Implementation of Augmented Reality for Introduction To Android Based Mammalian Animals Using The Marker Based Tracking Method

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Abstract – **Augmented Reality is a technology on 2-dimensional and 3-dimensional virtual objects that are combined into the real environment that is around us. With the ability of Augmented Reality that is able to change the atmosphere of children's learning that can be used as a medium of learning in the introduction of mammals for kindergarten children. This AR can provide interesting facilities such as displaying 3-dimensional objects of these mammals along with animal sounds and animations using Smartphones, so that children can interact and be more creative in recognizing these mammals, because children experience their golden age at the age of 4 to 7 years which is a time when children begin to receive stimuli, so that children will be faster to receive and catch on learning from the introduction of these mammals by using Augmented Reality Technology. The results of testing on the Vuforia plugin and making the AR application on Unity can provide a good information result, where the use of AR can bring up mammalian objects by pointing the Smartphone at the marker, so that all mammals can be recognized properly. This shows that children's interest around 85% in terms of UI/UX appearance, and 70% of children have no problems in running the Mammal Animal AR application.**
Keywords – *Augmented Reality, Education, Animals, Waterfall Method, Vuforia.*

I. INTRODUCTION

Technology today has developed rapidly in every field that utilizes technology. Technology is very useful if the technology is used for both formal and informal education. Information can make it easy for users, especially useful in multimedia applications that are easy to understand so that with an interesting application, children are easier to interact and easily capture a learning medium. The introduction of mammals can train the brain's power to imagine and stimulate children's brain abilities. Before using multimedia technology, so far children still used multimedia technology a lot. So far, children still use books in the introduction of animals. With the development of multimedia technology, it is very helpful to recognize several types of mammals. This technology is equipped with features that support such as the use of sound and three-dimensional object shapes, with the presence of supporting features, children will not be bored in learning so that children will know more fun and easily understood. Multimedia technology is an application developed using animated features such as 2D and 3D objects which can be known as Augmented Reality (AR). AR is a multimedia technology where a two-dimensional or three-dimensional virtual object is combined into a three-dimensional real-world form then projects a virtual object into real-time. As time goes by, today's technology allows the development of applications in various fields including educational media and entertainment media. This discussion will be raised in a literature study that can be interpreted as a step in obtaining information from the results of the research to be carried out, regardless of whether a study uses field or laboratory research..

II. LITERATURE REVIEW

A. Augmented Reality Definition

Augmented Reality research aims to develop technology that allows computers to the real world. Augmented Reality allows users to see two-dimensional or three-dimensional virtual objects projected in the real world. (Emerging Technologies of Augmented Reality: Interfaces and Design). This AR technology can insert certain information into the virtual world and display it in the real world with the help of equipment such as webcams, computers, Android phones, and special glasses.Users or users in the real world cannot see virtual objects with the naked eye, to identify the object an intermediary is needed in the form of a computer and a camera that will later insert virtual objects into the real world. Augmented Reality aims to take the real world as a basis by combining several virtual technologies and adding contextual data so that the understanding of humans as users becomes clearer. This contextual data can be in the form of audio commentary, location data, historical context, or in other forms.

B. Marker Definition

In making an AR, you must use a marker. A marker is a marker or image that can be detected by computer systems through video images in image processing, pattern recognition, and computer vision techniques. Once detected, an appropriate scale and pose for the camera will be defined. This approach is called marker-based tracking and is widely used in AR.

III. RESEARCH METHODOLOGY

The method used in this research is the Marker Based Tracking method. This application was developed using

