Research Article

Application of Landscape Architecture 3D Visualization Design System Based on AI Technology

Yong Zhang

College of Animation and Digital Art, Anhui Sanlian University, Hefei 230601, Anhui, China

Correspondence should be addressed to Yong Zhang: ysxy@slu.edu.cn

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With the vigorous development of computer, two-dimensional data acquisition technology and massive data dynamic visualization information technology, two-dimensional geographic information system (GIS) has gradually matured, and has been transferred from the initial visual expression to thematic application. Because 3D geographic information system has the characteristics of multidimensional data processing, classification, and presentation of information, it breaks through the confinement of monotonously displayed information on the traditional two-dimensional plane and has made breakthroughs in government assisted decision-making, national resource investigation, intelligent transportation, and other fields. E-commerce has been widely used in the field, and it is also very obvious in the field of spatial information socialization, playing an irreplaceable intergenerational effect. The visualization of landscape design is one of the key technologies to construct 3D GIS. Based on the combination of basic research and practical application, this paper deeply analyzes the openness of the garden 3D visualization system using artificial intelligence technology and completes the overall structured design of the 3D visualization system on the basis of studying the practical value and feasibility. Combined with the construction of the system, it is true to determine the acquisition method and construction method of three-dimensional landscape architecture model data, classify the landscape architecture information, and establish geometric model type libraries and texture model libraries. At the same time, the system adopts the object-oriented spatial relational database management mode to organize and manage the three-dimensional landscape building data efficiently and quickly. Determine the corresponding software and hardware configurations, carry out the interface design of the system and the division of functional modules, and establish a three-dimensional terrain visualization system for landscape architecture. In order to improve the operational efficiency of the system, the data is rationally organized and managed while taking optimization measures for the 3D model. Finally, the system adopts AI technology and uses component technology to realize the research of the intelligent terminal application system of landscape architecture.

1. Introduction

In recent years, with the development of artificial intelligence technology, artificial intelligence technology in many related disciplines of the application are very extensive; for scientific theory and practical application, artificial intelligence technology has become an independent technical body, and the main areas of artificial intelligence include automation technology, intelligent translation, aerospace technology, automatic control of programs, and other complex physical tasks. In information visualization design, the application of artificial intelligence technology can play a role in the advantages of information visualization design and has a positive role in promoting the further development of visual design. As early as 18 years ago, Professor Negroponte, still at the Massachusetts Institute of Technology, published “Digital Survival,” a book depicting a possible digital future, in which people see a new way of life, a future world filled with the Internet and digits [1]. Negroponte said: “Computation is no longer just about computers; it determines our existence. The best way to predict the future is to create it.” Discovering existing problems, open up possibilities that are difficult to discover in specific regions, and then produce unique and excellent solutions. Indeed, technology also touches on the details of life. Our reliance on technology is growing. People’s demand for
information technology is getting higher and higher. Digital information technology has brought great changes to people's daily life, making people regard the convenience brought by technical equipment as a basic element in their daily life. People have become accustomed to integrating mobile phones, tablet computers and other portable digital products and network technologies into their lives and careers. People are used to convenient and fast big data transmission methods, such as watching IMAX movies in the theater, watching the latest reports with Google glasses, etc., to experience the surreal effect brought by visual technology, and this digital method is also subtly changing people's thinking mode and life style [2].

Since the mid-1960s, Roger Tomlinson proposed to use electronic computers to process maps and started large-scale scientific research activities such as system theory, spatial models, and resource assessment. This attempt was the first to use geographic information systems. Digital technology is playing an increasingly important role in the current landscape design process, with the development background of the distinct symbol of the computer age. The future era is the era of digital and information [3]. Especially in urban construction and urban and rural planning, which are closely related to the development of the landscape architecture industry, the design of big data, data simulation technology, artificial intelligence technology system, and the application of modern information technology are helpful to deal with many more complex problems. In terms of landscape, these methods have gradually penetrated into all aspects of the subject field, and the original computer-aided methods have changed [4].

