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Research Article

Urban Landscape Design Based on Data Fusion and Computer Virtual Reality Technology

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The rapid urbanization development has brought huge opportunities for the development of architectural landscape design, and naturally there will be various huge challenges accordingly. What this kind of development speed presents to people is the rapid emergence of new urban areas, endless new construction projects, and so on. This paper conducts research on urban landscape design based on data fusion and computer virtual reality technology. The purpose is to use the dual guidance of data fusion technology and virtual reality technology to demonstrate the feasibility of creating a more planned urban landscape design. This article uses SketchUp software for modeling and uses a digital camera for continuous digital photography. Firstly, multiple digital landscape images are merged into a complete panoramic image. Then, the simplified model is imported into the virtual reality platform to adjust the material and scene lighting of the model, and the plan is checked in the virtual reality platform, and the model and volume of the model are analyzed and compared. Finally, design an auxiliary program and export it together with the effect image. The research results show that when the virtual landscape reaches 400, the frame rate can be kept above 30. It can be seen that the efficiency of this algorithm is higher than that of the original algorithm. When the scene thread and the rendering thread are parallel, the frame floats up and down in 9, and the time spent on the frame is reduced by about 40%. The conclusion is that the accuracy of the landscape planning system based on virtual reality technology is higher than that of the traditional algorithm, and the degree of scene simulation is more realistic. It has contributed to the construction and application of landscape systems. The application of data fusion technology and virtual reality technology in urban landscape design can achieve considerable results in terms of modeling ability, design ability, innovation ability, and expression ability, and the design ability has reached a score of 8.82.

1. Introduction

In recent years, with the rapid development of related digital technologies such as virtual reality and augmented reality, virtual landscapes based on these digital technologies have had an impact and challenge on the theory and practice of traditional landscapes. On the one hand, the virtual landscape transforms the carrier of landscape design from the physical real world to the digital virtual world, breaking the traditional way of landscape generation and the expression of results; on the other hand, virtual landscape itself is a combination of virtual and digital forms. The characteristics, as well as the characteristics that can provide users with immersion, interactivity, and experience, are the deepening and expansion of the landscape field, and it is also a kind of trend of the times born under the background of the rapid development of science and technology.

Landscape planning and design is an intentional process of changing the existing ecological environment to improve the living environment. This is a complex application process, which requires general participation in the adjustment of design elements, three-dimensional space, comprehensive information management, decision support, and design scheme. Simplify the designer's work, improve the work efficiency, and make the design plan conform to the original environment. This requires a landscape planning and design, it is a new auxiliary design tool, and it is a virtual reality technology. Virtual reality technology refers to the use of computer technology, the production of vision, hearing, strength, touch, movement, and other real virtual environment, and through a variety of external output detection equipment to immerse users in the environment.

In the research of virtual reality and landscape design systems, Khosravi and Hemami take predators as the research object, use multiple decision-making standards, and combine decision-making experiments and evaluation laboratories with network analysis methods (ANP), which is the most important species in the landscape; the criteria are classified and selected. Then, they used weighting criteria, niche models, expert information, and local community attitudes to score 10 candidate species based on 13 criteria. They finally determined a set of complementary landscape species for landscape ecological planning [1]. Shafiezadeh et al.'s goal is to maximize biodiversity by including coastal habitats that meet the requirements of key species, reduce population isolation, and improve the resilience of natural habitats to new development plans. First, they used the generalized linear model (GLM), generalized enhancement model (GBM), random forest (RF), and maximum entropy (MaxEnt) models to simulate suitable habitats for seven main species and then combined the habitat suitability map obtained by SDM with the appropriate range of spawning green turtles and the potential habitats of aquatic and semiaquatic birds. On this basis, they used the simulated annealing algorithm to select new land and coastal protection areas in six scenarios [2]. Lei et al. proposed a cloud-based urban planning and design support system. The digital attributes of his design plan include design details such as land use area, building restrictions, urban design style, architectural design, landscape, and traffic/built environment/sun/wind/noise simulation. Next, the application practice of cloud-based virtual reality city design support system is divided into three application cases: synchronization, decentralized synchronization, and decentralized asynchronous [3].

In order to ensure the rationality of garden landscape design, Kim et al. simulated the effect of landscape planning, which has important practicality. They designed a landscape planning effect simulation system based on virtual reality technology, aiming to solve the problems of two landscape planning effect simulation systems proposed in the traditional system. Their entire system framework includes user layer, application layer, and display layer. According to the frame structure of the system, select acquisition equipment, main control equipment, output equipment, and display equipment. Next, according to the system framework, design the system software to execute the main program [4]. The schemes proposed by the above studies have different degrees of problems in terms of stability and practicability. Therefore, it is necessary to use computer technology to improve the planning efficiency and practicability of the scheme.

In this research, we first introduced the basic characteristics and technical composition of virtual reality technology and then explained the three development stages of urban landscape planning and design. This article also details the impact of virtual reality technology on the urban landscape planning and design process. The algorithm in this research focuses on iterative function systems and morphological modeling. The innovation of this paper is to use SketchUp software to design courtyard landscape and then use virtual reality interactive platform to realize the system function. The virtual reality technology landscape planning system can be directly modeled and analyzed in the design platform, system algorithm comparison analysis, simulation system simulation analysis, and system stability analysis, which are very convenient and intuitive. For this research, it can be found that the landscape planning system based on virtual reality technology is more accurate and efficient, which is very helpful to the designer's work.

2. Virtual Reality Technology and Landscape Planning

2.1. Basic Characteristics of Virtual Reality

2.1.1. Immersion. The concept of immersion is that users can feel their role in virtual reality environments. Under ideal conditions, users in a virtual environment may feel difficulty in distinguishing between true and false [5, 6].

2.1.2. Interactivity. An interactive concept is the degree of user manipulating objects in a virtual environment and receiving feedback. For example, in a virtual environment, when the user extends and grasps an object, it is felt that there is something in the hand and the weight of the object. There is also an object that causes the displacement of the object to move to the virtual environment [7, 8].

2.1.3. Imagination. The concept of imagination is the digital model of each object and a variety of data rules, according to the needs of users, and the degree of self-movement in the virtual environment. In the multidimensional space of digital information, users learn knowledge comprehensively according to their personal cognitive ability, exert self-discipline, and form new opinions. These features are important features to distinguish virtual reality technology from computer visualization technology and multimedia technology [9, 10].

Virtual reality is the synthesis of various technologies. These three characteristics affect each other. It is precisely because of their coexistence that a realistic computer generation environment integrating vision, hearing, and touch is created.

