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The Comparison and Analysis of Several Common VR Panoramic Display Methods

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Abstract. With the development of information technology, VR panoramic display technology has been widely used in medical industry, game industry, entertainment industry and other industries. VR panoramic display technology has a very broad development prospect. In this paper, the characteristics of several VR panoramic display methods are analyzed, and the methods of panoramic display are compared in three directions: display form, production method and display media. According to the characteristics of panoramic display technology, several aspects are summarized and evaluated, and the advantages and disadvantages of various methods are analyzed.

Keywords: VR, Panoramic display, Analysis, Contrast.

1. Introduction

VR technology, as one of the most popular front-edge technologies, has been widely used in the field of exhibition with its unique advantages, and has injected new vitality into artistic communication and cultural communication, and its importance is self-evident [1]. The vigorous development of cultural industry not only can bring huge economic benefits, but also has far-reaching cultural impact. The exhibition design, as an effective means of propaganda for cultural and creative industries, has some problems, such as the lack of cultural connotation, too conservative and insufficient innovation, etc. [2], the VR technology can effectively solve the problem, optimize the display design and provide the front-edge technical support, in a variety of forms, a unique sensory experience is brought to people.

VR panoramic display technology is accompanied by the development of computer technology, combining digital media technology, graphic image technology, network technology, multimedia technology, sensing technology and other information technologies, emphasizing visual reality, panoramic viewing and immersive interactive experience [3]. The technology of panoramic display experience has experienced technical stages such as single view panorama, strip panorama and immersive panorama. As the core of panoramic display technology, with the development of information technology, it has entered a new stage.

With the development of VR technology, panoramic technology can realize the reappearance of virtual scene more comprehensively, and bring people a sense of reality. Therefore, panoramic display technology has been widely used in various industries [4]. Panoramic display technology with its strong immersion and interaction, in various industries play a unique advantage, panoramic display technology has the following characteristics:

1) Omni-directional: a comprehensive display of all views in the 360- degree sphere range, can be used in the panoramic player with the left mouse button drag or use VR glasses to view the scene in all directions.

2) Strong human-computer interaction: the viewing and displaying of full visual angle can move, install and scale in six directions, and the experience of human-computer interaction can be further enhanced after the configuration of VR equipment [5].

3) The display is clear and smooth: the panoramic roaming technology integrates advanced network technology and streaming media technology, which can transmit panoramic material with high quality and high speed, and show the effect of each location.

The most important steps in the creation process of panoramic display technology are the determination of display form, then the production, and finally the display media display the finished

works [6]. But there is not only one choice whether it is the form of display, the way of production or the medium of display, but the relative research on the advantages, disadvantages and characteristics of various choices is relatively few for the time being. Therefore, this paper will compare and analyze the various choices in these steps, and find out their advantages and disadvantages.

2. Display Forms

There are three main forms of mainstream display: panoramic picture, panoramic video and panoramic interaction. The following three forms will be introduced and compared according to their respective characteristics.

2.1 Panoramic Image

360° panoramic image, as its name implies, is an omnidirectional image of 360 degrees of reality that gives people a three-dimensional sense of vision, an image with an angle of view exceeding that of a person's normal view, and the panoramic image here refers to an image with a horizontal perspective of 360 degrees and a vertical view of 180 degrees. You can completely restore all the things that people have around an environment without a dead angle at a given moment [7].360 °panoramic image needs to capture the image information of the entire scene through a professional camera or to use modeling software for panoramic rendering, using software to assemble the images, and playing them with a special player for virtual reality browsing. Present to the viewer.

The three biggest features of panoramic images are as follows:

1) Facticity: Most of the 360 °panoramic images are based on the photos of the real scene, thus preserving the authenticity of the scene to the maximum extent;

2) The effect of a 360-degree circle: Although the pictures are flat, the 360 panoramic images that are displayed through the panoramic picture player can give people a three-dimensional spatial feel and make the viewer feel like they are in it;

3) The production cost is low and the production cycle is short: Even if a single panoramic image needs to be stitched and fused at a later stage, the processing speed is fast.

2.2 Panoramic Video

Panoramic video is a kind of video that is recorded at 360 degrees through a panoramic camera, filmed and transcoded, and then transferred to the gyroscope of the device through a special player. The viewer is free to adjust up and down to the left and right for 360 degrees of omnidirectional viewing.

The panoramic video turns the static panoramic picture into a dynamic video image by connecting 30 pictures per second. It also has the functions of sound, depth of field, and movable. Meanwhile, it has the characteristics of sound and picture alignment, sound and picture synchronization, and can Shows the dynamic changes of the scene. Compared with traditional panoramic images, there has been a qualitative leap, but the amount of data to be processed is large, and the range of users' self-selection is relatively small, most of which can only be experienced according to the plan of the creators.

