Remote Tutoring System of Ideological and Political Course Based on Mobile Client

Xiaopan Chen(✉) and Jianjun Tang

Jiangxi University of Software Professional Technology, Nanchang 330041, China
chenxiaopan0154@163.com

Abstract. Long-distance tutoring system can not quickly from the massive learning resources in search of users interested in resources. Therefore, this paper puts forward the design of distance tutoring system based on mobile client. In the hardware part, the FPGA ARM framework is adopted, and the XGMII interface is connected with the harmonic sub-layer of the link layer to realize the continuous transmission of a large number of data streams.In the software part, the interactive structure of the system is designed to form a good docking and interactive relationship between online learning and after-class learning mode. Design module structure based on mobile client, to meet the needs of students' online VOD courseware, curriculum information and teacher information. Based on the hybrid recommendation algorithm, the personalized course recommendation is carried out, and the courses are retrieved from the relevant course recommendation database and returned to users. System test results show that the system designed in this paper can reduce the maximum response time of user query and processing applications, so it is more practical.

Keywords: Mobile client · College education · Ideological and political course · Remote tutoring · Teaching system · System design

1 Introduction

The ideological and political course in colleges and universities is the main channel to carry out the education of Marxist theory and socialism with Chinese characteristics in the new era for college students, and it is the basic task and central link to carry out the moral education in colleges and universities, as well as the important position to cultivate the new generation who shoulder the responsibility of national rejuvenation. The mobile client has brought about a tremendous change in people's lifestyle. Mobile client instead of the original information transmission channels, as long as connected to the mobile Internet, you can access to information, so that people's lives more convenient. With the continuous development of mobile Internet, people can not only rely on the original fixed terminal equipment, but also can not be restricted by the local information access anytime and anywhere. With the continuous development of mobile information technology and social economy, the use of mobile terminals has popularized all aspects of people's lives, the impact is very wide. People use smartphones to accomplish many

© ICST Institute for Computer Sciences, Social Informatics and Telecommunications Engineering 2023
Published by Springer Nature Switzerland AG 2023. All Rights Reserved
W. Fu and L. Yun (Eds.): ADHIP 2022, LNICST 468, pp. 339–352, 2023.
https://doi.org/10.1007/978-3-031-28787-9_26

social activities. Mobile terminal device not only changes people's life style, but also changes people's way of learning. With the development of the times, in the process of education modernization, mobile cloud teaching is popular among college students in the new era, which has a profound impact on the mode of thinking, learning style and behavior of college students [1].

In order to serve more users, it is urgent to find a more efficient and novel learning model. In this environment, mobile learning has become the focus of research. Mobile learning devices rely on PAD, mobile phones and other portable devices, so that users can learn anytime and anywhere. Learners are more and more likely to use mobile terminal devices to participate in learning activities, no longer keen to participate in learning activities through the traditional personal computer, thus creating a mobile learning model. Learners use mobile terminal devices to acquire learning resources more conveniently and quickly through mobile learning platform, and then complete learning activities and achieve learning objectives. The key of ideological and political education is how to make use of the mobile cloud teaching technology to cooperate with the ideological and political class in colleges and universities, accurately convey knowledge goals, guide students to actively master skills and realize that the emotional attitude and values imparted are the key to ideological and political education. At present, colleges and universities should integrate the teaching content based on the modern Internet technology, and deliver it to the students, so as to facilitate students to achieve online testing and autonomous learning, and improve learning efficiency. The remote tutoring system of ideological and political courses in colleges and universities transforms the traditional teaching mode by using the mobile cloud teaching technology. The development of the new era and the popularization of intelligent terminals provide convenient conditions for the effective coordination of mobile cloud teaching and ideological and political courses in colleges [3].

