A Study on Video Content Scalability Using Holographic Production Technology

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홀로그래픽 프로젝션 기술을 활용한 영상 콘텐츠 확장성 연구

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Abstract Stereoscopic imaging is an important branch in the field of digital imaging, and has grown significantly over the last two decades through research and development. Hologram projection technology based on stereoscopic technology has been a social issue since the development of the Hungarian physicist Daniel Garber in 1947. It is becoming more and more important as stereoscopic works using similar technologies are applied to various fields. This study analyzed content cases using classical and creative stereoscopic technology from the perspective of digital image content design and explored the multiprotocol direction of holographic projection.

Key Words : Stereo Vision, Stereoscopic Visualization Technology, Holographic Projection, Front-projected Holographic Display, Video Content

요 약 입체영상 기술은 디지털 영상 분야의 중요한 갈래이며, 지난 20여년 동안 연구와 발전을 거쳐 크게 성장하였다. 이 기술은 많은 분야에서 더 다양화되고 중요한 영상콘텐츠 제작 방법으로 발전하고 있다. 입체영상 기술에 기초한 홀로그램 투영 기술은 1947년 영국 헝가리계 물리학자 대니얼 가버의 이론적 연구 이후 홀로그램 기술은 지속적이면서 빠른 속도로 발전해 사회적으로 이슈화 되었다. 현재 진정한 홀로그램 기술에는 미치지 못하지만, 이와 유사한 기술을 활용한 입체영상 작품이 다양한 분야에 응용되면서 점점 더 중요하게 부각되고 있다. 본 연구는 디지털 영상콘텐츠 디자인 설계의 관점에서 고전적이고 창의적인 입체영상 기술을 활용한 콘텐츠 사례를 분석하고 홀로그램 투영의 멀티 프로토콜 방향을 모색하였다.

주제어 : 스테레오 비전, 입체영상 기술, 홀로그래픽 프로젝션, 홀로그램 투영, 영상 콘텐츠

1. Introduction

1.1 Objectives and Background of the Research

With the advent of the fourth revolution of science and technology and the age of 5G communication, graphics, images, video, and audio have replaced paper and text. Regardless of whether you use a computer to make two-dimensional (hereinafter referred to as 2D) and three-dimensional (hereinafter referred to as 3D) animations or filmed videos, you need a platform to show them to the audience[1]. With the rapid development of new media technology, holographic projection technology has become a hot topic of application for the many platform display methods of content media.

Holographic projection technology is to virtualize information such as computer-made images and videos and present it in a 3D space through mapping, making the picture look more livelier. However, what we are currently seeing is not a holographic projection in the strict sense, but a stereo vision technology similar to holographic projection[7].

This paper hopes to analyze the innovativeness of the content applicable to this technology by investigating the application of this kind of stereo vision technology similar to holographic projection and their production characteristics in new media. The aim is to show more novel 3D new media content works to the public through the platform of holographic projection technology; at the same time, it hopes to use this research to seek for multiple applications of holographic projection technology[2-4].

1.2 Range of the Research

The scope of this paper is a study of the production direction of the content design in the media visualization products presented by the stereo vision technology similar to the holographic projection. It hopes that by analyzing the development trend of stereo vision, from the perspective of its application, it will be refined into different types. The research focus of this article is to study the similarities and differences of the corresponding new media content according to the application direction of stereo vision technology.

2. Theoretical Background

2.1 The Concept of Holographic Projection

Holographic projection technology, also called virtual imaging technology, is a technology that uses the principles of interference and diffraction to record and reproduce real 3D images of objects. Holographic projection can present 3D illusions in the air. For example, performers on the stage can perform dynamic performances through their limbs, expressions, etc, interact with these 3D illusions of harmony and cleverly, and cooperate to complete the performance[5,8]. Shocking performance picture. Holographic projection technology has a wide range of applications, including product exhibitions, car or clothing conferences, stage performances, variety shows, film and television dramas, bar entertainment, interactive venue projection, museums, and expos[10,11].

2.2 The Type of Holographic Projection

Holographic projection technology can be subdivided into optical holographic technology, digital holographic technology, computational holographic technology, microwave holographic technology, reflective holographic technology, acoustic holographic technology, and so on[11]. This technology is used in various fields such as display, measurement, encryption, identification, etc. Our common traditional holographic technology is optical holography[12].

However, due to technical problems, the holography we usually know is often not a holographic projection in the strict sense, but a similar holographic projection that uses Pepper's ghost and Edge blanking to achieve 3D effects[6]. The currently implemented 3D technologies (not real holographic projection technologies) are mainly the ones that appear in Table 1.

Table 1. Realized stereo vision technology similar to holographic projection

Area	Name	Representative Work
United States	Air projection and interactive technology	
	360-degree holographic display	
Japan	A laser beam was use to projected entity 3D image	
	Pepper's ghost	
China	Rotating LED display technology	

3. Methods

The study method of this subject is based on the theoretical background of case analysis based on a realistic background.

