Construction of Environment Art Design System in Web Mode

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Abstract. With the national emphasis on environmental issues is gradually increasing, more and more experts and scholars on the environmental art design system of more and more research. The requirement of environmental art design system is getting higher and higher. Traditionally, two-dimensional images are used to describe environmental art geography, and the environmental information obtained lacks intuitiveness and interactivity. The purpose of this paper is to realize the social sharing and service of environmental art information so that the public can conveniently enjoy the risk warning service of environmental information. Starting from the framework reconstruction of system construction, this paper takes the Web framework pattern as the basic framework of system realization, and creates different entity models and terrain models in virtual environment through Creator modeling software. After collecting the original environmental data, the edge processing of the environmental data is carried out to produce the 3D environmental design system. In the process of 3D virtual reproduction of the environment, Vega driver software was used to shape the Web 3D scene of the environment, and the Marine environment module in Vega was used to realize dynamic and static environment simulation and simulation effect. The experimental results show that the display effect of the environmental art design system constructed in the Web mode is more realistic, intuitive, interactive and satisfactory.

Keywords: Web Mode, Environmental Art Design, Creator Modeling, Environmental Information

1. Introduction
The unique geographical position of our country determines that our territorial environment has complex and changeable characteristics. The environmental geographic information database is obtained from the two-dimensional map to form a multidimensional space environment on land, air, water surface and underwater, and the simulation design of the environment is realized based on the geographic information, which has extensive application value in the field of environmental virtual battlefield, environmental resource development and environmental meteorological data forecast. Traditionally, two-dimensional maps are used to describe the environment, and the environmental
geographic information obtained lacks intuitiveness and interactivity. Therefore, it has become the focus of people's analysis to realize 3D virtual reproduction of environment by three-dimensional electronic graph and Web technology.

The research on the combination of environmental art design system and computer system architecture started early in foreign countries. As early as 1998, the European Union proposed the "emergency prediction system for unexpected Danube accidents" to solve environmental pollution accidents, combining GIS spatial technology model with water model [1-2]. Up to now, emergency and early warning schemes for sudden environmental pollution are emerging one after another at home and abroad. Many developed countries combine advanced information technology, adopt simulation technology, analyze through mathematical models, and establish relevant public service information systems [3]. "Chemical information network CSIN system" developed by us environmental protection agency. China started the research and construction of environmental technology design system late, and started the sudden emergency response mechanism for environmental problems later than developed countries [4-5]. However, since 2012, the development speed has been greatly improved, followed by the r&d and application of environmental art design system in tianjin, Shanghai, Beijing and other cities [6].

At present, domestic and foreign researches in the field of environmental art design have invested a lot and made some remarkable achievements, but there are still some obvious deficiencies [7]. The most important manifestation is that, under the development trend of the information age, few researches and applications combine environmental art model with Web technology [8]. In the application of Web technology, it is limited to simple operations such as display, query, input and analysis, but lacks in-depth development of this technology [9]. In terms of the functional realization of existing products, the data and information in the platform are relatively closed, the update is slow, and the workload is large. There is still a certain gap between the platform and the actual application, and it is difficult to realize the expected social value, which has great limitations [10]. In order to make up for these shortcomings of existing researches, this paper, by referring to advanced technologies at home and abroad, carries out the research and development of environmental art design system based on Web mode [11]. In the process of data database construction and model construction, digital model simulation and display are adopted to provide reference for relevant public service platform construction research through Web technology. AJAX technology is used for data interaction, combined with some characteristics of environmental art design, and multi-source environmental diffusion model algorithm is used to predict environmental data, providing the environmental department with an efficient, complete and public-oriented platform for environmental art information management and analysis [12].

2. Method

2.1 Key Technologies for the Realization of Environmental Art Design System

Creator modeling software is a necessary entity model and environment terrain model to obtain the geographical environment and original information model. The software adopts modeling function module Terrain to conduct independent modeling of ded files in the corresponding format, and constructs environmental features, and obtains environmental Terrain model data in DFD format through GeoFeature module.

The two-dimensional images directly captured are often chaotic due to the discrete characteristics of the data in the elevation transmission. To obtain the grid data in the same area, the initial graph data must be positive. In general, the modification of the initial graph is to supplement the data. Carry out prediction on the values of each uncertain point, and carry out weighted calculation on the values of the known points in the near neighbors to obtain the values of the uncertain point, and obtain the weights given based on the distance:
\[ f(x, y) = \left[ \sum_{i=1}^{n} W(d_i)z_i \right] / \sum_{i=1}^{n} W(d_i) \] (1)

Where, \( W(di) \) is the weight function; \( Z_i \) is the number of the \( i \)th known point; \( D_i \) is the distance between point \( I \) and the uncertain point. The distribution between adjacent discrete points and uncertain points is different, which has different interference effects on \( f(x,y) \). \( W(di)=1 \) /\( di \) is the best result, and the inverse ratio of \( di \) squared determines the value of \( W(di) \).

