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Research and Practice on Application of Virtual Reality Technology in Virtual Estate Exhibition

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Abstract

   With the rapid development of computer technology, virtual reality technology has been widely used in various fields. This paper makes exploration on technical solution and realization methods of virtual reality technology in virtual estate .Though modeling by using 3DS MAX modeling tool, the virtual reality technology based on Virtools realizes interaction between users and virtual objects in virtual scenes to develop 3D virtual estate roaming exibition system.

1. General

       Virtual reality technology (shortened formVR：Virtual Reality) uses generation technology of 3D graph, multi-sensor interaction technology and high-resolution display technology to generate simulative 3D virtual environment. Users enter virtual scene to be a member in it by using sensing equipment such as special helmet, data glove, etc, or input devices such as keyboard, mouse, etc. At the same time, users interact with virtual environment in real time mode to perceive and operate various objects in it, and this enables users to feel like experience in the real field. At present, this technology has been widely applied in various fields like environmental design, building design, aerospace, medical practice, military training, physical training and entertainment games and so on. Also it avoids all kinds of inconvenience and danger caused by real experiments and operation and breaks the limitation of space and time.

 1.1 Three basic characteristics of virtual reality technology

 1.1.1 Immersion

    Users can be immersed into virtual environment generated by computers or thrown into virtual senses generated by computers, just like they are in real field. What you see, hear, smell, and touch are completely the same as what you feel in reality. It is core of virtual reality system.

 1.1.2 Interaction

    Interactive capacity between users and various objects in virtual scene. It is key factor to promote people-computer harmony. After entering the virtual environment, users interact with multi-dimensional information through multiple sensors. Users can do some necessary operation, and relevant responses will be made by virtual environment, which are

the same as what is happening in reality. For example, when pick up a basketball in virtual environment, you can feel its weight and it can bounce after being thrown onto ground.

1.1.3 Imagination

Users gain perceptual and rational knowledge in an integrated qualitative and quantitative environment through immersion in "real" virtual environment and interaction with it. It is helpful to deepen concept, germinate new ideas and produce a great improvement in understanding it.

1.2 Types of Virtual reality technology

Virtual reality technology can be classified into four types according to different forms of users participating in VR and different immersing degree.

1.2.1 Desktop virtual reality

Desktop virtual reality uses personal computer and low-level work station for simulation, Computer screen is used as a window for users to observe the virtual environment. Various input equipments are used to realize the interaction with virtual environment, including mouse, tacking ball and space ball and so on. Users are required to make use of input equipments, so that they can observe the virtual environment in a range of 360 degree and operate the objects in it.

1.2.2 Immersive virtual reality

High-level virtual reality system can provide a fully immersive experience which makes users feel they are in the virtual environment. Users are in a new and virtual environment generated based on Helmet-Mounted Display and other equipments with sense of sight, sense of hearing and others all enclosed; Users are absorbed by it and completely immerse themselves in it based on position tracker, data glove, other manual control input equipments and sound, etc and feels like experience in a real area.

1.2.3 Virtual reality with augmented reality

Virtual reality with augmented reality means that virtual reality technology is used not only to simulate real world, but also to enhance the feeling of real environment for users. That is to enhance the feeling that can not be sensed or are inconvenient to be sensed in real life.

1.2.4 Distributed virtual reality

Distributed virtual reality system means that many users are connected by computer network to participate in the same virtual space at the same time and to experience the virtual environment together. Thus, the virtual reality is promoted to a higher level. In distributed virtual reality system, more than one user observes and operates a same virtual environment using network to achieve the purpose of coordinating work.

2. Application of virtual reality technology in real estate field

Using virtual reality technology to show a full or part of landscape of building becomes an advanced solution for experience building selling and decoration. It uses computer technology to establish a virtual 3D environment with a characteristic of interaction for which it can interact with users. Currently this has become a characteristic or symbol of building quality, scale and strength in current real estate field.

Unique advantages of virtual estate are as follows.

2.1 The best natural communication mode

By using virtual reality technology developers can estimate characteristics and advantage and disadvantage of each plan through personal feeling to make the best solution. Not only can the wrong decision be avoided, but also potential market value of the estate can be greatly improved, which can improve utilization ratio of land resources and success rate of project development to protect the resources. The virtual reality technology can be used as exhibition tool of big project to build the realistic three-dimensional dynamic model and multi-faceted display outside and inside of structures space and function. It can make the public have an intense interest to participate in. During the estate

business, the application of virtual reality technology can make the public participate and feel personally in the 3D virtual environment.

