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Computer-Aided Design AND APPLICATIONS

Design and Realization of Environmental Art System in View of Virtual Reality CAD Technology

Mingming Zhang[1*] and Enhui Yang[2]

[1]Art College, Anhui Jianzhu University, Hefei 230009, China, zmm@ahjzu.edu.cn
[2]Art College, Anhui Jianzhu University, Hefei 230009, China, actcg@163.com

Corresponding author: Mingming Zhang, zmm@ahjzu.edu.cn

Abstract. As an applied product combining modern technology and art, virtual reality technology has established a leap-forward product display virtual space and three-dimensional display platform in the process of combining with the environmental art industry, providing a carrier for development. A personalized and spatialized multi-dimensional display mode for the environmental art industry. An important tool for innovation and reform in the environmental art industry. This paper analyzes the application form of virtual reality technology combined with CAD technology in the environmental art industry and the opportunities and challenges it faces, so as to provide reference for related industries.

Keywords: Virtual Reality; Environmental art design; CAD technology.
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1 INTRODUCTION

With the development of digitalization, networking and integration in the Internet era, the three-dimensional animation display of environmental art has become an important carrier of the current industry's innovative display form. As a platform for displaying art in model space, virtual reality shows multiple designs in the way of virtual space creation and construction. It is not only conducive to the image display of three-dimensional space, the maximum efficiency of the use of modern means to complete the environmental art innovation, but also conducive to the art industry product development acceleration, design cycle compression, quality improvement and cost reduction, is the environmental art industry to show the key means of the industry competitiveness.

In recent years, CAD technology has made rapid development, has been relatively good to solve the plane and space analysis and calculation problems, the vast majority of analysis and calculation programs have CAD interface, so that the calculation results are graphical, the designer from the heavy structural calculation work to free. presently. Designers can easily complete the two-dimensional environmental art design with the help of drawing software. Computer-aided

design or CAD techniques and drafting refers to the use of computer systems to assist in the creation, modification and analysis of designs and optimizations. The CAD system consists of hardware and software. The hardware includes hardware platform equipment such as processing computing equipment, graphics display equipment, external storage equipment, data graphics input and output equipment and related information transmission, software system includes system related software, support software (graphics, Chinese characters, etc.) and professional application software, CAD software is a powerful, easy-to-learn and open software that is not only convenient for users to use, And the system itself can be continuously expanded and improved. Therefore, It is commonly used in microcomputers and workstations. With the continuous improvement and development of the region CAD basic theory and application technology, designers have higher and higher demands for the functions of CAD systems, and the three-dimensional CAD system has good visualization, intuitive image, high design efficiency and can provide complete design and process for all aspects of CIMS engineering The advantages of manufacturing information and other advantages make its modern traditional pure two-dimensional CAD system become an inevitable historical development. The concept of digitalization encompasses many aspects. At the most direct application level, one of the characteristics of digitalization is to replace the material basis with information. In the past, the well site of human life used material as the carrier, carrying information exchange, network, information carrier and media, etc., which made the information society replace the material flow with the information flow and realized the transformation. Digitalization is changing the way people live. Digital technology has put forward new requirements for architectural space and form as functional carriers, and some old types of environmental art design will be gradually transformed or even replaced by new ones. This new trend will bring about major changes to art as a carrier of the environment.

