Research on E-learning Scene Construction in Multimedia Service of Digital Library

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Abstract:

In recent years, digital library as the library used multimedia technology to store, display and access to various books and information and the development and extension of the traditional library, has important functions in the era for high speed of information exchange. Broad market space has brought great opportunities for the development of digital library, but the accompanying problems remain to be resolved, and the new technology and theories related to the construction of digital library have become the research focus nowadays. Virtual reality technology, as the most advanced new technology in the field of computer science, can be used to transform the two-dimensional digital library and the plane document information into three-dimensional information, building a more realistic digital learning scene. In order to discuss the application prospect of virtual reality technology in digital library, the research firstly refers to relevant literature to study the significance and characteristics of the digital library and to study the definition, characteristics and types of virtual reality technology. And then virtual reality technology is used to design and construct the e-learning scene in digital library and carry out small range of trial. The users are interviewed to understand their feeling and evaluation of the learning system. The results show that the learning system is advanced and effective for construct the e-learning scene of digital library. Virtual reality technology can be popularized and developed in e-learning environment of digital library field in the future.

Keywords: *Information exchange, Digital library, Virtual reality technology, E-learning environment, Hardware system.*

I. INTRODUCTION

Information exchange has become more convenient and efficient in current society, and the traditional books and documents are no longer able to meet people's demands for knowledge in information age. To digitize the documents, pictures and books in use of the high-speed and highly efficient Internet can better facilitate people's acquisition of information, so digital library emerges as the times require. In the middle of the last century, the research and deployment of digital library in China began to be implemented. Since then, a large number of plans and projects related to digital library have been started and implemented, and the digital library has been accomplished in places including Shanghai and Jiangsu, all of which bring the development and construction of digital library in our country into a new stage and also bring the

informatization a great step forward. With the rapid development of the Internet, digital library can enable us to more conveniently access to greater amount of knowledge at home. The construction of a digital learning scene using virtual reality technology has an epochal significance for the development of digital library. This paper is a study of the integration of them, which means to build e-learning scenes utilizing virtual reality technology.

For the problems raised in this paper, the relevant scholars have conducted a very in-depth research and achieved very good results. In 1945, the American scholars put forward the concept and theory of digital library and proposed to record the collection of books in the library with computers so as to facilitate the students' search query [1]. Digital library is a process of collection and construction of the traditional library, and scanning and photograph are used to convert the books into binary coding and have them stored in computers [2]. The digital library mainly consists of user interface, database system, retrieval system and pretreatment system group. It is distributed on the network and can be used in different computer systems [3]. Virtual reality technology, a multidisciplinary integrated technology, can create a virtual world with the help of computer simulation system and immerse the users into the environment through three-dimensional dynamic scene and entity behavior [4]. Virtual reality technology can enable educational technology to have a great development, because it can create an environment of "self-regulated learning" for students and change the traditional boring teaching mode, making the students acquire knowledge and skills by feeling the information environment [5].

The second part of this paper analyzes the related theories of digital library and virtual reality technology, and introduces their characteristics, functions and theoretical basis. On the basis of theoretical research, the third part discusses the application method and realization process of virtual reality technology in e-learning scene construction for multimedia service of digital library. Through the investigation and data analysis in the fourth part, it is proved that the application of virtual reality technology in the field of digital library is feasible and advanced and that this research direction is of great significance. The fifth part concludes the whole paper and points out the deficiencies of the study, indicating the research direction in the future.

II. STATE OF THE ART

2.1 The Composition and Characteristics of Digital Library

Digital library is a kind of extension and development of traditional physical library under the background of information age. It can not only provide reading, learning and other services of traditional library, but also integrate collection, retrieval and other functions of museums and archives, forming a platform providing comprehensive information access service [6]. Meanwhile, relying on the internet, digital library has no time and space constraints in use, and it can realize seamless connection and intelligent retrieval of multi platforms and multi systems, thus providing a very convenient condition for people to obtain information with tablet computer and smart phone having access to digital library.

