



Design of Online Teaching System Based on Clustering Algorithm

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Abstract. According to the poor online teaching effect, this paper proposes the online teaching system based on clustering algorithm, optimizes the structure configuration in the system hardware, improves the system software module function, screen and evaluate the teaching information combined with the clustering algorithm, and optimizes the teaching management steps. Finally, the design system has highly practical application and can improve the online teaching effect of garment rendering drawing course.

Keywords: Clustering algorithm · Clothing drawing · Online teaching · Information screening

1 Introduction

At present, with the extensive development of computer technology, it is playing an increasingly important role in the field of education. In this case, the continuous deepening and development of online teaching mode has given birth to many online teaching systems, which provide convenience for students' online learning. For example, Zhou-jumping designed a computer-aided classroom teaching system based on data mining to solve the problems of poor information utilization, low intelligence and personalization in the existing computer-aided teaching mode. The system module design adopts three-layer b/s structure. Using information collection module to collect and store student information data; The user information preprocessing module preprocesses the information data as the data of the personalized data source in the personalized data analysis module. Through the personalized data analysis model, the data mining parallelization technology is adopted, the data clustering center is updated through the K-means clustering algorithm and the map reduce parallel computing framework, the clustering performance index is minimized, the data in the personalized data source is effectively mined and analyzed, and the analyzed conclusions are regularized to generate teaching rules, which are presented to students through human-computer interaction, so as to improve the intelligence and personalization of the teaching system [1]; Gaoweimei designed a computer-based Chinese network assisted instruction system. Firstly, the system process, overall framework and network structure are comprehensively analyzed. Secondly, the system function modules are explored in detail based on the three users of

students, teachers and administrators, and the system design is completed [2]; Zhangliqun designed an online auxiliary teaching system for music courses based on ZigBee. The hardware of the system includes a transceiver, a sound quality sensor and a resource manager. A DIN rail type online auxiliary teaching area is added to the transceiver to improve the integration between the transceiver and other devices; The default output current of the sensor is 15 mA, and the working voltage is $dc12-24\text{ V} \pm 10\%$. The sensor is connected to other hardware through the two-wire mode. The memory of the resource manager is 256 μg , and the CC2430 chip is added to improve the sensitivity of the system. Through logical storage, information management, shared processing and online puzzle solving, the software flow is realized, so as to complete the design of the teaching system [3].

With the development of campus informatization and “Internet+”, universities have gradually transformed from digital campus to “smart campus”. Smart campus is a new stage of information development of colleges and universities, which reflects the deep integration of technology and business, and the high integration of resources and application [4]. With the help of a new generation of information technology, the class can fully perceive the work, study, life and other scene characteristics of campus groups, so as to establish an intelligent teaching environment and a comfortable living environment. At the same time, the online teaching system of the clothing renderings mapping course should unify the information portal and identity authentication, integrate the data scattered in various departments, and provide cross-departmental comprehensive information services such as personnel, teaching, students, scientific research, assets and equipment and finance. After the staff pass the identity certification, they will have the corresponding authority, and they can carry out teaching and scientific research management, administrative office and service information inquiry [5]. In addition, Smart Campus has realized the goal of integrating digital teaching resources, created an active, collaborative and exploratory digital learning environment, established a new teaching mode of teacher-student interaction, and can better serve the teaching of clothing renderings drawing courses. Based on this paper, this paper proposes an online teaching system design method based on the clustering algorithm. In order to better carry out online teaching of clothing rendering and drawing course, this paper introduces clustering algorithm into this field, and designs an online teaching system based on clustering algorithm. By optimizing the system hardware configuration, improving the system software module function, combining the clustering algorithm to screen and evaluate the teaching information, optimize the teaching management steps, and complete the design of the whole system.

2 Clothing Rendering Drawing Course Online Teaching System

2.1 Hardware Configuration of the Course Online Teaching System

The system is mainly designed to realize online teaching, and the system uses DOT NET and Web Service to provide an application interface for system integration and data integration. The front-end implementation of the system requires a generous and beautiful interface, and a friendly and convenient user operation. The main objectives of the system design are the following: to meet the functional needs of the online teaching

system [6]. Students can easily enter the front-end of the system and conduct information browsing, online examination, online communication, job submission and other functions; the system design functions should be simple, easy to use and practical. Excessive complex system will bring users into mistakes. The goal of the system design is to adopt the current more common online teaching process to achieve, so that the system is easy to use, simple and powerful [7]. The system design should pay attention to the principle of system scalability and reusability; the system design functions need simple operation, beautiful interface and good user experience. Design the system network deployment, as shown in Fig. 1.

