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Android-Based Drug Information Application Using Augmented Reality Technology

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Abstract

The use of Augmented Reality technology in the pharmaceutical sector, particularly in pharmacies, has introduced significant innovations in providing drug information to consumers. AR applications can help healthcare workers and patients better understand drug use through three-dimensional visualization superimposed on the real environment. Observations at Sultan Abdul Aziz Syah Peureulak Hospital indicate that 70% of patients still experience confusion regarding the drug information provided by pharmacy staff. This difficulty is caused by the complexity of the information, lack of personal interaction, or low health literacy. To address this problem, the Android-based Mediscan application was developed using AR technology. This application utilizes Unity and Vuforia Engine software to present drug information visually in card form via the smart device screen. Users can point the camera at a particular drug and receive complete information regarding general indications, dosage, drug class, contraindications, and side effects. This research aims to develop the Mediscan application, calculate the level of patient understanding, measure consumer satisfaction, and evaluate the impact of using AR in presenting drug information. The System Development Life Cycle methodology with the Waterfall model was used in this research. The results show that AR technology can be implemented in Android-based applications to present drug information visually and interactively. The majority of patients feel more informed and gain a better understanding of the medication they are taking. AR technology in the Mediscan application improves user experience, supports the education and training of medical personnel and patients, and enhances the quality of healthcare services in hospitals. This application also makes it easier for medical personnel and pharmacists to convey drug information more effectively and efficiently.

Keywords: *Augmented Reality, Mediscan, Interactive Media, Health Education.*

1. Introduction

Augmented Reality technology in the pharmaceutical sector, especially in pharmacies, brings interesting innovations in providing drug information to consumers [1]. AR applications are also an effective tool in engaging health professionals and patients in a deeper understanding of medication use. The use of this technology provides the ability to display 3D objects added to the real environment directly using the technology [2]. This application allows Android device users to easily access information about medications in hospitals. This information is presented in virtual form with a clear usage guide available in the application [3] [4].

Based on the results of field observations by asking patients directly about drug information provided by pharmacy staff, it shows that as many as 70% of patients at Sultan Abdul Aziz Syah Peureulak Hospital still experience confusion regarding drug information provided by pharmacy staff, providing a significant picture of the problem. understanding of drugs among patients [5] [6]. The results of this observation illustrate that the majority of patients face difficulties in understanding the information provided by pharmacy staff regarding general indications, drug dosage, drug class, contraindications, and side effects of the drug. It is predicted that the causes of this confusion may involve the complexity of the information conveyed, a lack of personal interaction to explain in detail, or perhaps a lack of health literacy among patients [7] [8].

One way to overcome patient problems at Sultan Abdul Aziz Syah Peureulak Hospital regarding understanding drug information is to design an Android application using Augmented Reality technology [9] [10]. AR is a concept that combines objects from the real world with objects from the virtual world created by computers. This technology adds additional information to real objects, making the boundaries between the real world and the digital world increasingly blurred. With the help of this technology, the area around us can be connected with virtual elements [11] [12].

Therefore, based on this background, the Android application named "Mediscan" was created to help patients at Sultan Abdul Aziz Syah Peureulak Hospital find information about the medicines provided by pharmacy staff. This application was designed using Unity software and Vuforia Engine as a database [13] [14]. To use this application, patients can point their smart device's camera at the medication, and Mediscan will display complete information visually in card form on the device's screen. The information displayed includes general indications, dosage, drug class, contraindications, and side effects. With an easy-to-understand interface, this application provides clarity and easy access to information for patients, making the medication management process more transparent and easier to understand [15] [16].

2. Literature Review

2.1. Application

An application is a program that is ready to be used to carry out various commands to solve problems using data processing techniques on a computer or smartphone. The aim is to get results that are more accurate and follow the application. Meanwhile, Applications are computer programs created to help users carry out various desired tasks [17].

2.2. Android

Android is an operating system for cell phones that uses Linux as a basis. Android offers an open platform for developers that can be used on a variety of mobile devices. This OS is usually used on smartphones and tablets, similar to Symbian OS on Nokia, iOS on Apple, and OS Blackberry [18] [19].

2.3. Drug

Based on (Regulation of the Minister of Health No. 74 of 2016) Medicines are a combination of substances including biological products that are used to influence or investigate physiological systems or pathological conditions to determine diagnosis, prevention, healing, recovery, and improvement. health and contraception for humans.

