The Research of the Effect of Applying AR Technology in the Teaching of Higher Vocational Training Courses

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Abstract. Augmented reality is a kind of virtual reality technology. It can superpose the virtual view and the real view, enhance some objects in the real view, and make people have a more intuitive and realistic sensory experience. This paper first introduces the technical characteristics of augmented reality and the relationship between augmented reality technology and education, and then introduces the application of augmented reality in current education of 0–6 years old, K12 and other stages. The next we focuses on the training course of higher vocational education, Several experiments in the augmented reality-assisted training class were conducted. The feasibility of using augmented reality in training courses was discussed. The effectiveness of teaching was also analyzed. The advantages of using the augmented reality of learning aids to assist in practical training were analyzed. The article concludes with a conclusion that affirms the potential of augmented reality in education.

Keywords: Augmented reality · Education · Learning aids
Higher vocational education · Training course

1 Introduction

With the development of information technology, more and more new technologies are applied in education. With the help of information technology, people have made many breakthroughs in education. Augmented reality is a kind of virtual reality technology. Augmented reality is based on computer graphics and other disciplines. By calculating the user's current direction and position, adding the virtual information to the user's view of the real world in real time, augmented reality technology can be used to enhance some objects in the real view so as to enable the user to surpass the reality Sensory experience. By strengthening the practical teaching, the transmission loss of knowledge details in traditional education can be reduced and the quality of teaching improved.

Ivan Sutherland developed the first augmented reality system in 1966 [1] Sword of Damocles. The word augmented reality was first used by Tom Caudell and David Mizell in 1992 in the paper [2] Augmented reality: an application of heads-up display technology to manual manufacturing processes. Burdea G and Coiffet P in their book

S. Liu et al. (Eds.): eLEOT 2018, LNICST 243, pp. 214–221, 2018.
https://doi.org/10.1007/978-3-319-93719-9_28

Virtual Reality Systems and Applications proposed virtual reality "3I" features [3], namely Interactivity, Immersion and Imagination.

The New Media Alliance [4, 5] has listed augmented reality as a new technology that has a significant impact on education in the Horizon Report since 2011 and has introduced the trend of influence of augmented reality technology to education in every horizon report in recent years. In addition, the change from "augmented reality" to "augmented reality" in the horizon report shows that more sophisticated augmented reality technologies have been applied to some aspects of education.

2 Relate Work

The earliest application of virtual reality technology to teaching was Billinghurst [6], which produced a "Magic Book," and the reader took a special glasses to see virtual 3D characters, objects and animations on the Magic Book. This practice enriched the contents of the book, and increased the fun of reading.

Hornecker and Dünserc designed an AR book [7] that allows children to interact with avatars in books through physical paddles, focusing on analyzing how children acquire knowledge and skills from the virtual world through an interactive process. Children were found to have performed better with the help of the digital virtual world.

Education researchers such as Cai and Zhang proposed the concept of an augmented reality learning environment [8, 9] in 2010, and published The Book of the Future, in which the pendulum and Newton's law in physics experimental production are selected into AR books and participated in the 17th Beijing International Book Fair in 2010. Cai S et al. through the production of convex lens imaging AR demonstration experiments and water molecules, diamond molecular composition demonstration experiments and applied them to physics and chemistry classes for eighth graders to prove that students' use of AR-assisted experimental learning is easier to grasp Knowledge points in the experiment.

In the mobile learning can be used for some unconventional teaching environment, outdoor, etc., users can use mobile phones and other mobile devices to interact with the external environment to complete the learning task. Furió et al. in 2013, they developed a series of augmented reality games for learning knowledge of tourist attractions [10], helping students to more easily remember scene details and stories of scenic spots.

In practical training, Bacca and Baldiris have developed a tag-based mobile AR application called Paint-CAR [11] to support the repair of automotive lacquer in automotive maintenance training courses, a training session of teaching, and through the use of the program's teaching results, cross-sectional assessment of the teaching and research had be developed. Chen Xiangdong, Qiao Chen designed a circuit based on augmented reality appliances, students learn the manual by reading, you can operate their own instruments, through the learning camera to shoot a specific circuit board, you can display the school's display On the display of 3D AR teaching animation, training teaching practice more secure and flexible. BMW also independently developed a teaching system in 2014, "BMW Repair Glasses" [12], which can guide the maintenance staff to interact with the teaching system through sound. In the process of BMW assembly teaching, the glasses superimpose the virtual animation on the images

of real car parts. In this demonstration, maintenance personnel can intuitively understand each assembly step and complete the assembly according to the demonstration.

