

Virtual Reality Application of Motor Vehicle Simulation Test for Making SIM C Mobile Based

Zulchairi¹, Husaini^{2*}, Hari Toha Hidayat³

⁽¹⁾ ⁽²⁾ ⁽³⁾ Department of Information and Computer Technology, Politeknik Negeri Lhokseumawe, Indonesia

*Corresponding Author: husaini@pnl.ac.id

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Abstract

Virtual reality technology allows a person to simulate an object that presents a visual display similar to the real world. The problem that occurs regarding this research is that many people do not know that the motor vehicle simulation test for making a SIM C, because of that many people are lazy to go to make a SIM C, and people are often confused in the driving test for making a SIM C. So the purpose of building this virtual reality application is to conduct a motor vehicle simulation test more specifically so that they can find out how the motor vehicle simulation test is to get a SIM C. Through this information media, people can interact directly with virtual reality applications to find out simulation tests that are more interesting and easy to understand. The application built displays animated objects and text on mobile android in real time, aiming to find out pass and not pass when doing this simulation from the application that has been made. Testing is done by playing this simulation which when playing the simulation we must go at a maximum speed of 30 kph if it is more than 30 kph then we will be declared a failure of the test and if the driver goes off the track or hits the obstacle it will be declared a failure. So you have to repeat from the beginning and each mistake is given a 2x chance to repeat and if the rider still fails the 3rd simulation test then the rider is declared a failure in conducting the simulation test. If the motorcyclist does not crash and successfully passes all obstacles or does not get out of the way and does not exceed the speed of 30 kph to the finish, he will pass and be entitled to a C driver's license. fps testing in the application is to see the speed of the application on mobile android and the average fps on fps is 24 - 64 fps, so from the results of the fps test using android 1, namely android 7.0 the test results are from 59.9 fps to 60.1 fps, while from testing android 2, namely android 9.0 the test results are from 59.9 to 60.1. In testing this questionnaire we will find the entire number of question values by summing them up using the Likert scale method and then based on the results of these calculations the value obtained on all questions is 81.6%, it can be concluded that the virtual reality application of motor vehicle simulation tests for making a mobile-based SIM C is very good when used by users.

Keywords: Application, Virtual Reality, Gyroscope Sensor, Mobile, Simulation, Likert Scale.

1. Introduction

Technology that can be used as a learning aid is virtual reality technology. Virtual reality technology allows a person to perform a simulation of an object that presents a visual display similar to the real world. This technology is quite interesting because the display is made with the help of computer graphics such as blender, so that it can see the objects in it look like real. This application is run with an android smartphone using the help of a cardboard or vr box which will make users seem to explore and see an environment that looks real by moving the head left, right, up, down or rotating 360 degrees [1].

Driver's License (SIM) is proof of registration and identification given by the police to someone who has met administrative requirements, is physically and mentally healthy, understands traffic regulations and is skilled in driving a motor vehicle [2].

The problem that occurs regarding this research is that many people do not know that the motor vehicle simulation test for making a SIM C, because of that many people are lazy to go to make a SIM C, and people are often confused in the driving test for making a SIM C.

Based on the above problems, the researcher will make an application with the title "Virtual Application Reality Test Simulation Motor Vehicle for Making SIM C Mobile Based". This application will show how to test motor vehicle simulations in the form of 3D objects and use text.

2. Methods

2.1. Virtual Reality

The earliest virtual reality technology was the Aspen Cinema Map, created by MIT in 1977. The program is a rough simulation of the city of Aspen in Colorado, where users can wander in large in both seasons, and the third is a basic three-dimensional (3D) model of a large city [3]. one of three styles namely summer, winter and polygon. The first two have been based on photographs, as the researchers actually photographed every possible movement through the street view of the city.

2.2. Android

Android is an open source Linux-based operating system designed for touchscreen mobile devices such as smartphones and tablet computers. Android was originally developed by Android, Inc. with financial support from Google, which purchased it in 2005. The operating system was officially released in 2007, along with the establishment of Open The first Android phone went on sale in October 2008.

Then to develop Android, the Open Handset Alliance was formed which is a consortium of 34 hardware, software and telecommunications companies [4].

2.3. Cardboard SDK

Cardboard SDK is an SDK or Software Development Kit that can be integrated with Unity so that it allows Unity users to create Virtual Reality applications for Android and iOS platforms that run on Google Cardboard. Currently the features contained in the cardboard SDK are getting better and easier to apply by developers into applications that have been made. So with the latest features of the cardboard SDK developers can be creative and make interesting and good applications to use [5].

2.4. System Design

2.4.1. 3D Object Creation

Creating 3D objects in the virtual application reality test simulation of motorized vehicles for making a mobile-based SIM C can be seen in Figure 1 below.

