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Research on Digital Preservation and Virtual Display Technology of Industrial Heritage

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Abstract. In order to solve the problem that the connection between the host-side equipment and the client-side equipment is not close, which leads to the unclear display of industrial heritage, the research on digital protection and virtual display technology of industrial heritage is proposed. In this paper, on the basis of B/S architecture, the host-side platform equipment and client-side platform equipment are connected on demand. Then the virtual reality is used to determine the location of the user role, and establish the human-computer interaction mode, and then through the way of perfecting the database storage system, to realize the construction of the system software execution environment. The experimental results show that during the whole experimental process, the mean value of the contact tightness index between the host-side equipment and the client-side equipment of the experimental group is relatively high, while the mean value of the control group is relatively low. From the perspective of limit value, the experimental group, the□The maximum value of the indicator amounted to 35.5%, compared to the control group□Compared with the maximum value of 18.9%, it has increased by 16.6%. Conclusion: Compared with the traditional system, the tightness of connection between the host device and the client device of the system is always maintained at a high level, which can meet the practical application requirements of clearly displaying industrial heritage.

Keywords. Virtual Reality, Interactive Processing Technology, Industrial Heritage,Digital Display, B/S Architecture

1. Introduction

Industrial heritage refers to the industrial legacy formed in the process of development in the industrial field with historical and continuity of cultural characteristics of the industrial heritage industry, its specific point is left behind by the form of industrial history activities to build the buildings and structures and buildings and structures within the formation of the craft, tools, technology, landscape and other material or non-material show and form a historical research value and significance [1]. Industrial heritage has formed a special industrial culture and historical relics, such as the process of industrial history, traditional old industrial technology, scientific research value, industrial social form, industrial architecture and other industrial culture and relics of the spirit of industrial culture and the embodiment of the spirit [2]. With the change and transformation of the times, the industrial heritage legacy is more and more extensive, involving more and more, such as buildings, industrial machinery and

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equipment, industrial plants, industrial sites, etc., education, military, transportation, etc. are closely related to industrial heritage [3].

The earliest development of the industrial revolution for the United Kingdom, the United Kingdom is also the earliest industrial heritage to pay attention to and protection of the country, and the protection of the industrial revolution in the United Kingdom phase of the scope has been relatively wide, such as generators, factories, factories, houses, buildings, steam engines, etc. [4]. After the reform and opening up, with China's industrial revolution spanning the development process, in the rapid and sustained development of economic construction, many of the old industrial production areas gradually replaced by new industries, emerging technologies, traditional industrial production areas facing a new period of reconstruction, transformation, improvement, reuse, many industrial production areas have become a historical site to promote and develop the process of indispensable historical and cultural relics [5]. With the development of the times, under the intelligent development of high-tech information technology, the use of virtual reality technology combined with industrial heritage, the formation of industrial heritage culture in the field of digital conversion of the unique form, the use of virtual reality technology so that the industrial heritage culture and connotation of the industrial heritage to quickly let people to recognize and understand the value of the industrial heritage to be embodied [6].

Virtual technology relies on its multi-dimensional interactivity, immersion, instant imaginative features for a number of industrial areas of in-depth research and development to bring a major breakthrough, at this stage, such as automobiles, hospitals, military science, etc. in the research of virtual reality technology have been combined into [7]. Although virtual reality technology is still in the stage of continuous exploration and research, there are still many can be improved and perfected, the technology is still to be more mature, still can not stop the virtual reality technology by the industrial field of attention, and continue to expand the scope of application of the application of virtual reality technology has been made to realize the digitalization of industrial heritage to provide the basis of research to provide protection and achieve certain results breakthrough [8]. The realization of industrial heritage digitization is a necessary way to follow the development of the scientific and technological era, and it is necessary to continue to integrate virtual reality technology, an emerging technology, into the industrial heritage exploration and design to effectively do the improvement and combination, in order to realize the reform mode of industrial heritage digitization [9]. The combination of virtual reality technology and industrial heritage, so that industrial heritage digitization to achieve a more comprehensive exploration and development, and continue to obtain the attention of researchers, improve the cultural value of industrial heritage, enhance the sustainable development of an important role [10]. Whether in the application of bioengineering, aerospace engineering, automotive industry and other industrial fields have brought high feedback and evaluation, so the realization of the combination of virtual reality technology and industrial heritage has a high value, is the trend of the digital development of industrial heritage must go [11].

