

Retraction

Retracted: Research on Intelligent Function Design of Vocational Education System under Mobile Learning Mode

Journal of Mathematics

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Journal of Mathematics has retracted the article titled “Research on Intelligent Function Design of Vocational Education System under Mobile Learning Mode” [1] due to concerns that the peer review process has been compromised.

Following an investigation conducted by the Hindawi Research Integrity team [2], significant concerns were identified with the peer reviewers assigned to this article; the investigation has concluded that the peer review process was compromised. We therefore can no longer trust the peer review process, and the article is being retracted with the agreement of the Chief Editor.

References

- [1] L. Qing, “Research on Intelligent Function Design of Vocational Education System under Mobile Learning Mode,” *Journal of Mathematics*, vol. 2022, Article ID 9684363, 10 pages, 2022.
- [2] L. Ferguson, “Advancing Research Integrity Collaboratively and with Vigour,” 2022, <https://www.hindawi.com/post/advancing-research-integrity-collaboratively-and-vigour/>.

Research Article

Research on Intelligent Function Design of Vocational Education System under Mobile Learning Mode

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Because the traditional vocational education system has intelligent functions, long running time, and low recommendation accuracy of vocational education resources, the vocational education system under mobile learning mode is designed. The system is designed through the registration and login function module, course learning function module, examination and evaluation function module, communication and interaction function module, mobile learning function module, and personalized recommendation function module. In the personalized recommendation function module, the user's preference for vocational education resources is obtained by calculating the user's interest weight, as well as personalized recommendation of vocational education resources. The simulation results show that the intelligent function of vocational education system can operate normally under the designed mobile learning mode, the operation efficiency is high, and the effect of Vocational Education Resource Recommendation is good.

1. Introduction

Despite the fact that vocational education is at the forefront of the nation, innovative classroom reform concepts have played a significant role in its growth. There are still many problems in the cultivation of modern vocational education, particularly secondary vocational education, and the only digital campus network or public network information transmission network courses used in teaching, particularly micro courses, are few and far from meeting the needs [1]. The content of network resources is unappealing, and the building of network resources is inadequate [2]. Network and teaching informatization have received insufficient attention; teaching information resources are organized in their own way; there are no unified norms; teaching information is difficult to share; it cannot adapt to current information technology developments; and it has not been fully applied to classroom teaching. In actuality, the cost of utilizing different kinds of public websites is too expensive, making use uncomfortable; information professionalism is lacking, making use low and inconvenient. Various vocational education application support systems have a poor overall impact, low quality, and inconsistent after-sales

service [3]. The use of mobile learning technology, combined with students' own characteristics, and the use of mobile phones, PDA, and other mobile learning terminals can not only obtain the required learning courses. Therefore, it is of great practical significance and practical value to design vocational education system under mobile learning mode and study its intelligent function [4].

Literature [5] designs the vocational education and teaching assistance system based on WeChat public platform. Firstly, the overall architecture of vocational education and teaching assistance system, the system hardware and software under the overall architecture, and the system hardware through PC and server are designed, and then the PC is integrated into WeChat public platform to design the system software function modules, including database and WeChat public platform. According to the system hardware and software design, the design of vocational education teaching assistant system is realized. Finally, the simulation experiment shows that the designed system has good functionality. Literature [6] designs a vocational education auxiliary teaching system based on data mining. The system designs the overall architecture of vocational education auxiliary teaching system through three-tier B/S structure and designs the system

functional structure according to the system architecture, including acquisition function module, storage function module, processing function module, analysis function module, and mining function module. However, the intelligent functions of the above two systems run for a long time, resulting in low system operation efficiency. Literature [7] used the Python framework to create the general structure of a distant teaching aid system for vocational education, as well as the system function modules, which included acquisition, preprocessing, recognition, and query. To obtain student face images, the obtained student face images are preprocessed, the student face images are captured and aligned, and OpenCV technology was used. Facial feature information was extracted and recognized to determine the students' status, and the results were sent to the front end for teachers to view. Teachers may use the query module to look up students' previous learning status to use as a reference for increasing the quality of vocational education. Through the map browsing module, point recording module, data query module, coefficient calculation module, weather viewing module, route preview module, and occurrence survey, literature [8] designed the field geology teaching assistant system on the Android studio platform and verified the overall performance of the system through multiple iterative experiments, in order to lay a good foundation for students' academic performance. However, the above two systems have low accuracy in recommending educational resources, resulting in poor recommendation effect.

In view of the problems existing in the above system, this paper designs the intelligent function of the vocational education system under the mobile learning mode, tests the intelligent function of the system, verifies the effectiveness and timeliness of the system designed in this paper, improves the intelligence and personalization of the vocational education teaching system, and lays a good foundation for the improvement of students' academic performance.

