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Retraction

Retracted: Application of 3D Virtual Scanning Technology in Landscape Planning of Complex Landscape Gardens

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This article has been retracted by Hindawi following an investigation undertaken by the publisher [1]. This investigation has uncovered evidence of one or more of the following indicators of systematic manipulation of the publication process:

(1) Discrepancies in scope
(2) Discrepancies in the description of the research reported
(3) Discrepancies between the availability of data and the research described
(4) Inappropriate citations
(5) Incoherent, meaningless and/or irrelevant content included in the article
(6) Peer-review manipulation

The presence of these indicators undermines our confidence in the integrity of the article's content and we cannot, therefore, vouch for its reliability. Please note that this notice is intended solely to alert readers that the content of this article is unreliable. We have not investigated whether authors were aware of or involved in the systematic manipulation of the publication process.

Wiley and Hindawi regrets that the usual quality checks did not identify these issues before publication and have since put additional measures in place to safeguard research integrity.

We wish to credit our own Research Integrity and Research Publishing teams and anonymous and named external researchers and research integrity experts for contributing to this investigation.

The corresponding author, as the representative of all authors, has been given the opportunity to register their agreement or disagreement to this retraction. We have kept a record of any response received.

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[1] C. Huang and Y. Zheng, "Application of 3D Virtual Scanning Technology in Landscape Planning of Complex Landscape Gardens," *Wireless Communications and Mobile Computing*, vol. 2022, Article ID 5495825, 7 pages, 2022.

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Research Article

Application of 3D Virtual Scanning Technology in Landscape Planning of Complex Landscape Gardens

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In order to solve the problem of technical precision in landscape planning of complex landscape garden topography, the authors propose a research using 3D virtual scanning technology. The main content of this research is based on the overall architecture of the 3D virtual landscape planning system, the construction of the system architecture, and the optimization of VR design scenarios; finally, through experiments, the feasibility of 3D virtual scanning technology is obtained. Experimental results show that the number of landscape connection points measured by the author is more than 1500, and the accuracy is between 0.2 and 0.6 pixels, indicating that for the mutual connection and orientation between models, the system has a good application prospect in the landscape planning of complex landscape garden topography. The research on 3D virtual scanning technology is proven, and it can meet the application in the landscape planning of complex landscape garden topography.

1. Introduction

With the acceleration of China's economic development and urbanization, garden landscape has gradually been paid attention to [1]. Garden terrain landscape is the ground with objects such as garden pieces, water bodies, garden buildings, plants, and roads within the set range and is the basic structure of the garden skeleton. Garden topography is usually an artificially constructed ground topography on the flat ground based on natural landscape topography. Reasonably adding terrain landscape to the garden landscape can improve the artistry of the garden landscape and create a more delicate and beautiful landscape. Terrain includes complex and diverse types, mainly divided into two categories: natural terrain such as valleys, mountains, hills, grasslands, and plains. From the perspective of the garden, the terrain includes mounds, terraces, slopes, flats, or horizontal changes caused by steps and slopes, which are artificial terrains.

In terms of form, natural beauty is the main way of Chinese gardens, the design of landscape topography is random and flexible, and it is necessary to constantly modify and adjust the design scheme, which increases the difficulty of garden topography and landscape design [2]. There are usually overlapping areas in the complex landscape garden terrain landscape; in order to improve the artistry of garden design, it is necessary to carry out three-dimensional reconstruction of the superimposed area existing in the complex landscape garden topography and landscape; the current three-dimensional reconstruction method of the superimposed area of the garden topography and landscape exists. In the problem of low reconstruction efficiency and low precision, in-depth analysis is needed, and the 3D reconstruction method of the overlapping area of garden topography and landscape needs to be studied.

