Research on the Space Design and Planning of Natural Landscape Architecture Based on Virtual Reality Technology

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Abstract. VR tech can build a realistic space scene, ameliorate the sense of human-computer interaction and experience, realize the effective and vivid simulation of the architectural space scene, so as to stimulate and release the imagination and creativity of designers, so it has important research value. Based on this, this paper first analyses the architecture of VR system, then studies the utilization of VR tech in natural landscape architectural space design and planning, and finally gives the process of architectural planning and design based on VR.

Keywords: Space Design and Planning, Natural Landscape Architecture, VR

1. Introduction

With the iterative progress and maturity of computer tech, it has been widely and deeply studied and popularized in many fields, especially the utilization of computer tech represented by VR tech in natural landscape architectural space design, which greatly accelerates the optimization and amelioration of architectural space design level and efficiency [1]. VR tech is based on the progress of computer and human-computer interaction tech, and has a broad utilization space and scene advantages. VR tech can build a realistic space scene and further enhance the sense of interaction and experience between human and computer. Specifically to the natural landscape architectural space design level, the use of VR tech can achieve effective and vivid simulation of the architectural space scene, so as to stimulate and release the imagination and creativity of designers.

VR tech in the micro level can bring the overall amelioration of visual, auditory and other sensory experience to the designers and users of architectural space, so that they can obtain a more real experience [2]. At the macro level, VR tech integrates the advanced achievements of computer, info and intelligence, creating a more macro and three-dimensional virtual scene. The advantages of VR tech in several aspects as shown in Figure 1 greatly expand the user's sensory cognition, and constantly develop and optimize in the direction of diversification and modernization.
In addition, the utilization of VR tech in the field of natural landscape architectural space design and planning has brought great changes to the natural architectural design industry, which has a profound impact on and changed the traditional mode and method of architectural space design and planning. At the conceptual level of natural landscape architecture design and planning, VR tech can provide designers with more abundant and diversified building info materials. In terms of economic benefits, the utilization of VR tech can significantly reduce the time and cost of natural building space design and planning, especially through the virtual design exhibition, it can find potential problems in advance, and avoid the delay and cost increase caused by changes and rework [3]. In terms of social and economic benefits, the utilization of VR tech can realize the comprehensive collection and processing of building info and data, realize the sharing of resources, ensure the scientificity and rationality of design and planning, reduce the waste of materials and reduce the adverse impact on the natural environment.

In a word, VR tech with its info storage, processing and display capabilities, can realize the virtual and dynamic display of natural building space, and has incomparable utilization advantages compared with traditional design and planning methods. The 3D space display, human-computer interaction and virtual space design and construction function of VR tech can significantly ameliorate the efficiency and quality of the design and planning work for natural landscape architecture space designers and planners [4]. Moreover, using VR tech to carry out the scene construction and adjustment of architectural space design can provide scientific and reasonable basis and info support for the optimization, comparative design and planning scheme. Therefore, the study of natural landscape architecture space design and planning based on VR tech has important engineering practice value.

![Figure 1. Typical characteristics and advantages of VR tech](image)

**2. The architecture of VR system**

2.1. **The concept and connotation of VR tech**

Virtual reality tech is to use computer tech to generate interactive simulation environment, and make the virtual environment can give people a sense of immersion. Secondly, users can interact with some objects in the environment in a natural way, not using conventional input devices, but using gestures, posture and natural language to carry out human-computer interaction. Virtual reality is a virtual environment generated by computer system to give people a sense of immersion. Virtual environment system can provide a variety of sensory stimulation represented by vision, hearing and touch.
2.2. The composition of VR system

VR system is mainly composed of sound system, reality and observation equipment, interactive equipment and data acquisition equipment. Among them, the display and observation equipment is the method and device to generate immersion, which usually consists of display, fast response working platform, large screen projection and panorama [5]. Secondly, the interactive equipment of virtual reality system is mainly force feedback equipment, which provides interactive info feedback, which brings a stronger sense of real experience. In addition, as another interactive method between users and virtual environment, voice system in VR system helps to enhance spatial info, especially when space is beyond the scope of view, it provides more stereo feedback, and data driven sound can transmit the attribute info of the object. 3D data acquisition equipment mainly includes static and dynamic data acquisition to achieve motion capture and 3D data reconstruction.

2.3. Architecture of VR system

The architecture of VR system mainly includes two parts: non distributed VR system architecture and distributed VR system architecture. The non-distributed VR system is composed of device server, session management and utilization process [6]. The structure of distributed VR system includes data model composed of centralized structure and replication structure. Among them, the centralized data model is simple in structure and easy to implement, but it has high requirements for network communication bandwidth. The replicated data model structure needs less network bandwidth and has good interactive response effect, but the structure is more complex and difficult to maintain and backup. The software structure of VR system based on distributed simulation model is shown in Figure 2 below.

