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Research on Mobile Augmented Reality Technology Based on We Chat Mini Program for Children's Picture Book

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ABSTRACT--- Picture books are the most suitable form of books for children to read. Reading picture books can cultivate children's imagination and thinking ability, which plays an important role in the cultivation of children's quality. This paper designs a set of AR system for children's picture books based on wechat mini program. The system uses webgl and three. js to make AR mini program on wechat. We use 3ds for different characters in the picture book Max makes 3D models. Record voiceovers and edit them with Adobe Audition based on different story scenarios in the picture book. The experimental results show that as long as the wechat mini program function is used, the system can be easily used to experience AR technology, improve the audio-visual experience of children's picture books, and experience the virtual interaction and immersion that traditional picture books do not have.

Keywords--- mobile augmented raeality, wechat mini program, picture book.

1. INTRODUCTION

Mobile Augmented Reality (MAR) applies augmented reality to mobile device terminals. It inherits the three major features of augmented reality: virtual-real integration, three-dimensional registration, and real-time interaction, while improving the flexibility and practicability of augmented reality systems. Mobile augmented reality technology Integrate the virtual environment with the real environment on the screen, so that the user is perceptually convinced that the virtual environment is an integral part of the real environment around him. At present, mobile augmented reality technology has a wide range of applications in various fields such as digital medical research, education and training, military exercises, and entertainment. It has important research significance and practical application value.

In this regard, many domestic and foreign scholars have carried out research. Cheng Kun-Hung and Tsai Chin-Chung [1] study the interaction of children with parents sharing reading and augmented reality (AR) picture books. It is proposed that the interactive mode of AR book sharing reading can bring positive AR learning experience and further improve children's learning performance. Yang Yang [2] proposed the use of mobile AR technology to improve students' learning enthusiasm. And discussed the problems and application prospects of mobile AR technology in e-learning. But he only proposed this concept and idea, and did not mention how to realize it. Huang Yakun , Qiao Xiuquan, etc. [3]have realized AR effects through web pages, but the methods they use can only be run on the PC side, and are not adapted for mobile terminals. Qiao Xiuquan , Ren Pei , etc. [4] proposed that Web-based AR (Web AR) implementation can provide users with a popular mobile AR experience, and the emergence of 5G mobile communication networks is likely to improve mobile AR-intensive computing in Web-based methods communication efficiency. They presented the latest technologies and existing implementations of mobile AR, as well as the enabling technologies and challenges when AR is combined with the web. But they did not study how to apply the technology to mobile devices through software. Ribeiro Roberto, Ramos João etc. [5] developed a web-based ar's drone training program. However, due to performance issues, the current H5 solution cannot achieve a very perfect performance experience. And because the performance of the actual mobile phone brands is different and uneven, and the OpenES performance on the web is still worse than the OpenGL performance on the desktop. Selek, Murat and Kıymaz , Yunus E. [6] developed an AR system with Unity3D platform and VuforiaAR software development kit , but the VuforiaAR they used requires users to store data files on

Vouforia's server, there may be data Security risks. Fuguo Peng and Zhai Jing [7] designed and implemented the mobile AR system in the exhibition hall, but they only displayed the 3D model, and did not display the animation effect of the 3D model. And the system they designed also has problems such as low accuracy and low timeliness of image tracking. Petrovic Nenad , Roblek Vasja , Khokhobaia Merab , etc. [8] developed mobile applications about travel using AR. js based on web library. However, due to adaptation reasons, AR. js cannot be used on wechat Mini Programs. Kim, Shinhyo , Park, Jihyun, and Kim, Jusub [9]propose an AR book system that can assist in thematic reading. But this system is not suitable as an AR system for children's picture books. St ănic ă , Iulia-Cristina , Moldoveanu, Alin , etc. [10] developed a mobile application for physical book ar annotation , but the function of this program is relatively simple, only adding annotations and social functions to books to improve books , the content displayed by AR is not rich enough, and AR technology cannot be used well to increase the immersion of readers when reading.

We found that there are no wechat mini program for children's AR picture books. Most of the current mobile AR solutions still have many shortcomings, such as high learning costs , incompatibility with different mobile devices, high business engine prices, and hidden dangers in data security. Moreover, the AR applications currently on the market require users to download additional apps, which will bring inconvenience to users when using them. In China, most users use wechat as their primary social tool. Mini programs on wechat do not need to be downloaded and installed, and users only need to open wechat to use them. We found that there is no AR picture book wechat mini program system on the market. In this regard, we propose a wechat mini program AR system based on webgl technology and three. js , so that users can experience mobile AR technology without downloading and installing additional software , eliminating the cumbersomeness of downloading additional software. Realize the dream of application "at your fingertips".

2. SYSTEM FUNCTIONAL ARCHITECTURE

The mobile augmented reality of children's picture book system can be divided into three parts: background explanation, model display, and dynamic interaction.

Background explanation: Use voice and text to introduce the content of children's picture books.