2. Mobile Learning Mode

Information technology and Internet technologies are combined in the mobile learning mode. It is an e-learning-based informal distant learning style. Learners' learning is more convenient and ways are more diverse when a digital multiterminal all media learning platform is established [9]. All learners may log in, view, and download a vast variety of learning materials, whether they are using mobile phones, tablets, PCs, or other terminal devices.

The mobile learning mode builds an information service system serving open education and lifelong education through the system construction of a portal platform and three centers. The structural framework of the mobile learning platform is shown in Figure 1.

In the structure of mobile learning platform, the server needs to build five server clusters: basic platform server cluster, application server cluster, data storage server cluster, data exchange server cluster, and basic application network and security. Three simulation warehouses are established: user data warehouse, application data warehouse, and resource data warehouse [10].

3. Design of Intelligent Function Module of Vocational Education System under Mobile Learning Mode

3.1. System Intelligent Function Architecture. Combined with the mobile learning mode, the intelligent functional architecture of vocational education system is designed, as shown in Figure 2.

The whole vocational education system is logically divided into five layers: customer operation end, logic verification, business logic, data interface, and data resource layer. In the mobile learning mode, the first three layers can be regarded as the function realization of the mobile client, and the last two layers can be regarded as the server-side function [11].

3.2. Design of Registration Function Module. In order to strengthen the management of the mobile learning platform of the vocational education system, learners need to register and establish a personal account before logging in. Before logging in to the learning platform for learning each time, they need to enter personal account, password, and other information. After background verification, if the verification is successful, they can perform specific operations on the platform according to the permissions given by the system [12]. After successful login, the user information is saved in the session. The specific process is as follows:

- (i) Log in to the interface of vocational education system and enter user name and password
- (ii) Learners click Submit, and the entered user name and password are encapsulated into JSON format, encrypted with 3DES algorithm, and submitted to the web server
- (iii) The web server decrypts 3DES and restores the data in JSON format and then parses the JSON data to obtain the user name and password
- (iv) Verify the entered user name and password, and process the verification results accordingly
- (v) If the user exists in the database server and is legal, the result is returned to the web server [13]
- (vi) The web server returns encrypted JSON format data to the mobile client
- (vii) Decrypt according to the returned result, obtain the original data, and initialize according to the returned result
- (viii) The mobile client prompts that the login is successful, so as to obtain the corresponding operation permission [14]

3.3. Course Learning Function Module Design. The course learning function is divided into my course, popular course, course evaluation, and other specific functions. The details are as follows.

3.3.1. My Course. After successful login, each user has a dedicated personal learning space to record their learning status, learning progress, and relevant course selection

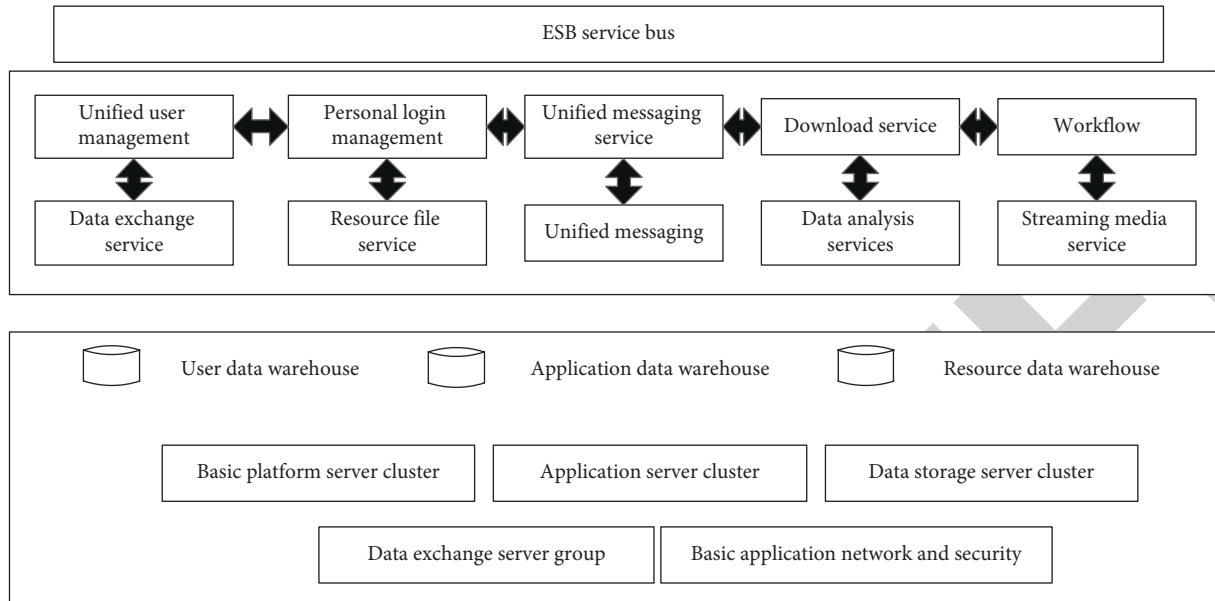


FIGURE 1: Structural framework of mobile learning platform.

