VIRTUAL REALITY MUSICAL MUSEUM

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ABSTRACT

Virtual Museum by far defines the idea of promoting artifacts virtually using electronic devices. Even though there are virtual museums existed throughout the world, but the number appearance of virtual museum internally in Malaysia is still considered few. Furthermore, there are very few virtual museum globally that focuses on musical artifacts especially those that are of traditional and ethnic categories. Virtual Reality Musical Museum (VRM2) has been developed to produce a simple but complete virtual museum about Malaysian historical musical objects through Virtual Reality technology. VRM2 delivers an immersive virtual environment that makes users feels being present in the virtual environment as if the users are being in a real life musical instruments museum. It also provides the global community with the knowledge of Malaysian historical musical instruments to preserve the values of these instruments from being forgotten in the coming future. VRM2 consists of 3D artificial Malaysian musical artifacts, manipulation capabilities, artifacts’ sounds examples, walkthrough and valuable information. Users can manipulate the 3D objects where they can either move, resized and also rotate to view the objects in different angles. VRM2 is hoped to gain user’s interest in musical artifacts through Virtual Reality Technology as a new way of delivering information.

Virtual Reality, museum, Malaysian musical instruments

1.0 Introduction

Virtual Reality (VR) is one of the technologies which help in various scientific, engineering and education fields. It is a high-end user-computer interface that involves real-time simulation and interactions through multiple sensorial channels. [1] VR has even become the source of living in certain industries which introduces creative and graphical applications. The usage of virtual reality as a source of information delivery centre and education has shown that learning has become extra effective. The VR elements used in an education system indirectly help users to feel the existence within the education environment. Information and knowledge gaining also has met particularly new effective and interesting ways through virtual reality development.

A virtual museum is an organized collection of electronic artifacts and information resources. Virtual Reality museums are museums that exists virtually with computer generated animation and stimulation of virtual building paths and virtual historical artifacts that are modeled similarly with the real world objects. According to Lepouras et.al [2], there are some reasons which justify the need for VR system within the museum environment. The reasons are lack of space, vivid presentation, virtual heritage visualization, visualization of hazardous sites, mobile exhibition, navigational aid and aiding the exhibition design process. The Virtual Reality museums allow users to walkthrough museums and exhibition centers virtually with computational devices, for example a personal desktop computer, without physically being present on the real museums’ ground. Information on artifacts and historical collections are presented virtually to users without needing users to go all the way to a specific museum in order to learn about historical information. At the same time, users can interact with the Virtual Reality museums user interfaces in order to control their movements in the virtual world and manipulate virtual objects that exist in the virtual world.

This paper will discuss the problems, objectives, methods and findings from the
Musical Instruments museums are quite rare around the world and if a musical instrument museum is built, the museum can only be visited by the community around the area. Therefore, there are uncountable limitations in delivering historical information to the entire world. A few problem statements have inspired the idea of creating a musical instruments museum. There is only few existence of virtual musical instruments museum across the Internet or even in the real life world. There are several websites which share information about historical musical instruments but only in 2-Dimensional and pictorial representation. Most historical artifacts have values through different angle of view and 2-Dimensional pictorial representation will not satisfy users’ perception due to existing curiosity on the incomplete representation.

2-Dimensional and pictorial representation of historical artifacts will not be that interesting due to limitation of users’ participation and interactivity in learning or gaining information. Even in a real museum, historical artifacts can only be viewed as the way the artifacts are placed without allowing visitors to manipulate and view closely these artifacts from different angles. Lack of space in a real life museum also limits most museums from displaying all of the museums’ artifacts. Most museums tend to keep too fragile or valuable historical objects from public view which prevents the public from knowing the existence of these objects.

There are several historical objects that cannot be displayed anymore in a real museum due to a few unavoidable reasons like objects’ are being repaired or the objects are no longer exist. This problem can actually be solved by the usage of virtual reality through remodeling. The experience of walking through the real life museums is limited only to certain communities at remote location and the knowledge can hardly be shared by the entire world due to geographical boundaries. Musical instruments artifacts shown in most websites are not equipped with exemplary sounds which is important as the core values of a musical instrument.

