APPLICATION DEVELOPMENT SUPPORT COLORING BOOK USING AUGMENTED REALITY PUBLISHER OF RUANG KATA

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ABSTRACT

Ruang Kata is one of the publishers of Kawan Pustaka that was established in early 2009. Books published by Ruang Kata are children's category books, supporting lessons, language, computer engineering, music, and life style. One of the books published by Ruang Kata is the Coloring of the Wild Animals. The book was published by the Word Room Publisher with no ISBN 978-602-1576-56-4.

Based on a thesis that has been written by one of the students of University Computer Indonesia majoring in Informatics Engineering Development Application Live Texturing Coloring Book Using Augmented Reality as a supporter of coloring learning activities supported by mobile media, and has been used by one of the leading publishers or publishers in Bandung. Where the application helps children to do coloring learning activities. However, there are some shortcomings that cause the application to be less interactive, such as the absence of a three-dimensional background object, moving objects only in accordance with the system, no virtual button to move the three-dimensional objects, making it less attractive and less interaction between applications with the user. In this case required the development of the application to make it more interesting and interactive.

Based on the results of Blackbox testing can be concluded that the functionality contained in the application to function properly and based on beta testing can be concluded that the development of coloring book support applications using augmented reality in the Publisher of Ruang Kata has been successful in helping children finish the work of coloring in the form of three-dimensional Making the Color Animation Coloring Book of the Word Room is more interesting, interactive and the applications created can be easy to use by users, And succeeded in developing a live textur application coloring book using existing augmented reality to be more optimal in the suitability of objects with markers and develop applications become more interactive.

Kata Kunci: *Augmented Reality, Life Texture, Coloring Book, Coloring, Word Space, Wild Animals*

1. INTRODUCTION

Ruang Kata is one of the publishers of Kawan Pustaka that was established in early 2009. Books published by Ruang Kata are children's category books, supporting lessons, language, computer engineering, music, and life style. One of the books published by Ruang Kata is the Coloring of the Wild AnimalsThe book is published by Word Class Publisher with no ISBN 978-602-1576-56-4. In this book children can only color in the form of two dimensions only so that the book is less interesting and children often feel bored when doing coloring activities. After conducting interviews to Mr. Ade Saeful Muslim, SP.t As the Managing Editor that, the book Coloring Wild Animals issue Ruang Kata This is less appealing, and it needs applications with suitable technology for the book, so that the coloring activity in the book becomes more interesting and interactive.

Technological developments at the moment have a major effect on process transfers, job transfers, and business transfers. Along with these technological developments, at this moment anything is made in real time and interactive. So the needs we need can be available and fulfilled. In addition, the development of technology is used as a medium of learning and entertainment by some people or companies who want to improve their business either in the field of goods or services.

Based on a thesis that has been written by one of the students of Indonesia Computer University majoring in Informatics Engineering Development Application Live Texturing Coloring Book Using Augmented Reality as a supporter of coloring learning activities supported by mobile media, and has been used by one of the leading publishers or publishers in Bandung. Where the application helps children to do coloring learning activities.

But in the application there are still some shortcomings that cause the application is less interactive, Such as the absence of a three-dimensional background object, moving objects only in accordance with the system, no virtual button to move the three-dimensional object, Making it less

interesting and less interaction between applications with user. In this case required the development of the application to make it more interesting and interactive. From the questionnaires submitted on March 11, 2017 to 50 respondents, it is known that 74% said coloring activity in two dimensions is less interesting, and 88% of respondents stated that they often feel bored when doing coloring activities [1]. So the conclusions of interviews and questionnaires that have been submitted to 50 respondents is the coloring activity in the form of two dimensions less interesting so that children often feel bored when doing coloring activities, it needs application support coloring book using augmented reality for the book Coloring Wild Animals Issues Ruang Kata So that the book becomes more interesting and more interactive so that children do not often feel bored when doing coloring activities.

As a supporter of the problems that have been described above required a solution that can help children in coloring books by Ruang Kata publisher and can develop existing applications and can increase interaction. The proposed solution is to develop coloring book support applications using augmented reality as proposed and approved by Ruang Kata Publisher. From the above description got the title of research are: "**Application Development Supporting Coloring Books Using Augmented Reality in Ruang Kata Publishers".**

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 thesis research is to develop applications coloring book support using augmented reality for the book Coloring Wild Animals published by Ruang Kata.