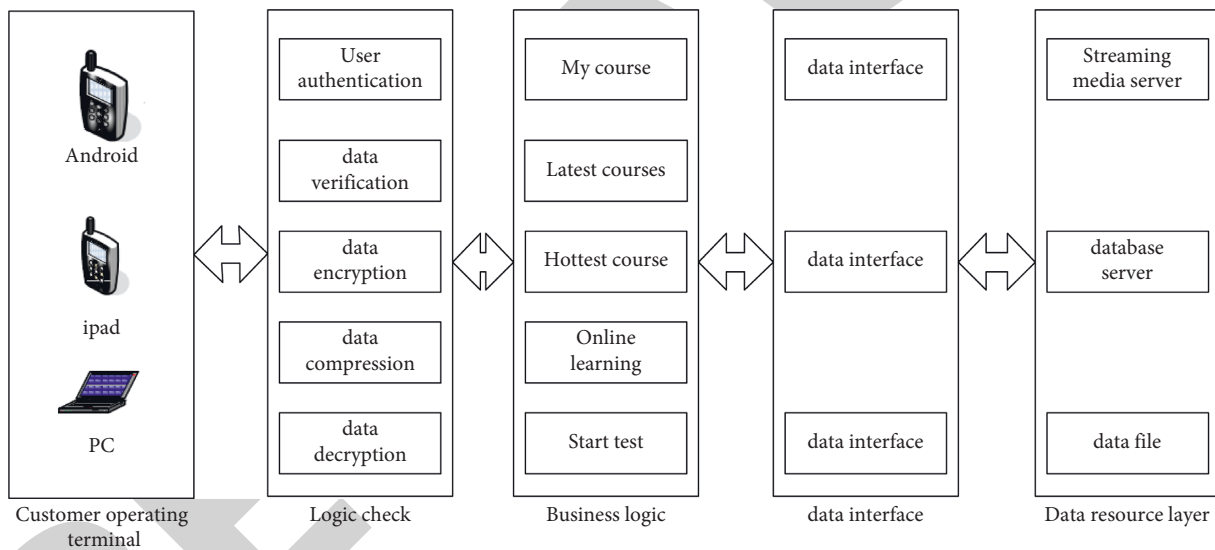


FIGURE 2: Intelligent functional architecture of vocational education system.

results [15]. Users can query the course selection list in “my courses” to record the courses they are interested in. Here, you need to query the associated vocational education course information in the database according to the user ID and site ID. The specific process is as follows:

- (i) On the premise of successful login, the user clicks the “my course” button [16].
- (ii) After the client listens to the user’s click behavior, it will call the “my course” query interface through HTTP post.
- (iii) The web server decrypts and deserializes JSON format data to find out whether there is user login information in the session.

- (iv) The web server queries the database for its associated course information according to the user ID and site ID in the session. There may be no or multiple courses [17].
- (v) The database returns the course list records according to the query results.
- (vi) The web server encapsulates the data into JSON format according to the course list and encrypts it with 3DES.
- (vii) The web server returns the encrypted information of my course to the mobile client.
- (viii) The mobile client decrypts the data according to the specific format, reads the JSON format data, and initializes the course list.

- (ix) The mobile client presents the “my courses” list data in a specific layout and style [18].

3.3.2. *Ranking of Popular Courses.* Popular courses are vocational education courses with high learning frequency. The more people learn, the higher the ranking, which represents the quality of the course to a certain extent. The specific work flow is as follows:

- (i) On the premise of successful login, the user clicks the “popular course ranking” button.
- (ii) After the client listens to the user’s click behavior, it will call the click ranking query interface through HTTP post.
- (iii) The web server decrypts and deserializes JSON format data to find out whether there is user login information in the session [19].
- (iv) The web server queries the course information in the database according to the user ID and sorts it in descending order according to the number of clicks; that is, the more popular the course is, the higher it is.
- (v) The database returns the course list record.
- (vi) The web server assembles JSON format data according to the course list and encrypts it with 3DES.
- (vii) The web server returns the encrypted information of the click ranking course to the mobile client [20].
- (viii) The mobile client decrypts the data, submits JSON format data, and initializes the ranking list.
- (ix) The mobile client displays the list of popular courses to users according to specific layout and style.

