



Design and Development of Android Application for Clarinet Flash Video Teaching in Mobile Internet Environment

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Abstract. In order to establish a diversified unique clarinet teaching system, form a better clarinet talent training system, and cultivate clarinet inheritors for China, this paper makes use of the advantages of mobile platform, using Java language for Android system, J2ee framework and Flash video software technology to develop clarinet teaching system. Clarinet teaching system provides a centralized learning platform for students and teachers by developing four functional modules: online classroom, extracurricular learning, message push and training homework. Through this platform, teachers can publish some teaching resources and supervise students' learning. Students can participate in the whole clarinet learning, browse the extracurricular learning resources, complete the prescribed learning tasks and do homework exercises, thus realizing a comprehensive clarinet learning platform.

Keywords: mobile platform · clarinet teaching · Android · teaching platform

1 Introduction

With the continuous development of globalization, more and more foreign musical instruments are pouring into China, and clarinet is one of them. Nowadays, clarinet has spread in China for a hundred years. Clarinet teaching is a music discipline that integrates the playing technique of clarinet, the playing mechanism of timbre, artistic expression and musical accomplishment. At present, the clarinet education in our country has made great progress, and the comprehensive quality requirements for clarinet performers are gradually improved. However, under the traditional teaching mode, clarinet classroom teaching emphasizes theory and knowledge teaching, with teachers giving priority to teaching, and students' participation in class performance is limited. If students do not fully grasp the knowledge points in class, they can only "learn" passively after class, and they need to spend a lot of time reviewing the music theory content by themselves, which will affect students' acceptance and application of knowledge, thus causing students to be afraid of difficulties and bored with learning, which is not conducive to the improvement of students' clarinet playing ability. Moreover, since 2019, COVID-19, which is raging all over the world, has posed a strong challenge to music education all over the world. The eyes of education departments of various governments have suddenly focused on online education, which was not the mainstream teaching mode before,

so the classroom teaching mode was quickly replaced by online teaching. Therefore, we have a new orientation and thinking on the online training mode of clarinet music talents. In the case that students and teachers can not meet frequently because of the epidemic situation, and many performance practice teaching activities can't be carried out normally, online teaching and practice become an effective means of clarinet teaching [5]. So the author of this paper began to pay attention to the research of clarinet teaching with the help of mobile platform. Mobile platform devices, such as smart phones and tablets, are used as learning tools, and information technology and Internet technology are applied to realize the dissemination of learning content and rapid learning. Moreover, the number of mobile internet users in China is growing rapidly. As of December 2021, the number of mobile internet users in China has reached 1.029 billion, an increase of 42.98 million compared with December 2020, and the proportion of internet users using mobile phones is 99.7%. The proportion of Internet users surfing the Internet by mobile phones has further increased [9]. Among them, Android system of smart phone terminal quickly gained the favor of college students because of its excellent system performance and good user experience, occupying the largest proportion in the market. The market share of Android OS in China's mobile operating system market reached 68.6%. This provides necessary hardware support for mobile learning. Compared with the traditional PC teaching website, the network teaching platform based on mobile terminal mainly adopts mobile information technology to build an information clarinet teaching platform. Mobile devices, such as smart phones, make learners no longer limited by the place of study, and they can study at any time and any place. Because the epidemic can not be studied in the campus classroom, mobile devices make families a second classroom for students to learn clarinet [2].

Based on the analysis of the above situation, the author thinks that a clarinet teaching system based on mobile platform should be established. The system is developed based on Android platform and J2EE framework using Java language, in which the video playing function is developed by using Flash video player software with good performance and wide application. This system can integrate the music resources involved in clarinet teaching, realize the online communication between students and teachers, and improve the efficiency of students' online learning of clarinet. Clarinet teaching platform system can overcome the limitations of offline teaching methods on teaching place, time and personnel. Students can learn the information-based learning resources related to clarinet at any time and any place, which is convenient for students to use little time to learn, thus improving the learning effect. This system helps the campus to establish a unique clarinet teaching system and cultivate clarinet inheritors. I believe that through the joint efforts of many parties, the clarinet will be carried forward and the Chinese voice with artistic appeal and vitality will be truly played.

