EAI Endorsed Transactions
on Scalable Information Systems
Research Article EAI.EU

Unit test system of online English course based on SSH Framework

Wang Hainan[1] and Jerry Chun-wei Lin[2,*]

[1]School of Foreign Language, Jilin University of Architecture and Technology, Changchun, China
[2]Department of Computer Science, Electrical Engineering and Mathematical Sciences, Western Norway University of Applied Sciences, Bergen, Norway

Abstract

Aiming at the problems of poor test effect and imperfect system function in the existing English course unit test system, an online English course unit test system based on SSH framework is designed to accurately recommend the required online English course resources for students and better assist students to complete the English course unit test. The SSH framework integrates the characteristics of the three mainstream open source frameworks of struts, spring and hibernate, and designs an online English course unit test system including presentation layer, business logic layer and data persistence layer. A variety of databases in the data persistence layer select MySQL database for data storage, The business logic layer uses the personalized English Course Resource Recommendation Model Based on three-dimensional feature collaborative control of the business server to meet the personalized needs of students' English courses, uses the application server to complete the front-end examination and back-end management of the system, and displays the system test results through the presentation layer. The experiment shows that the online English curriculum resources recommended by the system have obvious differences, strong adaptability and high matching degree; The CPU utilization rate of the system is always below 25%, the disk reading and writing speed is fast, and the fluctuation difference is not higher than 1000KB / s. The system has high storage performance.

Keywords: SSH framework; Unit test; Online English courses; Mysql database; Three dimensional features; Business logic layer

Received on 16 December 2021, accepted on 17 January 2022, published on 26 January 2022

doi: 10.4108/eai.26-1-2022.172999

Corresponding author. Email: jerrylin@ieee.org

1. Introduction

In recent years, the state has accelerated the reform of the education system and built a rapidly developed national education system based on education. Under the guidance of this strategy of rejuvenating the country through science and education, as an important base for the country to cultivate talents, it is an inevitable trend to realize educational informatization, modernization and standardization [1]. To mainly realize educational modernization, it should first realize the informatization and modernization of teaching management methods and management means, and testing is the key link of teaching management. Therefore, the informatization and modernization of test mode has become an important part of realizing educational modernization [2]. At present, the scale invariant unconstrained online learning studied by Kotowski [3] only considers the online supervised learning problem, in which the instance (input vector) and comparator (weight vector) are unconstrained. This method is too limited to improve teachers' professional level. Therefore, Lopez and Gordillo proposed to compare traditional teaching with game based learning and use computer science education games written by teachers [4]. Although it can be used to make educational video games, which can not only improve students' interest in use, but also innovate teachers' teaching mode, it is difficult to adapt to everyone due to the lack of targeted resource recommendation methods. Wan and Niu studied a self-organizing e-learning recommendation method

based on learning resources [5]. Most content-based (CB) recommendation systems provide recommendations according to the matching rules between learners and learning objects (LO). This learner oriented approach is limited in detecting learner changes, and the adaptability and diversity of recommendations are very low. Literature [6] designed an online evaluation management system of professional courses based on SOA architecture. The system first designs the hardware of the system, mainly including core processor, data processor, etc., and then uses SOA architecture to design the software of the system, mainly including login module, topic management module and performance evaluation module. The system design is completed through the design of system software and hardware. The system improves the efficiency of system evaluation, but the data in the system database is not comprehensive, which affects the universal use of other subjects.

SSH (struts + Spring + Hibernate) is not a framework, but an integrated whole of multiple frameworks. At present, it is widely used in a variety of system platforms. As an open source framework, its Web application can enable developers to quickly and efficiently integrate clear framework structure and Web applications with high repeatability and low maintenance cost . Therefore, this paper proposes an unit test system of online English course based on SSH framework, which makes the online test provide favorable conditions for the separation of teaching and examination, the sharing of teaching resources and the rational arrangement of teaching. The system takes MySQL as the background database and designs an English course unit test system based on SSH framework. In the course unit for teachers, combined with students' ability level, the individualized unit test content of English course can be generated, so that students can make efficient use of learning time and gradually improve their grades according to their ability to master knowledge. The technical route of this paper is as follows:

(1) The SSH framework integrates the characteristics of struts, spring and hibernate, and designs an online English course unit test system including presentation layer, business logic layer and data persistence layer.

(2) Various databases in the data persistence layer select MySQL database for data storage. The business logic layer uses the personalized English Course Resource Recommendation Model Based on three-dimensional feature collaborative control of the business server to meet the personalized needs of students' English courses.

(3) The application server is used to complete the front-end examination and back-end management of the system, and the system test results are displayed through the presentation layer.

