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RESEARCH ON DESIGN OF VIRTUAL MUSEUM OF SUBMERGED TRADITIONAL ARCHITECTURES IN THREE GORGES RESERVOIR AREA

ZHENG XU[1], TONGSHENG PAN[1,*], RUIZHI ZHANG[1], XIAONAN WANG[2], HE KANG[3]

[1]*China Three Gorges University*
Yichang, 443002, P.R. China;

[2]*Wuhan University of Technology*
Wuhan, 430070, P.R. China;

[3]*Jingdezhen Ceramic Institute*
Jingdezhen, 333099, P.R. China

ABSTRACT—The construction of Three Gorges Project has made some of cultural relics under state or province protection inundated; therefore, it is of great necessity to do document research on those submerged traditional architectures and to build a sharing database of resources and a virtual restoration. However, the construction of the virtual museum for those submerged traditional architectures in Three Gorges Reservoir Area is still at the initial stage. In order to further the development of the research, this paper provides development procedure of Unity3D and approaches to technical realization of the virtual museum, aiming at building a resource platform clearly clarified and easily retrieved for the study and establishment of the virtual museum. It is believed that this job will play a significant role in protecting human cultural heritage and accelerating the progress of cultural undertakings.

Key Words: Traditional Architecture; Virtual Museum; Unity3D; Virtual Technology

1. INTRODUCTION

The Three Gorges connects Bashu (in Sichuan Province) and Jingxiang (in Hubei Province), where scenery has been particularly fascinating for visitors since ancient times. And now due to the Three Gorges Project, they have become a worldwide focus point once again. Along with water impounding, many lands, houses, temples and ancestral halls where people live are drown so that millions of people have to abandon their fertile farmlands and move to other places [1]. While the fact is that the Three Gorges Reservoir Area possesses numerous ancient cultural heritages, including ancient sites, tombs and buildings and all of which have been swallowed by the water. With no doubt, we must take some measures to save and well protect them from now on [2]. As is said, owing to the Three Gorges project, a lot of places have been submerged and people have been transferred, which are mainly 4 counties of Hubei Province and other 16 districts and counties of Chongqing Municipality, with five minority autonomous counties contained. The main

part of the Virtual Museum is the submerged traditional buildings. According to a large-scale survey organized by over 30 scientific research institutes and universities covering architecture, archaeology and economy etc., there are in total 1282 inundated areas and buildings under protection (829 underground structures and 453 surface structures),mainly including historic sites under state protection like Baiheliang Hydrologic Inscriptions, Yunyang Zhang Fei Temple, Zhongxian Shibaozhai Temple and Han Que etc.; historic sites under province protection such as Chupung Kiosk, Riverside Stone Carving etc.; historic sites under regional protection like Xixiangkou Tombs, Xiaxikou Tombs, Wuyuan Bridge and Jichuan Bridge etc.

In terms of display examples of traditional architectures in Three Gorges Area, though real dwellings of Phoenix Hill in Maoping Town of Zigui County, Yichang, Hubei Province have been displayed in concentration, the main part of traditional buildings particularly those virtual display equipment and technical applications of submerged traditional architectures as well as current situation of Virtual Museum are still at the primary stage. Therefore, it is definitely a positive and far-reaching significant action to do document research on those traditional architectures, and to build a library sharing of resources and a virtual restoration. This Virtual Museum, based on plentiful investigations, surveys, analysis and researches, was authorized and started to set up in December, 2014. It contains three parts, firstly, virtual reality technology and network technique should be used to make real traditional buildings in the Three Gorges Area a real 3D or a modeling database by image data collection, thus conserving important information such as all data of original type and spatial relationship and realizing scientific, high-accuracy and perpetual maintenance of architectures in danger; secondly, these technologies are to be applied into improving reparation accuracy of traditional buildings and making prognosis for protection methods to be taken, simultaneously shortening the project schedule; thirdly, network technique is used to integrate the architecture resources, and virtual technology is used to profoundly, vividly and realistically present temporal appearance, construction and technical features as well as historical and cultural value of traditional architectures.

This project is conducive to further enrich document resource database and multimedia resource database, basically realizing unified management and resource sharing of underwater traditional buildings in Three Gorges Reservoir Area and providing a resource platform which is distinctly clarified and easily searched for the study and exploitation of the Three Gorges. In this project., data modeling and virtual simulation are used to restore original appearance of underwater buildings, and other techniques including digital fabrication, construction of resource platform and mobile APP etc. are applied to comprehensively unfolding those traditional buildings. It is deeply deemed that it is creative and of great importance to push the development of cultural technology through these effective methods.

