

Virtual Reality for Introducing Informatics Laboratory on University of Trunojoyo Madura

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ABSTRACT

Nowadays, the development of increasingly advanced technology, one of the rapidly evolving technology at this time that smartphones based on Android. However, the development of technology is not comparable with the needs of students, for example in the introduction of the laboratory environment. During the introduction of the lab environment is still done manually without involving a technology to introduce a laboratory environment and it is less effective and efficient because need effort and a long time. For of these problem is make a Virtual Reality(VR) based android of 3D architectural visualization with a study area of information Technology Laboratory (TIF) UTM. From this application, students can explore and get to know Laboratories TIF simply using a smartphone based on Android, so students do not need to come lively. From the test result data, laboratory TIF VR applications can run well in 6 test device but the device Andromax R1 gyroscope is not functioning properly. From the results of testing applications using a questionnaire obtained, the average value of the respondents based user verification is 89% good, 11% Less good, and 0% unfavorable. And the average value of the entire question by 95%.

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1. Main text

Laboratory (Lab.) Is a building in which is equipped with equipment and materials based on certain scientific methods to conduct scientific experiments, research, learning practices, testing activities, calibration, and production of certain materials. In a narrow sense, the laboratory is a means and infrastructure to assist students in conducting practical and research activities. In UTM itself there is a Laboratory building named Lab. Integrated. Lab. Integrated is a collection of several Labs. from different study programs, including Marine Sciences, Agribusiness, Informatics Engineering, Industrial Engineering and Others. Because the incorporation of Lab. from some of the Study Programs including Lab. Informatics Engineering (TIF), causing many students confusion in finding the location of the Lab. TIF. This causes students to visit the Lab incorrectly. that should be addressed. To facilitate the introduction of the Lab. TIF to new students requires a Virtual Reality (VR) Technology.

"Virtual Reality (VR) or Virtual Environment (VE) is a technology that allows one to simulate an object using a computer that is able to generate a three-dimensional atmosphere that makes the user as if physically involved [1]". To realize 3D objects in VR, a supporting tool is needed. One of the supporting tools of VR is Google Cardboard. Google Cardboard was released by Google to support users trying out new experiences namely 3D Experience VR that uses Smartphones as a

platform. Previously there was a similar VR support device, the Oculus Rift. The oculus rift functions the same as Google Cardboard. However, because the price of Oculus rift is expensive so it cannot be reached by the middle to lower classes. Therefore, Google released Google Cardboard as a support tool for VR at a price that is affordable for everyone so everyone can try the 3D Experience VR experience.

From this description, VR using Google Cardboard can be used as a solution to provide new experiences for students who want to explore the Lab Building. TIF. For making VR applications using Unity3D software. Whereas for making 3D modeling using Blender Software.

This study aims to create an Android-based 3D VR application that is an architectural visualization type with a Lab area study. TIF UTM. It is expected that the research results can provide additional insight in the form of new concepts in the introduction of a building by utilizing VR technology. It is also hoped that with the 3D modeling facilities students can find out the visualization of the place or Lab space. TIF to be addressed.

2. Literature Review

In this study an application was made that could introduce Lab. TIF UTM in virtual 3D by implementing VR technology using Unity3D. This study refers to research number one and three in Table 1. In research number one it is explained that in the implementation phase there are two

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parts, namely integration outside of Unity3D and integration within Unity3D, for integration outside of Unity3D including data collection and modeling, for the phase integration in Unity3D includes lighting, level design, sound, animation and others. In research number three for making VR applications built using Unity3D and Blender, as well as explaining the stages in making VR applications that are determining application boundaries, making level maps of the Majapahit Hotel Surabaya building, making 3D objects, making the characters of heroes, doing scripting using C # programming language and application testing. This research was also built using the Unity3D and Blender applications as research number three, at the implementation phase two parts are needed, namely integration outside of Unity3D and inside Unity3D as research number one. However, this research combines Unity3D with Carboard SDK for creating virtual Labs. TIF, as well as using Google Cardboard as a VR support tool with a smartphone as the screen so the user seems to be inside the VR application. Besides being able to browse the Lab Environment. Virtual TIF in 3D users can also play game features