(4) Experimental analysis

(5) Conclusion

2. Unit test system of online English course based on SSH Framework

2.1. Structure analysis of SSH frame

At present, SSH framework is the most extensive integrated development mode in Java EE enterprise applications. SSH framework integrates the three mainstream open source frameworks of Struts, Spring and Hibernate, which are respectively applied to the presentation layer, business logic layer and data persistence layer of the system, realizes inter layer decoupling, and has the characteristics of high scalability, high performance and high security, making Java EE enterprise development more fast and efficient. SSH is an integration framework of struts + Spring + hibernate. The system integrating SSH framework is divided into four layers: presentation layer, business logic layer, data persistence layer and domain module layer, so as to help developers build web applications with clear structure, good reusability and convenient maintenance in a short time. Struts is used as the overall infrastructure of the system, which is responsible for the separation of MVC. In the model part of Struts framework, it controls business jump, uses hibernate framework to support the persistence layer, and spring manages struts and hibernate. The SSH framework structure is shown in Figure 1:

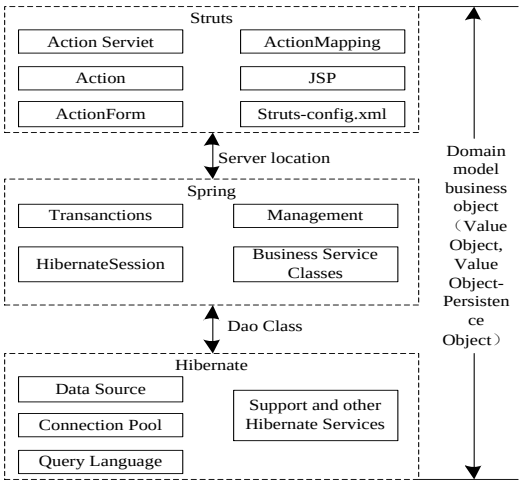


Figure 1. SSH frame structure

As can be seen from Figure 1, Struts is responsible for the Web layer and process control. ActionFormBean receives the data submitted by the form in the web page, then processes it through Action, and then forwards it to the corresponding web page. Action is defined in struts-config•xml and loaded by Action-Servlet. Spring: is responsible for business management, business logic processing and flow. Business Service Classers provide a unified interface call for Action, encapsulating the data access object of the persistence layer, such as DAO. Hibernate: is responsible for data persistence and encapsulates the underlying basic operations on the background database.

2.2. Design of the overall structure of the system

Based on the SSH framework, an unit test system of online English course including presentation layer, business logic layer and data persistence layer is designed. The system functions are completed through front-end examination and back-end management. The functions of the front-end examination include reading test papers from the question bank and completing students' unit test of online English course; The back-end management functions are used for a series of management controls, which are designed in combination with B / S mode. The structure of unit test system of online English course based on SSH framework is shown in Figure 2.

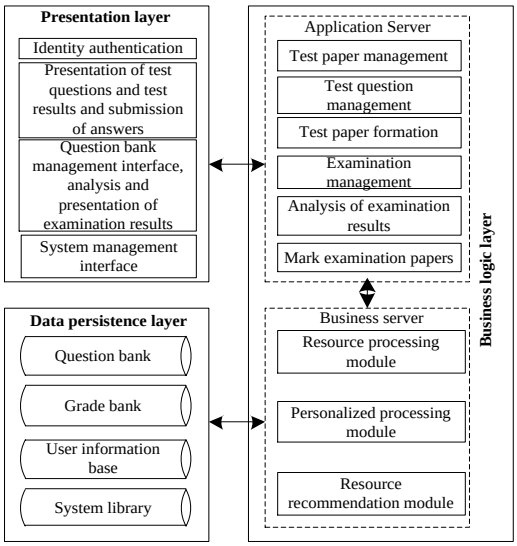


Figure 2. overall system structure

According to Figure 2, the system uses the presentation layer, business logic layer and data persistence layer to realize the system front-end test and back-end management functions. The front-end test is responsible for online test and test recovery, and the back-end management is responsible for system management and teacher management. The following details are introduced:

(1) Online test: students enter their admission card number to enter the test interface, the computer starts timing, and the system automatically keeps the answer after students finish each question. After the students answer the questions, the submit button is clicked to complete the whole test.

(2) Test recovery: during the test, various emergencies may occur in the test, such as crash, power failure, etc., which will interrupt the student's test process, which requires the test system to have the ability of test recovery. In the system, every time a student answers a question, the system will submit and record the student's answer to the server. When the test is interrupted due to unexpected circumstances, students can log in again, the test system retrieves the test paper and answer data from the server, restores the test site, and students continue to answer questions from the breakpoint [7].

(3) System management: mainly includes user management and authority management. Among them, user management establishes an intuitive means of personnel classification through the organizational structure tree, which corresponds to the actual organizational structure of customers, so as to facilitate test management. For the classification of users, question bank, test paper, test, score and public information, the corresponding operation permissions of different categories of users are determined by setting different levels of roles such as viewing, managing content and managing directory [8].

(4) Teacher management, student information management, question bank management and test paper management: the main functions of teacher management include student information management, question bank management, test paper management, marking management and score management; Student information management mainly refers to the addition, modification and deletion of the name, gender, class, student number and other information of the students participating in the test, so as to facilitate the management of the students by the teachers at any time; Item bank management refers to the classification, import, export and batch maintenance of real test questions, including subjective and objective questions[9].

