DEVELOPMENT A 3D VIRTUAL MAP BASED ANDROID CASE STUDIES AT KEBUN BINATANG BANDUNG

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ABSTRACT

The Zoo is the place to observe animals in the environment created by man, by adjusting shelter animals. The Zoo has also become a place for recreation in the show to the public which serves as a place of education. The difficulty in finding routes and locations of animals in the Zoo became one of the major factors in the problems in the Kebun Binatang Bandung. Information about the animals still little that can be gained by visitors in because still using wooden boards. Thus is created a medium in the form of an application called "Virtual 3D Map of Kebun Binatang Bandung " that expect can provide routes and locations of the animals at the Zoo, as well as provide information about the animals at the Zoo are maximum. In the search location Kebun Binatang Bandung animals on utilizing virtual folders to indicate the location of each animal and as well as to maximize search routes for each location algorithm utilizing animals A Star Pathfinding. Based on the results of testing of an application that has been made is obtained that the application "Virtual 3D Map of Kebun Binatang Bandung " can give you the routes and locations of animals as well as provide information on animals with an interesting look so visitors can use the application conveniently and get information-information in need while in the Kebun Binatang Bandung.

***Keyword** : Zoo, Kebun Binatang Bandung, 3D Virtual Map. 3D Virtual Map Application, Media Information Kebun Binatang Bandung.*

1. INTRODUCTION

The Zoo is a place of introduction of various wild animals for the public. One of them is a Zoo located in the city of Bandung [1]. This diversity is used by humans as a recreation to enjoy or get information in an interesting way by looking at the animal directly. Not only 1 type of animals are at the Zoo but there are an awful lot like carnivores, herbivores or omnivores.

Based on the questionnaire been done to the 20 respondents consisting of men and women that, very limited unmarked folder and directions, and information about the detail of any animals still use wood. It resulted in. First, the visitor who was away on a folder and directions of the Board will ask the officer who drove, but officers did not always exist in every corner of the Zoo's location. Secondly, visitors sometimes have to paddle any animal cages when the visitors only want to see certain animals or animal who has not woman reports herself saw. And third, less detailed information concerning his or her animals such as the name and description of the animals on the visit because the information boards animals still use wood. It could be said that the use of information that is less effective because the wood wears over his running time the wood will be fragile and damaged

The solution to the above problem has. First, is the solution to the limited unmarked folder and directions. We can create applications that make the Zoo a folder path to the SE or any of the location of the animal. Create application folders can decrease the price of the Zoo must create a folder or a new Ene in every corner of the Zoo's location. Second, is the solution to less effective routes if traveled but just want to see particular animals or animals that have not been seen. Provide directions on the application folders in the Zoo with AStar pathfinding algorithm uses as a route search [2] can make users know the one the right for certain animal to the location you wish to view or animals that have not been seen. Third, is the solution of the detail information of animals that still use wood. Create application folders, Zoo party need not fear the rainy conditions that made the detail information of the animal becomes less complete and the Zoo did not have to report such as when using wood. They have to constantly replace the planks when the Board already cannot be read or does not deserve to be shared.

Based on the above issue, then taken a final assignment topics with titles "DEVELOPMENT A 3D VIRTUAL MAP BASED ANDROID CASE STUDIES AT KEBUN BINATANG BANDUNG", in hopes of making people who reside at the Zoo no longer trouble or confusion when wanting to know information/location of the animal you wish to see as well as streamline the route with the fastest path to that location.

1.1 Goal and Purpose

Based on existing problems, then the intent of the development of this application is to the utilization of Virtual 3D Map and information at the Zoo.

As for the goal that will be achieved from the utilization of this application are as follows:

1. *Provide information and locations of the animals at the Zoo with 3D visuals to make it look attractive.*
2. *To make the route more effectively by way of choosing the shortest route to get to the location of the animal you wish to see or be able to see the whole animal with just one round of*
3. *Displays interesting information about animals such as the name of the animal and the animal effectively without explanation should be afraid of problems such as enclosed wooden leaves, brittle or damaged.*

1.2 A Method Of Software Development

In the construction of Virtual 3D Map applications using software development method MDLC (Multimedia Development Life Cycle) version of the Luther – Sutopo which consists of 6 stages, namely, the collection of design concepts, materials, manufacture, testing and the distribution of as in picture 1 [3].

