrams that are created are the DFD (Data Flow Diagram) that shows the flow of the course information in the application. ERD (Entity Relationship Diagram) shows relationships between entities in the database so that the system can be formed by combining other diagrams. DFDs and ERDs are mostly used by systems designers to simplify designing management and decision support systems (Ashry, 2017). In this process the layout is designed alongside the software system.

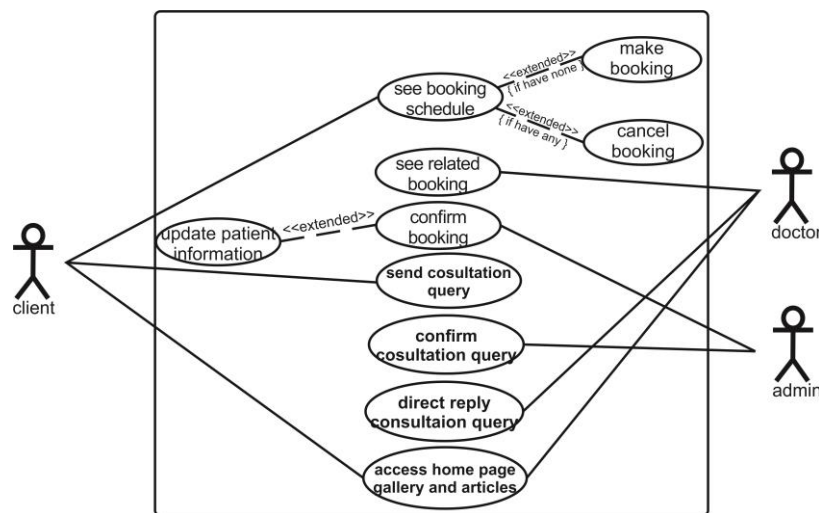


Figure 2. Use Cases

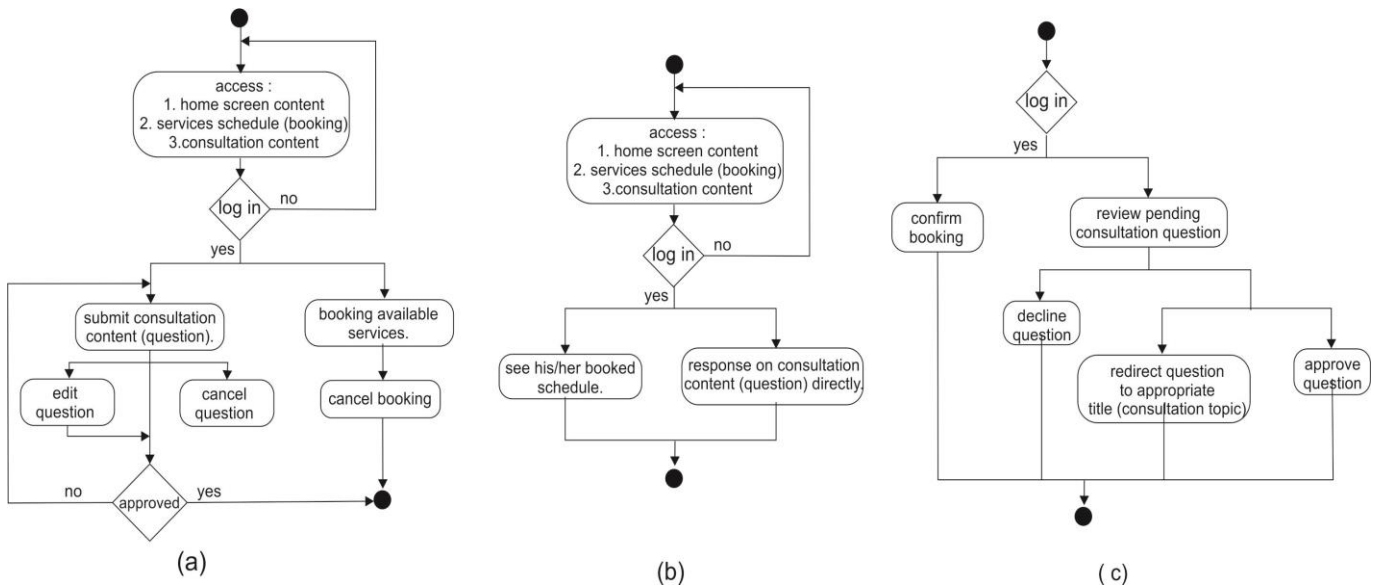


Figure 3. Activity Diagram: (a) user, (b) doctor, (c) admin

Based on the diagram the mobile based application will have home section where the users can access some content such as health article or any article from the hospital and they can also access some gallery pictures of the hospital. Log in/sign in section will be developed to give further access of the features for the users. The mobile application is going to be used both by the patient and the doctor as the users while the admin is going to use web base application as a their console to maintenance or monitor the data. Sections needed by the users other than login section are booking section and online consultation section where booking section for patient and doctor is different, booking section for the patient will show all available services from the hospital that is ready to be booked by patients for the next seven days while for the doctor it will show the related booked time to services which the doctor is responsible on it. Some additional section will be developed to support the application such as notification section, setting section and etc.

