

APPLICATION OF ZOO AR PHOTO SERVICE WITH ANIMALS BASED ON AUGMENTED REALITY AND LEAP MOTION TECHNOLOGY

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ABSTRACT

The purpose of this research is to describe the use of augmented reality and leap motion technology as a media to help and make it easy for visitors in taking photos and interacting with animals in Bandung zoo. The data that used in this research are the data which was taken in Bandung zoo by giving questionnaires to visitors, doing interview with a zoo officer, observation, and literature studies to support the theory that can solve the problem. The problem that arises in Bandung zoo is the difficulty of visitors for taking a picture with animals because there are wild animals and sick animals. Based on the problem, there is one of the solution to help and make it easy for visitors in taking photos and interacting with animals in Bandung zoo is by apply Augmented Reality and Leap Motion technology using the marker based on tracking method. Based on the results of the questionnaire to visitors and interview with an officer, it can be concluded that the applications which had been built are in accordance with user needs such as this application can help an officer and make it easy for visitors to take a picture and interact with animals in Bandung Zoo.

Keywords: Augmented Reality, Leap Motion, Marker, Bandung Zoo, Photo Service

1. INTRODUCTION

1.1. Research Background

Bandung Zoo is one of the flora and fauna attractions that is located at zoo road number 6, Lebak Siliwangi, Coblong, Bandung and is located right beside the Bandung Institute of Technology Campus. Founded in 1930 by Bandung Zoological Park, Bandung zoo stands on a wavy topography with a land area of nearly 14 ha.

In Bandung Zoo, there are around 800 species of animals in total, consisting of classes of mammals, aves, reptiles, and fish. This is what makes Bandung Zoo as an educational tour for tourists, especially for children to get to know the types of animals that exist and take photos as memorable moment. Photo activity is an activity that is mostly carried out by tourists, especially children.

Based on observations and interviews conducted in Bandung Zoo on October 15, 2018 together with Mr. drh. Dedi Trisasongko who served

as Head of Health and Research in Bandung Zoo, that the Bandung Zoo has not provided many photo services with animals due to several factors. Different with Taman Safari II, which is located in Pasuruan, East Java, which has many photo session services with animals and has been well organized. The reason that the Bandung Zoo does not provide many photo services is one of the factors of the animal itself. There are wild animals that cannot be approached by children and group photos. These wild animals are dangerous if children try to interact directly.

Another thing that has made the unavailability of many photo services in Bandung Zoo is the condition of sick animals. Diseased animals can make children unable to interact directly and take photos together. Diseased animals can endanger children because the exposure they cause may interfere with children's health problems as well.

Based on the results of the questionnaire given to 30 respondents who were in Bandung Zoo, that 73% of tourists knew of animals and 27% of tourists did not know animals. As many as 67% of tourists like animals but cannot take pictures together because there are not many photo services together in Bandung Zoo. The difficulty of tourists to be able to take pictures together with animals make tourists unable to get closer to the animals. And as much as 33% of tourists don't like animals because they are afraid and make these tourists increasingly unable to get to know animals more closely.

Based on the background that has been described, the proposed application of photo services with animals in Bandung Zoo as an alternative for tourists, especially children to get to know animals more closely. The proposed application is a photo-shaped application that uses augmented reality technology to display animals in real-time in three-dimensional forms [9]. Meanwhile, leap motion technology is used for interacting with animals [10]. This application is made on a desktop basis. Therefore, it is proposed the zoo AR photo service with animals based on augmented reality and using leap motion technology.

1.2. Purpose and Objectives

The purpose of this research is to build an application zoo AR photo service with animals based on augmented reality and leap motion technology. While the objectives to be achieved from this research are as follows:

1. Providing photo services with animals in Bandung Zoo.
2. Make it easy for tourists to interact and take photos with wild animals and sick animals in Bandung Zoo.
3. Make it easy for tourists to get to know more closely with animals in Bandung Zoo.

2. RESEARCH CONTENT

2.1. Augmented Reality

Augmented Reality (AR) is an environment that input 2D or 3D virtual objects into a real environment. AR allows users to interact in real-time with the system. The use of AR today has expanded to various aspects of our lives and projected to experience very significant developments. This is because the use of AR is very interesting and easy to use for doing things, for example in marketing strategies and product introduction to consumers [16].