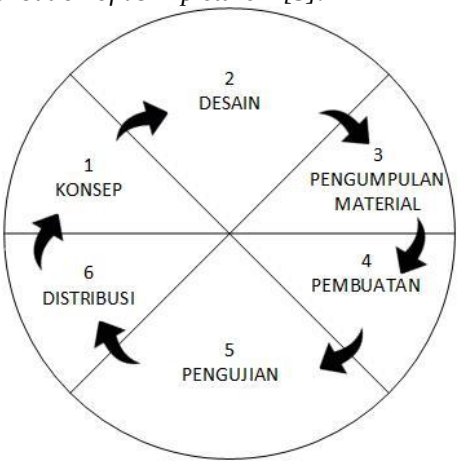


Figure 1 Metode MDLC Luther – Sutopo

2. THE CONTENT OF RESEARCH

2.1 The Cornerstone Of The Theory

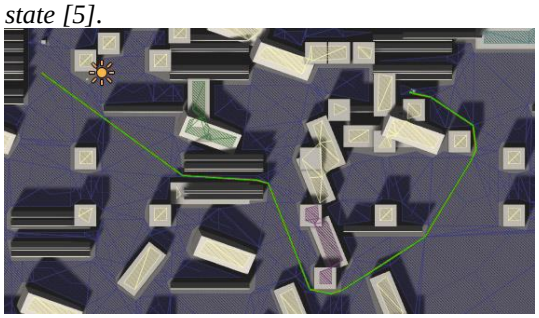
The cornerstone of the theory of the construction of 3D Virtual Application Folder outlines the basic theories to the analysis process system and supports the process of the construction of 3D Virtual application folder.

2.1.1 Map

A map is an overview of the Earth's surface in flat areas with a certain scale through a system of projection. A map can be presented in many different ways, ranging from conventional printed maps to a digital map that appears on a computer screen. The term is derived from the Greece map of the Prado's Mappa meaning talk or cloth cover table. But generally, the sense of the map sheet is all or part of the Earth's surface on the flat areas that are minimized with the use of a certain scale. A map is a two-dimensional representation of a three-dimensional space [4]. The study of map making is called cartography. Many maps have a scale, which determines how big the objects on the map in a State that actually. A collection of some of the map called an atlas

2.1.2 *A Star Pathfinding Method*

*AStar is a graph search algorithm/tree looking for the line from a start point to a predetermined endpoint. The principle of this algorithm is to find the shortest path from an initial node (starting point) to the destination node with the smallest price (F). A * take into account the cost of the current state to the destination with the heuristic function, these algorithms also consider the cost that had been taken over from the initial state to the current state [5].*



Picture 2 A Star Pathfinding Method

2.1.3 Unity

Unity Technologies is a developer of Unity, one of the most popular licensed 3D game engine or game engine. Unity also has ideas or also called Integrated Development Environment i.e. MonoDevelop that aims to integrate all the scripts that we make into Unity so that it can be directly processed. Unity is usually used for

making car game or browser but can be used for PC and Console [6].



Picture 3 Unity

2.1.4 Vuforia

Vuforia SDK is Augmented Reality (AR) devoted to mobile devices that enables the creation of applications AR. using Computer Vision technology to identify and track 2D images and 3D objects are simple, such as boxes, pipes, desks, etc. are real-time [7].



Picture 4 Vuforia SDK

2.2 Analisis Sistem

System analysis can be defined as the description of a system or software application that will be built into parts of its components with a view to identifying and evaluating problems as well as the expected needs.

