Optimization of Computer-Aided Graphic Design System Based on Virtual Reality Technology

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Abstract. Conventional community design mainly depends on its core graphic design. Computer-aided graphic design determines the corresponding cross-section design, profile design and three-dimensional visual design of the community. Therefore, continuous optimization of computer-aided graphic design makes the plane scene more intelligent and the corresponding intuitive characteristics more prominent. Based on this, firstly, this paper will carry out information modeling based on the corresponding plane characteristics of the conventional community. The corresponding modeling objects include community geographic environment modeling, equipment modeling and associated constraint information modeling. Then, the corresponding database is established based on the modeling information, and the corresponding database is used to model and constrain the corresponding information. Under the corresponding constraint background, this paper creatively proposes to describe the corresponding graphic design based on virtual reality technology. Under this background, compared with the traditional description form, the corresponding description form in this paper can more truly show the face of the currently designed community, and can also realize human-computer interaction, which effectively experience the real living environment of the community. In the actual verification process, this paper uses the 3D engine as the 3D enhancement and rendering tool of plane graphics, which realize the convenience of virtual reality technology. The case selected for the corresponding verification design is a complex community at the junction of urban and rural areas. The verification results show that the system proposed in this paper can give customers a better display than traditional technology, At the same time, it also further improves the design efficiency and satisfaction.

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1 INTRODUCTION

With the continuous development of computer-aided graphic design technology, it has essentially become the core and foundation of community and square design. To a certain extent, the advantages and disadvantages of graphic design directly affect the design of horizontal section, vertical section and engineering quantity of the whole graphic design. Therefore, how to be efficient, Intuitive design related engineering graphic design is very meaningful [1-2]. The traditional computer-aided graphic design is only limited to the two-dimensional graphic display of relevant cases, which mainly depends on the information collected at all levels of the designed cases. At the same time, it carries out the integration, analysis and processing of key factors or modules based on such information, and uses external and internal conditions for information constraints, At the same time, establish the corresponding database and manage and analyze the above data. However, the development of traditional computer-aided graphic design is only limited to the technical development of database level, and ignores the development of visualization and human-computer interaction technology of the whole graphic design. Therefore, conventional computer-aided graphic design systems such as graphic integrated design system and digital graphic design system have simple and rough system design, the corresponding database lacks corresponding independent management mechanism and organization mechanism. At the same time, the traditional visualization function and human-computer interaction function of computer-aided graphic design can be almost ignored, and a large number of design intentions and ideas of designers cannot be fully and vividly displayed in front of customers [3]. Therefore, based on the above analysis and research, the corresponding software design level of the traditional computer-aided graphic design system is still at a relatively low level.

As a product of interdisciplinary technology, virtual reality technology is essentially a technology that displays abstract and planar design cases or design scenes in real time, directly or indirectly according to the view of physical reality environment [4]. The corresponding different algorithms can enhance the key elements in the image to be displayed in real time. Conventional virtual reality technology in the corresponding mobile terminal or computer client needs to rely on the performance of the device itself. It needs to be equipped with a large number of sensors of virtual reality technology. At the same time, it also needs a powerful data processing chip to process and analyze a large number of detailed data [5]. The integration technology based on the integration of virtual reality technology and traditional computer-aided graphic design has become one of the key technologies to promote computer-aided graphic design to realize intelligence, interaction and visualization. The main core ideas of the integration of the two technologies are as follows: carry out detailed modeling based on the case scenarios to be designed, design the equipment data models of various cases and environments, so as to establish the plane database corresponding to the corresponding equipment data model, and establish the association between the corresponding scenarios and the corresponding database, Based on this, the behavior model of the corresponding environment plane is established. Finally, the virtual reality rendering is carried out based on the corresponding behavior model, the model established by the corresponding detailed data is visualized, and the human-computer interaction module is added to enable users to deeply experience the corresponding human-computer interaction and the interaction between people and environment in the virtual reality environment [6].

In view of the above analysis of the disadvantages of the traditional computer-aided graphic design system, this paper first carries out information modeling based on the corresponding plane characteristics of the conventional community. The corresponding modeling objects include community geographic environment modeling, equipment modeling and associated constraint

information modeling, and then establishes the corresponding database based on the modeling information, At the same time, the corresponding database is used to model and constrain the corresponding information. The corresponding graphic design is described based on constraints and combined with virtual reality technology. Under this background, compared with the traditional description form, the corresponding description form in this paper can more truly show the face of the currently designed community, and realize man-machine interaction, so as to truly experience the real living environment of the community. In the actual verification process, this paper uses the 3D engine as the 3D enhancement and rendering tool of plane graphics, so as to realize the convenience of virtual reality technology. The case selected for the corresponding verification design is a complex community at the junction of urban and rural areas. The verification results show that the system proposed in this paper can give customers a better display than traditional technology, At the same time, it also further improves the design efficiency and satisfaction.

