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Architectural Visualization of Buildings with Virtual Reality 360 using Website Based Prototyping Method

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Abstract

This study aims to develop an interactive and immersive 360-degree Virtual Reality (VR) architectural visualization using the prototyping method. This iterative approach allows system development based on user feedback, ensuring results that better meet user needs. The process involves creating a 3D architectural model with SketchUp, which is then integrated into a website platform using HTML and CSS. This model enables users to explore building designs in real-time through a 360-degree view. Hosting technology is used to make the visualization accessible online anytime and anywhere. System evaluation is conducted through user testing focused on visual accuracy, ease of navigation, and user satisfaction. The results show that VR 360-based architectural visualization provides a more engaging and realistic experience, enhances design understanding, and supports communication between architects and clients. This integration helps accelerate decision-making and offers an innovative solution for the modern architecture industry.

Keywords: *Virtual Reality, Architectural Visualization, Website, Prototyping, Real-Time 360.*

1. Introduction

Virtual Reality (VR) is a technology that simulates a virtual environment resembling the real world through 3D images or videos. With computer support, VR creates a realistic interactive experience, making users feel as if they are present in it. This technology is also capable of providing high-quality visuals that are responsive to user movements, thus offering an interesting immersive experience in various fields such as education and entertainment[1]. STMIK TIME is a private higher education institution located on Jalan Merbabu, Medan, and has been established since 2002. The main focus of this campus is in the field of information technology and computers, with a vision of producing competent graduates who are able to compete in the industrial world. In line with technological developments, STMIK TIME continues to innovate in promotional methods to reach prospective students more effectively.

Promotions that have been carried out so far still rely on conventional media such as videos of campus activities and live presentations, which require prospective students to be physically present to get to know the campus environment. This approach is considered inefficient because it requires a lot of time, money, and energy. In the digital era like today, a more modern and interactive promotional strategy is needed to attract the attention of the younger generation who are accustomed to technology. One alternative that can be utilized is Virtual Reality (VR) 360 technology. By integrating VR 360 into the campus website, prospective students can explore campus buildings and facilities virtually through their digital devices. This technology allows for more immersive and realistic information delivery, and provides an experience as if you were directly on campus.

Although potential, the utilization of this technology still requires further study related to the technical integration process into the STMIK TIME website platform, as well as evaluating its effectiveness in supporting campus promotion. Therefore, this study was conducted to design a campus building visualization model based on VR 360 technology using the prototyping method. This visualization is designed to be accessible online and is expected to provide a more real exploration experience for prospective students. In addition to increasing the attractiveness of promotion, this approach also provides an efficient solution that is in accordance with the needs of today's digital generation.

2. Theoretical Foundation

2.1 Architectural Visualization

Visualization is a technique for presenting information in visual form such as images, graphs, or animations. This approach transforms data into a visual or tabular display so that the relationships between elements or attributes in the data can be understood and analyzed more easily. [2].

Architecture, as an important part of human culture, is related to various aspects of life such as art, engineering, spatial planning, geography, and history. In the context of art, architecture is considered as an art form in construction that involves aesthetics and building ornaments.

From an engineering perspective, architecture includes planning and construction by considering structure, function, and beauty. While from a spatial planning perspective, architecture focuses on providing space that meets the needs of certain individual or group activities. [3]. Architectural visualization refers to the process of creating graphical representations that aim to explain building designs in greater depth. This process is essential to help architects, designers, and clients understand the design through realistic depictions that depict the form, function, and aesthetics of the building. [4].

2.2 Building

Buildings refer to physical structures that are constructed through a construction process and are tied to a specific location. These structures can be on the ground, underground, or above water. The main function of a building is to provide space for humans to carry out various activities, such as housing, worship, business, social activities, culture, and other special activities.[5].

2.3 Virtual Reality 360

Virtual Reality (VR) technology has a long history, dating back to the 19th century. In 1838, the stereoscope was invented as a device that used two mirrors to create the illusion of three-dimensional (3D) images. This invention later evolved into the View-Master in 1939, a popular device for viewing 3D images. In 1956, Morton Heilig introduced the Sensorama, a simulator that could mimic the experience of driving in a city through stimuli such as sound, vibration, and smell. Then, in 1960, Heilig created the Telesphere Mask, a device similar to modern VR glasses. This technology continued to attract the attention of investors, which accelerated its development and progress. The term "Virtual Reality" began to be widely known in the 1980s, thanks to Jaron Lanier, a VR pioneer, who developed devices such as VR glasses and gloves to enhance the user experience.

