Computer Life (CPL) ISSN: 1819-4818
DELIVERING QUALITY SCIENCE TO THE WORLD

Research on the interactive mode between AR and VR

Dejia Zhang

Wenzhou Vocational & Technical College, Wenzhou.325035, Peoples R China

---

Abstract: Augmented Reality (AR) refers to the construction of virtual objects in real scenes, which combine the real world with the virtual world. Virtual Reality (VR) is the complete construction of a Virtual world, allowing users to immerse themselves in the Virtual world.
Keywords: Augmented Reality; Virtual Reality; Human-computer interaction mode.

---

1. INTRODUCTION

1.1 Research background and significance

With the development of technology, Augmented Reality (AR) and Virtual Reality (VR) are more and more attractive to people, and they have gained great development in recent years.A 2015 investment report pointed out that AR and VR are another promising technology in the future [1-2].At present, HTC, Facebook, Samsung, Apple, Alphabet and other technology companies have conducted relevant research and development [3-6].

In the field of education, with the rapid development of computer science and technology, traditional blackboard teaching is gradually replaced by colorful multimedia teaching. The great convenience brought by multimedia teaching has been highly praised by both teachers and students, but it has gradually revealed the shortcomings of multimedia presentation such as lack of image and specificity, lack of immersion, lack of interactive experience and inability to conduct independent learning. However, AR and VR technologies emerging in recent years can effectively compensate for the above disadvantages. This project focuses on applying AR and VR technologies to education, so that students can have better learning experience.

Since AR and VR have new experiences, it is particularly important to discuss mature human-computer interaction modes. The key of human-computer interaction technology of AR is to control virtual objects in the real environment so that they have better natural interaction experience. The key technology of human-computer interaction in VR is natural interaction in a fully virtual environment. AR and VR combination, can bring a whole new experience for the user, because almost every intelligent mobile terminal platform, using intelligent mobile terminal as one of the components of display and interaction, more economic than other solutions, more popular, so this topic research based on AR and VR human-computer interaction scheme of intelligent mobile terminal, and its application in the development of education application. In the development of education application, in traditional medicine education paper textbooks can only show two-dimensional pictures. Compared with traditional paper textbooks, "ARVR textbooks" based on AR and VR technology can bring new application experience to people, make up for the deficiency of multimedia teaching, and

can be expanded to the whole education
The domain is used.

2. AR AND VR TECHNICAL SOLUTIONS AND PLATFORMS

2.1 Introduction to AR technology

In recent years, a newly emerging technology featuring virtual and real combination, real-time interaction, three-dimensional registration and other features that virtual technology does not have has achieved rapid development, and this technology is AR technology [7]. AR technology has great potential and value for growth. Although China's research on AR technology is not as good as that of foreign countries, it has become increasingly mature. AR technology has been widely applied in education, entertainment, medicine, military, industry and other industries. The application of AR technology in the field of education can enhance students' learning interest, help them to tap their potential, and make students' understanding of relevant knowledge more transparent

