

Construction of Interactive Online Teaching System for English Speech Based on Web

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Abstract—Based on the increasingly close international exchange environment, English as an important language tool, has been promoting international friendly communication in every way. Therefore, the society has put forward stricter requirements for English professionals. However, at present, the traditional English teaching mode in colleges and universities can no longer meet the needs of the society and students. In order to ensure the high-quality development of talents, this paper uses FFmpeg as a decoding tool, combines streaming media technology with computer technology, and constructs a Web-based interactive online teaching system for English speeches. With Linux as the operating system, B/S architecture as the development framework, and Java Web application development framework to develop the system server, the functions of the system are detailed and perfect. The system will deploy the overall development in layers in MVC mode, so as to maintain the operating efficiency of the system and promote the further study and growth of high-quality English professionals. In the comprehensive evaluation part of the system, the analytic hierarchy process (AHP), which combines qualitative and quantitative analysis, is used to calculate, and the functional linear regression model is used as the statistical basis of the data, thus further optimizing the evaluation system of efficient English speech.

Keywords-interactive learning; English speech; online teaching system; FFmpeg; AHP algorithm

1 INTRODUCTION

The development and evolution of digital technology has further promoted friendly exchanges among countries. As the main language tool for international communication, English has gradually become a popular language for all countries to learn. As far as China is concerned, English is the key subject of nine-year compulsory education, and its teaching mode is constantly changing to adapt to the times. In all stages of teaching, English learning focuses on listening, speaking, reading and writing. However, in practice, teachers often only focus on reading and writing, thus neglecting the training of listening and speaking, which hinders the development of students' oral communication ability and logical thinking ability. As the main

way to exercise students' spoken English, English speaking class should increase teaching time and improve teaching configuration, so that students can gradually improve their logical thinking ability and language organization ability in speaking. However, as far as the current development of college English speech teaching is concerned, there are still some problems to be solved. First of all, most colleges and universities don't realize the importance of public speaking courses in English teaching. The emphasis of training English majors in colleges and universities is always on reading and writing, rather than on cultivating students' critical thinking ability. The cultivation of oral expression ability is mainly based on "formalism", ignoring students' learning needs. Secondly, the teaching mode of college English speech is outdated. Many colleges and universities are still using the traditional English speech teaching mode, which focuses on classroom demonstration. In this teaching mode, students' creative thinking and self-thinking ability can not be released, which will imprison students' thoughts and hinder their overall development in the long run. Finally, the supporting facilities of college English speech teaching are imperfect, which hinders the development of speech teaching. [1]

In view of the above-mentioned problems, colleges and universities should constantly adjust the curriculum structure and teaching content of English public speaking, focusing on the needs of the society and students, so as to construct a practical teaching system of English public speaking. The Web-based interactive online teaching system for English major speeches constructed in this paper combines digital electronic technology with higher education, fully applies the advantages of information technology to English speech teaching, enriches the teaching resources of English speech with diversified teaching tools and equipment, high-frequency communication resources and convenient and free interaction, and ensures the smooth development of speech teaching. The system combines streaming media technology with Web application development, and constructs a new interactive online teaching system with FFmpeg as decoding tool. The application of streaming media technology in the system enables the teaching communication between teachers and students to be free from the limitation of time and space, thus ensuring the learning efficiency. The interactive online learning function provided by this system is more suitable for college students' living and learning habits, and promotes the further development of college English speech teaching.

2 KEY TECHNOLOGIES

2.1 Web technology

Web is a network service based on the Internet, which provides users with the required operation interface. The core component of Web is webpage, which can be divided into static and dynamic. Static webpages are presented in the form of text, pictures, videos and audio. Dynamic Web pages can automatically generate new pages, which is convenient for users to call other web applications through web pages. As far as current practical applications are concerned, most of them are web pages that combine dynamic and static.

The early Web service operation of is relatively simple, mainly running in browsers and servers. When the user's request is sent to the server, the server will give the corresponding reply, and then the reply information of the server will be interpreted by the browser, thus forming a

complete operation process. The whole process needs to know the relationship among browser, server, resources (files), and their deployment locations. There are the following basic presentation ways of Web technologies. The basic technologies include HTML and HTTP protocols. HTML is the presentation way of compiled data, while HTTP is a set of communication standards. Httpd is a tool for processing HTTP requests. When HTTP sends a request, httpd will start the corresponding service to process the user's request. Generally, it encapsulates the HTML corresponding to the server into a reply object, and then feeds it back to the user. The user can analyze the reply with the browser to get the final content. The technologies that can be selected for the overall implementation of the server include ASP.NET, Java and PHP. Diversified development technology systems and gradually innovative framework structures promote the richness and power of the functions of the Web server, and further reduce the workload of Web design and development, improve work efficiency and reduce development difficulty.

