Mobile Networks and Applications (2022) 27:1174–1185
https://doi.org/10.1007/s11036-022-01943-5

Design of Distance Assistance System for Intelligent Education by Web-based Applications

Chao Yang[1] **· Jerry Chun-Wei Lin**[2]

Accepted: 9 February 2022 / Published online: 9 March 2022

Abstract
In order to improve the quality of distance education and solve the problem of slow data processing of the teaching system, an intelligent distance education assistance system based on WEB is developed in this paper. After verification, students, teachers and administrators log into the distance intelligent teaching assistance system and transmit various information to the interface of the teaching and administration subsystems. The submitted information is merged using the Bayesian model for integrating educational resources in the digital cloud to create a distance education database that supports the system with data. At the same time, the evaluation of the business logic of the data is performed. After the data is converted to other formats in the subsequent convertible database, it returns to the user interface to provide browsing and consulting functions for users. The experimental results show that the designed system can realize the remote auxiliary function of intelligent education and effectively improve the quality of teaching. The real-time data acquisition rate of the system in this paper is always equal to the set value. The average acceleration of the system in this paper is 5.5 and the data processing efficiency is higher. The minimum safety factor of the system is between 7.8 and 8.5, and the system has high stability. The user satisfaction of the system is over 93%, and the accuracy of the collected data is relatively high. The auxiliary system designed in this paper can provide a stable and efficient application environment for distance education.

Keywords WEB · Intelligent education · Distance assistance teaching system · Teaching support · Resource management

1 Introduction

In traditional education, teachers are the source of knowledge, and students learn by absorbing the information imparted by teachers. As recipients of instruction, students in the teaching process are only able to passively absorb knowledge, and their initiative and self-initiative cannot be fully mobilized. The quality of teaching is usually evaluated according to students' academic performance, which leads to attaching too much importance to grades and paying attention only to the education of a few top students, hurting the self-esteem of most students and ignoring the development and cultivation of most students' abilities. From this point of view, this is not only a great waste of educational resources, but also a strangulation of students' personality and creativity [1].

With the rapid development of multimedia technology, the multimedia classroom has become commonplace at many colleges and universities. Many courses are taught in the multimedia classroom. The teaching method has changed from traditional classroom teaching to computer-based teaching in multimedia classroom. Teachers use multimedia devices to show students the teaching content in the form of images, texts, sounds and pictures with the help of multimedia learning programs and other multimedia materials, so that students can be influenced and receive information in a comprehensive way and achieve good teaching results [2]. However, after an extensive study of teachers and students teaching multimedia in our school, it was found that this teaching method has some shortcomings. First, a large amount of information is passed in multimedia teaching. Students need to listen carefully in class. Many students are

✉ Jerry Chun-Wei Lin
jerrylin@ieee.org

Chao Yang
yc@hfuu.edu.cn

[1] Fundamental Teaching and Engineering Training Center, Hefei University, Hefei, China

[2] Department of Computer Science, Electrical Engineering and Mathematical Sciences, Western Norway University of Applied Sciences, Bergen, Norway

not used to taking notes. Some students try to take notes but often cannot keep up with the progress of the teacher's lectures. This is not conducive to students' self-study after class. Second, classes are designed to be multimedia. During teaching, teachers need to load and carry the required teaching materials and other materials on the mobile storage medium, which is very inconvenient [3]. Third, the interaction and communication with students has not improved with the use of multimedia teaching, nor has traditional classroom teaching. In view of the above problems, some teachers create personal homepages, provide students with learning materials outside the classroom, answer students' questions, and regularly update the contents of the personal homepages. In order to update the contents of the homepages, the homepages need to be changed with the help of editing programs, which is very inconvenient. In recent years, the rapid development of computer network technology has led mankind into the "information age". The saying of the "global village" has caught on with most people. With the rapid development of multimedia technology and network technology, networked learning has become possible [4]. It overcomes the limitations of the traditional campus and can create a broader learning environment without time and space constraints. The network can enable learners to participate more actively and increase their interest in learning. At the same time, it can also realize teaching without real-time. Therefore, using the development of network technology to establish a network teaching platform for remedial teaching is an effective teaching tool and the best way to achieve the sharing of information and resources. Considering the development of network teaching, it is necessary to develop a more customized platform for network teaching. In this regard, Luo studied the teaching platform of College of Public Course Information based on SPOC. The three-tier B/S architecture model is used to run advanced applications and link them with the database. In this method, a curriculum information module, teaching materials module, teaching activities module, assessment module, and statistics module are developed. On this basis, you can operate and teach the platform. However, due to the large amount of data to be processed, the working speed of the system needs to be improved [5]. Tong et al. designed the College of Physics mobile learning platform based on Android, but they had obvious relevance. In the architecture of Android platform, the C/S model is used to design the mobile client and server. The functional modules mainly include the system login module, learning resources module, online discussion module and personal center module. The system uses a MySQL database to link entities, attributes and entities. However, the system cannot be divided in terms of resource management and needs further improvement [6]. In order to solve the problems of the current system, in this article, we will discuss why it is crucial to develop a more customized online tutoring teaching platform for college English to meet the demands of developing English teaching for online education.

Using the network learning platform, students can move from passive to active learning at any time in the network environment (WEB). On this platform, students are the focus of instruction. Students conduct personalized learning so that teachers and students can overcome the time and space constraints in the communication process. In WEB-based teaching, the contradiction between fewer teaching hours and a significant increase in the amount of curriculum information, as well as the contradiction between a significant increase in the number of students and the weakness of teachers, is better resolved. Through the network platform for basic computer courses of college, it can not only cultivate students' ability to acquire knowledge through the network, but also promote the cultivation of students' independent spirit and cooperation quality [7].

With the progress of science and technology, WEB technology has been widely used in education. The traditional teaching process, teaching methods and teaching materials can no longer be adapted to the current educational situation, and the classroom-oriented teaching model can no longer meet the requirements of the information age [8]. The creation of WEB -based distance education system for intelligent education is the inevitable embodiment of the development of modern information technology on campus. It has the advantages of traditional distance education - it is not limited by time, space and place, and can be extended to all corners of society through the Internet. Anyone can freely learn through the network at any time and any place and get quality education at a lower cost, which makes the traditional distance education system more intelligent, adaptable, maintainable and expandable.

