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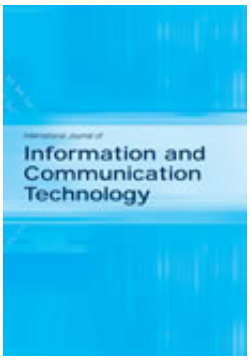

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Computer multimedia art pattern and visual communication design integrating virtual reality technology and big data image processing

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Computer multimedia art pattern and visual communication design integrating virtual reality technology and big data image processing

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Abstract: With the continuous progress of social economy, the pursuit and demand of people for art are getting higher and higher. However, due to the limitations of designers' understanding, technical skill levels, and costs, they are unable to meet all the demands of users. In view of these insufficiencies and limitations, the technology related to virtual reality (VR) and big data image processing is introduced in this paper. Our innovation lies in the integration of these technologies to establish a digital model of space based on geographical location, which not only consolidates the business logic in the visual expression of multimedia art patterns but also implements the integration of indoor and outdoor spatial information drawing. By creating virtual scenes, we implement 3D image reconstruction of complex scenes, achieving real scene experience and obtaining better visual communication effects. The uniqueness of our approach is further demonstrated through simulation experiments, indicating that the proposed virtual reality technology and big data image processing are highly effective and can support computer multimedia art patterns and visual communication design.

Keywords: virtual reality; VR; visual communication; image processing; landscape reconstruction.

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1 Introduction

With the continuous progress of social economy, the demand of people for aesthetics is getting higher and higher. Traditional design methods and models can no longer effectively provide multiple sets of selective solutions to choose from due to the limitations of costs, designer's skill level, and other factors (Liu et al., 2016; Delhey and Peters, 2017). As a result, there are certain deficiencies and limitations in the specific application of visual communication. The introduction of computer graphics processing technology and internet of things technology into the specific design field has effectively driven the transformation of design system models and methods. In the practical engineering use process, computer technology has enhanced the efficiency of design (Hu, 2016; Wu et al., 2015). In recent years, the continuous maturity and in-depth application of virtual reality technology can display different environments in the same environment, allowing people to experience different virtual environments in a real environment. In this way, the new model allows the users to put forward new requirements and needs for design. On the one hand, excellent design can effectively contribute to the quality of interior architectural space arrangement, which can be pleasing to the eye and achieve twice the result with half the effort. On the other hand, this approach can also make the best of the energy efficiency of technology for users to achieve new functions and reduce traditional costs. In the past traditional design, the corresponding drawings were designed for specific user needs, and users constantly iterated and modified the versions in accordance with the specific design solutions. In the whole process of modification and perfection, customers can only put forward non-specialised requirements and criteria as they do not have profound professional knowledge, while designers can only explain to users through traditional paper solutions as they cannot provide design effects intuitively. As a result, the cognitive bias between the client and the designer can easily arise, resulting in the final design results not fully matching the user's demands. In addition, it should be noted that the traditional design process leads to relatively high design costs due to the long design cycle, and repeated revisions also increase the specific design workload in detail, which does not ensure that the designer can focus on further optimisation and refinement of the work (Saterbak et al., 2018; Stout et al., 2020). Interior design is one of the extremely vital research directions, and the effective enhancement of interior design can realise the important supporting role of multimedia technology in the field of design. Traditional interior design is often affected by daylight, noise and other factors, and thus cannot achieve a specific, effective and precise classification of scenes. The introduction of virtual reality (VR) technology and big data image processing technology into the design field can turn users' ideas into real, interactive concrete scenes, and users can use specific terminals to realise roaming and flying in the scenes to observe the design effects at different heights and directions from the first perspective. The big data image processing technology is a specific means of implementing the use of computers to process image information, which mainly has the advantages of relatively wide processing range and high accuracy of processing results. The big data processing technology has gradually become the focus and also the bottleneck of computer research in recent years. Due to the progress of the virtual reality technology, big data processing technology can deliver an obvious immersive effect and a strong ability to reproduce scenes that has been introduced and used by a number of industries (Zhang and Zheng, 2016; Hendrikse et al., 2018).