Digital library must firstly have a certain scale and volume of resources, including books, documents and pictures; and secondly, network equipment and communication conditions are required to connect to the Internet; finally, the operation of digital library requires a set of standardized software system, mainly used for information creation, management, query and issuance [7].

Digital library has the following four major advantages:

(1) The storage requires small space and does not break easily
Compared with the traditional paper-based media, the digitized storage of file documents with optical disk and hard disk has great advantages, being compact and having the original data properly preserved.

(2) Convenient query
Digital library will be equipped with computer retrieval system, so you can search for your desired information through the keywords, being more convenient than the traditional way of searching by accession number in the library.

(3) Remote delivery of information
Referring to paper books is very time-consuming, and it often takes plenty of time for the learners to go to the library. The digital library makes it possible to obtain information at home through Internet.

(4) Information sharing
A book can only be lent to a person at a time, so the traditional library will purchase several volumes to meet the needs of more people, which resulted in the waste of resources. But all the information of digital library can be shared and used by many people simultaneously, which greatly improves the usage rate of information.

2.2 Definition of Virtual Reality Technology

Virtual reality technology (VR) was originally proposed by Jaron Lanier, the founder of VPL Company in the United States. At present, "VR" is very common on the Internet, television and other media, and virtual reality technology has been used in many fields. It can create a dreamy scene to enhance the interest of the users [8].

In a narrow sense, virtual reality technology is the process to simulate the real world by generating images with 3D computer technology and multimedia sensor interface. The realization of virtual reality technology requires the input and output devices including head mounted display, stereophony and action recognizer, the virtual software system which is used to simulate the dynamic characteristics and interaction rules of the real environment and the computer system which is used to process graphics, sound and other information. The following Fig 1 shows a typical application scenario of virtual reality technology [9].

Fig.1: VR application scenario

2.3 The Characteristics of Virtual Reality Technology

To achieve virtual reality, the 3D modeling of computer technology is required to simulate a virtual world combining multiple sensory including vision, audition, touch and olfaction. This virtual world can be a replication completely showing the real world, and it can also be a completely fictional world, presenting a dreamlike environment [10].

There are many ways to generate and implement virtual reality technology, and the effects are different with different devices. But on the whole, the following three systems are indispensible:

(1) Measurement system: used to recognize the user's behavior, thus achieving the interaction between people and the VR;

(2) Simulation system: used to virtualize and digitize the real world; together with the input and output devices of the computer system, they form the hardware and software of this system;

(3) Presentation system: used to percept and feedback the users' action and convey the visual, auditory, tactile and other sensory information to the users.

There are many different understandings for the definition of virtual reality technology, but its characteristics of immersion, interaction and imagination proposed on the annual world electronic conference in 1993 have been recognized by scholars all over the world, which are the most prominent features of virtual reality technology [11].

2.4 Types of Virtual Reality Technology

Virtual reality technology can be applied in a broad sense and in a narrow sense and according to the interaction and immersion degree of the system, it can be divided into four kind of virtual reality system including desktop system, immersive, enhanced and distributed system [12].

Desktop virtual reality system: it can carry out simple data and graphics processing with the computer as the core, and use the display screen to present the virtual world. At the same time, the users can be equipped with 3D glasses, headphones, touch gloves and other equipment to enhance the interaction between the user and the virtual world. Although wearing 3D glasses, headphones and other equipment, the users are not completely isolated from the real world, unable to ensure full devotion with certain disturbance. However, the advantages of the desktop system lie in its relatively low requirements of hardware and the low cost, making it widely used [13].

Immersive virtual reality system: devices including special VR helmets and gloves are used to provide the users with comprehensively visual, auditory and tactile sensory stimulation. The users are completely isolated from the real world, which can bring a better interactive experience. But the disadvantage is that the expensive specialized equipment including VR helmets and gloves leads to the high cost of the immersive system, which restricts its promotion and application [14].

Enhanced virtual reality system: it can combine the real world and the virtual environment, forming an environment integrating the virtual and the reality.

Distributed virtual reality system: users of different spatial positions can participate in the same virtual environment through the internet, not only achieving the interaction between people and the VR but also promoting exchange and cooperation between people.

