DEVELOPMENT LIVE TEXURING COLORING BOOK APPLICATION USING AUGMENTED REALITY

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ABSTRACT

DAR! Mizan was one book publisher located in JL. Cinambo No. 135 Cisaranten Wetan, Bandung. Since the beginning of stand DAR! Mizan develop coloring book series, one that is Mewarnai Asyik Dinosaurus. The book was illustrated by Iwan Yuswandi and published by Dar! Mizan with no ISBN 9789797528966. In the book that children can only coloring book in the form of 2D, then there are many children who often feel bored while doing activities coloring, this is confirmed by a questionnaire that is by percentage as much as 82% of the respondents.

Live texturing augmented reality is one of the technological innovations of augmented reality in increasing interaction between humans and machines. By leveraging the technology live texturing coloring book augmented reality the child can see and do activities coloring in the form of a three dimensional object, by means of directing the camera to marker, then the child can see objects in the form of three-dimensional Dinosaurs and can perform activities in the real colouring based on colors in accordance with scratches on the marker.

Based on the testing of alpha can be drawn the conclusion that the functionality contained on the application may function properly and based on beta testing can be drawn the conclusion that the application live texturing coloring book using this augmented reality makes the child be not often feel bored while doing the coloring.

Keywords: Augmented Reality, Live Texturing, Coloring Book, coloring, Dar! Mizan

I INTRODUCTION

DAR! Mizan is one book publisher located in Jl. Cinambo No. 135 Cisaranten Wetan Bandung. Since its establishment DAR! Mizan develop coloring book series, one of which is Mewarnai Asyik Dinosaurus. Coloring is a form of creativity triggers activity, where children are invited to give one or more strokes of color on a shape or pattern of the image, creating an artistic creation. Coloring has become part of the skills that should be mastered children from an early age due to understand the colors are as important as mastering math, reading, and writing.

Mewarnai Asyik Dinosaurus book is illustrated by Iwan Yuswandi and published by Dar! Mizan with no ISBN 9789797528966. In the book that children can only coloring book in the form of 2D. After conducting an interview with Mr. Dadan Ramadhan as a responsible Dar! Mizan, found that books published by Dar! Mizan Mewarnai Asyik Dinosaurus be sufficient, because only can color in the form of 2D, the company Dar! Mizan require additional features that are new to the book Mewarnai Asyik Dinosaurus for the book to be more interactive and can help children be more skilled.

The questionnaires were presented to the 50 respondents (buyers of books published by Dar! Mizan) known to 90.4% agree that the coloring is an activity that is loved by children, 89.6% agree that the coloring can train your focus and concentration, it was also 82% agree Child often feel bored while coloring. So the conclusion of the questionnaire are the respondents (buyers of books published by Dar! Mizan) agree that the coloring is an activity that is very loved by children and can train focus and concentration, but the other children often feel bored while coloring a picture in the form of two-dimensional alone [2].

*Live texturing augmented reality*is one of the innovative augmented reality technology in improving the interaction between man and machine. Texturing live with augmented reality technology, an object which previously could only be seen in two dimensions to three dimensions, and can appear as a virtual object that entered into the real environment in real time. As well as presenting a texture process taken from a scratch color on two-dimensional images for both visible and clogged into a real three-dimensional object.

Based on the issues that were outlined above required a solution that could help children in coloring books published by Dar! Mizan. The proposed solution is to build a live application texturing coloring book using augmented reality according offered and approved by the company Dar! Mizan. From exposure above the didapatlah titled: "Devlopment Live Texturing Coloring Book Application Using Augmented Reality".

1.2 Purpose and Objectives

Based on the problems that have been described in the background and the formulation of the problem, the purpose of this research is to build a live application texturing coloring book uses augmented reality to Mewarnai Asyik Dinosaurus books published by Dar! Mizan.

The overall objective of this application is built are:

1. Helping children Dinosaurs Coloring finishing works in three dimensions.
2. Make Mewarnai Asyik Dinosaurus books published by Dar! Mizan be interactive.

