

Original Research Article

Research on Environmental Art Design Method Based on Edge Computing and Interactive Virtual Simulation

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Abstract: This paper discusses the application and characteristics of edge computing and interactive virtual simulation in environmental art design. As a data processing and storage method, edge computing supports the interactive experience of works of art by reducing data transmission delay and improving real-time feedback speed. Interactive virtual simulation technology expands the innovation possibility of design and optimizes the final performance effect of works of art by digitally simulating real scenes.

Keywords: Edge calculation; Interactive virtual simulation; Environmental art design; Real time feedback

1. Introduction

With the progress of science and technology and the development of digital technology, edge computing and interactive virtual simulation have shown great potential in the field of art design. Interactive virtual simulation technology uses digital simulation technology, which enables artists to carry out creative experiments and design optimization in virtual space, avoiding the cost and time constraints in the traditional construction process. This paper will discuss how to combine edge computing and interactive virtual simulation technology to improve the innovation level and artistic expression of environmental art design, and the influence of this technology integration on future artistic creation.

2. Characteristics of Edge Computing and Interactive Virtual Simulation

2.1. Environmental Art Design Method of Edge Computing

As a new computing mode, edge computing has the characteristics of real-time data processing, low delay and efficient resource utilization, which brings new possibilities for environmental art design. Edge computing has the ability of real-time data processing. In the process of environmental art design, designers need to analyze and process a large number of real-time data in order to optimize and adjust the design scheme. Edge computing can realize fast data processing and improve the efficiency and quality of design. Edge calculation has low delay characteristics^[1]. In environmental art design, designers need to adjust and optimize the design scheme in real time to meet the ever-changing design requirements.

Edge computing can make efficient use of resources. Traditional design methods often need a lot of computing resources and storage space to process and store large-scale data, such as high-definition videos and large images. This not only increases the cost, but also limits the designer's flexibility in experiment and creative exploration. Edge computing effectively reduces the delay and bandwidth requirements of data transmission by pushing data processing and storage to edge devices closer to the data source, thus reducing the overall design cost. Traditional design methods may not be able to achieve immediate feedback due to the delay of data transmission and processing, which limits the interactivity and perceptual effect of works of art. Edge computing

moves data processing closer to users, which can realize data processing and feedback in almost imperceptible time, greatly improving the interactive experience between works and audiences.

2.2. Environmental Art Design Method of Interactive Virtual Simulation

The application of interactive virtual simulation technology in the field of environmental art design provides a brand-new design tool and experience for designers. Interactive virtual simulation technology has the characteristics of user participation, high visual effect and flexible interactive experience, which has brought revolutionary changes to environmental art design. Interactive virtual simulation technology has user participation. In environmental art design, designers need to communicate closely with customers to understand their needs and expectations. Interactive virtual simulation technology can make designers and customers participate in the design process together, and realize the optimization and adjustment of design scheme through real-time interaction and feedback. Interactive virtual simulation technology has a highly visual effect^[2].

Interactive virtual simulation technology has flexible interactive experience. Designers can interact and operate with the design scheme in real time through touch screen, gesture recognition and virtual reality devices^[3]. This flexible interactive experience not only improves the efficiency and quality of design, but also provides designers with more creative space and possibilities. The environmental art design method of interactive virtual simulation technology has the characteristics of user participation, high visual effect and flexible interactive experience, which brings new opportunities and challenges to environmental art design. Designers can make full use of the advantages of interactive virtual simulation technology, improve the satisfaction of design effect and user experience, and realize a more humanized and personalized design scheme.

2.3. Combination of Edge Computing and Interactive Virtual Simulation

The combination of edge computing and interactive virtual simulation has brought unprecedented innovation and change to the field of environmental art design. This combination combines the real-time, low-delay and high-efficiency characteristics of edge computing with the user participation, high visual effect and flexible interactive experience of interactive virtual simulation, which provides a brand-new design method and experience for environmental art design. The combination of edge computing and interactive virtual simulation realizes the combination of real-time and interactive. Through the real-time data processing ability of edge computing, designers can obtain and analyze a large number of environmental data such as illumination, temperature and humidity in real time, and realize the real-time adjustment and optimization of the design scheme^[4].

