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Design Media Interactive of Mobile Augmented Reality (AR) in Education for Health Learning

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ABSTRACT

Abstract– Augmented Reality (AR) is a technology that is developing rapidly nowadays, the use of Augmented reality technology is widely used in various fields, one of which is health. The application of augmented reality to health is not only done technically but also in the form of learning. There are still many things that have not been achieved regarding Health education. This research was conducted to realize innovative and interesting learning for students, this application is designed to simplify, save costs and increase student interest in learning without having to reduce the information conveyed. The result of this research is the Design of an Augmented Reality Mobile Application for health that focuses on learning. Test results 80% of students said that 80% said they were very good at implementing AR applications for health learning.

1. INTRODUCTION

Education and technology are two inseparable things. The development of education will continue to be in line with the advancement of existing technology. This is in line with educational goals that shape the character of students to be able to learn for life. Of course, in the learning process there will be development of knowledge in certain learning subjects as a result of increasing one's curiosity and technology that always changes over time.

One of the education that is quite important is education in the health sector. Many lessons have not yet been realized, especially in Health. Education is currently still mostly done using written learning media such as books. Health learning using books is less effective today, especially for children. Learning such as the introduction of human organs,

drugs and the introduction of small living things that are invisible to the naked eye such as viruses or bacteria must be packaged as attractively as possible in order to get good interest from them.

Augmented reality is a technology that can combine the real and virtual worlds in a certain way, which can combine physical and digital phenomena[1]. Augmented reality directly and indirectly provides a physical, real-world environment whose elements are "additional" made by computers or extracted from real-world sensor inputs such as sound, video, graphics, or GPS data [2]. Augmented reality increases a person's perception of reality, by including digital objects in the real world environment.

Today, AR offers unique affordability that can combine the physical and virtual worlds. This is a new way to manipulate how we interact with the world. Without replacing the real world, this technology adds virtual information on top of the real world with continuous and implicit user control over viewing angles and interactivity [3].

The way AR works is through devices that display real-world environments with the addition of virtual objects, animations, text, data or sounds that users see from computer screens, smartphones, tablets, glasses, headsets, and other screen display systems [4]. These devices will become media that combines reality between the real and virtual worlds.

Along with the development of science and technology, there will be many new breakthroughs regarding educational methods for wider and more diverse study subjects [5]. One method that is currently being intensively developed is learning using augmented reality technology. Several literatures have shown the use of AR as an educational medium [6]. Through AR, students can develop important practices and literacy that cannot be obtained with other learning technologies [7]. There are several advantages of utilizing AR for learning, such as: Availability of the desired that AR has provided, Positive impact on cognitive load and motivation, Positive effect on collaborative experiences, Easily visualize complex and abstract concepts, Possibility to perceive difficult phenomena.

Augmented Reality technology is a solution related to learning that has not been achieved. Many studies still have limitations related to the delivery of information, especially in the field of Health [8]. Among them: Availability of medical devices that support the learning process in schools, Limited access from the school to medical devices that support the learning process, Lack of specific information related to Health learning such as still using 2D learning in the introduction of body organs, viruses, bacteria and others. -other, Purchase of medical equipment as a learning process which is quite expensive.

The limitations that arise are the motivation to be able to develop AR in pharmacy learning. With AR, students can see visuals of various things related to the introduction of health such as organs, drugs and viruses [9]. With this case in mind, we aim to create an application that applies augmented reality (AR) technology as a learning medium for students. This application will be designed as an introduction to Health library that contains

3D visualizations along with detailed information about various human organs, forms of viruses and also the introduction of drugs as student study material. In addition, this application can also be used as a valid source of information for the wider community regarding Health learning information [10]. Because in the era of the industrial revolution 4.0, interactive learning is needed [1].

2. RESEARCH METHOD

In making this application, we use RND (Research and Development) and we use the waterfall method. The type of research carried out Mix quantitatively and qualitatively. There are 5 (five) stages in the Waterfall method, namely requirements analysis and definition, system and software design, implementation and unit testing, integration and system testing, and operation and maintenance [11]. The following is an image and an explanation of the waterfall method according to Ian Sommerville.

