



Intelligent Interactive Mobile Teaching Platform in Colleges and Universities Based on Artificial Intelligence Network

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Abstract. Under the condition of today's network technology, the realization of online teaching has become a reality and accepted by most colleges and universities. It has become a popular technology for online teaching platform to complete online teaching tasks. However, the traditional online teaching platform does not give enough consideration to the interaction between teachers and students. Under this background, an intelligent interactive mobile teaching platform in colleges and universities based on artificial intelligence network is designed. This paper analyzes the design objectives and key technologies of the platform, and designs a platform framework based on B/S three-tier architecture. With the enhanced 16-bit MCU (MC9S12DG128) as the core, four hardware modules are designed. The platform database is designed with reference to SQL Server 2000 database technology, and five functional modules are designed. The test results show that the average delay of the platform is 1866 ms when there are 1000 concurrent users, and it has good application performance.

Keywords: Artificial intelligence network · Platform frame · Hardware · Function module · Mobile teaching platform

1 Introduction

With the advent of the era of knowledge economy, the traditional teaching mode has been unable to meet the needs of modern society for higher education, and the educational resources are wasted to a certain extent due to the limitation of time and space. Information technology, especially computer network and multimedia technology, has penetrated into all fields of modern society, and provided a broad development space for the optimization and sharing of educational resources. Under this background, modern distance education shows its great superiority and feasibility. At the same time, with the popularization of computers and the development of Internet technology, artificial intelligence network technology has developed rapidly, and its application in the field of education has become more and more extensive, and the way of educational information

dissemination has also changed, which has led to great changes in educational models, concepts and methods. The application of artificial intelligence network in the field of education not only provides students with plenty of learning opportunities, but also provides students with rich teaching resources, which makes learning activities more autonomous, breaks the limit of traditional teaching time and space, and accelerates the pace of updating teaching content and system. At present, network teaching is mainly conducted through virtual classroom and wireless network. In virtual classroom, the network can provide students with a man-machine interface with pictures, texts, audio and video, and provide a knowledge base that is more in line with students' thought expansion and a large-scale information base organized by hypertext structure. Therefore, it is easy to stimulate students' interest in learning. Network teaching can not be limited by time and space, as long as there are network conditions in any place, we can learn independently through the network. Using traditional computer-assisted instruction usually presets all the teaching contents in the system on a single computer according to the programming method. Although the computer-aided instruction system can teach online with its intelligence, the lack of necessary communication means leads to the inability of interaction between teachers and students. Some scholars have suggested that using network platform in PBL teaching of immunology can break through the limitations of time and space and teachers. Students can interact with tutors anytime, anywhere to find PBL case information, which is helpful for teaching [2]. Some scholars have proposed to use data mining method to extract the relationship between students and teachers in art teaching, and apply it to multidimensional analysis of data, which enhances the structural integrity of teaching system [3]. Therefore, an intelligent interactive mobile teaching platform for colleges and universities based on artificial intelligence network is designed.

2 Design of Intelligent Interactive Mobile Teaching Platform in Colleges and Universities

With the development of computer and network technology, the space of education is no longer limited to traditional classrooms, and the form of education has also broken through the traditional teaching mode. The teaching platform system based on artificial intelligence network has the characteristics of unlimited time and space, various forms, flexibility and convenience, etc., and has been gradually applied to practical teaching activities as a brand-new modern education method, which has become a powerful supplement to traditional education forms. How to effectively carry out network teaching activities has gradually become an important topic in the construction of teaching informatization in higher vocational colleges, and the construction of network teaching platform has become the foundation and key to solve this problem. Based on the work practice of "Intelligent Interactive Mobile Teaching Platform for Colleges and Universities Based on Artificial Intelligence Network" designed and developed by the author, this paper discusses the design pattern, overall structure and system implementation scheme of the network teaching platform, and explores the application of educational informatization in teaching through the realization of examples.

