Research Article

Ceramic Painting and Traditional Cultural Element Fusion Composition Design Based on Virtual Reality

Xiaobing Hu [ID],[1] **Yuanqian Lai** [ID],[2] **Dan Zhao,**[1] **Fang Tong,**[1] **Yingshuang Hu,**[1] **and Yingzhuo Li**[1]

[1]School of Fine Art, Anqing Normal University, Anqing, 246052 Anhui, China
[2]School of Art, Southeast University, Nanjing, 210018 Jiangsu, China

Correspondence should be addressed to Yuanqian Lai; 101300148@seu.edu.cn

Chinese traditional ceramic culture and art are an important foundation for the progress of civilization today, and these cultural foundations are closely related to the daily lives of modern people. Traditional ceramics, as a valuable cultural heritage leftover from ancient times, are inseparable from the various daily lives of modern people and have always played an important leading role in modern people's daily life. Ceramic painting is also an important embodiment form of traditional culture, and the integration of the two is very conducive to enriching people's spiritual world. This paper proposes a VRML-oriented method suitable for establishing a virtual ceramic product space model, that is, a method of building a VRML model with 3DS MAX and other three-dimensional modeling tools combined with a VRML visual editor. According to this method, based on the LOD node, the method is given the optimization and integration method of the virtual ceramic display space scene and completed the modeling of the outdoor background and building required by the virtual ceramic product display space scene. Subsequently, the interactivity of the virtual ceramic display space in the web application is explained, the realization method of the color switching and placement of the virtual ceramic product based on the built-in sensor is proposed, and the interaction based on the external data source of the web page is also given. Finally, in this article, the response time of the page can be basically controlled below 4 s/time, and after a long-term stress test, the system can still maintain the stability of operation, and the probability of serious errors is less than 0.512%.

1. Introduction

Realistic communication technology in virtual environment scenes has been a major development and innovation product of modern high-tech in our country, involving many emerging technologies including human-computer interaction-integrated virtual network communication technology, computer-integrated network communication technology, ergonomics and human optics, and artificial intelligence. The most basic scene reality virtual environment scene reality man-machine integration overall design process technology is to generate a variety of physical entities including sight, hearing, touch, and smell that can directly act on an individual person through virtual creation. Some Chinese designers' traditional Chinese painting design artistic ideas and concepts are relatively conservative, and the improved artistic style of traditional Chinese modern painting designers lacks the breath and rhythmic beauty of Chinese classical art. Or, for example, some veteran Chinese designers unilaterally pursue the Westernization of traditional Chinese art, simply because they pursue the artistic ideas and concepts of traditional Chinese painting and design that can replicate the art and culture of Western painting and design, and from the ideas and connotations of these designers completely ignore the traditional protection and inheritance of China, the Chinese modern traditional painting and design art culture.

After thousands of years of history, the production of Chinese ceramics has developed into the world's ceramic manufacturing center. In the investigation of current

ceramic paintings, it can be noticed that the current way of displaying ceramic products is still focused on two-dimensional planes, either using photos or using flat patterns. According to the survey of users' needs, there are limitations to the way of displaying ceramic products. For example, for artistic ceramics, the style and disharmony of home and home decoration, whether the size is suitable for the home space, etc., only through it is not intuitive to perceive the product photos. This is undoubtedly of great significance for improving the presale service of ceramic products. Therefore, providing an interactive virtual display system for ceramic products has become the focus of this article.

Regarding the display of ceramic products in the ceramic painting platform, some researchers have proposed the feasibility study of building a VR (virtual reality) display platform for ceramic products based on e-commerce, and related researchers have started web-based ceramic research on product three-dimensional information release technology. Andersen et al. introduced in detail the historical origin and artistic development of Chinese ceramic paintings, analyzed the current state of the art development trend of Chinese ceramic paintings, and analyzed the element structure of China and traditional ceramic culture in modern Chinese ceramic art paintings. After in-depth thinking, the Chinese and Western ceramic cultures are combined with each other, learning from each other's strengths and then gradually forming a more modern ceramic art painting, but the research has not done well in the part of cultural integration [1]. Zhang analyzed that China in traditional ceramic culture painting is also an important element of traditional ceramic culture; at the same time, from the combination of Chinese and Western painting styles, traditional and modern painting techniques, the further manifestation of academic ideas, the further deepening of traditional Chinese cultural elements, etc. All aspects looked forward to the future development direction of ceramic painting, but the composition did not keep up with the times [2]. In order to effectively solve the current traditional multiscreen information display management system, TV image signal reception and display rate is obviously too low, single-channel TV image signal output display rate is obviously limited, etc., designing a new TV 3D based on network virtualization and real network technology animated TV image multiscreen information display management system. Make full use of the new animated 3D image information processing system platform, and plan the multiscreen display system power supply, 3D multiscreen display SOCD, and other display system modules to complete the overall hardware equipment operation management environment system construction of the new multiscreen display management system. And the study did not have the feasibility of implementation [3]. Rheingold conducted case studies from the perspectives of traditional drama painting facial makeup, ink painting elements, traditional painting patterns and decorative patterns, traditional Chinese folk culture, etc., and discussed how to perfectly integrate Chinese traditional Chinese folk cultural design elements into our country's modern traditional packaging works. In the design, the creation presents the future of traditional packaging design works that

not only have national characteristics but also have a strong sense of the times. This research lacks the current cross-age technology [4]. Kandaurova and Lee designed a virtual class-based chemical engineering laboratory system based on basic technologies such as j2een; detailed analysis proposed an object-oriented and virtual class-based basic components such as java bean structural design and a virtual interactive type of this technology. The realization and solution of the system design platform for the basic virtual-based chemical engineering experiment platform; at the same time, a detailed analysis of a basic virtual-based chemical engineering experiment. The main design technical characteristics and basic advantages, modeling method, and construction technology of a virtual basic chemical engineering experimental platform system design platform under the system network, but this method has not been implemented [5]. The comprehensive application of virtual fusion reality technology design in the practice of modern cultural science research technology in the research topic of Huang et al. and the comprehensive application of virtual fusion reality technology design to the technical elements of Chinese traditional modern culture belong to the combination of Chinese traditional modern culture and our country's modern high. The cultural research subject category of the integration of science and technology has profound theoretical significance and strong social practical significance, and this principle only stays at the theoretical stage [6]. Xu et al., through in-depth analysis of the main elements of Chinese traditional Chinese national traditional Chinese modern national cultural product design and the design of traditional Chinese modern national cultural and artistic products and discussion of comprehensive art theory, have transformed traditional modern cultural products from continuous innovation of "made in China" to reinnovation to "created in China." Better and effectively integrate and inherit the excellent Chinese traditional essence of Chinese traditional Chinese national culture and modern Chinese national culture, blend the old and new modern cultures, truly achieve the basic realization of "national is world," and gradually basically realize and make the design of traditional Chinese modern national culture and art products in China more diversified, cosmopolitan, and personalized. However, this method is too simplistic [7].