2 Distance assistance system for intelligent education

2.1 Overall structure of the system

The WEB based intelligent education support system developed in this work uses the B/S structure mode. The development of the B/S structure system for intelligent education in an Internet/intranet environment has the following features: The client software only needs to install the browser, and the hardware configuration requirements are low. It is easy to manage and maintain, with extremely low management cost and lower maintenance, which is conducive for managers and developers to focus on the reasonable organization of the structure of the information system and better provide technical support for various enterprises. The browser software can be downloaded and updated directly from the

Internet for free. You can browse online resources without spending money [9].

The main content of this system is online learning and online examination. In designing the online learning subsystem, we approach the system from three sides, namely students, teachers, and administrators. When designing the online examination subsystem, we approach the system from two aspects, namely examinees and managers. In the online learning subsystem, students need to change their personal information after logging in. During the change process, they need to change their login name and password. This data is received by text and then transferred to the Users table. An issue management window should also be set up. In the question management window, it must be possible to link to the content of the chapter to which the question belongs so that students can better understand the content of the chapter. Online questions are an important feature for students. Students must be registered members to ask questions, otherwise they will not be able to ask questions. In addition, the class must be selected when asking questions, and the instructor is also registered through the drop-down list. The system also logs into different interfaces by assessing "teachers" and "students" [10]. Teachers must have higher authority to modify data and upload learning content. In the design process, teachers need to upload personal courseware at any time and make appropriate rules for the upload address. The administrator mainly takes care of adding and deleting class information and announcement information.

In the online exam subsystem, candidates can select exam subjects after registering and entering them, and then take the exam. Once the examinee has taken the exam, he or she will complete the entire exam process in one go. It is not possible to refresh or log in again. The main functions of this subsystem are automatic creation of exam sheets and grading. As long as the administrator enters the relevant parameters of the topic selection, the system can automatically complete the selection of test questions and the creation of exam papers [11]. The online examination requires a high level of security. The main functional design is that the examinee selects the exam content for the exam and the administrator handles the paper production and user management. The overall architecture of this system is shown in Fig. 1.

The system is mainly oriented to students, teachers, and administrators. The corresponding module content is designed from these three roles. Among them, the content of the module for teacher users includes homework correction submission, online response to questions, and question bank maintenance. The content of the module for student users includes courses, homework submission, self-monitoring, and online questioning. The administrator's module content

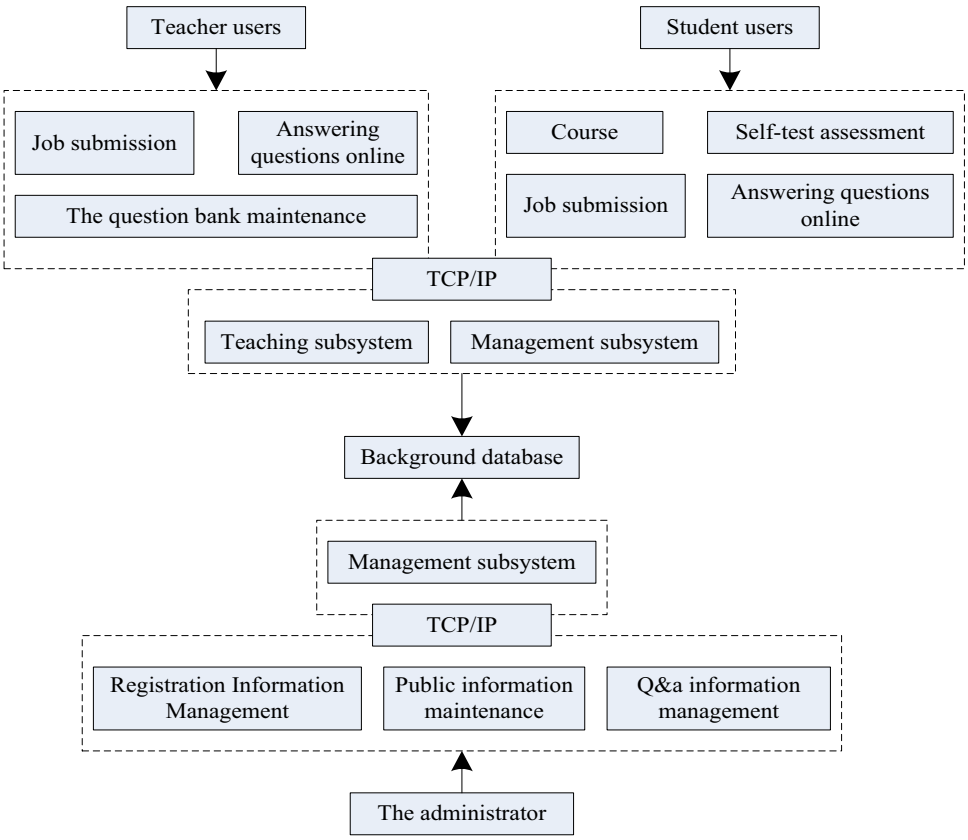

Fig. 1 Overall architecture of distance assistance system for intelligent education based on Web

includes registration information management, information maintenance, and question and answer information management. The database is connected to the three modules to store and maintain the data of the teaching system and the management system.

2.2 Design of the functional structure of system

The roles of the distance assistance system for intelligent education designed in this paper are divided into students, teachers and administrators. The functions of the system mainly include four functional modules: Teaching Support, Resource Management, Education Management, and System Management. After authentication, the user logs in to the distance intelligent education assistance system and then can operate the system according to their respective permissions [12]. Fig. 2 shows the main functional structure of the system.

