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Investigation of the Original Site Reproduction of Ancient Buildings Based on Holographic Projection Technology

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Abstract

With the development of China's economy, social progress, and the improvement of scientific and technological level, the application of holographic projection technology has gradually attracted people's attention, and holographic projection technology has penetrated into various industries. For the content of this article, holographic projection technology plays a very important role in the research process of reconstructing the original site of ancient buildings. Therefore, in order to proficiently apply holographic projection technology in the reconstruction process of ancient building sites, based on the content of holographic projection technology, this paper studies the practical application of holographic projection technology in the reconstruction of ancient building sites in China, and proposes the development prospects of holographic projection technology in the ancient building protection industry in the future, providing reference significance for future ancient building protection work.

Keywords: *Holographic projection technology; Ancient architecture; Reconstruction of the original site of ancient buildings.*

1. Introduction

The reproduction of ancient architectural sites is of great significance for the dissemination of Chinese culture in contemporary society, as well as for promoting economic development, cultural heritage inheritance, and educational enlightenment. How to promote and showcase ancient architecture more effectively and attractively has always been a focus of public research, and has also become a driving force for the further development of human civilization. With the continuous development of network information technology, the original site reconstruction of ancient buildings has undergone certain changes (Wu Junxing, 2019). The screen that implements holographic projection technology has advantages such as high simulation accuracy, strong immersion, and low display cost. It has gradually been applied in many unimportant situations, at least achieving the best presentation effect.

At present, many ancient buildings in China are undergoing restoration, preservation, and reproduction. However, due to the lack of structural drawings of buildings, it is difficult to assess the degree of damage and investigate indoor conditions, making it difficult to carry out the restoration and reproduction of ancient buildings. Ancient buildings require

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a fast and comprehensive method to reproduce and showcase them (Lu Shizhong, et al, 2022). Holographic projection technology itself is a technology with three-dimensional characteristics, based on interference characteristics, and assisted by diffraction characteristics. It can reproduce objects and ensure their clarity, meeting the needs of building protection. Therefore, on the basis of accurately understanding the content and advantages of technology, it is necessary to conduct a comprehensive analysis of the technology application process, identify the shortcomings reflected in the application process, and use this as a basis. The advantages of holographic projection technology are shown in Table 1. By further enhancing the application effect of this technology, it provides support for the continuous development and progress of ancient building protection.

Table 1 Advantages of holographic projection technology

	Advantages	Embody
Holographic	Novel form	Compared with traditional 3D display technology, holographic images do not require professional display equipment and can be viewed with the naked eye to achieve very realistic 3D display effects.
	Highly technical	This is a process of integrating multiple technologies. In practice, it is necessary to combine various technologies such as sensing technology, touch technology, voice control, etc. in order to achieve a perfect combination of visual effects and interactive experiences.
	Flexible size	The holographic projection imaging quality is good, and the imaging area can be customized according to customer needs, with a maximum of over 40 meters and a minimum of 20-30 centimeters. It is suitable for the needs of different industries and customers, and meets the best holographic image display of various products.
	Strong interactivity	Display design utilizes holographic projection technology to transform static objects into dynamic ones, transforming from unilateral displays to interactive displays with the audience.

2. Overview of holographic projection technology

2.1 Concept of holographic projection technology

Holographic projection technology is a virtual imaging technology and a 3D effect projection technology. It is a technique that relies on the principles of interference and diffraction to record and reconstruct the illusion of three-dimensional objects. In holographic projection imaging, the audience can clearly see that the holographic projection system projects three-dimensional images into the air of the actual scene, creating an atmosphere that is both unreal and real. The effect is unique and has a strong sense of depth and technology; Its top is transparent and truly spatial imaging; It has bright colors, high contrast, and high clarity; It has a sense of space and perspective, forming aerial fantasies (Deng Kailing, et al, 2023). The middle part can also be combined with physical objects to achieve the integration of images and physical objects; It can also configure a touch screen specifically for audience interaction. Unlike modern projection, which cannot express three-dimensional effects on a two-dimensional plane through the perspective rules of visual focus, in the display method based on conditional holographic projection technology, the viewer can clearly see the three-dimensional image of the object without observing it. Using specific image information and perception devices can also achieve communication and interaction effects, creating a better search and interaction experience.

2.2 Development History of Holographic Projection Technology

According to the development timeline, holographic projection technology can be divided into four stages, namely the embryonic stage, exploration stage, bottleneck stage, and development stage, as shown in Figure 1.