The structure of this paper is as follows: the second section of this paper will analyze the current situation of the integration of computer-aided design and virtual reality technology; The third section of this paper will carry out information modeling based on the corresponding plane characteristics of the conventional community. The corresponding modeling objects include community geographic environment modeling, equipment modeling and associated constraint information modeling, and then establish the corresponding database based on the modeling information, At the same time, the corresponding database is used to model and constrain the corresponding information, and the system is designed based on virtual reality technology; The fourth section of this paper is mainly validation experiment and analysis; Finally, this paper will be summarized.

2 RELATED STUDIES

At the level of computer-aided graphic design optimization and virtual reality technology, a large number of research institutions and researchers have studied and analyzed all aspects of technical details. Early European researchers Ohlbrock and D'Acunto [7] and FAVI et al. [8] took the plane optimization of community or square case design as the design goal, so based on this, they put forward many case optimization models and design models under computer-aided design, which basically use mathematical models for qualitative description when representing the corresponding scene elements, Therefore, there is a lack of relatively accurate quantitative description, and its corresponding visualization and human-computer interaction application modules can be basically ignored; Relevant researchers Lorusso et al. [9] improved the visualization of computer-aided graphic design by adding a three-dimensional visual simulation link after the design. Based on this link as the main evaluation index of the feasibility and advantages and disadvantages of the design scheme, this system shows the design details to a certain extent and has the function of visualization, However, the main purpose of its corresponding visualization technology is only limited to verification, not the consideration of visualization and human-computer interaction; Bernardo and Duarte [10] have improved the three-dimensional visualization of computer-aided graphic design, which mainly adds geographic information system. The corresponding cases are described and analyzed in combination with geographic information system and corresponding computer-aided graphic design system. The corresponding improved system contains a large amount of data, At the same time, its corresponding data classification and data storage are also refined. Although the system has certain advantages, it consumes too much resources. At the same time, its corresponding system is relatively complex. The compatibility between GIS and computer-aided graphic design system is also a difficulty.

3 OPTIMIZATION ANALYSIS OF COMPUTER AIDED GRAPHIC DESIGN SYSTEM BASED ON VIRTUAL REALITY TECHNOLOGY

This section will discuss and analyze the improved computer-aided graphic design system from the combination of virtual reality technology and computer-aided technology [11]. At the modeling level, this paper will carry out information modeling from the corresponding plane characteristics of the conventional community. The corresponding modeling objects include community geographic environment modeling, equipment modeling and associated constraint information modeling. Then, the corresponding database is established based on the modeling information, and the corresponding database is used to model and constrain the corresponding information. The corresponding graphic design is described based on constraints and virtual reality technology. At the level of virtual reality technology, the three-dimensional display is mainly carried out for the data after modeling, and the corresponding human-computer interaction module is added to increase the customer's cognition of the case and increase the richness of the case. The corresponding overall architecture is shown in Figure 1:

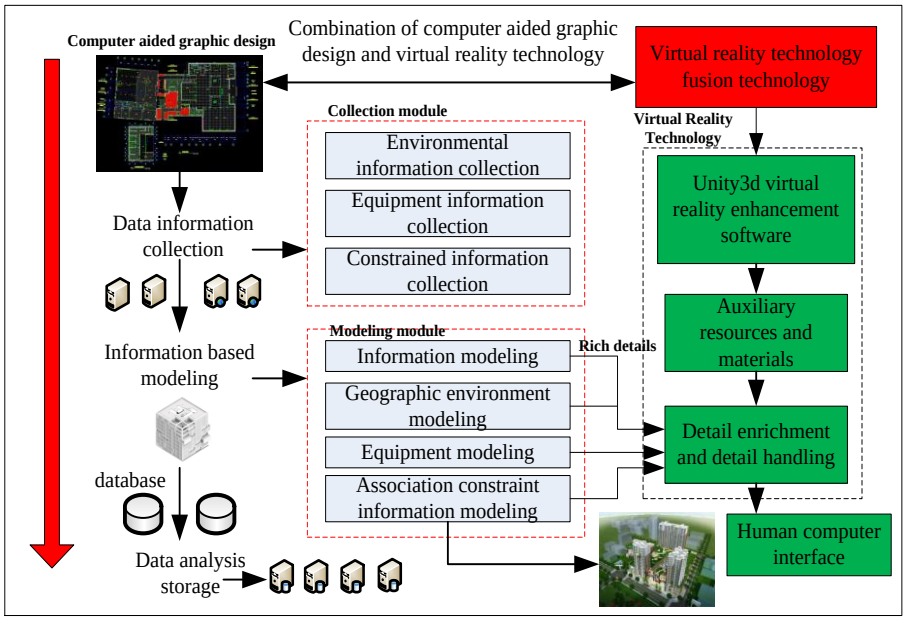

Figure 1: Optimization principle framework of computer aided graphic design system based on Virtual Reality Technology.

3.1 Modeling Analysis

In case modeling, we first need to collect the information of the corresponding case and carry out the corresponding modeling based on the information. The information collected mainly includes the following: case site information, case site equipment information, geographic environment information and corresponding association constraint information. The corresponding information collection elements are shown in Figure 2 below. It can be seen from the figure that the collected case site information includes the case site road map and infrastructure information map. Based on this, the special data interface needs to be fully considered in the graphic design, so as to realize the needs of community cases; The corresponding community geographic environment modeling is mainly to collect the digital terrain, digital geology and corresponding digital environment information in the case community environment. This information should be the

product of the combination of data information and social information. The corresponding digital terrain is mainly the most basic digital data in the case geographic environment, The corresponding digital geology is mainly the key element to determine the major infrastructure of the case community, and the corresponding digital environmental information mainly includes the corresponding rivers and protected buildings in the case; The corresponding case equipment information mainly includes the facilities and equipment of various basic functions corresponding to the case community, collect their corresponding information, and describe their key positions, dimensions and attributes in detail; At the corresponding association constraint information level, it mainly collects and studies the association constraints between equipment at all levels, effectively organizes and manages these complex association and constraint relationships by establishing the association constraint information model, comprehensively considers the role of association constraints in the formation of plane schemes, and automatically identifies and adaptively adjusts the association constraint information, Make the formed plane scheme meet the specific provisions of association constraints.

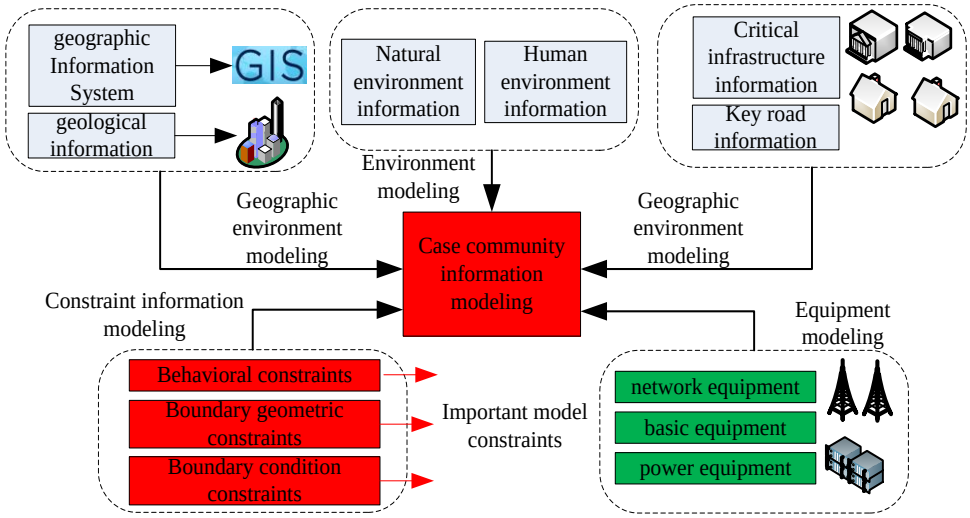

Figure 2: Information collection framework of computer aided graphic design system based on Virtual Reality Technology.

Based on the above information collection level, the corresponding management database is established to meet the establishment of the final case behavior model and case data model. In the database design, the data structure and the data information related to each data are mainly considered. At the same time, based on this design, the corresponding road database design, equipment database design, infrastructure database design and the database design of corresponding rivers and other natural mountains and rivers are designed.

