

Learning Media Based on Augmented Reality Applied on the Lesson of Electrical Network Protection System

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Abstract. Technology is created and developed to help people work more efficiently. One of them is Augmented Reality technology. Augmented Reality is a technology that combines two or three dimensional virtual objects into the real three-dimensional environments, then it is projecting the virtual objects in real time, in this case it was possible to help ease the learning process for displaying props and also to increase students attention. In this study, the learning media based on Augmented Reality applied to the subject of Electrical Network Protection System.

1. Introduction

1.1. Background

It is undeniable that today's technological advances are growing very rapidly. This is evidenced by the many innovations that have been made in this world. Technology is created and developed to help humans in doing work to be more efficient [1]. Technology today is still growing rapidly and inspire innovation and new works. One of them is Augmented Reality technology. Augmented Reality is a technology that replaces two-dimensional virtual objects and three-dimensional dimensions, then projecting virtual objects in real time [2]. This technology uses a system integrated into Smartphone or other gadgets. This is intended to help the perception and interaction with the real world.

In Indonesia, especially in the world of self-education, learning with the concept of Augmented Reality is still new, because this technology is only popular with the military world, Augmented Reality Technology in education to be a learning tool for fun learning process [3].

For that Augmented Reality technology in Indonesia to become an up to date teaching method and make this Augmented Reality technology as a fun learning media, it is necessary supporting tools such as Smartphone that can be integrated with this technology.

Smartphone users in Indonesia are increasing every time. Indonesia icated ranked fifth as Smartphone users in the world. About 80% of people in Indonesia have Smartphone [4], with the rapid increase of Smartphone in Indonesia, it can be used to integrate Augmented Reality technology into Smartphone.

1.2. Problem Formulation

Based on the above background, the issues raised in the writing of this Final Project are:

- How to facilitate displaying props on the subjects of Electrical Network Protection?
- How to follow the development of technology in teaching and learning activities?



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- What is responsible for this planning?
- How to improve student learning attention?

1.3. Purpose

In accordance with the formulation of the above problems, then to be achieved in writing this Final Project is:

- To facilitate the students know the tool in question in the learning process of Electrical Network Protection
- To make teaching and learning activities up to date with the development of the times
- Use more effective gadgets
- Improving student's learning attention

2. Theoretical Review

2.1. Electrical Network Protection Subject

Electrical Network Protection Subject is one part of the productive learning group at Vocational High School, where in the Curriculum 2013 the subjects of the Basic Network are included in the C3 (Apply) group for class XI. Curriculum 2013 is a new curriculum applied by the government to replace the Education Unit Level Curriculum that has been valid for approximately 6 years. The scope of Basic Network material includes the concept of power system, network protection equipment, etc [5].

2.2. Teaching Module

Module is a way of organizing learning materials that pay attention to the function of education. That is, through a module of learning is expected to bring learners the basic competencies expected to bring learners to the basic competencies expected.

2.3. Augmented Reality

Augmented Reality as the incorporation of real and virtual objects in real environments, runs interactively in real time, and there is integration between the three dimensions, the virtual object integrated into the real world [6]. The incorporation of real and virtual objects is possible with appropriate display technology, interactivity is possible through certain input devices, and good integration requires effective tracking.

2.4. Augmented Reality Book

Augmented Reality Book (AR-Book) or in Indonesian means Augmented Reality based book is a merger between a regular books with AR technology. AR-Book outline has two main components, a book with a Quick Response Code (QR) type marker on almost every page, and the second is an apparatus for capturing markers and displaying the results [7].

2.5. Unity 3D

Unity 3D is an integrated tool for creating 3-dimensional object shapes in video games or for other interactive contexts such as Architectural Visualization or real-time 3D animation. The environment of Unity 3D development runs on Microsoft Windows and Mac OS X, as well as applications created by Unity 3D can run on Windows, Mac, Xbox 360, PlayStation 3, Wii, iPad, iPhone and do not miss the Android platform.

2.6. Vuforia

Vuforia is a software library for augmented reality, which uses a consistent source of computer vision that focuses on image recognition. Vuforia has many features and capabilities, which can help developers to realize their thinking without any technical limitations. With support for iOS, Android and

Unity3D, the Vuforia platform supports developers to create apps that can be used across virtually every smartphone and tablet [6].

2.7. Marker

The AR application creation process required a marker as a marker to display an object. In making marker required an image file with extension .JPG which will be uploaded to QCAR official site. Markers that have been uploaded will be rated quality by the system, the more rating with an asterisk the better marker quality will be. Markers used should tend to have a contrasting color to get the best rating, bad markers will be difficult to detect device or even not work.

2.8. Android

Android is a Linux-based operating system for mobile phones such as smart phones and tablet computers [8]. Android provides an open platform for developers to create their own applications for use by various propulsion devices. Android is an open source operating system, and Google is releasing its code under the Apache License.

3. Results and Discussion

3.1. Tool Design

Tool design can see in figure 1.

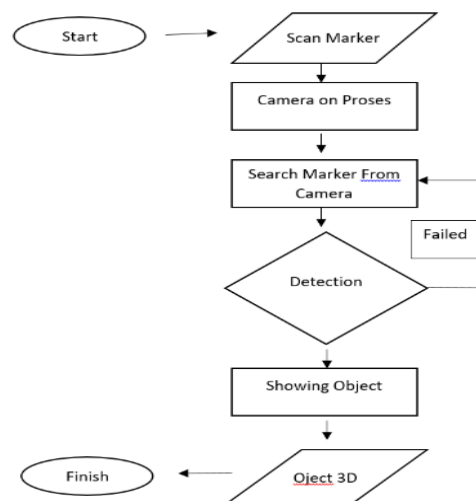


Figure 1. Tool Design.