At present, environmental protection has become one of the most important issues in the survival and development of human beings in the world. Human beings are fully aware of the necessity of environmental protection, especially the rapid development of modern urbanization, which reduces the green area and brings huge air and environmental pollution. Urban landscape design should be based on the principle of ecology and diversity, and provide people with a healthy and beautiful living environment. Today, when economic and social development and environmental protection require harmonious development, we are more aware of the need to create necessary guarantees for the sustainable development of environmental protection [5].

Landscape architecture is a basic science for sustainable construction and improvement of human settlement conditions. It has been included in the national first-class discipline. However, it still needs the full cooperation of the whole field and scholars to make greater development in the field of basic theoretical research and practical application. The creation and consumption of wisdom have become the "new weather" in the field of landscape construction. In the past two decades, the degree and importance of standardization of Landscape Architecture disciplines and technologies have been unprecedentedly improved, followed by normative issues, which have gradually pushed knowledge research, innovation, and verification onto the track of scientific development. However, in the face of the great opportunities in the 21st century, the field of landscape architecture must continue to expand, including landscape science and technology, ecology, agricultural science, computer technology, finance, industrial design, and art related to architectural design, urban planning [6]. Multiple disciplines permeate each other and expand new development directions.

Although the international status of China's landscape architecture specialty still needs to be improved, foreign experts say that the employment rate of China's landscape architecture engineers is still far lower than that of architects and planners, and China's domestic specialties are generally the same. With the introduction of urban planning and landscape design, the key role of landscape design in urban planning and design is more and more prominent [7]. Many experts and scholars have pointed out that the construction of garden industry will bring brand-new vitality and impact to China's emerging urbanization construction process, and become an indispensable part of China's urbanization process. Among the few design elements, it has become the main technical means for the orderly development of urban space. It also shows that landscape architects must pay more attention to the new situation of the extensive application of modern information technology in urban landscape forests on the basis of retaining the basic design theoretical knowledge described in Figure 1.

AI technology is characterized by digital simulation with a computer application software system to form a digital model of the landscape. Not only landforms, vegetation systems, water bodies, and climates but also various fragments, curved surfaces, bumps, irregular surfaces, and dynamic, fleeting landscape elements can form three-dimensional visualization in the form of digital models results. Thus, the details of a three-dimensional landscape are almost identical to the real world, not only breaking through the abstraction of two-dimensional maps and profiles but also providing a dynamic view of the landscape from different angles from different perspectives, unlike the single perspective of computer graphics or photo montage technology. In addition, the three-dimensional landscape also has its greatest advantage: the change of landscape elements can be changed by the data in the geographic information system, and accordingly, it is intuitively reflected in the three-dimensional landscape. In European and American countries, AI has become a new creation tool and production method in the current IFC industry. It has been used in engineering cases, which intuitively proves the value advantage of artificial intelligence [8]. Building information module is the most direct application of digital technology in the construction industry. By bringing the life cycle theory into all the work centers of the construction industry, it integrates all the scattered work information. This reduces the possibility of mistakes and creates opportunities for smooth work, thus greatly shortening the project duration, reducing the project cost, and improving the quality of the project content. Due to the rapid application of artificial intelligence technology in construction, engineering, building management, and other industries, the national nibms has issued relevant building artificial intelligence specifications. The current architectural design industry has
also begun to gradually introduce and popularize computer and other auxiliary technologies. This form has been widely recognized by designers and has also well met the needs of the international market [9].

Landscape architecture is a dynamic entity constrained by natural environment and artificial use, and its design covers a wide range of scales and research objects [10]. With this in mind, landscape architecture design and planning management processes are developed to take into account the user population’s response to natural changes and their vision for the future over time. However, the design itself in the landscape architecture is not generated at one time and needs to be revised and scrutinized a lot, which is a very time-consuming and labor-intensive process. A convenient process is necessary for designers and planners. In recent years, computer graphics, capable of creating increasingly realistic virtual environments to represent actual or possible future landscapes, have been used by architects, = landscape architects, and urban planners in their designs. This can bring a good understanding of the project design to the owners or users to view and understand their design concepts so that designers can create more options with relatively less time and energy. However, a complete software platform that can be applied to landscape architecture design has not yet been provided, which will cause the development of the landscape architecture industry to lag behind other disciplines. Therefore, it is necessary to build an information model suitable for the landscape industry to carry out information transformation for the industry as a future trend.

