Virtual Reality Website of Indonesia National Monument and Its Environment

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Abstract. National Monument (Monumen Nasional) is an Indonesia National Monument building where located in Jakarta. This monument is a symbol of Jakarta and it is a pride monument of the people in Jakarta and Indonesia country. This National Monument also has a museum about the history of the Indonesian country. To provide information to the general public, in this research we created and developed models of 3D graphics from the National Monument and the surrounding environment. Virtual Reality technology was used to display the visualization of the National Monument and the surrounding environment in 3D graphics form. Latest programming technology makes it possible to display 3D objects via the internet browser. This research used Unity3D and WebGL to make virtual reality models that can be implemented and showed on a Website. The result from this research is the development of 3-dimensional Website of the National Monument and its objects surrounding the environment that can be displayed through the Web browser. The virtual reality of whole objects was divided into a number of scenes, so that it can be displayed in real time visualization.

1. Introduction
National Monument (Monumen Nasional) or popularly abbreviated with the “Tugu Monas” is a 132-meter-high memorial monument as the memory of the resistance and the Indonesian people's struggle for independence from Dutch colonial. National Monument was built during the reign of president Sukarno on August 17th, 1961. Tugu Monas was opened to the public on July 12, 1975. Monas has gilded flame symbolizing the spirit of Indonesian struggle blazing. The National Monument is located in the centre of Merdeka Square, Central Jakarta.

The development of Monas commemorate and preserve the Indonesian struggle for independence during the revolution of 1945, in order to continue to inspire patriotism and spirit of present and future generations. Figure 1 shows the real National Monument in a picture.

Submission and dissemination of information about the monument to the public becomes important because every region in Indonesia has experience a form of colonialism and fighting to repel the invaders. Dissemination of this information is intended to make the public and the citizens of Indonesia always remember and not to forget the history of the struggle for Indonesian independence patriot.

One way of disseminating information today that effective is to utilize computer technology, such as web-based application programs and the Internet. Computers today can not only be used to process data and information in the form of text, but also in other formats such as images, moving images (animation), 3-dimensional models, simulations, sound and video. Through this diverse format that
allows information from a source can be packaged into a form more attractive, easier, and effective in their delivery.

Figure 1. National monument statue.

The issues raised in this research is how to design and develop a three-dimensional graphic models of the National Monument and inform it the people of Indonesia as well as foreign tourists through 3D computer graphics technology and Web technology. By modeling the National Monument in the form of a 3D graphic model in visual way, the important information from the National Monument and its surrounding objects can be conveyed to the public.

The purpose of this study include: disseminating information to the public about the National Monument and its objects in surrounding environment, providing information about the struggle for independence patriot in dioramas room, and apply the knowledge in the field of information technology and computer graphics by developing the virtual reality website.

A number of previous studies have used virtual reality technology to display 3D graphics along with the surrounding environment. An example that shows a 3D model are displayed in VRML format in which the model can be interactive and onshore users navigate the 3D virtual environment, through the control of the keyboard or other control device [1]. Another VRML model was Heidelberg city as shown in Figure 2.

Figure 2. Visualization of virtual reality with VRML technology [2].

2. Literature review

2.1. 3D Model and virtual reality

3D modelling is the process of developing a mathematical representation of any three-dimensional surface of an object (either inanimate or living) via specialized software. Modelling results is referred to as 3D models which can be created automatically or manually.
Currently, there are many software as 3D modeller. There are commercial software 3D Studio MaxTM and there is also freeware like BlenderTM. Such software is the 3D computer graphics program has feature to create animations, 3D models, and image by having the capabilities and features to create three-dimensional models, particle systems, dynamic simulation, shader, illumination, as well as animation.

Virtual Reality (VR) is a technology that allows one to simulate on a real object using a computer that is able to generate a 3D atmosphere that makes the user as physically involved. This technology can be used for learning in visual form so as to facilitate the learning process. VR technology itself has actually been around since the 1960s and is known in some form, implementation of VR itself with regard to the depiction of a scope that is presented in the use of computers, VR technology itself is actually a method used to simulate an environment and make the user as being in situations and places that become the object of VR, both in taking control and interact directly with the environment.

2.2. WebGL

WebGL is part of HTML[5] technology, as bundled in most browsers that support HTML5 technology. WebGL can work on multiple browser-based desktop and mobile. WebGL has developed and makes searching the web more beautiful in appearance because it displays a visualization of moving, from a game to data visualization. WebGL was developed by the Khronos Group, which is an agency that also regulates OpenGL, and is a free cross-platform API that brings OpenGLES 2.0 to the web as a 3D drawing context in HTML.

This study used Unity3D, which is software used for several kinds of things, such as for the visualization of the model, making 3D games and animated objects. Unity3D WebGL allows developers produce 3 dimensional VR models that can later be displayed through a web browser. A number of previous studies that utilize WebGL to display 3-dimensional objects in a large size, for example, to produce a virtual museum [3], Cultural Heritage [4], Architectural Heritage Learning [5], Cultural Artifacts [6], Virtual Educational [7] and Huge City Model [8].

