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Online Art Design Network Security Education System Based on Intelligent Image Processing Algorithm

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Abstract.

In order to improve the effect of online art design education, based on 3D virtual simulation technology, this paper improves the traditional signal processing and image processing algorithms to construct an online art design education system based on 3D virtual simulation technology.The application server side of the online art design education system based on 3D virtual simulation technology constructed in this paper is each computer terminal, that is, a web browser. The database server is placed in the management service center and set up in each teaching service area. Moreover, users are connected to the management service center through the business network to realize data upload and information exchange.In addition, on the basis of algorithm improvement, this paper combines the functional requirements to construct the system structure, and combines the actual situation to verify the system performance.The experimental research results show that the system constructed in this paper has certain effects in the display of art design works and the improvement of teaching effects.

Keywords:3D simulation; virtual simulation; online art design; education system; network security

1. INTRODUCTION

Public art education in colleges and universities refers to a form of extensive aesthetic education among college students. That is to say, it is through the teaching of art knowledge, the use of music, art design, painting, sculpture, literature, drama, film and other artistic methods to conduct sentiment education to people. It is a comprehensive education integrating entertainment, appreciation and basic knowledge [1].Since the new era of our country, public art education has become an important part of the school's overall education. Most colleges and universities have also set up special student art groups to enrich the art life on campus.However, in general, compared with European and American countries, my country's public art education in colleges and universities started late and developed slowly, and there is still a lot of room for development. At the same time, the phenomenon of marginalization, mechanization, and skillful of public art education in colleges and universities is still the main problem [2]. In addition, the role of public art education in colleges and universities that enables people to develop in an all-round way and to improve a harmonious personality is far from being played out.

Public art education belongs to the category of aesthetic education. Through public art education, it helps to form correct aesthetic concepts. Through various forms of artistic expression, art education shows people the truth, goodness, and beauty, distinguishes the false and the ugliness, subtly purifies the soul, and washes flexibility, so that people can learn the truth from the beauty, regulate their own virtues, and form a perfect and healthy personality.Our country's training of students is based on the comprehensive development of moral, intellectual, physical, aesthetic, and labor education. Among them, aesthetic education refers to aesthetic education, which cultivates students' correct aesthetic awareness through art education, and teaches them to feel and understand beauty. Moreover, art education is the most important way to implement aesthetic education [3].However, the current public art education in my country's universities is far from perfect, and students have not been able to get the aesthetic education they deserve. Therefore, as we advocate the all-round development of people, we should pay more attention to the role and significance of public art education. Public art education is an indispensable part of our lives, and an important way for us to improve our personality, perfect our personality, and develop in an all-round way.Nowadays, in the field of education, distance learning programs have developed rapidly due to their clear themes, sharpness and flexibility. The long-distance teaching process makes full use of "time fragments" for teaching and guidance, which greatly enhances the flexibility and mobility of teaching, helps students mobilize fragmented time for learning outside the classroom, assists classroom teaching, and greatly improves the efficiency of learning.In the same way, the use of remote teaching methods facilitates the use of massive teaching resources on the Internet. Moreover, through a constructive learning method, distance learning starts from a small and subtle point, and starts from the needs of students. At the same time, dis-

tance teaching emphasizes student learning instead of teacher teaching, so that people can learn a certain amount of knowledge within ten minutes.

2. RELATED WORK

The theory and practice of art education in schools in some developed countries in the world can provide us with useful reference and reference [4]. From the art education in developed countries such as the United States, France, the United Kingdom, and Japan, it can be summarized as the following characteristics: in terms of understanding the importance of art education, all countries regard art education as a compulsory course for students in compulsory education [5].The literature [6] pointed out that art curriculum is the core subject of school education, and asserted: "Education without art is incomplete education."The literature [7] emphasized the need to effectively strengthen the position of art courses in schools. French schools have set up special "art education" courses from the first grade of elementary school. Students study 5-9 hours a week, and scores are calculated in the same way as French, mathematics, history, and geography.The literature [8] pointed out that knowledge can make up for it, but art cannot wait for the children to grow up to be nurtured. That is a devastating interruption. Japan and Australia stipulate that art courses are compulsory courses and must be open to all students in establishing the goals of art education. They all emphasize on improving students' artistic aesthetic quality through art education, cultivating people's imagination, developing people's creative ability, cultivating individuals with comprehensive harmony, rich emotions and strong life consciousness, and promoting social development [9].The literature [10] emphasized the development of human potential, providing opportunities for creativity and self-expression and enjoying success. The literature [11] emphasized that cultivating talents with rich spiritual world and vigorous vitality. The literature [12] emphasized that art must "enable the full development of students' abilities. In terms of selecting the content of art education, it has the characteristics of interdisciplinary, multi-level, comprehensive, and life-oriented. For example, the content of American art education is "comprehensive art"

