Research on Optical Display Technology of Virtual Reality Technology Based on Optical Image

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Abstract. In order to overcome the limitations of traditional optical display technology, a novel optical display technology based on optical image virtual reality technology is proposed. The optical display technology combines with virtual reality technology, relying on the Internet platform, fully and comprehensively simulates the visual display effect of human eyes. The results show that the optical display technology can break through the limitations of traditional optical display technology, improve the display effect, and build a high immersion virtual reality world for users.

Keywords: Optical image; Virtual reality technology; Optical display technology; Artificial intelligence.

1. Introduction
At present, in the information age, the emergence of virtual reality technology has a profound impact on people's production activities and lifestyle. At the same time, virtual reality technology can build a virtual space with high immersion for users, so as to present good display effect for users. At present, the optical display technology of virtual reality technology still has some defects in imaging. This paper proposes a novel optical display technology of opportunity optical image virtual reality technology, and forecasts the future development trend of optical display technology based on optical image virtual reality technology, which provides a theoretical reference for the researchers in the field of optical image and virtual reality technology.

2. Theoretical basis
2.1. Virtual Reality Technology
Virtual reality technology was born in the 20th century. It is a new kind of science and technology. At the same time, because of its strong practicability, virtual reality technology has attracted the attention of people from all walks of life and began to be introduced into various fields. Virtual reality technology involves a variety of science and technology, such as computer technology, electronic information technology, simulation technology and so on. Virtual reality technology can build a virtual environment for users [1]. Relying on Internet platform and computer technology, it can build a very realistic virtual world. At present, the social productivity is constantly improving, science and technology is also in the rapid development stage, all walks of life demand for virtual reality technology is rising, it is obvious
that virtual reality technology has become a hot science and technology in the 21st century, is combining with more and more fields, and is constantly applied and developed.

![Fig.1 Key technologies of virtual reality](image)

From the perspective of technology, virtual reality technology is different from other high-tech features is the construction of realistic virtual space. Through computer technology, virtual reality technology can generate virtual space according to the needs of users. At the same time, users can enter the virtual space and carry out various activities. The application and development of virtual reality technology cannot do without big data, which makes full use of the data in people's daily life. At the same time, virtual reality technology is also combined with other intelligent devices to build the virtual space that users need. In addition, more importantly, virtual reality technology can build materials that do not exist in real life. Through 3D model, virtual reality technology can meet the needs of users [2].

At present, virtual reality technology is constantly introduced into a broader field, which also shows that virtual reality technology has been recognized by more people. In addition, virtual reality technology also has a powerful simulation system, which can improve the human-computer interaction ability, so that users can get real feedback in the process of operation. The multiple characteristics of virtual reality technology meet the needs of contemporary users. Relying on the Internet platform, virtual reality technology has become one of the most popular science and technology in the 21st century.

![Fig.2 Workflow of virtual reality system](image)

Virtual reality technology, in essence, combines computer technology to build three-dimensional virtual space, and fully mobilizes the user's sensory system, such as vision, hearing, touch, smell and so on, so that users can feel the advanced nature of virtual reality technology. In the process of the application and development of virtual reality technology, the key to the construction of virtual environment is the display technology of virtual image. This paper discusses the optical display technology of virtual reality technology based on optical image. Obviously, if we want to give full play to the immersion of virtual reality technology and obtain a high immersion virtual space, we have to make full use of the theoretical knowledge of optical images [3].

2.2. Requirements of Image Construction Based on Virtual Reality Technology

The application purpose of virtual reality technology is to provide services for the construction of virtual reality world. In other words, virtual reality technology needs to build realistic virtual space to provide users with a good sense of immersion. The so-called sense of immersion is the reality of virtual
environment constructed by virtual reality technology that users can experience. In the application process of virtual reality technology, the construction of image should start from the human visual characteristics. The angle of view of human eyes is 150° horizontally and 120° vertically. In addition, the visual angles of two human eyes only partially coincide, and the overlapping area is about 50° to 60°. At the same time, when two human eyes observe the same thing, the angle of view of the left eye is different from that of the right eye due to the different position of the left eye and the right eye [4]. Therefore, the designer should make the display device have a similar perspective and resolution with the human eye, so as to display a good visual effect, so as to meet the visual needs of users.