The application of VR and big data image processing technology in the field of design is not novel; however, the integration and application of these technologies in the specific context of computer multimedia art patterns and visual communication design, as presented in this paper, represents a unique and innovative approach.

For the purpose of addressing these limitations and demands, attempts are made in this paper to introduce virtual reality technology and big data image processing technology to analyse the real demands of users for the interactive interior space experience by sorting out the visual communication business logic of multimedia art patterns. Comprehensive drawing of indoor and outdoor space information, building new patterns of virtual scenes through the comparison with traditional design methods, and implementing complex scene 3D image reconstruction, with the purpose to improve the quality and effect of design, reduce the cost of design, and provide users with better interactive experience.

2 Virtual reality technology and big data image processing

In the history of China, bamboo, silk and other writing records was replaced by paper, and this specific carrier carrying information continued for many years. The advent of the internet era has led to a richer and more diversified way of accessing information; that is, not only in the aspect of the amount of information available, but also in the aspect of its effectiveness and timeliness. Any event occurring in different geographical locations can be transmitted anywhere through various terminals (such as smartphones, smart tablets, and other terminals). In such a general environment, the efficiency and frequency of updating traditional paper-based carriers cannot be matched, while inhibiting the interest of people in purchasing (Hendrikse et al., 2018; Liu et al., 2016; Wu and Li, 2020).

In such a context, the design approach of visual communication must change in accordance with the development of the internet and fully embrace its growth.

1 Transformation of advertising in different media

The initial advertising posters were often presented by hand, and the presentation of such posters could only be done through the presentation of paintings. With the popularity and progress of paper printing technology, for the purpose of integrate printing technology and change the traditional design method, some designers designed some works that can be repeatedly printed. Typically, through the white lines, the outline of ink and repeat printing can be delivered; as the modern printing technology continues to be applied in depth, and many designers have changed the design ideas and ways of colour variation, turning to simple colour matching or flat paint the corresponding effect to achieve the depiction.

2 Transformation of books in different media

Based on the development and enrichment of modern printing, the production level and production quality of paper books have also improved significantly, typically such as paper books, books on wood panels, acrylic books and many other new materials are increasingly preferred by the market and loved by users. For example, in the book Mei Lanfang, through the positive and negative dimensions, Mr. Mei

Lanfang's life trajectory, and stage performance are presented in a way similar to the 3D model design of the building, is a model of the book loved by users.

3 Transformation of packaging in different media

With regard to packaging design, its essence includes two basic functions, one of which is the place display at the counter or window, and the other is the effective protection in the process of transmission or transportation.

4 Brand design in different media

From the perspective of design change, the change of logo is more evident. Fox used a static logo at the beginning of its establishment, and further changed it to a dynamic logo due to the need to keep up with the development of movies. Due to the requirements to keep up with the development of the film transformed into a dynamic logo, subsequent upgrades were all colour changes, dynamic changes, but the content remained almost unchanged.

In the system of virtual design, it mainly focuses on the design of the following functions.

1 visual simulation expression of the interior environment.

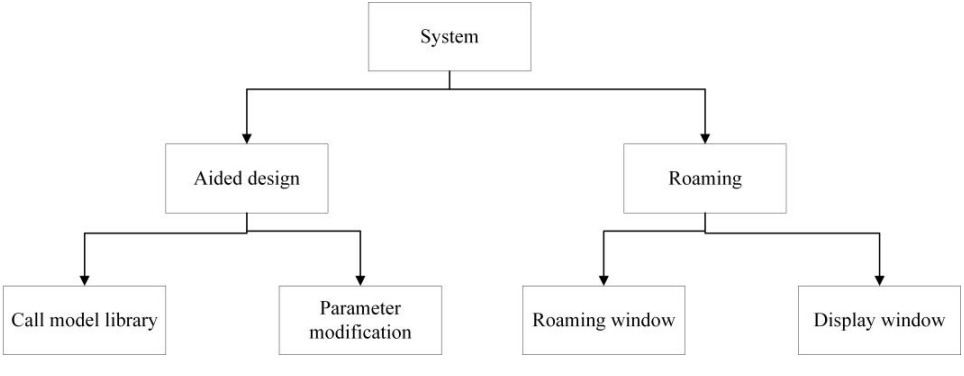
2 sharing of data

3 human-computer interactivity.

