

Application of Augmented Reality as a Multimedia Learning Media: Case Study of Videography

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Abstract: The application of AR (augmented reality) is currently growing and adopted by various fields, including in the field of education. AR can be combined with conventional teaching materials such as books to provide more in-depth experience and understanding of the material to be conveyed. This research utilizes AR technology which is used in multimedia lecture teaching modules that discuss videography material. Testing by comparing the minimum distance and maximum distance on the marker printed on white paper and opaque paper. The results of the study found that teaching modules printed on white paper were better in AR tracking at a certain distance compared to modules printed on opaque paper. The similarity between markers with each other also makes the application display object incompatibility with the marker.

1 INTRODUCTION

Learning media is one of the factors that can improve the quality of education. The use of learning media can increase motivation and interest for students in the teaching and learning process. Integration between learning media and technology is busy nowadays. This is done with the aim of producing learning media that are more effective and efficient (Afdal et al., 2018; Amir, 2017).

Multimedia-based computer technology was later adopted to support interactive learning media. The technology is very effective for students to understand the material taught compared to conventional learning methods. This is in line with the standard learning process contained in the Government Regulation of the Republic of Indonesia number 19 in article 19 which reads: "The learning process in educational units is held interactively, inspiring, fun, challenging, motivating students to actively participate, and providing sufficient space for initiatives, creativity, and independence in accordance with the talents, interests, and physical and psychological development of students" (Hanan et al., 2018; Republik Indonesia, 2005).

One of the technological advancements that are widely adopted in today's learning media is Augmented Reality (AR). AR is a technology that allows virtual information generated by computers to be combined into a real environment. The presence of

AR can bridge between real and virtual in real-time. The application of AR is currently growing and adopted by various fields, including in the field of education. AR can be combined with conventional teaching materials such as books to provide more in-depth experience and understanding of the material to be conveyed (Jung and Dieck, 2018; Riyanto, 2015).

In this study, the author will use AR technology which is used in multimedia lecture teaching modules that discuss videography material. Videography material that is full of practices is not optimal if it only uses teaching materials in the form of text, so it is considered necessary to use AR as a media that can display material information in the form of videos. This is expected to help students to more easily digest lecture material using AR-based learning media (Wulansari et al., 2013).

2 RESEARCH METHODS

The method used in this study is the Multimedia Development Life Cycle (MDLC) method. The MDLC method is used to create AR-based learning material that uses multimedia content in the form of videos. This method consists of several phases, namely: Concept, Design, Material Collecting, Assembly, Testing, and Distribution. The following is a general description of MDLC in Figure 1.

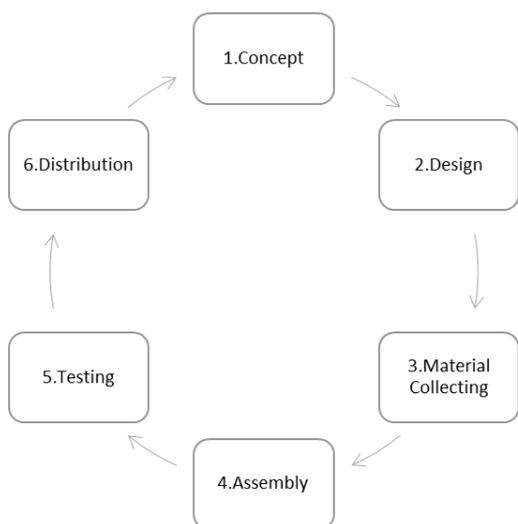


Figure 1: MDLC development model

The initial concept in this study was to develop a video-based augmented reality application as a supporter of learning about videography. At the design phase, a text-based teaching module will be designed that contains some teaching material on videography. After that, a marker is designed to refer to certain material. Each material each has 1 marker that will help the reader to use AR technology when scanning the marker that has been made (Azuma, 1997; Azuma et al., 2001).

At the material collection phase, a number of resources will be collected in designing teaching materials and making applications such as markers and videos supporting teaching materials. Furthermore, in this step, the application supporting materials will be processed. AR application development uses Unity and vuforia. The AR application will be used on mobile devices based on the Android operating system (Milgram et al., 1995).

