Digitization and Development of Dai People’s Slow-wheeling

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Keywords: Field stitching, Slow wheel pottery, digital, Laser positioning.

Abstract. Quite a few traditional ethnic skills are on the brink of losing. This paper introduces the latest development techniques of computer graphics, image processing, field stitching technology, virtual reality and somatosensory recognition to safeguard the traditional skills of ethnic minorities that Dai People's Slow Wheel. Firstly, use MultiGen creator to build the models such as soil, mud, slow wheel, gas kiln and Chung machine. Secondly, use VEGA to build pottery scenes; moreover, accurately record, capture, locate and determine the corresponding action model through the action capture, positioning technology, the successor of the pottery action to. Finally, record the action model, physical model and environmental information into the Oracle database and load the environment through the BS Contact browser. Well using of the Internet helps to show the process of slow wheel pottery in a wider range, so that the traditional pottery art could break geographical restrictions.

Introduction

The slow wheel is the most important pottery tool invented by mankind when producing pottery. It made the walls of the pottery uniform and the shape more beautiful. But soon, the slow wheel is replaced by fast wheel technology, which is more likely to be billet forming, meeting large quantities’ production requirements and more advanced. About four thousand years ago, fast wheel became the most popular pottery tools, while the slow wheel pottery almost no longer existed. In the Dai nationality area of Xishuangbanna, Yunnan Province, it now still retains the hand-made plastic, plate and slow wheel making pottery method. It not only provides a dynamic example for the study of the history of pottery technology from the technical form, but also provides an indispensable material for studying the tradition and vicissitude of Dai culture as an important cultural form. Because of this, Dai Slow wheel pottery art is listed as the first batch of national intangible cultural heritage [1].

We could digital safeguard the traditional skills of ethnic minorities —slow wheel pottery of Dai nationality through the VR technology, computer graphics, image processing, laser positioning technology, field stitching technology, virtual reality, somatosensory identification and other information field of the latest development of technical means, therefore it can greatly restore the traditional handicrafts and skills of ethnic minorities. By collecting pottery shape, texture, materials and other data information through technical means, we can record them into the computer as the professional research materials. The use of multimedia virtual scene modeling, multimedia virtual scene coordination display and other virtual reality technology, the intangible cultural heritage, especially the traditional characteristics of the production of ethnic minorities, the use of way, consumption, circulation, dissemination of heritage and other real reproduction, and even can restore some skills to produce the environment, the background of the times, historical background, let experiencer in depth. It has a significant effect for the full understanding of the traditional skills of ethnic minorities and it is of great significance for the inheritance and promotion of technology[2]. This article involves the technology, methods can also be transplanted to other traditional skills, ancient books and other protection, rescue.
Digital Protection Method of Slow Wheel

Digital Recovery and Protection of Dai People 's Slow - wheeling Pottery

Unlike paper, weaving, lacquerware or grotto fresco artifacts which can be saved well in the museum, minority traditional art is an intangible cultural heritage. Traditional crafts of ethnic minorities cannot be preserved in the form of cultural relics such as pottery, paper making, forging tools, as well as the historical background of art and the background of times, therefore it needs to be preserved through modern advanced digital technology.

Tool Modeling

As this paper focuses on the recovery work of the endangered skills with virtual reality technology, we have high requirements on real-time performance, user's sense of experience, immersion and human-computer interaction. Based on Multigen Creator's powerful real-time interactive features, good compatibility and powerful model texture processing capabilities, we chose it as a slow wheel's modeling tool.

We use Multigen Creator to model the main tools used in the process of Dai's slow-wheeling pottery, such as pestle, sieve, pottery, pottery, bamboo knife, pottery, template, wood hammer, wood scraper. After that, convert to Open Flight.flt format [3].

Pottery Technology Action Positioning

At present, the main positioning technology in the field of virtual reality has infrared positioning, laser positioning, visible light positioning, low power Bluetooth positioning and etc. [4].

Through the comparative analysis, the advantages and disadvantages are summarized in Table 1 below

<table>
<thead>
<tr>
<th>Positioning technology</th>
<th>advantage</th>
<th>disadvantage</th>
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<tbody>
<tr>
<td>Infrared positioning</td>
<td>The highest precision, low delay, good positioning effect</td>
<td>high cost</td>
</tr>
<tr>
<td>Laser positioning</td>
<td>Low cost, higher positioning accuracy</td>
<td>Need a certain amount of enclosed space</td>
</tr>
<tr>
<td>Visible light positioning</td>
<td>The algorithm is simple, cheap, easy to expand</td>
<td>Accuracy is not as good as laser and infrared</td>
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</tbody>
</table>

