DEVELOPMENT OF ELECTRONIC HEALTH RECORD SYSTEM FOR MOBILE-BASED MEDICAL SERVICE APPLICATION IN PEKANBARU MILITARY HOSPITAL

TUGAS AKHIR

Disusun Sebagai Salah Satu Syarat
Untuk Memperoleh Gelar Sarjana Teknik
Pada Jurusan Teknik Informatika

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PEKANBARU
2024

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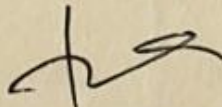
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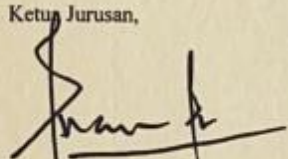
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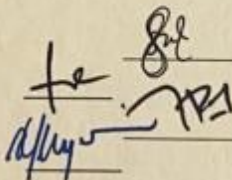
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بِسْمِ اللهِ الرَّحْمَنِ الرَّحِيْمِ

Dalam Kesempatan ini, penulis ingin mengucapkan rasa ribuan terima kasih kepada pihak yang telah banyak membantu, karya ini didekasikan kepada

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Sebagai bentuk rasa terima kasih yang tak terhingga, penulis persembahkan Tugas Akhir ini kepada Ayah (Lindo Leo Putra) dan Mama (Ernentis Susanti) yang telah memberikan kasih sayang, restu, dukungan, pembelajaran hidup dan cinta yang tak terbatas. Meski hanya berupa selembar kertas, Semoga ini merupakan langkah awal dapat membuat Ayah dan Mama bangga. Meskipun beliau tidak sempat merasakan pendidikan hingga bangku perkuliahan, namun beliau selalu berdoa kepada Allah SWT Tuhan yang maha esa dan mampu mendidik penulis menjadi seorang yang kuat dan tegar dalam setiap rintangan yang dihadapi oleh penulis hingga sampai menyelesaikan Tugas Akhir ini dengan tepat waktu. Terima kasih Ayah, dan Terima kasih mama.

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My Biggest Support System

Selain kedua orang tua penulis, penulis mengucapkan ribuan terima kasih kepada Alifia Aprila atas dukungan, kebaikan, dan semangat yang diberikan kepada penulis dalam penyelesaian tugas akhir ini.

Teman-Teman

Tak lupa pula kepada teman-teman penulis terkhususnya TIF F 2020 yang selalu memberikan dukungan dan masukan.

SURAT PERNYATAAN

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Development of Electronic Health Record System for Mobile-Based Medical Service Application in Pekanbaru Military Hospital

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Development of Electronic Health Record System for Mobile-Based Medical Service Application in Pekanbaru Military Hospital

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ABSTRACT: Pekanbaru Military Hospital has implemented an Electronic Health Record System to improve the health service system to patients. Currently, the registration process available at the hospital is still offline, this will cause a buildup of waiting time due to patients who arrive at the same time in the morning. In addition, the absence of information regarding the ongoing queue at the polyclinic causes patients to not know the queue number at the polyclinic where the patient is treated. This research aims to develop a multiplatform mobile-based medical service application using Flutter technology. The software development methodology used in this research is Rapid Application Development (RAD) where the development process is carried out in stages and iteratively, with a focus on speed and flexibility. The testing technique is carried out using the Black Box Testing method to ensure that all application functionality runs according to predetermined specifications and the User Acceptance Test technique to evaluate the extent to which this application can be accepted and used by users. The result of this research is a multiplatform mobile-based medical service application with several features including: online registration for polyclinic services, polyclinic running queue information for patients to find out the queue number and estimated waiting time, visit history for presenting service history information and patient medical resumes, and running bill info for providing general patient transaction information during inpatient services. Black Box Testing results show that all functionality runs well and as expected. The results of testing with the User Acceptance Test show that this application gets a satisfaction percentage of 84%, which indicates that this application can be well received by users and is suitable for use.

KEYWORDS: Electronic Health Records, Mobile Health Application, Registration Online, Flutter

I. INTRODUCTION

The development of information technology has changed the world to be easy and fast, and has become a tool for society, especially in public services, including in the health sector. Several health care facilities such as clinics, health center (Puskesmas) and hospitals have implemented information technology to support their operational activities [1]. Hospitals are required to improve the quality of the quality of health services by utilizing current technological developments in order to compete well, one of these technological developments is by implementing Electronic Health Record (EHR). [2].