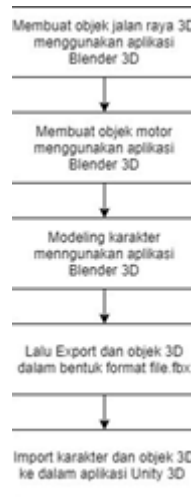


Figure 1. Block Diagram of 3D Object Creation

Based on the picture above, is the process of making 3D objects, the first step is to create a highway track object using the Blender 3D application. Next, create a motorcycle object using the Blender 3D application. Next, create a 3D character which we can control using a joystick and show the start of the driving simulation. In the last stage, 3D characters and objects are exported into the Unity application format, namely file.fbx format, which then the 3D characters and objects are imported into the Unity application.

2.4.2. Application Development in Unity

The stages of making virtual reality applications for motor vehicle simulation tests for making mobile-based SIM C can be seen in Figure 2 below.



Figure 2. Block Diagram of Application Development in Unity

Based on the picture above, is the process of making applications in unity, the first step is to run the unity 3D application that has been installed, the second step is to import 3D characters and objects that have been made in the blender application into unity 3D, the third step is to make 3D characters and objects can run by being controlled using a joystick. For the joystick control program, it can be downloaded from the asset store, the fourth stage is installing the Cardboard SDK and JDK, then setting the Android SDK and JDK directories, after that in the Preferences section select Virtual Reality in the Player Settings section. The last step is to set the Build application using the Android SDK platform.

2.4.3. Use Case Diagram

Use case Diagram is used to describe the function of the system created and can be seen in Figure 3 below.

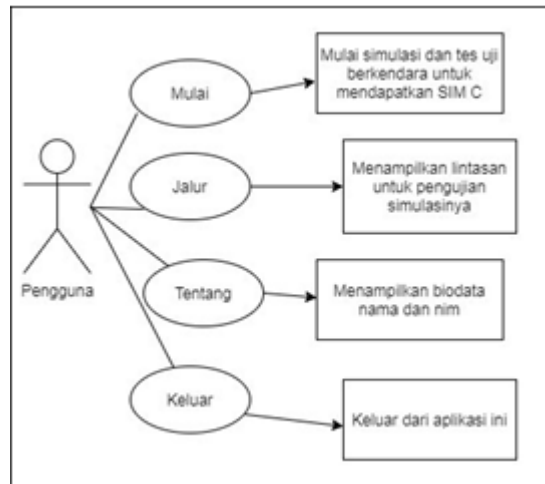


Figure 3. Application Use Case Diagram

- 1) Start Menu Use Case
Use case on the Start menu is to explain how to start a driving simulation for testing to get a C license.
- 2) Path Menu Use Case
Use case on the Path menu is to display the road plan or image that we will pass for driving simulations to get a C license.
- 3) Use Case About Menu
Use Case About Menu is to display the bio of who made the application.
- 4) Exit Menu Use Case
Use Exit Menu Case is to exit the applicatio

2.4.4. Activity Diagram

What needs to be considered here is that the activity diagram describes system activity not what actors do, so it can be seen in Figure 4 below.

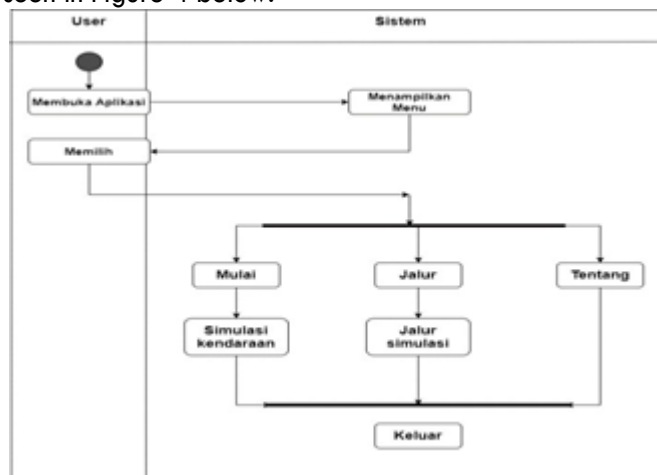


Figure 4. Application Activity Diagram

Activity diagram is first the user opens the application then the system will display the menu then the user will select so there are four menus that appear, namely the first start menu in the start menu there is a simulation test display to go to a motor vehicle for making a SIM C, after that press the Kaluar menu then return to the initial menu display then enter the second menu, namely the path menu where when we enter the path menu it will display a simulation path for users to simulate and we select the exit menu again and return to the initial menu display then enter the third menu, namely the about menu then we exit again and the menu display returns to the initial display again.

