Application of Virtual Reality Technology Based on Bim in Architectural Engineering Design

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Abstract: With the rapid growth of sci & tech, the new technology in architectural engineering has also advanced by leaps and bounds, and the traditional two-dimensional design method of architectural engineering can no longer meet the needs of modern society. Building information model (BIM) and virtual reality (VR) technology are the important foothold for the comprehensive and optimized combination of information technology and architectural engineering design, and provide effective technical and platform support for solving the current design problems of architectural engineering projects. This article discusses the application of VR based on BIM in architectural engineering design, in order to realize dynamic management of engineering data on this basis, so as to improve the construction efficiency of the whole architectural engineering and promote the further improvement of architectural engineering design level.

1. Introduction

The functions, facade modeling and internal streamline of buildings tend to be diversified, and the requirements for structural, electrical, equipment and other matching majors are gradually improved[1]. BIM and VR are the important foothold to realize the comprehensive optimization of information technology and architectural engineering design. As the results of innovative use of modern information technology, they provide effective technical and platform support for coping with the current design problems of architectural engineering projects[2]. BIM runs through the whole life cycle from design, construction to operation of a building project, and its effective application can bring huge economic benefits to all stages of the project[3]. The application of BIM can not only improve the quality and efficiency of construction project design, reduce the rework rate during construction, but also ensure the smooth completion of construction period and save project funds[4]. The application of BIM and VR can integrate the construction data of building engineering and determine the three-dimensional model of building engineering[5]. The model has the characteristics of visualization and simulation. Once the relevant personnel find the conflict in the model, they can directly adjust it and effectively solve the engineering conflict problem in the design stage.

Applying BIM to the field of architectural engineering design, on the one hand, it can realize the optimization of architectural engineering design, on the other hand, it can also improve the working efficiency of the whole architectural engineering[6]. BIM or building information management is to

create a three-dimensional building model based on the information data in the building project, and use digital information to simulate the real information in the building[7]. A large number of practical applications have proved that the advantages of BIM and VR are mainly reflected in visual operation, three-dimensional model construction and intuitive management[8]. As far as architectural engineering design is concerned, the previous two-dimensional design mode has caused designers, supervisors and engineers to be unable to fully understand the project design results and fully ensure the scientificity and rationality of the design scheme[9]. This article discusses the application of VR based on BIM in architectural engineering design, in order to realize dynamic management of engineering data on this basis, so as to improve the construction efficiency of the whole architectural engineering and promote the further improvement of architectural engineering design level.

2. Characteristics of BIM

In the process of building engineering design, BIM can deepen the design of high-rise building engineering and effectively improve the social efficiency of building engineering. Compared with other technologies, BIM has the characteristics of high efficiency and quickness. Whether it is the construction unit or the customer of the building construction, when solving the problems related to the building construction design, they must cooperate and coordinate with each other, otherwise the work will be difficult to carry out[10]. If there are problems in the architectural design drawings or the construction itself during the construction, all the people involved in the design and construction of the architectural project must be called together to find out the causes of the problems, and on this basis, effective measures should be taken to solve the problems.

In the process of complex reinforcement node arrangement construction, the correct use of BIM can improve the working efficiency of construction, shorten the construction time of one week at the longest time, effectively shorten the construction period and improve the working efficiency. In the process of construction, every link and step of construction needs to be optimized continuously. On the surface, it seems that this optimization has no essential connection with BIM. However, if this technology is applied to the construction industry, it can better complete the optimization of construction projects and greatly improve the level of construction engineering design. BIM simulates the whole project in three dimensions according to the construction design scheme by establishing a three-dimensional model, so that managers can directly see the problems existing in the engineering design and then adjust them in time. This method can reduce the probability of safety accidents in construction projects, shorten the construction time and improve the construction efficiency of the whole project.

3. Key Technologies in BIM Architectural Engineering Design Optimization

BIM can deepen the design of high-rise building projects, and on this basis, effectively improve the social efficiency of building projects. If BIM is applied to the complex reinforcement node arrangement, the construction period can be effectively shortened and the construction efficiency of the whole project can be greatly improved. Through the technical process connection and building information such as foundation model, the work efficiency of complex nodes can be improved, and the construction personnel can fully understand the specific situation of the construction project, which is helpful to improve the construction quality of the construction project and ensure the reliability of the construction project. The application of this technology does not need to be optimized and adjusted in actual construction projects, on the one hand, it can improve work efficiency, on the other hand, it can also save manpower and material resources. The application of BIM can realize the optimal design of super high-rise buildings, and can provide a general

contracting management mode based on BIM for construction projects. This management mode can be organically combined with subcontracting management to realize the concrete application of the deepening results of building model, greatly improve the construction quality of high-rise building projects and create a good overall image for building construction units. In the construction drawing design stage, the main basis for constructing BIM construction drawing model is provided by the construction drawing provided by the designer and the BIM model in the preliminary design stage. In this stage, the consistency check and model integration check of BIM model should be similar to the corresponding process in the preliminary design stage. After the final approved BIM construction drawing model is obtained, BIM optimization in the construction drawing design stage is operated by BIM engineers.