![Figure 2. Software structure of VR system based on DS model](image)

3. Utilization of VR tech in space design and planning of natural landscape architecture

3.1. Utilization advantages of VR tech in architectural space design and planning

The design and planning of natural landscape architecture space need to solve two public problems, that is, the design effect of architectural space is unknown, the real built architectural space effect is often quite different from the expected; the engineering quality of architectural space design is
difficult to effectively control [7]. The utilization of VR tech in the architectural space design and planning strengthens the visibility and representativeness of the natural landscape architectural space design process, provides users with interactive design and visual impression, so as to accelerate the actual construction of the architectural space more in line with expectations. In addition, through VR virtual demonstration, the problems and engineering loopholes in the process of architectural space design can be found in advance, so as to avoid the later design changes and engineering rework.

3.2. Utilization of VR tech in design and construction of building space structure

In the virtual environment created by VR tech, the space model of natural landscape architecture is established to form a simulation system, so that the model in the system has dynamic performance, and the space model in the system is virtual assembled, and the construction scheme is modified in the visual environment of human-computer interaction [8]. In addition, the use of virtual reality tech can make a lot of comparison, analysis and optimization of different architectural space design and planning schemes in a short time, so as to ensure the optimization of the final construction scheme. VR model can truly restore the building spatial data of natural landscape, let designers and planners see the virtual space in a short time, and experience the overall scene and landscape of the building.

3.3. Using VR tech to ameliorate the space design effect of natural landscape architecture

The utilization of VR tech in the space design and planning display of natural landscape architecture has become more and more mature. While providing immersive experience, it can further enhance the authenticity of modeling and rendering [9]. Secondly, by improving the motion capture accuracy and display resolution of VR plug-in, it can further provide stronger computing power and effective software and hardware connection for the design and planning of natural landscape architecture space. In addition, with the continuous amelioration of intelligent, ecological and environmental protection, multi-functional and personalized requirements of natural landscape architectural space, its architectural space structure design is more and more complex, and it needs to further strengthen the connection between architectural space design and construction system. Therefore, the natural landscape architectural space design and planning process needs to further ameliorate the quality of design and construction platform, ameliorate the quality of architectural space design and planning.

4. Space design and planning strategy of natural landscape architecture based on VR tech

4.1. Design of architectural space environment based on VR thinking

First of all, in the time and super time experience thinking, the natural landscape architecture space design level, clear time order and degree, so that designers and planners can feel the time dimension in the process of time architecture space design [10]. Secondly, in the space and super space experience thinking of natural landscape architecture space design level, using VR tech, design a dynamic interactive virtual space, expand the scope of people's space cognition, and fully mobilize the initiative of designers and planners. In addition, in the design level of natural landscape architecture space under the thinking of material and non-material experience, through the introduction of material and non-material factors to strengthen the interaction of design and planning process, and strengthen the impact of smell and vision under VR system to ameliorate user experience and interest.
4.2. Process of architectural planning and design based on VR

The process of natural landscape architecture space design and planning based on VR tech is shown in Figure 3 below. By reducing the number of elements contained in the scene as much as possible, the ideal interactivity is achieved. Secondly, by setting a reasonable light, it helps to highlight the object and achieve a reasonable visual imitation. In addition, it studies the relationship and influence between virtual environment and human perception from visual requirements, movement and motion discomfort, so as to create the adaptability of human perception.

![Flowchart of the process](image)

**Figure 3.** Process of natural landscape architecture space design and planning based on VR tech

4.3. Utilization of VR tech in architectural space design and planning

The utilization of VR tech in the design and planning of natural landscape architecture space should first reflect the principle of people-oriented, and reflect the artistic conception and timeliness of natural landscape architecture space, so as to bring users stronger sensory experience. Secondly, in the process of landscape planning, the proportion of natural landscape and landscape is determined. In addition, with the help of VR tech to determine the best roaming path, from the time, distance, viewing angle and experience and other dimensions to determine the optimal solution. By determining the type of natural landscape project, making the corresponding model, building the landscape elements in the virtual scene.

5. Conclusion

In summary, the utilization of VR tech can realize the comprehensive collection and processing of building info and data, realize the sharing of resources, ensure the scientificity and rationality of design and planning, reduce the waste of materials and reduce the adverse impact on the natural environment. Based on the research of VR system architecture, this paper analyzes the composition and architecture of VR system. Through the analysis of the utilization of VR tech in the design and planning of natural landscape architecture space, this paper studies the utilization of VR tech in the design and construction of architectural space structure. Through the research on the natural landscape architecture space design and planning strategy based on VR tech, this paper analyzes the utilization methods of VR tech in architectural space design and planning.

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