2.2.1 Problem Analysis

Problem analysis is a form of exposure on the issue prior to the building of a simulation application 3D map tool to locate animals, providing information, and give you the best route, as for problems encountered are:

1. *Visitor experience It is difficult will be the locations of any animal because the map is only within its entrance it makes visitors who are in the midst of the difficulties other animals know the location, visitors will be asked the clerk where the the location of the animal but not every time there is always staff in every corner of the Zoo*
2. *Visitors a good route through difficulties and are likely to have to repeatedly go around in order to see the whole animal or only see certain animals. The effective route here is the correct route for the animals to the place where we are headed*
3. *Visitors will experience difficulties information-interesting information about animals such as the name of the animal and an explanation of each of the animals that reside at the Zoo because of the information covered wooden leaves or are already fragile and damaged by long-time/often to a shower of*

2.2.2 Analysis Of The Running System

The description of the system that is run by the Bandung Zoo. The description of the systems that run them are procedures entered the Zoo, see a map and asked the location of the animal receive information

1. *The procedure of entering the Zoo is as follows:*

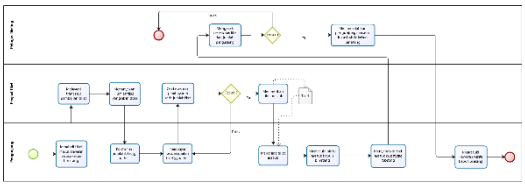


Figure 5 The Procedure Of Entering The Zoo

2. *Procedure for viewing a map is as follows:*

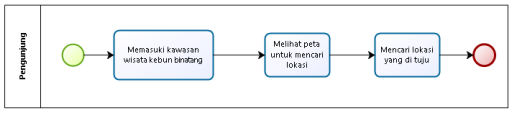


Figure 6 Procedure For Viewing Map

3. *The procedure of asking the location of the animal goes to information is as follows:*

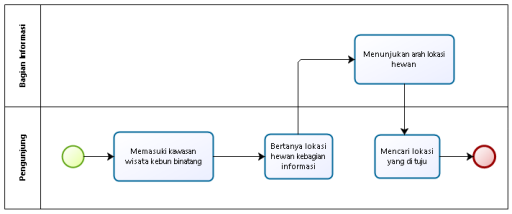


Figure 7 The procedure of Asking the location of Animals to the Information

2.2.3 The Collection Of Multi-Media Materials

At this stage done gathering materials such as images, animation, following the creation of images, animations and other things needed for the next phase.

1. *Animal Modeling*

At this stage do the rendering of the object. Following are the results of rendering animals.

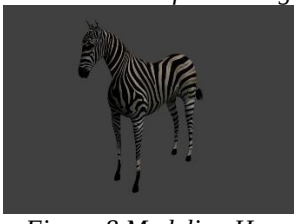


Figure 8 Modeling Hewan

2. *Map Modeling*

At this stage do the rendering on the object map. Following is the result of rendering a map.

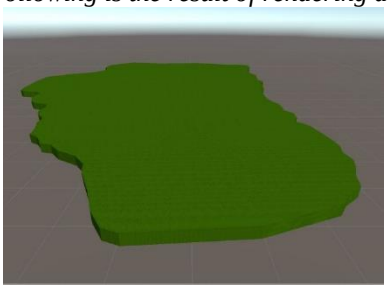


Figure 9 Modeling Map

3. The merger on a map

At this stage do the merge on the object. Following are the results of rendering.

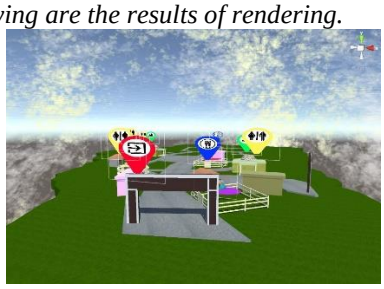


Figure 10 Map

2.2.4 Model 3D Analysis

Creation of 3D objects to visualize that later will be used in the simulation of 3D Virtual Application Folder as tools to be built. As for the 3D models of therapy that scenario is expected to be made are as follows.