The concept of mobile teaching was first proposed as a form of mobile learning abroad. On the one hand, mobile teaching and mobile learning are only different in terms of subjects. The same system is a learning platform for students and a teaching system for teachers. On the other hand, mobile teaching is a more advanced concept based on the concept of mobile learning. It adds more interactive features as well as personalized study settings. Mobile teaching takes the client as the carrier, allowing students to use the client to learn. In this process, the teaching activities between teachers and students can be reflected more and more. Mobile learning resources present as digital resources, a mobile phone has a very large amount of data, users can freely access mobile devices in the data, compared with the PC and traditional classroom, mobile client is more available. Based on the mobile client, this paper designs a remote tutoring system of ideological and political courses in colleges and universities. It forms a complete, universal and process-oriented teaching mode through the timely learning and simultaneous participation of the mobile end, which can greatly break the constraints of the traditional mode and enhance the effectiveness of ideological and political courses.

2 Hardware Design of Remote Tutoring Teaching System for Ideological and Political Course in Colleges

FPGA ARM framework is adopted in the hardware part of the remote tutoring system. FPGA processes high-speed network data interface, and ARM processor completes configuration management, authentication and encryption.The hardware framework of the system is shown in Fig. 1.

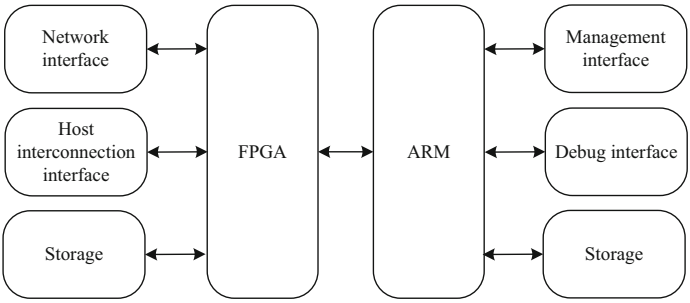

Fig. 1. The hardware framework of the system

The function of the processor module is to receive the data of the system through various communication protocols and different pins. This system uses nRF51822, which is based on ARM Cortex-M0 architecture and promoted by Nordic Company, as the main chip of MCU. The chip has a size of 256K flash and 32K of memory, while the internal integration of 2.4 GHz Bluetooth wireless communications, Bluetooth 4.0 protocol to support low-power standards. According to the requirement of the system, the network data exchange is mainly realized by Ethernet interface, and the management interface is 10/100/1000M adaptive network interface. WIS is added to the WAN physical layer model to achieve seamless connectivity to the SDH. NRF51822 is a multi-protocol SoC with flexible pins, powerful features and low power consumption. There are three sources of low frequency clock signals: external crystal oscillation, internal RC oscillation circuit generation and high frequency crystal oscillation synthesis. The physical layer is connected upwards through the XGMII interface to the harmonic sublayer in the link layer, and is compatible with the previous gigabit Ethernet standards upward from the MAC. So it can support the original upper layer service without changing the Ethernet frame format, which is convenient for unified management and maintenance, avoids the conversion between different protocol standards, and reduces the upgrade cost and improves the application value.

Because the PCB itself will have a certain stray capacitance, this capacitance value is very small and unstable, will cause unstable crystal work, starting difficult, in the crystal two connected with two 12pF load capacitor, crystal work in the resonant frequency state, the circuit is easy to start oscillation, more stable. Encode eight XGMII octets into 66-bit chunks, or reverse decode. Converts encoded data to a 16-bit stream and transmits it to the PMA, or conversely receives a 16-bit stream from the PMA. On the dielectric independent interface, GMII interface is defined in IEEE-802.3 standard, which includes

data line, time line and control line. External low-frequency crystal pins XL1 and XL2 share the same pin with GPIO, so a two-pin passive low-frequency chip crystal with a frequency of 32.768 kHz is externally positioned on the P0.26 and P0.27 pins, and the model is FC-135. The XC1 and XC2 pins are outfitted with a 16MHz 2520 passive HF crystal. To further reduce circuit costs, RGMII uses a 4-bit data interface and a 125 MHz reference clock to transmit data along a double-sided edge. Input 2.8 V power supply due to external interference or circuit itself, the superposition of a variety of high-frequency noise, will affect the input signal and lead to load circuit problems.

