Implementation of Internet-based Virtual Reality Technology in Interior Design

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Abstract: Virtual Reality (VR) technology, as a new practical technology that has gradually developed and improved since the 21st century, comprehensively simulates real scenes and has broad application prospects in interior design. This article mainly focuses on the application of virtual reality technology in the digital virtualization design of indoor products. It constructs a scene experience system for indoor design in a virtual environment, analyzes the feasibility of combining virtual reality technology with indoor product design based on actual creative experience, and explores the new product display form of virtual reality scenes. Finally, a survey is conducted through a questionnaire survey, the results show that over 98% of users are satisfied with the system.

Keyword: Virtual Reality, Interior Design, Scene Experience, VR Scenes

1. Introduction

VR panoramic technology is an important branch of virtual reality technology. Its emergence quickly became the focus of attention in the engineering and technology communities. It constructs an artificial virtual environment through computer technology, which is based on static image virtual reality technology. By constructing realistic three-dimensional spaces through computers, the viewer experiences a sense of immersion visually. At present, this technology has been widely applied in various fields such as real estate, tourist attractions, hotels, exhibition halls, multimedia promotion, and has brought huge economic benefits to various fields [1].

The implementation of VR+strategy has promoted the integration and development of VR technology with various industries, and the integration of VR panoramic technology with interior design has also become a new development trend. VR panoramic technology has changed the limitations of traditional interior design graphic and image expression, and some abstract design data has also been presented intuitively, providing greater benefits for various relevant audiences [2]. It better expresses the designer's design philosophy, strengthens communication channels between designers and customers, saves costs for enterprises, improves work efficiency, and provides strong guarantees for subsequent services, performance accumulation, and business expansion of enterprises. Therefore, the research on the application of VR panoramic technology in the entire process of interior design has

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important practical significance. With the continuous progress and development of society, the traditional presentation of drawings in interior design can no longer meet the needs of customers [3]. There is an urgent need for practitioners in interior design to continuously improve the display methods of design schemes. With the continuous maturity of VR panoramic technology, its display efficiency is becoming more and more perfect and reflected, allowing designers to fully reflect their design concepts in design schemes. Therefore, The application of VR panoramic technology in interior design has become a routine operation for relevant practitioners, which is also a major breakthrough in interior de [4]sign technology. Some enterprises also use the effective combination of VR and BIM to simulate the construction scenarios of indoor design, effectively avoiding risks such as construction waste, rework, and repetitive operations, bringing good reputation and economic benefits to the enterprises. The application of VR panoramic technology in interior design shows an overall upward trend. In foreign countries, the integration and development of VR+interior design is also flourishing, and VR technology is leading the interior design industry to accelerate upgrading [5]. In the UK, BBCone TV has launched the VR interior design themed reality show "VirtuallyHome", which is "a brand new, cutting-edge interior design program centered around people in design difficulties". It "helps designers with limited budgets avoid making expensive interior design mistakes" and "allows designers to showcase their dream designs in VR and then realize them in reality", as soon as the program was launched, it ushered in a viewing frenzy, making the application of VR panoramic technology in interior design more deeply rooted and effectively promoted [6].

The innovation of this study is mainly reflected in the involvement of VR panoramic technology in various stages of the entire interior design process and the construction of panoramic scenes. This enriches the integration of the two, focusing on solving the pain points of traditional interior design methods, and exploring new methods and technologies in interior design [7].

2. The Application of VR Technology in Interior Design

2.1 Virtual Reality Technology

Virtual reality, also known as VR technology, refers to the comprehensive utilization of various scientific technologies such as computer image science and technology, multimedia teaching science and technology, human-machine interaction science and technology, internet information, sensors and detection technology, three-dimensional representation technology, and simulation technology to create a real artificial virtual environment that integrates vision, hearing, and touch. In a virtual environment, users can interact with objects in their daily lives in the most natural way with professional technical equipment (such as stereoscopic glasses, helmets, data gloves, trackers, sensors, etc.), thereby achieving a stronger sense of immersion and realism [8].