Electronic Health Record (EHR) is a collection of patient information stored electronically in a digital format. The Electronic Health Record includes all important administrative clinical data relevant to the care provided to an individual by a provider [3]. The development of Electronic Health Record (EHR) is a significant transformation from traditional paper medical records to electronic format through information and communication technology. These innovations enable more efficient and secure electronic storage, management and sharing of medical information, which in turn improves the quality and effectiveness of healthcare services. With an EHR, medical providers can access a patient's medical history quickly and accurately, which in turn supports better decision-making and more coordinated patient care [4].

Health services implementation of multiplatform mobile-based applications for medical services can provide services to the community by meeting user needs in real time, consistently, and accurately [5]. So that the higher the level of medical services provided to patients, the higher the level of fulfillment of patient satisfaction [6].

Information technology users continue to increase from year to year [7]. Information technology users continue to increase from year to year. This has led to a high increase in the number of smartphone users to reach 5.22 billion users. This development increases the number of applications developed to help the people, including the health sector [8]. The application of Mobile Applications in healthcare can have a positive impact on improving healthcare services, monitoring patient status, enabling remote assistance, and improving access to healthcare in remote areas [9]. Through integration with electronic health records, patient healthcare information can be used by healthcare decision makers to manage care plans and support medical actions. [10].

Developing a mobile application is the right choice, although it is important to consider that the application can operate on various platforms, considering that in September 2018, 77% of users used Android, 21% used iOS, and 2% used other platforms. [11]. The use of smartphones continues to increase over time, in line with the increasing sophistication of its technology with a variety of new features and relatively affordable prices [12]. Therefore, the development of mobile applications is carried out with a cross-platform approach using the Flutter framework. [13]. Flutter is an SDK or open source framework developed by Google to create or develop applications that can run on Android or iOS operating systems. Flutter uses Dart programming language in coding [14]. Nowadays, cross-platform mobile app development is becoming a preferred option to create apps at a more affordable cost and faster turnaround time. Cross-platform, often referred to as WORA (Write Once, Run Anywhere), allows developers to write code that can run on both Android and iOS platforms [15].

Pekanbaru Military Hospital currently has The Electronic Health Record System is divided into 2 parts, namely the medical service module and non-medical services, in the medical service section consisting of registration service modules, Emergency Room services, polyclinic services, laboratory services, radiology services, nutrition services, and pharmaceutical services. Non-medical services consist of human resource service modules, asset services, billing services, and dashboard information executive services. The registration service process at the Pekanbaru Military Hospital currently still has to be done conventionally or on-site. [16].

Based on the results of observations and interviews with one of the heads at the Pekanbaru Military Hospital in 1 day patients who register on Monday to Wednesday are the most with an average of 50-60 / day and patients who register on Thursday to Friday patients who register the most with an average of 20-30 / day and 90% of them are BPJS Kesehatan patients. The registration process that is still carried out on-site at the registration counter causes a pile of queues because patients come unscheduled and patients will wait long until they are served with the next examination. In addition, patients cannot see the polyclinic running queue online, currently patients can only see only through the monitor screen in the hospital. In addition, the problem that occurs is that patients cannot see their medical resume history, especially for patients who have been visiting / treating at the military hospital for a long time and general patients who are hospitalized / outpatient they also do not know how much their hospitalization / outpatient costs are.

II. RESEARCH METHODOLOGY
A. Research Stages
The research stage is a stage that explains the steps of conducting a study so that it runs in accordance with the expected objectives. This research implements a Mobile-

