Research on the Development and Construction of Virtual Reality Teaching Resources Based on Artificial Intelligence

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Abstract—With the rapid development of artificial intelligence, people are beginning to research virtual reality technology. In the teaching process, computer simulations, digital models and interactive media are used to build a complete and functional knowledge structure system that can help students learn and understand the course content better, as well as improve communication and collaboration between teachers and students. The platform makes it easier for teachers and students to discuss, communicate and share resources and information with each other to improve teacher-student interaction and knowledge sharing, and also enables the school to carry out more targeted reform and innovation work and research on course content. Throughout the process, students are able to make good use of virtual reality technology for their learning activities and thus achieve their teaching objectives.

Keywords- Artificial intelligence. Virtual reality. Development and construction of teaching resources. Collaborative filtering recommendation algorithms.

1 INTRODUCTION

With the development of science and technology, the field of education is also constantly reforming and innovating, and the traditional teaching model is no longer able to meet the requirements of the times. As a new, scientific and highly intelligent technology, virtual reality combines computer network with human communication to form a complete system structure to deal with various information resources, and simulates various problems and knowledge points involved in the real world by combining data, images and other means. In order to provide students with an interactive learning environment, and then help students better construction of knowledge. At the same time, in the process of virtual reality teaching resources development and construction, we should also pay attention to the combination of multi-dimensional data, images and other means and methods of teaching, so as to realize the mutual integration and common development between virtual reality technology and traditional education mode, students and teachers and schools [1].

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2 DEVELOPMENT TECHNOLOGY OF VIRTUAL REALITY TEACHING RESOURCES

2.1 Platform Development Model

2.1.1 B/S development mode

B/S development mode refers to the organic combination of advanced computer-aided teaching resources such as virtual reality technology, 3D animation and database, which can be realized by establishing a model that can guide students' learning behavior when constructing virtual real environment scenes, so as to realize the sharing of virtual teaching resources. This mode is mainly through the simulation of the computer environment, and with the help of 3D animation and database to build models, and then transform the real scene into the form of text, sound and graphics, so as to achieve virtual reality teaching. In the modeling process, the real scenes are transformed into images, sounds and other forms through the analysis of different data. In this process, a student-oriented virtual reality teaching platform system is built by combining multi-class modeling techniques and interactive learning methods [2].

2.1.2 Three-layer Architecture

The three-layer architecture mainly refers to the development, construction and application of virtual reality teaching resources. Among them, the layer platform includes three layers: the representation layer, business logic layer and data layer, and its architecture system is shown in Figure 1. The representation layer mainly stores the data of virtual reality teaching, uses the server side and database to realize the relevant information, and establishes the interactive model in the platform. Users can complete all functional operations of the system through the representation layer, including the uploading of learning behaviors and interactive data, and can also retrieve relevant contents in the database, which can also support teaching activities. The business logic layer is to store the data of virtual reality teaching, and users can establish the corresponding models in the platform through the server side and the database, and then realize the relevant functions according to different roles. The work to be done by the business logic layer includes making business rules in the information system and realizing the interactive operation of the system. The data layer mainly manages the information input by users, establishes the model in the platform [3], and converts it into digital files for storage, edits and processes the data in the platform, manages the information input by users, and stores it in the database, and also needs to use virtual reality technology to achieve the desired effect in terms of functions and performance in teaching activities.

