Optimal Design of Vocal Music Teaching Platform Based on Virtual Reality Technology

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Abstract. Through virtual reality technology, human-machine immersive interactive system, virtual scene, beautiful structure of music teaching is implemented, and the new concept of using virtual experience is the real technology of music teaching. To create a virtual reality system with high sensitivity and multi-dimensional perception: create a variety of scene models, create the best data for transmission, and create a suitable scene model; The use of dot matrix technology to focus on the face, the use of projection screen transmission technology to connect virtual characters in time; With the help of positioning and tracking technology, the gestures of virtual characters are optimized and important information is stored in multiple versions of the virtual camera. The above methods have been proven in practice to solve the problem of promoting internal knowledge, access, transmission, and other knowledge of students, and thus to sing the thinking and expression of students in the educational process.

Keywords: Virtual reality · Vocal interaction · human-computer interaction

1 Introduction

Due to the effectiveness of music education, emotional sensitivity and expression in the process of singing is very valuable and rarely used in the study of virtual reality. Some real-world virtual teaching programs suffer from problems such as ineffectiveness, unsatisfying dialogue, poor visual content, and poor performance. These problems can be summarized as follows: First, some researchers make three-dimensional data on Arcsoft Panorama Maker, so that singers can follow the recommendations given in advance in the panoramic framework for audio-visual communication and obtain different models of audio-visual experience. Those. It is difficult to create an interactive work with a lack of perceptual interaction, a lack of clarity between the singing heart and the words [1].

Second, some researchers use next-generation technology (VRPlatfom) to create deep three-dimensional data, which not only provides users with various options related to singing, but also can associate facial expressions to a certain extent. However, the work and blank space are not good, the image algorithm is not optimized enough, and the real-time image calculation often crashes. Based on the analysis of the advantages and disadvantages of the above technology, this study tries to use virtual reality engine technology (unity3D) as the main tool to take advantage of design, face, motion and

F. Huang et al. (Eds.): ICAIE 2023, AHCS 15, pp. 394–400, 2024.
https://doi.org/10.2991/978-94-6463-242-2_49

multi-camera recording. To allow more accurate, flexible and interactive use of the singing model [2].

2 Advantages of Simulation Teaching System Platform Based on Human-Computer Interaction Virtual Reality Technology

2.1 Enhance the Sensory Experience of Classroom Teaching

Using virtual reality technology to build a simulation teaching system platform can simulate the real teaching scene, and during the teaching period, the real scene can be simulated by virtual reality technology, which will bring more intuitive and real experience to students. There are some problems in the traditional teaching mode, such as the boring content of classroom teaching. After enriching students' sensory experience in the classroom, students' interest in learning will be obviously improved, which will establish a stable basic environment for the following teaching plans. Sensory experience is a necessary condition to enhance students' interest in learning and knowledge mastery. In the traditional teaching mode, the content of knowledge contacted by learning is relatively simple. After the introduction of virtual reality simulation teaching platform, the interaction between students and teachers' homes has also been enhanced, and the teaching promotion effect is obvious [3].

2.2 Improve Students' Learning Efficiency

After the application of the virtual simulation teaching system, different types of learning resources can be shared with students in the classroom, which fully stimulates students' memory senses and improves the solidity of knowledge point memory. Learning efficiency is not obvious only by mechanical practice and recitation, which leads students to be in a state of fatigue learning, and the knowledge they have learned can only form a short impression, which will be forgotten after a period of time. After the application of virtual reality simulation teaching system, this problem has been solved. In the classroom, rich and interesting learning resources, including pictures, videos and other modes, are displayed to students through simulation software, and the knowledge points are more clear and concise. This not only lightens students' study pressure, but also helps students to form a deep impression and firmly grasp relevant knowledge points [4].

3 Construction of Virtual Reality Simulation Teaching System Platform Based on Human-Computer Interaction

3.1 Hardware Structure Composition

In the design of software platform, it is necessary to determine the hardware composition first, and make different choices according to the specific hardware requirements of teaching tasks. The signal receiver is used to control the instruction in the process of data transmission and realize the display of the design courseware through the virtual reality

platform. Data gloves can capture gestures and actions and transfer them to the system platform. Gesture recognition is a specific part of interactive teaching software, which is related to the final application effect of teaching software. Stereo glasses are required to be worn by every student. Through stereo glasses, we can watch the simulation effect which is close to reality, and realize human-computer interaction in virtual reality [5]. The functional level of hardware equipment needs to be matched and selected according to specific teaching tasks. Hardware equipment is also a carrier part of software function realization. If a stable hardware system is designed, the software function realization can be carried out more efficiently.

3.2 Software Design Composition of the Application of Software Composition

Including DivisionMockup2000i2, RapidVRM, Trackd, pro/e. Build the required software into the following subsets, so as to realize the mutual exchange between software and hardware systems, and establish the following system composition flow chart (see Fig. 1). There is a man-machine interaction environment in the system. When the action is captured in the virtual reality teaching platform, the tracked parameters need to be re-integrated and displayed on the display screen after internal processing of the system, which is consistent with the real action. In this environment, the internal control model of each system is constructed, and the software composition is carried out according to the function realization flow in the figure. In the actual design, it is also necessary to reflect the functional cooperation form between hardware and software. After the system is started, the software part will run automatically, and the final parameters will be integrated and calculated to meet the standards required by the teaching task [6].