The objectives to be achieved from this final project are as follows:

1. Helping children complete the coloring activity of Coloring Animals Book published by Ruang Kata in three dimensional form.
2. Creating Color Animation Coloring book by Ruang Kata becomes more interactive. Developing a live textur coloring book application and building coloring book support applications using augmented reality to be more optimal in the suitability of objects with markers and develop applications become more interactive.

2. Research Contents

2.1 Research Methodology

The research method used is descriptive. Descriptive method is a way of expressing objective truth. The truth is a goal, while this method is the way. The use of methods is intended to disclose the truths based on scientific evidence. Therefore, methods can also be interpreted as procedures or sequences of ways that are systematically explored in scientific truth. While research can be interpreted as a scientific work to be done in a systematic, orderly and orderly. [1].

In extracting information on the preparation of this report, the method used is [1]:

1. Study of literature
   Literature study is a technique of collecting data through books, journals, and the Internet in order to obtain information or data relating to the title of research for applications built in accordance with the expected user.

2. Observation

   Data collection techniques by conducting research and direct review of the problems taken.
3. Interview

   Technique of collecting data by holding Question answer directly and indirectly to party which have relation with topic taken.
4. Questionnaire

   Questionnaires are data collection techniques by providing a set of questions or statements to respondents about the applications built. The purpose is to collect various data and facts that are needed in supporting research.

The method undertaken in the development process of this application is the method of developing multimedia applications Luther version. There are several stages in software development with this method is as follows [2]:

1. Concept
   The concept stage is to define the objectives, including the identification of the audience, the kinds of applications (presentations, interactive, etc.), application objectives (information, entertainment, training, etc.) and general specifications. Kind of application in this research that is interactive multimedia.
2. Design
   Design is the step of making specification in detail about program architecture, style, appearance and requirement of material or material for project specification is made enough detail so that at next stage, that collecting material and assembly is not required new decision, but using what has been determined on Stage design. In the development of this application began the process of design program architecture, interface display, and collection of materials or materials for the program that tools to be used, such as Blender3D for 3D modeling, Unity3D used for program development, AdobePhotoshop used for coloring and texture creation.

3. Material Collecting
   This stage is where the collection of materials that fit the needs done. This stage can be done in parallel with the Assembly stage. Pada Some cases, Material Collecting stage and Assembly stage will be done in a linear manner not parallel. Materials needed in multimedia can be obtained from sources such as libraries, existing materials on the other hand, or special making by outsiders. In the construction of this application the collecting material stage is the process of collecting materials such as images of wild animals in accordance with the images contained in the book Coloring Wild Animals published by Ruang Kata and also information about the animal.
4. Assembly
   The Assembly stage is the stage where all multimedia objects are created. Making this application is based on the design phase begins with the process of 3D object modeling that refers to the image of wild animals in the book Coloring Wild Animation published Space Room that has been collected in the material collecting stage, this process is done by using tools Blender3D for 3D modeling. After the process of modeling is done the process of making coloring book support applications using augmented reality (coding) starting from the provision of gettexture, controller, trigger, and information.
5. Testing
   Testing is done after the completion of the manufacturing phase and all data has been entered, firstly doing modular testing to ascertain whether the result is as desired. Some systems have features that can provide information when errors occur in the program. In the development of this application, the testing phase is to run an application that has been created to check whether there is still a functional that has not run.
6. Distribution
   Phase distribution is also the stage where evaluation of a multimedia product is done. With the evaluation, will be able to develop a better system in the future. At this stage do build the application into a package that will be implemented in the smartphone users.

   Stages of software development using Luther Multimedia Application Development method is illustrated in Figure 1 below:

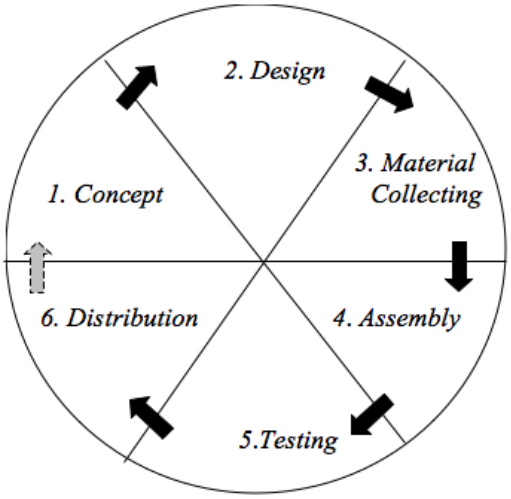


Figure 1 Multimedia application development methods (luther sutopo)

2.2 System Analyst

Analysis aims to identify the problems that exist in the system and determine the needs of the system built. Analysis includes problem analysis, non-functional requirements analysis, and functional analysis..

