Journal of Combinatorial Mathematics
and Combinatorial Computing
www.combinatorialpress.com/jcmcc

Design of Interactive Teaching System for Online Art Course Based on Embedded and Matching Tree

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ABSTRACT

In the context of mobile Internet, the art teaching platform pays more attention to anytime, anywhere, and users can learn anytime, anywhere, regardless of the location of the environment. Therefore, it is necessary to design a reasonable interactive teaching system for analysis and testing, provide users with matching and learning of online art courses, and provide corresponding response measures. To properly solve the problem of course matching and selection, we have developed a new system that combines matching trees and embedded technology. Firstly, the matching tree algorithm is used for similarity diagnosis between art courses and user preferences and has achieved good results in similarity diagnosis and matching. Secondly, an interactive teaching system architecture for online art courses was built using embedded technology, which improved the efficiency of the interactive teaching system. Finally, the applicability of the established similarity matching model was verified through simulation testing of the learning system.

Keywords: online art courses, interactive teaching systems, embedded systems, matching trees

1. Introduction

Embedded is a special computer system with devices or devices as components. Generally, an embedded system is an embedded processor control board, which stores the control programmed in ROM [1-2]. In practice, any device with a digital interface, such as watches, microwave ovens, video recorders, automobiles, etc. are using embedded systems, and some embedded systems have an operating system, but most embedded systems complete the design of the entire control logic through a single programmed [3]. Embedded technology has developed rapidly in recent years, but the embedded industry involves a wide range of mutual characteristics are obvious. For example, many industries: mobile phones, PDA, car navigation, industrial control, military, multimedia terminals, gateways, digital TV... Mobile phone field: mobile devices represented by mobile phones can be called one of the fastest growing embedded industries in recent years [4-5]. On one hand, it is

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Received 01 March 2024; Revised 25 May 2024; Accepted 10 November 2024; Published Online 16 April 2025.
DOI: 10.61091/jcmcc127b-256

because of the massive promotion of mobile phones, on the other hand, it is because of the rapid development of its functions, and in the era of China's 5G is becoming more and more developed, it can be foreseen that the whole mobile phone industry will undergo a huge change in both hardware and software [6-7]. Power consumption, features, bandwidth, price, all of these have become fashionable words in the world of phone hardware.

From the point of view of software technology, I believe that the platform of mobile phone software operating system will tend to be standardized and unified. With the passage of time, the function of mobile phone will be more and more, from the most basic telephone function into a PDA, digital camera, game machine, etc., more and more tend to become an independent mobile terminal [8-9]. We will complete and verify an embedded interactive teaching platform, first of all, we will build an Android-based system, and then we will program according to the specific design of each function, and we will use a flowchart to represent its main ideas and algorithms in the programming process [10]. In this chapter, we will also do a complete test of the system to ensure that the system is correct. Therefore, it is necessary to design a reasonable interactive teaching system for analysis and testing, provide users with matching and learning of online art courses, and provide corresponding response measures [11-13]. To properly solve the problem of course matching and selection, we have developed a new system that combines matching trees and embedded technology. Firstly, the matching tree algorithm is used for diagnosing the similarity between art courses and user preferences and has achieved good results in similarity diagnosis and matching.

2. Status of Interactive Teaching of Online Art Courses with Embedded Technology

2.1. Embedded Teaching in the College Classroom Application

2.1.1. The Concept and Significance of Embedded Teaching. “Embedded” teaching refers to the fact that teachers, based on professional courses and theoretical teaching, search for the optimal combination of different educational and teaching modules, apply a variety of teaching strategies and teaching resources to guide students, and make different educational elements effectively embedded. It is necessary to make the teaching content more enriched and improve students' thinking level to make students have continuous learning interest [14-15]. In the reform of art teaching at the secondary level, embedded teaching must be used, and teachers should recognize the practical needs of this modern educational thinking, value students' learning initiative, and deepen students' knowledge and understanding of all kinds of knowledge, so that the importance and value of immersion teaching can be maximized. Scholars in the analysis of embedded teaching clearly pointed out that this teaching model facilitates a change in the traditional concept of teaching and learning in higher education, so that teachers can devote more energy to their students and thus make further adjustments to educational strategies and ideas to ensure that they are relevant and targeted [16-17].