In the past decade, virtual reality technology has quietly emerged. It is a computer system that creates a three-dimensional virtual world. This virtual environment created by the system acts on the user's visual, auditory, and tactile senses, so that the user has an immersive feeling, and the user enters the environment naturally through the computer, interacts with objects in the operating system, and then becomes immersed in it. Virtual reality has three most prominent features, namely interactivity, immersion and conceptuality. As a practical technology, virtual reality technology has a large-scale application prospect in the field of environmental art design. Zhou [1] proposed the design and implementation of interactive virtual technology digital art teaching system. Jillella [2] and others established a VR-based scene roaming experience system by integrating digital image processing, computer graphics, multimedia technology, sensor technology and other aspects of information technology and its branches. Shan P and Sun W [3] took the application of computer virtual reality technology in the construction of environmental art design system as the starting point, and realized three-dimensional and seamless reproduction in environmental art design. As a product of the combination of technical thinking and artistic thinking, virtual reality technology has the characteristics of virtuality, comprehensiveness and spatiality. Among them, virtuality refers to the ability to combine with the virtual environment in a specific way to display various content resources in a virtual mode; comprehensive means that a demonstration medium can be established with the help of visual forms, and virtual space can be experienced through multi-dimensional information creation; spatiality refers to the simulation reality and interactive emotions of human-computer interaction can be formed with the help of three-dimensional rendering capabilities. The combination of virtual reality technology and environmental art is very conducive to the organic combination of virtual reality, CAD technology and art design, providing designers and viewers with a richer design perception and visual experience. In terms of actual performance, due to the expressive needs of three-dimensional forms for texture and motion, virtual reality technology in the environmental art industry uses the application of three-dimensional geometric parameter data in the field of virtual reality art design to establish three-dimensional art by using two-dimensional paper sample design, through the combination of digital models, to build a dynamic art presentation of digital models. Chen and Sharma [4] use the chaotic generation method based on the three-dimensional environment

landscape model to generate and implement the virtual environment form. Zhang [5] analyzes the expression of environmental art design based on virtual technology, introducing virtual reality technology into modern environmental art design, and designers can process virtual reality systems through computers. Calì et al. [6] and based on the basic process of computer-aided design, conduct requirements research and analysis of decorative arts systems. Virtual reality can also use virtual simulation to simulate the dynamic effect of the combination of environment and art, realize the compatibility of the system database with the environmental database, complete the free interaction of the database, and maximize the design efficiency and design effect.

2 ENVIRONMENTAL ART DESIGN

Urban environmental art design mainly refers to the artistic design of different landscapes in the city. There are factors such as geography, humanities, science and technology, history, construction, and hydrology in the art design of the urban environment, which comprehensively presents a colorful urban development prospect. Urban environment art design is that for the design landscape of the city, more into the city's multi-faceted factors, fully reflect a city's unique style, through design, to promote the city has a certain local characteristic and representative. Environmental art design needs to be based on naturalness, and then in view of the current circumstances of social development, promote the more rationalization of urban environmental art design, and ultimately be able to better serve people, fully reflecting the main purpose of people-oriented and respecting society.

Currently, the rapidly developing the economy has prompted the emergence of commercial buildings in the city on a large scale, which has prompted many architectural design processes around it to be affected to a certain extent, and gradually develop towards commercial architectural styles. This prompted the style of the building complex to also begin to change, resulting in the gradual integration of characteristic buildings in the city, but this main feature was not the style that the city wanted to have. When one of these styles develops to a certain scale, it will bring a beautiful scenery to the city. Because of the large number of commercial style buildings, the urban style has also changed, and the urban atmosphere has also changed, and finally deviated from the original design goal, and even led to visual fatigue, which led to a decrease in the aesthetics of the city. In many cities, there is still the shadow of classic architecture, and at the same time, more cities have proposed more buildings that copy historical classics, prompting classic buildings to reappear in the sky. Historical classic buildings have their own characteristic artistic embodiment, but also have more places worth learning, but also for more people to learn opportunities. Classic architecture not only has a unique historical significance, so there is nothing wrong with imitating it [7]. However, most cities lack innovation in the process of imitation, resulting in the lack of characteristics of local buildings and monotonous art forms. There are different degrees of monotony in the form of environmental art design, and urban environmental design can follow a model, lacking design centers and styles. In addition, the lack of reasonable layout between buildings leads to the monotony of the overall urban environment. This has a certain impact on the psychological feelings of urban residents, and it lacks novelty. As a result, the urban environmental design is difficult to make a good impression, and it is more conservative and closed as a whole. For the cities in front of them, most cities fail to effectively protect traditional characteristic buildings in the process of modern environmental technology design, resulting in many valuable and excellent classic characteristic buildings being seriously damaged in the new design process [8]. In this case, the city lacks local characteristics during the design of the new environment, and it will cost more money to rebuild it later, and it will also make it difficult to fully reflect the characteristics.