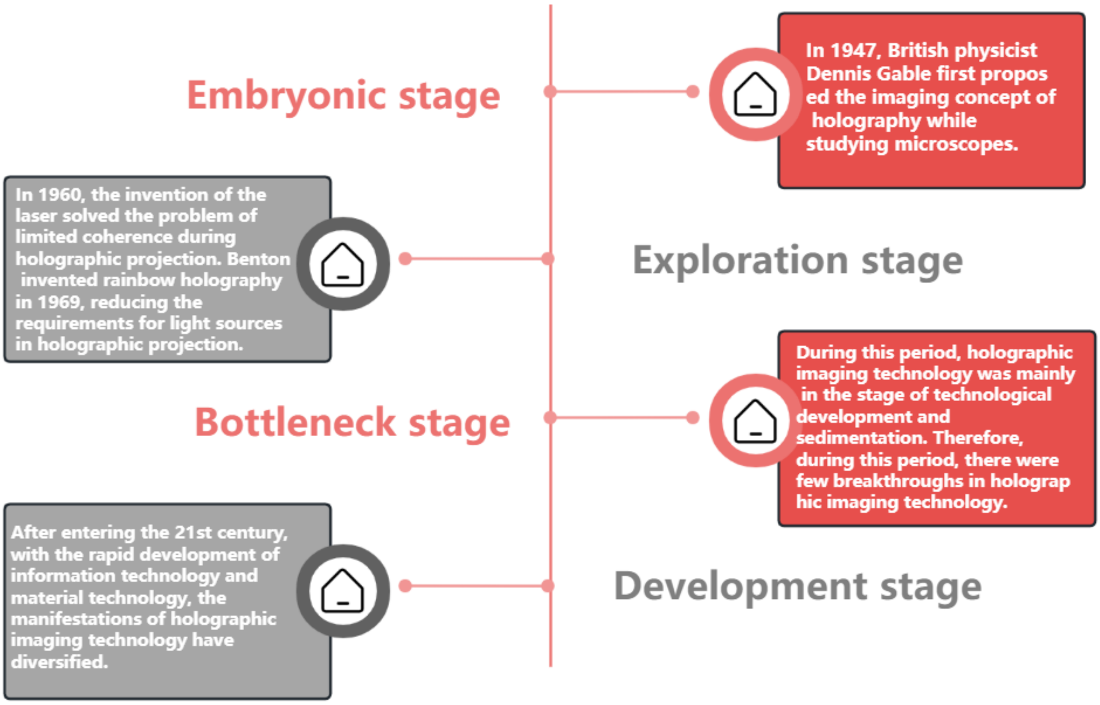

Figure 1 Development History of Holographic Projection Technology

2.2.1 budding stage

In 1947, British physicist Dennis Gable first proposed the concept of holographic imaging while studying microscopes. The concept of holographic projection is gradually emerging in front of the public.

2.2.2 Exploration phase

In 1960, the invention of laser solved the problem of insufficient holographic projection technology. Holographic projection technology reached a certain level of development during this period (Zhang Shilai&Wu Zhiying, 2021). In 1962, Soviet scientist Yuri Denisuk took the first direct optical holographic projection photo, which could record three-dimensional objects. Leith and Upatniks, staff members of the Radar Laboratory at the University of Michigan, applied the theory of "side view radar" in the communication industry to stereo imaging based on virtual imaging technology and discovered off-axis holographic technology, which has also taken virtual imaging technology to a new level and significantly improved projection imaging performance. In 1969, Benton suddenly discovered rainbow stereo imaging, which increased the demand for light sources in holographic projection.

2.2.3 Bottleneck stage

In the 1970s and 1980s, holographic projection technology dominated the fields of interest to scientists at that time. Many people are committed to the research of holographic projection technology. During this period, most holographic imaging technologies were in the stage of technological development and deposition. Therefore, there were few breakthroughs in holographic imaging technology during this period.

2.2.4 Development stage

After entering the 21st century, with the rapid development of information technology and material technology, the manifestations of holographic imaging technology have become increasingly diverse (Chao Brian, et al, 2023). In 2001, holographic film technology was developed; In 2006, 360-degree ghost imaging technology was widely applied; In 2008, 3D holographic display screen has been developed; In 2014, the 3D holographic projection chip was successfully developed; In 2017, the 3D imaging fan 3D screen was developed and put into use.

2.3 Classification and principles of holographic projection technology

Broadly speaking, holographic projection is a type of holographic image, but there are certain differences in certain imaging principles between the two (Yaraghi Shaghayegh, et al, 2023). The true holographic imaging technology relies on the principles of light interference and diffraction to record information and reproduce false three-dimensional images of objects. However, research project technology is difficult to effectively utilize and currently only appears directly in film and television works. Researchers have never stopped researching holographic projection technology. Through the efforts of researchers, holographic technology has made certain breakthroughs in holographic projection, and its manifestations have gradually become diversified. If not comprehensively summarized, it can be roughly divided into two types: designing and implementing imaging based on projection and reflection principles, and imaging based on visual illusion principles.

2.3.1 Projection reflection principle imaging

(1) Pyramid holographic projection

Pyramid holographic projection imaging typically relies on the principle of light reflection to reflect light signals onto prisms within the cone (Jeon Hosung&Hahn Joonku, 2022). The principle of light reflection is as follows；

$$C = \arcsin\frac{n_2}{n_1} \qquad \text{(Formula 1)}$$

(C is the critical angle) When light strikes the interface between two media, it only reflects without refracting. When light is directed from a dense medium to a sparse medium, the refracting angle will be greater than the incident angle. When the incident angle increases to a certain value, the refractive angle will reach 90.

When optical signals are combined, they form a spatial shape with the image of the virtual object, as shown in Figure 2.

