Application of Artificial Intelligence Technology on Online Cultural Education Mobile Terminal

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Abstract. In order to meet the functional and performance requirements of users for online cultural education mobile terminals, the application research of artificial intelligence technology on online cultural education mobile terminals is proposed. The overall architecture of online culture and education mobile terminal is designed using artificial intelligence technology. Through communication connection design and identity verification design, the communication function of mobile terminal is designed. Combining the curriculum center module, evaluation module, terminal user information acquisition module and mobile terminal load balance module, the functional module of online culture and education mobile terminal is designed. Realize the application of artificial intelligence technology online cultural and educational mobile terminals. The test results show that the authentication module, course center module and evaluation module of the mobile terminal in this paper can meet the needs of users. In terms of user information acquisition delay and load balancing, they can also meet the performance requirements of users for mobile terminals.

Keywords: Artificial Intelligence Technology · Cultural Education · Mobile Terminal · Function Module

1 Introduction

The birth of distance online education has brought revolutionary innovation and development to China's education industry. This high-quality and low-cost learning method enables students to enjoy the most cost-effective and high-quality online cultural and educational resources [1] through the online education platform. With the deepening of education, students' demand for learning conditions is also constantly improving. Compared with the traditional online education, which has a fixed learning environment in time and space, the birth of mobile terminals has become an innovative breakthrough. Through the special carrier of mobile phones, the online cultural and educational resources of non academic and non academic degrees are promoted to the people, breaking the limits of learning time and space, greatly expanding the space and objects of online cultural education, and making the perfect combination of mobile networks and high-quality educational resources. The mobile communication terminal provides

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real-time, convenience and multimedia, which can easily communicate with training institutions, students and lecturers and share information anytime, anywhere.

In domestic research, Liu Weijun et al. [2] considered the slow speed of traditional terminal online education data mining technology. In order to solve this problem, they proposed a model driven terminal online education data mining technology. Use the data transformation method of association analysis to transform data, and then use the model driven crowd behavior modeling method to design the task flow of terminal online education data mining. After the above work is completed, the key technologies of model driven data mining are optimized through screening, selecting data subsets, coding, setting thresholds, and evolutionary steps to achieve efficient data mining for terminal online education. The experimental results show that the mining speed of the proposed technology is similar when the data set size is small, and the mining speed increases gradually when the data set size is large. However, the mining speed of the traditional technology using a small dataset is basically similar to that using a large dataset, which proves that the proposed technology is faster. Kang Mengjie [3] designed an integrated student management terminal based on the Internet of Things technology to improve the informatization level of student management. The RFID module is designed based on the Internet of Things technology to realize the management of students' location information and teaching information. The embedded microprocessor is designed in the processor module to realize the control and data transmission of the terminal. In the tag anti-collision module, combining the dynamic frame slot algorithm and CGCT algorithm, the anti-collision algorithm of RF tags is designed to solve the tag collision problem in identification. In the database module, student information table, college information table and other data tables are designed to store terminal information. Design a variety of management procedures, including attendance management procedures, user information management procedures, etc., to achieve application module design. The terminal test results show that the multi label reading time of the design terminal is relatively short, the memory utilization rate is always lower than 50%, the CPU utilization rate is always lower than 55%, and the resources accessed by users match their own permissions relatively well.

In foreign studies, Zhang J et al. [4] took college English courses as an example to study the mobile terminal system of intelligent college English teaching and training mode. Based on the introduction of the concept, architecture, characteristics of WAP technology and the WAP application software development tools needed in the mobile terminal system teaching mode, this paper attempts to build a mobile terminal system teaching mode. This paper describes the model, proposes the collaborative filtering algorithm, and discusses how to use the collaborative filtering algorithm to construct the matrix and calculate the similarity. In order to verify the effectiveness of the system model, the test level comparison and questionnaire survey were conducted on the teaching model. The experimental results of this paper show that 91.8% of the students said that their comprehensive English level has been improved in the process of applying the mobile terminal system teaching mode. In addition, 87.5% of the students said it was necessary or basically necessary to use English for professional teaching, and 76.2% of the students were very satisfied with this model.