2.2. Kind of Augmented Reality

Based on the marker, augmented reality is divided into two types, namely:

1. Marker-based Augmented Reality is a sign or identifier that will be identified or identified by the augmented reality device through the camera. This introduction and identification is used to add virtual objects to the real environment.
2. Markerless Augmented Reality is different from marker-based augmented reality, this markerless method does not require a sign or identifier to display virtual objects. Some types of markerless augmented reality examples are face tracking, 3D object tracking, motion tracking, and GPS based tracking.

2.3. Leap Motion

Leap Motion (Hand Motion Tracking) is a term for recording hand movements used as digital models and it is an additional device that can be connected to a computer and can be used to replace both mouse and keyboard functions. The function of the tool called leap motion, can help users control or replace the mouse and keyboard tasks on the computer only with hand and finger movements [10].

2.4. Inteface App Program of Leap Motion

Leap motion has an application program interface which is divided into two, namely:

1. Native Application Interfaces are provided through dynamically loaded libraries. This library provides a link between leap motion and provides tracking data for the application that has created. Libraries using C++ and Objective-C applications, or through one language binding are provided for Java, C#, and Python.
2. The WebSocket interface as a leap motion service that is run through WebSocket can be accessed using domain localhost through port 6437. The WebSocket interface provides tracking data in the

form of JSON messages. A Javascript client library is provided to retrieve JSON messages and present tracking data as ordinary Javascript objects.

2.5. Discussion

Problem analysis is a step carried out to temporarily examine the causes of problems that occur in a research. The problem analysis in this research as follows:

1. Bandung Zoo which has less than 800 species of animals still does not provide many photo services with animals.
2. It is difficult for tourists, especially children to take pictures with animals because there are wild animals that cannot be approached directly and cannot interact because there are sick animals that cannot be approached in Bandung Zoo.
3. The difficulty of tourists to carry out activities with several animals make tourists unable to get to know animals more closely in Bandung Zoo.

2.6. Architecture System

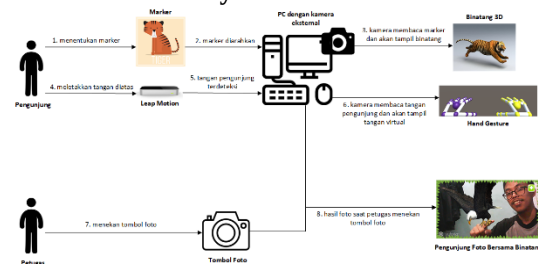


Figure 1. System Architecture

This is a description of the system architecture that will be built:

1. Visitors determine what animal markers they want to display. There are 4 markers that can be used, there are tigers, bears, eagles and elephants.
2. Markers are directed at the camera to display animals on a laptop or PC screen.
3. The camera reads the marker and the animal will appear on the screen.
4. Visitors put hands on leap motion to interact with animals.
5. The officer presses the photo button for visitors to take photos with animals.
6. The photo button will trigger capture and visitors can see the results of the photo with the animal.

2.7. Analysis of Augmented Reality

2.7.1. Marker Based Tracking Method

Making an augmented reality uses several methods, one of them is marker based tracking. By default, markers do use a black frame with a pattern in the center of the frame, but in its development, the marker does not have to be black and white. The zoo AR photo service with animals uses markers with colored concepts to bring up 3D objects. The computer will know the position of the marker and make it into a virtual 3D form at the point (0, 0, 0) and 3 axes namely X, Y, and Z. The marker will be

recorded through the camera in realtime. Then the marker is used to recognize the object to be added. The added object will be processed using a computer and webcam which are displayed on the screen through the introduction of a marker.



Figure 2. Marker Based Tracking Flow Method

2.7.2. Using Vuforia Library

The stages of an image will be used as a marker that uses the vuforia library as a supporter to create augmented reality and Unity3D applications as an integrated development environment. Basically vuforia has provided tools as feature initialization on markers named target manager system. The functions are to provide features and ratings on images that are used as markers.

