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Implementation of Ball Object Recognition Using Augmented Reality for Elementary School Level

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ABSTRACT

Technology is developing rapidly in this modern era. This fast-developing technology helps humans deal with various kinds of problems. One of the developing technologies is augmented reality. Augmented reality can solve the problem for someone who wants to see their designs appear in the real world. Not only that, augmented reality can also be built on Android using the multimedia application development method and can be built using the Unity 3D engine. In Unity the objects used can be made using a 3D blender and the Vuforia Engine for Augmented Reality, the objects used are basketballs and baseballs.

Keywords: Augmented Reality, Android, Multimedia, Vuforia, Unity 3D

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1. INTRODUCTION

Augmented reality (AR) is a technology that combines objects from the real world and virtual objects in real-time conditions. The combination of real and virtual objects occurs with the support of the right technology while the interaction that is carried out can occur using certain devices. AR is a variation of Virtual Environments (VE), or better known as Virtual Reality (VR). VR technology makes users join in a virtual environment as a whole. While Augmented reality technology is developing very quickly, in Indonesia itself there have been many applications that use AR technology[1].

In the development of today's era, augmented reality can also be used as a learning medium to explain the information received and also provide interaction in the learning process. Augmented reality has also been applied in devices used by many people such as on mobile phones[2].

This basketball and baseball object recognition application for children uses Augmented Reality technology, because using this technology, users can see objects in real three-dimensional (3D) form, compared to using other applications. Augmented Reality technology can be used as an alternative as a learning medium for children [3], in building object recognition applications and examples of objects for the application are basketball and baseball, this Augmented Reality technology can be used in a book or photo to introduce objects more realistically and as a learning medium for children [4].

2. LITERATURE REVIEW

2.1 Basketball

According to Sugito (2013) basketball is a branch of sport game that uses a ball, which can be passed or thrown to a friend. The ball is bounced on the floor in place or while walking and the goal is to put the basketball into the opponent's basket[5].

2.2 Kasti Ball

The game of kasti ball is a game played by two teams by throwing, catching, and hitting the kasti ball with a bat or flat stick. The ball used is a tennis ball. Thus, this game falls into the category of small ball sports [6].

2.3 Augmented Reality

Augmented Reality technology is an interactive technology that combines the real world and the virtual world (Martono, 2011). However, in contrast to virtual reality which combines real objects (users) into a virtual environment, augmented reality combines virtual objects in a real environment. The main advantage of Augmented Reality compared to virtual reality is that its development is easier and cheaper (Nugraha, 2014). Augmented Reality (AR)-based technology is widely used today, where this technology can add virtual objects, both 2-dimensional and 3-dimensional, into a real environment that is displayed in real time and simultaneously with the help of hardware, namely a camera [7].

2.4 Blender

A fairly popular open source application for processing computer graphics is Blender image, reinforcement, particle simulation, fluid and smoke simulation, animation can also be used for video editing and can even create games.

2.5 Unity 3D

Unity 3D is an engine for creating games that run on various platforms such as Windows, Linux, Mac OS, Android, iOS and even game consoles. Unity's capabilities are a very powerful engine for creating video games and editors have a simple interface for developers. This engine also supports various files to support the development of a game or application.

2.6 Vuforia

Vuforia can be used for application development in unity 3D. Vuforia sdk is a software for augmented reality development. Vuforia makes it easy to create augmented reality applications. Vuforia can recognize objects by tracking markers or target images that are stored in the Vuforia database. Image tracking uses vison computer technology in Vuforia.

2.7 Marker

Markerless is a technique in AR to display virtual objects using images or other techniques. The markerless technique used in this study is user-defined target. To use this technique, application developers can use the user-defined target class in Vuforia. The User Defined Target Building Behavior class is a class that generates a dataset from photos taken by users in real time (Lee & Choi, 2014). This technique was developed by Vuforia with the aim that users can determine the desired image as a target without having to define it first on the Vuforia website. With this facility, the AR that is developed is more flexible and easier for users. In marker identification, the camera will receive the object and acquire the image by refracting light in the reflection of the object through the camera lens [8].

3. RESEARCH METHODOLOGY

The method that will be used to develop this application uses the MDLC (Multimedia Development Life Cycle) methodology version of Luther - Sutopo which consists of 6 stages[9], namely concept, design, material collecting, assembly, and distribution.

3.1 Concept

The concept is a stage to determine the implementation objectives and initial descriptions and determine the users of this application with the objectives of the program being created.