The AXI bus protocol has also developed two standards, AXI4-Lite and AXI4-Stream. The AXI 4-Lite standard specifies that all transmissions have a burst length of 1 and a data bit width of 32 bits or 64 bits. It is a lightweight AXI bus that simplifies read-write timing control, reduces overhead and latency, and is suitable for passing a small amount of control and configuration information. VDD pin connected with 100nF capacitor, external high voltage is higher than the capacitor capacitor capacitor charge voltage, lower than the capacitor plate on both sides of the plate voltage discharge. In the process of continuous charging and discharging, the high-frequency noise of voltage will be weakened, so that the voltage tends to be stable. The AXI 4-Stream standard eliminates addresses, adopts the concept of data flow, and supports packet transfer patterns, making it ideal for passing large amounts of contiguous data flow between interfaces.

3 Software Design of Distance Tutoring Teaching System for Ideological and Political Courses in Colleges

3.1 Interactive Design of Distance Tutoring System

The characteristics of distance tutoring in ideological and political courses in colleges and universities are as follows: the basic knowledge of the course is explained by online video. Students are required to complete online course assignments, exams, etc. The remote tutoring and teaching system of ideological and political courses, supported by student information database, user portrait system, intelligent evaluation and feedback system, embodies the operation logic and management thought of data collection and verification, algorithm modeling, content supply and learning feedback [4]. The online assessment is mainly carried out by teachers and teaching assistants, but it includes the characteristic link of “peer assessment”, that is, learners and learners can also evaluate each other. Students have different learning purposes in the process of using the remote tutoring system of ideological and political courses. This is mainly due to their own learning habits, learning ability and knowledge base, there are differences, so in order to further improve the user experience, the system should be user needs analysis, so that users feel more personalized service [5]. The model diagram for each of these interactions is shown in Fig. 2.

The interactive process between the system and the learners runs through the whole process from the login to the logout. After logging into the system, the learners need to fill out the questionnaire of the system’s learning needs. After cleaning, extracting, parsing, converting and verifying the collected heterogeneous unstructured data, a data warehouse is created according to the pre-set criteria and paths. Numerous “data warehouse”

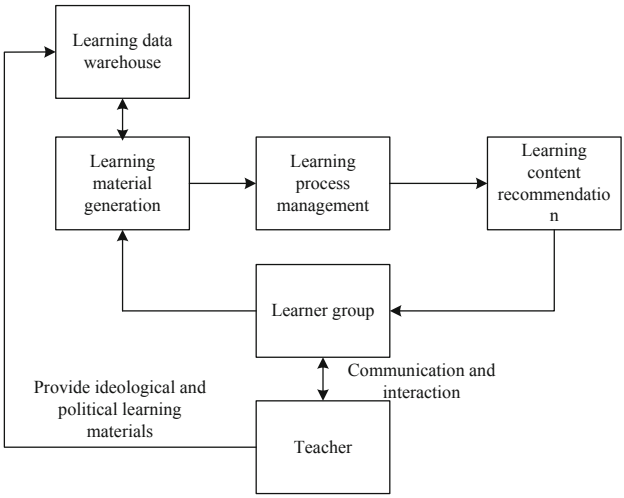

Fig. 2. System Interaction Model

permutations and combinations constitute the big data system of student information, and the stored data constitute the original assets and basic support of the service model of big data precision teaching platform. Students must learn to control time and develop their ability to choose a learning path or learning rate.

The remote tutoring system of ideological and political course can go deep into every student's learning process, track and grasp the whole state of learner's learning, and analyze each student's learning behavior in detail. The remote tutoring system of ideological and political courses quickly locates all the relevant information entries of college students, and constructs the user learning portrait and visual model. In this way, teachers can see the differences and particularities of learning habits, interests, preferences, laws and needs of college students of different ages and majors from user portraits, and scientifically judge the development trend of their thoughts and behaviors [6]. In order to improve the level of miniaturization, the system will process the learning materials and reduce their strength further, which leads to the development of data fragmentation. The system can understand the basic information of learners by testing each fragmented content, and recommend the knowledge and new knowledge that learners have not yet mastered to learners.

Systematic summary of each student's learning characteristics, basic grasp of each student's learning law, and then targeted to guide students, in order to develop personalized teaching program. For those who do not need, or temporarily do not need, or through their own books already understand the video knowledge can be skipped. So that learning with great autonomy, so as not to waste time and energy. The distance tutoring system provides corresponding teaching environment, video, course and supporting PPT, highlights the ideological and moral education value effect of network resources, forms a good docking, interaction and balance relationship between online learning and after-class learning mode, and realizes personalized excavation in the individual development of college students.

