



The Introduction of 3D applications Animal In Indonesia Using Augmented Reality Marker-Based Tracking Method

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ABSTRACT

In this study, specifically about endangered animals can be done with a variety of media and for users aged 5 to 10 and must be accompanied by parents. This research Utilizes the benefits of marker-based tracking methods to familiarize endangered animals in 3D on sponsored smartphone devices. Augmented Reality Also has a FAST Angle Detection algorithm to support a marker object in it. In the results and testing of 300 angles produce 18.75% of objects Obtained, 81.25% of the objects are not supported, for an angle of 600 produces 27.08% of objects received overall, 54.17% of objects received mostly, 18.75% the object is not liked and the angle of 900 produces 58.4% of the objects taken as a whole, 33.3% of the most objects Obtained, 8.

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1. Introduction

Animals in Indonesia is abundant kind and is one of the uniqueness in the country of Indonesia. The number of species endemic to Indonesia would not be found in other parts of the world. Endangered animals is the term given to endangered existence. This scarcity is caused by human actions that damage the ecosystem. Endangered species should be protected and preserved as it is to cope with the threat of extinction.

One of the technological developments that are currently being grown rapidly is Augmented Reality. In a previous study aims to teach behavior and social norms to children. The teaching process is done by using a virtual pet simulation game for learning more fun and engaging, so expect children will be more enthusiastic to participate in learning.

The main advantage of augmented reality than virtual reality is his pengembangan- easier and cheaper. Another advantage of augmented reality that can be implemented in a broad range of media. As an application in a smartphone. Based on previous studies Marker-based tracking is one method of augmented reality. Marker-based tracking black and white illustration in the form of a square with a thick black border and white background. The computer will recognize the position and orientation of the marker and create a 3D virtual world that is the point (0,0,0) and three axes, namely X, Y, Z. By using marker-based tracking identification of patterns to recognize the target image is easier and faster process.

2. Method

A. Research methods

This research method describes the stages of making an application where the application is basically done to resolve the problem, it can be seen below:

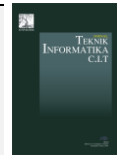


Fig 1. Phase manufacture Research

In Figure 1 Phase Preparation of research was initiated on the data collection, data collection takes some 3D objects that will be created. Furthermore identifikasi aims issues in order to know the problems that exist in the previous issue of research journal to be used as a reference for the formulation of the problem earlier. Then the 3D modeling process to display an object that is already installed in the application. In the application design process for the manufacture of assets that have been terancang in unity and displays a rare animal a 3D object by adding information, sound and rotation. If an error in the testing process will be tested back. If in the process of building a successful test will be conducted for an apk to be able to run on smartphones.

B. Design Applications

This design can apply the concept to see made in the application form. In this application, the first display 2D shapes that displays the menu in the application. Both show the view in 3D displays 3D objects to be displayed on the camera output.

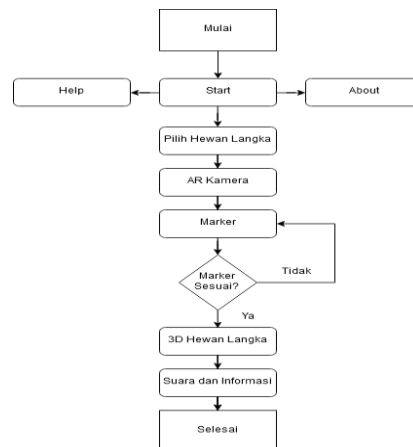
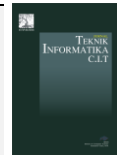


Fig 2. Application Development Phase

Figure 2 illustrates in research to create applications for the introduction of endangered animals in Indonesia as well as information from the application if the user goes into the start menu there is a selection menu, help, about and when entered at the start menu and a selection of rare animals. Users must access the camera and then mengscan marker. If the marker is already terdektesi by the camera, will appear 3D views, information and sound. If the user wants to see app makers then turned to look about and users will want to see the working process of the application then turned to see help

C. Based Marker Trackig

Marker-Based Tracking Augmented Reality a method that utilizes a marker usually in the form of black and white illustrations or other rectangular with a thick black border and white background. Through the expected position on a computer or a smartphone camera, the computer or the smartphone will make the process of creating a 2D or 3D virtual world