2 Key Technologies

2.1 Mobile Platform Technology: Android System

Android is a free and open source operating system based on Linux kernel (excluding GNU components). Android operating system has become the largest smartphone operating system in the world. The biggest advantage of open source is that Android platform

will have a growing team of developers, and with the increasing abundance of users and applications, it will inevitably make Android, a brand-new platform, mature and stable. Android is mainly used in mobile devices, such as smart phones and tablets, led and developed by Google Inc. And Open Handset Alliance. The first Android smartphone was released in October 2008. Android has gradually expanded to tablet computers and other fields, such as TV, digital cameras, game consoles, smart watches and so on.

As can be seen from Fig. 1, Android system architecture is a four-tier structure. From the top to the bottom, there are application layer, application framework layer, system runtime layer and Linux kernel layer. Applications in the application layer include client, SMS short message program, calendar, map, browser, contact manager, etc. All of the applications are written in the JAVA language. Moreover, these applications can be replaced by other applications developed by developers, which is different from the system software of other mobile phone operating systems, which is more flexible and personalized. The application framework layer is the foundation of our Android development, and many core applications also realize their core functions through this layer. This layer simplifies the reuse of components, and developers can directly use the components provided by it for rapid application development, or realize personalized expansion through inheritance. Similarly, the application reuse mechanism also makes it easy for users to replace program components. As can be seen from the figure, the system runtime layer can be divided into two parts, namely the system library and the Android runtime library. The system library is the support of the application framework and an important link between the application framework layer and the Linux kernel layer. Android runtime library, the program is executed in Android runtime, which is divided into two parts: core library and Dalvik virtual machine. The core library provides Java language API, and also includes Android core API. Every Android program has an instance of Dalvik virtual machine, and it is executed in this instance. Android core system services such as security, memory management, process management, network protocol and driver model all depend on Linux kernel [8].

The process of commonly used Internet development app is roughly as follows: product planning first, and demand research. The product designer draws the app wireframe and provides it to the UI designer. The UI designer designs the visual draft according to the wireframe, and the programmer builds the UI framework according to the visual draft at the front end. Then the programmer develops the functions of the back-end server according to the requirements document. Finally, the tester writes the test case, tests it according to the schedule, and the programmer fixes the bugs that return to the test feedback, and submits it to the beta version for testing and passing, and then submits it to the operation and publishes it to the channel online.

2.2 C/S Architecture

C/S analysis: C is the first letter of English word “Client”, which means client, and S is the first letter of English word “Server”, which means server. C/S (Client Server) is a two-tier architecture. The two tiers are: the first tier, the client-presentation tier (interface tier and logic tier). The second layer, server mode-database layer. The C/S architecture process is that the client sends a Request to the server (i.e. the database), and then the database finally Response back to the client according to the client’s request, because the