3 CAD AND VIRTUAL REALITY

The current widely adopted CAD systems began in the mid-1970s, and they are mainly two-dimensional interactive drawing systems and three-dimensional geometric modeling systems [9].

At present, three-dimensional geometric modeling technology has been widely used to describe the shape and structure of products and their components, analyze and calculate, and generate data processing information. In terms of modeling methods, in addition to the traditional geometric modeling, a characteristic modeling system and a two-dimensional and three-dimensional parametric design system have been introduced, resulting in a system in which various modeling methods intersect and integrate with each other, it can be said that the current CAD system has achieved the interrelationship of two-dimensional and three-dimensional model modification, as well as CAD/CAM Information integration [10]. But CAD technology is still moving forward, the next generation of CAD system will be a comprehensive environmental support system to support new product design, which and virtual reality system as shown in Figure 1, it can fully support off-site, digital, using different design philosophies and methods of product design work, integration, networking, and intelligence are the functional goals pursued by the next generation of CAD systems.

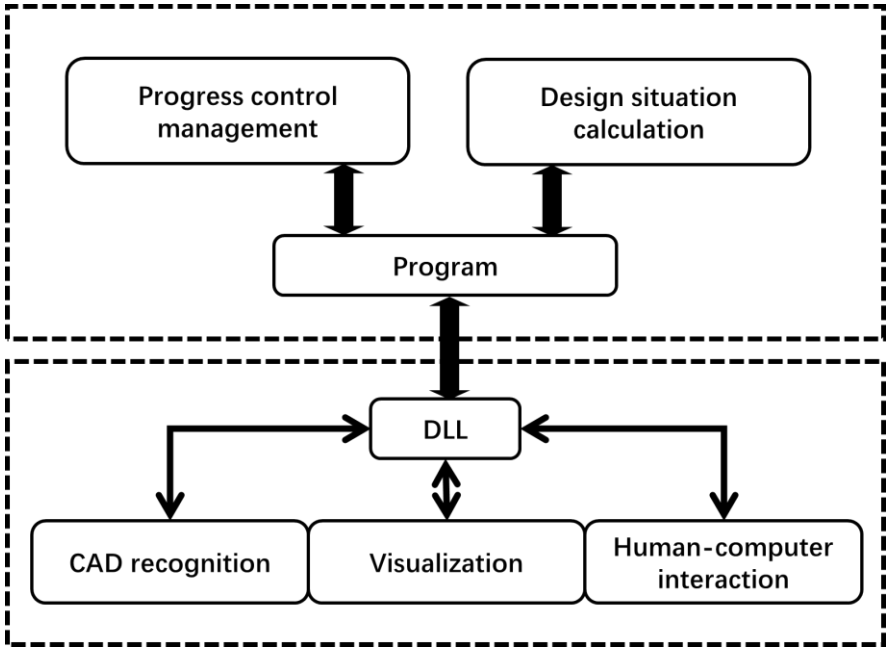

Figure 1: Overall system structure diagram.

Virtual reality is a computer interface technology, that is, the use of computers to generate a realistic, artificial virtual environment with a variety of perceptions, but people in the environment, through a variety of sensing interactive devices (such as stereoscopic helmets, data gloves, data clothing, etc.) and this virtual environment for real-time natural interaction, resulting in a sense of immersion, its orthogonal projection method as shown in Figure 2. Essentially, virtual reality is a very advanced interface between computers and users, through the screen coordinate system shown in Figure 3 projection to the visual coordinate system, it provides users with intuitive and natural interaction methods such as vision, hearing, touch, etc., which maximizes user convenience and improves the efficiency of the entire system. For example, visualizing and operationalizing a concept design or idea is a form of virtual reality. In general, virtual reality has four characteristics: multi-sensing. In the virtual environment, in addition to the usual computer visual perception, users also have multiple perceptions such as hearing, touch, movement, movement, and even smell and smell. It refers to the real degree of the user as the protagonist in

the virtual environment. The virtual reality system can temporarily separate the user from the external environment and completely integrate into the generated virtual world; With the degree of naturalness, users can conduct real-time, real-time interaction and virtual environment through 3D interactive devices, from the inside out, from the outside to the inside.

