Research on the Application of Virtual Reality (VR) in Museum Intelligent System

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Abstract. VR technology is characterized by interactivity, immersion and strong imagination, so it has been widely used in museum exhibition design. Based on the disadvantages of the museum's previous exhibition design, this paper analyzes the application prospect of VR technology in the future, and makes a lot of discussions on the specific application of VR technology in the museum's exhibition design, hoping to provide effective suggestions for the museum's specific exhibition design.

Keywords: Virtual Reality; Wisdom Museum; Research.

1. Introduction

Digital museum based on Virtual Reality (VR) and Augmented Reality (AR) technology is one of the research hotspots of museum technology. With the continuous progress and development of computer vision technology in recent years, digital museum has been gradually studied. Domestically, the representative "Virtual Palace Museum" and "Digital Dunhuang" are the pioneers of this research. The use of AR technology in digital museums has gained more favor in the early days, and visitors can experience sensory experience brought by AR technology only by installing corresponding apps in their mobile phones. This technology can use pre-designed virtual additional information to enhance the information of exhibition objects that visitors see in museums and improve interactive sightseeing. Therefore, VR technology should be fully utilized in the exhibition design of modern museums, so as to better display museum collections, enhance visitors' interest in collections, and thus play a better role in cultural communication.

2. Application Advantages of VR Technology in Museum Exhibition Design

2.1 Interactive Advantages of VR Technology

The core feature of VR technology in museum exhibition is its strong interactivity, which enables the benign interaction among visitors, exhibition hall environment and exhibits. VR technology can better meet the needs of visitors, who can choose their own content, interactive forms and guide ways to independently learn more about history and culture. At the same time, the museum can better know visitors' demands for various kinds of information in a short time, so as to optimize exhibition design. VR technology meets people's demand for simulated real space, and different exhibits can be applied to specific scenes in a virtual form, achieving better interaction between audience and collections, enabling visitors to better understand the information of exhibits through vision, hearing and touch and thereby maximizing the artistic charm of collections.

2.2 Imaginative Advantages of VR Technology

VR technology can help museums construct optimized virtual space, break through the constraints of museum space environment, and give visitors a more novel experience. The construction of virtual space can also help museums to scientifically simulate different environments, so as to maximize the role of virtual space. VR technology can expand users' creativity and interaction with virtual space, thus improving their experience and generating their novel ideas. In the past, visitors could only know about exhibits through showcase, but VR technology enables visitors to perceive exhibits from different senses through virtual space, and truly interact with products, thus significantly enhancing visitors' experience.

2.3 Immersive Advantages of VR Technology

VR technology can help exhibition designers to build a more scientific virtual space, and make visitors feel immersive in the virtual space where visitors can mobilize a variety of sensory organs to perceive exhibits for a more realistic experience. Visitors often have direct communication and contact with products in a virtual form when in virtual space, which gets them more involved in the study and understanding of exhibits, and significantly enhances their interest and experience. The application of VR technology enables visitors to more rapidly understand the relevant knowledge of exhibits, obtain more valuable information and enrich their own knowledge system.

3. Design and Implementation of Museum Intelligent System

Museum intelligent system is mainly composed of AR and VR function modules. The interactive function of digital exhibits is mainly based on AR technology, such as detailed introduction and independent explanation of exhibits. The navigation and map functions of the exhibition hall are mainly based on VR technology, which enables visitors to visit the exhibition hall as if they were in a real museum with the help of keyboard, mouse and somatosensory devices.