4. Application of VR Based on BIM in Architectural Engineering Design

4.1 Realization of Quality Control Objectives

For architectural analysis, because the traditional method can only design the exterior of the architectural model, that is, it can only outline the shape of the building simply, and it cannot provide all kinds of effective data support for accurate design. The optimized application of BIM and VR in architectural engineering design focuses on the realization of quality control objectives. Quality management is the core of current project management, and it is also a key concern in the design stage. The specific application of BIM in architectural engineering design optimization is of great significance to the construction industry, which is conducive to promoting the growth of the construction industry. For engineering projects, there are many uncontrollable factors besides controllable factors in quality control. Uncontrollable factors are sudden, which will also have a negative impact on project management. Project quality management needs to be implemented in the whole process of quality construction. The data conversion process of building information model based on environmental performance analysis is shown in Figure 1.
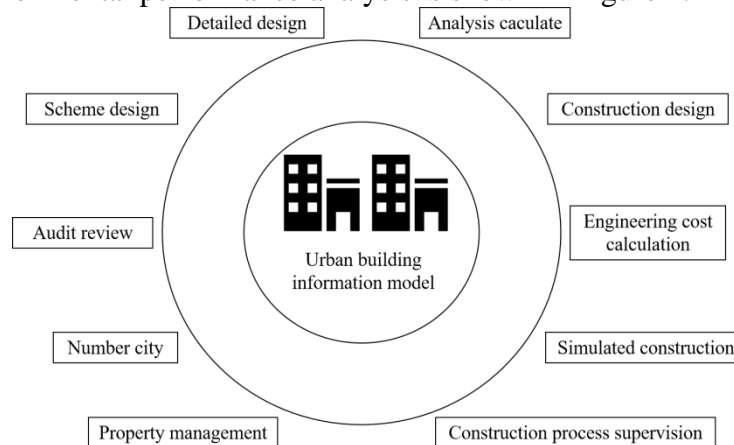

Figure 1 Data Conversion Process of Building Information Model Based on Environmental Performance Analysis

In the process of building construction, many workers are faced with a situation that a large number of electromechanical pipelines are concentrated in the underground part, which are complicated and frequently changed, greatly increasing the difficulty of pipeline arrangement in high-rise buildings. BIM aims to realize information integration and provide a convenient collaboration system for employees in various departments. By working on the same platform, designers of all departments can share information, that is, all personnel can receive timely messages at the same time, reducing the time of information transmission, thus increasing work

efficiency. With the help of BIM and VR, data information can be updated in time, and then presented in the form of cost data table, which plays a very important role for later personnel to realize data call.

4.2 Automatic Arrangement of Structural Construction

For architectural achievements, static renderings are a method to show architectural design concepts adopted by most construction industries in China at present. Because most of the renderings are formed after the company's post-rendering and processing, although the pictures look beautiful, there are many problems, such as lack of authenticity and failure to effectively reflect their local characteristics. Compared with other buildings, the construction of super high-rise buildings is relatively complicated, which requires us to use BIM to deepen the design one by one. The application of BIM-based VR to construction projects can make the architectural design displayed through three-dimensional models and realize visual operation. In the actual construction of building model, including specific modeling, specific component use, treatment of different details and accurate use of various parts, all the above aspects exist independently and have a close relationship. The classification of three-dimensional spatial data models of urban architectural design is shown in Figure 2.
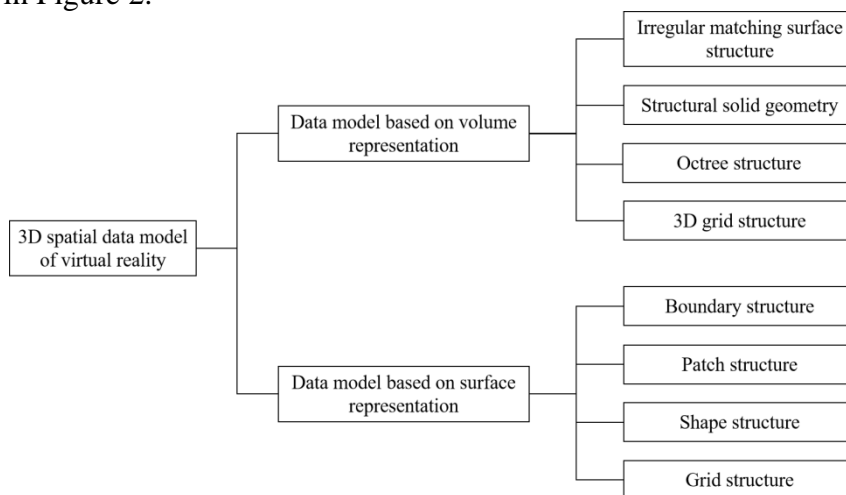

Figure 2 Classification of 3d Spatial Data Models for Urban Architectural Design

Designers can sort out all kinds of structural information through the three-dimensional building model, which is convenient for people to make scientific judgments by calling information data. Designers can deal with the corresponding coordinates with the help of the three-dimensional model, so that designers can determine whether the setting of columns is scientific and reasonable with the help of the coordinate position.

5. Conclusions

With the progress of the project construction, the model information is constantly deepened into the completed model through the interactive feedback of the construction, and finally handed over to the operation and maintenance to assist the asset management. This series makes the design have a deeper understanding of the "whole life cycle" design concept. Applying BIM-based VR to the optimization of construction projects can improve the overall work efficiency of construction projects, thus achieving seamless communication between different stages and professions, which is of great significance to the overall construction industry and the overall growth of China. Combined with the current technical application, we should strengthen the construction of quality objectives,

coordinate and deal with the coordination of components, actively strengthen the high-level construction of personnel, pay attention to the support of hardware systems, etc., improve the scientificity and rationality of design, and lay the foundation for the formation of scientific design scheme for engineering projects. After the scheme design is completed, the collision detection of BIM professional model is completed by VR, and the optimized layout and construction scheme simulation are carried out. The intuitive three-dimensional model helps all participants understand the design intention correctly, and completes the summary of the whole project through three dimensions, making the design scheme more reasonable, detecting the collision in advance, coordinating as soon as possible, and avoiding mistakes in professional cooperation.

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