II CONTENT OF RESEARCH

2.1 Research Methodology

This research method has several stages in the development of research related live texturing coloring book app uses augmented reality to support the development of applications and writing in this study:

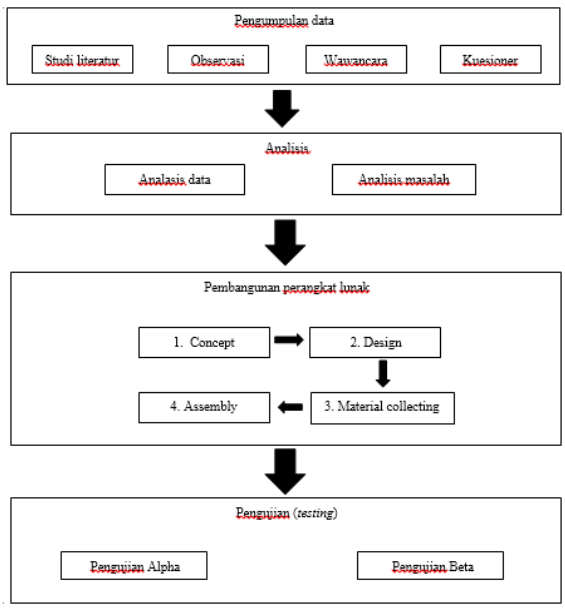


Figure 1. Research methods

In conducting this research needs to be a framework of measures planned and systematic way in order to facilitate the research process. The research in making live texturing application of augmented reality coloring book consists of four phases or stages.

The first phase of data collection is done in the neighborhood Dar! Mizan. The data collection phase into 4 stages, among which:

1. Study of literature
   The study of literature is data collection through books, journals, and the Internet to obtain information or data relating to the title of the research so that applications built in accordance with the expected users.
2. Observation
   Data collection techniques by conducting research and peninjajuan directly to permasalahaan taken.
3. Interview
   Data collection techniques by conducting question and answer directly and indirectly kepeda parties that are related to topics taken.
4. questionnaires
   Questionnaires are data collection techniques by providing a set of questions or statements to the respondents regarding the applications are built.

The goal is to collect various data and facts necessary to support the research.

After the data has been collected next is the second stage of analysis, where data that have been obtained are analyzed and then didapatlah problem. This stage is divided into two, namely:

1. Data analysis
   Data analysis stage is the stage to check the completeness of the data from the interviews, the results of the questionnaire, and the application needs to be made.
2. Problem analysis
   Phase analysis of the problem is the stage to analyze the problems that exist somewhere research.

The third stage is the stage of software development method. In this stage of the method used for developing applications in this study adopts the method according to Sutopo Luther [1]. Here are the stages of software development methods are used:

1. Concept

Stage Concept (concept) is the stage for the purpose and audience identification. Besides determining the kinds of applications (presentation, interactive, etc.) and the intended application (entertainment, training, learning, etc.). At this stage of applications made ie interactive multimedia (live texturing) using augmented reality technology and application purpose of learning in terms of coloring.

2. Design

Stage Design (perncangan) is the stage of making the specification of the architecture program, style, appearance and material requirements / materials for the program. At this stage it began design display interface (interface), design three-dimensional model using Blender.

3. Material collecting

Collecting Material stage is the stage in which the collected material according to the needs done. This stage can be done in parallel with the Assembly stage. At this stage of collecting and compiling materials that have been designed to be collected and incorporated into a live application texturing coloring book.

4. Assembly

Stage Assembly (manufacture) is the stage where all objects or multimedia materials created. Object creation is based on the stage of the design process begins with the modeling three-dimensional objects that refer to the book Dinosaurs Coloring Fun. After going through some process and then start giving coding that can be seen live texturing and can be used on android.