3 Design and Development

The target we show in this paper is to show the effect of Applying AR Technology in Teaching, so we Designed and Developed some AR-learning aids to assist it.

Unity3d is a cross-platform engine for creating games and applications developed by UnityTechnologies.Vuforia is an augmented reality SDK from PTC Inc. Using Vuforia + Unity, you can develop a variety of augmented reality applications based on the Android, IOS, Web, ARWear and other platforms.

The authors based on Unity and Vuforia developed a mobile application that describes the formation of an industrial Ethernet network, as shown in Fig. 1. The user can install the application on the phone, and use the phone's camera to shoot a specific training manual, then learn the industrial Ethernet networking process, and according to the requirements of the experimental operation. The application first takes advantage of the phone camera to capture the real scene in the camera and then Vuforia spatially registers the place where the virtual information is presented with a special marker with a feature point (pictorial on the training manual) and will eventually be made in Unity 3D virtual model is superimposed on the scene, the application of the working principle shown in Fig. 2.

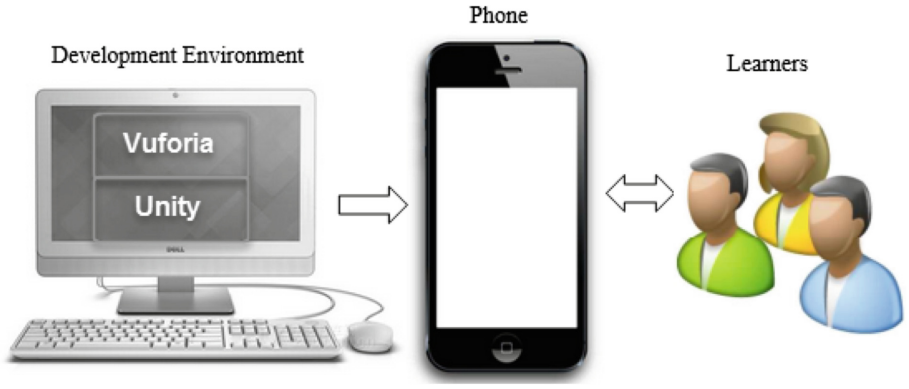

Fig. 1. The development process

In the same way, the author developed a mobile application that can be used in the teaching of computer network training course and made it into a set of training aids system according to the real-world training environment by using AR glasses of RealMaker's RealSeer DK1. As shown in Fig. 3. Users can wear RearSeer DK1 glasses through real training tools in real training environment to practice, the training system will identify training tools, and will use the operation of the tool in 3D animation superimposed on the appropriate position on the tool to guide the user training operation.

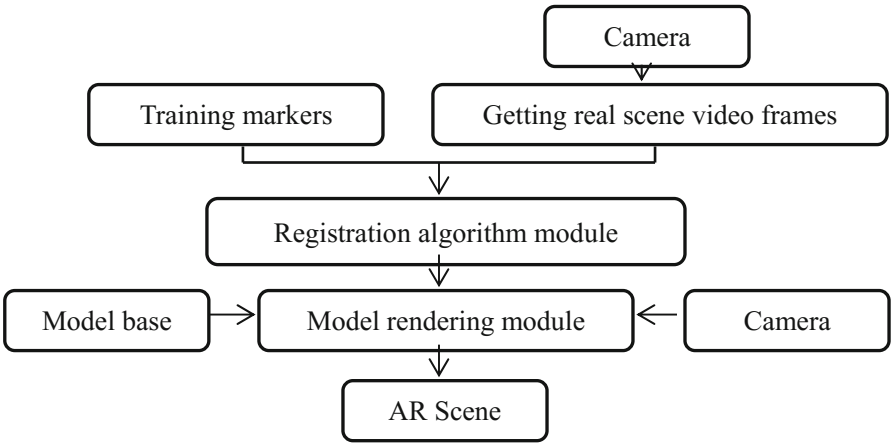

Fig. 2. Principle of the application

Fig. 3. RearSeer AR training teaching system

4 Test with Students

Due to the esoteric nature of the course "Building Industrial Ethernet", the process of building an Ethernet network is complicated and the safety requirements are high. Therefore, students need to be familiar with the principles and operating points before they can acquire the skills through simulated exercises. Using the AR mobile app, students used engineering to test students in higher education. Students first used the mobile phone to view the training manual in the training room and then reviewed the course principles and operating points through the AR 3D animation displayed in the mobile phone, as shown in Fig. 4 As shown. Finally, through the phone in the AR operation game perform simulation exercises, as shown in Fig. 5.

