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Augmented Reality Media As A Butterfly Metamorphosis Learning Method Based Marker Tracking

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ABSTRACT

This study specifically the butterfly metamorphosis of learning can be done with various media for users of grades 4 through 5 elementary schools and must be attenuated by the instructor in the learning process. This study uses a marker-based search method to help study the butterfly metamorphosis in 3D on a smartphone registered devices. Augmented Reality Also has a Rapid Angle Detection algorithm to support a marker object in it. In the results and application testing colors are not suitable for the visualization process while it is still a perspective that can be processed by the Angle Rapid Detection algorithm and 0-20% in light testing can not be used 21-40% of long Appears 41- 100% faster Appearsr,

1. Introduction

As the development of today's technology, there are various ways to display a three-dimensional simulation. Augmented Reality is one way to display the 3D simulation of an object you wantdisplayed or disimulasikan.Proses pemebelajaran butterfly metamorphosis in general through science textbooks of primary school children using 2D drawings and an explanation.

Argumented Reality becomes a new way of communication content, as a combination of text, 3D models, sound, which gives a new perspective.

In a previous study, conducted research related to Butterfly Metamorphosis Visualization Tool Using Augmented Reality Animated In another study, the use of Marker-Based Tracking method also used in the metamorphosis of a butterfly Simulation of 3D as a medium of learning biology. Introduction of using Augmented Reality also carried out to study the metamorphosis, butterfly animated visualization of Augmented Reality

The introduction of the 3D object that displays design models butterfly metamorphosis also conducted research bebasi learning applications android Augmented Reality

A similar study conducted by Kadi Janutriyuda, where the research using Marker-Based Tracking in Augmented Reality technology for the analysis and design of applications pembelajran butterfly metamorphosis based Augmented Reality

Based on previous research can be created the problem in this research is how to apply the learning method butterfly metamorphosis that is more interesting and easier to understand, and to make a metamorphosis learning method based on Augmented Reality technology looks interesting to be learned by the user.

The purpose of this study is applying the Augmented Reality app as a learning medium metamorphosis insects are more attractive and easy to understand, and build learning applications butterfly metamorphosis Android-based Augmented Reality

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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 design, manufacture specifications at this stage of the program architecture, views and needs of the material or materials for the program. Then the data collection process on the data collection required some 3D objects that will be created. Furthermore, the drafting and formulation At this stage all of the objects or multimedia material has been obtained then arranged according to the design, once composed into the manufacturing phase of the application using Unity3D. Testing 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.

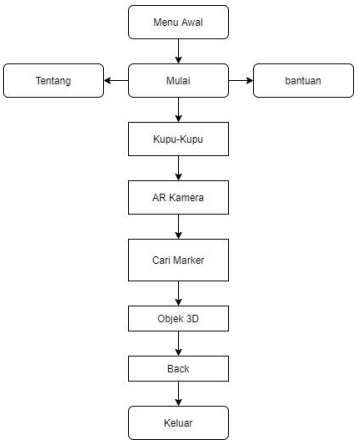

Fig 2. Application Development Phase

In Figure 2 describes the research made an application for learning the metamorphosis of butterflies as well as information from the application if the user goes into the menu there is a menu selection began, help, about and when entered at the start menu and selection of butterflies. Users must access the camera and then mengscan marker. If the marker is already terdekteksi by the camera, will appear in 3D view,

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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 p. There are different cases in this determination for each difference, namely:

$$C = \begin{cases} In < Ip - t & gelap \\ Ip - t < In < Ip + t & normal \\ Ip - t < In & terang \end{cases}$$

Information :
ln = dot pixel intensities in the n
lp = intensity of the center point
T = threshold

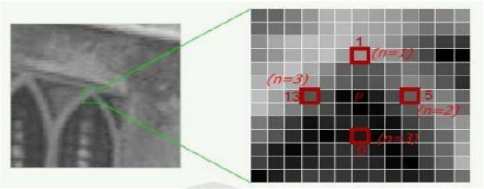

Fig 1, FAST point angle detection per-

E. Fast Corner Detection Algorithm Flowchart

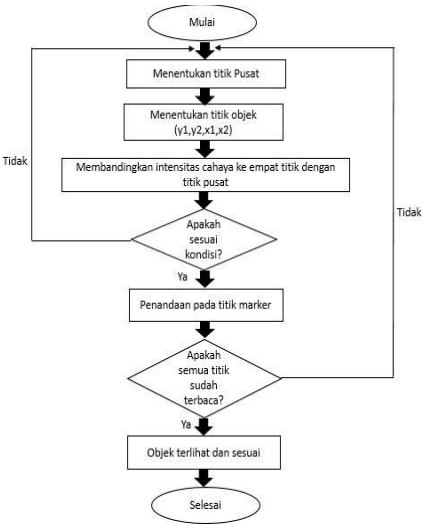

Fig 2, FAST Corner Detection Algorithm

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

a. Determining the point on the part of the image at the start position (xp, yp)
b. Determining the section on four points. On the first point (n = 1) are the coordinates (xp, yp + 3), part on the second point (n = 2) are the coordinates (xp + 3, yp), part of the third point at coordinates (n = 3) section at coordinates (xp, yp-3), on the fourth point (n = 4) section at coordinates (XP- 3, yp)
c. 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
d. To determine the point at an angle, all pixels will be divided by three subsets, namely; Dark Pixel, Pixel similiar, and P brighter.
e. If it is to repeat the whole process has been compared to a point on the image intensity

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 gen5th
Video Graphics Array (VGA)	Intel HD Graphics Nvidia 930m (2 GB)
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 Application

design	Information
	Display the menu consists of the introduction of rare animals Start, About, help, Exit
	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

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design	Information
	
	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

Fig 5. *Marker Augmenred Reality*

In Figure 5 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 6. Display butterfly

In Figure 6 show with scene objects butterflies with butterflies and featuring the voices, the information therein.