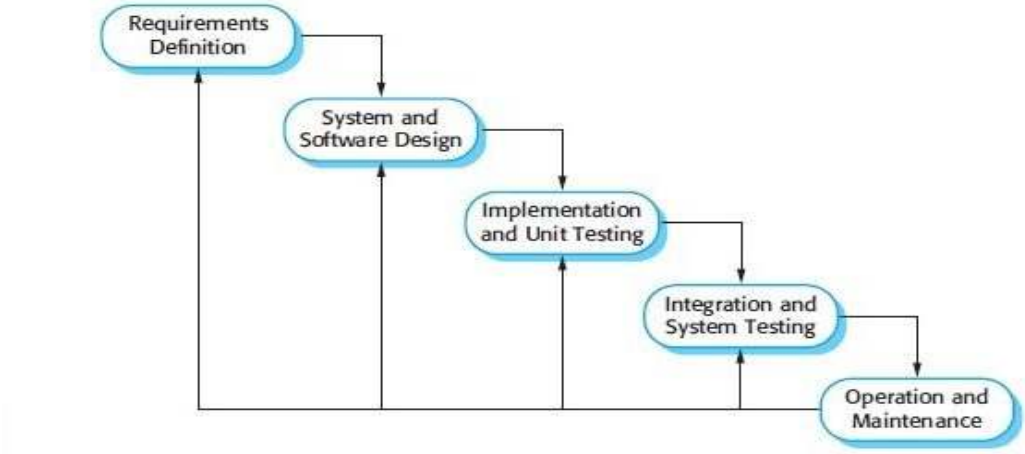

Figure 1. Waterfall Source: Ian Sommerville

Based Figure 1 step Requirements Analysis and Definition is the stage of determining the features, constraints and objectives of the system through consultation with system users. All of these will be defined in detail and serve as system specifications. In the System and Software Design stage, a system architecture will be formed based on the requirements that have been set. In addition, identification and description of the basic abstractions of software systems and their relationships are carried out. At the Implementation and Unit Testing stages, the results of the software design will be realized into a set of programs or program units. Each unit will be tested whether it meets its specifications or not. In this stage of Integration and System Testing, each program unit will be integrated with each other and tested as a complete system to ensure that the system meets the existing requirements. After that the system will be sent to the system user. In this

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Operation and Maintenance stage, the system is installed and put into use. In addition, it also fixes errors that were not found at the manufacturing stage. In this stage, system development is also carried out such as adding new features and functions.

3. RESULTS AND DISCUSSION

Before designing and implementing the application, there are several analyzes that must be done first. It aims to provide clarity on the system to be implemented. The following is the result of the design carried out:

3.1. Determine the type of device and operating system used

Application - is an AR-based Health learning library application that can be used and accessed from anywhere and anytime [13]. This aims to provide flexibility for users to be able to access drug information that is already available. We do a comparison between computers and smartphones for consideration. The results of considering these two options can be summarized as follows:

Table 1. Type of device and operating system used

Description	Computer	Mobile
Portability	Less	Good
Availability of supporting devices	Less	Good
Ease of implementation	Less	Good
User availability	Less	Good

Taking into account various possibilities such as portability, availability of supporting devices, ease of implementation and user availability, the suitable device is a mobile device. After determining the type of device to be used, the next analysis is to determine what operating system is used. The following is a comparison of some of the most popular operating systems on mobile devices [14]:

Table 2. Types of devices and operating systems (OS) used

Description	Android	iOs	*Windows Phone*
User availability	Good	Good	Less
Availability of AR supporting devices	Good	Good	Less
Ease of implementation of AR	Good	Less	Less
Affordability	Good	Less	Less
Future OS prospects	Good	Good	Less

With the above considerations, the application name application will be applied to mobile devices with the Android operating system.

3.2. Choose the software used to support application development

The development of this application will be carried out using the Unity engine. This is because Unity makes it easy for developers to be able to create mobile-based applications easily. Unity has also provided the ability to be able to develop augmented reality (AR) based applications.

However, before starting the implementation, the SDK will be determined first. By doing some comparisons on the SDK which is quite popular for Android mobile-based AR applications as follows:

Table 3. App creation support

Object	Vuvoria	DroidAR	*ARToolkit*
Unity	✓		✓
3D Object Tracking	✓	✓	
User Friendly	✓	✓	
Ease of implementation	✓		✓
Affordability	✓	✓	✓
Availability	✓	✓	✓

The table above shows that Vuforia has advantages compared to other SDKs as an SDK that will be combined with Unity. Vuforia has advantages in terms of ease and implementation of the Unity software so that the SDK chosen for the development of this application is the Vuforia SDK.