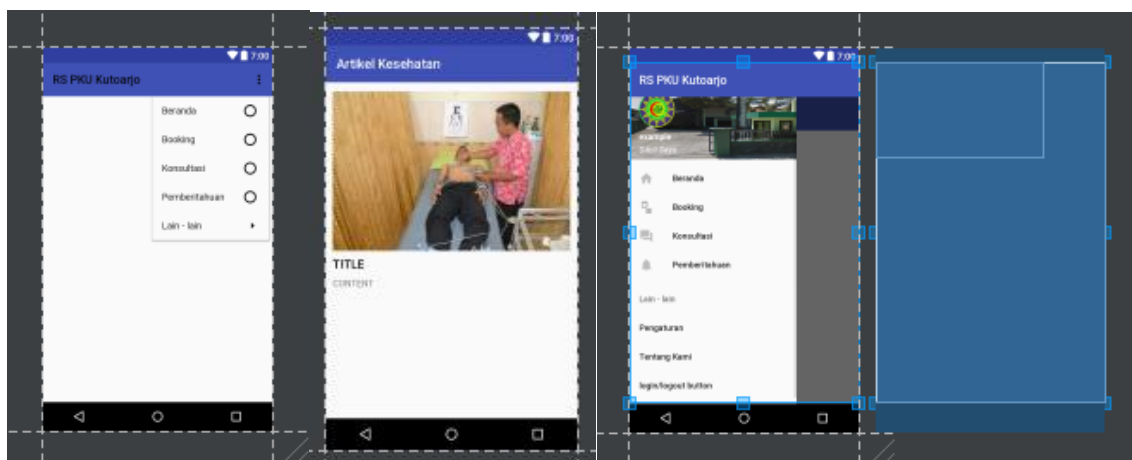


Figure 4. Interface Design

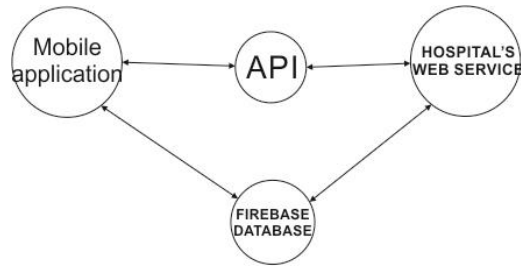


Figure 5. DFD Level 0

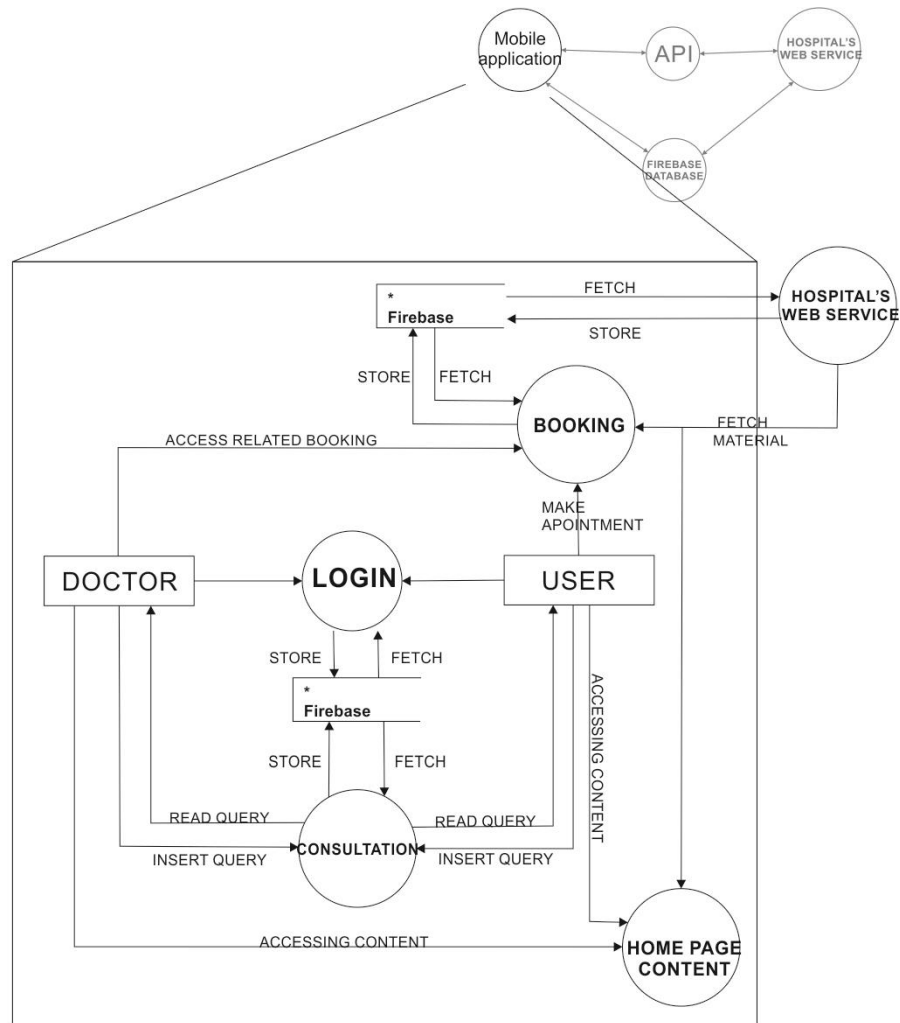


Figure 6. DFD Level 1

The application will access the hospital's database to get articles content from the web site, and access medical services schedule and staff's user information to authenticate doctor log in activity. The data will flow between mobile application and hospital's database server through simple REST API and the data is going to be in json node. The application use firebase authentication feature to accomplish log in/sign in activity, when a user is logged in successfully the application will read user's information detail and store it in firebase database for future usage. Booking section will show the schedule for each available medical service according to the data from

the hospital's database server. When a patient book a medical service the detail information will be stored in firebase database, each time booking section load the medical services schedule it will check the firebase database for the related schedule whether it has already booked or not, if it has been booked the application will give mark to the service on the booking list according to the stored booking detail on the firebase related to the service name, responsible doctor, date and time to make sure there will be no other patient able to book a same booking in the exact same schedule. The booking section for doctor will first check on the firebase database whether there is any patients book the service that he/she responsible on then compare the information with the service schedule from the hospital's database server and show only the schedule related to the schedule. On consultation feature the logged in users can send their question about health problem that will be stored on firebase database with pending stat, admin web based application will access the question detail to be reviewed, when the admin approve that a question have appropriate content the system will change the question stat from pending to be approved and the mobile application will show it and give notification to related user whether their question is being approved or not.

