

# Application of Virtual Reality Technology in Architectural Design

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**Abstract.** Virtual reality technology is a new technology that transcends the boundaries of space and time. It has not only changed my life, work, and behavior, but also guesses that it will continue to affect. However, relying on traditional architectural design patterns can no longer meet today's science and technology. Development needs. Construction design has the nature of imagining the future and thus coincides with the expression of the will of virtual reality technology, so the application of virtual reality technology to architectural design is an inevitable development trend.

**Keywords:** Virtual Reality; Architectural design; Application.

## 1. Introduction

The term virtual reality was first coined by Jay Lanier of the United States in the 1980s. Virtual Reality (VR) is a simulation computer system that can create and experience a virtual world. It was first used in the military and aerospace fields. A brand-new 3D space simulation environment. Virtual reality provides visual, auditory, tactile and other related sensory simulations to the user, making it immersive to the scenes and things in the virtual environment. You can freely observe things in three-dimensional space, and even manipulate things in three-dimensional space, so as to truly realize human-computer interaction.

## 2. About Virtual Reality

The development of virtual reality technology always revolves around its three characteristics, namely immersion, interactivity and imagination. The first feature of virtual reality technology: immersion, computer technology simulation produces a highly realistic three-dimensional simulation space, so that users feel as if they have entered a real objective world, and a sense of immersiveness is produced on the senses. The second feature of virtual reality technology: interactivity, which means that users can interact with things in the virtual environment, and even manipulate things and communicate in the virtual scene. The second feature of virtual reality technology: imagination, virtual reality scenes can transcend the limits of the real world, and can more ideally present the designer's ideas, and turn the thinking concept into a tangible and perceptible three-dimensional space. Breaking the constraints of the traditional objective world for free thinking can inspire creative thinking.

Early virtual reality technology used stereo glasses, sensing gloves and other related sensory auxiliary devices to generate a three-dimensional stereo environment. The computer terminal transmits the internal space simulation information to the connected sensory auxiliary device, and then the sensory auxiliary device sends the information to the user in the form of perception such as sight, hearing, and touch. The sensory auxiliary device receives the information and then feeds back the user behavior to the computer terminal to make corresponding adjustments. This is to achieve the most basic human-computer interaction. However, with the continuous development and improvement of scientific technology and simulation technology, today's virtual reality technology has also begun to develop in many fields. With the help of virtual reality technology, architectural design can effectively solve the limitations in design expression.

### **3. The Impact of Virtual Reality Technology on Architectural Design**

Before the popularization of computer technology, traditional architectural design mainly used two-dimensional modes such as flat, vertical, and cross-section drawings as the main means, and three-dimensional graphics were also expressed in the form of two-dimensional drawings. With the development and wide application of computer technology, the emergence of computers and related supporting software has greatly improved the designer's work efficiency, and the design field has begun a revolution that 'throws away drawing boards for design'. The application of AutoCAD the drawing pen, tool ruler, drawing board, drawing paper and other tools of traditional architectural design have gradually been replaced by computers. Until the extensive application of software such as 3DSMAX and Sketchup in the field of architectural design, it has gradually moved from the two-dimensional era to the three-dimensional era .Although there are various expression methods such as architectural drawings, miniature models, renderings, 3D animations, etc., they can communicate the design information to users in a more complete and rich manner, and facilitate the mutual interaction of technical staff in various positions during the implementation of the design plan. Communication. However, there are still many disadvantages. Although the architectural design has developed to a three-dimensional model by this time, it is only a development process and not the end. For example, architectural renderings and three-dimensional animation textures are becoming more and more realistic. It's getting richer and richer, but it has a strong performance effect, but people at this time, it is in a passive state, it can only accept the information passed to you by the screen, and it does not have real-time interactivity. Most of the miniature models have been reduced in scale and displayed in a bird's-eye view, but they cannot be viewed from the perspective of normal activities and patterns to experience, lack of authentic experience.

With the continuous development of today's virtual reality technology and its application in architectural design, let the design realize the transformation from "interface to cyberspace". Users will be able to perceive things constructed based on the real world in a virtual space, roam a variety of real-time interactive operations at any time in the constructed virtual space, and touch, change perspectives, locations, routes, etc. as they please Feel the scene changes and effects in the virtual space. For the essence of architectural design imagining the future, all the experience and knowledge of the designer is to point to the next new design. The feedback of the future space provided by virtual reality technology is invaluable to the designer. It also shows that virtual reality is a future tool for architectural design.

### **4. Application of Virtual Reality Technology in Architectural Design**

Before the advent of virtual reality technology, architectural design was limited by expression tools. The design concept can only be expressed based on the designer's past experience and tools that are incomplete. However, the construction of physical buildings is an almost irreversible process. Unfortunately, it must be a problem left after many buildings are completed. However, the emergence of virtual reality technology enables the design to be completely and truly presented without actual construction, so that it can be evaluated in the process of experience, identify problems and modifications, avoid design errors, and make each design eventually perfect.

