Intangible Heritage Protection Based on Virtual Reality Technology

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Abstract. With the rapid development of digital technology, advanced digital technologies such as virtual reality have been gradually used in intangible cultural heritage protection projects to improve the protection quality. By analyzing the status quo of protecting the intangible cultural heritage of ethnic minorities in China, we explain the protection methods of digital technology and the advantages of virtual reality technology in this paper. The typical “intangible cultural heritage” project of the Autumn Festival in West Hunan is taken as an example, and a digital protection solution based on virtual reality technology is proposed.

Keywords: Intangible Cultural Heritage, Digital Technology, Virtual Reality

1. Introduction
Early in the 1980s, Western countries began to use digital technology to protect intangible cultural heritage (abbreviated as “intangible heritage”) and make remarkable achievements in the 1990s [1]. Since the 21st century, countries have paid increasing attention to “intangible heritage” and used laws, policies, education, technology, etc. to protect and carry forward the “intangible heritage”. Dependence conditions and the limits of the contemporary protection awareness [2–3], these traditional protection methods seem to be unsatisfactory. If long-term protection and heritage of “intangible cultural heritage” are required, it is very urgent to make full use of advanced digital technology [4]. Digital Technology (Digital Technology) is a science and technology associated with electronic computers. It refers to using specific equipment to convert various information, including pictures, text, sound, and images, into binary that can be recognized by electronic computers. Digital “0” and “1” technology for calculation, processing, storage, transmission, propagation, and reduction [5], digital technology has been widely used in civil security, and electronic digital computers, numerical control technology, communication equipment, digital instruments, electronics Products, military equipment, and other fields have achieved excellent results. Hence, digital technology can not only record the
“intangible cultural heritage” data saved [6] but also use the virtual reality technology to restore and rescue many endangered “intangible heritage”, and at the same time can make “intangible heritage” infiltrate all aspects of people's life, forming a Chinese culture full of flowers.

2. Digital Protection of Intangible Heritage

2.1. Digital Protection Technology for Intangible Cultural Heritage
Currently, with the development of information technology, more and more information technologies are applied to the protection of intangible cultural heritage. The intangible cultural heritage digital protection technologies are as follows:

2.2. Digital Preservation Technology for Intangible Cultural Heritage. With the development of information technology, high-precision graphics and image equipment have been successively produced, and more accurate and correct digital preservation and archiving technologies have also been born. Its leading data storage technologies, such as three-dimensional scanning technology, digital photography technology, and recording technology using a recording pen. The digital archives formed by these digital storage technologies have high accuracy, are easy to save and copy, and can save a lot of storage space.

2.3. Virtual Reality Technology. Virtual reality (VR) technology is a method of simulating and restoring intangible cultural heritage through the fusion of multiple digital technologies. In the “intangible heritage” environment of VR, people can feel all aspects of intangible heritage in an all-round way. In addition, its biggest feature is the interactivity. Users can do some simple operations and start Get corresponding feedback in the VR environment, as shown in Figure 1.

![VR technology](image)

**Figure 1.** VR technology.

2.4. VR technology and its advantages
Users can perceive the surrounding environment and its changes through hearing, touch, smell, taste, force, movement, etc., just like in the real environment, at the same time, they can make different actions autonomously, and can get real-time responses, feeling “intangible heritage” “Charm. Its
characteristics are: after putting on the device, people can be in the “intangible heritage” environment, can feel all the things in it, and can interact with it, experience the beauty it brings, and it is difficult to distinguish true from false in real life. The protection of “intangible heritage” by VR technology has authenticity. It can add many environmental factors that depend on the existence of “intangible heritage” that have disappeared due to natural disasters and social changes in the environment of VR, and record and restore the “intangible heritage”. The original appearance of the “remains” that relies on the original ecology can be reproduced so that the public can experience the charm of the “heritage”. VR technology has a strong dissemination capacity to protect the legacy, and it can be digitized through VR technology, which can be transmitted on the network at high speed and convenience and can also be retrieved and called conveniently and quickly. This method breaks time and space. Users only need to wear basic VR equipment, and they can search the digital museum for the knowledge they want to know, experience, and share it through the Internet.

The cost of VR technology to protect the legacy is low. Although this method has a higher cost in the early development, data collection, and modeling, its maintenance cost is lower in the later stage. Compared with traditional protection methods, its total cost is far less than that in the traditional method.

3. Implementation of Miao Ethnic Group’s Autumn Festival System Based on VR Technology

3.1 System Composition

As an interactive system for the Autumn Festival, on the one hand, it must display the visual information of the Autumn Festival scenes and activities. On the other hand, it must meet the needs of real-time interaction. Therefore, there are two main parts in the composition of the system: the virtual autumn in the computer space Scene control and drive control platform for this virtual space. The system composition is shown in Figure 2.

![Figure 2. Composition of the Autumn Festival system based on VR.](image)

3.1.1 Scene Generation. Given the complexity in the environment of the Autumn Festival and the difficulty of thorough restoration, a field survey in the western Hunan region is required to identify local information and county records through oral dictation of local residents, and experience the
existing Autumn Festival customs. Original digital resources, including copy recording and analog creation, mainly text, images, audio and video, three-dimensional objects. The collected information is categorized and digitized by the following methods: Firstly, the literature, pictures, images, and other physical data of the Autumn Festival are sorted, sorted, digitally converted, and stored. Second, digitized text, images, and audio and video recordings of the venues, props, etc. for the Autumn Festival practice are sorted, sorted, and stored. Third, digital technology will be used to catch up with the dynamic process of Autumn Festival activities, and record, classify, and digitally store them dynamically, three-dimensionally, and with high definition.

