Design of Digital Campus Somatosensory Interactive System Based on Unity3D and VR Technology

Yajing Chen\textsuperscript{a}, Xiaoqin Luo\textsuperscript{b}
Quanzhou University of Information Engineering, Quanzhou, China.
\textsuperscript{a}397248312@qq.com, \textsuperscript{b}172094309@qq.com

Abstract. With the rapid development of science and technology, new science and technology are constantly impacting on all areas of our lives. As a new technology of human-computer interaction, somatosensory interaction technology is bound to set off a new revolution in the field of education. Based on Unity3D and VR technology, this paper will study the design of digital campus somatosensory interaction system. The application of somatosensory technology in multimedia interactive teaching system can make the teaching system solve many problems of current man-machine system. This article understands the somatosensory interaction and analyzes its application in the teaching model. The results show that the somatosensory interaction technology has more powerful interactive functions and simpler control, and can more intuitively demonstrate the teaching content. So that students can experience the new teaching experience of somatosensory technology in multimedia teaching, making the abstract content in teaching more vivid, visual and concrete.

1. Introduction

The optimal disposal of virtual reality technology is the key to ensure the full realization of the value of Unity3D resources. Therefore, from the perspective of the optimization and development of virtual reality technology, the related system design work is optimized [1]. The most natural way, such as voice, body sensation, gestures, brain waves, etc., through different sensors to achieve control of intelligent machines such as computers, free from traditional interactions such as mouse and keyboard [2]. Somatosensory interaction technology, as a technology that implements human-computer dialogue in an efficient way through computer input and output devices, has gone through a one-dimensional green character console interface [3]. From the two-dimensional graphical user interface operated by mouse to the multi-touch technology commonly used now, it has developed rapidly and has been widely used. Somatosensory interaction means no longer stop at gesture input, speech recognition and sensory feedback, and new forms of somatosensory interaction emerge as the times require [4]. At present, the mode of human-computer interaction is generally limited to mouse and keyboard. It is precisely because the singleness of this transmission mode hinders the further development of somatosensory interaction, and the gap between input and output efficiency in somatosensory interaction becomes larger and larger [5]. In this process, the user's emotion and spatial experience will show different changes according to the state of the environment [6]. This project adopts advanced somatosensory technology. It does not need any equipment, but only needs hands and feet to capture the human body's moving thread through the recognizer to control the terminal equipment.

With the rapid development of electronic technology, more and more fields are applied to modern technologies such as somatosensory and wireless intelligent control. Somatosensory interaction is an interactive mode that directly interacts with peripheral devices or environments by means of limb
movements, sounds, eye movements, etc. [7]. With the rapid development of science and technology, a higher level of somatosensory interaction concept has put forward a huge demand for interaction methods. Many researchers have begun to study the multi-channel interface of new interaction technologies [8]. The current research focuses on gesture input, speech recognition and sensory feedback. The somatosensory technology can realize the recognition and capture of the human body motion state without the wearable capture device, and complete the somatosensory interaction process by recognizing the user's motion, face and voice [9]. In recent years, the vigorous development of natural somatosensory interaction technology has received increasing attention. At the cloning game show in Germany and a number of famous foreign game animation exhibitions, many game companies have proposed new somatosensory game support. With the development of the times and the progress of the game industry, somatosensory games have gradually become the mainstream of the game market [10]. And the development of relevant technology development measures is a matter of great concern to many virtual reality technology masters. Somatosensory interaction relies on human motion recognition to convey the operator's commands to the computer. This technology has broad application prospects in the fields of medical health, aerospace, virtual reality, and somatosensory games.

2. Somatosensory interaction

2.1. Somatosensory interaction

Somatosensory interaction technology is mainly to study the exchange of information between people and computers. It mainly includes two parts: human to computer and computer to human information exchange. Gesture segmentation is performed by the skin color model based on the Unity3D support vector machine. The method of somatosensory interaction design is used to analyze the user space requirements of the teaching space, which can solve the user's own emotional expectations and design intentions. Nowadays, somatosensory technology is still in the development stage, but it has been widely applied to games, film and television, medical care, etc. With the changes of the times and the development of science and technology, the application field of somatosensory technology will be further expanded. For example, we apply it to the teaching field to control the automatic page turning and drawing functions of the teaching software VR, and to control the intelligent equipment of the classroom with gestures and voice. In addition, according to the interactive processing characteristics of the message driver, the design and disposal of the message framework should be carried out for all kinds of observation activities, so that the message manager module can effectively correspond to the module message center by virtue of the advantages of observation mode. Based on the experimental system, students can define a variety of operating commands to realize the operation and control of computers and other equipment. People can use keyboard, mouse, joystick, data clothing, eye tracker, position tracker, data glove, pressure pen and other equipment. The appearance of somatosensory technology is of great significance for promoting the development of human-computer interaction. Under the somatosensory technology, the device can capture the user's actions, facial recognition and voice recognition in real time to achieve the input function. Therefore, there is also a roaming mode that defines the interactive recognition between the virtual human and the somatosensory. In this system, it is impossible for the human body to roam and walk using the real human motion range recognized by the somatosensory interactive recognition to be the walking distance of the virtual human.