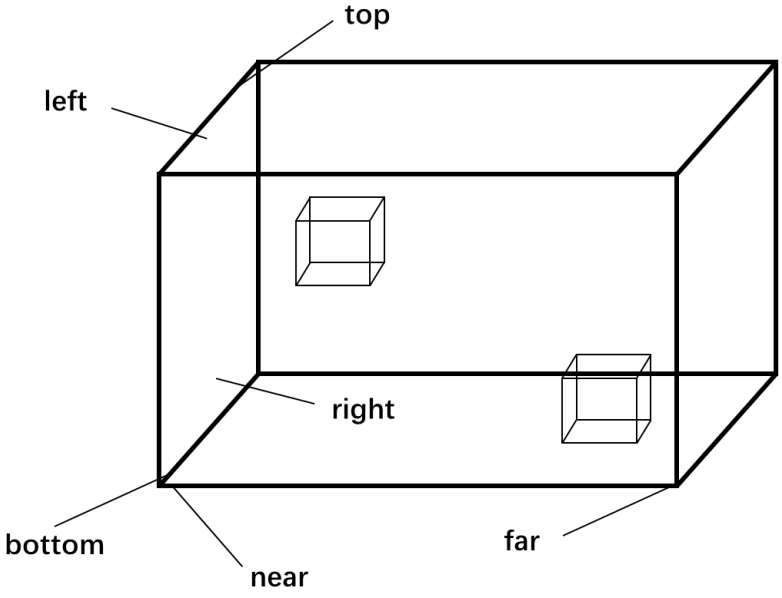

Figure 2: Orthogonal projection scene.

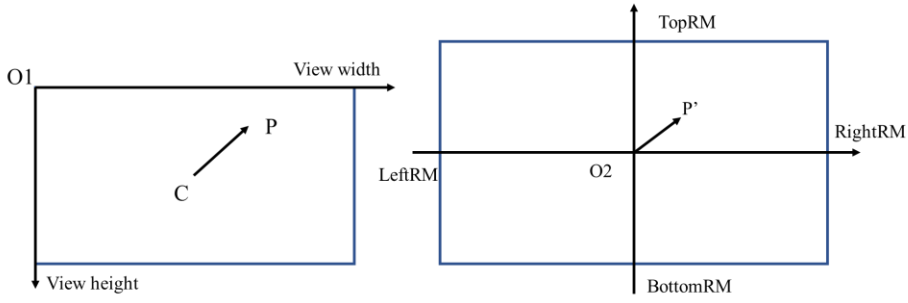

Figure 3: Projecting the screen coordinate system into the visual coordinate system.

For some vertical clothing websites or corporate brands, the virtual display of clothing not only has a gap between technology and understanding, but also needs to recognize the actual performance level of the current clothing virtual reality. In the practical application of this technology, there is a certain gap between the actual application effect of virtual reality technology in many fields and the expectation [11]. Especially for general enterprises, the conditions for environmental art design are lacking. Therefore, the use of art in virtual reality technology can combine art and high-fidelity environment, starting from the high-end level, with the help of the combination of virtual environment, deepen the 3D display of the real environment and artistic design, and complete the virtual 3D construction from top to bottom. Basic requirements for mudding web presentations.