2. Literature review

In the Internet environment, due to the existence of external interference information, the close relationship between the host-side equipment and the client

equipment is very easy to be affected, which is also the main reason that the clarity level of industrial cultural heritage information display is difficult to reach the actual standard. Although the traditional industrial heritage display system can realize on-demand sorting of data and information parameters, it is difficult to ensure that the contact behavior between the host-side equipment always maintains the I close state [12].

In recent years, the industrial heritage group has received wide attention and protection, and the government and related organizations have taken a series of measures to protect and develop this heritage group in order to promote the protection of cultural heritage and the development of tourism. Virtual reality contains computer applications, simulation applications, electronic information and other technical means, can be in the role of the computer virtual simulation program, to give participants a fully immersive experience [13]. Zhang, M et al. proposed that the interactive technology is a kind of data processing means with the ability of information exchange and transmission, with a certain degree of resource integration, can be the Internet information parameter collection, and can be written in the text, and can be used as the basis for the development of the cultural heritage and tourism. It can gather the information parameter of the Internet, and can feedback the data information to the established host unit in the form of text carrier [14]. The virtual reality gradually combined with interactive technology, can guarantee the stability of information transmission at the same time, the establishment of the host platform and the client platform between the data interoperability relationship, on the one hand, so that the data and information parameters can be transmitted to the target location within a certain period of time, on the other hand, can also avoid the impact of external information on the Internet environment.

Therefore, this study takes a certain place as the research background and designs a new type of digital display system for industrial heritage with the support of virtual reality and interactive technology.

3. Methodology

3.1 System hardware design

The hardware execution environment of the industrial heritage digital display system consists of three parts: B/S architecture, host-side platform and client-side platform, and the specific design methods are as follows.

B/S architecture, as the basis for the construction of the industrial heritage digital display system, consists of three parts: Browser Server, Servlet Transition Bridge, and Database Server, and the specific structure is shown in Figure 1.

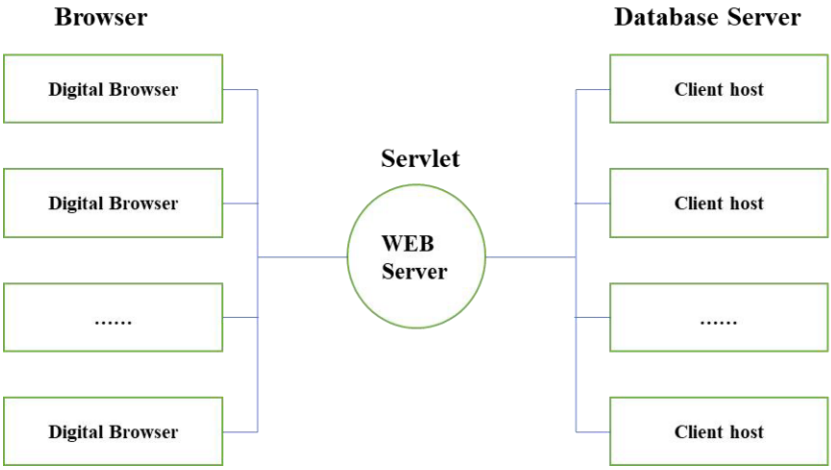

Figure 1.B/S architecture of the digital presentation system for industrial heritage

The Browser server contains multiple digital browser structures, which can integrate and process the input industrial heritage information, extract the information parameters in the data information related to the host platform, and feed them back to the lower-level hardware application structures. servlet transition bridges are responsible for transferring the industrial heritage information stored in the digital browser to the Database Server server organization, and in the process, determine the tightness of the real-time connection between the host device and the client device. Database Server server contains several client application hosts, which are responsible for receiving the industrial heritage information output from the higher-level structure, and in the preliminary processing of data parameters, the information file that meets the transmission requirements can be fed back to the system. The Database Server server contains several client application hosts, which are responsible for receiving the output of industrial heritage information from the higher structure, and at the same time of preliminary processing of data parameters, the information files can be fed back to the system in accordance with the transmission requirements.

