

IMPLEMENTATION OF VIRTUAL REALITY FOR PHOTOGRAPHY EXHIBITIONS

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ABSTRACT

Art exhibitions are one way to communicate a work of art while displaying creations that can be enjoyed by visitors. However, it takes a very high cost to make a good exhibition hall, and many people are too lazy to go to the exhibition if it is just to look around. In this era of technology 4.0, many new innovations have emerged in human life, one of which is virtual reality. Virtual reality is increasingly being used as an alternative to visiting a place without having to come there directly. This research aims to create an Android system using virtual reality that provides an experience to users viewing works virtually. Virtual reality prepares a representative space to display works and also does not need to incur high costs while still providing quality and complete information from exhibition speakers. This research was built using Blender and Unity. In the application design analysis, there are four main stages: (1) analysis, (2) design, (3) product development, and (4) product testing. The results of the assessment conducted by the virtual reality lecturer obtained an average result of 89%. In addition, the results of trials for students obtained an average percentage of 94% and were included in the very good category. The results of this study show that AR has indeed proven feasible to be used as a learning medium in introducing photographic works with 2D and 3D Animation, and therefore the potential to make exhibitions in VR is also used for other courses and learning. The result of this research is that an Android-based virtual reality system can simulate the exhibition of artwork.

Keywords: *Virtual reality, Unity, Blender, Artwork, Android*

1. INTRODUCTION

Technology today is developing very rapidly, as is information technology that is widely used today, namely the internet. The internet is widely used in various circles with diverse usage needs. The development of the internet from time to time has experienced many developments and improvements in terms of speed and very wide network coverage. Technology has influenced many things in the field of computerization to become more effective and efficient. The branch of computers that is developing today is in the field of visual graphics and multimedia. The development of computer graphics in 2023 is considered very different from previous years and is growing rapidly. Multimedia is one of the technologies that supports various interaction media to produce interesting applications [2].

Exhibition is an activity where one or more people exhibit various kinds of products, either in the form of goods, works, or services, to potential customers. The exhibition can also function as a promotional medium to display product displays to buyers or observers, and it can also be a place to convey ideas or ideas that can be appreciated by many people by displaying prototypes of products that will be produced in the future [3]. Photography exhibitions are one way to bring and display works of art to the public. The purpose of holding a photography exhibition is to express photographic works so that they can be enjoyed by many people [4]. However, traditionally organized photography exhibitions often limit visitors' experience of exploring such works. There are also exhibition organizers who have difficulty in finding the exhibition location they want. Therefore, there is a need for technological innovation that can improve the experience of visitors in enjoying photo exhibitions and make it easier for exhibition organizers to create a

photography exhibition according to their own wishes [5]. One of the technological innovations available in Industry 4.0 is *Virtual Reality* (VR). The concept of online exhibitions has been widely carried out and held in various regions. Usually, the concept of this photography exhibition is to visualize 3D frame animation and photographic works, which will be seen from the same angle as reality, where 3D is an object that has space with length, width, and height [4].

Virtual reality is a technology that can create interactive and immersive experiences in the digital world. In the context of this photography exhibition, *Virtual reality* can be used to create a virtual environment that allows visitors to feel of the atmosphere in the exhibition without having to come directly to the exhibition location or even anywhere else. *Virtual reality* provides unlimited space because the visuals of the environment can be created through digital illusions. *Virtual reality* technology takes users into exciting and dynamic new worlds that can display spaces and models that cannot be found or are difficult to find in the real world [6]. VR (virtual reality) media has quite the potential as a learning medium that attracts students. Mainly in learning desciense courses in animation and VR. In this case, the researcher intends to develop VR as a photography exhibition medium, so that the exhibition in question is a virtual or digital photography exhibition. Basically, virtual exhibitions are included in the multimedia category because they contain content consisting of combining several media, such as sound, image, and text.

The purpose of this research is to create an Android system using *virtual reality* that provides users with the experience of viewing works virtually and helps art exhibition organizers exhibit their works without incurring expensive costs. [2] This research refers to “Digital Showroom Design Research in Virtual Reality Media as an Effort to Provide Interactive Showrooms” by differentiating photographic work data and virtual space design. We used photographic works photographed by the author himself and designed a 3x3 virtual space. But this application has problem and limitations, such as being limited to only 1 location, using the waterfall-type SDLC method, and only being run through *Android*.

2. RESEARCH METHODOLOGY

Blender is a free and open-source 2D and 3D design tool. Blender supports all 3D workflows, such as modeling, compositing, rigging, simulation, animation, rendering, motion tracking, and even video editing and game creation. Blender is perfect for individuals or small studios that are interested in 3D projects. Blender can be used to learn the basics of creating model views from animation [6]. Unity3D is software used for the development of a game as a virtual reality development platform. Virtual reality can also allow users to interact with the virtual assets provided [7]. Unity is very easy to use; just create an object and be given a function to run that object. Each object has variables; these variables must be understood in order to make a quality game. The following are the parts of Unity: the first part is assets, which is a storage area in Unity that stores sounds, images, videos, and textures [8].