#### **4.1 Visualize Design Results**

Virtual reality technology can present the design effect in a real state, and can show the design scheme in an all-round way at an ideal angle. It breaks the traditional architectural design and can only be combined with its own subjective imagination through drawings, renderings, etc. Imagine the final physical effect. This enables the designer to accurately express the details of the design and also facilitates the user to intuitively understand the final design effect. The two sides of the design can make adjustments to the existing scheme in a timely manner after communicating and communicating. Virtual reality technology will be able to present the overall architectural design and environment, such as terrain, human landscape, traffic planning, and bridges are all represented in virtual spaces, making the design more viable and the user 's understanding of the design more

profound. Users can also express their feelings and suggestions in a timely manner, increasing the communication between users and designers, and adjusting more ideal solutions.

#### **4.2 Carry out Scheme Selection and Interactive Optimization Design**

In the process of architectural design, the designer uses computer technology to design and compare multiple screens based on different needs, backgrounds, and environments, and conducts a comparative analysis to select an optimal one. Virtual reality technology can increase the interactivity of the architectural design, and can switch between different scenarios at any time during the interaction, in order to compare and analyze the details of different schemes, weigh the advantages and disadvantages between different schemes, and modify them more efficiently. At the same time, you can compare the plan before and after the modification, and make adjustments to select the most suitable plan. Furthermore, in the process of design deepening, virtual reality technology is more convenient for professionals to understand the design concept, reducing conflicts between related professionals and increasing communication between them, making the design scheme more scientific.

#### **4.3 Effectively Save Investment and Operating Costs**

During the design process, virtual reality technology shows designers and users a full range of effects, provides repeated browsing and comparison, and makes timely amendments to the shortcomings of the solution. Users no longer rely on imagination to imagine the effect of the final construction of the building, and can experience the most realistic works directly through virtual reality technology. Designers can modify the most satisfactory plan according to user needs and carry out construction according to the final plan. This can effectively avoid reverse repair after the construction is completed and greatly reduce investment and operating costs.

#### **4.4 Demonstrate Building Construction Technology**

The construction project is mainly developed and completed by the design unit, construction unit and construction unit, but the project is first implemented by the architectural design, so the designer must consider the overall situation during the design process, not only the construction The unit's requirements for the design of a construction project must also consider the possibility of implementation of the construction technology of the relevant construction unit. Therefore, it is particularly important to demonstrate the feasibility of the construction technology. Virtual reality technology can simulate the construction of a building to verify whether there are safety and scientific quality problems caused by construction technology during the construction process, and accordingly modify the design plan to avoid major accidents and ensure the safety of the design plan Reasonable and practical.

### **5. Realization Method of Virtual Reality Technology in Building Design**

Virtual reality technology involves a wide range of fields, and it needs more in-depth research and development to mature and steadily apply it to architectural design. From the above, it can be seen that the application of virtual reality technology to construction design can not only display the design results intuitively, but also carry out scheme screening and interactive optimization design, effectively save investment and operating costs, and demonstrate building construction technology. It is possible to place the user in a real experience design effect in a virtual space. It can be seen that the widespread application of virtual reality technology in architectural design will be a historic impetus. After relevant analysis, the current application of virtual reality technology in architectural design is mainly divided into two aspects: software and hardware:

#### **5.1 Virtual Reality Hardware System**

For virtual reality technology to fully realize the three characteristics of immersion, interactivity, and imagination, professional sensor receiving and output devices are needed. The sensor receiving

and output devices include data gloves, force feedback steering wheels, and stereo glasses. Users can input their actual behavioral activities into the computer through the sensing device and then map them to the virtual environment. The sensing device plays a media role in the interaction process with the virtual environment. The orientation tracking device can map the obtained user behavior to the virtual space in a more accurate and timely manner. The virtual space uses computer computing to feedback information to the user through sensory perception through sensory devices, allowing the user to perceive the visual, auditory and tactile aspects in a virtual way. Space and harmony are the virtual reality of architectural design.

## 5.2 Virtual Reality Software System

In order for the virtual reality technology to allow users to truly experience the immersive immersion in the space they establish, first they need to build a virtual three-dimensional model that meets the design concept expectations or is consistent with the objective world. This model needs to accurately represent objective things such as buildings, environment, and space. It also needs to process the performance of colors, materials, shadows, and lighting. The main steps of constructing a visual virtual three-dimensional model are: first, geometric modeling, which mainly constructs the three-dimensional geometric structure in the virtual space; second, image modeling, which mainly performs color, material, shadow, and lighting performance based on geometric modeling Processing; the third is behavior modeling. It mainly describes the trajectory and behavior of things. Geometric modeling can mainly be realized by software such as 3DSMAX, AUTOCAD, SKECHUP, MAYA, REVIT. However, with a three-dimensional model, you need to implement image modeling through image special effects processing software such as PHOTOSHOP, AE, and Combustion, and describe the physical characteristics of the model in detail and special effect processing to improve the realistic visual effects of the scene., Materials all express different feelings. The above are all expressing the lifelike static three-dimensional space environment, then the behavior modeling is the dynamic characteristics embodied, which makes the static model interact with the user. In different behaviors of the user, such as walking, running, flying, etc., the change of the surrounding environment movement can be felt through the first-person "viewpoint", which can be achieved through a virtual camera. Make the whole environment, perspective, including changes in optical fiber can be moved to achieve a realistic virtual reality space.

## 6. Conclusion

The application of virtual reality technology in architectural design has an important role in promoting the development of the architectural design field. With the continuous improvement of virtual reality technology, it will also provide a wider space for architectural design. At the same time, virtual reality technology has brought new ideas to architectural design. As long as continuous experimentation and deepening can make architectural design continue to develop.

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