2. State of the Art

2.1. Application Status of Foreign AI Technology

AI technology does not require excessive investment in equipment, and AI design concepts have been developed and used in the AEC industry (AEC industry refers to the construction, engineering, and construction industries, involving three aspects: housing construction, civil engineering construction, and installation) for more than 20 years, such as product model design, virtual building, and smart object model concepts. In the past, because 2D was a nonconsistent graphic file (e.g., the floor plan and elevation map could not be updated automatically), it belonged to incoherent data information. Today’s 3DAI can perfectly solve this problem. Various countries have issued relevant policies and regulations in their AEC industries to encourage the use of AI in industrial production [11]. The use of AI best practices can be efficient and effective. AI technology has four main advantages in industrial industries, including expanding design potential, simplifying project management, improving safety, and improving accuracy. AI may challenge some of the constrained design, construction, and management of built environments. The AI project implementation plan guide of the American Smart Building Alliance (building SMART alliance (bSa)) conducts a survey and research on the current use of AI in the AEC field in the United States and sorts out different applications of AI. It is believed that the AI planning team can choose and implement the application plan of AI according to the actual situation of the construction project. From planning, design, construction to operation, and maintenance development stages, some applications span one or more stages, and some applications are limited to a certain stage. Because there have been many research reviews of AI in the field of construction, and it is not the focus of this research field, we will not repeat the application of AI in the field of construction [12].

Professor Cote. P of Harvard University in the United States proposed the concept of “smart city” and pointed out that the combination of AI technology and GIS technology to carry out the construction of digital city believes that this method can realize the real digital city [13]. Dr. Buhmann, President of the International Society for Digital Landscape, has retrieved documents in recent years, including books, journals, and conference papers through five academic paper collection institutions, including SpringerLink, Automation in construction, ProQuest, Google Books, and Scholar, using AI, AI and landscape architecture, landscape model and landscape information model, and other keywords to search.
for relevant literature content, and found that, from 2002 to 2012, AI-related articles and AI applications in landscape architecture showed a slow growth trend. With the popularity of AI in recent years, its application in other industries has become more and more extensive, and related research has also emerged in an endless stream. Foreign conferences on landscape architecture research are also actively discussing how to apply AI to landscape architecture design [14]. Henri Achten discussed the extension concept of "building information modeling" (BIM) in the field of landscape architecture around a recently started doctoral research project. Software developers of AI technology, such as Autodesk and Nemetschek Vectorworks, also expand the functions of their AI software and develop different functional modules to meet the needs of designers in different design fields. For example, Vectorworks software has developed a landscape architecture module, lighting design module, infrastructure module, rendering plug-ins, and other design file libraries on the basis of the architecture module to provide designers with AI technology assistance in their fields.

2.2. Application Status of Domestic AI Technology. The use of AI in China first appeared in Hong Kong. The Bird’s Nest National Stadium of the 2008 Beijing Olympic Games and the National Aquatics Center of the Water Cube are both successful cases of applying AI; the corresponding national pavilions of many countries at the 2010 Shanghai World Expo were designed and constructed using the AI platform technology. There are also many building cases in Taiwan where artificial intelligence is applied. Many key points such as coastal landscape renovation, restoration of traditional wooden buildings, deep ocean application, and transformation of the plant into a Resort Park in Hualien Marine Resort, Taiwan, have been helped by artificial intelligence technology, which has reduced the error of the whole project by 30%, and saved the cost for the enterprise [15].

Many domestic architectural engineering design institutes have also begun to set up artificial intelligence teams to design building facilities. Artificial intelligence technology has also been widely used in some major projects in first-tier cities. The galaxy SOHO building project in Chaoyang District of Beijing was completed by Zaha Hadid Architects. The whole process from scheme design to solid model manufacturing to actual construction involves the use of artificial intelligence technology software, such as Revit software [16]. The introduction of AI into real estate projects is also the focus of real estate developers. After industrialization, Vanke Real Estate can save energy as follows (Table 1).

The prospect of using AI in real estate projects is very promising. For the integrated design of landscape architecture in real estate projects, the location, distance, body shape, and so on between buildings can be scientifically planned for the analysis of sunlight and wind environment in the project.

