



Networked Teaching System of College Basketball Course Based on Virtual Reality

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Abstract. Aiming at the poor performance of the traditional college basketball course networked teaching system, with the purpose of improving the performance of college basketball course networked teaching system, a virtual reality-based college basketball course networked teaching system is designed. Through the user registration module design, the question answering module design and the student user management module design, the hardware design of the system is completed, and the software design of the system is completed through the management of college basketball course resources and the design of the student basketball course homework management program. The design of the networked teaching system of the course. The test results show that the network teaching system of College Basketball Course Based on virtual reality has reached the design requirements and has higher performance.

Keywords: Virtual reality technology · Basketball course · Network teaching · System performance

1 Introduction

With the continuous development of network technology, the continuous development of information-based teaching equipment, teaching methods and teaching resources are becoming increasingly rich. The traditional teaching mode dominated by teachers can not adapt to the current teaching environment of higher education. It has become an inevitable requirement of education reform to widely apply information technology to the whole process of teaching and learning, so as to improve teaching quality and optimize talent training. The cultivation mode has positive significance [1–3]. In the information-based teaching environment, virtual reality technology based on information technology and personalized learning has emerged. After a period of practice and discussion, people have a clearer understanding of virtual reality technology. Virtual reality technology has not received much attention and in-depth practical research in Chinese physical education. Today when individualized teaching is advocated, research on the value and implementation strategies of virtual reality technology in the teaching of public physical education in colleges and universities is of great significance for deepening the reform of college physical education and improving teaching quality [4–6].

With the continuous deepening of college physical education reform, coupled with the profound changes in college enrollment structure, the original physical education model no longer meets the requirements of higher education for talent training. The construction of new teaching mode has become an important link in the reform of physical education, which can promote the reform of physical education, improve the quality of classroom teaching and cultivate qualified talents needed by the society. And so on. The essence of virtual reality technology is to use information technology and network technology to change the learning environment, make the learning process more personalized, give students more time and space for independent learning, promote classroom communication and interaction, and facilitate a good teacher-student relationship. Construct. The efficient use of network resources is conducive to promoting teachers' development and expansion of curriculum resources [7].

The goal of training students in Colleges and universities is to cultivate labor skilled talents who meet the needs of economic and social development. From the perspective of employment, it puts forward more realistic and specific requirements for students' operational ability, physical quality and physical health. Therefore, in the process of practical teaching, higher education pays more attention to the training of students' hands-on ability and labor skills, and pays attention to cultivating students' will and quality of hard work. As far as public physical education is concerned, the tasks of the class also focus on quality training such as strength, so that students have a stronger physique and cultivate students' tenacious will.

Miller et al. [8] described the functions of the applicant processing system designed for the virtual hotel chain. The system described in detail in the case includes a web form in which applicants can complete and submit work applications. The system also includes a desktop application for hotel managers and human resources departments to track applications and process job offers. The webform and desktop applications share a centralized database. This case is based on an actual system development project completed by a student for a real hotel chain. The materials in the case can be used for system analysis and design, database management, and web design courses. Teaching notes, including entity relationship diagrams, data dictionaries, data flow diagrams, job application forms, prototype screenshots and discussion questions are available on the JISE website.

Based on the above background, this article applies virtual reality technology to the design of the college basketball course networked teaching system. Through the user registration module design, the question answering module design and the student user management module design, the hardware design of the system is completed, and the college basketball course is managed. Resource and student basketball course homework management program design, completed the software design of the system, and completed the networked teaching system design of college basketball courses according to the hardware design and software design. And the effectiveness of the system is verified by simulation experiments.

2 Hardware Design of Network Teaching System for Basketball Course in Colleges

2.1 Design of User Registration Module

Student user registration is an important part of the college basketball course networked teaching system. Student users must register with their student ID to log in to the system. The student registration flowchart is shown in Fig. 1.