2.2. Three Development Stages of Landscape Planning and Design. The first stage was a palace, courtyard, and private garden provided by several classes led by the emperor in the context of the agricultural age [11]. It is an aesthetic creation that includes an early Chinese landscape painting that emphasizes Western concepts of formal beauty and natural beauty [12]. This is a source of modern landscape planning and design, and is a fertile soil for its growth [13, 14]. In early history of horticulture, it was primarily based on personal preferences, but was also determined by the background of the times [11]. These horticultural works are based on personal will and reflect the interest of atrium owners. Unlike the European garden of the same period, I emphasized the beauty of nature. Mimic the natural landscape and configure a small model in the garden [15, 16].

The second phase is a park and green space system that provides service to working classes and urban residents in the context of industrial age. This is the first public landscape shared by the collective public in human history. In this system, green space plays a role as a place of leisure and entertainment for urban residents, emphasizing coverage and per capita occupancy. In addition to the traditional concept of environmental landscape planning and design, the protection and utilization of natural resources based on land, as well as the ecological environment protection as a result, have become another important mission of modern landscape planning and design workers. This stage is a process from individual subjective emotion to group's reasonable judgment, from courtyard and trees in front of and behind the house to landscape resources of city and region, and then from poetic and artistic intention of writers and poets to scientific and reasonable analysis of planning designers. The values, judgment standards, practice scope, professional background, and theoretical methods of traditional landscape architecture have been greatly expanded and changed [17, 18].

The third stage is to develop to the present postindustrial era, that is, the information age, to pursue the concept of harmonious coexistence and sustainable development between man and nature. The world is characterized by knowledge economy and highly artistic technology. New materials, new energy sources, and advanced processing technologies have been developed and utilized. The arrival of the postindustrial era has greatly changed people's views and concepts of time and space, and the production of knowledge and information has also expanded the space of people's spiritual life [19, 20]. Human beings are no longer busy meeting material needs, but also pursuing happiness and self-implementation. Manufacturing method, life philosophy, values, and design aesthetics are also compared with the traditional methods before. This series of changes has played an important role in promoting landscape planning and design. In this stage, the planning and design of landscape is not only the significance of surface planning but also its field and significance are expanding and enriching. Landscape planning and design is directly related to social development; pay attention to the scientific and reasonable attitude towards all land resources. It emphasizes human development and sustainable development of resources and environment and pays attention to the possibility of reuse and regeneration of energy and resources [21, 22].

2.3. Influence of Data Fusion and Virtual Reality Technology on the Process of Landscape Planning and Design

2.3.1. Influence on the Analytical Process. The ideal website can meet the requirements of the project to the maximum extent with minimal changes. Therefore, choosing a website is very important for the success or failure of the whole project. In this process, the website is comprehensively analyzed through the collected information, and the virtual scene is used to judge the feasibility of the project. It is helpful for the development of design work to carry out field investigation repeatedly, to grasp the situation of the site, to grasp the feeling of the site and the relationship between the site and the surrounding environment, and to grasp the basic situation of the site. Analysis is the first step in the entire planning and design and also the most important step in the workload. In order to supplement and complete the virtual scene, completely useful website information is needed [23, 24].

2.3.2. Impact on Integrated Process. The range of research and analysis has been implemented. In this process, by designing the basic terrain, vegetation, and road conditions of the network and strictly controlling the system delivery, the advantages, disadvantages, and possibilities of the website include the designer's need to have a deep understanding of the website to gradually establish a comprehensive virtual scene. At this point, the designer clearly understood the appearance and meaning of the website. In other words, you can start planning and fantasizing. Separating constraints and opportunities reveals established problem conditions and "viable predictability" that the designer imposes on the environment. Find a reasonable design plan from a website constraint and finally resolve constraints. Facing the opportunities offered by the basic terms of the website, we need to make the most of its benefits [25, 26].

2.3.3. Impact on Presumption Process. According to the actual environment of the planning area, the virtual scene is made to support the design work. After understanding the characteristics of each block, the function is divided. In the virtual scene, designers plan and design the corresponding area comprehensively. The rationality of the design plan is discussed, and the virtual scene and the actual scene are mixed together. The interaction between man and computer has two levels of meaning. One is the interaction between the designer and the virtual scene. In the process of design planning, designers who can design virtual scenes must have a sense of "immersive" belief. Only when they have scene ideas can they be expressed by computers, designers need to experience the rationality of the design plan and the adjustment with the surrounding environment in real time. This requires input of the virtual scene experience design plan at all stages of the design. Make a summary of the plan and adjust what is unreasonable. The second is to participate in the design plan generally. In the virtual reality scene, the result information image is displayed in front of the audience, giving a sense of immersion, and the participants can feedback their mood to the designer. This information plays an important role in improving the design plan [27, 28].

2.3.4. Impact on the Practice Process. Due to the highly interactive features of augmented reality technology itself, it can be associated with users in various ways in the process of transmitting these venues, history, humanities, and other information to users, so it has a variety of information transmission methods. In contemporary landscape space, augmented reality can superimpose virtual information with real scenes, so it can strengthen and expand the expression of real-world information elements, which is conducive to more convenient, efficient, and personalized acquisition of information, and can create good interactive user experience.

2.4. Iterated Function System. Since the scene generated by the IFS has self-similarity and each part is a small copy of the whole, the IFS will be regarded as a piece of small fragments similar to the whole. As long as the affine has been determined, the transformation parameters will be regarded as the same as mastering the overall information of the scene. According to the collage theorem, you can get some generation rules for a specific figure and draw the whole figure. The iterative function system has convergence and shape preservation [29, 30].

2.4.1. Self-Similar Transformation and Affine Transformation. Self-similar transformation is equivalent to a compound of equidistant transformation and uniform scaling, which is similar to similar triangles, and the volume ratio remains unchanged. Affine transformation means that in geometry, a vector space is transformed into another vector space by a linear transformation followed by a translation. The invariants of affine transformation are parallel lines, the proportion of the length of parallel lines, and the proportion of the area. Definition of similar transformation: given the mapping $S : R^n \longrightarrow R^n$, if there is a constant c not less than zero, there is

$$|S(x) - S(y)| = c|x - y|, \quad \forall x, y \in R^n, \tag{1}$$

where s is called a similarity transformation on R^n and c is called similarity ratio, where $|\cdot|$ is a norm on R^n.

Definition of affine transformation: given the mapping $f : R^n \longrightarrow R^n$, for any $x = (x_1, x_2, \cdots, x_n)^{\mathrm{T}} \in R^n$, there are

$$f(x) = Ax + t, \tag{2}$$

where f is called affine transformation, $A = (a_{ij})$ is a nonsingular matrix of $n \times n$, and $t = (t_1, t_2, \cdots, t_n)^{\mathrm{T}}$ is a constant vector.