Professor Li Xiong of Beijing Forestry University has reviewed in detail the advantages of AI technology, such as efficiency improvement, convenient working mode, high information sharing, nondestructive transmission, and resource saving brought about by AI technology in construction and related industries. By introducing AI into landscape architecture design and construction, traditional problems such as no innovation, complex construction management, low construction safety, and poor accuracy can be solved.

2.3. Application Status of 3D Digital Technology in Landscape Architecture at Home and Abroad. Domestic research on the application of digital technology in urban landscape design is carried out on the basis of deep understanding of foreign literature. Due to the progress of science and software technology, the teachers of colleges and universities at home and abroad have made fruitful achievements in relevant fields, and the research results are mainly published in academic conferences, magazines, and periodicals in the form of books and academic papers so that everyone can master the new scientific research trend [17]. Parameterized design is the design process that writes the project itself as a function and a process through modifying the initial conditions, calculates the engineering results by computer, and realizes the automation of the design process, which well shows what is parametric design, how to use various software technologies to realize the parametric design of complex forms, and the way of thinking applied to larger scale urban design.

Professor Chi Zhiwei of the Institute of construction and urban planning of Tongji University and others discussed the basic requirements of the parametric design of urban landscape design and gave the main technical framework involved in the urban landscape parametric scheme and the parametric model. And creatively uses the matrix diagram to establish the parameter combination method to represent the different parameters of each variable. This specification provides methods to help designers make adjustments and decisions. This technology is easy to apply to small and medium-sized landscape design, and its easy to grasp structure and operation process also makes a meaningful study on the data use of this scale.

Bao Ruiqing, a professor from the school of materials of Beijing Forestry University, also explained in detail how the three fields are interdependent in the auxiliary landscaping construction by using computer-aided landscape design, GIS, and ecological-aided design technology. This is also helpful for software selection under various conditions. This shows that the in-depth application of landscape design and computer is conducive to the formation of discipline links in various fields.

2.4. Combining Visualization with Landscape Model. The meaning of the term “three-dimensional visualization” is “a simulation, which uses real three-dimensional images to express the visual art expression of the landscape area and allows users to freely view and explore the terrain in all areas with limited vision.” The ideal three-dimensional visualization mode is the three-dimensional spatial architectural
landscape mode established under the given design instruction, so we need to understand how to integrate this technical means into the landscape design concept. Lynch & hack pointed out that if the designer only relies on his past work experience and visual experience, he will lose the opportunity to discover the hidden information in the website. The design scheme of all design websites is independent. This unique attribute usually comes from the difference between design and site information, as shown in Figure 2. Perhaps we need to understand the network itself from a close distance and link the creativity of the web page with the height of the page design. The on-site work is completed in two steps. The establishment of "virtual world" (i.e. the idea in the mind of the landscape designer) is determined by the mind of the designer. They believe that images and physical models are traditional visual forms used to help designers build such internal models ("virtual worlds") [18]. However, with the development of modern technology, this metaphor has also been proved to have great advantages in using 3D modeling and real-time visualization technology in landscape design. Essentially, it is now possible to construct digital virtual worlds using interactive 3D visual models of the landscape to support Lynch's theory.

Obviously, in the strengthening stage, designers can combine interactive 3D scene visualization with architectural design activities, and visualization is also a way to promote interaction between designers and architects. When they see some visualization, they may apply their knowledge and experience to the model. Bringing designers, scientists, and stakeholders together to create visualization, and the ability to discover the essence of space allows 3D visualization technology to support the research around the conceptual model of participants, thus increasing the active participation of human beings, as shown in Figure 3. This in turn can also increase mutual understanding with other participants [19].

In the process of product design, using interactive 3D visualization information technology can make product design and visualization 3D model more convenient. The flexible three-D model allows the redesign of the three-D landscape model. Landscape design and consulting companies are constantly supported by visual information technology, such as plan, section, aerial view, and rendering. In the interactive 3D scene visualization mode, we can manipulate the visualization by ourselves, for example, using a variety of sensory stimulation to generate an immersive feeling and run independently on the model. In this way, it can bring convincing value to the user's two-dimensional image. When interactive 3D visualization is carried out through this collaborative method, participants can better understand the scene through the interaction of the visualization process, so as to form the unity of credibility in the whole landscape design process. The details are shown in Figure 4.