2.3 Problem Analysis

Problem analysis is the first step of system analysis. This step is needed to find out what problems occur within the system that is running.

Problem analysis aims to explain the problems that existed at the time of research in the Publisher Ruang Kata, before the development of applications coloring book support using augmented reality. Based on the analysis of problems that have been done, there are several problems namely:

1. In the book Coloring of Wild Animals published by Ruang Kata children can only color the book in the form of two-dimensional images only so it can not help children finish coloring activities in the form of three-dimensional.
2. Applications built for the Coloring of Wild Animals published by Ruang Kata are less interactive, so children often get bored while doing coloring activities.
3. In the application of live texturing coloring book augmented reality that already exist this object is in the application only displays the object characters only, there is no background object, still the lack of interaction between the user and the application, three-dimensional objects exist in the previous application only move according to the system, There is no virtual button to move the three-dimensional object.

2.4 Analysis of Similar Applications

Analysis of similar applications is done to provide an overview of the system for easier development and as a reference in developing applications to be achieved.

This application explains and helps the coloring activity in a three-dimensional object that will help the child in completing the coloring work. Here is an analysis of live texturing application coloring book that has been made by one of the students of University Computer Indonesia and has been used by one of the leading publishers or publishers in Bandung as seen in the picture 3.2



Figure 2 Icon of similar application

In the image view 2 is a live application icon texturing coloring book that has been made by one student Indonesia Computer University and has been used by one of the leading publishers or publishers in Bandung. Icon application is illustrated Dinosaur, because according to the book he took the Coloring Fun Dinosaurs published by Mizan.



Figure 3 Display the previous app menu

In the picture view 3 is the main menu view of live texturing application coloring book that has been made by one of the University Computer Indonesia students and has been used by one of the leading publishing company or book in Bandung. In the main menu view there are three menus are Coloring menu that serves to scan markers and display Dinosaur objects in the form of three dimensions, About applications that serve to know the explanation of the application, How to use that serves to mengatahui info how to use the application.

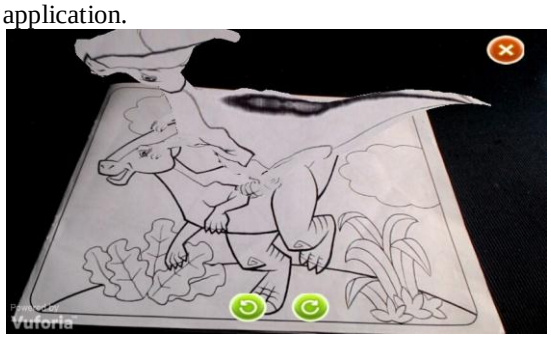


Figure 4 Three-dimensional object of previous app

In the picture view 4 is a three-dimensional object application display application live texturing coloring book that has been made by one student University Computer Indonesia and has been used by one of the leading publishing company or book in Bandung. In the application there are only three-dimensional objects Dinosaurs only, no three-dimensional objects for the background such as cloud objects, grasses and plants.



Figure 5 App views on apps in previous apps

In the picture view 5 is the display of info about the application of live texturing coloring book that has been made by one student University Computer Indonesia and has been used by one of the leading publishers or publishers in Bandung. Info view about this app serves to know the explanation of the created application.



Figure 6 Info how to use previous app

In view of picture 6 is display info how to use application of live texturing coloring book which have been made by one student of University Computer Indonesia and already used by one of the leading publishers or publishers in Bandung. Display info how to use this function to mengatahui info how to use in app.