2.2 The best convenient design tool

The virtual reality is not only a demonstration media, but also a design tool. It reflects the designer's thought through vision form. For example, before establishing a building, first, think about the building's structure and shape, and then quantify them. Many design drawings are also needed, of course, only the one who knows how can understand those drawings. Virtual reality can change this kind of idea into the visible virtual object and environment. It makes use of the traditional sand table of the past which can be upgraded to digital perfect design patterns, and it greatly improve the quality and efficiency of the design and planning.

2.3 The advanced marketing measure

During the estate sales, by using the virtual reality technology, clients can walk freely in the virtual reality system and watch anything. It breaches the no- interaction weakness in three-dimensional animation and also breaches the weakness that can't feel building space from a normal person perspective in sand table model. It brings a hardly match sense of reality and scene feeling, and it can get the purchasing decision rapidly and correctly accelerate the sales speed.

2.4 The fastest propagation mode

It propagates widely and rapidly in internet in the form of multimedia and can conveniently and rapidly get the product information.

Comparisons between various displaying modes are shown in the following table:

	Performance effect	Regional restrictions	Cost devoted	Information content	Influence time	Interaction
Plane figure	Weak	No	Low	Small	Short term	No
Sand table	General	Yes	General	General	Disposable	No
Model room	Strong	Yes	High	Big	Disposable	Yes
Virtual reality	Strong	No	General	Big	Long term	Yes

Various indexes of virtual reality solution have distinct advantage.

To sum up, because of the characteristic of virtual reality technology and application in the estate, it can greatly improve the quality of project planning, reduce cost and risk, expedite the process of project, and enhance the understanding and management of the relevant department. And it upgrades the brand effect of estate developer and promotes the estate sales. This is a more advanced comprehensive and visual sales mode, and a competitive marketing mode. It must bring a long term benefit. Thus, the application of virtual estate displays a good application foreground for us.

3. Realization of virtual estate roaming exhibition

Currently, there are many technologies and software used to make virtual reality，For example: Cult3D、Anark、ViewPoint、Virtools . Now, "Development of virtual decoration demonstration system" is taken as an example to illustrate our realization method.

3.1 Below aspects are mainly needed to be considered before development.

A　The quantity of models related to virtual estate is large relatively. For scene data, it is much better to adopt hierarchy of tree structure for organization and management.

B　Definite hierarchy and attribute management on unit model and related parameters

C　Roaming is related to various physical movements, such as collision, gravity and particle. It is required that the physical engine shall be mature.

D　Currently, computing speed of common computer may not be fast and there is a certain delay in the network speed. So the generated files shall have relatively small volume and can be delivered in streaming media mode.

3.2 System structure
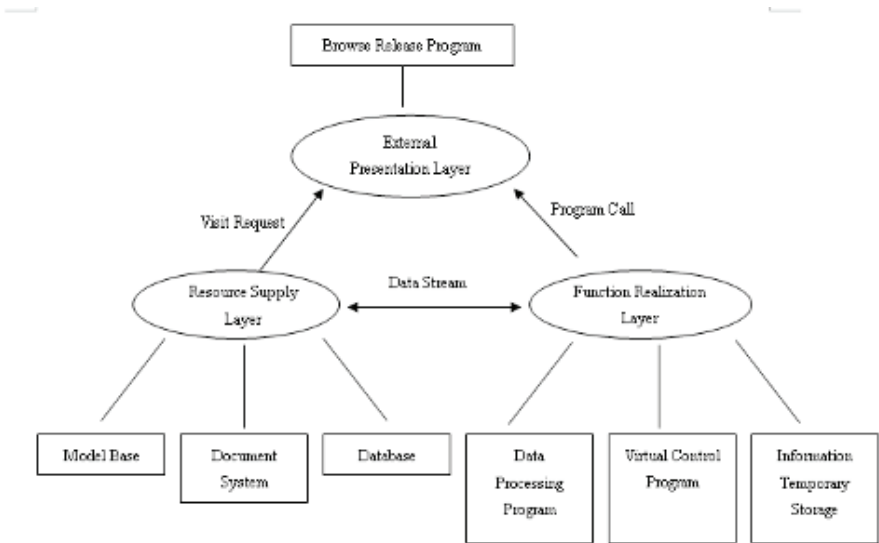
Fig 1 model will be used in the system structure

Fig. 1 Demo system chart for virtual estate

3.3 Realization Tool

Through the comprehensive comparison, this system will adopt 3DMAX、FLEX、VIRTOOLS to develop system.

3.4 Application scene

According to different requirements, realization of virtual demostration system is mainly conducted from two points of view: microcosmic (exhibition of virtual household type and the model room) and macroscopic (exhibition of virtual building and environment).

3.5 Exhibition of virtual household type and model room

3.5.1 Development process

For the exhibition of virtual household type and model rooms, development is made through the following procedures: Plan design of household type->modeling of 3D structure ->Replacement of decoration effect-> Realization of indoor virtual roaming, to realize the exhibition roaming effect.