3.1 Questions of the Research

1) Why is the stereo vision technology currently realized not a holographic projection technology in the true sense?

2) What are the types of stereo vision technology?

3) What are the application directions of holographic projection technology?

4) What are the characteristics of different types of stereo vision technology in the production of video content?

3.2 Methods of the Research

Based on the theoretical support of the holographic projection technology background, it screens for excellent holographic projection cases in China, South Korea, and other countries overseas, analyzes, compares and summarizes them[9]. At the same time, the similarities and differences in their content design are compared, so as to analyze in detail the characteristics and correlations between different media content and their respective key points in the application of holographic projection technology (for example, more prominent lighting effects or more attention to 3D visual effects). Through theoretical research and analysis, a basic theoretical reference frame has been formed.

4. Case Analysis

4.1 Stereo Vision Technology and Holographic Projection Technology

In science fiction movies, we often see a scene like this: the protagonist gently waves his hand, and a virtual display screens to appear in front of him. The content of the screen can not only be arbitrarily switched, but also can be achieved thousands of miles through it Outside people talk face to face. This is holographic projection technology.

At present, the most holographic projection technology we have seen is probably in various concerts.

As shown in Fig.1, in 2010, the famous Japanese virtual idol Hatsune Miku(初音ミク) appeared at the concert through holographic projection technology. Although the technology at that time was not mature enough, the 3D Hatsune Miku received widespread attention as soon as it debuted, and the transition to 2D to 3D effects brought a strong visual impact to the audience.

Fig. 1. 3D Hatsune Miku on concert in 2010

In Fig.2, during the concert of Dr. Dre (Andre Romelle Young) and Snoop Doggy Dogg (Cordozar Calvin Broadus Jr.), the late American hip-hop superstar 2Pac (Tupac Amaru Shakur) re-entered the stage with virtual images. The virtual images not only can sing and dance on the stage, can even walk back and forth and say hello to the audience, everything looks very real.
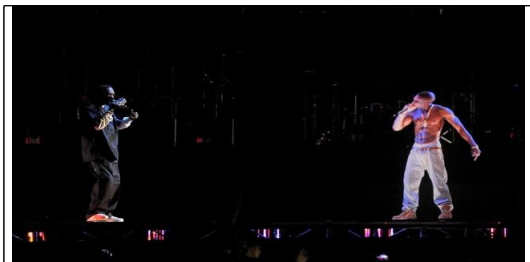

Fig. 2. 2Pac re-entered the stage with virtual images

Regarding the difference between the two, in simple terms, true holographic projection does not require any special medium to display the image in the air above, and viewing from any angle will not affect the clarity, and people can walk through the picture. The Pepper's ghost is a visual effect formed by refracting the light source with optical materials inclined to various angles, and the audience can only watch the movie at a specific angle.

Therefore, we say that the biggest problem currently facing holographic projection is the medium. Because no light will be refracted without a medium, which means that effects similar to those in science fiction can't be achieved.

4.2 The Application Directions of Holographic Projection Technology

Holographic projection technology can not only generate 3D aerial illusions, but also allow the illusions to interact with the performers, complete the performance together, and produce shocking performance effects. Its application scenarios are extensive and can be flexibly changed according to different application environments. Through Table 2, we can see several common application areas of holographic projection technology.

Of course, the application fields of holographic projection technology are far more than those in Table 2, there are many more[13-16]. With the continuous development of scientific and technological development, the application field of holographic projection technology will also be broader.

Table 2. Realized stereo vision technology similar to holographic projection

No.	Application area	Instructions
1	Hologram Runway Show	When performing a catwalk shows, fashion designers are notoriously demanding in their details. And holographic projection technology can not only create beautiful scenes to set off the theme expressed by the designer, combined with virtual reality can also show the designer's work from multiple angles, attracting the attention of consumers.
2	Holographic Stage Performance	People or objects that are unlikely to appear on the scene are displayed on the stage through holographic images. Do virtual reality combined with real effects. For example: Jay Chou (Chinese singer) toured

		the world in 2013, using holographic imaging technology to invite Teresa Teng, who died, to perform on the same stage; using holographic imaging technology and real-life actors to achieve real-life and water, fire and light Interaction of objects adds more magical colors to the entire show.
3	Holographic Wedding Show	The traditional wedding mode already cannot meet the needs of new people. In order to create a romantic scene atmosphere and leave a good impression, by using holographic projection technology, the wedding scene is made into various scenes that new people want. So as to create a gorgeous, sci-fi, and beautiful and romantic scene effects for the audience and new people.
4	Holographic Commercial Show	The holographic image technology is applied to the product display cabinet. The physical products are combined with the holographic images floating in the air, more reflects the unique properties of the product. For example: the use of holographic images of the auto show to allow customers to learn more about the performance and materials of this car.
5	Holographic Education and Teaching	Compared with the traditional teaching method, it can get rid of a single book teaching and projection ppt teaching mode. Holographic projection technology can present real 3D images with clear images, fast animation conversion, and stunning visual effects. This application can help students improve their ability to diverge thinking, focus attention, and better memory.