Table 1 Analysis Model 3D

Primate	Reptile	Herbivores	Carnivore	Avifauna
Orang Utan	Cobra	Horse	Leopard	Macaw
Surili	*Python*	*Zebra*	*Lion*	*Jalak Bali*
Wau-Wau	crocodile	*camel*	*Sumatran tiger*	cockatoo
Beruk	*Crocodile sanyulang*	*Elephant*	Bear	*Beo*
Siamang	Turtle	Spotted deer	*binturung*	Peacock
		pig		Stork
		Tapir		Eagle
		Hippopotamus		*pelican*

2.2.5 Analysis of the reading QRcode

Application in awoke requires reading the marker/QRcode to know the location of a visitor is located. This analysis of wear vuforia for the reading of the marker and marker treated by augmented reality SDK. Following are the results of the image that has been inserted the marker. Unity package.

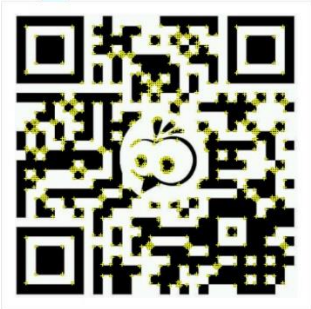


Figure 11 Analysis Of The Reading QRcode

Looks that appear dots coordinates in the image, those points that will be detected by the system or augmented reality camera.

2.2.6 Analysis A Star Pathfinding Method

The analysis method of A Start Pathfinding to know how to work and how to wear A Star Pathfinding on unityunity. The workings of A Star Pathfinding turned out to be the same as the other package at unity, namely downloading an advance package and then import. Following are the results from the use of A Star Pathfinding

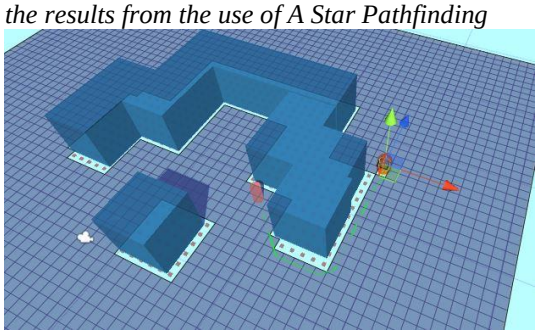


Figure 12 The Analysis Method Of A Star Pathfinding

Looks that appear green lines that lead AI on the target. The line is the line that will be going through AI towards its target. And there are parts that are not closed grid. It shows that the line cannot be passed by AI to go to target.

2.2.7 Analysis Of System Architecture

The application to be built is an Android-based application that serves to display the 3D map simulation as a tool for visitors to know the locations of each animal and the animal information.

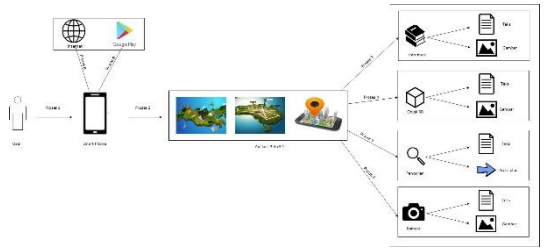


Figure 13 Analysis Of System Architecture

The following is a description of the architecture of the system:
Process 1 = User access smartphone
Process A = internet connected should Smartphone to download the application
Process B = Smartphone access the play store to download an application
Process 2 = opens Smartphones from the 3D map
The process Of application 3 = 3D map can see information about the animal
The process Of application 4 = 3D map can see the animals with 3D objects
5 = process Of 3D map can locate
6 = process Of 3D map can use cameras to scan the QR code

2.3 Non Functional Requirements Analysis

Non-functional requirements analysis is an analysis that is used to find out the system requirements specification. As for the non-functional needs analysis consists of hardware requirements, software requirements, as well as the analysis of the user.

2.3.1 Analysis of Hardware Requirement

The following are the hardware requirements of the software applications that will be built. As for the following hardware specifications are widely used by the community:

Table 2 Specifications of the hardware

Hardware	*Minimum*
Storage	*8 GB*
Screen	*Touchscreen*
RAM	*2 GB*

While the specifications of the hardware needed to run the applications that will be built are as follows:

Table 3 Minimum Hardware Specifications

Hardware	*Minimum*
Free Storage	*1 GB*
Screen	*Touchscreen*
RAM	*1 GB*

2.3.2 Software Analysis

The following are the software requirements of software applications that will be built. As for the following software requirements specification is required to build software applications.