4 REALIZATION OF ENVIRONMENT ART SYSTEM BASED ON VIRTUAL REALITY AND CAD TECHNOLOGY

4.1 Characteristics of Environmental Art Systems based on Virtual Reality CAD Technology

CAD has been rapidly developed in the past 20 years, and its modeling technology has been relatively mature, but there are still many shortcomings in the widely used 3D CAD modeling system: (1) THE CAD system still uses a keyboard and a two-dimensional mouse for data and instruction input, and the interaction ability is poor. Designers cannot use other perceptual functions other than vision, such as hearing and touch, etc.; (2) THE CAD system operation is complex and difficult to grasp, and often defines the specific dimensions of the structure when modeling, which inevitably limits the designer's creative thinking, especially in the conceptual design stage; (3) the CAD system visualization is not high. It is often necessary to manufacture a physical prototype to find design defects; (4) the current CAD system cannot carry out deep design, such as assembly analysis and interference inspection. In order to overcome these defects, virtual reality technology has been introduced into the CAD system, using a wealth of interactive means and perception functions, in the virtual environment for convenient auxiliary design, the test situation is shown in Figure 4. In this way, the virtual reality-based CAD system came into being, which inherits the advantages of traditional CAD technology and provides a realistic, natural and multi-perception design environment for the CAD system, which can greatly be optimized for efficiency and quality of design. Based on the characteristics of the virtual reality CAD system (1) when the designer conducts THE CAD operation, it is more concise and intuitive, and it can make the most of the design ability of the designer and increase the design efficiency and quality. (2) Virtual operation with a virtual prototype can predict whether the design machine will have maintenance or operation obstacles in the future, as shown in Figure 5 of the test evaluation. (3) During the design phase, the customer can monitor the design method adopted by the designer to ensure that the design does not lead to waste or unnecessary production process. (4) Increases the chance of finding fatal flaws, helps eliminate unplanned changes, and validates designs with virtual reality technology before determining them. (5) It can eliminate the cost of manufacturing physical models and most of the physical tests, reducing costs. (6) Before designing, reduce the number of reworks by ensuring the shape function and assembly function. (7) It is convenient to compare the virtual prototype scheme and select the optimal scheme.

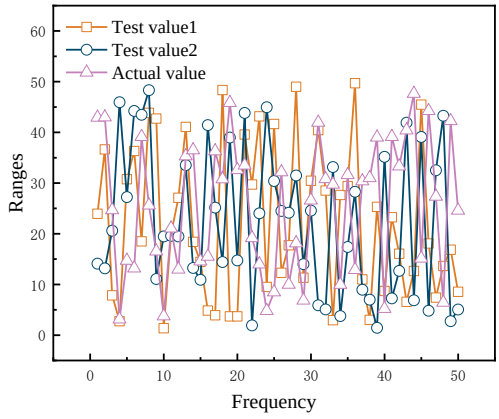

Figure 4: System truth value vs. test value.

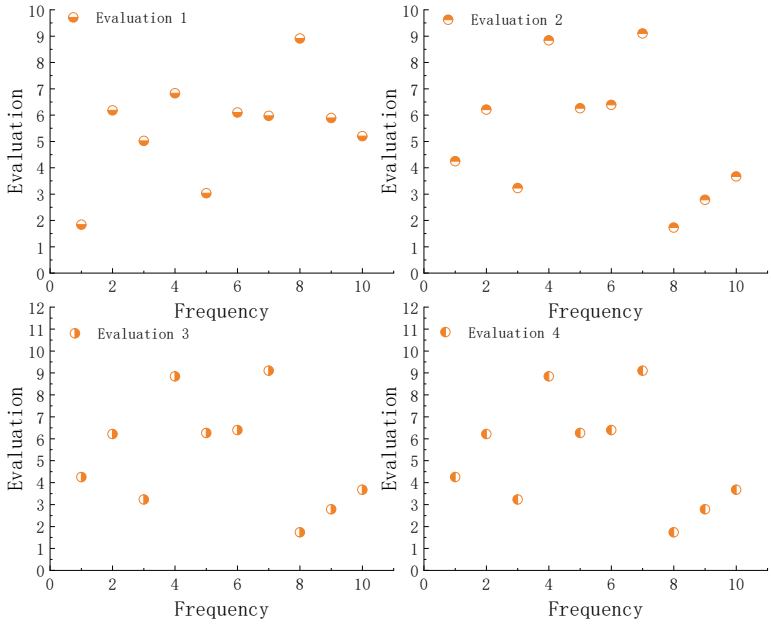

Figure 5: System test evaluation values.