3.3. Application Design

After determining the system and device requirements to be used, the next step is to design how the application will be implemented. The purpose of this design is to facilitate the development team in implementing the application [15]. In addition, the suitability of the final result with the design will be a major consideration for the successful implementation of this project.

3.3.1. Determining Application System Requirements

The application that is built must be in accordance with the needs of the user, the application that is built is not exaggerated or not reduced so that the application can run smoothly on the user's device and have benefits according to needs [16]. Here are our application system requirements [17]:

- The application provides the main feature, namely Augmented Reality
- The application provides several Health learning menu features.
- Applications can display virtual objects in the form of 3D objects.
- Applications can display information related to Health learning.

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3.3.2. Application Data Needs

To be able to display Augmented Reality information, of course it will require some data. This data contains information about health-related AR assets or materials such as 3D objects and explanations of human organs, drugs and viruses. Data can be obtained from the internet regarding existing information. If these data have been obtained, then the object can be visualized using marker-based AR.

3.3.3. Software Requirements

Software requirements in the development of health learning applications in this study include: Draw.io, Whimsical, Canva, Figma, Unity, 3D sketch. This tool is effective and supportive as previous researchers have done [18], [19], [20].

3.4. Application

Application design is the process used in the prototyping lifecycle area of the Dynamic Systems Development Method to gather business requirements when developing a new information system for an Application. In this study, the design process of an application on a mobile platform is based on the development of creativity, so that it does not only produce a functional design but is also interesting, especially in everyday learning.

The creative design of mobile applications in this study takes a very important role in an application. Without a good user interface design, users or students will not feel interested in using applications that are designed and which will be built later. Therefore, user experience is one of the keys to user comfort in using an application.

The following is the result of designing a creative health learning application design which includes application architecture, wireframes, color palettes, application logos, application icons, and application UI.

3.4.1. Logo App

The concept of the application logo that we took was based on the theme, namely health. Which then applies the colors that the selected color palette as the principle of consistency is then defined into the logo. The application logo can be seen in Figure 2.

Figure 2. App Logo

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3.4.2. Application architecture

In designing the application architecture in this research, a comprehensive design of an application system and its supporting infrastructure is designed to serve the business needs or business support embedded in the application. The application architecture design can be seen in Figure 3.

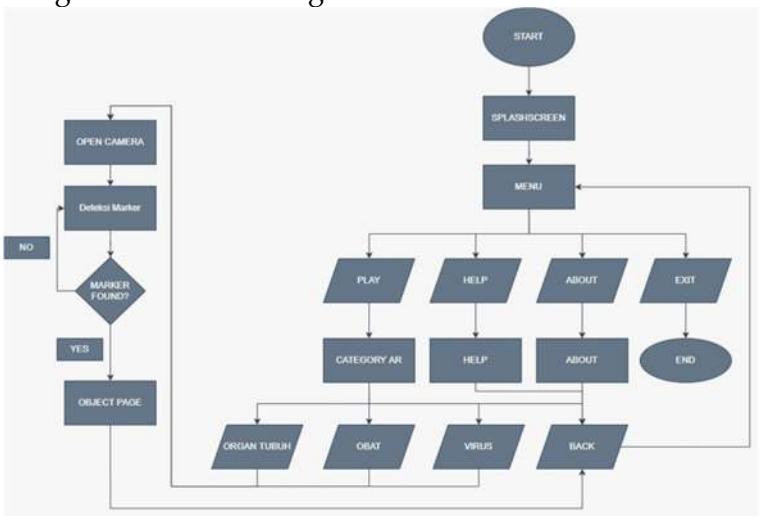

Figure 3. Application Architecture

3.4.3. Wireframes

In the process of designing or making wireframes using Whimsical software. At this stage the application is designed in the form of a visual chart which will then be processed into a UI using predetermined colors.