Distance education itself covers a wide range of markets, especially China's vast population base, the number of colleges and universities can not meet the needs of most people to receive higher education, which means that China's distance education has a huge space for development. At the same time, with the progress of the times, knowledge and technology, lifelong education has become the future trend. People from all walks of life need to involve different levels and different kinds of knowledge. The distance education model can successfully solve this problem in the information age today. On the other hand, statistics show that the use rate of smart phones has reached 70% worldwide, and the use rate of mobile terminals in China is also in a booming period. Therefore, the combination of distance education and mobile Internet technology and the design of online cultural education mobile terminals have important theoretical significance and practical application value. Artificial intelligence technology can provide personalized recommendations and customize learning content based on users' learning behavior and preferences. By analyzing user data, provide cultural and educational resources and learning paths suitable for each student's learning level, and provide a more personalized learning experience. Therefore, this article proposes the application of artificial intelligence technology on online cultural education mobile terminals. Adopt Natural language processing technology in artificial intelligence technology and Mina network framework to establish the overall architecture of online cultural education mobile terminal. Based on the overall architecture of the terminal, design online cultural education mobile terminal functions, including mobile terminal communication function, course center module, evaluation module, end user information acquisition module, and mobile terminal load balancing module. In the design of mobile terminal communication functions, an identity verification module is added to ensure user security. Students can register for courses online and participate in online assessments through this terminal. Online cultural education mobile terminals based on artificial intelligence technology can quickly obtain user information, have a small load, and have good application performance.

2 Design the Overall Architecture of Online Cultural Education Mobile Terminal

The online cultural education mobile terminal designed with AI technology mainly meets the needs of student users. Using Natural language processing technology in artificial intelligence technology, online cultural education mobile terminals can process and analyze user information. Natural language processing technology provides corresponding online cultural and educational information by identifying the user's purpose. Users can download the client software and register. After logging in, users can see the online culture and other information that has been opened and can be learned through intelligent terminals, and use various business modules through the Internet under the Mina framework [5]. Using the Mina framework for data interaction with servers can achieve reliable data transmission and ensure the normal operation of mobile terminals under artificial intelligence technology. The server mainly uses SQLite for data storage, capable of efficiently managing and storing a large amount of user data. The client uses JSON, XML and other network interfaces provided by the server-side Web system to realize data exchange. The overall architecture of online cultural education mobile terminal is shown in Fig. 1.

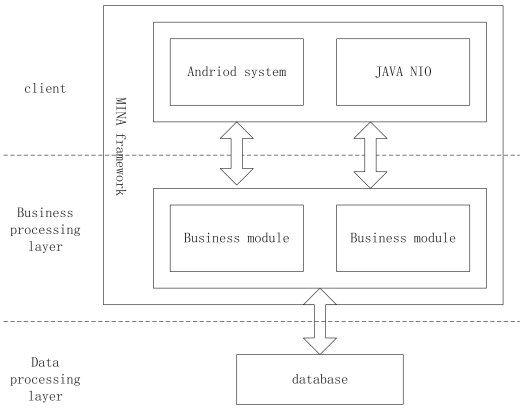

Fig. 1. Overall Structure of Online Culture and Education Mobile Terminal

According to the above demand analysis, the online cultural education mobile terminal based on artificial intelligence technology mainly meets the needs of students and the design and implementation of the C/S mode of the system, the design and implementation using C/S mode can enable students to easily access the required educational content and services on mobile terminals. The physical architecture of the mobile terminal is shown in Fig. 2.

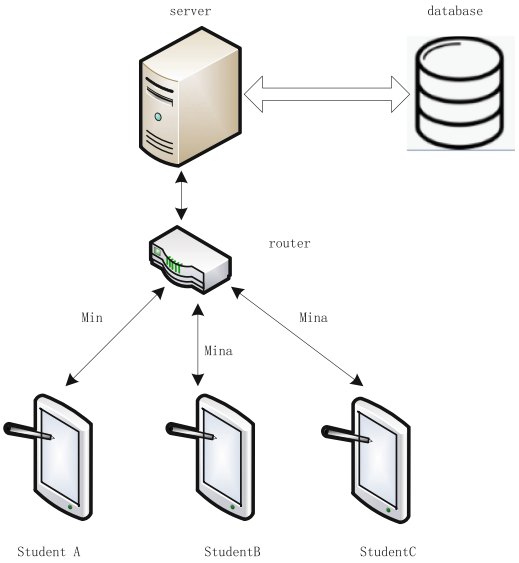

Fig. 2. Physical architecture of online cultural education mobile terminal

The client mainly interacts with the server through Mina network framework, and each mobile terminal is connected to the server through a router. The server is used to

manage each business module of the system, store all user information, and ensure the normal operation of the mobile terminal under artificial intelligence technology.