2.5 Comparison of Similar Applications

The comparison contained in the application live texturing the previous coloring book and application development is contained in the table 3.1

Table 1 Comparison of application

No	Komponen	Aplikasi *live texturing coloring book* sebelumnya	Pengembangan aplikasi penunjang buku mewarnai menggunakan *augmented reality*
1	Bahasa	Bahasa Indonesia	Bahasa Indonesia
2	Menu	Pada aplikasi ini terlalu banyakpilihan menu	Pada aplikasi ini tampilan menu lebih *simple*, mudah untuk dimengerti
3	Grafis	Tiga dimensi	Tiga dimensi
5	Tombol	Tidak terdapat tombol *virtual button*	Pada aplikasi ini terdapat tombol *virtual button* yang berfungsi untuk menggerakkan objek
6	Objek tiga dimensi	Tidak terdapat objek background tiga dimensi	Pada aplikasi ini terdapat objek background tiga dimensi

Pada table 1 There are differences and developments between the previous application with the application that will be made.

2.6 Data Analysis

Data analysis describes the data to be used in coloring book support applications using augmented reality, the data used in the form of text, audio and three-dimensional objects. Here is a picture of the data analysis shown in Figure 7

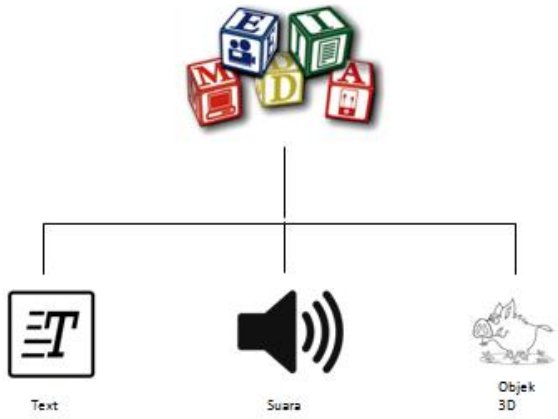


Figure 7 Data analysis

Data used in coloring book support applications using augmented reality of each data type and certain formats are::

1. Text data displayed in the form of text type string data.
2. The sound data is displayed in the form of sound with MP3 format.

The three-dimensional object data displayed is a three-dimensional object created using Blender.

2.7 Analysis of System Architecture

Analysis of system architecture is the path where the system runs an application. The following is an analysis of the previous application system architecture found in Figure 8

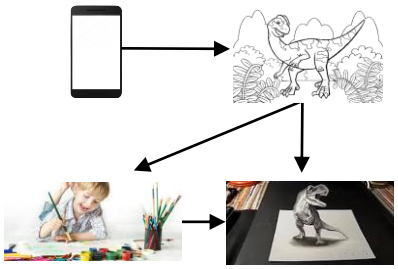


Figure 8 System architecture in previous applications

The system architecture contained in the previous application can only display and color the object only, its three dimensional objects can not be moved as per the user's desire, therefore the lack of user interaction with the application.

With the lack of user interaction with the previous application then developed applications coloring book support using augmented reality, so users with applications will be more interactive. Here is an overview of system architecture that looks like in figure 9

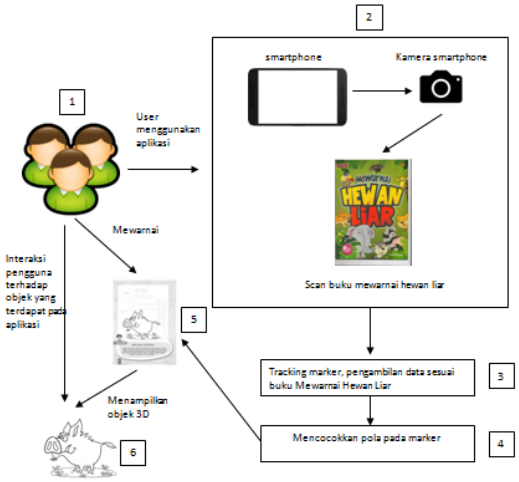


Figure 9 System architecture

To do the coloring activity, the user will start by opening the application on the smartphone (android), then the camera will detect the book in which there are wild animals in accordance with the book Coloring Wild Animals published by the Word Room, after which will appear three-dimensional objects augmented reality and can Colored simultaneously according to the color to be scratched on the marker. In addition users can move the existing three-dimensional object towards the user's wishes. Surely this can help users more interact with the application.

