Application Mobile-Based Augmented Reality for Endemic Animals of Central Kalimantan

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Abstract

The existence of endemic animals typical of Central Kalimantan, such as orangutans and hornbills, is included in the protected species situation because the population numbers have increased slightly along with the clearing of land for the plantation sector, making orangutan and hornbill areas that should be beautiful and natural disappear. Because of this, a medium for conveying information and a unique introduction to the public is needed to know how important it is to know and know the various endangered species in Central Kalimantan to preserve animals. Therefore, this research aims to create an application for Central Kalimantan endemic animals using Mobile-based Augmented Reality to introduce Central Kalimantan's rare animals, starting from the area of residence, characteristics, leading food, and information about animal habitats. The application development process uses the Markerless Augmented Reality (AR) method, which displays 3D objects without using unique markers such as photos or images. The application development stage includes the planning, design, data collection, 3D object creation, application development and application testing using Blackbox testing with the Text Case method, which produces application testing descriptively explaining the application work process. The application for displaying 3D objects was tested in 5 trials, with an average of 5 seconds, and the marker appeared to display 3D objects. This application can have an impact on progress in the field of informatics as a medium for delivering information and learning media using Augmented Reality Markerless.

Keywords: Mobile Apps; Endangered Animals; Augmented Reality; Vuforia SDK; Unity 3D

Abstrak

Keberadaan satwa endemik khas Kalimantan Tengah seperti orang utan dan burung enggang masuk ke dalam situasi satwa dilindungi sebab jumlah populasi yang bertambah sedikit disertai dengan pembukaan lahan sebagai sektor perkebunan membuat wilayah orang utan dan burung enggang yang seharusnya asri dan alami menghilang. Oleh karena ini diperlukan media penyampaian informasi maupun pengenalan khusus kepada masyarakat untuk mengetahui betapa pentingnya untuk mengenal dan mengetahui berbagai satwa langka yang dimiliki Kalimantan Tengah demi menjaga kelestarian satwa. Maka oleh karena itu penelitian ini bertujuan untuk menciptakan sebuah aplikasi satwa endemik Kalimantan Tengah menggunakan Augmented Reality berbasis Mobile untuk memperkenalkan satwa-satwa langka khas Kalimantan Tengah. Mulai dari daerah tempat tinggal, ciri-ciri, makanan utama, dan informasi mengenai habitat satwaProses pengembangan aplikasi menggunakan metode Augmented Reality (AR) Markerless yang merupakan teknik menampilkan objek 3D tanpa menggunakan marker khusus seperti foto atau gambar. Dalam tahapan pengembangan aplikasi ini memuat tahap perencanaan, perancangan, pengumpulan data, pembuatan objek 3D, tahap pembuatan aplikasi dan pengujian aplikasi menggunakan pengujian Blackbox dengan metode Text Case yang menghasilkan pengujian aplikasi secara deskriptif menjelaskan proses kerja aplikasi. Pengujian aplikasi menampilan objek 3D dilakukan 5 kali uji coba yang rata-rata dalam 5 detik marker muncul untuk menampilkan objek 3D. Aplikasi ini dapat memberikan dampak kemajuan dalam bidang ilmu informatika sebagai media penyampaian informasi dan media pembelajaran dengan menggunakan Augmented Reality Markerless.

Kata kunci: Aplikasi Mobile; Satwa langka; Augmented Reality; Vuforia SDK; Unity 3D

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INTRODUCTION

Central Kalimantan province has a large distribution of endemic fauna compared to other regions such as East Kalimantan, South Kalimantan, North Kalimantan, and West Kalimantan. Central Kalimantan has a large area, so it has a wide variety of endemic animals (Rizal et al.,2020). For example, there are endemic animals such as orangutans, hornbills, bobcats, honey bears, gibbons, and slow lorises. However, the existence of this endemic animal is an endangered situation.

The scarcity of endemic fauna in Central Kalimantan is caused by several factors, such as mass logging, the distribution of development of residential areas, and poaching (Budiaman & Audia, 2022). The destruction of ecosystems and natural habitats of wildlife reduces their growth drastically, thus bringing disaster to the preservation of these endemic animals (Aristides et al., 2016).

Because of this, researchers want to create an application that can introduce endangered endemic animals of Central Kalimantan, using markerless-based augmented reality technology in the application. Users efficiently operate the application using only the smartphone camera (Sakulwichitsintu, 2023). The availability of unique markers will help users operate this application, which will then display data on the animals' characteristics and-dimensional (3D) images (Indarti & Laraswati, 2020).