4.3 Features of Holographic Projection Technology in Content Production

In order to bring better visual effects of the audience, different application directions of stereo vision technology (that similar holographic projection technology that can be achieved by current technology), have certain differences in the corresponding presentation content. When designing the content, It will highlight the characteristics it wants to show from different directions.

4.3.1 Content Design for Holographic Stage

In the stage design process, the introduction of holographic projection technology breaks for the space and time limitations of traditional stage design, which can bring a new visual experience to the audience and inject a modern aesthetics into the stage. However, because the application of this direction is still affected by technical and

financial factors, it has not been widely used in stage design at home and abroad. Therefore, the holographic projection technology is currently more applied to some large-scale evening parties.

As shown in Fig.3, this is the "Shu Embroidery" program completed by China at the 2015 *Spring Festival Gala*. This is also a typical application of this technology on the stage design. It is also one of the most expensive programs in the 2015 *Spring Festival Gala*.

Fig. 3. "Shu Embroidery" program

"Shu Embroidery" program uses a 45-degree holographic projection film. By set an LED display on the ground, the pre-made video is played on the LED display, and then the 45-degree holographic projection film is used to refract visible light into the eyes of the audience. From the viewer's perspective, the LED display on the ground cannot be seen. As a result, the stage showed a magical and 3D effect. People saw the red lotus flying on the stage and singer Li Yuchun drawing beautiful scenery such as the moon by hand. At this moment, the four "Li Yuchun" are performing on the stage at the same time, representing the four seasons of spring, summer, autumn, and winter. Whether the audience in front of the TV set or the audience at the scene cannot distinguish which one is the real singer. Which one is the display of holographic projection technology.

4.3.2 Content Design for Holographic Exhibitions

With the rapid development of presentation technology and information technology, the digital holographic exhibition hall has become the most acceptable display method for people. Holographic technology can make the content displayed more intuitive and understandable. The audience is no longer satisfied with the isolated and static display of cultural relics, and it is no longer satisfied with the regular and fixed-point mode of visitation[16]. Therefore, diverse of holographic exhibition methods and presentation methods are imperative.

The University of Southern California Schwarzler Foundation was founded by Steven Spielberg in 1994 to commemorate the survivors of the Holocaust. The foundation worked with the museum to create the first holographic cinema experience exhibition hall using natural language processing (automatically manipulating natural language through software). Fig.4 shows the Take a Stand Center at the Holocaust Museum in Illinois, USA. The stories of the holocaust survivors are preserved and displayed with the help of holographic technology[14].

Fig. 4. The Take a Stand Center

4.3.3 Content Design for Holographic Education

The school is an important place for everyone to learn and educate. Here, not only can you learn knowledge, increase your knowledge, exercise your interpersonal skills, etc. In addition, you can understand science and know science. Therefore, it is especially important to the school to keep pace with the times. The advent of the 5G digital age has also brought new opportunities to school education. The use of holographic projection teaching makes the classroom independent of the area, and can communicate with famous teachers everywhere in real time, bringing more fun and insight to students' learning and life.

Fig. 5. The "special" biology class

As shown in Fig.5, this is a "special" biology class on March 21, 2018, at Shanghai Xinqiao Middle School. In the classroom, human organs, tissues, nerves, bones, etc. are presented in front of students in the form of holograms. Unlike the flat pictures and text on books, the content of holographic teaching is 3D, allowing knowledge to "jump out" of books[13].

This novel teaching method shows the teaching content to the greatest extent, with all-round and multi-angles, allowing students to master each knowledge point in observation. At the same time, it breaks the traditional teaching pattern and brings students a different learning experience with vivid teaching content, rich interactive operations, and interesting teaching processes.

4.4 Sensory Experience in Holographic Projection

In summary, by listing and analyzing several

different holographic projection technology cases, we can find that in the holographic projection project, the most relevant to the scene is the sensory experience. Sensory experience is the most basic experience. It is based on the five senses of a person: sight, hearing, smell, taste, and touch.

Therefore, for the different application directions of holographic projection technology, the biggest difference in content design is to highlight the sensory experience that it wants to make the audience feel. For example, the purpose of the holographic stage is to bring a grand visual feast to the audience, so in its content design, the presentation of 3D special effects should be more prominent; in holographic display, we should highlight the details of the displayed objects or events; in holographic education, we should highlight the authenticity and scientificity of the presented content.

5. Conclusion

In this Paper, through the conceptual analysis of the holographic projection, as well as the difference between the currently already achieved stereo vision and the real holographic technology, we can see that although there are technical and financial problems with holographic projection, it is still the future hot issue of science and technology. If hardware limitations that video content creators cannot solve on their own are addressed, they can expect the scalability of video content using Holographic Projection technology in more areas. And this paper is hoped that through induction and analysis and comparison, it will provide a theoretical basis for reference when making holographic projection video content in the future.

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