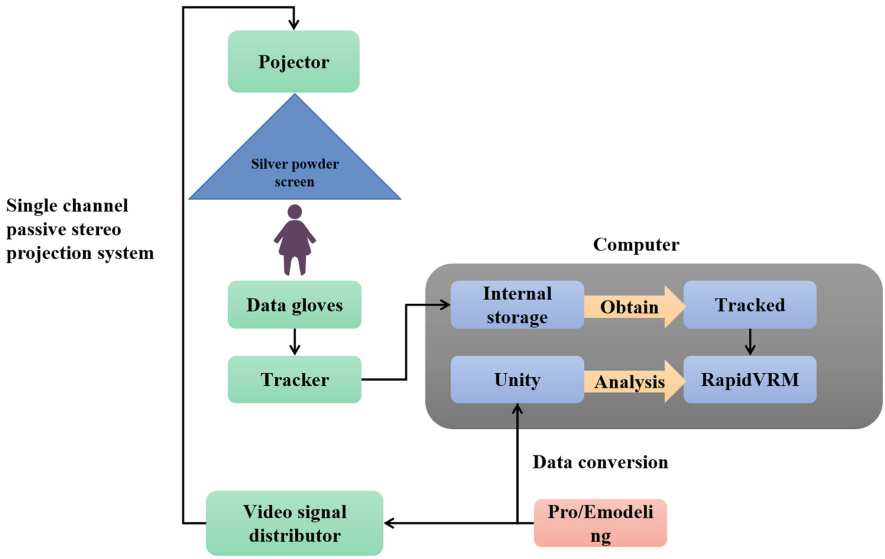

Fig. 1. System composition diagram

4 Key Technologies to Realize the Platform Design of Virtual Reality Simulation Teaching System

4.1 3D Modeling

To realize this technology, three-dimensional modeling is needed to establish a suitable visual platform effect for the next system platform application. Three-dimensional modeling needs to be carried out on the basis of the system platform, and all kinds of functions needed and data resources that need to be further constructed on the basis of functions are observed. According to the control function that needs to be realized next, the field modeling processing is carried out, and the program running model is constructed [7]. The realization of different processes also needs to be carried out on the basis of digital modeling. According to the instruction requirements in information data transmission, the next transmission port docking is carried out to avoid the phenomenon of data transmission interruption. In the face of different data transmission, we should also make obvious differences in three-dimensional modeling and observe the functions that need to be further improved in each port. The establishment of three-dimensional model should be combined with object_adapters_11.0 software to realize on-site functional operation control and build a three-dimensional scene needed in reality [8].

4.2 Data Conversion

Data conversion is aimed at the progress between real input and virtual scene, and data transmission and docking are carried out according to the requests generated in the application of teaching software. The realization of data conversion function requires the cooperation of peripheral software and internal control software at the same time. With the data generated in the peripheral equipment, the software system will automatically match and convert the data into software that can be recognized in the teaching system, so as to achieve the best data conversion effect. For the data conversion effects in different design schemes, it is necessary to analyze and use them in combination with actual use scenarios to achieve internal control [9–11]. The scenes built in the virtual reality simulation teaching system are completely handled according to the reality proportion, so the data conversion task is also very important, which is related to the final design concept and the parts that need to be further improved in the system. Data conversion is a single item, which should not only aim at the common program design in the conversion process, but also reflect the demand for software functions during teaching, and make data processing the content needed during teaching. Select the trackd.conf file, automatically repair it during data conversion, and exchange it with the converted scene, so as to achieve the realistic simulation effect in the system [12].

4.3 Operation Identification and Command Acquisition

In order to design this part of the function, it is necessary to establish a teaching database and obtain resources from the network platform to make the resources contained in the database more comprehensive. Attention should be paid to the security of information

acquisition and the potential safety hazards in use. Fully construct the on-site operation identification instructions, and start the relevant functional modules on the basis of command acquisition. Only during the teaching task can the internal functions of the system be fully utilized to complete the construction of relevant instructions. The schematic diagram is passively displayed in a single channel, and the field control instructions are constructed [13]. The field control principle is constructed in a single channel mode, which enriches the control instructions and achieves a more ideal operation and use effect. The design of teaching system platform should consider whether the data processing ability of the conversion part can achieve the best use effect, avoid the phenomenon of insufficient running ability in actual operation and processing, and affect the final function realization. Operation identification and command acquisition are based on single channel system, which can identify data more efficiently and convert them into related command instructions [14].

4.4 Gesture Capture Method

Signal detection is a complex task in virtual reality, and the singer must wear an Oculus quest2 virtual head display device and a hand controller on a computer. After that, the depth sensor of the camera is installed in the front of the head display device, which is lowered by 13.4°, so that the singer can observe his interpretation in time and track the changes of the fingertips in time. Left-to-right arm movement: back, stop, forward. If the position of the finger is in the zero static zone (zc), there is no movement; As the finger tip is extended forward from the resting zone, the red progress of learning movement speed increases linearly with finger distance [15–17].