Landscape design has existed since ancient times, but with the development of computer technology, AutoCAD, Photoshop, 3Ds Max, and other drawing software have been developed, which has promoted the design of landscape architecture to be systematic, comprehensive, real, reasonable, beautiful, accurate, efficient, easy to modify, and so on [3]. However, with the development of society, on the basis of new ecological civilization and informatization requirements, the landscape architecture planning industry has covered the construction of urban ecological areas and infrastructure, making urban landscape architecture planning more difficult. To this end, some scholars have proposed digital landscape planning, using computer computing and graphics capabilities to analyze the spatial environment of landscape planning, rationally constructing objective and rigorous design logic, so that landscape architecture has scientific, artistic, and social value.

2. Literature Review

With the vigorous development of the country's current economy, at present, the research on digital landscape architecture landscape planning methods at home and abroad needs to be planned from several aspects such as genealogy, parametric design, and computer-generated design [4]. Foreign countries have also established a digital landscape architecture landscape planning method with four processes of digital model-sensitive system network urbanism-self-realization from the part to the whole and the whole to the part and completed the digital landscape architecture landscape planning, but this set of methods only stayed at the research level and did not carry out specific practice. In China, from the perspective of landscape parametric design, the basic system framework and parameter composition types are studied; based on this, the landscape garden landscape is planned on the computer through digital methods; however, there are landscape garden landscapes, and the software cannot use the full parameters. For this reason, the visualization technology is introduced; according to the spatial geographic information of the landscape architecture, the landscape architecture is planned digitally, and the design of the digital landscape architecture landscape planning system based on the visualization technology is proposed. At present, 3D modeling tools and computer graphics technology are gradually developing, and 3D virtual reality technology is gradually becoming mature [5]. 3D virtual VR technology is an advanced technology combining perception ability and information interaction, which integrates Internet technology, multimedia technology, and 3D mapping technology. The integration of science and technology and artistic atmosphere has become an important concept in modern landscape planning and design, so the requirements of landscape design are constantly improving, not only to consider the visual experience but also to integrate the designed landscape into the surrounding environment, and it is necessary to consider whether the ecological vegetation is in a state of sustainable development. Therefore, ordinary landscape design systems cannot meet the high demands of modern landscape planning. For example, the real landscape data collected by the GIS-based landscape planning system is inaccurate, and the visualization effect of the constructed virtual landscape model is poor. During the landscape planning process of the segmented control landscape planning system, the effect of integrating the landscape and the surrounding environment is poor, and it does not meet the standard of three-dimensional virtual landscape planning and design. The authors use three-dimensional virtual VR technology to design a landscape planning system, which improves the effect and effectiveness of landscape planning; it can reach modern planning standards for different types of landscape planning and has won unanimous praise from the masses in many aspects.

In view of the above problems, the authors propose the application of 3D virtual scanning technology in the landscape planning of complex landscape garden topography. The main content of this research is based on the overall architecture of the 3D virtual landscape planning system, the construction of the system architecture, and the optimization of VR design scenarios; finally, the feasibility of 3D virtual scanning technology is obtained through experiments [6].

3. Research Methods

3.1. Overall Architecture of the 3D Virtual Landscape Planning System

(1) Extraction of contour edge features of garden topography and landscape overlay area

The contour edge of the landscape overlay area of the garden has undulating characteristics, which can be represented by the positional relationship between the reference point and the midpoint of the contour edge [7]. With the 3D simulation method for complex landscape garden topography and landscape overlay area, the characteristics of the superimposed area of garden topography and landscape are described by the relative position relationship of local extreme points. Let R_i and H_i represent the position parameters, and normalize the position parameters to

$$r_i = kR_i, \quad (1)$$

$$h_i = kH_i. \quad (2)$$

In the formula, k represents the normalization coefficient. Through the normalized position parameters, the feature vector T of the contour edge of the landscape overlay area of the garden is obtained, which is

$$T = (t_1, t_2, \cdots, t_{N-1}) = [(r_1, h_1), (r_2, h_2), \cdots, (r_{N-1}, h_{N-1})]. \quad (3)$$

The eigenvector T is called the eigenvector of the contour edge of the garden topography and landscape overlay area, and it is a vector formed by the arrangement of two-dimensional data points; any data unit represents the relative position of the extreme value in the contour edge of the garden topography and landscape overlay area [8].