3.3.3. *Curriculum Evaluation.* Mobile terminal users can evaluate the selected courses or courses they study. According to the system regulations, each learner can only evaluate each course once and cannot evaluate it again. The specific process is as follows:

- (i) On the premise of successful login, the user clicks “course evaluation”
- (ii) After listening to the user’s click behavior, the client assembles JSON format data, calls the evaluation interface, and submits the serialized byte stream through HTTP post [21]
- (iii) The web server decrypts and deserializes JSON format data to find out whether there is user login information in the session
- (iv) The web server adds an evaluation in the evaluation data table according to the evaluation level submitted by the user, user ID, and course ID
- (v) The database returned a successful insert
- (vi) The web server queries the evaluation table to calculate the average value of the evaluation of this course

- (vii) The database server returns the average value of the evaluation
- (viii) The web server encapsulates JSON format data according to the course list, adds the average value of the course evaluation, and encrypts it with 3DES
- (ix) The web server encapsulates the JSON format data, serializes it, encrypts it, and returns it to the mobile client
- (x) The mobile client decrypts the data and submits JSON format data [22]
- (xi) The client prompts the user that the evaluation is successful

3.4. *Design of Examination and Evaluation Function Module.* The function of examination and evaluation is to test the course learning module. The specific interaction is shown in Figure 3.

The specific interaction process is as follows:

- (i) Learners enter the examination and evaluation interface and select the evaluation method according to the actual needs.
- (ii) The test evaluation interface sends a request to the server, and the server reads the test questions from the database according to the user’s request and returns to the test evaluation interface.
- (iii) The learner carries out the answer test. After all the questions are answered, the test completion request is submitted to the server. After receiving the learner’s request, the server checks the answers according to the extracted questions and generates the evaluation results [23].
- (iv) Of course, learners can view the evaluation results or send multiple evaluation results to the server. The server makes comprehensive statistics according to learners’ previous answers and responds to the evaluation data statistics report to learners.

3.5. *Design of Communication and Interaction Function Module.* Communication and interaction are grouped according to learners’ interests. Learners can apply for adding groups according to their personal interests or create groups as managers. Members of the group can publish relevant topics or activities, share, and grow together. The specific interaction process is shown in Figure 4.

The whole interaction process is as follows:

- (1) Learners may use the interactive interface to look at information such as hot groups, recent themes, and recent actions. If the user picks a popular group in this interface, it will submit a request to the server.
- (2) The server handles the request after receiving the command. If it needs to read data from the database, it will make a request to do so [24].
- (3) The database replies to the server by retrieving relevant data in response to the server’s request.