According to the Regulation of the Minister of Health of the Republic of Indonesia, Number 917/Menkes/Per/X/1993, "Drug classification aims to increase the safety and accuracy of use and distribution protection which includes over-the-counter drugs, limited to over-the-counter drugs, hard drugs, psychotropics, and narcotics. "For medicines that can be obtained without a doctor's prescription, special markings must be placed on the packaging and label".

2.3. Unity

Unity is a tool for creating games that can be played on various types of devices, such as computers. This material discusses how the basic system works in making games using Unity [19]. Unity 3D is a platform for creating games built using the C++ programming language. Unity 3D supports various programming languages such as JavaScript, C#, and Boo. Unity is similar to other game engines such as Blender Game Engine and Virtools. The advantage of Unity 3D is that it can be used on Windows and Mac OS and can create games for multiple platforms. Unity 3D also supports creating games for consoles such as the Xbox 360 and PlayStation.

2.3. Vuvoria Engine

Vuforia is a Software Development Kit (SDK) for Augmented Reality for mobile devices that enables the creation of Augmented Reality applications. The Vuforia SDK is also available to bundle with Unity, namely the Vuforia Extension AR for Unity. Vuforia is equipped with computer technology Vision to be able to identify and detect Target Images and simple 3D objects such as tubes, directly.

Vuforia SDK supports multiple target types computing 2D and 3D Markerless images, 3D multi targets, and outline marker shapes. Additional highlights of the SDK include nearby collision detection using virtual buttons, you will be able to select target images in real time, and computing capabilities at runtime. Vuforia provides an Application Programming Interface (API) in C++, Java, and Objective-C.

2.3. Unified Modeling Language

Unified Modeling Language is a programming language that uses images and diagrams to design, build, and document object-based software development systems. With UML, we can more easily understand and explain how software works.

UML also has a blueprint system that includes business process concepts and creates classes using components used in certain programming languages, such as database schemas and software systems. With UML, we can describe business processes, design classes, and organize the components needed in software development.

2.3.1 Use Cases

One type of UML diagram that shows how the system and users interact is the Use Case diagram. This diagram provides a quick overview of who uses the application and what they can do.

2.3.1 Activity Diagrams

Activity Diagrams or activity diagrams are diagrams that describe processes in the system. This diagram explains the process sequence vertically and shows use case development with activity flow.

Menu sequences or system business processes can represent flows or activities. Rosa AS wrote, “Activity diagrams do not explain actor behavior” in his book Software Engineering. This could mean that activity diagrams can only be used to describe systems or workflow activities.

2.3.1. Sequence Diagrams

A sequence diagram is a detailed description of how the parts of a system are interconnected. This diagram displays execution time as well as messages or commands sent between system components. Objects involved in an activity are usually arranged from left to right in the diagram [20].

3. Methods

This research uses the System Development Life Cycle method. The Waterfall method was chosen because it is simple and systematic, consisting of several stages where the results of each stage can be used as input for the next stage [21] [22].

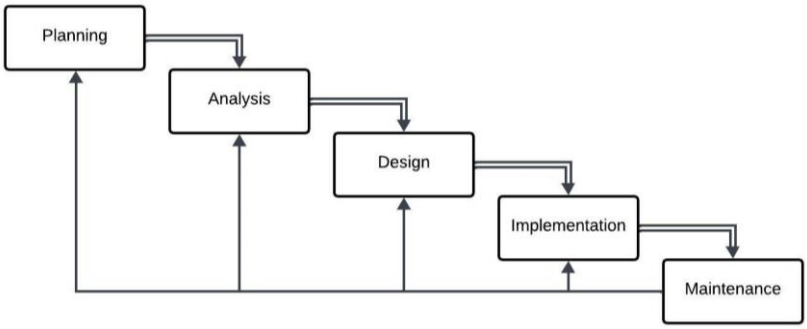

Figure 1. Stages Of SDLC Waterfall System Development

According to the development of the framework, several stages are required in the SDLC, namely:

1. Planning aims to identify and determine the system to be developed and the goals to be achieved.
2. Analysis is the research stage of an existing system to design a new system or update an existing system. At this stage, a literature study is carried out to find cases that can be handled by the system, as well as identify existing systems to be developed.
3. Design is the stage for determining the steps or techniques that will be applied in developing a new system or improving an existing system. The design process also involves analyzing the function of each step or technique to be built.
4. Implementation is the stage where the system design that has been prepared or developed is implemented. This stage also includes system testing to ensure that the system functions properly.
5. System maintenance (Maintenance) is the process of maintaining a system so that it can operate properly during its use.