3.1 Technology Roadmap

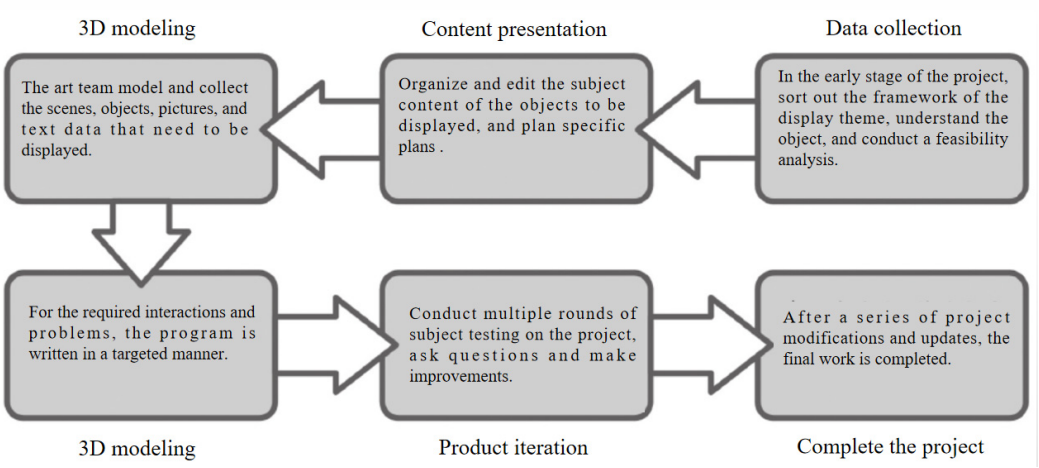

Figure 1. Technology roadmap

3.2 Enhancement Module

Visual tracking registration technology is the core of interactive module, which includes computer-based technology and sensor-based technology, of which the former has been extensively applied. Using manual marking, computer-based technology marks the marking points in the real scene, which can be seamlessly integrated with the display objects in the real scene almost without error, and thus can greatly reduce the requirements on the hardware configuration of the computer itself and control hardware cost. There are four main steps for visual tracking registration by using manual marking method. Firstly, image acquisition is carried out on display objects. Secondly, collected images are pre-processed for conversion. Thirdly, the image with the marked points is identified and matched to find the operation area. Finally, the ID of the marked exhibit is determined to identify the mark. The main process is shown in Figure 2.

Figure 2. Mark recognition process

3.3 Virtual Roaming Module

The virtual roaming module is mainly achieved with the help of U3D platform. The modeled virtual museum scene is imported into the U3D software. Then by adding the virtual tour component, visitors can walk forward and backward with the keyboard cursor and freely switch perspectives with mouse. If you cooperate with head-mounted VR devices with somatosensory functions such as HTC and Oculus, you can realize a more immersive tour experience.

4. Application Analysis of VR Panoramic Technology --Take Gaochun Museum as an Example

In order to give visitors a better visiting experience and enhance the application of network digitization and virtual reality technology, Gaochun Museum decided to use VR panoramic technology, 3D digitization technology, artificial intelligence and other high-tech technologies to present fine exhibitions to the public through the Internet platform. Taking Gaochun Museum's "Farming, Reading, Passing on Family-Celebrity Painting and Calligraphy Exhibition in Collection" as an example (Figure 3), the digital construction of this exhibition involves software system and digital acquisition. The software includes digital exhibition system, CMS digital management system, official website WeChat and other apps.

The system mainly displays 3D digital exhibition halls, 3D cultural relics, audio and video, pictures and texts restored online, and provides immersive, interactive and convenient intelligent visiting and guiding services for the audience. CMS digital management system is mainly responsible for editing, processing and managing the input digital content. Official website and WeChat are mainly responsible for introducing the information, collection information and service information of Gaochun Museum to the public, and providing customer services, so that the public can timely communicate with Gaochun Museum.

Figure 3. VR panoramic display in Gaochun Museum

Digital collection is to restore the three-dimensional real scene of "Farming and Reading Family-Celebrity Painting and Calligraphy Exhibition in Collection", add hot spots, panoramic roaming, quick navigation and other functions, realize three-dimensional, digital, physical scene integration, dynamic landscape model, etc., complete online display, make the exhibition more ornamental, and improve visitors' cognition and understanding of the exhibition. "Farming, reading and passing on family-calligraphy and painting exhibition of celebrities in the library" mainly uses VR panoramic technology, including spherical screen technology and high pole panoramic technology. The

application of high-end 3D scanning equipment, such as ball screen camera, makes the virtual scene more realistic and highly restores the original appearance of the scene. Moreover, progressive resolution browsing method also ensures the clarity of panoramic pictures without affecting the fluency, which greatly improves visitors' visiting experience and the interaction between collections and visitors. It can automatically realize scene application, abandon the traditional panorama camera stand-alone panoramic switching, and support free exploration in 3D scenes and immersive roaming for changing scenes. With sufficient preparation for digital collection, VR panoramic display of "Farming and Reading Family-Celebrity Painting and Calligraphy Exhibition in Collection" can be presented to the public. With VR panoramic display, visitors can get immersive viewing experience by using mobile phones, computers, iPad and other electronic devices. With the support of a well-developed, advanced and flexible architecture design system and a unified content management, publishing and application platform, Gaochun Museum has produced and released a VR online virtual panoramic exhibition for many excellent exhibitions such as "Cut and Color-Exhibition of Paper-cut Works of Folk Artist Fu Shanhe in Collection". These exhibits displayed by VR panoramic technology not only greatly enrich the digital exhibition content of Gaochun Museum, but also enable Gaochun Museum to open a road to the digital exhibition era. VR panoramic technology not only promotes the communication and interaction between visitors and Gaochun Museum, but also enables visitors to obtain more information about museum exhibitions.

5. Conclusion

With the continuous breakthrough and innovation of VR panoramic technology, the opportunity of virtual environment experience will be greatly increased. VR panoramic technology plays an important role in protecting cultural relics, improving users' visiting experience and exerting the social education function of museums. I believe that in the near future, the continuous development and application of VR panoramic technology will provide more powerful assistance for the digital exhibition of museums.

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