Among them, the roles in the teaching support module are mainly teachers and students. After users log in to the system, teachers can manage course courseware online, arrange and modify homework, upload courseware related materials, etc. Students can browse the course materials, complete their homework online, ask teachers questions, etc. This module mainly consists of two sub-modules: course teaching and teacher-student communication. The course teaching submodule provides functions such as browsing course materials, course announcements, tutoring and Q&A, VOD on demand, homework review, etc. [13]. It can centrally manage the developed courseware resources, students can search for the corresponding courseware address of the selected course, and teachers can search for the corresponding courseware address of the previous course; publish instant messages about the course; teachers can upload teaching help files, classic cases, frequently asked questions and answers related to the course for students to download and learn; provide excellent teaching video resources for students and teachers; teachers can assign, correct and analyze course assignments and search the overall situation of assignments; students can modify and submit assignments online and browse teachers' comments to understand the mastery of knowledge points; teachers can input test questions and answers through the system, and students can independently select the appropriate chapters for the test; After the user logs into the remote intelligent education support system, the system automatically tracks the user's operation and provides detailed attendance records and log reports at any time [14]. The teacher-student communication platform sub-module has the functions of classroom discussion and academic forum. Users can discuss and express their opinions on course-related topics to provide teachers and students with powerful online communication tools.

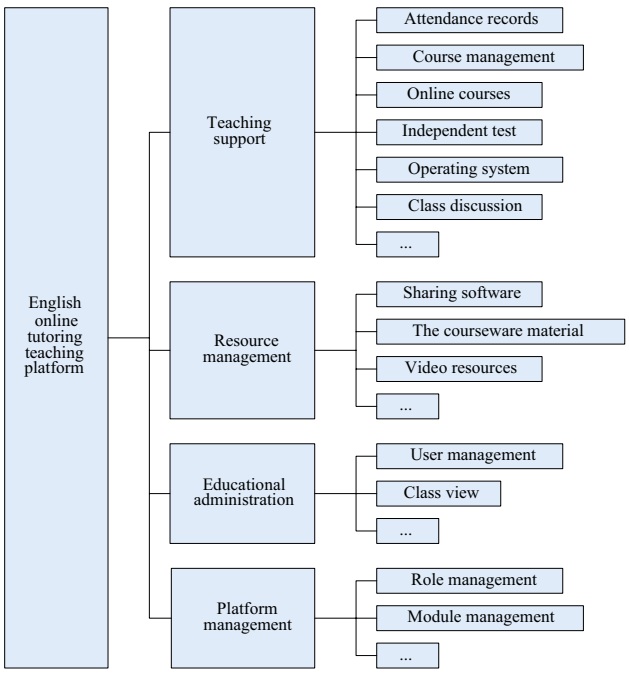

Fig. 2 Main functional structure of the system

The resource module contains shared software resources and resources for educational materials. The shared software resources are aimed at all users and provide them with extensive shared software resources. The instructional material resources are primarily targeted at instructors and provide rich and varied multimedia materials to meet the instructional needs of instructors in developing network courseware [15]. It mainly consists of four parts: the resource storage sub-module, the resource type management sub-module, the resource modification sub-module, and the resource search sub-module. The resource type management submodule is intended for the system maintenance staff. The administrator can set up the resource directory according to the type and also has the authority to add, delete, and modify the resource directory; the resource storage submodule is for teachers and system maintenance personnel and can add different types of instructional resources to the resource library; the resource modification submodule is for teachers and system maintenance personnel. Resource authors and administrators can change the attributes of resources, including description, type, author, size, and other related information, or delete a resource record; shared software resource retrieval in the resource retrieval submodule is for all users, and instructional material resource retrieval is mainly for teachers. Search is based on full-text search based on expressions with several combined search methods for keywords and resource types.

The teaching management module provides mainly teaching-related management functions, including user management, course management, classroom observation, and other submodules. The object-oriented user management sub module is for educational administrators and system

administrators. User management is the management of system user information and permissions, including role-based management of users and user role permission assignment, such as user management, user permission management, user role management, user role permission management, and user password management [16]. User management includes displaying basic user information and course selection, suspending the activation of an account, and resetting user password. The course resource management submodule includes adding and modifying a new course, setting whether the course is charged, viewing student payments, etc. In the lesson observation submodule, educational administrators can review traditional lesson arrangements after logging in.

The system administration module is geared towards the system administrator. Its main functions include customization of the system interface, customization of user rights, management of various functional submodules, etc., which provide powerful system management and updating functions.

2.3 Background database

Various data resources are stored on the database server, including a knowledge database, an information database, and a resource base. The domain knowledge base is a knowledge base composed of knowledge about specific domain courses. Its main function is to organize teaching materials and store and manage all knowledge in relevant teaching domains. The basic unit of the test question bank is the test question. The structure of test questions includes not only the text of the questions, but also specific answers and evaluation criteria [17].

Each question in the question bank has basic attributes such as knowledge level, difficulty, and question type. These attributes change dynamically. For example, when a topic is used more frequently, its difficulty is decreased. The teaching strategies library mainly stores various teaching rules. It allows selection of rules such as learning environment, number of learning tasks, learning difficulty, and whether to enter the review and test links, and provides a basis for teachers to make decisions [18]. The student information database stores students' personal information, such as student number, name, age, etc., and simultaneously records the learning situation, including learning time, times, content, current level, and learning ability. The question bank stores students' learning problems and answers. The composition of the teaching materials database is shown in Fig. 3.

2.4 Integration of education resources based on cloud computing

To effectively classify and optimize the allocation of educational resources, a Bayesian-based digital cloud computing integration model of educational resources is introduced into the system infrastructure module [19]. For the database of cloud storage resources of the system in this paper, there are n groups of education resource data. The data in each group are vectors with d dimensions, and the formula for the classification space is:

$$\Omega = \{w_1, w_2, \ldots, w_n\} \tag{1}$$

In equation (1), w is the educational resource data of different groups. The vector formula of table characteristics is:

$$\vec{x} = (x_1, x_2, \ldots, x_d)^T \tag{2}$$

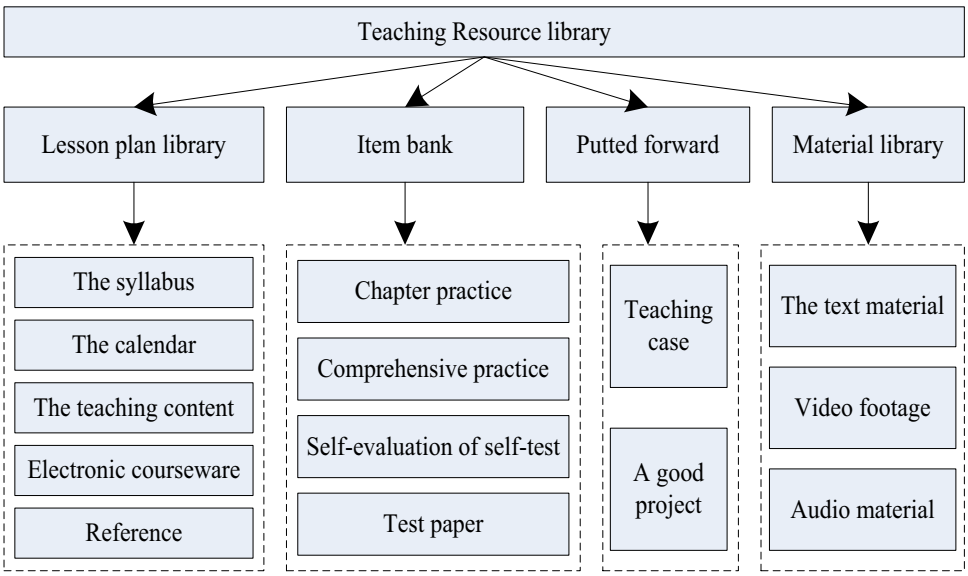

Fig. 3 Composition of education resource database

The classification discriminant function formula of educational digital cloud resources is:

$$P(w_i|\vec{x}) > P(w_j|\vec{x}) \rightarrow w \in w_1 (j = 1, 2, \ldots, nandj \neq i \rightarrow w \in w_i) \tag{3}$$

$$p(\vec{x}|w_i)P(w_i) > p\left(\vec{x}\middle|w_j\right)P(w_j)(j = 1, 2, \ldots, nandj \neq i \rightarrow w \in w_i) \tag{4}$$

In equations (3) and (4), P represents the text resource mode, and p represents the audio-visual resource mode.

Let each dimension of each type of data obey normal distribution respectively, and the following is obtained:

$$f\left(x_j^{wp}\right) = \frac{1}{\sqrt{2\pi}\sigma_j^{wp}} \exp\left\{-\frac{\left(x-\mu_j^{wp}\right)^2}{2\sigma_j^{wp^2}}\right\}$$

According to the theory of mathematical statistics, the sample correction value is the unbiased estimator of μ and the sample mean value is the unbiased estimator σ_j^{wp} of σ^2. The approximate value is obtained:

$$\mu_j^{wp} = X_j^{xp} \tag{6}$$

$$\sigma_j^{wp^2} = \frac{1}{n-1}\sum_{i=1}^{n}\left(X_{ij}^{wp} - \overline{X}_j^{wp}\right)^2 \tag{7}$$

In equation (7), i is the number of samples. X_{ij}^{wp} is a simple sample of the normal population X. $\bar{X}_j^{wp}$ is the average sample of the normal population.

Bayesian decision-making is a risk-based decision. Although decision-makers cannot control the changes of objective factors, they have control over the possible conditions of their changes and the distribution probabilities of various conditions. And use the expected value, which is the average situation that may occur in the future, as the decision criterion. It can quantitatively evaluate the possibility of survey results. It can be used continuously in the decision-making process according to specific conditions, so that the decision-making is gradually improved and more scientific. So this paper chooses this strategy to integrate teaching resources. Bayesian decision rule is selected:

$$l(x) = \frac{p(\vec{x}|w_i)}{p\left(\vec{x}\middle|w_j\right)} > \frac{p(w_j)}{p(w_i)}(j = 1, 2, \ldots, nandj \neq i \rightarrow w \in w_i) \tag{8}$$

If data from different dimensions are independent, then:

$$l(x) = \frac{p(\vec{x}|w_i)}{p\left(\vec{x}\middle|w_j\right)} = \frac{f(\vec{x}|w_i)}{f(\vec{x}|w_i)} = \prod_q^n \frac{f_q(x_q|w_i)}{f_q(x_q|w_i)} = \prod_q^n \frac{\frac{1}{\sigma_q^{wp}}\exp\left\{-\frac{\left(x-\mu_i^{wi}\right)^2}{2\sigma_q^{wp^2}}\right\}}{\frac{1}{\sigma_q^{wp}}\exp\left\{-\frac{\left(x-\mu_j^{wi}\right)^2}{2\sigma_q^{wp^2}}\right\}} \tag{9}$$

Set the threshold value as:

$$\frac{P(w_j)}{P(w_i)} = \frac{N_j}{N_i}, \tag{10}$$

where, N_j represents the number of class j data of classification samples and N_i represents the number of class i data of classification samples. The category can be judged by comparing the threshold value, and finally the classification accuracy can be calculated.

2.5 Workflow of the system

The workflow of the distance assistance system for intelligent education is shown in Fig. 4.

After the user enters the system, the system prompts the user to register or enter security information, depending on the user's situation. For normal users, the system provides services such as browsing courseware information, participating in problem discussions, retrieving difficult problems, taking self-tests, reviewing test results, getting study aids, and so on [20]. Teachers can maintain the system and have the authority to update test questions, update course materials, update web pages, post announcements, update friend links, update images, and so on. Administrators can furthermore update teacher information.

3 Experimental analysis

A provincial university is used to test the operation of this system, and the data is transmitted via the Internet. There are 36,887 teachers and students at this university. The experimental subjects included a total of 60 English courses. Fifty students are randomly selected for system operation test, and the results of the test are output by computer statistics. The effectiveness of the system is verified from multiple perspectives by analyzing the data collection rate, system speedup ratio, message conflict test, and system security. The experimental hardware CPU is Intel Core i7 4600U, and the operating system is Windows 8 and above. The web server version is Tomcat 7.0. The real-time data acquisition rate of the system under different sampling rate settings is tested to verify the effect of the system in

