



Indonesian Journal of Multidisciplinary Research



Journal homepage: <http://ejournal.upi.edu/index.php/IJOMR/>

Application of Augmented Reality Technology with the Fuzzy Logic Method as an Online Physical Education Lecture Method in the New Normal Era

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ABSTRACTS

This research aims to create Augmented Reality about basic physics practicum tutorials on the Sound Wave Resonance module in the Department of Computer Systems at the Universitas Komputer Indonesia (UNIKOM) based on Android. The advantages of this technology can be used as a medium of online learning if there is an emergency that results in not implementing conventional learning so that learning activities remain effective. This application program is intended to facilitate the Lecturer / Laboratory Assistant in presenting the material as well as attracting student learning interest in practicum learning. The method used in this study was a qualitative method by describing the condition of the Basic Physics Laboratory in the computer engineering department, and the system development method used is the paradigm method, Waterfall. Data was collected through interviews with the Chair of the Basic Physics Laboratory. This study results obtained an information system that allows the practitioner to compare the calculations' results mathematically with the application, and practicum can understand the material easily and fun.

ARTICLE INFO

Article History:

Received 30 Jan 2021

Revised 10 Feb 2021

Accepted 11 Feb 2021

Available online 11 Feb 2021

Keyword:

Augmented Reality,
Fuzzy Logic,
Education,
Technology

1. INTRODUCTION

Augmented Reality (AR) is an invention and innovation in the developing multimedia and image processing fields. This technology can lift a previously flat object or two-dimensional to be as real as one with the surrounding environment (Billingshurst, 2002). AR is part of Environment Reality (ER) or also known as Virtual Reality (VR) (Ibáñez and Delgado-Kloos, 2018). It can carry out visual communication such as writing shapes or images from a virtual computer into the real world (Palmarini, 2018). AR interface allows users to see the real world and virtual images located at a real place and object location. The AR interface enhances the real-world experience, unlike the VR interface, which draws users from the real world and enters the visual screen (Ozdemir, 2018). In the outline, the difference between VR and AR lies in user interaction (Tzima, 2019). This application uses the fuzzy method because most of the wrong agreement's information and one of the humans' greatest abilities to prepare information that is not precisely efficient and unclear. Fuzzy logic was first introduced by Prof. Lotfi A. Zadeh in 1965 (Tzima, 2019). In the Oxford dictionary, the term fuzzy is defined as blurred, unclear, incorrectly defined, and confused. A fuzzy system is a knowledge-based system or rule base. The core of a fuzzy system is the rules (IF-THEN Rules) set on a fuzzy knowledge base. Android is an operating system for Linux-based mobile devices that includes an operating system, middleware, and applications. Developing Android applications provides an Android SDK that provides tools and APIs for application developers with the Android platform (Challenor and Ma, 2019). Making Android-based learning media consists of two ways: using a programming language such as JDK (Sumitra and Supatmi, 2019). By seeing the development of technology and communication media can help to learn effectively. Previous research was conducted by Ginting and Hidayat that discusses the benefits of augmented reality technology as an android-based developer tool and research that found this research using two methods of Marker-Based AR and Tracking Marker (Supatmi and Sumitra, 2019).

The main purpose of the development of AR technology is to provide an understanding and information in the real world, where it takes the basis in the real world. Then, the system will add contextual data to clarify someone's understanding of the information to be absorbed. The advantages of this technology can be used as a medium of online learning if there is an emergency that results in not implementing conventional learning so that learning activities remain effective. This application program is intended to facilitate the Lecturer / Laboratory Assistant in presenting the material as well as attracting student-learning interest in practicum learning. In this application, there is a practicum data processing menu so that the practitioner can compare the results of mathematical calculations with the application. This menu uses the Fuzzy Mamdani method, which is used to determine the Sound Wave Resonance. It is expected that with this application, practicum participants can understand the material easily.

2. METHODS

The method used in this research was a qualitative method with a study of Basic Physics Laboratory in the UNIKOM computer engineering department, and the system development method used is the paradigm method, namely Waterfall method (See **Figure 1**). Data was collected through interviews with the Chair of the Basic Physics Laboratory, and the primary data used were documents/notes from the Basic Physics Laboratory, while secondary data were taken from journals and books. The waterfall method is a systematic and sequential model of information system development (Tan, 2016). The waterfall method stages are as follows: (1) Requirements Analysis, all software requirements and specifications to be made

must be completed this fall. Information can be obtained from literature studies and field observations; (2) Design, this scenario is created using a diagram of the use case program function; (3) Implementation, Implementation is designed to create systems and make systems that have been designed. The system is designed in the form of a program using C # as a programming language; (4) Testing, Testing is done to test the system that has been made. The trial data obtained will be completed so that conclusions can be drawn. It is planned that the test will be carried out by entering various types of inputs into the system; (5) Analysis, this stage is done by making a report on the system's design and construction, then analyze the work on the system. The Mamdani Fuzzy Inference System (FIS) method Ebrahim Mamdani proposed the first type of fuzzy inference system (FIS) in 1975 (Acosta, 2019). FIS Mamdani has fuzzy input and fuzzy output. FIS is an appropriate way to map an input space into an output space.