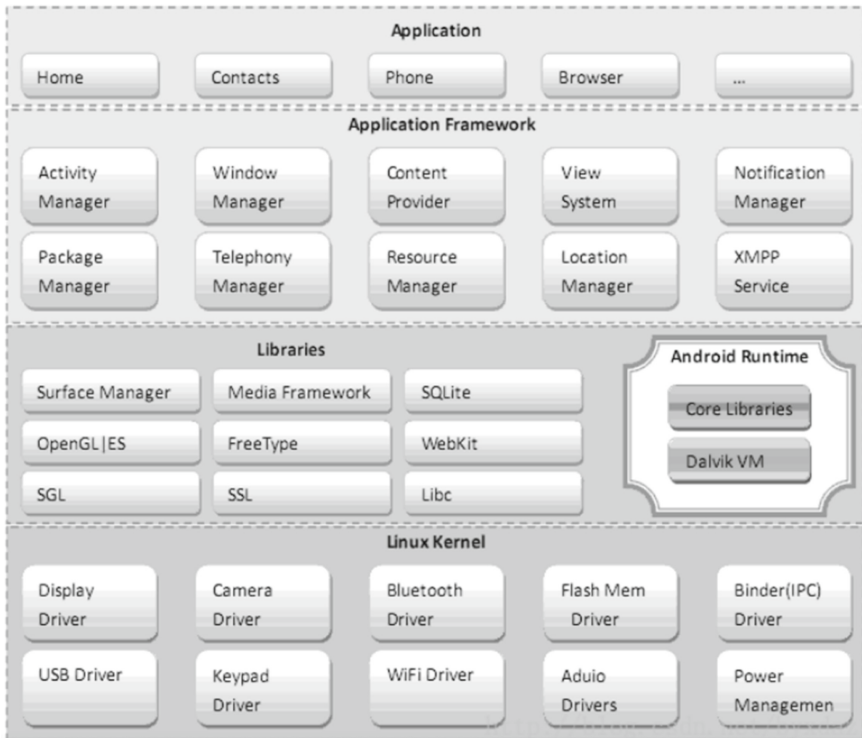


Fig. 1. Android framework diagram

client needs to realize most of the business logic and interface display. In this architecture, the client part needs to bear a lot of pressure, because the display logic and transaction processing are included in it, and the data can be persisted through the interaction with the database (usually the implementation of SQL or stored procedures), so as to meet the needs of actual projects. The advantage of C/S architecture is that the interface and operation can be very rich. Security performance can be easily guaranteed, and it is not difficult to achieve multi-layer authentication. Because there is only one layer of interaction, the response speed is fast. However, the disadvantage is that the application area is narrow, and it is usually used in LAN. Because the program needs to be installed before it can be used, it is not suitable for some unknown users. The maintenance cost is high, and once an upgrade occurs, all client programs need to be changed [1] (Fig. 2).

2.3 J2EE

This system adopts the JavaEE framework, which has become the current enterprise application system design and development framework with good compatibility and expansibility. Because its development language Java is cross-platform, the application system developed by Java EE can be deployed in Windows, Unix, Linux and other operating systems, which greatly reduces the cost of system migration and maintenance under

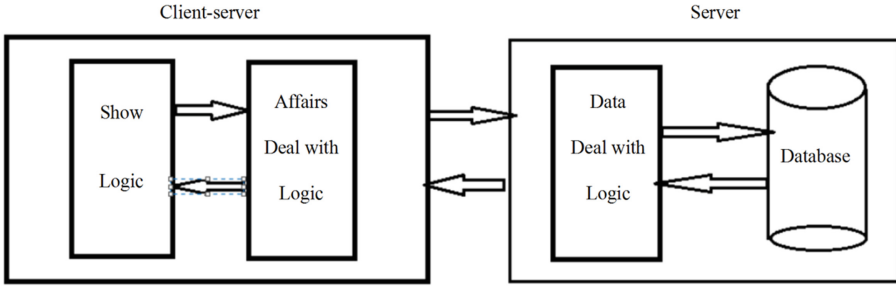


Fig. 2. C/S architecture demonstration diagram

different platforms and protects the investment of existing information resources. At present, common operating systems include Windows and Linux series. In the deployment of enterprise-level application systems, especially in large enterprises, multiple operating systems are often used to meet complex business requirements, and the application frameworks developed by different manufacturers are also different. Realizing data sharing within enterprises has become an important direction of unit informatization. Therefore, transplanting and deploying application systems under different platforms provides a foundation for unit data sharing. In the JavaEE framework, SSH, MVC, EJB and other frameworks can be used. Developers can choose corresponding development frameworks and tools according to their basic business function requirements and system business scale. These tools have rich code bases, so developers can design and develop powerful application systems without caring about internal implementation details. Powerful development tools save developers' time and improve development efficiency. Java improves system performance through load balance adjustment. Generally, enterprise-level application systems are aimed at many users, and a large number of concurrent accesses will occur among operating users in a certain period of time. Therefore, the performance of the system determines the stable operation of the system. Java EE internally provides a load balance adjustment, which can ensure the performance and stability of the application system [10].

2.4 Development Environment

According to the requirements of development and the use of key technologies, the author completes the configuration and deployment of the development environment. The application design and development environment is divided into Android front-end development environment and back-end server development environment.

The front-end development environment based on Android is developed on Windows 10. The development package is JDK1.8, the mobile client is Android 9.0, and the client is integrated under IntelliJ IDEA, with Android studio version of 3.4.

The back-end development and integration environment of this system is Eclipse4.5, the development language is Java, and the J2EE framework is adopted. The system database is MySQL8.0.28, and the server is Apache Tomcat9.0. The video playing function of the system is realized by using Eclipse and flash builder for java and flex communication applications.

Open Android Studio and select “File” -> “New” -> “Import project...” in the main page. In the “select Eclipse or grad le project to import” dialog box, select the path of eclipse project, and then click the “OK” button. In the “Import Project from ADT (Eclipse Android)” that pops up, select the “Import Destination Directory” path. We can use to import Android studio projects into Eclipse. Based on the above technical introduction and environment deployment, the feasibility of building the development environment of this system is ensured [7].

