

Intangible Cultural Heritage Display using Augmented Reality Technology of Xtion PRO Interaction

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Abstract — In order to promote the display effects of intangible cultural heritage, a display method based on augmented reality technology of Xtion PRO interaction is proposed, which can be divided into three phases. In early-stage preparation, we determine the display content, clarify work style and make planning for specific content of column. In specific production phase, we conduct user interface design and three-dimensional modeling respectively by both two-dimension group and three-dimension team. Finally, we gather information for 3D intangible cultural heritage display system to complete system testing.

Keywords - *interaction technology; augmented reality; intangible cultural heritage; display*

I. INTRODUCTION

As valuable achievements of human civilization, intangible cultural heritage has very valuable historical research value. However, with acceleration of modernization of the society, plenty of valuable intangible cultural heritages are threatened by lack of protection. For a long time, it has been a commonly used means to adopt museums, exhibition centers to protect precious historical data and support intangible cultural heritage successor and the like, all of which have greatly contributed to intangible cultural heritage protection. However, due to the need of modernization of all areas, intangible cultural heritage protection is confronted with many difficulties. With rapid development of information technology, interaction media make it possible for intangible cultural heritage to be transformed, reproduced and recovered to become shared and renewable digital form to help realize permanent preservation of intangible cultural heritage, promote propagation of intangible cultural heritage and provide abundant digital learning resources for intangible cultural heritage education, playing an active role for promoting intangible cultural heritage protection and heritage. With continuously advancing technology, higher reproduction has become highlight of intangible cultural heritage digitization. Original form can be simulated in an increasingly realistic manner in digital form, allowing audience to have immersive feeling. After all, digitalized intangible cultural heritages are results of second creation, which may fail in completely presenting real intangible cultural heritage so as to lack authenticity. Meanwhile, current situation of intangible cultural heritage digitization relies too much on digital technology to ignore connotation of cultural heritage itself with the original vitality missing in the presented digital content. Such problems widely exist in intangible cultural heritage oriented digital applications. Therefore, using digital technology for intangible cultural heritage protection is not done once and for all but a double-edged sword. As a result, during digitization process of intangible cultural heritage, it is important to use the cultural

logic of intangible cultural heritage development to lay emphasis on cultural connotation of intangible cultural heritage instead of simply pursuing realistic degree of physical simulation technology. Meanwhile, due to limitation in the form of intangible cultural heritage, visitors only have access to simple understanding of it by historical description and cultural relic protection. Thus, the lack of entertainment and interaction in learning process gives rise to propagation effect which is not so ideal.

In order to better popularize intangible cultural heritage, the task will display intangible cultural heritage in a vivid manner with the help of augmented reality technology and somatosensory interaction technology. People can experience the fun of virtual operation while learning corresponding intangible cultural knowledge to truly popularize traditional intangible culture in a scientific manner.

II. INTANGIBLE CULTURAL HERITAGE DISPLAY SYSTEM BASED ON INTERACTION TECHNOLOGY

A. Augmented reality technology

Augmented reality technology (AR for short) is the extension for virtual reality technology, which fuses virtual objects and scenes generated by computer or prompted information from system to the real world in a real-time manner to enhance degree of perception for the real world. recently, due to the important role played by AR technology in exhibition, design, publishing, entertainment and other fields, AR technology has been rated as one of the top 10 most dynamic and promising technology.

Augmented reality technology in system is shown in Fig.1, where Fig. 1(a) is a certain intangible cultural heritage; Fig. 1(b) is system hardware device of which the Xtion PRO color camera on the top of the screen may acquire real images in the real world. Then, no matter how users move it, the intangible culture will not have deflection or penetration phenomena as if they are really wearing them. Even if operators turn around or jump, virtual intangible culture will

present excellent follow-up characteristics to bring users favorable interaction experience.