Table 4 Specification of Software Development

Software	*Specification*
Operating System	*Android 5.1 (Lolipop)*
Blender	*2.77*
Unity	*64-bit*
Adobe Illustrator	

While the specification of software requirements needed to run the applications that will be built is the U.S. follows:

Table 5 Minimal Software Requirements Specifications

Software	*Specification*
Sistem Operasi	*Android 5.1 (Lolipop)*

2.3.3 User Analysis

User analysis is intended to find out what is needed by the user who will use the application on this research, as for the parameters of the potential users of the applications are categorized into 2 parts, namely knowledge and user experience and user characteristics.

1. *Knowledge and user experience*

Table 6 Knowledge and User Experience

Knowledge and User Experience	
Android Knowledge	*Can operate the basic of android*
Experience of System	*Understand the application installation*
Application Experience	*Can use a common application on android*

2. *User Characteristics*

Table 7 Karakteristik Pengguna

Karakteristik Pengguna	
Age	*18 years old*
Gender	*Male and Female*
The use of hand	*Both in good condition*

2.4 A Functional Requirement Analysis

A functional needs analysis conducted to know the description of the process activities which will be implemented in the software applications that will be built. On this analysis using UML modeling (Unified Modeling Language).

2.4.1 Use Case Diagram

Use Case Diagram is a model that shows the look of the system from the perspective of the user so that it can describe what the system will do without explaining how the system does it [8].

Now here is a Use Case Diagram of 3D Virtual Application Folder

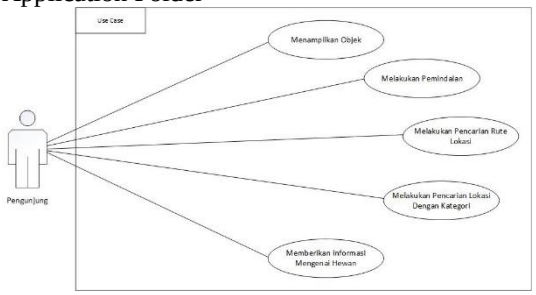


Figure 1 Use Case Diagram

2.4.2 Class Diagram

Class Diagram serves to show the static features of the system and not represents the specific process. Now here is a class diagram of 3D Virtual Application Folder

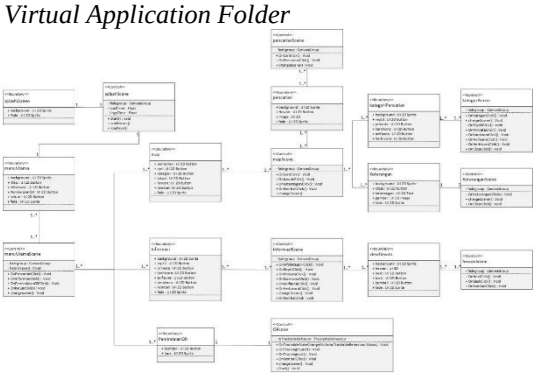


Figure 14 Class Diagram

2.5 Design Of The System

The design of the system is an overview of the design and manufacture of the applications will be built, the design of application divided four IE: Menu structure, Designing Interfaces, Semantic Networks and the design Method. As for the following is the menu structure of the 3D Virtual Application Folder

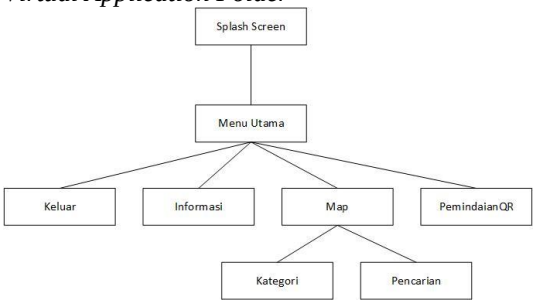


Figure 15 Design Of the Menu Structure

The menu of the Virtual 3D Map applications consists of three main menus: Map, information, and PemindaianQR

2.6 Interface Implementation

Interface implementation is done by taking a picture of an application that has been built where each image would represent the overall application that has been built.