Based on the above database, the case behavior model and data model are established. Through the analysis of typical community cases, a large amount of information and equipment can be regarded as line element properties, line element dimensions, line element coordinates, etc. in order to express the information related to case equipment, a two-dimensional array is used to describe the behavior of relevant equipment and infrastructure in case community, and a new case behavior model is reconstructed based on this line description. The corresponding behavior model representation and corresponding value elements are shown in Table 1 below.

Two-dimensional array form	meaning	Value			
[1][1]	Line element starting point 1	straight line	circular	Arc	spot
[1][2]	Line element starting point 2	R	L	L	A
[x][3]	Line element starting point 3	L	R	0	0
[x][4]	Line element starting point 4	L	0	L	R
[x][5]	Line element starting point 5	R	A	A	0
[x][6]	Line element starting point 6	L	R	0	L
...	...	...	...	...	...
[x][y]	Line element starting point n	...	...	...	...

Table 1: Key elements and values of behavior model of community cases.

The data model is established based on this behavior model. The corresponding data model is essentially a boundary constraint model. Based on the general situation of community plane cases, the boundary constraint model is set. The corresponding constraint standards are as follows: the end point of the frontline element is the same as the starting point of the rear line element, the tangent azimuth is the same, and whether the curvature is continuous. The corresponding three classical constraints are shown in Formula 1, formula 2 and formula 3. The corresponding constraints include circles, curves and transition curves. The corresponding elements in the corresponding formula are case parameters.

$$\begin{bmatrix} \varepsilon_1 \dots \varepsilon_n \\ \delta_1 \dots \delta_{n1} \\ \gamma_1 \dots \gamma_n \\ \theta_1 \dots \theta_n \end{bmatrix} = \begin{bmatrix} \varepsilon \\ \delta + m + n \\ \gamma + \gamma \cos a \\ \gamma + \gamma \sin a \end{bmatrix} \tag{1}$$

$$\begin{bmatrix} \varepsilon_1 \dots \varepsilon_n \\ \delta_1 \dots \delta_{n1} \\ \gamma_1 \dots \gamma_n \\ \theta_1 \dots \theta_n \end{bmatrix} = \begin{bmatrix} \varepsilon + m * b/(a * b) \\ \delta + m + b \\ \gamma + \gamma * \cos a * \tan(m/(2 * n)) + \gamma * \sin a * \tan(m/(2 * n)) \\ \gamma + \gamma * \sin a * \tan(m/(2 * n)) + \gamma * \sin b * \tan(m/(2 * n)) \end{bmatrix} \tag{2}$$

$$\begin{bmatrix} \varepsilon_1 \ldots \varepsilon_n \\ \delta_1 \ldots \delta_{n1} \\ \gamma_1 \ldots \gamma_n \\ \theta_1 \ldots \theta_n \end{bmatrix} = \begin{bmatrix} \varepsilon + \lambda * k \\ \delta + l_0 \\ \gamma + \gamma \cos(a + k * \pi / 2) + \gamma \cos a \\ \gamma + \gamma \sin(a + k * \pi / 2) + \gamma \sin a \end{bmatrix} \tag{3}$$

3.2 Application of Virtual Reality Technology

Based on the modeling of the above community cases and the model description based on virtual reality technology, the main virtual reality development engine in this paper is unity3d virtual reality enhancement software. The corresponding virtual reality technology structure block diagram is shown in Figure 3. The principle architecture includes many behavior models of the case community and other corresponding auxiliary resources and materials. The corresponding implementation steps of virtual reality are as follows: firstly, sort out all kinds of models that have been completed in advance, and analyze and render the key models in detail; Based on the analysis, the 3D rendering enhancement of the behavior model is completed, and its details are improved and enriched; For the models that have been rendered with three-dimensional enhancement, the association interaction is carried out, and the human-computer interaction module is added for human-computer interaction; The corresponding processed model and the model after 3D rendering are stored and memorized.