3.2 Design Module Structure Based on Mobile Client

The teaching mode of ideological and political course and mobile cloud teaching in colleges and universities is very promising. To some extent, the thinking that should be cultivated and guided by ideological and political course has a common point with the dissemination and openness of mobile interconnection. Curriculum learning is the most important part of students' learning activities, and the main purpose of the curriculum learning function is to meet the needs of students for online on-demand courseware, access to curriculum information and teacher information [7]. Simply put, smartphones are used to learn online lessons and videos. Based on the fast speed of information transmission, wide coverage and far extension of mobile cloud teaching, classroom teaching has greatly expanded and enriched the teaching methods of ideological and political courses by virtue of such distinctive characteristics and the popularization of mobile terminals of college students as a realistic basis, and should give full play to the openness of mobile cloud teaching. Through the analysis of the remote tutoring and teaching system of ideological and political courses in colleges and universities, we can know that the overall structure of the system consists of many modules and the corresponding interfaces are used to connect the various modules. At the same time, the system modules can also be divided into the backstage side of the system server and the mobile client side. The module structure based on the mobile client design is shown in Fig. 3.

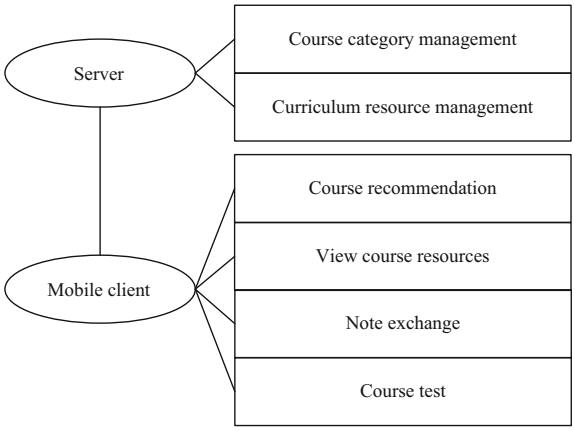

Fig. 3. System module structure

Course information maintenance mainly includes course information addition, course information viewing, course information modification, course information off the shelf and so on. Its main business logic is to add, check, modify and delete the database. According to the teaching plan, the learning time of each chapter can not be less than 95% of the total length of the video. The timing will provide the basis for the assessment of this course, and can save the history of learning, so that the students can continue to learn the video courseware. When adding the course information, first

fill in the relevant information of the course on the page, then click the save button to save the course information to the database. Clicking the save button sends an HTTP request to invoke CourseController's addCourseInfo interface. The interface first calls the checkWords method of the CourseService to check for illegal characters in the course information. If so, an error code is returned, prompting for illegal characters in the added course information; otherwise, the addCourseInfo method of CourseService is called to add the course information to the database. Returns a hint of success after a successful addition. Instructional administrators manage all the resources of the course. Teachers use the course resources to design the course, design the course and then generate multimedia courses. Then instructional administrators are required to review the generated multimedia courses. When the course passes the review, instructional administrators are required to post these multimedia courses on the mobile learning platform. Only then can students achieve the goal of online learning of multimedia video courseware.

The course search function is mainly responsible for course retrieval according to the keywords entered by users. Keyword retrieval is an important means for users to search curriculum resources in massive courses. It needs to return retrieval data to users quickly and accurately. Mobile terminal information dissemination itself on the impact of students imperceptibly, for the accumulation of various types of information is the accumulation of more and more, become towers. In order to meet the needs of fast and accurate retrieval, this paper realizes course search function based on distributed search engine ES. First, an IK Chinese word breaker is installed on the ES server for word breakers to process course title and description information for matching when retrieving using keywords; then, an Index and Type are set up on the ES server and the course data in the database is synchronized to the ES using the logstash plug-in; and finally, the course related services are configured.