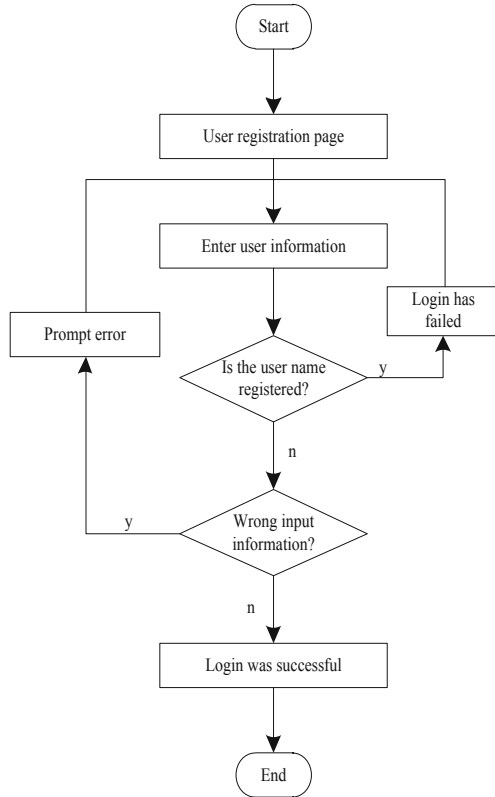


Fig. 1. Flow chart of student registration

After students enter the login page, click the “registration account” button on the page to register users.

The student’s student ID is the only identifier that distinguishes the student. After entering the registration page, the student user needs to use the student ID as the user name to register. When submitting the information, the system will check whether the user name has been registered. If the user name is registered, it will prompt Registration failed, need to register again.

If the input information is wrong, such as the wrong e-mail address, a prompt will be given and can continue to register; if the registration is successful, will be prompted to register successfully. Click the login system connection to return to the system login page for user login.

2.2 Question Answering Module Design

The question and answer section provides a platform for students to communicate with teachers and students. Students who have questions during the course of learning basketball can use this board to ask questions and consult the teacher’s answer. At the same time, they can check the questions raised by other students and the answers of teachers in this plate [9]. After the student user submits the relevant question information through the question page, the information will be submitted to the teacher background question answering management module. The teacher user can perform corresponding management operations on the question, and can review the questions raised by the student user. After the review is passed and responded, Students will be able to see the corresponding information in the question answering module, and the question answering flowchart is shown in Fig. 2.

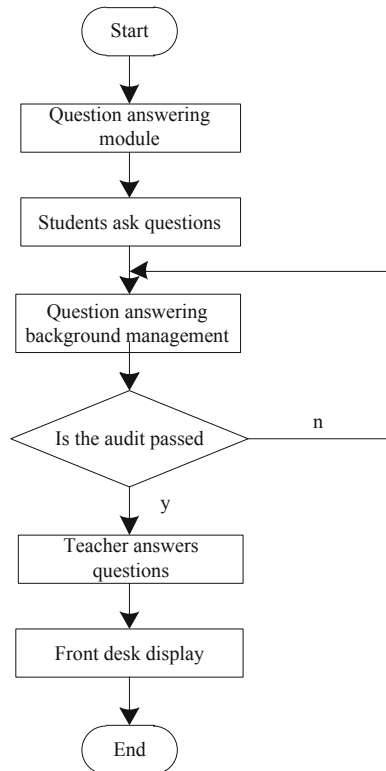


Fig. 2. Question answering flowchart

In the question answering module, student users can view, search and ask questions by category. The key operations are as follows:

Step1: View questions by category: In the Q&A module, student users can view all question information or view question information by real question type. The key operation for viewing by real question type is to pass the `type_name` of the real question type and receive the `type_name` value of the classification page.

Step 2: search question: in the question answering module, student users can search for relevant question titles through the search function, and set the record set first;

Step3: Asking questions: In the question answering module, student users can ask questions to the teacher by entering the subject, content and selecting the question type.

In the question information submitted by students, the hidden field `passid` is set to limit the display of question information in the question answering interface. By default, `passid` is 0, that is, the audit authority is 0 (failed). Only after the teacher user reviews and sets the permission to 1 (that is, passed), it can be displayed in the system question answering interface.

2.3 Design of Student User Management Module

In the student user management interface, teachers can operate as follows:

Step1: Student user search function: Teacher users can enter the name of the student user in the search bar of the student user management interface to search.

Step2: student user query function of each class: in the student user management module, the teacher user can query the information of all student users in each class in the list by viewing the class list and clicking the class list, and carry out corresponding management operation on the student user information. The main key technology to realize this function is to use the class name as the `class_The name` field information is passed as a URL parameter, and the class is passed through the URL when the record set is established on the receiving page_ The name field information filters the database records and displays them.