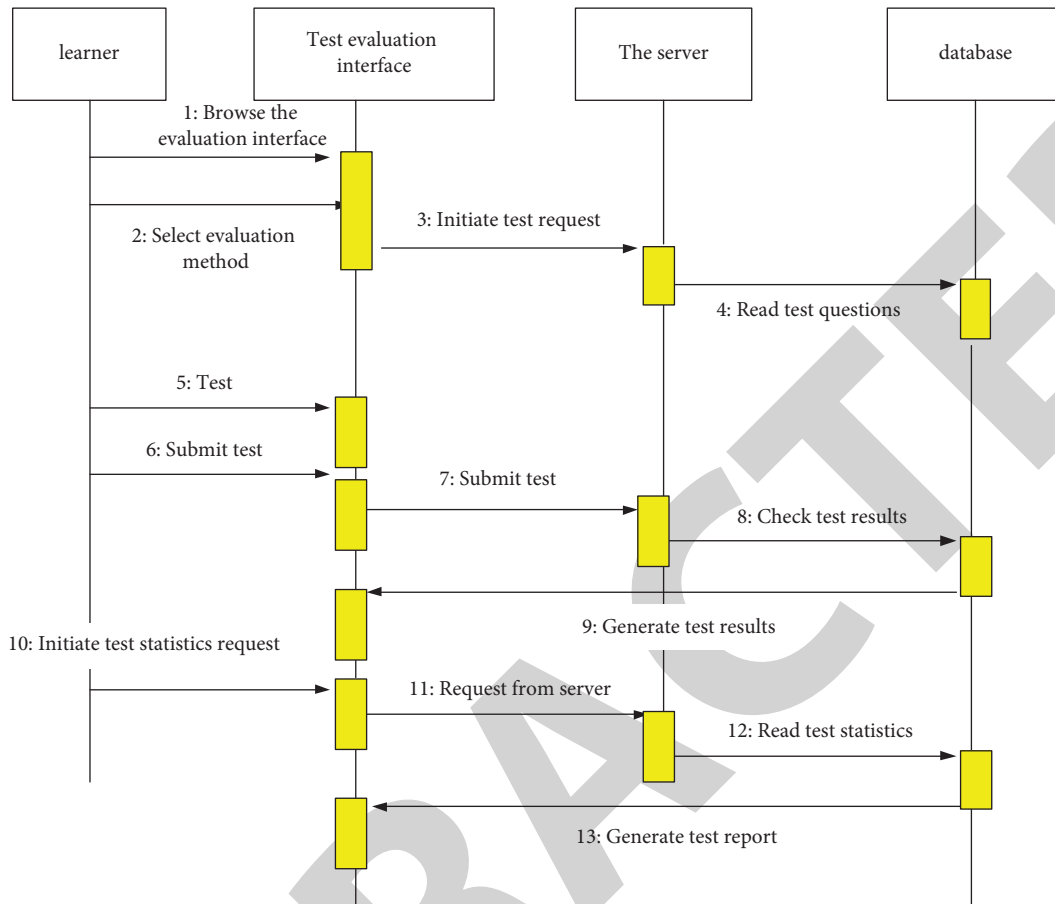


FIGURE 3: Interaction flow of test module.

- (4) The server wraps the data and delivers it in a certain manner in the interactive interface after receiving it.

provide them with a selection of different resources and assessment levels from which they may pick according to their preferences [26, 27].

3.6. Design of Mobile Learning Function Module. The mobile learning module enables students to find learning materials online through mobile terminals, including text, pictures, audio, video, and other forms of resources and can obtain the required materials at any time. You can also customize and obtain relevant learning services through SMS [25]. In addition, learners can also connect to the resource server through the Internet and upload their own resources. The module provides two learning modes, one is live (on-demand) learning and the other is autonomous learning, and also provides a word query service, as shown in Figure 5.

- (1) Upload the whole process of the teacher's course explanation in the form of video to the mobile terminal and categorize it according to the course topic so that students may study on-demand.
- (2) Students may study on their own by accessing the learning information they need. If students choose synchronous learning as their learning style, the system will automatically supply them with the following sorts of learning materials for each class, based on their learning progress and teaching goals. If students opt to explore freely, the system will

3.7. Design of Personalized Recommendation Function Module. For the subject distribution of vocational education resources, $A = \{A_1, A_2, \dots, A_T\}$ is defined to represent the subject set of vocational education resources. For a vocational education resource l , the posterior probability is $p(A_i|l)$. Therefore, the main part vector of vocational education resources composed of posterior probability is $(p(A_1|l), p(A_2|l), \dots, p(A_T|l))$, and L represents the number of subject sets of vocational education resources. For the user's interest orientation, suppose that l represents the set of vocational education resources published by the user and then the L -dimensional vector (w_1, w_2, \dots, w_L) represents the user's interest orientation in vocational education resources, and the calculation formula is

$$w_i = \sum_{j=1}^d p(A_i|l_j). \quad (1)$$

According to the user's interest weight, w_i is improved by personalized adaptive learning, and the following result is obtained:

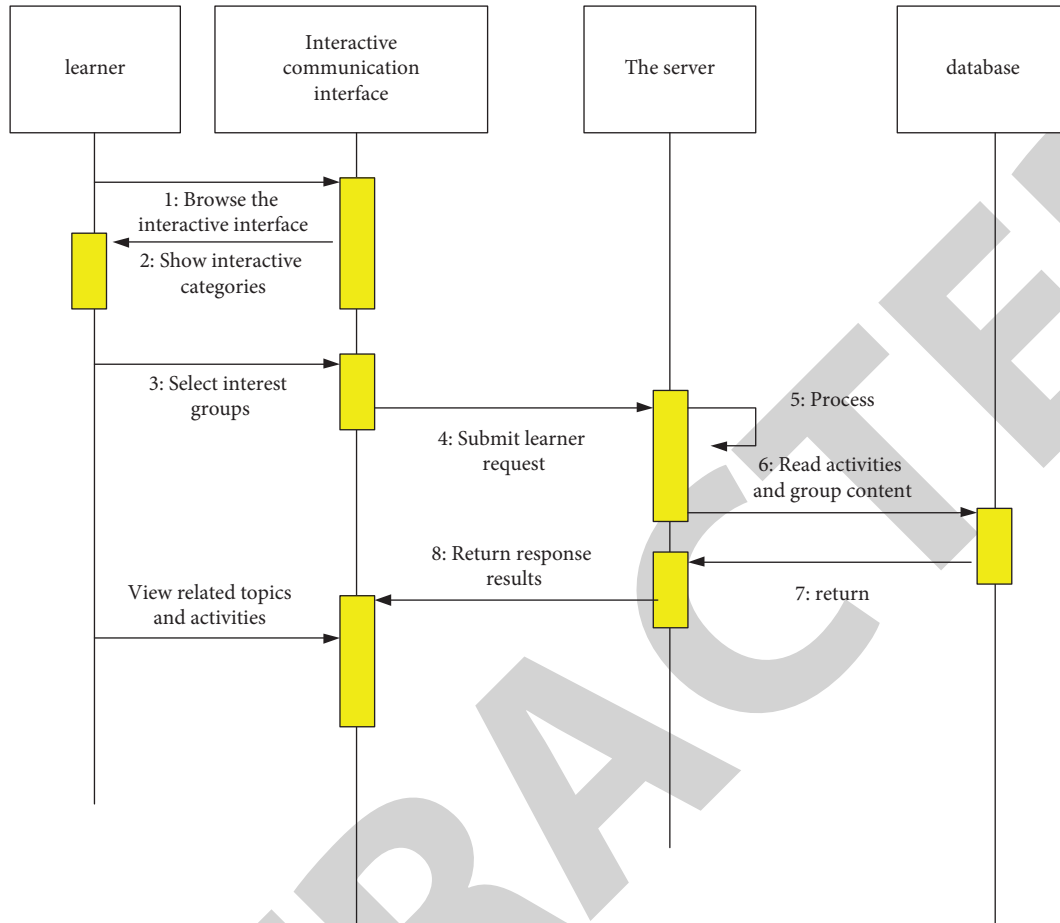


FIGURE 4: Sequence diagram of communication and interaction module.

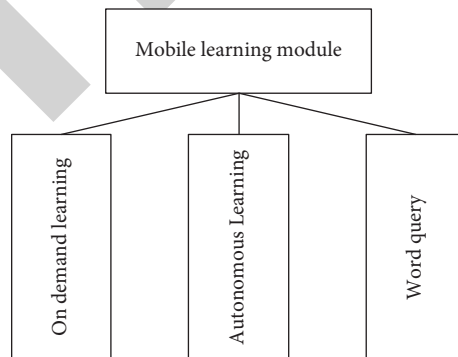


FIGURE 5: Mobile learning module.

$$w_i = \sum_{j=1}^d s_j p(A_i | t_j), \quad (2)$$

where s_j represents the user's interest weight value in vocational education resources, which can reflect the user's preference set for vocational education resources. The greater the value of s_j , the higher the user's preference for vocational education resources.

Assuming that the vocational education resource l is composed of n words, the n word is marked as w_n , and the

subject of w_n is defined as z_{w_n} , and then the probability of z_{w_n} is calculated as

$$P(z_{u_i} = j | Z_{t,i}, l, \varphi, s) \propto \frac{P(z_{w_i} = j, Z_{t,i}, l | \varphi, s)}{P(Z_{t,i}, l | \varphi, s)}. \quad (3)$$

On the basis of formula (3), if the subject distribution of word v_n is $W_{v_n} = (w_1, w_2, \dots, w_T)$, then the standardization probability of w_i is

TABLE 1: Test environment.

Testing environment	To configure	Parameter
Hardware environment	CPU	Pentium Quad Processor
Software environment	Memory capacity	2 G
Testing environment	Hard disk capacity	250 G
Hardware environment	Graphics card	Intel integrated graphics card
Software environment	Operating system	Windows XP SP2
	Programing language	Java

$$v_j = \frac{P(z_{x_i} = j | Z_{t,i}, l, \varphi, s)}{\sum_{j=1}^L P(z_{u_i} = j | Z_{t,i}, l, \varphi, s)}. \quad (4)$$

The probability that vocational education resource l belongs to topic j is

$$\theta_{t,j} = \frac{n(j, l) + s}{n(l) + Ls}. \quad (5)$$

According to $\theta_{t,j}$, the average preference similarity of users in R cycles can be defined:

$$\text{sim}_R = \frac{\sum_{(1/2)}^R \text{sim}(u_{k-1}, u_k)}{R - 1}. \quad (6)$$

In order to facilitate comparison, the user's average preference similarity can be personalized adaptive learning to calculate the user's preference similarity:

$$\text{sim}(U_{k-1}, U_k) = \cos \theta = \frac{\overrightarrow{u_{k-1}} \cdot \overrightarrow{u_k}}{\|u_{k-1}\| \|u_k\|}. \quad (7)$$

4. Simulation Experiment Analysis

In order to verify the effectiveness of the intelligent function of vocational education system in practical application under the mobile learning mode designed in this paper, a simulation test is carried out. The test environment is shown in Table 1.

