Optimization Design of Green Building Landscape Space Environment Based on VR Virtual Technology

Xiaochen Wang1,*

1Nanchang Institute of Science and Technology, Jiangxi, 330108

*Corresponding author email: 358709828@nut.edu.cn

Abstract. At present, China does not pay enough attention to the cognition of a person's specific psychological behavior feelings for green buildings in China, and it fails to introduce the psychological behavior feelings of specific people into the overall design and construction process of green buildings in China. In view of these problems, this paper puts forward the research of green building landscape space environment optimization design based on VR virtual technology. According to the current situation of green building landscape space environment design in China, this paper proposes the construction of objective function, and calculates the optimization satisfaction value of square and pedestrian street, and obtains the average satisfaction of two kinds of landscape space are 0.6 and 0.46 respectively. The results show that the facilities and green area are well planned, with high satisfaction. Through the comparative analysis of the effect, interactive experience and viewing effect between traditional architectural design and VR architectural landscape design, it is concluded that VR architectural landscape design is obviously superior to traditional design. VR virtual technology provides technical support for the optimization design of green building landscape space environment.

Keywords: VR Virtual Technology, Green Building, Optimized Design, Interactive Experience

1. Introduction
Virtual reality technology in our country started on the basis of foreign research and development, so it started late. Compared with foreign developed countries, there is still a certain distance [1-3]. In recent years, the investment, application and development of virtual reality technology in various industries in China have achieved good results. Under the general trend, the relevant departments of the national government have issued favorable policies to support the development of VR technology and industry [4-5]. Even some domestic colleges and universities actively lead teachers and students to set up research groups to invest in VR technology research. With the development of 5g and the support of national policies, VR green building has become one of the top ten trends in China's future consumer market.

China's green building industry has made great progress. According to the relevant information management platform, 8595 green building projects have been completed, with a total construction
area of 1523.11 million square meters\(^ {6-7}\). The rapid development also brings some problems that can not be ignored, such as: the attention to the optimization of green building landscape space environment is seriously insufficient, mainly related to the indoor environmental quality, paying attention to the physiological feelings of indoor sound and light, hot and humid environment and indoor air quality, and not paying enough attention to the user's psychological feelings; the user's behavior cannot be introduced into the green building design process, leading to the user's green building The sense of building gain is not prominent\(^ {8-10}\).

In this paper, according to the actual situation of green building landscape space environment optimization, the analysis shows that there is still insufficient investment in VR virtual technology in green building landscape space environment optimization design. This paper establishes the research on the optimization design of green building landscape space environment based on VR virtual technology. In the research, according to the characteristics of green building landscape, combined with VR virtual technology, it puts forward development strategy, which has a positive impact on the optimization of green building landscape space environment, and effectively improves the competitiveness of green building landscape space environment optimization design, and enhance the comprehensive strength.

2. Application of Virtual Reality Technology in Green Building Design and Construction of Objective Function

2.1. Application of Virtual Reality Technology in Green Building Design

Introduction of user behavior: as a person's specific behavior cannot be described in a certain amount, the full introduction of VR technology will enable the whole green intelligent building design to be realized from a user's specific feelings, and a user's specific behavior can be directly integrated into the whole process of green intelligent building design, which may not be realized by any previous technology. Virtual augmented reality scene technology can not only help to simulate the user experience of a building and space, but also greatly improve the user evaluation after the user experience is completed. Users can not only have a deep understanding of modern architecture from the perspective of three-dimensional space, but also understand the various characteristics of building materials from the use scale of two-dimensional space, and timely provide feedback information to architectural designers.

2.2. Objective Function Construction

Through the design analysis of green belt, seat, parking space and other environmental factors in VR high-tech building design, and realizing the design optimization of the overall landscape display space of green building, an objective balance function of green building design cost and urban residents' life satisfaction is constructed.

