Design and Implementation of VR Digital Displaysystem for Tujia Mogus Dance

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Abstract: *Virtual Reality (VR) is a research hotspot in the field of computer graphics in recent years, which is widely used. Tujia Maogusi dance is a national intangible cultural heritage of our country and the crystallization of Tujia civilization. This paper takes Tujia Maogusi dance as the research object, combining with virtual reality technology, proposes the design path of VR digital display system based on Tujia Maogusi dance, and applies this path to show the VR digital cultural performance of Tujia Maogusi dance. The research shows that the VR digital display system of Tujia Maogusi dance has certain practicality, interactivity and invasiveness, which provides a reference scheme for the live display of intangible cultural heritage in China.*

Keywords: *virtual reality technology; intangible cultural heritage; moguls dance; cultural digitization*

1. Introduction

Intangible cultural heritage is the cultural property left behind in the process of human development, and is the crystallization of the wisdom of various countries, nations and peoples. According to statistics, there are 324 traditional dances selected for China's intangible cultural heritage list, which is an oriental art form with unique Chinese civilization and charm. As one of China's ethnic minorities, the Tujia family has an ancient civilization and unique culture, and its long history and folk customs have created the crystallization of Tujia civilization - the Tujia Mao Gus Dance. At present, the display of Tujia Mogus dance still follows the traditional way, which is limited by time, space, weather and other reasons. Virtual Reality (VR) technology is a computer simulation system to reconstruct a virtual environment into which users enter for virtual, immersive and interactive simulation experience. This paper takes VR technology as the core, proposes the research direction of VR digital display system for Tujia Mao Gus dance, designs the design path of VR digital display system applied to Tujia Mao Gus dance, and applies the path to complete the design and implementation of Tujia Mao Gus dance example. The VR digital technology combined with Tujia Mao Gus Dance studied in this paper is a new cultural display mode of deep integration, which opens a new door for the interconnection of culture and technology.

2. Virtual Reality Technology and VR Digitalization

2.1. Virtual Reality Technology

Virtual reality technology is a series of high-tech integration, which contains computer technology, computer graphics, multimedia technology, artificial intelligence, human-computer interaction theory, sensor technology, display technology, high-speed parallel real-time computing technology, as well as human behavior, ergonomics and many other key technologies[1]. Virtual reality technology refers to the computer-generated three-dimensional virtual digital image, animation, sound, text accurately superimposed in the virtual space, through the trip simulation of the physical environment to provide users with a sensory experience, allowing users to enter it for an immersive virtual experience in a technology. From the point of view of technology implementation[2], VR technology has three typical characteristics: "immersion", "interaction" and "imagination".

2.2. VR digitization

VR digitization is the digital creation of real content through computer technology, in which

physical objects or expressions (landscape, architecture, language, folklore, culture, people, art activities, etc.) are embedded in computer programs in three-dimensional virtual form (models, images, text, animation, sound), developed and processed through the technical means of virtual reality technology, and then displayed in real-world terminal devices[3]. The operation principle of VR digitalization is to integrate and interact with digital contents and virtual scenes, so that users can have a virtual experience, in which digital contents are the key of the whole experience system, and the quality of digital contents will directly affect the experience of the whole system. Different from the traditional presentation method, VR digitalization shows the deep intergration of science and technology and society, and the virtual interaction of the body senses such as hearing, vision and touch, bringing the users an immersive, interactive and perceptive virtual experience.

3. Mao Gus Dance VR digital display system key technology

3.1. Motion capture technology

Motion capture technology refers to the motion capture system to collect the character's movement data to the system, need the Tujia Mao Gus dance inheritors to wear the motion capture system costume carrying a sensing device, will capture the data information transmitted to the background analysis library and real-time calculation, and then speak the data to the virtual character model, to achieve the virtual character model to make the actual human action[4].

3.2. Virtual tracking technology

In the process of constructing the VR digital display system of Tujia Mao Gus dance, the virtual tracking technology is crucial. Tujia Mao Gus dance action range is large, high technical difficulty, using the traditional virtual character frame by frame design action, can not achieve 1:1 realistic restoration requirements, the accurate effect is not only greatly reduced, and even out of the Mao Gus dance action category. The use of virtual motion tracking technology can perfectly solve the problems of accuracy and standardization[5]. The system will finely track each movement and transmit it to the computing system, which will attach the movement data to the virtual character model after calculation and analysis to realize the accurate performance information of Mao Gus dance movement. In this paper, Optitracker optical tracking product is used to serve the virtual dance motion capture module in this paper with low latency & wide area VR capture technology technology for virtual simulation system (CAVE) and head-up display (HMD).