Next is the testing phase using the camera of a mobile device with the Android operating system. The test is done by trying to scan the markers that have been made using white paper and opaque paper with various lighting conditions, and the distance whether the marker can display the video so that the use of AR can be well adopted in the teaching material. In the last phase, the distribution will be made instructions on the use of teaching materials along with the AR applications that have been made. Thus the teaching material can be used and utilized by those who want to use it.

3 RESULTS AND DISCUSSION

3.1 Concept

The concept in this study is to create an augmented reality application that is used in a text-based multimedia teaching material. The learning material chosen is about videography. The material used in this study is about the 8 basic movements of the camera in videography.

The concept of the 8 basic movements is explained through text in teaching materials, then the function of the augmented reality application designed is as an additional medium that will display video-based tutorials on the 8 basic movements of the camera. The following research concepts can be seen in Figure 2.

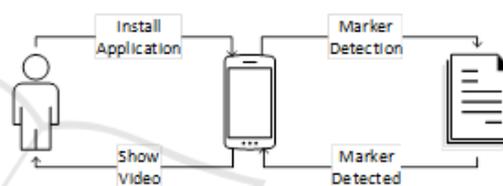


Figure 2: The concept of Augmented Reality developed

3.2 Design

Augmented reality application developed using Unity version 2018.2.11 which is integrated with Vuforia as a marker storage database. The application is designed later through a compiler (output) process with the output in the form of an .apk extension so that the application can be run on an Android device. Android devices that can run this augmented reality application with minimum specifications using Android 4.1 JellyBean and the maximum specifications of Android 8.0 Oreo.

For making augmented reality markers using the Adobe Photoshop CS 6 application. Markers are made using certain black and white letter combinations that aim to obtain a high contrast level with the aim of the marker being more easily recognized during application testing.

Next is making a simple teaching module about the basic techniques of videography. This teaching module is designed using the Microsoft word application. In this module a brief explanation of 8 types of basic camera movements for video capture is accompanied by examples of how to take through tutorial videos that will appear when scanned augmented reality markers use an Android device.

3.3 Material Collecting

The resources collected in this step are teaching modules along with video tutorials supporting learning materials basic techniques of camera movement on videography. The teaching module adopted in this research is based on journals and several websites that discuss basic shooting techniques in the science of videography.

After the teaching module is finished, the next step is to make a video tutorial related to the basic techniques of shooting on videography. Each of the techniques described will contain 1 tutorial video and 1 marker. The following examples of teaching materials and markers can be seen in Figure 3.



Figure 3: Teaching materials along with markers that will display the learning video tutorial when scanned

marker making technique is adopted at this phase by making markers based on the names of each camera movement technique. An example is in the discussion of zoom techniques, the word 'zoom' is used for making markers. When discussing the dolly technique, the word 'dolly' is used as a marker on the marker. In order for the marker to be easily recognized during the application experiment, the color combination used must produce a high degree of contrast. Simple colors that have high contrast are black and white. So that the color is chosen as the main color on the marker that will be made. Black will be the edge surrounding the marker, and will become the color of the word made. White is used as the background for the marker. Markers used in this study can be seen in figure 4.

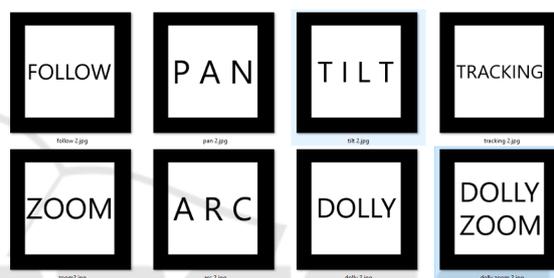


Figure 4: The marker that will be tested

3.4 Assembly

This research began by making teaching material about the basic techniques of camera movement in videography. Next, 8 simple modules are produced as teaching material. Then followed by making 8 markers. Last is to create an augmented reality application that is integrated with the teaching modules that have been created.

3.4.1 Production of Teaching Modules

The material presented in this teaching module only discusses the basic techniques of camera movement in discussions about videography. By collecting learning material from journals and websites, 8 teaching modules are produced representing eight camera movement techniques discussed in this module which include a discussion of techniques: zoom, tilt, dolly, dolly zoom, arc, follow, tracking and pan. The resulting document is created using the Microsoft Word application.