3.0 Objectives

Virtual Reality Musical Museum or VRM2 has been developed with the following objectives:

- Use Virtual Reality Technology as a new way of delivering information about musical artifacts.
- Publishing a web-based Virtual Reality system globally through the Internet for everyone to learn about musical instruments historical values.
- Deliver an immersive virtual environment that makes users feel being present in the virtual environment as if the users are in a real life musical instruments museum.
- Produce a virtual museum that is complete with easily understandable information about historical musical objects.
- Provide the global community with the knowledge of historical musical instruments to preserve the values of these instruments from being forgotten in the future.

The target users for this system are musical artifact researchers, students and educationists, musical instruments’ lovers, and musical museum coordinators who are willing to share extra information about musical instruments with the system developer in order to add more virtual musical artifacts for future enhancement, and any individuals who are interested in learning about musical instruments’ history.

4.0 Virtual Reality Musical Museum (VRM2)

VRM2 scope is divided into five subsections, which uses still text, still graphics and still images as the discrete media. As for continuous media, 3D components, Moving Graphics, Interactive buttons and Sound are used. All the elements above are used in the full system of VRM2. Combination of all the seven media creates a multimedia based system that delivers information and functionality with dynamic interfaces. Multimedia requirements as a whole for VRM2 can be viewed from these different important aspects which are digital form, connection speed and media integration.

There are four main types of components used in VRM2 which are 3-Dimensional
Component, 2-Dimensional Animation, Still Object and Interaction component. All four types of components are integrated under a single system’s platform and work simultaneously in a uniformed way.

Metaphors are one of the most important aspects in designing a user interface. Wojciechowski, [4] and Giangrandi, [5] in their articles stressed on the importance of metaphors in delivering information to users. A Virtual Reality museum interfaces must provide users with an intuitive human computer interface based on well-known metaphors. The users should be able to interact with digital contents easily and naturally like interacting with objects in a real world. The best information delivery in Virtual Reality museums occurs when users are engaged cognitively, physically and emotionally by the metaphors used in the virtual world. In order to enhance understanding in the Virtual Reality museum, the interfaces should stimulate curiosity, creativity and fun.

4.1 Musical Instruments

VRM2 focuses on musical instruments in delivering the application. VRM2 3D objects are modeled according to Malaysian Traditional Instruments[3] in three different categories; Percussions, Strings Instruments and Wind Instruments. Both Percussions and String instruments consists of 10 instruments. The examples of percussions are rebana, angklung, boning and kompang. Strings Instruments examples are sitar, erhu, gambus and rebab. Wind Instruments has 7 instruments with Sompoton, serunai and Indian flute as the examples.

4.2 Virtual environment and 3-Dimensional (3D) objects

Virtual world is the main 3D platform which allows user to move in within. The designing process of virtual world includes designs of five different exhibition halls which have different arrangement of musical instruments. The basic hall shape is designed first before adding in all the other individual 3D musical artifacts to be arranged in the virtual world. Here, light designing is included to give suitable view within 3D exhibition hall. The example arrangement of 3D components architecture is shown in figure 1.

All 3D objects in VRM2 are mainly representation of 3D musical instruments or artifacts. The development of 3D objects for VRM2 is done by creating the sub-parts of a musical instrument and by joining the parts later on the same platform to form the complete musical instruments. For example, the object “sitar” is created when all the sub-parts of the object like neck, body, strings and tuning pegs are created first before being joined together as a full “sitar”. The evolution of the “sitar” 3D modeling in Figure 2 shows how each sub-parts are independently combined to create the “sitar”.