3 Functional Design of Online Cultural Education Mobile Terminal

3.1 Mobile Terminal Communication Function Design

3.1.1 Communication Connection Design

The online cultural education learning terminal, as the client itself, does not directly process the user's request for service, but sends the user's request information to the server. The application calls the interface processing information provided by the server, and carries out relevant operations by calling the server API [6]. After receiving the request, the server confirms the information and returns it to the client, and the client will feed back the received results to the user, The system involves the main APIs, including Validate, Selectcourse, CheckExam, Notices, UserInfo, and SystemSetting APIs. The above interfaces are designed according to different functions and encapsulated in different Servlets for storage in the business logic layer for centralized processing. The interface calls are shown in Fig. 3.

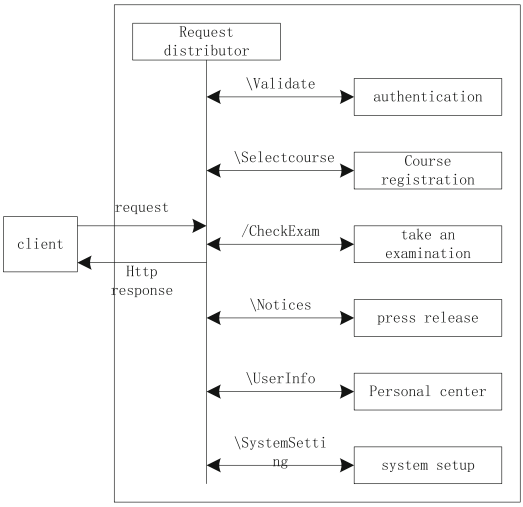

Fig. 3. Server side interface call diagram

As an online cultural education mobile terminal, it is mainly used to realize communication, data interaction, interface interaction and other functions. The interface is the activity involved in the terminal, which is used to realize two functions, namely, to obtain data from the server and display the space used for interface design for user operation and input the data that users need to operate and bind them to the processing module to read and write the data, finally upload to the server, where the data interaction format between the client and the server is JSON [7]. The client architecture is shown in Fig. 4.

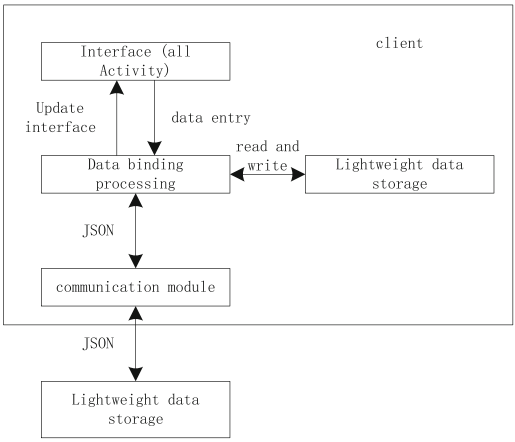

Fig. 4. Client architecture

3.1.2 Identity Authentication Design

The authentication module is a key for users to enter the client. Only legitimate users who have passed the system authentication can successfully log in to the client and use the relevant functions of the client, which also indicates that the communication between the client and the server is successful. The specific flow chart of the client login module is shown in Fig. 5 below.

It can be seen from the flow chart of the module that the user does not need to submit the data to the server before entering the mobile terminal. First, the network availability check and data format verification are carried out locally on the client. When these are verified, the data is sent to the server to verify the user's effectiveness. After successful login, the user can jump to the main system interface.

3.2 Course Center Module

The course center module is a core module of the entire mobile terminal. The following is the workflow of the course center module:

Step 1: Students log in to the client, and all course information is initialized.

Step 2: After the system reads the student login information, it reads the major, and displays the optional courses according to the major. Students can register online or cancel the registered courses.

Step 3: Students can choose to play videos online or download and watch the learning courses. Students can evaluate the courses during the learning process [8], and can also communicate online.

The flow chart of online student enrollment is shown in Fig. 6.