3.4.2 Markers Production

At this phase the author makes 8 markers using the Adobe Photoshop CS 6 application. The

3.4.3 Production of Augmented Reality Application

The phases of making augmented reality applications use 2 main tools, Vuforia engine and Unity. Vuforia engine functions as a database of marker storage that has been created. Unity functions as processing software that can process graphics, images, sounds, animations and so on. Unity is a cross platform software that can produce application output in various formats such as .exe, .apk, and so on.

In the first phase is registering 8 markers that have been made at Vuforia. After all the markers have been uploaded, a rating statement for each marker will appear. The rating is rated with a star with a maximum value of 5 stars and a minimum of 0 stars. If the marker gets a 5 star rating, it indicates that the marker is more easily detected. Conversely, if the rating is closer to 0, the more the marker will be more difficult to detect.

Of the 8 markers that have been uploaded to Vuforia, we got 7 markers with a rating of 4 stars and 1 marker that has a rating of 3 stars. The following is the appearance after the entire marker has been uploaded to Vuforia as can be seen in Figure 5.

| Target Name | Type | Rating |
|-------------|--------------|--------|
| zoom-2 | Single Image | ★★★★★ |
| tracking-2 | Single Image | ★★★★★ |
| tilt-2 | Single Image | ★★★★★ |
| pan-2 | Single Image | ★★★★★ |
| follow-2 | Single Image | ★★★★★ |
| dollyzoom-2 | Single Image | ★★★★★ |
| dolly-2 | Single Image | ★★★★★ |
| arc-2 | Single Image | ★★★★★ |

Figure 5: Display of the marker uploaded to Vuforia

The second phase is to make an augmented reality project using Unity. The project in this study as well as the name of the application produced is VideografiAR. The following picture of the project that has been made using Unity can be seen in Figure 6.

The project consists of 1 main scene called videografiar which contains 8 marker objects. In Figure 5.12 you can see the naming of objects based on the name of the marker preceded by the word 'ImageTarget' in front of it. Each object contains each marker along with the tutorial video which will then be displayed when the camera on the android device detects the marker.

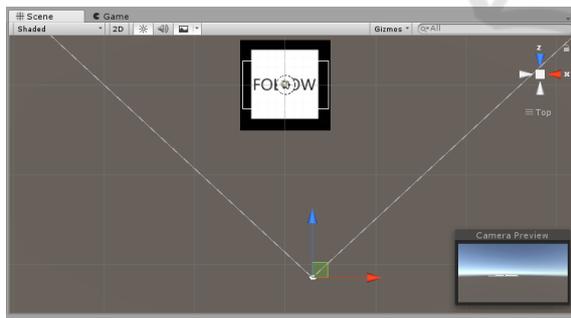


Figure 6: Display of the marker uploaded to Vuforia

After completing all objects in the main scene, the next is to do the build process. The build process is a process that will make a scene that has been made into an output in the form of an application with a certain format. In this project the selected build process is the Android platform. The following look of the build can be seen in Figure 7.

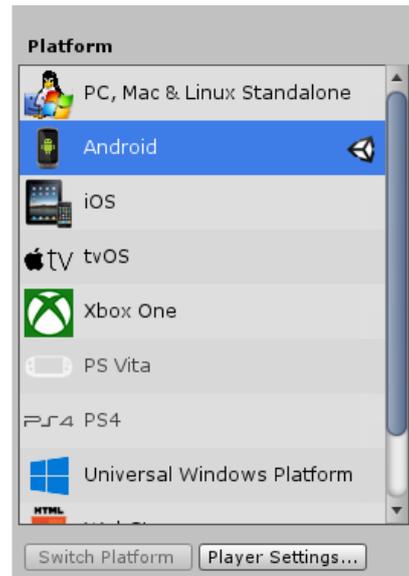


Figure 7: Build process in Unity

3.5 Testing

After the application creation process is complete, then the application is installed on an Android device to be tested. Android devices used in this trial are Samsung S7 Edge with the following specifications:

- Operating System: Android 8.0.0 Oreo
- Memory: 4GB RAM, Internal: 32GB
- Rear Camera: 12 MP

The test in this study uses 2 types of paper with different colors. The first paper is white HVS paper and the second paper is opaque paper with a darker color. All markers were printed on both types of paper, then tested how the minimum and maximum distance of the marker was successfully tracked using the augmented reality application. The following test documentation can be seen in Figure 8 and Figure 9.