This application can be accessed mobile via each smartphone. So it can be ascertained that everyone with a smartphone can try running this application. This application is intended for the general public, especially early childhood (Novaliendry et al., 2022).

There are several research results conducted by previous researchers with fields and themes similar to research on designing applications for endemic animals in Central Kalimantan using mobile-based augmented reality, which is used as input material described as follows.

Research by (Meilin Mongilala et al., 2019), entitled Interactive Learning Application for North Sulawesi Animal Recognition Using Augmented Reality. The study discussed the use of augmented reality in introducing North Sulawesi animals by displaying 3D objects as learning media accompanied by a brief explanation of the animal information. App creation using Vuforia, Android, Unity 3D, Blender, Zbrush, UML, and Black Box. Application users are visitors and administrators.

Research by (Novitasari, 2019), with the title Application for Recognition of Traditional Indonesian Weapons Using Android-Based Augmented Reality. The study discussed: The process of making applications and 3D objects of traditional Indonesian weapons using augmented reality technology applied to mobile devices—app creation using Vuforia, Android, Unity 3D, and Blender. Application users are visitors and administrators. This application resulted in the implementation of augmented reality for learning about traditional Indonesian weapons.

Research (Abdulghani & Sati, 2019) entitled Introduction to Indonesian Traditional Houses Using Augmented Reality Technology with the Marker-Based Tracking Method as a Learning Media. The study discusses the application of augmented reality technology in introducing custom houses using 3D objects. The methods used are markless and marker-based tracking that uses unique markers in their application—app creation using Unity 3D. Application users are visitors and administrators.

Research by (Efendi & Marinda, 2019) titled Mobile Based 3D, Augmented Reality Tourist Attraction Application. The research discusses the application of tourist attraction applications using augmented reality technology in its implementation—app creation using SketchUp and Unity 3D. Application users are visitors and administrators. The application displays attractions containing information about these attractions, accompanied by the application of augmented reality to make the application more interactive.

Research by (Fathoni et al., 2020) entitled Design and Build an Animal Learning Module Application for Children Based on Mobile Augmented Reality. The study discusses the application of augmented reality technology in animal learning modules aimed at children—app creation using Vuforia and Unity 3D. Application users are visitors, teachers, and administrators. The application of augmented reality technology in producing more interactive modules can increase children's requests to learn about existing animals.

The difference between the five references with the title raised by the author lies in the method and application used, namely the use of markerless methods and the application of mobile augmented reality that uses 3D objects directly in the application in the introduction of the endemic fauna of Central Kalimantan. In the five references, previous researchers only used the marker-based method, which requires media in photos or images to display 3D objects. This application utilizes the latest method in the form of a markerless-based method. So it does not require photos or images as media that will display 3D objects. 3D objects are

integrated into the application to be used immediately.

They are using the latest version of Unity 3D and use 3D objects with a more detailed design of the animals to be displayed. This application can dash and is more interactive in its use. The 3D objects displayed can be moved in real-time without needing rotation buttons or image magnification. Users only need to press the location marker of the 3D object to be displayed so that users can interact objectively by pointing to the mobile device's camera to show the details of the 3D object displayed.

RESEARCH METHODS

Augmented reality is the merging of real-world environments and computer-created virtual worlds so that the boundary between the two becomes very thin and realistic (Fakhrudin et al., 2019). Augmented reality can provide a detailed picture of an object displayed in 3-dimensional (3D) form (Pune et al., 2021.). The natural and virtual worlds combine to provide images and information, making it more accessible for users to display, interpret, and explain an object, design, and other things (Elmqaddem, 2019).
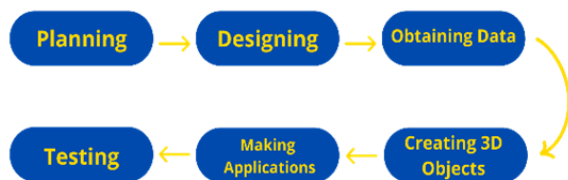
Research Flow

Figure 1. Research Flow

Figure 1 shows the research flow containing planning, designing, obtaining data, creating 3D objects, creating applications, and trials (Astuti & Subekti, 2022).

Planning
The initial stage in designing the application workflow of endemic animals of Central Kalimantan.

Designing
The process of designing the appearance design of the application that contains an overview of the application menu.

Obtaining Data
In obtaining data, researchers researched previous research with yields and similarities regarding the

research title on designing endemic animal applications in Central Kalimantan using mobile-based augmented reality (Firman Ghozali et al., 2021). Researchers used qualitative methods to interview several online communities that know Central Kalimantan's endemic animals (Syahrul Rizal et al., 2019). The data obtained is in the form of information about the characteristics of animals that will be used as information listed in the application.