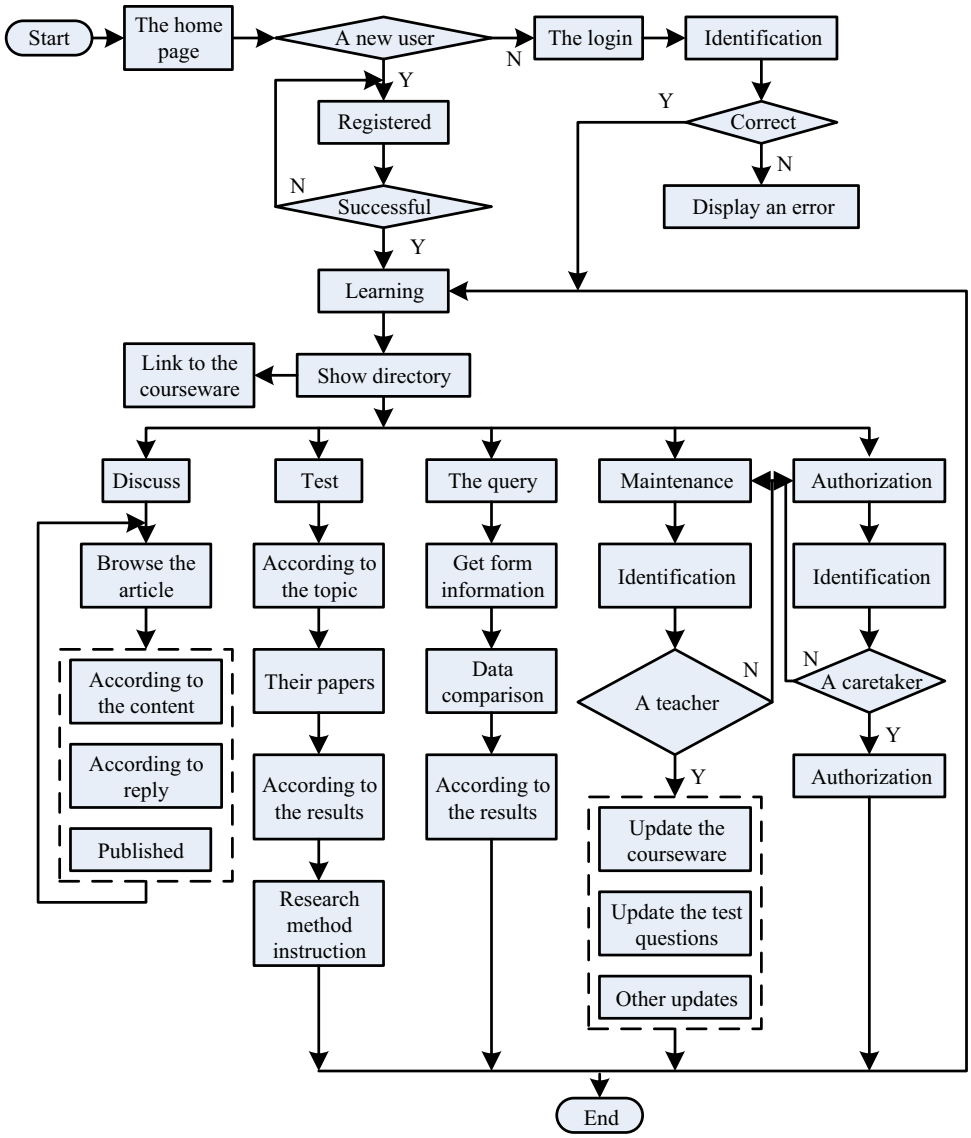

Fig. 4 Flowchart of the distance assistance system for intelligent education

acquiring educational resources. The results are shown in Fig. 5.

From the analysis of Fig. 5, when the setting value of the sampling rate is 5, the real-time data acquisition rate of the system in this paper is equal to the setting value; with the continuous increase of the setting value of the sampling rate, the real-time data acquisition rate of the system in this paper is always equal to the setting value, indicating that the system in this paper can normally complete the acquisition of educational resources according to the setting value and there is no delay in the acquisition of educational resources; when the sampling rate is set to 50. The above results show that this system can greatly improve the acquisition rate of educational resources and meet the requirements of this system.

The acceleration of the process of integrating educational resources is verified using the system in this paper, the SPOC-based public course information system of the university [5] and the Android-based mobile physics learning system of university [6]. The results are shown in Fig. 6.

Compared to Fig. 6, the acceleration rate of the system in this paper in the process of integrating educational resources is higher than that of the other two systems when integrating educational resources. Therefore, it can be concluded that the system in this paper has a high integration speed. For the speedup ratio of a 4GB file, the average speedup ratio of the system in this paper is about 2.5, the average speedup ratio of the system in reference [5] and the system in [6] are about 2 and 1.5, respectively; for the speedup ratio of a 6GB file, the average speedup ratio of the fusion in this paper is about 5.5, the average speedup ratio of the system in reference [5] and the system in [6] in reference are about 4 and 3.5, respectively, and the speedup ratio of a 6GB file is higher than that of a 4GB file. The experiments show that

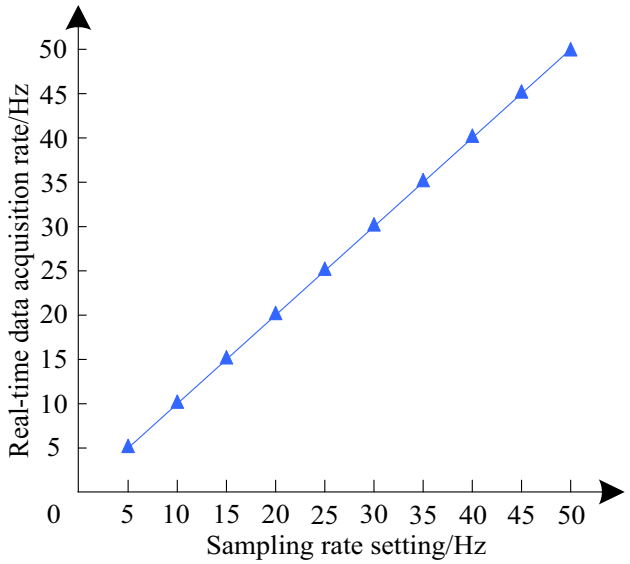

Fig. 5 Real-time data acquisition rate results before and after the system in this paper is used

the larger the file size, the higher the average speedup ratio of the system fusion, and the system is more suitable for processing massive data fusion.