In the development of a two-dimensional plane to a three-dimensional plane based on ceramic painting, the limitation of three-dimensional objects is broken. Three-dimensional images show three-dimensional forms. The image can present an independent object in an omnidirectional and multiangle form, which has many huge advantages that traditional two-dimensional images cannot match with other plane stereo images. However, the development time of web-3D is relatively short, especially since the three-dimensional modeling and display of ceramic products is still in its infancy, and the application in the integration of ceramic painting and traditional culture has just started. The technical research guidance of this article will mainly focus on the ceramic product model modeling and function display technology system that integrates three-dimensional ceramics and traditional Chinese craft culture in the entire

web system environment, that is, how to achieve it in the entire web system environment. Three-dimensional ceramic product model function construction and technical demonstration research and guide the design of a set of effective technical solutions to achieve the function construction and technical demonstration of the three-dimensional ceramic product model in the entire web system environment.

2. Theories and Overview of Ceramic Painting and Traditional Cultural Elements

2.1. Overview of Traditional Cultural Elements. The traditional cultural elements mentioned in this article mainly refer to the representative information symbols with regional characteristics of various ethnic groups with Chinese local characteristics. To put it simply, that is, traditional Chinese vessel shapes, traditional ceramic decorative patterns, and traditional expression techniques [8, 9]. In the past, our views on art were more of an objective view of the traditional art and even traditional culture of each country and nation within the scope of local Chinese national art. Today, in the context of great changes in the "global" art that has become a general trend, Chinese ceramic products must be treated in the big view of the world. This has become an important prerequisite, from the rapid development of "painted pottery" and "Jomon" in ancient times to modern times. Due to the various appearances of China's domestic ceramic building decoration material industry, the ceramic decoration industry has undergone thousands of years of rapid development, evolution, and transformation. It is an indispensable and important object in the fashion field of today's dining table and interior decoration. As shown in Figure 1, it is the traditional Chinese cultural elements we see in our daily lives.

As far as the concept of "element" is concerned, "'element' is the basic component of product modeling. Any pattern and product composition must be constructed with elements." From the current domestic market, modern ceramics for daily use has a performance technique. There are two types, one is the realism: taking nature as the prototype and drawing on the dry blanks with realism; the other is the expression: taking the nature as the prototype to conduct secondary abstraction, refinement, and reorganization. The modern national cultural graphics mostly abstract, refine, and reorganize the original graphics and emphasize the modernity of Chinese elements [10, 11].

Chinese traditional cultural elements, due to their unique advantages, can fully demonstrate the ceramic culture with Chinese characteristics in the reasonable application of modern daily-use ceramics. Since ancient times, China's aesthetic criticism of artworks has its own distinctive aesthetic concepts, and these aesthetic concepts have become important indicators for judging an artwork. Since ancient times, Chinese artists have said in terms of the level of artistic expression: "'God, Wonderful, Powerful, Yi-Four Grades Theory', simply means: 'God' gets its charm, 'wonder' gets its meaning, 'Can' is similar in shape, and 'Easy' is natural." These classic traditional artistic thoughts have contributed to the Chinese traditional national cultural thoughts. And

FIGURE 1: Traditional cultural elements in daily necessities.

under the guidance of this traditional national cultural thought, the Chinese people's aesthetic construction of art has been formed, which can be used as a lasting guiding value. The compilation and summary of these guiding ideologies are not fabricated out of thin air by the ancients. They are in line with the living habits and thinking of the representative Chinese people. They serve the people [12, 13]. It can be seen that China's traditional culture has its unique advantages and regional characteristics, which are in line with the Chinese people's morality, outlook on life, and ideology. The evolution of its traditional culture is shown in Figure 2.

2.2. Overview of Ceramic Painting. The elements of traditional Chinese painting are the indispensable essence of painting culture in ancient our country. It has highly integrated and condensed the artistic charm of ancient Chinese painting culture and has continuously innovated and incorporated other forms of artistic expression in the course of thousands of years of artistic development and evolution. Among them, ceramic painting works are the most typical representatives. Chinese traditional art Chinese painting fully integrates its elements into the painting of ceramic works. On the one hand, it greatly promotes the career development and social progress of our country's ceramic works, painting, literature, and art. On the other hand, it greatly improves the art and cultural collection value of traditional Chinese calligraphy and French painting and the meaning of artistic heritage. The painting of ceramic works draws lessons from and perfectly integrates the elements of Chinese traditional art and traditional Chinese painting, and its basic compositional expression rules are consistent with traditional Chinese art and traditional Chinese painting to a large extent. The biggest difference between Chinese traditional Chinese painting and modern Western painting is that the former emphasizes sentiment and meaning, while the latter emphasizes color and form. The basic composition rules for ceramic paintings fully embody a basic compositional expression rule of traditional Chinese art and traditional Chinese painting. The main compositional expressions are the harmony of the subject and the object, the degree of selection and combination, the combination of density, and a large number of colors. This basic composition rule used for the painting of ceramic works also fully reflects the overall artistic structure characteristics of traditional Chinese art and traditional Chinese painting. While emphasizing the main characteristics of traditional paintings, it uses clever overall layout techniques and structures to set off the overall traditional paintings, the cultural charm and artistic conception of China.
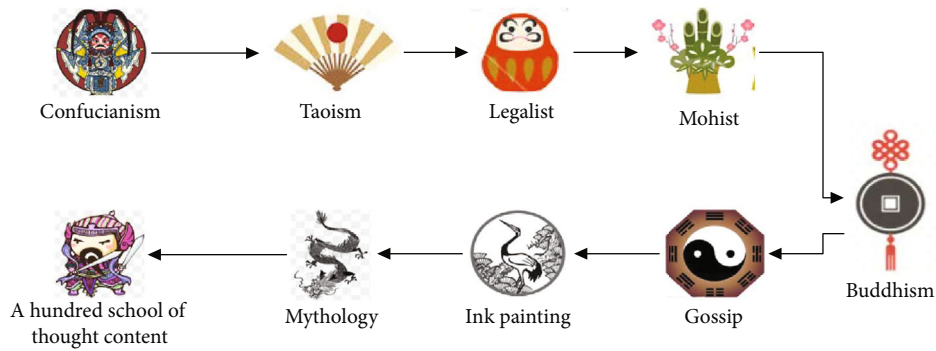
Figure 2: The evolution history of Chinese traditional culture.