The required test time is the time to complete at least the last 24 of the 30 measurements, and the difference between the repeated measurements is used to analyze the differences at different levels to show the small target and large target points. See Table 1 and Table 2 for settings.

Table 1. Beta coefficient (small target) (m/s)

	$\beta = 12$	$\beta = 21$	$\beta = 30$	Pvalue
Total time(s)	74.5(48.0)	62.6(18.3)	82.0(31.4)	0.18
Excellent control	4.5(0.5)	3.8(0.9)	3.6(0.7)	0.0001
No shoulder fatigue	4.2(0.9)	4.1(1.0)	4.2(1.1)	0.65

Table 2. Dead zone width (small target) (mm)

	Dzw = 10	Dzw = 25	Dzw = 40	Pvalue
Total time(s)	71.9(22.8)	71.0(32.5)	73.0(38.2)	0.94
Excellent control	3.5(0.7)	3.8(0.9)	4.2(0.9)	0.15
No shoulder fatigue	4.4(1.0)	4.2(0.9)	4.3(1.0)	0.59

5 Conclusion

Compared with the traditional vocal music teaching methods, the vocal music teaching platform based on virtual reality can give singers a wider choice of space and can also play a positive role in promoting the singing level. Its advantages are as follows:

1) It can be free from the constraints of real physical space-time, cost and other conditions, effectively saving hardware costs, and it is also an intelligent interactive experience process based on a high simulation environment.
2) Different virtual content elements can be constructed, public participation can be well realized, and various sensory organs of the singer can be effectively stimulated.
3) It can bring more accurate, delicate and diversified immersion and presence to the virtual reality experience of vocal music interaction.

References

1. Gong, X. (2022). Research on discrete dynamic system modeling of vocal performance teaching platform based on big data environment. Discrete Dynamics in Nature and Society, 2022(38), 991-998.
2. Dai, D. D. (2021). Design of online music teaching system based on b/s architecture. Hindawi Limited, 11(65), 1589-1591.
3. Xu, T., & Hawamdeh, S. (2022). Immersion teaching method of business English based on virtual reality technology. Journal of Information & Knowledge Management, 35(6), 58-65.
4. Qian, J. (2022). Research on artificial intelligence technology of virtual reality teaching method in digital media art creation. Journal of Internet Technology, 985(1), 23.
5. Ling, Y. (2022). Design and implementation of the platform for multimedia resource sharing based on cloud technology. 2014 5th International Conference on Information Technology for Manufacturing Systems (ITMS 2014), 46(7), 45782-45788.
6. Wu, W., Sivaparthipan, C. B., & Sanz-Prieto, I. (2021). Application of automobile modelling optimization design based on virtual reality technology. Journal of Interconnection Networks, 66(13), 638-644.
7. Huang, Y. (2022). Design of personalised English distance teaching platform based on artificial intelligence. Journal of Information & Knowledge Management, 389(65), 41-43.
8. Fang, J., & Deng, W. (2021). Design of lingnan cultural gene implantation cultural and creative products based on virtual reality technology. Mathematical Problems in Engineering, 3(32), 018923252.
9. Cai, Y., & Zhao, T. (2021). Performance analysis of distance teaching classroom based on machine learning and virtual reality. Journal of Intelligent & Fuzzy Systems: Applications in Engineering and Technology, 5(2), 40.

10. Yang, H., Zhang, X., Fang, G., Li, J., & Ying, J. (2021). Design of signal and system virtual teaching course platform based on labview. MATEC Web of Conferences, 336(15), 05006.
11. Ma, X. (2021). Analysis on the application of multimedia-assisted music teaching based on ai technology. Advances in multimedia, 23(1), 2021-2028.
12. Zhu, Z., & Du, Y. (2021). Research on interior design optimization based on virtual reality technology. Journal of Physics Conference Series, 1746(98), 012063.
13. Xie, J., & Liu, Y. (2021). Research on environmental art design system based on virtual reality technology. Journal of Physics: Conference Series, 1992(2), 022129 (5pp).
14. Wang, S., Xu, Q., & Liu, Y. (2021). Research on the creation of film and tv works based on virtual reality technology. Journal of Physics Conference Series, 1744(3), 032015.
15. Jiang, S., Wang, L., & Dong, Y. (2021). Application of virtual reality human-computer interaction technology based on the sensor in English teaching. Hindawi Limited, 1988(5), 0852344.
16. Li, Z., Huo, G., Feng, Y., & Ma, Z. (2021). Application of virtual reality based on 3d-cta in intracranial aneurysm surgery. Journal of Healthcare Engineering, 2000(9), 38-45.
17. Zheng, W., Ye, Y., & Zang, H. (2022). Application of bim technology in prefabricated buildings based on virtual reality. Computational intelligence and neuroscience, 2022(19), 9756255.