### 2.2 3D virtual Reproduction Method of Environmental Art Design System

Vega is a visual software tool for virtual reality and real-time visual simulation, which consists of graphical environment interface, C language application program interface API, utility library functions, etc. In this paper, virtual reality technology is used to create a realistic environment, from which information such as terrain, waves, rain and fog can be observed. The terrain environment includes static 3D solid model and dynamic 3D solid model. The static and dynamic models are mainly reefs, lighthouses, aircraft and ships on the surface of the environment. The Visual system implements the generation technology through the computer, adopts the Windows 2016 development platform, Visual C++ development tools, and the Creator modeling software and Vega driver software to realize the 3D virtual reproduction of the environment. The 3D scene rendering has realized the simulation of environment water surface and seabed effect, light simulation, water surface effect simulation and ship simulation, etc. Vega environment module USES the wave model of position fluctuation of connection points to generate dynamic environment, and simulates different waves based on six environmental states. The virtual wave reproduction process is to shape the actual wave through 10 sinusoidal curves and non-harmonic frequencies, then the wave height is obtained:

\[ y = H_{\text{tide}} + \sum_{i=1}^{10} A_i \cos\left[k_i(x \sin \theta + z \cos \theta) + w_i t + \phi_i\right] \] (2)

Where: the coordinates of sea surface control point are \((x,y,z)\); The mean sea level tidal height is \( H_{\text{tide}} \); The amplitude of the unit regular wave is \( A_i \), and the gravitational acceleration is \( g = 8.37 \).  

The triangular surface that shapes the environment object in Creator has the texture effect seen from the height, while the texture effect cannot be seen from the bottom. So the 800 by 800 square plane is deployed to the \((x,y,z)\) position, with the plane facing down. \((x,y)\) is the latitude and longitude coordinates of the observer, ensuring that the virtual effect of the environment can be observed at any roaming position of the object.

### 3. Experiment

#### 3.1 System Deployment Planning

Before the formal deployment of the system, the overall design should first meet the user's application needs, easy to use, management and maintenance, and become a powerful tool it can rely on. Combined with the actual work needs, this paper strives to achieve on the basis of practicality to further have a certain advanced, as far as possible to use advanced technology, methods, equipment and so on, improve the technical level of the system. The purpose of the development of environmental art design system is to realize the social sharing and service of the information of emergency measures for sudden pollution accidents. The realization of the system should reduce the cost as far as possible on the premise of achieving the function and performance indexes. As a large-scale and key information system application involving multiple industries and departments, security and reliability are also crucial. At the same time, pay attention to the integrity of the system structure and technical standardization, easy to carry out large-scale promotion.
3.2 Architecture Design
The architecture is designed to minimize the load on the user terminal, with map processing and computation as services, a B/S architecture, and the end user accessing the Web server in the browser to operate the application. Completing a model application requires the participation of three servers.

The firstly is that the compute service performs an operation and returns the result to the IIS service, but the result cannot be displayed directly on the interface.

Secondly, the IIS service that provides the user interface accepts the user request and the parameters required by the model. After sorting out the data, the query control module hands over the request to the computing service.

Finally, the IIS service collates the result of the calculation service and sends it to the GIS service, which processes the request, draws the layer with the result of the calculation service, and finally sends the information of the layer that can be used for display back to the IIS service for loading and displaying to the user.

4. Discussion

4.1 System Implementation
The near map of the three-dimensional electronic environment map model in the environmental art design system in Web mode can clearly observe the high level and landform of the environmental terrain information. The rendering obtained by the 3D visualization effect of the seabed topography obtained by the virtual reproduction technology in a certain sea area under the Web mode has obvious enhancement effect, and it can be seen that the 3D virtual reproduction result obtained by the method in this paper is realistic and accurate.

4.2 System Test
Through the assembly of the system hardware and the programming of the monitoring system platform, the design and implementation of the environmental art design system under the Web mode are completed. It is also necessary to test and analyze the reliability and stability of the system.

The systematic test method adopted in this paper is to place the air temperature and humidity sensor in the laboratory to collect the air temperature and humidity value between 9:00 and 19:00, and at the same time use the German Testo 905-H9 temperature and humidity meter with known accuracy to record the hourly data as the control. Testo 905-h9 has a temperature resolution of 0.1 °C, an accuracy of ± 0.05 °C, and a humidity resolution of 0.2%. In the experiment, the temperature and humidity sensor was set to collect data once in 10 seconds and was always on. In theory, a temperature and humidity data every 10 seconds, but for the actual application, 6 kinds of sensor data calculation with the same GPRS module to transmit, so there may be data congestion and competition, lead to the server side to adopt sets of data is only 10 seconds time interval is not completely, but the total amount of transfer data within a fixed period of time, the basic balance.

During the ten hours of the experiment, a total of 3,268 pieces of temperature and humidity data were received, not significantly different from the theoretical number of 3,300 pieces of data, indicating that packet loss was not obvious in the process of data transmission and reading, which could be ignored. The results of the air humidity sensitivity test of the system are shown in figure 1 below. At the same time, the number of data strips is analyzed by dividing two hours into time periods. It can be seen from the data that the overall data transmission is evenly distributed.
Figure 1. Test results of environmental humidity of the system

At the same time, the temperature and humidity were measured manually by using the temperature and humidity meter with known accuracy at the time of the hour, and the temperature and humidity data collected at the time of the hour were compared. Since the data collected by the collecting system may not be completely at the hour of the hour, the data with the smallest time interval from the hour were used for the test, as shown in Table 1 below.