In recent years, the number of researches on somatosensory interaction is increasing, which shows that the research of this project is being paid attention to by a large number of scholars. Figure 1 shows the increase and decrease trend of the number of related researches in recent years.
2.2. Somatosensory interaction technology

Somatosensory interaction technology, also known as somatosensory interaction, is the third revolution that leads the new trend of somatosensory interaction after mouse and keyboard and multi-touch. Combined with the technical operation characteristics between different modules, the paper studies the driving control measures of message resources, analyzes the value of message center, ensures the observation and transmission of message resources, and further adapts to the actual operation requirements of message center management system. This case scenario will demonstrate how to control the user's Unity3D with bones and how to drive small models with various joint points. This is a Unity3D, which accurately, rapidly and dynamically captures human motion information for motion recognition, and converts the recognized various somatosensory information into corresponding operation commands. Through these two collection methods, a dynamic somatosensory recognition response is formed, and the process of somatosensory interaction is completed. In the era of rapid development of Internet technology, smartphones and multi-touch have come one after another, and multi-touch technology opens another window for somatosensory interaction. It makes everyone realize that the keyboard can be part of the touch, and many commands can actually be done by various ways of swiping the touch screen on multiple touch screens. It can effectively make the design closer to improving the teaching environment and teaching quality, enhance the user's interest and pleasure in learning, and achieve the ultimate goal of designing the teaching space.

20 volunteers were selected as experimental subjects. According to the preset indicators, each group of 5 experiments was conducted in the range of 2m to 4m from the somatosensory interaction device. A total of 100 experiments were performed. The results obtained are shown in Table 1, and the recognition accuracy rate is above 90%.

| Action              | Instruction   | Recognition rate |
|---------------------|---------------|------------------|
| Hands swinging to the sides | Start showing  | 91%              |
| Wave to the left     | Page forward  | 92%              |
| Wave to the right    | Page backward | 96%              |
| Hands over your head | End of screening | 93%            |

2.3. Virtual and real fusion technology

Virtual and real fusion technology refers to a technology that combines computer-generated virtual objects or information into the real environment that users want to experience by means of computer graphics and image technology, somatosensory interaction technology, image display technology and multimedia technology. The design based on somatosensory interaction is designed from the traditional physical form design, that is, the idea of “creating objects” to the user-oriented perspective, that is, the consciousness of “service and care”. We mainly introduce the parts of somatosensory control, voice control and classroom intelligent device control. The basic design of the message manager framework needs to closely combine the operation of the message queue to classify the message modules so that
the design value of the message framework can be fully realized. Through the application of somatosensory technology and visual simulation technology in the field of building simulation, a systematic verification mechanism has been formed. In somatosensory interaction, it is first necessary to realize modules that conform to somatosensory interaction. These modules realize themselves by using the interface of somatosensory interaction, and then provide calls for their top-level application programs. Natural somatosensory interaction is also called natural user interface, which uses people's daily skills to realize the interaction between people and computers. Including virtual reality, augmented reality, multi-touch, voice recognition, eye tracking, face recognition, somatosensory operation, brain-computer interface and many other categories. The traditional somatosensory interaction device itself increases the gap between people and the virtual world or augmented reality world, because the constraints of peripherals themselves destroy the natural requirements of people's interaction. Its core lies in allowing computers to have more accurate and effective "eyes" to observe the world and complete various instructions according to human actions, instead of simply using somatosensory technology to replace the click operation of mouse and keyboard. Somatosensory interaction is a technology that interacts with computers by means of gestures and body language of users, breaking the shackles of traditional peripherals on people's bodies and enabling people to deal with the virtual world or augmented reality world more naturally.

3. Application of Somatosensory Interaction Technology in Education

3.1. Somatosensory interaction technology can liberate teachers from the platform

Information technology is not only a sharp weapon in teaching for teachers, but also an effective tool to assist students in learning. Somatosensory interaction technology separates teachers from traditional somatosensory interaction equipment, allowing teachers to walk down the platform freely and truly approach, walk into and integrate with students. Therefore, combined with the actual characteristics of the current player's technical operation, it adapts to the value control requirements of the role model and further conforms to the operation control requirements of the role manager by virtue of the smoothness characteristics of the art model. Provide strong support for optimizing the overall value of game resources. Using real human walking recognition to drive the movement of virtual people, the system defines two ways, namely walking mode and running mode. Identify the real human body corresponding action to achieve virtual human drive, the speed can be customized. As a judgment of the effect of the model formulation, covering the details of the human body, it can completely reflect the difference between different body types and better recognize the human body posture. Different light reference planes are set and marked by the light source calibration technique, and the three-dimensional acquisition is completed by the difference calculation. It is natural to promote pure "self-teaching" teaching to a "collective inquiry" type of activity class. Promote teachers to truly learn and progress together with students, and transform the teaching and learning on the podium into a guiding study around them.