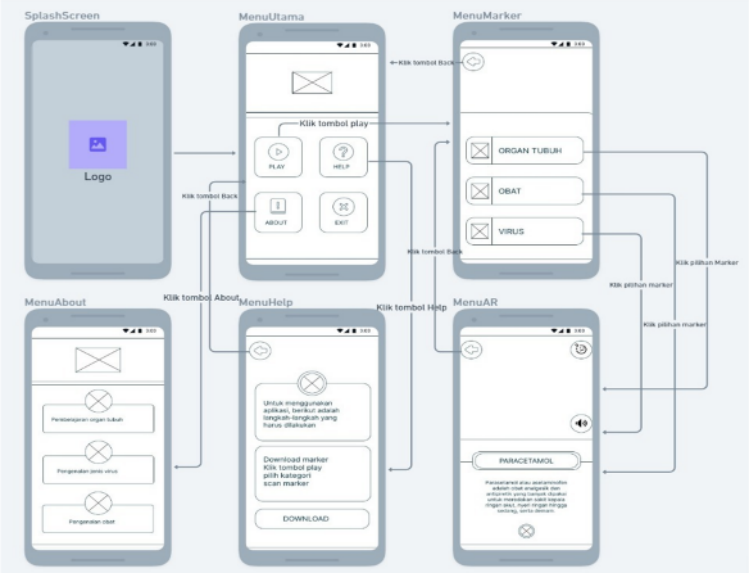

Figure 4. Application Architecture

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3.4.4. Color Palettee

Determining a color is of course very important. In making this health learning application, using 3 color categories, namely in the Blue, White, and Green color categories. In the Blue color category there are 2 types. The color palette of the application is presented in **Figure 5.**

Figure 5. Color Palettee

3.4.5. Icon

This icon is used so that users can find out the functionality of the buttons of the application. So that users can go to the desired page or section. The icons in this application are taken from the flaticon.com website. The selected icon can be seen in Figure 6.

Figure 6. Icon App

3.4.6. Typeface

The font in this health learning application uses the Montserrat type. This type of Montserrat features a flexible and attractive font type to use in our application. The monstserrat font can be seen in Figure 7.

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Figure 7. Typeface

3.5. User Interface (UI) Application

The UI development of this application was made after designing the wireframe and the types of colors used. UI or user interface design is the process of building an interface that focuses on the style and appearance that is interactive for the user. The goal is to make the interface simple, accessible to users and aesthetically pleasing. The UI of the designed application can be seen in Figure 8.

(a) (b) (c)

(d) (e) (f)

Figure 8. User Interface (UI) Application (a) SplashScreen, (b) Main course, (c) Marker Pages, (d) AR page, (e) About Page (f) Help Page

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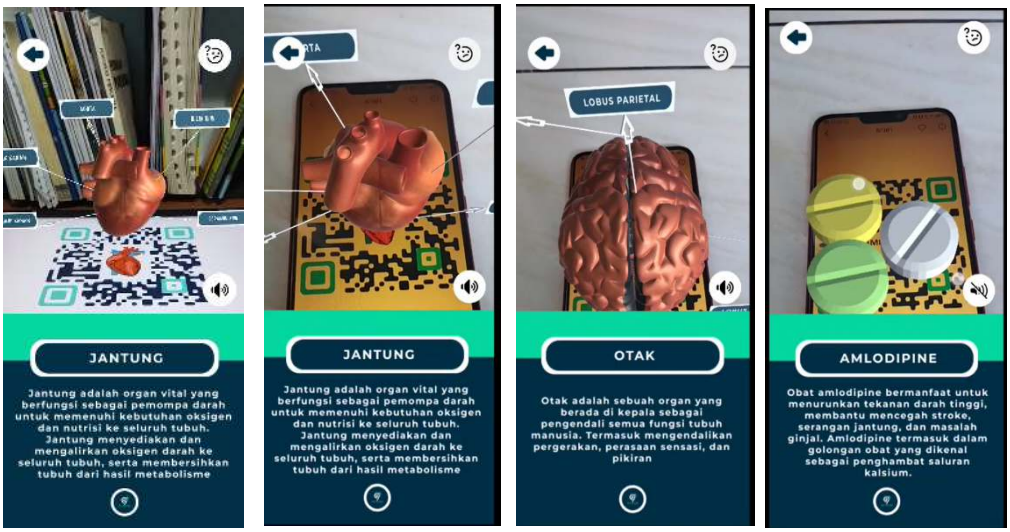
Based figure 7 In the results of the application design according to the design, this study designed an AR application that was made using the help of Unity 3D software and the Vuforia SDK. with the following results:

The main page is an application dashboard with several menus in it such as play, help, about and exit. This page is an Augmented Reality page, where there are select categories. AR category is still in the development stage to continue to add health category as a health learning application in order to provide more complete information to users. but in this implementation, there are still three AR category menus, namely organs, drugs and viruses.