4.2 Realization of Virtual Reality Technology Combined with CAD Technology in Environmental Art

Environmental art design plays a key role, and the quality and design work level are directly related to product quality, performance, development cycle and technical and economic benefits. At present, various new methods, new theories, and new technologies of modern design are constantly emerging, especially the CAD technology emerging as computer technology develops, which has fundamentally changed the design methods and greatly enhanced the efficiency and quality of design work.

Generally speaking, environmental art conceptual design is program design, which is the primary stage of the entire environmental art design process, and it is also a relatively critical stage. At this stage, the shape and exact size of the product do not need to be precisely defined, and the current CAD system requires the designer to give the shape characteristics and precise size when modeling, which is unnecessary. In the structural design of complex products, the design can be carried out intuitively through virtual reality technology to avoid possible interference and other unreasonable problems, and the evaluation situation is shown in Figure 6.

The number of parts of large products is large, the structure is complex, the variety is diverse, and the materials are different, so it is difficult to clearly express the position relationship between the assembly process of large products and the artistic parts by traditional means, and the evaluation results of the products are shown in Figure 7. Using virtual reality technology, the individual components are modeled in a computer, and then the assembly process of mechanical products can be dynamically demonstrated. If the user wears stereoscopic glasses or data gloves, they can intuitively see the three-dimensional assembly effect and can also do the assembly themselves.

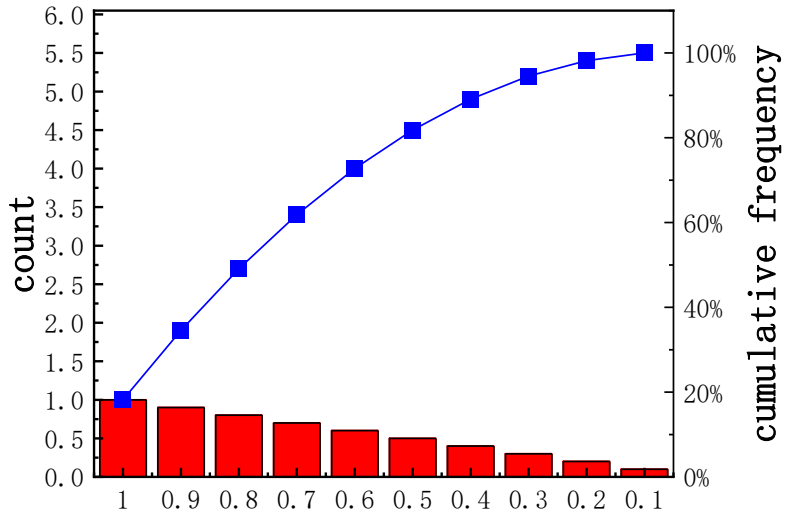

Figure 6: Applied evaluation probability and statistics chart.

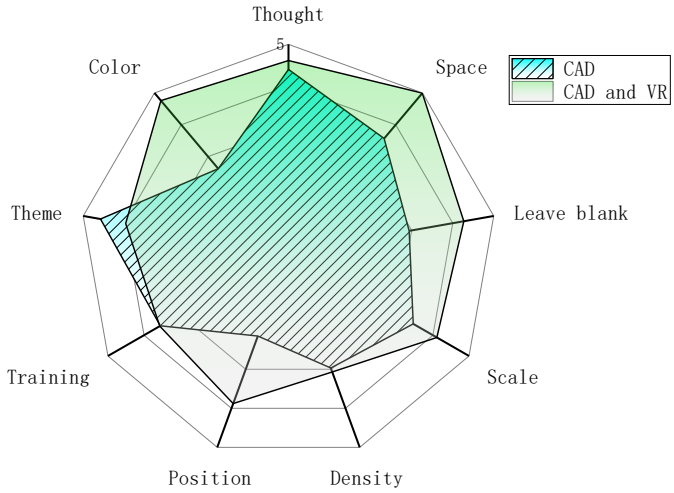

Figure 7: Artwork test evaluation diagram.