“Embedded” college art teaching in the new situation of practical significance: it is a modern concept of education and education mode, a new type of teaching mode adapted to the requirements of the new era, which is conducive to breaking the constraints and impact of the traditional teaching mode on students. By analyzing the embedded teaching in college art teaching, scholars believe that the function and value of this teaching mode is more obvious. Teachers with more teaching experience will actively integrate various teaching concepts, teaching elements and teaching resources in classroom teaching, and guide students with appropriate interventions, so that the whole classroom is full of fun, and students can be fully engaged in teaching, to achieve the purpose of independent learning [18]. Secondly, “embedded” teaching in colleges and universities is an effective way to reflect the actual value of art education in colleges and universities. In classroom teaching, teachers should actively integrate various practical teaching activities, and guide students

to learn independently and develop their hands-on skills. Let the students learn to use the art knowledge they have learnt to solve the problems encountered in real life in their independent participation. Ultimately, if the secondary school art embedded teaching mode can be effectively reformed, the number of interactions between teachers and students can be increased, so that teaching and learning can be truly reflected, thus significantly improving the quality of education and teaching.

2.1.2. Application Status of Embedded Teaching. In the college classroom, embedded teaching is mainly to put the students' learning activities in the specific course teaching, the teaching content and teaching methods combined, so that students feel the value and significance of their own learning in the classroom, so as to stimulate the students' enthusiasm for learning. In the college classroom, teachers can improve students' learning efficiency by adopting the embedded teaching method, to improve the teaching quality of the classroom. The use of embedded teaching in the college classroom can help teachers to better organize teaching activities and increase students' interest in learning. Therefore, teachers can integrate embedded teaching into the college classroom [19]. For example, by integrating interactive teaching into the college classroom, it can make students feel the value and significance of their own learning in the process of interaction. Therefore, embedded teaching is a kind of efficient education method that can make students learn better and develop better.

2.1.3. The Difference Between Interactive Teaching and Embedded Teaching. The use of embedded teaching in the college classroom allows students to feel the value and significance of their learning in an interactive process. Teachers need to stimulate students' interest in learning when conducting teaching activities so that students can feel the value and significance of their own learning in the process of interaction. For example, before the beginning of each lesson, teachers can ask students to share their own pre-reading content, and then teachers will explain and analyse the pre-reading content shared by students, so as to let students understand the problems and deficiencies of their own learning content, and thus help students to better analyse and solve these problems [20]. In the classroom, teachers can organise group discussions for students to give full play to their imagination and creativity in the process of discussion so as to increase students' interest in learning. Teachers can let students discuss in groups first, and then summarise, generalise and analyse the results of these group discussions. After summarising and analysing the results, teachers can stimulate students' interest and enthusiasm in learning through classroom questions or other means. For example, the teacher can ask students to share the methods and techniques they used to answer the questions after discussing them first.

Interactive teaching and embedded teaching are two different ways of education, and the differences between them are mainly in the following aspects: Firstly, in interactive teaching, the roles of teachers and students are different. Teachers are the organisers and guides of the whole teaching activity, while students are the participants in the whole learning activity. Secondly, in interactive teaching, there is a certain distance between teachers and students. But in embedded teaching, there is an equal and harmonious relationship between teachers and students.

2.2. Current Status of the Application of Embedded Teaching in Online Art Interactive Classroom

During the New Crown epidemic, “classes were suspended without stopping school”, and art teachers in primary and secondary schools all over the country were teaching art online. In the process of online teaching, teachers used the embedded teaching method, that is, through teachers to students “personalised” tutoring, the use of online platforms to assist art teaching. For example, through the online live teaching, WeChat group, QQ group, etc. to carry out online art interactive teaching, according to the student's learning situation and timely adjustment of the teaching

programme, so that the art classroom is more interesting and interactive. Through online art interactive teaching, it promotes students' mastery of art knowledge, and also makes students feel the charm of art. The development of online art interactive teaching requires teachers to have solid professional knowledge and skilful teaching skills to create a relaxed and pleasant learning atmosphere for students. Therefore, teachers must start from themselves and continuously improve their professional ability and teaching level. In addition, teachers should constantly update their educational concepts and educational methods to meet the needs of art education reform and development in the new era.

At the same time, it is necessary to cultivate students' interests and hobbies in art learning. Interest is the best teacher, and with interest comes motivation and learning power. Teachers should create various situations to make students have a strong interest in art. At the same time, we should take students as the main body, teachers as the leading role, and give full play to students' independent learning and exploratory learning and other aspects of online art interactive teaching.

3. The Online Art Course System Platform Design of Embedded Technology

3.1. Content of the Online Art Course System Design with Embedded Technology

The system is divided into multiple subsystems, in which modularity is the in-depth extraction and refinement of the subsystems to achieve the reusability of the subsystems, thus making the whole system more reasonable. According to the requirement analysis specification, based on the overall design principle, the system is divided into the following parts:

3.1.1. System Login and Registration Module. Login and registration is a very critical task. In this system, the user's collection and chargeable studies require the user to log in first. If possible, then you can log in through some social network accounts, such as Renren, Sina Weibo, Tencent QQ, which can be directly logged in, eliminating a lot of cumbersome registration procedures.