Affine transformation is basically a kind of scale transformation which changes in different directions with different proportions. It can be realized by the combination of a series of atomic transformations, such as rotation transformation, scaling transformation, translation transformation, and shear transformation.

In two-dimensional space, the basic transformation formulas of self-similar transformation and affine transformation are as follows.

Rotation transformation is as follows:

$$\begin{bmatrix} x' \\ y' \\ 1 \end{bmatrix} = \begin{bmatrix} \cos\theta, & -\sin\theta, & 0 \\ \sin\theta, & \cos\theta, & 0 \\ 0, & 0, & 1 \end{bmatrix} \begin{bmatrix} x \\ y \\ 1 \end{bmatrix}. \tag{3}$$

Reflection transformation is as follows:

$$\begin{bmatrix} x' \\ y' \\ 1 \end{bmatrix} = \begin{bmatrix} 1, & 0, & 0 \\ 0, & -1, & 0 \\ 0, & 0, & 1 \end{bmatrix} \begin{bmatrix} x \\ y \\ 1 \end{bmatrix}. \tag{4}$$

Scale transform is as follows:

$$\begin{bmatrix} x' \\ y' \\ 1 \end{bmatrix} = \begin{bmatrix} s_x, & 0, & 0 \\ 0, & s_y, & 0 \\ 0, & 0, & 1 \end{bmatrix} \begin{bmatrix} x \\ y \\ 1 \end{bmatrix}. \tag{5}$$

Translation transformation is as follows:

$$\begin{bmatrix} x' \\ y' \\ 1 \end{bmatrix} = \begin{bmatrix} 1, & 0, & t_x \\ 0, & 1, & t_y \\ 0, & 0, & 1 \end{bmatrix} \begin{bmatrix} x \\ y \\ 1 \end{bmatrix}. \tag{6}$$

Shear transformation is as follows:

$$\begin{bmatrix} x' \\ y' \\ 1 \end{bmatrix} = \begin{bmatrix} 1, & b, & 0 \\ d, & 1, & 0 \\ 0, & 0, & 1 \end{bmatrix} \begin{bmatrix} x \\ y \\ 1 \end{bmatrix}. \tag{7}$$

2.4.2. Iterated Function System. Let $(X ; d)$ be a complete metric space and $\{f_n\}_{n=1}^N$ be a family of continuous functions from X to x; then, $\{X ; f_n, n = 1, 2, \cdots, N\}$ is said to be an iterative function system. $\{f_n\}_{n=1}^N$ is an iterative function system without causing confusion. Let $x^* \in X$ be called

$$A(x^*) = \lim_{k \longrightarrow \infty} f^k(x^*), \tag{8}$$

which is the attractor of $\{X ; f^1, f^2, f^3, \cdots, f^N\}$, where the limit is defined as when point $a \in A(x^*)$, if and only if there are infinitely many K for any ε neighborhood $O(a ; \varepsilon)$ of a, such that $O(a ; \varepsilon) \cap f^k(x^*) \neq \varphi$.

2.4.3. Stochastic Iterated Function System. The stochastic iterated function system is composed of an iterated function system $\{X ; f_n, n = 1, 2, \cdots, N\}$ and a probability set $\{p_n\}$, where $\sum_{n=1}^N p_n = 1$.

Each probability p_n corresponds to the transformation f_n, so the stochastic iterated function system is expressed as $\{X ; f_n, p_n, n = 1, 2, \cdots, N\}$. Suppose $\{f_i\}$ is a set of affine transformations in the plane.

$$f_i(x) = B_i x + t_i, \quad i = 1, 2, \cdots, N, \tag{9}$$

where

$$B_i = \begin{pmatrix} a_i, b_i \\ c_i, d_i \end{pmatrix}, \quad t_i = \begin{pmatrix} e_i \\ g_i \end{pmatrix}. \tag{10}$$

Then, the calculation formula of probability p_i is as follows:

$$p_i = \frac{|a_i d_i - b_i c_i|}{\sum_{i=1}^{N} |a_i d_i - b_i c_i|}, \quad i = 1, 2, \cdots, N. \tag{11}$$

Then, the corresponding f_n is selected by probability p_i for transformation, and then, a new point is obtained. In this way, a series of points can be obtained by repeated iteration. These point sets are displayed on the screen to get a complete fractal image.

2.5. Morphological Modeling. In graphics, morphological operation is an image processing method based on the mathematical form of binary image set theory. In recent years, it has been widely used in the field of digital image processing and machine vision, forming a unique digital image analysis method and theory.

Generally, morphological image processing is represented by neighborhood operation. Specially defined neighborhoods are called "structural elements" and perform specific logical operations on regions corresponding to binary images at each pixel location. The result of the operation is the corresponding pixel of the output image. The effect of morphological operation varies according to the size and content of construction elements and the nature of logical operation. The general morphological operations are corrosion and expansion.

Extension is the process of merging all background points in contact with the object into the object and extending the boundary to the outside, holes that can be used to fill objects. If a and B are combinations of Z, then a is defined by B expansion as follows:

$$A \oplus B = \left\{ z \middle| \left(\widehat{B}\right)_z \cap A \neq \varphi \right\}. \tag{12}$$

The binary image D generated by the expansion from B to a is a set of points $z\,(x, y)$ satisfying the following conditions. When the origin of $\widehat{B}$ transformation is point $z\,(x, y)$, the intersection point between $\widehat{B}$ and a is not empty.

Expansion can be rewritten as follows:

$$A \oplus B = \left\{ \left[z \middle| \left(\widehat{B}\right)_z \cap A \right] \subseteq A \right\}. \tag{13}$$

First find the reflection set $\widehat{B}$ of B and convert the reflection set by Z. The expansion of set B to a is a set of all transformations Z. These transformations Z must satisfy at least one element that overlaps a after transformation. Group B is often referred to as structural elements.

Corrosion is the process of removing boundary points and reducing the boundary to the inside, which can be used to delete small, meaningless objects. The general concept of corrosion is defined as follows:

$$A \Theta B = \left\{ z \middle| (B)_z \subseteq A \right\}. \tag{14}$$

The erosion of a of set B is the set in which all elements Z in the set must be transformed $(B)\,z$ of set B contained in set a. In other words, the binary image e generated by B etching a is a set of points $Z\,(x, y)$ satisfying the following conditions. When the origin of B is transformed into point $z\,(x,$ $y)$, B is completely contained in a.