Virtual reality technology has obvious immersion, interactivity, and constructiveness. Immersion refers to the use of computer simulation effects to allow users to form fantasies about entering virtual scenes, and act as active participants in the virtual world, even being able to change fictional objects in the virtual world through operations. Interactivity refers to users using interactive VR devices to

interact with objects in the virtual natural environment, manipulate fictional objects, and receive feedback from the virtual natural environment [9]. Virtual reality technology emphasizes the naturalness of human-computer interaction, but the implementation of interaction requires strong hardware system support. Conceptual thinking refers to the thinking process in which users obtain virtual reality experiences in an illusory natural environment. Virtual reality technology has a very open design experience, allowing users to immerse themselves in an illusory natural environment. In addition to enjoying real natural experiences, it can also simulate those impossible natural experiences.

The manifestations of virtual reality technology generally include VR technology based on images and panoramic technology based on image information. Image based VR technology typically refers to the construction, pasting, and rendering of 3D or stereoscopic images of scenes and objects in virtual reality environments, typically completed through specialized modeling software such as 3DMax, Sketchup, etc. This method can realistically display scene content in the real world, with outstanding effects and excellent real-time interaction [10].

Panoramic technology based on image information refers to the use of cameras to go to the real scene location to take pictures, stand in the central area of the location to take pictures, and take instant pictures of the scene picture information at 360 degrees in the horizontal direction and 360 degrees in the vertical direction. After that, the image information is comprehensively managed in a professional form through professional software, and finally, panoramic viewing is achieved by professional playing methods. This form of representation changes the shortcomings of traditional single graphics that have a large amount of information and are not comprehensive enough. It virtualizes two-dimensional graphics into three-dimensional to display the complete information around the actual scene, thereby giving users a stronger authenticity and immersive experience [11].

2.2 Interaction of Product Experience

The realism brought about by virtual reality technology is not the same as what we call the reality of material objective existence in our daily lives. When we evaluate a visual work that looks very real, it refers to our subjective perception of reality from a visual and auditory perspective. If the story plot is true, it is a true evaluation of narrative logic and content, which should be understood as sensory authenticity, the reality that people feel is inevitably related to their subjective emotions and virtual imagination. Virtual reality technology precisely meets the needs of the public's imagination, creating a visual real world. It transforms the original visual viewing into behavioral tactile perception, significantly improving the perception range, and elevating reality to the height of experience [12].

For example, in the interactive device of IKEA's "Virtual Home Experience" in Germany, the audience can change the content presented by virtual art by manipulating the scene images, home products within the scene, etc. in the interaction of home scenes. Experients may have varying degrees of reaction when appreciating, and feel the differences brought by different scenarios, which will enable users to obtain their own unique experience [13].

2.3 Advantages of VR Technology

(1) Generate Simplicity

As is well known, the entire process of interior design is a complex and labor-intensive process. For designers, it is not only a mental task, but also a physical one. If the threshold of VR panoramic technology operation is too high and the workload is too large, its application can actually be counterproductive. Fortunately, through practice, it has been found that the application of VR panoramic technology in interior design does not require high software and hardware requirements, and the operation is also very user-friendly. The workload is not large, and it can also play a good auxiliary role in the designer's design. This can be said to be a blessing for designers. The operator only needs a VR Omnidirectional (360-degree) camera combined with an app to obtain panoramic images, and then through the panoramic image conversion software to process the images accordingly, the real scene can be generated [14].

(2) Strong immersion

Immersion, also known as presence, is the degree of authenticity that users experience in a virtual environment [15]. VR panoramic images are generated based on the production of real scenes, which can fully show the structure, materials, and colors of real scenes, and the effect is authentic. VR panoramic images can be browsed and interacted through computers and mobile phones. In order to get a better sense of immersion, you can also connect VR glasses, watch with VR glasses, and experience space roaming in a virtual indoor environment, which can well enhance the user's sense of experience and satisfaction. Therefore, the design concept of Interior designer can be better presented.

(3)High comprehensiveness

The acquisition of VR panoramic images, whether hardware or software, is achieved through ultra wide angle spherical lenses, which can record 720 degrees of scenes without dead angles, comprehensively recording all visible objects in the current real scene, avoiding omission. In the interior design VR panoramic scene, one can not only observe the details, but also take control of the overall situation, with a myriad of elements in sight.

(4) Good interactivity

In indoor design VR panoramic virtual scenes, users are not passive in their perception, but can change the content of their perception by changing their own operations. In addition, VR panoramic images can insert multimedia data such as text, pictures, audio and video. They can also quickly switch space and query more scene details through hotspots and thumbnails to generate more interaction with the scene.