4. Mao Gus Dance VR digital display system overall design

4.1. Mao Gus dance VR digital display system architecture design

Structurally, the system can be divided into the following five aspects: Tujia Mao Gus dance information database, Tujia Mao Gus dance digital content, Tujia Mao Gus dance function module, head-mounted display device, and immersive experience. As shown in Figure 1. The underlying engine contains engine scripts written in C# on the Unity3d integration platform to achieve the program functions required by the system. Application software includes 3Dmax, maya, zbrush and other geometric modeling software, responsible for the fine production of 3D scenes[6], 3D characters and other digital content, and finally by the head-mounted display, which is also the output device of the final form of virtual reality, for the final effect display, this system can be equipped with HTCvive, PSVR and other mainstream head-mounted display use.
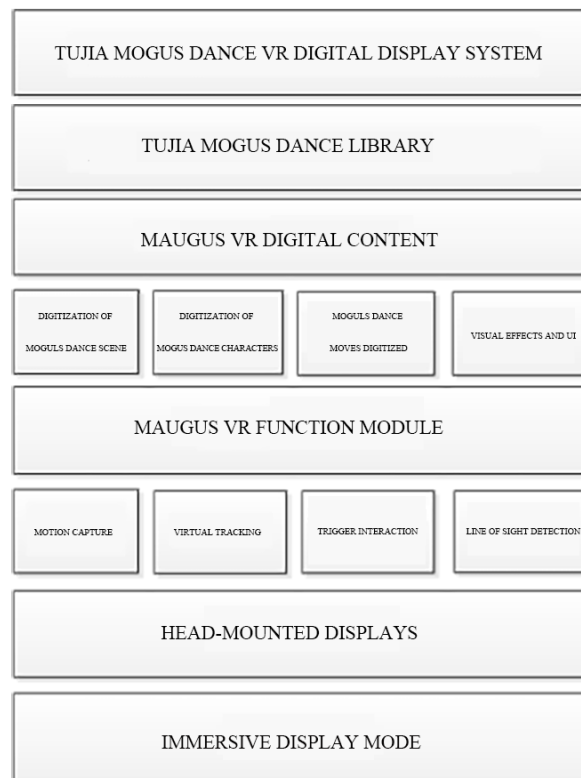
Figure 1: System architecture diagram

4.2. Information database of Mao Gus dance VR digital display system

Virtual reality technology is based on a huge amount of data, first of all, it needs to integrate the massive cultural resource information of Tujia Mao Gus dance to get a complete content database. Overall planning for the development of the whole system, complete the preliminary planning work and interaction design. The information database of Tujia Mao Gus Dance mainly relies on strong data support, covering historical information, humanistic heritage[7], detailed explanation of movements, representatives of inheritors, etc. of Tujia group Mao Gus Dance, so that these data and information are filed and classified, so that each Tujia Mao Gus Dance can become an independent category option, and finally form a data set, packaged and uploaded to the system database, which should also contain user requirements, system The database should also contain user requirements content, system information, etc. to form comprehensive information, that is, all data about the system are grouped into the database level.

4.3. Functional design of Moguls Dance VR digital display system

The digital content of Tujia Mao Gus Dance VR includes: VR digitization of Mao Gus scene model, VR digitization of Mao Gus characters, and VR digitization of Mao Gus dance movements.

The production software for making Tujia Mao Gus Dance VR digital scenes and characters needs to use the latest PBR digital production process, applying geometric modeling software such as maya and zbrush, which is responsible for the fine production of digital scenes and digital characters resources needed for the whole system. Mao Gus dance movement VR digitalization needs to design different 3D styles according to different styles of dance[8], use the motion capture system OptiTrack to capture the real movement of each dance, collect the complete dance data, and then bind to the well-made 3D virtual character model to make the digital virtual character model "jump". Finally, we use visual tools such as ps and lumion to take charge of the visual effects function.

4.4. Digital content production of Mao Gus Dance VR digital display system

Need to apply a lot of functions, which is mainly written by the underlying engine Unity3d C# language functional script, to be able to achieve the required system functions. The system functions