based Medical Service Application using the Rapid Application Development (RAD) method which is a development in designing and building an information system or software in a structured manner. Rapid Application Development (RAD) is a software process model that emphasizes short, iterative development cycles. This model allows software development to be done incrementally and regularly, with a focus on speed and flexibility to produce products that are fast and responsive to user needs [17].
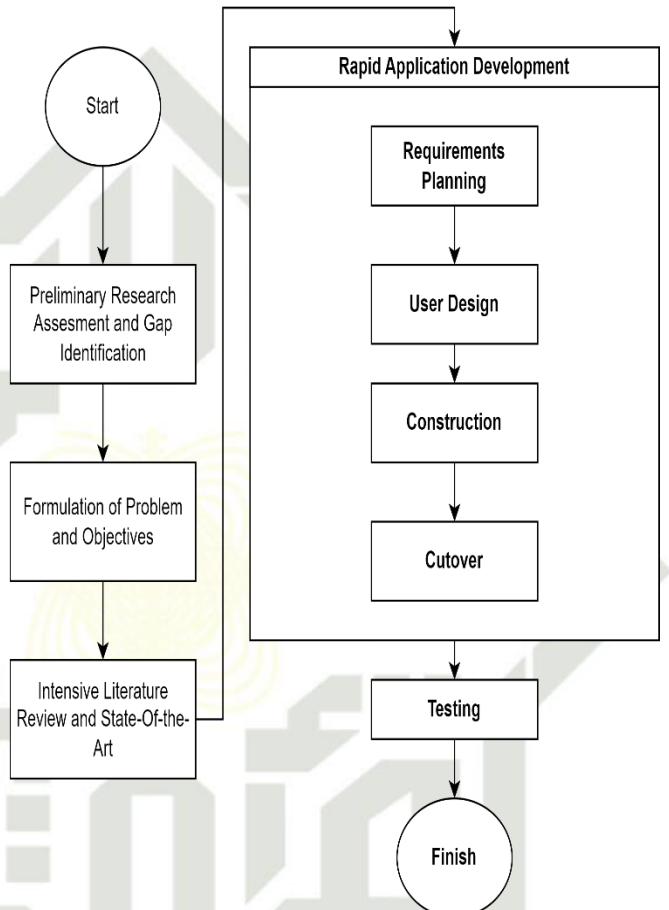

Figure 1. Research Stages

B. Preliminary Research Assesment and Gap Identification
To begin the research, researchers conducted direct assessments and observations at the Pekanbaru Military Hospital as for the problems that researchers found, there were several parts of the medical service, namely in the registration counter which is currently still carried out offline, in the polyclinic section there is no information about the current queue and there is no online medical resume results, in the payment counter or billing there is no information about the estimated cost of inpatient / outpatient treatment. The results of the research conducted, namely, researchers will develop a multiplatform mobile-based medical service application.

C. Formulation of Problem and Objectives
From the assessment that has been carried out in the preliminary research assessment and gap identification, the researcher also conducted an interview with the head of IT &

some patients at the Pekanbaru Military Hospital. The problems that occur are due to several things, namely:

1. Mornings are often the time when a high number of patients come to the registration counter at the same time. This condition often triggers buildup and long queues at the registration counter. Especially the current registration system is still done offline which requires patients to come directly to the registration counter. This causes patients to stay longer at the registration counter before getting health treatment at the polyclinic where they seek treatment.

2. The patient's ignorance of the polyclinic's running queue number after registering from the registration counter. This causes the patient to not know what queue to be in among other patients when the clinic is crowded.

3. Patients who have completed treatment are currently still given medical resume results using paper. This causes ineffective use of paper over time and results in the paper being lost / damaged.

4. General patients seeking outpatient/inpatient treatment do not know how much they are expected to pay before going to the payment counter.

As a solution to overcome the problems that have been analyzed and interviewed, the researcher will design a mobile-based medical service application. In developing this application, researchers need the Electronic Health Record module that already exists at the Pekanbaru Miltary Hospital to be implemented into the application to be built. The problem limitation is to avoid the discussion deviating from the subject matter. The limitations of this research problem are as follows:

1. The mobile application to be built can only be used on Android and iOS platforms.

2. This application can only be used for existing patients who have registered at Pekanbaru Military Hospital.

3. BPJS bridging is only a simulation, because the data is so sensitive.

D. Intensive Literature Review and State-of-the-Art

Based on the formulation of the problem and research objectives, researchers analyzed and compiled information relevant to the development of multiplatform mobile-based medical service applications. In this process, the results of the literature review and state-of-the-art analysis will become one of the main foundations in the development of the application.

Putri Febriana Aulia, Muhammad Dedi Irawan in 2023 on "Development of Patient Service Applications Applying the Mobile-Based Rapid Application Development Method" This study developed an Android-based registration application for the Yazid Pratama clinic using React Native and MySQL to improve service quality. This system makes it easier for patients to register and get accurate information,

and saves time by avoiding long queues. The development method used is Rapid Application Development (RAD) and the results of User Acceptance Testing (UAT) show system acceptance of 88.5%.

Bella Primin, Adityo Permana Wibowo in 2023 on "Implementation of Mobile-Based Applications for Health Services" This research aims to develop a mobile application for Karangampel Health Center, which provides services such as doctor practice schedules, online registration, examination history, and online referral letter submission. This application also features a quick ambulance call. Using the Systems Development Life Cycle (SDLC) method with a prototype approach, this system is designed to improve the efficiency of health services that are currently not computerized. Application testing using the black box method showed a result of 80%, indicating that the application is feasible to use.