OSPF Router- ID is the unique identifier of the system router. The OSPF Router-ID conflict of the system is tested in the form of a video stream. The video stream is retrieved and played using the embedded system protocol in the system PC, and the changes in the number of video stream messages during the system application are counted. The results are shown in Fig. 7.

From the analysis of Fig. 7, the number of messages in the playback of the video stream varies with the playback time of the video stream. The number of messages in the initial video stream is small, and the message count curve shows an interrupted state after a certain time, which indicates that the OSPF Router-ID on the PC side is conflicted at this time. When the system is applied in this work, the value of the video stream message is high and there is no interruption in the message count curve, indicating that the transmission instruction issued by the system when mobilizing educational resources can call the OSPF Router-ID, reducing the conflict between OSPF Router-IDs. Therefore, the message count of video stream playback is high and its curve is smooth. The above results show that the system in this paper is minimally affected by OSPF Router-ID conflicts in the application process and has good applicability.

The security factor is used to test the security of system resource storage in this paper. Cross-site scripting (XSS) is selected to attack the resources stored in this system and test the security parameters of the system in this paper when

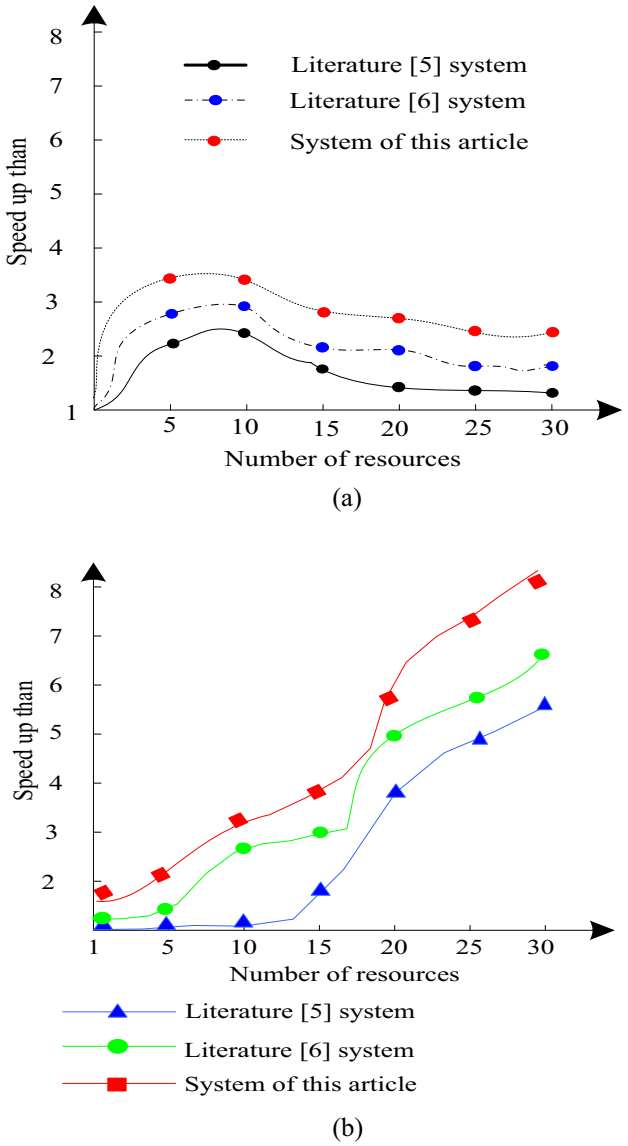

Fig. 6 Acceleration ratio of three systems. (**a**) (**b**)

storing various resources. The higher the value, the higher the security of the system resource storage. The test results are shown in Fig. 8.

Fig. 8 shows that the security parameters stored in the five resources decrease as the number of attacks increases. At different times of the attacks, the difference between the security parameters stored in the five resources is small. When the number of attacks reaches 80, the security parameters do not change, the minimum security factor remains between 7.8 and 8.5, and the security parameters are high. This shows that the security of storing system resources in this paper is high. Since the framework chosen in the development process is universal, the user-side access test of this system is performed with operating systems such as Windows XP,

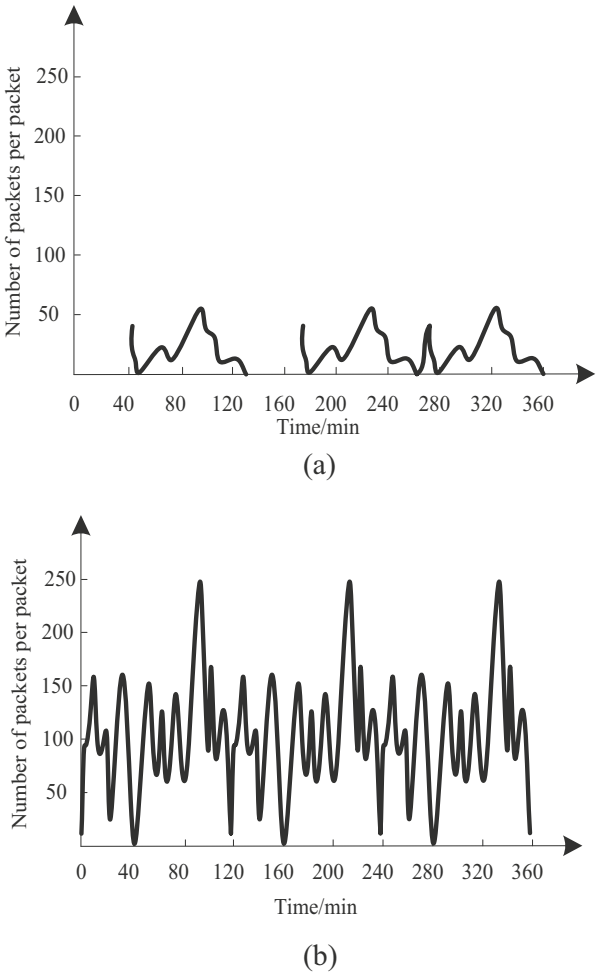

Fig. 7 Conflict test results. (**a**) (**b**)