3D virtual simulation technology has been applied in many places. The National Aeronautics and Space Administration (NASA) applies VR technology to the training of astronauts, and has established a VR training system for the operation of the International Space Station, satellite maintenance, and space flight simulation [13].NASA even combined the mission images sent by the Curiosity Mars rover with VR technology, and used Microsoft's HoloLens device to simulate the environment on the Martian surface for astronauts and engineers to explore. The HITLab laboratory established by the University of Washington (UW) has been committed to the application research of VR technology. HITLab's research directions mainly include medical treatment, manufacturing, education and design.The SnowWorld system developed by it establishes a virtual ice and snow world to relieve the pain of burn patients. The clinical trial results show that the treatment program is effective.George Mason University (GMU) has developed a set of interactive fluid virtual simulation experiment system, which simulates the realistic and complex fluid characteristics in a dynamic virtual environment, such as ships passing water,mixing liquids, mixing insoluble fluids (such as water and oil), mixing fluids of different colors, the flow of rainfall and rainwater on the ground, and the interaction between different fluids.These simulation results are used in advertising, education, art and training [14]. The School of Architecture, Jordan University of Science and Technology has developed a virtual simulation experiment system for building construction, which uses virtual reality technology in teaching to enhance students' interest in learning.The system can provide immersive and non-immersive virtual reality experiences, and provide 4D construction models (three-dimensional models and time dimensions) for specific building construction phases. The evaluation and investigation show that the virtual simulation experiment teaching form has better three-axis realization ability than the traditional teaching method [15].

3. VARIATIONAL MODAL DECOMPOSITION METHOD OF 3D VIRTUAL SIMULATION SIGNAL

Variational modal decomposition is to decompose the signal $x(t)$ into a certain number of sparse eigenmode functions $m_k(t)$, each modal function $m_k(t)$ fluctuates around the center frequency ω_k, that is, the bandwidth around the center frequency is limited.The bandwidth can first be obtained by estimating the squared l_2-norm

of the gradient of the frequency-shifted signal.First, the real mode m_k is transformed into an analytic signal m_k^+ with a unilateral frequency spectrum with non-negative frequency through the Hlibert transform[16].

$$m_k^+(t)=\left(\delta(t)+\frac{j}{\pi t}\right)*m_k(t) \quad (1)$$

Then, by multiplying the frequency with the exponential harmonics adjusted to the respective center frequencies, the spectrum is shifted to the baseband.

$$m_k^B(t)=\left(\delta(t)+\frac{j}{\pi t}\right)*m_k(t)e^{-j\omega_k t} \quad (2)$$

Finally, the bandwidth is estimated by the squared l_2 -norm of the gradient[17].

$$\Delta\omega=\left\|\partial t\left[\left(\delta(t)+\frac{j}{\pi t}\right)*m_k(t)e^{-j\omega_k t}\right]\right\|_2^2 \quad (3)$$

Then, the estimated bandwidth of all modal components can be expressed as a constrained variational model.

$$\begin{aligned}&\min_{\{m_k(t)\},\{\omega_k\}}=\sum_{k=1}^{K}\left\|\partial t\left[\left(\delta(t)+\frac{j}{\pi t}\right)*m_k(t)e^{-j\omega_k t}\right]\right\|_2^2 \quad (4)\\ &s.t.\sum_{k=1}^{K}m_k(t)=x(t)\end{aligned}$$

In the formula, $\delta(\cdot)$ is the Dirac Delta function, the symbol * represents the convolution operation, and K is the number of extracted target eigenmode functions.

$$\begin{aligned}&L\left[\{m_k(t)\},\{\omega_k\},\lambda(t)\right]=\alpha\sum_{k=1}^{K}\left\|\partial t\left[\left(\delta(t)+\frac{j}{\pi t}\right)*m_k(t)e^{-j\omega_k t}\right]\right\|_2^2 \quad (5)\\ &+\left\|x(t)-\sum_{k=1}^{K}m_k(t)\right\|_2^2+\left\langle\lambda(t),x(t)-\sum_{k=1}^{K}m_k(t)\right\rangle\end{aligned}$$

In the formula, $\lambda(t)$ is the Lagrange multiplier, α is the balance parameter of the data authenticity constraint, and $\langle\cdot,\cdot\rangle$ is the inner product.