Rahayu Amalia, Nurul Huda in 2020 about "Implementation of Health Service Information System at Smart Medica Clinic" This research develops a web-based information system for Smart Medica Clinic, which currently still manages data manually. This system is designed to provide up-to-date information about doctors and their schedules, improve service and patient satisfaction at the clinic which is one of the largest in Sekayu Regency. Built using the Waterfall method, PHP programming language, and MySQL database, the system aims to facilitate access to information and improve the efficiency of health services.

Mohammad M. Qabajeh, Shima Mousa, Hamam Abo Saleh, and Jamila Abo Hasan in 2023 about "Designing an Android Application for Electronic Booking in Health Clinics and Building Health Record System" This study aims to improve doctor-patient interaction by using fast internet and smartphones. Parents often find it difficult to remember children's vaccination details due to heavy workloads and lack of awareness of disease symptoms, increasing health risks. This study developed an Android-based mobile application and interactive website for effective vaccination appointments for children up to six years of age. Supported by a centralized database, the system includes Patient, Doctor, Nurse, and Manager modules to improve healthcare quality, streamline appointment scheduling, and ensure timely vaccination.

Muhammad Hery Santoso, Eko Dayu Anggara in 2021 about "Designing Mobile Application of Health Service Information System in East Purwokerto District" This research aims to develop an application that makes it easy for users to find health services such as hospitals, health centers, and clinics. By considering facilities, medical personnel, and geographical location, this application is designed to be easy to use and understand. The method used is Waterfall, which includes the stages of planning, design analysis, coding, and testing. Benefit testing was conducted based on ULEA (usability, learnability, efficiency, and acceptability). The

results showed that the developed application can function properly and in accordance with the research objectives.

III. RESULTS AND DISCUSSION

A. Requirements Planning

Requirements Planning process based on the background described in the introduction. So, researchers will analyze the medical service application by conducting observations and interviews with the Head of IT to understand what needs are needed by patients, find solutions to problems experienced by patients, and compile what features will be applied to medical service applications at the Pekanbaru Military Hospital.

B. User Design

At the user design stage, this stage is carried out after analyzing what is needed before designing the system. Researchers and programmers can build and show visual representations of designs and work patterns to users. The application design that will be made is described in a UML (Unified Modeling Languange) diagram using a Use Case Diagram describing the set of actors involved with the system to be created. The use case diagram describes one actor involved in the mobile-based medical service application, namely the patient in Figure 2.
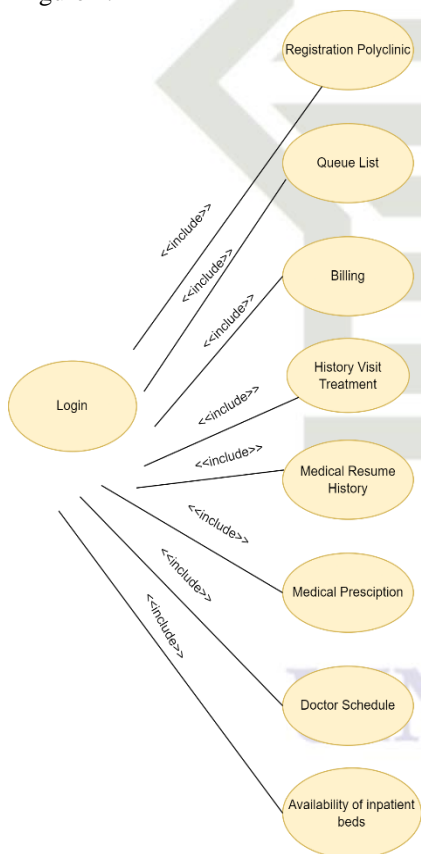

Figure 2. *Use Case Diagram*

C. Construction

The developed medical service application is made with 4 main features starting from the polyclinic registration feature, in the polyclinic registration feature the patient can fill in where the poly wants to seek treatment and the date of

treatment reservation so that after the patient registers the patient will get a queue number directly at the poly where the patient registers.

Furthermore, the polyclinic queue feature allows patients to view information about the running queue from the estimated time, current queue number, patient queue number and remaining queue, so that patients can monitor the queue online and can monitor the queue number and estimated time without having to wait longer at the polyclinic.