(5) Score management for test results: if there are objective questions on the paper (such as multiple-choice questions, cloze, etc.), the system will score automatically; For some subjective questions , the designated rater will score manually, and then enter the evaluation score into the system. Teachers can manually modify students' test scores through score management.

2.3. Database design

Various databases in the data persistence layer are selected from MySQL developed by TC.X.Data insult AB company in Swedish. MySQL is an exquisite, multi-user, multi-threaded and cross platform relational database. At the same time, it is also a distributed database management system with client and server architecture. Because it is powerful, flexible and easy to use, fast and stable, and has rich application program interface (AP1), it is widely used in enterprises [10]. The specific structure of MySQL database is shown in Figure 3.

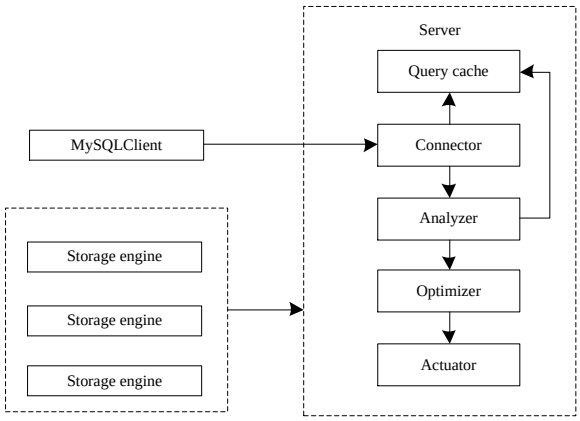


Figure 3. MySQL database structure

According to Figure 3, MySQL database structure includes client, connector, query cache, analyzer, optimizer, executor and storage engine. The connector is responsible for managing connections, including authority authentication. The content of English courses such as syntax analysis and lexical analysis is processed by the analyzer. The optimizer is responsible for executing the plan and selecting the index. Finally, the actuator executes the results. The storage engine that stores data and provides a read-write interface [11].

MySQL has three advantages. First, it is fully multithreaded, suitable for multi CPU use. Second, it is multi-platform. Many platforms support use, and their functions are different. Third, it is a very flexible and secure authority system. The database design is divided into the following six stages: demand analysis stage; Conceptual design stage; Logic design stage; Physical design stage; Database implementation stage; The specific flow chart of database operation and maintenance stage is shown in Figure 4.

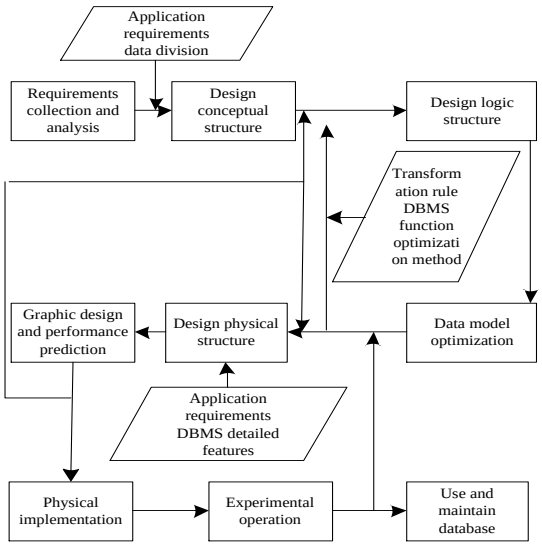


Figure 4. MySQL database design flow chart

According to Figure 4, the first stage is the demand analysis stage, which designs the conceptual structure according to the demand collection and analysis. This is the conceptual design stage, and then it is to start the logic design stage, including the design logic structure and data model optimization, then enter the design of physical structure, graphic design and performance prediction. The next step is the database implementation stage, which first carries out physical implementation, and then enters the experimental operation. The operation affects the database operation and maintenance stage, which includes the use and maintenance of the database. The application requirements here affect the design conceptual structure, and the design logic structure can be changed due to transformation rules, DBMS function optimization method, graphic design, performance prediction and data model optimization.

2.4. Analysis of online examination process

The users of unit test system of online English course based on SSH framework include system administrator, teacher user and student user. Among them, teacher user and student user are the main users of the system, and system administrator is mainly used to ensure the security and data reliability of the system [12]. Because the unit test system of online English course has a large number of student users, and they are also the largest beneficiary group, the business process of student users is introduced in detail.

Student users' unit test system of online English course is mainly used to participate in the test. After the test is completed, they can also query their personal test scores and modify their personal information. Specifically, the operation process of student users is shown in Figure 5.