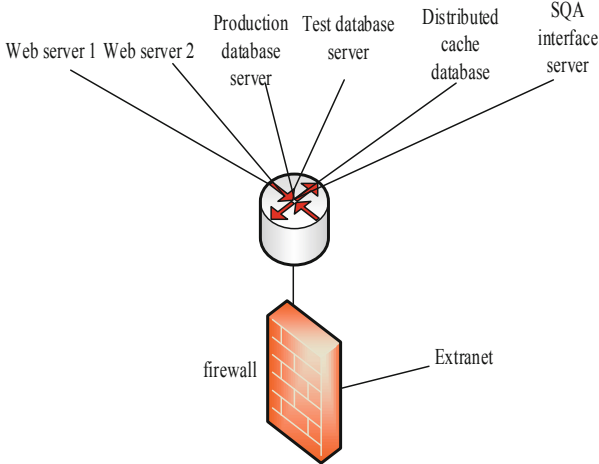


Fig. 1. System network deployment diagram

Based on B/S network online teaching system throughout the design process of independent learning ability training strategy, make full use of the existing network foundation to create network-based teaching platform, teachers do not need to consider the technical details of the system, will put more energy into the construction and integration of teaching content and resources, focus on cultivating students' independent learning ability [8]. Students can access various teaching resources through the teaching platform, and can cluster through message boards, chat rooms, etc. Based on the above considerations, the B/S mode is adopted to design the network online teaching system, the background server adopts JSP components and SQL Server2005 database system, and the front desk client adopts the browser to realize it. The physical architecture of the B/S-based system is shown in Fig. 2:

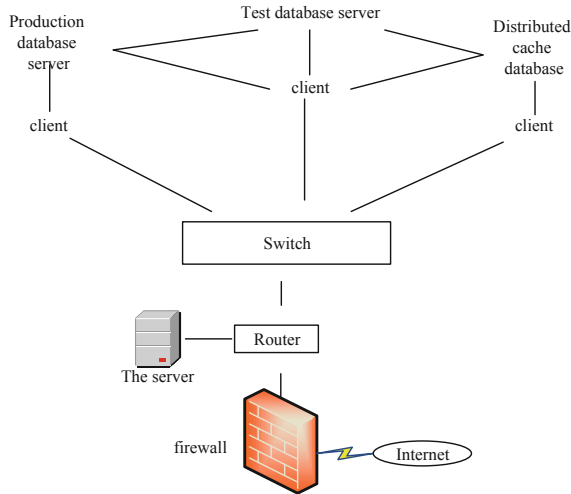


Fig. 2. Physical topology diagram of the network online teaching system based on B/S

The B/S-based network online teaching system uses the Windows 2008 Server development platform, developing tools and environments for the Microsoft ASP.NET3.5 and Visual Studio 2008. proscenium ASP. The NET network development language can establish a powerful WEB application service programming framework, using SQL Server2005Standard Edition at the background database end, and Standard edition is a data service management and analysis platform suitable for small and medium-sized enterprises. The system adopts the B/S three-layer service framework mode.

2.2 Functional Structure Optimization of the System Software

The system is based on the Web software system of Internet network, using B/S development mode. The online teaching system includes four sub-systems: teaching management subsystem, multimedia teaching subsystem, student management subsystem, and teacher management subsystem. The functional structure of the system software is shown in Fig. 3:

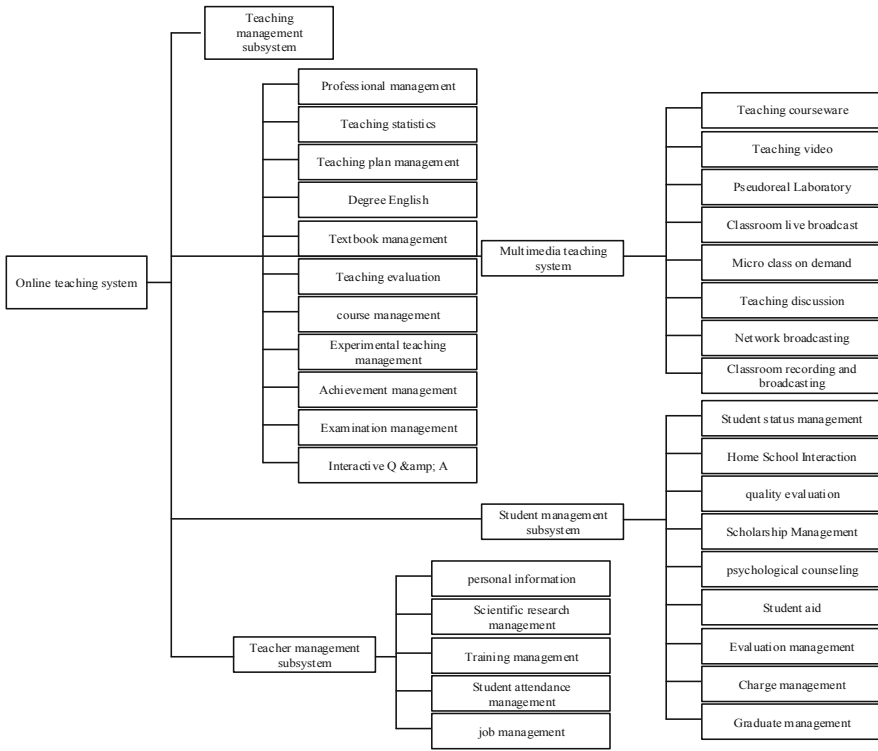


Fig. 3. Functional structure optimization of the system software

As shown in Fig. 3, the system design part of this paper is mainly divided into four systems, including teaching management subsystem, teacher management subsystem, student management subsystem and multimedia teaching system. Each subsystem has different functions and constitutes a complete teaching system. The system adopts B/S mode, and the server is divided into three layers, namely Web service layer, middle layer and data service layer [9]. At the Web service layer, Is and ASP are generated in response

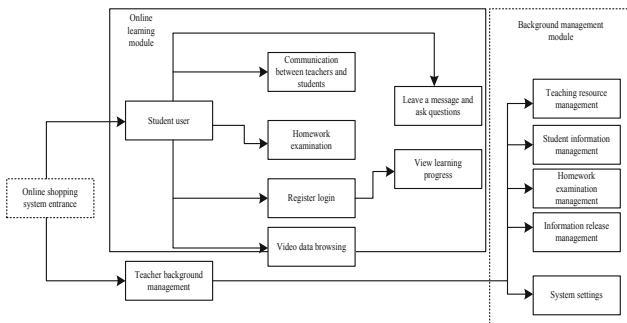


Fig. 4. Division of the main functional modules of the system

to the request of users. The main functional modules include student online learning and teacher background management, and the division of the main functional modules of the system is shown in Fig. 4.

Teaching resources are the basis of online learning. Teachers can realize the release and sharing of resources through the system. The richer the resources, the greater the choice of students in online learning. Based on this, students can further optimize their collaborative operation, and the steps are as shown in Fig. 5.

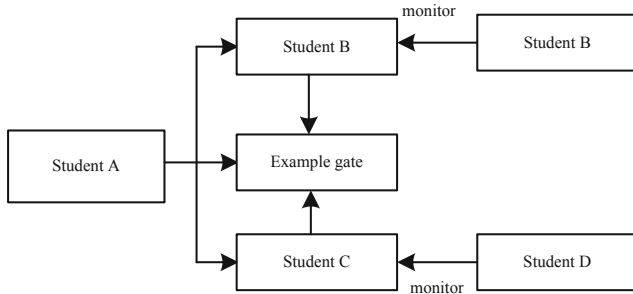


Fig. 5. System operation procedure optimization

Resource management includes resource upload, download, comment and resource playback functions, where teachers have resource upload function, and students have resource download, resource review and resource playback functions. To design a learning system that combines the CDIO and the Internet teaching platform, it is necessary to integrate the CDIO engineering education mode into the network teaching platform. The system business process combining CDIO is shown in Fig. 6.