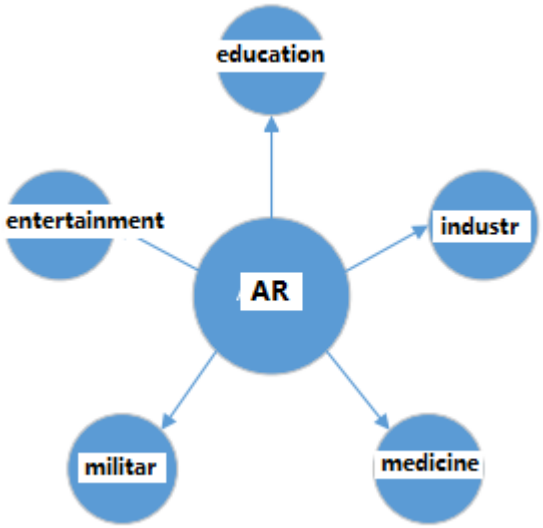


Figure 1 main application areas of AR

2.2 Introduction of VR technology

VR (Virtual Reality, VR) are the most widely used in the current digital field a technology, it and network technology, multimedia technology and known as the three best prospects of computer technology, is a comprehensive computer graphics technology, sensor technology, human-computer interaction technology, network technology, stereo display technology and simulation technology and developed a variety of technologies such as comprehensive technology (29-30).According to the definition of Institute of Electrical and Electronics Engineers, VR refers to the virtual simulation of real situations in the aspects of vision, hearing, smell, taste, touch and so on, in which users can conduct relevant operations and feedback in real time. VR technology was first proposed by Ivan Sutherland in the "Ultimatedisplay" report on the International Federation for Information Processing in the 1960s. In the 1980s, Jaron Lanier, one of the founders of VPL Research, formally proposed the word "Virtual Reality". VR technology achieved great development in the 1990s. Since the beginning of this century, in order to improve the rendering quality and transmission speed, VR technology has integrated rapidly developing XML, JAVA and other advanced development technologies. After applying powerful 3D computing capacity and interactive technology, VR has entered a new era of rapid development.

3. RESEARCH ON THE INTERACTIVE MODE BETWEEN AR AND VR

3.1 Introduction of Leap Motion

Leap Motion, shown in figure 3.1, was released by Leap in 2013. Leap Motion using infrared imaging principle, tracking the activities of the hands, fingers and hand-held gadget, a unique combination of software and hardware technology, using both hands can achieve VR human-computer interaction, as in the real world and interactive digital content, has the characteristics of high precision and low time delay, the error is within 0.01 mm, delay for 5-10 ms, can track at a speed of not less than 200 frames per second hands that the degree of accuracy for the most part of the user needed to complete the man-machine interactive operation smoothly

Figure 2 Leap Motion

Its main core components include a narrow band filter, two infrared cameras, three infrared LED light sources and a USB high-speed chip. Leap Motion is an optical tracking system based on binocular stereo vision. Like the human eye, double cameras can be used to locate coordinates of space objects, and the difference of vision can be used to generate spatial depth perception .

The Leap Motion controller USES infrared LED lights to provide backlight. When a target object, such as a finger, is moving, the infrared light is reflected, and the narrow band filter filters out other visible and ultraviolet light. At the same time, the dual cameras take stereo images of the target object, capture the image from different angles, and re-establish the data information of the target object in all aspects of the three-dimensional space through calculation. Leap Motion's detection range is basically a space of 25-600mm above the controller, and its recognition range is basically an inverted pyramid. First, Leap Motion will create a right-handed cartesian coordinate system with the center of the controller as the origin, with the units of mm X and Z axis horizontal, and the Y-axis vertical as shown in figure 3

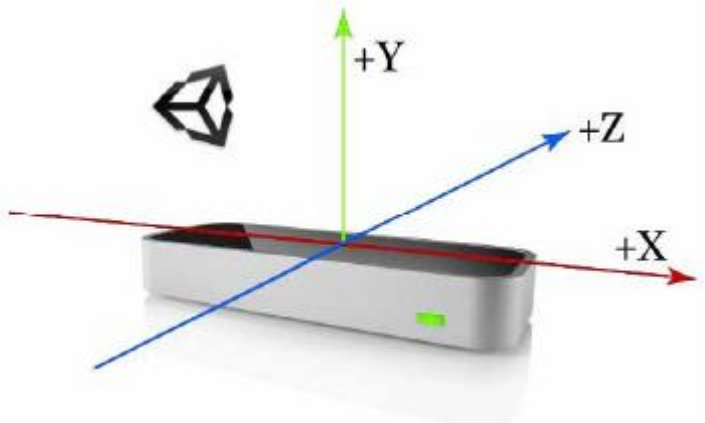


FIG. 3 Leap Motion coordinate system

When a target object such as a finger enters the detection range, the Leap Motion software assigns it a unique ID indicator in the field of view that will not change (the object that re-enters the detection area will reassign the ID). In order to facilitate the query of the information of the moving object,

relevant functions provided by Leap Motion are also attached.The controller sends the motion data of the target object (called frames) on a regular basis, and a Frame object Frame contains attributes such as Fingers, Hands, Pointable, and Tools, which is responsible for providing tracking data, gestures, and overall movement factors within the visual range.