2.3 Implement and Unit Testing

Implementing the design to codes the authors start with java and XML language programming to develop the user interface, while working on layout the program to fetch data from MySQL database of Hospital's Information System was developed. In this paper HttpURLConnection java class was used to make a secure communication between the mobile application and the database server. Simple REST API was developed using PHP programming language in order to standardize the difference of data structures in the communication process. The REST API is also used to send mobile application's notification in particular condition.

```

18 if(isset($_GET['apicall'])){
19     switch ($_GET['apicall']) {
20         case "prefetch":
21             if(isTheseParametersAvailable(array('rspku_mobile'))){
22                 if($_POST['rspku_mobile']=="prefetch data"||$_POST['rspku_mobile']=="fetch data"){
23                     echo json_encode(array("article"=>articles(),"gallery"=>gallery(),"features"=>serviceData()));
24                 }
25             }
26             break;
27         case "features":
28             if(isTheseParametersAvailable(array('rspku_mobile'))){
29                 if($_POST['rspku_mobile']=="services data"){
30                     echo json_encode(serviceData());
31                 }
32             }
33             break;
34         case "login":
35             if(isTheseParametersAvailable(array('rspku_mobile','uid','unip','pwd'))){
36                 if($_POST['rspku_mobile']=="login doctor"){
37
38                     $mysqli = new mysqli ('localhost', 'root', '', 'simpkukutoarjo');
39
40                     if(mysqli_connect_errno()){
41                         echo array("response"=>"error");
42                         exit();
43                     }
44

```

Figure 7. Sample of API

Booking and consultation system is powered by Firebase database to accomplish the needs of real-time database in the application. The Firebase Real-time database is a cloud hosted database and scalable NoSQL database where the data is stored as JSON and synchronized in real-time to every connected client and capable to share on real-time database instance to cross-platform app.

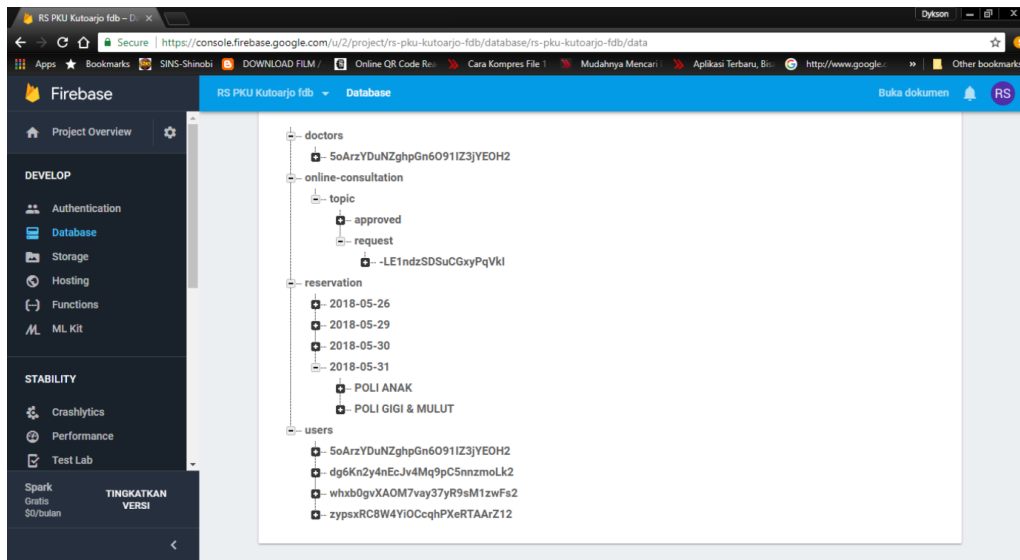


Figure 8. Firebase database

Notification system in this application is also supported with SMS system. The developer use commerce service from a provider to build the system, but this is not the main thread of the development so we did not focusing for this matter.

2.4 Integration and System Testing

Adjustments and configurations of the hospital's Information System are needed to make the mobile application system fully operated, because it cannot be apart from the hospital's Information System, it play a role in some feature of the whole mobile application system.