2.1 Platform Design Goal

In order to know what kind of technical support the network teaching platform needs, we first need to know the design goal of the platform. The design of a network teaching platform should reflect the following objectives: make full use of the software and hardware resources of the existing network, apply artificial intelligence network, establish an interactive, open and easy-to-use environment, and facilitate the use and communication of three users. On this basis, the platform design must also meet the following objectives:

- Content-oriented subjective goal when combining teaching content with technical means;
- We should not only base ourselves on today's advanced technology, but also consider the forward-looking goal of future technology development;
- Enable the teaching of different disciplines and the use of different user groups to achieve a unified universal goal;
- The economic goal of obtaining the most efficient teaching benefit with the lowest possible investment.

2.2 Key Technologies of Platform

ASP Technology

ASP (Microsoft Active Server Pages) is the abbreviation of active server page, and it is a scripting environment on the server side developed by Microsoft, which can be used to create dynamic WEB pages or generate powerful WEB applications. ASP can combine HTML pages, script commands and ActiveX components to create dynamic and interactive WEB pages and WEB-based applications.

ASP is a WEB page technology on the server side, which runs on the server side (web server) rather than on the client side (visitor's browser). When a customer requests an ASP file, the server first interprets the file as a standard HTML file and then sends it to the customer. There are two advantages to running on the server side: first, it can be free from the limitation of the client browser; Second, it is very convenient to exchange data with the data server. Strictly speaking, ASP is not a language, it just provides a running environment to run Script. The language it uses is still Vbscript or JavaScript, or it can be a combination of both.

Database Technology

Using SQL Server 2000 database technology as the DBMS of this system, it has high efficiency data analysis performance, flexible business expansibility, security of integration with operating system and ease of use of customers and management tools, which improves the efficiency of management and reduces the cost of system operation and maintenance. SQL Server 2000, as a database developed by Microsoft on Windows series platform, is a fully functional database management system. SQL Server 2000 also has the function of rapidly developing new Internet systems. Especially, it can directly store XML data and output search results in XML format, which is conducive to the interoperability of heterogeneous systems and lays the cornerstone of Internet-oriented enterprise

applications and services [4]. In the case of using the relational database engine of SQL Server 2000, XML data can be stored in relational tables, and queries can return relevant results in XML format. In addition, XML support simplifies the integration of back-end systems and realizes seamless data transmission across firewalls. You can also access SQL Server 2000 by using HPE HperText Transfer Protocol (HTTP), so as to realize secure Web connection for SQL Server 2000 database and online analytical processing (OLAP) cube without extra programming. SQL Server 2000 adds OLAP online analytical processing function, which allows many users to use some features of data warehouse for analysis.

Streaming Media Technology

With the rapid development of the Internet age, streaming media technology is being widely used and gradually known by people. With the popularization of broadband network, people can even play movies or watch live programs online, and these applications can not be realized without the support of technology, and streaming media technology plays an important role in it [5].

At present, the streaming media technologies adopted in the market are mainly composed of two series: Real Media technology developed by the most representative Real Network company and Windows Media technology launched by Microsoft company, and a small amount of Quick-Time technology of Apple company is also adopted. Compared with the traditional multimedia technology, they have the following common features in technology.

- 1) Adopt audio and video encoder with high compression rate and high quality;
- 2) Coding mode with multiple bit rates;
- 3) Have intelligent flow control technology;
- 4) Support script command transmission mode;
- 5) Different from the WEB server mode, it makes up for the deficiency of Web server function;

2.3 Platform Frame Design

At the end of 1990s, with the in-depth application of network technology in all walks of life, a new architecture, three-tier B/S network architecture, appeared in IT industry with low cost, low management overhead and the advantages of Client/Server computing mode. If the C/S architecture is called “thick client/server” computing mode, then the three-tier B/S architecture can be called “thin client/server” computing mode [6].

The technical feature of the three-tier (or multi-tier) B/S architecture is that one (or more) middleware layers are added to the two-tier architecture. It moves the application program originally running on the client in the C/S architecture to the middleware layer, and the client is only responsible for displaying the interface for interaction with users and a small amount of data processing (such as data legitimacy check). The client submits the collected information (requests) to the middleware server, which performs corresponding business processing (including database operation) and then feeds back the processing results to the client. When the number or demand of teaching content and clients changes greatly, it is easy for the system to be overloaded and its performance will be greatly

reduced. The three-tier architecture can greatly improve the performance of the system, and the database server is only responsible for storing and managing data, which can reduce the amount of data transmission and the load of the network [7]. Especially, the three-tier structure system designed by technology can achieve interoperability and cross-platform operation.

