

# Construction of Internet-based Nationalized Teaching Platform for Piano Music —— Taking the Piano Accompaniment of Morin Khuur as an Example

Yang Cao

Hulunbuir University, Hulunbuir, Inner Mongolia, China caoyang1637@dlvtc.edu.cn

## ABSTRACT

Under the current Internet environment, a platform of piano music nationalization teaching is built with Web technology as the core and high-performance CDN streaming media technology, which effectively solves the problems of small audience, difficult teaching and lack of teaching resources. With the application advantages of network information technology and streaming media technology, the system has realized the reform of piano music teaching mode with the functions of live teaching, online teaching, resource sharing and personal space, which has become a good supplement to classroom teaching. The form of live teaching can shorten the distance between teachers and students, improve the efficiency of communication by barrage or online message, facilitate students to get professional advice from teachers, stimulate students' interest in learning, improve students' piano performance and creation level, and further promote the integration of piano music art and national music art represented by Morin khuur, and then carry out scientific creation, highlighting the nationalization style of piano music.

**Keywords:** Web technology; CDN streaming media technology; piano music nationalization; teaching system

# **1.INTRODUCTION**

At present, in music colleges and comprehensive universities, piano performance major belongs to the first category of instrumental music education, which mainly trains students to master piano solo, ensemble and accompaniment, and includes special guidance such as repertoire, keyboard and pedal skills, concert and personal style shaping and development. The teaching model and ideas has always followed the western piano education model, and has been fully standardized and systematic. This complete teaching system and teaching mode embodies its scientificity and practicality, and also presents the bottleneck of the development of piano education. [1] In China, there are obvious differences between local music and western music in history, culture and national character. The education and development of piano music is bound to be integrated into Chinese national music culture, showing a certain national music style. Nationalization of piano refers to the incorporation of national music expressions in piano performance, and the creation of piano music works

with national elements. For example, in terms of harmony, the adaptation of the suona song "Mountain Spring" is completed by using the pentatonic chord structure. In the aspect of texture, the piano accompaniment of "Fengyang Flower Drum" is completed by changing the rhythm to express the artistic conception of the main melody. In terms of playing techniques, the piano can complete the accompaniment of the national song "Making Golden Embroidery Pieces" by imitating the national musical instrument Chinese Zither. The nationalization of piano education plays a vital role in the development of the whole piano art field. Only with the vigorous development of piano education can Chinese piano culture spread to the world faster and better, and the world can hear more and more beautiful sounds of Chinese piano. [2]

In the process of nationalization of piano music in China, the rich national music styles of minority areas in China can naturally become the material of piano music creation. With folk songs, musical instruments, songs and dances as the main body, the piano processing has been carried out, and many nationalized explorations have been made in the aspects of melody lines, polyphonic thinking and piano texture, with remarkable results. [3] Among them, the typical representative is the creation and arrangement of the piano accompaniment Morin khuur in Mongolian music. In Morin khuur's performance, the vigorous and soft timbre and unique rhythm and melody lines can show the emotional tone of the music. The piano accompaniment can complement and integrate the timbre of Ma Tougin, and render music works with its unique melody and sound effects, thus enhancing the musical appeal. This way provides a good reference for the nationalization development of piano music in Mongolian region, and it has also become the only way for the nationalization and systematization of piano education. However, it is not difficult for us to find out the existing problems of nationalization teaching of piano education, such as the lack of teaching consciousness, the overall teaching method is single. The audience of students is small, and there are very few students who can create, arrange and play Chinese piano works. Lack of teaching resources, traditional teaching materials are not enough to promote the implementation and development of piano nationalization education, and other resources are relatively closed. The teaching of piano accompaniment with Morin khuur is difficult, it needs a lot of time to practice skills, and teachers' teaching tasks are heavy. In view of this, this paper holds that with the help of the current advanced network information technology, based on the development of Web technology, the piano music nationalization teaching platform is constructed by using CDN highperformance streaming media technology, so that teachers can solve the problems of time, space and audience in the current classroom teaching mode by means of live teaching. At the same time, the system supports online learning function and resource sharing function, so as to alleviate the current dilemma of lack of teaching resources. The piano music nationalization

teaching platform can further improve students' piano level, encourage students to devote themselves to the development of Chinese piano industry, and promote the development of piano music nationalization with Chinese piano nationalization education.