3.1.2. Course Display Module. The art teaching platform provides users with a lot of tutorials on the server that can be learnt, but on the mobile phone, the tutorials on the server have to be displayed in an appropriate way, so it is necessary to ensure that the course module has a fast response time and can be reused. At the end of the query, it needs to be queried and after the query is over, it can be reused to show the result of the query. In the tutorial display module, a list format that can be scrolled up and down should be used, as well as as asynchronous loading and slow display in the list, so as to enhance the response and storage space.

3.1.3. Course Classification Module. There are a lot of tutorials in the art education platform, and if these tutorials are not properly categorised, then the system will look a bit disorganised. Therefore, combining the proper course classification with the course display model can make it easier for users to make course selection.

3.2. Rovide similarity analysis for matching books

The matching tree algorithm first preprocesses all subscription sets into a tree, and after the messages arrive, traverses the established tree to find all matches between messages and events. Its core is the matching tree. The index establishes a mapping relationship between the location information of information and content storage. The information index is divided into forward index and inverted index. The edge represents the test result, not the leaf node represents a test. The subscription conditions that need to be matched should be associated with the leaf nodes.

$$f = f(x) \tag{1}$$

Constraints:

$$\begin{aligned} & x_j' \le x_j \le x_j''\left(j=1,2,\ldots,n\right) \\ & g_j \le g_j''\left(j=1,2,\ldots,n\right) \\ & h_j' \le h_j(x)\left(j=1,2,\ldots,n\right) \\ & w_j' \le w_j(x) \le w_j''\left(j=1,2,\ldots,n\right) \end{aligned} \tag{2}$$

X represents the testing edge, which indicates the subscriptions that can be reached through X, where this edge does not care about the testing results. This subscription is a predicate that includes leaf nodes.

$$Q(x,q)=\frac{f}{f_0}+\sum_j p_x\left(x_j\right)+q\left[\sum_j p_g\left(g_j\right)+\sum_j p_h\left(h_j\right)+\sum_j p_w\left(w_j\right)\right] \tag{3}$$

In which, p_x, p_g, p_h, p_w is a penalty factor for constrained design variables and state variables. By using the gradient method for unconstrained optimization problems, the iterative formula is expressed as follows,

$$x^{(j+1)}=x^{(j)}+s_j d^{(j)} \tag{4}$$

When matching algorithms, in order to quickly respond to query requests, we usually establish indexes. By indexing, when responding to query requests, the system can quickly find the user's needs.

$$\begin{aligned} & \left|f^{(j)}-f^{(j-1)}\right| \le \tau \\ & \left|f^{(j)}-f^{(b)}\right| \le \tau \end{aligned} \tag{5}$$

The forward index is expressed inthe form of "document keyword", and the location information of each keyword in the document is recorded inthe table.

$$D(v)=\sum C\left(v_i,v_j\right),\ \text{where } v_i,v_j \in V \tag{6}$$

When searching, scan the words in each document in order of their document number and output all matching keywords. The establishment process and organization form of forward index are relatively simple.

$$D\left(v_0\right) \le D\left(v_1\right) \le D\left(v_2\right) \le \cdots \le D\left(v_n\right) \tag{7}$$

The design concept of inverted index is table of contents, which allows us to quickly find the specific location of content through the table of contents.

$$D\left(v_{n+1}\right)=\min\left\{D\left(v_n\right)+C\left(v_i,w\right)\right\},\ \text{where } v_i \in U, w \in V-U \tag{8}$$

In inverted indexing, words may appear in multiple documents or appear once or multiple times ina single document. Therefore, the address in the 'directory' is a list of document numbers.

Each item in the list contains all the positional information where this word appears in the document.

3.3. Database Design of Embedded Teaching System

The database is a very crucial aspect in the detailed design of the whole software system. Android is tailor-made for the users with a miniature, inbuilt, good performance and suitable for small scale devices. The development of the database on sqlite is similar to the design of a large database in general, and JDBC avoids differences in the operation of the database.

