Research on the Application of Virtual Reality Technology in Shopping Platform

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ABSTRACT. *The main mode of current user online shopping is to view, select and purchase images on the display screen, which is singular and boring, cannot meet users'expectations for a three-dimensional, real, and immersive shopping experience. This article applies VR technology to online shopping, by creating an interactive virtual scene to satisfy the user's shopping experience.*

KEYWORDS: Online shopping; Three-dimensional; Immersive; VR

1. Introduction

Shopping online is becoming more and more popular, which is really changing people's way of life. However, the traditional shopping search mode cannot meet the requirements of convenience and efficiency completely. For those who are not good at using the Internet, the search process is too difficult for them to buy what they need.

Therefore, it is very necessary to design a software which connects their vision with shopping, and operates in VR glasses. When the buyers focus on the selected product, their purchase information and methods are displayed on the glasses in real time, people then confirm the purchase link to pay for the item by clicking the VR glasses button.

2. Technology and Equipment

2.1 Virtual Reality

Virtual reality technology (Hereinafter referred to as "VR") is an interdisciplinary subject of virtual technology developed on the basis of computer graphics, computer simulation technology, man-machine interface technology, multimedia technology and sensing technology. The research on VR began in the 1960`s. VR is a new way to visualize and interact with complex data through computers. It is a qualitative leap compared with traditional man-machine interface. The "Reality" in VR generally refers to any thing or environment that exists in the world in the physical or functional sense. It can be realized practically, difficultly or

impossibly. And "Virtual" means what can be generated by computer. Therefore, VR is a special kind of environment generated by a computer, people can "project" themselves into it by using various special devices, operate and control the environment to achieve their purposes. That is, people are the master of this environment. The essence of VR is the communication technology between human and computer, which can support almost any human activities and apply to any field.

The key technologies in this VR shopping platform are: holographic modeling (including Stereoscopic Imaging, Three-dimensional Transform etc.) and natural interactions.

2.1.1 Stereoscopic Imaging

The reason why people can recognize the distance and size of things is because the two eyes of the person make different observations from different directions while observing things in reality. Objects are imaged independently on the retinas of the left and right eyes of the person, and this difference causes the parallax of both eyes. These two images are synthesized under the influence of the brain, so that things in the real world have a stereoscopic sensation. The essence of binocular parallax is that there is a certain distance between the eyes, which creates an angle when looking at things. Binocular parallax is the root cause of stereo imaging.

For a normal two-dimensional image, the gray level of the image can be used to generate the relevant depth of field information, thereby obtaining partial depth data of the image. However, a single image lacks reference frame and depth clues, so the three-dimensional effect formed by one image is limited. Depth clues in the same scene can be obtained from two images with parallax, to form a complete three-dimensional effect[1].

Stereoscopic imaging technology is the use of related equipment to simulate the human eye to generate stereoscopic vision related principles, through software to achieve a three-dimensional sense.

2.1.2 Three-dimensional Transform

In computer technology, graphics transformation is an important content. Complex graphics can be formed by performing multiple transformations and combinations of simple graphics, which are also used to convert real-world scenes into observation displays on the output device. The geometric transformation maintains the topological relationship and composition rules of the graphic, and changes their geometric relationship only, including translation, scaling, rotation, and projection.

The three-dimensional geometric transformation adds corresponding z-coordinates to the two-dimensional geometric transformation. It uses a four-dimensional vector to represent the position of a three-dimensional object. The geometric transformation of the spatial position can be done by multiplying by a 4 * 4 matrix in the left side of the vector[2].

The coordinate transformation in different coordinate systems can be realized by superimposing the three-dimensional transformation matrix, thereby changing the

three-dimensional scene description from one coordinate system to another coordinate system. The modeling of the scene and the realization of the three-dimensional perspective are based on the three-dimensional transformation technique of computer graphics.

2.1.3 Natural Interaction

The development of VR systems is inseparable from good human-machine interaction, and human-machine interaction is inseparable from collision detection. The design of collision detection affects the authenticity and immersion of VR systems. The purpose of collision detection is to determine whether two virtual models in the three-dimensional space have contacted.

Common collision detection algorithms include sphere collision algorithm, boundary box detection algorithm and OBB tree collision detection algorithm. The quality of collision detection algorithm directly affects the speed of interactive feedback of the system, and then affects the user experience. There are many excellent collision detection algorithms in Unity development platform, users can achieve good collision detection functions by adding the implementation script of collision detection directly to the model in the virtual scene.