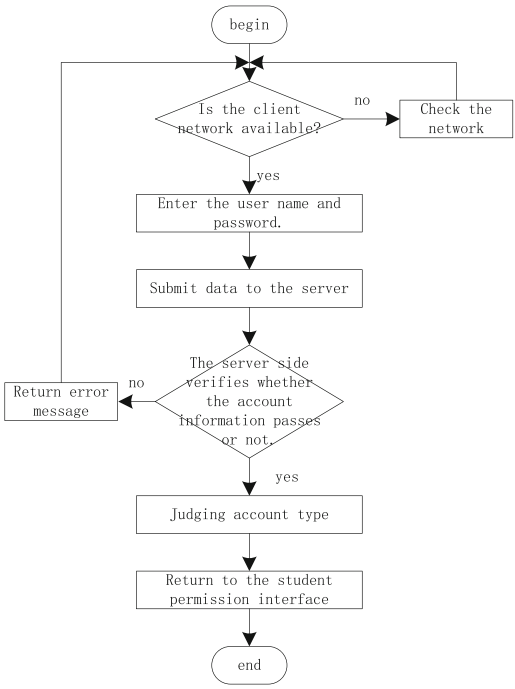

Fig. 5. Login module flow chart

3.3 Evaluation Module

The main function of the evaluation module is to carry out exercises for course learning. The training methods include basic training, simulated examination and online examination [9]. If students choose the basic training mode, they can select the question type for training. During the question making process, they can collect the wrong questions stored in the system by default, and the collected questions and wrong questions can be viewed in the personal center. At the same time, students can take a mock exam on the eve of the exam to get familiar with the exam question type and time. The mock exam completely simulates the online exam process and adopts the real-time timing scoring method. When the system announces the exam information, students will take the exam at the corresponding time. The evaluation module flow chart is shown in Fig. 7.

3.4 Design the Terminal User Information Acquisition Module

When fast acquiring end-user information, first establish vector space, use idf algorithm to calculate the weight of end-user information, complete feature selection of user information through information gain method, and complete fast acquiring end-user information according to KNN acquisition method.

Vocabulary is the basic expression item in the end user information. It shows certain rules and has a high frequency of occurrence [10] in the end user information. User information is obtained through different feature words.

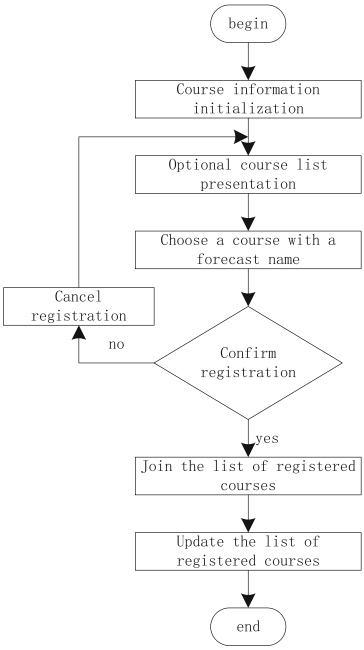

Fig. 6. Flow Chart of Online Course Registration

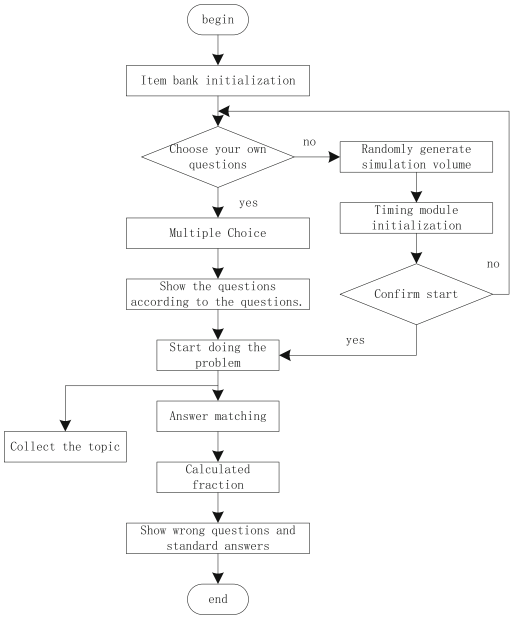

Fig. 7. Evaluation module flow chart

The vector space expression of end user information is:

$$v(d_i) = \left(w_1(d_i), w_2(d_2), \cdots, w_j(d_i)\right) \tag{1}$$

where, j it represents the total number of feature items used in the selection of end user information features, $w_j(d_i)$ on behalf of the j end user information feature items in the terminal document d_i weight value in.

df Represent the frequency of the end user information document, which means that the terminal contains $term_i$ user information of feature item, recorded as df_i. In the terminal, df_i the larger it is, the more characteristic it represents $term_i$ the lower the accuracy of measuring the similarity between user information in the terminal. idf it represents the inverted document frequency in the terminal, and represents the characteristics of user information feature items in the entire terminal document collection. Its role is to measure the distribution status of user information feature items in the entire terminal document collection. idf and df in general, it is inversely proportional, and its calculation formula is:

$$idf_i = \log\left(\frac{N}{df_i}\right) \tag{2}$$

where, N represents the total number of user information in the end user information document collection.