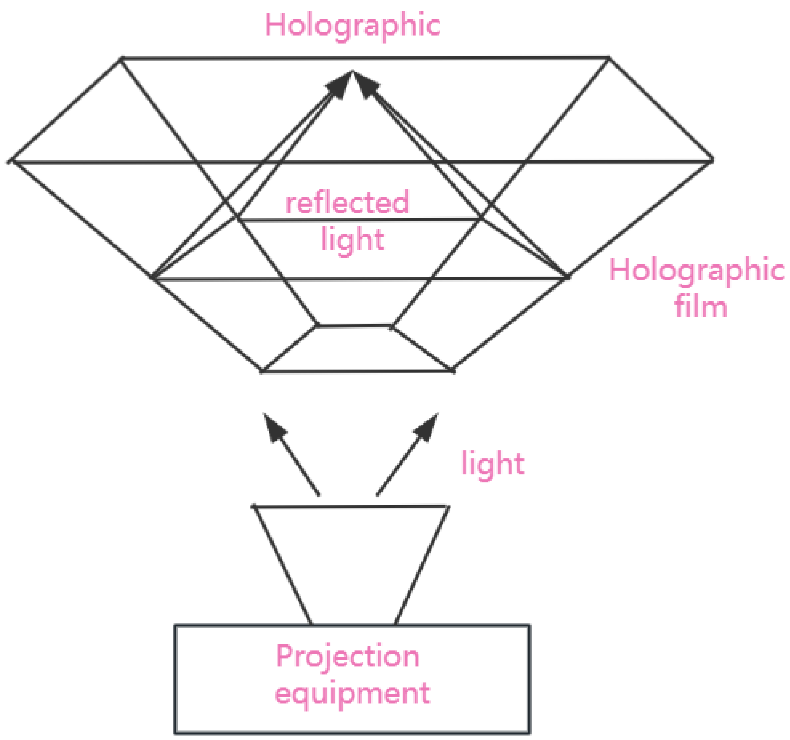

Figure 2 Pyramid holographic projection

(2) Holographic film projection

From the perspective of imaging principle, holographic film projection can allow the audience to see the scenery behind it while maintaining clear imaging. The image quality is 100% clear and bright, and reaches an extraordinary ultra-thin state. The projection film creates a crystal clear visual effect, capturing the curiosity and attention of the audience in the first place, and disseminating high-quality visual information without hindering the display of on-site exhibits (Maddalena Laura, et al, 2022). There is a significant difference from the three-dimensional imaging pyramid, where holographic film projection is not limited by the venue and design, making design and dissemination ubiquitous, allowing inspiration, imagination, and technological fashion to permeate the entire environment, as shown in Figure 3.

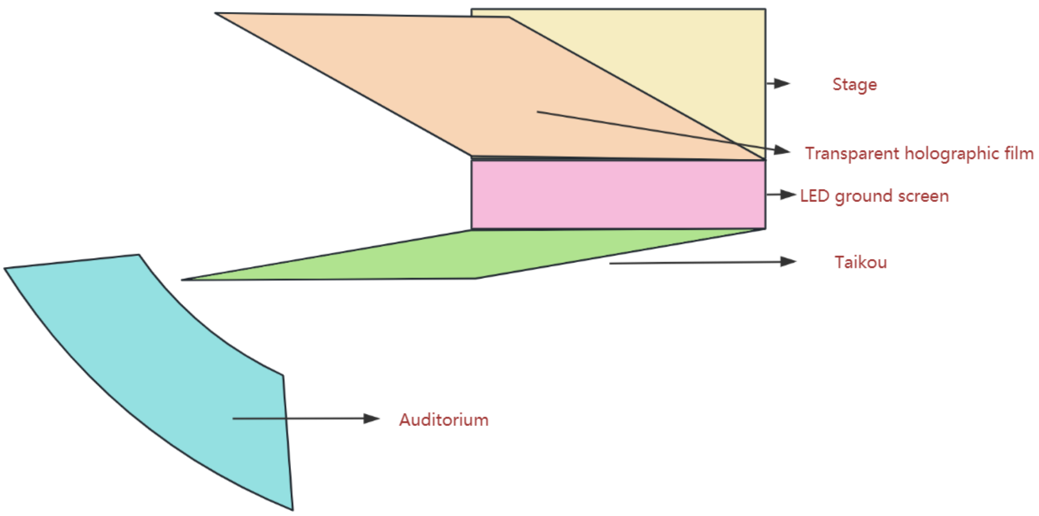

Figure 3 Holographic Film Projection

(3) Water curtain projection

The water curtain projection method should pay attention to the use of equipment to create a large amount of water mist. Tengsheng's water mist serves as a carrier for information display. The image is projected onto the water curtain using a projection device, which cannot create a three-dimensional image effect. Due to the need for additional projection of water mist, it is highly influenced by location and environment (Askari Mehdi&Park Jae Hyeung, 2022). At present, this method is usually mainly used for some large-scale outdoor venues.

2.3.2 Visual illusion principle imaging

The main application of optical illusion principle imaging is holographic fans. It mainly uses the principle of visual persistence of the human eye. The fan blades are equipped with a CNC LED bead array, which forms a continuous dynamic effect when rotating at high speed, deceiving the human brain and causing the objects seen by humans to intersect with each other in three-dimensional space. Everyone has two eyes, each with a viewing angle of approximately 80 degrees, but the viewing angle of the two eyes together is only 120 degrees, which means that the viewing angle of 40 degrees overlaps. Therefore, the things we see with our left and right eyes are different. The information received by our left and right eyes is transmitted to the brain, which makes judgments about the distance between objects, thus forming a sense of stereoscopy. 3D stereo technology is generated by simulating this process (Bantounos Konstantinos, et al, 2022). Before the emergence of 3D projection, it is necessary to take 3D shots of objects at 120 degrees. When watching 3D movies, if you don't wear 3D glasses, the image will appear ghosting or you won't be able to see anything clearly. This is because the screen image is formed by the continuous movement of two frames from different angles, and cannot be achieved with just one frame.