System testing cycle is accomplished using black box method, focusing on the functionality of each part of the system. The test was done by simulating the application for each entity then fix the system when any error is happened. This cycle still running on until there is no error found in the testing.

2.5 Operation and Maintenance

The application will be operated in hospital of PKU Muhammadiyah Kutoarjo. Some error could be occurred therefor monitoring and upgrading will be conducted as the application operate to make it better and improve features to be user friendly application.

3.RESULT AND DISCUSSION

3.1 Result of the development

The application is about four main sections. These sections are for booking and online consultation features, and notification section as a supportive section for those two sections. The fourth section is the home section which is providing data from the hospital's web site database, this section is meant to promote hospital activities to the users. The users in this application are classified into 3 users. The first user is any user that is using the application, the second user is any user who signed in with their phone number, and the last user is the doctor where they have to sign in with their phone number and then they have to input their user id and password from the hospital's Information System database. This application use Firebase authentication feature to handle the sign in or log in activity. All sections are free to access by all users but to do action in booking and consultation feature the user should be a logged in.

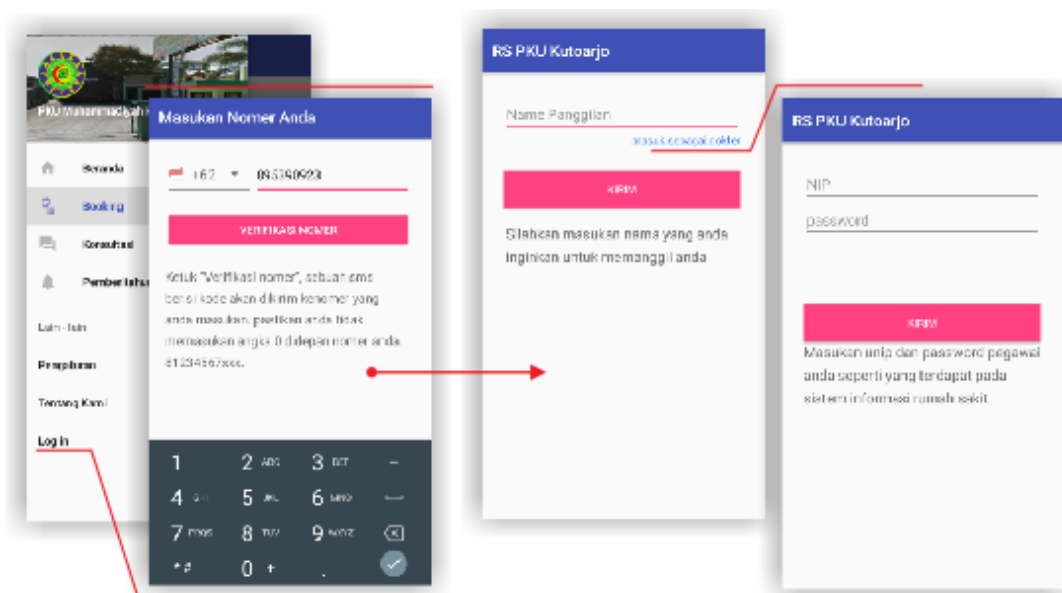


Figure 9. Login Interface

Home section of this application will be helpful for the hospital to promote their services, their activities and the health awareness to the society. This section provide data from the hospital web site such as images form the gallery and healthiness articles in the main page. With `HttpURLConnection` method from java programing language library the application manage to make a single request to access simple REST API created by the developer and fetch data from MySQL database server of the hospital's web site. Data received with this method is delivered in string of JSON node then the application encode the data in JAVA programming language into JSON object or array. Gallery images are shown in slide show while the articles are divided into two lists in two frames. The first article list is sorted based on the latest article being posted while another article list

is sorted based on how many comment it has in it which the developer call it as popularity. Both frames only shows seven articles each list but user can see all provided articles by tapping on more button.