The whole teaching platform logically adopts a three-tier architecture, and the system framework is designed, as shown in Fig. 1.

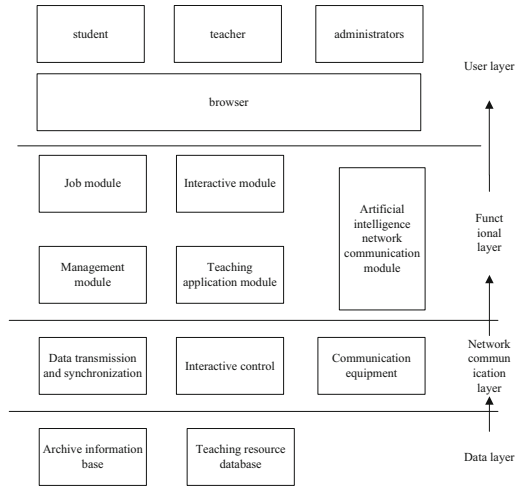


Fig. 1. Platform framework

User Layer

The user layer is equivalent to the window of the whole system. Users can directly access the system through this layer to realize the interaction with the system, thus completing the work that needs to be realized. In order to facilitate users to enter the system with different identities, the system is divided into three different user interfaces, namely, teacher interface, student interface and administrator interface. Different users have different permissions, and the permissions from low to high are students, teachers and administrators, as shown in Fig. 2 below. Students are faced with what they want to learn. Teachers enter the background to manage teaching contents through certification, and administrators have the highest permissions. After certification, they can manage all contents and system settings. The user layer adopts browser mode, and the interface is as friendly as possible for the convenience of users [8]. This layer is mainly implemented by Web dorms of ASP. NET.

Functional Layer

The function layer is the connecting part between the user layer and the data layer, but

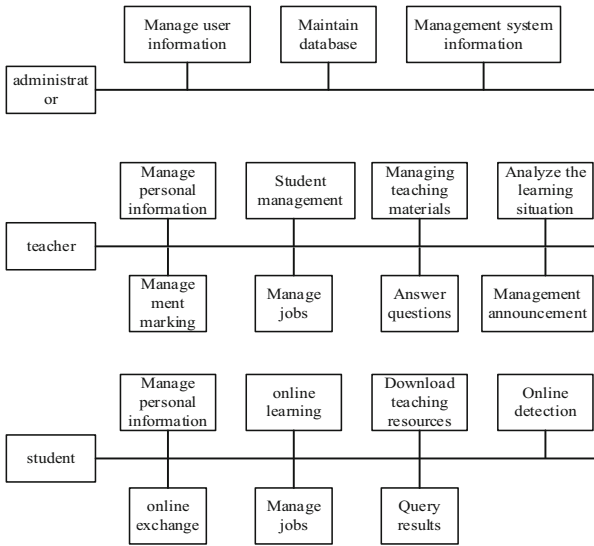


Fig. 2. User management authority of teaching platform

it is not a simple connection, but a detailed classification of users’ needs. It consists of many modules, which can be stored on the Server side according to their different functions. The functional layer in this system includes three parts: teacher subsystem, student subsystem and administrator subsystem, and each part is composed of several modules. The function layer realizes fast data access to the data layer through ADO.NET.

Communication Layer

The communication layer is similar to the CLL layer in CSCL model. Its main function is to provide reliable communication connection for interactive teaching system and a unified cooperative communication link for the upper layer. This layer uses XML-based message format for transmission.

Data Layer

The data layer is the foundation of the whole system. It consists of three parts: user information database, teaching resource database and knowledge structure database. The user information database includes the basic information of students, teachers and other managers. The teaching resource database mainly provides data support for the teaching and auxiliary subsystems, including lesson plans, courseware, videos, homework, test questions and so on. Knowledge database mainly organizes information resources rationally. The data layer all uses stored procedures to operate the underlying data.