3.3.1. Sqlite Database Design Based on Android Embedded Platform. The sqlite relational database is a popular small database for embedded setups such as mobile phones and tablets. It also provides some general database methods like relational tables, relational queries, database processes etc.Android system has built-in sqlite database operation API, users can use SQLiteOpenHelper to achieve the database creation, open and other operations, and use onCreate and onUpgrade etc. To delay the database creation to the time when the database needs to be started, so as to ensure the fast response of the system. In this paper, we used a Sqlite client under WindowsXP to manage its data, such as a management platform called FireFoxSqliteManager shown in Figure 1.

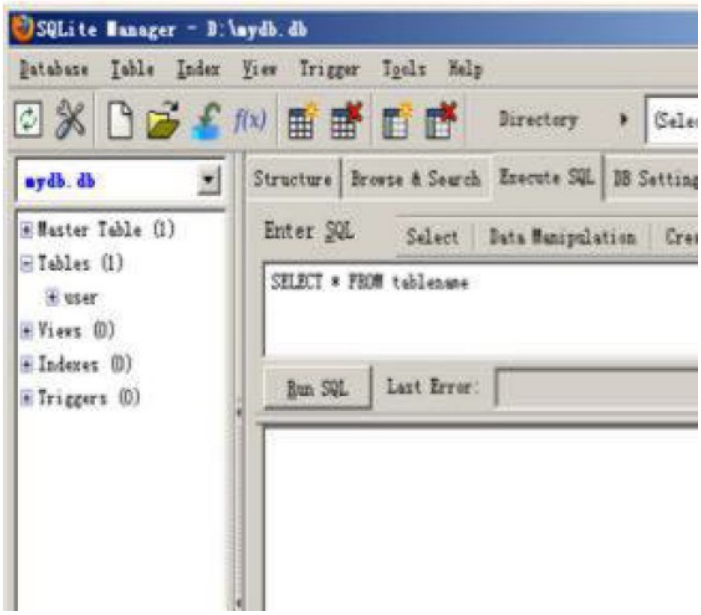

Fig. 1. FireFoxSqliteManager management platform

SQLiteOpenHelper can get a database instance through getReadableDatabase or getWriteDatabase and manipulate the database through JDBC syntax. Another way to do this is through SQL database inserts, updates, and deletes. These methods take some SQL statements as real parameters. The conceptual diagram of mobile edge computing is shown in Figure 2.

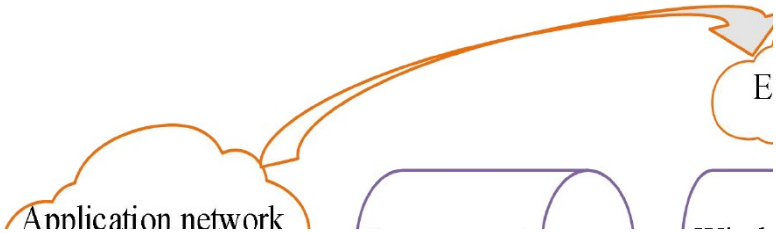

Fig. 2. Conceptual diagram of mobile edge computing

Mobile edge computing (MEC) can be defined as an implementation of edge computing, which introduces computing and storage functions to the edge of the radio access network, thereby reducing waiting time by moving the cloud and service platform to the edge of the network. In the design of software, if we rely solely on the API of the software, it will bring a lot of inconvenience, so we must use a software system to achieve the maintenance of the data of the software. Based on the embedded platform of Android, the hypervisor of sqlite is integrated with the system, and it is debugged and managed by adbshell commands. An intuitive and efficient graphical management method was used for the design and implementation of the system.

3.3.2. Design of Database Architecture. According to the E-R model diagram, we carry out the design of the database architecture, here the focus is on the design of the database table, which contains the name of the data table, the initial value of the data table fields and the setting of the data table key andso on.

The user table contains attributes such as user name, password, nickname, balance, and modules such as login and favourites, which are designed according to the table structure in Table 1.

Table 1. Design of user table structure

FIELDNAME	FIELDTYPE	FIELDDESCRIPTION
USERNAME	VARCHAR15	Username, primarykey
PASSWORD	VARCHAR15	Userpassword, loginpassword
NICKNAME	VARCHAR15	Usernickname, asshowninthecomments
BALANCE	FLOAT	User's balance

The tutorial table contains attributes such as tutorial ID, name, category ID, lesson duration, price, and status. Table 2 shows the Tutorial table structure design.