3D Model display: Display the corresponding 3D model by scanning the pictures on the picture book.

Dynamic interaction: Users can rotate, zoom and other operations on the 3D model.

The system function is shown in Fig. 1

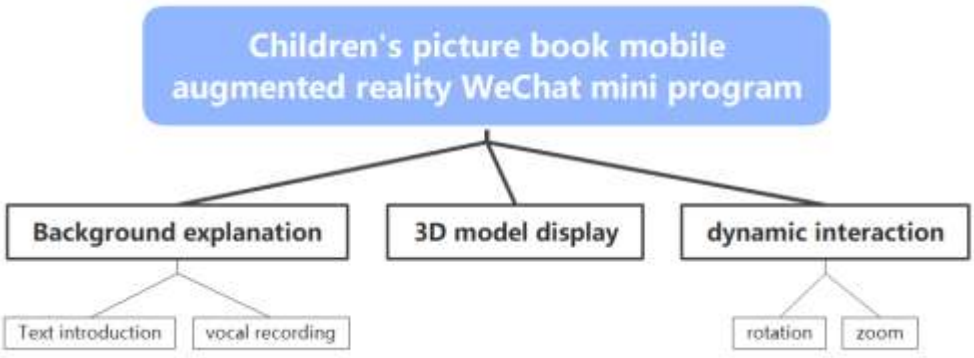

Fig. 1: System Functional Framework

2.1Background explanation

The text content on the picture book is played through audio. For children with little literacy, vocal recording can help them better understand the content of the picture book. Second, audio books can promote the development of children's language skills, while enhancing their thinking skills and

imagination.

In addition to audio, the AR mini program can also display text content, which can supplement the content of the picture book, so that children can understand the content of the picture book more comprehensively.

2.2 3D model display

Compared with traditional picture books, the advantage of AR picture books is that through technical processing , the content in the book can be presented in a three- dimensional form, and the presentation of the content is more three-dimensional and intuitive. Therefore, we make corresponding 3D models for different characters in the picture book. This intuitive three-dimensional book is easier to attract children's interest, making reading more lively and interesting.

2.3Dynamic interaction

Users can rotate, zoom and other operations on the 3D model displayed by the mini program. Let users see the content displayed by the AR effect in all directions.

3. IMPLEMENTATION OF FUNCTIONAL MODULES

3.1.Children's picture books used in this system

The children's picture books selected in this system are based on Chinese Peking Opera. The picture book introduces the different trades, facial makeup and makeup process in Peking Opera in the form of situational stories. Children can learn about Chinese traditional culture by reading this picture book.

3.2.Design of 3D model

The design of the 3D model refers to the character image in the picture book, and the character of the picture book is extracted for secondary rendering. We used 3ds Max software to make corresponding 3D models for different characters in the picture book and saved the models as ".fbx" format. We use the "HUAWEI CLOUD" OBS storage service to store model data on HUAWEI CLOUD servers. Using the obs-browser software, you can easily manage 3D models stored on HUAWEI CLOUD, and update and modify 3D models.

3.3. 3D model display

We implanted the open source three.js into the wechat mini program, and used the loadModel() function of three. js to display the 3D model in the wechat mini program. At the same time, use the "onTouchstart()" function and "onTouchmove()" function to control the rotation, scaling and other operations of the 3D model. Call the 3D model stored on HUAWEI CLOUD through the interface in the function.

3.4.Vocal recording

The narration of the story plays a role in supplementing the plot and enriching the emotion of the whole picture book story. According to the storyline, in the process of designing the human voice reading corresponding to the picture book story, we use Adobe Audition software to control and adjust the timbre and pitch, so that the sound meets the cognitive needs of target children and users.

3.5.Background music

The background music can well help interpret the emotional tone of the whole picture book story. We choose the background music according to the overall style and theme of the picture book. The picture book supported by this system is a light and lively short story. The same lively and lively music is selected in the selection of background music, and children readers can feel a relaxed and pleasant reading atmosphere from the music.

4. EXPERIMENTAL RESULTS AND ANLYSIS

4.1 The software and hardware environment of the system

This AR system is developed using computer-side software and experiments are carried out on smartphones Computer:

(1) Hardware: Intel(R) Core(TM) i5-9300H CPU , 16 G memory

(2) Software : 3ds Max 2019 , wechat Developer Tools v1. 05. 2201240 , obs-browser +, Adobe Audition

Smartphone: (1) Hardware: iPhone 13 256 G

(3) Software: iOS 15. 3. 1 , wechat v8. 0. 18

Picture book: Different Wah Ya Ya

4.2Experimental results

This system consists of a paper picture book Different Wah Ya Ya and an AR wechat mini program. Different Wah Ya Ya (as shown in Fig. 2) is a picture book written by Chinese writer Henry Zhang and painted by Lian Xuefen. This picture book introduces China's Peking Opera culture. The illustrations are cute and childlike, and are very suitable for children to read.