D. Fast Corner Detection Algorithm

FAST (Features from Accelerated Segment Test) Corner Detection a corner point determination algorithm invented by Edward Rosten. Corner angle detection or detection is a process of computer vision system to detect the corners of the object. Detection of this approach is used for special values of the object such as shape and detection, so that the bow between the two sides with a point value as dominant and the opposite direction of the point. In his algorithm scheme is determined assuming a corner point calom point p variables with data input 16 pixels around the p [8]. There are different cases in this determination for each difference, namely:

$$C = \begin{cases} I_n < I_p - t \\ I_p - t < I_n < I_p + t \\ I_p - t < I_n \end{cases} \quad \begin{matrix} \text{gelap} \\ \text{normal} \\ \text{terang} \end{matrix} \quad (1)$$

Information :

I_n = dot pixel intensities in the n

I_p = intensity of the center point

T = threshold

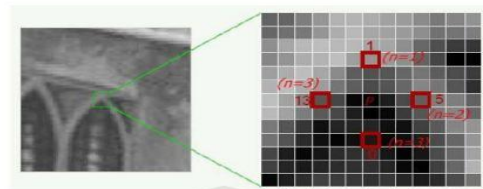


Fig 1, FAST point angle detection per-

E. Fast Corner Detection Algorithm Flowchart

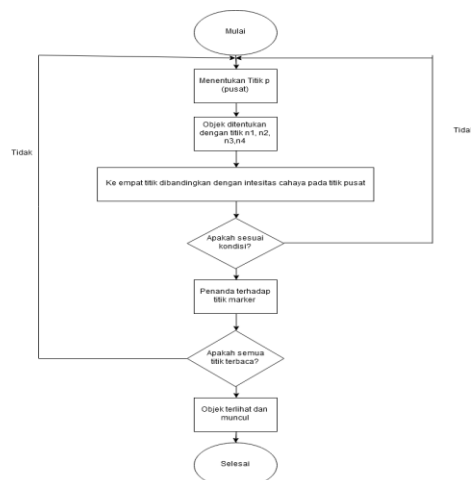


Fig 2, FAST Corner Detection Algorithm

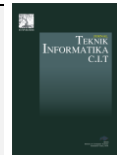
In Figure 4 illustrates the process stages FAST Corner Detection Algorithm as follows:

- Determining the point on the part of the image at the start position (x_p, y_p)
- Determining the section on four points. On the first point $(n = 1)$ are the coordinates $(x_p, y_p + 3)$, part on the second point $(n = 2)$ are the coordinates $(x_p + 3, y_p)$, part of the third point at coordinates $(n = 3)$ section at coordinates $(x_p, y_p - 3)$, on the fourth point $(n = 4)$ section at coordinates $(x_p - 3, y_p)$
- Comparison of the intensity at the center point p with four points around. If there are at least three points that meet the following conditions, then the center point p is a vertex



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- d) To determine the point at an angle, all pixels will be divided by three subsets, namely; Dark Pixel, Pixel similar, and P brighter.
- e) If it is to repeat the whole process has been compared to a point on the image intensity
- F. Vuforia Engine SDK

Vuforia SDK is a Software Development Kit that uses Augmented Reality-based mobile device screen to see into the world of augmented reality in which the real and virtual worlds appear side by side. This application makes the camera preview directly on the smartphone layer to represent the views of the physical world. 3D objects will appear directly on the screen smartphone, so it will look 3D objects are in the real world, Vuforia SDK consists of two main components, namely the Library QCAR and Target Management System. The following explanation of Target Management:

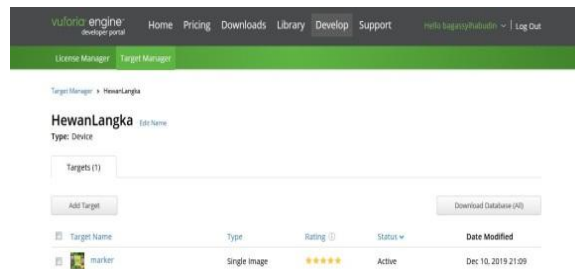


Fig 3, Vuforia Engine SDK

In Vuforia Engine marker uploaded to the database. If the rating augmentable get a high rating then the image is detected. Rating of 0 indicates the target being tracked at all if the star rating of 1 to 5 menunjukkan easier to detect targets on the image.