The fourth stage is the testing phase, this stage is the stage where the research and application has been completed and will be tested, the following is a testing phase conducted in this study:

1. Alpha testing

Alpha testing is done aim to find errors or deficiencies in the software being tested. This test is intended to determine the software that made already meet the criteria in accordance with the purpose of designing the software.

2. Beta testing

Beta testing is testing conducted objectively where the testing is done directly to the user or the respondent.

2.2 Analysis System

The analysis system can be defined as the decomposition of a system whose whole into its component parts with a view to identifying and evaluating problems-problems, opportunities, barriers that occur and needs expected to be proposed improvements. Analysis can also be defined as the study of the existing system with the aim of designing a new system or updated. In the process of making an absolute system of research and analysis of the system to be built.

2.3 Analysis of the Running System

System analysis or analysis of the process is the stage that gives an overview of the system is running now. This analysis aims to provide a more detailed picture of how the system is running.

Children activities Coloring Fun dinosaur coloring book published by Dar! Mizan in two-dimensional form. After coloring the book, the child will get the work in the form of two-dimensional coloring. Here is a scenario the current system:

1. Users select images to be colored
2. Start doing the coloring activity
3. Seeing the results of coloring

2.4 System Architecture Analysis

Three-dimensional objects to be created based on the images of dinosaurs that are in the book published by Dar Dinosaurs Coloring Fun! Mizan. Here is an overview of the system architecture:

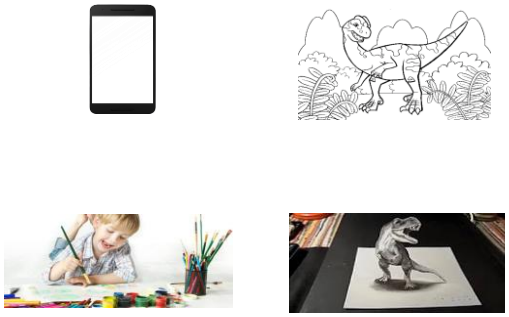


Figure 2. System Architecture Analysis

To perform the coloring activity, the user will start by opening an application on your smartphone (android), and then the camera will detect a marker pattern that has been provided, after which it will appear three-dimensional objects can be colored augmented reality and simultaneously fit the color that will be inscribed on the marker. Surely this can help the child to color finish the work in three dimensions making it more interactive.

1.2 Design analysis

In this design stage pictures that are in the book published by Dar Dinosaurs Coloring Asik! Mizan used as reference in making three-dimensional models, modeling is done by using the tools Blender. This stage will produce three-dimensional models. The steps of the three-dimensional modeling is as follows:

1. *Modeling*

At this stage the model is based on objects that are in the book published by Dar Dinosaurs Coloring Fun! Mizan, in this case used as a reference image of the object. Here is a description of the object to be dimodeling:

a. Dinosaurs two-dimensional objects

The object of this dinosaur was taken from the book published by Dar Dinosaurs Coloring Fun! Mizan. Here is a sample picture :

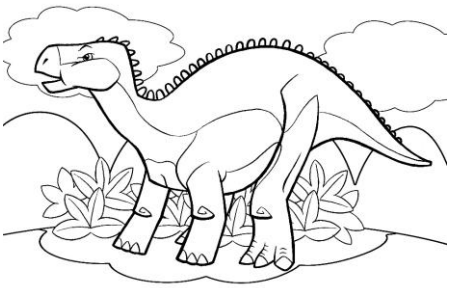


Figure 3. Examples of object images of dinosaurs

b. Dinosaurs three-dimensional objects
Once the form is unknown dinosaur images taken from books published by Dar Dinosaurs Coloring Fun! This Mizan, then made replica is shaped three-dimensional object.