Corrosion and expansion is a set of complementary and reflective operations.

$$(A \Theta B)^c = A^c \oplus \widehat{B}, \quad (A \oplus B)^c = A^c \Theta \widehat{B}. \tag{15}$$

2.6. Data Fusion Technology. The research content of data fusion is extremely rich, and the basic theories involved are also very extensive, and the method of data fusion is the core of data fusion research. Data-level fusion is the fusion carried out directly on the original data layer. Data synthesis and analysis are carried out before various sensors are preprocessed. The increasing maturity of information technology and the popularization of computer technology have created the best application and research environment for the further application of satellite remote sensing technology. The functions of image acquisition devices are not the same, but the requirements for resolution are the same. In this paper, the urban landscape design image processed by computer virtual reality technology has greatly improved the image resolution shown by software equipment on the basis of the improvement of the calculation speed of digital processing chip. The data fusion system is shown in Figure 1. For global goal and local constraints, the block extractor and segmenter are used for data acquisition and information processing, the three-dimensional model is established for data fusion, and the simulation parameter diagram is transmitted to the server. Research in the field of remote sensing technology continues to deepen, and the sensors used to observe things have gradually improved their functions. When observing the physics of the earth's surface, different types of objects can reflect different electromagnetic waves. According to this phenomenon, they can be in different wavelength ranges. Distinguish different objects. Spatial resolution can be used as an important indicator for evaluating sensor performance and remote sensing information, and it can provide an important reference basis for the identification and sharing of ground features.

Broadly speaking, physical model parameters can be obtained, such as ground reflectivity, emissivity, or earth surface temperature. In a narrow sense, it refers to the actual reflectance data of ground objects. It is used to eliminate the influence of atmospheric vapor, oxygen, and other gases on the reflection of ground objects, as well as the influence of scattered molecules and aerosols. Under most conditions,

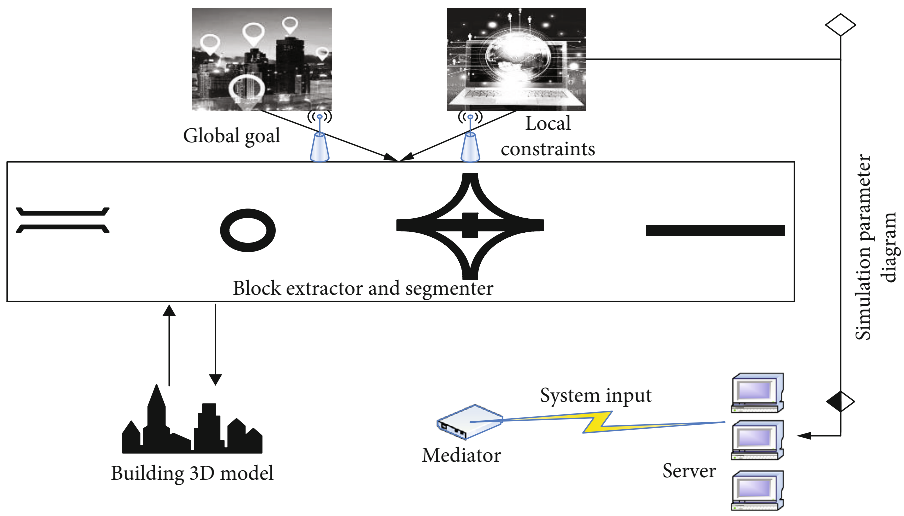

Figure 1: Data fusion architectural design.

atmospheric correction is also the process of inverting the true reflectivity of ground objects. Use the cluster analysis algorithm to analyze the image physical model parameters and others; then, there are

$$S_i(a,b) = \min\{S_i(e,r), S_i(j,r)\},$$
$$S_i(e,j) = \frac{1}{t_e t_j}\cdot\sum_{i\in H}\sum_{j\in H} s_i(a,b), \tag{16}$$

where a and b, respectively, represent the two plant samples, the difference between the two types is S_i, e and j are the clustering characteristics, and $\sum_{i\in H}\sum_{j\in H}$ is the framework for identifying the common ground between the two samples. In the data fusion process, a recursive relationship is presented, which can be expressed by the following formula:

$$S_h(e,j) = \frac{h_e}{h_a} * S_i(a,b) + \frac{h_j}{h_b} * S_h(e,j),$$
$$S_h(a,b) = \sqrt{\frac{h_e}{h_i} * S_i^2(a,b) + \frac{h_j}{h_i}\cdot S^2(e,j)_i - \frac{h_e}{h_i} * \frac{h_j}{h_i}}, \tag{17}$$

where h_e/h_a determines the size of the difference between the two; the larger the value, the greater the feature conflict; (h_e/h_i) $*$ (h_j/h_i) is the basic probability distribution value, which is defined as follows:

$$G_i(r) = \sum_{r\in\alpha}\frac{|a\cap b|}{|b|} * \frac{l(b)}{1-l(\alpha)},$$
$$F(l_1,l_2) = \left[\frac{1}{2}\sum_{r\in\alpha}^{1}|G_i(a_1) - G_i(b_1)|^2\right]. \tag{18}$$

The choice of l value not only affects the complexity of the calculation but also the result of the calculation. α is a complete recognition framework system, and r is multiple subsets.

3. Modeling of Virtual Reality Technology Landscape Design System

3.1. SketchUp Software Modeling. First, take pictures without interrupting the use of a digital camera. The generated digital images of the landscape will be merged into a complete panoramic image. Use professional software to create a large terrain boundary rectangle and paste an integrated landscape image. The landscape map gives the building a hierarchical structure. Professional image processing software can be used for texture processing. During the modeling process, it has been confirmed that the model is regular to avoid repeated surfing through patch interlacing. Realize part of the building by simplifying the settings of the imitation mode. Since the number of plant surfaces in the scene is the largest, we need to focus on modeling this part of the plant. This is done by combining two-dimensional and three-dimensional methods to edit plants and paste plants. Some 3D devices require high precision, and the model is simplified by removing unimportant leaves and branches. In this way, the overall appearance is not affected and the number of parts can be reduced. After the scene modeling is completed, delete all unnecessary parts of the scene by cleaning the plug-in model to reduce the number of faces.

3.2. Virtual Reality Interactive Platform. Unity 3D is a comprehensive game development and interaction platform designed and developed by unity technology. This platform can be used in Windows, Mac, iPhone, and Android to provide a series of interactive content, such as architecture visualization, 3D animation, and 3D games. In this way, users can experience the virtual reality world at any time with a mobile client.

3.3. Specific Process of Landscape Design. The main steps to apply virtual reality technology to landscape design are as follows. First, decide the design. The plan of each scene is designed with 3ds Max software. After completion, clear the redundant line and import SketchUp software; the specific steps are summarized as follows: (1) Draw the model foundation. (2) Draw the bottom shape of the model on the foundation. (3) Press the shortcut key of stretching command: P to stretch each block of the model. (4) Draw details on the model to determine the positioning of the observation angle of the model. (5) Move and copy blocks, quickly build models, and select materials. Be sure to export image files to facilitate the postprocessing stage through landscape images. After a simplified model is imported into an actual platform, the model material and scene lighting are adjusted; then, the virtual reality platform is examined and the material and volume of the model are analyzed and compared. Design static export rendering and executable files, landscape roaming animations, etc.