Based on the data detected in each frame, the controller translates the action into action factors such as translation, rotation and scaling, and USES complex algorithms to generate motion information, identify and judge the motion track of the target object, and finally achieve interactive feedback with the display screen. Leap Motion was mainly used as a Motion controller for computer platform at the beginning. Due to the rapid development of AR and VR industry in recent years, it has gradually developed into a mobile terminal platform, which can provide a natural human-computer interaction between AR and VR. Therefore, it has a broad development prospect, with over 200,000 developers currently. Its Chinese name is translated as "li shi", which includes a controller hardware and a set of complex software platform. It allows users to interact with AR and VR content through simple gestures, and owns its own app store, mainly involving VR content, AR content application and games.The difference with Microsoft's Kinect figure 4 is that Leap Motion is only the size of a normal U disk, and can be controlled flexibly within 4 cubic feet of close space. It can track all 10 fingers.

Figure 4 device

With the launch of Leap Motion, developers have developed various imaginative applications for it: the famous NASA USES Leap Motion to remotely control the Athlete six-arm detector. Robbie Tilton of the United States USES Leap Motion to control the hologram and USES Leap Motion technology to flip the earth

In addition, the official mall is also included in the application to use finger manipulation to browse the web or operating system, use gestures to control to change the map shrinkage, high speed control of the game, precise drawing 2 d or 3 d, let the engineer to interact with the 3 d model, in the air by swiping signed the function such as digital documents, especially with the rapid development of AR and VR, Leap adaptation for a variety of "PC + VR" and "Mobile + VR" mode of VR helmet, animating the AR with the rapid development of VR technology,

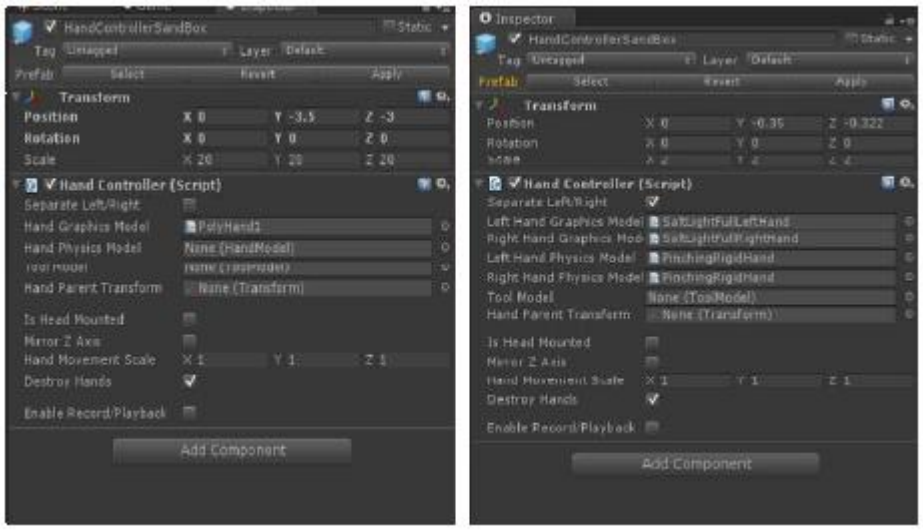
3.2 Use Leap Motion gesture recognition for man-machine interaction

Application in VR scene, Leap Motion can bring the natural way of human-computer interaction, the most accepted, give people immersive feeling, can build a realistic user experience, such as the application in the field of education to build a virtual laboratory, can be convenient for students to learn, because without purchasing entity experimental equipment with the model, it can greatly decrease the cost of the laboratory construction, also because of its simple and easy to carry, students can study at any time, compared with the entity equipment operated in VR scene can diversify the design process of experience some difficult to understand the complex process,It can be shown in a virtual lab.For Leap Motion has mainly used in PC, and this topic mainly studies how mobile AR and

VR applications in the field of education, so the Leap Motion how to human-computer interaction, applied to the mobile terminal is particularly important, with the development of a simple identification of children education APP, for example discussed below under the Unity 3 d how to apply the Leap Motion gesture recognition for human-computer interaction, the identification of main function is to help children learn some simple cube.