As the panoramic video can be viewed in all directions, the technology is rapidly applied to the scenic spots and scenic spots, and the publicity and display of the tourist spots through the panoramic video can play a remarkable effect. At the same time, the unreachable scenery can be photographed and produced so that tourists can see the scenery that they can't see at ordinary times.

2.3 Panoramic Interaction

The interactive phase of the panoramic interaction is greatly improved compared with the panoramic picture and the panoramic video. In addition to the 360-degree rotary viewing, the panoramic roaming also provides the user with the manipulation functions such as enlargement, reduction, hot spot switching among the scenes, and the like, so as to achieve the effect of simulating

and reproducing the real environment of the scene. Panoramic virtual has increased the user's self-choice, and changed the traditional visit mode from "let you see what you see" to "I can see whatever I want" to meet the needs of the user to the maximum extent. It is mainly used in two modes: panoramic picture roaming and panoramic roaming system.

Panoramic picture roaming is a series of ordinary panoramic images made into a complete panoramic display system, with better user experience and operation function, can enlarge and reduce the space scene, move up and down from any direction to watch the scene, Logo, images, audio, video, text and other information can be inserted in the scene. The panoramic picture roaming is mostly based on web, the mainstream tools such as 720yun etc., and the panoramic display file is smaller, the load speed on the network is faster, the hardware requirement of the user is not high, the mobile phone or the ordinary home computer can run smoothly.

The panoramic roaming system is built on the basis of 3D modeling and programming language, and realizes the network dynamic interactive functions of user and virtual product model, such as scaling, rotating, moving, color and material, and so on. At the same time, the animation, sound and other functions of the product model are realized. The resulting files can run independently on various devices, and the VR display system has the characteristics of cross-platform, extensibility, high efficiency and so on. So, it has been widely used in many fields.

2.4 Results

By analyzing the characteristics of panoramic picture panoramic video and panoramic interactive panoramic display we can observe that each display form has its advantages and disadvantages. From the four aspects of production cost, interactive experience, display effect, and market demand, it is divided into four levels of A, B, C, and D to evaluate several display modes. Except for the lowest production cost of A and the highest of D, the other three aspects are the highest A and the lowest D, which gives Table 1.

Table 1. Display form Contrast Result

	Production cost	**Interactive experience**	**Display effect**	**Market demand**
Panoramic image	A	D	D	D
Panoramic video	C	C	B	C
Panoramic picture roaming	B	B	C	A
panoramic roaming system	D	A	A	B

3. Manufacturing Methods

No matter which kind of display form, the panoramic material is made mainly in the field shooting, the two-dimensional drawing, and the three-dimensional modeling, in which the field shooting and the three-dimensional production are relatively widely used. Two-dimensional drawing works are relatively few.

3.1 Field Shooting

Field shooting generally takes pictures of the environment to be displayed through panoramic shooting equipment, which can take panoramic pictures and panoramic videos. Most of them need to be stitched up after shooting, in order to derive 360-degree panoramic pictures or panoramic videos. Compared with the traditional picture and the video, the steps are relatively complex, but compared with the two-dimensional drawing or three-dimensional modeling, the preparation period is short, the manufacturing cost is lower, and the acquisition is convenient, and the preparation work of the original image material of the panoramic image is simple, a single anti-camera and image processing

software can quickly produce a panoramic image. At the same time, the real image is more realistic than the traditional virtual reality, people can see each scene clearly and intuitively, the objects on display, and restore the concrete image in the reality, so the credibility is high.

3.2 3D Production

3D production has been used in virtual reality for a long time. It is a traditional panoramic display method.3D production is mostly used in panoramic display system, and the production process is realized by the steps of pre-planning, field investigation, design and display scheme, 3D modeling and model integration, and finally the realization of interactive functions (Fig.1).

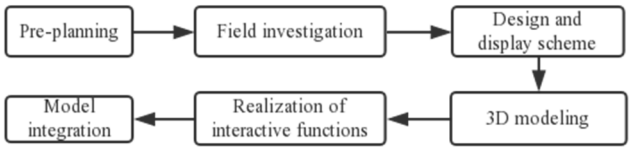

Fig 1. 3D panoramic process

The characteristics of this method of production are as follows:

Production costs are relatively high, production cycle is also longer: The traditional 3D scene only needs the complete modeling and rendering of the camera display, while in the panoramic display, it needs to deal with every corner of the 3D scene completely, and the workload is great. Moreover, the interactive system of panoramic display is based on programming language, and the technical threshold is also high.

The display effect is good, the interaction way is various: Users can zoom, rotate, move, color material and other properties of the scene in the panoramic experience. At the same time, it can realize the animation, sound and other functions of the product model according to the idea of the creators.

