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UTILIZATION OF AUGMENTED REALITY TECHNOLOGY IN 3D VISUALIZATION OF HIGH SCHOOL OF ADISUTJIPTO TECHNOLOGY BASED ON ANDROID

Anggraini Kusumaningrum[1], Astika Ayuningtyas[2], Jodio Blasius Lopes[3]

Informatics Engineering Study Program
Adisutjipto College of Technology Yogyakarta
Jl. Janti, Blok-R, Lanud Adisutjipto Yogyakarta
anggraini@stta.ac.id[1], astika@stta.ac.id[2], lopesjodio@gmail.com[3]

Abstract

Adisutjipto College of Technology in introducing campus information that is still using print and internet media, therefore, an application is needed that can introduce and provide information on buildings on campus by utilizing Augmented Reality technology. With the technology of Augmented Reality able to provide real information and can interact directly with buildings on campus. This application was created using the Unity and Vuforia application. Making 3D models using the Google SketchUp application which is then exported to the Unity application. Testing is done to detect markers of light intensity, distance, marker size, and color. From the results of testing markers for light intensity of at least 4 lx and effective detection distance between 20 cm to 40 cm and marker size of at least 350 x 350 Pixels, while the color has no effect due to edge detection which is the basic technique of reading by Vuforia markers. This application has been successfully made in Augmented Reality in the form of STTA 3D visualization as a supporting medium for the introduction of the Adisutjipto College of Technology Yogyakarta environment. This application can only be run on Android-based smartphones with a minimum version of 5.0.

Keywords: Augmented Reality, marker, 3D, visualization, Android.

PRELIMINARY

Yogyakarta Adisutjipto College of Technology is one of the Private Colleges organized by the Yogyakarta Air Force's Adi Usaha Foundation located in Yogyakarta. Information about the campus is an important thing to provide understanding or information to the wider community about Yogyakarta Adisutjipto College of Technology. In terms of campus introduction activities, Adisutjipto Yogyakarta College of Technology uses internet media and brochures containing pictures and information about the campus. Of course, in this way it is felt that it is still less creative and innovative which could reduce interest or lack of information in terms of facilities for the community or prospective new students.

Information needs in the promotion media are still mostly using conventional methods and have not combined elements of modern technology. One form of technology that is developing now that can be used is Augmented Reality. Prabowo in his study entitled Design and Implementation of Augmented Reality as a Media for Housing Sales Promotion argues that Augmented reality is one of the technological developments that have been used lately in the field of interaction. The use of this technology will be very helpful in conveying information to users in different and more interesting ways [1]. Edward in his study entitled Augmented Reality Visualization of the Batam State Polytechnic Campus Using the Single Marker Method said Augmented Reality is a technology that combines virtual objects with 3 dimensions into a real environment and then projects the results of virtual objects, namely buildings, paths and signs. [2]. Maramis in his research entitled Augmented Reality on Android Applications to Show the Fatek Building said Augmented Reality is a new technology that is creative and is used to introduce something or also as a medium for learning. [3].

Augmented Reality can be applied to all senses, not only in visual form, but also

includes hearing, touch, and others. Information to be displayed by virtual objects can help users in carrying out activities in the real world [4]. In its use Augmented Reality requires a marker to trigger the emergence of virtual objects into the real world, namely a marker. Marker is a special marker that has a certain pattern so that when the camera detects Marker, 3- dimensional objects can be displayed [5].

Based on the above studies so that the appeal of the community increases, especially prospective new students, supporting media that is more interesting and informative is needed so a supporting media application is needed to introduce the Adisutjipto College of Technology building to an interactive society by utilizing Augmented Reality technology.

METHOD

The method used for visual design uses Unified Modeling Language (UML). Use case diagrams are modeling to illustrate the behavior of the system to be created. Use case diagrams represent an interaction between actors and systems that is very useful in determining the organizational structure and model of a system. Following Figure 1 is a use case of 3D STTA Building visualization application.
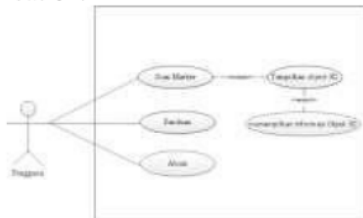

Figure 1. Use case STTA 3D Visualization Application Diagram

Sequence diagram scan marker is a diagram used to explain the flow of displaying 3D visualization of objects and information about 3D objects. The following Figure 2 is a sequence of scan marker sequences.

Figure 2. Scan Marker Sequence Diagram.

The design of the activity diagram of the marker marker explains the activity of the user performing the scanning process using the smartphone camera and the rendering results of 3D object visualization on the smartphone screen and displays information of each 3D object. Following Figure 3 shows the scan marker activity diagram menu.
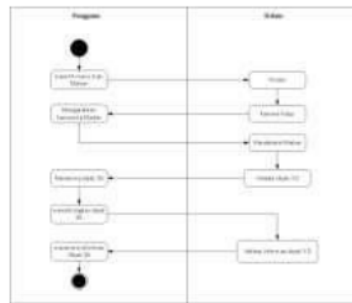

Figure 3. *Activity Diagram Scan Marker*

In designing 3D objects two things are done namely modeling and texturing. Modeling is done with references that have been collected previously, namely making 3D models of buildings according to their original shape. This modeling makes use of functions in the Google SketchUp application, among others, Rectangle or Line to make floors, walls, doors, windows, poles and roofs. Meanwhile, to make the thickness of the object using the Push / Pull function for example to make the thickness of the wall or floor. While texturing is giving color and material to the original 3D model so that the model's appearance becomes realistic. This texturing process utilizes colors or materials contained in the Google SkectUp application, for example, the use of colors on walls or poles, while materials such as on roofs, trees, floors, glass, roads and so forth.