On this page the user can find out how to run the application. besides that the user can also download the marker used via the download button that has been provided. for the about page itself is a page that describes the application.

3.6. Augmented Reality Results.

This page is a page that uses the camera on a smartphone so that the user is asked to allow the application to access the camera to display Augmented Reality objects. There are several buttons on this page, such as the voice button, missing and a pop up description and also the back button will appear. The results of Augmented Reality displayed are presented in Figure 8.



(a) (b) (c) (d)

Figure 8. Augmented Reality Results (a) heart, (b) detail heart, (c) brain (d) drug

3.7. Application Test Results

Application testing is carried out on an Android smartphone that supports AR with the following results:

Table 3. Application Test Results on Smartphones

Action	Application	Results
Pressing the Play button	Displays the AR category page	Success
Pressing the Help button	The application displays the Help page	Success
Pressing the About button	The application displays the About page	Success
Pressing the Exit Button	Exit the app	Success
Pressing the Back button	Back to previous page	Success
Pushing the organ, virus and drug button on the AR category page	The application displays the AR page.	Success
Scan marker	Displays 3D objects and description information.	Success
Pressing the sound play button	Show sound.	Success
Pressing the sound stop button	Sound stops	Success
Hit the hide caption button.	Description omitted	Success

From the table above, it can be concluded that the application has been running according to the previous design and can be implemented.

Software testing is the process of running and evaluating a software to test whether the software meets the requirements or not to determine the difference between the expected results and the actual results. The following will describe several things related to testing of marker based Augmented Reality Health Learning application software.

Field tests were conducted on 15 students randomly as respondents from vocational and high school students in the Special Region of Yogyakarta who studied in the field of health. From the results of the analysis of the limited field test, it is known that the average percentage of the 20 subjects (items) of the assessment. This application is included in the very good criteria because 12 students answered very good, 2 were good and 1 was Neither agree nor disagree /Pretty good. The level of application achievement based on the results of field tests for a good scale is presented in Table 4 and Figure 9.

Table 4. Level of Achievement of field test results

Achievement Level Criteria	Percentage (%)	Total students
Strongly Agree /Very good	80%	12
Agree /Good	13,3%	2
Neither agree nor disagree /Pretty good	6,7%	1
Disagree /Not good	0	0
Strongly disagree /Very Not Good	0	0

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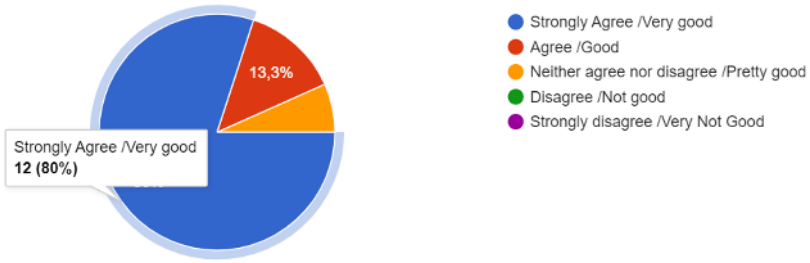

Figure 9. Visualization of Limited Trial in the Field

4. CONCLUSION

Based on the design of AR-based health learning applications that have been carried out, the conclusions that can be drawn are:

a. The UI concept is simple and not difficult for students, of course, it will make it easier to operate the application, especially in the application, a help feature has been provided if students have difficulty using this AR application at any time. It is proven that from the limited test of 12 students, the level of achievement is very good with a presentation of 80%, and 13.3% is good.
b. By providing learning (in the health sector) based on AR (Augmented Reality) this will certainly make students more interactive in the teaching and learning process. Students can easily see directly 3D objects (eg kidneys) not only see 2D images presented in books, because it can be seen in their daily lives that the most widely implemented learning method is conventional methods that only rely on books, explanations from the teacher. By relying on AR learning, it will attract the attention of students in an innovative teaching and learning process so that students will not feel bored anymore.

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