2.3. Optical Display Principle in Virtual Reality Technology
Virtual reality technology, in essence, is to use computers to build a highly interactive and immersive virtual three-dimensional space for users. The virtual three-dimensional space based on virtual reality technology has multiple characteristics, which make the virtual world constructed by it extremely lifelike. From the technical point of view, virtual reality technology is a new computer simulation system, which gives full play to the advantages of simulation technology, combined with optical imaging mechanism to build a virtual world. In the process of building virtual environment with virtual reality technology, the data information from multiple sources is combined to create a high immersion experience mode based on three-dimensional dynamic information, which can fully meet the fundamental needs of the vast majority of users. The imaging principle of virtual reality technology based on optical image starts from the basic elements, such as object shape, position, etc., which can obtain static and dynamic image information. Due to the different position of human left eye and right eye, there are differences in feature extraction of the same thing. Human brain will process the acquired visual information according to the feedback information from human left and right eyes, and then construct the three-dimensional effect of the object [5]. Obviously, to build a high fidelity and high immersion virtual world, we must combine the theoretical knowledge of human binocular parallax, strengthen the processing and guidance of the acquired image information, and then build a high fidelity three-dimensional virtual space. In addition, full use of eye tracker can build a more realistic virtual reality world.

![Fig.3 Principle of retinal projection](image)

3. Optical display method of stereoscopic effect in virtual reality

3.1. Stereoscopic Method
For virtual reality technology, stereo mirror method is the most convenient method to construct virtual space. In essence, stereoscopic method is to simulate the human left and right eyes through two lenses, so as to enlarge the virtual image. In addition, the stereoscope method needs to use two cameras simultaneously to capture the image data information of the stereo scene. When using stereo mirror method to build virtual reality environment, it is necessary to set the lens optical axis at a distance of 65mm, which also enables users to obtain the data information of two stereo images, so as to construct
high fidelity three-dimensional images [6]. Stereoscopic mirror method can reduce the color of the image and make the color display effect of virtual imaging more prominent. However, it is worth noting that this method needs the help of electronic circuits to present a good virtual reality image, which also makes the process of image construction more complex. Therefore, in the major areas, the popularity of stereoscopic method is relatively low.

3.2. Color Difference Method
The essence of color difference method is to set the color of the left eye image and the right eye image into different colors in the intelligent device simulating the human eye. Specifically, the color of left eye image and right eye image is set as complementary color. In addition, the color of the left eye image and the right eye image can be overlapped and displayed on the screen to construct a black-and-white stereo image. As the main method of early stereo projection, chromatic aberration method is mainly used for the construction and processing of static images [7].

3.3. Polarized Light Method
Polarized light filter can process light waves from different directions and eliminate the interference factors, so that the remaining part of the light wave is more in line with the conditions of image construction. Polarized light method, in essence, is to set the same filter in the two polarization directions, which can not only block the light, but also make the light path according to the user's needs, and then realize the three-dimensional virtual imaging.

3.4. Grating Method
Grating method is also called cylindrical mirror method. In essence, the grating method divides the images observed from the left eye and the images observed in the right eye into two vertical pixels, and combines the left eye image and the right eye image to form a three-dimensional image through overlapping overlaps. Therefore, the three-dimensional image constructed by grating method is composed of several groups of lines overlapping, and each line is overlapped in the three-dimensional image, which also makes the three-dimensional sense of virtual reality image very prominent.

3.5. Laser Holographic Projection Method
As the most widely used virtual imaging technology in the world, laser holographic projection makes full use of optical diffraction technology and optical interference technology. Compared with camera imaging, holographic projection recorder has its own characteristics. It makes full use of the imaging method of optical image, and can collect the key information of virtual three-dimensional environment, and construct high fidelity three-dimensional image [8].