Figure 8: Markers printed on white paper and opaque paper

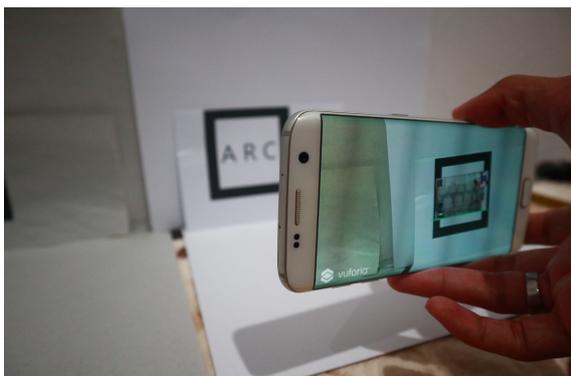


Figure 9: Markers detected using an android device and displaying a tutorial video

After testing, the following results from the test can be seen in table 1. From the test, it can be concluded that there is a difference in the farthest distance of the marker printed on white paper and opaque paper. Of the 8 markers tested, markers printed on white paper can be detected at distances greater than 5 to 10 cm compared to markers printed on opaque paper. For the detection of markers at the shortest distance on white paper and opaque paper each is at the same distance of 5cm.

Table 1: The marker detection test results using an Android device

| No | Marker Name | Marker Rating | White Paper | | Opaque Paper | |
|----|-------------|---------------|-------------------|-------------------|-------------------|-------------------|
| | | | Shortest Distance | Farthest Distance | Shortest Distance | Farthest Distance |
| 1 | Pan | 4 | 5 cm | 70 cm | 5 cm | 65 cm |
| 2 | Zoom | 4 | 5 cm | 90 cm | 5 cm | 85 cm |
| 3 | Tracking | 4 | 5 cm | 65 cm | 5 cm | 55 cm |
| 4 | Follow | 4 | 5 cm | 75 cm | 5 cm | 60 cm |
| 5 | Dolly | 4 | 5 cm | 85 cm | 5 cm | 80 cm |
| 6 | Tilt | 3 | 5 cm | 30 cm | 5 cm | 25 cm |
| 7 | Dolly Zoom | 4 | 5 cm | 90 cm | 5 cm | 85 cm |
| 8 | Arc | 4 | 5 cm | 85 cm | 5 cm | 70 cm |

All markers tested successfully displayed videography learning tutorial videos using the augmented reality VideographyAR application. Markers with a rating of 3 produce the farthest distance shorter than markers with a rating of 4. When tracking markers with a lower rating, the camera on an android device must be closer to the marker less than 30 cm.

Especially for markers with the name "Dolly Zoom" there is still confusion in displaying video content. The one that should appear is a dolly zoom videography technique tutorial video, but at the time of testing, several times the video tutorial on dolly videography and the zoom videography technique came along. This is because the marker with the name "Dolly Zoom" contains the word dolly and zoom

which is also used in the marker "Dolly" and "Zoom". So that when the marker design must be considered so that between markers with one another do not have similarities.

3.6 Distribution

After the testing is done, the next is the distribution process. At this stage, all teaching materials, applications with .apk format and procedures for using the application are stored in the same folder as VideografiAR. Then it is left to those who need augmented reality teaching materials in learning the basic techniques of videography.

4 CONCLUSION

The VideografiAR augmented reality application that has been developed successfully displays video learning tutorials to complete the videography learning module by utilizing markers embedded in the learning module. From the tests conducted Markers printed on white paper are better at tracking at a distance than markers printed on opaque paper. Another factor influencing marker tracking is the rating of the marker. The higher the marker's rating used, the further the range of marker tracking to display the learning tutorial video. In the design of markers it is better to avoid the same word / form, because it has the potential to cause tracking errors by the application, so the video tutorial displayed does not match the marker being tracked.

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