Interactive virtual simulation technology can generate realistic three-dimensional visual effects, so that designers and users can feel and evaluate the design scheme more intuitively, and improve the visual effect and artistic expression of the design. The combination of edge computing and interactive virtual simulation has stimulated innovative design thinking. Through interactive virtual simulation technology, designers can break through the limitations of traditional two-dimensional drawings and models, and design and create in a more intuitive and immersive way. Edge computing can provide real-time data support and optimization suggestions, stimulate designers' innovative inspiration, and promote the development and reform of design thinking^[5].

3. Problems in Edge Computing and Interactive Virtual Simulation

3.1. Technical Difficulty

Although edge computing and interactive virtual simulation have great potential and advantages in the field of environmental art design, they still face a series of technical problems in practical application. The solution of these technical problems is very important to promote the innovation and development in the field of environmental art design. Technical compatibility is an important technical problem. The combination of edge computing and interactive virtual simulation technology requires close integration and compatibility between different technologies. At present, there are still problems such as communication barriers between different technology platforms and incompatible data formats, which lead to the unsmooth integration and integration of technologies, and limit its application effect in the field of environmental art design.

In the process of environmental art design, a large number of real-time data such as sensor data and user interaction data need to be processed. Edge computing devices may have performance bottlenecks and delay problems in processing and transmitting real-time data, which affect the real-time design and user experience. Technical compatibility, limitation of computing and storage resources, and real-time data processing and transmission are the main technical problems faced by edge computing and interactive virtual simulation in the field of environmental art design. To solve these problems, we need to study and explore deeply, and seek more efficient and compatible technical solutions, so as to realize the extensive application and innovative development of edge computing and interactive virtual simulation in the field of environmental art design.

3.2. Application Problem

Because different users have different needs and preferences for environmental art design, how to use interactive virtual simulation technology to realize personalized customization of user experience has become a key issue. Designers need to accurately grasp the needs of users through technical means such as user behavior analysis and preference mining, so as to provide design schemes that meet personal tastes.

In the virtual simulation environment, the design scheme may be very idealistic and artistic, but in practical application, the factors that need to be considered are far more than visual effects. How to effectively map the design elements in the virtual environment with the conditional constraints in the actual environment to ensure the feasibility and adaptability of the design scheme is a challenge that designers need to face when applying edge computing and interactive virtual simulation technology. The synergy of design process is also an application problem. Environmental art design often involves close cooperation among multiple designers, engineers and customers. How to use interactive virtual simulation technology to achieve effective collaboration in the design process and improve the efficiency of team cooperation is an application problem to be solved. Designers need to consider the construction of collaborative work environment, the setting of communication mechanism, version control and the management of design iteration.

3.3. Marketing Problem

The application of edge computing and interactive virtual simulation technology in the field of environmental art design has not been widely recognized in the market, and many designers and customers have limited knowledge and understanding of these two technologies. How to improve the market's awareness of edge computing and interactive virtual simulation technology, and establish the spread of technical advantages and application value has become a key issue in market promotion.

The application of edge computing and interactive virtual simulation technology needs to invest some hardware equipment, software development and personnel training costs. For some small and medium-sized design enterprises and designers, these costs may constitute a certain burden. How to reduce the cost and improve the cost-effectiveness as much as possible while ensuring the technical quality and application effect is a problem that needs to be solved in marketing. Market competition is also a big challenge for the market promotion of edge computing and interactive virtual simulation technology. Traditional environmental art design methods and tools have formed a relatively stable market structure, and new edge computing and interactive virtual simulation technologies need to face the competitive pressure from traditional competitors if they want to enter the market.

4. Optimization Countermeasures of Edge Computing and Interactive Virtual Simulation

4.1. Technical Optimization

The development of edge computing and interactive virtual simulation technology is still evolving, which requires continuous technical research and innovation to solve the existing problems. Researchers should pay attention to the development of cutting-edge technologies, deeply study the core technologies of edge computing and interactive virtual simulation, such as real-time data processing, three-dimensional visualization and user interaction, and constantly optimize technical algorithms to improve technical performance and stability. Improving technology compatibility and interoperability is the focus of technology optimization.