For the View medical resume results feature this feature will display all the results of the patient's medical resume history during treatment at the poly from complaints, a summary of the history of the disease, blood pressure, pulse, laboratory diagnostic actions, radiology diagnostic actions, and other diagnostic actions. This can make it easier for patients to see a summary of the treatment history that has been done by the doctor to the patient.

And for the billing feature the patient can see all the detailed cost information from registration fees, treatment fees, drug costs, and hospitalization fees and the patient can see the total amount of payment that the patient must be prepared to pay and the patient can see the amount the patient has paid.

The application that has been developed has a structure that becomes a route or description of the data displayed in the multiplatform mobile-based medical service application, as seen in Figure 3. The following is an overview of the application structure, where all data displayed is taken from modules that already exist in the Electronic Health Record (EHR) system at the Pekanbaru Military Hospital.
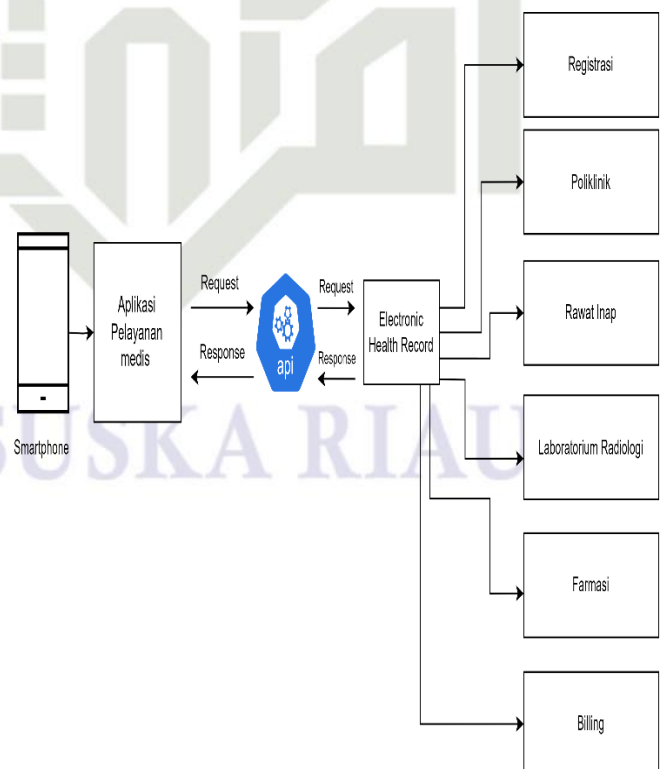

Figure 3. Mobile-based Medical Service Application Architecture

D. Implementation of Application Results

The following is the implementation of the system that has been developed, including the poly list page where patients can register online for treatment according to the desired poly and can determine the schedule and hours in Figure 4 below.
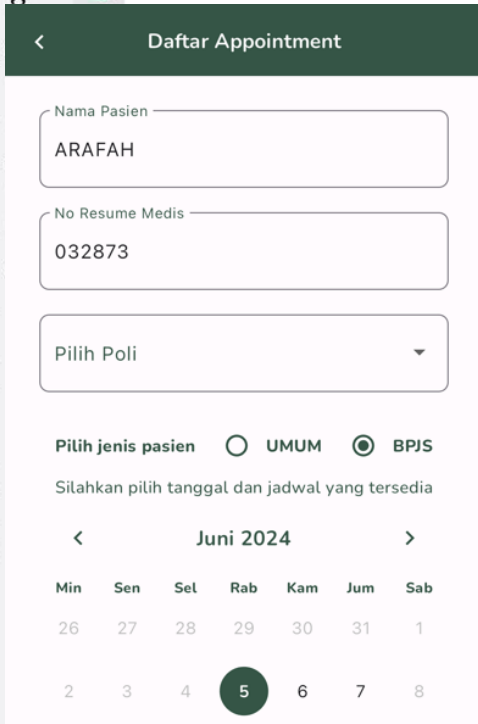
Figure 4. Registration Screen

On the queue details page in Figure 5 the patient can see the poly queue in detail, and the patient can see the queue that is being called and the number of remaining queues before the patient is called to the poly room.

Figure 5. Poly Queue Screen Details

On the billing details page as shown in Figure 6. Allows patients to view the entire history of details during treatment and details of fees that have been paid / not yet by the patient.

Figure 6. *Billing Detail Screen*

The Medical Resume page menu in Figure 7. Patients can see the entire medical summary during treatment, patients can also see who the doctor is who treats the patient.