2.4 System Hardware

This platform takes the enhanced 16-bit MCU (MC9S12DG128) as the core, and mainly consists of the following four modules. Each module is a relatively independent small

practical experimental system, and the control function of each module is realized through the expansion of I/O interface.

- (1) The experimental control module realizes the control of stepping motor or DC motor.
- (2) The analog-to-digital conversion module of the system realizes the A/D conversion and D/A conversion functions.
- (3) The experimental clock module realizes the function of calendar clock stopwatch.
- (4) Routine experiment module and extended experiment module, realizing routine experiment and extended experiment of single chip microcomputer.

MC9S12DG128 is an enhanced 16-bit single-chip microcomputer in S12 series single-chip microcomputer introduced by Freescale Company, which is rich in on-chip resources and widely used. It integrates 16-bit central processing unit HCS 12 CPU, 128-kbyte Flash EEPROM, 8-kbyte RAM, 2-kbyte EEPROM, 2 asynchronous serial interfaces SCI, 2 synchronous serial interfaces SPI, 8-channel enhanced capture timer (ECT) with IC/OC function, 2 8-channel 10-bit ADCs, 1 8-channel PWM and 1 BDLC module. Two CAN 2.OAB softwares are compatible with the CAN controller MSCAN, one Byteflight module, one IIC module and rich IO ports. MC9S 12DG128 has all 16-bit external data channels, and can run in 8-bit narrow mode, so that 8-bit wide memory modules can be used to reduce costs. In addition, MC9S12DG128 also contains PLL circuit, which allows adjustment of power consumption and performance to suit specific applications. MC9S12DG128 can run at the highest S OM crystal oscillator, that is, 25M bus speed, and has three low power consumption modes: stop, pseudo stop and wait. MC9S 12DG128 is available in 80-pin and 112-pin packages, which gives users great freedom in design.

2.5 Database Design

To design an effective database, we must consider the problem from the viewpoint of system engineering. Because this website is an artificial intelligence network teaching platform, there are many kinds of course resources, so there are many corresponding data tables, including: article system data sheet; Download system data sheet (downloading system data sheet); Electronic lesson plan data sheet (electronic lesson plans data sheet); The FLASH system data sheet; Classified information sheet; Image data sheet (photo system data sheet); Exam Text, etc. Exam Text is a collection of test records, which is used to store detailed information of all test questions in various subjects. It includes the main test number (primary key), the subject number of the test questions, the type of questions, the difficulty of the test questions, the stem content of the test questions, the alternative answers of the test questions, the standard answers of the test questions, the entry time of the test questions, the storage path of the picture files and video files if the test questions contain pictures and video data, the answer times and the correct answers of the questions, which have nothing to do with the specific test papers. All the data tables stored in the database are classified and stored in the form of codes. Considering that the corresponding technologies are extensive, I will not repeat them here.

2.6 Main Function Module Design

Management Module

Website management: user management and course management constitute the three main modules of the platform management module.

Website management module: Users with management status operate the website management module and effectively manage the settings of the whole platform, making the whole platform more reasonable.

User management module: learners log on to the platform as ordinary users, and use some modules and resources of the user management module platform to help them learn.

Course management module: users with the status of course teachers can manage the course, which is beneficial to their management of the whole course. Moreover, teachers can fully control all the settings of the curriculum including other teachers through the curriculum management module.

Teaching Application Module

The main function of the teaching application module is to provide interactive teaching environment for teachers and students and facilitate teaching activities. In order to achieve the above goals, the teaching application module needs to provide a variety of different types of teaching application tools to realize multi-dimensional interaction with users. In order to make each teaching application independent and display in different areas of Activity, it is necessary to separate the view of teaching application from its specific functions.

Teaching tools are designed based on the View control provided by Android application framework. The View control is the basic control provided by Android system for user interface, which represents a rectangular area on the display screen and is responsible for image drawing and event handling in this area. The View control provides the `onDraw ()` method to redraw the area and the `invalid ()` method to update the area.