After an overall analysis of cost and positioning accuracy, laser positioning is of a wider and excellent application, and it is more suitable for precise action positioning what slow wheel pottery skills required. We will take use of the HTC Vive's Lighthouse positioning technology. Lighthouse indoor positioning technology does not need the camera, but locate the moving objects by laser and light sensor. The two laser emitters are placed diagonally to form a 15 x 15 foot rectangular area, which can be adjusted according to the actual space size. The laser beam is emitted by two rows of fixed LED lights inside the transmitter, 6 times per second. Designed with two scanning modules within each laser emitter, it laser scanning the 15 x 15 foot space alternately in the horizontal and vertical directions to position space. The specific process is shown in Figure 2 below.
Stereoscopic Display

In the construction of the virtual slow wheel pottery environment, in order to increase the realism of the experiential environment and the slow-wheeling process, experimenter can use the wearable device to achieve human-computer interaction, such as three-dimensional helmets, data gloves, headphones and so on. Among them, the data gloves are used to achieve specific operation of the pottery, real-time capture movements of human hand, identify and reproduce movements of hand in the environment, so as to achieve human-computer interaction. As for the high immersion of VR system, we need the panoramic three-dimensional helmet (HMD).

Experiments show that, generally human being’s eye field of view is 150 °×120 °. But for field of view of two eyes will overlap, the view of two eyes is about 200 °×120 ° in total. Though the most sensitive field of view of human’s eye is only 6 ° ~ 8 ° or so, the human visual sensitivity will drop fast outside this area. It has little effect on the surrounding field of view in our real environment, but it is very important for surrounding field of view of the virtual reality system. The main reasons are as follow: First, peripheral view is beneficial for enhancing the immersion of virtual reality system. Second, it is of an important significance to enhance the ability of environmental perception. Third, the larger peripheral field of view has a significant effect for the liberating the head and reducing the search time, which can make the experiencer more comfortable in the virtual reality system. The problem we are facing is that how to improve the field of view of stereoscopic display device.

At present, the main way to improve the field of view in the HMD design is the optical system design. In other words, a single eyepiece optical system design is difficult to meet the panoramic three-dimensional HMD design requirements due to the limitations of hardware technology, such as the larger field of view requirements, the pupil aperture requirements, the pupil distance, distortion and high quality requirements of the image. But the field stitching technology is very easy to achieve the above requirements. The field of view stitching technology allocates a larger field of view into a number of lens groups rather than a lens group, so that each group of lenses only needs to achieve smaller field of view. As a result, each group of lenses field design will be relatively simple. As it is shown in Figure 3 below, the optical axis of each group of lenses is centered on the center of rotation of the human eye and then arranged at a certain angle. Simply, the smaller images presented by each unit lens splice together and form a large image we want. We set the angle of the unit lens group relative to the center of view of the human lens to the angle θ, and define the range of ±ω' for each unit lens group. The field of view of any unit lens group relative to eyes visual axis center formation of the human eye's field of view is: ω = θ + ω' [5].

Figure 2. Laser Positioning Flow Chart.
We can get the unit lens relative to the central axis of view of the angle $\theta$ according to the field of view of the unit lens and the field of view of the human eye with respect to the center of view of the eye and provide the necessary basis for the splicing of each unit lens. HMD requires the design of the eyes of the eyes around $160^\circ \times 60^\circ$ or so, binocular field of view overlap angle of around $80^\circ \times 60^\circ$ or so, so the monocular field of view should be $120^\circ \times 60^\circ$. If we use $4 \times 3$ array type unit lens splicing, then it is required for each unit lens field of view at least $30^\circ \times 20^\circ$.

At the same time in order to ensure seamlessly splicing different images, it must be made between each unit lens has a certain field of view overlap. So we use the unit lens field of view is $33^\circ \times 24^\circ$, to achieve the unit lens between the field of view overlap is $4^\circ \times 6^\circ$ [5]. The field of view splicing of helmet display is divided into two parts: segmentation and splicing. The images of segmentation and splicing diagram are shown in Figure 4.

The image segmentation is done by the corresponding visual simulation software, and image splicing is done by the visual optical system and the human eye. Visual simulation software draw a large image in the virtual environment, then the large image is divided into 12 small images in accordance with the $4 \times 3$ array, and these 12 small images have similar parts. 12 small images are input to different OLED microdisplay, then reach the retina through the optical system and the human eye. Finally in the retina, they form into a complete image rather than the separation of 12 images and achieve seamless image.

**Summary**

At present, most of the protection methods of traditional ethnic minorities in China are in the VCD, the corresponding skills of video, books and other means. Today, in this information explosion society, this kind of spread effect is very limited. In the face of this situation, this paper tends to take a digital protection at slow wheel pottery of Dai nationality by making use of computer graphics, image processing, field stitching technology, virtual reality, somatosensory...
recognition and other information field of the latest development of technical. Then, this intangible cultural heritage could break the region, time and space constraints and get a deeper and wider range of protection and dissemination through the Internet. Besides, it provides a new method for the protection and dissemination of other traditional skills, which can facilitate the traditional culture protection work adapting the change of times, therefore more ethnic minorities traditional art could revitalize in the today’s modernized and informative society.

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, The 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


