Implementation of Augmented Reality Learning Media Technology at the Primary and Secondary Education Levels in Cimahi City, West Java

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Article Info	ABSTRACT
	Currently the development of technology is progressing very rapidly and its development cannot be stopped. With so many advanced technologies that have emerged, various kinds of human work can be done in more innovative ways. One example is in the field of education. Currently, there are various kinds of technology-based learning media, one of which is learning media using Augmented Reality technology or often shortened to AR. Application Development as Learning Media to Build Space for Elementary/Junior High School Level Using Marker Augmented Reality Method is one form of utilizing AR technology in the field of education, especially as a learning medium. With the creation of this Augmented Reality-based learning media for building space, It is hoped that students can understand learning materials easily, and students' interest in learning can increase because the objects in the space are designed to be attractive, colorful, and interactive to avoid boredom. Based on this, this research is one of the new breakthroughs in the world of education that utilizes technological advances and helps teachers provide more interesting learning media. Meanwhile, the results of this study are in the form of an AR application and a mathematical book (module). this research is one of the new breakthroughs in the world of education that utilizes technological advances and helps teachers provide more interesting learning media. Meanwhile, the results of this study are in the form of an AR application and a mathematical book (module). this research is one of the new breakthroughs in the world of education that utilizes technological advances and helps teachers provide more interesting learning media. Meanwhile, the results of this study are in the form of an AR application and a mathematical book (module).

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1. INTRODUCTION

Technology is now a part of every human activity. Its very fast and unstoppable growth makes it an inseparable component in various aspects of life today[1].With the presence of technology in various aspects of human life, it has an impact on the processing time and also the energy needed to complete it. One example of current technological developments is the emergence of various kinds of increasingly sophisticated mobile devices or smartphones[2].Currently, the use of mobile devices is not just for sending messages or for making calls, but its functions have expanded. With one mobile device we can search and get information, control and control the use of office or home equipment, manage files, educational media, pay various bills, to manage administrative activities in an institution/organization.

The wider function of the mobile device is also supported by the development of Android which is increasingly advanced day by day. Android is an operating system for Linux-based mobile devices or phones that includes an operating system, middleware, and applications. Its open source nature makes many

developers or developers competing to create Android-based applications[3]. In addition, based on data from the Indonesian Operating System Market Share for the period December 2018 - December 2019 obtained from statcounter, the Android operating system occupies the position of 51.24% while the iOS operating system is in the position of 3.66%, thus the Android operating system is the most widely used operating system. by the Indonesian people. In line with the development of increasingly advanced technology, the field of education is currently growing and undergoing very significant changes, one example of which is the existence of teaching aids that utilize technological advances for certain subjects. These teaching aids are usually used in subjects that require real objects in the learning process which aims to help students understand the learning material.

Building space is one of the materials in mathematics that requires teaching aids in the learning process. Without direct teaching aids, students can only see the two-dimensional images through books or imagine the objects in the space themselves.[4]. In addition, without any teaching aids the level of interest in learning of students becomes less because students cannot see or feel real objects of space. Thus, teaching aids are needed in order to help students learn and also visualize spatial shapes. However, the current teaching aids on the market are quite expensive, they can be damaged or lost, students cannot take the teaching aids home, and they are no longer in accordance with current conditions that use technology.[5]. To replace these conventional teaching aids, now there is a technology called Augmented Reality or commonly abbreviated as AR[6]. Augmented Reality or AR is a field of computer research that combines 3D graphic data with the real world or in other words the reality that is added to a media.[7]. The media can be in the form of paper, a marker or a marker through certain input devices.[8]While Marker Augmented Reality is one type of Augmented Reality that recognizes markers and identifies patterns from a marker to add a virtual object to the real environment.[9]. In its application, this AR application will use a smartphone where when the marker used is scanned, the AR object will appear on the user's smartphone screen.[10].

2.   RESEARCH METHOD
2.1 Method of collecting data
To obtain data and information related to this research, the data collection methods used are as follows:
a. Literature review
    Literature study is a method of collecting data by searching for theories, articles, scientific works, books, print media, and other library sources related to the application to be built.
b. Observation
    Collecting data by direct observation of the system that is running.
c. Interview
    Collecting data by conducting questions and answers with related parties to find out what needs are needed.