Formula (4) expresses the minimization problem. The saddle point in formula (5) can be obtained by updating $\{m_k(t)\},\{\omega_k\},\lambda(t)$ alternately in two directions, which is the solution of formula (5)[18].

The equivalent minimization problem of formula (5) is solved, and each essential modal function $m_k(t)$ is updated with the optimal solution.

$$\begin{aligned}m_k(t)&=\arg\min_{m_k}L\left[\{m_k(t)\},\{\omega_k\},\lambda(t)\right]\\ &=\arg\min_{m_k}\left\{\begin{array}{l}\alpha\sum_{k=1}^{K}\left\|\partial t\left[\left(\delta(t)+\frac{j}{\pi t}\right)*m_k(t)e^{-j\omega_k t}\right]\right\|_2^2\\ +\left\|x(t)-\sum_{k=1}^{K}m_k(t)+\frac{\lambda(t)}{2}\right\|_2^2\end{array}\right\} \quad (6)\end{aligned}$$

In the frequency domain, the solution of formula (6) is:

$$\hat{m}_k(\omega)=\frac{\hat{x}(\omega)-\sum_{i\neq k}\hat{m}_i(\omega)+\frac{1}{2}\hat{\lambda}(\omega)}{1+2\alpha(\omega-\omega_k)^2} \quad (7)$$

When formula (7) is subjected to the inverse Fourier transform and the real part is taken, the essential modal function in the time domain can be obtained.

The minimization problem equivalentof formula (5) is solved, and the center frequency m of each essential modal function $m_k(t)$ is updated using the optimal solution ω_k [19].

$$\begin{aligned}\omega_k &= \arg\min_{\omega_k} L\left[\{m_k(t)\},\{\omega_k\},\lambda(t)\right] \\ &= \arg\min_{\omega_k} \sum_{k=1}^{K}\left\{\left\|\partial t\left[\left(\delta(t)+\frac{j}{\pi t}\right)* m_k(t)e^{-j\omega_k t}\right]\right\|_2^2\right\}\end{aligned} \tag{8}$$

The center frequency ω_k is the center of gravity of the corresponding eigenmode function power spectrum $\hat{m}_k(\omega)$, and the center of gravity of the eigenmode function power spectrum is[20]:

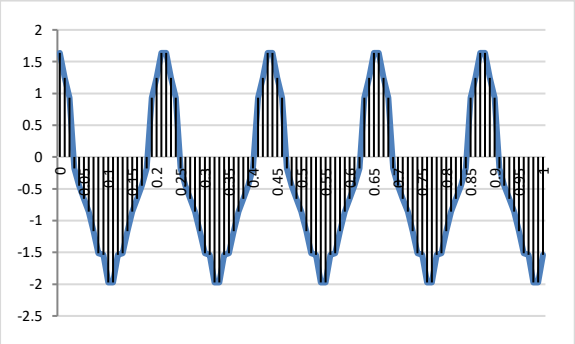
$$\omega_k = \frac{\int_0^\infty \omega\left|\hat{m}_k(\omega)^2\right| d\omega}{\int_0^\infty \left|\hat{m}_k(\omega)^2\right| d\omega} \tag{9}$$

4. ANALYTICAL SIGNAL VERIFICATION OF VARIATIONAL MODAL DECOMPOSITION

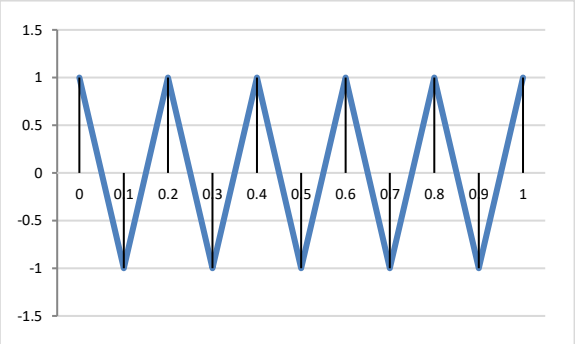
In order to verify the superiority of the VMD algorithm in signal decomposition, a composite analog signal composed of harmonic signals and random noise signals is used as the object to study and analyze. The analog signal expression is as follows:

$$\begin{aligned} x &= x_1 + x_2 + x_3 + \delta \\ x_1 &= \cos(10\pi t) \\ x_2 &= 1/4\cos(80\pi t) \\ x_3 &= 1/2\cos(600\pi t)\end{aligned} \tag{10}$$

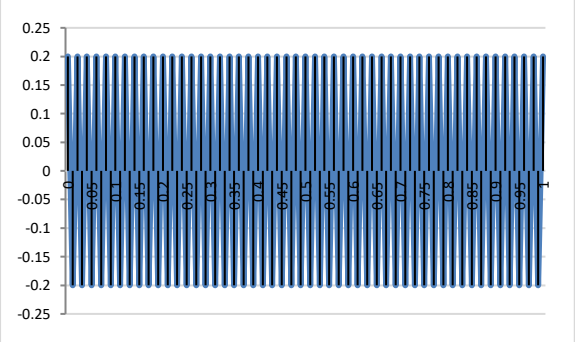
In the formula, δ represents the Gaussian white noise of the signal-to-noise ratio $SNR = 10dB$. Each harmonic signal and noise-containing analog signal are shown in Figure 1[21].



