

Exploring virtual reality technology in high-rise building design to enhance user experience

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Abstract:

With the continuous progress of design technology and science and technology, virtual reality (VR) technology is used broadly in architectural design. Since the early twenty-first century, skyscrapers have appeared more and more in the world, and the complexity of their structure and the diversity of their functions often make the design not comprehensive. Through virtual reality, high-rise design provides a highly reproducible, detailed simulation of real-time collaboration platforms between designers and users. In this way, it improves the efficiency of project design and enhances the user experience.

Keywords: virtual reality, high-rise building design, Characteristics of users, experience of users

1. Introduction to virtual reality technology

The application of virtual reality technology in design, mainly the actual drawings presented in the three-dimensional environment, uses software technology and consists of components of a realistic effect, real-time interaction, and three-dimensional virtual space. Using virtual reality technology in high-rise building design can bring designers ideas and innovation and create positive communication between designers and users. Through virtual reality, technology can promote the design towards a broader prospect.

1.1 Development of virtual reality technology

Virtual reality technology was proposed in 1935 in the United States science fiction novel. There is the

concept of the virtual reality germination stage. In the 1960s, American computer scientist Ivan Sutherland put forward the notion of virtual reality and developed the first virtual reality system. Since the 21st century, virtual reality technology has grown rapidly, and the software development system has continuously improved. Virtual reality technology is gradually applied to architectural design, enabling designers to communicate with customers, exchange ideas, and reduce unnecessary rework and modification.

1.2 Characteristics of virtual reality technology in high-rise building

1.2.1 Immersion

Immersion is the most important feature of virtual reality technology. It allows users to move freely in immersive environments and feel the changes in the surrounding space, making it seem as if they have

entered the real world.

1.2.2 Interaction

Interactivity means the user can operate in real-time in the virtual environment through the VR device using voice messages and gestures in the virtual world. It is a good way to change the architectural design.

1.2.3 Imagination

Users can interact with their surroundings in a virtual space and expand their thinking through sensory and cognitive abilities, such as virtual modeling and creating scenarios that allow users to express and create freely.

2. Difficulties of high-rise building

2.1 Control of high-rise building scale

In High-rise architecture projects, traditional two-dimensional drawings and 3D reddening make it difficult to control the building design scale so that the building can be beautiful and coordinated with the entire city design. Whether high-rise commercial or high-rise residential, it must be combined with its architectural style and the surrounding city buildings in harmony with the designer's excellent design capabilities.

2.2 variety of public space layout

There are plenty of public spaces in high-rise buildings, such as the lobby, restroom, elevator, and sky landscape. The design needs to consider the requirements of work and life. When architects design, they must meet the different requirements of different users.

2.3 Difficulties of structure

High-rise buildings have high requirements for structural design and layout, requiring designers to consider the structure and rationalize the layout of the building space simultaneously. Designers of different specialties need to collaborate to complete the design, which can cause information asymmetry in the design, resulting in losses.

3. Characteristics of high-rise building users

In traditional building design, the end buyer of the building often considers the user. The quality of the building design usually determines the user's experience. However, in the overall design of high-rise buildings, the end user is not the only user. In the procedure of high-rise building construction, there will be multiple users from different aspects. In the architectural planning and design stage, the

relevant government needs to understand the match between the program and the corporate planning of the city. They also need to be concerned with the project standards. Traditional two-dimensional drawings and three-dimensional renderings make it hard to achieve the effect of the immersive experience. Virtual reality technology enables government departments a platform to understand the fit between the project and corporate city planning.

In the formal design phase of architectural design, developer companies use virtual reality technology in a virtual environment to allow designers to clearly understand the developers' understanding of design intent, as the developer needs a better design and more savings in capital expenditure. The traditional program discussion, through the drawings, the effect of the PPT report the way, boring and a single, in the design of high-rise buildings, the complex functional requirements, molding characteristics, are the need for much time to communicate. In the virtual reality platform, the developer can discuss the program with the design on a unified platform, avoiding wasting time and resources for repeated modifications.