(2) System architecture

The authors conduct virtual landscape planning from two aspects of 3D landscape modeling and virtual VR technology. Through 3D laser scanning technology, the main point cloud data of a landscape scan is obtained. 3ds Max software and cloud data are used to build the main landscape planning model, and satellite maps and other data are used to obtain the landscape plan [9]. Based on the plan, plan the main buildings, flowers, trees, roads, and other landscape facilities of the landscape. Use PS technology and real scene photos to get the actual landscape situation, set the lighting and material maps, and introduce the processed photos into the VR virtual landscape simulation platform; design the VR

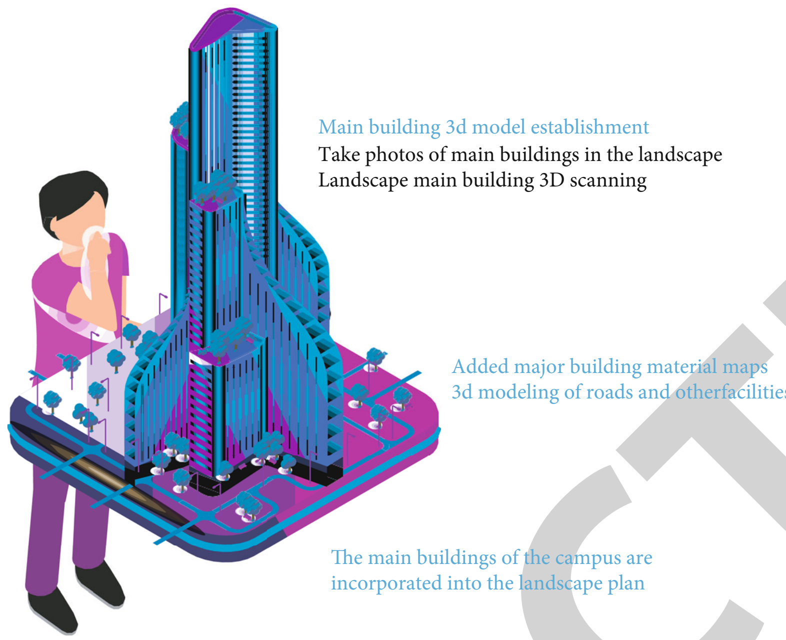

Figure 1: Frame diagram of the landscape 3D virtual system.

interface and add scripts to obtain a 3D virtual landscape planning roaming system, and the system contains a variety of roaming methods. Figure 1 is a design frame diagram of a landscape planning system of 3D virtual VR technology.

Scan buildings in a landscape with a Trimble TX5 3D laser scanner to get color point clouds. Taking a building as an example, since the building is divided into multiple components and has a complex structure, in order to ensure accurate registration in the later stage and reduce redundant data, multiple scanning sites are set up; in order to ensure that there are overlapping parts between sites and avoid setting up too many sites, the point cloud data obtained by registration and splicing scans need to be further processed and saved. The processing of point cloud data includes filtering noise, deleting useless points, processing redundant points, and optimizing the number of points [10]. Finally, change the format of the point cloud data, and import it into 3ds Max to build a 3D model of the virtual landscape.

(3) Establishment of a 3D model of road in landscape

The system makes a landscape 3D model in 3ds Max software, the 3D model is the basis of 3D virtual VR technology landscape planning system design, 3D virtual VR technology creates a scene through the 3D model and achieves the effect of roaming landscape, and the quality of the 3D model seriously affects the interaction effect of the system. Build a three-dimensional model according to the actual situation of the landscape, select large buildings and all objects around the buildings in the landscape to build the model gradually, form a complete landscape, build a 3D model reasonably according to the scale, and arrange it in a suitable position [11].