However, the interactive 3D visualization of landscape modeling may not be able to fully replace other forms of visualization. Therefore, if the designer finds himself unable to understand the connotation of his architectural design, the traditional form of landscape visualization can meet the needs of people who want to know. Some views of 3D images can be used as the visualization to convert more environmental details, and the same landscape modeling visualization can also be applied to other levels of architectural design. Therefore, once the scientific calculation visualization model of the agricultural park used to cultivate commercial cash crops is developed, the changes of the crops in the agricultural park can be predicted through interactive visualization during the impact of architectural design ideas. It is also helpful to understand the model representation in interactive 3D modeling software tools. There are two commonly used software to show the interactive 3D visualization suitable for checking the results of the on-site design meeting.

There are many types of schemes in the first category. You can create and view any 3D objects in two environments at the same time: computer-aided design software (i.e., CAD application software), such as Auto CAD, and three-D construction packages used as advanced rendering schemes (such as Maya and 3D Studio MAX). The boundaries between more and more application software development tools are blurred by application software packages (such as sketch up). These software packages can also carry out CAD style product design based on the general three-dimensional space model. In addition, there is 3D GIS, which is essentially a standard geographic information system service, expressed in the form of 3D views under different views and relational data storage for 2D geographic information data. This form of visual three-dimensional model is often combined with a mouse or keyboard control with a user interface controlled by menus or icons, although it has become possible to directly operate external controls of available three-dimensional views. Computer vision game design allows users to feel the landscape mode from the visual level, rather than distracting the graphics around the GUI (graphical user interface). It creates an immersive and easy to master three-dimensional visual expression technology, and can use standard video game consoles to realize different operation modes, so as to create a higher picture expression depth in three-dimensional modeling.

Building a 3D landscape visualization model requires three basic elements: software that can display the model in real time and process it, a computer that can run the software efficiently, and a 3D model of the area, as is shown in Figure 5.

Although there are more software packages (vector-works, lumion, simetriy3d, and Cinema+D3D) or computer engines that can switch the real 3D mode and more convenient computer hardware, the main problem is to establish the 3D visual and landscape mode. Before the three-dimensional model needs to be established, a large amount of data must be collected to establish the model in the required detailed range as shown in Table 2.

### Table 1: Vanke Real Estate can save energy after industrialization.

| Steel          | Reduced by 50% |
|----------------|----------------|
| Construction energy consumption | Reduced by 30% |
| Construction budget        | Reduced by 25% |
| Wood loss reduced         | Reduced by 75% |
| Construction waste        | Reduced by 80% |
| Renovation waste          | Reduced by 90% |
3. Methodology

Webgl (full write webgraphics Library) is a three-D drawing specification. By using the JavaScript binding of OpenGL es 2.0, webgl combines JavaScript with OpenGL es 2.0 standard to depict the hardware three-D of HTML /five canvas. Web developers can more smoothly display the three-D picture model on the web page through system graphics, thus realizing more complex navigation and data visualization. Supported by a variety of open source JavaScript implementation engines, WebGL has the characteristics of realizing cross-platform applications. Common WebGL implementation engines are shown in Table 3 [20].

3.1. Affine Transformation. Affine transformation is a transformation obtained by translation after the graphics are linearly transformed. The derivation process of the affine transformation matrix is described in the following.

A point in three-dimensional space is represented by homogeneous coordinates, and the fourth component is 1. For example, translate the point \( P(x, y, z, 1) \) to the point \( P'(x', y', z', 1) \): \( x' = x + ax, y' = y + a, z' = z + u \).