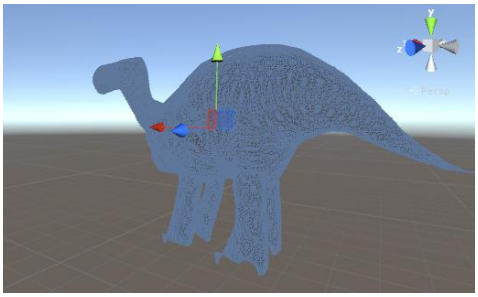


Figure 4. Sample images of 3D objects Dinosaurs

2. *Texturing Object*

After the modeling of 3D objects and then perform the texturing Dinosaurs image object, namely to give texture image, the result can be seen in the following figure:

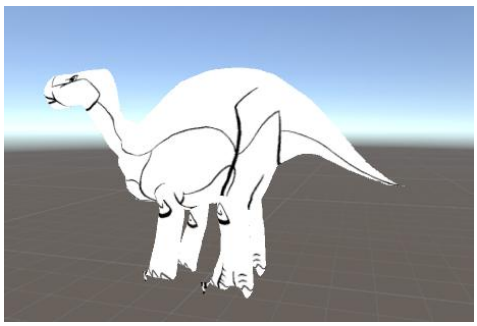


Figure 5. Sample images of 3D objects after being given texture

3. *Rigging*

Having done *texturing* object and then perform the rigging objects, namely by giving the bone so that the object can be moved, the results can be seen in the following figure:

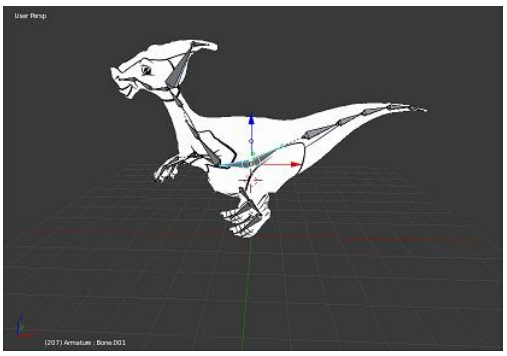


Figure 6. Sample images Dinosaurs 3D object after dirigging

2.5 Use Case Diagram

*Use Case*The diagram is a UML diagram that models used to describe the functional requirenment expected from a system. Here is the design of the processes contained in the application live texturing coloring book using augmented reality:

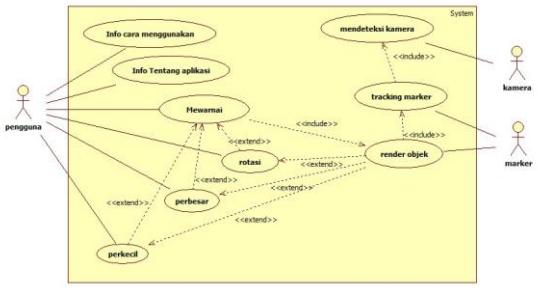


Figure 7. Use Case Diagram

2.6 Activity Diagram

Activity diagrams or *activity diagram*illustrates the flow of work or activity of a system or business process or menu on the software. As one example diagram built activity on the system is as follows:

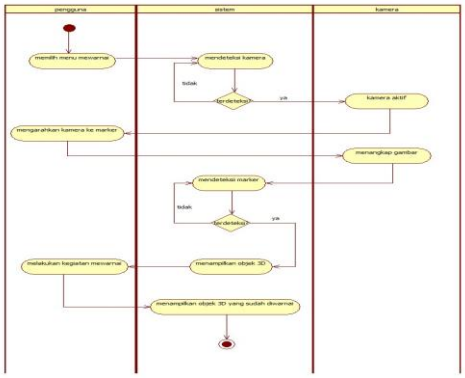


Figure 8. *Activity Diagram* color

2.7 Class Diagram

Class Diagram describe the types (attribute) object in the system and various types of relationships or relationships (method / operation) static that exists between them. This chart gives a general overview of the system. Such as the types of objects to show his class and the relationships between them, as well as a detailed explanation of each class in the model system. Class diagrams are static (not changing), which will show what it is the interaction but did not explain what happens when they interact, the following is an overview class diagram of the design application:

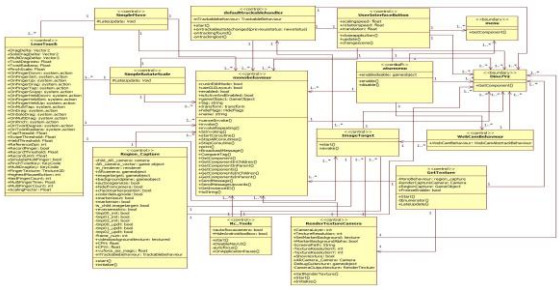


Figure 9. *Class Diagram*

2.8 Sequence Diagram

sequence diagrams is a diagram illustrating the interaction between objects and indicates communication between these objects. The diagram also shows a series of messages exchanged by the objects that perform a task or specific actions. Here is one example Sequence Diagram:

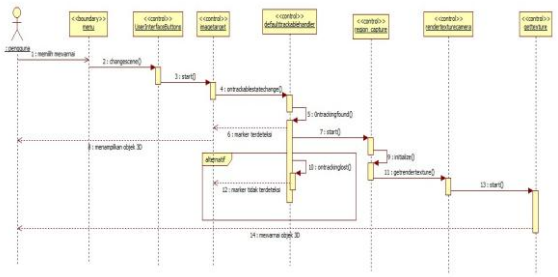


Figure 10. *sequence Diagram* color

2.9 Implementation Hardware Requirements

The minimum specifications required hardware in order to run applications *Live Texturing Coloring Book* This optimally is as follows:

Table 1. Hardware minimum specification required

No.	Hardware	Specification
1	*Processor*	Qualcomm MSM8230 Snapdragon Dual-core 1GHzGPU
2	Memory	RAM: 512 MB
3	OS	Android OS, v4.0 (Ice Cream Sandwich)
4	Screen resolution	Custom
5	Camera	2 MP

2.10 Implementation Class

In the construction of Live Texturing Coloring Book app uses Augmented Reality there are several classes. Table implementation class can be seen as follows:

Table 2. implementation Class

No.	Class name	Physical File Name	Executable File Name	Information
1	AturMenu	Menu.unity	AturMenu.cs	Function to display the menu
2	UserInterfaceButton	Menu.unity Dino7v2.unity	UserInterfaceButton.cs	Serves to control buttons and replacing scene
3	WebCamBehaviour	Dino7v2.unity	WebCamBehaviour.cs	Serves to activate the camera
4	GetTexture	Dino7v2.unity	GetTexture.cs	Serves to live texturing coloring book
5	Render Texture Camera	Dino7v2.unity	RenderTextureCamera.cs	Serves to show the color of the object
6	ImageTargetBehaviour	Dino7v2.unity	ImageTargetBehaviour.cs	Serves to process inisisalisasi marker
7	DefaultTrackableHendler	Dino7v2.unity	DefaultTrackableHendler.cs	Functions to control detection marker
8	Rc_Tools	Dino7v2.unity	Rc_Tools.cs	Serves to control the auto focus camera
10	Simple Rotate Scale	Dino7v2.unity	SimpleRotateScale.cs	Serves to rotate the object
11	Simple Move	Dino7v2.unity	SimpleMove.cs	Function to zoom in and out objects

2.11 Implementation interface

Implementation of the application interface *live texturing coloring book* using augmented reality are as follows:

Table 3. Implementation interface

No.	interface	name interface	Physical File Name	Information
1	T01	Main course	Menu.unity	Maps to display the main menu
2	T02	About the application	Menu.unity	The page displays on live applications texturing coloring book
3	T03	How to use	Menu.unity	Page in which there are ways to use live applications texturing coloring book
4	T04	color	Dino7v2.unity	Page in which there are objects augmented reality and the object can be colored directly correspond scratches on the color marker
5	M01	exit application	Menu.unity	The page displays a confirmation if the user wants to exit the application

2.12 Testing Distance

In testing the use of distance markers, the closer the distance marker with the camera will result in the size of the marker is detected the greater, so it can be caught well. However, when the distance marker farther the camera with the size of the marker that was caught on camera getting smaller, so that the marker pattern becomes unclear and resulted in no detectable marker.