Unity3D software, Blender, and additional plugins, namely the Vuforia SDK. At the testing stage, this application is carried out on smartphone devices with the Android operating system 8.1.0 Oreo. Augmented Reality for the introduction of mammals is a multimedia-based application developed on the Android platform that can make it easier for children at an early age or kindergarten students to recognize mammals with three-dimensional objects [1]. The flowchart diagram in this mammal recognition application has a flow procedure used in this application. The flowchart circuit in the application can be seen in Fig. 1 in the following.
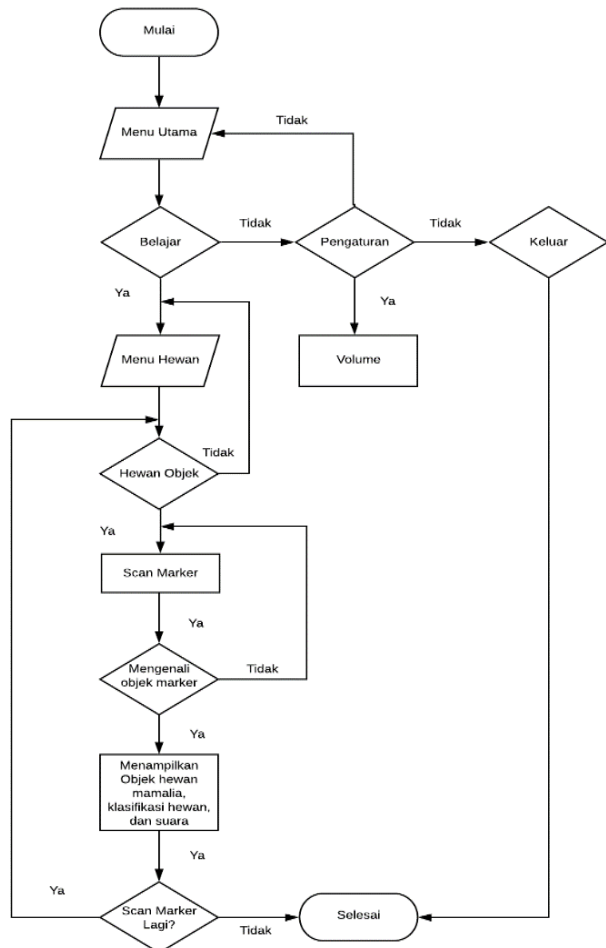

Figure. 1 Flowchart of Mammals Animal AR Application.

A. Marker Based Tracking Method

The method used in making this application uses a marker-based tracing method which can be developed on Augmented Reality technology. Using this method in its design in the form of an illustration in black and white with a square shape. The marker-based tracking method uses three main axes consisting of the X, Y, and Z axes which are the assistance of the coordinate points (0,0,0) and this method is a virtual detector in the 3-dimensional form [2]. To display an object using the marker-based tracking method, the thing that must be done to visualize is that the camera on a smartphone must be integrated into marker-based tracking which functions to display all objects and information on animals. The mechanism process in the marker-based tracking method can be seen in Figure 2. As follows.
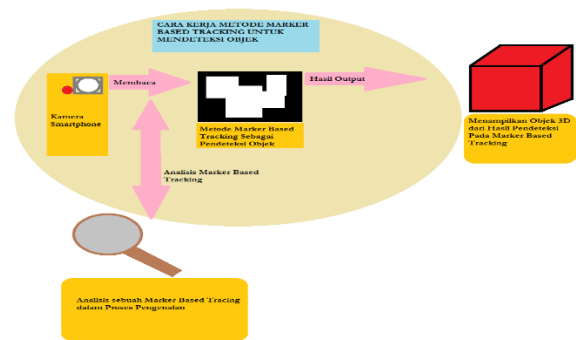

Figure. 2 How the Marker Based Tracking Method Works.

1. Smartphone Camera
The camera is a tool to help AR applications to read marker-based tracking which will later be displayed on the smartphone screen. By using a smartphone device on the camera, it can detect marker-based tracking in the vicinity of the object's environment.

2. Marker Based Tracking
Marker Based Tracking can be used as a marker to display the output results on objects according to the objects that have been created in the Vuforia plugin. The marker will be read if the camera on the smartphone can integrate with the marker.

3. Marker Analysis
An analysis of a marker is a 3D object and information that will display the output on the smartphone screen when the marker is recognized. This marker analysis stage is in the form of 3D objects in mammals along with information.

4. Displaying Object Results
This stage is the final result of the process of working on marker-based tracking, where after the marker is read by a smartphone camera, the marker will issue 3D objects and information on mammals [9].

B. Augmented Reality

Augmented Reality is a technology created with multimedia capabilities so that it can be applied with objects in the form of 2D and 3D animation into the real world with locations that have been detected using markers. AR technology with VR each still has different characteristics, such as AR which has the characteristics of displaying a 2D or 3D object into the real world by reading a marker that has become the intended location, while in VR it has the characteristics to change the atmosphere of the world. real into a virtual object using VR glasses that can change the lens to appear as if it exists in a virtual world. Augmented Reality can simplify real-world objects with virtual objects so that information is not only for users directly. The ability of a device to perform track is divided into 2 parts, namely marker tracking, and markerless tracking. Marker Tracking is an image or object that is ready to use and is set in position when the 3D object exists. Meanwhile, Markerless Tracking is a programmable system that can be used to detect several color objects and objects with predetermined patterns. With Markerless Tracking capabilities, objects can be displayed into the markerless by detecting an object colored like red. This

ability in markerless tracking can only look for red objects, once found, the object will display a red visual object.