3.5.2 Key points in design

A After the CAD household type is imported to 3DMAX, Free Camera should be set up to be used to simulate virtual visual angle of people.

B The light will bring texture through baking. Unwrap Uvw will be used for spreading. This texture can only be replaced after it is endued with Materials Textures in VIRTOOLS. t.

Fig. 2 Three-dimensional channel of object   Fig. 3 Illumination information of object surface

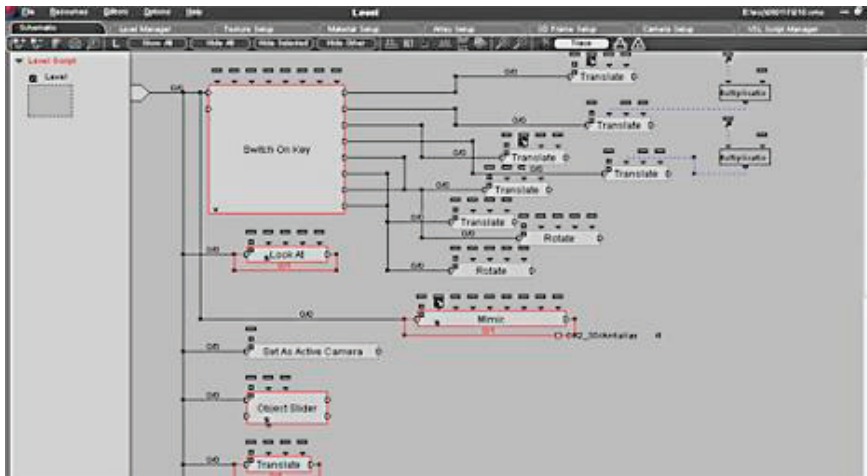C For keyboard control, focus, buffering, refer to below programs to set parameters

Fig. 4 Setting of Virtools program

After the completion of design, the users can visit room style, household type and decoration by themselves, and they also can use pinpoint navigation mode to browsing.

Several popular decoration styles are integrated into this system. Users can change tools and living facilities, turn on or off lamps in rooms, set arrangement and hue of rooms according to their own preferences and enjoy comfort of rooms personally. Also, users can clearly understand all information on the household type like dimensions and layout during roaming and decoration. Such wonderful living environment in the future must be impressive in the future.

3.5.3 Example display

The following case is a virtual decoration demonstration system designed for Changzhou Jieli Wood Industry Co., Ltd.

Fig. 5 Plan of household type

Fig. 6 Three-dimensional model

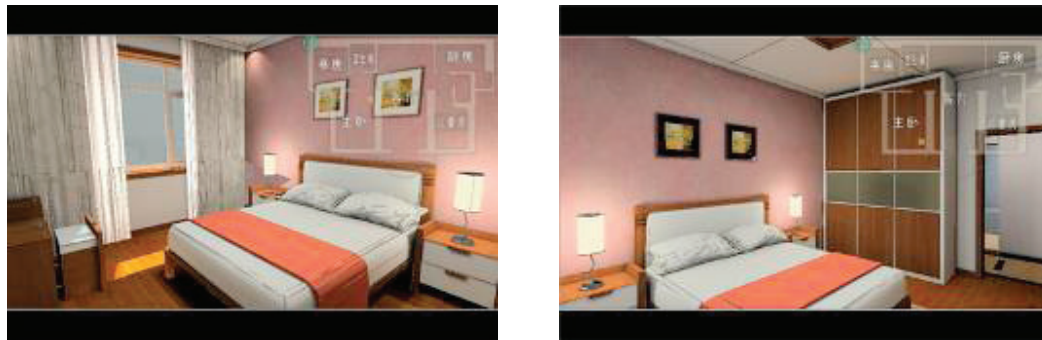Fig. 7 Color change and object regulation based on RIA

Fig. 8 Indoor virtual roaming based on VT

3.6 Virtual building and environment exhibition

Information of one building needed to be transmitted to users includes overall layout of the community, landscape of the community, building appearance, building distribution and common space of floor.

Overall layout and landscape design of the community can be embodied through real-time aerial roaming. With pinpoint navigation mode, landscape and space which it is important to show can be navigated on the map. The users can rapidly position desired areas for view. Also, with the function of sweeping-over at fixed point, surrounding landscape can be transmitted to viewers in real time mode by means of simulating visual angle of human beings.

Specific design procedure and technical details are similar to those of the first type and thus will not be described here.

4. Conclusions

To some extent, the virtual real estate system resolves many problems above even including time-space coherence. It has wide application prospect. However, we must clearly know that there are many theoretical problem and technical barriers which are not resolved yet. So we also need to give close attention, make constant efforts and be bold in exploration.

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