When idf when the value of is larger, it indicates the characteristic item $term_i$ it plays a greater role in the end user information differentiation. When there is only one characteristic item in one end user information, $idf_i = \log N$ when a feature item exists in all user information of the terminal, $idf = \log 1 = 0$.

set up $\{c_1, c_2, \cdots, c_n\}$ it is a collection of user information categories in the terminal target space. Characteristic value of user information $term_i$ the information gain formula of is:

$$G(T) = f(t) \sum_{i=1}^{n} f(c_i|t) \cdot \log f(c_i|t) \tag{3}$$

where, t characteristic items representing user information, c_i the category representing the end user information. For the end user information category c_i and user information characteristics t, in the information gain, by examining the user information category c_i whether the user information feature item appears t, measure user information characteristics t for end user information category c_i information gain of. When user information feature item t and user information category c_i when the information gain of is greater, the user information characteristics t for user information category c_i the greater the contribution, the more important.

Using machine learning algorithms in artificial intelligence technology to calculate user information similarity and information weights, and select the one with the highest similarity to user information in the training user information set k user information, set an initial value of user information h the initial value of user information is generally in the range of hundreds to thousands. At the end of the new user information h among the

neighbors, the weight of each user information is calculated in order. The calculation formula is as follows:

$$W_{xj} = \sum_{i=1}^{k} \mathrm{sim}_{xi} \cdot y_{ij} \tag{4}$$

where, W_{xj} information on behalf of new users x stay j weight in user information, sim_{xi} information on behalf of new users x and user information i similarity between, y_{ij} it is a constant 1 or 0. By comparing the weights of various user information, the end user information can be quickly acquired.

3.5 Design Mobile Terminal Load Balancing Module (2 Under Cloud Platform)

Hypothesis $K/K/1$ indicates the waiting value model of the wireless source for terminal information request, $I_{\max}$ indicates the total length of information queue of multi terminal system, I it indicates the length of the information queue of the multi terminal system. When the server load is higher, the remaining processing capacity of the terminal node will be very low. This indicates that the value of the processing capacity of the multi terminal node is determined by the number of loads on the multi terminal node [11]. The formula for calculating the processing capacity of the multi terminal node is as follows:

$$\vartheta = \left(1 - \frac{Q_Load}{MaxLoad}\right) * M_0 \tag{5}$$

where, *Q_Load* represents the comprehensive load of multiple terminal nodes, *MaxLoad* indicates the load value when the multi terminal node is fully loaded. When the CPU utilization and memory utilization are both 100%, the number of running programs is obtained by calculating the values of the maximum number of processes supported by the operating system, M_0 it indicates that the server node can complete tasks per second in the optimal state. According to the terminal information request radio source waiting value model [12], when the number of cloud service stations is equal to 1, the calculation formula of tasks completed by the multi terminal system is as follows:

$$W = \frac{o^*}{\vartheta} \tag{6}$$

where, o^* it indicates the amount of tasks completed by the information request. When the expected information queue that is not joined is an information queue that is not queued, the expression that can continue to hold the information processing capacity is as follows:

$$I_p = \frac{I_{\max}}{W} - I \tag{7}$$

According to the above formula φ it represents the average arrival rate of expected information. The queuing law is calculated as follows:

$$I_p = o\left(1 + \frac{w}{1-o}\right) = \frac{o}{1-o} = \frac{\varphi}{\vartheta - \varphi} \tag{8}$$

According to the above formula, the average arrival rate of expected information is calculated as follows:

$$\varphi = \frac{I_p}{1 + I_p} * \frac{(MaxLoad - Q_Load) * M}{MaxLoad} \tag{9}$$