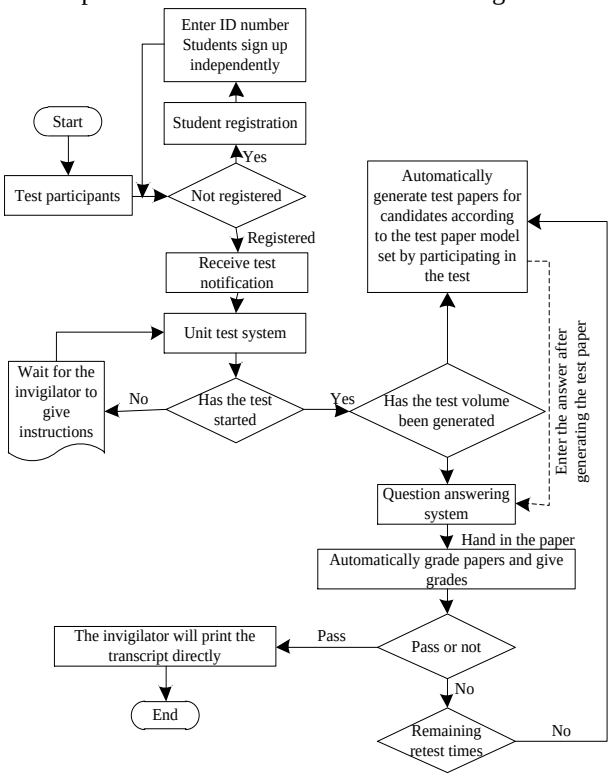


Figure 5. Operation flow chart of student user

According to Figure 5, if the student user is not a system user, he must register as a system user, otherwise the system will refuse the login request of the student user. After successful login, the student can test and register for the English course unit content.

After the monitoring teacher issues the test notice, the student user can click to enter the test interface. At this time, the system will start timing to determine whether the test is over; After the start test button at the test point, the system will generate the unit test paper according to the unit test paper generation rules set of English course by the teacher user. On the basis of the successful generation of the unit test paper, the unit test system of online English course will display the test paper to the student user, and the student user can start answering questions; Student users can answer questions online. In this process, student users cannot leave the screen and will prohibit student users from copying.

In addition, it will always record the time and judge whether the timing is over. The answers in the answer process will be saved in the cache. After the student user completes the answer, they click to submit, and the system will submit the test answer to the system database. It is worth noting that if the user does not actively submit the test answer after the test time, the system will force the existing answer to be submitted to the system; After the students submit their answers, the online test system will be started for marking. The system will compare the students' answers with the standard answers of the unit test questions of English course, and generate scores according to the standard answers. If there are subjective questions in the unit test paper, the teacher needs to mark the paper manually. After marking, the system will add the test scores generated by the candidates to the database, for students to query [13]. After the results are published, students can enter the system to query their personal results, and can use the print function to print out their personal results for viewing.

2.5. Resource recommendation method of online English course

The business server in the business logic layer of the system is responsible for students' personalized resource recommendation of online English course. Its essence is to match the characteristics of online English course resources with students' characteristics to obtain the optimal solution, and then obtain the personalized resource recommendation sequence of online English course. At present, the resource recommendation of online English course aims to recommend to multiple students. The main factors considered are: whether the difficulty of online English course resources matches students' ability level, whether the learning time of English course meets students' expected learning time of the English course, and whether the learning concept corresponding to online English course resources matches students' expected learning objectives [14]; the factor of single student should also be considered; Whether students' preference for English course types matches the content type of online English course resources, and whether the media type of online English course resources meets students' preference for English course media types [15]. According to the description of the above problems, the system proposes a personalized resource recommendation model of English course based on three-dimensional feature collaborative control. The specific model is shown in Figure 6.

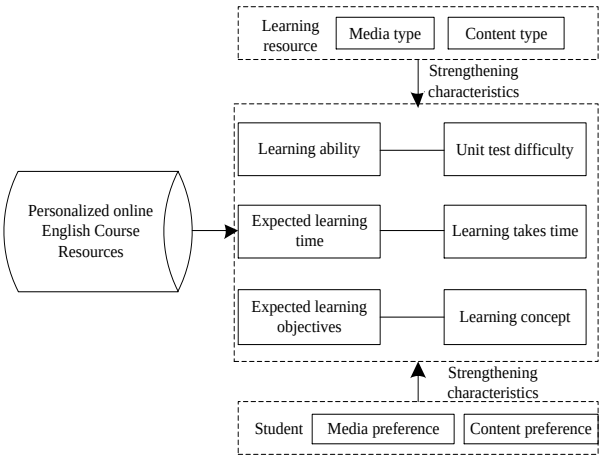


Figure 6. Unit test recommendation model of personalized English course

As can be seen from Figure 6, the multi student feature in the three-dimensional feature represents the student feature extracted for the presence of multiple students; The characteristics of English course resources are the characteristics of English course resources that match many students; Reinforcement features refer to the problems of small difference and low accuracy in the final recommended resource sequence of personalized English course when considering the characteristics of multiple students [16].