2.4.5. Practicality Test

At the practicality test stage to measure the level of practicality of the product produced, the practical analysis test uses the following formula.

$$P = \frac{\sum F}{N} \times 100\%$$

Where:

- P : Final score
- F : Total score acquisition
- N : Maximum score

Table 1. Practicality Test Level Category

No	Assessment	Description
1	80 < P ≤ 100	Very good
2	60 < P ≤ 80	Good
3	40 < P ≤ 60	Neutral
4	20 < P ≤ 40	Not Good
5	00 < P ≤ 20	Not very good

Android specifications used in the application can be seen in the following table.

Table 2. Android Specifications

Device	Specifications
1	OS : Android v5.1 (Lollipop)
	RAM : 2 GB
	Resolution : 1080 x 1920
	Prosesor : Mediatek MT6795 Helio
	:
2	OS : Android v6.0 (Marshmallow)
	RAM : 4 GB
	Resolution : 1080 x 1920
	Prosesor : Mediatek 210 Helio
	:
3	OS : Android v7.0 (Nougat)
	RAM : 4 GB
	Resolution : 720 x 1280
	Prosesor : Qualcomm Snapdragon 625
	:
4	OS : Android 8.1 (Oreo)
	RAM : 2 GB
	Resolution : 2160 x 1920 pixel, 5.0"
	Prosesor : Qualcomm MSM8917 Snapdragon 425
	:
5	OS : Android v9 (Pie)
	RAM : 4 GB
	Resolution : 1080 x 2280 pixel, 6.0"
	Prosesor : <u>Qualcom Snapdragon 636</u>
	:

3. Result and Discussions


After that, the next stage is the testing and discussion process.

3.1. FPS Testing Results on Device Application

This test is done to get the frame per second value for each page being run. Frame per second test results can be seen in Table 3 and 4.


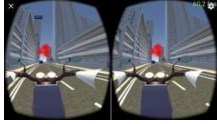

Table 3. fps testing of applications on device 1



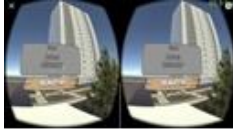
No	Testing Component		FPS
	Page	Result	

1	Menu		59,9 fps
2	Mulai		60,2 fps
3	Scene button exit and start		59,8 fps
4	path		59,8 fps
5	Scene button out of the way		59,9 fps
6	about		59,9 fps

Based on Table 3, the results of testing applications using one device with Android 7.0 (Nougat) operating system specifications produce FPS values for each page and scene that is run, starting from 59.9 fps to 60.1 fps. The FPS value generated in this test is above the normal value, so it can be said that the application's graphics performance is very good.

Table 4. Fps testing of the application against the device

No	Testing Component		FPS
	Page	Result	
1	Menu		59,9 fps
2	Mulai		59,9 fps
3	Scene button exit and start		59,8 fps

4	path		60,2 fps
5	Scene button out of the way		59,9 fps
6	about		59,9 fps

Based on the test results of tables 3 and 4, the FPS value for each page and scene run is above the normal value, namely on device one the value obtained starts from 59.8 fps to 60.1 fps and on device two the value obtained is 59.9 and 60.1 so that it can be said that the application's graphics performance on both devices is very good.

3.2. Application Testing Results Against Device

This test is carried out to see whether the application is capable of being embedded in these existing devices.

Table 5. Application testing on the device


No	Component Testing	Device Testing Results				
		1	2	3	4	5
1	Opening the App	-	✓	✓	✓	✓
2	Menu	-	-	✓	✓	✓
3	Start	-	-	✓	-	✓
4	Simulation scene	-	-	✓	-	✓
5	Path	-	✓	✓	✓	✓
6	Trajectory Scene	-	✓	✓	✓	✓
7	About	-	✓	✓	✓	✓
8	Scene Biodata	-	✓	✓	✓	✓
9	Exit	-	✓	✓	✓	✓

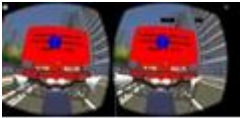
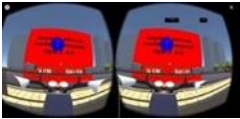

Based on the data from the results of testing the application on the device in table 5 the application is successfully run on several devices or smartphones with different specifications. Of the 5 smartphones tested, only on device 2 to device 5 the application can be run starting from opening the application, simulation scene, path scene, about and exit because this application does not support use on the android operating system version 5 even though it has a RAM capacity of 2 GB. As for the Menu page, Start and simulation scenes cannot be run on device 1 due to the small RAM capacity of 2 GB even though this application has been supported for the android operating system version 5. The application can be run perfectly on device 3 to device 5 the application can be run completely 4 path 60.2 fps due to RAM capacity ranging between 3 GB and 4 GB and android operating system version 6 to version 9 has been supported to run this application.