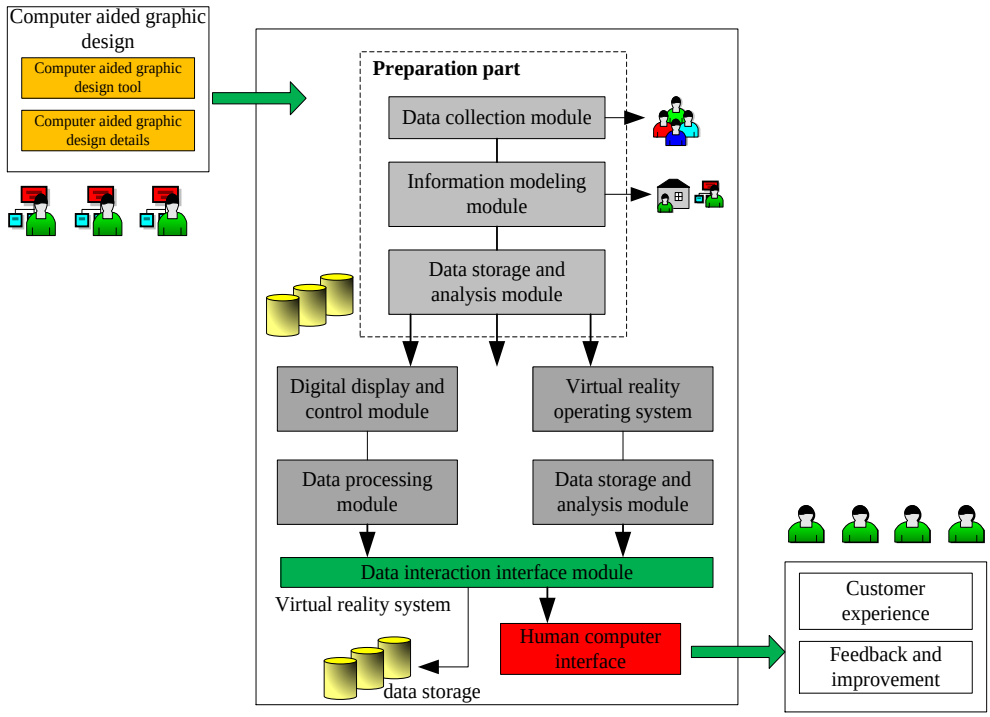

Figure 3: Schematic framework of virtual reality technology.

4 EXPERIMENT AND ANALYSIS

For a large community case, the computer-aided graphic design based on virtual reality technology is designed. The community mainly includes basic facility information, natural scenery information, road and river information, etc. Based on this, firstly, the corresponding key information is modeled and processed, and the corresponding key information plane design is as follows:

1. Road design of community case

Firstly, the corresponding geographic information system is imported into the corresponding computer to determine the corresponding road information, and then the corresponding road specific information is processed and described in detail according to the corresponding modeling situation.

2. Graphic design of key infrastructure

The main regional key infrastructure mainly includes station and other infrastructure, including corresponding new roads and extension of old roads. The scheme of main road plane design includes reference point clip straight line algorithm.

The corresponding final community case scheme is shown in the Figure 4 below:

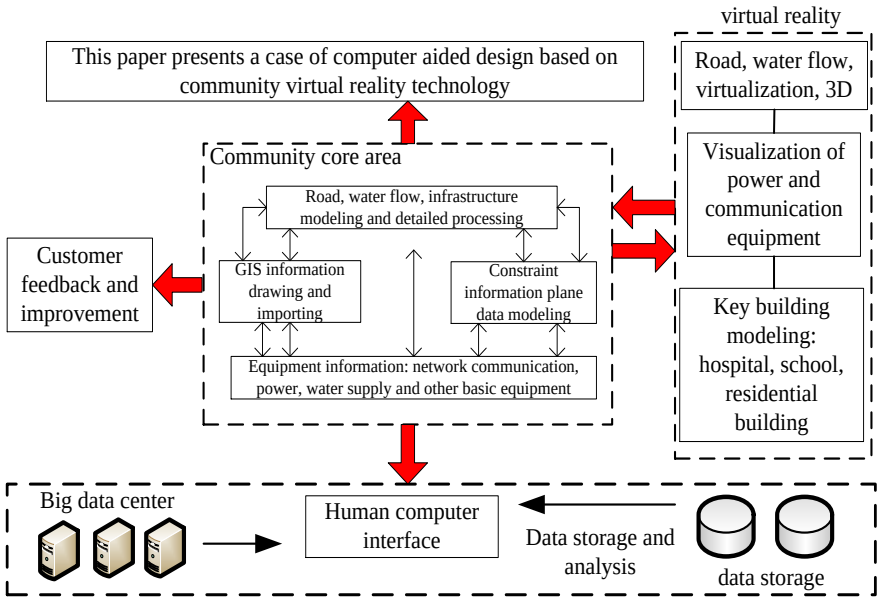

Figure 4: Case community modeling diagram.