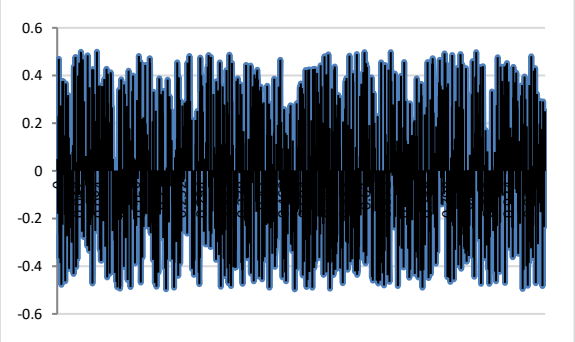
(a) Time domain waveform of analog signal



(b) Harmonic signal x1 time domain waveform



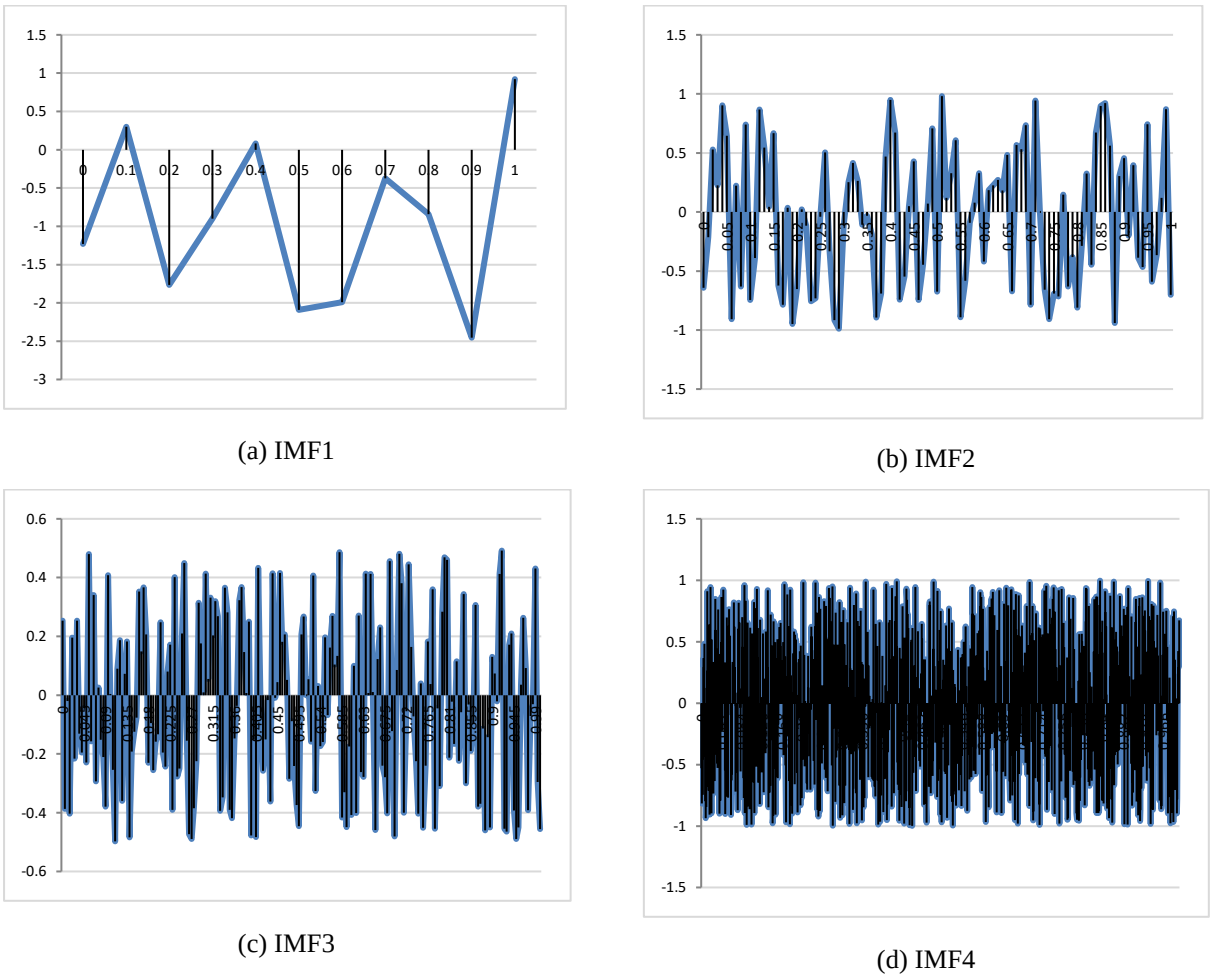
(c) Harmonic signal x2 time domain waveform