(1) Application of construction engineering cost management objective calculation functions. The objective price function of construction facilities can include the cost prices of various types of construction facilities:

\[
\min \text{cost} = \sum_{i=0}^{n} a_j \times \Delta X_j
\]

Where: \(\text{cost}\) represents the input cost of architectural landscape facilities, \(a_j\) represents the price of architectural landscape facilities, and \(\Delta X_j\) represents the number of architectural landscape facilities.

(2) Life satisfaction measurement functions of urban residents. In a certain proportion of landscape facilities in a building, the more landscape facilities in the building, the higher the residents' satisfaction with landscape. In the fixed scale area of the building space, the larger the building scale area of buildings and landscape service facilities, the number of buildings may be reduced accordingly.
At this time, the landscape demand of residents' daily living activities cannot be met, which leads to the decline of residents' satisfaction; when the overall scale of landscape service facilities in residential buildings is small, the number may increase correspondingly, and the layout will be more intensive, which will affect the landscape aesthetic feeling of the whole residential building and the overall environmental landscape planning, so that the residents' satisfaction may also decline. Based on the above considerations, the tourism satisfaction measurement function of residents can be generally expressed and defined as:

$$\max S = \sum_{\Delta X_j} W_j \times (X_j + \Delta X_j)$$  \hspace{1cm} (2)

$$\max S = \Delta X_j \in E$$  \hspace{1cm} (3)

Where: $S$ represents satisfaction, $W_j$ represents the weight value of facilities, $X_j$ represents the number of landscape facilities installed in the building, and $\Delta X_j$ represents the number of added landscape facilities.

3. Experimental Results and Analysis

Objective function proposed in this paper is used to optimize the architectural landscape space environment, and the satisfaction degree is used to express people's recognition. According to the above table, the results of the comprehensive evaluation of the landscape factors in Table 1 are consistent with the results of the comprehensive evaluation of people's satisfaction with the landscape; The optimization algorithm in this paper has been able to effectively achieve a good Chinese green home building landscape and space environment management optimization.

Compared with the optimization satisfaction values of square and Pedestrian Street in Table 1, the average satisfaction of the two landscape spaces is 0.6 and 0.46 respectively. The results show that the public satisfaction of the square is the highest. One of the main reasons is that the square street is the main activity area for modern people's entertainment and leisure, and its entertainment facilities and indoor green land area have been well planned in China.

| Evaluation items    | Pedestrian Street | square  |
|---------------------|-------------------|---------|
| sense of security   | 0.3               | 0.51    |
| privacy             | 0.37              | 0.40    |
| Greening rate       | 0.57              | 0.82    |
| Convenience         | 0.50              | 0.60    |
| Leisure atmosphere  | 0.35              | 0.71    |
| individualization   | 0.66              | 0.54    |

4. Discussion

4.1. Application of VR Technology in Green Building Landscape Design

(1) Design Technology

At present, some green landscape design technology enterprises at home and abroad have successfully developed and launched the green landscape design application technology software platform based on VR design kernel, and widely applied it in design practice, and constructed China's green landscape architecture based on system virtualization and reality design technology. VR design software is widely used in the design process of two-dimensional green engineering building two-dimensional landscape entity products. It can effectively solve the problem of real-time
integration engineering design between two-dimensional plane landscape abstraction and three-dimensional landscape entity, and construct the real-time roaming system model design scene of two-dimensional green engineering building entity landscape. To realize the differentiation of two-dimensional green engineering building entity landscape model scene and three-dimensional landscape, as well as the climate change effect in different seasons, it can provide real-time roaming design new experience for users and enterprises.

(2) Interactive experience

Interactive technology is another important feature of mobile phone virtualization and real-world interaction technology. It is mainly reflected in the software and hardware, auxiliary interactive devices and application scenarios based on mobile phone virtualization and real-world interaction technology. It can build and build a perfect bridge between mobile phone users and technical designers. Its working principle is: through the use of various virtual environment hardware technology can build a large-scale virtual landscape environment virtual reality scene, users can not only wear small VR contact lenses or other small VR head wearing equipment directly into the virtual scene, experience the various landscape virtual atmosphere under the virtual environment, and conduct interactive induction. The main application fields are: RVR super landscape, large theme park or large characteristic theme cinema, etc.