3D feature description of model

(1) Description of multi learner feature

Based on the above model, the multi learner feature *LF* can be described as equation (1):

$$\begin{cases} L=\{L_1,L_2,\cdots,L_K\} \\ A=\{A_1,A_2,\cdots,A_K\} \\ H=\{H_1,H_2,\cdots,H_K\} \\ t_{up} \\ t_{down} \end{cases} \quad (1)$$

Where, t_{up} represents the upper limit of the expected learning time of student L_k 's English course unit test, and t_{low} represents the lower limit of expected learning time

of student L_k's English course unit test. L represents K students $1 \le k \le K$; A represents the ability level of K students, A_k represents the ability level of L_k students; H represents the expected learning objectives of K students, and each H_k has M binaries. The matrix expression (2) is:

$$H_{k\times m} = \begin{bmatrix} H_{11} \cdots H_{K1} \\ H_{12} \cdots H_{K2} \\ \vdots \quad \cdots \quad \vdots \\ H_{1M} \cdots H_{KM} \end{bmatrix}$$
$$H_{km} = \begin{Bmatrix} 1, & match \\ 0, & unmatch \end{Bmatrix} \tag{2}$$

Where, H_{km} is used to judge whether the learning concept C_m meets the expected learning goal, where $1 \le m \le M$.

(2) Characteristics of English course resources

The characteristics *RF* of online English course resources can be described as equation (3):

$$\begin{cases} C = \{C_1, C_2, \cdots, C_M\} \\ LM = \{LM_1, LM_2, \cdots, LM_N\} \\ D = \{D_1, D_2, \cdots, D_N\} \\ R = \{R_1, R_2, \cdots, R_M\} \\ t = \{t_1, t_2, \cdots, t_N\} \end{cases} \tag{3}$$

Where, C represents M concepts that students expect to learn from online English course resources; LM represents N candidate online English course resources matching learning concepts; D represents the difficulty level of N candidate online English course resources, D_n represents the difficulty level of online English course resources LM_n; t represents the time required to complete the English course, t_n represents the time required to complete the online English course resource LM_n, R represents the candidate online English course resources matching all learning concepts, each R_m has N binaries, and the matrix is expressed as equation (4):

$$R_{m\times n} = \begin{bmatrix} R_{11} \cdots R_{M1} \\ R_{12} \cdots R_{M2} \\ \vdots \quad \cdots \quad \vdots \\ H_{1N} \cdots H_{MN} \end{bmatrix}$$
$$R_{km} = \begin{Bmatrix} 1, & match \\ 0, & unmatch \end{Bmatrix} \tag{4}$$

Here, R_{mn} is used to judge whether the online English course resource LM_n matches the learning concept C_m, where $1 \le n \le N$.

(3) Enhanced feature description

As a reinforcement feature, the personalized feature *PF* of single student plays a decisive role in the accuracy of online English course resource recommendation [17], which can be described as equation (5):

$$\begin{cases} MP = \{MP_1, \cdots, MP_M\} \\ CP = \{CP_1, \cdots, CP_M\} \\ MK = \{MK_1, \cdots, MK_M\} \\ CK = \{CK_1, \cdots, CK_M\} \end{cases} \tag{5}$$

Where, MP represents students' media preference for English course knowledge points, and each MP_m contains G one-dimensional vectors, which is equation (6):

$$MP_{m\times g} = \begin{bmatrix} MP_{11} \cdots MP_{M1} \\ MP_{12} \cdots MP_{M2} \\ \vdots \quad \cdots \quad \vdots \\ MP_{1G} \cdots MP_{MG} \end{bmatrix} \tag{6}$$

Where, the value of G represents the number of media types contained in online English course resources, $1 \le g \le G$. The value of MP_m is a real number, which represents the preference of students for the g-th media type of the m-th concept.

CP represents students' preference for the content of English course knowledge points. Each CP_m contains G one-dimensional vectors, which is equation (7):

$$CP_{m\times g} = \begin{bmatrix} CP_{11} \cdots CP_{M1} \\ CP_{12} \cdots CP_{M2} \\ \vdots \quad \cdots \quad \vdots \\ CP_{1G} \cdots CP_{MG} \end{bmatrix} \tag{7}$$

The number of G is the number of content types contained in the learning resources. The value of CP_m is a real number, indicating the students' preference value for the g content type of the m knowledge point.

MK represents the media type of online English course resources matching the concept, i.e., pictures, slides and documents. Each MK_m contains N one-dimensional vectors, which is equation (8):

$$MK_{m\times n}=\begin{bmatrix} MK_{11}\cdots MK_{M1} \\ MK_{12}\cdots MK_{M2} \\ \vdots \quad \cdots \quad \vdots \\ MK_{1N}\cdots MP_{MN} \end{bmatrix} \tag{8}$$

$$MK_{mn}=\begin{cases} \text{picture} \\ \text{slide} \\ \text{file} \end{cases}$$

Where, the value of MK_{mn} is an integer, representing the media type of the n -th learning resource corresponding to the m knowledge point.

CK is the online English course resource type corresponding to the knowledge points, i.e. English words, grammar and phrases. Each CK_m contains N one-dimensional vectors, which is equation (9):

$$CK_{m\times n}=\begin{bmatrix} CK_{11}\cdots CK_{M1} \\ CK_{12}\cdots CK_{M2} \\ \vdots \quad \cdots \quad \vdots \\ CK_{1N}\cdots CP_{MN} \end{bmatrix} \tag{9}$$

$$CK_{mn}=\begin{cases} word \\ \text{grammar} \\ \text{phrase} \end{cases}$$

Where, the value of CK_m is an integer, indicating the n -th English course content type corresponding to the m -th knowledge.