In essence, the virtual reality environment construction of indoor systems using mature commercial platforms is to achieve specific computer-aided analysis of design, slow travel and excursion of indoor space effects. The main content of the auxiliary design analysis can be divided into the following aspects: on this basis, for the purpose of better presenting the roaming results, the use of specific windows to display 3D virtual reality scenes, the integration of the household structure to assist in the design of the path tour, to facilitate the user and the designer to display the effect.

The hierarchical structure of the system mainly includes the roaming and the auxiliary design model. The details are shown in Figure 1.

Figure 1 Hierarchical structure of the system

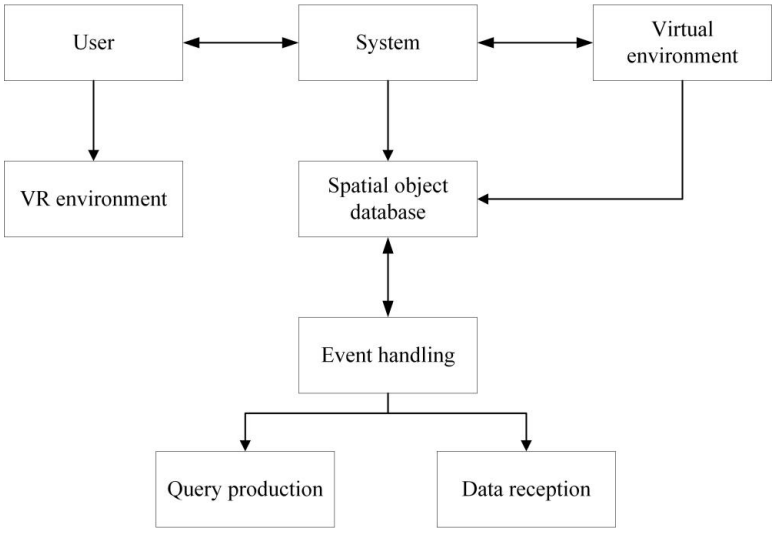


For the purpose of ensuring the effect and stability of the whole virtual reality environment, this paper integrates two methods: 3D model and real image. Based on the real image method, the corresponding panoramic image is used to implement the way of

browsing the overall indoor space, horizontal space and other environments, and to realise the conversion of spatial perspectives in different positions through the fitting of pictures and texture increase mapping, so as to finally realise the reconstruction and analysis of the indoor spatial 3D image. Based on the 3D modelling approach, on the other hand, first creates a virtual environment corresponding to the mapping according to the specific environment, uses mature software to build modelling to achieve rendering and unification, and outputs a specific spatial reconstruction. On this basis, the corresponding theories will be used for data management, analysis, and visualisation of 3D space to achieve effective virtual reality reconstruction and specific reconstruction of graphics in a fixed space using specific tools (Liu et al., 2015; Vigoroso et al., 2020).

For the purpose of meeting the users' requirements, it is necessary to take the integration of function, data and effect into comprehensive consideration. For the model management platform in the background, it is required to implement the interaction of virtual reality of indoor spatial information, and finally realise the simulation of indoor landscape distribution. In this way, the virtual reality environment can be displayed in different perspectives and locations, and the specific images can be effectively reconstructed. The specific structure diagram is shown in Figure 2.