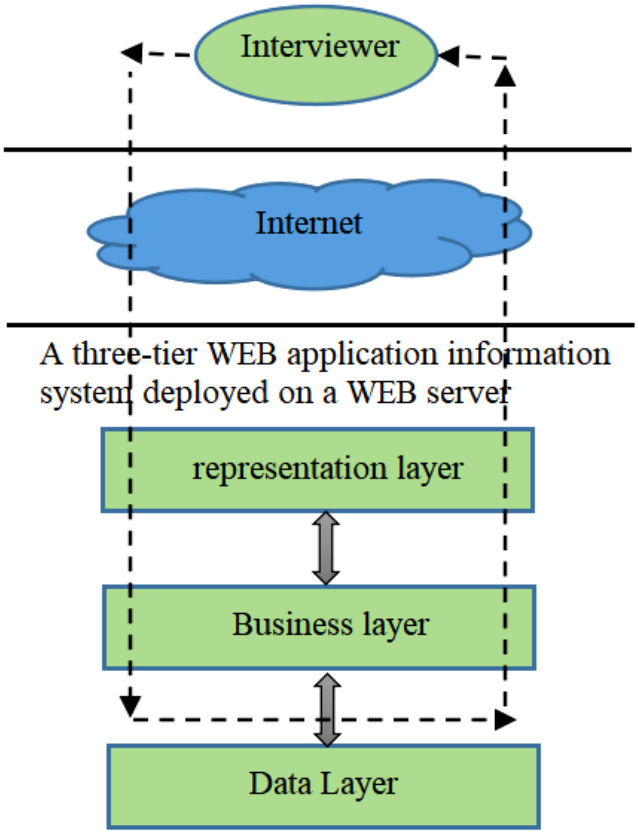

Figure 1. Three-tier architecture system

2.2 Development Platforms and Tools

2.2.1 ASP.NET technology

ASP.NET technology is currently the most popular computer programming technology and is characterized by its power and practicality. The software is colorful, easy to learn and easy to use. It is very user-controlled and user-managed, and gives programmers more freedom to perform complex arithmetic tasks, as well as data sharing and interconnectivity with other databases. It is not only very friendly and convenient in interaction, but it does not need any interface to access the software directly (e.g. SSH, MySQL).

2.2.2 MVC framework technology

In the construction of virtual reality teaching resources development, we can display the required knowledge, images and animations and other multimedia materials. For example, students can take digital tests or other forms of mock exams, which can help students master computer skills

and teachers understand how good or bad the learners are in terms of course content and their own design, so that they can prepare and refer to the relevant work in the future. These are the key points that need to be used in the development of virtual reality teaching resources. MVC mode (Model-view-Controller) is commonly referred to as the "model-view-controller" mode. The whole MVC is composed of Model, View and Controller [4]. It can transform abstract knowledge into images and specific and intuitive graphics, and can also express the designer's design, production and management process of teaching resources through the model. Meanwhile, this mode is also a kind of virtual reality technology. The flow chart of this mode is shown in Figure 2:

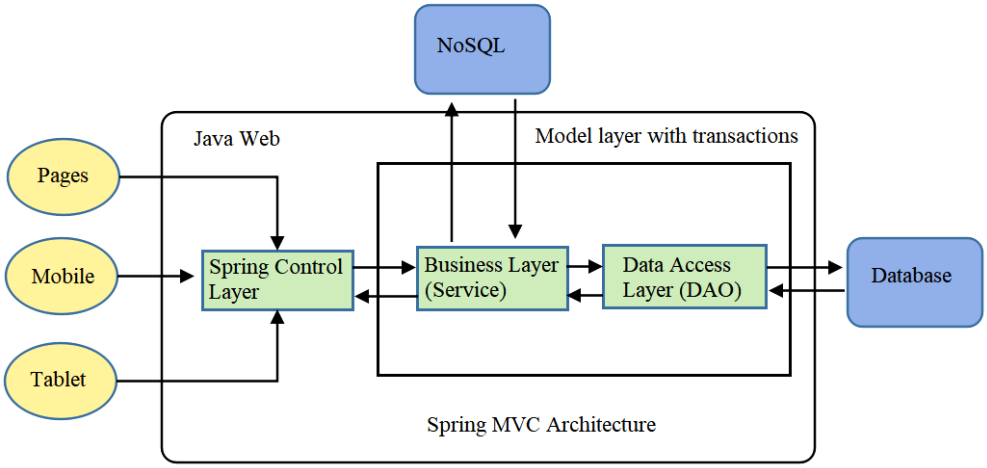

Figure 2. MVC architecture

2.3 Database Technology

Almost all database systems can work with. NET platform combined, for. NET system provides database support and provides a powerful information management platform for NET system. The development of this system chooses SQL SERVER as the database, and uses SQLServer database to realize the development and construction of virtual reality teaching resources. The system has the characteristics of strong interactivity, portability and security, which can provide a reliable support platform for school education management, and can efficiently pass the data business to the surface layer dynamically through the logical processing layer, and present it to the user in the form of page data, so as to realize the association between data and business, which is convenient for the user to manage the teaching process in real time, and at the same time this also provides a good information platform for school informatization construction [5]. The system architecture of ASP.NET combined with SQL SERVER is shown in Figure 3.