(a) Original model (b) System hardware device (c) Virtual reality effect

Figure 1. Application of augmented reality technology in the system

B. Interaction technology

Originating from game industry, interaction technology refers in particular to the human-computer interaction by body movement, body sense and other methods. Early somatosensory has to use expensive data gloves, 3D helmet and other hardware for realization. With real-time depth camera technology and body sense interaction algorithm becoming increasingly mature, especially successive release of Microsoft Kinect and ASUS Xtion PRO, in is not until recent days, immense potential has been revealed in somatosensory interaction technology for electronic entertainment, interactive education, medical assistance, machine vision, and other practical applications.

The somatosensory device selected by the system is the Xtion PRO developed by Microsoft, which has 3 asymmetric lenses. The middle one is a RGB color camera for capture real-time color image; the ones on the left and right are infrared projector and infrared camera respectively, transmitting and receiving infrared ray to provide depth

information. By virtue of Xtion PRO somatosensory device, the system can not only easily acquire all the video information in the scenes, but also can judge operation intention by detecting user's action. For example, user waving hands means to change content to be watched; hand staying at certain position for more than 2s means to select certain intangible cultural heritage and is ready for operation and so on. In other words, Xtion PRO has realized the brand new experience for users as if "you are the remote control" to eliminate the gap between users and operating objects, improving the degree of immersion and experience of the whole display system.

C. Working process of the system

Realization process of the system is divided to 3 parts of preparation stage, production and testing stage. Detailed working process is shown in Fig.2. The key to early-stage preparation is to decide system display scheme to not only decide display content, clarify work style and design specific columns but also make planning for the specific content of every sub-column. In the material collecting and sorting phase, all kinds of materials related to display themes are to be acquired with the help of network and professional database. In the specific production phase, it can be carried out in two-dimension group and three-dimension group simultaneously. The two-dimension group mainly completes user interface design by graphic design software, model making, etc.; and three-dimension group uses professional three-dimensional modeling software to establish models as well as a series of work including lighting design and material editing. Finally, all the information gathers in "3D intangible culture display system" to complete system testing.

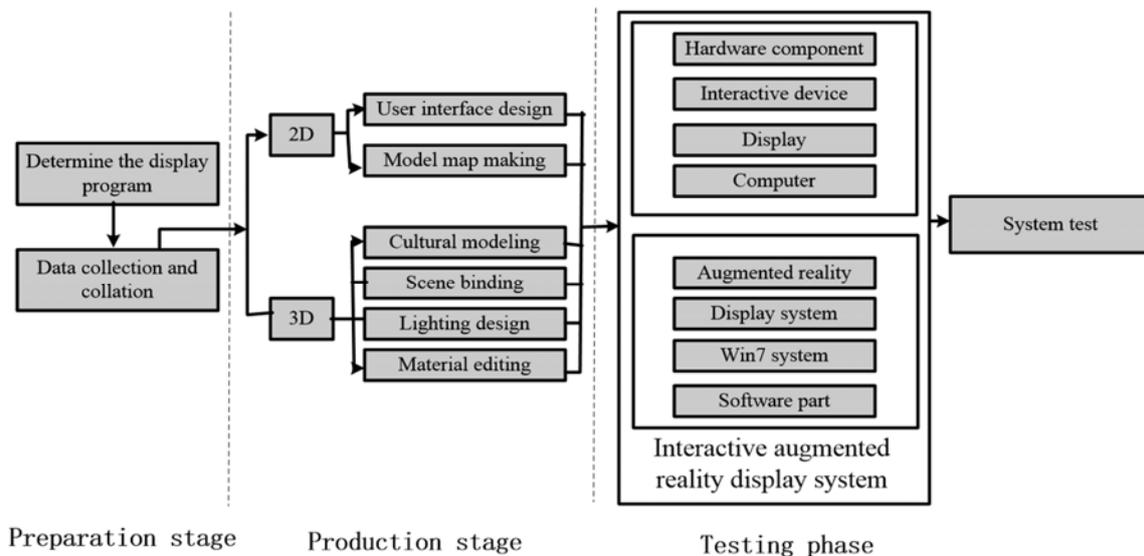


Figure 2. Working process of the system

III. DESIGN AND REALIZATION OF INTANGIBLE CULTURE DISPLAY SYSTEM

A. System function system

The system not only contains intangible culture operation function, but also it utilizes words, picture, videos and other multimedia comprehensively introduce the cultural background behind different intangible cultures, which is an intangible culture displaying platform integrating education, entertainment and interactivity. The display system is the first of its kind in China. Detailed functions are shown in Table 1.