Step3: Basic student user management operations: In the student user management interface, the teacher can add, update and delete student users accordingly. Since student users use their student ID as their user name when registering, they can distinguish different users. Therefore, in the update operation, the user name and student ID of the student user are set as “read-only” attributes.

Through the user registration module design, question answering module design and student user management module design, the hardware design of the system is realized.

3 Software Design of Network Teaching System for Basketball Course in Colleges

3.1 Management of College Basketball Curriculum Resources

Students choose courses including watching course videos, browsing course content, downloading courseware, etc. [10]. According to the constructivist learning view, students are the subject of cognition, that is, students can actively learn. Each student will build his own understanding of new knowledge based on his own original experience, and re-understand and re-understand new knowledge, coding. “Students should choose the curriculum resources uploaded by teachers with their own cognitive structure, so as to improve their learning efficiency”. The process of course resource management is shown in Fig. 3. And for the sake of security, only the login users can use the teaching resources uploaded by teachers to learn.

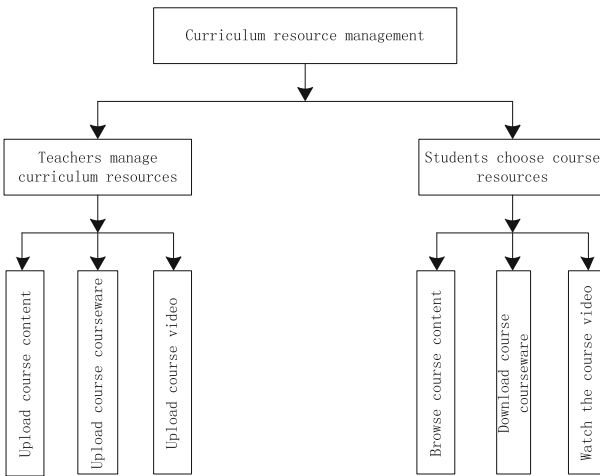


Fig. 3. Course resource management flowchart

Curriculum resource management includes two parts: teachers manage curriculum resources and students choose curriculum resources. Teacher resource management is to provide students with various curriculum resources through the system, including course video, course courseware, course schedule, course assignment, etc. According to the behavioral learning theory, the curriculum resources uploaded by teachers should create a positive learning atmosphere for students to maximize the positive behaviors of students and eliminate negative behaviors. The curriculum resources uploaded by teachers should follow the cognitive order of students, Sort from simple to difficult, shallow to deep. Curriculum resources should be combined with students’ learning experience as much as possible to improve students’ understanding of curriculum resources and improve students’ autonomous learning ability.

3.2 Design of Homework Management Program for Students' Basketball Course

The homework management module mainly has the function of teachers assigning homework and the function of students completing homework. The teacher assignment process is shown in Fig. 4.

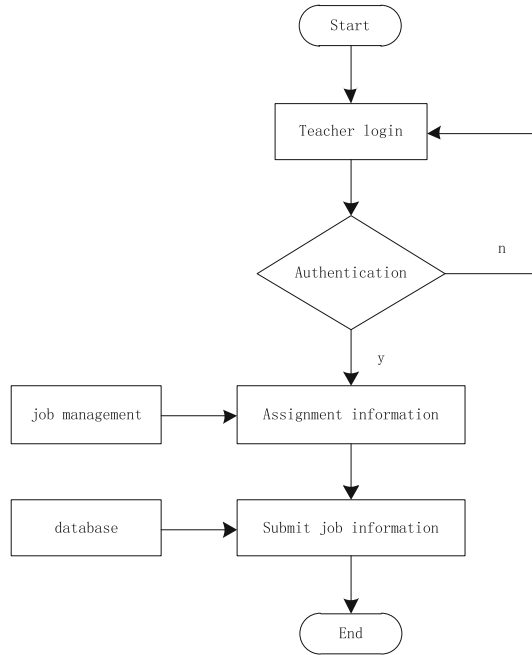


Fig. 4. Flow chart of teacher's assignment

The teacher assigns the course homework according to the selected course. Assignment of the homework includes two parts: filling in the overall information of the homework and the detailed information of the homework. The overall information of the assignment includes: the course ID of the assignment, the name of the assignment, the submission time and the deadline. The detailed information of the assignment is the topic design of the assignment. There are four kinds of homework questions: single choice questions, multiple choice questions, short answer questions and application questions. The information of single choice questions and multiple choice questions should include the content of the questions, options, question scores and standard answers, while the information of short answer questions and application questions should include the content of the questions, reference answers and question scores.