2.5 The Application of Virtual Reality Technology in Digital Library

Digitization is the inevitable way leading to development for traditional library. With the development of society, people demand more and more for knowledge and information. We found from the statistical results of TABLE I that China has a large population but with small number of public libraries and limited collection of books [15].

TABLE I. The public library in 2006

INDICATORS	TOTAL	Children's library	The national library	Provincial library	The municipal library	County library
NUMBER OF INSTITUTIONS	2952	94	1	38	343	2570

PRACTITIONERS	54475	1764	1573	7666	13858	31378
THE COLLECTION	69719	2321	3137	18624	18435	29523
CIRCULATION	38151	1881	448	4702	12389	20612
CHECKED	15316	934	31	1318	4594	9373
NUMBER OF LECTURES	35175	1878	158	2972	9280	22765
EXHIBIT NUMBER	10479	502	60	753	2356	7310
NUMBER OF COMPUTERS	157528	4987	3180	15874	33421	105053

It can be seen from the above-mentioned data that the existing number of libraries and books are far from being able to meet people's demand for books, which makes the construction of digital library particularly important, because it can effectively solve the contradiction between people's increasing demand and the limited resources of books.

III. METHODOLOGY

After studying the relevant theories, we believe that it is very reasonable to construct the e-learning scene of digital library with the virtual reality technology, and that it has a good development prospect. Taking into account the cost of the learning system and the promotion difficulty, we firstly choose the desktop virtual reality system which has relatively simple technology requirements and low hardware equipment request.

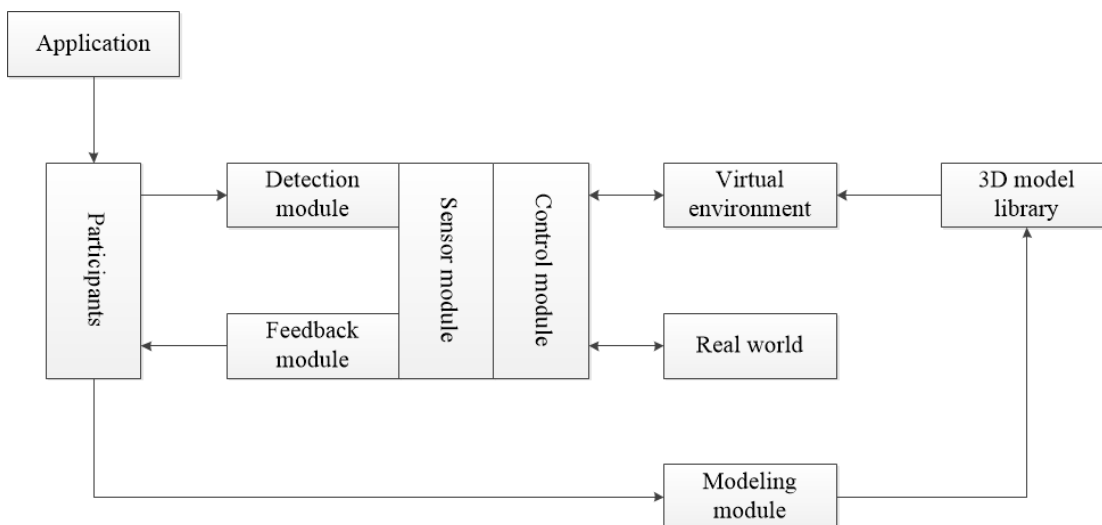3.1 System Hardware Structure

Fig 2: Digital library of hardware system

As shown above in Fig 2, our learning system consists of sensor module, detecting module, feedback module, and database. The action commands from the users will be detected and transmitted through the detecting module and the sensor module; and then the feedback module will feed back the results to the users in the visual, auditory and tactile form. The database stores the virtual information of the real world, from which the computer extracts corresponding data for modeling to present the virtual environment to the users.

3.2 System Software Development

Hardware is the foundation of the construction of our learning scene system and the software platform is the most key point to implement the system. Only with the cooperation of the software platform, we can achieve the desired effect.

The software is mainly developed for the construction of scene-driven 3D graphics and the secondary development of the application function.