# 2.RELATED TECHNICAL INTRODUCTION

## 2.1. Web Technology

Web is a service that can provide efficient and convenient information retrieval for users accessing the Internet, and its overall design and development depends on Web technology. The Web application development technology includes two parts: Web front-end development and Web back-end development, as shown in Figure 1. Among them, the core of Web front-end development technology is markup text language HTML, style rendering mode CSS and script programming control language JavaScript. Web front-end development technology can realize the man-machine interaction between users and systems, and can also show the data information on the server side to users. The core of Web back-end development technology is to use a variety of object-oriented programming languages to complete the development of server-side functions, such as Java, PHP, Python, C, C++. The specific development contents include business logic, data storage and processing, message queue processing, and the design and definition of multiple data interfaces, such as Web front-end interface, third-party interface and server internal interface. [4] Web back-end development technology focuses on the interaction between users and databases under the control of Web server to handle the corresponding business logic design, data access, platform stability and performance, etc.



Figure 1: Web development technical architecture diagram

## 2.2. Streaming Technology

Streaming media technology is a multimedia network transmission technology, which refers to the

transmission of files by specific data streams. The current streaming media content includes sound, video, text, image, animation and so on. The core of streaming media technology lies in using specific algorithms to compress multimedia files into tiny compressed data packets, which are transmitted continuously and in real time by the streaming media server through specific network protocols. After receiving these compressed data packets, the client is decompressed by specific decoding software and plays them. [5] In this paper, the live teaching function of piano music nationalization teaching platform mainly uses video streaming and audio streaming. The transmission process is shown in Figure 2. First, the audio and video content is collected. After encoding and compression, the streaming media files are uploaded to the streaming media server through the streaming media transmission protocol. This process is also called push flow. Then the client also acquires the resources of the streaming media server through the streaming media transmission protocol, and finishes decoding and playing, which is called pull flow.



Figure 2: Streaming media technology operation framework diagram

# 2.2.1. Encoding Scheme

Encing tools can split and compress the collected audio and video data by certain algorithms, and package them into compressed data packets with corresponding formats to prepare for the subsequent data transmission. [6] Table 1 shows the video encoding scheme table, in which H.264 is the current popular video coding scheme. Under the same image quality, the encoding efficiency of H.264 far exceeds that of MPEG2 and MPEG4. Table 2 shows the audio encoding scheme. AAC is a high compression ratio audio compression algorithm in the table. The compression ratio of AAC is 18:1, and the overall performance is better under the same performance specifications. ACC encoding scheme is also used in this system.

 Table 1: Video encoding scheme

Encoding scheme	Producer	Release time
H.265	MPEGITU-T	2013
H.264	MPEG/ITU-T	2003
MPEG4	MPEG	2001
MPEG2	MPEG4	1994
VP9	Google	2019

Table 2: I	Audio	encoding	scheme
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Encoding scheme	Producer	Release time
ACC	MPEG	1997
AC-3	Dolby Inc	1992
MP3	MPEG	1993
WMA	Microsoft Inc	1999

# 2.2.2. Transport Protocol

At present, the commonly used transmission protocols are RTMP (Real Time Messaging Protocol) and HLS (HTTP Live Streaming). RTMP can encapsulate media data into messages, then split them into multiple message blocks and complete the transmission. RTMP needs Flash plug-in to play media files in the process of streaming, but in practical application, HLS protocol is often used to replace RTMP to complete streaming. HLS has been widely used because of its strong cross-platform adaptability and support for HTML5 video player.

# 2.3. CDN

CDN(Content Delivery Network) refers to the technology that is specially responsible for content network distribution, which can be simply regarded as a caching technology. Streaming media technology has three main characteristics: large capacity, high time sensitivity and high interactive requirements. In the face of numerous clients' access requirements, it is difficult to fully meet the clients' needs by relying solely on network transmission, and there are often problems of network delay or slow response. However, under CDN technology, the streaming media server caches the content to a nearby network node, and when the client obtains relevant resources, it can directly obtain them from the nearby node, thus avoiding the network delay caused by a large number of users accessing the server at the same time and improving the response speed of the system to user access. [7]

#### 2.4. Development Environment

According to the design requirements of piano music nationalization teaching platform and the design and formulation of related transmission protocols, there are two technical lines in the overall development and design, one is to realize the live teaching function, the other is to realize the online learning and auxiliary teaching function.