Construction of objective function based on collaborative domination of three-dimensional features

Personalized resource recommendation of online English course can be realized by constructing fitness function, which is conducive to promoting the application of heuristic algorithm in learning field [18]. Personalized resource recommendation of online English course method constructs fitness function based on three-dimensional characteristic parameters, and makes unit test of English course meet students' needs through the following objective function [19].

The difference between online English course resources and students' expected goals can be expressed as $\left|R_{mn}-H_{km}\right|$. in practical application, there are multiple concepts and online English course resources, $1\le n\le N, 1\le m\le M$. If the decision variable is added, there is equation (10):

$$\sum_{m-1}^{M}\sum_{n-1}^{N}\left|X_{nk}R_{mn}-X_{nk}H_{km}\right| \tag{10}$$

The objective function F_1 describes which online English course resource corresponds to the learning concept of students' needs. The difference satisfying F_1 can be obtained from the above equation, which is equation (11):

$$F_1=\frac{\sum_{m-1}^{M}\sum_{n-1}^{N}\left|X_{nk}r_{mn}-X_{nk}h_{km}\right|}{\sum_{n=1}^{N}X_{nk}}, 1\le k\le K \tag{11}$$

The difference between students' ability level and the difficulty level of online English course resources can be expressed as: $\left|D_m-A_k\right|$. With the increase of online English course resources, $1\le n\le N$, $1\le k\le K$, and the difference is $\sum_{n=1}^{N}\left|X_{nk}D_m-X_{nk}A_k\right|$.

Therefore, F_2 can be used as an objective function to describe which learning resource is suitable for students' ability. In order to ensure that the learning of online English course resources can be completed within the expected time, the objective function F_3 can be obtained, as shown in equation (12) for details:

$$F_2=\frac{\sum_{m-1}^{M}\sum_{n-1}^{N}\left|X_{nk}r_{mn}-X_{nk}h_{km}\right|}{\sum_{n=1}^{N}X_{nk}}, 1\le k\le K$$

$$F_3=\left(\max\left(0,\sum_{n-1}^{N}t_nX_{nk}\text{-}t_{up}\right)\right)+\left(\max\left(t_{down}\text{-}\sum_{n-1}^{N}t_nX_{nk},0\right)\right) \tag{12}$$

After multiplying by the corresponding weight, the fitness function of the group recommendation stage is

expressed as $\min f_1(x)$, and then continue to consider the personalized characteristics. The media preference is expressed as MKP_{mg}, shown in equation (13) for specific calculation:

$$\min f_1(x) = \sum_{j=1}^{3} \omega_j F_j$$
$$MKP_{mg} = \frac{1}{\sum_{g=1}^{G} Num4_{mg}} \square Num4_{mg} \quad (13)$$

The objective function is calculated from MKP_{mg} and expressed as equation (14):

$$F_4 = \frac{1}{G} \times \sum_{g=1}^{G} \left| MP_{mg} - MKP_{mg} \right|, 1 \le m \le M \quad (14)$$

Where, MKP_{mg} represents the percentage of the media type and all knowledge points of the online English course resources, and F_4 is the average difference between the students' preference for the media type of a knowledge point and the media type of the knowledge point. If $X_{mn}MK_{mn}$ is $g = 1,2,3,4,5$, the type value $Num4_{mg}$ increases by 1, otherwise it is 0. $X_{mn}MK_{mn}$ indicates the type of unit test media covering a certain knowledge point.

Similarly, the content type preference is expressed as CKP_{mg}, and F_5 is calculated from CKP_{mg}.The details is shown in equation (15):

$$CKP_{mg} = \frac{Num5_{mg}}{\sum_{g=1}^{G} Num5_{mg}}$$
$$F_5 = \frac{1}{G} \times \sum_{g=1}^{G} \left| CP_{mg} CKP_{mg} \right|, 1 \le m \le M \quad (15)$$

Where, CKP_{mg} represents the percentage of the content type and all knowledge points of the online English course resources, and F_5 represents the average difference between students' preference for the content type of knowledge points and the content type. If $X_{mn}CK_{mn}$ is $g = 1,2,3,4$, the type value $Num5_{mg}$ increases by 1, otherwise it is 0. $X_{mn}CK_{mn}$ indicates the content type of online English course resources covering a certain knowledge point.

Therefore, after adding a single student's personalized feature, the corresponding weight value is set according to the importance to obtain the final fitness function, as shown in equation (16):

$$\min f_2(x) = \sum_{j=1}^{3} \omega_j F_j + \omega_4 F_4 + \omega_5 F_5 \quad (16)$$

Decision variables

The recommended English course resources are initialized as: $X = \{X_1, X_2, \cdots, X_N\}$, each X_n contains K vectors, using X_{nk} binary code. If $X_{nk} = 1$, the English course resources are recommended; If $X_{nk} = 0$, the English course resource is not recommended.