According to the above formula, φ the value of is Q_Load is a function of the Q_Load it shows that when the load of a terminal node is high, the amount of information required will decrease, which reflects the load balancing core. The expression of multi terminal adaptive load balancing information distribution is as follows:

$$A_\iota = \left[\frac{\varphi_\iota}{\sum_{\tau=1}^{m} \varphi_\tau} \right] * I_{all} \tag{10}$$

where, I_{all} represents all information queues of the multi terminal load balancer port, A indicates the number of terminal nodes in the multi terminal system, φ_ι represents a multi terminal node ι average arrival rate of, A_ι indicates an ECS node ι the amount of tasks completed by the information request should be obtained. When using a server in the form of FIFO, if the load balancer will rotate to assign output or input information to each terminal node [13–15], if the amount of information of the terminal node meets the requirements, it will not be allocated.

The queuing theory is used to calculate the processing capacity of multiple terminal nodes, and the information handling capacity is calculated at the same time. According to the queuing law, the average arrival rate of expected information is obtained. When the load of a terminal node is high, the amount of information required will be reduced, and the adaptive load balancing of multiple terminals is realized.

4 Test Analysis

4.1 Test Environment

This article mainly introduces the design and development of the distance education learning terminal, so the running environment is mainly for the test of the client environment. The main test environment is as follows:

Test environment 1: Android PAD, 8-inch main screen, 1280 × 800 screen resolution, Android OS 4.3

Test environment 2: Android PAD, 7-inch main screen, 480 × 800 screen resolution, Android OS 4.1

Test whether different screen sizes and resolutions fit the application. In the development process, the mobile phone manufacturers and manufacturers in the market are different, so that the mobile phone or tablet has different specifications. The application developed in this paper will run on different mobile phones or tablets. The UI interface of the same application will display differently on different devices.

The development environment is set at 1280 × 800 screen resolution, 1280 × The 800 screen resolution tablet can display a friendly user interface, while the system's UI interface is 800 × The 480 screen resolution can also adapt to the device screen size.

4.2 Function Test

In order to ensure the smooth operation of the mobile terminal designed in this paper, the function of each module is tested. The detailed results are as follows. The terminal can be carried out smoothly as a whole, with good results. If there is a slight deficiency, modification suggestions will be proposed in the test analysis.

The authentication module can normally match the user information and load the corresponding main page. The authentication function adopts the threshold test, and the test results are shown in Table 1.

Table 1. Authentication module test table

step	Test module	Test content	Test method	test result
1	User Login	Whether the user can log in normally	Do not enter ID, password and verification code	Remind you to enter ID, password and verification code
2	User Login	Whether the user can log in normally	Enter wrong user name, password and verification code	Remind that the ID, password and verification code entered are wrong
3	User Login	Whether the user can log in normally	Close the client's network connection	Remind you to check the system network connection
4	User Login	Whether the user can log in normally	Shut down the server	Connection timeout, server side exception, please contact the administrator
5	User Login	Whether the user can log in normally	The information input is accurate and the network connection is normal	Successfully enter the main interface of mobile terminal

The course center module can obtain majors according to student login information and display the list of unselected courses according to majors. Students can also cancel the selected courses within the specified time. Courses can be played online and tracked to record the learning process. At the same time, courses can be downloaded. The default storage address is memory card. Students can evaluate courses. The system has no word limit, and will be improved later, with 140 characters as the limit. The test results are shown in Table 2.

The evaluation module can obtain majors and carry out targeted question type training according to the student login information. Students can start the timing function in the process of simulated examination, count down in seconds and score in real time. The test results are shown in Table 3.

Table 2. Module Test Table of Course Center

step	Test module	Test content	Test method	test result
1	Course Center	Show unregistered courses	Whether to display courses according to majors	Course information initialization and display according to specialty
2	Course Center	Cancel Enrollment	Can I cancel the course	Selected courses can be canceled and reloaded into unselected lines
3	Course Center	Online playing of courses	Whether it can be played online	Video and audio can be played online, and learning records can be displayed
4	Course Center	Course download	Can I download courseware	Video and audio files can be downloaded. The default storage address is the memory card
5	Course Center	Course evaluation	Whether the course can be evaluated	The number of words should be limited for evaluable courses

Table 3. Test Table of Evaluation Module

step	Test module	Test content	Test method	test result
1	Evaluation	Basic question type training	Whether the question type is displayed according to the specialty	Initialise question bank and display question types according to specialty
2	Evaluation	Timing function	Can you time	The entry test timing function is enabled, in seconds
3	Evaluation	Scoring function	Whether to score	Enter the exam scoring function to score in real time
4	Evaluation	Collection topic	Can I collect the topic	Click Collect to successfully collect the question
5	Evaluation	Collection error	Whether to collect wrong questions	Answer matching error, automatic collection of wrong questions

According to the above tests, the authentication module, course center module and evaluation module of the mobile terminal in this article can all pass the functional test to meet the needs of users.