Strengthening the integration of edge computing and cloud computing is also one of the directions of technology optimization. The combination of edge computing and cloud computing can realize the optimal allocation of computing resources and load balance, and improve the overall performance of environmental art design. By combining edge computing with cloud computing, we can give full play to their advantages, realize real-time processing and analysis of large-scale design data, and improve design efficiency and flexibility. Technology optimization is an important means to improve the performance and application effect of edge computing and interactive virtual simulation technology.

4.2. Application Optimization

In order to improve the user experience, designers should deeply understand the needs of users, and constantly adjust and optimize the interactive virtual simulation environment by means of user research and user testing. By improving the interface design, providing customized design tools and functions, and increasing user participation and interaction, users' satisfaction and experience can be improved. Establishing an effective mapping method between design and actual environment is the key to application optimization. Designers need to consider how to effectively map the design elements in the virtual environment with the conditions in the actual environment. By using advanced simulation technology and data analysis methods, the virtual design scheme can be accurately corresponding to the actual environmental conditions, and the feasibility and adaptability of the design scheme can be ensured.

In order to achieve effective design collaboration, we can promote the close cooperation among designers, engineers and customers by developing collaboration platforms and tools, providing real-time communication, sharing design resources, version control and other functions. Strengthening teamwork can improve the efficiency and quality of the design process and promote the development of innovation and creativity. Application optimization is an important means to improve the practical application effect of edge computing

and interactive virtual simulation technology in the field of environmental art design. By optimizing the user experience, establishing an effective mapping method between design and actual environment, and improving the synergy of design process, the potential of edge computing and interactive virtual simulation technology can be fully exerted, and the development and progress in the field of environmental art design can be promoted.

4.3. Marketing Promotion Optimization

In order to promote the market popularization and application development of edge computing and interactive virtual simulation technology in the field of environmental art design, a series of optimization measures need to be taken from the marketing level. Improving market awareness is the key to market promotion and optimization. The advantages and application value of edge computing and interactive virtual simulation technology can be popularized to designers and customers by increasing publicity and carrying out various promotional activities. By writing professional articles, attending industry exhibitions and conducting online and offline seminars, the market's awareness and acceptance of this technology can be enhanced. Strengthening market competitive advantage is also the key to market promotion and optimization. Through in-depth understanding of market demand and competitive situation, we can find unique market positioning and competitive advantage. Through cooperation with leading enterprises in the industry to jointly develop the market, as well as through brand building and marketing strategies, the popularity and influence of technology in the market will be enhanced.

5. Conclusion

Edge computing and interactive virtual simulation technology show unique advantages and innovative potential in environmental art design. Edge computing enhances the interactive experience between works of art and audience by providing real-time data processing and feedback. Interactive virtual simulation provides artists with unlimited possibilities for creative experiments and design optimization in virtual space. The combination of the two not only improves the design efficiency, but also expands the boundary of artistic creation, opening up new prospects for the integration of art and technology. With the further development of technology and the expansion of application scenarios, edge computing and interactive virtual simulation technology will continue to play an important role in the field of environmental art design, bringing more possibilities for creators to innovate and express.

References

- [1] Jiang Shouhua, Shu Hui, Jun Chen. Research on the design of integrated operation and maintenance management platform based on edge AI computing architecture [J]. *Changjiang Information Communication*, 2023, 36(6):113-116.
- [2] Chen Xiang, Ye Yubin, Seo Woo. Research on EHS Management System Based on Edge Computing [J]. *Information and Computer*, 2022, 34(15):4.
- [3] Sun Yutong. Design and Implementation of Edge Computing System Based on Artificial Intelligence [J]. *Science and Technology Innovation and Application*, 2023, 13(33):132-135.
- [4] Yolanda. Research on the Infrastructure Construction of Data Collection for Modern Commercial Logistics Enterprises Based on Edge Computing [J]. *Intelligent Manufacturing*, 2022(6):99-103.
- [5] Wang Xiaobo, Han Dongxing, Wang Dongqiang. Research and practice of intelligent IOT system for power grid infrastructure based on edge computing framework [J]. *Electrical Technology*, 2022, 23(10):96-103.