

Application Study of Virtual Reality in Real Estate Industry

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Abstract: - Virtual reality includes all natural simulation and realistic experience technology and methods. Its main target is to realize the real-life experience and human-computer interaction based on nature, and system which can achieve such a goal totally or partly is known as virtual reality system. This paper discusses the application of virtual reality technology in real estate industry, and researches the way to achieve this technology both from hardware system and software system.

Key-Words: - VR; Real Estate; Simulation; VRML; Construction; Application

1 Introduction

Virtual reality technology (being referred to as VR) is firstly developed and used by U.S. astronauts' training course. From 1991, German began to adopt VR in architectural design. At the end of 20th century, many European and North American design and real estate companies have begun widespread use of VR for architectural design and real estate sales. And VR gradually replaced the traditional means such as computer model and map, and become a major sale and design tool.

As for the use of VR technology in China, there were restrictions on the promotion and popularization of that technology due to the high development cost and use cost of VR in the early stage. In recent years, however, as the technology matures, the cost of VR has been in a significant decline, image effectiveness gained a great improvement, and its features are in the growing wealth. Both the price and performance are able to meet the needs of powerful domestic users, and the simplicity of VR could also be accepted by ordinary people.

This paper analyzes the application and realization method of VR technology in real estate industry, and tries to provide useful lessons for better adaption to the development of information technology for real estate industry and companies.

2 The Definition of VR and Its Features

2.1 The Definition of VR

VR (Virtual Reality) is a computer system which could help people to create and experience virtual world, it can form a multi-dimensional information

space in which people can immerse in, go beyond and interact.

The firstly emerging VR system is a three-dimensional display system which uses 3-D glasses, sensing gloves and a series of auxiliary sensing equipment. By using these facilities, people could input a variety of actions information to the computer in a natural way, and gain three-dimensional vision, hearing, and touch through visual, auditory, tactile, and other sensing devices. Feeling will change with the change of people's action. In fact, VR technology not only refers to the technology wearing a helmet and gloves, but also refers to all natural Simulation and realistic experience technology and methods. The main target of VR is to realize the real-life experience and human-computer interaction based on nature, and system which can achieve such a goal totally or partly is known as virtual reality system. Systems like "Artificial Reality", "Virtual Environment", "Cyber Space" and so on, can be considered to be virtual reality in the form of different terms.

2.2 The Features of VR

Virtual environment is an interactive visual simulation generated by computer, in which users will have a sense of immersion with the effect of vision, hearing and touch. A good VR environment is a large-scale integrated systematic environment being composed of with computer graphics, image processing, pattern recognition, multi-sensor, and voice processing and network technology. Its features are as follows:

(1) Immersion

By using computer graphics, the three-dimensional virtual environment is much alike

to the real world, so users will get a visual immersion in the virtual environment. That is the first VR technology feature: a sense of immersion.

(2) Interaction

VR is a user-oriented system, and the user could interact with virtual objects in the environment. The virtualization scenario is operational for users and this constitutes the second VR technology feature: interactivity.

(3) Imagination

VR system is not a real system, and it only reflects the idea of designers. VR could make those ideas become virtual objects, and change the traditional design mode which use sand table into a digital virtual realistic one. Hence the quality and efficiency of design and planning would greatly be enhanced. This is the third character of VR: imagination.

3 The Application of VR in Real Estate Industry

From the advent of VRML norms in 1994 to the conversion of X3D to VRML in 2000, virtual technology has developed greatly. X3D integrates some developing advanced technology such as JAVA and XML, and realizes parametric and visual computing. Nowadays many large-scale graph and image processing software such as 3DStudioMAX and director all corporate basic VR technology. The main application of VR in real estate industry is in the following areas.

3.1 VR Technology in Building Design

There is a wide range of applications for VR technology in the field of construction. By real-time three-dimensional performance capabilities and interactive human-computer operating environment, VR technology opens up a new train of thought in construction filled with art and technology. Under this technology, the showing of building can throw away the traditional methods such as plane showing, elevation showing. Designers can create three-dimensional models of the various components of proposed building designed by themselves by three-dimensional modeling and VR technology in the computer, and complete the simulation of building. With virtual construction the designer could not only show the overall appearance of the building to the owners before construction, but also go into the designed scene with potential users, feel the space, scale, light and sound changes. In the environment people and simulated nature are interacted and could

feel the strengths and weaknesses of design and make some suggestions.