3.3 Politics Course Recommendation Module Implementation

The main function of the Think Politics Course Recommendation Service is to recommend similar courses to users as they browse through the details of a course. The relevant course recommendation set of each course in the system has been calculated by the course recommendation engine, and the relevant course recommendation service only needs to obtain the relevant course recommendation set corresponding to the course from the relevant course recommendation database upon request, and then return it to the user. Mobile Cloud Teaching collects and collects the dynamic data of students' learning conditions, analyzes the data, and carries out targeted differential teaching, forming a new teaching model. It can provide detailed data for the teachers of ideological and political lesson to teach and prepare for the special topic of teaching and research. It can help teachers of ideological and political lesson to cultivate students' ability to pay attention to politics, understand current events and temper their thinking while teaching knowledge, cultivating ability and shaping value.

Course recommendation module is divided into two sections, the first section is the non-personalized hot course recommendation, hot recommendation is based on the whole system users click on the order of courses, select the whole network to high click on the course recommended to users. The second section is personalized recommendation, through the analysis of user tags set and history browsing records, to recommend users

may be interested in the course, add humanized design. The user's implicit feature vectors and the curriculum cluster center feature vectors are used as the input of MapReduce, and the user's affinity for the curriculum cluster center is calculated according to formula (1), then the curriculum cluster center with the highest user's affinity is selected. The calculation formula is as follows:

$$p = \alpha_1\beta_1 + \cdots + \alpha_u\beta_u \tag{1}$$

In Formula (1), p represents the user's preference for each course under that category; α represents the user's implicit feature vector; β represents the course clustering center feature vector; and u represents the number of users. Content-based recommendation algorithm extracts features according to the tags filled in by users when they register and issue courses, so it can effectively solve the cold start problem. Sort the calculated popularity in descending order, select the Top10 courses for each user as their recommended candidate set, and save them in the userlikecoursel.txt file. The cosine similarity between user implicit feature vectors is calculated as follows:

$$\chi(\alpha_1, \alpha_2) = \frac{\alpha_1\alpha_2}{\|\alpha_1\|\|\alpha_2\|} \tag{2}$$

In formula (2), χ represents the cosine similarity between eigenvectors. The cosine similarity is sorted in descending order, and the users of Top-10 cosine similarity are selected as their similar user groups for each user. Project-based collaborative filtering recommendation algorithm solves the long tail problem by recommending courses of interest to users who have operations on the same course. Calculate the user's preference for similar user history scoring courses (the courses that the user has scored are not included in the calculation). The formula is as follows:

$$\gamma = \varpi_1 + \frac{\chi(\alpha, \beta)(\varpi_1 - \varpi_2)}{\chi(\alpha, \beta)} \tag{3}$$

In formula (3), γ represents the likeness of a history graded course; ϖ_1 represents the average grade for all graded courses; and ϖ_2 represents the grade for a single course. Save the recommended candidate set to the userlikecourse2.txt file. Based on the analysis of the algorithms and problems above, this system combines the collaborative filtering recommendation algorithm with the content-based recommendation algorithm as a hybrid recommendation algorithm. The proposed candidate set is sorted according to the degree of preference, and the course of Top-10 is selected as its recommended candidate set for each user. Personalized course recommendation is returned to the selected section of the homepage through the above mixed calculation, and non- Personalized course recommendation is returned to the rotated section of the homepage by counting the number of students. The trigger page for the course recommendation service is the course details page. When the user enters the course details page, the browser triggers the JS script to send an Ajax request to the relevant course recommendation service to obtain the course recommendations. So far, the design of distance tutoring system of ideological and political courses based on mobile client is completed.

4 Experimental Research

4.1 Experimental Preparation

From the point of view of the whole distance tutoring system of ideological and political courses in colleges and universities, the system test is a vital operation method. In order to avoid errors in the design and development of the long-distance tutoring system of ideological and political courses, we should test the system repeatedly in order to reduce the possibility of errors and ensure the system to be in the optimal state.

The deployment environment of system test is based on Windows operating system. The technology used in system development is .NET technology. In order to match with the development technology, IIS server needs to be deployed. The database used in this system is the SQL Server2013 database with many advantages. Using IIS server as the Web server, can deal with a variety of different types of data, but also has a large capacity of data storage. The Web server is configured as follows: CPU: intel core 2.8 GHz; memory: 8 G; hard disk: 2 TB.