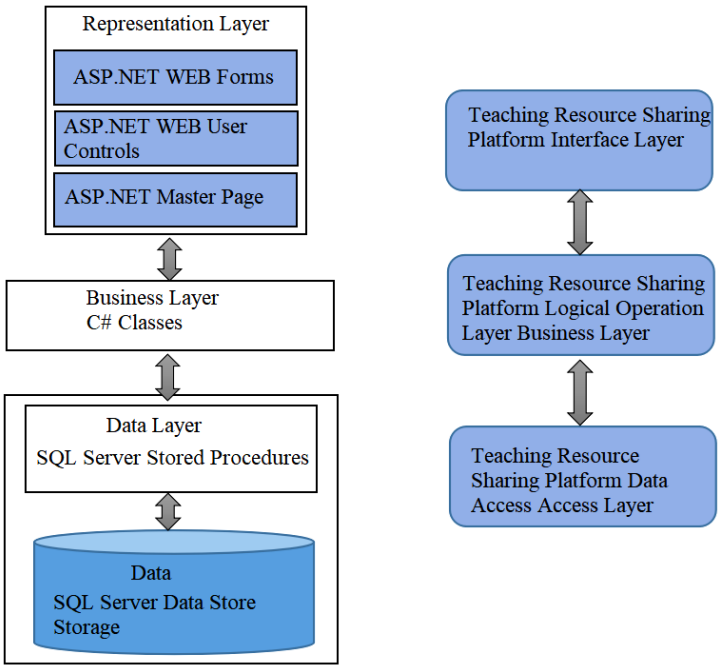

Figure 3. System architecture of ASP.NET combined with SQL SERVER

2.4 Recommendation Technology Based on Collaborative Filtering Recommendation Algorithm

The same filtering algorithm is a probability-based recommendation method, which performs statistical analysis of known data, then combines it with existing information to form a prediction model, and generalizes the prediction model, and then applies it in virtual reality teaching, so that it can realize the mining and processing of unknown data.

We need to measure the similarity of items in the clustering process and search for the similarity of nearest neighbor items, and then proceed to the next step of classification, so as to predict future trends. However, virtual reality technology has just emerged in recent years and has been widely used in various fields. Different from traditional teaching mode, it breaks through time and space restrictions, conventional learning methods and communication modes between teachers and students, which enables educators to participate in various activities in a more flexible and diversified way. At the same time, because of its colorful and easy to operate interactive functions, so more and more people pay attention to it. Two commonly used similarity calculation formulas are as follows: Pearson correlation coefficient and cosine similarity [6].

2.4.1 Pearson coefficient

Pearson correlation coefficient is a similarity calculation method based on correlation coefficient, which is developed on the basis of virtual reality technology. As the computer network, modern communication industry, multimedia education and other fields require increasing artificial

intelligence computing ability, the traditional teaching model is difficult to meet students' learning interests, but through the virtual reality system assisted teaching can make teachers and students more closely together, and can make it better for the classroom service [7]. Suppose U is the set of users who rate item i and item j, then Pearson correlation coefficient Formula is shown as (1) :

$$sim(i,j)=\frac{\sum_{u,U}(R_{u,i}-\overline{R}_i)(R_{u,j}-\overline{R}_j)}{\sqrt{(\sum_{u,U}R_{u,i}-\overline{R}_i)^2}\sqrt{(\sum_{u,U}R_{u,j}-\overline{R}_j)^2}} \quad (1)$$

2.4.2 Similarity of cosine

Cosine similarity refers to the difference between virtual reality teaching resources and real teaching content to a certain extent. In different types of courses, students may have multiple views on the same knowledge point. For example, learners believe that the teacher can focus on understanding and mastering a certain knowledge or skill when explaining, while the teacher needs to focus on a specific aspect of difficult problems when teaching. Assuming that item i and item j are two n-dimensional vectors, the similarity of the two items is calculated by the Angle between the two vectors. For the m×n scoring matrix, the item and the item calculation formula are expressed as similarity as shown in Formula (2):

$$sim(i,j)=\cos(\vec{i},\vec{j})\frac{\vec{i},\vec{j}}{|\vec{i}|\cdot|\vec{j}|} \quad (2)$$