Figure 2 Structure of the virtual reality system

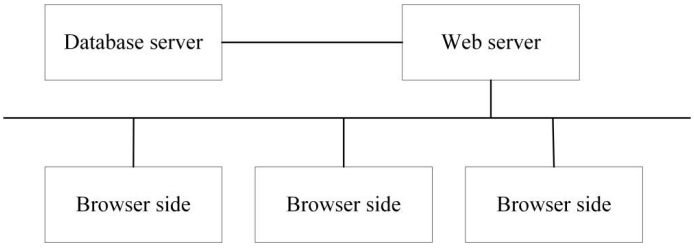


It can be observed from the structure in Figure 2 that, multiple associated mobile terminals are set for connection, with the specific mainframe as the most important core. In the specific structure, input and output are implemented by working through the computer and using the terminal. The structure established in this way can ensure that the users share the corresponding resources, which is a great improvement for the efficiency and effectiveness of the presentation (Haustein et al., 2015; Uetz et al., 2015).

On this basis, for the purpose of further improving the performance and efficiency, a new web server layer is added to the traditional structure. Thus, the users do not need to store and manage the data, but simply browsing and operating the data through the browser of the mobile terminal. The original server can be specifically used as the

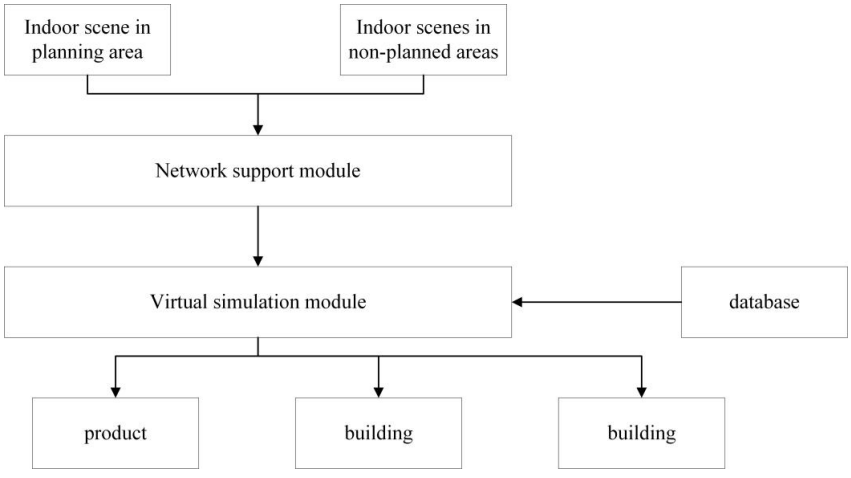
database server to implement the specific database management installation. The specific network structure is described in Figure 3.

Figure 3 Network structure



The design platform of the interior is developed by using panoramic image processing, the development of the 3D virtual reality technology mainly includes three modules, and the specific hardware framework is shown in Figure 4.

Figure 4 Framework of the interior design system



The interior design system mainly includes three modules: processing of real images, virtual reality simulation, and database. The specific functions are described as the following.

The target detection of the image can be oriented towards the processing of the live image and the inversion of the true information of the image, with the purpose to filter out the noise information and increasing the possibility of the image to be detected (Zhang and Zheng, 2016; Liu, 2020). The description of the image is mainly responsible for the elimination of redundant information, firstly for the feature extraction and target identification of the image, and then for the further analysis and utilisation of the target.

Virtual reality simulation can be effectively divided based on the corresponding functions, which can be specifically divided into the following categories:

- building models: various styles and heights
- vegetation models: different types and models

- furniture models: beds, tables and home appliances
- small items category: stools, flower pots, and coat hangers
- marking and identification category: area marking model
- brush texture model: floor tile painting brush and wall painting brush.

When users carry out specific operations, they first need to select the appropriate graphics from the corresponding material library and match them with the terrain to ensure smooth navigation and reduce the occurrence of response delays.

In the aspect of specific access to perceptual information, people tend to access it through visual communication. In this way, it can be seen that visual communication is a highly crucial way and technical means. While observing pictures and texts, one can acquire the corresponding knowledge, which is usually of a richer type and can be pictures, texts, videos, numbers, symbols, and so on (Raoufi et al., 2019).