Finally, the digitized digital resources stored in categories are used to build a database for the Autumn Festival.

Virtual environment modeling has many elements to catch the Autumn Festival. As the main performance object, scene activities are the focus of modeling. In order to show the realistic Autumn Festival in the virtual scene, the collected data information, graphics rendering technology, stereo synthesis and stereo display technology, human-computer interaction technology, system integration technology, and other modeling are used to generate three-dimensional images in real time to build a virtual environment.

3.1.2. Implementation of Roaming Interactive Platform. The interaction between the autumn interactive virtual platform and the virtual scene is “real time”. Through the control of the virtual characters in the virtual scene, the scene can be freely roamed, and the information of the Autumn Festival can be viewed in real-time by clicking the mouse on the scene, activities, and character clicks. The interactive settings of the roaming system are divided into the following modules by function:

① Interface Interaction. Including the roaming system startup screen tab design, browsing map function, roaming path selection, function switching, and other related functions related to the interactive interface.

② Character Movement. Including the driving of the character motion animation in the scene, the driving of the object motion in the scene, the control of the keyboard, mouse, etc. of the motion of the object.

③ Information Query. Get all kinds of information about the Autumn Festival in the virtual scene based on the mouse position.

3.1.3. Release of the Virtual Interaction System. Web-based browser publishing using Internet technology. The system has the following characteristics: First, it well demonstrates the Autumn Festival and breaks through the one-way nature of traditional display and publicity. In this system, users can fully understand all kinds of information for catching the Autumn Festival and maximize the sharing of resources. Not only is it sound and colorful, but the website can also interact with the user. Putting on the device, users can experience the Autumn Festival in person. Secondly, the system breaks through the restrictions of the time and space and material conditions of traditional Autumn Festival live event displays and exhibitions, creating conditions for the cross-temporal and cross-ethnic publicity and dissemination of Autumn Festival. Finally, it can meet various needs perfectly, such as the storage and management of autumn data. Hence, it provides a flexible
perspective, breaks the constraints of time and space and can significantly facilitate the development of online virtual tourism. Also, due to the convenience and widespread dissemination of the Internet, the Autumn Festival system makes the Autumn Festival information not only a collection and research but also a display function and educational significance.

The standard output of the virtual interactive sensor is shown in equation (1):

\[ \text{Out} = \frac{\text{raw}_{\text{vel}} - \text{raw}_{\text{min}}}{(\text{raw}_{\text{max}} - \text{raw}_{\text{min}})} \max \]  

(1)

Where max represents the sensor system function setting of the interactive system.

The software calibration program supporting the sensor sets the dynamic range from 0 to 255, as shown in the calculation equation (2):

\[ V_{\text{scaled}} = \frac{V_{\text{measured}} - V_{\text{min}}}{(V_{\text{max}} - V_{\text{min}})} \times 255 \]  

(2)

3.2. Use of Key Technologies

VR technology is a combination of multiple technologies and has been widely used in many fields such as medical treatment and games. However, if you want to use VR technology to restore the original ecological environment and material carrier of “intangible heritage” and show its original ecological characteristics, The support of mainstream technologies of VR is still inseparable.

(1) Dynamic Environment Modeling Technology

Currently, this technology is applied in the mining and railway industries, and some problems encountered in practice are simplified through simulation.

(2) Real-time 3D Imaging Technology

The image update needs to reach a specific frequency to meet the “real-time” requirement. Supported by this technology, the dynamic changes of the “intangible heritage” environment can be clearly demonstrated.

(3) Wide-angle Stereo Display Technology

In the “intangible heritage” environment of VR, this technology is indispensable for users to experience the three-dimensional sense of the environment.

(4) Sensing Technology

The sensing devices in VR mainly include two parts: one is a three-dimensional helmet display, data gloves, data clothes, and other sensing devices that are worn on the operator for human-computer interaction; the other is set up for correct perception Various visual, auditory, tactile, force and other sensing devices in the VR environment. With the help of sensing devices, users cannot only visually experience “intangible heritage”, but also experience the national charm brought by “intangible heritage” in many aspects such as hearing and smell.

(5) Human-computer Interaction Technology

The biggest feature of VR technology is interactivity, which needs to be achieved by human-computer interaction technology. This technology mainly uses computer input and output devices to implement human-computer dialogue in an effective manner. In the “intangible cultural heritage” environment of VR, this technology can be used to achieve user interaction with the virtual
environment.

4. Conclusions
With the development and maturity of VR technology, it will play an increasingly important role in “intangible cultural heritage” protection. Currently, both China and foreign countries are actively exploring its application to the protection of “heritage”, and some achievements have been made. However, there are still challenges, e.g., a unified standard for the “heritage” database construction has yet to be established, the engineering workload for the “heritage” digital development is huge, and the application of VR technology to “intangible cultural heritage” protection in the real sense has remained in the theoretical level.

Acknowledgement
Project Fund: A key project of the central university “Study on Visual Image Narrative in Gansu Minority Folk Ceremony” (Project No.: 31920170112).

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