Teaching application tools are implemented based on View controls, and event listeners are also needed to capture the user's operations on the teaching application tools and inform the controller of the user's operations, so as to realize the response of the teaching application to the user's operations. There are two kinds of user operations for teaching application: touching the View control and clicking the function button. Android application framework provides `OnTouchListener` interface to monitor touch events.

Artificial Intelligence Network Communication Module

In order to enter the virtual classroom of the network, accept the guidance of teachers from different places and cooperate with students from different places, users of the interactive teaching system must require them to use mobile terminals as computing devices, access the Internet and communicate with other users on the basis of the network model designed by the system. Considering that the application scenario of the teaching system belongs to small-scale teaching, the system adopts the C/S framework, and the star connection is used between teachers and students.

The network module adopts TCP connection and XML message format. In order to facilitate receiving and sending messages and improve communication efficiency, the network communication module does not open a thread for each connection to realize communication, but uses Select mode of Socket to communicate. Android provides ServerSocketChannel and Selector to complete the non-blocking communication mode of Android terminal.

The network module first registers the Selector Selector, and after monitoring is started, it enters the select loop. Every time there is a new SelectionKey, it may come from the newly established connection with new readable data, or a new connection may be established. At this time, it is necessary to judge and handle it according to the event of SelectionKey. If there is no new SelectionKey and no stop notice is received, the selection will continue.

After the interactive teaching system is started, when students want to join a teacher's class, they need to apply to the teacher server for connection. If the teacher server has started the service and is running normally, the teacher server will accept the student's connection application and add the student to the current student list. When the first connection fails, the system will try again several times. If all attempts fail, the system will report to the user. During the teaching process, either the teacher or the student can terminate the communication. For the mobile terminal of the interactive teaching system, if the teacher terminates the class normally, the mobile terminal of the interactive teaching system will disconnect after receiving the disconnection message of the teacher. If the teacher disconnects abnormally, the interactive teaching system will close the current communication session and try to reconnect after detecting the disconnection. If many attempts fail, the system will report to the user. When the mobile terminal of the interactive teaching system actively terminates the connection, the mobile terminal of the interactive teaching system will send a notice of disconnection to the teacher server, and after receiving the reply from the teacher server, it will actively disconnect, and the teacher server will delete the student from the current student list.

Homework Module

As we all know, the main body of interactive teaching is students, and it is very important to establish rich homework modules to improve the teaching quality. In the system setting, front-line teachers can set the highest score of each course and the completion time of homework, and students apply for late homework, etc. based on the actual situation of the course. For students' homework, the system also comes with a set of question bank suitable for students. Teachers can select questions from the question bank and then assign them to students to do. At the same time, teachers can limit the time of their own questions. When students log in to the system to do homework, they log in to the interactive teaching information system of colleges and universities, and then finish the specified questions within the specified time. Finally, the system will automatically judge the answer and return the completion of the test questions and the final score to the teacher.

In addition to the automatic correction of homework by the interactive teaching information system in colleges and universities, after the teachers' evaluation and examination papers are completed, the failed homework will be returned. After the students

log in to the system, they will be prompted on the homepage of the system for the failed homework until the students confirm it.

Interactive Evaluation Module

In the teaching process, after students log in to the interactive teaching information system of colleges and universities, they first evaluate the documents specified by teachers. After submitting the evaluation correctly, teachers can open the evaluation content and then manage the evaluation of students. The flexible option setting of interactive teaching information system in colleges and universities can greatly improve the quality of teaching interaction. The system gives students the right to evaluate teaching. When the teaching process is over, students can evaluate teachers' teaching activities. Teachers can only view the evaluation contents, but can't view the evaluation sources. At the same time, teachers have the right to explain the evaluation contents.

3 System Test

Through the above contents, an intelligent interactive mobile teaching platform in colleges and universities has been constructed. In order to verify the application performance of the platform, this paper adopts a comparative experiment to test the reliability of the platform in the laboratory LAN environment, taking the teaching achievement and the delay of concurrent user information transmission as experimental indicators.

3.1 Testing Environment

The mobile terminal of the interactive teaching system is based on Android operating system, while the teacher terminal uses Windows operating system, and the test is carried out with multiple Android mobile terminals. The test is carried out in the LAN environment of the laboratory. It should be noted that the PC uses the wired network, while the mobile terminal uses the wireless network.