Creating 3D Objects
Design 3D object designs through software like Blender 3D (Rasheed et al., 2021). The design process of animal models will be displayed in the form of 3D objects.

Making Application
The design stage of the application of endemic animals typical of Central Kalimantan through software in the form of Unity 3D.

Blackbox Testing
Testing in this final results used black box testing techniques with the Test Case Equivalence Partitions method based on the Black Box Testing (Novalia & Voutama, 2022).

RESULTS AND DISCUSSION

The initial stage is an application menu flow design shown in Figure 2.
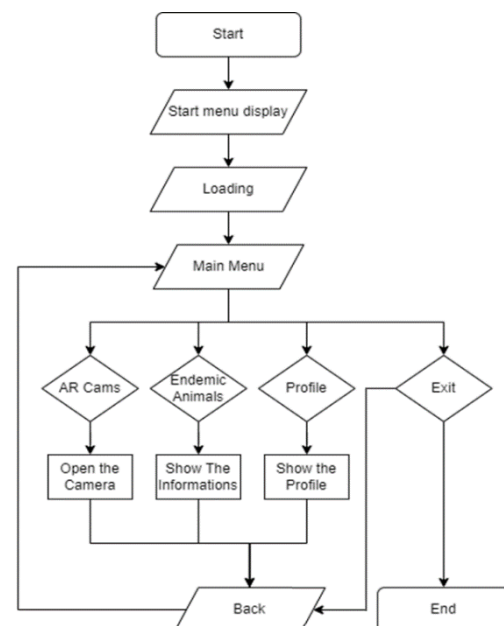

Figure 2. Menu Flow

a. Start
    The start button aims to start the applications, indicating that the application is starting. The initial menu display continues with the loading view, and the application enters the main menu.
b. Start Menu Display
    This menu will display the application screen splash as an application display logo.
c. Loading
    This animation process entered into the application will proceed to the main menu.
d. Main Menu
    The main menu button works as a continuation of Loading, and four buttons have their Flowchart function at the end with an exit button.
e. ARCams
    The ARCams button acts as a scanner media, displays 3D objects, and opens the camera.
f. Endemic Animals
The endemic animal's button displays information about the animal being displayed.
g. Profile
    The profile button is a menu that displays information about the application developer's biodata.
h. Open The Camera
    This process is an advanced stage of the ARCams button that will open the smartphone camera and display a 3D object.
i. Show The Information
    This process is an advanced stage of the Endemic Animals button, displaying information about endemic animals.
j. Show The Profile
    This process is an advanced stage of the Profile button to display the application developer information.
k. Back
    This button serves as a button to return to the main menu.
l. Exit
    The Exit button aims to exit the application.
m. End
    This stage signifies the end of the flowchart workflow.

Designing

The results of the initial design process of the application will be shown in Figure 3. Based on figure 3 displays an initial overview of the display of information, 3D objects, and animal lists. The information display contains data in the form of animal characteristics displayed on the information menu, accompanied by the AR Cams menu as a medium for the appearance of 3D objects. The 3D object menu will automatically display 3D objects

using the camera. There is a Back button to the information menu. Then the animal list menu contains a list of animal options that you want to display.
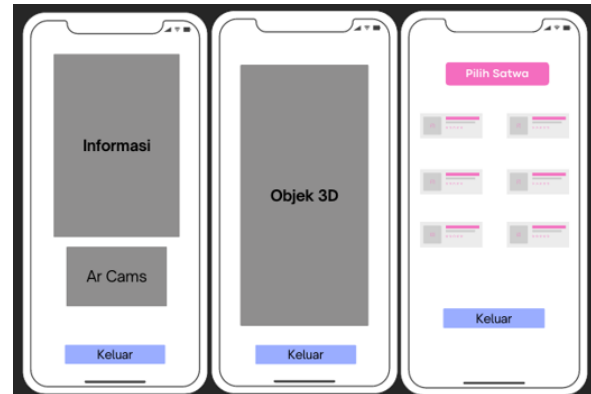