3 Computer graphic image design and visual communication design based on virtual reality technology

3.1 Integration among the three technologies

The development of modern science and technology often requires the integration and support of VR technology, computer technology, and visual communication technology to achieve better visual effects. In the mutual design process of computer graphics design and visual communication, the use of virtual display technology allows the users to feel the surrounding environment in a realistic way and implement the specific interaction through somatosensory, so as to further stimulate the creative motivation of designers, for the purpose of achieve further improvement and enrichment of the design concept and to realise the interactive performance of the work.

Typically, the requirements of design elements for light should be integrated with computer image processing technology and virtual reality technology to fuse and effectively process these elements to achieve the effect desired by the designer. Although there are some differences between computer image processing technology and visual communication technology in the aspect of achieving the effect, it is possible to integrate the advantages of both technologies in a comprehensive manner based on the requirements of the users to implement different expressions of various scenes, fuse dynamic and static elements, design unique shapes and colourful solutions, and enable users to experience the effect of combining motion and reality in specific virtual reality sessions, so as to ultimately achieve the optimisation of solutions and meet the real needs of users.

3.2 Analysis of the relationship among the three technologies

Based on virtual reality technology can realise the design of image design and visual communication, more attention needs to be paid to the effective design of 3D visual method. Adhering to the principle of computer's 3D view, the original design image is effectively synthesised and processed to realise the conversion of graphics in the design

process of 3D images (Brun and Gasparini, 2016; Wu et al., 2015). In accordance with different demands, various effects are designed. By observing or browsing in different viewpoints, analyse the effects common in virtual reality and, at the same time, remove the redundant effects and elements.

However, it should also be noted that as the demands of users are often unclear, multiple designs and iterations are required to ensure further optimisation and adjustment of the related model or solution.

The virtual reality technology can be used to express any point in space with a specific range effectively, and the processing often needs to depend on the virtual reality technology. Firstly, it is necessary to realise sampling of the original image, post-synthesis processing of the image by using computer image processing technology, and layering optimisation design based on visual communication design. Based on the requirements of stitching, the complete stitching of the image is realised, and finally the panorama is formed. The final principle of the design is to use the design method to find the analysis of object overlap and implement the similarity point for technical processing.

3.3 Design applications among the three technologies

1 Text image design and image packaging design based on the virtual reality technology

   In the relationship between virtual reality technology and computer graphic image design, visual communication design, graphic image design is the most basic design basis, when processing text design. The most common processing technology is through computer image processing technology to achieve the effect in combination of the virtual and the real.

2 Advertising design based on the virtual reality technology

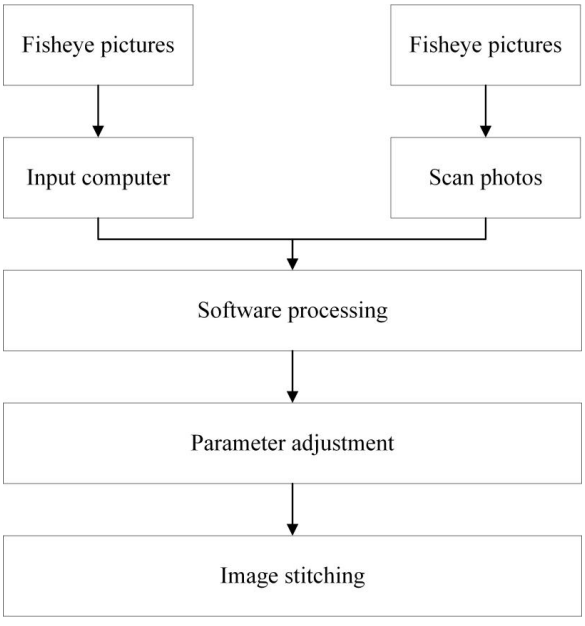
   In the specific advertising, film and television industry, the corresponding design relies on computer image processing technology, visual communication related technology.