Somatosensory interaction is a smart technology that can be manipulated as you wish without using any control device to interact directly with digital devices and the environment. The block diagram of somatosensory recognition and control is shown in Figure 2.
Fig. 2 Block diagram of somatosensory recognition and control

3.2. Somatosensory interaction technology can effectively solve the limitations of some teachers' own conditions

From the traditional "blackboard + chalk" to "multimedia integrated machine + push-pull blackboard", marking the advancement of education, and the application of physical interaction technology in education will make education technology leap to a higher level. Under the premise of modularity of the somatosensory interaction design factor, the overall design process was added, deleted and changed, and an analysis process with better design and low learning cost was established. The intelligent curtain network control system is controlled by the illumination intensity of the environment, the change of humidity and the wireless control. When the illumination intensity is strong, the curtains are closed. Now, in order to facilitate the operation of teachers and the watching of students in the back of the classroom, the screen size of the integrated TV or whiteboard will be expanded as much as possible. According to the technical characteristics of the animation resources playing components, combined with the complexity of the virtual reality environment, the update technology is used to operate the animation components control center, providing basic support for more adaptation layer technical operations. During roaming, steering is required, but it is easy to make mistakes by directly recognizing human steering with VR. Therefore, this system defines steering as hand-side horizontal lift, i.e. left-hand horizontal lift means left turn and right-hand horizontal lift means right turn, thus realizing VR-driven virtual campus roaming. However, while expanding the screen size, some teachers' height and arm length will affect the teaching effect.

The basic principle of the recognition algorithm is mainly realized by judging the depth change threshold M of 20 bone marker points. In the formula, V represents the actual measured depth value of the bone marking point; C represents the initial measured bone marker depth; Q represents the depth difference between the two bone marker points. The details are as follows:

$$Q_e = \frac{(C_0 - C_e) V}{m}$$  \hspace{1cm} (1)

3.3. Somatosensory interaction technology protects teachers' physical and mental health

No matter standing in front of an integrated TV set or "projector+whiteboard", the teacher will be placed under a strong light electromagnetic radiation environment. The physical layer is embodied in the dryness, humidity, temperature, lighting and other factors in the teaching space, i.e. the physical factors of light environment and thermal environment. The special effect animation is used to realize the technical docking with the character manager, so that the optimization of animation technology can be realized under the condition that the value of the specific character attack mode is judged. Of course, the somatosensory interaction technology provides us with the convenience of somatosensory interaction. It is far more limited to the simpler flat text presentation control of VR. Many techniques
can be realized by the technology developed by this experimental system. Static somatosensory recognition has certain limitations and is currently constrained by various technological developments. Although it is in line with the "national standard", but such a long distance and long days, it may still have a negative impact on the physical and mental health of teachers. The extensive layer mainly includes the lighting and teaching interaction devices in the teaching space. At present, the most obvious problem has been that the high-intensity integrated television is very irritating to the eyes of teachers who operate at close range. Long-term use may lead to a sharp decline in vision, and it is still unclear whether there are other hidden injuries.

Baking can convert the lighting, material and other effects rendered in a non-real-time environment into a real-time interactive environment, that is, fix the light and shadow information in Unity3D on the texture, and then paste the baked texture back into the 3D interactive scene. Going to the second technique, therefore, it is necessary to add an appropriate light source to the scene before baking, and then perform the baking of the scene after visual and technical requirements to avoid distortion of the black face of the model, affecting the degree of system simulation and image display.

Fig. 3 Graphic display

4. Summary
Somatosensory interaction technology has an irreplaceable position in the field of education. The way of somatosensory interaction directly affects the quality and efficiency of teaching. In the design of teaching space, designers should pay more attention to the relationship between human and spatial factors, pay more attention to the service role of teaching space, and pay more attention to the somatosensory interaction design and interaction quality of teaching space. The application of somatosensory technology in the control system of teaching software, classroom lighting and curtains, bid farewell to the traditional mouse, keyboard, remote control, etc., allowing people to interact with the control terminal in a more natural way. Somatosensory roaming technology is a new technology and a hot issue of current research. How to better apply somatosensory technology to virtual roaming system will be further studied. We should better realize the natural somatosensory control of visitors. Somatosensory technology will become the origin of the third somatosensory interactive revolution. Somatosensory technology has brought a brand new way of operation in somatosensory interaction, but this technology still needs to be improved and perfected. Therefore, the teaching space based on somatosensory interaction design can become an important means to stimulate teachers and students' creativity, innovation, critical thinking, teamwork and free and open thinking. With the development of science and technology, it is believed that somatosensory technology can overcome the difficulties in practical application, be applied more widely and deeply in the field of education, and play an increasingly important role.

Acknowledgments
This article is: Fujian Province Young and Middle-aged Teacher Education Research Project JAT170750

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