(d) Harmonic signal x3 time domain waveform

Figure 1 Analog signal with noise

The signal shown in Figure 2 is decomposed by the EMD algorithm and the VMD algorithm. Since the analog signal is composed of three groups of harmonic signals with different frequencies and one group of random noise signals, we set $K=4$ when decomposing.The decomposed time-domain waveforms are shown in Figure. From top to bottom, they are the time-domain waveforms of IMF1-IMF4 components[22].



(a) IMF1

(b) IMF2

(c) IMF3

(d) IMF4

Figure 2 EMD analysis results

After that, the signal separation performance of the VMD algorithm is further analyzed, and the main frequency protruding parts are located at 5 Hz, 40 Hz, 300 Hz, and 400 Hz in the frequency domain diagram of each component. Among them, the IMF4 component is the noise signal component. In the analog signal frequency domain diagram, the main highlight is that the frequency coincides with the above frequency, which is also the characteristic frequency of the input harmonic signal component. This shows that the VMD algorithm can effectively separate effective signal components from noisy signals[23].

The purpose of FRFT is to solve the analytical solution of linear time-varying partial differential equations. Later, Mc Bride et al. used the integral form to make a more rigorous mathematical definition of the FRFT proposed by Namias. Lohmann explained the physical meaning of FRFT. FRFT is equivalent to the $\alpha\pi/2$ angle of rotation in the two-number phase space of WVD, where α is the power of FRFT.Ran Qiwen and others studied the discrete FRFT algorithm and designed various forms of FRFT operators.

Generally, the p-order FRFT of function n can be expressed as $X_p(u)$ or $F^p x(t)$,The result is expressed on the domain:

$$X_p(u)=F^p x(t)=F^p\left[x(t)\right](u)=\left(F^p\left[x\right]\right)(u) \quad (11)$$

In the formula, $F^p[\cdot]$ or F^p is the p-order FRFT operator.This operator transforms the signal x or the function $x(t)$ into its fractional Fourier transform form X_p or $X_p(u)$, respectively.

The basic definition of FRFT is:

$$f_p(u)=\int_{-\infty}^{\infty} K_p(u,t) f(t) dt \quad (12)$$

In the formula, $K_p(u,t)$ is the kernel function of FRFT, which can be expressed as:

$$K_p(u,t)=\begin{cases} A_\alpha \exp\left[j\pi\left(u^2\cot\alpha - 2ut\csc\alpha\right)\right], \alpha \neq n\pi \\ \delta(u-t), \alpha = 2n\pi \\ \delta(u+t), \alpha = (2n+1)\pi \end{cases} \quad (13)$$

In the formula,

$$A_\alpha = \frac{\exp\left[-j\pi\,\mathrm{sgn}(\sin\alpha)/4 + j\alpha/2\right]}{|\sin\alpha|^{1/2}}, \alpha = p\pi/2 \quad (14)$$

n is an integer.

When the fractional order is $p=1$, there is $\alpha=\pi/2, A_\alpha=1$. From formula (12), we obtain:

$$f_1(u)=\int_{-\infty}^{\infty} e^{-j2\pi ut} f(t) dt \quad (15)$$

It can be seen that $f_1(u)$ is the ordinary Fourier transform of $f(t)$.Similarly, $f_{-1}(u)$ is the ordinary inverse Fourier transform of $f(t)$. Therefore, FRFT can be considered as a generalized Fourier transform.