2.4.3 Corrects cosine similarity

In virtual reality teaching, the correction of cosine similarity needs the help of image processing and animation rendering functions. First of all, the students should be grouped into several groups according to the different characteristics of each person. Then, digital signal synthesis technology is used to realize cosine similarity correction, and the cosine similarity of the students is corrected to be positive [8]. Then, virtual reality technology is used to analyze these data. Finally, multi-stage comparison judgment is completed by auxiliary means such as multimedia playback and sound editing, so as to achieve the purpose of optimal judgment.

The implementation of collaborative filtering recommendation system depends on user rating and other behaviors. It mainly classifies some problems that may exist in users' knowledge through the analysis of user data. Meanwhile, sparse scoring matrix and bottleneck of recommendation speed are also common problems encountered by collaborative recommendation system. Therefore, the clustering method is used to divide the crowd into several categories and classify similar categories, so as to achieve the clustering of user data and recommend different knowledge for each category. In this way, collaborative filtering recommendation can be realized. The specific recommendation algorithm is shown in Formula (3) :

$$sim(u_1,u_2)=1-\frac{\sqrt{\sum_{u\in U}(r_{u_1,i}-r_{u_2,i})^2}}{commonItems} \quad (3)$$

In the collaborative filtering algorithm, users are ultimately recommended to those who are at the top of our ranking. In order to get the ranking, it is necessary to perform an estimated score for each item in the recommendation system according to the similarity matrix. Specific calculation Formulas (4) and (5) have been explained in detail.

$$pred(u,i)=\frac{\sum_{i\in ratedItems(u)}(sim(u,v)*r_{u,i})}{\sum_{i\in ratedItems(u)}sim(u,v)} \quad (4)$$

$$pred(u,i)=\bar{r}_u+\frac{\sum_{b\in N}(sim(u,v)*(r_{v,i}-\bar{r}_v)}{\sum_{b\in N}sim(u,v)} \quad (5)$$

3 VIRTUAL REALITY TEACHING RESOURCE DEVELOPMENT PLATFORM IMPLEMENTATION

3.1 Platform user management implementation

The platform user management of virtual reality teaching system is mainly to carry out unified, normative and authoritative authentication for teachers and students with different authority, so as to realize the mutual communication between different levels of personnel. For example, a super administrator can be set up in the virtual training room to maintain the account. The administrator is responsible for the information transfer between background programs and foreground functions, and the ordinary user includes the login password of registered members and other related operations. In addition, it is also necessary to manage the registration authority and identity authentication. Such a management mode can avoid the inconsistency between the account and password, and it can effectively prevent criminals from using virtual reality technology to commit crimes [9].

3.2 Teaching Resources Upload Implementation

The main purpose of uploading teaching resources is to provide students with a platform on which teachers can show the knowledge points and difficulties they need to learn. In this way, students can not only improve their understanding of theoretical knowledge, but also learn more about their professional development, and improve their learning enthusiasm to a certain extent. For example: Virtual reality involves some common problems, relevant cases, teaching content and other aspects that need to upload files and materials. These information are resources that can be obtained and consulted by the school staff. However, when uploading files, the information needs to be classified and the content format and data type should be adjusted accordingly. This can better improve students' interest in learning.