2.8 Analysis of Modeling

At this stage of modeling the data that have been obtained in the book Coloring Wild Animals published Kata kata dijadikanacuan in making three-dimensional model, modeling is done by using tools Blender. The three-dimensional modeling steps are as follows:

a. Two-dimensional Pangolin Objects

This Pangolin Object is taken from the book Coloring Wild Animals published by the Word Room. Here is an example of the picture shown in Figure 10

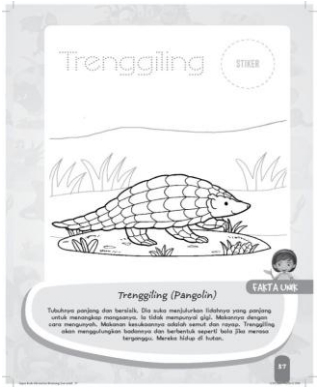


Figure 10 Pangolin

b. Three-dimensional pangolin Object

Once it is known the shape of the image of Pangolin taken from the book of Coloring of Wild Animals published by the Word Room, then made a replica that is in the form of a three-dimensional object, after which a three dimensional background object is created. Here is a picture of a three-dimensional anteater object as shown in Figure 11

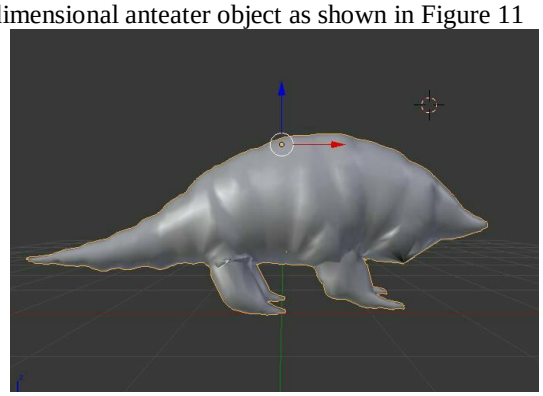
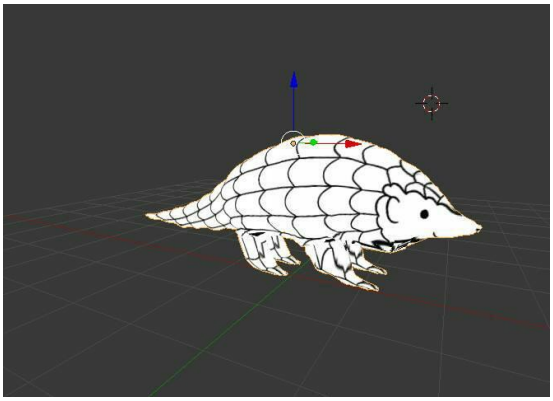


Figure 11 Three-dimensional pangolin Object

c. Texturing Object

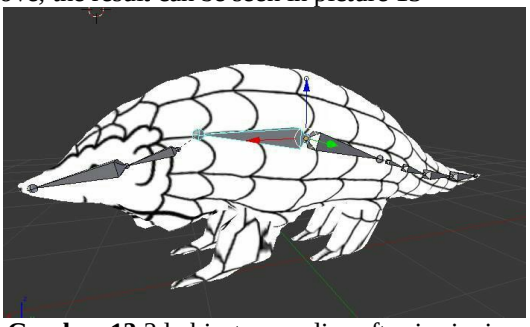
After doing 3D object modeling of Animal Pangolin image then done texturing object, that is by giving texture image, the result can be seen in picture 12



Gambar 12 3d object pangolins after being given texture

d. Rigging

After doing texturing object then done rigging object, that is by giving bone for object can move, the result can be seen in picture 13



Gambar 13 3d object pangolins after in rigging

2.9 Marker-making analysis

The marker used in this application refers to the book of Coloring of Wild Animals published by the Word Room for marker determination, the process of making the image into a marker is done by vuforia by uploading a marker image on the develover vuforia web page after the image is converted to generate a file with the format .unitypackage. The file is then used as input on engin unity3D to detect the image being marked. Here is a plot of the process of making markers through web vuforia as in figure 14