Because $\alpha = p\pi/2$ in the kernel function only appears in the parameter position of the trigonometric function, the definition with p as the parameter takes 4 as the period. Therefore, we only need to examine $p\in(-2,2]$.When $p=0$, $f_0(u)=f(u)$.When $p=\pm 2$, $f_{\pm 2}(u)=f(-u)$.The above facts are expressed by operators as:

$$F^0 = I \quad (16)$$

$$F^1 = F(\textit{Ordinary Fourier transform}) \quad (17)$$

$$F^2 = P(\textit{Parity operator}) \quad (18)$$

$$F^3 = FP = PF \quad (19)$$

$$F^4 = F^0 = I \quad (20)$$

$$F^{4n\pm p} = F^{4n'\pm p} = F^{\pm p} \quad (21)$$

In the formula, n, n' is any integer.

An important property of FRFT is the additivity of the fractional order, which is expressed as:

$$F^{p_1}F^{p_2} = F^{p_1\pm p_2} = F^{p_2}F^{p_1} \quad (22)$$

The order additivity of FRFT can also be called rotational additivity, which reflects the periodicity of the order.

5. CONSTRUCTION OF ONLINE ART DESIGN EDUCATION SYSTEM BASED ON 3D VIRTUAL SIMULATION TECHNOLOGY

The network architecture of the online art design education system based on 3D virtual simulation technology constructed in this paper is shown in Figure 3:

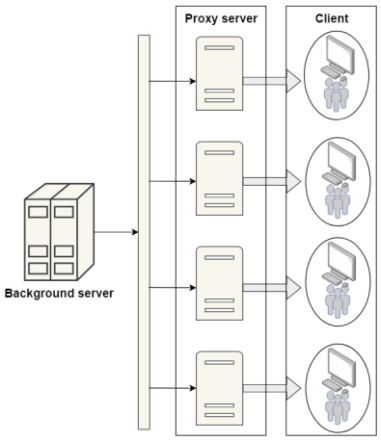


Figure 3 Architecture diagram of online art design education system based on 3D virtual simulation technology

(1) Student user management: The student user management module adopts a common design method, including login and registration modules, user information maintenance and update modules, online course selection, course scheduling, and examination modules. Before student users can start online learning, they need to register users and fill in user information. Information such as course selection is associated with a certain user and is part of the user information.(2) Business management: Business management is a function commonly used by system administrators. It mainly realizes the functions of tuition collection, addition, deletion and modification of student and teacher user information, data backup, and business analysis.(3) Data storage, transmission, and security modules: in this management system, it is divided into functional modules such as video compression, data transmission, and data security. We must optimize network communication and video transmission while ensuring video quality, video continuity, and data security.(4) Art design arrangement teaching module: the overall goal of this large module is to realize electronic art design arrangement and learning, allowing students to conveniently innovate art design actions, and interact with the system for learning and arrangement. Its functions can be divided into conditional search sub-modules, generating actions, combining and using modules, and artistic design using innovation, editing, and storage modules.(5) System user management: It sets the account and password of the system user of the system, restricts the authority of the login user, manages the system's database data, and queries the login status of the login system user.

When a pixel occupies a large number of digits, it can express more and richer colors. On the whole, the color of the image is more colorful and the resolution is higher. Researchers have developed a new graphic format-vector graphics. As the name suggests, a vector is to replace the "bit" in a bitmap with a vector.

This system uses bitmaps to store artistic design actions, thereby subtracting post-processing, and there is no need to convert between bitmaps and vectors. A digital image of M×N pixels can be represented by an M×N two-dimensional array IP in the algorithm language, as shown in Figure 4.

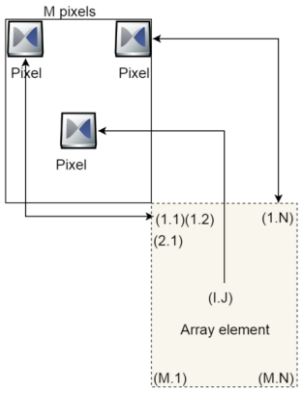


Figure 4 Digital images are stored in a two-dimensional array

Adjacency List is a kind of chained storage structure of graph, and is similar to the linked list of children in tree structure. Usually, the adjacency list is also called adjacency list. The schematic diagram of the adjacent linked list is shown in Figure 5.

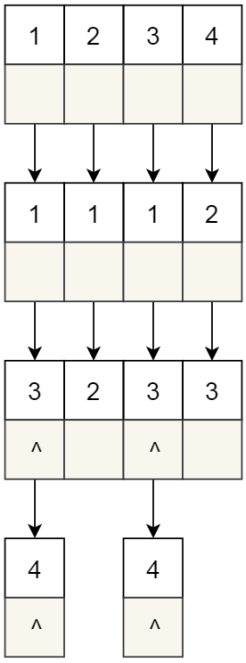


Figure 5 Schematic diagram of adjacency linked list

It is a scene modeling language used to build real world scene models or people's fictional three-dimensional worlds. It is the mainstream language for making three-dimensional interactive websites based on WWW on the Internet, and it is platform-independent.In essence, it is a web-oriented, object-oriented three-dimensional modeling language, and it is an interpreted language.