2.2 Streaming media technology

Streaming media is a multimedia transmission technology that combines network audio and video organically and transmits in real time. Its technical core lies in converting video, audio and other files into a continuous transmission medium-data stream, that is, using a specific algorithm to compress multimedia files into tiny compressed data packets, which are transmitted continuously and in real time by a streaming media server through a specific network protocol. After the client receives these compressed data packets, it is decompressed and played by a specific decoding software. [2] Users don't have to wait for files to be downloaded during use. After a short time of buffering, they can watch audio/video with the help of tools. This streaming mode greatly improves the efficiency of file use. Starting from the audio/video collection content, after encoding and compression, the streaming media files are uploaded to the streaming media server through streaming media transmission protocol, which is also called push flow. Then, the client also obtains the resources of the streaming media server through the streaming media transmission protocol, and finishes decoding and playing. This process is called pull flow.

In the process of streaming media transmission, it is necessary to rely on appropriate transmission protocols. For example, the file transmission on the Internet is mostly based on TCP protocol, and ftp transmission protocol is also used. However, with the development of electronic technology, these transmission protocols have been gradually replaced. At present, streaming media transmission data is generally based on udp protocol, and RTP/RSP is used for real-time data transmission. The specific process is shown in Figure 1. At present, three main protocols commonly used in streaming media technology are RTMP, HTTP-FLV and HLS. RTMP, the real-time message transfer protocol, is the most widely used protocol in live broadcast. [3] It has the advantages of good real-time, strong compatibility, good data confidentiality and high stability, so it is the best choice to realize the interactive teaching function in this system.

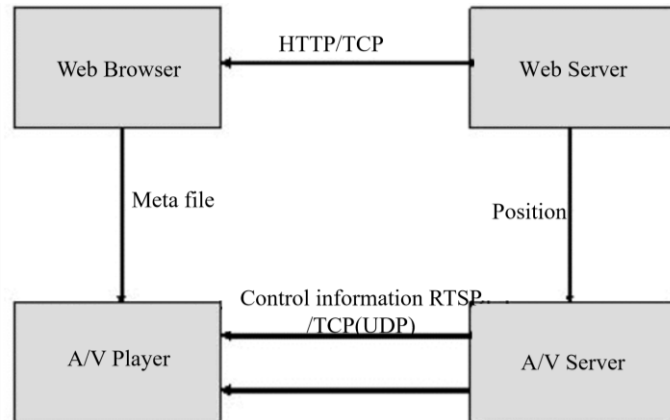


Figure 1. Streaming media transmission process (Source: https://lmtw.com/mzw/content/detail/id/9732/keyword_id/-1)

2.3 MVC

MVC is one of the programming modes in ASP.NET, and it is a special mode for creating Web applications. MVC layering helps to manage complicated program applications, and programmers can pay attention to one aspect for a long time. Besides, MVC layering can also focus on view design without relying on logical business, making it easier to test program applications. MVC can divide system components into three layers in detail, namely view, model and controller. The view layer is mainly responsible for page display and user data interaction. There are many technologies to realize page view, including HTML, CSS, JS and other front-end technologies. The model layer is mainly responsible for the realization of system function modules, the modules that carry data and calculate the requests submitted by users. [4] The specific operation process is shown in Figure 2. Most of the models are implemented with JavaBean. JavaBean is a reusable component, which can be used in any structure only after being written once. The controller layer is responsible for summarizing the work of the first two layers, that is, corresponding the view to the model. The construction of this platform takes MVC pattern as the whole frame structure, and the development and creation are based on the component-based layered development technology. Distributed multi-tier technology is an important development technology to create this platform. Using this technology can effectively realize the functions of the traditional pattern, and it has certain advantages in scalability and maintainability of the platform.