2.4 Holographic projection imaging steps

A simple method is to use the principle of cross interference to record the light wave information of the information object, which is the process of capturing images. The subject cannot be connected to the diffuse object beam under laser irradiation; The other part of the laser, the reference beam of the photographic developer, is irradiated onto the virtual object film, and the effect is superimposed on the object beam to maximize the full interference power (Hsinfu Huang&Chin wei Chen, 2019). Adjust the phase and amplitude of the point. Convert the light waves of an object into space to represent it, and the change in intensity records all the light wave information of the object using the contrast and distance between the lines between them. After processing programs such as development and fixation, holographic images are formed on the film that leaves recording information and disrupts lines.

When the frequency of the simplest matrix of two beams of light is the same and the vibration direction is the same, under the condition of constant internal initial communication signal, it is impossible for the two beams of light to intervene. The composite set light intensity at any point in the interference field is as follows:

$$I = I_1 + I_2 + 2\sqrt{I_1 I_2}\cos\frac{2\pi}{\lambda}\Delta$$

(Formula 2)

In the formula, Δ is the optical path difference between two beams of light reaching a certain point; I_1、I_2 are the intensities of two beams of light, respectively; λ is the wavelength of light.

Interference fringes are trajectories of points with the same optical path difference, and the following two equations are respectively for bright and dark fringes

$$\Delta = m\lambda$$

(Formula 3)

$$\Delta = \left(m + \frac{1}{2} \right) \lambda$$

(Formula 4)

In the formula, m is the interference level of the interference fringes. The optical path difference Δ between two optical paths in an interferometer can be expressed as

$$\Delta = \sum_i n_i I_i - \sum_j n_j I_j$$

(Formula 5)

In the formula, n_i and I_i are the refractive indices of the two optical paths of the interferometer; n_j and I_j are the geometric paths of the two optical paths of the interferometer.

In white light interference, the interference intensity formed by two coherent beams of light can be expressed in a general form.

$$I = R + S + 2\sqrt{R * S} * m(\Phi)\cos\Phi$$

(Formula 6)

In the formula, R and S are the intensity of two coherent beams of light, Φ is the phase related to the depth of the measured surface, and m can be regarded as the contrast, which is related to the spectral composition of the interference light in phase Φ.

According to interference theory, for any surface structure, if a light wave with wavelength λ is used for measurement, the relationship between the depth h of any point on the measured surface and the measured phase Φ is (for reflective measurement):

$$2h = m\lambda + \frac{\lambda}{2\pi}\Phi$$

(Formula 7)

In the formula, m is the order of interference fringes, and Φ is the measured phase,and $\Phi \in [-\pi, \ \pi]$.

Borrowing the principle of diffraction to suddenly reveal the light wave information of an object is a very useful step, which is an imaging process. Regardless of the laser irradiation, the light waves diffracted by linearly recorded sine holograms can usually generate two images, namely ancient images and conjugate images (Ruby Ann Longos Ayo, et al, 2022). The deformed image does not have a strong three-dimensional sense, and the visual effect itself is fake. All parts of the hologram record the light information of the total average point on the object. In principle, each work can also reproduce images of most ancient objects, and can also be exposed through the internet. When the image has been recorded dozens of times and on the same negative side. So the image can also be separated so that it is not displayed or disturbed.

According to the Huygens Fresnel principle, it can be seen as the result of the coherent superposition of secondary waves emitted from any point on the wave surface Σ between S and P at point P, as shown in Figure 4.

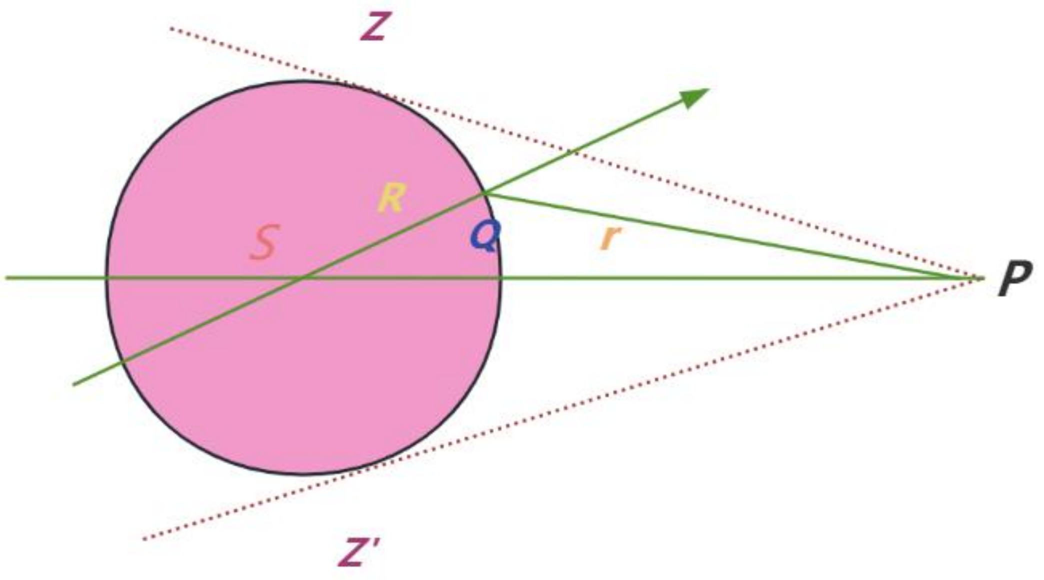

Figure 4 Schematic diagram of Huygens Fresnel principle

The contribution of the secondary wave source on the $d\sigma$ panel to the P-point light field is $\tilde{E}(Q)$.