2.2 Process Model
The process model used to build this spatial AR application uses the methodology multimedia development. According to Binanto (2010), the multimedia development methodology consists of six stages, namely concept (conception), design (design), collecting material (collection of materials), assembly (compilation), testing (testing), and distribution (distribution). The reason for using the multimedia development methodology as a process model in the development of this application is because the application that is built is included in a multimedia application, where there is a process of making 3D models and also providing animation to 3D objects created.[11].
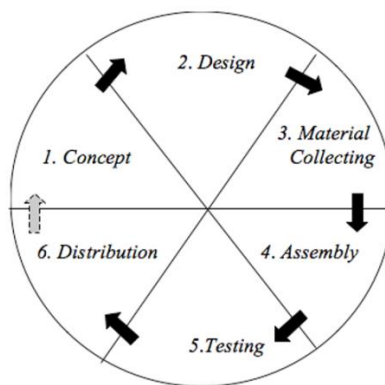

Figure 1. Multimedia Development Methodology (Luther, 1994)

2.2 Systems Development Approach

The system development approach method in developing this application uses Object Oriented. The reason for using this method is because the system development uses an Object Oriented-based programming language, where using this approach will facilitate the modeling process. The results of the analysis are described using the Unified Modeling Language (UML) tool. UML is a tool used to facilitate the development of Object Oriented-based applications where UML modeling describes in full how the application will be used by its users. The diagrams that will be used in the analysis of the system built are as follows:

a. Use Case diagrams
b. Class diagrams
c. Sequence diagrams
d. Activity diagrams

3.   RESULTS AND ANALYSIS
3.1 System Design

System design is the preparatory stage for designing and building a system. System design aims to provide a clear picture of the system to be built. In the design stage of this system, an overview of the flow / workings of the application is given according to the needs of the user. The flow / workings of the application that is built will be poured into conceptual modeling using UML (Unified Modeling Language) diagrams.

3.2 Use Case Diagrams

Use case or use case diagram is a modeling to describe the behavior (behavior) of the application to be built. Use case describes an interaction between one or more actors with the application being built. Or in other words, use cases are used to find out what functions are in an application and who has the right to use those functions. This definition includes user identification, use case identification and scenarios or how the application is built.
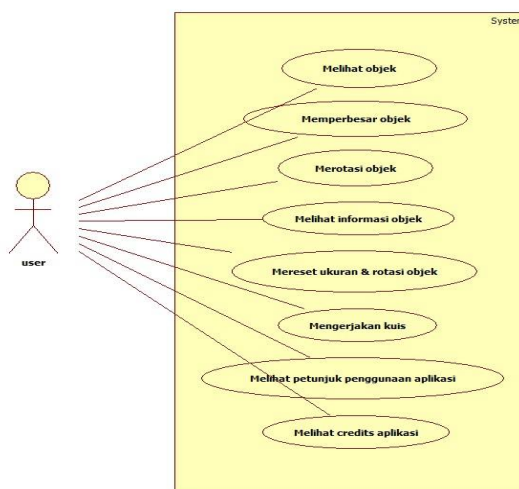

Figure 2. Use Case Diagram of AR Applications Build Space

3.3 Activity Diagrams

Activity diagrams or activity diagrams describe workflows or activities that occur in a system. From the first to the end, this diagram shows the steps in the work process of the system that has been created.
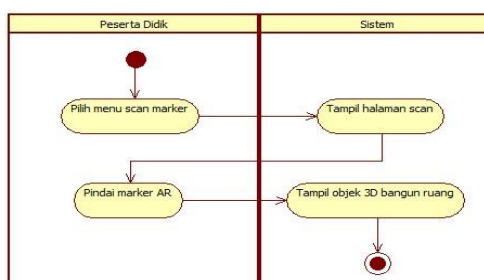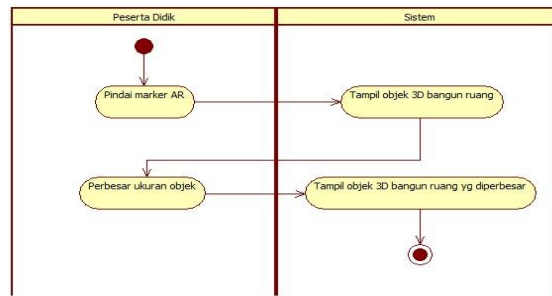

Figure 3. Activity Diagram Viewing Objects

Figure 4. Activity Diagram Enlarge Object

3.4 Sequence Diagrams

Sequence diagram or sequence diagram is a diagram that describes the behavior of objects in the use case sequentially by describing the life time (life time) of objects and messages sent and received between objects.
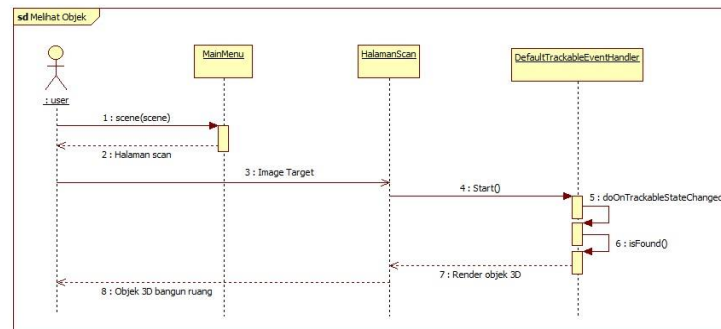