In the test environment, the network architecture of vocational education system under the mobile learning mode is built, as shown in Figure 6.

Under the above background, the registration and login function module, course learning function module, and examination and evaluation function module are selected for testing.

4.1. Registration and Login Function Module Test

Purpose: to verify whether the module operates according to normal business logic

Test content: whether the user can log in normally

Test results are shown in Table 2.

The test contents and results are shown in Table 3.

4.2. *Course Learning Function Module Test.* Objective: to verify whether the module displays, plays, and evaluates courses normally.

4.3. *Test and Evaluation Function Module Test.* Objective: to verify whether the module displays, plays, and evaluates courses normally.

The test contents and results are shown in Table 4.

According to Tables 2–4, the intelligent function of vocational education system under the mobile learning mode designed in this paper can operate normally and the system performance is good.

In order to further verify the effectiveness of the system in this paper, the vocational education system under the mobile learning mode designed in this paper, the vocational education auxiliary teaching system based on data mining designed in literature [28], and the vocational education distance teaching auxiliary system based on facial feature recognition designed in literature [29] are used to compare and analyze the running time of intelligent functions. The comparison results are shown in Table 5.

According to Table 5, the running time of the intelligent function of the vocational education system under the mobile learning mode designed in this paper is within 15.0 s, and the running time of the intelligent function of the vocational education auxiliary teaching system based on data mining designed in literature [30] is within 38.9 s; in literature [31], the running time of the intelligent function of the distance teaching auxiliary system of vocational education based on facial feature recognition is within 28.9 s. Under the mobile learning mode designed in this paper, the running time of the intelligent function of the vocational education system is short and the operation efficiency is high.

In order to further verify the effectiveness of this system, the vocational education system, literature [32] system, and literature system under the mobile learning mode designed in this paper are used to recommend vocational education resources and test the recommendation accuracy of the three systems. The test results are shown in Figure 7.

According to Figure 7, under the mobile learning mode designed in this paper, the accuracy of Vocational Education Resource Recommendation by vocational education system can reach 100%, the accuracy of Vocational Education

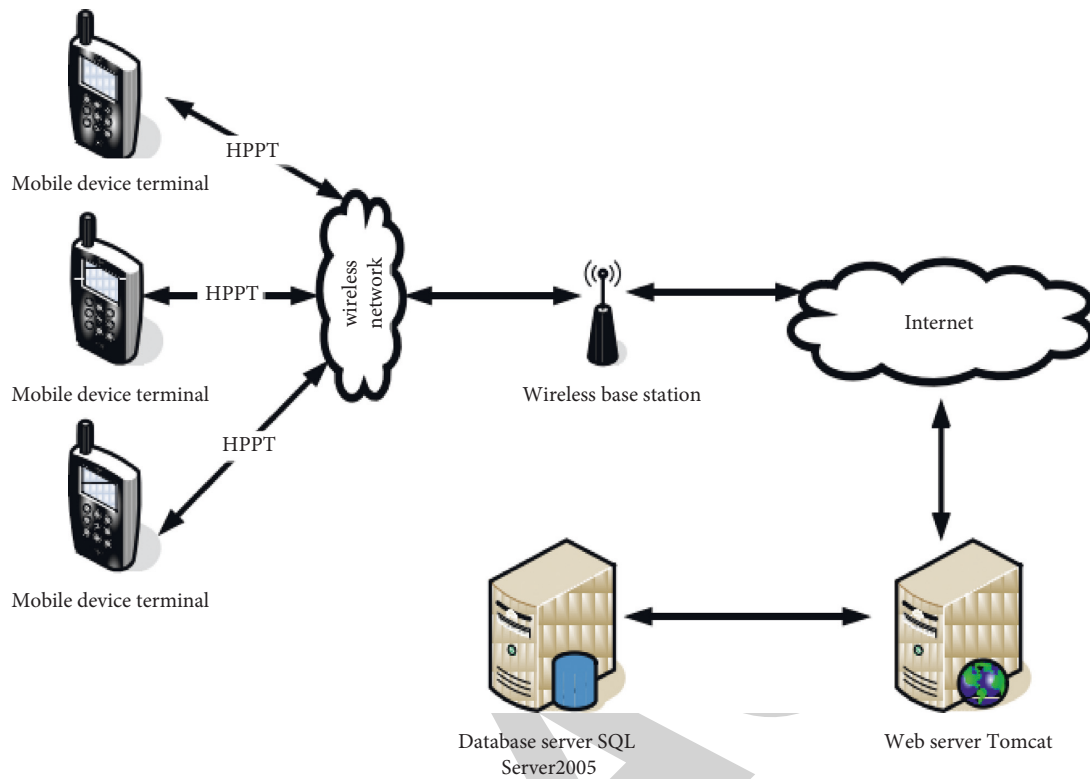


FIGURE 6: Network architecture of vocational education system under mobile learning mode.

