

Research on the Digital Communication and Development of Yunnan Bai Embroidery

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Abstract. Our country attaches great importance to the protection and development of intangible culture these days, but the shortcoming of discoloration, breakage and occupying too much space still exist in the traditional way of museum protection. This paper starts from the analysis of the above problems, and then cogitates why and how to use the virtual reality (VR) technology to better solve these problems and analyzes this specific object of the Yunnan Bai embroidery in order to achieve its full human value and economic value. Firstly, using 3D MAX to design and produce the three-dimensional model of the embroideries of Bai nationality. Secondly, using the large number of embroidery model data that we collect to construct the Yunnan Bai embroidery model database. Next, creating a digital display system of virtual embroidery and putting the digital display system to the PC client websites and mobile phone applications to achieve information sharing. Finally, through the use of virtual display technology for three-dimensional design of embroidery, the embroidery clothing, bedding and other works with modern style can be designed so as to continuously pursue and give full play to the charm and economic value of embroidery.

1. Introduction

Bai nationality is one of the ethnic minorities in Yunnan with rich and colorful culture. What is more, it is one of the nations with a long history and ancient culture. The embroidery of Bai nationality in Dali has a long history, the most representative is the embroidery in Wase Town. It was widely circulated in the local place and has a solid foundation for the masses. It also has a strong artistic and outlook appreciating. Many works has great influence in the state of Dali and Yunnan province because it's full of national style and local characteristics. Embroidery is the oldest cultural symbol of Bai nationality. However, with the impact of modern wave of ethnic cultures, handmade embroidery technology has begun extinct. There is nothing should do but protect [1].

With the continuous development of VR technology, the cultural industry innovation combined with VR technology has rapid expansion in some areas among the cultural industry. Using VR technology can preserve the samples of embroidery by using pictures, videos, scanners and other forms stored in a storage medium. From this way, posterity can easily understand, generalize and inherit the culture of embroidery, so as to prevent the embroidery art dies. The embroidery art of Yunnan minority is growing rapidly and gets much attention and research. Yunnan minority's embroidery art is more and more popular and many people began to accept and recognize it under the "VR+" era. The digital protection, development, utilization and transmission of intangible culture is a



new way to protect the intangible cultural heritage in the information age. It is also a strategic measure with the social significance of digital era [2].

2. The Digital Protection Methods of the Bai Embroidery

2.1. Making Three-Dimensional Model and Audio Interpretation of Bai Embroidery in Yunnan

First of all, through the ways of photographs, videos and other methods to collect a large number of Bai embroidery works on the field. And then, making 3D models with these classified and organized works. 3D MAX is mainly used to make 3D models since this software has powerful function, good expansibility, simple operation, accessible and dramatic image effect and other features. At the same time, it also can fluently and steadily cooperate with other software. Different kinds of embroidery 3D models can be made by 3D MAX and the production process must be paid attention to handle the shape, color, texture and other aspects of the embroidery. Next, it is executed the command of the "export" in menu and be saved as VRML (.wr1). After making these models, we can use the audio editing software of Audacity to edit the sound and realize the sound interpretation. Then, we use the X3D editor to write the content of the scene and call the audio. After that, the file can be opened in the software of BS Contact [3]. The 3D models of Bai embroidery are shown in Figure 1 and Figure 2.

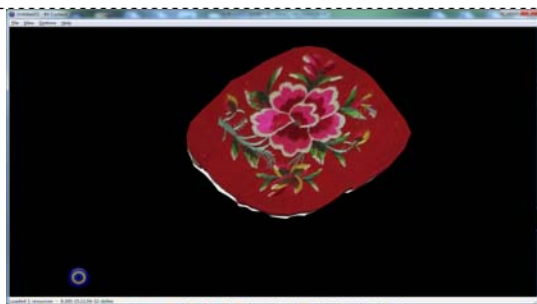


Figure 1. The orthographic view of the three dimensional model of Bai embroidery flower pattern

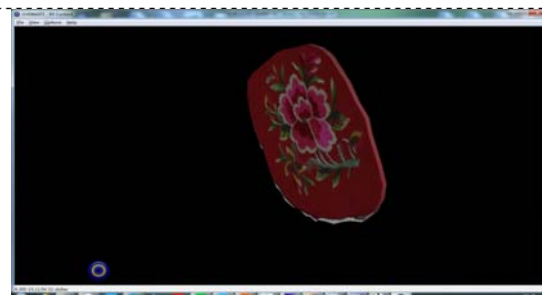


Figure 2. The side view of the three dimensional model of Bai embroidery flower pattern