The software platform can enable the computer to show the virtual environment more authentically, intuitively and vividly and greatly enhance the user experience without increasing any input of hardware.

The commonly used development language is VRML, a kind of object-oriented programming language, which is mainly used for 3D modeling. It can be can be used in cross platform and has very strong applicability, making it the current mainstream language. The interaction and animation of VRML are time driven, and two kinds of event driving are acceptable to the VRML scene, which are trigger events and direct events written from the external program interface.

The construction of digital learning scenes in digital library should be close to the reality and try to reproduce the real environment as much as possible so that the users can ignore the surrounding situations and be fully devoted to the exploration of knowledge. Therefore, the construction of learning situations should include the following aspects: the library's architectural design, interior design, environmental layout and appearance rendering.

IV. RESULT ANALYSIS AND DISCUSSION

In the third part, the e-learning scene of digital library is designed and constructed. After using for a period of time, all users are surveyed to obtain the information about the users' feeling and evaluation for the interface design, operation mode and resource volume of the digital library constructed with virtual reality technology. The results are as shown in the TABLE II, Fig 3, TABLE III, Fig 4, TABLE IV and Fig 5.

TABLE II. Evaluation of interface design

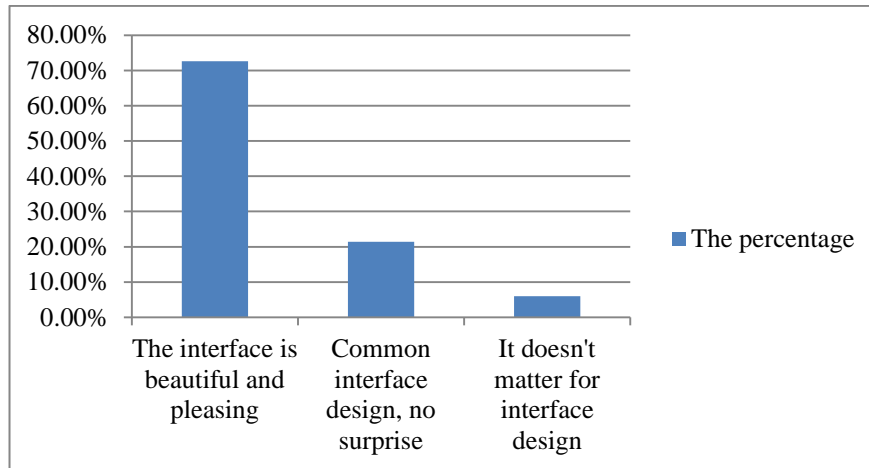| EVALUATION	THE PERCENTAGE
THE INTERFACE IS BEAUTIFUL AND PLEASING	72.6%
COMMON INTERFACE DESIGN NO SURPRISE	21.4%
IT DOESN'T MATTER FOR INTERFACE DESIGN	6.0%

Fig 3: Evaluation of interface design

TABLE III. Evaluation of operating mode

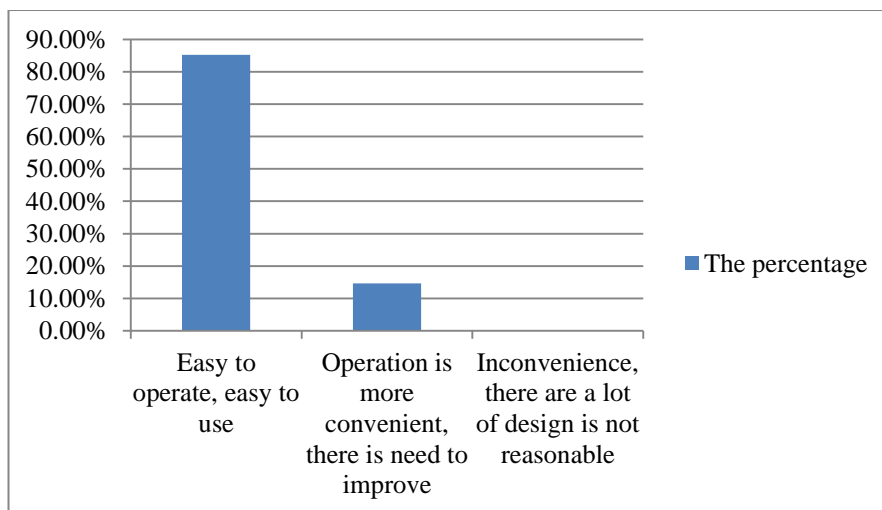| EVALUATION	THE PERCENTAGE
EASY TO OPERATE, EASY TO USE	85.20%
OPERATION IS MORE CONVENIENT, THERE IS NEED TO IMPROVE	14.60%
INCONVENIENCE, THERE ARE A LOT OF DESIGN IS NOT REASONABLE	0.20%