3.2. Implementation and Unit Testing

3.2.1. Software Requirements Based on the Analysis Performed. The software needed in the development of the Augmented Reality Based Interactive Learning Module for this Basic Network Subject is as follows:

- Unity 3D and Vuforia as library software to develop applications.

3.2.2. Hardware Requirement. This application will be developed on laptops with the following specifications:

- 15.6 "HD (1366 x 768) Glossy with integrated camera
- 8GB DDR4 2133 MHz memory
- Intel® Core™ i7-3520M Processor CPU @ 2.90 GHz
- Android Smartphone with Android 5.1 Operating System Specification, 1.2GHz Eight Core Processor, 3.0 GB RAM

3.3. *Integration and System Testing*

The testing phase is the stage of testing to determine the application of the teaching module that has been made in accordance with the design and there is still an error or not. The purpose of this stage is to look for as many errors as possible before the unexpected during the manufacture until the application is complete

3.4. *Operation and Maintenance*

In this research, the maintenance phase is not done by the researcher because the researcher only makes prototype application only and has not set the application environment is operated.

4. **Discussion**

4.1. *Software Implementation*

Implementation of an Augmented Reality Interactive Learning Interactive software application for Basic Network Subjects consists of software implementation environments, software implementation constraints, implementation of software architecture, software process implementation, and implementation of software interface screens.

4.2. *Application implementation environment*

Application implementation environment of Augmented Reality Based Interactive Learning Module for Basic Network Subjects is done on the following software and hardware environment:

4.2.1. *Software Specification.*

In the software environment, the Augmented Reality-Based Interactive Learning Module application for Network Electrical Subjects runs on the following environments:

- Microsoft Windows 7 Professional Operating System.
- Android Smartphone operating system specification Android 5.1, 1.2GHz Eight Core Processor, 3.0 GB RAM
- Android Tools SDK.
- Vuforia Qualcomm Augmented Reality.
- Unity4.6.1

4.2.2. *Hardware Specification*

In the hardware environment, applications the Augmented Reality Based Interactive Learning Module for Basic Network Subjects runs on the following environments:

a) Computers

- 15.6 "HD (1366 x 768) Glossy with integrated camera
- 8GB DDR4 2133 MHz memory
- Intel® Core™ i7-3520M Processor CPU @ 2.90 GHz
- Equipped with input and output tools.

b) Android devices

- Smartphone OPPO F1S Selfie Expert
- Resolution 480 x 800 pixels, 5.0 inches.
- 1.2GHz Eight Core Processor, 3.0 GB RAM.
- RAM 3.0 GB.
- 8 MP primary camera

4.3. *Implementation of Markers (Markers)*

In accordance with functional model design which has been created, required markers placed in the teaching module to be tracked by a smartphone camera that already contained the Augmented Reality

application. The Augmented Reality Interactive Learning Module software uses a data base device that is ready-to-use bookmark images uploaded to official vuforia sites, then the marker image is processed into a Module AR. Unity package library file for download

4.4. Implementation Screen Software Interface

Implementation of software interface screen is implemented using the features contained in Unity 3D.

5. Conclusions

Interactive Based Trial Module Augmented Reality is an application that contains basic network learning materials in the form of augmented reality that displays 3D objects. Steps for making AR-based lab modules:

- Preparation of the application development environment in the form of hardware and software settings
- Creation of 3D models to be displayed
- Marker creation and configuration d) 3D model settings to be displayed AR in the AR library environment
- Testing

Support hardware and software in making AR-based mobile software needs to be considered carefully because error messages that appear often caused by problems support system.

References

- [1] Burdea G C and Coiffet P 1994 *Virtual reality technology* (London: Wiley-Interscience)
- [2] Bimber O and Raskar R 2005 *Spatial augmented reality: merging real and virtual worlds* CRC press
- [3] Kesim M and Ozarslan Y 2012 Augmented reality in education: current technologies and the potential for education *Procedia-Social and Behavioral Sciences* 47, 297-302.
- [4] Putra E Y, Wahyudi A K and Dumingan C 2016 A proposed combination of photogrammetry, Augmented Reality and Virtual Reality Headset for heritage visualisation *Informatics and Computing (ICIC), International Conference* 43-48
- [5] Utami I A A, Arthana I K R and Darmawiguna I G M 2015 Pengembangan Modul Ajar Interaktif Berbasis Augmented Reality Untuk Mata Pelajaran Jaringan Dasar Di Smk Negeri 3 Singaraja *KARMAPATI (Kumpulan Artikel Mahasiswa Pendidikan Teknik Informatika)* ISSN: 2252-9063 4 (5)
- [6] Azuma R T 1997 A survey of augmented reality *Presence: Teleoperators & Virtual Environments* 6 (4) 355-385
- [7] Hutahae R, Isnanto R R and Martono K T 2015 Perancangan Aplikasi Multimedia Untuk Pembelajaran Gerbang Logika Menggunakan Augmented Reality *Jurnal Teknologi dan Sistem Komputer* 3(1) 125-131
- [8] Nosrati, M., Karimi, R., & Hasanvand, H. A. (2012). Mobile computing: principles, devices and operating systems. *World Applied Programming*, 2(7), 399-408.