In the delivery stage, the final users of the high-rise building have their own needs for using the building before the purchase. They do not have enough professional knowledge, so obtaining the information they want from the drawings and publicity is hard. They need to understand the layout of the high-rise, the lumens of the house, and some spatial perception information immensely. As users, they want to understand the layout and decoration of the buildings.

4. Application of Virtual Reality in Tall Building Design

In High-rise building projects, people can use virtual reality technology to represent the structure and the elevation of the buildings into visible objects and environments. In the early stage of design, designers can simulate their ideas through virtual reality and see the effect in advance in the virtual environment, which saves time and reduces costs. Because the design of high-rise buildings involves many professional fields, a specialized designer can not complete the work independently; it is necessary to complete several professional departments together. Although the collection of various professional discussions together, many problems are unpredicted, resulting in much rework and terrible effects. The methods of using virtual reality technology are sophisticated and closer to the base of the architectural design industry, and it is a kind of information technology sharing assistance under today's data sharing. In the current era of construction digitalization,

the combination of virtual reality technology and architectural design is a breakthrough in traditional architecture because it is more scientific and valuable, with the development routine of the times, to promote the development of construction digitalization and to promote the intelligence of the construction industry.

4.1 Virtual reality technology immersive experience

Virtual reality technology in high-rise building design can give designers and users an immersive experience of the architectural design process; compared with traditional drawings, users can experience the architectural design process in a virtual reality environment. By establishing a virtual space, the user can move freely in the space and feel the design characteristics of high-rise buildings; it can solve the problem of scale sense. In the virtual reality immersive experience, the user and the designer can be outstanding in the virtual space to feel the scale of the building and the coordination of the surrounding buildings.

4.2 Interactive Virtual Reality Experience

Virtual reality enables interactive decision-making in design, refining every step from concept to completion. Space planning is the cornerstone of architectural design, determining the functionality and comfort of a building's interior environment. Through virtual reality technology, multiple designers and users can visualize and design different layout scenarios in an immersive, interactive, three-dimensional space. This virtual space can simulate a sense of space and scale not available in 2D drawings. In terms of material and color selection, virtual reality technology can provide a highly realistic feeling of material and color, avoiding the distorted performance on drawings and renderings, resulting in inconsistency between the effect and feeling after completion. At the same time, the light design is also a significant part of the design of high-rise buildings. Virtual reality technology can help architects understand the light conditions of the project site better, and the design can be simulated through virtual reality technology's light conditions for optical design. The design can quickly and efficiently change by simulating the natural light and, according to the user's different use of the function, simulate the optical scene in different environmental scenarios. Virtual reality provides a comfortable optical environment for the user and reduces energy consumption through the rational use of natural

light. This real-time interaction allows the design team to interact with the user in real time and modify the program to ensure its feasibility while meeting the user's needs as much as possible.

4.3 Conceptual Use of Virtual Reality Technology

The conceptual use of virtual reality technology provides designers and users with a visualization and immersion platform. In traditional architectural design, drawings are the most direct way to express ideas and programs, but complicated flat drawings require users and designers to have good spatial imagination. At the same time, it is difficult to show the richness of conceptualization in two-dimensional drawings, and every change requires modification and adjustment of drawings. On the contrary, in the virtual reality scenario, the user can freely conceptualize the design, and each design concept can be efficiently completed through the equipment without having to go to a wide range of drawings to modify.

4.4 Virtual Reality Technology in High-Rise Building Design User Evaluation

Virtual reality technology can be used to evaluate user experience in building design. Through virtual reality technology, designers can create virtual environments to allow users to understand the program better; the traditional designer and the user communicate the program through two-dimensional drawings and renderings, making it difficult to fully express the designer's intentions. With virtual reality technology, architects can let users experience the design program better through a simulated virtual scene. In the virtual environment, the feedback of the user's immersive experience is evaluated to optimize the design solution. This immersive experience improves the quality of the design as well as the satisfaction of the users.