Table 2. Tutorial table structure design

FIELDNAME	FIELDTYPE	FIELDDESCRIPTION
ID	INT	Tutorialnumber, primarykey
NAME	VARCHAR15	Tutorialname
SORT_ID	INT	TheclassificationIDthatthetutorialbelongsto, actingasaforeignkey
HOUR	INT	Tutoriallessonhours
PRICE	FLOAT	Thepriceofthistutorial
STATE	INT	Representsthetutorialprice, priceandsoon
SURL	VARCHAR100	Andasmallfigureurlrelatedtothistutorial
BURL	VARCHAR100	Andalargegraphurlrelatedtothistutorial

Classification table mainly includes attributes such as classification ID, classification name, etc. It is mainly used in conjunction with the tutorial table, and Table 3 shows the classification table structure design.

Table 3. Classification table structure design

FIELD NAME	FIELD TYPE	FIELD DESCRIPTION
ID	INT	Classification number, primary key
NAME	VARCHAR50	classification name

The download list contains the course number, course ID, download progress, download address and so on. Table 4 shows the download table structure design

Table 4. Download table structure design

FIELD NAME	FIELD TYPE	FIELD DESCRIPTION
CNUM	INT	Class hour number
CID	INT	Curriculum ID
PROGRESS	INT	Download progress, anintegerbetween0and100
URL	VARCHAR100	downloadlink

During the browsing process, the user can comment on the content viewed, and other users can also comment on the content viewed and provide their own insights based on it. Table 5 shows the structure design of comment table.

Table 5. Structure design of comment table

FIELDNAME	FIELDTYPE	FIELD DESCRIPTION
USERNAME	VARCHAR15	Comment on user name
CONTENT	TEXT	Comment on the content
TITLE	VARCHAR100	Comment on the title
TIME	DATETIME	Time to post comments

The main function of the collection table is to contain the collected course IDs, the user name of the collector, etc. It is based on the favourites module, which saves the information requested online locally and matches the collected content according to the collection table in the repository, e.g., the structure of the collection table is shown in Table 6.

Table 6. Structure design of the favourites table

FIELD NAME	FIELD TYPE	FIELD DESCRIPTION
CID	INT	Course number, foreign keys
USERNAME	VARCHAR15	Collector username

System request, network request and so on, and then on the basis of this, the whole system is broken down into specific functions, which is the most crucial step. In this chapter, the database is also described in detail, the development of the system is closely related to the database, even embedded devices, the data is managed through the sqlite database. This chapter provides a detailed analysis of the requirements of reality and structures the various tables in the database.

4. Embedded Teaching System Functional Implementation and Application

In this chapter, we will complete and verify an embedded interactive teaching platform, first of all, we will build an Android-based system, and then we will program according to the specific design of each function, and we will use a flowchart to represent its main ideas and algorithms in the programming process. In this chapter, we will also do a complete test of the system to ensure that the system is correct.

4.1. Embedded Teaching System Implementation

This embedded teaching system has a total of the following aspects of implementation: first, the system architecture is built. The system is based on the Android embedded platform, and the terminal hardware is used as the carrier to build the embedded art online interactive classroom system. On the terminal hardware, an ultra-high-definition camera is used to collect the screen, which is transmitted to the cloud in real time through the Android embedded platform. On the cloud platform, the received screen data are encoded, stored and distributed to achieve the interactive teaching function of the art online interactive classroom. Second, the system operation process. After logging into the cloud platform, the user first enters the live teaching page to make online registration and teaching reservation; then clicks on the button of booking a live course and selects the live room with the largest number of viewers; after that, enters the interface of the live classroom and selects the teacher and students who need to watch; finally, clicks on the button of starting the class to conduct the class. In addition, audio and video data processing. Capture and

encode the students' class images on the front-end device, send the encoded packets to the cloud platform for audio processing; parse the audio and video packets into the students' voice and image information on the cloud platform; and then send the processed packets to the live classroom interface or directly to the students' terminal devices through the RTSP protocol. Finally, the interface design on the teacher's side. Teachers can access the system interface through the browser for teaching operations before, during and after the class. Meanwhile, the teacher's side also provides functional modules such as message notification, electronic whiteboard, textbook sharing, homework submission, and file sharing.

4.2. Testing of Embedded Systems

After completing the system design, the most important task is to conduct testing on the system through specified methods. The development of Android embedded programs mainly uses the Java programming language. When it comes to the implementation of specific functions, it is necessary to express the implementation methods and key points in the form of flowcharts. The course display module requires the server to display the queried information in the form of a list, and the course categories should be displayed in the same interface as the courses to facilitate user filtering of information. After a detailed description of the system's functional requirements and main technologies, the implementation process of the system is provided. By analyzing the program flowchart and system requirements, the system's functions can be divided into two major modules. Figure 3 shows the testing effectiveness of the teaching platform under different data stream classification indicators.