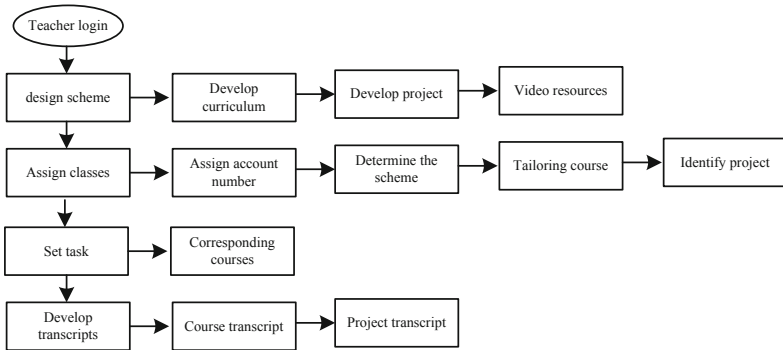


Fig. 6. Teacher-end business processing process

Based on the above business process, the requirements of the system are analyzed. The overall requirement analysis results of this system are shown in the table and are divided into multiple functional modules. The specific system design requirements are shown in Table 1:

Table 1. The requirements analysis table

Serial number	Modular	Function
A	Account management	Distinguish between ordinary users and administrators. Administrators have more functions than ordinary users
B	Personal information management	Maintenance of user personal information
C	Programme Management	Teaching program management
D	Course management	Managing courses according to different technical directions is the basis for the division of teaching resources
E	Training project management	Integrate CDIO teaching mode, and extract technical points from practical training projects as key teaching contents
F	Teaching resource management	Including the overall management of teaching resources such as teaching materials, videos and lecturers
G	Teaching management	Teachers and users should first create classes
H	Class management	Administrators can create classes
I	System management	System status reading and setting, data backup, etc

When uploading the resources, you need to submit the information about the resource classification, resource name and detailed description of the resources to facilitate the students to query the resources. Once the resource is uploaded, students are able to browse and download it locally for subsequent learning. Teachers are responsible for the increase, modification and deletion of teaching resources to the courses managed, such as adding a new syllabus, new test questions, homework and examination subjects, modifying the existing test questions, homework, and must be removed from the database when the resources are outdated and inconsistent with the course or there are errors in the resources.

2.3 Implementation of Online Teaching of Garment Drawing Course

In designing a series of functions proposed by the online teaching system of clothing drawing courses, it is to choose the development platform and development framework selected by the system, and to adopt a series of mature system components to accelerate the development efficiency. After completing the system framework construction and component selection mentioned above, the next step is to conduct the coding work, where the public module to the system needs to be designed first. The formula of the

clustering space definition of the clustering algorithm optimization algorithm is:

$$l = (a_1, a_2, \dots, a_i) - d(x + y)/k - m \tag{1}$$

In this case, the parameters k and m in the algorithm will be fixed and will no longer be constrained by the parameter space of the problem. The sequence of parameter a_i is transformed in the space of (x, y) , and the range of sequence d is unlimited. The parameter space e' of the practical problem is in the range of sequence space (n_d, m_d) , and the sequence s is unchanged. The clustering space and parameter space can be obtained by transformation and inverse transformation (2).

$$g = \frac{(n_d + m_d)}{100l - x - y} - da_i/e' - s \tag{2}$$

After information conversion based on the above algorithm, teaching information management is realized in the database, and a basic platform is further formed to form a unified access entrance and a unified information display platform. The software of this system is the operating system software, database system software installed on each server, etc. The specific requirements are shown in Table 2:

Table 2. System software setup requirements

Software name	Configuration description	Quantity
Database	SQL SERVER2017	1
Middleware	Tomcat7.5	2
Report software	MicroStrategy	2

The online teaching system adopts the general design idea of 3 + N, that is, the data access layer business logic layer and user interface layer, on each layer according to the complexity of specific functions, the plan molecular layer. Account management is the main function of the administrator, and the administrator can add and delete accounts through this function. The specific use-case descriptions of this function are shown in Table 3.