X3D editor is used to achieve the combination of three-dimensional embroidery model and audio, the audience not only can appreciate embroidery, but also can hear specific explanations. Part of the script codes are as follows:

```
<![CDATA[ecmascript:
    function Magnifier()
    {
        if(b==0)
        { b=1;
            string [0] ='maps/suoxiao.png';
            fandajin.url=string;x3d.translation.z=(Camera1.position.z-x3d.translation.z)/2;
            x3d.translation.x=(Camera1.position.x-x3d.translation.x)/2;
        }
        else if(b==1)
        {b=0;
            string [0] ='maps/fangda.png';
            fandajin.url=string;
            x3d.translation.z=0;
            x3d.translation.x=0;
        }
    }
}
```

The calling segment of the audio is:

```
<Sound intensity="1" spatialize="true" maxFront="35" maxBack="25" minFront="20"
minBack="10">
  <AudioClip url="sound/X3D.wav" loop="true">
  </AudioClip>
</Sound>
```

Figure 3 shows the audio playback test.



Figure 3. audio playback test

2.2. Constructing the Model Database of Bai Embroidery

Making a more efficiently database can satisfy the demands of information and processing requirements. What is more, it can solve the problems of data sharing and storage. Firstly, people can use the equipments such as camera, voice recorder to collect embroidery pictures, audios and videos information in the field. Raw materials, tools, skills, styles and other information of embroidery should be collected as comprehensive as possible [4]. Oracle database software is used to search and modify the data because of the varieties of software. Building 3D model database requires the model checking, rendering, integration and pretreatment. After that, the model database of Bai embroidery can be build.

1) Model checking

Model checking refers to examine the integrity of model, the correctness of texture and model and texture naming normalization carefully to prevent errors and influence of the later finding and transfer.

2) Model rendering

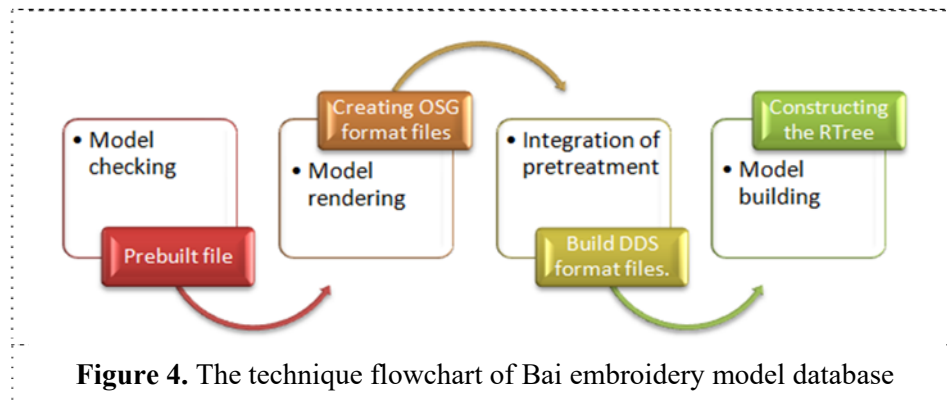
Model rendering sets scene light with the 3D MAX software, thus forming the model rendering mapping. The model will be more realistic by using the lights and shadows. Then, we can transform the rendered data into OSG format files by OsgExp plug-in.

3) Model integration and pretreatment

Model integration and pretreatment is a procedure to preprocess the model and texture data of the OSG format file exported in the model rendering step. First of all, depositing model automatically to the appropriate folder based on the partition of model. Then, adding watermark in batches for the model texture and export for the DDS format files.

4) Model building

Collecting the scattered model files and checking again the watch effect of model scene. Next, packaging the scattered model files into the scene data files and importing the Oracle database. Finally, classifying the category and constructing the 3D RTree spatial index [5]. The technique flowchart of Bai embroidery model database is shown in Figure 4.