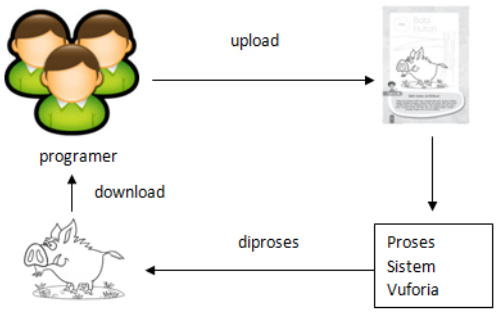


Figure 14 The process of making markers

2.10 Augmented Reality Creation Analysis

Case method analysis is an analysis that describes how the augmented reality process from the initial initialization, tracking marker, the process of bringing up a three-dimensional object, up to the live textur process. In designing the application with Augmented Reality technology that is to combine virtual object with real object, in this case virtual object in the form of three-dimensional object which corresponds to book of Liarterbitan Animals of Word Room captured by camera phone with certain pattern.

1. Import vuforia sdk ke Unity

Here is a view where vuforia sdk that had been downloaded, then imported into Unity, as shown in Figure 15

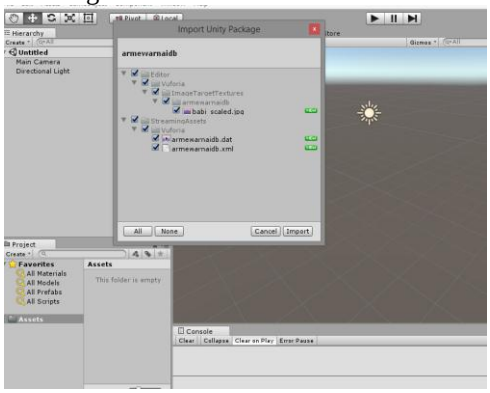


Figure 15 import vuforia sdk ke unity

2. Add prefab arcamera and imagetarget to hierarchy

In this section is the step of entering the arcamera preef and imagetarget into hierarchy. Here is how it looks like in Figure 16

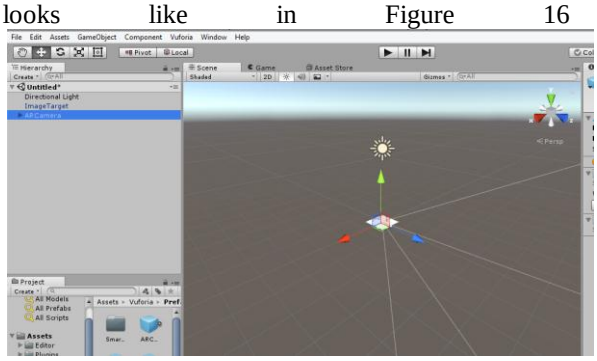


Figure 16 Step insert into hierarchy

3. Enter the three-dimensional object

In this section is the stage of inserting a three-dimensional object into Unity. Here is how to insert a three-dimensional object into Unity as shown in Figure 17

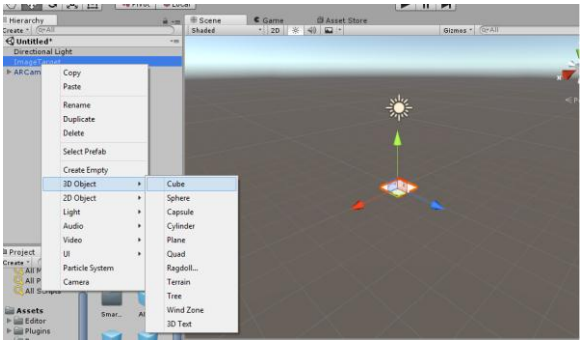


Figure 17 How to insert 3d objects

4. Insert serial number

The last step is to enter the serial number that can be obtained on the website vuforia on arcamera. Here is how it looks like in Figure 18

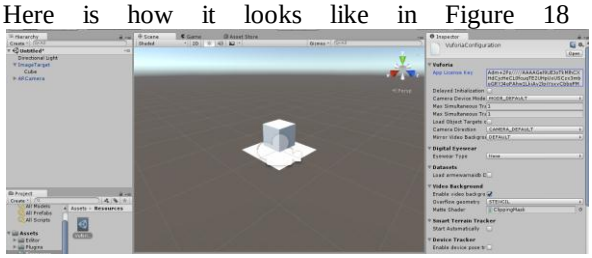


Figure 18 How to insert serial number

2.11 Hardware Analysis

Minimum hardware specifications that can be used to run applications can be seen in table 2

