



Design of Innovation and Entrepreneurship Teaching System for Ideological and Political Courses in Universities Based on Online and Offline Integration

Fang Liu^(✉)

Department of Foundational Courses,
Shenyang Institute of Science and Technology, Shenyang 110167, China

Abstract. In current university teaching systems, single-threaded databases are often used as system databases, but such databases tend to occupy a high percentage of system servers during operation. Therefore, the design of innovation and entrepreneurship teaching system for college ideological and political courses based on online and offline integration is proposed. Use Mysql multi-threaded database as the system database, and use collaborative filtering to calculate the allocation of teaching resources. Design the network topology and data structure of the system. According to the requirements of online and offline integration, formulate functional modules and build a mixed teaching mode. The experimental results prove that the system meets the design function requirements, the server occupancy rate is low, and it has certain feasibility.

Keywords: Database · System design · Online and offline integration · Collaborative filtering algorithm

1 Introduction

Today with the development of computer network technology, online mobile education has developed into an extremely important part of the education field [1–3]. Mobile teaching is a way to make teaching methods and teaching resources quickly accepted by students through smart devices and wireless networks. In my country, mobile learning refers to the process in which teachers use smart devices for Internet teaching and students who listen to classes use smart devices to learn. At present, mobile terminals are widely used by major colleges and universities, currently using: blackboards, whiteboards, and projectors, as well as the use of advanced intelligent equipment, supporting intelligent teaching systems for new teaching [4–6].

Domestic researchers conducted detailed studies on traditional teaching methods, summarized the problems existing in traditional education methods, and proposed solutions to traditional education problems including: the design of cloud architecture requires the use of new cloud, network, and terminal technologies. And it requires a

wide range of application-side technologies and cannot be ignored. However, in order to reduce the complexity of the system, single-threaded databases are often used as mobile teaching databases, but such databases often require a lot of resources to query when extracting user data., The system occupies a lot and is not suitable for teaching systems under multiple users [7, 8].

2 The Software Design of Innovation and Entrepreneurship Teaching System for College Ideological and Political Courses

2.1 System Database Selection and Establishment

A database refers to a collection of data that is stored on a computer's storage device for a long time and organized according to a certain model, which can be shared by various users or applications [9, 10]. Including databases, database management systems, and database systems. A database is a warehouse for storing data. A collection of organized and shareable large amounts of data stored in the computer for a long time [11–13]. The data in the database is described and stored according to a certain model organization, while maintaining small redundancy, high independence and easy scalability, and the data can be shared [14–16]. This article chooses the Mysql database, which supports multi-threading and multi-processor. The database implements SQL function library through a highly optimized class library, without any memory allocation after query initialization. The main data types are: 1, 2, 3, 4 and 8 byte length unsigned/signed integers, DATETIME, DOUBLE, CHAR, VARCHAR, TEXT, BLOB, DATE, TIME, FLOAT, TIMESTAMP, YEAR and ENUM types. The system supports aggregate functions (COUNT, COUNT(DISTINCT), AVG, STD, SUM, MAX) and MIN, and fully supports the GROUP BY and ORDER BY clauses of SQL. The system supports LEFT OUTER JOIN and ODBC of ANSI SQL, and all columns have default values. The system can mix tables from different databases in the same query. The system can use INSERT to insert a subset of the table columns, and those columns without clear values are set as default values.

2.2 System Collaborative Filtering Operation

The collaborative filtering algorithm is used to calculate the resource recommendation module. When a registered user of the system accesses the resource recommendation page, the recommendation system will calculate the teaching resources that the user may like based on the collaborative filtering algorithm, and then recommend it to the user. The recommended resources are calculated by the user's evaluation of the teaching resources. This system uses a combination of user-based collaborative filtering recommendation and item-based collaborative filtering recommendation for recommendation. The calculation process is shown in Fig. 1:

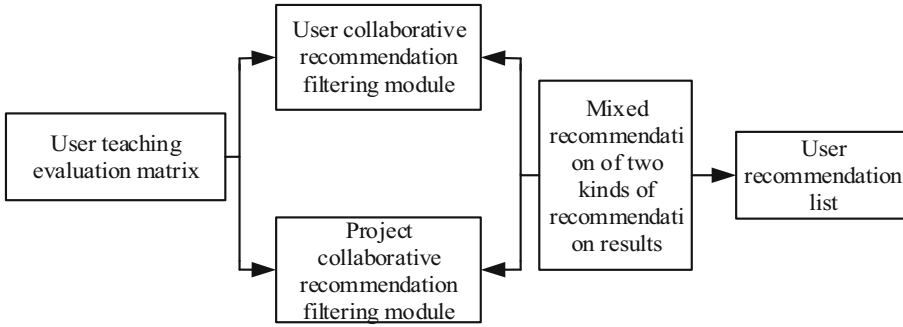


Fig. 1. Collaborative filtering operation process

In addition to recommendations, collaborative filtering operations can also indicate the user’s teaching resource score. Take the matrix R as an $m \times n$ matrix, m represents the number of users, n represents the number of corresponding teaching resources, R_{ij} represents the rating of the i user on the j teaching resource. The user’s teaching resource scoring matrix is shown in Table 1:

Table 1. User-teaching resource rating table

User/Item	1	...	i	...	N
U_1	R_{1_1}	...	R_{1_i}	...	R_{1_n}
...
U_i	R_{i_1}	...	R_{i_i}	...	R_{i_n}
...
U_m	R_{m_1}	...	R_{m_i}	...	R_{m_n}

According to the user-teaching material scoring matrix, the adjusted cosine similarity formula is adopted to find the neighbors of the target user, and the neighbors are in descending order. For the target user a , the corresponding adjacent set is M , $M = \{M_1, M_2, \dots, M_k\}$, and a does not belong to M , and the similarity between M_1 and M_k is $sim(a, M_k)$, and the similarity is arranged from small to large, then it shows that M_1 and user a are the most similar, their interests are the closest, and M_1 and M_k are the least similar. Then the similarity $sim(a, M_k)$ between user a and user k is shown in formula (1):

$$sim(a, k) = \frac{\sum_{p \in I} (R_{a,p} - \bar{R}_a)(R_{k,p} - \bar{R}_k)}{\sqrt{\sum_{p \in I} (R_{a,p} - \bar{R}_a)^2} \times \sqrt{\sum_{p \in I} (R_{k,p} - \bar{R}_k)^2}} \tag{1}$$

In formula (1), set I represents the set of teaching resources required by user a and user k , $R_{a,p}$ represents user a ’s rating of teaching resource p , $R_{k,p}$ represents user k ’s

rating of teaching resource p , and \overline{R}_a represents user a 's rating of teaching resource Average score, \overline{R}_k represents the average score of user k 's rating of teaching resources. Among the users closest to the target user, predict the score, calculate the recommendation degree based on the similarity, and recommend the teaching resources with the top n scores among all the teaching resources to the target user, and the template user a 's teaching of the score The score $P_{a,i}$ of resource i is shown in formula (2):

$$P_{a,i} = \overline{R}_a + \frac{\sum_{k \in M_a} sim(a, k) \times (R_{k,i} - \overline{R}_k)}{\sum_{k \in M_a} (|sim(a, k)|)} \quad (2)$$

In the formula (2), M_a represents the set of nearest neighbors of user a , $sim(a, k)$ represents the similarity between user a and user k calculated in the previous step, and \overline{R}_k represents the average score of user k for teaching resources, \overline{R}_a represents user a for the average score of the teaching resource score, $R_{k,i}$ represents user k 's score for teaching resource i .

2.3 System Network Topology

This paper divides the system's network structure into internal local area network and external network, and protects data users through security devices. The system protects internal data security and access security through a firewall. The various servers and developers of the system are protected in the firewall, while external users pass through the firewall through the Internet to access the system and corresponding resources deployed on the application server. This process is protected and restricted by the firewall. If malicious attacks and pressures are found, there will be corresponding security policies to ensure. The topological structure of the system is shown in Fig. 2:

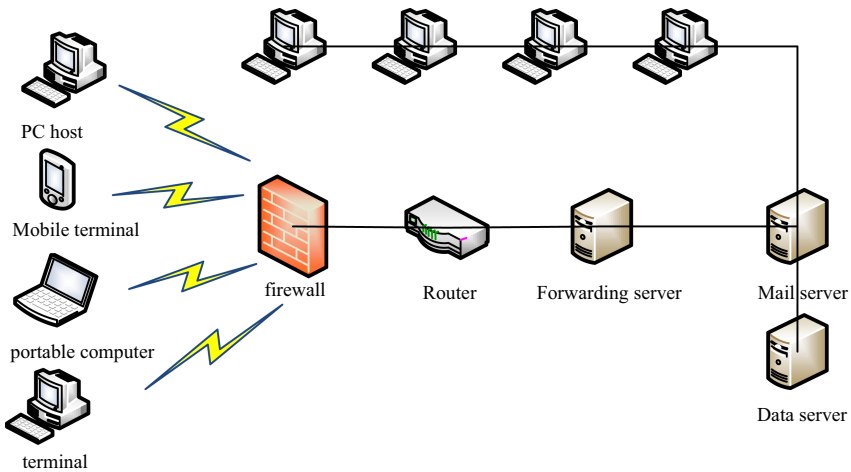


Fig. 2. System network topology

This system runs on the network inside the firewall to provide online teaching services for students and teachers. Because of the large number of people, there may be a large number of visits during use. In order to ensure that teachers and students are not hindered when using the system and ensure the speed of data processing, the data buffer pool technology is used to solve the problem of concurrent access by a large number of users on the Internet, allowing users to queue for access to prevent system instability or inability to respond to the access phenomenon in time to ensure system performance. Since the operating platform of the system is a campus network, the impact will be very large, and the system security requirements are relatively high, considering the three aspects of data security, network security and system security. For network security, the first step to ensure network security is to ensure the security of network equipment, so that unauthorized users cannot access related network equipment. Regarding ensuring the security of network equipment, the network center has configured related firewalls and intrusion detection systems in order to ensure the security of the server and prevent unauthorized intrusion by intentions. The second is system security. The system can be configured to use identity authentication for general users to restrict users from accessing certain information. It is stipulated that users can only enter the system and browse related information if they have a qualified user name and password. Special users not only need a username and password, but also an IP address in the whitelist set by the system to ensure that their information is not leaked during the operation of the system. The data security of the system uses RAID5 disk arrays as database server storage to ensure the normal operation of the system to prevent data loss and provide the system with complete and incremental backup methods such as off-site storage and CD burning. It can back up the past data to solve the problem of data and information loss caused by improper operation.

2.4 System Data Structure

This article chooses XML format as the system data format on the data structure used by the system. The XML format has good extensibility. According to the parameters and semantic requirements of user data, users establish their own needs [17–19]. At the same time, since the data format is plain text, it can be independent of platforms and applications. XML does not describe the explicit format of the data, but focuses on describing the meaning of the data itself. It has the advantages of convenient query and high efficiency database. Moreover, XML can express various data type relationships, such as inheritance relationships, tree relationships, and chain relationships. Because XML uses text description techniques, for humans, its data description is easier to understand than data in a database table. In the process of use, the XML file needs to be parsed. XML file parsing refers to: converting the unstructured characters of the XML file into components that comply with XML grammar rules. The components have a certain hierarchical structure and are easy to view. DOM, SAX and other technologies can be used for mobile WeChat platform analysis. This article uses DOM that fully supports iOS and Android for analysis. DOM (Document Object Model) is a document object model. The content of the XML file can be added, deleted, modified, and read using DOM objects. The working principle of DOM: parse the file into independent attributes, elements and other nodes. The content of the XML file is expressed in the form of a node tree, and

the content of the XML file can be accessed and modified through the nodes of the node tree. So as to realize all aspects of dynamic operation of XML files. Since DOM has nothing to do with programming languages, programs and scripting languages such as Python and Shell can access and modify the content and structure of XML files [20, 21].

2.5 System Function Module Design

In the teaching system of this article, the released teaching system includes questionnaires, teaching notices, feedback, examination information, exercises and file management. **Questionnaire:** The teacher will conduct a questionnaire survey on the taught courses, which helps to improve the quality of teaching. Use the statistics module to count the information after the questionnaire survey and display it in a more intuitive way; through the import module, select the EXCEL file to import on the PC side to update the content of the questionnaire survey menu item in the mobile client; through the export module, the questionnaire survey The results are exported as EXCEL files. **Teaching notice:** It helps students to understand the school consultation in time. Through the import module, select the EXCEL file to import on the PC side to update the content of the teaching notification item in the mobile client; through the export module, export the results of the questionnaire as an EXCEL file. **Feedback:** For the questionnaire survey organized by the teacher, students will give feedback through the feedback menu of the client. Export the results of the opinion survey as an EXCEL file through the export module. **Exam information:** Through the import module, select the EXCEL file to import on the PC side to update the content of the individual test information in the mobile client; through the export module, export the results of the exam information as an EXCEL file. **Exercises:** through the import module, select the EXCEL file on the PC to import, update the content of the exercises in the mobile client; through the export module, export the results of the exercises as an EXCEL file. **Document management:** It is the database management of learning materials and learning consultation. It can add, delete, and modify the content of the mobile client's micro-classes, work display, and news reports.