Through virtual reality technology, problems can be found in advance, and design modifications or other measures can be taken to ensure construction time and product quality. Performance evaluation of virtual prototypes. In the traditional manufacturing industry, the quality and working performance of the product can only be determined through trial operation after the product is produced. With virtual reality technology, designers can visually evaluate the performance of the design at the design stage. A product of the combination of virtual reality and a CAD system that is much more efficient than a traditional CAD system when building complex models with multiple cavities. In the three-dimensional virtual environment interface, the user is led by the system to a

suitable surface, directly on the surface to create a feature, the creation effect is shown in Figure 8.

Figure 8: System simulation scenario diagram.

5 CONCLUSION

Art originates from life, and environmental art contains the long-term survival wisdom of working people, but it is fragmented and unsystematic, information resources are closed, and regional development is lagging behind, making products unable to expand and improve. In order to better enhance environmental art, we must adapt to the rhythm of the times and give full play to the role of relevant resources. The combination of the environment and modern creative products can start from the art design course, input environmental art design knowledge to students with a certain artistic foundation, combine the concept of modern product design, and guide students to carry out cultural innovation product research and development based on characteristics. A summary of the various cultural resources that blend with each other, extract the available cultural symbols, integrate traditional crafts, and transform them into new forms of application, so that the products serve culture more.

This research is the follow-up function expansion of traditional CAD software, and also the expansion of the previous work of traditional design software. It is a brand-new attempt to integrate CAD technology and virtual reality technology. This paper proposes a solution for transitioning from CAD to virtual reality. The solution can be realized on a common PC. By reading the format file of Auto CAD, it can directly become a three-dimensional solid model after some manual intervention. Through the rich 3D modeling mechanism, these 3D models describing building components can be reproduced in a visual way, and the material properties of each part are further specified in this environment to form a "holographic" art building. Undoubtedly, supporting collaborative design, remote design and information sharing in the network environment, integration, intelligence and collaboration will undoubtedly become the new development direction of CAD technology. Although the degree of automation of generating 3D solid modeling is not high enough, it still relies on human understanding to determine which 2D primitives and the logical relationship of primitives to generate entities. If the knowledge base and artificial intelligence technology are combined on the basis of this scheme, it can be realized better automation. In addition, a complete system is established, through the integration and management of computer hardware, software and data resources, under the support of streaming media technology, to complete the online exhibition of art works. The construction of the whole system is based on the existing mature software model and combined with the advanced streaming media transmission technology to realize an application system that is easy to operate and easy to manage and publish. According to the specific needs and characteristics of the online exhibition of artworks, the application of key technologies will be highlighted.

The final research and development of the environmental art system based on CAD technology and virtual reality technology has made the exhibition and exchange of art works held by art

colleges more safe, efficient and low-cost. At the same time, the comprehensive function of the system also makes it have a huge potential research and application market. The target system is put into use online, and various monitoring and management for art exhibitions are carried out, which is convenient for users to query and manage the information of art works, standardize the review process of exhibits, improve the management quality and efficiency, and meet the online exhibition of works. The practicability of the system has been fully reflected. In addition, the interface of the system is very intuitive, and the function operation is also very easy to use, thus greatly reducing the cost of manpower and material resources.

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Mingming Zhang, https://orcid.org/0000-0003-2471-1619
Enhui Yang, https://orcid.org/0000-0002-5784-0751

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