2.2 VR glasses

VR device is a kind of device that can simulate the real world in the virtual environment with the corresponding software. In general, virtual devices use the virtual environment created by software to make users feel immersed in it as if they were in the real world by enclosing the human vision in the device, and the virtual environment can be output through the monitor. Virtual devices typically include interactive input devices which engage users in the virtual environment and interact with them[3].

Generally speaking, a complete set of virtual devices should include three different devices: input devices, output devices, and application software. The input devices include data gloves, handles, etc. Output equipment including display, audio, etc. The application software is mainly to obtain 3d data of real things and convert them into 3d digital models.

VR glasses are a common headset display device for virtual reality. It uses software to build a virtual scene, uses a gyroscope to capture the user's head angle to synchronously adjust the virtual scene, and uses the lens to display the scene, as shown in figure 1. In this way, users can get the same experience in the virtual world as in the real world.
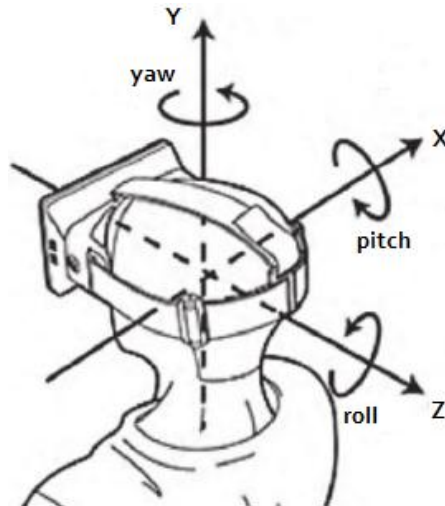
Figure. 1 VR device coordinates

1. Requirements Analysis

The application scene of this research is virtual shopping, which enables users to have real feelings of shopping in virtual space and realize immersive shopping experience.In order to achieve the goals, the system should focus on the construction of scene and the immersive interaction.
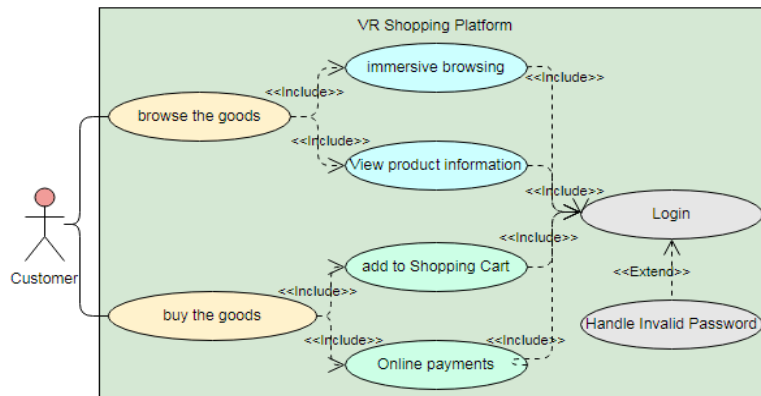

Figure. 2 Use case diagram

According to the actual situation of the interaction process between users and the system, the system use case diagram can be drawn, as shown in figure 2. As shown, immersive browsing is the main function of the system, and it is also the key problem to be solved in this study.

Users use VR glasses to immerse themselves in the virtual environment created by the platform to experience the immersive shopping experience. At the same time, the somatosensory camera is used to realize the space position information capture of the human body, and then mapped in the virtual space to link the user's visual system with the motion sensing system, so that the user can roam in the virtual environment to make the feeling more realistic. When purchasing a product, the user interacts with the system using the body language to complete the transaction of the product.

2. Other Requirements

Stereoscopic display improves the generation of immersion greatly. It also affects the user's sense of reality whether the virtual scene model is detailed or not. The model should be as close to reality as possible without affecting the operation of the system, so detail capture techniques should also be applied here.

The running speed of the system includes the loading speed of virtual scene and the response speed of user interaction. The loading speed of virtual scene depends on the size of scene model. Therefore, the relationship between them should be handled reasonably, and the immersive shopping platform has higher realism and real-time responsiveness. The interaction in the virtual scene should be simple and conform to human behavior.

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