Taking a landscape building as an example, the whole process of building a model using point cloud data in 3ds Max is analyzed. When constructing a 3D model, the point cloud data is regarded as a reference, the point cloud data of the building is captured, and the main outline of the building is drawn; select the extrude command in the modifier, convert the sketched building spline into a 3D wall model, an editable polygon, and then draw the door of the building based on the point cloud data by dividing, connecting, contouring, and chamfering windows and other accessories [12].

If the 3D model of the building landscape wants to achieve the effect of roaming, it needs to be imported into the VR design software; therefore, it is required that the number of faces of the model should not be too many when building the 3D model, and the model should be simplified as much as possible to achieve coexistence of speed and accuracy. If the model is closely connected or the distance is small, the above models are combined [13]. It should be noted that each submodel constructed is required to be named in a tree-like nomenclature, and finally, the three-dimensional model of the landscape building is obtained.

The 3D modeling process of the road is shown in Figure 2; it can be seen that after the data is input, the road is faced with the choice of straight and curved roads; if the road is not straight, the road point cloud data needs to be discrete, and then, the next step is performed; finally, save the completed road model for output.

Based on the above-mentioned method for establishing a three-dimensional model of a landscape building, a three-dimensional model of a road is constructed; the following is the main data information of the road: (1) the road is a flat curve. It consists of the road centerline, the road red line, and the two lane edges. (2) The road has vertical information. The determination method is the road vertical curve or road end level. (3) The road has discrete spacing. Refer to the default value of the system, which can be modified according to the specific situation.

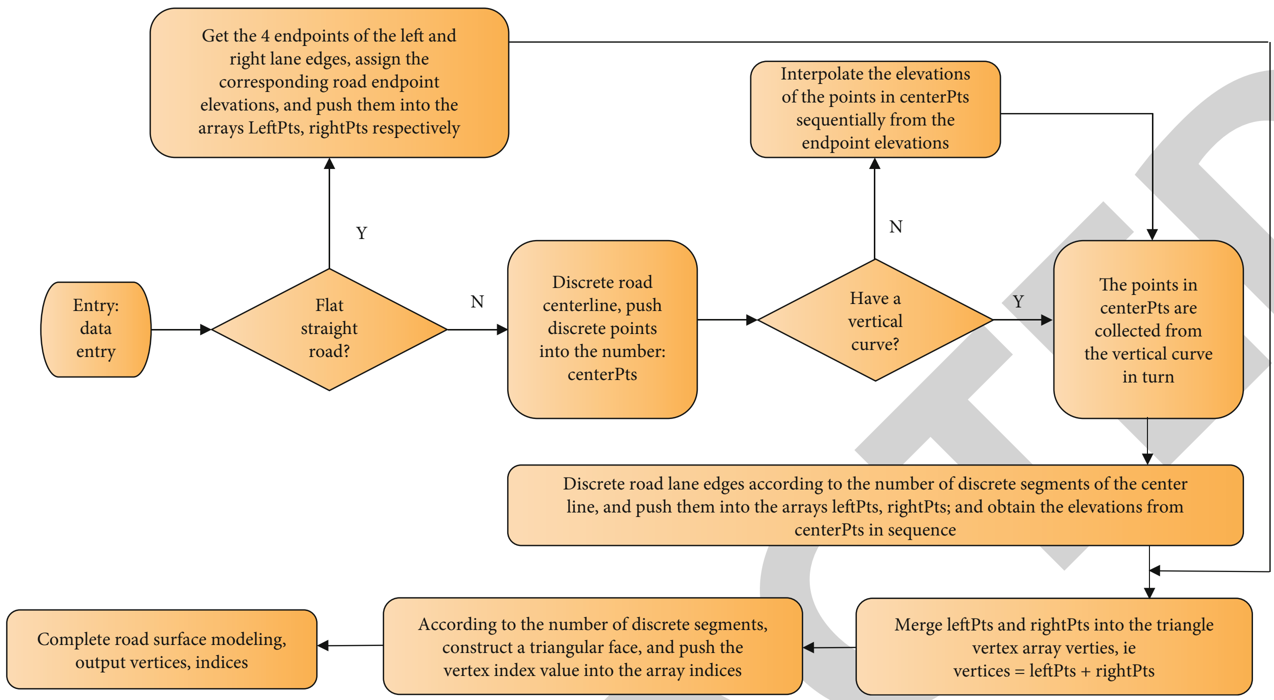

Figure 2: Flow chart of road 3D modeling.