2. DEVELOPMENT PROCEDURE OF THE VIRTUAL MUSEUM OF SUBMERGED TRADITIONAL ARCHITECTURES IN THREE GORGES RESERVOIR AREA

Unity3D is a composite game exploitation environment of cross-platform and hierarchical style, and it is also an integrated professional game engine possessing visualized editing, detailed property modifier and dynamic game preview, as shown in Figure 1. Unity3D's greatest advantage is to be economical, and it can be used directly through web browser without downloading client [3]. Unity3D supports C#, JavaScript, Boo scripting to develop languages and is often used to fast make interactive contents, such as 3D video game, architecture and information visualization etc.

Information visualization system of Virtual Museum sees Unity3D as a development platform and adopts B/S. Table 2 presents the main structure of the system, which covers three levels, client layer, application service layer and data server layer.

2.1 Client Layer

Client layer refers to interface between information visualization system and users, and it is mainly composed of HTML, the interpretation and execution of the browser, and Unity3D browser plug-in.

Exhibition information of 3D collections shows to the users forms of 3D exhibit intuitively and the users can click to check the graphics and text information of those collections.

Museum collection information browsing refers to browse cultural relics and knowledge of an exhibition stand, including those which do not appear in the 3D exhibition hall. Visualized information browsing means information of those cultural relics and knowledge is shown to the users in form of an information tree structure.

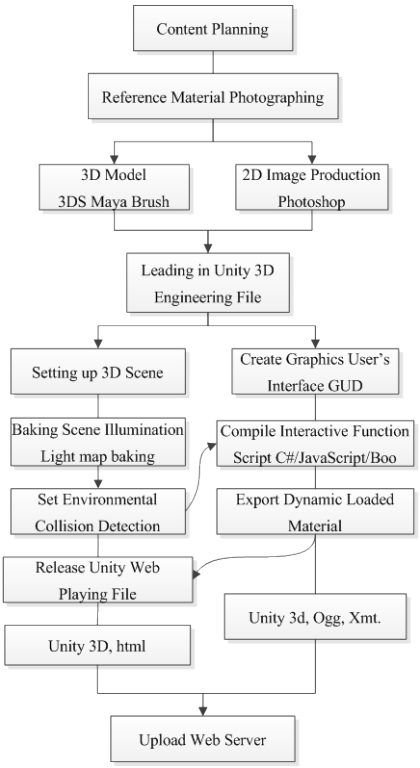

Figure 1. Information Visualization Development Process of Unity3D.

2.2 Application Service Layer

Application service layer provides for the client layer data information of those collections. Website static data automatically generates modules. Resource management module of the virtual museum calls a museum system interface from a data library management system, gains the data information and transfers it into a data format that the client needs.

2.3 Data Server Layer

Data server layer is responsible for restoration and providing data information the application service layer needs. Digital collection management system keeps all the texts and graphical information of those collections, as shown in Figure 2.

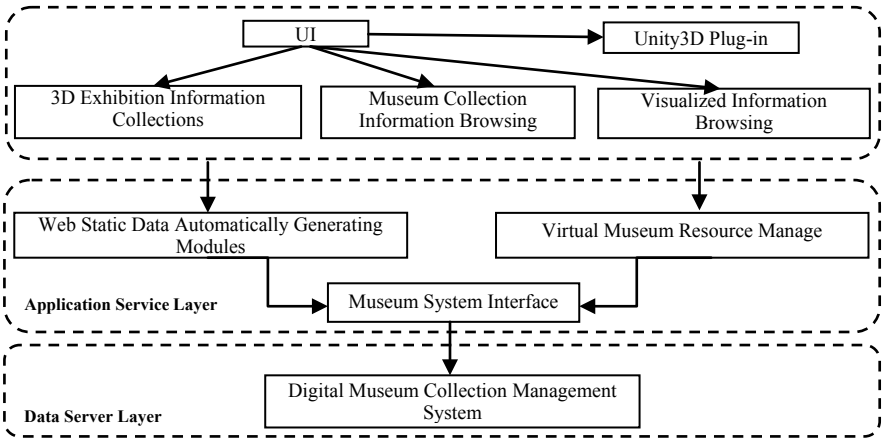

Figure 2. System Structure Diagram.

3. FUNCTIONAL AND TECHNICAL REALIZATION OF THE VIRTUAL MUSEUM OF SUBMERGED TRADITIONAL ARCHITECTURES IN THREE GORGES RESERVOIR AREA

Up to now, there exist several kinds of virtual museum contains, one is fully 3D virtual museum which makes exquisite modeling to the museum as well as the cultural relics and characters in the museum; the second one formed by a panoramic view of real sight of exhibition hall and pictures and texts specifically introduces two-dimensional and three-dimensional; the third one renders a 3D scene to 2D [4]. The virtual museum mostly adopts the first one, and combining with 2D animation techniques completes the whole exhibition. And the 3D scene, display and cultural relics use 3D modeling techniques (Figure 3) to realize cultural relic's exhibition function by using 2D mutual animation technique. The function of the whole museum comes into being through integrated virtual reality technology.