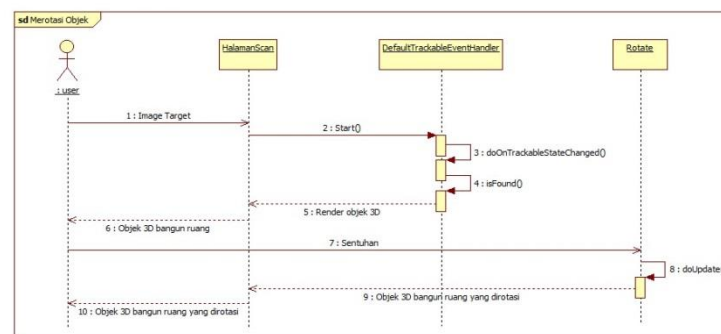Figure 5. Sequence Diagram Viewing Objects

Figure 6. Sequence Diagram of Rotating Objects

3.5 Class Diagrams

Class diagram or class diagram is a diagram that describes the structure of the system in terms of defining the classes that will be created to build the system. Classes have what are called attributes and methods or operations. Below is the class diagram of the spatial AR application:
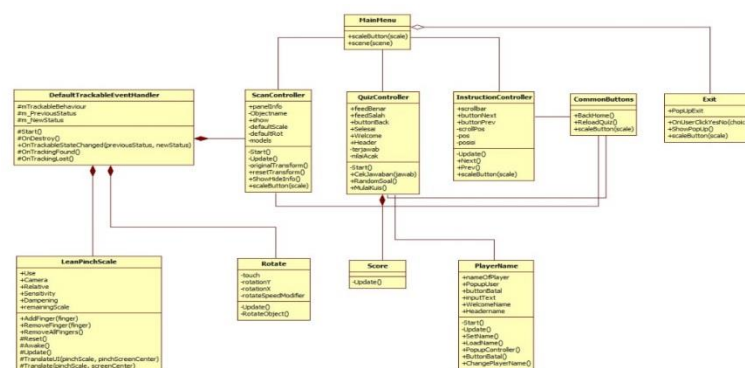

Figure 6. *Class* AR Application Diagram Build Space

3.6 Implementation
3.6.1 Main Menu Display

When the user first opens the AR wake-up application, the application will first display the Unity default splash screen. After the splash screen is displayed, the application will display the main menu. In the main menu, there are 5 buttons where 4 of them are buttons that go to 4 different scenes. While 1 other button, namely the exit button will display a popup window. In addition, on the main menu there are animations and also backsounds so that the application is more attractive to users. The following is a display of the main menu of the AR wake-up application:
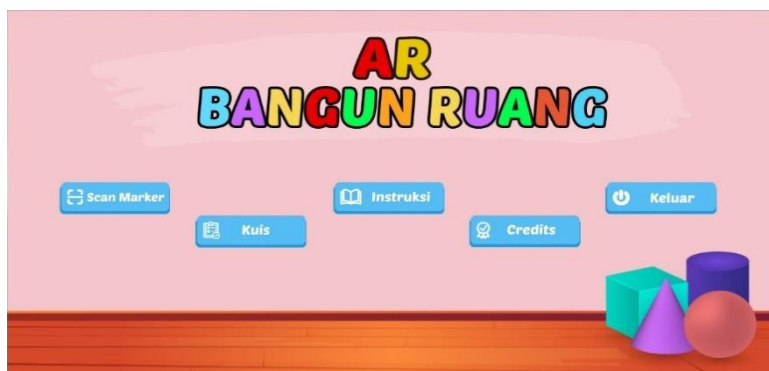

Figure 7. Application Main Menu

3.6.2 Scan Marker Page Display

Next is the scan marker page display. This scan marker page will be displayed when the user presses the scan marker button on the main page. When the scan marker page opens, the camera will automatically activate. This scene is used to detect a predetermined marker. The following is a display of the scan marker page:
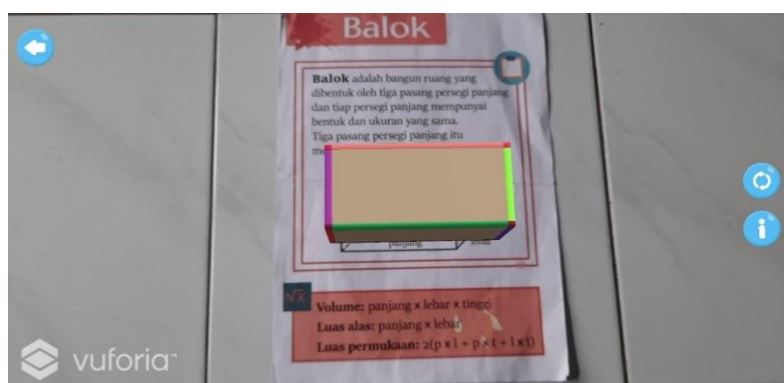