Table 2 Minimum hardware specifications

No	Perangkat Keras	Spesifikasi
1	*Processor*	Quad-Core 1.4 GHz
2	Memori	RAM: 1.5 GB
3	OS	Android 6.0.1 (Marshmallow)
4	Display	720 x 1280 pixels (~294 ppi pixel density)
5	Kamera	8 MP

2.12 Software Analysis

The software required for the development process of coloring book support applications using augmented reality contained in table 3

Table 3 Software specifications for building applications

No	Perangkat Lunak	Spesifikasi
1	Sistem Operasi Windows	Windows 7
2	Tools pembangunan	Unity 3D
3	Tools desain	Adobe Photoshop CS5, Blender

2.13 Usecase diagram

Use Case Diagram is a UML diagram model used to describe the expected functional requirenment of a system. The following is the design of the processes contained in the development of coloring book support applications using augmented reality as shown in Figure 19

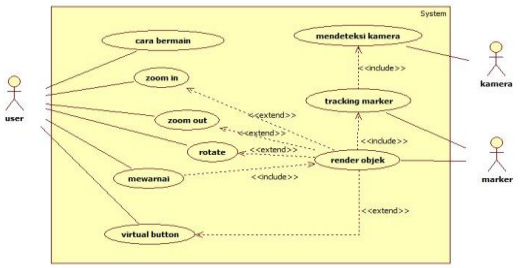


Figure 19 Usecase diagram

2.14 Activity diagram

Activity diagrams or activity diagrams describe the workflow or activity of a system or business process or menu found in the software. The activity diagram on the system to be built is as follows:

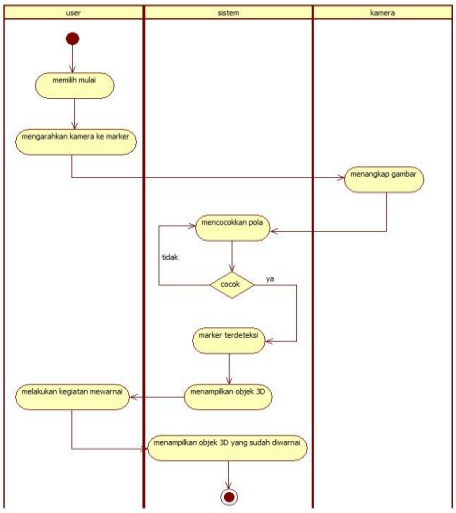


Figure 20 Activity diagram coloring

2.15 The user chooses to start then the system responds to open the application, then the user directs the camera to the marker and then the camera captures the image, then the system matches the marker pattern and displays the three-dimensional object, after which the user performs the coloring activity and then the system displays the three-dimensional object after coloring . Activity diagram coloring seen in figure 20

2.16 Class diagram

Class diagrams describe the structure of the system in terms of defining the classes that will be created to build the system. Class diagrams are created so that the classes created in the application match the design of the class diagrams that exist in the design documentation. Class diagram of coloring book support applications using augmented reality can be seen in Figure 21 for an explanation by type on the class diagram.

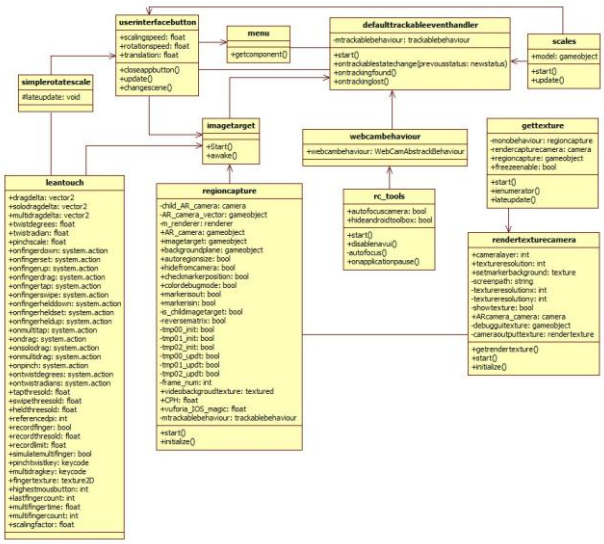


Figure 21 class diagram

2.17 Sequence diagram

Sequence diagram is a diagram that describes the interaction between objects and indicates the communication between the objects. This diagram also shows a series of messages exchanged by objects performing certain tasks or actions.