In the principle of operation of the composition art of the main body of the main painting of Chinese traditional modern ceramics and murals, although the main body of the realistic modern ceramic mural has always been the main artistic focus of using the main picture, it is in the main painting creation process and a lot of it. The white space of the ceramic main body painting is an important artistic key to using the main body to highlight the artistic conception of the ceramic main body painting. Under this principle of application of the art of ceramic composition art, which combines fiction, reality, and nature, the subject painting of ceramics and murals still exudes a classic and elegant artistic charm that belongs to traditional Chinese modern ceramics and Chinese paintings. China, the hometown of ceramics, has a long cultural history. However, in today's economic globalization, the pace is lagging behind other countries [14, 15]. This is worthy of our deep consideration and consideration. From the perspective of material science, China's modern daily ceramic design art is defined as the scope of industrial product design. The ceramic production process is shown in Figure 3.

This composition expression form of ceramic element painting takes the beauty of harmony as the composition basis and uses a large number of ceramic elements of Chinese painting for composition, which can not only fully reflect the aesthetic elements of contemporary China's national traditional ceramic culture but also skillfully combine to create a harmonious aesthetic realm of the unity of heaven and man and the coexistence of virtual and real nature in ceramic painting. This is similar to the traditional Chinese Taijiquan pattern in Chinese composition. Although there are contradictions or conflicts between black and white in the Taijiquan pattern, it is very harmonious in the painting as a whole. The seven functions of ceramic craft art painting can not only make everyone's figure flower and bird painting, figure painting, landscape, and figures which can be perfectly reflected in detail and humanization at the same time but also effectively ensure the harmony of the main art plans of these paintings without any conflict and confusion. The seven main art compositions and seven different forms of traditional modern Chinese painting ceramic craft art painting are very similar to the seven main art composition themes in our modern traditional Chinese painting modern art Chinese painting,

which can be specifically divided into different angles and levels, such as straight line, inclination, freedom, lamination, and "Zhi". The main composition of six different words has seven different forms and dozens of categories. Generally, most of the artistic themes in our traditional and modern traditional Chinese painting works can be roughly divided into more than 30 categories: figures, flower and bird painting figures, landscape and oil painting figures, and flower and bird painting. Generally, we think that most of the themes in these three types of traditional Chinese painting can be typical artistic theme elements in our traditional and modern traditional Chinese painting [16, 17]. In modern ceramic traditional painting, the theme elements of traditional ceramic traditional painting can be widely popularized and applied, which is an important form in which the artistic elements of ceramic traditional painting can be integrated into modern ceramic traditional painting. Modern ceramic traditional painting elements are deeply influenced by modern traditional ceramic traditional painting elements. The themes of ceramic painting elements basically focus on traditional Chinese painting figures, landscapes and figures, flowers, and birds. Among them, landscape figure painting focuses on highlighting the harmonious relationship between ancient people and modern society, landscape painting focuses on highlighting the harmonious relationship between ancient people and nature, and flower and bird painting focuses on showing the natural relationship of harmonious coexistence between ancient nature and modern people. After the reform and opening up, the painting art theme of China's traditional ceramic painting has gradually increased, but its practical application is still the art theme of Western traditional ceramic painting. Accordingly, ceramic art painting has become many painting schools because it is widely influenced by traditional ceramic traditional Chinese painting and can be divided according to different painting themes. In other words, many themes of ceramic art painting are mainly inherited from Western traditional ceramic painting, such as northern Chinese landscape ceramic painting school, southern Chinese landscape ceramic painting school, Songjiang School, and Huangshan School, which have been fully reflected in China's ceramic art painting [18, 19].

In the modern ceramic three-dimensional painting, the traditional ceramic Chinese painting creation technique has
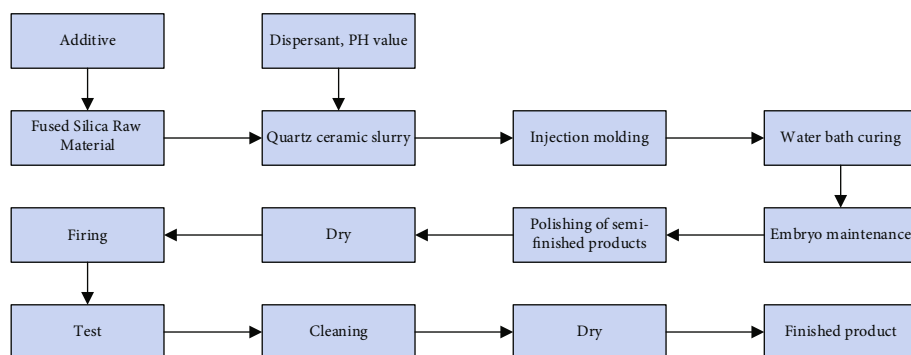
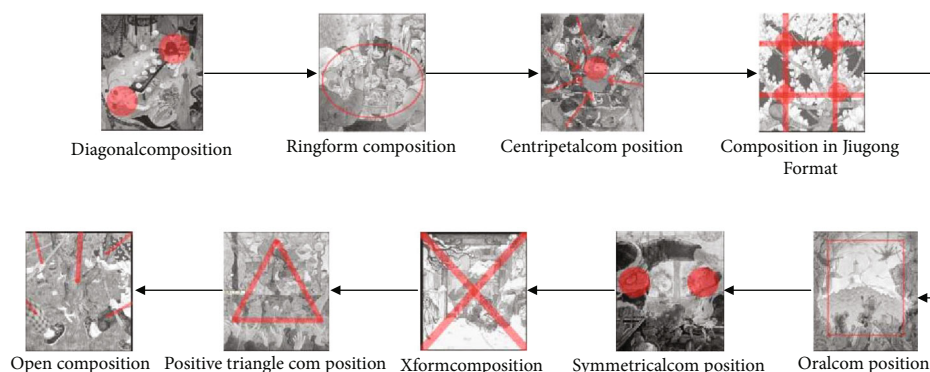FIGURE 3: Process flow chart of ceramic preparation.