The objects of VRML are called nodes, and the collection of sub-nodes can form a complex scene. Nodes can be reused through examples. After giving them names and defining them, a dynamic VR (virtual world) can be established.

What VRML creates is an accessible and participating world. VRML combines nodes to form a scene, and then renders the scene into an image on the screen, and can realize Web3D.It is very tedious and complicated to manually write VRML scene model files. Wrl files, and it is almost impossible for large scene models. In recent years, many software vendors have used 3DS max to build scene models, install corresponding output plug-ins, and then directly create scene model files. Now, the most famous Wed3D graphics software companies, such as cult3D and viwepoint, can directly output their special file format scene model files in 3DS max.Figure 6 shows an example of works of the art design education system.

(a)

(b)

(c)

Figure 6 Examples of works of the art design education system

6. TEST OF ONLINE ART DESIGN EDUCATION SYSTEM BASED ON 3D VIRTUAL SIMULATION TECHNOLOGY

The online art design education system test based on 3D virtual simulation technology constructed in this paper is to combine the confirmed software, computer hardware, peripherals, network and other elements together to perform various assembly tests and confirmation tests of the information system.Its purpose is to find out the inconsistencies or contradictions between the art design distance education system and the user's needs by comparing with the needs of the system, so as to propose a more complete plan. The test environment is shown in Figure 7.

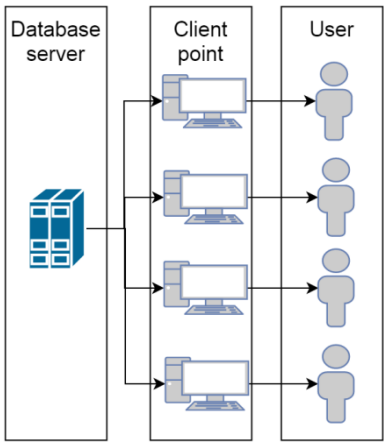


Figure 7 Test environment

When testing the system, this paper mainly evaluates the online art design education effect of the system and the application effect of 3D virtual simulation in art design.

First of all, this paper carries out the display effect of the art design based on 3D virtual simulation technology, and evaluates the effect by means of scoring. The results are shown in Table 1 and Figure 8.

Table 1 Statistical table of the scores of the display effect of the works of art design based on 3D virtual simulation technology

NO.	Scores	NO.	Scores	NO.	Scores	NO.	Scores
1	81.5	26	84.0	51	82.1	76	79.2
2	91.3	27	85.0	52	81.2	77	87.5
3	82.0	28	79.6	53	86.4	78	82.3
4	83.7	29	90.7	54	86.4	79	86.3
5	78.3	30	81.3	55	92.3	80	82.0
6	90.7	31	88.7	56	78.5	81	82.8

7	87.9	32	88.1	57	92.5	82	86.6
8	78.3	33	91.3	58	78.9	83	86.6
9	90.9	34	84.7	59	84.5	84	88.2
10	92.1	35	79.2	60	89.2	85	80.2
11	92.8	36	90.4	61	79.9	86	89.3
12	92.7	37	91.2	62	87.6	87	90.6
13	86.2	38	92.2	63	79.0	88	80.7
14	88.6	39	84.6	64	79.9	89	85.5
15	86.9	40	91.7	65	91.6	90	80.1
16	87.0	41	86.4	66	80.1	91	79.7
17	89.0	42	83.3	67	89.4	92	80.7
18	81.8	43	79.1	68	87.7	93	86.2
19	87.4	44	81.1	69	86.0	94	79.0
20	79.1	45	85.9	70	81.8	95	79.1
21	85.6	46	81.0	71	84.6	96	90.2
22	90.5	47	93.0	72	90.7	97	92.6
23	85.2	48	85.5	73	85.3	98	91.6
24	90.3	49	81.3	74	87.2	99	78.3
25	84.0	50	79.7	75	89.5	100	91.5

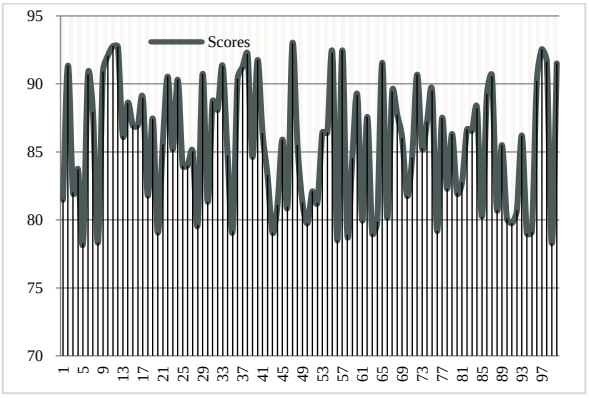


Figure 8Statistical diagram of the scores of the display effect of the works of art design based on 3D virtual simulation technology