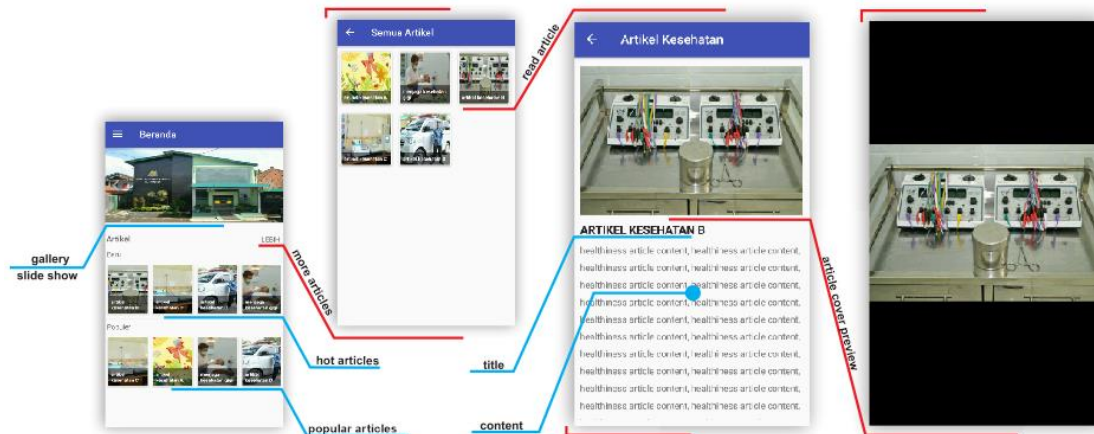


Figure 10. Home Interface

Booking section is where users can see particular medical services provided by the hospital. The application access the hospital database server to get the schedule of the service, the data contains service name, the schedule for each service including day, time and the responsible doctor. There is category buttons to sort the list of schedule based on the service name, day name and the doctor. The list is only showing for the next 7 days, means that users can reserve any service within 7 days ahead. Users can only make a booking for each service provided but they can make another booking with different service and different time form the booking that they already have. Any schedule on the list will turn red when it is 15 minutes before the mentioned time, red colored time indicate that the time is expired and cannot be picked up to make a booking. The background color will turn gray if another user has reserved it, while your booking will turn into green on the list. The different between regular users and doctor is that doctors cannot see the scheduled for each service, they can only see the booked list that is related to them. There will be three notifications that reminding the user about his booking, first is 15 minutes before the time, second is when it is the time but he has not confirm his booking to the front desk of the hospital and third is when the service close time and the user still has not confirm his booking. When the user confirm his booking to the front desk, the staff will input the patient data to the hospital's Information System database and when the patient pay the bill in cashier there will be a note that he used booking feature and get some discount or stuff.