$$d\,\tilde{E}(P) = CK(\theta)\tilde{E}(Q)\frac{e^{ikr}}{r}d\sigma$$ (Formula 8)

C is the proportional coefficient, $r = \overline{Q}\overline{P}$ and $K(\theta)$ are called tilt factors, which are quantities related to the angle θ (known as the angle of incidence) between the normal of the element wave surface and $\overline{Q}\overline{P}$.

According to Fresnel's hypothesis: when $\theta = 0$, K has a maximum value; As θ increases, K rapidly decreases, and at $\theta \geq \pi / 2$, K=0, as shown in Figure 5.

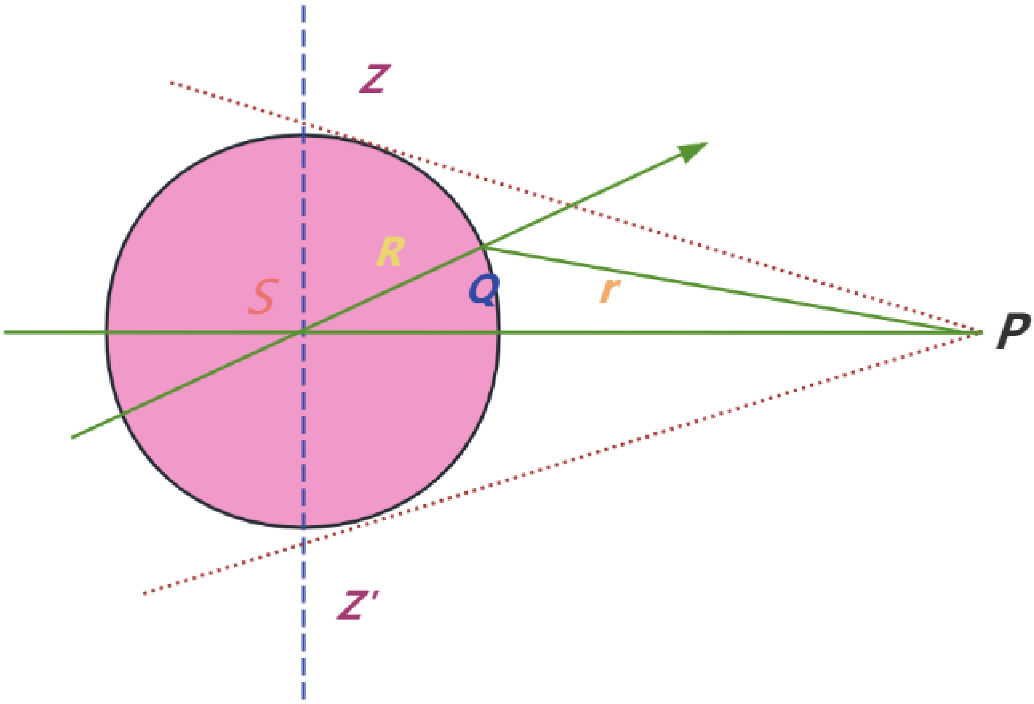

Figure 5 Illustrated Hypothesis of Huygens Fresnel Principle

So the complex amplitude of the light field at point P is

$$\tilde{E}(P) = C\iint_{E} \tilde{E}(Q)\frac{e^{ikr}}{r}K(\theta)d\sigma \qquad \text{(Formula 9)}$$

Another approach is to study the diffraction of a small hole on an infinitely large opaque screen, as shown in the Figure 6:

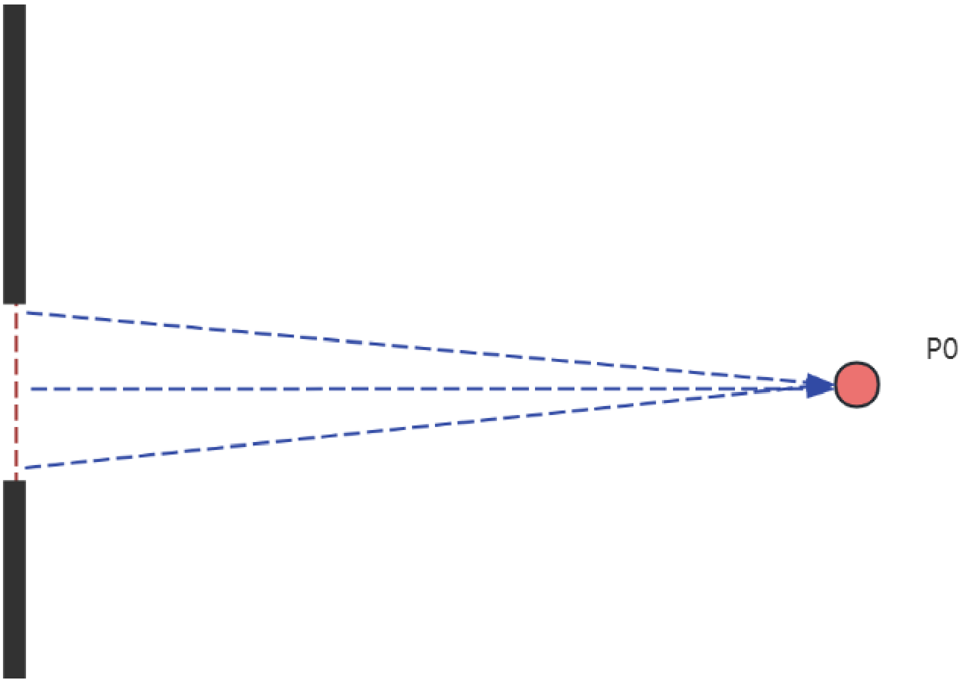

Figure 6 Diffraction diagram of light

According to the Maxwell equations, in the case of vacuum passivity, the optical disturbance U (r, t) satisfies the Helmholtz equation.

$$\nabla^2 U + k^2 U = 0$$

(Formula 10)

P0 is the observation point.

3. Feasibility and Limitations of the Application of Holographic Projection in the Reconstruction of Ancient Building Sites

Compared with other virtual projection technologies, holographic projection technology utilizes a high lumen value projector to project the preprocessed animation and video intended for expression onto acrylic plate imaging film, and finally through diffraction and refraction of light. The similarities and differences between holographic projection and AR technology are shown in Table 2. Currently, popular technologies include aerial interactive projection technology, laser beam technology, and 360 degree holographic display technology (Santos David, et al., 2023). With the maturity of this holographic projection technology, replicas of lost sites in the field of ancient building restoration and protection can be displayed in people's eyes through projection. Among the three existing 3D holographic projection technologies, the third type, a 360 degree holographic display screen, can serve as a projection medium for ancient buildings, and then reproduce them within it. And because it was released in the form of a night view at night, it can save energy and respond to the low-carbon concept at that time.

Table 2 Differences and Similarities between Holographic Projection Technology and AR Technology

Object	Difference		Common ground
	In terms of meaning	From a characteristic perspective	
Holographic projection technology	Holographic projection technology can be called virtual imaging technology. Through projection technology, optical interference, scattering, and even diffraction, very strong three-dimensional images can be obtained.	Naked eye 3D imaging allows for viewing of 3D effects without the need to wear any equipment.	Virtual images can be used to create visual effects, providing excellent interaction and visual experience.
AR technology	Augmented reality: It requires a camera to capture specific objects or images for overlay, and uses a computer to build a model to overlay them into a real environment.	1. Information integration between the real and virtual worlds. 2. Real time interactivity, real-time projection of images based on your position, angle, etc., and interaction. 2. 3. 3. It is the addition of positioning virtual objects in three-	

		dimensional scale space.	

3.1 Feasibility of applying holographic projection in the reconstruction of ancient building sites

As a development prospect, holographic projection is very promising. Although it has not yet reached its mature stage, the initial implementation of prototype technology in the market has greatly surprised the public. Therefore, it is used as an alternative solution. This technology is an important means for the restoration and protection of ancient buildings and is worth utilizing.

Firstly, the holographic projection effect is surprising (Altunişik Ahmet Can, etal, 2019). Nowadays, the more common architectural lighting shows have become the main choice for architectural-themed activities, and the cool dynamic lighting brings endless charm to buildings. As the main research object for the reproduction of ancient buildings, the light show will endow the ancient city wall with value and significance beyond the VR reproduction of ancient buildings, and even more directly attract people to come to ancient buildings and moats. New ancient buildings reappear in front of the world, and through dynamic forms, the shock to society will multiply.

Secondly, the principle of holographic projection can be applied to ancient building replication projects. As long as you design the content you want to project and then use the device to project it onto existing media, you can reproduce ancient buildings in the air. Due to the presence of media projection in the air, there is a gap between reproductions (Yao Lichun and Yang Weiping, 2023). The difference between ancient buildings and these cases is only due to their size and geographical environment, so as long as we act according to principles, it is very possible to reproduce those ancient buildings.

Thirdly, the holographic projection effect can perfectly complement the reproduction of ancient buildings. Among all current technologies, holographic projection is the closest to reproducing ancient architectural targets, as long as it can overcome the problems of placement of projection equipment and oversized city walls. For example, Beijing at night reproduces the majestic ancient city walls of the past, while showcasing the perfect integration of technology and ancient architecture.

In short, holographic projection can provide the most surprising architectural projection effects on the market today.

3.2 Limitations of holographic projection in the reconstruction of ancient building sites

As far as the existing 3D holographic projection technology is concerned, the holographic projection technology currently applied in research and practice is still far from large-scale use and commercialization. There are still imperfections and immaturities in the research of reconstructing the original site of ancient city walls.

Firstly, the existence of projection media. Due to the immaturity of existing 3D holographic projection technology, the projection of ancient buildings still requires media to complete the process in the air. However, for ancient buildings such as ancient city walls, the quantity, height, and width of ancient city walls are not comparable to ordinary buildings. With such a large-scale media layout, the city walls may cause some damage to the existing ancient city (Chen Dan, 2022). Compared to the original intention of protecting ancient buildings, the gains outweigh the losses. More importantly, regardless of the medium used, once the layout is perfect, apart from the darkness at night, it does not match the overall style of ancient buildings during the day, which is also a certain degree of damage.