In VR design, it has three modes, and each method has its own characteristics. Kaur's method focuses more on the user's interaction with the environment; the VRID method tends to focus on interfaces; and the Polcar method is used to plan all aspects of each section in detail. To create a large and detailed project application, it would be better to combine all three methods [9]. Simulation can be used to show changes in the structure of a real system that cannot actually be studied at the right time. Thus, simulation can help change the real system by entering only a small amount of data and looking for a picture through a small or simple-scale system in which manipulation or control will be carried out to see the effect [10].

Learning media developed based on virtual reality offers advantages, including the ability for students to see the form directly in teaching and learning activities because the learning media developed is presented in virtual reality and can be witnessed directly by students. Learning media: this virtual reality-based learning medium is very effective and qualified for use in children's learning activities. This virtual reality-based learning medium can improve student learning outcomes [3]. Learning trials offered through the use of virtual reality technology are very suitable for needs during a pandemic and are needed for daily use in learning. YouTube VR is open source and easily accessible by using low-end VR devices such as cardboard VR and affordable VR headsets or goggles. The results of the trial showed that there was an increase in interest in learning and an increase in participants' understanding of the material delivered through YouTube VR [11].

This application uses the following development flowchart system, as presented in Figure 1. Before general use, conducting trials is very important to find out the feasibility of VR-based photo exhibition applications and to build development in creating good and quality exhibitions for users. Figure 1 shows a development flowchart of virtual exhibition products based on VR technology in four stages: (1) requirement analysis, (2) system design, (3) implementation/product development, and (4) testing/product trials.

In the analysis of designing virtual reality-based photo exhibitions, the selected space objects need to consider several factors such as resource availability, accessibility, and visual appeal. The data of the photo design ideas themselves then need to be carefully thought out and planned, including the selection of photographic techniques that are in accordance with the objects taken.

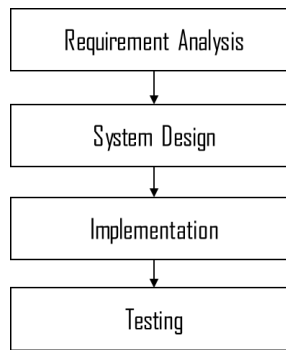


Figure 1. Methodological flowchart

Once it has been designed, the next step is to apply it to the virtual reality exhibition. This process involves selecting the right application to ensure images look clear and crisp in a virtual environment. Some applications that can be considered include image processing, 3D modeling software with Blender and Unity applications, and designing with interactive tools to create realistic virtual environments.

The design of the room and photos of the exhibition were made in a blender. Then exported in 3D object format. In Unity, 3D object files are imported so that user skeletons and running logic can be created. At this stage, users can walk at the exhibition site using the C# language in the Unity software

3. RESULTS AND DISCUSSION

There are two types of virtual photo exhibition design: (1) system flow design and (2) application display design. In the system flow design, the system flow is made with the aim of providing an overview of how the program to be developed runs. This system is developed following the flowchart method, as shown in Figure 2.

Figure 2 shows the display of the application when it is run, which is made by referring to the type of application that the researcher developed. Because the type of application developed is a 3D exhibition. Before the application is made, several software tools are needed. Unity is computer software to make a game, AR, or VR, but Unity does not have the software needed to create virtual reality, so it needs an SDK, namely Google VR. The design of the exhibition room was made using the Blender application. With a high imagination to build a photographic work that can be enjoyed by the general public, through the Unity application as a place for 3D design, create a virtual reality exhibition room with interiors with quality photographic works around the exhibition so that users can enjoy and feel like they are in the room.