are divided into 5 parts. First is the interactive performance of the operation handle buttons, including trackpad Bessel curve shift function and side button switching function, which can realize the character roaming function. Second is the instruction ui and instruction arrows to guide the user to move and interact. Again is the voice library function, including the background sound of Mao Gus dance history introduction and dance explanation sound. There is also the cg animation playback function, which plays relevant video materials for users to enjoy. Finally, there is the scene transfer function, which can realize the switching of various performance scenes[9]. All the above functions are realized by the Unity plug-in, as shown in Figure 2.
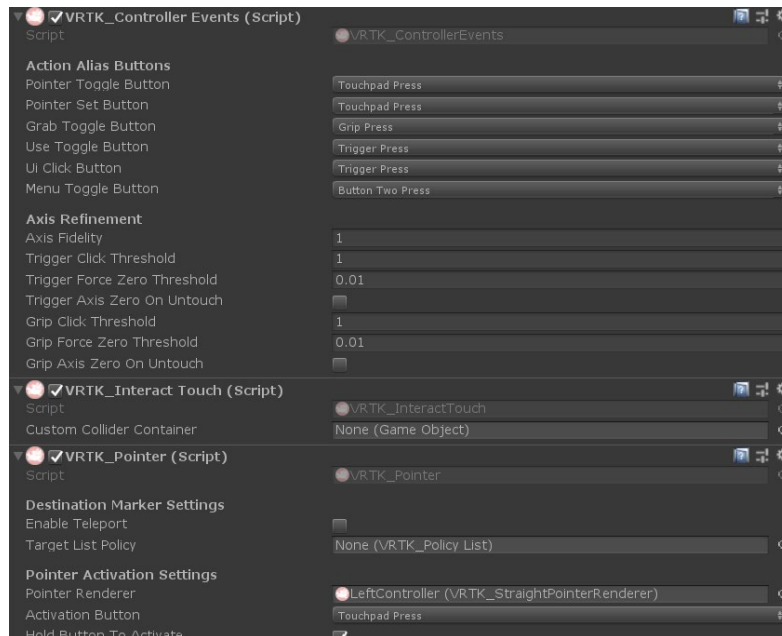
Figure 2: System Function List

4.5. Mao Gus dance VR digital display system integration

Tujia traditional dance VR digital display system by the final Unity engine to complete the system integration, import digital content into the Unity platform integration adjustment, synchronous interaction function integration, to achieve system interaction. Finally, the system will extract the VR digital digital content for real-time 3D rendering[10], the generated content and the virtual environment accurately overlay fusion, and finally packaged and output the executable EXE file to run the test.

5. Mao Gus Dance VR digital display system example application

5.1. The current situation of displaying Mao Gus dance of Tujia family

Mao Gus dance is attached to the life form of primitive farming society and is the original soil of Tujia culture. However, with the transformation and progress of society and productivity, only a very small number of Mao Gus dance remains in the original display and performance by villagers, inheritors and performing artists, and most of them are stationed in tourist attractions and become a kind of tourism products, performed by staff at specific times and occasions to meet the demand of ordinary tourists for the curiosity consumption of the mysterious culture of the Tujia family, and the gap between art and life has arisen. The gap between art and life.

5.2. Development of VR digital display system for Tujia Mao Gus dance

First of all, the project started to design the system architecture of Mao Gus VR digital display system, and completed the preliminary planning after finding a lot of historical documents and video materials and conducting field investigation. The overall design is "Sweeping Hall" themed VR digital dance, one VR digital theme scene and several Mao Gus VR digital virtual characters, the development process is shown in Figure 3[11].
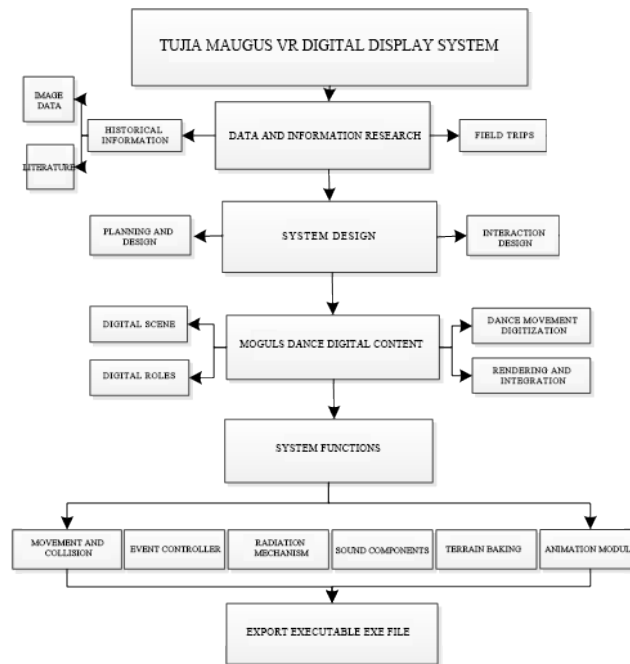
Figure 3: System development flow chart