3. RESULTS AND DISCUSSION

At this stage, the program mechanism is planned, which includes input and output forms. It is a description of the processed data and information. The following is an animated display image that will be created. In **Figure 2**, it is the display when the practitioner first opens the application. In this view, there is the UNIKOM logo.

Figure 3 shows the initial menu display of the application, there is the name of the application, and there is a scan marker, data processing, about, and exit menu.

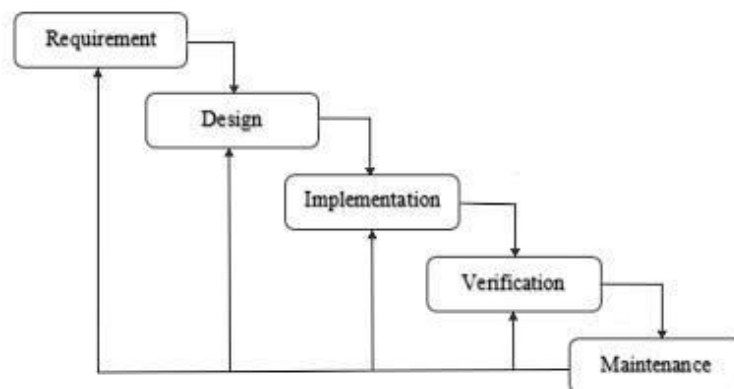


Figure 1. Waterfall Diagram



Figure 2. Welcome Screen

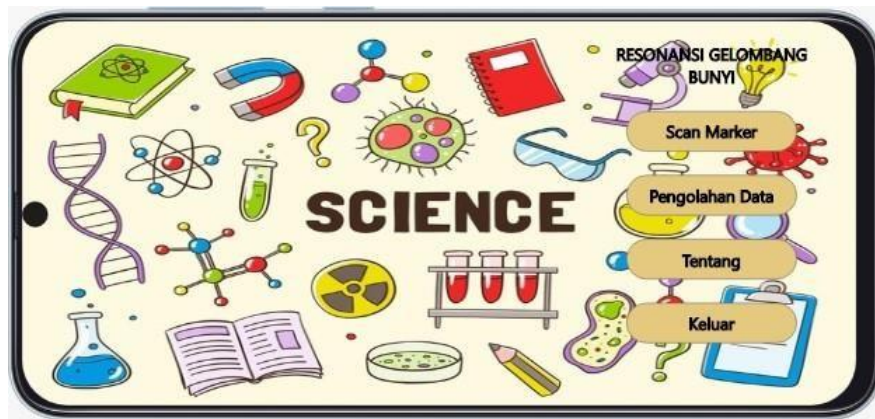


Figure 3. Home Page Application

Figure 4 shows the display of Practical Data Processing obtained by practical when doing practice. The practitioner input data contained in the table. Then, press the result button to compare the ideal e value with the calculated e value.

Figure 5 shows the Scan Marker Menu display. It will be displayed when the practitioner selects the scan marker menu containing 3D objects. The practitioner asked to scan the marker contained in the practicum module to display 3D objects on this menu.

Peristiwa resonansi ke - n	Panjang kolom udara		
	Percobaan 1 L (m)	Percobaan 2 L (m)	L rata - rata

Figure 4. Data Processing Using Fuzzy Mamdani

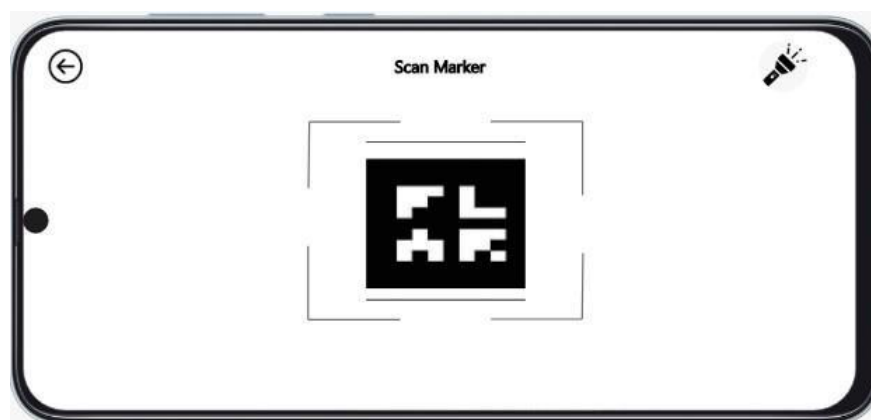


Figure 5. Scan Marker Menu Display

4. CONCLUSION

The development of technology has a significant influence on humans. One of them is Augmented Reality (AR) technology, which is a technology that creates 3D virtual objects into real environments in real-time. The advantages of this technology can be used as online learning media if there is an emergency that results in not applying conventional learning so that learning activities remain effective. This menu used the Fuzzy Mamdani method, which is used to determine the Sound Wave Resonance.

5. ACKNOWLEDGEMENTS

We would like to thank Universitas Komputer Indonesia for providing the opportunity in writing this paper especially the lecturers who provide insights, also to everyone who assisted in the making of this paper.

5. AUTHORS' NOTE

The authors declare that there is no conflict of interest regarding the publication of this article. Authors confirmed that the paper was free of plagiarism.

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