The translation can be expressed in the form of column matrix addition. In order to facilitate the calculation and combination of other affine transformation operations, the operation form is \( P = TP \). From the translation of point \( P \), we can derive the expression for \( T \):

\[
T = \begin{bmatrix} 1 & 0 & 0 & a_x \\ 0 & 1 & 0 & a_y \\ 0 & 0 & 1 & a_z \\ 0 & 0 & 0 & 1 \end{bmatrix}.
\]

The fixed point of the model in this paper is the origin, so in three-dimensional space, the model can be rotated around any axis, and the origin must be on the rotation axis. In addition, the unit vector of the rotation axis is \( A(x, y, z) \), and the point \( P \) is rotated around the vector \( A \) by 0 angles to
obtain the transformation of the point \( P \) as \( TP \). There are third-order matrices \( H \) and \( K \), so the expression for \( T \) is

\[
T = H + \cos \theta \cdot (1 - H) + \cos \theta \cdot K,
\]

(2)

where \( I \) is the third-order identity matrix.

Euler rotation only needs three values to represent the rotation state of the object, that is, the rotation angle around the three axes of \( x \), \( y \), and \( z \). Using these three values, three rotation transformation matrices can be calculated, and the final rotation transformation matrix is their product. It should be noted, however, that the commutative law does not apply at this time. Therefore, the rotation transformation matrices obtained by different rotation orders around the three axes are also different.

The expression for the rotation of point \( P \) around the \( z \)-axis is \( P = RP \), and the equation is obtained:

\[
\begin{align*}
x' &= x\cos\theta - y\sin\theta, \\
y' &= x\sin\theta - y\cos\theta, \\
z' &= z.
\end{align*}
\]

The expression for \( Rz \) can be obtained. Similarly, the transformation matrix \( Rx \) rotated around the \( x \)-axis and the transformation matrix \( Ry \) rotated around the \( y \)-axis can be calculated.

| Main classification | Name of software | Notes |
|---------------------|------------------|-------|
| Model building tools| Rhinoceros        | 3D model building tools |
|                     | Grasshopper      | A visual node programming modeling parametric tool based on rhinoceros |
|                     | Autodesk Revit   | Building 3D construction software that supports building information modeling (BIM) |
|                     | Cinema 4D        | 3D drawing software with extremely high computing speed and powerful rendering |
|                     | Vectorworks      | 3D drawing software, switch between 2D and 3D perspectives in real time |
|                     | Autodesk 3ds Max | 3D animation rendering and production tools |
|                     | SketchUp         | 3D model building software |
|                     | Xfrog            | Modeling tools for making trees, flowers, and plants |
|                     | AutoCAD Civil 3D | Building information modeling for civil engineering |
|                     | Simmetry 3D      | 3D model building software that supports environment rendering |
| Post rendering tools| VUE              | 3D natural landscape design software, emphasizing later |
|                     | Vray             | High-quality rendering software |
|                     | Lumion           | Simulation scene creation software |

Table 3: Common WebGL implementation engines.

| Engine name       | Introduction |
|-------------------|--------------|
| Babylon.js        | Known as the best JavaScript 3D game engine; the application is inclined to web game development |
| PlayCanvas        | An enterprise-level open source project that encapsulates a large number of tools that can be used to rapidly develop 3D games |
| Blend4Web         | An engine that works with the modeling tool blender |
| Enchant           | Ability to create simple apps and games based on HTML5 |
| Three.js          | Currently the most popular WebGL implementation engine, with an active community and rich cases |
Any rotation transformation matrix with a fixed point as the origin can be represented by the product of the rotation transformations around the three coordinate axes: 

\[ R = R_z R_y R_x \]

(4)

The above is the expression of the affine transformation matrix, and the model matrix of the three-dimensional graphics can be expressed as the product of the above transformation matrices.

### 3.2. View Transformation Matrix

The perspective projection matrix can be obtained only when the viewpoint is at the origin of the coordinates, which is realized in the positive direction of the z-axis. In fact, the position of the viewpoint is arbitrary, and the direction of the line of sight is also arbitrary. On the basis of determining the origin and the positive direction of the z-axis, the view transformation matrix is determined by the viewpoint position in the non-origin viewpoint and the line of sight in the nonpositive direction of the z-axis so that it is consistent with the position of the origin and the positive direction of the z-axis. This process is earlier than the projection transform.