3. Experimental analysis

This system is applied to the unit test of online English courses in a foreign language education institution to verify the resource recommendation of online English course and storage performance of the system in this paper. In order to ensure the accuracy of the experiment, the data length selected in the experimental test is 200byte, which is in line with the experimental research and improves the accuracy of the experiment.

3.1 Experimental scheme design

The experiment selected the knowledge points of a unit in the online English course of the foreign language education institution. The knowledge points of the English course unit are shown in Figure 7.

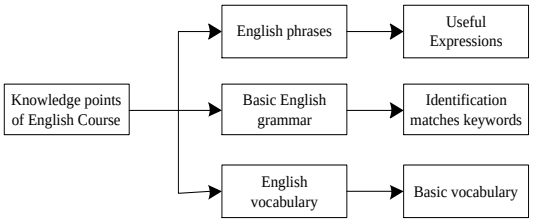


Figure 7. knowledge module of English course unit

As can be seen from Figure 7, the selected English course knowledge points include English phrases, basic English grammar and English vocabulary, which are often covered in English course units. These are also the knowledge points that students want to master most,

which can better reflect the application value of the system.

It is assumed that an existing student A is interested in learning the online English course. According to the system description and the construction rules of five objective functions, and to ensure that the experiment can specifically recommend the best online English course resources, the initialization parameters of the experiment are random initialization, as shown in Table 1.

Table 1. initialization parameter conditions

Objective function	Parameter condition	
Objective function 1	Expected learning objectives	Basic English grammar
Objective function 2	Ease of fit	Level 4
Objective function 3	Expected learning time	30 Minutes
Objective function 4	Expected media type	Slide
Objective function 5	Expected content type	Example explanation

3.2 analysis of experimental results

According to the system, the parameter conditions of unit test and experiment initialization are calculated through the constructed objective function, and the fitness function is optimized with an improved algorithm to obtain the recommended results of English course resources on the outgoing line, as shown in Table 2.

Table 2. recommended results of unit test

Online English course resource serial number	Output results
1	0
2	1
3	1
4	0
...	0
60	1
...	0
95	1
96	1
...	0
100	1

In Table 5, 1 indicates that the online English course resources corresponding to the serial number are recommended to student A, and 0 is not recommended. It can be observed that the online English course resources with serial numbers of 2, 3, 60, 95, 96100 are the recommended results, indicating that these online English course resources comply with table 4.

Further, in order to verify that the online English course resources recommended by the system have different advantages, combined with the recommended examples in Table 4, English course resources are recommended to students A, B and C respectively through the unconstrained online learning system with the same scale in reference [3], the e-learning recommendation system based on learning resources self-organization in reference [5] and the system in this paper, The initialization parameters of three students are different. 15 online English course resources are numbered from 1 to 15, so each student can get a resource recommendation sequence online English course, as shown in Figure 8.

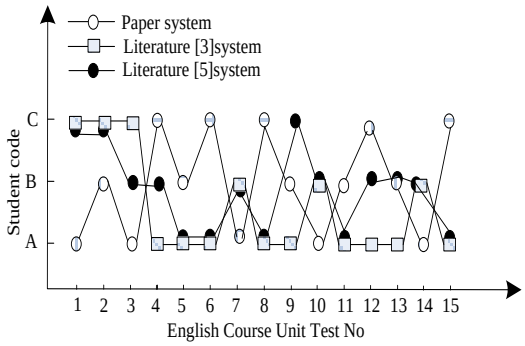
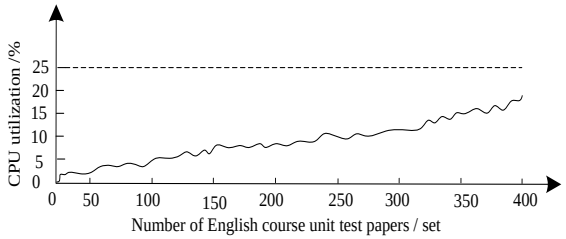


Figure 8. Recommended sequence diagram of unit test

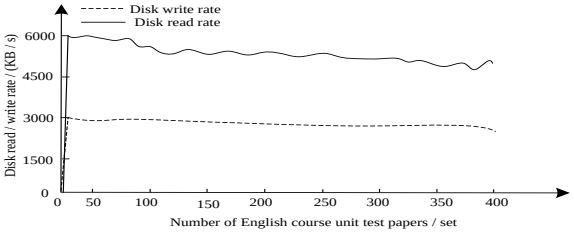
As can be seen from Figure 8, the resource sequences of online English course recommended by the system are obviously different. The sequences recommended by the system in the comparative reference [3] and reference [5] are relatively similar, which shows that the system in this paper has strong adaptability to problems, has better ability to recommend online English course resources that meet the needs of students, and can recommend online English course resources with higher matching degree for students with different characteristics.

The system will generate a certain number of unit test papers of English course according to the students' specific learning situation. With the students' learning progress, a new batch of unit test papers will be produced, which is a challenge to the performance of the MySQL database of the system. Efficient system operation is the basis for supporting the application. Therefore, after 3 months of application of the system in this paper, with the increase of unit test volume, the operation of the system is recorded, and CPU utilization, disk read rate, disk write

rate and maximum sampling rate are taken as verification indicators. The specific operation is shown in Figure 9.