Here are some simple test cases: system user login, user registration, testing system page jump function, course recommendation view and teaching case view. Through the above use cases, we test the system in a black box and analyze each function. The test results show that the system basically meets the requirements of the remote tutoring system of ideological and political courses for mobile clients. Functionally, the system can achieve the desired goal.

4.2 Results and Analysis

On the basis of testing the actual functions of the remote tutoring system of ideological and political courses based on mobile client, the performance of the system is further tested. The selected performance test metrics are the maximum response time for user queries and the maximum response time for processing requests. The number of concurrent users for the test settings is 200, 500, and 1000. The performance test results of the system are compared with those of the distance tutoring system based on microservice architecture and deep learning. Under the different number of concurrent users, the comparison results of the maximum response time of each system user query are shown in Table 1 ~ Table 3.

In the test of 200 concurrent users, the maximum response time of user query of the remote tutoring teaching system of ideological and political courses based on mobile client is 1477 ms, which is 413 ms and 548 ms shorter than that of the teaching system based on micro-service architecture and deep learning.

In the test of 500 concurrent users, the maximum user query response time of the remote tutoring system for ideological and political courses based on mobile client is 2253 ms, which is 481 ms and 624 ms shorter than the teaching system based on micro-service architecture and deep learning.

Table 1. Comparison of query maximum response times for the number of concurrent users 200 (ms)

Number of tests	Remote tutoring system of ideological and political course based on mobile client	Distance tutoring system of ideological and political course based on microservice architecture	Distance tutoring system of ideological and political course based on deep learning
1	1549	1875	2037
2	1488	1746	2184
3	1366	1988	1958
4	1533	1804	1946
5	1455	1867	1819
6	1327	1981	1955
7	1514	1752	2021
8	1478	2078	2164
9	1506	1899	2237
10	1553	1906	1925

Table 2. Comparison of query maximum response times for 500 concurrent users (ms)

Number of tests	Remote tutoring system of ideological and political course based on mobile client	Distance tutoring system of ideological and political course based on microservice architecture	Distance tutoring system of ideological and political course based on deep learning
1	2316	2636	2938
2	2107	2528	2806
3	2352	2760	2757
4	2285	2895	2978
5	2390	2859	2882
6	2263	2723	3063
7	2134	2906	2809
8	2028	2877	2754
9	2316	2542	2874
10	2342	2612	2913

Table 3. Comparison of query maximum response times for 1000 concurrent users (ms)

Number of tests	Remote tutoring system of ideological and political course based on mobile client	Distance tutoring system of ideological and political course based on microservice architecture	Distance tutoring system of ideological and political course based on deep learning
1	2623	3409	3865
2	2768	3580	3720
3	2648	3665	3933
4	2592	3727	3854
5	2507	3578	3788
6	2664	3815	3846
7	2586	3582	3710
8	2548	3653	3801
9	2623	3664	3927
10	2465	3732	3865

In the test of 1000 concurrent users, the maximum response time of user query of the remote tutoring teaching system of ideological and political courses based on mobile client is 2602 ms, which shortens 1039 ms and 1229 ms compared with the teaching system based on micro-service architecture and deep learning. For different number of concurrent users, the comparison results of the maximum response times for each system are shown in Tables 4–6.

In the test of 200 concurrent users, the maximum response time of the mobile client-based remote tutoring system for ideological and political courses is 1979 ms, which is 522 ms and 724 ms shorter than that of the system based on micro-service architecture and deep learning.

In the test of 500 concurrent users, the maximum response time of the remote tutoring system for ideological and political courses based on mobile client is 3186 ms, which is 568 ms and 734 ms shorter than the system based on micro-service architecture and deep learning.

In the test of 1000 concurrent users, the maximum response time of the remote tutoring system for ideological and political courses based on mobile client is 3801 ms, which is 496 ms and 814 ms shorter than that based on micro-service architecture and deep learning. The test results show that the system can reduce the maximum response time of user query and processing applications, and is better than the two long-distance tutoring systems in overall efficiency.