3.2 Design

Design is a stage to create a design of the program that is created. The design that is created will include how the program works, navigation and design of the interface. The design that is created is the design of the program from the beginning to the end of the program.

3.3 Material Collection

Material collection is a stage in collecting materials for making a program. In material collection, materials can be taken from various sources and materials can also be made to meet the design requirements. Materials can be in the form of clip art, photos, animations, audio files, and even 3D models.

3.4 Assembly

Assembly is the stage for combining the materials that have already been made collect. Materials will be put together according to the concept and following the design plan. It can also be said that this stage is the program creation stage.

3.5 Testing

The Testing stage is the stage when the program creation status is complete. Testing begins when the program starts running. Testing will test the functionality from the beginning until the application is finished being used. Where testing will look for errors or bugs in the program and can be fixed immediately[10].

4. RESULTS AND DISCUSSION

4.1 Brief Description of the Application

This application is an android application that uses the implementation of augmented reality in its working method which will display a 3D model of a basketball and baseball by pointing the camera at a marker in the form of an image.

4.2 Concept

4.2.1 Users

The 3D model application of basketball and baseball will have users who want to see a 3D model of the ball.

4.2.2 Application Type

3D applications for basketball and baseball models have different types of applications runs on the Android operating system. This application also uses the internal camera its use.

4.2.3 Purpose of Creating the Application

The 3D ball model application aims to display a 3D ball model by implementing augmented reality technology that runs on Android.

4.2.4 Specifications

The 3D basketball and baseball model applications have the following specifications :

a. The model will appear when the camera is directed at the target image.
b. Making basketball and baseball models in blender software.
c. Android applications are made in unity software.
d. Augmented reality is made using the Vuforia sdk plugin in unity.

4.3 Design

The next step in developing a 3D sofa model application is design. Design is the step after the concept. Design aims to create a plan for how the application being created will work. The design will be created with a storyboard for each scene.

4.3.1 Storyboard

AR Page Scene

The AR page scene is an open page when opening the application. This page functions to display 3D models of basketball and baseball that use augmented reality technology that can be viewed using the camera on android.

4.3.2 User Interface Design

AR Page Interface Design.

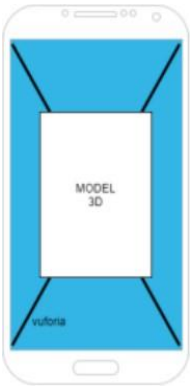

Figure 1
Scan AR Page

4.3.3 Application Flowchart

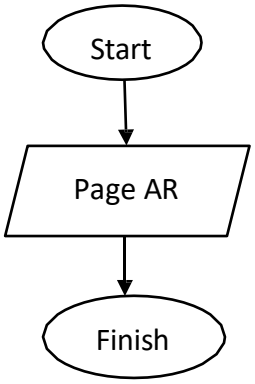

Figure 2
Flowchart

4.4 Material Collecting (Collection of Materials or Materials)

The next development of the 3D sofa model application is collecting materials.
This application will use materials that have been collected. The materials collected are in accordance with the concept that has been created. The materials collected are like 3D models of basketballs and baseballs.

4.4.1 Image elements and 3D models used in the 3D basketball and baseball model applications

Figure 3
Image elements and 3D models

4.5 Assembly

The AR page is the main page in the 3D basketball and baseball model application. This scene uses materials that have been collected in its creation.

Where the materials used are 3D basketball and baseball models and photos of basketball and baseball with QR as the target image. The 3D basketball and baseball objects will appear when the camera is pointed at the target image. Vuforia will display 3D basketball and baseball models that are united with the real world.

Here is a view of the application.

Figure 4
AR basketball and baseball

4.6 Testing

Testing will be done using the black box testing method. This method will test the functionality of the features in the 3D model application of basketball and baseball models.

Table 1
Test results using the blackbox testing method

No	Testing	Expected Result	Output Result	Test Result
1	Installing applications (.apk) on smartphones with Android operating systems	Application installed	Application successfully installed	Success
2	Run the application by clicking on the application that is already installed on the smartphone	Enter the application and display the AR page	Successfully entered the AR page	Success
3	Pointing the camera at the AR page on the tager	Showing a 3D ball object basketball and baseball	Successfully displaying a 3D ball object basketball and baseball	Success

5. CONCLUSION

Applications built by implementing augmented reality on android applications can solve problems by successfully displaying 3D models of basketball and baseball. Where application development uses 5 multimedia development life cycle (MDLC) methods. 3D models are created in the blender application. Applications are created in unity 3D using the vuforia engine for augmented reality.

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