4. Results and Discussion

4.1. Systems Analysis

At Sultan Abdul Aziz Syah Peureulak Hospital, the current manual system often experiences problems such as errors in verifying prescriptions, searching for drugs that take a long time, and a lack of detailed interaction between pharmacists and patients. The MEDISCAN application is here to overcome this problem by using Augmented Reality technology. Users can scan drugs and immediately get complete information such as indications, dosage, side effects, and how to use them through AR visualization. With this integration, the drug verification and dispensing process is expected to be faster, more accurate, and provide a more informative experience for patients. This is also expected to reduce pharmacist workload and improve overall hospital efficiency.

4.2. Mediscan Application System Design

4.2.1. Use Case Diagram of the MEDISCAN application

Use Case describes how actors run the system to carry out activities. The performance requirements of a system contained in the Mediscan application are presented in Figure 2 with several requirements such as opening the AR menu where when the user directs his cellphone camera towards the drug he wants to detect, drug information will appear consisting of (general indication, dose, drug class, effect). side and contraindications, then the user can also access the application guide page, application information display, and exit button.

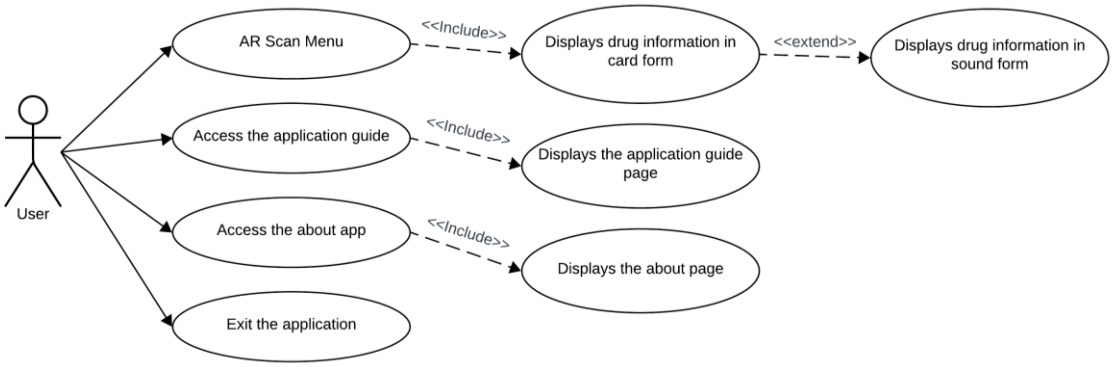

Figure 2. Mediscan Application Diagram Use Cases

4.2.2. MEDISCAN application Activity Diagram

1. AR application scan page activity diagram

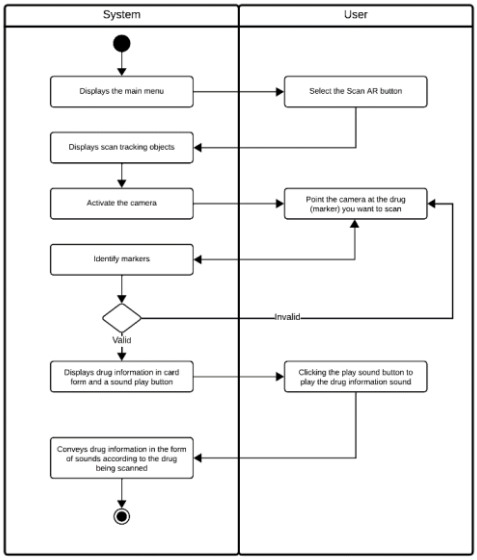

Figure 3. Mediscan App AR Scan Page Activity Diagram

Activity Diagram page AR Scan is used to display AR objects in the Mediscan application, first, the system displays the main menu when the application is run, then the user selects the AR Scan menu, and after that, the system displays an object tracking scan by activating the user's cellphone camera, the user directs his cellphone camera towards the drug (marker) that you want to detect if the system successfully detects the drug (marker) then the drug information along with the play sound button to play the drug information sound will appear and if it is not successful then it will remain in the process of detecting the marker.

2. Application guide page activity diagram

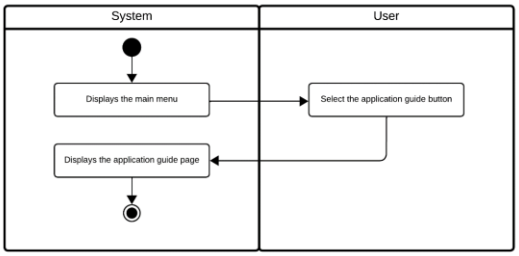

Figure 4. Mediscan Application Activity Diagram Guide Page

Activity Diagram is used to display a guide page on how to use the Mediscan application, the system displays the application's main page when the user clicks on the application guide button, and then the system displays the application guide page.