4.3 Performance Test

In order to avoid the singleness of the experimental results, in the performance test, comparing mobile terminals based on model driven and intelligent training mode with those in the text, and the terminal user information acquisition delay and load balance are tested. The results are as follows.

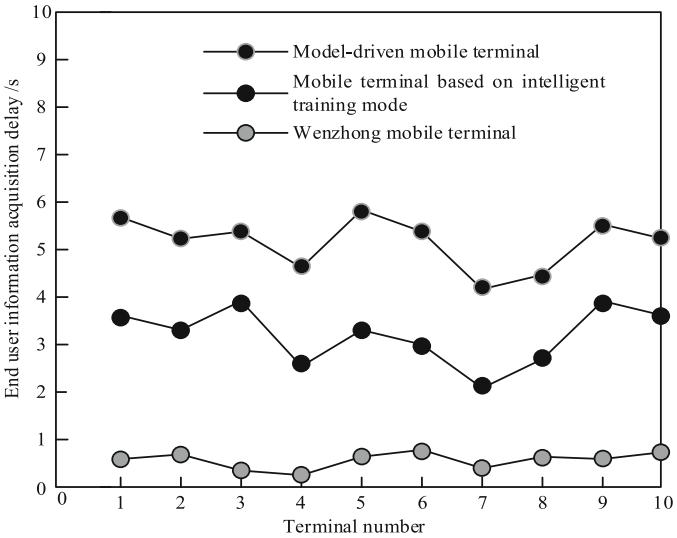

Fig. 8. End user information acquisition delay

According to the results in Fig. 8, among model driven mobile terminals, mobile terminals based on intelligent training mode, the delay of user information acquisition exceeds 2s, which cannot guarantee the real-time nature of user information acquisition. The mobile terminal based on artificial intelligence technology can control the delay of user information acquisition within 1s, improve the efficiency of user information acquisition, and meet the performance requirements of users for mobile terminals.

It can be seen from the results in Fig. 9 that the load balance of model driven mobile terminals, intelligent training mode based mobile terminals in operation is less than 80%, while the load balance of AI based mobile terminals in operation is more than 90%, indicating that the mobile terminals designed in this paper are more stable in operation.

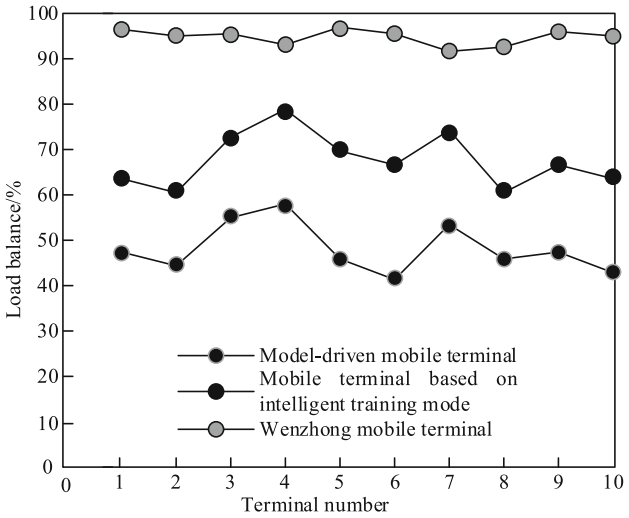

Fig. 9. Load balance

5 Conclusion

This paper proposes the application research of artificial intelligence technology on online cultural education mobile terminal. Through testing, it is found that the function and performance of the mobile terminal can meet the needs of users. Although the research in this paper has achieved certain results, there are still many shortcomings. For the development of Android technology, the current development of Android system is at its peak, and Android technology is mature and increasingly refined. In terms of its current market share, its dominant position is hard to shake, so it is a trend to develop application software on Android system devices. In the future, on the basis of completing the basic functions of software, it is necessary to improve the software performance.

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