3.4. Construction of Development Environment. NDK: using the local development kit NDK, developers can use C/C + + language description of the program. This contains all the tools needed to execute C/C + + code and creates compiled files for this. Some other language programming programs can be put into the Android application package. Good compatibility is with all programs on Android system.

3.5. LOD Technology of Virtual Landscape. If the viewpoint is far away from the object, the basic principle of the LOD technology is shown as a low LOD, and the object only contains a few polygons associated with the object, and when the viewpoint moves to the object, the real-time system will gradually replace it. Using LOD technology can effectively improve the polygon usage rate of the model database and obtain the best visual effect under limited conditions. Since the geometric model of most polygons is more complex, it can be simplified by LOD technology. Generally speaking, the LOD methods used to simplify the geometric model are subdivision, sampling, and subtraction.

4. Landscape Planning Simulation System Based on Virtual Reality Technology

4.1. Modeling and Design of Landscape Planning System Based on Virtual Reality Technology

4.1.1. Bottleneck Positioning. It can be divided into three paragraphs, and a paragraph can be divided into three paragraphs. CPU stage: the application program is executed by the CPU and sends commands to the graphics processing system. Geometric processing stage: a bridge connecting device drive memory and graphics memory, including polygon operations such as coordinate conversion. The rasterization stage: the triangles are rasterized, and the pixel interpolation is carried out with graphics pipeline, including texture mapping, α fusion, writing color values to the frame buffer, and other pixel operations. To optimize the pipeline, first determine the location of the bottleneck and then optimize it, so that the location of the bottleneck can be transferred to other stages until each stage reaches a balance. The statistics results of CPU occupancy, memory value, and FPS value before system optimization are shown in Table 1.

It can be seen from Table 1 that when the leaves are turned off, FPS value rises from 37 to 73, CPU occupancy decreases by 10% when texture is turned off, and CPU occupancy starts from 92% after reducing display resolution. It can be seen that the bottleneck of this system is mainly in the geometric processing stage and the grating stage.

4.1.2. OpenGL Coordinate System. In this study, VR software is implemented by mobile phone. The screen size of the mobile phone window is 640×960 pixels. The field coordinate system takes the upper left corner of the screen or window as the origin of the coordinate, and $(0, 0)$ is used to represent the positive x-axis direction. The direction is indicated by the red arrow, the positive direction of the y-axis down, and the direction represented by the blue arrow. In OpenGL ES, use the $(0, 0)$ Cadillac coordinate system in the lower left corner. Unlike the view coordinate system, in the Cadillac coordinate system, moving to the upper part of the view is the positive direction of the y-axis. The direction is indicated by the blue arrow. Therefore, when drawing an image with OpenGL ES, you must convert the image coordinates from the view coordinate system to the OpenGL ES coordinate system. The view coordinate point is shown in Figure 2.

In this system, the rendering of virtual image is one of the keys of VR display. As shown in Figure 3, you first need to understand 3D geometry and the quartet cyan coordinate system. When the coordinate system corresponds to the mobile phone screen, the origin represents the center position of the screen.

As can be seen from Figures 2 and 3, this process is realized by matrix operation when OpenGL ES is used to draw virtual images. After the system sends the image conversion command, the system generates the conversion matrix and multiplies the conversion matrix with the current matrix to obtain a new matrix. In OpenGL ES, all object coordinates are located in the same coordinate system, namely, (x, y, Z, w).

OpenGL ES has two kinds of matrices. One is to use modelviewmatrix to realize object transformation. This is used to move, scale, or rotate objects in a program. The other is the projection matrix for projection transformation. There is only one matrix that can be activated at the same time. Functions related to OpenGL matrix transformation only affect the current active matrix. Among them, gloadidentity represents the activity matrix of the same kind, and the other three transformations represent the transfer, scaling, and rotation matrices. In this AR system, the configuration and scaling of virtual message wall are mainly realized by matrix transformation.

4.1.3. Virtual Reality Collision Detection. In this survey, as shown in Table 2, AABB bounding box, OBB bounding box, spherical bounding box, and packaging box are used to carry out experiments, respectively, and the generation

Table 1: CPU occupancy, memory value, and FPS display before optimization.

Operating system configuration	Display resolution	CPU occupancy	Memory value (M)	FPS value
Windows XP	1024 × 768	93%	12.729	38
CPU: Intel P4, 2.4 GHz	1024 × 768	93%	12.721	38
	1024 × 768	93%	12.729	74
Memory: 512 M	1024 × 768	83%	11.577	
Graphics card: MX440, 64 M	1024 × 768	93%	12.706	38
	800 × 600	86%	12.720	38

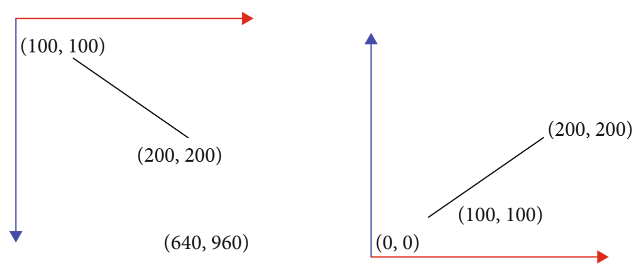

Figure 2: View coordinates.

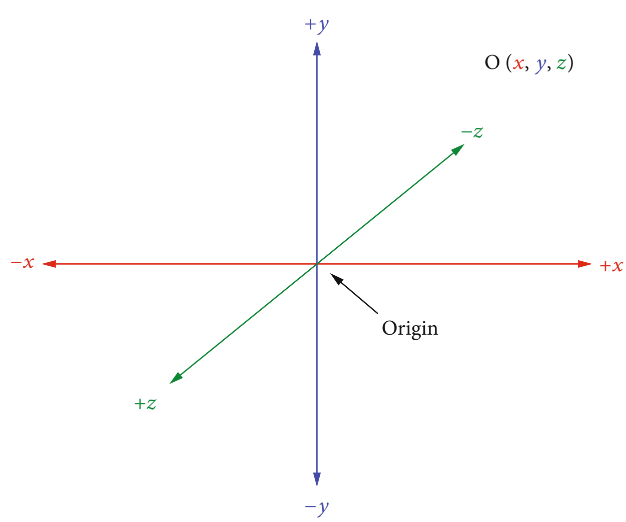

Figure 3: Cartesian coordinate system.