Under the live teaching function, the overall architecture is divided into three parts: encoder, streaming media server and client player. The encoding work adopts FFmpeg, which converts audio collected by microphone and video digital signals collected by camera into streams according to AAC audio compression encoding algorithm and H.264 video compression encoding algorithm respectively, and packages them in MPEG2-TS and FLV formats respectively. After that, the system will send the encapsulated audio and video files to the streaming media server according to the RTMP protocol to complete the streaming operation. [8] The streaming media server is built by Nginx and Nginx-Rtmp-Module modules, which can completely match and adapt to CDN technology, and improve the comprehensive performance and application range of the streaming media server. The operating system is Linux CentOS 7.0. Finally, the client player uses JWplayer framework to build a Flash player. The working process of the player is shown in Figure 3. In the figure, HLS protocol realizes the streaming operation of the player to the streaming media server, and after the video and audio are unpacked and decoded respectively, the audio and video content can be played synchronously. In which, the binding event of the player () object is defined to realize the playing and stopping of the player, so as to facilitate the control of the client user's autonomy. The specific code is shown in Figure 4.



Figure 3: Player workflow chart

//Pause playback
('.player-play').click(function() {
 if (thePlayer .getstate() != 'PLAYING') {
 thePlayer。 play(true);
 this.value = 'Pause';
 } else {
 thePlayer.play(false);
 this.value = 'Play';
 }
});

Figure 4: Player play and pause control key code

In addition, we use the design idea of PHP+Tomcat+MySQL+ThinkPHP to realize the online learning and auxiliary teaching function. The overall design scheme of the Web server will adopt MVC mode to ensure the regulation of the user's demand by the Web server and the integration of the database. According to the use requirements of the system, online learning and auxiliary teaching need a lot of digital resources to support it. The system uses MySQL as some static files and needs corresponding storage media, and undertakes the overall running capacity and expansion of the system. [9] Through the introduction of the above key technology theories, we have determined the overall environment of system development, the configuration of related software and tools, and also made clear the technical feasibility of the overall project of piano music nationalization teaching platform

#### **3.REQUIREMENTS ANALYSIS**

#### 3.1. System Requirements Analysis

According to different user roles, the overall function of piano music nationalization teaching platform needs to be divided into two subsystems: teacher side and student side. Among them, student side can realize the functions of live course learning, online learning, resource sharing, personal space and so on. Teacher side can realize resource management, online live classroom, communication and interaction, and online viewing.

The system supports different users to register accounts according to their own roles, so as to divide the permissions of different users and roles. For teachers, as the implementer of the whole piano music nationalization education, they shoulder the tasks of designation, implementation, control and adjustment of the whole teaching plan. The authority they have in the system is mainly divided into two parts, the first is online live teaching. In this way, teachers can give classes to students at any time without being limited by time and space, and strengthen classroom interaction and communication between teachers and students. All kinds of questions and doubts of students in piano accompaniment Morin khuur can be answered in time. In addition, it is more convenient for teachers to complete the teaching of course content by playing in person, so as to achieve a more intuitive and accurate teaching effect. Secondly, teachers can also be responsible for making, uploading and maintaining online teaching content resources, answering students' special questions, commenting on students' works, etc., so as to realize the function of online auxiliary teaching, so as to reduce teachers' daily workload and improve teachers' work efficiency.

On the student side, students can learn independently through online learning resources, or they can learn online about the playing skills of piano accompaniment Morin khuur by watching the teacher's live course, and they can interact with the teacher during the watching process, which is convenient for the teacher to coach and help students. With the sharing of resources, the system supports students to collect, download and forward teaching resources, which is convenient for students to study anytime, anywhere. Personal space can facilitate schools to upload their own personal performances or creative works in time, and facilitate teachers to give professional comments and guidance.