FIGURE 4: Various composition techniques of ceramic painting.

been fully promoted and applied. Ceramic creators may also choose different ceramic painting creation techniques according to different modern ceramic painting shapes and themes in three-dimensional paintings. Modern ceramic three-dimensional painting, like traditional Chinese painting, pays attention to three-dimensional layout and comprehensive management. It is not only limited to the real environment but is based on the subjective visual experience of the painter and the needs of the ceramic creator. The points of multiple objects are placed in the same ceramic picture. Modern ceramic three-dimensional paintings can use multipoint scattering perspective or linear scattering multipoint linear perspective, and the points of different objects can be moved appropriately to fully meet the layout and management needs of ceramic painters. It has strong creative flexibility. The painting technique is shown in Figure 4.

All in all, ceramic art painting design is a unique modern art design. It is another kind of artistic creation and spiritual reflection that condenses the extreme changes of our people's contemporary realistic social lifestyles. It must always be based on our country's long history of artistic development. The characteristic of traditional ceramic painting is an idea and essence. It must be rooted in enhancing national consciousness and promoting national spiritual culture. Under the guidance of various national spiritual cultures that are advancing with the times, create a variety of Chinese national characteristics that meet the needs of the people's artistic aesthetics and culture and support the national spiritual culture. Various selective research and reference on

various modeling design techniques and main theme elements in the artistic creation of Chinese traditional ceramic painting design. So that it can fully integrate and absorb the elements of modern art in our country and promote each other. Further, vigorously promote the scientific development and artistic innovation of modern art design in our country [20, 21].

2.3. Technical Background of Virtual Reality. In order to better realize the integration of ceramic painting and traditional culture, it is inevitably inseparable from the support of reliable science and technology. Due to its simple syntax and clear structure, the virtual reality modeling language (virtual reality modeling language, VRML) is suitable for users to construct 3D virtual object structure models on the World Wide Web. With the emergence of VRML, any web browser with a built-in VRML web browser support plug-in can also directly click to open and automatically browse a three-dimensional virtual reality world built with the user's VRML plug-in [22, 23].

Virtual digital reality may initially be a professional term created by the American VPL company's code name jaronlanier in 1989 to represent a kind of realism concept that describes the human presence in the mobile computer virtual space environment. The main research and application content of virtual digital reality-related technologies can mainly include object-oriented graphic simulation of two-dimensional objects, modeling of three-dimensional object topographic maps, graphic fusion simulation technology of
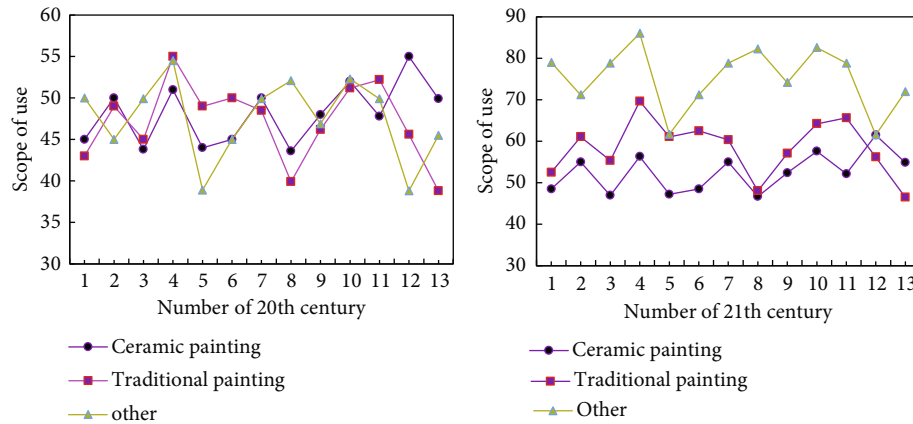
FIGURE 5: The development and use trend of virtual reality technology.

human and object scenes, simulation of graphics and images, real-time graphic generation integrated application with image synthesis, OVR graphic interface in an intelligent computer operating system, graphic representation of multi-dimensional object information, real-time processing and object-oriented programming in an intelligent concurrent image processing system, high-performance mobile computer graphic processing, distributed virtual environment, and intelligent virtual digital reality based on the virtual environment of the Internet [24, 25]. The main application areas of technologies related to virtual digital reality mainly include architectural engineering cad (compute raided design), graphic simulation in the overall design process of urban planning and civil construction engineering, military and civil architectural graphic simulation, virtual office environment, visual computing, entertainment (game and film production, etc.), medical system, and display system [26, 27].

When science and technology develop to this stage, visual information has developed from paper to current electronic media, enriching the way of information dissemination, such dissemination is more convenient, and the audience is more widely accepted. The emergence of economic globalization is the root cause of the arrival of the image age. Consumption values in contemporary society have further promoted the development of the image era. Image-style painting can become an independent visual world, and people have become accustomed to using images to express their thoughts and emotions. The rapid development of science and technology not only promotes economic development but also promotes people's way of viewing classic paintings. When some of the world's masterpieces are not convenient for global transportation, the use of images has completely changed people's way of viewing and the cognitive structure. The rebreaking of virtual reality played a vital role. Figure 5 shows the development of virtual reality over time.