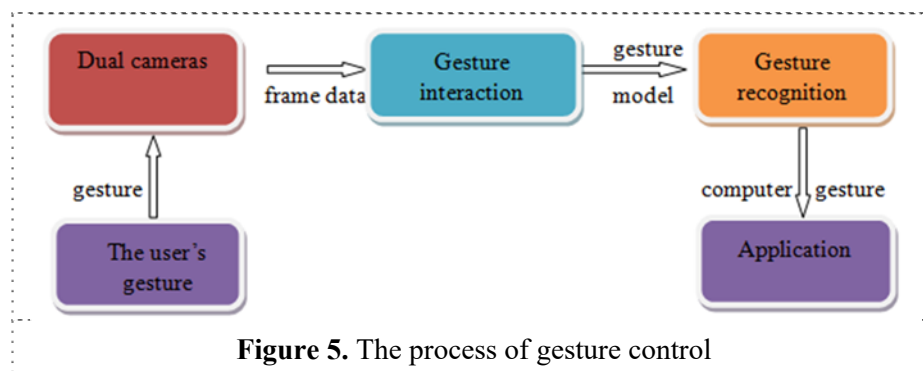
2.3. Constructing the Digital Display System of the Bai Embroidery

In order to show and create the interaction model of digital display system of the Bai embroidery, people combine the created 3D model with Leap Motion and Unity 3D model engine.

Compared with other long-distance sensors equipments, such as Kinect and Wii, Leap Motion as a millimeter desktop close gesture control equipment focuses more on the capture and recognizes the close detail action of one's hands and fingers. Leap Motion unites with phantom imaging technology are applied to the close interaction of equipment model, and it will be more immersive and the shown effect will be much better, just like the real objects in your hand and can be arbitrary controlled.

Unity 3D is the most commonly used virtual development of the engine at present stage. It not only has a powerful scene editing and rendering capabilities but also provides better support for Leap Motion equipment at the same time.

2.3.1. The gesture control process based on Leap Motion. Leap Motion gesture control process is the key to realize the human-computer interaction. Here we can use Unity 3D as the platform, the user input gestures, Leap Motion to open the device, and through the camera to detect the user's gestures. And then the gesture data is extracted from the video information, so as to calculate the gesture model which can be identified by computer [6]. The gesture control process is shown in Figure 5.



Leap Motion primarily uses TBD technology when tracking gestures. TBD technology is mainly used to track the coordinates of objects, such as fingertips and pens in three-dimensional space. TBD technology focuses on whether detection target appears in the sensor's detection range, if the target appears at the t moment, $\delta t = 1$; else $\delta t = 0$. The front t frame sequence is measured by an imaging sensor, the represented as $z1: t = \{z1, z2, \dots, Zk\}$. The scanned plane of the sensor is divided into resolution cells as the size of $\Delta x \times \Delta y$ [7]. At the sampling t moment, any resolution cell (i, j) records a $Z_t^{(i,j)}$, then the t measurement $Z_t^{(i,j)}$ can be expressed as formula (1) and formula (2):

$$Z_t^{(i,j)} = I_t^{(i,j)}(x, y) + n_t^{(i,j)} \quad \delta t = 1 \quad (1)$$

$$Z_t^{(i,j)} = n_t^{(i,j)} \quad \delta t = 0 \quad (2)$$

In formula (1) and formula (2): At the t moment, the target is the center of mass (x, y) , $I_t^{(i,j)}(x, y)$ is the intensity of the pixel (i, j) , and $n_t^{(i,j)}$ is the noise measurement.

2.3.2. The implementation of the display system. The key technologies to implement the system are the configuration and driver of the scene. It mainly implement in Unity 3D engine. Leap provides Plugins in the Leap DeveloperKit, when we use it, we can import it into the Unity Asset folder to implement Unity's call to Leap. We use the above 3DMAX model to convert the FBX format file and then import Unity 3D to build a three-dimensional scene, and use Mono Develop for C # scripting to achieve the scene driver, after that, it can be released at the Windows platform by using Unity 3D and import display system to interactive presentation [8]. At the same time, we show the system platform through the network, so that the audience in the computer, mobile phones and other devices on micro-blog, blog, forums, QQ and other software to watch online embroidery show. As a result, the embroidery works can be appreciated cross-time and cross-space [9]. The display system of digital protection of Bai embroidery is shown in Figure 6:

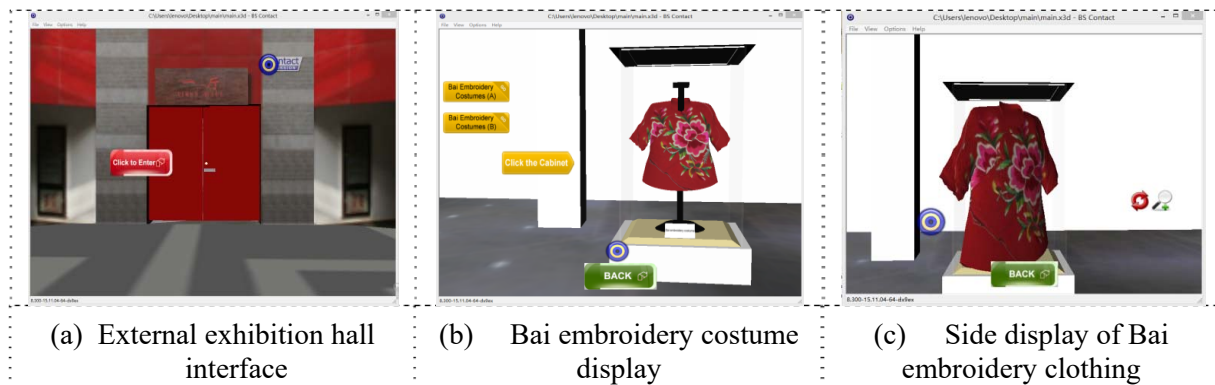


Figure 6. Bai embroidery display system

3. The Application of Digital Protection of Bai Nationality Embroidery in the Development of Modern Embroidery

The embroidery of Bai has a series of new features such as close stitches, elegant designs, vivid image, properly close and fold the nature, brilliant color, graceful and grander. Each piece of embroidery is a fine piece of art with high ornamental and collectible value. In the digital display system of Bai embroidery, people not only can visually and comprehensively see the effect of the various directions of the Bai embroidery, but also can hear the voice. After that, the human-computer interaction can be realized, the embroidery can be better protected and inherited.

Nowadays, people like to pursue fashion and pay attention to personality. Clothing with national characteristics conforms the current personalized aesthetic trend [10]. Therefore, we can use VR technology to create modern clothes to provide more styles of modern embroidery products. Some popular approval could be put into mass production so as to avoid the overproduction of outdated products. This system also can realize human-machine interaction and let people chose their favorite embroidery decoration, thus the products can be innovated and the user's sense of immersion can be improved.

4. Conclusion

This paper aims at the existing protection and development problems of Bai embroidery. By putting forward the application of VR technology to build the digital protection and display system, the audience can realize 3D stereo viewing and human-computer interaction experience. Through the use of network platform, computers, mobile phones and other devices to spread, so as to better protect and

inherit the hand-made embroidery of Yunnan Bai nationality. Meanwhile, on this basis and further proposed to create a display system of Bai embroidery patterns, modern clothing and other works, so that the consumers customize the product style that they really like. What is more, it can meet the needs of different people to realize the protection and inheritance, so as to promote the sustainable development of the local economy.

Acknowledgment

This research is supported by The 2017 Special Funds for The Protection of Minority Traditional Culture of Yunnan Ethnic and Religious Affairs Commission (The Digital Promotion and Dissemination of Yi Nationality Costumes in Yunnan Minority Nationality and Digital Protection of Yunnan Bai Clay under The Background of VR+culture). Project of Virtual Simulation Experiment Teaching Center of Electrical Engineering in Yunnan Province, Regional Science Fund of The National Natural Science Foundation of China (Grant: 61365007/ F030406) and The Graduate Student Innovation Fund of Yunnan Minzu University.

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References

- [1] Chen Yu. Digital protection of cultural relics collection-From the perspective of digital protection of Heilongjiang Museum [J]. Journal of Heilongjiang Institute of socialism, 2015, (2): 59-61.
- [2] Gong Longyu. Digital protection and inheritance of Miao embroidery in Xiangxi [J]. Comedy House, 2016 (10): 152-154.
- [3] Xu Wu. Virtual reality technology [M]. Hangzhou: Zhejiang University press, 2013.
- [4] Dai Jun Bo. Research on the application of multimedia technology in the digital protection of the intangible cultural heritage of the Manchu people [J]. Journal of Library Science, 2013,14 (7): 31-37.
- [5] Wang Changhan. Construction of 3D model database for Chongqing urban area planning and management [J]. Surveying and Mapping, 2014 (2): 107-111.
- [6] Huang Jun, Jing Hong. Gesture control technology based on Leap Motion [J]. System Application, 2015,24 (10):259-263.
- [7] Zhang huijuan, liang yan, cheng yongmei, pan quan, zhang hongcai. The research progress of the monitoring technique in the weak movement of movement [J]. Infrared Technology, 2003, 28 (7).
- [8] Lin Dejiang. Research on digital display system based on Leap Motion somatosensory control technology [J]. Journal of Gun Launch and Control, 2015,36 (4): 86-90.
- [9] Liang Huie. Preliminary study on digital display art of national costume museum [J]. Southeast Culture, 2014, (6).
- [10] Chen Siyuan. Innovative design and Application Research on the silver pattern of Miao Nationality in Xiangxi [J]. Art Science and Technology, 2015,17 (4): 51-54.