Research on Application of Virtual Reality Technology in Information Retrieval

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Abstract. Virtual reality technology has three characteristics: immersive, interactive and imaginary. It adds new multi-dimensional feelings and human-computer interaction methods. It has a wide range of library scene construction, information resources construction and reader service work. However, at the current stage, virtual reality technology encounters the problems of low commercialization of virtual reality technology equipment in library applications, the lack of mature vision generation technology itself, and the shortage of libraries using virtual reality technology. Therefore, the library should actively focus on virtual Real-world technology and two visual scene generation technologies are used interchangeably to increase propaganda and promote virtual reality technology.

1. Introduction
With the development of science and technology, more and more technologies have been applied to libraries, such as database technology, two-dimensional code technology, radio frequency technology, Wi-fi technology, and virtual reality technology[1-3]. Some of these technologies have matured in the library, such as database technology and Wi-fi technology. Some technologies are still in the exploration stage in the library. Virtual reality technology is one of technologies[4-6]. Virtual reality technology is a collection of technologies such as simulation, computer graphics, sensing, and multimedia technologies[7-9]. What are the potential applications of the virtual reality technology in libraries? Besides potential application advantages, what The problems, these are the issues that virtual reality technology must consider in the prospect of library applications.

2. Virtual reality technology
Virtual reality is also called virtual environment, artificial reality and so on. Virtual reality technology generally includes simulation, interaction, artificial, immersive, cognitive, and network communication[10,11]. Virtual reality technology is regarded as a "next generation computing platform". Its purpose is to create a virtual environment that allows users to immerse themselves in and interact with the virtual world. Through special equipment, the environment is simulated as much as possible in the virtual environment. Due to the influence of foreign research on virtual reality, in recent years, the research on domestic virtual reality has also gradually emerged.

3. Application of Virtual Reality Technology
Virtual reality is also called virtual environment, artificial reality and so on. Virtual reality technology generally includes simulation, interaction, man-made, immersive, cognitive and network communication. How to provide readers with personalized, personalized services has become an important goal of library development and reform. Paying attention to the development of science and
technology and actively using high technology to serve users have become an important measure for the library to improve reader services. There are still many deficiencies in the traditional library work flow, such as the flatness of resources and the backwardness of reader service tools.

As a human-machine interface based on nature, virtual reality technology emphasizes people-centeredness and brings immersive feelings to people. Therefore, it is necessary to promote virtual reality technology in the library community. At the same time, the virtual reality technology was used to successfully experience the virtual search room and reading room in the National Library’s “National Digital Library Virtual Tour”, “Virtual Reality Reader Station” and “National Digital Library Online Roaming” to prove the virtual reality. With the development and improvement of computer software and hardware, immersive virtual reality systems will be as popular as computers.

### Table 1. Application of Virtual Reality Technology

| Style          | Field of application               |
|----------------|------------------------------------|
| Internet cafes | National Digital Virtual Tour      |
| National Library’s | Virtual Reality Reader Station |   |
| National Library’s | National Digital Library Online Roaming | |

### 3.1 Scene Construction

The scene construction is the visual scene generation part of the virtual reality technology, that is, constructing realistic virtual scenes. Taking the realistic library as a prototype, designing a library virtual scene with immersive sense is the most important problem that the virtual reality technology solves in library applications. Building a virtual scene in a library can not only realize the scene roaming in the second phase of the national library, but also include the specific work such as the arrangement of books, the adjustment of the racking position, the selection of the reading room location, and the virtual scene. Physical designs are used to facilitate the work of librarians and save manpower and material resources.

Visual scene generation mainly studies how to generate scene models that meet visual fidelity requirements under existing computer processing performance conditions, and users can interact with the scene models that simulate complex worlds in real time. The current mature scene generation techniques mainly include traditional 3D modeling techniques and image-based rendering techniques.

### 3.2 Information Resources Construction

The construction of information resources, that is, the construction of collections, and the use of virtual reality technology can change the status of information resources. Existing information resources include paper and digital resources. On the basis of digital collections, using virtual reality technology to display the knowledge in the book in the form of a virtual world will maximize the educational function of the library. Its preliminary use at present is the three-dimensionalization of information resources, which can effectively change the characteristics of the existing information resources’ planarization and provide readers with three-dimensional resources. The three-dimensionalization of information resources, that is, the processing of virtual reality technology on the physical carriers of information resources, can give readers the feeling of reading books in the real world.
3.3 Reader Service Work

On the basis of strengthening the construction of information resources, how to develop readers and how to provide readers with better services, namely reader service work, has become the centerpiece of the library. In a series of links of reader service work, the application of virtual reality technology will significantly improve the quality of reader service work.