3.2. VR Design Scene Optimization

(1) Scene design

After being imported into VR, the architectural landscape scene is prone to some situations such as nondisplay and flickering of some patches; during 3D modeling, some models that have been built should be imported into the VR design platform in time; determine whether there is a problem with this part of the model; if there is a problem, it should be corrected in time to prevent the same problem from subsequent 3D modeling; follow this method to gradually import the built 3D model of building landscape; reduce the problems after baking, and avoid increasing the workload [14]. After the scene is baked and imported into the VR design platform, check the model in the scene in detail; if there is a seam problem in the model, scale the model in the VR design platform. If the model is damaged, etc., the model needs to be corrected again by 3ds Max. Use the editor in the VR design platform to adjust the shadows, textures, and other phenomena of the scene. Use PS to match colors, adjust the scene saturation and texture hue, and improve the light and dark comparison of texture hues by changing curves, sharpening, and other commands. It is worth noting that when the glass material in 3ds Max is imported into the VR design platform, it needs to be modified because the glass material cannot automatically render the transparent effect in VR [15].

(2) Design of the VR virtual landscape simulation platform

As a new technology, VR virtual simulation is of great significance to the development of economy and society, and there is a lot of room for expansion. Figure 3 shows the VR virtual landscape simulation platform.

It can be seen from Figure 3 that the VR virtual landscape simulation platform consists of a cluster simulation and network communication module, a simulation core work module, a VR scene editing module, and modeling and output modules [16]. The functions of each module of the VR virtual landscape simulation platform are analyzed, and the results are as follows:

(1) Cluster simulation and network communication module. The main function of this module is to reach. For the purpose of off-site simulation, the main function is to effectively exert the computing power of landscape planning VR virtual design [17]

(2) Simulation core working module. Taking the OSG 3D virtual module as the center point, adjust the kernel simulation task scheduling, including the simulation database management module and the large-scale terrain module; this module is a large-scale terrain simulation module based on the OSG 3D simulation support platform, a hydrodynamic particle system simulation module, and a special effects simulation module [18]

(3) Modeling and output module. Use this module to build models and scenes in 3D roaming, import models into VR to build VR scenes, and add simulation properties [19]

(4) VR scene editing module. Using the VR scene built by the previous module, use the VR scene editing