Table 1. Comparison results of ambient temperature sensor data and manual measurement data

| Manual measurement | Sensor induction value | Hour of the hour | Sensor induction time | Relative error (%) |
|--------------------|------------------------|------------------|-----------------------|--------------------|
| 17.4               | 17.6                   | 9:00             | 9:00:03               | 0.32               |
| 18.2               | 18.4                   | 10:00            | 10:00:06              | 0.26               |
| 20.1               | 19.9                   | 11:00            | 11:00:03              | 0.29               |
| 21.3               | 21.1                   | 12:00            | 12:00:07              | 0.34               |
| 20.5               | 20.7                   | 13:00            | 13:00:04              | 0.43               |
| 24.1               | 23.9                   | 14:00            | 14:00:03              | 0.27               |
| 19.5               | 19.6                   | 15:00            | 15:00:08              | 0.38               |
| 22.7               | 22.6                   | 16:00            | 16:00:05              | 0.35               |
| 21.4               | 21.5                   | 17:00            | 17:00:02              | 0.42               |
| 22.6               | 22.4                   | 18:00            | 18:00:06              | 0.27               |
| 23.8               | 23.7                   | 19:00            | 19:00:01              | 0.3                |

It can be seen from the table that the relative error of the measurement values of the two instruments is kept between 0.26 and 0.43, indicating that the environmental art design system constructed in this study has a high credibility in practical application.

5. Conclusion

This paper studies the construction process of environment art design system in Web mode and discusses the realization scheme of obtaining more realistic and intuitive environment 3D virtual effect. The structural framework and design ideas of the system platform meet the requirements of environmental art design and realize the standardization and digitalization of environmental art design system management. The system test and application results show that the system platform runs stably, the operation is simple, and the result display is intuitive. Therefore, it has strong social and
environmental benefits. At the same time, the research results can form commercial software products, which can be applied and promoted in large, medium and small cities, with great economic value and application prospects.

References
[1] Zhang. Analysis on the development trend of environmental art design model from the perspective of cultural heritage and classical reconstruction[J]. International Technology Management, 2017, 4(3):82-83.
[2] Stacey Van Dahm. The Rhetoric of Mural Design: Performing Citizenship through Narrative in Philadelphia's Imagining Frankford Mural Project[J]. MELUS: Multi-Ethnic Literature of the U.S. 2017, 42(1):93-94.
[3] Ying ZENG. BODY-SCALE PERCEPTION AND EXPERIENCE: A TERRAIN-BASED FOUNDATION STUDIO OF LANDSCAPE ARCHITECTURE[J]. Landscape Architecture Frontiers, 2018, 6(5):327-329.
[4] Leena Karrasch, Martin Maier, Thomas Klenke. Collaborative Landscape Planning: Co-Design of Ecosystem-Based Land Management Scenarios[J]. Sustainability, 2017, 9(9):126-129.
[5] Aitziber Suárez-Bilbao, Naroa Garcia-Ibaibarriaga, Alvaro Arrizabalaga. Paleoenvironmental and Paleoclimatic approach to the Late Pleistocene site of Artazu VII (Arrasate, Northern Iberian Peninsula) using small vertebrates[J]. Ameghiniana, 2017, 54(6):216-219.
[6] Mishra, I, Zhou, H, Sun, J. Hierarchical CoP/Ni5P4/CoP microsheet arrays as a robust pH-universal electrocatalyst for efficient hydrogen generation[J]. Energy & Environmental Science, 2018, 327(326):240-246.
[7] Giulia Cérè⁎, Yacine Rezgui, Wanqing Zhao. Critical review of existing built environment resilience frameworks: Directions for future research[J]. International Journal of Disaster Risk Reduction, 2017, 25(38):56-58.
[8] Shreya Mukherjee, Surya V. Devaguptapu, Anna Sviripa. Low-Temperature Ammonia Decomposition Catalysts for Hydrogen Generation[J]. Applied Catalysis B Environmental, 2017, 226(322):162-181.
[9] Xiaoguang Duan, Hongqi Sun, Zongping Shao. Nonradical Reactions in Environmental Remediation Processes: Uncertainty and Challenges[J]. Applied Catalysis B Environmental, 2018, 224(218):973-982.
[10] Eugene Ch'ng, Dew Harrison, Samantha Moore. Shift-Life Interactive Art: Mixed-Reality Artificial Ecosystem Simulation[J]. Presence Teleoperators & Virtual Environments, 2017, 26(2):157-181.
[11] Zhang YH, Gong YJ, Gu TL. DECAL: Decomposition-Based Coevolutionary Algorithm for Many-Objective Optimization[J]. IEEE Transactions on Cybernetics, 2019, 53(27):27-41.
[12] Tao Zhang. Influence and Impact of CAD on Environmental Art Design Paradigm Under Digital Background[J]. International Technology Management, 2017, 45(6):69-71.