Table 3. Add a user account use case description table

Use case description	Content
Business participants	Administrators
Describe	This use case verifies whether the administrator can add new users to the system and distinguish student and teacher accounts

(continued)

Table 3. (continued)

Use case description	Content
Preconditions	Nothing
Trigger condition	After logging in the administrator account, click “user account management”
Basic process	Add a new account and set the initial password; Log in with a new account
Abnormal process	Add an existing account and promote “account already exists”
End	Login succeeded, jump to personal information page

The online teaching system of clothing drawing course is based on the Android operating system and is divided into blocks according to the functions. It is mainly divided into three modules: teaching application module, cluster control module and network communication module. The cluster control module and the network communication module both provide services for the teaching application module to support the user clustering and collaboration function in the teaching. The core of the design of the system is the choice of the knowledge base, a regular collection that can dig out different effective data and can use the data entropy-based data mining algorithm. In addition, the teaching application module is presented above the Mainactivity in the form of a custom View control, and directly clusters with the user. The system structure is shown in Fig. 7.

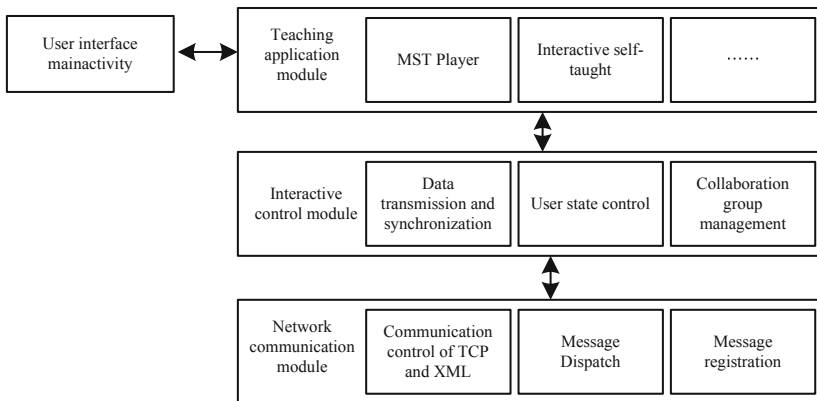


Fig. 7. Optimization of the system teaching structure

The online teaching system uses training programmes as the basis for all course design. After the completion of the classes, students should first make a training plan, and then determine what courses the class will need to take and do according to the training program. The training scheme management includes the new scheme, modification scheme, deletion scheme and other functions. The specific program flow chart design of the training scheme management is shown in Fig. 8.

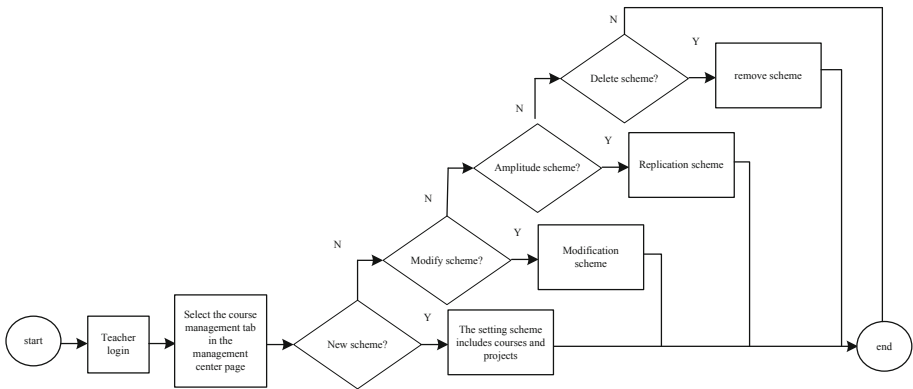


Fig. 8. Functional program flow chart of teaching training program

The course management function is developed for teachers and is one of the basic functions of teaching resource management. The premise of using this function is to complete the training program setting, curriculum management is the process of training program refinement, the purpose is to implement the knowledge points in the training program, and the engineering education mode in the specific curriculum. If the training plan is not set, the course list is not displayed in the course management list; if the training plan is set, then teacher users can continue to conduct course management functions such as syllabus management, teaching task management and teaching teacher management. The flow chart of the procedures for garment drawing course management is shown in Fig. 9:

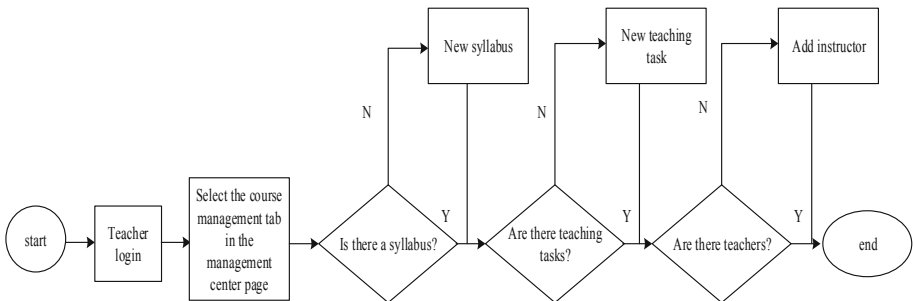


Fig. 9. Flow chart of the course management program

The main function of the teaching application module is to provide a teaching clustering environment for teachers and students to facilitate the development of teaching activities. To achieve the above goals, the teaching application modules need to provide a variety of different types of teaching application tools to achieve multidimensional clustering with users. In order to make each teaching application independent and to be displayed in different regions, the view of the teaching application should be separated

from its specific functions. Therefore, the teaching application tool framework is shown in Fig. 10:

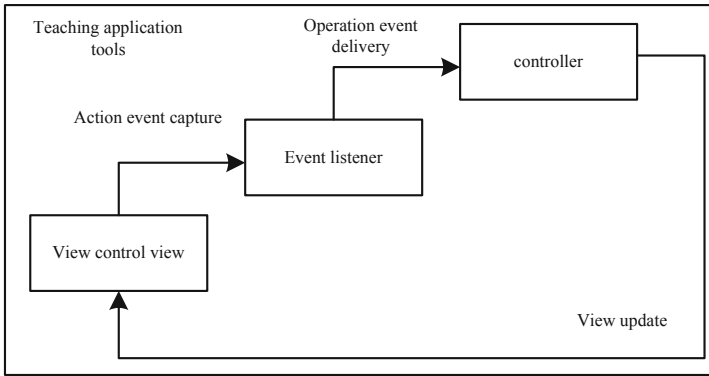


Fig. 10. The Teaching Application Tool Framework

The teaching application tools are all designed based on the view control view provided by the androk application framework. The view control is the basic control provided for the user interface by the Android system, which represents a rectangular area on the display screen and is responsible for image drawing and event processing in that area.

3 Analysis of the Experimental Results

Functional test is mainly demand verification, which is to ensure that the final system implementation is consistent with the initial demand analysis, can meet the needs of the user, the correct performance test through pressure test, the purpose is to verify whether the operation of the system, whether the normal test environment is shown in Table 4.

Table 4. List of test environments

Serial number	Name	Hardware environment	Software environment
A	The server	12 GB memory	MySQL Server 5.8
B	Client	Six 160 gsata hard drives	Windows7
C	Network environment	Wan 100 Mbps	-

The installation operating system is Windows XP Professional, the background server is S QL Server, it uses the IS service, and the computer is minimally configured with 512 MB of CPU1.0G memory. For software performance tests in specific operating environment and load conditions, this system mainly focuses on the impact of the simultaneous number of online people on the response time, as shown in Table 5.

Table 5. Performance test cases

Test item	Number of people online at the same time	Expected average response time	Actual average response time
a	80	Less than 2S	0.465
b	150	Less than 2S	0.685
c	260	Less than 3S	1.325
d	350	Less than 3S	1.658
e	1200	Less than 3S	1.989

Performance indicators mainly include response time, throughput, and so on. Performance testing is to test whether the software system can meet the previously expected performance requirements. Performance is an important part of the system, and the corresponding performance indicators have been set in the demand stage, which are the focus of the performance test stage. Performance testing is designed to test the performance of clustering online teaching systems during mobile and teacher side clustering. The timely response to clustering data has a great impact on the clustering experience and requires focus. The test is divided into unoptimized situation and optimized, mainly to test the time delay of clustering data between teachers and students' equipment. Considering the frequency of clustering, the test mainly adopts the cluster whiteboard tool as the test target. Compared with the courseware play synchronization, the number of cluster whiteboard synchronization data is larger, which can more explain the actual situation. First, first consider the cluster data transfer round time between the teacher and the student side without closing the Nagk algorithm, as shown in Fig. 11 and Fig. 12.