FIG. 5 Leap Motion import diagram

After importing, Create Empty in the Hierarchy of Unity 3D changes the name as Leap Motion Controller, and drag the Hand Controller Sand Box prefabricated in the Prefabs folder to the Leap Motion Controller folder.



A before modification B after modification

Figure 6 before and after modification of Hand Controller

It mainly modified the Hand Controller script, checked the Separate Left/Right and set the following four scripts respectively as Salt Light Full Left Hand, Salt Light Full Right Hand, Pinching Rigid Hand and Pinching Rigid Hand, which respectively defined the Left Hand model and the two-handed

grabbing effect property. For the purpose of demonstrating the interaction effect, six planes are built under the Leap Motion Controller, with the top, bottom, left, right, front and back, and the mapping process. Then, the Inspector is added with Mesh Collider and Box Collider to enable it to detect the collision effect. Use of Cube, Sphere, Capsule build a Cube, cuboid, cylinder, Sphere each 2 add texture and the Inspector attributes control bar to add Rigid body rigid body and apply Gravity attribute, adjust its Gravity attribute size, add Box starts collision, write Grab able Object script logic. The overall environment is well constructed, as shown in figure 7.

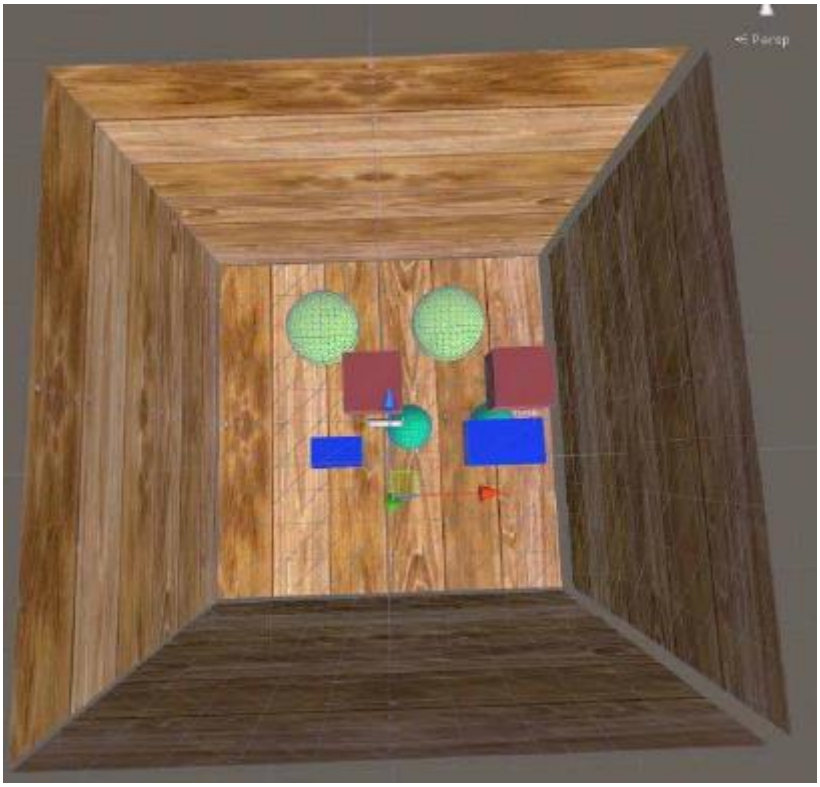


Figure7 around and bottom of the precast

If you look at something with one eye, you can't distinguish the depth of field. Only when you look at something with two glasses can you get the depth of field effect. This is because the two glasses are not in the same position, and the images you see are slightly different. On mobile devices, we can make full use of the screen to build two slightly offset images on the left and right, and then wear VR glasses to achieve an immersive experience. Here is the next simple implementation. After the above interactive scenes are constructed, VR experience with immersion is realized. The above programs need to be improved, the Main Camera is modified to be Stereo Camera Left, a Camera is added to be named Stereo Camera Right, and its parameters are modified as shown in FIG.8.