3. Application about page activity diagram

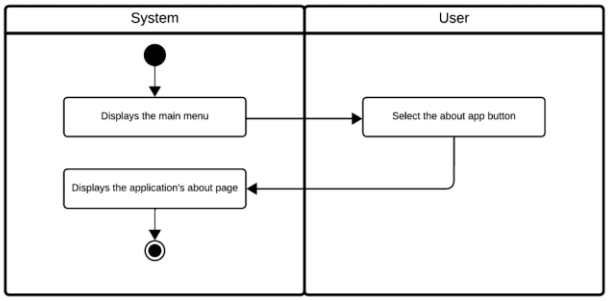

Figure 5. Mediscan Application Activity Diagram About Page

The Activity Diagram page about the application is used to display a page about how to use the Mediscan application, the system displays the main page of the application when the user clicks on the About Application button, and then the system displays the page about the application.

4. Application exit activity diagram

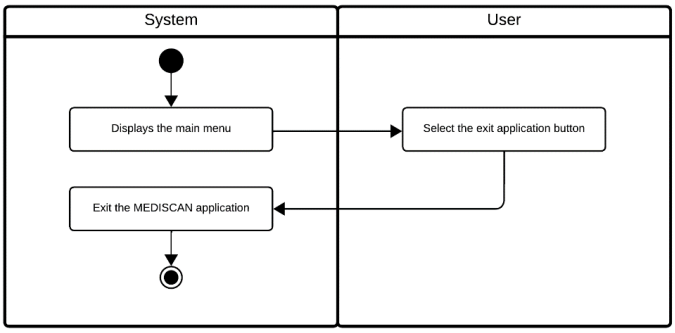

Figure 6. Exit Mediscan Application Activity Diagram

Activity Diagram is used to exit the Mediscan application, when the system displays the main page the user clicks the application exit button, then the system will automatically exit the application.

4.2.2 Sequence Mediscan application diagram

1. Sequence AR Scan Page Diagram

The Sequence Diagram in the Mediscan application describes the flow of the Augmented Reality application system where the user starts by looking at the interface and clicking the button to scan AR. The system then opens and activates the camera, which is used to scan the marker. Once a marker is recognized, the system verifies the marker's availability and retrieves the associated AR object for display. The AR object is then sent back to the main control to be displayed to the user, allowing the user to see the AR object associated with the scanned marker. For a clearer picture, see the image below:

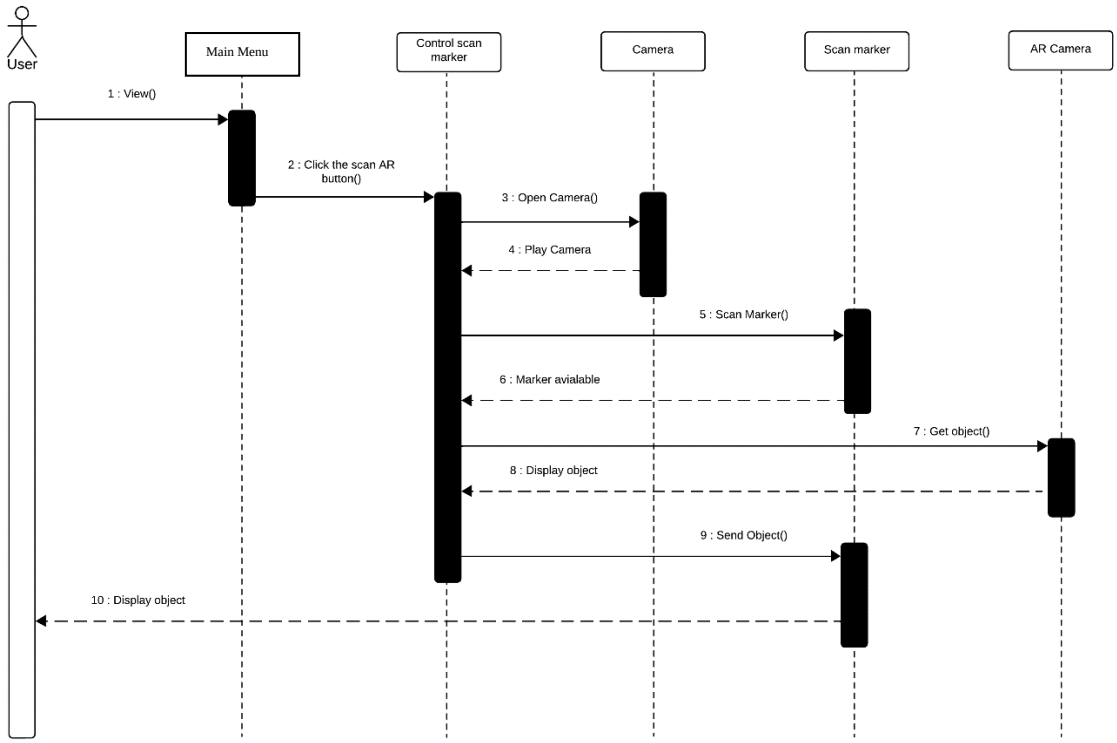

Figure 7. Mediscan Application AR Scan Page Sequence Diagram

2. Sequence Guide Page Diagram

A sequence diagram is used to display the Mediscan application guide page, when the user opens the application and the system displays the main page then the user clicks the application guide button, and then the system displays the application guide page.

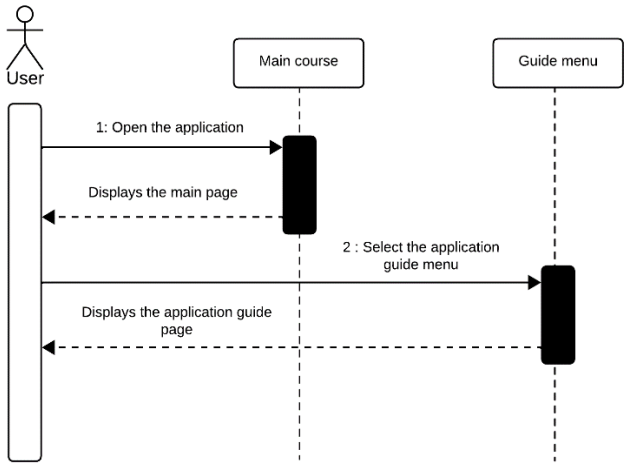

Figure 8. Mediscan Application AR Guide Page Sequence Diagram

3. Sequence About Page Diagram

The Sequence Diagram of the page about the application is used to display the Mediscan application guide page, when the user opens the application and the system displays the main page the user clicks the About application button, and then the system displays the page about the application.

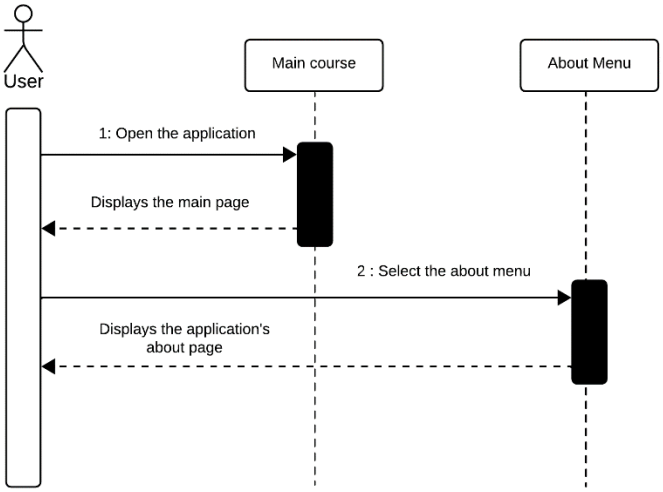

Figure 9. Mediscan Application AR About Page Sequence Diagram

4. Application exit activity diagram

A sequence diagram is used to exit the Mediscan application, when the user opens the application and the system displays the main page then the user clicks the application exit button, and then the system automatically exits the application.