Figure 3. Application Design

Creating 3D Objects

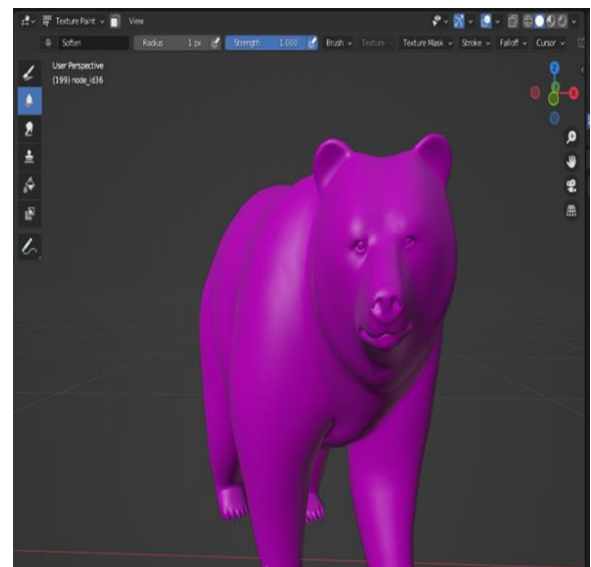The process of creating 3D objects using Blender 3D in making them will be shown in Figure 4.

Figure 4. Making 3D Object

Figure 4 shows the process of creating 3D objects by designing the object design as the original. The design displayed is in the form of a honey bear.

Making Applications

In the process of making this application using Unity 3D as the creation media. In addition,

media in the form of the Vuforia SDK is used to access the markerless camera menu in Unity 3D. Figure 5 will show the process of creating an application through Unity 3D.
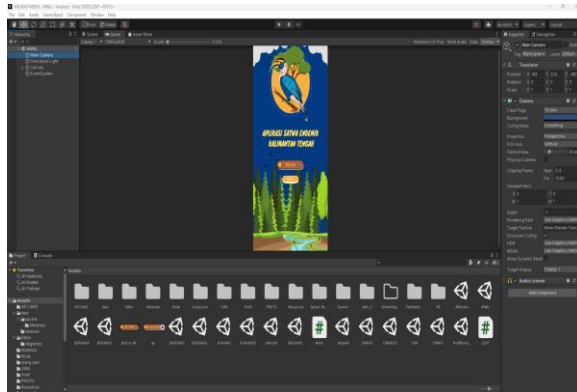

Figure 5. Making Applications

Figure 6 will show the process of applying the markerless augmented reality method to the application.
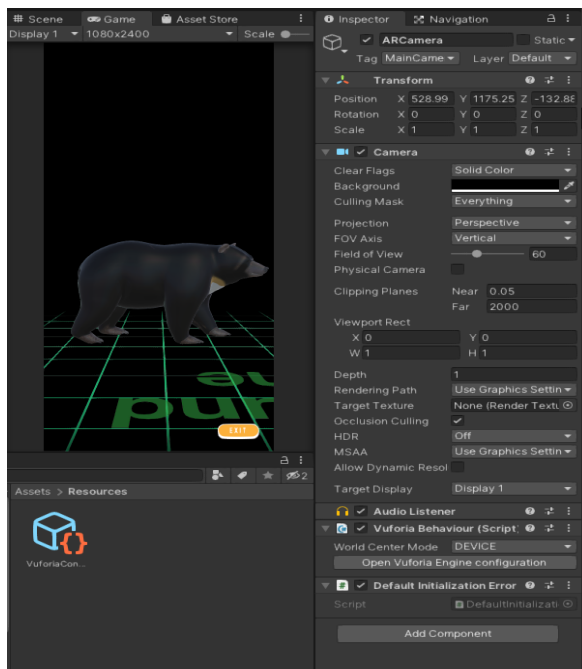

Figure 6. Unity 3D Implementation

Figure 6 shows the stage of designing 3D objects using the markerless method. Vuforia SDK, as a markerless camera in Unity 3D, provides an advantage in the form of no need for media in the form of photos or images as a medium for the appearance of 3D objects.

Using Vuforia SDK as a markerless camera media is done by entering the camera application license code so that Unity 3D can automatically

access the markerless camera menu. Then by adding the camera will display 3D objects without any media. Figure 7 will be displayed the results of using the markerless augmented reality method in the application.
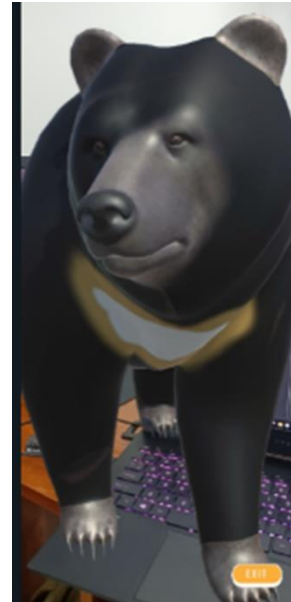