After that, I wrote other relevant codes, selected the Android platform at Build Settings, and made some simple configuration at Player Settings, mainly changing the Position X axis of Transform in Stereo Camera Right to -0.03, that is, the Camera moves 0.03 to the left and changing the Viewport Rect W to 0.5 in Camera control.

A left camera B right camera

Figure 8 left camera and right camera Inspector modification

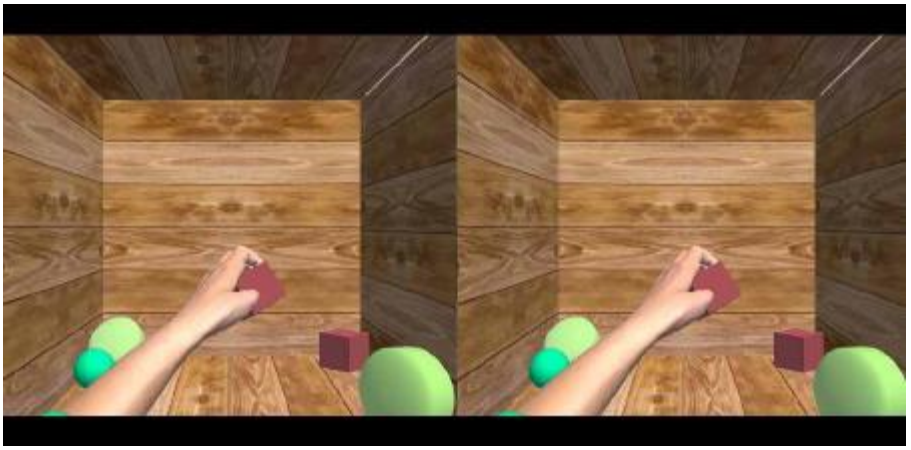


Figure 9 application operation diagram

But it is worth noting that the application of this method is simple to achieve the VR experience, but because of the working principle of the VR headsets are usually achieved by optical zoom around on the screen content immersive experience, in order to let the user on the vision with true immersive, virtual reality devices as possible coverage of the human eye vision scope, so you need to pack in VR headsets a specific sphere radian lenses, but using arc lens to the traditional image projected on the eyes, the image is distorted, the human eye, there is no way to get the location in the virtual space, so there will be a edge distortion. The distortion problem can be solved by processing the VR headset hardware from the VR lens or by using relevant algorithms in the software, in which the Cardboard SDK provides this solution to prevent distortion

4. CONCLUSION

The innovation of this paper is to use mobile terminal equipment as the main component of AR and VR development. Compared with the "PC+VR" scheme, more AR and VR contents are developed, which can greatly reduce hardware costs. In addition, AR and VR technology were used to develop corresponding applications in the original paper textbooks, which greatly enhanced the vitality of the original paper textbooks and improved the learning effect of users.

REFERENCES

[1] Xu Dehua, Zhang Xueyan. China's VR technology development status, application prospects and countermeasures [J]. Manager, 2017, (01): 271.
[2] Huang Xianli, Luo Dongmei. Intelligent home control APP design based on Xunfei voice technology [J]. Fujian Computer, 2016, (08): 112+145.
[3] Wang Yang. Design and implementation of indoor Wi Fi positioning system based on Android [D]. Nanjing University, 2016.
[4] Zhang Yu. Reality is also virtual reality and reality [J]. Robotics Industry, 2016, (02): 48-54.
[5] Wang Xiaoyu. Research on the reappearance technology of the heavy virtual 3D Dunhuang Mogao Grottoes [D]. Xi'an Engineering University, 2016.
[6] Wang Zhiqiang. Research and implementation of virtual robotic arm system based on mobile augmented reality [d]. Hebei University of Engineering, 2015.
[7] Wang Xinghe. Research on mobile augmented reality technology based on Android terminal [D]. Beijing University of Posts and Telecommunications, 2013.