Figure 7. *Medical Resume Screen*

E. Black box Testing

Testing on mobile-based medical service applications using the BlackBox testing method, which is a testing system that is carried out by testing the functionality of the input and output system produced [18]. At this stage, researchers will conduct trials on the Mobile-Based Medical Service Application. Blackbox testing in this study uses 1 test variable including:

a) Patient login testing
b) Testing the polyclinic registration
c) Testing to see visit history
d) Testing to see billing history
e) Testing to see Medical Resumes
f) Testing to see Drug Prescriptions

Table 1. Blackbox Testing

N	Menu	Data Field	Testing	Results obtained	Conclusion
1.	Login	Username Password	True False	The system does not grant access and displays a message "Nomor rekam medis atau tanggal lahir anda salah."	**Success**
		Username Password	False False	The system does not grant access and displays a message "Data tidak boleh kosong"	**Success**
		Username Password	True True	The system will accept the access and the page will be redirected to the dashboard page.	**Success**
2.	Polyclinic Registration	poli_id tipe_pembayaran tanggal_daftar	True True True	The system displays a message "Berhasil mendaftar!" For patients who register on the same day, the page will be directed to the poly queue page and for patients who register on another day, the page will be directed to the visit history.	**Success**
		poli_id tipe_pembayaran tanggal_daftar	False True True	The system displays a message "Silahkan pilih poli dan jadwal terlebih dahulu".	**Success**
3.	Poly Queue	Button Poly Queue	True	The system will display the patient's poly queue page	**Success**
4.	Billing	Button Billing	True	The system will display the patient's billing history page during treatment.	**Success**
5.	Medical Resume	Button View Medical Resume	True	The system will display the results of the patient's medical resume history	**Success**
6.	Prescription Medicine	Button View Prescription Medicine	True	The system will display the results of the patient's drug prescription during treatment.	**Success**

F. User Acceptance Test

User Acceptance Testing (UAT) is a testing process by users which is intended to produce documents and serve as evidence that the system used can be accepted or not by the user, if the test results can be considered to meet the needs of the user then the application can be operated [19]. The

assessment in this test uses the Likert Scale. The Likert scale is the most widely used scale in research surveys. The Likert scale has at least four or more questions combined into a value or score that represents the attitudes and opinions of individuals [20].

Table 2. Result User Acceptance Test (UAT)

NO	Question	Answer				
		STS	TS	N	S	SS
1	The appearance of the App is easy to understand				4	
2	This application makes it easier for me to get information on polyclinic queue services				4	
3	The app is easy to use by users				2	2
4	This app makes it easy for me to register for treatment				3	1
5	The application already provides the information needed				3	1

After the test results have been obtained, the next step researchers will weight and calculate the test results. The following is a table of answer weights and calculation of test results on the user acceptance test.

Table 3. Score Description

Description	Score
SA : Strongly agree	5
A : Agree	4
N : Neutral	3
D : Disagree	2
SD : Strongly Disagree	1

Maximum score for each question: 5×4 Respondents = 20

The results of the test calculation using the Likert Scale, namely:

- First Question Score = 16 : 20 × 100% = 80 %
- Second Question Score = 16 : 20 × 100% = 80 %
- Third Question Score = 18 : 20 × 100% = 90 %
- Fourth Question Score = 17 : 20 × 100 % = 85 %
- Fifth question score = 17 : 20 × 100 % = 85 %

So that the results of the User Acceptance Test percentage calculation are obtained, namely:

$$Percentage = \frac{(16 + 16 + 18 + 17 + 17)}{(5 \times 5 \times 4)} \times 100\%$$

$$Percentage = \frac{84}{100} \times 100\%$$

$Percentage = 84\%$

IV. CONCLUSION

Based on the results of the research that has been done, it can be concluded that this research produces a mobile-based medical service application with features including:

1. Helps patients to register for treatment to the clinic online without having to go to the registration counter and avoid the accumulation of queues in the morning at the registration counter.
2. Make it easy for patients to monitor the order of the polyclinic walking queue.
3. Helps patients to view medical resume history.
4. Make it easy for general patients to see the cost of the current inpatient bill.

Based on the results of BlackBox testing results in application functionality so that it runs successfully and the results of UAT testing obtained 84% results showing the application is feasible to use.

With this mobile-based medical service application can help medical personnel and doctors in carrying out their operational activities and improve health services to patients. The suggestions that can be proposed for the development of further mobile-based medical service applications are the need for additional features for medical services to improve better health services for patients at the Pekanbaru Military Hospital.

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