VR technology has brought a new means of expression for the performance of the construction. In the application of VR technology, people can be in a virtual three-dimensional environment, and observe the scene of the future construction with dynamic interactive way. And also people can look at the scene from any angle and any distance, can choose and switch to a variety of movement patterns freely, such as walking, driving and flying, and are free to control the browse line. In addition, when roaming in the process, people can also realize real-time switch and comparison among different designs and environmental effects. And that can not be achieved in the traditional construction effect drawings and three-dimensional animations.

3.2 VR Technology in the Structural Analysis Test

In structural design, the situation of reinforcement components can express only through structural layout plans. While the responses in different loads for structure, the destruction characteristics and ultimate strength are analyzed by destruction test of structure models. As structure responds quickly under high-speed load, people can only observe the final result but not the whole process and analyze the deformation and damage according to outward look. Such work can only be done by professionals in laboratory and is high-cost, high-risk, so it is very necessary to explore the new test method for structure.

By establishment of three-dimensional model of beams, plates and columns with VR technology, people can perform computer simulation and make real-time observation of components. Also people can simulate the real stress of the components imposed by external forces, and analyze the relationship between external force and deformation through the use of professional software. By computer simulation, one can observe the whole process of destruction, collect related data and analyze the entire destruction process of the components. As for the long-term creep people may speed up the process of change, so that it will become clear for people to observe.

In addition, by the destructive testing of the structure in the computer system through VR technology, people can further refine the structural design of the program, so as to simplify the structure calculation while meet the safety requirements, hence the real estate investment will be saved.

3.3 VR Technology in the Project Bidding Process

Owners may ask all the tenders to display the construction project with VR technology, so as to make it clear which option is the best.

3.4 VR Technology in the Display of Real Estate

Though there are lots of pictures, introductions and models in display of buildings in the traditional mode of marketing, but they could not express the design intent adequately. Some important factors such as figures of residential quarters, building form, height and density and so on could not be expressed clearly in two-dimensional graphics and text, and the microfilm mode's problem is serious distortion of spatial scale. Although the animation has made some improvement, but its path is pre-designed, and do not let the buyers "to look at wherever you want to see", so the advantages of properties for sale are often not reflected.

By using VR technology companies could complete the construction of residential quarters in computer which should be constructed after several years. Now the buyers could not only see and feel the scene of the quarter directly, but also they could roam in the district, and watch the residential environment from any location. The most prominent feature of sales literature, quarter model and model room showing by the support of virtual reality technology is a comprehensive breakthrough of the graphic design limitations. Each chamber has a vivid three-dimensional space, it can guide the audience into an interactive environment in which the sense of reality and visualization would reached the best point. People will feel immersed in it and the enormous appeal is ideal for real estate sales.

3.5 VR Technology in the Property Management

The rapid process of urbanization has brought a number of super-large cities. With the improvement of people's living standards, the demand for property

management services become higher and higher. Community management become more and more diversified according to the expanding of quarter, the functional expansion of community and the rapid increase in the number of ground and underground facilities. The visualization and information of property management are the common request of owners and employees. Digital city includes all the information of urban planning, real estate, transportation, pipeline network and the population situation. Virtual property and intelligent property management information system become possible on this basis. Virtual property is based on GIS technology, it establishes a basic database including all the details in the residential quarter such as buildings, green grass, underground and on the ground pipeline facilities, security and disaster prevention facilities and basic household information (as small as door type and window model). This will not only save a great deal of manpower, all districts of a city are entities in the screen, being an armchair traveler, people could understand the details of city and thus it will be easy for property management.

3.6 VR Technology in Indoor Decoration

The traditional model can only reflect the surface of things such as the location of the properties, landscaping, levels and family rooms. They are not intuitive, and cannot be used to configure for indoor decoration program. Using virtual reality technology people can change interior decorating ideas into tangible objects and the virtual environment. Buyers may decorate the room with a variety of virtual decorating materials provided by the system and can transform his position in a room to observe the effects of the design until they are satisfied.

In interactive display through three-dimensional virtual simulation technology, when customers see a unit, systems can provide several different programs for customers to browse and decorate.

The application of VR technology in the real estate field is shown in Figure 1.