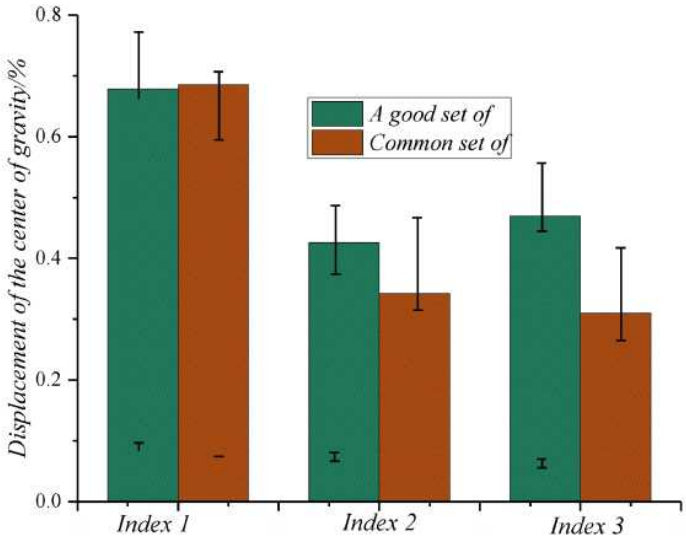

Fig. 3. Testing effectiveness of teaching platform under different data stream classification indicators

As shown in Figure 3, there are significant differences in the testing applications of teaching platforms under different data stream classification indicators. Therefore, the importance of examples used to train classifiers in the data stream will change over time, especially in non-stationary environments where concept drift occurs and the current data distribution will be significantly different from the previous distribution. Use the error rate of the model as the evaluation metric for the model. Figure 4 shows the application of mathematical mining effects under different data flow models.

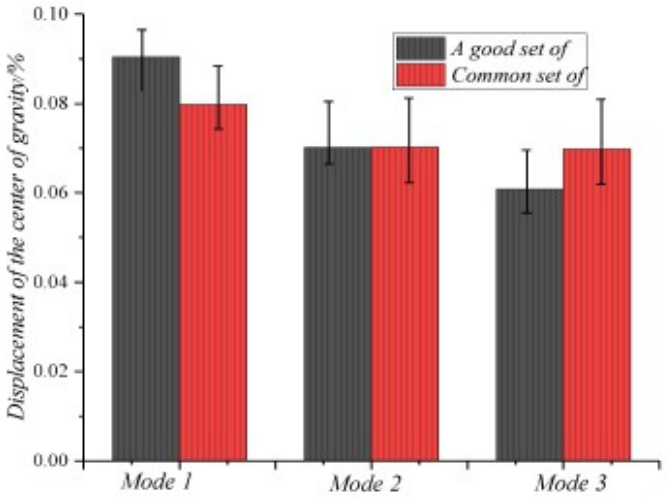

Fig. 4. Application of mathematical mining effects under different data flow models

Figure 4 shows the layout of the application implementation interface for mathematical mining effects under different data flow models. Because it is on the same page, the interface design is more complicated. The entire interface is managed by LinearLayout, witha title bar at the top and two category buttons. The classification button uses a Button, which not only requires text but also two different backgrounds to be set for the Button. The pitching list is used in conjunction with the list view, which can be moved up or down to display the complete pitching list. Each item comes from a related layer that includes an image view and some text views. There is a toolbar at the bottom of this interface, so you only need to use the included. Figure 5 shows the network testing results of teaching platform resources in different network environments.

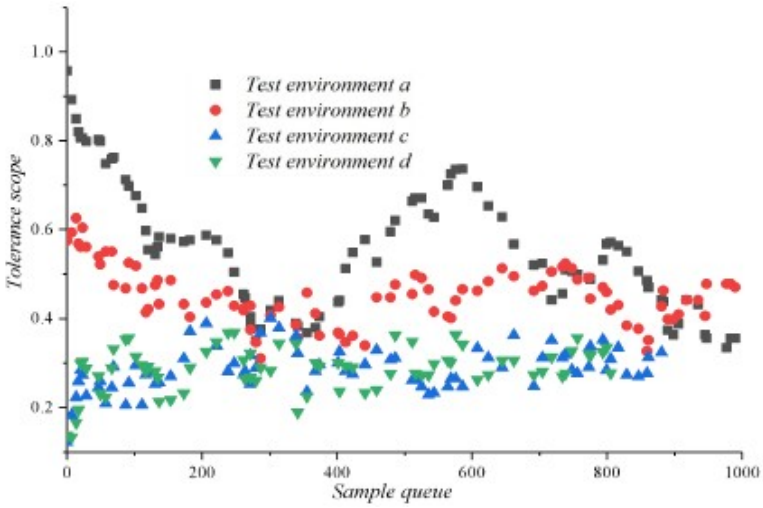

Fig. 5. Network testing of teaching platform resources in different network environments