The mainframe platform of the industrial heritage digital display system consists of five parts: strategy layer, scope layer, structure layer, framework layer and presentation layer, and the implementation capabilities of each hierarchy are as follows.

①Strategy layer: the strategy layer equipment is the core component of the host platform, which is capable of determining the actual transmission capacity of the industrial heritage information without violating the design requirements of virtual reality and interactive technology, and can formulate the subsequent execution instructions of the display system in conjunction with the digital browser structure of the B/S architecture.

② Scope layer: the scope layer structure can process the industrial heritage information regionally, as the subordinate structure of the strategic layer equipment, it is responsible for processing the data and information parameters to be displayed, and it can feedback the information files to the core display components for the client platform equipment to retrieve and make use of under the effect of the output channel organization.

(iii) Structural layer: Structural layer devices are in charge of data access

commands related to industrial heritage information, and are equipment transition devices in the host-side platform.

④ framework layer: the framework layer structure has a certain degree of connectivity adaptability, responsible for planning the actual role of the host side of the platform form, in general, the more industrial heritage information to be transmitted, the framework layer system in the application of the structure of the continuity of the stronger.

⑤ Expression layer: the expression layer structure is directly connected to the display host of the digital system, which is responsible for supervising the transmission of industrial heritage information and planning the transmission of relevant data and information, so that the whole display system can maintain a relatively stable connection state for a long time.

Client platform to LIMS chip as the core application structure, can unite the left and right ends of the digital interface, prompting the industrial heritage information from one host device to another host device rapid transmission, so that the display instructions can be fully applied, and ultimately make the host side of the device and the client device between the contact behavior gradually tends to be close [16]. Specific connection diagram shown in Figure 2.

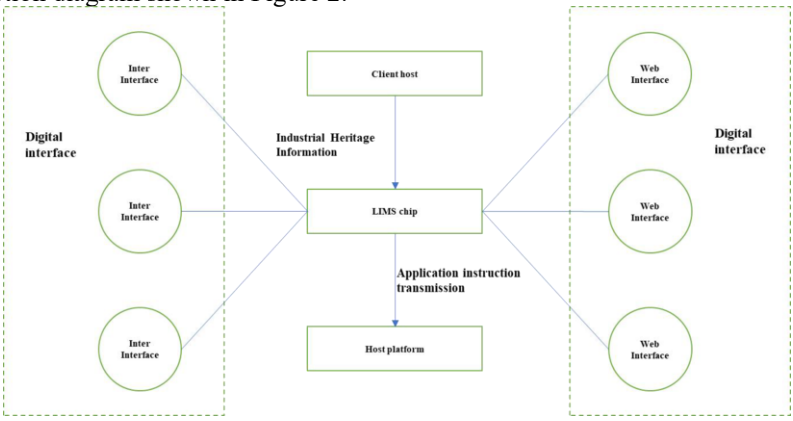

Figure 2. Schematic diagram of the structure of the client platform

As a subordinate connection structure of the industrial heritage digital display system, the client platform determines the adaptive capacity of the data information parameter, if the host-side platform as the only information output element, it can be assumed that the more frequent the demand for the connection between the platform and the platform, the stronger the practical ability of the client host [17].

3.2 Software design of the digital display system for industrial heritage

On the basis of hardware implementation structure at all levels, according to the virtual reality and interactive technology, the definition of user roles, and then through the definition of human-computer interaction behavior, improve the form of connection of the database storage system, so as to realize the construction of the software implementation environment of the digital display system, and the combination of the two, to complete the overall design of the digital display system of industrial heritage based on virtual reality and interactive technology.

3.2.1 Virtual user role design

The virtual user role in the industrial heritage digital display system consists of two parts: the host-side object and the client-side object. Among them, the host-side virtual user role, as the source of interaction of industrial heritage information, has strong data scalability at the macro level, can split a data object into multiple associated information parameters, and can establish the connection relationship between the host-side and the original information parameters under the role of virtual reality technology [18].