TABLE 1. SYSTEM FUNCTION LIST

Column name	Sub-column	Manifestation			
		Character	Picture	Video	Virtual realization
Porcelain of past dynasties	Han Dynasty	√	√		√
	Tang Dynasty	√	√		
	Song Dynasty	√	√		
Costumes of past dynasties	Han Ethnic Group	√	√	√	√
	Mongol Ethnic Group	√	√	√	
	Miao Ethnic Group	√	√	√	
Shadow Puppetry of past dynasties	Yuan Dynasty	√	√		√
	Ming Dynasty	√	√		
	Qing Dynasty	√	√		√

The system designs three columns of intangible culture of past dynasties, intangible culture of ethnic groups and intangible culture of Olympic Games. Each column includes 8 sub-columns and time sequence and diversity degree of intangible cultures shall be considered in the selection of sub-column. At present, the system has already integrated large amount of character and picture sources but video and virtual operation shall be enhanced. As the characteristics of intangible culture, most works remaining were created within one hundred years and the works with a long history are in bad conditions. Therefore, computer graphics shall do adequate post processing, which shows the integration of art and technology in the subject.

B. User Interface Design

Chinese characteristics are kept in the user interface design of display system and symmetric layout is used in the main interface and secondary interface (Figure 3) to highlight traditional intangible culture. Four columns in the main interface are clearly arranged from top to bottom and different columns are connected by the hick lines and blurry clouds. It shows different themes are associated somehow. Illustration is used in the secondary interface. Form features of different intangible cultures are outlined by simple lines and simple and light colors match their themes accordingly.



Figure 3. System user interface design

Somatosensory interaction system is different from ordinary graphic interface system. As gesture control is not as precise as mouse operation, good visual expression shall be guaranteed on the user interface design of system and recognition and control of Xtion PRO somatosensory equipment shall be facilitated. Considering the features above, system realizes interaction task by use of large-area rectangular button. User only needs to stand in the 1.5-3.0m area in front of the equipment and the system would recognize position of hands automatically. If the user put hand on a button for over 2s, he/she confirms entering this column.

C. Modeling

3D intangible culture modeling is the key to realize the system. Generally, fabrication of an intangible culture model requires the following steps:

- (1) Select exhibits (material object is the best or detailed picture information shall be required as support);
- (2) Collect information (take pictures of material object from different angles, summarize corresponding literature and images as background introduction);
- (3) 3D intangible culture model fabrication (use ads Max and CLO professional intangible culture modeling software to fabricate the model and save the model in fbx format);
- (4) Make maps (make maps on the basis of pictures taken in Step (2) with help of Photoshop and save them in jpg format);
- (5) Model format conversion (use unity 3D game engine to compose the documents in Step (3) and Step (4) into u3d format).
- (6) Upload model to background database of 3D somatosensory image matching system. After display system is started up, it would detect data updating and intangible culture model in the database can be downloaded via wireless network.

Special attention shall be paid in 3D intangible culture modeling process of the system. As virtual intangible culture rendering of the system is real-time operation and the computation amount is huge, the page number of each intangible culture work shall be less than 3000 or the user experience would be affected. To reduce the work page number in the intangible culture model to the great extent, complicated geometric model is replaced with map effect in the system. Meanwhile, multi-layer intangible culture can only be realized by the shadow effect in the map so all the

intangible cultures can be expressed fluently in the operation. See Figure 4.



Figure 4. Display effect

IV. CONCLUSION

Intangible cultural heritages are treasures of China and important component in traditional Chinese culture. Technology brings a new presentation form for intangible culture and endows traditional culture more exuberant vigor. The subject is aimed to the leading technologies of augmented reality technique and interaction technique to present the colorful culture background behind the intangible cultural heritages to the public, improve the cultural accomplishment of Chinese people and enhance a sense of national pride.

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