2.1. Virtual Reality

VR is a technology that allows users to interact with an environment that is simulated by a computer (computer-simulated environment), where an actual environment is emulated or really an environment that only exists in the imagination. Another case with Augmented Reality (AR) where the environment displayed is still in the form of the original environment but added a new virtual object, to display AR objects in the real environment requires markers and markesless as input devices. VR application is mostly in the form of visual experience displayed on a computer screen, stereoscopic lens and smartphone. In some simulations many include additional information sensors such as accelerometer, gyroscope, magnetic and sound. Users can interact with the virtual environment through input devices such as keyboards, mice, joysticks, magnetic sensors or through other electronic devices such as electronic gloves, virtual hand shoulders or treadmills. In this concept, it is explained that in this world there is a continuum that runs from the real environment to the virtual environment. They concluded that generic mixed Reality (MR) is one environment where the real world and virtual world are presented together on one screen. Augmented Reality is closest to the real environment and Virtual Environment is the farthest from the real environment, and Augmented Virtuality (AV) is closest to Virtual Environment [5].

2.2. Google Cardboard

Google Cardboard is a VR support tool developed by Google with cardboard material folded and using a smartphone as the screen. On Google Cardboard there are two 25 mm biconvex lenses with focal 45, besides that there is also a magnet and a ring-shaped metal that functions as a click command, if the user pulls and releases the ring, the magnetometer sensor will detect changes in the magnetic field and read it as input from the user. An example of using Google Cardboard is when a user is playing a VR game, then it is as if the user is in the game world, and when the user is watching 3D video the user is as if he was in a cinema [6].

2.3. Unity3D

Unity 3D is a cross-platform based game engine. Unity can be used to make games and applications that can be used on computer devices, smartphones, iPhones, PS3, and even X-BOX. Unity is an integrated tool for creating games, building architecture and simulations.

In this study Unity3D is used in the VR Lab simulation section. TIF, installation of 3D content that was previously created using Blender 3D Editor, and provides control to run automatically on the player and gives control to the player's movements by following the direction of the user's head. The advantage of using the Unity3D Game engine over using other Game engines in making VR is that Unity3D supports Google Cardboard by installing the Cardboard SDK plugin on Unity3D and many Unity3D documentations that discuss VR so that it's easier for authors to build VR applications.

2.4. 3D Blender

Blender is a software used to create animated films, visual effects, 3D print models, interactive 3D applications and video games. Blender has several features including 3D modeling, texturing, animation, video editing, and rendering. In this research blender is used in making 3D content such as buildings, chairs, tables, cabinets, printers, computers, CPUs, blackboards and other 3D objects.

2.5. Gyroscope Sensor

Gyroscope sensor is a device that is used to detect a motion in accordance with gravity by applying the principle of angular fixity. Gyroscope is often used on robots or helicopters and other sophisticated tools. In this study the device used to run the VR application must have a gyroscope sensor because without the gyroscope sensor the player in the VR game cannot adjust its movements to the user's head movements, if the user turns around or looks up, the player will not look back or look up according to the user's movements by therefore when the user will run the VR application the user is recommended to use a device that has a gyroscope sensor.

3. Methods

This reasearch methtds folwn using flowchat descibe in Figure 1. TIF. The first stage is analyzing the needs which include the needs of the device and data requirements. The intended device requirements are software and hardware. In this case the intended software includes 3D Editor, image editor and game engine while hardware includes Computers, smartphones and VR Viewing Devices. For data needs namely Lab Plan. TIF and architecture in the Lab. TIF. After that the system is implemented and the last application will be built on an android smartphone so that it can be tested to analyze errors in the application.