3.2 Functional Test

With the support of big data, the teaching effects of traditional system and distance teaching system based on artificial intelligence network are compared and analyzed. On the basis of a total of 300, compare the average scores of the two kinds of distance education, as shown in Table 1.

Table 1. Comparison of average scores

| Number of students | The designed teaching platform | Traditional teaching platform |
|--------------------|--------------------------------|-------------------------------|
| 100 | 263.25 | 221.21 |
| 200 | 254.21 | 201.52 |
| 300 | 235.69 | 198.65 |
| 400 | 222.57 | 188.44 |
| 500 | 217.52 | 178.42 |

From Table 1, it can be seen that with the growth of students, the application of the designed teaching platform for teaching, students' achievements have been higher than the application effect of traditional teaching platform. Therefore, using the distance teaching platform based on artificial intelligence network is more conducive to teaching and improving students' achievements.

3.3 Performance Test

LoadRunner is a performance test software. By simulating the real user behavior, real-time monitoring of load, concurrency and performance and the finished test report, the possible bottlenecks of the system are analyzed. One of the most effective means of LoadRunner should be concurrency control, which can simulate the operation of thousands of users in the same business at the same time by setting in the console.

Scenario description-user retrieval concurrency delay.

Explanation: Under the condition of strict concurrency, whether the interactive teaching platform resource retrieval can support the number of concurrent users is 1000.

Simulation scenario description: The number of users simulated by the tool is 200, 400, 600, 800 and 1000 respectively (all users operate concurrently), and each user initiates several retrieval processes to test the concurrent delay of user retrieval. The test results are shown in Table 2 below.

Table 2. User retrieval concurrency delay

| subscriber number | Average delay/ms | Maximum delay/ms | Minimum delay/ms | Average concurrency delay index |
|-------------------|------------------|------------------|------------------|---------------------------------|
| 200 | 536 | 1225 | 862 | 2.26 |
| 400 | 869 | 1562 | 862 | 3.11 |
| 600 | 1022 | 1658 | 827 | 3.52 |
| 800 | 1526 | 2284 | 1433 | 4.48 |
| 1000 | 1866 | 2144 | 1563 | 5.69 |

Average delay calculation formula:

$$\bar{Y} = \frac{\sum_{i=1}^n x_i}{n} \quad (1)$$

where \bar{Y} represents the average delay; x_i represents the delay of the i rd user; n represents the number of users.

Concurrent delay index:

$$\bar{Y} = \frac{\sum_{i=1}^n (x_{\max} - \bar{Y})}{x_{\max} - x_{\min}} \quad (2)$$

where x_{\max} represents the maximum delay; x_{\min} represents the minimum delay.

As can be seen from Table 2, the delay and delay index are both small, reaching the research goal.

4 Concluding Remarks

To sum up, when the current information age marked by multimedia has become a powerful supporting technology for the revolutionary change of pedagogy, people pay more and more attention to the advantages of distance learning based on artificial intelligence network. The characteristics of distance education system such as complexity, concurrency and individualized teaching are all very suitable for artificial intelligence technology. Therefore, artificial intelligence teaching technology has broad application prospects in distance education. The use of this system has a certain learning ability of artificial intelligence. By applying artificial intelligence technology to teaching data analysis, by setting up a multi-level teaching platform and using multi-modules to coordinate the information interaction between teachers and students in teaching, the auxiliary education system can provide a convenient learning platform for students. In the design of distance education system, it is still in the primary stage of system design, and the real realization of the system still needs to be optimized in many aspects. I hope that through the design of this system, it can provide new ideas for the research and help the next research work. In the future design of distance learning system of artificial intelligence network, it can still be improved from the following three aspects:

- 1) The introduction of computer simulation technology into the system can provide technical support for the application of distance education system;
- 2) Set up a collaborative interactive learning environment for system simulation verification, so that the system is more suitable for the actual education mode;
- 3) Under a large number of different information environments, teachers should supervise students' learning with the support of network data, and evaluate their learning results in time.

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