From Figure 5, it can be seen that the network testing effect of teaching platform resources under different network environments. In the corresponding activity class documentation of the class demonstration, it is necessary to create an asynchronous request task for application and analysis to the network, complete the settings of the ListView Adapter, and fill in the list view data. During the implementation process, activity documents dynamically determine whether to display all courses, search for courses, or like a certain course, and present them according to the corresponding columns. When users use the category button to filter courses, the activity must execute filtering features. Favorites are used to display favorite tutorials and reuse tutorial demonstration modules.

The sharing function allows your friends to share the experiences and lessons you have learned. Although the page of the favorites is duplicated, the items in the menu are different, so to design a new one for each item, you can use LinearLayout as the outermost container, which contains ImageView, TextView, etc. You can also delete the favorites item by clicking the button, which will pop up a dialog box on the favorites item. Shared services require the use of APIs from social networking platforms, for example, Sina Weibo provides APIs for Sina Weibo, but the APIs must undergo security authentication, which means users must be redirected to an authentication page, and then after verifying their identity through this authentication, the message will be published to Weibo. Figure 6 shows the simulation results of the resource throughput of the applied mathematics education system under different testing standards.

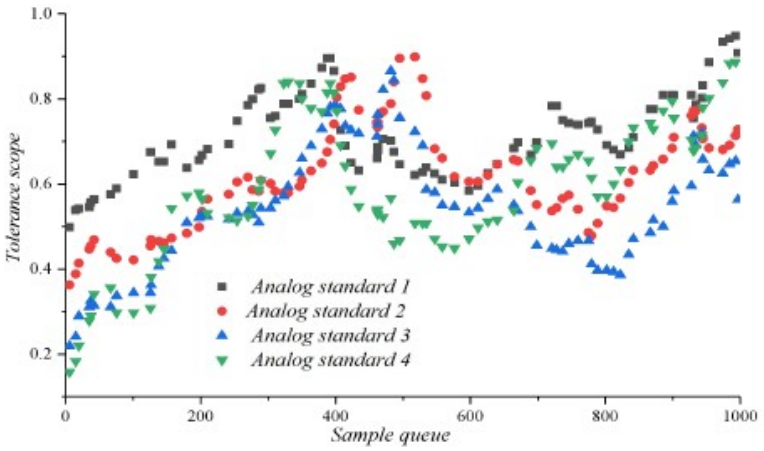

Fig. 6. Simulation of Resource Throughput of Teaching Platform System under Different Testing Standards

From Figure 6, under different testing standards, the error rate of predicting the sample dataset of the applied education system resource network is relatively low. At present, there are mainly two types of art online teaching software products on the market: one is pure software products, such as "painting", "art cloud classroom", etc., which only support one-way video streaming transmission; Secondly, hardware products such as "Soundnet" and "Art Cloud Classroom" only support one-way video streaming transmission; The second is hardware products such as "Soundnet" and "Art Cloud Classroom". The other type is hardware products such as "voice networks" and "screen displays", which only support one-way video streaming. The former cannot meet the real-time interaction and communication needs of students, resulting in poor teaching effectiveness. The latter is due to the high cost of hardware equipment, single functionality, and insufficient interfaces, resulting in low product usage

4.3. Embedded Teaching System Application

The function of the system is to ensure that the software can operate normally by fully testing the performance of the software, which has a better network and operating environment, as shown in Table 7.

Table 7. System functional test analysis table

TEST MODULE	TEST CONTENT	EXPECTED GOAL: ANTICIPATED GOAL	TEST RESULT
YOU RECOMMEND ON	Can request the recommendation module through the network, and correctly display and can slide left and right	Correct request network, the interface display is correct, left and right slide smoothly	Be in line with forecast; meet expectation
COURSE DISPLAY WITH CLASSIFICATION	Can request the network and display all classes and programs; can interact up and down, can sort and filter	Correct request network, the course display is beautiful, slide up and down smoothly, the classification and filtering function is correct	Be in line with forecast; meet expectation
FAVORITE	Correct display of the user's favorite course, can delete the favorite course	Display the collection course correctly, and you can delete the collection course	Be in line with forecast; meet expectation
DOWNLOAD MANAGEMENT	Can continue to download tutorials, can manage the downloaded tutorials	You can download the courses correctly, and you can learn and delete the downloaded courses	Be in line with forecast; meet expectation
SHARE AND SYSTEM SETTINGS	You can take your interest in the tutorial, share it on Weibo, and set up the relevant items of the system	Can be shared through Weibo, the system Settings work correctly	Be in line with forecast; meet expectation
USER LOGIN REGISTRATION	Verify the execution of the login registration process, and verify the relevant reflection of the login error	You can log onto the system, and perform the prompt function	Be in line with forecast; meet expectation

As can be seen from Table 7, the software designed in this thesis can meet the requirements of users and achieve the intended development purpose.