Table 2: Comparison of hierarchical bounding box collision detection.

Bounding box type	Generation time (ms)	Detection time (ms)	Detection accuracy (%)
AABB bounding box	104	518	54
OBB bounding box	380	233	77
Sphere bounding box	157	170	62
Capsule bounding box	235	126	92

time, collection output time, and detection accuracy of various bounding boxes are, respectively, analyzed.

The construction complexity, compactness, whether the bounding box is updated when the virtual human moves and rotates, and the complexity characteristics of collision detection of these four bounding boxes are summarized, as shown in Table 3 (the value represents the level, and the greater the value, the higher the complexity and the better the compactness).

This research is a scene simulation experiment in virtual environment. According to the shape characteristics of the virtual scene, the tightening degree of the fast bounding box is the best, and there is no need to update the bounding box during the virtual scene switching. High accuracy of collision detection is higher than the other three bounding boxes.

4.2. Comparison with Landscape Planning Simulation System Algorithms

4.2.1. Parallel Experiment of Thread String. It can be processed in parallel with other scene thread tasks to improve the reproduction efficiency. Several experiments are carried out in rendering thread and serial parallel, and frame data is used to represent the comparison results. The comparison results are shown in Figure 3.

As can be seen from Figure 4, when the landscape thread and rendering thread are continuously floating up and down, the frame parallel to scene thread and rendering thread floats up and down 9, and the time spent on a frame is reduced by 40%. However, it is impossible to improve the rendering of large-scale virtual scenes because it only relies on thread parallel processing.

4.2.2. Comparative Experiment of Two-Layer Clipping Algorithm and Single-Layer Clipping Algorithm. In this study, the two-level pruning algorithm firstly performs the fade in and fade out advanced algorithm pruning of the whole scene, deleting the remote objects that are not in the set field of view, and only reduces the objects in the rendering field of view to call. A second trimming is performed in the cell division and blind area of the field of view (e.g., the back of the building) determined by the second visibility.

The frame rate (FPS) best reflects the engine rendering efficiency. The larger the FPS, the higher the rendering efficiency. Therefore, in this article, only flod is used for single-layer clipping, and fcull is used only. The FPS

Table 3: Comparison of bounding box characteristics.

Bounding box type	Structural complexity	Compactness	Update	Detection complexity
AABB bounding box	1	2	No	2
OBB bounding box	4	3	Yes	4
Sphere bounding box	3	2	No	2
Capsule bounding box	3	4	No	3

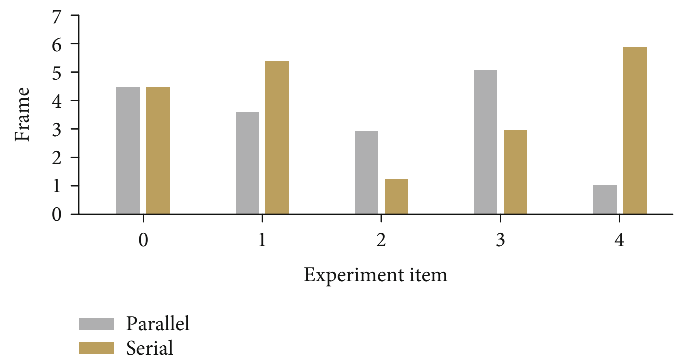

Figure 4: Comparison of serial and parallel experimental frames.

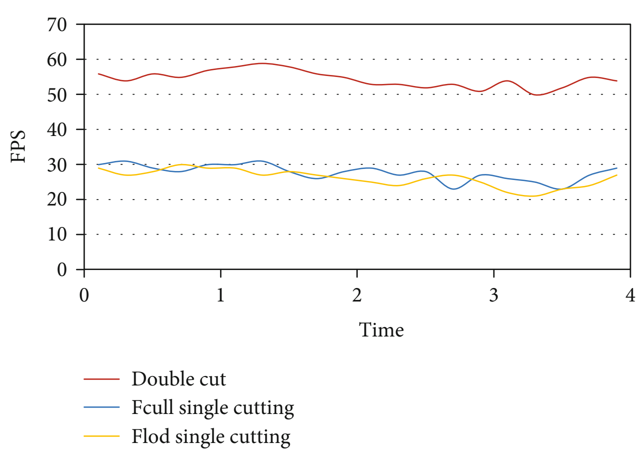

Figure 5: Comparison of FPS with double cropping and single cropping.

experiment compares the two tailoring methods proposed in this paper. Three levels of LOD level are set here, the start distance of low-speed rejection algorithm is set as 400 cm, and the end distance E is set as 600 cm. Each FPS is averaged by three levels of FPS. As shown in Figure 4, the FPS with double-layer cutting and single-layer cutting is compared.

As can be seen from Figure 5, only flod single-layer limiting FPS is about 30, and fcull single-layer limiting FPS is about 30. The proposed two-layer limiting FPS in this paper reaches about 55, which has been greatly improved and the rendering efficiency is improved.

4.3. Simulation of Landscape Planning Simulation System Based on Virtual Reality Technology. The simulation consists of three parts: measuring box, master node, and slave node. It is mainly used to simulate the size of the scene. The master node mainly performs routing broadcast and polling each node, which will automatically generate the IP node set. The simulation reachability of wireless ad hoc network is shown in Figure 6.

As shown in Figure 7, the simulation of wireless ad hoc network can save forwarding rate, it can be seen that there are three values of the reachability rate, and the saved transmission rate and the average delay of the wireless network simulation executed in the virtual engine. The comparison of experimental data in this paper shows that the difference is less than 1%. This shows that the simulation technology of virtual engine is very effective and reliable.

The average delay of the simulation of the wireless ad hoc network is shown in Figure 8. The simulation of wireless address network of virtual engine is mainly the method of polling and broadcasting the master node; that is, the address is used to determine the broadcast form, transmission speed, broadcast time interval, and delay of subnode. In the virtual engine, the routing protocol is optimized according to the demand vector distance. This mainly includes the routing of broadcast packet, response packet, error packet, and message packet.

4.4. Stability of Landscape Planning Effect Simulation System. In the virtual engine, in order to use frame rate (FPS) to measure the rendering effect of an item, this survey uses frame rate to represent the rendering efficiency of CPU, and GPU uses the time of calculating a frame to measure the computation amount of algorithm, and histogram represents GPU. The line chart represents the change of FPS, the black bar chart and the line chart represent the algorithm used by the engine, and the red bar chart and line chart represent the algorithm proposed in this paper. The original algorithm and the algorithm data in this paper are shown in Table 4.