2.6.1 Interface Implementation SplashScreen

Implementation of the interface of the SplashScreen is as follows:

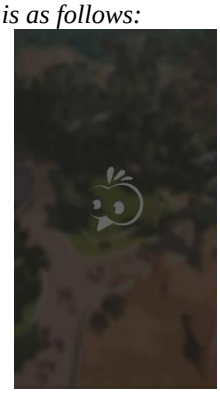


Figure 16 Interface SplashScreen

2.6.2 Interface Implementation Main Menu

Implementation of the interface of the main menu are as follows:



Figure 17 Interface Main Menu

2.6.3 Interface Implementation Map Menu

Implementation of interface from the menu folder is as follows:



Figure 18 Interface Map Menu

2.6.4 Interface Implementation Information Menu

Implementation of interface information is as follows:



Figure 19 Interface Menu Information

2.6.5 Interface Implementation Select Category Information

Implementation of the interface of the select a category of information is as follows:

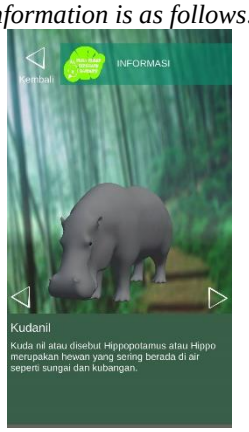


Figure 20 Interface Select Category Information

2.6.6 Interface Implementation ScanningQR Menu

Implementation of the pemindaianQR interface from the menu are as follows:



Figure 21 Interface Menu ScanningQR

2.6.7 Interface Implementation Scanning Result

Implementation of the interface of the results of the scan are as follows:



Figure 22 Interface Scanning

2.6.8 Interface Implementation Search Location

Implementation of the interface of the search locations are as follows :



Figure 23 Interface Search Location

2.6.9 Interface Implementation Search Location Result

Implementation of an interface of location search results are as follows:

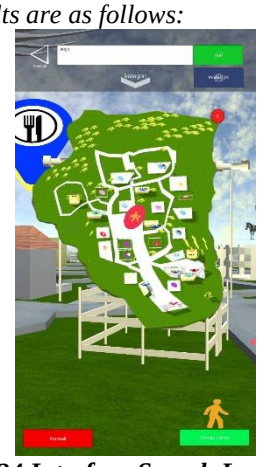


Figure 24 Interface Search Location Result

2.6.10 Interface Implementation Route to the Location

Implementation of the interface of a route to the location is as follows:



Figure 25 Interface Route to the Location

2.6.11 Interface Implementation Location Category

Implementation of the interface of the search location categories are as follows



Figure 26 Interface Location Category

2.6.12 Interface Implementation Search Result Location Category

Implementation of the interface of search results category location is as follows:



Figure 27 Interface Search Results Location Category

2.7 Testing System

System testing done to find out if the application has been built can be run. As for in testing system using three techniques testing functional testing, performance testing, and beta testing.

2.7.1 Functional Testing

Functional testing is done to see if the functionality has been designed already running or not, but here is a scenario testing functional testing.

Table 8 Scenario Testing

No	*Fungsionalitas*	*Testing Method*
1	*Searching Route Location*	*Black-Box*
2	*Do A Search With Location Kateogri*	*Black-Box*
3	*Provides Information About Animals*	*Black-Box*
4	*Perform A Scanning*	*Black-Box*

1. *Cases and Result Test*

The case tested the menu is select the folder that represents the overall testing select stage.

Table 9 Testing Map Select Menu

Action	*The expected results*	*The Test Results*	*Description*
Select Map Menu	*Display the Menu Map*	*Successfully display the folder Menu*	*Successfully*

2. *Test Conclusion*

Based on the overall functional testing done there were no errors and mistakes and all functions can be run well.