(5) Highly contagious

It is suitable for dissemination. The VR panoramic image file is small, and the release format is diverse. It is suitable for various forms of browsing and consulting. The VR panoramic display can be viewed smoothly on both the mobile phone and the computer. No special hardware facilities are required, and the display cost is low and the publicity efficiency is high. The convenience of this dissemination is a benefit for interior design companies engaged in marketing, as it can more effectively showcase their project results to customers, gain more customer favor, promote business, establish corporate image, and form a good reputation, to achieve the goal of improving the business capabilities of enterprise employees.

2.4 Related data Statistics Formula

For group spacing grouping data, first identifying the group with the most frequent variable values, which is the group with the mode, and then calculate the approximate value of Zhongshu according to the following formula. Lower bound formula is:

$$M_0 = L + \frac{\Delta_1}{\Delta_1+\Delta_2} * i \quad (1)$$

In the equation:$M_0$is the mode; L represents the lower bound of the mode;Δ represents the difference between the mode and other arrays; I represents the group spacing of the array.

Upper limit formula is:

$$M_0 = U - \frac{\Delta_2}{\Delta_1+\Delta_2} * i \quad (2)$$

Where U represents the upper limit of the array.

3. Design Overview

3.1 Image Processing

The acquisition of images is sometimes inevitably affected by objective factors such as equipment and scene lighting, resulting in defects. Therefore, we also need to use some graphics and image processing software to process the images, such as using Adobe Photoshop to adjust the clarity, hue, brightness, contrast, and even local details of the scene, in order to achieve more ideal image effects. This is crucial for the viewer to have a better visual experience, so it is important not to be careless. Of course, if we can get a good light and shadow effect in the real scene and shoot an ideal panoramic image when shooting, it will reduce the workload of our image processing.

3.2 Image Digitization

At this stage, we need to open the Pano2VR software, input the panoramic image we want to data, adjust and set the parameters such as the adjustment of the default entrance angle of panoramic viewing, view viewing limit, zoom degree of the field of view, image related user data, and insertion of multimedia (text, pictures, audio, video, etc.), enrich the information of panoramic images, and stimulate the viewer in multiple levels, directions, and senses through sound, light, and electricity, In order to achieve better presentation and experience effects.

3.3 Scenario Generation

In the design of this case, according to the main functions of the space, it can be divided into the porch, study, living room, dining room, kitchen, balcony, corridor, bedroom, cloakroom, main toilet, secondary toilet, etc. The shooting of panoramic images is generally based on these functional zones to view the scene at fixed points, and the connection between these spaces requires us to set interactive hotspots, scene

thumbnails, etc. for them through Pano2VR software or panoramic network platform, Complete the switching between scenes and build a complete home space scene. For a better visual experience, it can also load and edit the buttons and interface skins of interactive hotspots to achieve better interface effects.

3.4 Output Conversion File Format

After the above processing, if the panoramic image is not output in a specific format, it still needs the corresponding panoramic Graphics software to browse, which is a serious obstacle to the display of VR panoramic images and the dissemination and promotion of VR panoramic technology. Through Pano2VR software, we can output files to HTML, Flash, QuickTime and other formats, which is convenient for more web pages and browsers to view and enhance the popularity of VR panoramic technical communication sharing.

4. Analysis of Interior Design Questionnaire Survey Results Based on VR Technology

Offline experiencers experience VR models at different stages, observe them from multiple angles and directions, and then conduct questionnaires.

4.1. Graphic Clarity and Form

As shown in Figure 1, the satisfaction rate in terms of spatial tangibility and clarity is relatively average, with only 3% being very satisfied with clarity. The overall evaluation of most people is around average, while the overall satisfaction rate in terms of form is relatively satisfactory, with a satisfaction rate of over 65%.