From the above analysis, it can be seen that the application effect of 3D virtual playback technology in art design is very good, and the algorithm proposed in this paper is practical. On this basis, the teaching effect of the online art design education system based on 3D virtual simulation technology designed in this paper is evaluated, and it is also carried out by scoring method. The results are shown in Table 2 and Figure 9.

Table 2 Statistical table of the scoring of the teaching effect of the online art design education system based on 3D virtual simulation technology

NO.	Scores	NO.	Scores	NO.	Scores	NO.	Scores
1	74.7	26	82.1	51	80.5	76	79.7
2	77.4	27	86.7	52	82.1	77	85.8
3	86.9	28	73.8	53	77.2	78	79.4
4	75.0	29	87.5	54	85.5	79	76.5
5	77.6	30	79.2	55	74.1	80	79.9
6	76.8	31	87.1	56	79.3	81	82.3
7	89.6	32	80.4	57	82.1	82	88.7
8	76.0	33	77.1	58	81.2	83	79.3

9	78.6	34	78.0	59	86.4	84	75.0
10	89.8	35	73.8	60	75.6	85	73.7
11	84.8	36	74.9	61	88.5	86	75.2
12	75.1	37	82.3	62	75.1	87	78.5
13	84.6	38	79.3	63	89.2	88	86.3
14	88.4	39	85.8	64	75.6	89	84.0
15	84.6	40	84.3	65	75.5	90	87.8
16	80.6	41	87.2	66	89.8	91	78.0
17	73.1	42	78.5	67	74.0	92	78.8
18	82.2	43	78.6	68	86.1	93	75.6
19	81.1	44	81.5	69	87.4	94	86.8
20	77.9	45	75.6	70	86.0	95	89.8
21	75.4	46	73.5	71	75.5	96	85.8
22	79.3	47	78.1	72	86.5	97	83.6
23	86.7	48	88.1	73	77.1	98	76.6
24	80.7	49	89.9	74	83.8	99	83.7
25	84.7	50	81.5	75	77.6	100	87.1

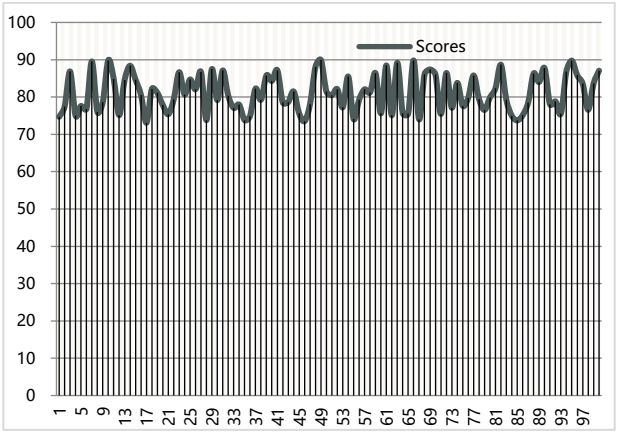


Figure 9 Statisticaldiagram of the scoring of the teaching effect of the online art design education system based on 3D virtual simulation technology

From the statistical results of teaching effect, it can be seen that the online art design education system based on 3D virtual simulation technology constructed in this paper has a good teaching effect and meets the expected requirements of the construction system.

7. CONCLUSION

This article combines virtual reality technology to construct an online art design education system based on 3D virtual simulation technology. Moreover, this paper makes bold innovations, introduces new ideas, and combines the latest technology on the general modules of the general digital distance learning system.Hot water, this paper adds several practical modules, such as data storage, transmission, security modules, art design and arrangement teaching modules, and so on.In terms of data transmission, this paper adopts a dynamic multimedia data transmission strategy to keep the delay to a minimum and make full use of the bandwidth available on the network. This article has improved the "double-buffer circular use" method.Since there is enough space to store data, it can resist the fickleness of the network, which is enough to eliminate the influence of the above unstable factors on the continuity of multimedia informationand ensure the teaching quality of the art design education system.When testing the system, this paper mainly evaluates the online art design education effect of the system and the application effect of 3D virtual simulation in art design. The research results show that the system constructed in this paper has certain effects.

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