3. Research method

In this study, basically there are two main things those are 3-dimensional modeling and visualizing in the form of virtual reality. It was needed to be prepared number of steps so that the end product of the 3D modeling of the National Monument and its objects surrounding area can be displayed visually on the Web. Users can explore the 3D models and its environments by controlling buttons on the keyboard or by using other control devices (mouse). The research method that was used in this research is presented in Figure 3.

![Figure 3. Step by step of research.](image)

The research was begun by need analysis. This is analyzing hardware and software that needed to generate a web-based application. Data Collection step was done by visiting the location of research i.e the National Monument. This step research was collected information of shape, dimension and texture of objects. 3-Dimensional modeling step was creating and modeling real National Monument and the objects that exist in the form of three-dimensional graphic models. The research continued with creating VR website, converting the 3-dimensional model that has been created in the form of virtual reality that can be showed with a web browser and developing a website. Testing step was testing of the models with examining the models to display whether the model correct or error to display.
4. Designing
The website was designed in 5 main menus. The menus are: home, gallery, history, about and virtual reality. Home menu shows the National Monument description, Gallery consists of the slide show many pictures of National Monument in real condition, History consists of the history of National Monument about menu shows the author of website and Virtual Reality menu consists of some scene virtual reality model of National Monument and Its environment. This navigation for the website is presented in figure 4.

![Website Navigation Structure](image)

**Figure 4.** Navigation structure of website.

5. Result
Result of the study was a three-dimensional model of the National Monument and the objects in surrounding environment, which can be displayed in a web browser and the website of the National Monument. The research data have been taken from the real National Monument. Texture data taken from real National Monument and then added to each object as original object. To generate the texture according to the dimensions of the original model, adding some texture on large objects must be adapted to the actual dimensions. Figure 5 shows the Website of National Monument with VR technology inside.

![National Monument Website](image)

**Figure 5.** The national monument website.
Virtual Reality shown through the website is placed in Virtual Reality and Gallery menu. Virtual reality modelling is done by dividing into a number of scenes, where in every scene featuring a specific object, either inside or outside the monument. This is done due consideration of the size of large models that will be hard for a computer that is used when rendering.

In the Gallery menu, there are 9 pieces VR which can be accessed by the user, i.e.: the National Monument, the Statue of Kartini, Diponegoro statue, Statue of MH Thamrin, the Statue of Five Hero, Reflection Garden, Deer Garden, Independence room, Top of Monas, and Museum. At any existing VR models, users can perform a walkthrough through via the keyboard by pressing the up arrow, down left and right. Image Virtual Reality of National Monument looks beyond is as shown in Figure 6.

![Virtual reality model of National Monument](image)

**Figure 6.** Virtual reality model of National Monument.

Furthermore, in Figure 7 (a), (b) dan (c) shows the virtual reality models for other scenes

![Virtual reality models for other scenes](image)

**Figure 7.** Scene of (a) Diponegoro Statue, (b) Deer Garden, and (c) Kartini Statue.

Another scene are from Top of National Monument and scene inside of the Monument i.e. the History museum of Indonesia, as seen in figure 8.

![Virtual reality models for other scenes](image)

**Figure 8.** Scene (a) from top of National Monument, (b) inside National Monument.
The Website has been tested on localhost, and will be published after the end of project on December 2016 on http://www.vr-monas.com. The testing was done by examining every existing menu: Home, Gallery, History, About and Virtual Reality. Especially for Virtual Reality menu of website, it was tested using control via the keyboard with arrow keys up, down, left and right. Besides, it was also tested by using mouse to navigate the virtual reality models.

The testing results of navigation in virtual reality models showed that the models can be controlled by the user, where the user can do a walkthrough the virtual reality models through keyboard and mouse. Testing was done by using two web browsers i.e. Mozilla Firefox and Google Chrome. The result of testing by a web browser Mozilla Firefox and Google Chrome obtained good results. Both browsers can display the virtual reality models in real time and users can explore virtual reality models with easy. Table 1 shows the result of testing to load virtual reality model of some scene of National Monument web. The testing was done using computer specification: Processor intel Core i7 5500U CPU @2,4GHz , RAM 4GB, NVIDIA Geforce 920M 4GB, and Operating System Win 8.1.

| Scene                  | Loading Time (second) |
|------------------------|-----------------------|
| National Monument Statue | 12.07                 |
| Moh. Thamrin Statue    | 26.16                 |
| Diponegoro Statue      | 29.68                 |
| Deer Garden            | 24.98                 |
| Five Hero Statue       | 25.72                 |
| Kartini Statue         | 23.70                 |
| Freedom Room           | 23.69                 |
| Reflection Garden      | 26.14                 |
| Top of Monas           | 23.62                 |

6. Conclusion
This research has successfully generated three-dimensional graphics modelling of Indonesia National Monument and objects surrounding the environment. Result of this 3d modelling and virtual reality models was successfully displayed in a web. The test results showed the model can be displayed in the web and the user can roam (walkthrough) in real time on the virtual reality models. Users can control the virtual reality models with a keyboard and mouse.

Suggestions for next development of this research is to add models incorporate more dynamic or animated elements in it, such as a human object, animal, or a moving vehicle. Thus the generated virtual reality can resemble the real conditions.

7. References
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