In the traditional ceramic product marketing process, users often only see samples of ceramic products and limited paving renderings. As for whether such products are consistent with their own home decoration style, they can only decide by imagination. If you can provide users with a vir-

tual ceramic product space for custom home decoration styles and interactively pave the corresponding ceramic products in it, the final three-dimensional effect can be viewed in real time, which is useful for improving the user experience and establishing the brand of ceramic manufacturers. The image and promotion of the sales of ceramic products are undoubtedly of great significance. The implementation of all this requires the establishment of a virtual ceramic product display space first. VRML uses the scene graph data structure based on Open Inventor 3D developed by SGI to establish a three-dimensional reality. The nodes in the VRML scene graph can be divided into two basic types: one type is used to represent modeling objects from an audiovisual perspective; this type of node is organized according to a hierarchical system and is mainly used for the spatial structure of the scene; the other type of nodes is generated by forming events that can form a route graph (route graph), which is often used to determine the dynamic change effect of the scene over time. For this reason, VRML modeling is used in the virtual ceramic product display space.

3. Virtual Reality Technology and Model Design

3.1. The Working Mechanism of VRML.
Generally, VRML files include file headers, scene graphs, prototypes, events, and other components. The interpretation, execution, and presentation of VRML files and interaction with users are all realized through the browser. The mechanism is basically the same as the rendering and presentation of HTML files on the browser side. The access method of VRML is based on the client (browser)/server model. The server provides the VRML file itself and the referenced resource files, such as images, audio, and video, and is responsible for responding to the HTTP request (request) sent from the client, that is, the browser, and responding with HTTP (response). The VRML is sent to the client in the form of a message, which is then parsed by the VRML plug-in loaded by the browser and presented to the user. The visual and auditory effects that the user obtains through the browser seem to be obtained from a certain position, that is, it has the effect

TABLE 1: Details of the learning layer system.

Learning layer	
Learning activity	Learning community
Situational experience	Learning target
Real-time interaction	Learning content
Learning test	Learning strategy
Intelligent assistance	Study plan
Remote collaboration	Smart computing

of virtual reality. This position and orientation in the scene are called the viewer. Considering the characteristics of the browser, VRML can also be regarded as platform-independent. The algorithm of the DRNN is

$$
\begin{aligned}
O(k) &= \sum_j w_j^o X_j(k), \\
X_j(k) &= f\left(S_j(k)\right), \\
S_j(k) &= w_j^d X_j(k-1) + \sum_i w_{ij}^I I_i(k), \\
f(x) &= \frac{1 - e^{-x}}{1 + e^{-x}}.
\end{aligned}
\tag{1}
$$

$ym(k)$ is the output answer of DRNN, and the error threshold between $u(k)$ and $y(k)$ is used as the input feedback adjustment data of DRNN.

The approximation error is

$$
\begin{aligned}
e(k) &= y(k) - y_m(k), \\
E(k) &= \frac{1}{2} e^2(k).
\end{aligned}
\tag{2}
$$

Virtual reality technology network modeling is adopted. One of the most common algorithm steps in this neural network is the BP algorithm. Its basic concept is the gradient descent method. Its learning rule is that the minimum value cannot exceed the average criterion of all data errors. The learning process is forward and backward and then adjusts the weight of each layer. The detailed list of the system is shown in Table 1.

Weight adjustment of output layer:

$$
\Delta w_j^o(k) = -\frac{\partial E(k)}{\partial w_j^o} = e(k) \frac{\partial y_m}{\partial w_j^o},
\tag{3}
$$

where $e(k)$ is the output weight calculated after the initial adjustment.

$$
\begin{aligned}
e(k) \frac{\partial y_m}{\partial w_j^o} &= e(k) X_j(k), \\
w_j^o(k) &= w_j^o(k-1) + \mu \Delta w_j^o(k).
\end{aligned}
\tag{4}
$$

Recursive layer weight adjustment:

$$
\begin{aligned}
\Delta w_j^D(k) &= -\frac{\partial E(k)}{\partial w_j^D} = e(k) \frac{\partial y_m}{\partial X_j^o} \frac{\partial X_j^o}{\partial w_j^D}, \\
e(k) \frac{\partial y_m}{\partial X_j^o} \frac{\partial X_j^o}{\partial w_j^D} &= e(k) w_j^O P_j(k), \\
w_j^D(k) &= w_j^D(k-1) + \mu \Delta w_j^D(k).
\end{aligned}
\tag{5}
$$

Input layer weight adjustment:

$$
\Delta w_{ij}^I(k) = --\frac{\partial E(k)}{\partial w_{ij}^I} = e(k) \frac{\partial y_m}{\partial X_j} \frac{\partial X_j}{\partial w_{ij}^I},
\tag{6}
$$

$$
e(k) \frac{\partial y_m}{\partial X_j} \frac{\partial X_j}{\partial w_{ij}^I} = e(k) w_j^O Q_j(k),
\tag{7}
$$

$$
w_{ij}^I(k) = w_{ij}^I(k-1) + \mu \Delta w_{ij}^I(k).
\tag{8}
$$

The value range in the above formula is [0,1]; according to formula (6) and formula (7), the sum formula can be derived.

$$
\begin{aligned}
P_j(k) &= \frac{\partial X_j}{\partial w_i^D} = f\left(S_j\right) X_j(k-1), \\
Q_{ij}(k) &= \frac{\partial X_i}{\partial w_{ij}^I} = f\left(S_j\right) I_i(k).
\end{aligned}
\tag{9}
$$

Because the weight is unstable, it will oscillate or converge in continuous learning, and the speed will change accordingly. To avoid sending this phenomenon, a momentum factor α is added for correction, correction for the problem of weight instability, or oscillations or convergence. The value range of α is [0, 1], and the weighting algorithm is

$$
\begin{aligned}
P &= (k_i, l_i), \quad i = 1, j = 1, \cdots, M, \\
k_1 &= l_1 = 1, \\
k_M &= l_M = M, \\
k_i &< k_{i+1}, \\
l_i &< l_{i+1}.
\end{aligned}
\tag{10}
$$