Figure 3. 3D Model of Ancient Architecture Model.

3D technology is used in the process of setting up interior and outdoor scenes and producing models of furniture and instruments. The architecture model is larger and more structured, thus it is mainly assisted by polygon modeling, Boolean operation, NURBS modeling; cornice and rake angle at the top of the building have complex structure, thus it can be realized through LOFT. Small implements are out of shape and changeable, thus we can choose composition modeling and lofting modeling. The model control numbers of subsection and size of charted, UVW expansion, additive maps and their complex structures etc. by deleting surface. Besides, when creating the model, to avoid disproportional problems, it's better to decide the real size of objects in advance and make sure the proportionality of objects. Figure 1 is 3D modeling with maps.

2D in the museum is under the help of 2D animation technology and scripting languages, using frame animation, fade-out effect, rolling kakemono, mouse following in the animation [5]. Key features of scripting languages include skipping, to load and to lay in external documents, of which the text is realized through loading external data. Loading external data can effectively reduce systematical data volume, while text effect cannot de defined by CSS type but XMI technology which controls the text formatting.

To reduce CPU occupation, speed up real-time rendering and keep real sense of the scene at the same time, when leading in virtual reality instruments, it is necessary to roast them. This system is mainly applying VRAY LIUHTINU MAP, zone modeling layer management and roasting at or outside a room. Camera need to be switched in the whole process when leading in so as to make sure systematical fluency. Once found in the scene broken or in principal section, finished products must be roasted repeatedly. And to put the scene into virtual reality instruments needs repeated experiments, adjust material parameters, reflection parameters and roasting chart let's shade degree etc.

Roaming scene often needs to install bird's eye animation. Among virtual reality instruments, the bird's eye viewing cameras run unstable, so it is easier to create deviation and dither. Therefore, in order to improve these details, it's better to set up line transacts in the modeling document as camera paths. We need to put a camera on the line transact, choose the center of the scene, set its overlooking angle and kakemono and then adjust in virtual reality instruments.

The final Virtual Museum offers three roaming functions, the first one is full browsing, i.e. the bird's eye viewing animation; the second one is to design in advance several reasonable roaming ways to make auto playing animation; the last one is that the users can walk freely and ask for help along the scene by using a mouse or a keyboard. The display function of the virtual museum is right under the control of a menu, and there are many groups which are clarified in accordance with differences among architecture's type, age, district and county. Then the users can click the menu to skip among various display platforms.

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REFERENCES

1. The State Council TGP Construction Commissioner's Office, the State Administration of Cultural Heritage, Traditional Architecture in Three Gorges Hubei Reservoir Area, Science Press, 2007.

2. Wang Lumao, Reproduction of Three Gorged Historical Appearance--Urgent Protection of Three Gorges Cultural Relics, Sichuan Cultural Relics, 1993.
3. Zhu Huijuan, Virtual Roaming System Based on Unity3D, Computer Systems & Applications, 2012.
4. Zhang Chi, Luo Tiejian, Design and Realization of Information Visualization System Based on Web by Wang Xianggen, Computer Systems & Applications, 2009.
5. Gao Fei, Walking into Virtual Museum, Art Panorama, 2011.

ABOUT THE AUTHORS

Z. Xu is a lecturer; deputy director of Environmental Art Department of College of Art of China Three Gorges University; postgraduate of Artistic Design of Sichuan Fine Arts Institute; member of CIID; visiting scholar of University of Guelph; part-time teacher of Sichuan Fine Arts Institute. He works mainly on environmental art. Achievements include directing one of International cooperation projects.

T. Pan graduated from University of Shanghai for Science and Technology and got his bachelor degree. He works mainly on IT and virtual stimulation. Achievements include directing one of 2014 Ministry of Culture Technological Innovation Projects; directing one of cooperative researches commissioned by University of Guelph.

R. Zhang graduated from Wuhan University of Technology and got his postgraduate degree. He works mainly on systematic design and design ethics. Achievements include directing and accomplishing one of 2012 Hubei Provincial Social Science Foundation; directing one of 2014 Ministry of Culture Technological Innovation project.

X. Wang entered Wuhan University of Technology to study Design as a master degree candidate. She works mainly on systematic design and design ethics. Achievements include participating in and accomplishing one of 2011 Hubei Education Department Humanities and Social Sciences Research Project.

K. He entered Jingdezhen Ceramic Institute to further study Ceramic Art Design as a master degree candidate. He works mainly on environmental art design and ceramic art design. Achievements include directing one of Jingdezhen Ceramic Institute project; participating in and accomplishing one of 2012 Hubei Provincial Social Science Foundation.