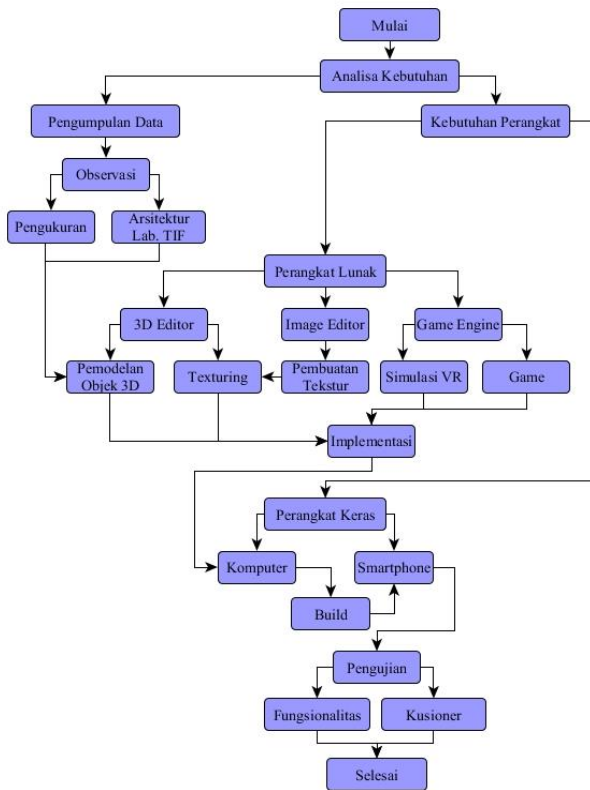


Figure 1. Research methods flowchart

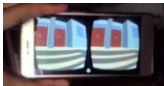

4. Result




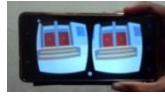
Testing work to determine the functionality of the application whether it is in accordance with the theory and the purpose of the study if there are still errors, it will be made improvements to the application.

4.1. Functional Test

The Result of Functional test shown on Table 1.

Table 1. An example of a table

Device	Spesification	VR Test	Result
Xiaomi Redmi 3	CPU Quad-core 1.5 GHz		Excellent
	Screen 1280 x 720 pixel (5.0 inch)		
	RAM 2 GB		
Xiaomi Redmi Note 2	Internal 16 GB		Excellent
	CPU Octa-core 2.0 GHz		
	Screen 1920 x 1080 pixel (5.5 inch)		
	RAM 2 GB		

Device	Spesification	VR Test	Result
Andromax R2	Internal 16 GB		Excelent
	CPU Octa-core 1.4 GHz		
	Screen 1280 x 720 pixel (5 inch)		
Xiaomi Mi4	Internal 16 GB		Excelent
	CPU Quad-core 2.5 GHz		
	Screen 1920 x 1080 pixel		
Xiaomi Redmi Note 3	Internal 16 GB		Excelent
	CPU Hexa-core 1.8 GHz		
	Screen 1920 x 1080 pixel (5.5 inch)		
Andromax R1	Internal 16 GB		Excelent, but gyroscope sensors do not work well
	CPU Quad-core 2.1 GHz		
	Screen 1280 x 720 pixel (5.0 inch)		
	RAM 2 GB		
	Internal 16 GB		

From the test results in Table 1 it can be concluded that the VR Lab application. TIF is able to run well on various devices, but on Andromax R1 gyroscope sensors do not function properly but other features can run well.

Device	Spesification	Scene Name	Loading Speed
Xiaomi Redmi Note 3	CPU Hexa-core 1.8 GHz RAM 2 GB Internal 16 GB	Scene Building Lab. TIF	4.76 Seconds
		Scene Lab. Mulmed & SIRPL	3.52 Seconds
		Scene Lab. CAI & Sister	3.54 Seconds
		Scene Lab. CC	3.58 Seconds
		Scene Lab. TIA+	3.63 Seconds
		Scene GameScreen	5.45 Seconds
Average			4.08 Seconds
Andromax R2	CPU Octa-core 1.4 GHz RAM 2 GB Internal 16 GB	Scene Building Lab. TIF	8.40 Seconds
		Scene Lab. Mulmed & SIRPL	4.25 Seconds
		Scene Lab. CAI & Sister	4.28 Seconds
Average		Scene Lab. CC	4.27 Seconds
		Scene Lab. TIA+	4.30 Seconds
		Scene GameScreen	9.17 Seconds
Average			5.77 Seconds