Among them, the abscissa is the time series of the characteristic matrix. The name is the simulation index of virtual reality technology. The dotted line represents the optimal matching path, that is, the path with the greatest similarity. The weighted Euclidean distance of the appropriate route in the calculation area is used to calculate the similarity of the nodes in the graph. In the traditional solution process of the GWR model, people often default the distance to the Euclidean distance measure, namely, the straight line distance. However, it is not appropriate to use only a single European distance measure, and the weighted European distance refers to the combination of multivariable European distance measurement to improve this problem. According
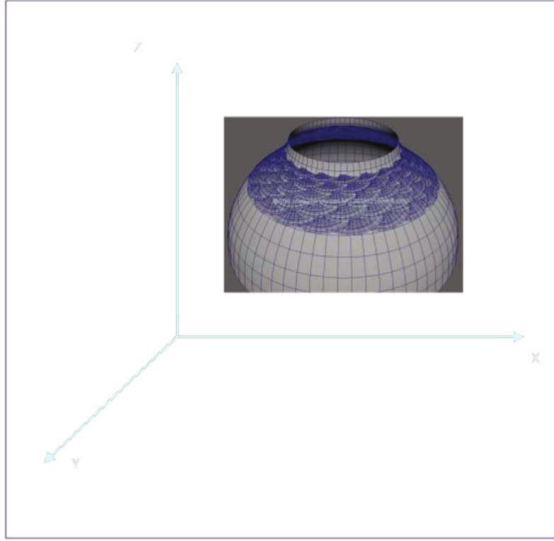
Figure 6: Example of ceramic bowl modeling.

to the formula, find the most similar time-series coordinates, through the comparison to find the most suitable path as shown in the figure above; in order to demonstrate the composition designed by the integration of ceramic painting and traditional cultural elements, the initial display effect is shown in Figure 6.

3.2. System Analysis. The traditional position of traditional culture in China's ceramic industry makes ceramic product sales account for a huge proportion of commercial trade. In recent years, due to the many intermediate links in the traditional ceramic sales model, the cost has remained high, even affecting the revival and rise of the ceramic industry. For this reason, relevant departments have put forward a construction plan for the integration of ceramic painting and traditional culture. In most of the current platforms, it can be seen that the display of ceramic products is mostly limited to a two-dimensional plane, which has certain limitations in display. The hardware equipment used in the system is shown in Table 2, compared with for the sales of other commodities, ceramic products have a certain degree of particularity. If consumers can experience the three-dimensional rendering effect of ceramic products in virtual reality, it will undoubtedly have important promotion significance for the development of ceramic industry business [28].

The target users in the ceramic painting display platform can be for enterprises, distributors, or end customers. The virtual ceramic display system is mainly responsible for the product display function in the e-commerce platform, providing users with interactive three-dimensional display to replace the traditional two-dimensional display. After analysis, the basic business process of the VRML-based virtual ceramic display system and its functional relationship with the e-commerce platform are shown in Figure 7.

After logging in to the system, you can enter personal information. Generally, it can include two parts: basic information for e-commerce, such as name, address, contact information, and payment method, and ceramic products

needed to establish a three-dimensional virtual ceramic exhibition space. The basic information of the installation environment, such as the area and floor height of the bathroom required for the bathroom system. On this basis, users can select ceramic products and intuitively feel the matching effect of ceramic products with the environment to be placed, such as the overall effect of tiles in the living room. If they are satisfied, they can add to the shopping cart through e-commerce, platform to make purchases. After receiving the goods for placement or paving, you can evaluate them according to the actual situation, and you can communicate with many users in the community forum to recommend your favorite ceramic products. The system can automatically recommend the corresponding ceramic products for new users according to the attention ranking, saving their selection time.

3.3. System Design. The e-commerce platform of the traditional cultural ceramic industry adopts the B/S architecture. The client will be mainly responsible for directly generating and automatically sending an HTTP request and sending the message to the background web application server. The web application server is mainly responsible for converting all received HTTP request messages into a SOAP (simple object access protocol); in simple terms, the object automatically accesses the service protocol of this request and forwards it to the application server in the background. After receiving a SOAP request in the background, the application server is mainly responsible for automatically calling the background business flow and logic and other related components, and connecting with the database. According to the SOAP request, it generates a data request corresponding to the SQL statement and submits it to the background database management system. Then, the database management system executes the SQL query and returns the execution result to the application server in the form of a message. In a multielectronic information application business platform that is traditionally used for virtual digital cultural ceramic craft model ceramic products in the industry display, the application server may also need to be responsible for each from a virtual digital cultural craft ceramic product industry display model library. Directly visit and obtain a predesigned and generated space for the virtual digital cultural craft ceramic product industry display response model library, and finally, complete it through the response reproduction method and respond to the corresponding SOAP form of the response. The web application server obtains the old SOAP form through the response to return the response and then returns the response in the new HTTP form and sends the response to the message in the form of the sending protocol. The htcp/ip is used to respond directly to the response through the response return protocol. The response is sent back to one; the transmission format of the application client is shown in Table 3, so that the corresponding virtual ceramic exhibition space scene can be viewed in the web browser with the VRML plug-in installed [29].

The network structure of the virtual ceramic product display system based on VRML is based on the e-commerce platform system. The existing system has registered corporate

TABLE 2: Hardware required for software use.