Figure 5 shows the process of students completing their homework.

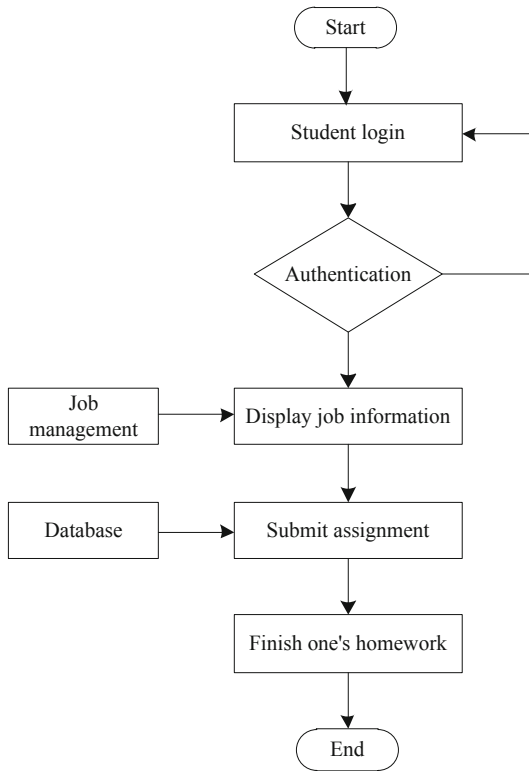


Fig. 5. Flow chart for students to complete homework

Operations on homework information should include selecting courses, viewing homework, completing homework, submitting homework, viewing corrections, etc. In the answer page, students need to complete the four types of questions respectively. Among them, single-choice questions can only choose only one item; multiple-choice questions need to choose at least two; application questions can view the files uploaded by the teacher or by themselves Upload files for teachers' reference. Marking homework belongs to the function of teacher users. According to the completion of homework, the teacher selects a student to grade. Among them, single-choice questions and multiple-choice questions have been automatically corrected by the system. The task for teachers to complete is to mark short answer questions and application questions. Teachers can grade according to the reference answers, and the score of teachers is less than the score of questions. For application questions, teachers can download the files uploaded by students for detailed evaluation.

4 System Test

A perfect college basketball course network teaching system, in order to make the system run normally, testing is an essential part. Although strict technical review has been adopted in the development process of the network teaching system of basketball course in Colleges and universities, it is inevitable to leave errors. If the errors and loopholes in the system are not found and corrected before they are put into operation, these loopholes and errors will directly affect the operation of the system. If the problems are corrected after they occur, the cost of manpower, material resources and so on will be required Greatly improved. Unit testing and functional testing are part of system testing. Unit testing is to let developers know that the code is executing correctly, and verifying whether the code performs its intended effect is the goal of functional testing. Unit tests are written from the perspective of the developer. The goal of each test is that the output we get is what we want when we enter it. What is written for the user is called a functional test. The purpose of the test is that the system runs to meet the user's requirements. The so-called software testing is mainly aimed at two aspects of function and performance. According to its process plan and related test tools, the results are analyzed and resolved accordingly. In summary, if want to improve software quality, many related software tests are indispensable.

4.1 Testing Environment

The test requirements of the system mainly include hardware requirements and software requirements. The specific configuration is as follows:

- Hardware requirements.

Test terminal: Recommend Intel Pentium 4 or higher processor, 8 GB memory or more, hard disk 300G or more, support USB interface, support multiple network access methods.

- Software requirements.

Test software: loaderunner.

Test browser: IE, firefox.

Test record: excel, Bugzilla.

4.2 System Performance Test

4.2.1 Concurrency Testing

The test scenario is shown in Table 1.

Step 1: first, log in to the system with the admin account;

Step 2: click “teacher management” on the function bar to enter the teacher management interface;

Step 3: click “new teacher” on the interface, and enter the teacher information “Zhang San, 45, male, 117124367@qq.com,13545075826”;

Step 4: click Submit;

Step 5: click "log out" on the function bar to put forward the system.

The test results are shown in Tables 1, 2, 3 and 4 below.