One of the problems of the distance between the camera and the marker is kefokusan level of the image captured by the camera. Quality camera features*autofocus*then the marker detection will run well. Besides the light factor is also important in reading the marker. Here are the results of testing the distance between the camera and the marker:

Table 4. testing Distance

Distance (Cm)	Testing Results Distance
0-10	Undetected, because the camera is too close to the marker
11-20	Detected properly
21-30	Detected properly
31-40	Detected properly
41-50	Detected properly
51-60	Detected, but sometimes the object of frequent blinking and inconsistent
61-70	Detected, but sometimes the object of frequent blinking and inconsistent
71-80	Detected, but sometimes the object of frequent blinking and inconsistent
81-90	Detected, but sometimes the object disappeared
91-100	Undetected, because the distance is too far

From a distance the test results that can be taken is when the distance marker with the camera 0-10cm marker is not detected, because the distance of the marker is too close to the camera, 11-50cm marker detected properly, at a distance of 51-80cm marker detected by the camera but sometimes an object flashing and inconsistent, at a distance of 81-90cm marker is detected but less so good and sometimes objects like disappeared, at a distance of 91-100 marker was not detected because the distance is too far.

2.13 Testing Light

In light of the marker testing is necessary, because otherwise dark room conditions are not detectable marker and the marker can not pull out the 3D object properly. Here is a marker test results:

Table 5. Testing Light

No.	Light unit			
	480 Lumens	660 Lumens	840 Lumens	1380 Lumens
1	Delay 1s	Detected	Detected	Detected
2	Detected	Detected	Detected	Detected
3	Detected	Detected	Detected	Detected
4	Delay 1s	Detected	Detected	Detected
5	Delay 1s	Detected	Detected	Detected

In the light of the test results obtained that 660 lumens, 840 lumens and 1380 lumens marker detected properly because enough light. While at 480 lumens marker detection process tended to last longer because the light is less bright.

2.14 Testing Against Position Marker

In testing the position of the marker, the smaller the angle of the camera with a marker degrees will result marker is not detected properly. But when the camera-degree angle with the greater marker then the marker is caught on camera getting better. Here are the results of testing against the marker position:

Table 6. Testing Against Position Marker

Position	The assay results of the marker position
0 degrees	Undetected, because the cameras are aligned with marker
30 degrees	Undetected, because the camera is too low almost parallel with marker
60 degrees	Detected properly
90 degrees	Detected properly
120 degrees	Detected properly
150 degrees	Undetected, because the camera is too low almost parallel with marker
180 degrees	Undetected, because the cameras are aligned with marker

On testing the position of the markers showed that 0 degrees and 180 degrees marker was not detected because the camera is aligned with the marker, at 30 degrees and 150 degrees marker was not detected because the camera is too low almost parallel with the marker, whereas at 60 degrees, 90 degrees and 120 degrees marker is detected well.

III COVER

3.1 Conclusion

Based on the results of research, analysis, system design, implementation and testing of the

questionnaire, it can be concluded that the application development Coloring Book Live Texturing using Augmented Reality is as follows:

1. This application helps children succeed in completing the work of dinosaur coloring in three dimensions.
2. By using live texturing technology coloring book augmented reality application is successfully making Mewarnai Asyik Dinosaurus book published by Dar! Mizan become more interactive.

3.2 Suggestion

Based on the results of the research, the suggestions can be put forward in order for the future to be an improvement and consideration are as follows:

1. Content three-dimensional object that is contained in this application are still many shortcomings. For further development of three-dimensional objects can be made as closely as possible with the accuracy of the model according to existing pictures in the book published by Dar Dinosaurs Coloring Fun! Mizan.
2. Lighting, distance and position of the marker is extremely important in detecting the marker. For the further development of lighting, distance and position of the marker can be optimized as possible.

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