In order to further verify the superiority of computer-aided graphic design based on virtual reality technology over traditional graphic design, this paper investigates the satisfaction of community design. The main survey sample is 100 community personnel. The corresponding satisfaction survey mainly includes three levels, and its corresponding index is the overall design satisfaction of the system, Human computer interaction satisfaction and corresponding design detail rendering satisfaction. The corresponding survey curves are shown in Figure 5, Figure 6 and Figure 7. From the figure, we can see the advantages of the algorithm in this paper. Compared with the traditional algorithm, it has better design advantages, more comprehensive grasp of details, and more prominent corresponding human-computer interaction function.

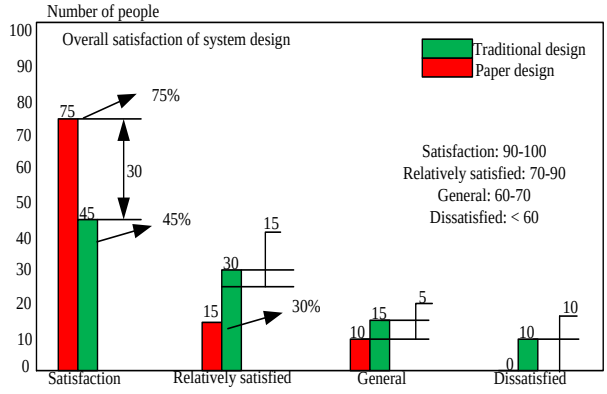

Figure 5: Comparison curve of overall satisfaction of system design (compared with traditional design).

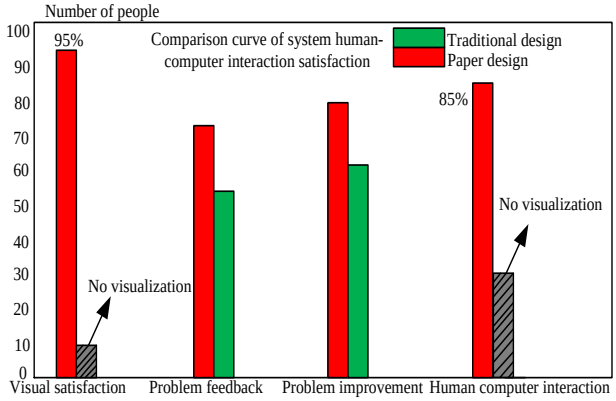

Figure 6: Comparison curve of system human-computer interaction satisfaction (compared with traditional design).

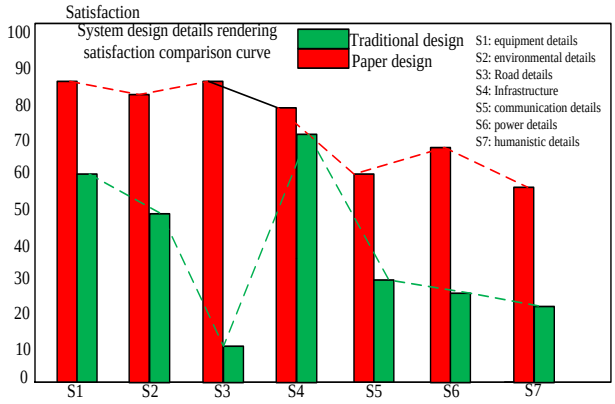

Figure 7: Comparison curve of system design detail rendering satisfaction (compared with traditional design).

Based on the above experimental results, it shows that the computer-aided graphic design optimized based on virtual reality has obvious advantages over the traditional computer-aided graphic design.

5 CONCLUSION

This paper mainly analyzes the research status of the integration of traditional computer-aided graphic design and virtual reality technology, and summarizes and analyzes the existing problems. In view of the disadvantages summarized, this paper starts with modeling, and carries out information modeling for the corresponding plane characteristics of the conventional community. The corresponding modeling objects include community geographic environment modeling, equipment modeling and associated constraint information modeling. Then, the corresponding database is established based on the modeling information, and the corresponding database is used to model and constrain the corresponding information. Under the constraint background, this paper describes the corresponding graphic design based on virtual reality technology. Under this background, compared with the traditional description form, the corresponding description form in this paper can more truly show the face of the currently designed community, and realize human-computer interaction, so as to truly experience the real living environment of the community. For a community design case, the design is based on the design system in this paper. The design results verify that the system proposed in this paper can give customers better display than traditional technology, and further improve the design efficiency and satisfaction. In the follow-up research, this paper will focus on the application of virtual reality technology in the case environment of complex community, and strive to solve the problem of corresponding algorithm resource consumption, so as to further realize the promotion of the system.

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