## 3.2. Global Design

The piano nationalization teaching platform adopts B/S architecture, with Linux as the operating system. The overall architecture is shown in Figure 5. The system uses Nginx as the proxy server to distribute the client's requests, and Tomcat server as the Web server provides Web application services to support the realization of online teaching functions and other auxiliary teaching functions. Nginx and Nginx-Rtmp-Module modules, as streaming media servers, provide audio and video file transmission and synchronization services. After the user logs in to the system through the client browser, the client will use different protocols to interact with the server according to the different requests. HTTP protocol corresponds to Web application service and RTMP protocol corresponds to streaming media online live broadcast service. In addition, Redis is the message channel of Tomcat and Nginx-Rtmp, which provides message queue as the communication mode between them to ensure the timeliness and stability of request processing. [10]



Figure 5: The overall architecture diagram of piano nationalization teaching platform

#### **4.FUNCTIONAL IMPLEMENTATION**

#### 4.1. Student Side

Under the platform of piano music nationalization teaching, student users can complete user registration through account application, and they can log in and use the system by using the browser under any terminal device connected to the Internet.

#### 4.1.1. Live Course Learning

Under this function module, student users can see the notice of live courses issued by teachers in the interface, and learn selectively according to their own time schedule and study plan, such as piano accompaniment Morin khuur allocation course, piano accompaniment Morin khuur practical training course and piano accompaniment Morin khuur harmony allocation course. In the live course, students can intuitively see and hear the teacher's piano playing process, and they can also be truly influenced by the actual effect of piano accompaniment by Morin khuur. Teachers put knowledge into actual performance, so that students can no longer understand the skills of piano performance and the arrangement, harmony and musical form necessary for accompanying Morin khuur by imagination as in classroom teaching. In addition, during the live course learning, students can ask teachers interactive questions at any time, and communicate in the live room in the form of text barrage. At the same time, students who watch can actively participate in the discussion, and teachers can grasp the real situation of students' learning according to the discussion.

#### 4.1.2. Online Learning

Under this function module, the system supports students' video review function of live courses, and the live courses will be backed up to the system database in the form of video content, which is convenient for students to watch later and repeatedly. At the same time, the online learning line also supports the viewing and downloading of learning materials such as courseware, graphic materials and exercises after class in classroom teaching, so that students can make use of their fragmented time and fully rely on the convenience of network resources to continuously learn and consolidate.

#### 4.1.3. Resource Sharing

Under the resource sharing module, the system also provides more extended knowledge outside the classroom, such as theoretical works on piano accompaniment arrangement, "Piano Performance and Accompanying Skills" by Zhang Jialin, "Piano Accompanying Art Aspects: How to Play Piano Accompanying Well" by Li Feilan, "Nationalization Exploration of Chinese Piano Music and Classics Reading" by Gu Xiaohui. As well as videos and audio materials played by famous artists, such as "Ten Thousand Horses Galloping" by Qi Baoligao, "Sulud in the Wind" by He Xige, etc. With the richness of network resources and diversity of presentation forms, students' horizons are broadened, students' interest in learning is stimulated. students are encouraged to think independently and explore actively, and students' exploring spirit is cultivated.

#### 4.1.4. Personal Space

Under this function module, the system supports learning to upload the works of Morin khuur, a piano accompaniment by individuals, in terms of score or actual performance, so as to save the students' works. At the same time, students can also forward their own works to teachers through their personal space, so as to obtain teachers' professional comments and guidance, and help students to improve their piano playing skills rapidly.

#### 4.2. Teacher Side

On the teacher side, its functional authority is completely different from the student side. Apart from online live teaching, it is more about sorting, making, uploading, updating and maintaining the teaching content resources. At the same time, teachers can also view, comment and guide the works, practice videos and audio materials uploaded by students. In the process of live teaching, teachers can collect audio and video content through personal computers, or microphones and cameras of mobile terminals. The content arrangement and setting of the whole live course also pays attention to the refinement of knowledge structure and the mastery of basic skills. Teachers can complete the education of students through live webcasting in a project-based or situational way, greatly changing the current teaching situation, reducing teachers' workload and improving work efficiency.

## **5.CONCLUSION**

College piano music nationalization teaching platform is based on Web technology and integrates CDN's high-performance streaming media technology, which realizes the online learning function of piano accompaniment Morin khuur allocation and helps college students master the knowledge and skills of piano accompaniment. Moreover, from the point of view of nationalization of piano music, the platform can enhance college students' ability to create and appreciate piano accompaniment music, and promote the integration and development of piano music and national music represented by Morin khuur, so as to make Chinese piano music glow with new vitality. The application of systematic innovative network information technology and streaming media technology has realized the reform of piano nationalization education mode, narrowed the distance between teachers and students, greatly improved the teaching quality of piano music, and provided reference for the current educational informatization reform in colleges and universities.

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