Figure 8. Scan Marker Pages

On this scan marker page, there are 3 buttons, namely the reset button (a button with two circular arrows), an info button (a button with an i image), and a return button. The reset button serves to restore the size and position of the rotation after the user enlarges or rotates the spatial object. The back button serves to return to the main menu of the application, while the info button serves to display the characteristics of the space. This is what it looks like when the info button is pressed:
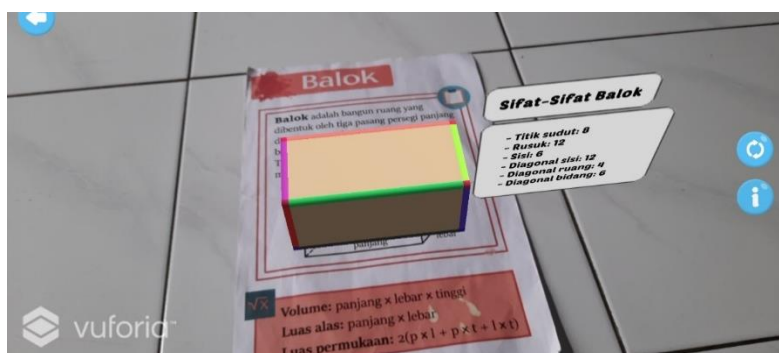

Figure 9. Display of Information (Properties) Build Space

3.6.3 Quiz Page Display

Quiz page is a page that is used as a means to evaluate student learning outcomes. On this quiz page, there are 10 questions about spatial structure in the form of multiple choice, each student who answers the question correctly will increase the score by 10, while if it is wrong, the score will not increase. Here's what the quiz page looks like:

Figure 10. Quiz Page

4.   CONCLUSION

Based on the research that has been done, it can be concluded as follows:

a.   The application that is built makes it easier for students to understand the learning material for building space.

b.   AR application to build space can increase students' interest in learning.

c.   The AR application has been equipped with a quiz feature that can be used as a benchmark to determine the level of students' understanding of the learning material.

REFERENCES

[1]   M. Claudia tom Dieck, T. J. (2019). *Augmented Reality and Virtual Reality The Power of AR and VR for Business*. Springer International Publishing.

[2]   Maulana, A. (2014). Aplikasi Augmented Reality Sebagai Media Pembelajaran Tata Surya. *Prosiding Seminar Ilmiah Nasional Komputer Dan Sistem Intelejen (KOMMIT 2014)*, *8*, 1–59.

[3]   Elmqaddem, N. (2019). Augmented Reality and Virtual Reality in education. Myth or reality? *International Journal of Emerging Technologies in Learning*, *14*(3), 234–242. https://doi.org/10.3991/ijet.v14i03.9289.

[4]   Hakim, L. (2018). Pengembangan Media Pembelajaran Pai Berbasis Augmented Reality. *Lentera Pendidikan : Jurnal Ilmu Tarbiyah Dan Keguruan*, *21*(1), 59–72. https://doi.org/10.24252/lp.2018v21n1i6.

[5]   Mauludin, R., Sukamto, A. S., & Muhardi, H. (2017). Penerapan Augmented Reality Sebagai Media Pembelajaran Sistem Pencernaan pada Manusia dalam Mata Pelajaran Biologi. *Jurnal Edukasi Dan Penelitian Informatika (JEPIN)*, *3*(2), 117. https://doi.org/10.26418/jp.v3i2.22676.

[6]   Ahmadi, R. A., Adler, J., & Ginting, S. L. (2017). TeknologiAugmented RealitySebagaiMedia PembelajaranGerakan Shalat. *Prosiding Seminar Nasional Komputer Dan Informatika (SENASKI)*, *2017*, 978–602.

[7]   Dieter Schmalstieg, T. H. (2016). *Augmented Reality Principles and Practice*. Pearson Education.

[8]   Steve Aukstakalnis. (2017). *Practical Augmented Reality A Guide to the Technologies, Applications, and Human Factors for AR and VR*. Addison-Wesley.

[9]   Andre Kurniawan Pamoedji, Maryuni, R. S. (2017). *Mudah Membuat Game Augmented Reality (AR) dan Virtual Reality (VR) dengan Unity 3D*. Elex Media Komputindo.

[10]   Ani Ismayani. (2020). *Membuat Sendiri Aplikasi Augmented Reality*. Elex Media Komputindo.

[11]   Binanto, I. (2010). Multimedia digital-dasar teori dan pengembangannya. Penerbit Andi.