B. Testing Applications

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

Table 4.
testing Applications

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Andorid	criteria Testing		
	3D objects	Sound	Response time
Xiaomi redmi S2	succeed	succeed	± 5 seconds
Xiaomi redmi 5+	succeed	succeed	± 3 seconds
Redmi Xiaomi Note 7 Pro	succeed	succeed	± 2 seconds

In Table 4 testing device S2 redmi Xiaomi, Xiaomi redmi 5+, redmi Xiaomi Note 7 Pro successfully display the object, featuring voice and rotate.

Table 5.
Testing of Distance and Time

Android	Penujian Distance		
	distance Minimal	Optimal distance	distance Maximum
Xiaomi redmi S2	± 10 cm	± 24 cm	± 80 cm
Xiaomi redmi 5+	± 10 cm	± 23 cm	± 98 cm
Redmi Xiaomi Note 7 Pro	± 8 cm	± 21 cm	± 104 cm

In Table 4 and 5 at the time and distance detection devices redmi Xiaomi S2 has a distance of 10-80 cm with a response time of ± 5 seconds, the Xiaomi redmi 5+ have 10- 98 cm distance with ± 3 seconds response time and the redmi Xiaomi Note 7 Pro has a range of 8-104 cm ± 2 second response time.

Table 6.
Testing Against Light

Android	Pengujian Against Light		
	0- 20%	21-40%	41-100%
Xiaomi redmi S2	Do not appear	old Appears	Appearing fast
Xiaomi redmi 5+	Do not appear	old Appears	Appearing fast
Redmi Xiaomi Note 7 Pro	Do not appear	old Appears	Appearing fast

In Table 6 testing of light using Perudupan brighness 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.
Angle Testing Results

Android	testing corner		
	300	600	900
Xiaomi redmi S2	No Appear	Appear	Appear
Xiaomi redmi 5+	No Appear	Appear	Appear
Redmi Xiaomi Note 7 Pro	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.

Table 8.
Testing Color And Size Resolution Marker

color Marker	Size Resolution Marker	Information
	360 Pixel	succeed

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color Marker	Size Resolution Marker	Information
	360 Pixel	succeed
	360 Pixel	succeed

Testing is done to identify the color of the marker to show the shape of a 3D object that is optimal with gray light, the display of 3D objects good, with a detection distance of 90 cm, while if the white color black with bright light has the appearance of 3D objects is very good with a detection distance 100cm, and if the color is not good with a detection distance of 58 cm black color with a bright light, the display of 3D objects to have good results

5. Conclusion

Of research and discussion can be summarized as follows:

a. Object recognition butterfly metamorphosis in 3D can run very well
b. The test results and wakktu distance at a minimum distance of 3 smartphone ± 8 cm and a maximum range of ± 104 cm requires an average of ± 2 seconds 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 can terbaca.ari
e. Marker color on the test results can be concluded that the maker of color does not affect the process of visualization of 3D objects for angle corners of the image can still be detected by algoritama fastcorner
f. From the test results can be seen that the size of the smallest resolution that can be visualized by fastcorner algorithm which is 360 pixels

6. Reference

[1] Wahyudi, A. K., Mewo, F. F., & Ganda, S. (2018). Perangkat Visualisasi Metamorfosis Kupu-kupu Menggunakan Animated Augmented Reality. *Sisfotenika*, *8*(1), 69-80.
[2] Janutriyuda, K., & Pratama, M. A. (2013). Simulasi Metamorfosis Kupu-Kupu 3d Berbasis Augmented Reality Sebagai Media Pembelajaran Biologi," pp. 1–6, 2013.
[3] S. Aisa, "Visualisasi Metamorfosis Kupu – Kupu Berbasis Augmented Reality (AR) Sebagai Media Pembelajaran Inovatif Ilmu Pengetahuan Alam," pp. 25–30, 2017
[4] F. F. Putra, J. N. Sari, and R. Suhatman, "Aplikasi Pembelajaran Metamorfosis Berbasis Android Augmented Reality," vol. 1, no. September, pp. 1–8, 2012.

Accredited "Rank 4"(Sinta 4), DIKTI, No. 36/E/KPT/2019, December 13th 2019.

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https://iocscience.org/ejournal/index.php/mantik/index

[5] F. Ningsih and L. Rusdiana, "Analisis Dan Desain Aplikasi Pembelajaran Metamorfosis Kupu-Kupu Berbasis Augmented Reality," vol. 2, no. 2, pp. 118–123, 2019

Accredited "Rank 4"(Sinta 4), DIKTI, No. 36/E/KPT/2019, December 13th 2019.