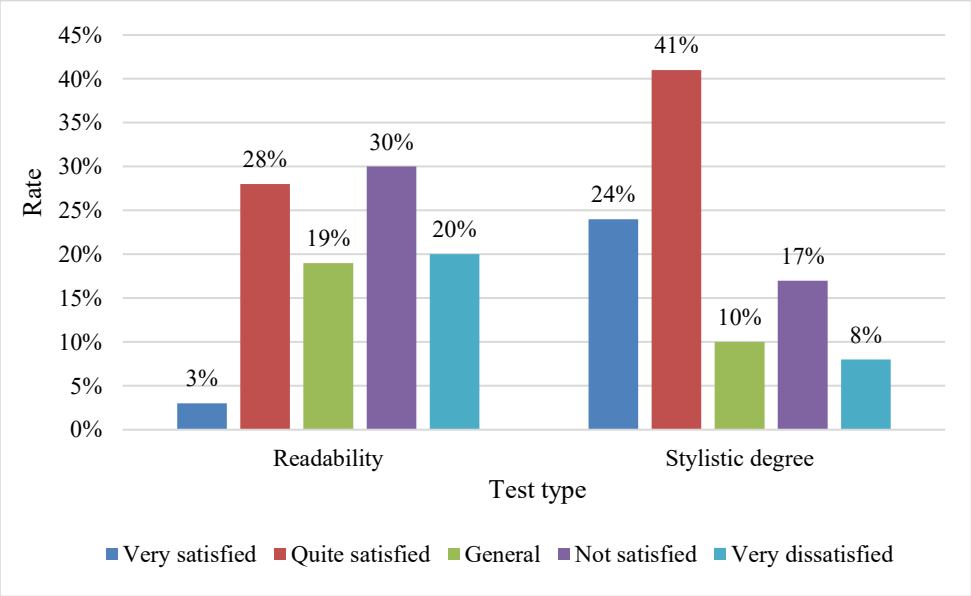

Fig.1 Investigation on the clarity and typicality of graphics

4.2. Content Richness Evaluation

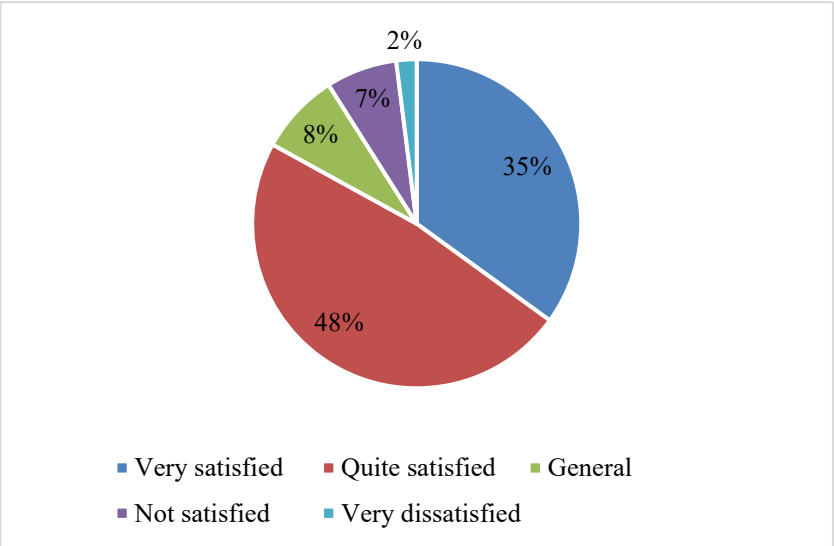

Fig.2 Content richness survey results

From Figure 2, it can be seen that in the VR based interior design experience, users are relatively satisfied with the richness of 3D graphics presented by VR technology, with 35% being very satisfied and 83% being overall satisfied.

4.3. Overall Satisfaction Survey

Table 1. Overall Satisfaction Survey

Investigation content	Are you satisfied	Will it be used
Very satisfied	30%	26%
Quite satisfied	58%	48%
General	8%	21%
Not satisfied	3%	3%
Very dissatisfied	1%	2%

From Table 1, it can be seen that the overall satisfaction level of all users with the content presented by this technology is 88%, 74% are willing to use this technology in the future, 4% are dissatisfied, and 5% are not able to use it.

5. Conclusions

With the rapid development of social economy and science and technology, the competition in the interior design industry intensifies, and consumers' material and spiritual needs continue to rise. Traditional interior design techniques are gradually unable to meet the higher market demands of the industry. The emergence and continuous maturity of VR panoramic technology have become a new and effective means for interior design professionals. This article takes the application of VR

panoramic technology in interior space design engineering as an example, but it is hoped that it will not be limited to the use of home space design. It is also hoped that VR panoramic technology will be extended to other types of interior design and various stages of the entire interior design project, so as to promote the true integration and development of VR panoramic technology and interior design.

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