3 Requirements Analysis

3.1 Functional Requirements

The clarinet teaching platform system based on mobile platform analyzes the needs of teachers and students. This system is a mobile teaching platform, which can enable users to use mobile terminal equipment for convenient learning. The study and teaching activities are no longer limited by region and time, and the fragmented time of students and teachers can be better utilized. At the same time, the platform integrates some excellent clarinet teaching resources videos on the Internet to form a teaching resource library, which can realize personalized course teaching. According to their own situation, students can repeatedly learn the knowledge points that they don't understand in the online classroom by dragging the progress bar, and choose a clarinet teacher course that suits their weaknesses to supplement their knowledge after class. Teachers can learn about students' weaknesses in the process of clarinet learning through homework, students' online lesson learning records and students' questions, so as to help teachers solve teaching problems and improve the overall clarinet teaching quality.

3.2 Global Design

For the mobile platform clarinet teaching system based on Android, the application development structure based on C/S is selected based on demand analysis. When designing, consider adopting the layered MVC model. The advantage of this method is that it can separate the overall division of the system, the processing of data and the performance of content, and improve the performance of the system. It is of great significance for the later development and maintenance. Communication between Android and server is realized by using CSS architecture through HttpClient.

The most important development structure of C/S is the request response interaction between the client and the server, that is, the interaction between the client interface and the server interface, and the information is parsed on the mobile phone by the feedback of the parsing server in the mobile phone client. On the front-end design interface of Android system, Android stdio is used to realize the UI design of each component of the interface. In the back-end design of the mobile teaching platform, the WEB server is introduced to realize the rapid data response processing in the mobile network mode, and the data can be quickly sent to the client through data packets. Classes are divided into client interface class and server interface class. The client interface class includes request processing class and result analysis class. Server interface class includes request

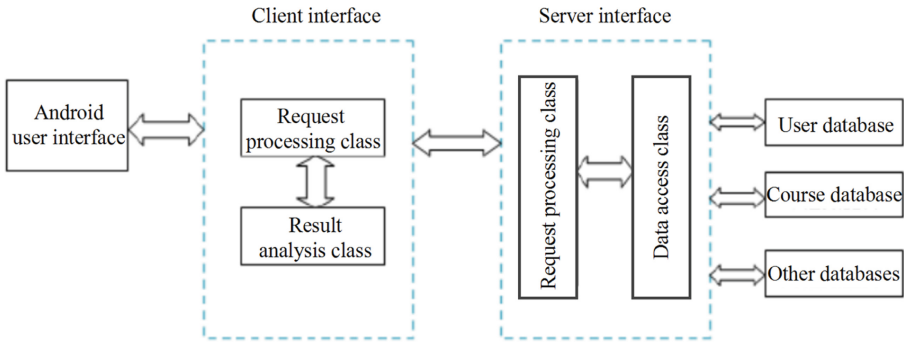


Fig. 3. Architecture diagram of the clarinet teaching platform

processing class and data access class. The server interfaces with user database, course data database and other databases. After the system is built, the software is tested through overall test and unit test, and then released to Android App Store [6] (Fig. 3).

4 Function Implementation

Flash-based clarinet video teaching system develops two user ports: teacher user and student user. Users enter their respective account numbers and passwords to log in to the system. In addition, all clients of the whole system only need to log in once, and the terminal equipment encrypts and stores the logged-in user identity information, provides an interface for querying the logged-in user identity information, and provides login and user registration interfaces.

User login integration steps are as follows:

- (1) Starting the system is that the login status judgment has been integrated into the customized browser, and the system does not need to consider it.
- (2) Javascript function is injected into the customized browser, and the system can call the function to obtain the logged-in user information. Javascript function: LoginApi.getLoginUser(:

The returned JSON object attributes include: `userId`, `userName`, `email`

For independent APK application, the integration steps of user login are as follows:

Query logged-in user information through Content Provider

Query URI: `com.zbkc.mci.provider.MCIUser`

Returns the Cursor column name: `_userId`, `_userName`, `_email`

4.1 Student Client

4.1.1 Online Classroom

Under the online classroom function module, students can learn the clarinet by playing the teaching video recorded by the instructor every week. By clicking on the list of

```

mSourceSearchDataSource = new ArrayList<Mobile<String, Object>>();//Video object
mSourceSearchData();
mSourceSearchDataSet = new SourceSearchDataSet(this,
mSourceSearchDataSource.getResources());
MobileSourceSecletNumber = (CaptionSearch)
findSearchById(R.id.Mobile_Source_seclet_num);
MobileSourceDelete = (Button) findSearchById(R.id.Mobile_Source_delete);
mGridSearch = (GridSearch) findSearchById(R.id.Mobile_Source_grid);
mGridSearch.setDataSet(mSourceSearchDataSet);
mGridSearch.setOnListClickListener(new DataSetSearch.OnListClickListener() {
public void onListClick(DataSetSearch<?> arg0, Search arg1, int arg2,
long arg3) {
String filePath =
mSourceSearchDataSource.get(arg2).get("mFilePath").toString().trim();
MobileSourceListImg = (FileSearch)
arg1.findSearchById(R.id.Mobile_Source_List_img);
MobileSourceListImgSelect = (FileSearch)
arg1.findSearchById(R.id.Mobile_Source_List_img_select);
}
}
}

```

Fig. 4. Play code of online classroom on mobile phone

online courses, students can see the constantly updated online teaching courses, which include theoretical clarinet fingering, mouth shape, breathing and pronunciation. There is also a demonstration video of the instructor's performance of the practice music in each teaching stage. In addition, the video player has been modified in this system. When the student user interrupts the playback, the next time it is turned on, the playback can continue until the last interruption, which optimizes the product experience of the student user. The video playing part of the online classroom on the mobile client is shown in Fig. 4.

4.1.2 Extracurricular Learning

Click to enter the extracurricular learning module, and students can see two categories of clarinet playing video resources. This part of resources includes video appreciation of famous music performances, such as the performance video of "Clarinet Concerto in A Major" performed by performer Wang Tao, and the concert performance video performed by Wuxi Fantasy Clarinet Ensemble. In addition, if students want to find extracurricular teaching resources according to their own weaknesses, this module also provides a collection of clarinet teaching and training by Li Kesi, a famous clarinet player, and teaching courses recorded by Tao Chunxiao, president of the Clarinet Society of China Music Association [4].

4.1.3 Message Push

This system provides the message push pop-up function. The messages received by the students include comments and interactive messages, private message notices between

teachers and students, homework notices issued by teachers and course notices. The system displays messages to students in a dynamic text way, and students can query and browse these messages through mobile App. Through the online communication module set in this system, students can ask teachers all kinds of problems they encounter in the classroom and clarinet performance training. After the teacher replies, the system background will pop up a message on the desktop to remind them, thus realizing online instant communication between teachers and students. In addition, there are comment areas under each video in the online classroom and extracurricular learning function modules, where students can share their learning experiences with other student users. After others reply, the system will push the interactive notification of reply [3].

4.1.4 Training Homework

After receiving the assignment notice issued by the teacher, the students need to complete the music practice required by the teacher within the specified time limit, and finish the assignment by recording the clarinet playing video of the specified track and submitting it to the system. After the assignment is completed, the teacher will give the assignment a grade and evaluation. Click to enter the training homework module, and the student users can also see the submitted homework records and the teacher's evaluation records, and review and adjust themselves in time.

4.2 Teacher Client

The main functions of the teacher client are similar to those of the student client, but the settings of sub-modules are different. Under the online classroom module and extracurricular learning module, teachers need to add, delete, and change this part of teaching resources on the student client. The way of submitting and uploading can be file uploading and external website video link. In particular, the video of online classroom requires teachers to determine the teaching content according to different stages, and record and submit the teaching content with cameras and microphones. Under the message push function, the content of the message received by the teacher client is the private message notification of teacher-student exchange. Moreover, teachers can complete the dynamic release of homework and class notices through this platform, and push them to the mobile phone for each student in a push way. Teachers can publish notices, but they can't modify or delete them after publication. In the training homework module, teachers can check the students' homework submissions and read the evaluation scores one by one.

5 Conclusion

Informatization is an inevitable trend of teaching reform and innovation. Teaching under the mobile platform has broken the originally closed teaching environment, and introduced mobile teaching tools into the classroom, providing students with richer and more diversified learning methods and choices. As the main medium of teaching, mobile tools have become a bridge between collective explanation in class and independent learning after class, evaluation and display in class and independent inquiry after class. The

classroom time is liberated, and teachers' assistance and influence can go beyond the limitations of the classroom and run through every teaching link, effectively stimulating students' enthusiasm for learning clarinet, promoting teachers' information-based teaching level to continuously improve, thus comprehensively improving clarinet teaching effect.

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