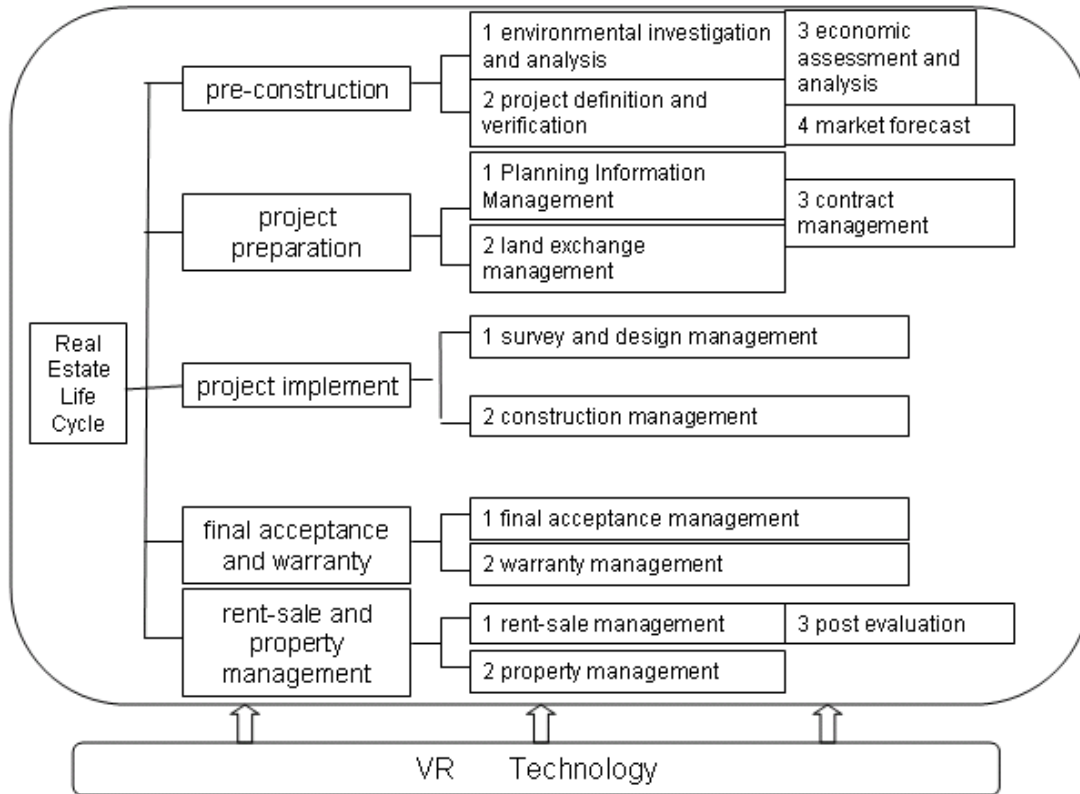


Figure 1 The application of VR technology in the real estate field

4 The Implementation Method of VR Technology in the Field of Real Estate

The realization of VR technology in the field of real estate is divided into two parts: hardware system and software systems.

4.1 Hardware System

A simple VR system does not need much complicated facilities, it only requires some simple equipment which could meet the needs of input and output, and a simple computer desktop interactive system can construct a simple desktop. But if one needs to realize the immersion, interaction and imagination of virtual reality technology, then professional information input and output facilities are needed. The information input equipments include keyboard, mouse, data gloves, handle and steering wheel; the information output equipments include high-performance projector, display adapter, polarizer and three-dimensional eye.

4.2 Software System

If one wants all participants in the real estate project life-cycle can feel the sense of immersion brought about by VR technology, it is necessary to create a virtual three-dimensional model. The virtual three-dimensional model should be in line with the designer's and the owner's needs. It should not only show accurately about the objective reality of the building and the environment, but also could express really the color, texture, shadow and light of the whole scene.

Technically, the establishment of the three-dimensional model is divided into three steps: the first step is to establish the geometry needed by the scene, known as the geometric modeling; the second step is to process the geometry's color, texture, shadow, and light, known as the physical modeling; the third step is to deal with the movement of objects on the basis of the physical modeling, which is called the behavior modeling. The three-dimensional model of the process is shown in Figure 2.

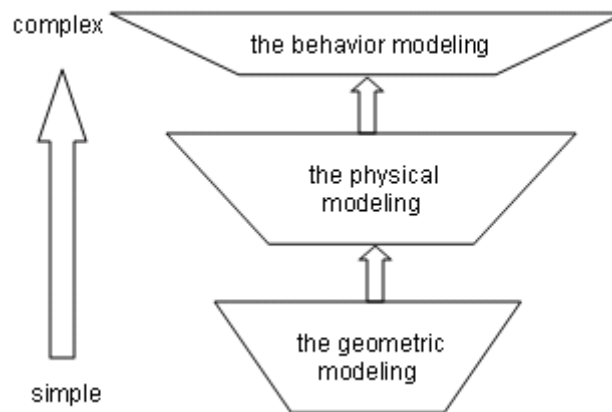


Figure 2 The three-dimensional model of the process

5 Conclusions

Though the development time of virtual reality technology is not long, but it wins a favor of the real estate industry for its true foresight. With the continuing reduce of cost, it will certainly play a bigger role in the real estate industry.

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