Figure. 3   Sample image on Marker Tracking

Gambar. 4   Example image on Markerless Tracking

C. Mammals

In this AR application, there are major developments in mammal animal objects, each of which there is 10 types of mammal animal objects that can be displayed through detection with Marker Tracking. The following names of mammals and pictures of objects in Table I.

Table I. Mammals name and animal object image

No.	Animal Name	Animal Object Image
1	Camel	 Figure. 5 Camel Animal Object.
2	Elephant	 Figure. 6 Elephant Animal Object.
3	Lion	 Figure. 7 Lion Animal Object.
4	Dog	 Figure. 8 Dog Animal Object.
5	Bear	 Figure. 9 Bear Animal Object.
6	Jaguar	 Figure. 10 Jaguar Animal Object.
7	Cat	 Figure. 11 Cat Animal Object.
8	Giraffe	 Figure. 12 Giraffe Animal Object.
9	Rabbit	 Figure. 13 Rabbit Animal Object.
10	Sheep	 Figure. 14 Sheep Animal Object.

D. Unity3D

The software is a cross-platform based game engine software. In this game development software, it can be used to create a game that can be run on every device such as Android, iPhone, PS3, X-Box, and Computer. Apart from game development, Unity is also able to create architectural simulations on buildings, buildings, and parks. In making games on Unity, of course, you have to use a special plugin to be integrated with a developer. In making Augmented Reality in development, of course, what must be used is to use additional plugins such as Vuforia, where Vuforia's job is to recognize a 3D image object so that it can be displayed via a marker, and the results will be visible in real-time.

IV.   RESULTS AND DISCUSSION
A. Results and Discussion of Applications

The results and discussion here discuss the Marker Tracking used in the application and several displays of mammal animal objects for animal recognition for children. In the AR application has a display and buttons that serve to direct the user to use the application which includes:

1. Splashscreen display

Splashscreen display is the initial part when opening the Augmented Reality Application to Recognize Mammals. Before entering the Main Menu page, this application will first display the page on Splashscreen as shown. 15.

Figure. 15 Splashscreen display.

2. Main Menu Display

The Main Menu view is a display that functions to run applications that can make it easier for users when they want to go to certain destinations in the application as shown in Figure. 16.

Figure. 16 Main Menu DIsplay.

3. Setting Display

The Settings view is a display that will set the main sound in this application so that users can adjust the main sound according to user convenience, as shown in Figure. 17.

Figure. 17 Settomg Display.

4. Display Menu Options on Animals

The menu options display in Animals aims to select objects in mammals, so users are free to select the menu on the animal they want to run first, as shown in Figure. 18.
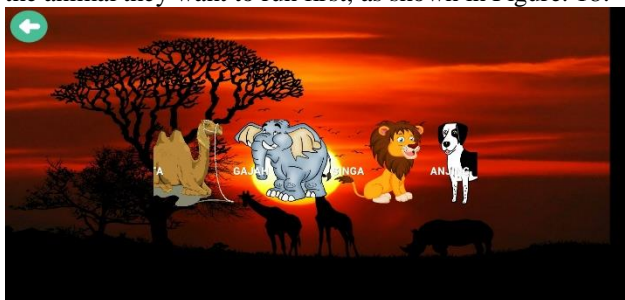

Figure. 18 Display of Menu Options on Animals.

5. AR Detection Display with Camera

AR Detection Display with Camera is the main display in this application, which aims to display a mammal animal object in the application. Before displaying mammal objects, this application displays a message for the Please Scan Marker first, therefore the user must set up a marker tracker to read each of these objects, as in Figure. 19.
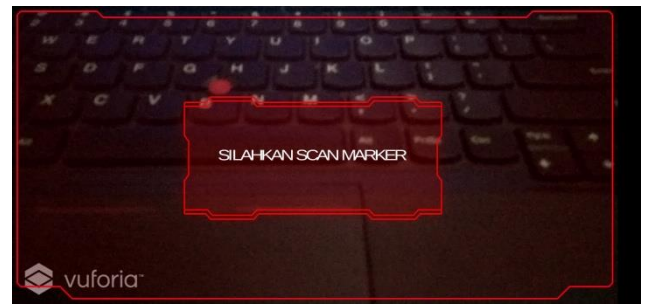

Figure. 19 AR Detection Display with Camera.