In the era of knowledge economy, with the deepening of the concept of lifelong learning, people are paying more and more attention to the improvement of their own knowledge and quality, and they urgently need various knowledge and information. This provides an opportunity for the development of libraries as one of the institutions for the preservation and transmission of human culture. However, there are also diversified trends in people's access to information and knowledge. Therefore, how the library attracts more readers and maintains its position in the dissemination of information culture has become a very important issue. The use of virtual reality technology can change the impression that the library is boring and cold in the user's mind. For example, the three-dimensional display of information resources and the virtual reality environment of the library building all add interest to reading. This will attract more citizens to enter the library and use the library's information resources.

Virtual reality technology emphasizes immersiveness and interactivity. For the users who come to the hall and those who are not in the hall, these two characteristics exactly match the reader's reading psychology. Because the reader's reading behavior is not only to increase knowledge and expand knowledge, but also a kind of leisure and entertainment. The successful case of applying virtual reality technology in the National Library fully proved the great role of virtual reality technology in attracting readers. Virtual reality technology emphasizes the natural interaction between people and the virtual environment, so that users can obtain their own knowledge in a simple way. This will enable the library to appear in front of readers in a brand new form.

The process of traditional literature retrieval is: When readers need to borrow books, they can first query the circulation status and call number of the books through the computer book retrieval system, and then access the open shelves according to the call number to obtain the physical books. This traditional retrieval method has the problem of obtaining physical books. When a reader searches for a book on the basis of the call number, he or she often wastes a lot of time searching for the bookshelf and the specific location of the book, and sometimes because other readers have not given up the borrowed books. When the book is put back in place, or the librarian does not return the returned book to the bookshelf, it will make it impossible for readers to find books available in the library. The application of virtual reality technology in the library can solve this problem. Virtual reality technology can be used to model the library in three dimensions. The overall architecture of the library and the three-dimensional position of each book are displayed in detail in a three-dimensional environment. The reader can first query the specific location of the desired book, and at the same time generate an optimized navigation path from the current position of the reader to the position of the bookshelf of the corresponding book.

4. Problems in Virtual Reality Technology in Library Applications

4.1 The commercialization of virtual reality technology equipment

The virtual reality technology emerged in the 1990s. It is based on the premise of computer simulation technology. It integrates computers, image generation and display, sensors, measurement and control, communications, multimedia, artificial intelligence, and software engineering. It is an integrated system technology group. The generation of virtual reality scenes that can interact in real time and generate immersion can not only require model construction, but also need tracking technology including space, sound, and vision. Most of the equipment required for immersive VR systems at present is in the experimental R&D phase, and has not yet been commercialized in mass production.
As a result, equipment prices are generally high, which greatly limits the promotion and application of virtual reality technology.

4.2 Problems with Visual Production Technology

Although the application of traditional 3D modeling techniques in libraries can allow readers to walk freely, there are also many problems. For example, the modelling process of complex models is cumbersome and requires a lot of work. At the same time, the change of each observation point or observation direction requires the drawing of complex models or scenes. To achieve real-time roaming, the scene drawing speed cannot be less than 24 frames / second, otherwise users will feel the screen is not smooth, and the current hardware status, only high-performance graphics workstations to meet the above requirements. Therefore, constructing a virtual scene that can realize real-time interaction has the problems of large programming volume and high hardware requirements for the computer.

5. Recommendations for Virtual Reality Applications in Modern Libraries

5.1 Libraries should pay active attention to virtual reality technology

Although the virtual reality technology is in a stage of perfect development, with the rapid development of science and technology, the hardware and software functions of the computer are gradually stronger, and the perfection of sensors and trackers will inevitably reduce the cost of constructing an immersive virtual reality environment. Ultimately, it will go into ordinary families. Since the library uses virtual reality technology to provide readers with more personalized and personalized services, the library should actively follow the development of virtual reality technology and adopt the latest results in a timely manner, instead of waiting for its development and ignoring this technology. When libraries use computers and their network technologies, they do not wait for their maturity, but rather to explore and grow in sync with them. Actively adopting new technologies not only improves the efficiency of library work, but also brings a variety of services to readers. Therefore, for the application of virtual reality technology in libraries, it is also necessary to actively integrate virtual reality technology with various work links in the museum according to the actual conditions of each library, so as to bring more quality services to readers.