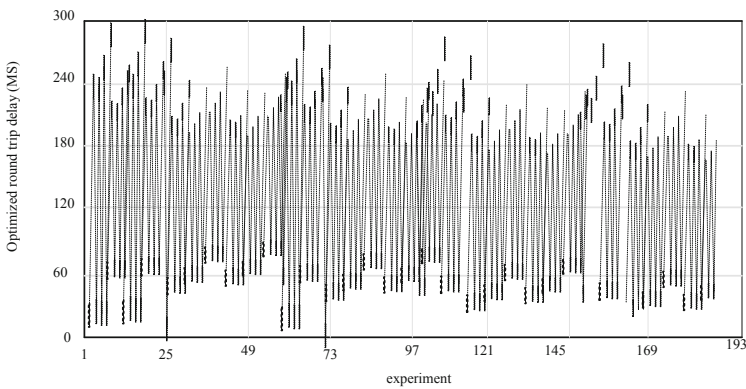


Fig. 11. Unoptimized system delay case

If the test results do not meet the set goals, the online teaching system can not be applied to the school to handle the relevant business. This can not only improve the

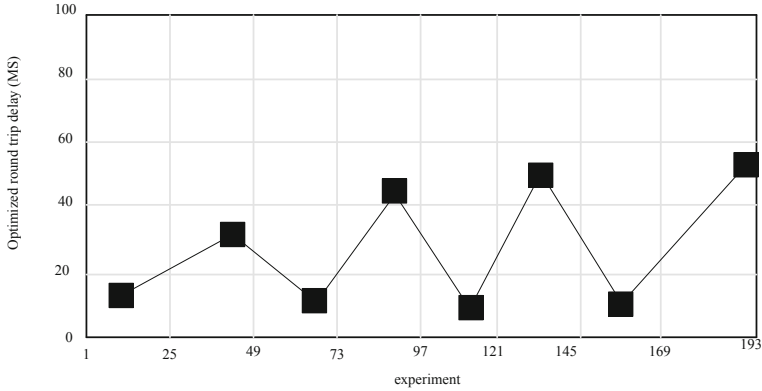


Fig. 12. The optimized system delay situation

efficiency of teaching management, but will reduce the efficiency. Therefore, the performance test must be conducted before the deployment, and the results of the performance tests can be matched to deploy the online teaching system to the school. LoadRunner software is mainly used to conduct the simulation test, according to the performance requirements, the concurrent access to 500 users, and the test results are shown in Table 6:

Table 6. System performance test results table

Number of concurrent users	Response speed (seconds)	CPU utilization (%)
60	1.25	1
120	1.35	1
180	1.45	1
240	1.55	4
300	1.59	8
360	1.78	12
420	1.98	15
480	2.21	20

As described above, the system has completed the functional tests and performance tests. There are three rounds of system tests to verify the system stability. The specific test results are shown in Table 7.

The test results from three rounds of system tests can show that the test defects showed an obvious convergence trend, and the Ver version 1.0 test passed 100%. Therefore, it can be proved that the design system can meet the functional and non-functional needs of the user, and can meet the system design principles. The reason for this good result is

Table 7. Results of three rounds of system testing

Test rounds	Software version	Number of test cases	Passing rate
First round	Ver0.6	1152	86%
Second round	Ver1.0	420	85%
Third round	Ver1.2	190	100%

that this design system optimizes the system hardware structure configuration, improves the system software module function, combines the clustering algorithm to screen and evaluate the teaching information, and optimizes the teaching management steps, which improves the functional effect of the system through all-round design.

4 Conclusion

In order to improve the effect of online teaching, this paper introduces clustering algorithm into this field and designs an online teaching system based on clustering algorithm. By optimizing the system hardware configuration, improving the system software module function, combining the clustering algorithm to screen and evaluate the teaching information, optimize the teaching management steps, and complete the design of the whole system. The system realizes the main function of online teaching, and has good operation efficiency, but also easy to maintain and transplant, through the combination of big data technology, the system can collect data cannot obtain or high cost, such as course name, homework, interactive information, learning time, test performance analysis, student login system, students' learning preferences and other behavior data, and is easily used for teaching process analysis, in order to fully improve students' learning experience, comprehensively improve the teaching effect. Although the system designed in this paper has the above advantages, it has not been compared with other systems in this study, so it is difficult to know the direction of improvement. In the next research process, it is necessary to strengthen the research in this regard to further improve the rationality of the design system.

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