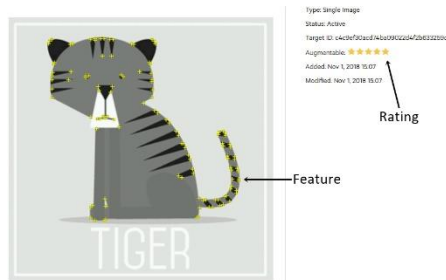


Figure 3. Feature and Rating Result

2.8. Analysis of Marker

In the stages of the process of developing technology-based augmented reality applications, a marker is needed for the application process. As for the way in making it by determining the sample image that you want to make as a marker. In this case the image sample used as a marker is an animal with the format .jpg.



Figure 4. Sample Marker Used

2.9. Analysis of Leap Motion

2.9.1. Leap Motion Controller

This device has a large interaction space with eight cubic feet, which takes an inverted pyramid shape or intersects the field of view of a binocular camera. This range is limited by the propagation of LED light through space, because it becomes much more difficult to deduce the position of the hand in 3D from outside a certain distance. The intensity of the LED lights is limited by the maximum current that can be pulled through a USB connection.



Figure 5. LED of Leap Motion Controller

2.10. Analysis of 3D Model

Analysis of 3D model is an analysis of 3D objects that will be used. This aims to maintain the level of similarity of the animation model that will be made with the actual model. Comparison of real models with 3D models is a reference in making 3D models so as not to deviate from the original model. In this animal recognition application there are 4 animals to be modeled, there are tigers, bears, eagles and elephants.

Table 1. Comparison Between Real and 3D Model

No	Models Name	Real Model	3D Model
1	Tiger		
2	Bear		
3	Eagle		
4	Elephant		

2.11. Analysis of Room Layout

Analysis of room layout is an analysis that describes the layout of the room for visitors to be able to take pictures with animals. The room layout serves to make it easier for visitors to take pictures with animals.

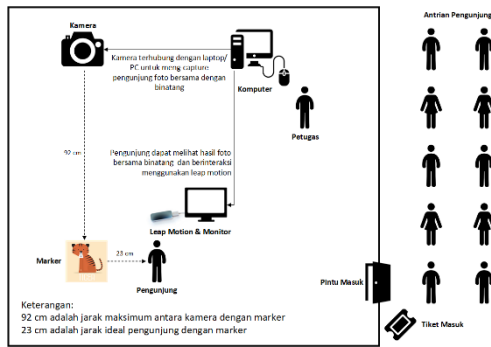


Figure 6. Room Layout

This is the process of visitors that be able to take pictures with animals:

1. Visitors queue at the entrance to buy tickets.
2. After visitors buy a ticket, visitors can wait outside in the photo booth.
3. The clerk calls the visitor that has been queue to enter the photo booth room.
4. Visitors provide entrance tickets to officer.
5. Visitors come to the photo provided and can take pictures with animals.
6. Visitors can interact with animals using leap motion.
7. The officer will press the photo button after the visitor is ready to take a photo with the animal.
8. Visitors can view the photos with animals.

2.12. Use Case Diagram

Use Case Diagrams are used to describe the functional requirements of the system to be built. Use cases describe interactions that occur between one actor or more with the system created, a use case is represented by a simple sequence of steps. Use case diagrams are used to recognize functions that are in the system and have the right to use these functions. What is preferred in this diagram is what the system does, not how the system does it.

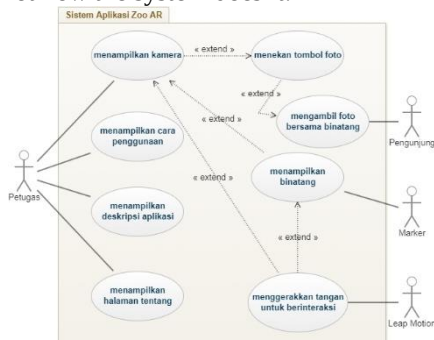


Figure 7. Use Case Diagram

2.13. Application Implementation

The zoo AR photo service with animals based on augmented reality and leap motion technology is a kind of photo service application in general. This application requires an installation process on a laptop or computer device. Users must have the ZooAR.exe file or open the Unity3D project file from the ZooAR application. After the application has

installed, the user can combine the additional tools, namely leap motion.