Fig. 2: Children's picture books selected by this system

This system uses HUAWEI CLOUD's OBS storage service to store 3D models. Log in to HUAWEI CLOUD's OBS storage service through the obs-browser + software, and you can directly manage the stored 3D models. Each model can be edited by clicking the action button to the right of it. (As shown in Fig. 3 and Fig. 4)

Fig. 3: Login interface of obs-browser

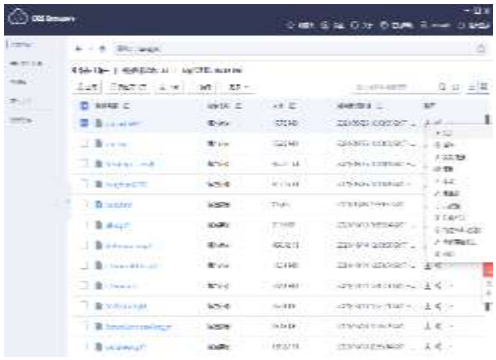

Fig. 4: Operation interface of obs-browser

When using this system, the user first enters the mini program through wechat. Click on the "Mini Program" after clicking on the wechat search box. Enter "Children's Picture Book Mobile Augmented Reality System" in the search bar to search for this system. (As shown in Fig. 5 and Fig. 6)

Fig. 5: wechat search interface

Fig. 6: Search in the search bar

After entering the home page of the mini program(As shown in Fig. 7), select " Scan and Recognition " , and scan one page of the paper picture book(As shown in Fig. 8).

Fig. 7: The home page of the mini program

Fig. 8: mini program scan

After waiting for the model to load, the 3D model will appear on the screen. (As shown in Fig. 9) Users can click the "play " button at the bottom of the screen to play the audio content of the picture book on this page. Users can use two-finger zoom and one-finger drag operations to view the displayed 3D model in an all-round way.

Fig. 9: Load the 3D model after scanning the corresponding image

Conclusion

This paper proposes a set of AR children's picture book mini program, which combines AR technology with children's picture books. With the addition of AR technology, picture books are no longer a single, static graphic content. With the support of AR technology, the content of the book can be displayed in a three-dimensional and intuitive manner, supplemented by audio content, which integrates the pictures in the picture book with the reality of the reader, bringing an immersive feeling. At the same time, the AR picture book system will also increase the difficulty of pirating books and protect the copyright of picture books to a certain extent. In addition, the system can run as long as the user opens wechat without downloading additional App. Therefore, the AR picture book system has important research significance and application value.

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REFERENCES

[1]. Cheng Kun-Hung,Tsai Chin-Chung. The interaction of child–parent shared reading with an augmented reality (AR) picture book and parents' conceptions of AR learning[J]. *British Journal of Educational Technology*,2016,47(1):203-222.

[2]. Yang Yang. Application of mobile AR in e-learning:An overview[J]. *Transactions on Edutainment XI*,2015, 8971:141-155

[3]. Huang Yakun,Qiao Xiuquan,Tan Zhijie. WebPoseEstimator: A fundamental and flexible pose estimation framework for mobile web AR[C]. *Proc. of 2021 IEEE Conference on Virtual Reality and 3D User Interfaces Abstracts and Workshops.* Institute of Electrical and Electronics Engineers Inc. 2021,pp. 478-479

[4]. Qiao, Xiuquan ; Ren, Pei ; Dustdar, Schahram. A New Era for Web AR with Mobile Edge Computing[J]. *IEEE Internet Computin*,2018,22(4) :46-55

[5]. Ribeiro, Roberto;Ramos, João ; Safadinho, David. Web ar solution for uav pilot training and usability testing[J]. *Sensors*,2021, 21(4):1-32

[6]. Selek, Murat ; Kıymaz, Yunus E. Implementation of the augmented reality to electronic practice[J]. *Computer Applications in Engineering Education*,2020, 28(2):420-434

[7]. Fuguo, Peng; Zhai, Jing. A mobile augmented reality system for exhibition hall based on Vuforia[C]. *Proc. of 2017 2nd International Conference on Image, Vision and Computing*. Institute of Electrical and Electronics Engineers Inc,2017,pp. 1049-1052

[8]. Petrovic Nenad ,Roblek Vasja ,Khokhobaia Merab,Gagnidze Ineza. AR-Enabled Mobile Apps to Support Post COVID-19 Tourism[C]. *Proc. of 15th International Conference on Advanced Technologies, Systems and Services in Telecommunications.* Institute of Electrical and Electronics Engineers Inc, 2021,pp. 253-256.

[9]. Kim Shinhyo,Park Jihyun,Kim Jusub. E-mmersive Book: The AR book that assists the syntopical reading[C]. *Proc. of the 9th Augmented Human International Conference.* AH 2018, February 7.

[10]. Stănică, Iulia-Cristina ; Moldoveanu, Alin ; Alabbasi, Hesham Adnan. Evolving the very act of reading with socio-collaborative dimensions - Ar-annotations over physical books[J]. *UPB Scientific Bulletin*,2020,82(2):3-14