Assuming that β denotes the interaction coefficient of virtual information at the host side, the $\overline{E}$ It represents the accumulated amount of industrial heritage information in the host end system in a unit time, λ represents the virtual composition conditions of the host end user role, and w_1, w_2,., w_n represent n different virtual composition characteristics of the host end user role. By combining the above physical quantities, the virtual user role definition conditions in the host platform can be expressed as:

$$e_1 = \frac{\beta \times |\overline{E}|^2}{\sqrt{\lambda \cdot (w_1^2 + w_2^2 + \cdots + w_n^2)}} \tag{1}$$

The client virtual user role, as the interaction destination of industrial heritage information, has strong transmission adaptability at the macro level, and is able to integrate and process the relevant data parameters in accordance with virtual reality and interaction techniques [19]. Assuming that R_1 and R_2 denote two different virtual information interaction coefficients in the client host per unit of time, and that R_1 and R_2 denote two different virtual information interaction coefficients in the client host per unit of time. $\hat{k}$ denotes the cumulative characteristics of industrial heritage information,j denotes the interaction coefficient of industrial heritage information in the client system, the $\vec{\chi}$ denotes the data information transmission vector in the client host, and h denotes the transmission coefficient of industrial heritage information in the client host. Associating the above physical quantities, the virtual user role definition condition in the client platform can be expressed as follows.

$$e_2 = \frac{\left|j \cdot \hat{k}^2 (R_1 + R_2)\right|}{h \times \vec{\chi}} \tag{2}$$

Virtual user roles satisfy the need for information interoperability between the host platform and the client platform, and in the process of defining role objects, all data computation commands must maintain correspondence with virtual reality and interaction principles.

3.2.2 Human-computer interaction models

Human-computer interaction mode is based on virtual reality technology, constructed data and information transmission interaction mode, usually with the host platform as the core output, with the client platform as the core input, and because the transmission of industrial heritage information does not have reversibility, so each platform object must be with the host of the digital display to maintain an independent data communication relationship.

Without considering other interference conditions, the application ability of HCI mode is directly affected by two physical indexes: virtual signal definition term and node interaction parameter. The virtual signal definition term can be expressed as α. In

the industrial heritage digital display system, the value of this physical index is always relatively low, basically within the physical interval of (0,1). The node interaction parameter can be expressed as ε. Under the support of virtual reality technology, the value of this physical index also belongs to the physical set of (0,1), but its actual value is always smaller than the index parameter α. Under the support of the above physical quantities, the formula (1) and (2) can be established. The discriminative expression of the application capability of the human-computer interaction mode of the industrial heritage digital display system can be defined as follows.

$$L_{\alpha-\varepsilon} = f \cdot \left(\frac{|\alpha \cdot e_1 + \varepsilon \cdot e_2|^2}{\sqrt{d^2+g^2}} \right) \tag{3}$$

In the formula, f represents the data interaction intensity between industrial heritage information, and d and g represent two different data and information virtual transmission behavior indicators. In the industrial heritage digital display system, the application ability of human-computer interaction mode determines the farthest transmission distance of data information parameters, which is also a standard numerical condition to measure whether the virtual reality technology meets the practical application requirements.

3.2.3 Database storage systems

Database storage system improvement is the end of the industrial heritage digital display system design links, can be known in the virtual reality and interactive technology on the basis of the implementation of the strength of the accumulated data and information parameter centralized processing, and then selected from the information parameter with obvious digital characteristics, respectively, feedback back to the host-side platform and client-side platform, on the one hand, to achieve the accurate differentiation of data and information, on the other hand, can also realize the close relationship between the platform equipment on-demand maintenance [20]. On the one hand, it can realize the accurate discrimination of data information, and on the other hand, it can also realize the on-demand maintenance of the close relationship between platform equipment [20].

In the actual application process, there is an obvious data and information interoperability relationship between the host platform and the client platform, that is, in the case of stable connection of the database storage system, the industrial heritage information can be accurately fed back to the client platform by the host platform under the role of digital channel organization, and with the prolongation of the system operation time, this information transmission behavior will not be affected in any way.

Supported by virtual reality and interactive technologies, the database enables the complete transfer of industrial heritage information and the on-demand presentation of data and information parameters with the help of digitized host components.

3.3 Experimental validation

The following experiments are designed to verify the application performance of the industrial heritage digital display system based on virtual reality and interactive technology.

The tightness of the connection between the host device and the client device can

be used to measure the clarity of the presentation of industrial heritage information, usually the stronger the connection, the higher the clarity of the presentation of industrial heritage information, and vice versa.