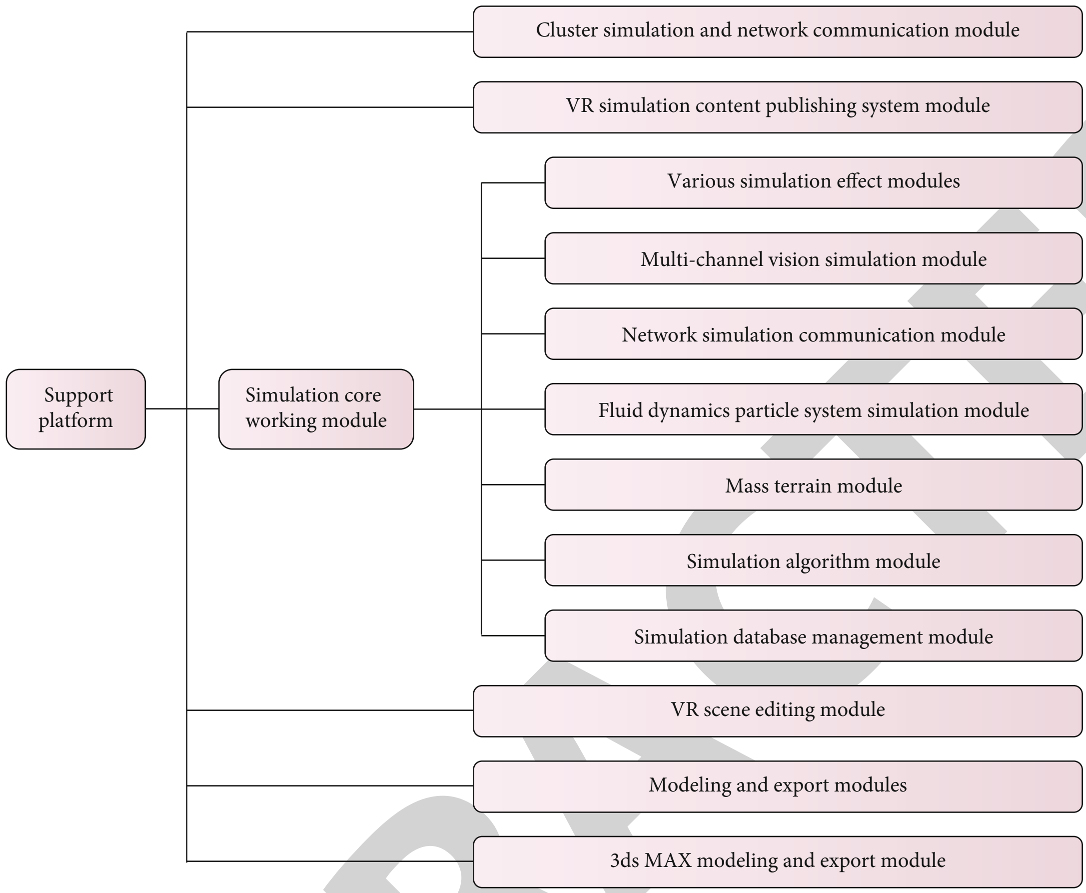

Figure 3: Design block diagram of the VR virtual landscape simulation platform.

module to add multiple attributes to the scene and implement 3ds Max modeling of architectural landscapes

4. Analysis of Results

In order to verify the effectiveness of landscape planning through the system, a simulation experiment study was carried out. The experimental comparison systems are the segmented control landscape planning system and GIS-based landscape planning system.

The landscape layout of a park is systematically planned, including factors such as the slope and aspect of the landscape, and the landscape planning performance of the system is analyzed from the perspective of data. The three-dimensional landscape virtual construction is disturbed by the terrain slope, and a planning suitability table needs to be formulated according to the virtual landscape grade. Table 1 shows the suitability classification of the three-dimensional landscape slope [20].

In the process of analyzing the landscape planning of the three systems, the comparison of the accuracy of processing 3D point cloud data is shown in Figure 4.

Analyzing Figure 4, we get that, under the same processing time, the system has much higher accuracy of point cloud data processing than the other two systems; the highest is 99%, and as the processing time increases, the accuracy of the system processing data also increases. If the landscape planning and design workload is large, the system has a great advantage. The accuracy rate of the segmentation control landscape planning system processing point cloud data is basically above 80% to 90%, and the highest is 89%, but compared with the system, there is still a lot of room for improvement. The accuracy rate of the GIS-based landscape planning system is basically 50% to 60%, and the highest is 59%. Therefore, the system has high accuracy in the processing of 3D point cloud data for landscape planning, which reduces the difficulty for overall landscape planning [21].

The experiment set 8 experimental park landscape models, analyzed the number of connection points and model orientation accuracy when the system constructed a 3D landscape model of the park, and verified the accuracy and stability of the ingested landscape points when the system constructed a 3D landscape model. Table 2 shows the obtained experimental results.