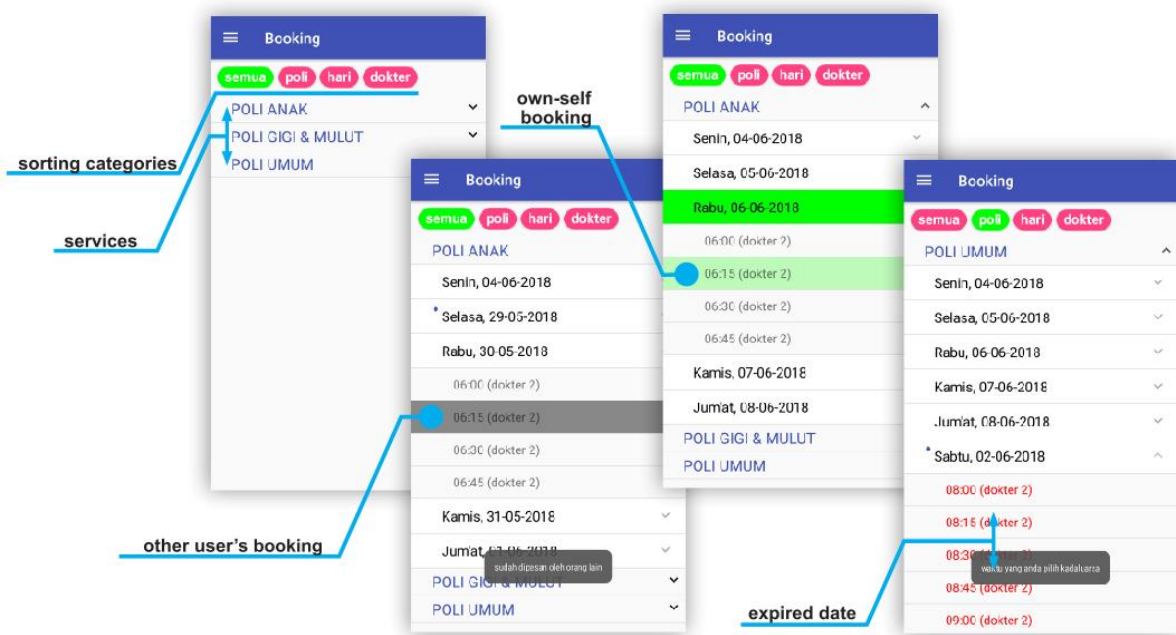


Figure 11. Booking Interface

Online consultation section is a page with a list of topics, each topic lead to conversation room which is public. This feature is meant to be a media to share medical problem and the solution, users will send query to the conversation and doctors can respond to the query and other users can get medical information from that query. The doctors can respond directly in any time but regular user need to wait until their query being inspected by admin whether it contain inappropriate content or not and while it being inspected the user cannot send another query in the same topic, it is a query for a topic. The topic can be created by any user, after the admin approve the request the topic will appear in the topic list, this feature is powered by Firebase to handle real-time database, the request from Firebase will pop up in admin console of hospital Information System.



Figure 12. Create Consultation New Topic

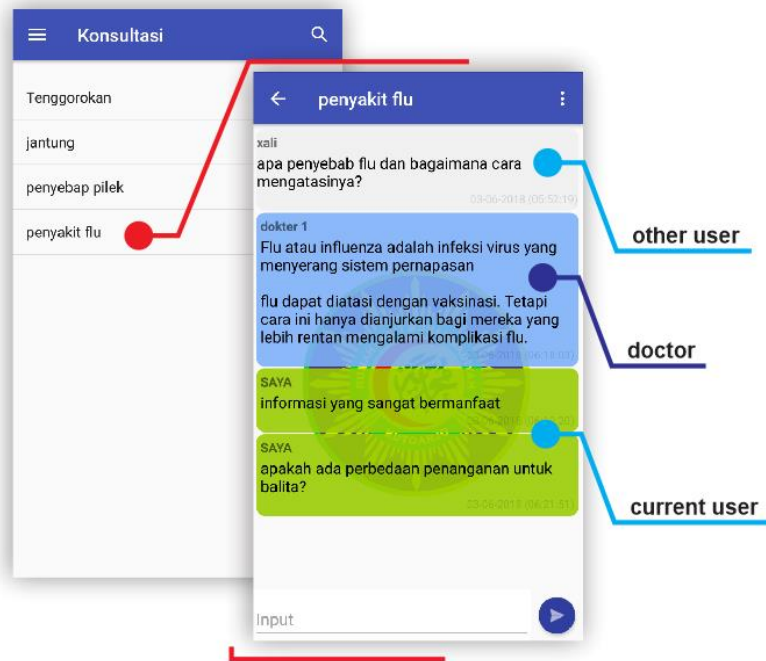


Figure 13. Consultation Chat Room

3.2 Black Box Testing

Black Box Testing is a type of testing that ignores the internal mechanism of a system or component and focuses solely on the output generated in response to the selected input and execution condition (Bhasin and other, 2014).