3. Results and Discussion

A. On Needs Analysis Tool

In the process the author needs require hardware devices (hardware) and software (software) in making the application, namely:

Table 1, Hardware (Hardware)

Device	Needs
processor	Intel Core i3
Video Graphics Array (VGA)	Intel HD Graphics
Hard Drive	1 TB
Random Access Memory (RAM)	4 GB

Table 2, Software (Software)

Needs
Unity 3D 3.5f1 2018 (64-bit)
SketchUp 2017
Corel Draw 2019 (64-bit)
Andorid Studio

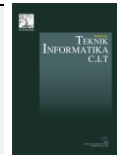
B. Storyboard

In this study makes the interface design to be displayed and written can be seen as follows:

Table 3. Storyboard Applications

design	Information
--------	-------------

Display the menu consists of the introduction of rare animals Start, Help, About, Exit



design

Information



See when opening the Start button there is an option that can be selected animal models



Display while opening the Help menu to show you how to run an application



Display when opening the menu is about to show the maker of the application and introduction of rare animals and



Display marker, serves to be read by the camera and is matched to the database vuforia. Making the marker using CorelDraw software in 2019

4. Discussion

A. Running Applications



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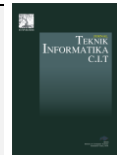


Fig 6. Marker Augmenred Reality

In Figure 6 views marker, serves to be read by the camera and is matched to the database vuforia. Making the marker using CorelDraw software in 2019



Fig 7. Rhino Lampung

In figure 7 show the rhino scene with objects Lampung and displaying sound, information and rotation therein.



Fig 8. Display Sumatra Elephant

In Figure 8 show with scene objects Sumatran elephants elephant and displaying sound, information and rotation therein.

B. Testing Applications

In three different smartphones such as the In Augmented Reality application testing performed Table 4:

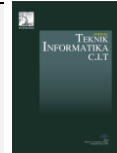
Table 4. Testing Applications

Andorid	criteria Testing		
	3D objects	Sound	Rotation
Samsung Galaxy	succeed	succeed	succeed



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Andorid	criteria Testing		
	3D objects	Sound	Rotation
S9 +			
Mi 2 Lite	succeed	succeed	succeed
Oppo A57	succeed	succeed	succeed

In Table 4 testing on the device Samsung Galaxy S9 +, Mi 2 Lite, Oppo A57 managed to display the object, featuring voice and rotate.

Table 5. Testing of Distance and Time

Android	Distance and Time Response		
	distance Minimal	distance Maximum	Time
Samsung Galaxy S9 +	± 12 cm	± 87 cm	± 1 sec
Mi 2 Lite	± 9 cm	± 57 cm	± 1 sec
Oppo A57	± 13 cm	± 52 cm	± 1 sec

In Table 5 the detection distance and time on the device Samsung Galaxy S9 + has a distance of 12-87 cm with a response time ± 1 sec, Mi-2 Lite has a distance of 9-57 cm with a response time ± 1 seconds and the device Oppo A57 has a range of 13 - 52 cm with ± 1 second response time.

Table 6. Testing Against Light

Android	Pengujian Against Light		
	0- 20%	21-40%	41-100%
Samsung Galaxy S9 +	Do not appear	old Appears	Appearing fast
Mi 2 Lite	Do not appear	old Appears	Appearing fast
Oppo A57	Do not appear	old Appears	Appearing fast

In Table 6 testing of light using Perudupan brightness application screen is made on 3 smartphones get 0-15% light test results will not show an object while the light 16% - 100% can display 3D objects on the screen smartphone

Table 7. Results of Testing Corner

Android	testing corner		
	300	600	900
Samsung Galaxy S9 +	No Appear	Appear	Appear
Mi 2 Lite	No Appear	Appear	Appear
Oppo A57	No Appear	Appear	Appear

on the table 3 angle test performed on 3 smartphone to get the angle 300 does not appear on the smartphone screen and the angle of 600-900 can be read to display the 3D object.