The next step was to complete the production of the Mogus Dance VR digital content production. Mao Gus dance scene design ideas from the historical background of the Mao Gus dance, Mao Gus dance originated in ancient times, so watch the original Mao Gus dance need to be matched with the topography of ancient times, with its echo. The topography of the ancient period includes vegetation, rocks and land, and similarly, the architectural style is mainly based on mao grass huts, assisted by living tools and fences to build a whole ancient village, and a giant fire is placed in the middle of the village, which is the "square" for the dance performance, and the dance activity is performed around the fire, as shown in Figure 4.
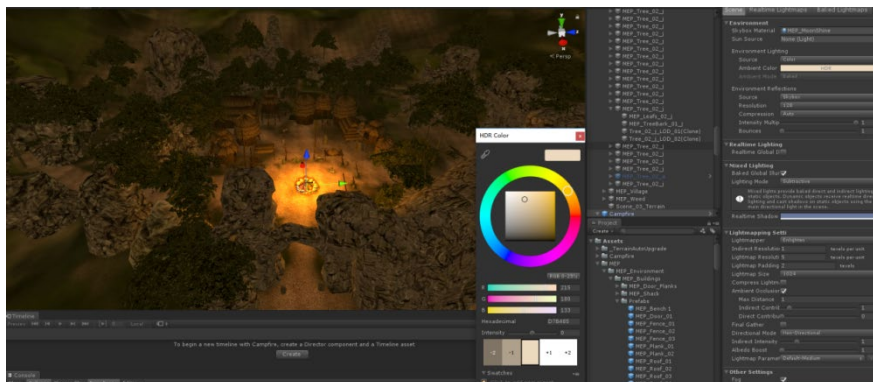
Figure 4: Moguls Dance VR digital scene

The second step is to complete the Mao Gus Dance VR digital character production, the character image design of the Tujia Mao Gus Dance VR digital display system uses the style of material records. Mao Gus dance character tied full of hair grass, five pieces per share, the belly in front of a bundle of more than a foot long and red cloth wrapped around the head of the grass handle, knotted grass for clothing to show that the ancestors will not weave cloth to make clothes, so in the process of creating the Mao Gus dance character needs to focus on the hair grass clothing, through maya, 3dmax and other software can be created 1:1 Mao Gus dance VR digital character, as shown in Figure 5.

Figure 5: Mogus Dance VR digital role

Through the motion capture technology to collect the above dance movement data, and then import the completed Mao Gus character model and the entire data source into MotionBuilder software and the complete dance movement data for fusion binding, as shown in Figure, then the virtual character can perform real dance movements, as shown in Figure 6.
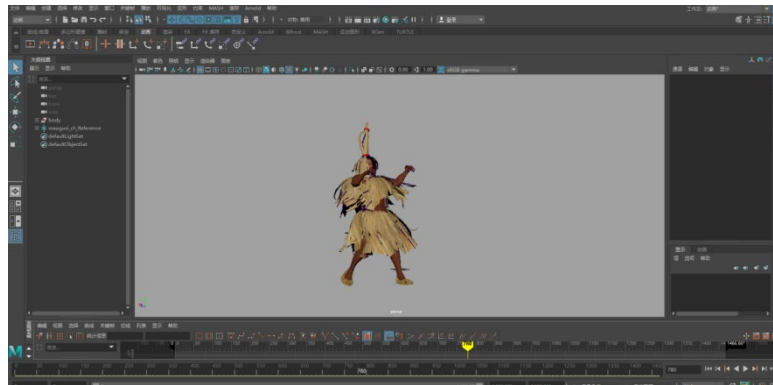
Figure 6: Maucus Dance Movement VR Digitization

Finally to achieve the integration of program functionality, its main code is shown below: in turn, the development of the creation of sound components (single instance mode) recorded Sounds; create the movement and collision board, add Collider component on the object, Collider component is the role of feedback game objects when the collision effect; create the camera Camera, the camera needs to mount the components required by the system. Transform (coordinate component), Transform refers to the user's coordinates in the virtual coordinate space, used to the user in the virtual space of translation, zoom in and out; the above functions in Visual Studio's main code interception, as shown in Figure 7.

Figure 7: Program code in Visual Studio

5.3. Example effect demonstration

This experimental test was conducted with the Htcvive pro device, and the tester implemented the test on the Tujia Mao Gus Dance VR digital display system. When the tester put on the headset of Htcvive pro, the computer executed the engineering file of the Tujia Mao Gus Dance VR digital display system and prepared to watch the display content of VR Mao Gus Dance.

As shown in Figure 8. The Mao Gus VR digital character started to perform according to the dance action of "sweeping the hall", the picture shows the Mao Gus unfolding their arms and doing the action of dispersing and sweeping the floor, which is highly consistent with the real Mao Gus dance.

Figure 8: Mogus Dance VR digital scenes in the "Sodo" theme dance show

6. Conclusion

This paper summarizes a set of development path of VR digital display system of Tujia Tujia Mao Gus Dance according to the idea of VR digital display of Tujia Mao Gus Dance, and demonstrates the development process of VR digital display system of Tujia Mao Gus Dance by combining with the real cultural background of Mao Gus Dance, which proves the feasibility of this path. The combination of VR digitalization and Tujia Mogus dance is a multi-disciplinary and innovative application, which provides a reference solution for the design and development of VR digital display system of traditional dances in more countries.

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