5. Misconceptions and Design Applications of Embedded Art Online Classroom Teaching

5.1. Misconceptions of the Embedded Art Online Classroom Interaction Mode

The art online interactive classroom referred to in this paper mainly refers to an online education mode in which teachers use the Android embedded platform, terminal hardware, video teaching software, terminal hardware, audio and video streaming transmission protocols and other tools to record and analyse the learning process of students in real time, and to assess the learning effect of students by collecting and collating their learning data.

In addition, the art online classroom also needs to have good compatibility and scalability. For example, in the traditional offline classroom, only one network port is needed to connect with the school computer system; while in the online classroom, multiple network ports need to be connected at the same time to meet the needs of different regions and different devices. This puts higher requirements on the Android embedded platform and terminal hardware. Therefore, we believe that although the traditional offline classroom can meet the needs of online interactive teaching for art courses, the lack of flexibility and scalability, as well as the high cost of the traditional offline classroom, have led to a certain limitation of its scope of use. For online interactive teaching, it can make up for the shortcomings of the traditional offline classroom, providing a more flexible and convenient solution for online teaching.

5.2. Embedded Online Art Classroom Interactive Teaching Design Application

In the art classroom, students can directly use the teacher's images through the touch terminal, and the teacher can also operate through the touch terminal, such as writing and painting. However, touch terminals also have some drawbacks, such as writing delay and drawing delay. Therefore, this paper proposes an embedded art online interactive classroom solution based on Android embedded platform and terminal hardware.

Firstly, the network is built for the teacher's end. As the main operator of the system, the teacher's end can be operated directly on the PC or mobile phone, and does not need to connect to the server or cloud platform. The student side can operate directly on the Android embedded platform without connecting to the server or cloud platform. The teaching platform, as one of the main operating software for art teaching, can realise the network construction and operation of the teaching software on the student side through the Android embedded platform and terminal hardware. Teachers can enter the teaching system by logging into the Android embedded platform account or terminal hardware account (e.g., smartphones, tablets, etc.) to carry out live webcasting courses.

Secondly, the teacher evaluates the students' works. Teachers evaluate students' works through classroom questions, homework corrections, group discussions, etc., and announce the evaluation results of each student's works in the classroom. Since the art teaching activities involve a large number of students' works in a variety of forms, the traditional offline classroom is usually evaluated in a many-to-many manner.

In addition, students' feedback on the content of the teacher's lecture. In traditional offline teaching activities, teachers mainly communicate with students through the board, lecture videos and other ways. While in the online teaching process, teachers need to use Android embedded platform, terminal hardware and other tools to record and analyse the students' learning process, and adjust the teaching content and teaching methods according to the feedback results.

Finally, in the traditional offline classroom, teachers and students can only communicate and give feedback through text, voice, pictures and other forms. However, in practical application, traditional offline classroom is often unable to meet the requirements of online teaching activities on the flexibility of the teaching scene due to the limitations of many conditions (such as the limitations of the size of the classroom space, the limitations of the cost of teaching equipment, etc.). For example, in the online art classroom, students' works need to be recorded and uploaded to the cloud (i.e. the teacher needs to display and evaluate all students' works online). In traditional offline classrooms, this requirement is often not realized due to the small classroom space and high cost of teaching equipment.

6. Conclusion

With the help of mobile networks and smartphones, web-based art education platforms provide students with a new way of learning. This way, with its convenience, timeliness, and speed, allows users to fully utilize all their free time to improve learning efficiency. In this increasingly large metropolis, with the intensification of traffic congestion and the acceleration of the pace of life, mobile education platforms will be widely welcomed by users. In order to correctly solve the problem of course matching and selection, we have developed a new system that combines matching trees and embedded technology. Firstly, the matching tree algorithm was applied for similarity diagnosis between art courses and user preferences, achieving good results in both similarity diagnosis and matching. Secondly, an interactive teaching system architecture for online art courses was constructed using embedded technology, which improved the efficiency of the interactive teaching system. Users can learn anytime, anywhere, regardless of the environment. In addition, we will further explore the design schemes of the platform under different applicable conditions.

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