5.2 Interactive Use of Two Visualization Techniques

With regard to the problems existing in the two current scene generation technologies, the library can use its advantages and avoid disadvantages, making comprehensive use of these two technologies. For example, based on the traditional three-dimensional modeling technology has a better sense of immersion, the library is suitable for the use of this technology in terms of high interaction requirements, and the application of this technology can reduce the geometric complexity of the scene, that is, reduce the number of realistic graphics that the algorithm needs to render to improve the efficiency of virtual scene drawing and achieve the requirements of real-time interaction. Complexity model simplification, visibility detection methods, textures instead of three-dimensional models, and geometric compression of models can be used. In addition, the use of modeling software such as AutoCAD, 3DS, etc. modeling can save complicated and time-consuming programming process. Just like the National Library’s “Virtual Tour of the National Digital Library” and the “National Digital Library Online Roaming” project, readers can create a sense of realism as if they were visiting the museum in person.

At present, the image-based rendering technology is mainly used for virtual exhibitions. For the funds and technology, the small and medium-sized libraries of the National Library can adopt the panoramic technology. The use of a fish-eye lens or an ordinary camera to collect real-life photos of the library and generate a highly realistic library model is one of the ways readers are familiar with the layout of the library. Especially for the precious exhibitions held in the library, the use of panoramic technologies will realistically “move onto” the Internet and expand the influence of the exhibition, so that readers who cannot visit the exhibition can easily watch the exhibition. This can not only spread
social culture more widely, but also reflect the public welfare of the library and guarantee the right of all citizens to use the library equally.

6. Conclusions
Applying virtual reality technology to the library will help the library provide users with a better experience in resource construction and service business. Through the combination of ultra-high definition resolution smart phones and virtual reality goggles applied to the library, users can realistically browse cultural and historic sites and cultural and historical resources in library databases. The virtual environment is played on ultra-high resolution smartphones, which will undoubtedly bring users more real feelings. After all, the mosaic-style virtual environment cannot replace the actual experience. It can be foreseen that virtual reality technology, as a new hot technology and topic nowadays, will continue its exploration in the application library.

References
[1] T. B. Sheridan. Defining our terms, Teleopera-tors and virtual environments, vol.1, pp. 272-274, 1992.
[2] G. Ahlberg, L. Enochsson, A. G. Gallagher, et al. Proficiency-based virtual reality training significantly reduces the error rate for residents during their first laparoscopic cholecystectomies, American Journal of Surgery, vol.193, pp. 797-804, 2007.
[3] M. Zyda. From visual simulation to virtual reality to games, Computer, vol.38, pp. 25-32, 2005.
[4] M. Moshell. Three views of virtual reality: virtual environments in the US military, Computer, vol.26, pp. 81-82, 1993.
[5] X.D. Yi. Experiencing the library in a panorama virtual reality environment, Library High Technology, vol.18, pp. 177-184, 2000.
[6] M. Prensky. Digital natives, digital immigrants part 1, On the Horizon, vol.9, pp. 1-6, 2001.
[7] D. T. Nicholson, C. Chalk, W. R. Funnell, et al. Can virtual reality improve anatomy education A randomised controlled study of a computer-generated three-dimensional anatomical ear model, Medical education, vol.40, pp. 1081-1087, 2006.
[8] T. P. Grantcharov, V. B. Kristiansen, J. Bendix, et al. Randomized clinical trial of virtual reality simulation for laparoscopic skills training, British Journal of Surgery, vol.91, pp. 146-150, 2004.
[9] B. O. Rothbaum, L. Hodges. A controlled study of virtual reality exposure therapy for the fear of flying, Journal of consulting and Clinical Psychology, vol.68, pp. 1020-1026, 2000.
[10] P. G. Zurkowski. The Information Service Environment Relationships and Priorities, National Commission on Libraries and Information Science, 1974.
[11] J. J. Shapiro, S. K. Hughes. Information literacy as a liberal art, Educom Review, vol.31, pp. 31-35, 2015.