Analysis of Table 2 shows that the number of landscape connection points measured by the author is more than 1500, and the accuracy is between 0.2 and 0.6 pixels; it shows that for the mutual connection and orientation between models, the system can obtain a sufficient number of connection points accurately and effectively to provide help for the calculation of model parameters. In addition, the interval fluctuation of the model orientation accuracy is small, indicating that the stability of the 3D modeling of the system is better. Therefore, the system has high reliability and stability

Table 1: Landscape suitability classification based on a three-dimensional slope.

Landscape planning	Slope (degree) 0-5	6-10	16-25	26-30	Over 30
Terrain utilization	Suitable for any landscape	Suitable for ordinary landscape	Simple landscape	Not suitable	Not suitable
Landscape design	Trees, lawns, flower beds, statues	Tree, lawn, flower bed	Lawn, flower bed	Lawn	Not suitable
Soil and water conservation	Unnecessary	Unnecessary	Unnecessary	Plant dwarf shrubs	Planting vegetation

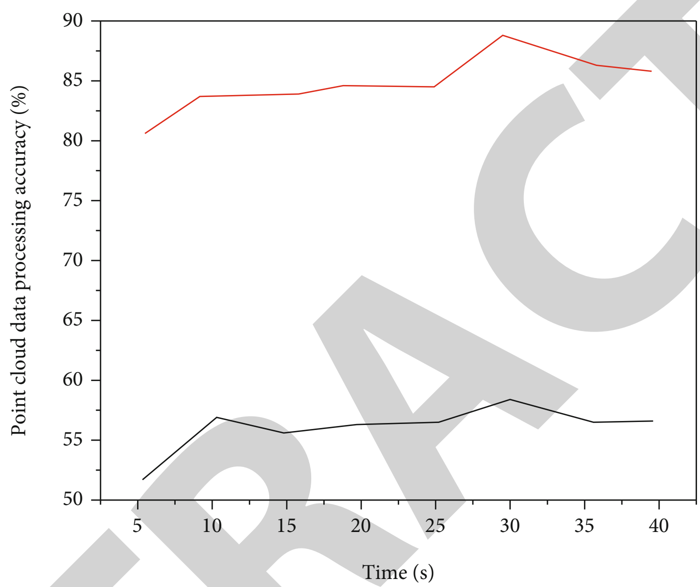

Figure 4: Comparison of 3D point cloud data processing accuracy.

Table 2: Experimental results.

Model number	Number of connection points (piece)	Model orientation accuracy (pixel)
M.0-3	1742	0.5995
M.1-3	2446	0.4698
M.2-1	2006	0.4719
M.3-2	2318	0.4433
M.4-3	1591	0.2281
M.5-6	2118	0.3857
M.6-7	1986	0.3298
M.7-8	1621	0.2883

in 3D virtual landscape modeling, laying a solid foundation for landscape planning. The advantage of the system is to accurately obtain the 3D point cloud data of the landscape through 3D laser scanning technology, build a 3D model based on the point cloud data information, create a 3D stereoscopic picture of the landscape, and improve the realism of the 3D virtual landscape. The simulation results show that the system has high satisfaction in landscape planning, provides help for urban landscape construction, and has a good application prospect in 3D virtual landscape planning and design.

5. Conclusion

In order to solve the problem of technical precision in landscape planning of complex landscape garden topography, the authors propose a research using 3D virtual scanning technology. The main content of this research is based on the overall architecture of the 3D virtual landscape planning system, the construction of the system architecture, and the optimization of VR design scenarios; finally, the feasibility of 3D virtual scanning technology is obtained through experiments. The number of landscape connection points measured by the authors is more than 1500, and the accuracy is between 0.2 and 0.6 pixels, indicating that for the mutual connection and orientation between models, the system has a good application prospect in the landscape planning of complex landscape garden topography.

Data Availability

The data used to support the findings of this study are available from the corresponding author upon request.

Conflicts of Interest

The authors declare that they have no conflicts of interest.

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