Table 4. Comparison of maximum response times for processing requests for 200 concurrent users (ms)

Number of tests	Remote tutoring system of ideological and political course based on mobile client	Distance tutoring system of ideological and political course based on microservice architecture	Distance tutoring system of ideological and political course based on deep learning
1	1842	2305	2643
2	1980	2556	2585
3	1865	2619	2760
4	1931	2463	2634
5	2054	2636	2757
6	2128	2552	2625
7	1815	2480	2816
8	1946	2522	2652
9	2083	2505	2792
10	2150	2367	2763

Table 5. Comparison of maximum response times for processing requests for 500 concurrent users (ms)

Number of tests	Remote tutoring system of ideological and political course based on mobile client	Distance tutoring system of ideological and political course based on microservice architecture	Distance tutoring system of ideological and political course based on deep learning
1	3156	3643	3869
2	3250	3789	3984
3	3185	3896	3957
4	3061	3665	4048
5	3224	3827	3916
6	3258	3851	3923
7	3112	3610	3866
8	3176	3875	3930
9	3283	3758	3725
10	3152	3626	3980

Table 6. Comparison of maximum response times for processing requests for the number of concurrent users 1000 (ms)

Number of tests	Remote Tutoring System of Ideological and Political Course Based on Mobile Client	Distance tutoring system of ideological and political course based on microservice architecture	Distance tutoring system of ideological and political course based on deep learning
1	3627	4142	4520
2	3858	4201	4665
3	3706	4364	4553
4	3563	4357	4647
5	3989	4288	4589
6	3825	4376	4762
7	3764	4453	4463
8	3931	4293	4552
9	3802	4232	4778
10	3943	4265	4616

Analysis of the above experimental results shows that the mobile client-based remote tutoring system designed in this paper has better processing performance when dealing with large concurrent user queries and course responses. Because this paper adopts the FPGA ARM architecture in hardware, and connects the XGMII interface with the harmonic sublayer of the link layer, it can realize the continuous transmission of large amounts of data. And can obtain personalized course resource recommendation results when users query, thus improving students' interest in learning.

5 Conclusions

The coordinated promotion of mobile teaching and ideological and political courses focuses on the use of new information technology to create a new situation in the teaching of ideological and political courses, rather than simply as a tool or means to assist teaching. This paper designs a remote tutoring system based on mobile client. We adopt the FPGA ARM architecture, and the XGMII interface is connected with the harmonic sublayer of the link layer, which can continuously transmit a large number of data streams. The module structure is designed based on the mobile client, which can meet the information needs of students and teachers. At the same time, it also has the function of personalized course recommendation. The system reduces the maximum response time of user queries and processing, and improves overall operational efficiency. However, the recommendation results in the learning system in this paper are obtained by offline calculation, and cannot be recommended according to the real-time behavior of users in the system. The next step is to add a user behavior collection function to the system to recommend course resources based on the user's real-time behavior.

References

1. Xu, M.-W., liu, Y.-Q., Huang, K., et al.: Autonomous learning system towards mobile intelligence. J. Software **31**(10), 3004–3018 (2020)
2. Xu, N., Fan, W.-h.: Research on interactive augmented reality teaching system for numerical optimization teaching. Comput. Simulation **37**(11), 203–206,298 (2020)
3. Yaru, G.: Research on 3D ideological and political teaching system based on multimedia perspective. Mod. Sci. Instrum. **38**(1), 140–144 (2021)
4. Zhu, L.-l.: Application online intelligent teaching system in colleges and universities based on artificial intelligence. J. Jiangxi Vocat. Techn. College Electricity **34**(2), 20–21 (2021)
5. Cui, Y., Wang, F., Chen, K.: Design of distance education system based on VR live broadcast. Experimental Technol. Manag, **37**(6), 132–136,140 (2020)
6. Wu, Juan.: Optimization design of college ideological and political teaching system based on multimedia technology. Techniques Autom. Appli. **39**(9), 180–182 (2020)
7. Zhang, L.: Design of distance teaching system based on artificial intelligence network. Mod. Electronics Technique **44**(2), 131–134 (2021)