(a)CPU utilization



(b)Disk read / write rate

Figure 9. system operation diagram

It can be seen from Figure 9 that the CPU utilization rate of the system increases slightly when dealing with the increasing unit test volumes, but the range is still less than 25%; The disk reading rate is about 6000kb / s and the disk writing rate is about 3000kb / s, with a small decrease, and the difference is no more than 1000KB / s, indicating that the system operation can cope with the continuously changing English course content, and can ensure the rapid operation of the system even if the unit test content is increasing. It shows that the system has strong performance and can be widely used.

4. Conclusion

After each teaching, students can evaluate the content of English course units online, and can also query the test results online. In the system, teachers need to input the teaching points of English course units, and students can sign up for testing. Each score is recorded and can be queried. The system can generate suitable test papers according to the characteristics of students, so that students can master unit knowledge points as soon as possible to avoid that the test paper is too difficult or too simple to hinder students' progress. According to the test results of students, teachers can timely understand the teaching effect and summarize the key points and pass rate of English course units. According to these data, teachers can recognize the shortcomings in daily classroom teaching, promote the improvement of their teaching level and lay a good foundation for the development of national education system.

References

[1] Liu S., Wang S., Liu X., et al (2022). Human Inertial Thinking Strategy: A Novel Fuzzy Reasoning Mechanism for IoT-Assisted Visual Monitoring, . IEEE Internet of Things Journal, online first, 10.1109/JIOT.2022.3142115.

[2] Igbokwe U. L., Nwokenna E. N., Eseadi C., et al (2019). Intervention for burnout among english education undergraduates: implications for course innovation. Medicine, 98(26): 16219.

[3] Kotowski W. (2020). Scale-invariant unconstrained online learning. Theoretical Computer Science, 80(02): 139-158.

[4] Lopez F. D., Gordillo A., Alarcon P. P., et al (2021). Comparing traditional teaching and game-based learning using teacher-authored games on computer science education. IEEE Transactions on Education, 21(19): 1-7.

[5] Wan S. & Niu Z. (2018). An e-learning recommendation approach based on the self-organization of learning resource. Knowledge-Based Systems, 160, 23(01):12-18.

[6] Dong J. W. (2021). Design of professional courses online evaluation management system based on SOA architecture. Modern Electronics Technique, 44(4): 88-92.

[7] Liu S., He T., Li J., et al (2022) An Effective Learning Evaluation Method Based on Text Data with Real-time Attribution - A Case Study for Mathematical Class with Students of Junior Middle School in China, ACM Transactions on Asian and Low-Resource Language Information Processing, online first, 10.1145/3474367.

[8] Moyo T., & Mckenna S. (2021). Constraints on improving higher education teaching and learning through funding. South African Journal of Science, 117, 36(03):12-16.

[9] Mustafa N. & Zahoor H. (2020). Sars-cov-2, higher education and mental wellbeing. International Journal of Molecular Medicine, 8(4): 18-22.

[10] LI F. J. (2019). Accurate Identification and Simulation of Access Information Tracking in Multi-User Database. Computer Simulation, 36(01): 373-376.

[11] XU C. J. (2019). Fast Capture Simulation of Change Track Information in Large Relational Database. Computer Simulation, 36(07): 292-295.

[12] Shuai L., Dongye L., Khan M., et al (2021). Effective Template Update Mechanism in Visual Tracking with Background Clutter. Neurocomputing, 458: 615-625.

[13] Igbokwe U. L., Nwokenna E. N., Eseadi C., et al (2019). Intervention for burnout among English education undergraduates: implications for course innovation. Medicine, 98(26): 16219.

[14] Shuai L., Dongye L., Gautam S, et al (2021). Overview and methods of correlation filter algorithms in object tracking. Complex & Intelligent Systems, 7: 1895-1917.

[15] Milojicic D. (2020). Accelerators for artificial intelligence and high-performance computing. Computer, 53(2): 14-22.

[16] Liu S., Guo C., Fadi A., et al (2020). Reliability of Response Region: A Novel Mechanism in Visual Tracking by Edge Computing for IIoT Environments, Mechanical Systems and Signal Processing, 138: 106537.

[17] Youcef D., Asma B., Gautam S., et al (2021). Fast and Accurate Deep Learning Framework for Secure Fault Diagnosis in the Industrial Internet of Things, IEEE Internet of Things Journal, online first, 10.1109/JIOT.2021.3092275.

[18] Asma B., Youcef D., Gautam S., et al (2021). A Two-Phase Anomaly Detection Model for Secure Intelligent

Transportation Ride-Hailing Trajectories, IEEE Transactions on Intelligent Transportation Systems, 22(7): 4496-4506.

[19] Shuai L. (2019). Introduction of Key Problems in Long-Distance Learning and Training, Mobile Networks and Applications, 24(1): 1-4.