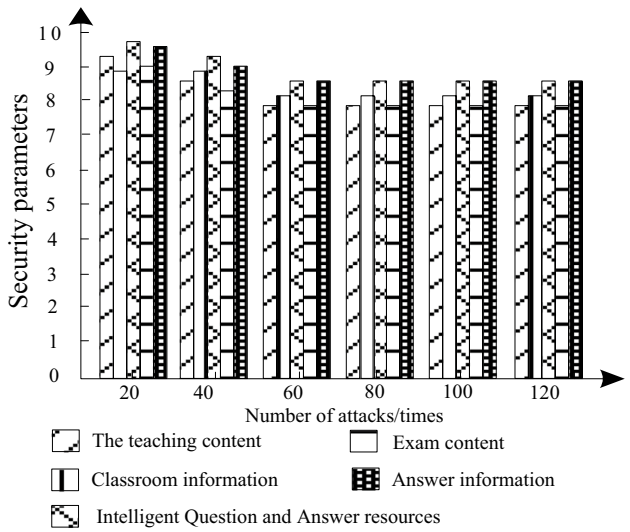

Fig. 8 Results of resource storage security test

Windows7, Ubuntu of Linux kernel, RedHat, Debain, and iOS of Apple to ensure the maximum compatibility of this system. Table 1 is the description of the compatibility test.

From Table 1, it can be seen that the above operating systems can normally access the system through the browser, so there are no problems when testing the operating system on the system client. The integrity of various functions of the system is tested, and the summary statistical information of the corresponding test results is shown in Table 2.

From Table 2, it can be seen that the success rate of the various functions of the system in this paper is high, always higher than 98%, the lowest success rate of the transmission test with duplicate data is 98%, the success rate of the test of the page link function and the information modification function is 99%, and the remaining function tests are as high as 100%, indicating that all the functions of the system in this paper are intact and the comprehensive test results are consistent with the expected results.

The operating performance of the system is mainly affected by the external environment, such as the network environment, server performance, the number of concurrent users, etc. In order to determine the critical point of system performance, it is usually necessary to test the system with a large number of users to evaluate the load capacity of the system. The simulated criticality test of the system ensures that the system still runs and responds normally even in the high concurrency state. Such a system can meet the requirements of college and college administration. Table 3 is the same concurrent user access test of the system in this paper, which simulates the users of 150 and 250 people, respectively, sends the request command to display the students' exam results concurrently, and records the index information of the exam data in their respective states. The test results are shown in Table 3.

From the test results in Table 3, the response speed of the system is always within 1s and the utilization of memory and processor does not exceed 30%. There are no bottlenecks and errors in the network. The system performance meets its own requirements, the response speed and concurrency ability are good, the CPU and memory utilization of the server are lower, the overall effect of the operation is good, and the operation process is relatively reliable. The statistics of students' learning success after using the system in this document are shown in Fig. 9.

As shown in Fig. 9, students' learning effort decreases after using this system, students' likelihood of discussing their knowledge increases, and learning behaviors and habits change, indicating that using this system can effectively improve students' eagerness to learn. The following 10 users evaluate the satisfaction after operating and using the

Table 1 Description of compatibility test

Use case number	D001	D002	D003	D004	D005
Use case description	IE6+Browse the system	Firefox Browse the system	Safira Browse the system	Chorme Browse the system	Opera Browse the system
Operation	Run the system using Internet Explorer 6	Run the system using the Firefox browser	Run the system using the Safira browser	Run the system using the chorme browser	Run the system using the Opera browser
Expected	Normal operation display	Normal operation display	Normal operation display	Normal operation display	Normal operation display

Table 2 Summary of function test results

Test function	The results obtained		
	Number of successful	Wrong number	The success rate
Page function link	99	1	99
Show data commit refresh check	100	0	100
Repeat data submission tests	98	2	98
Data normalization check	100	0	100
Enter specified data for testing	100	0	100
Data add function test	100	0	100
Check information modification function	99	1	99
Check the information query function	100	0	100
Save function check	100	0	100
Delete function Check	100	0	100
User permission assignment test	100	0	100

system, and test the satisfaction of the functions which are browsing the course materials, tutoring and Q&A, searching resources and observing the class in the users' hearts. The test results are shown in Fig. 10.

The results show that the satisfaction of ten users with the system's functions of browsing course materials, tutoring and Q&A, searching for resources, and observing classes is more than 93%, indicating that users are very satisfied with the system.

4 Conclusion

College English instruction is a hot topic for the future. Therefore, an Internet-based online tutoring and teaching platform for college English has been developed to realize the function of online tutoring and teaching of English, solve the problems that students and teachers may encounter in learning and teaching English, and further optimize the online tutoring and teaching platform for English. It can also improve the security of communication, data transmission and data storage under the premise of ensuring the stability of the platform. We will vigorously promote the Internet-based online tutoring and teaching platform for college English, help students and teachers free themselves from the rigid work in the traditional classroom, and improve the subjective initiative of students and teachers in the working and learning process. Because the experimental data is only the test data in the laboratory environment. After the platform is officially deployed and operated, it will be interfered by communication links and network transmission. More standardized and strict network optimization and server deployment connection tests are also needed to ensure that the response delay time of the platform is shortened as much as possible. In future research, we will beautify and

Table 3 Performance test scenarios and results of concurrent customers viewing student test score information

Test scenarios	Test indicators	The test measures	The numerical	Whether through
Number of concurrent users:300 Record number:10000(Maximum concurrent)	Average thing response time	Check the payment information with customers	0.996s	Yes
	System resources	CPU utilization	28.21%	Yes
	Throughput and CTR	Network bottlenecks	Nothing	Yes
	Error rate	Nothing	Nothing	Yes
Number of concurrent users:200 Record number:10000(The best concurrent)	Average thing response time	Check the payment information with customers	0.578s	Yes
	System resources	CPU utilization	17.34%	Yes
	Throughput and CTR	Network bottlenecks	Nothing	Yes
	Error rate	Nothing	Nothing	Yes