Fig 4: Evaluation of operating mode

TABLE IV. Evaluation of resource dimension

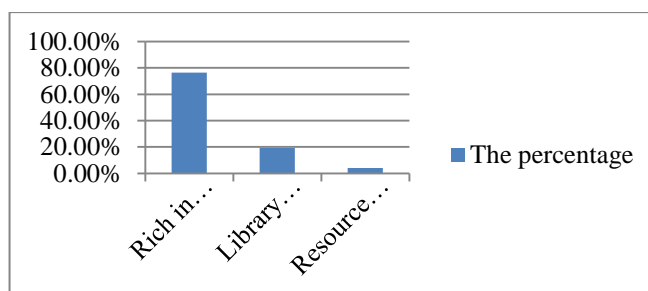| EVALUATION	THE PERCENTAGE
RICH IN NATURAL RESOURCES, THE CONTENT IS COMPLETE	76.30%
LIBRARY RESOURCES AND REAL ABOUT, LITTLE ADVANTAGE	19.50%
RESOURCES ARE LIMITED, SOME INFORMATION QUERY	4.20%

Fig 5: Evaluation of resource dimension

Through the data analysis, it is not hard to discover that compared with the traditional library, the digital library construct with virtual reality technology can provide better learning environments and faster and more convenient information query, greatly improving the learning efficiency. Meanwhile, the immersive feeling brought by virtual reality technology brings can make the users feel the atmosphere of the physical library at home while avoiding some uncertain interference.

Thus, we may safely draw the conclusion that virtual reality technology is effective and advanced to construct the e-learning scene of digital library and that it can be promoted in a wide range to provide good learning environments for users, to improve their learning efficiency and to enable quick access to information.

V. CONCLUSION

The concept of big data has penetrated into all aspects of work and life with data volume having increased dramatically in the current world, and the most directly related library development is facing enormous challenges and opportunities. With the development of social economy, the traditional way of information acquisition is no longer able to meet the increasing spiritual and cultural needs of the people. The construction of digital library taking advantage of high-speed and sharing features of the Internet is an important way to solve this problem. The digital library, based on network with its knowledge base being extendable, has no time and space limits and can achieve cross-library seamless connection and intelligent retrieval, providing very convenient conditions for people to obtain information.

Virtual reality technology can simulate the real environment to realize the interaction between man and machine. By changing the traditional operating mode, it gives the users an immersive feeling and transforms the traditional boring interaction between man and computer. Therefore, to construct the e-learning environment of digital library with virtual reality technology is a popular direction for the development of digital library, based on which this paper studies the feasibility and advancement of the scheme.

Through the research in this paper, we can draw the following conclusions. Digital library, the virtualization of physical library, is bound to emerge and develop. The construction of digital library is conducive to people's obtaining information, improving learning efficiency and meeting the spiritual and cultural needs of more people. Virtual reality technology, used to simulate the real environment, processes information through the computer technology and graphics technology and feeds them back to the users in an integrated sensory form, bringing usage experience close to the reality. The e-learning environment of digital library constructed with virtual reality technology can effectively improve the users' learning efficiency and provide convenient and efficient information retrieval, proving that the system is feasible and advanced.

Although this paper has achieved some achievements, there are still some deficiencies, mainly reflected by the short using time of the newly designed digital library system, small number of users and small volume of the survey data. Therefore, in the future research, we need to deepen the design, expand the application range of the system and constantly improve the usage experience.

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