4.5 Based on the application of virtual reality in the design process of high-rise buildings

The use of virtual reality technology provides a platform for architectural design. Compared to the traditional large number of drawings, the BIM modeling system can be more straightforward to find problems in the architectural design process. Many of the issues that are difficult to express on the drawings can be found and solved before construction. Therefore, the writer developed a complete design workflow based on virtual reality. As Figure 1

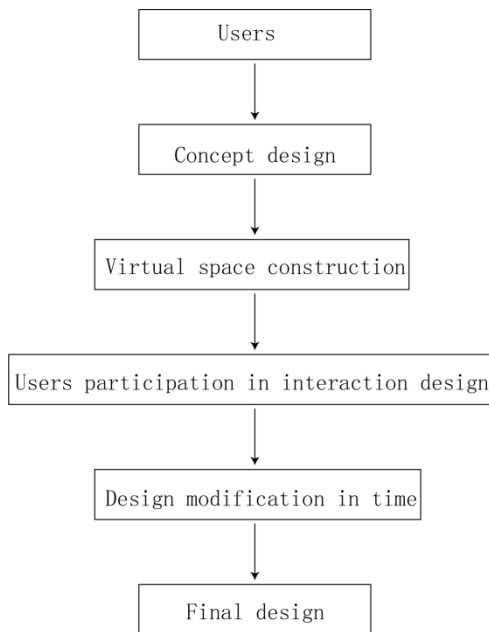


Figure 1 Workflow of VR in design

5. Results

Through the use of virtual reality technology in the application of high-rise design, the designer and the user have a robust platform that can be exchanged so that the architectural design from the beginning of the program can provide the designer and the user with an immersive platform to participate in the design process, through the creation of a virtual building model, the use of different material mapping in various areas, and the freedom to participate in the design of virtual scenarios, to The designers and users can express their ideas interactively. Through the immersive experience and real-time conceptualization, a high level of design efficiency is realized in the whole life cycle of the building, thus improving the feeling of all users in the whole process of building design. A complete design and construction workflow is formed using virtual reality technology as a platform by applying virtual reality technology at every stage of the architectural design process.

6. Discussion

The traditional BIM design achieves the purpose of visualization, but the overall BIM design shows the process, and the user is only passive participation; the BIM degree of specialization is relatively high for the ordinary user. According to their ideas, it is often difficult to change the design. For the designer, each change is a reworking of the preamble. Additionally, It is hard to show the designer's intention directly in the perception of space and the use of

materials. By adding virtual reality to the design process, users can easily understand the design process and ideas in an immersive way, which could allow them to add their suggestions and modifications to the design in time.

The traditional design is through the floor plan and three-dimensional rendering of the way to show the design concept, in the perception of space, the use of materials, because it is difficult to show the designer's ideas directly, but also difficult to let the user experience and perceive the characteristics of the program. High-rise building design is a multifaceted and complex process, usually requiring different professional architects and time to invest in collaborative design simultaneously. Some unnecessary errors will waste time and money. With virtual reality technology, a platform can be given to designers and users at the early stage of the period so that designers can have a clearer understanding of the user's needs and thus get more positive feedback from the user in the design. The layout and details of the space and the spatial scale can also be better experienced by the users in a more immersive way in the design. The problem of the sense of spatial scale is also effectively solved with virtual reality technology.

Virtual reality technology can reduce the cost of design and avoid repeated labor. In traditional projects, the designer usually needs to communicate with the users many times to make modifications. Because many design problems in the drawing stage are difficult to find, only the construction stage can be solved. Advanced design and construction simulation could give users a perfect plan with virtual reality. This not only lowers rework costs in construction but also improves construction efficiency.

7. Conclusion

In the case of high-rise buildings with complex majors, complicated functions, and many users, virtual reality design has become an indispensable part of high-rise building design, providing a powerful tool for architects to create and show their ideas. The user's participation can satisfy the design and minimize the design contradictions. At the same time, virtual reality technology needs to use better equipment to show the experience of design, which is also a central problem in using virtual reality technology in architectural design. In the future, with the continuous development and improvement of virtual reality equipment and carriers, virtual reality technology will be more commonly used in every stage of architectural design.

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