Teaching resource information to be stored in the database includes:

Resource name, resource category, resource remarks, resource uploading time, resource uploader, and resource sharing are the main contents of virtual reality teaching. Among them, the most important is to combine virtual reality technology with traditional classroom to build a platform that can meet the learning needs of different groups, facilitate teachers to summarize knowledge points and students to explore and communicate independently. The specific operation process is shown in Figure 4:

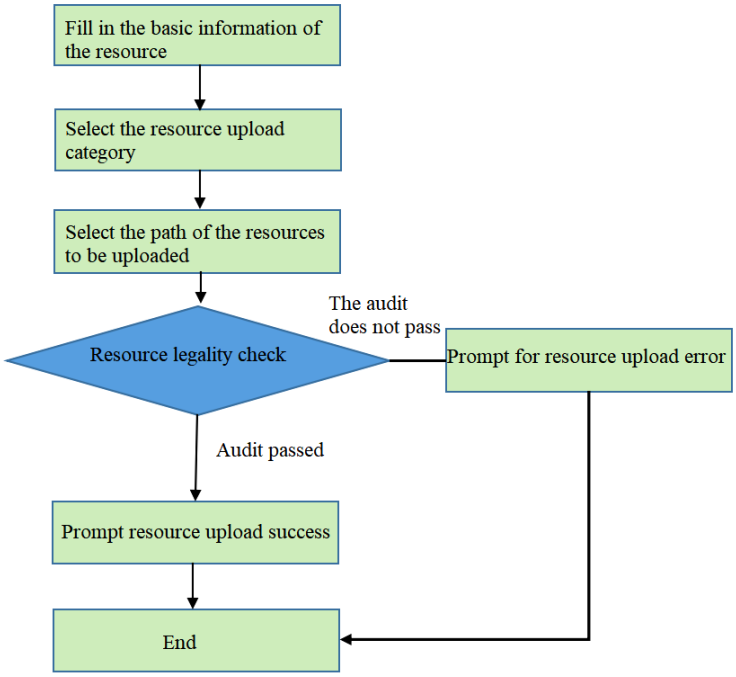

Figure 4. Basic information processing flow of teaching resources

3.3 Teaching Resources Recommended Implementation

In the learning process of virtual reality teaching resources, students can choose the appropriate course content according to their own needs, and teachers can organize and summarize the feedback information of students. First of all, as for the knowledge points of the course, because everyone has different interests, hobbies, personality characteristics and other factors, it is necessary to integrate the relevant knowledge points according to the actual needs of different users in teaching, so as to meet the different requirements of different students. Secondly, teachers can sort out, summarize and analyze the feedback information of students according to the actual situation, and summarize and sort out the relevant data, so as to provide reference for the establishment of virtual reality teaching resources in the future [10].

4 SYSTEM TEST

4.1 Platform Test Environment

The Web server uses DELL; CPU: Xeon E5-2403 1.8GHz; The memory is 4GB; The hard drive is 300GB;

The database server is DELL; The CPU is Xeon E5-2403 1.8GHz; The memory is 4GB; The hard disk is 5TB;

Hard disk :5TB

Operating system: The Windows Server 2008 OEM operating system has been pre-installed on all servers and the IS 8.0 service has been installed.

4.2 Platform Performance Test Cases

In this paper, a combination of white box test and black box test is adopted to obtain the performance test of the platform, as shown in Table 1:

Table 1. Performance test cases

Use Case Number	Test Content Platform Configuration Test	Test Results
XNCS-001	Single Platform Response Time Test	Able to successfully configure the system on Windows 2003/2008 system
XNCS-002	Multi-user platform response time test	Response time of single user resource browsing teaching resources is within within 3-5S
XNCS-003	Platform security performance test	Response time for multiple user resources to view educational resources is within Within 3-5S
XNCS-004	Platform data backup test	Illegal users cannot login to the platform
XNCS-005	Test Content Platform Configuration Test	Automatic database backup according to user settings

4.3 Conclusion of Test

This paper realizes the development of virtual reality teaching resources by using the method of combining white box test and black box test. This method can effectively detect students' learning situation and existing problems in knowledge construction, and can also provide reference for future teaching.

5 CONCLUSION

To sum up, with the continuous development of network technology, virtual reality teaching resources are playing a more and more important role in the field of education. It is the necessary and necessary condition for students to learn knowledge in the learning process. In the traditional

sense, teachers are the main body in classroom teaching. Nowadays, the society has higher quality and more comprehensive requirements for talents, which makes the school must change the previous single and immobilized mode to cultivate highly skilled application-oriented talents. At the same time, more practical problems need to be solved into the field of education, so as to achieve the goal of diversified development of education and provide students with a better learning environment and platform.

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