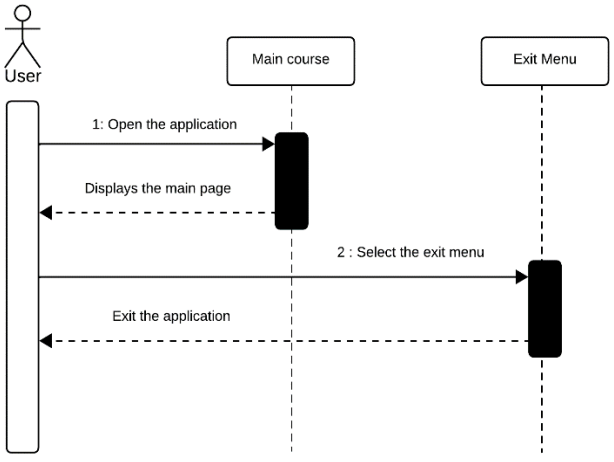

Figure 10. Exit Mediscan Application Sequence Diagram

4.3. Testing Scenario Black Mediscan Application Box

Black Box testing in the Mediscan application is applied to test the use of each button in the application so that it can be seen whether the buttons produce the correct output as expected. Black Box testing on the Android-based Mediscan application which uses Augmented Reality technology is described as follows:

Table 1. Black Box Test Results on Main Page Menu

No	Test Scenarios	Test Process	System Functions	Expected results	Test result
1.	AR Scan Button	Click the AR Scan Button	Enter the markerless Augmented Reality menu to display drug information	Displays drug information consisting of general indications, dosage, drug class, contraindications, and side effects in card form	Succeed
2.	Application guide button	Click the Guide Button	Enter the guide menu	Displays guide information on how to use the application	Succeed
3.	Button About Application	Click the About Button	Enter the About application menu	Displays information about the application	Succeed
4.	Exit Button	Click the Exit Button	To Exit the application	Exit the application	Succeed

4.4. MEDISCAN application system implementation

The system application was implemented by providing a 7-question questionnaire to 15 random people at the Sultan Abdul Azis Syah Peureulak Hospital pharmacy to find out how users responded to the Mediscan application.

Table 2. Results of user questionnaire answers

No.	Question	Number of Percentage of Respondents			
		Very good	Good	Not good	Not good
1.	Do you find it easy to find the drug information you are looking for in the Mediscan application?	13	2	0	0
2.	Do you like the appearance of the Mediscan application? Does it look attractive and easy to understand?	14	1	0	0
3.	Do you find it easy to move between pages in this application?	15	0	0	0
4.	What do you think about the speed of this app when searching for drug information?	13	2	0	0
5.	Is the AR feature in this application useful and helps you find out drug information?	14	1	0	0
6.	Is the text and information in this application easy to read and understand?	14	0	1	0
7.	What is your overall assessment of using the Mediscan application?	13	2	0	0

Based on the results of the questionnaire given to Mediscan application users, several responses were obtained regarding the performance and usability of the application. A total of 13 respondents felt it was very easy to find the drug information they were looking for in the Mediscan application, while 2 other respondents felt it was quite easy. Furthermore, 14 respondents liked the appearance of the Mediscan application because it was attractive and easy to understand, while 1 respondent felt the appearance was quite good.

Then, all respondents (15 people) found it very easy to move between pages in this application. Regarding the speed of the application in searching for drug information, 13 respondents rated it as very good, and 2 respondents rated it as good. The AR feature in this application also received a positive response, where 14 respondents felt this feature was very useful and helped them find out drug information, and 1 respondent felt it was quite useful. Apart from that, the text and information in this application were considered very easy to read and understand by 14 respondents, and 1 respondent considered it quite easy. Overall, 13 respondents gave a very good assessment of the Mediscan application, and 2 respondents gave a good rating. These results prove that the majority of users are happy with the performance and usefulness of the Mediscan application in helping them find and understand drug information.

5. Conclusion

Based on the results of research and development of the "Mediscan" application which has been carried out at Sultan Abdul Aziz Syah Peureulak Hospital, several important points can be concluded as follows:

1. AR technology can be implemented in Android-based applications to present drug information visually and interactively. The "Mediscan" application successfully combines real-world objects (drugs) with virtual objects (drug information) which are visualized via the user's cellphone.
2. This application can provide clear and easy-to-understand information regarding general indications, dosage, drug classes, contraindications, and side effects of drugs. The results of testing the Mediscan application on users and after that users filled out the questionnaire that was given showed that the majority of patients felt helped and gained a better understanding of drug information.
3. The integration of Augmented Reality technology in the Mediscan application at Sultan Abdul Aziz Syah Peureulak Hospital increases the presentation of drug information interactively and interestingly. Users can see a three-dimensional visual representation, making it easier to understand and identify medications. AR technology also improves the user experience with more immersive and efficient access to information, as well as supporting education and training for medical personnel and patients, thereby improving the quality of health services in hospitals.
4. This application also provides significant benefits for medical personnel and pharmacists in conveying drug information to patients. With this application, the communication process becomes more effective and efficient and reduces misunderstandings of drug information.

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