1. The test data under simulated 200 users are shown in Table 1 below.

Table 1. Performance of 200 users under the same time

Test items	Pre test data	Data after test
IO Occupancy rate	0%	10%
Memory usage	100M	300M
Packet increase	1224	1224
Test average feedback time	3.1	3.1
Test maximum feedback time	4.5	4.5

2. Simulate the test data under 500 users, as shown in Table 2 below.

Table 2. The performance of 500 users online at the same time

Test items	Pre test data	Post test data
IO Occupancy rate	0%	50%
Memory usage	100M	469M
Packet increase	2235	2235
Test average feedback time	4.7	4.7
Maximum feedback time for testing	5.8	5.8

3. The test data under simulated 800 users is shown in Table 3 below.

Table 3. Performance of 800 users under the same time

Test items	Pre test data	Post-test data
IO Occupancy rate	0%	60%
Memory usage	100M	538M
Packet increase	3421	3421
Test average feedback time	4.9	4.9
Maximum feedback time for testing	5.3	5.3

4. Test data under simulated 1000 users is shown in Table 4 below.

Table 4. The performance of 1000 users online at the same time

Test items	Pre test data	Post-test data
IO Occupancy rate	0%	54%
Memory usage	100M	634M
Packet increase	45231	45231
Test average feedback time	6.0	6.0
Maximum feedback time for testing	8.2	8.2

4.2.2 Response Speed Test

In order to better test the performance of the system under high load, the system uses the Loader Runner tool to create multiple groups of different numbers of users to perform simultaneous operations and record the system's response time. The items tested in this test are: login to the system, online communication, and online teaching. The test results are shown in Tables 5, 6 and 7 below.

Table 5. Landing system test

Landing system test case			
Precondition	Normal login interface		
Test target	Understand the performance of the system under multi-user login at the same time		
Method	Use the LoadRunner tool to simulate multi-user login scenarios and execute test scripts		
Number of concurrent tests	Average time to complete business(s)	Maximum time spent on business completion(s)	Average use of network packets
30	1.045	2.345	67
60	4.231	6.892	68
200	5.123	9.352	100

Table 6. Online AC test

Online communication test cases			
Prerequisite	Normal login system		
Test objectives	Understand the performance of the system in simultaneous online communication with multiple users		
Method	Use the LoadRunner tool to simulate multi-user online communication scenarios and execute test scripts		
Number of concurrent tests	Average time to complete business (s)	Maximum time spent on business completion (s)	Average use of network packets
30	1.235	2.231	64
60	3.123	6.234	66
200	5.123	11.233	79

4.3 Test Conclusion

After the performance test of the network teaching system of College Basketball Course Based on virtual reality, the system has reached the standard of design requirements. Under the condition of less than 200 users, the system has stable speed and good perfor-

Table 7. Online teaching test

Online teaching test cases			
Prerequisite	Normal login system		
Test objectives	Normal login system		
Method	Use LoadRunner tools to simulate multi-user online teaching scenarios and execute test scripts		
Number of concurrent tests	Average time to complete business (s)	Maximum time-consuming business completion (s)	Average use of network packets
30	1.892	3.123	72
60	5.122	8.213	75
200	6.781	13.112	129

mance, but when more than 200 users are online at the same time, the system is inefficient and slow to respond. At present, the optimization is carried out in the following ways:

1. Database access performance optimization

Establishing, opening and closing links are commonly used by users to access database resources. In the process of these operations, information exchange is necessary to ensure that the database can pass the authentication. When users open and close such operations, hibernate can use the connection pool to change the impact of these operations on the system. The user's database connection is stored in the connection pool, and the user takes it out when needed, and puts it back when not needed, and then waits for the customer to use and request it again. However, the carrying capacity of the connection pool is also limited. If the connection pool is still required to be used when the connection pool is fully loaded, this will have a great impact on the function of the connection pool.

2. Connector optimization

In the Tomcat server, a thread needs to be opened for each request to serve it. When there are too many users, due to the limited number of threads, it is necessary to wait for the completion of other business processing before continuing to use the thread, which results in slow user response. In order to ensure that the system is connected quickly, it is necessary to first recommend a connection pool with sufficient number of connections. This pool can well support the requirement that the system is online with 1000 people at the same time. Therefore, the system defines the number of connection pools as 1000, which greatly exceeds The original 800, but from the test results, it does solve the current problem of connection thread tension.

5 Conclusion

This paper proposes a networked teaching system for college basketball courses based on virtual reality. Through the hardware design and software design of the college basketball course networked teaching system, the networked teaching of college basketball courses is realized. The test results show that the system has high performance.

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