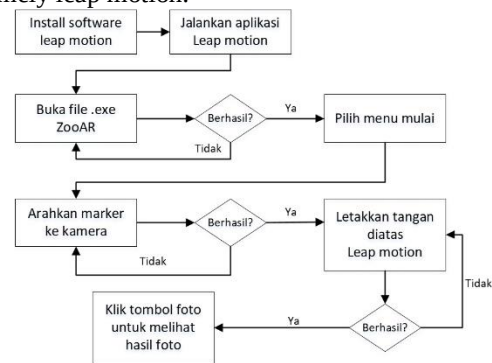


Figure 8. Application Implementation

This is the connection of the application implementation flow built:

1. Install software of leap motion.
2. Run the leap motion application.
3. Open the ZooAR application project file or executable file.
4. Select the start menu to enter the camera.
5. When the camera menu appears, point the marker to the camera.
6. When 3D animal objects appear, place your hands on leap motion to interact with animals.
7. Click the photo button to view the photos together with the animals.

2.14. Interface Implementation

The interface implementation carried out on the zoo AR application of photo services with animals based on augmented reality and leap motion technology consists of several views. The following are some interface displays that have been implemented.



Figure 9. Interface of Main Menu

The main menu interface is the initial display when the application starts. There are several menu in it, such as the camera menu, how to use page, application description page and about page.



Figure 10. Interface of How to Use Menu

The interface to the usage page is a page that will be displayed when the user presses the button to use. The page usage method describes how users can use the application.



Figure 11. Interface of Description Menu

The interface of the application description page is a page that will be displayed when the user presses the description button. The page description of the application description explains the description of the zoo AR photo service application with animals based on augmented reality and leap motion technology.

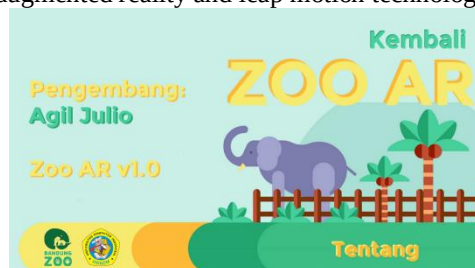


Figure 12. Interface of About Menu

The page interface is a page that will be displayed when the user presses the button about. The page views about explaining who the developer and version of the zoo AR application are photo services with animals based on augmented reality and leap motion technology and the name of the research location, the name of the agency.



Figure 13. Interface of Camera Menu

The camera menu interface is a display that will be displayed when the user presses the button starting at the main menu display. Display in the camera menu can access the camera to use augmented reality and leap motion technology.

2.15. System Testing

Tests are conducted with the aim of finding errors and deficiencies in the software being tested. The test is intended to find out whether the software is made whether it meets the criteria according to the purpose of software design. Alpha testing is done by black box testing techniques that focus more on finding program errors functionally. Whereas in beta testing carried out directly to respondents by

conducting interviews, questionnaires and observations on the user of the application that was built.

2.16. Alpha Testing

Table 2. Augmented Reality Testing

Case dan result testing (normal data)			
Data Input	Expected	Observation	Conclusion
Distance of 30 cm	Showing the display of augmented reality in the form of visualizing 3D animal objects	Virtual 3D animal objects appear on the application screen	Approved
Size images A4			Approved
Full color			Approved
The light is bright			Approved

3. CLOSING

3.1. Conclusion

The conclusion of the thesis research entitled: "Zoo AR Application Photo Services with Animals Based on Augmented Reality and Leap Motion Technology" are as follows:

1. Bandung Zoo has provided photo services through the zoo AR application with animal photo services based on augmented reality and leap motion technology.
2. This application can make it easier for tourists to interact and take photos with wild animals and sick animals.
3. This application can make it easier for tourists to get to know more closely with animals in Bandung Zoo.

3.2. Suggestion

The zoo AR photo service with animals in Bandung Zoo is far from perfect and still has many lack. Therefore it is necessary to develop and improve efforts so that this application can be even better. The suggestions for this application to run more optimally and attractively are as follows:

1. Develop the zoo AR photo service with animals by adding kinect to detect cameras and gestures simultaneously.
2. Develop markerless methods to facilitate the process of taking photos with animals.
3. Developing cross-platform applications for Android.

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