The tightness of the connection between the host-side device and the client-side device (ϖ), is directly affected by two physical metrics, namely, information input strength (θ_1) at the host side and information output strength (θ_2) at the client side, which are expressed as follows.

$$\varpi = \frac{\theta_1 \times \theta_2}{\Delta C} \tag{4}$$

Where, ΔC represents the unit change of industrial heritage information.

A virtual interactive network is used to sort the industrial heritage information of the experimental group, and then an equal amount of non-virtual interactive industrial heritage information is randomly selected as the data variable of the experimental group and inputted into the corresponding network host components respectively. Among them, the host of the control group is equipped with the traditional display system, and the host of the experimental group is equipped with the industrial heritage digital display system based on virtual reality and interactive technology designed in this study (all the data in this experiment are the industrial heritage information of a certain place).

4. results and discussion

Table 1 records the changes in the values of the information input strength θ_1 metric at the host side for the experimental and control groups.

Table 1. Experimental values for the strength of the information input at the host side

industrial heritage information Input quantity/$\times 10^7$ Mb	Host-side information input strength θ_1	
	The experimental group	Control group
1.5	5.9	3.7
3.0	6.3	4.0
4.5	6.7	4.4
6.0	7.2	4.8
7.5	7.8	5.1
9.0	8.4	5.1
10.5	8.6	5.1
12.0	8.6	5.3
13.5	8.6	5.5
15.0	8.6	5.9

Analyzing the numerical indexes in Table 1, it can be seen that with the increase of industrial heritage information input, the numerical change state of θ_1 index in the experimental group conforms to the tendency of rising and then stabilizing, while θ_1 index in the control group conforms to the tendency of rising and then stabilizing, and then continuing to rise. From the point of view of limit values alone, the maximum value of θ_1 in the experimental group is 8.6, which is 2.7 higher than the maximum value of θ_1 in the control group, which is 5.9.

Table 2 records the changes in the values of the client-side information output strength θ_2 metric in the experimental and control groups.

Table 2. Experimental values of the strength of the client's message output

Intangible Cultural Heritage Information Inputs /×10^7Mb	Host-side information input strength θ_2	
	The experimental group	Control group
1.5	6.1	4.4
3.0	6.1	4.4
4.5	6.2	4.4
6.0	6.1	4.5
7.5	6.0	4.5
9.0	6.3	4.5
10.5	6.1	4.5
12.0	6.1	4.7
13.5	6.2	4.7
15.0	6.1	4.8

Analyzing Table 2, it can be seen that, with the increase of industrial heritage information input, the θ_2 index of the experimental group always maintains a relatively stable value of the existence of the state, although there is a certain degree of increase in the value of the individual index parameter, but the amount of its change is relatively small; the θ_2 index of the control group always maintains the rising value of the state of change, but the overall mean level is always lower than that of the experimental group.

It can be seen from Table 1 and Table 2 that throughout the experiment, the unit value change of industrial heritage information input is always equal to 1.5×10^7 Mb, that is, the equation condition of $\Delta C=1.5 \times 10^7$ Mb is always true.

In summary, it can be seen that under the effect of the application system based on virtual reality and interactive technology, the numerical levels of θ_1 index and θ_2 index have been increased to different degrees, which can play a certain role in enhancing the tightness of the connection between the host-side equipment and the client-side equipment, and meet the actual application of clearly displaying the information of a certain place of industrial heritage, as compared with the traditional application system. The system is in line with the practical application of clearly displaying the industrial heritage information of a certain place compared with the traditional application system.

5. Conclusion

This paper proposes the research of industrial heritage digital protection and virtual display technology, under the influence of virtual reality and interactive technology, the digital display system starts from the point of view that the tightness of connection between host-side equipment and client-side equipment is not up to the standard, and unites the B/S architecture, and improves the connection form of host-side platform and client-side platform, which not only realizes the on-demand definition of the role of the virtual user but also builds a more stable human-computer interaction mode, thus making the industrial heritage information to be stored and applied in an accurate way. It not only realizes the on-demand definition of virtual user roles, but also builds a more stable human-computer interaction mode, so that the industrial heritage information can be accurately stored and applied. Compared with the traditional application system, the numerical level of the indexes of the output intensity of industrial heritage information in the host and client platforms of this system is higher, and it can realize the clear display of industrial heritage information.

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