Figure 7. Markerless Method Implementation

Figure 7 displays a 3D object display using the markerless augmented reality method. In the 3D object display stage, users only need to press the marker lock button to display 3D objects and lock the position of 3D objects. So that users can interact, such as seeing objects more closely, moving objects, and seeing all forms of 3D objects that have been provided. Figure 8 shows the shape of the locking marker.
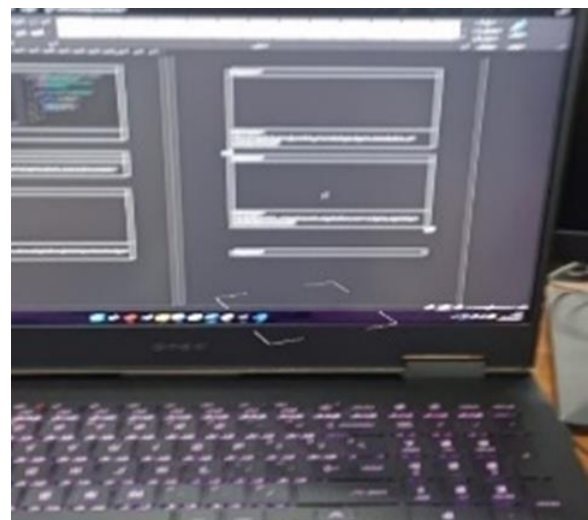

Figure 8. Marker Sign

Final Results

The application design stage depicts the application's appearance, such as menus, backgrounds, and logos. The 3D object design stage uses a 3D Blender to design animal 3D objects that have been prepared. The application development stage merges all stages implemented into Unity 3D. The first feature is the list of animals which is used to display a list of animals that will be presented in the form of 3D objects of animals along with information about the animals. The second feature is a profile that displays the profile of the app developer. The third feature is ARcams as the main feature which will display 3D animal objects. The fourth feature is information that will display data about animal information.

Animal List Menu Display

Figure 9 will show the display of the animal list menu, which contains a button containing the names of the prepared animals. The menu available includes animal names that will be displayed, such as gibbons, bears, lemurs, bobcats, hornbills, and orangutans.

Figure 9. Animal List Menu

Based on Figure 11, the animal list displays a list of animal names connected with a button to direct the application to open a 3D object and its information. There are six buttons consisting of the names of endemic animals of Central Kalimantan,

and then there is an exit button to return to the previous menu. If the user presses an area not connected with the button provided, the application will not respond to anything.

Blackbox Testing

Research continued at the stage of functional testing of the application system. Using a black box text case will describe the application's working process. The test results can be seen in Table 1, test case and Table 2, application testing of endemic animals of Central Kalimantan.

Table 1. Text Case

Code	Test Case	Expected Results
HA01	Press the start button on the start menu	The system will display the next menu as a list of animals and profiles.
HA02	Press the menu list button	The system displays a list of animals on the following menu.
HA03	Press the profile button	Displays the app's developer profile.
HA04	Press the animal name button	Displays the selected animal.
HA05	Pressing the ARcams button	Open the camera and display 3D objects
HA06	Press the exit button	Exit the application or return to the previous menu

Table 2. Test Case Testing of Applications

Code	Test Case	Expected Results	Test Results
HAR01	Press the menu list button	The system displays a list of animals on the following menu.	Displays the selected animal.
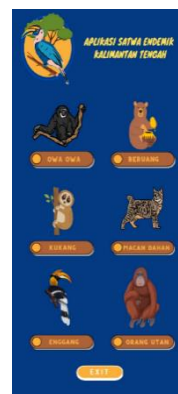
Based on Table 1 and Table 2, results are obtained if the application runs well. All menus and buttons can be used properly.

However, applying this markerless augmented reality method has two disadvantages. Namely, using markers on media with excessive lightings, such as sparkling white ceramic floors, will take time to display 3D objects. Second is the need for a mobile device that supports the markerless method; mobile devices with Android version 7.0 and below cannot display 3D objects with the markerless method.

CONCLUSIONS AND SUGGESTIONS

Conclusion

From the results of application testing, it was concluded that the primary purpose of developing this application to provide information media and learning media about endemic animals typical of Central Kalimantan had been achieved. The research stage was successfully carried out by fully producing an advance in the development of mobile device applications, especially in informatics, using the latest method in the form of markerless augmented reality as a medium that will convey information interactively and newer. This application can be an example for further research. Researchers in the future can add other features that can add to the usefulness and benefits of this application to make it more attractive and efficient.

Suggestion

Suggestions for more recent research are many media and tools that will make making 3D objects faster and more efficient easier so that it can take advantage of this in the future to develop similar applications by using 3D objects in their use.

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