4.3 Information

Information here refers to text and instructive information in the virtual environment about musical artifacts description and navigation instruction. Similar to a real museum, information about historical instruments like the construction materials, year, origins, function and other related information are included in the virtual environment to help users’ understandings about these historical objects. The instructive information included guide users how to navigate, manipulate and use the virtual environment.
One of the important interaction capabilities is the users’ camera movement. The system’s camera is designed and set in a way to allow users to move the camera around the virtual environment. The camera can be moved in the concept of a dolly camera together with a pan camera in the virtual environment with the usage of cursor keys. Users can walkthrough the virtual environment is similar to walking through a real museum.

VR environment containing individual 3D artifact is created with extra functionalities like object multi-angle rotation, parts viewing, background color changing and conversion of 3D artifact’s fill from solid to wireframe. Object manipulation, virtual walkthrough and rotating the 3D Artifacts are examples of the interaction capabilities in virtual environment. There are menus in the virtual world which consists of interactive buttons to allow users to move directly between virtual exhibition halls. Users can also use these menu buttons to manipulate each object and play the example sound of each instrument. There are also buttons that allows user to retrieve information about each instrument along users’ walkthrough passage in the virtual environment. Figure 3 shows an example of the artifact named “rebana” which has the feature of individual objects’ manipulation. Figure 4 shows the virtual walkthrough where users can use assigned keys to walk around the virtual environment. Figure 5 shows the ability for users to rotate 3D artifact name “serunai” from the front, back, left, right, clockwise and anti-clockwise view.
4.5 Multimedia Elements

Multimedia elements are included to drive better attraction in the system. The use of sound will help users understand more about the instruments. The sample of sound generated by each historical instrument is included in the virtual environment. These non virtual reality pages will include multimedia elements like animation, graphics, still text, dynamic text, images and sound in order to deliver an interactive plus attractive web page. These elements are designed and constructed in minimal memory capacity for Internet distribution.

Multimedia elements are also included in VR Sounds Page and VR Object Description Page, which allows users to play the musical artifacts virtually using representative keys on the keyboard. The object description page for each available musical artifact allows users to read scrollable description, while at the same time see the original image and playback the genuinely recorded sound of the artifact.

5.0 Conclusion

VRM2 is a project that consists of heavy 3-Dimensional applications in web based environment. The overall project is a radical approach in performing education and information sharing on musical artifacts. There are some advantages of this VRM2 such as good quality of 3D objects and graphics, no delay in controlling the interaction movements, all keyboard keys used in VRM2 virtual world can be used independently without having clashes, flexibility of object manipulation and maximum user control in manipulating objects. VRM2 uses the original, real textures and colors obtained from real environment artifacts’ images. Manipulation capabilities are limited only to keyboard key controls in 3D virtual worlds in order to focus users’ interaction with a single device without needing to switch to other interaction devices. VRM2 has extended key controls for walkthrough with the addition of two keys, which enable users to move the camera sideways, either to the right or left while the screen is still focusing to the front. It has short and direct explanation content describing the artifacts. This is because most users’ focuses tend to be attracted to 3D objects rather than words. However, if users wish to know in detail about a particular instrument, users can always go to the “originals” page linked from the VRM2 base website. Users can gain knowledge on an artifact and at the same time can choose to listen to the original sound of each artifact on the base website’s “originals” page.

There are some limitation like slow extraction process to display 3D content, poor reliability on the Java Plug-ins used in the development because the extraction process of virtual worlds’ pages are not consistent and a little delay happens when walkthrough is carried out in the virtual exhibition hall.

Some improvement and maintenance ideas are using a more flexible and reliable platform under a bigger scope and longer timeframe. Better modeling and compression techniques will be developed in order to reduce number of polygons which will reduce file sizes. This will help improve 3D rendering and reduce lag. The use of multimedia databases will be considered, which will reduce file size, reduce object redundancy which will improve rendering and overall system’s performance. Some of the suitable languages that can be used for multimedia 3D application with databases are XML and XVRML. Lastly, publish virtual world in HTML documents that has flexibility in page editing.

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References