Secondly, the problem of large volume projection. Holographic projection technology is currently widely used for dynamic lighting displays inside and outside buildings, or for interior decoration effects. The actual technology used for projection stage is widely used for real estate room displays and modern party stages. This is the case in the holographic projection process. When using projection, the volume must be relatively small to achieve a true effect (Xiong Weixiang and Li Yang, 2018). Therefore, coordination between equipment may encounter problems when repairing ancient buildings.

Thirdly, there is limited practical project experience. There are very few projects in real life that use holographic projection and VR to reproduce ancient city buildings. Therefore, if we accumulate practical experience in the application of holographic projection technology in the reconstruction process of ancient building sites through practical cases, it may not be possible to achieve this. Therefore, problems and obstacles encountered in the practical application of holographic projection technology cannot be solved in a short period of time. Breaking through these problems and obstacles requires continuous trial and error in various processes in order to ultimately complete the project progress.

Fourthly, the holographic projection imaging process is complex and costly. The complexity of the imaging process is limited by the development of modern technology, so applying holographic projection to protect ancient buildings is a challenge and a new attempt.

Overall, the requirements for using holographic projection are relatively strict. The large size of ancient buildings, the immaturity of the technology itself, the complexity of the projection process, the pressure of funds, and the lack of practical experience have all caused difficulties and technical problems in implementation.

3.3 Research on the Application of Holographic Projection in the Reconstruction of Ancient Building Sites

When using holographic projection technology, unlike VR technology, we must strictly and carefully investigate the surrounding environment of ancient buildings, as holographic projection has high requirements for the brightness of the environment (Yu Jialong and Wu Man, 2021). So we need to find a method to ensure that the ambient brightness meets the standard and complete the projection steps. The project plans to use holographic projection technology at night to ensure that the light environment of the building is not affected by sunlight and various types of building reflections, thereby better reproducing the original site of the ancient building.

Similar to using VR technology, the most important aspect of holographic projection is the final model effect used for display. Only by accurately reproducing as much as possible can we achieve the desired effect of crossing time and space to reproduce the original site of ancient architecture. Model restoration is only the beginning of the successful application of holographic projection, and ancient architectural models must be photographed from various angles. Angular deviation greatly reduces the overall influence of building models, making them much worse than before (Li Yueyue and Su Liping, 2023). Therefore, continuous effort and angle correction, as well as subsequent debugging and lighting processing, are important steps.

In addition, holographic projection, like VR, also requires the layout of projection equipment, as some ancient buildings are taller than other public buildings. Therefore, when investigating the surrounding environment, whether there are high-rise buildings nearby that can install projection equipment. It is an important factor in selecting existing ancient buildings.

The emergence of holographic projection has made virtual reality increasingly popular. Although this technology is still in the development stage and not yet mature, people's imagination and expectations of it have made its future clearer (Tu Fangdi, 2022). The application of holographic projection in the field of ancient building protection can open a new chapter in the protection of ancient buildings in China. It can not only practice the policy of "repairing old as old", but also promote the application of modern technology. To some extent, encourage ancient architecture to keep up with the times and move towards modernization.

4. Application Cases of Holographic Projection in the Reconstruction of Ancient Building Sites

4.1 Kaifeng Historical and Cultural Street

Kaifeng Historical and Cultural Street is one of the core cultural areas of Zhengzhou, with rich historical and cultural heritage. Zhengzhou, which has a strong "Song culture," and Xi'an, which has "Han Tang culture," as well as Beijing, which has "Ming and Qing culture," are listed as the three major cultural pillars. In the process of building an international tourist city in Kaifeng, it is necessary to improve the quality of "Song culture" and open it up for sharing (Makowski Micha ł, Et al., 2019). Therefore, the designer created a three-dimensional digital tourism system for the Kaifeng Historical and Cultural Street. Firstly, 3D modeling and simulation reproduction of cultural streets are carried out through VR and other technologies to construct a virtual street tourism system; The second is to use holographic projection technology, combining virtual and real, to project historical figures into real scenes through the air. For example, using holographic projection technology to reproduce the character of Teresa Teng and return to the human world, singing duets with Jay Chou, as shown in Figure 7. For example, when tourists go to a place, they can see historical celebrities discussing poetry, reciting poetry, and experiencing romantic events. By reproducing various allusions of past culture through holographic projection, one can not only experience the ancient life scenes in front of their eyes, but also create a sense of novelty. Therefore, Kaifeng Historical and Cultural Street utilizes modern technology to create modern and fashionable tourist attractions in line with the trend of the times.

Figure 7 Application of holographic projection technology to Deng Lijun's return to the world and Jay Chou's choir

The emergence of holographic projection technology allows tourists to experience the illusion of traveling through time and space even without VR-related electronic devices. It is magical and can add fun and attraction to the travel experience, making it a popular cultural avenue. The cultural and commercial values they bring are also diverse. The use of holographic projection technology is certainly not limited to this, but the correct and appropriate use of the technology also requires consideration and research.