3.3. Test Results Passed and Not Passed To Get a Driver's License C

This test is to find out the pass and not pass when doing this simulation of the application made at , can be seen in the following table.

Table 6. testing pass and not pass

No	Testing pass and do not pass		Description
	Scene	Test Result	
1	Simulation		Pass if you pass the obstacle course and make it to the finish and get the best score.

2	Simulation		Does not pass if the motorcyclist crashes into an obstacle and still has the opportunity 2 more times
3	Simulation		No pass if the motorcyclist goes out of the designated lane and still has 1 time again
4	Simulation		Does not pass if the driver hits an obstacle or leaves the lane and the speed exceeds 30 kph the driver will fail the simulation test.

Based on the data on the test results of passing and not passing in Table 6, namely in this graduation test, it passes if it passes or does not touch obstacles and does not exceed a speed of 30 kph and then reaches the finish and is declared a pass and is entitled to a driver's license C. If the motorcyclist hits an obstacle or goes off the track and exceeds the 30 kph speed that has been determined, it will be declared a failure and must repeat from the beginning of the simulation in each simulation given the opportunity to repeat 2x.

3.4. Questionnaire Testing Results

In this stage, the application feasibility test will be carried out by obtaining data from users. Testing was carried out on 33 users for applications that have been made by researchers, can be seen in Table 7 below.

Table 7. Questionnaire test results

No	Question	Value				
		STS	TS	N	S	SS
1	Is the Mobile-Based Virtual Reality Motor Vehicle Simulation Test Application for C Driver's License Acquisition appealing?			8	8	17
2	Is the user interface of the Virtual Reality Vehicle Simulation Test Application for Mobile-Based C Driver's License Creation interesting?		2	4	14	13
3	Is the Mobile-Based Virtual Reality Motor Vehicle Simulation Test Application for C Driver's License Acquisition useful for users?		2	8	9	14
4	Is the Mobile-Based Virtual Reality Motor Vehicle Simulation Test Application for C Driver's License Easy to Use?		2	9	11	11
5	Are the features/menus functioning properly?		2	5	15	11
6	The response of each process is in accordance with its respective function.		2	8	11	12
7	Is the simulation feature in the Mobile-based Motor Vehicle Simulation Test Virtual Reality Application for C Driver's License Acquisition very helpful?		2	7	11	13
8	Motorcycle for Mobile-Based SIM C Creation is easy to operate			9	12	12
Total		0	12	58	91	103

The following table will show the response results of 33 users to all questions contained in the questionnaire.

Table 8. results of respondent testing questions

No	Description	Skor	Respondents	Respondent Score
1	Very unfavorable	1	0	-
2	Not Good	2	12	24
3	Neutral	3	58	174
4	Good	4	91	364
5	Very good	5	103	512
Total			264	1077

Based on the data in Table 7, the percentage can be calculated using the equation formula as follows.

$$P = \frac{1077}{33 \times 8 \times 5} \times 100\% = 81,6 \%$$

Based on these calculations, the percentage result of all questions is 81.6%, it can be concluded that the virtual reality application of motor vehicle simulation tests for making a mobile-based SIM C is very good when used by users.

4. Conclusion

Based on the results of the research data discussion in the description of the previous chapter regarding the virtual reality application of motor vehicle simulation tests for making mobile-based SIM C, the following conclusions can be drawn:

1. The frame per second value obtained for each page and scene that is run is above the normal value, namely on both devices obtained values ranging from 59.8 fps to 60.2 fps so that it can be said that the application's graphics performance on both devices is very good.
2. Of the 5 smartphones tested the application on smartphones with specifications of RAM capacity from 2 GB to 4 GB and operating system version 4 (KitKat) to version 9 (Pie) obtained the application cannot run on smartphones with android operating system versions below version 5, the application can run perfectly on smartphones with android operating system specifications version 7 (Nougat) to version 9 (Pie) and RAM capacity of 3 GB to 4 GB while on smartphones with android version 5.1 (Lollipop) the application does not run perfectly due to the small RAM capacity of 2 GB.
3. To get a pass when we play this simulation, we must not hit these obstacles and must not go off the track when we play this simulation, if we violate it then we will be declared a failure for the simulation test to get a SIM C, and in the simulation we have the opportunity to play again, namely 2x if we fail the first simulation we will be given another 1x chance, and if we make it to the finish safely then we are declared a pass and are entitled to a SIM C.
4. In testing this questionnaire we will look for the entire number of question values by summing them up using the Likert scale method and then based on the results of these calculations the value obtained on all questions is 81.6%, it can be concluded that the virtual reality application of motor vehicle simulation tests for making a mobile-based SIM C is very good when used by users.

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