		Scene Building Lab. TIF	6.85 Seconds
Lenovo Vibe K4 Note	CPU Octa-core	Scene Lab. Mulmed & SIRPL	3.90 Seconds
	1.3 GHz	Scene Lab. CAI & Sister	3.91 Seconds
	RAM 3 GB	Scene Lab. CC	3.95 Seconds
	Internal 16 GB	Scene Lab. TIA+	3.97 Seconds
Average		Scene GameScreen	7.52 Seconds
			5.01 Seconds
		Scene Building Lab. TIF	7.13 Seconds
Sony Xperia Z1 Compact	CPU Quad-core	Scene Lab. Mulmed & SIRPL	3.82 Seconds
	2.2 GHz	Scene Lab. CAI & Sister	3.84 Seconds
	RAM 2 GB	Scene Lab. CC	3.90 Seconds
	Internal 16 GB	Scene Lab. TIA+	3.93 Seconds
Average		Scene Game Screen	7.78 Seconds
			5.06 Seconds

In Table 4 the data is the result of the trial speed of Loading VR Lab application. TIF on 4 devices. Testing is done to find out the minimum specifications of the smartphone so that the application can be smooth when running on the device. Testing is done by using 4 different devices in this case namely Xiaomi Redmi Note 3 and Andromax R2, Lenovo Vibe K4 Note, and Sony. From the test results in Table 4, the average value of each device is obtained. On Xiaomi Redmi Note 3 devices, an average of 4.08 seconds is obtained, Andromax R2 is 5.77 seconds, in Lenovo Vibe K4 Note is 5.01 seconds, and in Sony it is 5.06 seconds. Therefore it can be concluded that the minimum specifications of the smartphone used are Hexa-core 1.8 GHz CPU, 2GB RAM and 16GB Internal.

4.2. Application Quality Result

We test reaction from some respondent shows that the number of respondents who had visited the Lab. TIF of 14 people, respondents who have never visited the Lab. There are 6 TIFs, 10 of whom have tried VR applications, and 10 of those who have never tried VR applications.

Table 2. Respondent feedback

Num	Respondent Feedback	Had been visit Lab. TIF		Had been trying VR	
		Yes	No	Yes	No
1	Excelent	13	5	9	9
	Bad	1	1	1	1
	Very Bad	0	0	0	0
2	Excelent	14	5	10	9
	Bad	0	1	0	1

Num	Respondent Feedback	Had been visit Lab. TIF		Had been trying VR	
		Yes	No	Yes	No
3	Very Bad	0	0	0	0
	Excelent	9	5	8	6
	Bad	5	1	2	4
	Very Bad	0	0	0	0
4	Excelent	14	6	10	10
	Bad	0	0	0	0
	Very Bad	0	0	0	0
5	Excelent	12	6	10	8
	Bad	2	0	0	2
	Very Bad	0	0	0	0
	Excelent	9	5	7	7
6	Bad	5	1	3	3
	Very Bad	0	0	0	0
	Excelent	10	5	7	8
7	Bad	4	1	3	2
	Very Bad	0	0	0	0
	Excelent	14	6	10	10
8	Bad	0	0	0	0
	Very Bad	0	0	0	0
Result		14	6	10	10
Total		20		20	

5. Result

Based on the trials conducted there are conclusions drawn, namely:

- Using VR applications is more effective and efficient compared to coming directly to the laboratory building.
- From the test results and analysis shows that the application can run well on 6 test devices, but on the Andromax R1 device Gyroscope sensor cannot function properly.
- From the results of testing the application using a questionnaire obtained the average value of respondents based on user verification that is 89% said Good, 11% said Not Good and 0% said Very Poor.
- From the results of testing the application using the questionnaire obtained an average value of all questions that is equal to 95%, and the majority of users agree to use the VR Lab application. TIF as an introduction to Lab Environment. TIF UTM with a satisfaction level of 100%.

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