2.6 Integrated Online and Offline Hybrid Teaching Construction

Blended teaching is a teaching mode constructed together with the online teaching of the design system and the offline teaching mode of normal teaching. With "interaction" as the core, online education, face-to-face learning, and group collaboration are integrated to achieve a new educational model of meaning construction, which makes networked learning and traditional education shift from dual opposition to dual integration. Integration refers to the real combination of the Internet and education, making the teaching process more intelligent and comfortable. In this system, in addition to helping students learn online, the teaching resources in the database can also be developed for teachers and provide corresponding teaching information to ensure openness. At the same time, the use of the system's collaborative filtering operation method of the system in this article can help teachers in offline teaching to conduct statistics on teaching conditions.

At the same time, teachers can view the results of students' online system exams in the system, thereby helping teachers understand the deficiencies of current teaching courses. Improve teaching efficiency.

3 Experimental Analysis

In order to verify the feasibility of the design system, this paper conducts system test experiments, using a university's ideological and political course innovation and entrepreneurship teaching resources as the experimental system database data.

3.1 System Test Environment

The system test environment in the system experiment of this article is shown in Table 2:

Table 2. The system test environment

Equipment type	Name	Number
Hardware environment	PC (medium configuration)	1
	Web server	1
	Wifi device	1
	IOS smart mobile device	1
	Android Smart mobile device	1
	Windows smart mobile devices	1
Software environment	PC equipped with Windows 7 operating system	1
	IE browser	1
	Firefox browser	1
	Chrome browser	1

3.2 Login Test Results

The purpose of this test is to test whether the system can correctly verify user login information, and to check the validity of the entered user name and password. The test results are shown in Table 3:

The results in Table 3 show that the design system can meet the expected normal login.

Table 3. System login test

Experimental case	Experiment procedure	Expected result	Does it meet expectations
Do not enter information	Login directly without entering username and password	Login failed	Yes
Enter the username and password correctly	Enter the correct user name and corresponding password, and log in	login successful	Yes
Enter wrong username	Enter an available password, but enter a username that does not exist	Login failed	Yes
Wrong password	Output the existing user name, but input the wrong page	Login failed	Yes

Table 4. Course creation test case

Experimental case	Experiment process	Expected result	Does it meet expectations
Do not enter course information	Input is empty, preset conditions	Unable to create course	Yes
Enter only the course ID	Enter teacher username, preset conditions	Unable to create course	Yes
Enter only the course name	Add course name, preset conditions	Unable to create course	Yes
Enter the course ID and course name	Add course name and teacher user name, preset conditions	Create courses normally	Yes

3.3 Teacher Course Test

The follow-up experiment is carried out based on the actual use of the system when the teacher creates the course, to test whether the system can achieve normal course creation, the test results are shown in Table 4:

The test results in Table 4 prove that the design system can realize normal course creation functions.

3.4 Student Learning Test

When the system tests the learning function of students, it is necessary to consider whether students can receive system courses normally on mobile devices. The test results are shown in Table 5:

Table 5. Student learning function test

Experimental case	Experiment process	Expected result	Does it meet expectations
Use IOS phone to connect to Wifi	Use IOS mobile device to connect system Wifi	Automatically push out the course interface	Yes
Use mobile phones below Android 4.0 to connect to Wifi	Use mobile devices below Android 4.0 to connect to the system Wifi	No prompt	Yes
Use Android 4.0 or above to connect to Wifi	Prompt to open the browser to log in to the Wifi network	Automatically prompt to open the browser to push the course page	Yes

Experimental tests have proved that after connecting with the design system Wifi, the system can push out related system connection courses, and the external connection of the system is not yet suitable for mobile phone connections below Android 4.0.

3.5 System Load Bearing Experiment

In actual use, the teaching system often carries a large number of users at the same time, so it is necessary to test the load bearing capacity of the system under the condition of a large number of users. 150, 250, 350, 450, 550 users were used to jointly use the system for login and simulation learning, and to detect the load of the system server when the number of users increased. The test results are shown in Table 6:

Table 6. System load test

Number of experiments	Server memory load (%)	Server CPU load (%)	Number of participating classes in the experiment
150	11.27	15.45	3
250	13.75	16.55	5
350	14.92	17.15	7
450	16.17	18.24	9
550	17.46	19.89	11

The results in Table 6 show that when the system is carrying multiple users at the same time, the system can still maintain the load within the normal range, which proves that the server occupancy of the system is good. The load bearing capacity of the system in this paper is good, the effectiveness of the course is good, and it can be used in practical learning.

4 Concluding

Based on the teaching principles of online and offline integration, this paper draws up a teaching system with corresponding functions. At the same time, it uses a multi-threaded database to improve the load capacity of the system. The feasibility of the system is proved through tests. The follow-up research will detect the loopholes in the main body of the system to ensure the perfect function of the system and facilitate subsequent development.

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