Suppose the forward vector of a viewpoint is \( N \), the upward vector is \( V \), and the right vector is \( U \). Then, \( U, V, \) and \( N \) are unit orthogonal vectors to each other, and the cross product of the two vectors can obtain the third one, and the viewpoint position is \( P \). Assuming that the transformation matrix of the three vectors \( U, V, \) and \( N \) aligned with the coordinate axis is \( B \), according to formula (5), it can be known that \( U_B = (1, 0, 0), V_B = (0, 1, 0), \) and \( N_B = (0, 0, 1) \). The expression of matrix \( B \) is shown in equation (6):

\[
\begin{bmatrix}
U_x & U_y & U_z \\
V_x & V_y & V_z \\
N_x & N_y & N_z
\end{bmatrix}
B =
\begin{bmatrix}
1 & 0 & 0 \\
0 & 1 & 0 \\
0 & 0 & 1
\end{bmatrix}
\]

(5)

\[
B =
\begin{bmatrix}
U_x & U_y & U_z \\
V_x & V_y & V_z \\
N_x & N_y & N_z
\end{bmatrix}
\]

(6)

### 4. Result Analysis and Discussion

The three-dimensional landscape visualization technology based on geographic information system has dual characteristics; on the one hand, because its realistic three-dimensional visualization function has strong communication ability, on the other hand, the geographic information system based on three-dimensional visualization has a powerful information collection and processing function, which not only will make it favored by landscape planning but also may bring synergy between various disciplines as is shown in Table 4.

### 4.1. Test Planning Effect

Based on the experimental parameters set in this experiment, the first group of experiments was carried out. According to the digital landscape garden landscape selected in this experiment, the commonly used planning landmark proposition is used as the comparison object of this group of experiments. From the digital landscape planning area, four buildings A, B, C, and D are selected. Among these four buildings, a leisure area and parking lot are planned. The leisure area includes pavilions, lawns, fitness equipment, and parking lots. The field is divided into two areas for bicycles and electric vehicles, as is shown in Figure 6.

According to the locations of buildings A, B, C, and D shown in Figure 6, three groups of systems are used to plan the leisure areas and parking lots in buildings A, B, C, and D, respectively, and the results are solved according to the planning and solutions of the three groups of systems, the solution can obtain the required solution time, garden area

| Table 4: System operating environment. |
|-------------------------------------------------|-------------------------------------------------|
| Configure Parameter | Parameter |
|----------------------|-----------|
| Server | PC PH/400 |
| CPU | Intel Core i5 |
| Browser | Microsoft IE 8.0 |
| RAM | 4 GB |
| Hard disk | 6 G |
| CPU power | 2.4 GHz |

Figure 6: Locations of four buildings A, B, C, and D.
and parking lot area of the three groups of methods, and whether the garden and parking lot area exceed the planned area of the community. The solution comparison results of the three groups of systems are shown in Table 5.

It can be seen from Table 5 that although the time taken for the C system to solve is relatively short, the garden area and the parking lot area both exceed the planned area, and the obtained planning solution is the worst; for the B system, although the garden area and the area of the parking lot do not exceed the planned area, it takes the longest time; not only does the A system solver take the shortest time, but also the area of the garden and the parking lot does not exceed the planned area. It can be seen that the digital landscape area planning system designed this time can specifically plan the landscape according to the landscape area of the landscape garden, and the time is short. 2.2.2 system function test. The second group of experiments is carried out according to the results of the first group of experiments. According to the functional modules of the three groups of systems, a system test case is designed to detect the system operation function. From the four aspects of user management, database, system maintenance and planning, and design, the following cases are designed: ① When adding user information, if you do not fill in the required items, whether a prompt box will popup. ② When deleting or modifying user information, whether there is a prompt box. ③ After accidentally deleting the data information, whether there is a backup in the system. ④ Retrieve the data in the database, whether the retrieved content is consistent with the retrieved content. ⑤ When changing the user settings, whether there is security verification. ⑥ Change, delete, and add drawings, whether there is a prompt box. ⑦ Retrieve construction drawings and check whether construction drawings are classified by project category. According to the eight cases designed above, it is verified whether the system functions meet the expected results and whether there are any remaining problems during operation. There are test cases that fail in both system B and system C; that is, the test results do not match the actual expectations, and there are still some remaining problems in the cases that fail; all cases in system A pass; there are no legacy issues. It can be seen that the digital landscape architecture landscape planning system designed this time has perfect functions. 2.2.3 comparison of