The transmission is convenient, can use the powerful network to carry on the experience: At the same time, due to the variety of distribution methods, suitable for various forms of display.

3.3 Two-dimensional Drawing

2D rendering is less used in panoramic display because of its unique display effect, which is mainly used for some special creative display effects. For example, 2D panoramic painting-Reply Red Alert 2001(Fig.2).

Fig 2. Reply Red Alert 2001.

2D panorama needs to be drawn in a specific 3D environment, because the whole picture is a 360-degree panoramic picture, which is equivalent to a spherical seamless texture in 3D software, so the connection of the edge of the picture needs to be taken into account in 2D panorama drawing. Otherwise, there will be obvious picture fusion problems when playing in the panorama.

And the panoramic image and video are distorted. If you draw directly in the 2:1 ratio Equirectangular mode, you can't restore the distortion of the Equirectangular image in the field, so to avoid distortion during panoramic playback. In the process of two-dimensional drawing, it is

necessary to use a VR converter to convert the panoramic image into a normal viewing angle during panoramic playback, and then draw it, so as to draw a good panoramic image.

3.4 Results

By analyzing the characteristics of three kinds of panoramic making methods, such as field shooting, 3D modeling and 2D rendering, we can see that each of them has its own advantages and disadvantages. From the four aspects of production cost, interactive experience, authenticity and artistic effect, it is divided into three levels of A, B and C to evaluate several production methods. Except for the lowest production cost of A and the highest is C, the other three aspects are the highest A, and the lowest C, which gives Table 2.

Table 2. Comparison of Production Methods

	production cost	**interactive experience**	**authenticity**	**artistic effect**
Field Shooting	A	C	A	C
3D Production	C	A	B	B
Two-dimensional Drawing	B	B	C	A

4. Display Media

There are two kinds of panoramic display media: traditional screen and panoramic display device.

4.1 Traditional Screen

The traditional screen display is mainly displayed through our daily computer display screen and mobile phone screen, and played by a specific panoramic player, such as Insta player, UtoVR, etc., in addition, most mainstream video players have also recently added panoramic video playback features, such as win10's own video player, Youku, Potplayer, and so on. The screen of the computer or the mobile phone is convenient to carry out the panoramic experience, the popularization degree is the highest, and every user can carry out the panoramic experience without inputting any cost, but all the computer display and the mobile phone screen cannot realize good human-computer interaction, The viewing angle can only be adjusted up and down by clicking on the mouse or the finger, and the immersion feeling is not enough.

4.2 Stereo Display Device

Most of the panoramic display now needs a stereo display device to better feel that immersion, generally for headwear glasses, can be broadly divided into the following three: PCVR, VR integrated machine and mobile phone VR.

The phone VR is a panoramic display device that needs to put the phone into a display device, most notably Samsung Gear, Baofeng MoJing and Google cardboard. The biggest advantage is high popularity, low prices but can experience panoramic immersion, cost-effective

PCVR needs to be displayed in conjunction with a computer. It must be connected to the computer in order to experience it. Moreover, the requirements for the configuration of the computer are very high. For example, the price of the HTC VIVE, SONY PlayStation VR and Oculus Rift is generally higher(Fig.2). Has a very good display effect and interactive experience.

Fig 3. PCVR.

The VR integrated machine comes with its own screen, and the device itself has CPU and processor, with computing functions, such as Pico goblin2, Xiaomi VR, Oculus Go and so on. The advantage is portable and can be used without any other device. The disadvantage is that because of its limited size, the calculation will be relatively slow.

4.3 Results

By analyzing the characteristics of traditional screen and panoramic display equipment, we find that all kinds of display media have their advantages and disadvantages. From the four aspects of cost, interactive experience, immersion and popularity, it is divided into four levels A, B, C and D to evaluate several display media. Except for the lowest cost of A and the highest of D, the other three aspects are the highest A and the lowest D, which results in Table 3.

Table 3. Display Medium Contrast Results

	Cost	Interactive experience	Immersion	Popularity
Traditional Screen	A	D	D	A
Phone VR	B	C	C	B
VR Integrated Machine	C	B	B	D
PCVR	D	A	A	C

5. Conclusion

This paper takes panoramic display method as the research object, carries on the systematic theory research and the contrast analysis work to it, according to the panoramic display characteristic, has carried on the research to the panoramic display form, the production way and the display media each kind of choice, has carried on the research according to the panoramic display characteristic, Make the evaluation standard to compare it, analyze its advantages, disadvantages and characteristics. This paper provides a new theoretical support for the research and development of panoramic display and to a large extent provides a research basis for the application of panoramic display in the future. The study of panoramic display is a long process for people, new panoramic display technology is also emerging constantly, the research of wooden text is only based on what I can do, because the level and time is limited, some conclusions are drawn. However, there are still many unsolved problems in this field.

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