4.2 Shangqiu Hanliang Cultural Park

On the occasion of the National Day and Mid Autumn Festival in 2020, a large-scale 3D architectural projection show titled "Stars Shine and Moonlight" was staged at the Hanliang Cultural Park. Its clever and colorful lighting effects add new charm to the ancient architecture of Yaohua Palace. This projection show, a brand new fusion of classics and technology, incorporates modern and complex algorithms such as neural algorithms and 3D adjustments on the basis of cultural heritage (Suzuki Kohei, et al, 2019). Holographic projection adds dynamic magic to the three-dimensional architectural movement, making the viewing effect more diverse and highly visually impactful and surprising. The organizer designs 3D dynamic projection content and projects it into the building. Through an image fusion system, the 3D image is integrated into the entire physical structure of the building, providing a beautiful light and shadow effect for the building at night, thereby attracting tourists. People traveling at night can also use this dazzling effect to stimulate tourists' consumption, realizing the transformation of cultural value into architectural value, and then into commercial value. It can be said that it is a new form of integration of humanities, history, and technology.

4.3 Paris Notre Dame de Coeur Light Show Performance

At the beginning of 2017, Notre Dame de Paris celebrated the 100th anniversary of World War I with an architectural projection lighting show, commemorating and paying tribute to the heroic deeds of World War I. It tells the regrettable story of a soldier who died in war and was unable to see Notre Dame in Paris with his own eyes. At the end of the light show, the soldiers and comrades gathered in the form of souls under Notre Dame in Paris to fulfill their lifelong wishes, as shown in Figure 8. Architectural projection is not only a simple combination of culture and technology, but also provides inspiration and profound historical thinking (Kikukawa Shoki, et al, 2019). Holographic projection is a new digital technology that can provide dynamic effects on almost any planar projection material. Projecting art videos onto the exterior walls of buildings creates an organic combination of motion and stillness, bringing vitality to static architecture. In the utilization of ancient architecture, the cultural connotations of ancient architecture are discovered, and its classic historical stories are discovered. Combined with the restoration of technology, people are reminded of the history of ancient architecture or human history. Holographic projection technology is the best way to showcase ancient architecture.

Figure 8 Performance of the "Dame de coeur" lighting show at Notre Dame Cathedral in Paris

5. The significance of applying panoramic projection technology in the reconstruction of ancient building sites

5.1 Leveraging the Value of Ancient Architecture

Because some ancient buildings are built in areas with closed traffic, their value cannot be fully utilized. Holographic projection technology can display a virtual experience that is the same as reality, and enhance network technology to unify archaeological research data and cultural heritage sources, which can be disseminated domestically to the public without affecting the safety of ancient buildings (Ito Yasuo, et al, 2019).

5.2 Improving the level of ancient building protection technology

The ancient buildings in our country are rich in color and have diverse shapes. However, due to the influence of materials, the surface is prone to embrittlement, discoloration, peeling, and other phenomena. Even after manual repair, it is still difficult to save and preserve. The use of holographic projection technology to display images of ancient building restoration can assist in the color restoration work of ancient buildings and verify the feasibility of restoration technology; The combination of holographic projection technology and the Internet can showcase cultural relics in all aspects. Computers that allow the storage of real data from ancient buildings can help extend the lifespan of ancient buildings in more stringent environments.

5.3 Facilitate comprehensive display of ancient buildings

Holographic projection technology can record real scenes and restore the authenticity of the scene as much as possible. Its form is novel and its content is rich. In addition to interactively observing the scene itself, content such as text, audio, video, and hyperlinks can also be added. It has the characteristics of short production cycle, low image display cost, and strong timeliness. In general, the requirements for devices capable of playing holographic projection technology are not high. Ordinary mobile phones or computers can open the system and play it.

5.4 Extending the Storage Cycle of Ancient Building Materials

Traditional camera shooting is limited by the shooting angle and cannot participate in accurate calculation and description of the shooting part, and cannot generate more data information, affecting the correlation and direct input of digital information. Holographic projection technology can integrate digital information, program loading time, textual information and other data information with the platform, fully record the personnel, materials, mechanical equipment, technical solutions, processes, meeting minutes and other information during the construction process, and provide detailed explanations of shooting problems or issues during the shooting process. Please refer to the access record for details, and provide more information on the ongoing drawing program, Provide data assurance for the historical needs of information tracking throughout the entire project process. Panoramic photos can also form image data related to construction techniques, procedures, methods, and effects, making it easier to understand and preserve for a long time.

6. Conclusion

The application of holographic projection technology in the reproduction of ancient building sites has broken the boundaries of time and space, providing new perspectives and virtual experiences for the development and promotion of ancient buildings. At present, holographic projection technology has been widely applied in the fields of reconstruction systems and ancient building reconstruction. Relying on holographic projection technology, the structural beauty of modern Chinese ancient architecture can be displayed from multiple angles, effectively recording and protecting these national treasures, achieving digital management of ancient architecture, and protecting, automatically repairing, and inheriting ancient architecture. Holographic projection technology allows more people to travel through ancient architectural attractions with just the touch of their fingers, and experience the historical landscape and humanistic feelings brought by ancient architecture when witnessing or observing with their own eyes. However, the combination of holographic projection technology and ancient architecture not only provides a new technical method for the protection of ancient architecture, but also has important application and guiding significance for the protection of other ancient cultural heritage in China.

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