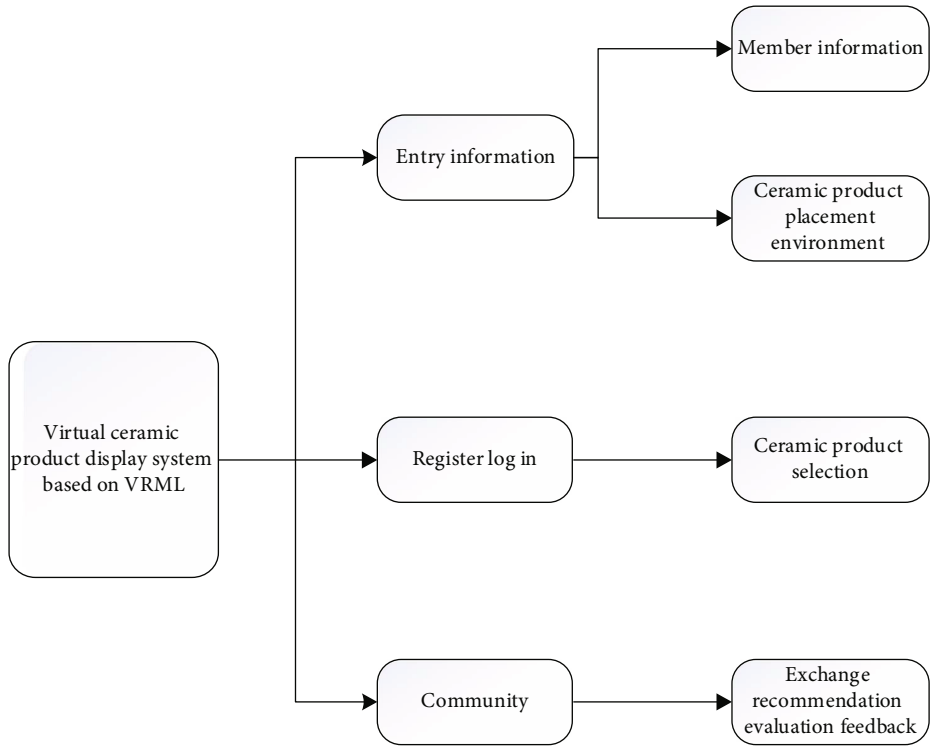| Hardware equipment	Software environment	Web environment	Collaboration method	Immersion
Computer Mouse Keyboard Earphone	Windows 7	Wireless network	Online partner	Semi-immersion

FIGURE 7: Basic business process of the system.

TABLE 3: B/S character transmission format.

Format field name	Format function	Number of digits (bit)
Coding system	ASCII characters 0-9, A-F	1 hexadecimal
Data bit	A start bit, 7 data bits	9
Error check field	Vertical redundancy check (LRC)	1

information and user information and provides information on the supply and demand of ceramic products. The data of the core business system is stored in the data center, and the common file transmission processing server can provide the source of the core business data for the system. The system still uses the B/S structure. The maintenance and online generation of ceramic product models and virtual ceramic display spaces are all based on the web application framework. The stability of the framework structure is shown in Figure 8.

The VRML-based virtual ceramic display system is part of the traditional cultural ceramic industry e-commerce platform, which can be attributed to the display layer or the view in the MVC model. At the same time, the virtual ceramic display system is relatively independent, further expanded and generalized, and can also be applied to e-commerce platforms in other industries or only as functional modules related to display.

4. Experimental Test and Result Analysis

4.1. Virtual Reality Transformation Test of Ceramic Painting. The function test adopts the ink cartridge test to detect the following:

(1) Whether the system function is implemented correctly

(2) Whether the system function is complete

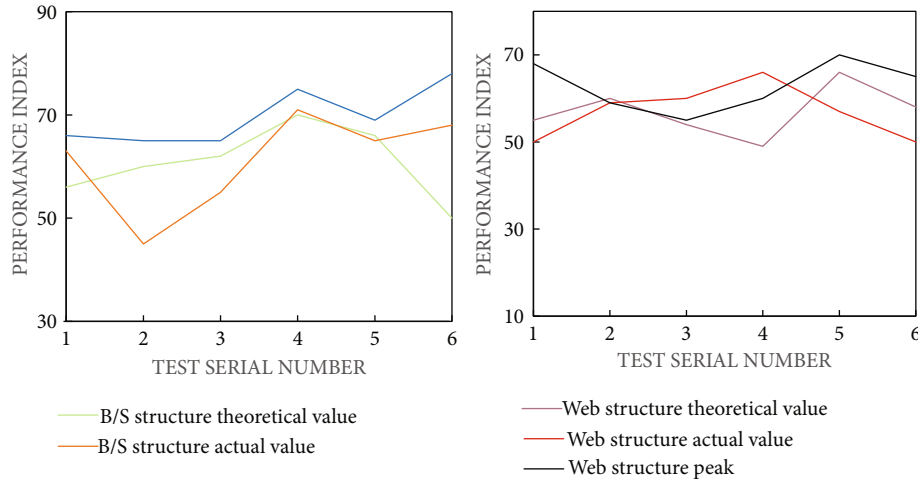(3) Whether the realization of system functions is operability

FIGURE 8: Comparison of algorithm structure stability parameters.

TABLE 4: Test cases and test results of ceramic product information maintenance function.

Test case		Test results	Response
	Set query conditions, click query to locate	The query record list meets the query conditions	<3S
Query positioning	Click reset conditions to clear the query conditions	Reset all query condition input boxes to empty	<1S
	In sorting, select the field to be sorted and ascending or descending order	The order of the records in the query is normal	<3S

(4) Whether the realization of the system function fully considers the ease of use, that is, whether it conforms to the user's daily habits

(5) Does the realization of the system function fully consider the possible errors of the system and whether it may cause problems to the user?

For current operating errors or misoperations, fault-tolerant measures such as data verification are adopted to prevent system crashes, etc. This requires the necessary collection of temporal data reflected by the platform to achieve better performance of the system.

The problem arises.

In the functional test, we mainly adopted common test methods such as equivalence class division, causality diagram, boundary value analysis, and error speculation, designed test cases with typical significance, and carried out corresponding functional tests for the corresponding modules. The following only takes the ceramic product information maintenance function as an example to explain the corresponding test process. Typical test cases and results of ceramic product information maintenance function are shown in Table 4.

After the system function test is passed, the automated test tool is used to simulate the customer to conduct a multiuser stress test to see whether the system can respond normally to concurrent user requests and have corresponding stability. Establish a concurrent user test environment to simulate 100, 300, and 900 online users, respectively, and

check whether the following performance indicators are normal:

(1) Whether the page response time is less than 5 seconds

(2) The system at least meets the requirement of more than 100 concurrent users

(3) When the number of concurrent users reaches 100, the average server CPU usage should be less than 95%, and the memory usage; the rate is less than 75%

Multithreading technology is used to simulate multiple browsers to send HTTP requests to the web server for a period of time, and the recording system provides performance indicators between HTTP responses. The test result data obtained for the login and ceramic product selection page is shown in Figure 9.