4 System analysis of interior design

4.1 Panoramic view of interior space reconstruction

For the purpose of ensuring the authenticity of the reconstruction of the interior space, the effective expression of the interior space is carried out by using various methods such as spherical and cubic columns to implement the reproduction of the digital model (Lou et al., 2019; Guan et al., 2018), and the specific panorama thus generated is shown in Figure 5.

Figure 5 Generation process of the spatial reconstruction panorama



4.2 Modification of the model materials

1 Simplification of the number of model faces.

   Through comparison tests, the number of surfaces is controlled at about 10,000.

2 Modification of the UV of the model.

   For the purpose of presenting the texture of the map correctly, each original model should have a map coordinate UV. In this way, no overlapping UV will be set in each mode. The original UV is retained, and a new mapping channel 2 is set for the model. The command is used to flatten the UV in this channel accordingly (Qian et al., 2017; Zhang and Zheng, 2016).

4.3 Preparation of the mapping materials

The material of the mapping is prepared based on the surface texture to achieve a complex texture of the model to further improve the model's shape and ensure that the 3D scene is closer to the display (Sagduyu et al., 2017; Feng et al., 2015; Bhat et al., 2020).

1 Baked lighting mapping: the texture baking technique refers to rendering max lighting information as a texture, and then making the baked texture to be mapped in the scene.

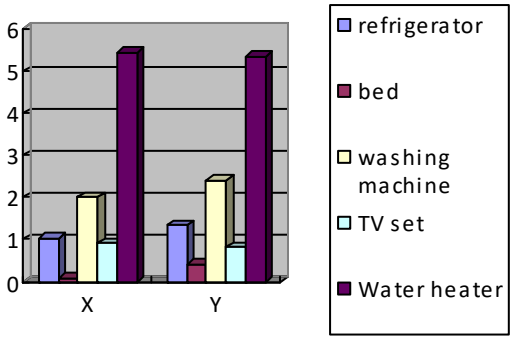
2 For the purpose of retaining the powerful rendering effect and applying it to virtual reality technology, the VRay lighting information is prepared into mapping by rendering to come up with the good lighting effect of mapping.

3 Preparation of the normal maps: normal maps are special textures that can be applied on 3D surfaces, which are different from the traditional textures that can only be applied to 2D surfaces.

5 Experimental results and analysis

For the purpose of facilitating the interior design system analysed in this paper, the following experiments are carried out under the normal conditions. Five home appliances such as washing machine, a bed in the bedroom, a refrigerator, a water heater, and a TV are selected for landscape reconstruction and detection analysis, and the specific parameter settings are shown in Figure 6.

Figure 6 Setting of the test parameters (see online version for colours)



The detection results are used to plot and reconstruct the panorama and compare the real position. The comparison between the detection results, and the real result of the digital model is shown in Figure 7, and the comparison between the normal model and the real results is shown in Figure 8.