6. Display Objects in Animals

The display of objects on animals is a display where if the marker has been read by the system in this application, then the marker will display a 3D object in mammals such as the elephant animal in the image. 20.


Picture. 20 Views of Objects on Animals.

B. Results of Capability Tests on Smartphone Devices

Results and discussion in conducting the testing phase which aims to measure the level of ability on a Smartphone in detecting marker tracking. Testing in this application with a 15x7 room and the help of sunlight in the detection of marker tracking, as in Figure 21 and Figure 22.

Picture. 21 Display the Smartpone Device's ability to detect marker tracking.
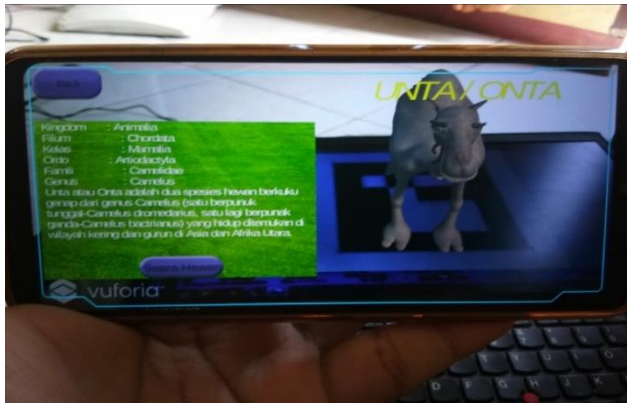
Picture. 22 Display the ability of a Smartphone Device in displaying objects in marker tracking.

### C. Testing Results of Children's Interest in AR Applications

Results and discussion in testing children's interest in the home environment. This study provides an assessment and analysis of the questionnaire given to 16 children around the home environment. The following are 5 summaries of the questionnaire questions distributed through Google Form regarding the results of the analysis:

1. Is the design in terms of the appearance of the AR application attractive? Figure 23 shows the evidence of the results of the analysis from the questionnaire in question No. 1.
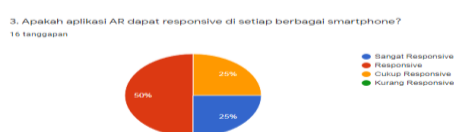

Picture. 23 The results of the questionnaire analysis on question No. 1.

2. Are there any drawbacks to the AR application? Figure 24 shows the evidence of the results of the analysis from the questionnaire in question No. 2.
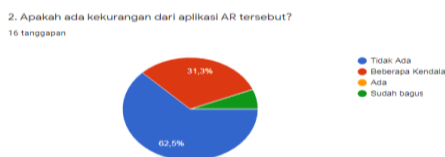
Picture. 24 The results of the questionnaire analysis on question No. 2.

3. Can the AR application be responsive to every smartphone? Figure 25 shows the evidence of the results of the analysis from the questionnaire in question No. 3.

Picture. 25 The results of the questionnaire analysis on question No. 3.

4. Can the AR application help children recognize mammals? Figure 26 shows the proof of the results of the analysis of the questionnaire in question No. 4.

Picture. 26 The results of the questionnaire analysis on question No. 4

5. Will the AR application be used again as a learning medium for children? Figure 27 shows the evidence of the results of the analysis from the questionnaire on question No. 5.

Picture. 27 Results of the questionnaire analysis of question No. 5.

V. CLOSING

Based on research and testing on the AR application, it can be concluded as follows:

- Three-dimensional objects in animals using the Blender application are good. Objects can move in rotation and can be precisely zoom
- Marker detection provided by the Vuforia plugin is excellent. Each object in mammals corresponds to the markers that have been scanned
- Each mammal animal object, each animal is equipped with a sound that is able to recognize animal sounds

After analyzing the entirety of this journal, some suggestions that I can present are as follows:

- For further development, this application can complement the introduction of animals to animal body parts
- Adding information in the form of animation on body parts of mammals
- Development in this application can be developed using Artificial Intelligent for adjustments in the form of objects

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JISA (Jurnal Informatika dan Sains) (e-ISSN: 2614-8404) is published by Program Studi Teknik Informatika, Universitas Trilogi
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2, April 2019, p-ISSN : 2460-3562 / e-ISSN : 2620-8989

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