RESULTS AND DISCUSSION

The results of research and discussion are applying and explaining the results of system design that has been made in the Unity application. Marker preparation is carried out to print images that were previously used as markers in the Vuforia database on paper media. This serves as a

place where 3D object rendering appears at the Adisujipto College of Technology building. Figure 4 is a picture of the print out marker.

Figure 4. Marker Preparation

The marker scan page is used to scan markers and as a place to display the rendering results of 3D objects, the Adisutjipto College of Technology building. In Figure 5 is the result of scanning on the marker that is rendering 3D objects of the Adisutjipto College of Technology Building.

Figure 12. Display of 3D Object Rendering Results

Marker testing is conducted to determine the things that affect the detection of markers, including testing markers of different sizes and colors, light intensity and distance of the smartphone camera that is effective for detecting markers. There are several pixel sizes of marker images used for testing, namely 500 x 500 px, 350 x 350 px and 100 x 100 px markers, each of which has a different color that is colored and black and white. For testing the intensity of the light used 3 pieces of electric lights with different light intensities, namely the intensity of non-bright light with a size of 4 lx intensity,

moderate light intensity with a measure of intensity of 22 lx and moderate light intensity with a measure of intensity of 34 lx measuring the intensity of light using an application Android Lux Light Meter. The test is carried out by installing the lamp at a height of 2 meters and with a minimum distance between the marker and the smartphone camera 10 cm and a maximum of 60 cm. successfully tested marker tests are marked with a check mark ($\sqrt{}$) and not successfully marked with a cross ($\times$). The following Table 1 results of tests that have been carried out.

Table 1. Marker Testing Results

Marker Size	Light Intensity (lx)	Marker Type							
		Colored Distance (cm)				Black White Distance (cm)			
		10	20	40	60	10	20	40	60
100 x 100 Pixel	4	×	×	×	×	×	×	×	×
	22	×	×	×	×	×	×	×	×
	34	×	×	×	×	×	×	×	×
350 x 350 Pixel	4	√	√	×	×	√	√	×	×
	22	√	√	×	×	√	√	×	×
	34	√	√	×	×	√	√	×	×
500 x 500 Pixel	4	√	√	√	×	√	√	√	×
	22	√	√	√	×	√	√	√	×
	34	√	√	√	×	√	√	√	×

Marker test results in Table 1 show the size of the marker 100 x 100 Pixels in color and black and white can not detect markers at all distances specified and all light intensities.

And in the marker measuring 350 x 350 Pixels in color and black and white markers can be detected at a distance of 10 cm and 20 cm and not detected at a distance of 40 cm and 60 cm in all light intensities. Whereas at the marker size of 500 x 500 Pixels detected at a distance of 10 cm, 20 cm, and 40 cm in all light intensities and not detected at a distance of 60 cm.

These results explain that the detection of markers is greatly affected by the size, intensity of the light and distance. The larger the size of a marker, the farther away the smartphone camera detects the marker and the smaller the marker size the closer the smartphone camera is to detecting the marker. Likewise in light intensity, the greater the size of the smartphone camera marker is able to detect a marker at a small light intensity, and the smaller the size of a smartphone camera marker cannot detect a marker at a small light intensity. Whereas the type of marker color is not very influential, this is due to edge detection which is the basic technique of marker reading by Vuforia.

CLOSING

Conclusion

Based on the results and discussion, the following conclusions can be drawn in this final report:

1. 3D Visualization Application Adisutjipto Yogyakarta High School Building Technology as a supporting media for introducing campus environment to the community by utilizing Augmented Reality technology in addition to using the website or campus brochures.
2. 3D Visualization Applications Yogyakarta Adisutjipto College of Technology Building at least runs on the Android operating system version 5.0.
3. The marker used is the logo of Yogyakarta Adisutjipto College of Technology.
4. Detection of markers is greatly affected by light intensity, distance

and size of the marker. From the test results markers for light intensity of at least 4 lx and effective detection distance between 20 cm to 40 cm. For marker size, the smaller the size of the marker, the smartphone camera is difficult to detect the marker so that the minimum size of the marker used is 350 x 350 Pixels. While the color on the marker does not really affect the detection process, this is due to edge detection which is the basic technique of reading the marker by Vuforia.

Suggestion

In this application there are still shortcomings and therefore there are some suggestions as material in further development which include:

1. The 3D objects presented are only the shape outside the Yogyakarta Adisutjipto College of Technology building, so it is hoped that in future developments it can display the inside of the building.
2. This application can only run on the Android operating system. It is expected that further application development can create applications that run on other operating systems such as iOS.

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