(3) Ornamental effect

Virtual scene construction based on virtual reality technology is the key field of virtual reality technology application. Green building landscape design usually uses virtual reality technology to realize the landscape effect.

Figure 1 and Table 2 show the comparative analysis of traditional architectural landscape design and VR architectural landscape design effect, interactive experience and viewing effect. It can be seen that VR architectural landscape effect is better.
Table 2. Comparative analysis of traditional architectural landscape design and VR architectural landscape design effect, interactive experience and viewing effect

| Investigation items  | Traditional architectural landscape design (%) | VR architectural landscape design (%) |
|----------------------|-----------------------------------------------|--------------------------------------|
| Design effect        | 67                                            | 89                                   |
| Interactive experience | 70                                             | 91                                   |
| Ornamental effect    | 66                                            | 93                                   |

Data in Figure 2 are from the satisfaction survey and analysis after VR virtual technology is put into use. It can be seen from Figure 2 that after VR virtual technology is put into use, the satisfaction degree of green building landscape space environment optimization design is increasing year by year. After the introduction of VR virtual technology, the visual, auditory and tactile effects of users are improved, and the effect is also significantly improved. They think that VR virtual technology has more advantages than disadvantages in the development of green building landscape space environment optimization design, and think that VR virtual technology is very necessary.

Figure 2. Survey and analysis of satisfaction after VR virtual technology is put into use

4.2. Differences between VR Technology and Traditional Expression Techniques

(1) Difference between VR technology and CAD

CAD is necessary design software for professional landscape architects. Its main function is to perfectly express the three-dimensional plane through three-dimensional line design. The planning book cannot directly and vividly reflect the final international implementation effect of the whole scheme, nor can it accurately understand the whole scheme from the overall perceptual objective angle, which brings a lot of reading difficulties to some non-professional and technical personnel. However, for some garden plants, it is difficult to accurately show their landscape three-dimensional sense. The use of three-dimensional perspective visual effect, the use of elevation and three-dimensional section effect to express, cannot accurately perceive its real three-dimensional landscape visual effect, the performance of its landscape color is also very limited, cannot directly realize the arbitrary reverse transmission of single information. Virtualization and realistic photography technology have combined a variety of modern technical means, forming a special artistic expression and artistic appeal.

(2) Difference between VR technology and 3D animation
In recent years, animation has become a more popular way of landscape display, which uses video as the media to show users. The audience can see the essence of the whole design through different sightseeing ways. This display is more vivid, but the animation is strictly in accordance with the film production process. According to the established stage, the initial completion of several video clips, the final composition of animation short film. Users can get environmental information from the video. If users want to observe the design results from different perspectives or heights, they must make it into a short film again and make it again. In contrast, when VR technology is integrated into landscape design, the advantages of VR display are very obvious. The observer can not only experience the sense of space that the designer wants to embody, but also can modify it according to the scene he wants, which greatly reduces the communication problems between designers and demanders, and brings convenience to them. It breaks through the limitations of traditional modeling methods in space and time.

5. Conclusions
In the process of research on the development of green building landscape space environment optimization design, this paper takes the introduction of VR virtual technology as the main line of research. After research, this paper considers that VR virtual technology is an indispensable part of green building landscape space environment optimization design. VR virtual technology gives full play to the advantages of standardization, intelligence and visualization, and is widely used in various fields of green building landscape design. Through investigation and analysis, VR architectural landscape design effect, interactive experience, viewing effect is obviously superior to the traditional design. For green building landscape design, if we want to make full use of VR virtual technology, we must integrate VR virtual technology with the actual situation of green building landscape effectively. Effective analysis of the development process of green building landscape in VR virtual technology, pay attention to scientific introduction, effective development strategy, ensure the effective development of green building landscape space environment design work.

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