Figure 7 Comparison of the digital model detection results and the real results

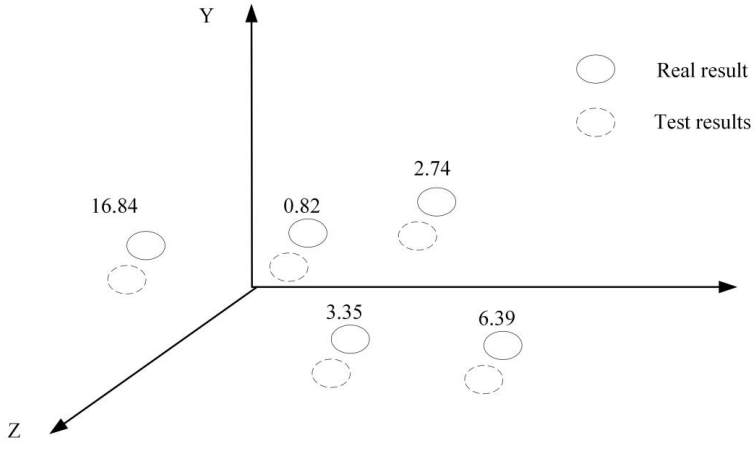
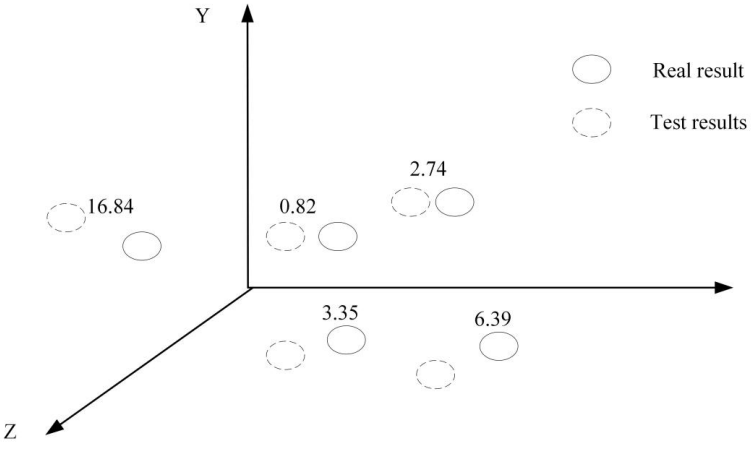


Figure 8 Comparison of the ordinary model and the real results



It can be observed from the results in Figures 7 and 8 that the reconstructed detection effect based on the immersive virtual reality algorithm is similar to the real effect comparison, and no significant change in the error associated with the visual communication is observed with the relevant changes in the index parameters.

5.1 Test content

For the purpose of ensuring that the interior design system is in the desired state, it is necessary to check whether all features and functions of the system are functioning in the desired way based on the test indexes in the experiment. The interior design system based on image processing and VR technology and the traditional interior design system are tested for the support of the related scenarios.

5.2 Results and analysis

From the results in Table 1, it can be observed that the traditional interior design system has a smaller range of scene support, while the interior design system based on image processing and virtual reality technology has a larger range of scene support. In addition, the system operated normally in the system test.

Table 1 Test results of the range of scenes supported by the two interior design systems.

Scene range (m^2)	*Traditional interior design system*	*The interior design system proposed in this paper*
100	Loaded	Loaded
200	Loaded	Loaded
300	Loaded	Loaded
400	Not loaded	Loaded
500	Not loaded	Loaded
600	Not loaded	Loaded
700	Not loaded	Loaded

It can be observed from the experimental results that the virtual reality technology and big data image processing technology proposed in this paper are highly effective and can support the design requirements.

6 Conclusions

With the continuous progress of social economy, the methods of art design continue to be more diversified, and the demands of users for design are also getting higher and higher. In view of these insufficiencies and limitations, the specific effects of visual communication of multimedia art patterns are sorted out based on virtual reality technology and big data image processing in this paper and virtual reality technology is used to implement the reconstruction of complex spatial anchor points and restore the real scenes. The computer image processing technology is applied to achieve complex 3D image reconstruction and obtain more satisfactory visual effects conveyed, with the purpose to reduce the production costs and improve the social value of the design. The results of the simulation experiment indicate that the virtual reality technology and big data image processing proposed in this paper are highly effective and can support the computer multimedia art patterns and visual communication design. Looking ahead, the integration of virtual reality and big data image processing technology in computer multimedia art patterns and visual communication design holds immense potential. As these technologies continue to evolve, we anticipate that they will enable even more sophisticated and immersive design experiences. Future research could explore the use of these technologies in broader design contexts, such as architectural design, product design, and advertising. Additionally, there is a need to further refine and optimise the algorithms and tools used in these technologies to enhance their efficiency and accuracy. By continuing to push the boundaries of what is possible with these technologies, we can create even more captivating and effective visual communication designs.

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