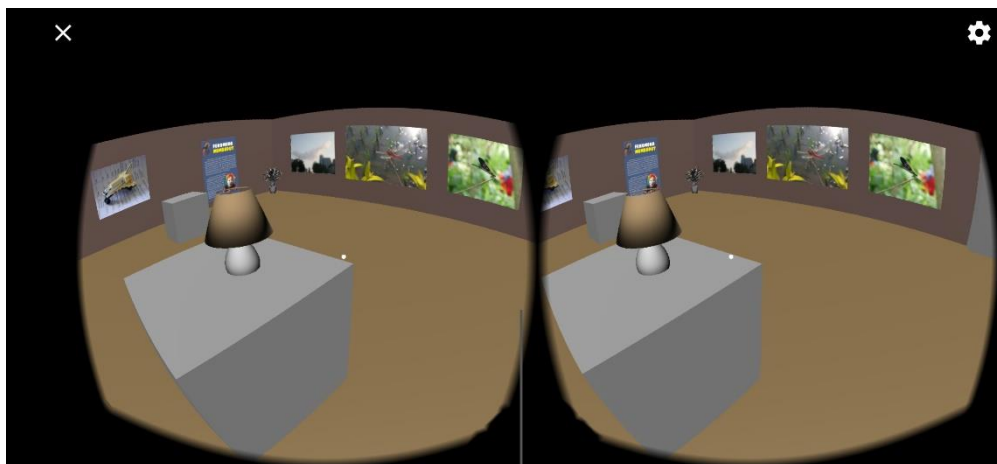


Figure 2. The display of the application

Table 1 Questionnaire

Questions	Virtual Reality Lecturer	S 1	S 2	S 3	S 4	S 5	S 6	S 7	S 8	S 9	S 10
Q1	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes
Q2	no	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes
Q3	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes
Q4	yes	yes	yes	no	yes	yes	yes	yes	yes	yes	yes
Q5	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes
Q6	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes
Q7	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes
Q8	yes	yes	yes	yes	yes	yes	yes	yes	no	no	no
Q9	yes	yes	yes	yes	yes	yes	yes	yes	no	yes	yes
mean	0.89	1	1	0.89	1	1	1	1	0.78	0.89	0.89
Q = Question	S = Student									mean of students	0.94

Questions about the questionnaire filled out are as follows:

- Q1 Is the application easy to learn?
- Q2 Is the application design pleasing to the eye?
- Q3 Is the application easy to use?
- Q4 Can the work in the photo be seen clearly?
- Q5 Do you agree that the application can simulate a photography exhibition well?
- Q6 Do you agree that the instructions provided are easy to understand?
- Q7 Does the application run well on an Android smartphone?
- Q8 Do you agree that the animation is not delayed?
- Q9 Do you agree that the application does not experience lag?

Then, in an effort to provide an opportunity for users to provide an assessment of this VR product, researchers provide a form as contained in Table 1 with the help of a Google Form to be filled out by users. Questions can be answered with yes or no. The use of this Google Form is intended so that the development process can be completed faster and the application is easy for users to operate. With the help of this Google Form, the data filled in by the user will be stored in the database. The questionnaire showed that the assessment of the virtual reality lecturer had an average of 0.89, or 89%. The assessment of 10 students also showed a good score of 0.94, or 94%.

This development stage is carried out by building a virtual reality result program into an application that can be operated on each Android smartphone with simple features through Unity as a development application. The choice is reasonable because Android Unity development software is easier, and there is also a free license feature compared to other Android development software such as Android Studio. While the hardware used is the ASUS A456U laptop and application experiments on Redmi 9 Android. The design that researchers developed using perspective techniques illustrates that the work displayed is in the form of 3D objects. The development of photo design with 3D design is done through the Blender application. The logic in this application is made using C# so that users can feel like they are walking around in a virtual exhibition room. The exhibition floor plan uses a 3x3 room surrounded by photography.

At the trial stage of this virtual exhibition product based on AR technology, there are two things done: (1) trials by virtual reality lecturers and (2) trials in virtual reality course classes. In this research trial, it involves virtual reality lecturers themselves with the aim of finding out whether there are photography exhibition applications with virtual reality that need to be developed again or do not run smoothly and are eligible for trial. Trials and assessments are carried out directly by virtual reality lecturers. The trial results are classified as very good, with an average result of 90% in the aspects of appearance, design, and feasibility of a photography exhibition application. After obtaining excellent results, researchers prepare for trials in virtual reality classrooms. Before the trial, researchers prepared a Google Form so that students could assess the feasibility of a photography exhibition application with virtual reality technology.

This trial phase is carried out by changing virtual reality into an Android system where students who want to try it can download the photography exhibition application directly using their respective smartphones. The results of trials by students in terms of design, RPL, and feasibility aspects of the system were very good. The average result (94%) of students in virtual reality classes is satisfaction with the design and functionality of the photography exhibition application. From these results, researchers found that the concept of virtual exhibitions is feasible to support the learning process in virtual reality courses.

4. CONCLUSION

This research aims to develop a virtual reality (VR)-based photography exhibition using Unity and Blender. The results of this study show that making VR-based photography exhibitions can provide benefits in several ways, namely that, due to the nature of VR-based photography exhibitions, visitors can feel the sensation of being in the location captured by the photo. This provides a more immersive user experience than just viewing photos in 2D, and by using VR technology, photography exhibitions can be accessed by people from different parts of the world without the need to come directly to the exhibition venue. This provides greater accessibility for visitors who are far away from the exhibition venue, and by creating VR-based photography exhibitions, the cost of renting exhibition venues and transportation of photographic works can be reduced. This can provide benefits in terms of cost efficiency, and in VR-based photography exhibitions, visitors can access these photos in different ways, for example, through walk-through or slide-show modes. This provides flexibility in the presentation of photographic works. In conclusion, the study shows that the creation of VR-based photography exhibitions can provide benefits in terms of a more immersive user experience, increased accessibility, cost reduction, and flexibility in presentation that result in an average of 94% satisfaction with this virtual reality application.

Suggestions that can be taken from research and trial results using Google Forms: Although the results of user responses from students and examiners are satisfactory, there are some small things that need to be fixed, such as a few small bugs where sometimes the photographic images on the VR exhibition wall are not visible, and the area of the exhibition in the application may be expanded again so that users can get around and can see more of their photographic works. For other things like design and others, it seems to be good enough. Hopefully, suggestions from users can be an inspiration for learning VR design in the future.

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