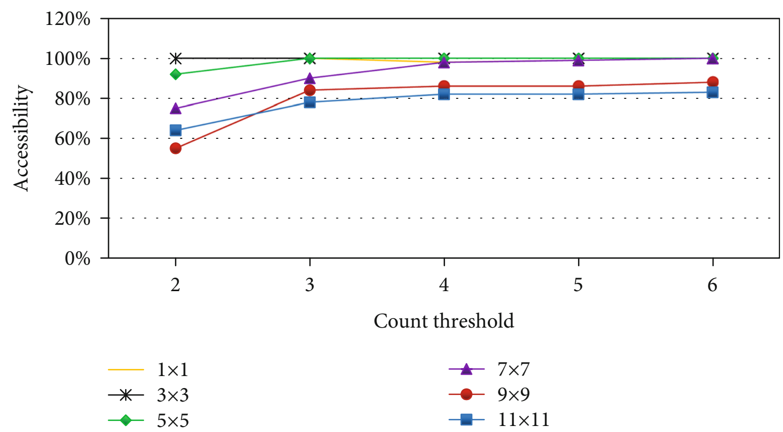

Figure 6: The simulation reachability of wireless ad hoc network.

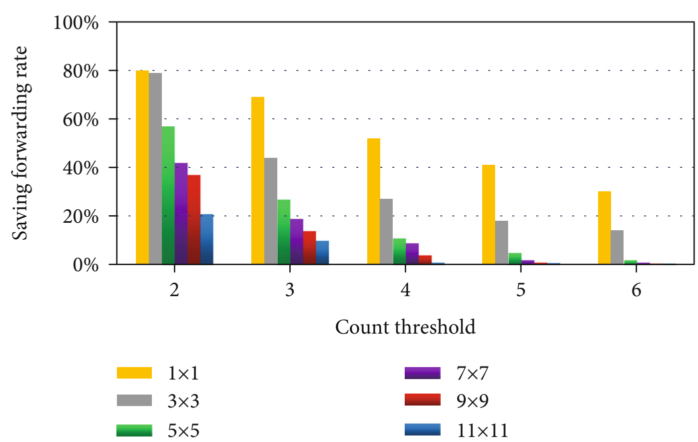

Figure 7: The simulation of ad hoc network can save forwarding rate.

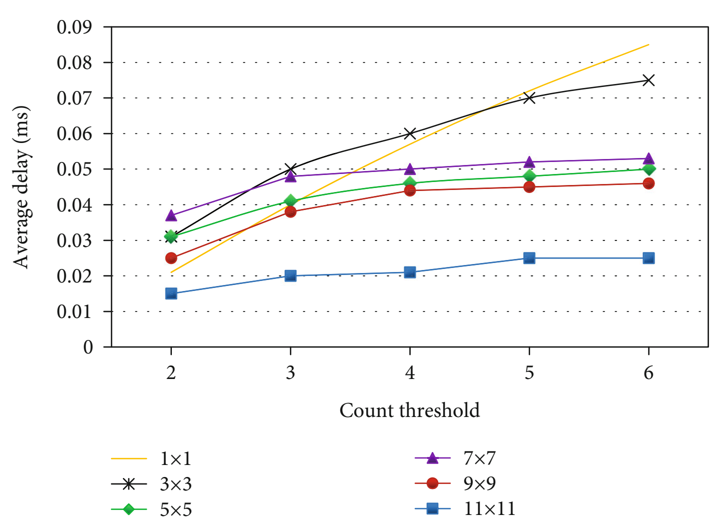

Figure 8: Average delay of simulation in ad hoc networks.

As shown in Figure 9, the experimental results of the original algorithm and the algorithm in this paper are compared.

As can be seen from Figure 9, the frame rate of the algorithm proposed in this paper is slightly improved, but with the increase of virtual scene, the difference of frame rate also

Table 4: Data of the original algorithm and the algorithm in this paper.

	1	2	3	4	5	6	7	8	9	10	11	12
Original frame time	5	24	41	53	60	68	75	84	85	75	64	49
Our algorithm frame time	5	8	11	15	21	24	27	28	32	27	25	18
Original FPS	57	55	53	51	50	49	42	39	37	48	53	55
Our algorithm FPS	57	58	55	53	52	50	49	48	49	51	52	56

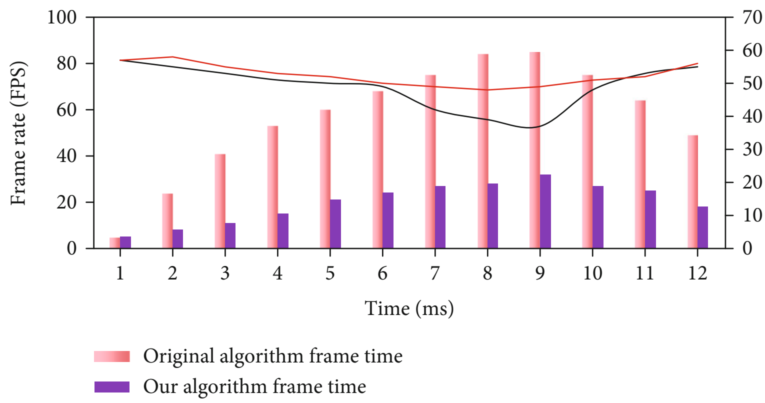

Figure 9: Experimental results of the original algorithm and our algorithm.

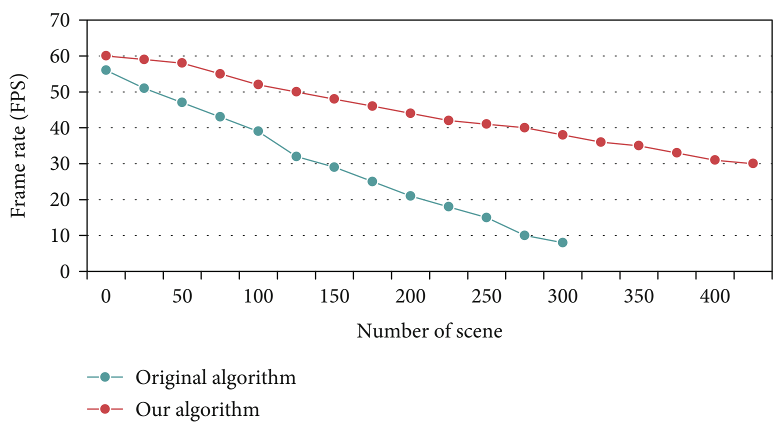

Figure 10: The original algorithm and our algorithm change with the number of landscape frames.

increases, and the time for GPU calculation increases. In the current virtual environment, in order to carry out scene simulation experiments, the virtual scene is gradually added. Whether the algorithm used in this paper can be effectively applied to large-scale virtual scene, in this experiment, the frame rate FPS is used to compare the simulation algorithm of the survey with the initial simulation algorithm, as shown in Figure 10.