Nowadays, VR technology is increasingly accessible and continues to develop rapidly. By using VR, the human brain can be directed to feel as if it is in a very realistic virtual world. This technology provides a great opportunity to create a virtual world that is different from the real world, with various innovations and benefits that continue to develop.[6]. VR is a technology that allows users to interact with a digital world that appears similar to the real world in three dimensions (3D). In the context of architectural visualization, VR offers an immersive experience, where users can virtually explore buildings as if they were directly inside them.[7].

2.4 Prototyping Methods

Prototyping is a method commonly applied in system development. This technique allows developers and users to interact directly during the development process, so that developers can more easily adapt the software to user needs[8]. The prototyping process includes five main stages, namely Communication, Quick Plan, Quick Design, Prototype Construction, Delivery & Feedback. This stage is further described in the illustration in Figure 1.

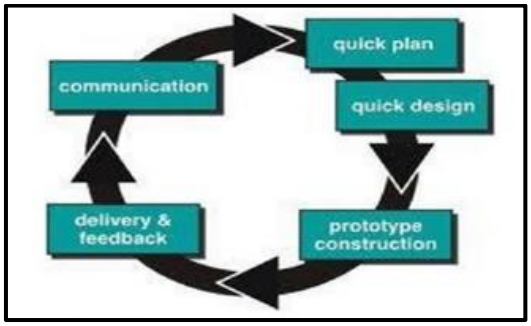

Fig. 1: Prototyping model

The Prototyping process consists of several stages that are interconnected and support each other. The explanation of each stage is as follows:

a. Communication
   At this stage, the developer and the client meet to discuss the general goals of the system to be developed. In this discussion, the main requirements are identified and a preliminary outline of the elements that will be part of the system is drawn up.
b. Quick Plan
   This stage involves planning that is done quickly and covers all aspects of the software that have been identified. This planning is the basis for making a prototype.
c. Quick Design and Modeling
   This stage focuses on creating visual representations or models of the parts of the software that are relevant to the user or client. This process aims to produce an initial prototype that illustrates the main functions of the system.
d. Construction of Prototype
   At this stage, a prototype framework is built based on the previously created design. This prototype is then used for further testing.
e. Delivery & Feedback
   At this stage, a prototype framework is built based on the previously created design. This prototype is then used for further testing.

2.5 Website

A website consists of several pages that display various types of information, such as text, static or animated images, audio, video, or a combination of these elements. Websites can be static or dynamic, with each page connected to the other through hyperlinks that allow easy navigation between pages.[9].

In addition to being accessible via the internet, websites can also be accessed via a local network (LAN) using an address called a URL (Uniform Resource Locator). All publicly available websites are known as the World Wide Web (WWW). Access to websites is done through a browser on a computer device. Some commonly used browsers include Internet Explorer, Mozilla Firefox, Netscape, Opera, and Google Chrome.

3. Research Method

3.1. Analysis

The analysis stage is the initial step in research that aims to gain a comprehensive understanding of the research work process. At this stage, problems related to increasing the effectiveness of the STMIK TIME campus promotion system to prospective students are identified. In addition, this stage also aims to formulate solutions in the form of innovative promotional media through a 360 virtual tour of the STMIK TIME campus. The analysis is carried out to evaluate existing conditions as a whole and design strategies to overcome the problems faced.

3.2 Design

The initial design stage includes planning and gathering needs to create a visualization of the STMIK TIME campus building. At this stage, identification of hardware and software needs, search for design references, initial sketching, and preparation of the design workflow are carried out. These steps aim to ensure that all required elements are available, so that the production process can take place effectively and efficiently.

4. Research Result

At this stage, the researcher displays the results of the website design along with the 360 virtual tour start feature that has been integrated into it. This website can be accessed online via a Virtual Private Server (VPS) or offline using XAMPP on localhost, either via Android, Ios, or desktop computers. This provides flexibility for users to access the website without being limited to one particular type of device.

When the website is accessed online via VPS (Virtual Private Server) at the addresshttps://103.172.204.241/Website_Time/, users will be directed to the home page as the initial display. On this page there are a number of buttons that function to direct users to other pages according to the options they choose.

1. Home View

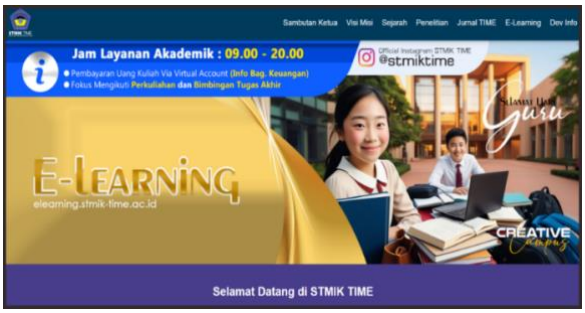

Fig. 2: Website home view

On this homepage, there are a number of menus that users can click on and will immediately direct them to the official STMIK TIME website via the addresshttp://stmik-time.ac.id/including the Chairman's Welcome Button, vision and mission, history, research, time journal, e learning, dev info.