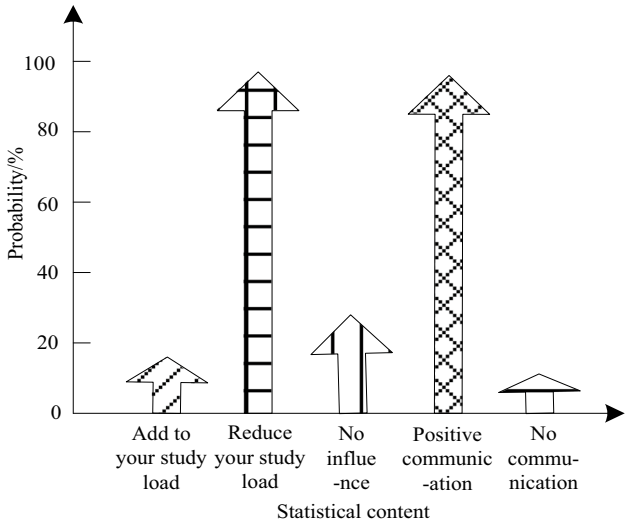

Fig. 9 Statistics of teaching effect

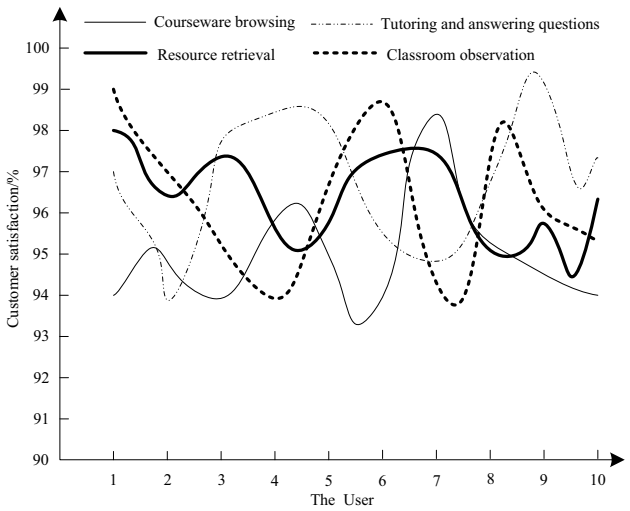

Fig. 10 Survey on user satisfaction

optimize the interface to make the software start-up speed and function realization process achieve better results.

Acknowledgements This work was supported by University-Industry Collaborative Education Program from the Ministry of Education of China (grant no. 202002163050).

Funding Open access funding provided by Western Norway University Of Applied Sciences.

Declarations

The authors have no relevant financial or non-financial interests to disclose. Chao Yang provided the algorithm and experimental results, wrote the manuscript, Jerry Chun-Wei Lin revised the paper, supervised and analyzed the experiment. We also declare that data availability and ethics approval is not applicable in this paper.

References

1. Naumova TA, Vytovtova NI, Mitiukov NW, Zulfugarzade TE (2017) Model of distant learning educational methods for the students with disabilities. Eur J Contemp Educ 6(3):565–573
2. Han LQ, Zhang ZH, Cheng YQ, Liu JM, Lei KC (2018) Research and practice of computer network teaching method based on online learning platform. Softw Eng 21(01):41–44
3. Zhou X, Wang J, Guo M, Gao Z (2019) Cross-platform online visualization system for open bim based on webgl. Multimed Tools Appl 78(20):28575–28590
4. Li R (2020) An artificial intelligence agent technology based web distance education system. J Intell Fuzzy Syst 40(3):1–11
5. Luo X (2019) Research on the Construction and Operation of Information Teaching Platform of University Public Courses Based on SPOC. Information Science 37(12):112–115
6. Tong, Y. X., Tian, Z. A. & Deng, H. Q. (2020). Design and Application Research of University Physics Mobile Learning Platform Based on Android. University physics, 39(04):51-55+75.
7. Baneres D, Robert C (2019) Evaluation of a new self-study platform for introductory digital systems. Interl J Eng Educ 35(1):286–303
8. Hegde V, Patil S, Rao SG (2019) Learning pathway: content management and identification of student behavior through online learning management in java. Intl J Recent Technol Eng 8(2):492–497
9. Lu H (2021) Application of wireless network and machine learning algorithm in entrepreneurship education of remote intelligent classroom. J Intell Fuzzy Syst 40(2):2133–2144
10. Liu S, Wang S, Liu X et al (2021) Fuzzy Detection aided Real-time and Robust Visual Tracking under Complex Environments. IEEE Trans Fuzzy Syst 29(1):90–102
11. Sun Z, Anbarasan M, Praveen Kumar D (2021) Design of online intelligent English teaching platform based on artificial intelligence techniques. Comput Intell 37(3):1166–1180
12. Liu S, Liu D, Srivastava G et al (2021) Overview and methods of correlation filter algorithms in object tracking. Complex Intell Syst 7:1895–1917
13. Xu X, Li D, Sun M, Yang S, Yu S, Manogaran G, Mavromoustakis CX (2019) Research on key technologies of smart campus teaching platform based on 5G network. IEEE Access 7:20664–20675
14. Dimitrienko YI, Gubareva EA, Zubarev KM, Chibisov VY, Grigorieva EN (2020) Open bmstu platform and teachers training in online courses development and implementation areas. ITM Web of Conferences 35(2):03015
15. Xiao J, Wang M, Jiang B, Li J (2018) A personalized recommendation system with combinational algorithm for online learning. J Ambient Intell Human Comput 9(3):667–677
16. Xu N, Fan WH (2020) Research on Interactive Augmented Reality Teaching System for Numerical Optimization Teaching. Computer. Simulation 37(11):203-206+298

17. Yusof MM, Wah NL, Mohamed R, Othman M (2018) E-learning tutoring system for sijil pelajaran malaysia (spm) english. MATEC Web of Conferences 150(5):05001
18. Benatti S, Montagna F, Kartsch V, Rahimi A, Rossi D, Benini L (2019) Online learning and classification of emg-based gestures on a parallel ultra-low power platform using hyperdimensional computing. IEEE Trans Biomed Circ Syst 13(3):516–528
19. Shuai L, Xinyu L, Shuai W et al (2021) Fuzzy-Aided Solution for Out-of-View Challenge in Visual Tracking under IoT Assisted Complex Environment. Neural Comput Appl 33(4):1055–1065
20. Tarim EA, Tekin HC (2020) Performance evaluation of webrtc-based online consultation platform. Turkish J Electric Eng Comput Sci 27(6):4314–4327