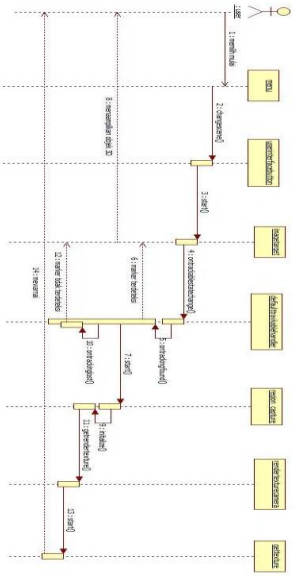


Figure 22 Sequence diagram coloring

2.18 Implementation

Device builders used in developing coloring book support applications using augmented reality itself are as follows:

1. Hardware Used

Here is the hardware used for the implementation of coloring book support applications using augmented reality contained in table 4

Table 4 Hardware Used

No	Perangkat keras	Spesifikasi
1	*Processor*	Hexa-core (4x1.3 Ghz Cortex A7)
2	*Memory*	RAM 2 GB
3	Kamera	8MP
4	*Display*	5.5 inches (~72,6% screen-to-body ratio)
5	*OS*	Jelly Bean 4.3

2. Software Used

Software specifications (software) on computers used to develop coloring book support applications using augmented reality are listed in table 5

Table 5 Software used

No	Perangkat Lunak	Spesifikasi
1	Sistem Operasi	Windows 7
2	Blender	Versi 2.78
3	Unity 3D Engine	Versi 5.2.0f3
4	Star UML	Versi 5.0.2.1570

2.18 Testing

Testing is the most important thing to do to find flaws and errors in the software being tested. Testing is intended to find out the software that is made already meet the appropriate criteria.

In this study testing conducted on the system that is functional testing (blackbox) and beta. The method used in this test is blackbox testing. Blackbox testing is a test that only observes the execution results through test data and functional checking of the software. Beta testing is used to determine the response of users to the application of coloring book support using augmented reality. For that will be tested using a questionnaire after the user knows and uses the application.

a. Black box Testing

Black box testing is done on the development side that records all errors and usage problems. Blackbox testing is done in a controlled environment.

b. Beta testing

Beta testing is a test conducted to determine the extent to which the usefulness of the application built, whether it has met expectations or not. For that in beta testing will be conducted research on a number of respondents or users of the system. Beta testing is done by giving the questionnaire format to 100 respondents.

Table 6 The results of the questionnaire

Item pertanyaan	(%) Jawaban Ya	(%) Jawaban Tidak
P1	80	20
P2	77	23
P3	84	16
P4	95	5
P5	86	14
P6	82	18
P7	74	26
P8	85	15
P9	42	58
Total	705	195
Rata-rata	78,33	21,66

To calculate the percentage of Yes's answers obtained from 100 statements, we calculate the total and the mean first as shown in table 5, then placed in the percentage scale range as follows:

Average value of answers Yes: 78.33

Number of statements: 100

78.33 / 100 x 100% = 78.33%

So based on the results of respondents from the 9 statements can be concluded that the application of coloring book support using augmented reality is very useful and can help learn coloring becomes more fun and more interesting and easy to understand in using the application (user friendly).

3. CLOSING

3.1 Conclusion

Based on the results of research, analysis, system design, implementation, and testing by distributing questionnaires to respondents, it can be concluded as follows:

1. Development of coloring book support applications using augmented reality has been successful in helping children finish their coloring work in the form of three dimensions.
2. Making the Coloring Book of the Wild Animals published by the Word Room is more interesting, interactive and the applications created can be easy to use by users.
3. Succeeding in developing live texturing coloring book apps using existing augmented reality to be more optimal in the suitability of objects with markers and develop applications become more interactive.

3.2 Suggestion

Based on the results of research, application development of coloring books using augmented reality is still far from perfect, for it needed the development is as follows:

1. The sound effects of this application are still deficient, so for further development the animal sound effects can be made in accordance with the voices of animals contained in the Book of Coloring of Wild Animals published by the Word Room, useful for users to recognize the sounds of the animals.
2. Specifications for the implementation of this application must use a fairly high specification, then the subsequent development of specifications for application implementation is made more optimal in order to be used by smartphone with minimum specifications so it feels light and does not eat much RAM.

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