Table 1. Black Box

No	Scenario	Test Case	Expectation	Result (Valid/Fail)
1	Login Button Testing	Tap on the button	Show the firebase authentication user interface	Valid
2	Send Verification Code for Login Activity	Type in a valid phone number to be sent a verification code	Acquire verification code through SMS, if the phone number is used for mobile data access verify it automatically, other user need to type in the code manually	Valid
3	Verify phone number	Type in verification code that is acquired by SMS	If the phone number is used for mobile data access verify it automatically, other user need to type in the code manually. If the code is correct proceed to the next activity, other shows alert that it is a wrong code	Valid

4	Abort Login Activity When User Close The App After verify the phone number and before they set the user display name	Verify the phone number with verification code then close the app or tap on back button	Abort login activity and recreate the application layout	Valid
5	Show user display name under hospital icon on drawer menu	Verify the phone number then type in user display name and tap on submit button	Recreate the application layout and set the text view under hospital icon on drawer menu into submitted user display name	Valid
6	Doctor Login Testing	Verify phone number then choose login as doctor menu and type in username and password as in hospital's Information System	If the username and password are correct the application will welcome the doctor, by salute and mention his/her name, other show alert that the input are incorrect	Valid
7	Show next and previous slide show picture on home screen	Tap on arrow right icon and left arrow icon	If tap on arrow right icon then show the next picture and if tap on left arrow icon then show the previous picture	Valid
8	Open an article from home screen	Tap on one of the article card view	Open article activity/layout and show the content	Valid
9	Open more article option	Tap on more button on home screen	Open article menu activity/layout with all available article on card views	Valid
10	User Booking	Choose the time and input the patient name.	If the time is available the application will generate scheduled notifications to reminding the user	Valid
11	Online Consultation	Create or pick a topic from the list and input the query	If the query is approved after being inspected by the admin, it will appear in the related conversation room	Valid
12	Push notification	Tap on notification banner	Activate the application from background and open it	Valid

4. CLOSING

4.1 Conclusion

The development of this mobile application with two main features which are booking medical treatment and online consultation will help hospital of PKU Muhammadiyah Kutoarjo to deliver their services deeper among the society. The application will make the customer or patient easier to

get medical treatment from the hospital. This is one of ways to promote health awareness and Muhammadiyah also put their interest and devote their self to the sake of people's goodness, in this matter is healthiness as in medical term.

Booking feature has some algorithms to support the system. The user cannot make more than one booking for a same medical treatment, but they can make another booking for another medical treatment as long as they set a different time with the booking they already have. The application will notify the user when the user has a booking in near time or when a booking has expired due to close time of the medical treatment when the user has not confirmed their booking to the admission. Booking section will show different thing between regular users and the doctors, regular users will see available schedule for each services in a week while doctors will only see booked time of their services.

Online consultation with chatting like application can be accessed by any users, the differences for each user is that unregistered users can only read while registered user can both read and write with a condition, every entry written by the users it will be reviewed by the admin whether it contains inappropriate thing or not before confirmed by the admin to be shown in the online consultation chat room, the doctors is given privileges to write responses without being reviewed by the admin. The application will give notification to the user whether their writing has been approved or denied, there is also a change that the admin will put their query to another topic that suit the user's query, there is topic for each online consultation chat room so users can see any queries from other users and the responses related to their issues.

Application home page shows materials from hospital's website which are articles and photo gallery, the articles are divided into two frame, the first frame is sorted by the latest update while the second is by its popularity which popularity mean is the number of comment from the web site user to the articles, each of frame only shows limited articles, there is a *more* button to see all available articles

4.2 Further Research

The application is not perfect but it does not mean it is not worthy, development and improvement in future can make this application better. Contents in home section is using SQL database which does not support real-time database, therefore the content in this section will not be update at the exact moment when the database get new data, the section need be refreshed by opening another section and go back to home section. Solution for this issue is to develop algorithm to trigger the application to fetch the new data or migrate the database to firebase database which supports real-time database.

As in the web site user can give comments on articles but in this mobile application there is no such feature, this could be another thing to be added for future

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