4.2. Overall Analysis. Among the technical specifications of VRML, the network data storage specifications of most service nodes are relatively special, which is not suitable for extended applications problems; these problems greatly affect the application of VRML technology. But for the script (external script) node, it can have a relatively independent domain SURL domain, which can be used for data mixed programming with other external scripting languages. Therefore, for example, it can create an external object data model applied to the javascript node to directly extract the
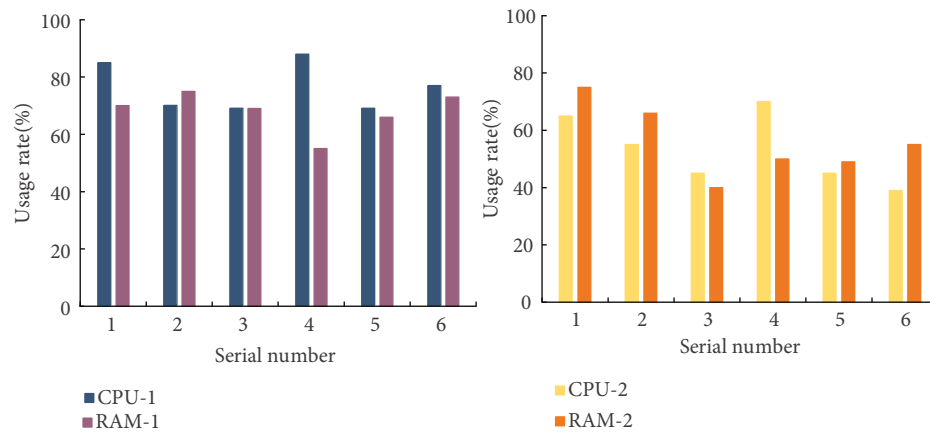
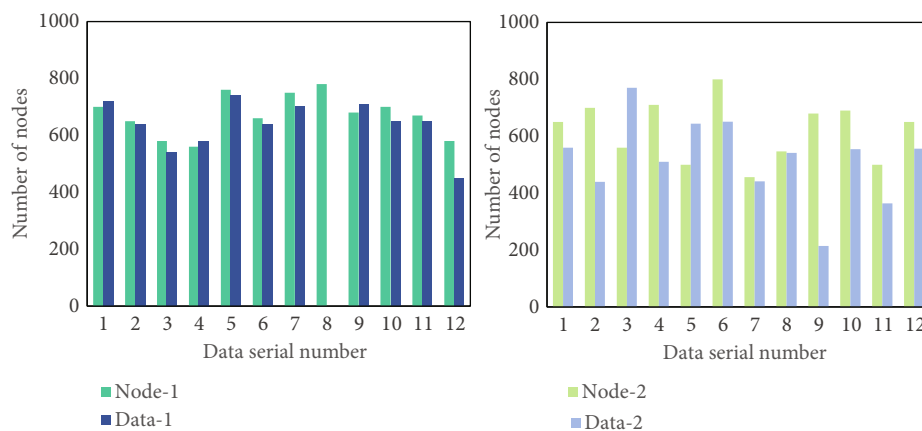FIGURE 9: CPU and memory module usage test data graph.

FIGURE 10: Data distribution of each node.

external object data and transfer the corresponding data to the VRML virtual space. The data collected in this way will be more close to the actual situation and have higher accuracy. In fact, the script node itself is actually a special lower-level programmable model node, since only the script node cannot be directly used to sense the actual operation of each user, in a virtual network 3D directly constructed by SC-CRML. The space is often in a state of no visibility, so users often need to directly embed it as a submodel node of a model management node and use their minds to realize seamless connection with any model node's network interface. The corresponding data distribution is shown in Figure 10.

After a complete test, the results obtained show that the system can basically meet the actual needs of users. For the common multiuser concurrency of e-commerce platforms, it can also complete the correct processing of multiuser online transactions. The response time of the page can basically be controlled below 4 s/time, and after a long-term stress test, the system can still keep running. The stability of the system, the probability of serious errors is less than 0.512%. Based on this, we can draw the following conclusions: the traditional cultural ceramic industry and its subordinate virtual ceramic display system are functional, stable, easy to use, safe, and reliable and basically have the ability to be put into commercial applications.

5. Conclusion

This paper focuses on the design and implementation of the subproject "Virtual Ceramic Display System," which is a combination of ceramic painting and traditional culture composition design. It focuses on the generation technology of virtual ceramic product space and studies the interaction of virtual display spaces in web pages. It designed and implemented a virtual ceramic display system based on VRML. This article mainly proposes a VRML-oriented method suitable for establishing a virtual ceramic product space model, that is, a method of building a VRML model with 3DS MAX and other three-dimensional modeling tools combined with a VRML visual editor. According to this method, based on the LOD node, the method is given the optimization and integration method of the virtual ceramic display space scene and completed the modeling o1f the outdoor background and building required by the virtual ceramic product display space scene. Research on the interactivity of the virtual ceramic display space in web applications, including the automatic interaction of VRML, the

interaction using the script node function, and the realization of the automatic display function of the virtual ceramic display space. Based on this model, the interaction between ceramic painting and traditional culture is enhanced in the integration of ceramic painting and traditional culture. A virtual ceramic product based on built-in sensors is proposed. The realization method of color switching and placement. For the interaction of external data sources on the web page, corresponding solutions are also given, which lays a technical foundation for the dynamic generation of a display space including designated ceramic products in the virtual ceramic display system. For the establishment and application of the virtual ceramic display system, although it has been practically applied, the response and display speed of the system is still restricted by the number of models. This is due to the fact that in addition to a large amount of model grid data, a large number of texture images are often attached to the model. How to further improve the response speed of the server and reduce the network transmission volume and the rendering speed of the browser side is a problem to be solved.

Data Availability

No data were used to support this study.

Conflicts of Interest

The authors declare that there is no conflict of interest with any financial organizations regarding the material reported in this manuscript.

Acknowledgments

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