2. Dev Info Page View

Fig. 3: Dev info page view

This view appears after the user selects the Dev Info menu. On the page, information related to the developers is displayed, including their names, roles or tasks, and contacts connected via links to Instagram accounts, which are marked with blue text. At the end of the page, a brief description of the collaboration in the STMIK TIME Virtual Reality Tour project is presented.

3. Resource Page View

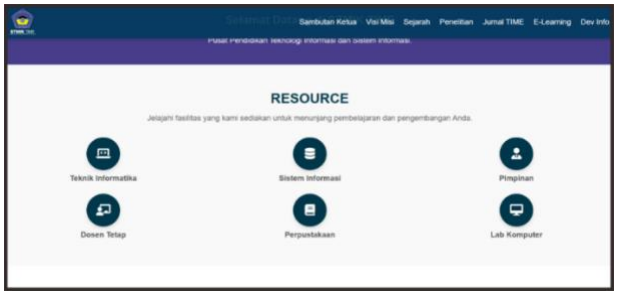

Fig. 4: Resource page view

This view will be seen when the user scrolls the page to the bottom. In that section, the user will find Resources containing a number of elements, namely the informatics engineering button, information system, leadership, permanent lecturers, library, computer lab. If the user clicks on one of these buttons, they will be directed to the stmik time website menuhttp://stmik-time.ac.id/

4. Come & See Our Facilities display

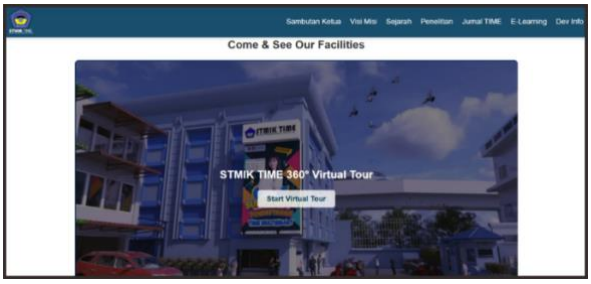

Fig. 5: Come & see our facilities page view

When users scroll further down the page, they will find the Come & See Our Facilities section. This section displays an illustration of the STMIK TIME campus design along with the Start Virtual Tour button. Through this button, users can access the STMIK TIME Virtual Tour display as shown in Figure 5.

5. View of the page Get to know STMIK TIME more closely

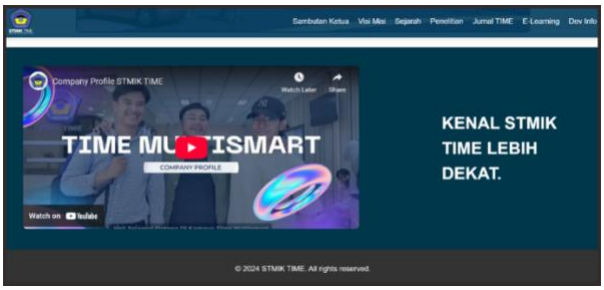

Fig. 6: STMIK TIME Company Profile Page View

Next, there is a display showing the STMIK TIME company profile video from YouTube entitled "Get to Know STMIK TIME Closer". This video functions as an information media that can be accessed online, either through a web browser or directly through the YouTube application on a smartphone device.

6. 360 Virtual Tour View (Building A STMIK TIME)

Fig. 7: Start Virtual Tour VR 360 Initial View

In this display, it is the initial display of the virtual tour start. There are many buildings, namely the A building of STMIK TIME, shophouses, white buildings, cars, and plants. The display of the STMIK TIME building in 3D model is made to resemble the original and this display is VR 360 is used so that users can explore the STMIK TIME campus virtually using the hotspot trigger button.

7. 360 Virtual Tour View (Building B and C STMIK TIME)

Fig. 8: VR Tour of Building B and C of STMIK TIME Campus

Figure 8 shows the exterior area of Buildings B and C. On the left side, a vehicle is parked near the wall, with several motorbikes parked nearby. In the middle of this area, there is a large tree that gives a natural and refreshing impression around the building. There is also a yellow security post with the words "SECURITY," which adds an element of security to the building environment. The facades of Buildings B and C have a striking blue color and several air conditioning units installed to give a modern look, while below it is an entrance that indicates access to the building [10].

5. Conclusion

Some conclusions based on the website designed by the author are as follows:

1. Virtual Reality (VR) 360 was successfully integrated into the STMIK TIME website through the 3Sixty virtual tour link, enabling interactive and realistic campus visualization without a physical visit.
2. This technology makes campus promotion more efficient and attractive to the younger generation who are familiar with the digital world, while strengthening the image of STMIK TIME as a modern and innovative campus.

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