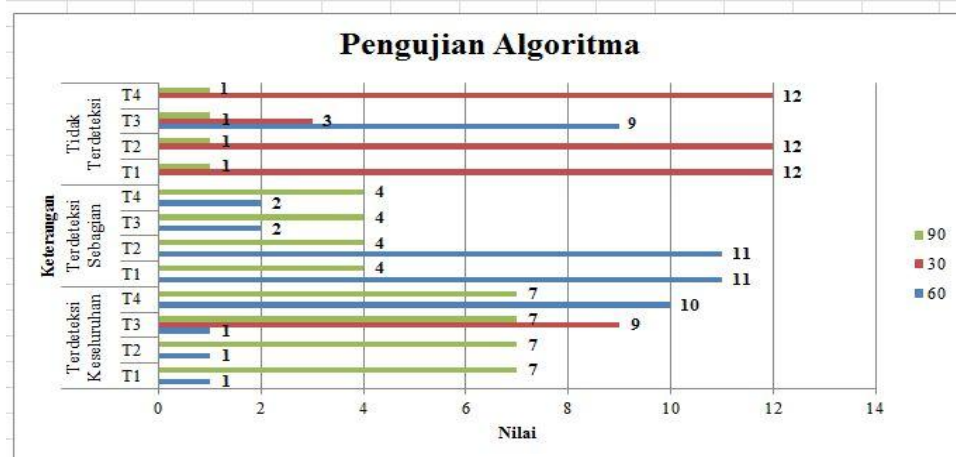
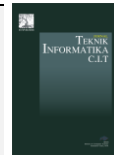


Fig 9. Results From Testing Fast Corner Detection Algorithm

In Figure 9 the weight of each distance and angle of the tested ie from the results that have been tested on the algorithm

Table 8. Results Pivot

Information	Point	Corner			Total
		30	60	90	
Detected Whole	T1	0	1	7	8
	T2	0	1	7	8
	T3	9	1	7	17
	T4	0	10	7	17
Detected partially	T1	0	11	4	15
	T2	0	11	4	15
	T3	0	2	4	6
	T4	0	2	4	6
No Detected	T1	12	0	1	13
	T2	12	0	1	13
	T3	3	9	1	13
	T4	12	0	1	13
Total		48	48	48	144

In Table 8 the test on the Fast Corner Detection Algorithm at a distance of 4 points is T1, T2, T3, T4 with an angle of 30, 60, 90 and the size of the marker 3R. The test is performed 144 times with a total of 48 times of testing each respective corner. The test results, namely:

- At position 300 on the corner there are a total of 48 times from testing point and angle. In the description Detected Overall there are 9 times test and 18.75% of detected objects and the description contained 39 times Not Detected 81.25% testing and the object is not detected.
- In a corner position 600 there are a total of 48 times from testing point and angle. In the description Detected Overall, there were 13 times of testing and overall 27.08% of detected objects, the information Detected Most are 26 and 54.17% of testing time the object was detected in part and on the information contained 9 Not Detected 18.75% testing and the object is not detected.
- In the angular position of 900 total 48 times from testing point and angle. In the description Detected Overall there are 28 times of testing and overall 58.4% of detected objects, the information Detected Most are 16 times the test and 33.3% partially detected objects and the description Not Detected contained 8.3% 4 testing and object not detected

5. Conclusion

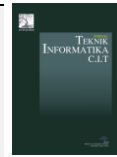
Of research and discussion can be summarized as follows:

- The introduction of rare animal objects in 3D can run very well



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- b) The test results and waktu distance at a minimum distance of 3 smartphone ± 9 cm and a maximum range of ± 87 cm takes an average of ± 1 second to display on the smartphone display
- c) From testing to light at 3 smartphone that is, when the light 0-15% AR does not appear to display 3D objects on the screen while the light 16-100% AR may appear and display 3D objects on the screen.
- d) From the test results at an angle of 0-15% angle of the object does not appear because the marker is not readable and at an angle of 310-900 legible.
- e) In the test results of the Fast Corner Detection angle 300 Detected Overall 18.75%, 81.25% Not Detected, angle 600 Detected Overall 27.08%, 54.17% Detected Some, Not Detected 18.75% and 58.4% Overall 900 Detected corner, Detected Part 33, 3%, Not Detected 8.3%.

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