| Case | Expected result | Test result | Remaining problem |
|------|----------------|-------------|------------------|
| 1    | Popup prompt   | Yes         | No               |
| 2    | Popup prompt   | Yes         | No               |
| 3    | Data backup exists | Yes | No               |
| 4    | Content is consistent | Yes | No               |
| 5    | Popup security verification message | Yes | No               |
| 6    | Popup security verification message | Yes | No               |
| 7    | Popup prompt   | Yes         | No               |
| 8    | Sort by category | Yes | No               |
| 1    | Popup prompt   | Yes         | No               |
| 2    | Popup prompt   | Yes         | No               |
| 3    | Data backup exists | No | Yes              |
| 4    | Content is consistent | Yes | No               |
| 5    | Popup security verification message | Yes | No               |
| 6    | Popup security verification message | No | Yes              |
| 7    | Popup prompt   | Yes         | No               |
| 8    | Sort by category | Yes | No               |
| 1    | Popup prompt   | Yes         | No               |
| 2    | Popup prompt   | Yes         | No               |
| 3    | Data backup exists | No | Yes              |
| 4    | Content is consistent | No | Yes              |
| 5    | Popup security verification message | Yes | No               |
| 6    | Popup security verification message | Yes | No               |
| 7    | Popup prompt   | Yes         | No               |
| 8    | Sort by category | No | Yes              |

Figure 7: Landscape planning accuracy of digital landscape architecture.

| TIMES (TIME) | ACCURACY (%) |
|-------------|--------------|
| 1           | 40           |
| 2           | 50           |
| 3           | 60           |
| 4           | 70           |
| 5           | 80           |
| 6           | 90           |
| 7           | 100          |

- A system
- B system

Table 5: The solution comparison results of the three groups of systems.
landscape panning accuracy of digital landscape architecture. According to the results of the first group of experiments and the second group of experiments, the third group of experiments was carried out, and the accuracy of digital landscape architecture landscape planning in the first group of experiments was extracted. In order to ensure the rigor of the experiment, 50 seconds, the three groups of systematically planning the digital landscape architecture landscape accuracy are shown in Figure 7, the digital landscape architecture planning accuracy. From Figure 7, it can be seen from the landscape planning accuracy of digital landscape architecture that the accuracy of system B planning digital landscape architecture has a fluctuation difference of as high as 14, the highest accuracy is only 81%, and the planning accuracy is the lowest; the accuracy of system C planning digital landscape architecture fluctuates. Although the difference is small, the planning accuracy still does not reach 90%; not only is the planning accuracy of the digital landscape architecture system A small, but also the lowest planning accuracy is 89% and the highest is 95%. It can be seen that the digital landscape area planning system designed this time has a high planning accuracy.

5. Conclusion

With the rapid development of the information age, the information models in the artificial intelligencesoftware of the landscape design industry are becoming more and more abundant. Landscape architecture itself is an industry that requires a perfect blend of art and science. Contemporary landscape design has changed from aesthetic design to practical design. The sustainable design combining science and technology with art is an inevitable trend. If we simply rely on the gorgeous appearance of buildings, or even blindly adopt advanced engineering technology, it will not only pollute people’s aesthetic feeling, but also lose the original value of landscape construction. Therefore, the landscape engineering information model must closely combine the good environmental performance conditions with the actual accuracy of the project, and the quantitative forms in the model construction, so as to create a good mode basis for the landscape engineering design. This is another question that needs people’s consideration.

After a large amount of data research and research on modeling of relevant landscape elements, we think that is reasonable in principle to carry out research on the same mode of landscaping system according to the landscape characteristics of different types of software platforms, which is only limited to technical means and software development. These remain to be explored. Therefore, according to the new problems of landscape planning, it is necessary to establish a landscape information model about on-site landscape design to make up for the theoretical deficiencies and expand the field of vision of on-site landscape design and construction.

Data Availability

The labeled dataset used to support the findings of this study is available from the author upon request.

Conflicts of Interest

The author declares that there are no conflicts of interest.

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