2.7.2 Performance Testing

Performance testing was done using the third application assistance i.e. GameBench [9], as well as an assessment of the results taken from the average FPS of any smartphone that has paired 3D Virtual application folder.

Following are the results of the calculation of the average of the testing that has been done to the three Android smartphones namely Asus Zenfone 5, Xiaomi Redmi Note 4 and the Samsung C7.

Table 10 The Results Of Testing Performance Testing

RAM	CPU	GPU	FPS
341 MB	23%	77%	27 fps

2.7.3 Beta Testing

Beta testing is done by way of disseminating a questionnaire to respondents to the appropriate target users who've designed before, and the questions asked are the questions referring to the research objectives to be assessed whether the making of 3D Virtual

Application Folder to resolve the issue that is occurring or not.

Now here is a scenario assessment of beta testing which consists of a list of questions to which users are taken using the technique of sampling snowball with the number of respondents 20 people as well as the weighting of assessment questionnaires that have been filed with the using the Likert scale.

1. Likert scale Assessment scenarios

To conduct the assessment of the answers to the questionnaire using Likert scale was used the following formula:

$$I = \frac{\sum s}{Jumlah\ Responden}$$

The above formula is used to calculate the interval of each answer obtained from the respondents, while for interval judgments used are as follows:

Table 11 Interval Skala Likert

CATEGORY	*WEIGHTS*	*INTERVAL*	*CONCLUSION*
Not	*1*	*0 – 0,99*	*Not Reached*
Enough	*2*	*1 – 1,99*	*Sufficiently Achieved*
Yes	*3*	*2 – 2,99*	*Has been reached.*

2. The Results Of The Assessment Of The First Goal

Based on the results of the calculation of the first objective questionnaire is obtained that the average value of an assessment questionnaire first goal is 2.2 and is a category "Achieved". Taken from each value of each question that consists of 3 questions covered.

3. The Second Purpose Of Assessment Results

Based on the results of the calculation of the first objective questionnaire is obtained that the average value of an assessment questionnaire first goal is 2.8 and is a category "Achieved". Taken from each value of each question that consists of 3 questions covered.

4. The Third Objective Assessment results

Berdasarkna second goal questionnaire calculation result is obtained that the average value of an assessment questionnaire a second goal is 2.3 and is a category "Achieved". Taken from each value of each question that consisted of two closed-questions

5. Conclusions Testing Beta Testing

Based on the results of beta testing is done using question form (questionnaire) which was presented to the 20 respondents using the method of sampling snowball with the age range of 18 and above.

Obtained for testing purposes the first respondents said that 3D Virtual Application map has been providing information and insights regarding wildlife-endemic which is in West Java with reference to the results of the average value of the interval on each question with the conclusion "Reached", and for the purpose of testing the two respondents said that 3D Virtual Application Folder can provide routes and locations of animals as well as provide information about the animals at the Zoo in bandung with reference to the average results the value of the interval on each question with the conclusion "Reached".

3. Cover

3.1 Conclusion

Based on the deliberations of the analysis, design, implementation and testing phase there are some conclusions from the construction of 3D Virtual Application Folder as the media information about the route and the location of the animal as well as information about the animals at The Bandung Zoo. As for the conclusion of the results of this research are as follows:

a. Application 3D Map Zoo can provide the location of the animals needed by the visitors.
b. Application 3D Map Zoo can provide the shortest route to get to the location of the animal you wish to view
c. Zoo 3D Map applications can provide information about the animals

3.2 Advice

The authors are aware of the proposed software development is still far from perfect and not optimal said in the application, therefore there are some suggestions that can be made into consideration in its development. As for the advice given in order that the system can be built for the better of which are:

a. Maximize 3D animated Animals in order to be more interactive
b. Interesting Information about the animals reproduce not only provides interesting information about the animals at the show on a map given by Zoo
c. Mengefisiensikan graphics on 3D modeling so as not too heavy when in use by the visitor

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