TABLE 2: Function test results of registration and login function module.

Use case	Test result
Do not enter ID, password, and verification code	Please enter ID, password, and verification code
Enter the wrong user name, password, and verification code	Remind that the ID, password, and verification code entered are incorrect
Close the client's network connection	Please check the system network connection
Shut down the server	Connection timeout, server-side exception, please contact the administrator
The information input is accurate and the network connection is normal	Successfully enter the system main interface

TABLE 3: Function test results of course learning function module.

Test content	Expected judgment	Test result
Teaching online broadcast	Can I play it online	Video and audio can be played online and according to the learning records
Teaching course download	Can I download the courseware	Video and audio files can be downloaded. The default storage address is memory card
Teaching curriculum evaluation	Can I evaluate the course	Word limit should be set for evaluable courses

TABLE 4: Function test results of test evaluation function module.

Test content	Expected judgment	Test result
Basic question type training	Is the question type displayed according to the specialty	Initialize the question bank and display the question type according to the selected course
Timing function	Can I time it	The test timing function is enabled, in seconds
Scoring function	Can you score	Enter the test scoring function to score in real time
Collection title	Can I collect topics	Click collect to successfully collect the question
Collection error	Can I collect wrong questions	Answer matching error automatic collection of wrong questions

TABLE 5: Comparison results of intelligent function running time (s).

Number of experiments/time	Literature [6] system	Literature [7] system	Paper system
10	32.5	21.2	11.2
20	33.6	22.2	11.5
30	34.5	23.1	11.6
40	34.9	23.8	12.5
50	35.1	24.5	12.9
60	36.5	25.0	13.4
70	36.9	25.4	13.5
80	37.0	26.7	14.0
90	37.2	27.2	14.5
100	38.9	28.9	15.0

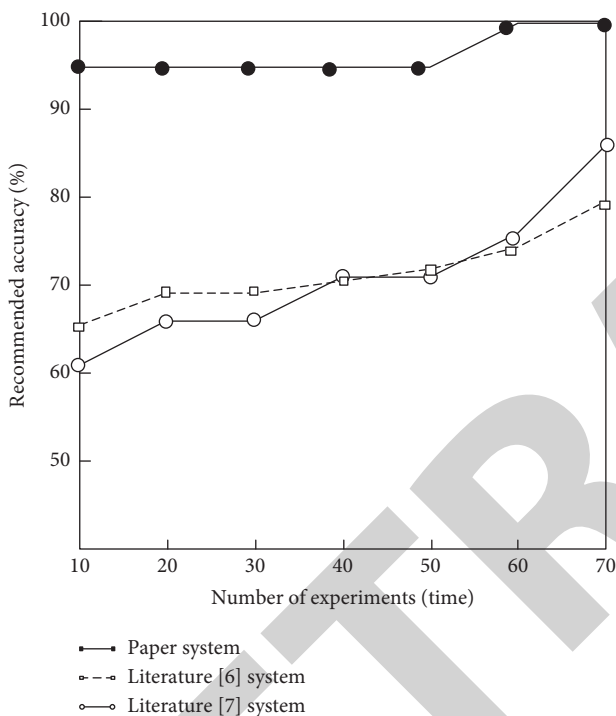


FIGURE 7: Comparison results of Vocational Education Resource Recommendation accuracy of three systems.

Resource Recommendation by literature [33] system is only 80%, and the accuracy of Vocational Education Resource Recommendation by literature [34] system is only 85%. Under the mobile learning mode, the vocational education system designed in this paper has the highest accuracy and the best recommendation effect.

5. Conclusion

In view of the low efficiency of the intelligent function of the traditional vocational education system and the poor effect of Vocational Education Resource Recommendation, in the mobile learning mode, through the registration and login function module, course learning function module, examination and evaluation function module, communication and interaction function module, mobile learning function module, and personalized recommendation function module, a new vocational education system is designed.

Through the personalized recommendation function module, the user's interest weight is calculated by using personalized adaptive learning to obtain the interest weight value of vocational education resources, and the personalized recommendation of vocational education resources is carried out according to the interest weight value. Finally, through the simulation test, the running time of the intelligent function of the vocational education system under the mobile learning mode designed in this paper is within 15.0 s, and the recommendation accuracy of vocational education resources is up to 100%. It is verified that the operation efficiency of this system is high and the recommendation effect of vocational education resources is good.

Data Availability

The data used to support the findings of this study are included within the article.

Conflicts of Interest

The author declares that there are no conflicts of interest.

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