The author applies RealSeer dk1 glasses-based training aids system to the training course of "Computer Network Technology" course. During the test, students first wear RearSeer glasses and adjust the lens to the proper position, and then hold the operation tool and put it move to the field of vision glasses, teaching aids to identify tools, the 3D

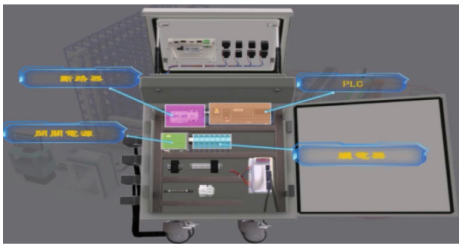

Fig. 4. AR technology shows the principle of building ethernet

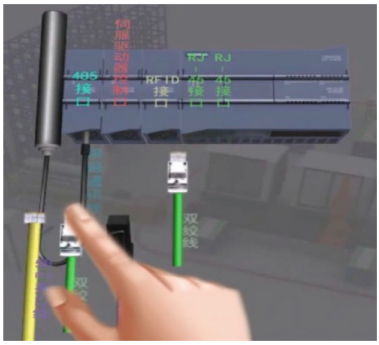

Fig. 5. Simulating exercises with AR games

teaching animation after distortion displayed on the lenses of RearSeer glasses. There is a yellow "sight" on the lens view, the students turn the head, the control of the yellow sight to virtual button to select which animation to play, as shown in Figs. 6 and 7. Finally, after viewing the teaching animation, students can push the lenses on the RealSeer glasses and perform the actual operation as shown in Fig. 8.

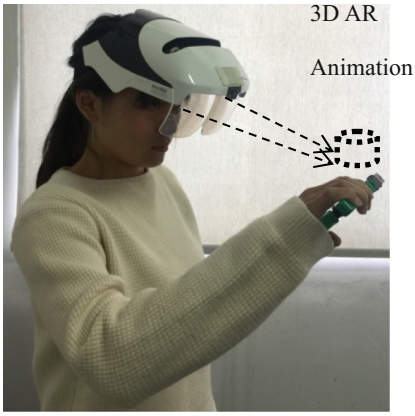

Fig. 6. AR view on tools

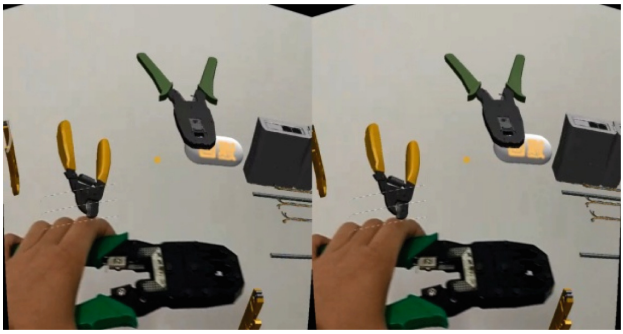

Fig. 7. The distorted AR view in RealSeer glasses

Fig. 8. Real operation practice

5 Results

Two experiments were conducted using the comparative method, the students were divided into two groups, one group using the traditional way of teaching, the other group using AR technology to assist teaching, after the end of the teaching on-site examinations, the results shown in Tables 1 and 2 Show.

Table 1. The result of "industrial ethernet construction" experiment

Group number	Test method	Passing rate	Remarks
1	paper	95.2%	Use AR-assisted instruction
2	paper	89.7%	Unused AR-assisted instruction

Table 2. The result of "computer network training" experiment

Group number	Test method	Passing rate	Remarks
1	actual operation	87.8%	Use AR-assisted instruction
2	Actual operation	82.1%	Unused AR-assisted instruction

The questionnaires were issued after the test in both experiments. 103 valid questionnaires were collected and the effective recovery rate was 98%. The survey results show that the teaching methods using AR technology are highly satisfied.

6 Conclusion

The AR technology is still in its early stage of development, it still needs special equipment and specific environment to assist the teaching process. At present, there are not many interactions that can be achieved during the teaching process [13]. However, according to the above example, AR technology in education has been involved in all stages of 0–6 years old, K12, higher education, involving many aspects of theory, practice teaching, the potential for application is huge, and with the development of AR technology, will continue to education zone To continuous, lasting changes in the future AR technology can also be combined with artificial intelligence, things and other technologies to design better teaching cases.

Acknowledgment. This work was supported by the teaching reaserches on high school provincial quality engineering project of Anhui high school grant No. 2016jyxm1119, No. 2016ckjh224 and No. 2016jyxm1118, Nature science research project of Anhui high school grant No. KJ2017A562.

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