4. Double center projection algorithm for optical display in virtual reality
In the process of building virtual reality image, the buffer of image material in the left eye and right eye needs to be combined with perspective projection to construct the image, so as to make the image outline of the target object clearer, so as to improve the three-dimensional and realistic sense of three-dimensional space. To construct high-quality virtual reality images, the left eye image and the right eye image need to be overlapped, so as to improve the stereo sense of the virtual image, which is also a type of optical perspective projection. In the process of constructing virtual reality image, the symmetry of balanced position of image is the basis of constructing three-dimensional image.

At present, the double center projection algorithm of optical display in virtual reality technology is an important way to construct high-quality 3D virtual reality images. The specific process of using the dual center projection algorithm of optical display in virtual reality technology is as follows:

In the process of photographing, the camera position is set as Z axis, and the point coordinates of the positive half axis of the axis are set as (0,0, d), where point D is the reference position of the camera equipment in the plane distance. Then, the image on the point coordinates (x, y, z) is projected onto the (X-Y) plane to obtain the point coordinates of the virtual reality image, that is [xd/(d-z),yd/(d-z)].
In the process of shooting, the user needs to set the axis spacing of the camera to C, which is also the
distance between the projection levels of the two cameras. Therefore, the perspective conditions of the
two images are \{([(x+c/2)d/(d-z)], [yd/(d-z)]\}. In addition, through the stereo display system, the two
cameras can overlay the scene and then project a more realistic stereo effect, thus reducing the difference
between the display effect captured by the machine and the image obtained by the human eye. This
method can maximize the immersion and fidelity of virtual reality environment.

At the same time, the operation mechanism of dual center projection algorithm of virtual reality
optical display is based on Zero Parallax plane, that is \{[(x+c/2)d/(d-z)-C/2], [yd/(d-z)]\} for the left eye
and \{[(x+c/2)d/(d-z)+C/2], [yd/(d-z)]\} for the right eye. Through the double center projection algorithm
of optical display of virtual reality technology, a more realistic visual effect can be constructed, which
makes the vision difference approach the visual effect of human eyes wirelessly, and then construct the
virtual reality image with high authenticity and high immersion [9].

5. Development trend of reactive display and eye tracking technology
Recently, researchers have begun to explore in-depth research on the scope of VR and VR applications
in the field of VR. At present, virtual reality technology is in the process of rapid development, at the
same time, virtual reality technology has also been introduced into the development of more and more
intelligent devices, the head mounted display is an important example. More and more theatres and
shopping malls are equipped with HMDS. It is believed that HMDS based on VR technology can
provide more significant virtual visual experience than traditional displays.

![Fig.4 Principle of monocular vision](image)

In addition, with the continuous development of virtual reality technology, eye tracking technology
has been praised by people for its higher resolution and recognition rate. It can also improve the visual
effects of virtual reality. At present, the first generation of virtual reality head display technology has
been gradually improved, and it can also provide users with various convenience. However, it is worth
noting that the pixel resolution and rendering effect of virtual environment constructed by virtual reality
technology still can not match the human visual rendering effect. Obviously, only relying on high-
resolution optical display technology, it is difficult to make a greater breakthrough in the display effect
of virtual reality environment [10].

At present, with the further research and analysis of eye tracking technology and rendering
technology, eye tracking technology has become the main technology to greatly improve the visual
reality effect of virtual reality. Specifically, the severe winter tracking technology can accurately locate
the location of the target object that the user is looking at, thus taking the target object as the rendering
object, and using the most frequent image to render the line of sight region according to the user's line
of sight range. Eye tracking technology can not only render the images in the range of users' line of sight,
but also reduce the rendering quality outside the range, so as to ensure the efficiency of virtual reality
system. Eye tracking technology can optimize the internal structure of the camera and display by
rendering the user's fixation point with high fidelity, so as to improve the pixel density of intelligent devices and achieve higher resolution.

6. Conclusion
Optical display technology is in the process of continuous development, there are a variety of optical display technology, such as stereo mirror method, chromatic aberration method, grating method, polarized light method, laser holographic projection method. However, it is worth noting that if only using a single optical display method, it is difficult to construct realistic virtual reality display effect.

In the process of the continuous development of optical display technology, there have been a number of research branches. The author believes that in the next few decades, optical display technology can continue to go deeper and further in the development direction and research direction of reactive display and eye tracking technology.

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