As can be seen from Figure 10, the scene simulation experiment uses the original simulation technology of the original algorithm. As the number of virtual landscapes increases, the frame rate will continue to decrease. If the number of virtual landscapes reaches about 300, the frame rate is already 10. The simulation algorithm proposed in this paper has been used in landscape simulation experiments. The frame rate decreases with the increase of the number of virtual scenes, but the speed of reduction is slower than that of the original algorithm. Even up to 400, the frame rate can be maintained above 30. The proposed algorithm is more efficient than the original algorithm.

4.5. Actual Construction Analysis of Urban Landscape Planning. The continuous development of information technology has brought profound changes and influences to all aspects of human living space. The planning and design of urban architectural landscape is also undergoing tremendous changes. People try to rely on the virtual reality technology that exists in the computer network to expand more diverse spatial environments and to appreciate the visual feast brought by the colorful virtual world. The connection and integration of the field of architectural landscape design and virtual technology is increasing. In the future, with the promotion of the public's demand for diversified display and interactive participation of architectural

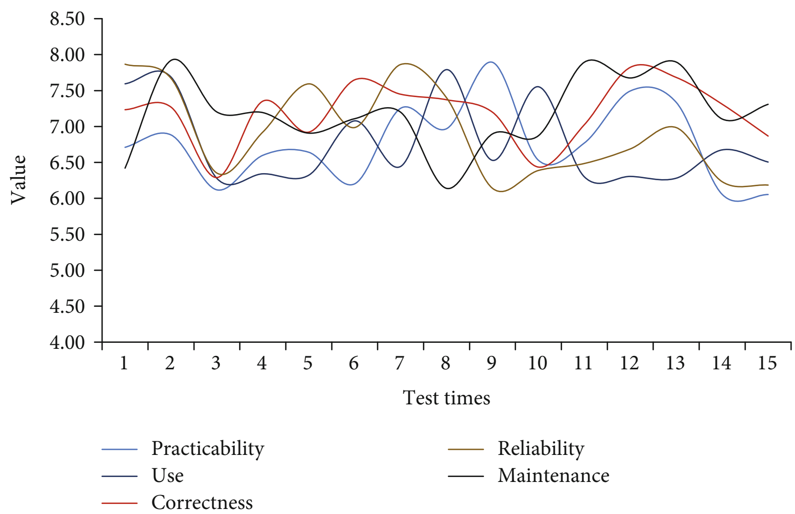

Figure 11: Virtual simulation to create urban landscape.

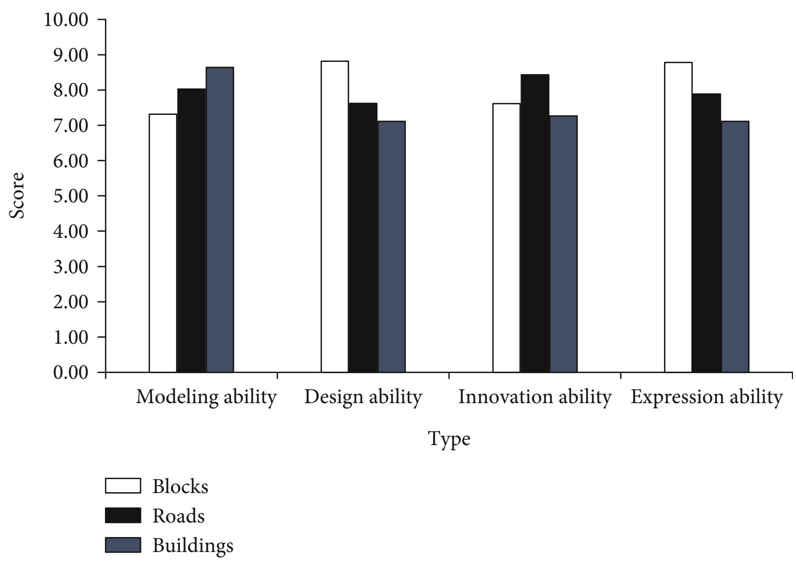

Figure 12: The expressiveness of the urban landscape.

landscapes, architectural landscape design application of virtual reality technology for plan design and diversified display will become the only way for its development. The application of virtual reality technology to architectural landscape design brings convenience to the control and grasp of the external form and internal structure of the architectural landscape design, such as the design style matching, the use of decorative materials, and the configuration of landscape and greening. The evaluation test is carried out after the virtual simulation creates the urban landscape, as shown in Figure 11.

The data in the above figure is an analysis of the practicality, ease of use, accuracy, reliability, and ease of maintenance in the application of existing virtual reality and data fusion technology and urban landscape design. It can be seen that no matter which aspect of performance, the urban landscape design is at a relatively high level. In order to have a more detailed understanding, data statistics were made on the expressiveness of the urban landscape shaped, as shown in Figure 12.

In contrast to the exaggerated beauty in the renderings, the virtual reality technology applied to the design scheme presents a conventional and more realistic real world. The use of virtual reality technology to assist architectural landscape design not only allows architectural landscape design works to break through the limitations of time and space but also gives designers the ability to reconstruct the space and time of the architectural landscape environment, especially in terms of modeling ability, design ability, innovation ability, and expression ability. More highlight its advantages.

5. Conclusion

Through this multidimensional real-time visual environment presentation technology, the design structure optimization and analysis of the architectural landscape environment and the display of the virtual architectural landscape can be more intuitive and convenient to ensure that the overall structure and local details of the design plan reached the unity of function and layout. This article describes in detail the impact of virtual reality technology on urban landscape design, combined with two detailed investigations on the production of interactive virtual urban landscape scene systems, and concludes that the existing virtual reality technology can be used to improve the quality of urban landscape design. In addition, this article explores ways to improve work efficiency, as well as new changes in landscape design content and expression methods in the context of the digital age. Based on the research results of theoretical research and design methods, the experimental practice of specific virtual landscapes is carried out to verify the research results obtained before and then provide a reference and basis for future research in this field. This paper proposes a new method to optimize the scene model using 3ds Max and SketchUp as a virtual scene modeling platform. This paper uses virtual reality technology to optimize urban landscape design and support decision-making, so as to achieve visual effect. After optimization, urban landscape planning has higher efficiency, richer performance technology, more information, higher analysis capabilities and accuracy, and more active functions. In addition, it is necessary to improve the effectiveness of urban landscape construction, improve the effectiveness of urban landscape management, optimize the conceptual design and make full use of the actual site, optimize the level of urban landscape resources, and promote the sustainable development of urban landscapes.

Data Availability

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

Conflicts of Interest

The authors declare that they have no conflicts of interest.

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