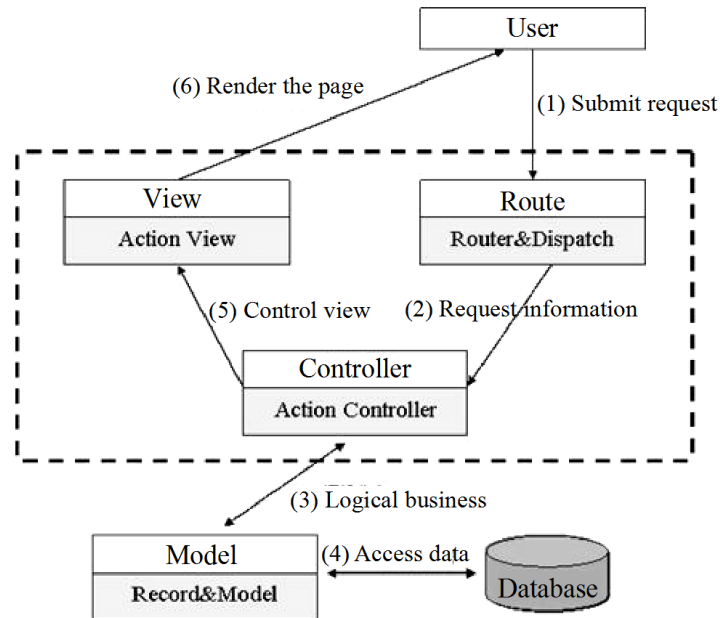


Figure 2. Flow diagram of the MVC operation

2.4 FFMPEG

FFmpeg is not only an audio and video coding and decoding tool, but also a set of audio and video decoding development kits. [2] As a codec development kit, it provides developers with rich call interfaces for audio and video processing. The main workflow of MPEG needs to go through six steps: first reading the input source for audio and video decapsulation (calling interface implementation in libavformat), then decoding each frame of audio and video data (calling interface implementation in libavcodec), then converting parameters to encode each frame of audio and video data (calling interface implementation in libavcodec) and finally repackaging audio and video.

2.5 Development process

According to the technical requirements of the above-mentioned related applications, the configuration and deployment of the development environment of interactive online teaching system for English speeches based on Web are completed. Firstly, Linux is used as the whole operating system to build the development environment, and FFmpeg is used as the development framework of streaming media. The development framework of Java Web application is used to develop the system server, which makes the functions of the system meticulous and perfect. The system will deploy the overall development in layers in MVC mode to maintain the operating efficiency of the system. In terms of server equipment, NGINX version 1.21.5 is deployed in the system to ensure that it can support the reception and distribution of functional data of the whole system. The specific building steps of the system are as follows: First, download the Nginx compression package and RTMP compression

package and install them. Then, configure Nginx. Option to install and compile Nginx. On the basis of the default configuration of Nginx, add the RTMP third-party module with the add-module command, and finally start Nginx with the ./nginx command. Nginx+RTMP server is selected as the streaming media server of interactive teaching system, and then RTMP module is deployed on Nginx to realize the forwarding of streaming media data.

In the development of the system client's personal learning function, it is developed with the help of JAVA language based on JDK1.8 environment. Struct2 development framework is deployed in IDEA, Tomcat9.0 is used as the Web server, MySQL database is used for data storage, and version 8.0.28 is selected. Use JavaCPP1.4.3 to trim the common library of FFmpeg4.2.1, so that the Native API can be converted into Java API, and then use JAVA CV1.5.4 to package the tools. Deploy JAVA CV on IDEA, and create a sub-project named ffmpeg-basic under the javacv-tutorials project to use FFmpeg to realize various functions related to streaming media. [3] Through the introduction of the above technologies and the configuration of the environment, the technical feasibility of constructing an interactive online teaching system for English speeches based on Web is determined.

3 FUNCTIONAL IMPLEMENTATION

3.1 Live broadcast learning module

When users access this system for the first time, they need to complete user registration according to the page instructions, and then choose their identity to log in. This system divides users into two categories: teacher users and student users, and provides different services for different users, so as to ensure that the system can accurately meet the needs of users. English speech teaching is a comprehensive course that integrates listening, speaking, reading and writing. The formation of English speech ability is shown in Figure 3.

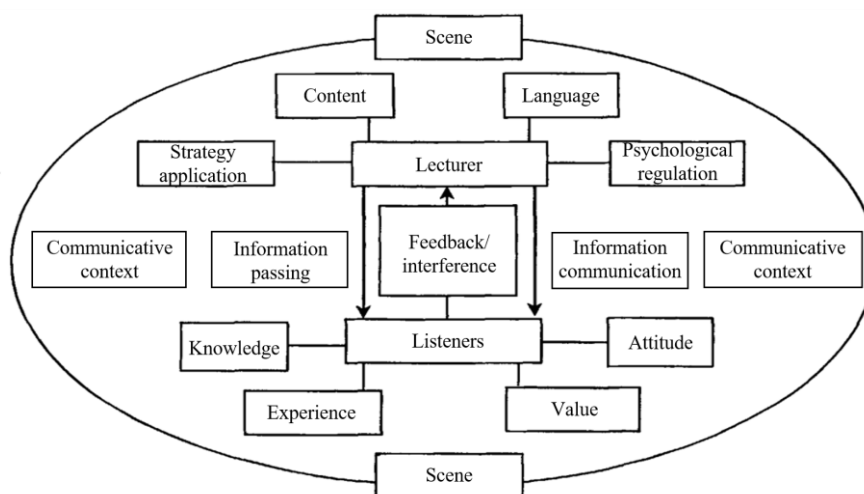


Figure 3. Composition figure of English speech ability

In the live broadcast learning module, student users can click on the live teaching room on the main page to start learning according to their personal preferences or needs. In the live broadcast room, students can make use of the barrage interactive function provided by the system to interact with teachers cordially, and when in doubt, they can also send it out with the help of barrage, and teachers and users will solve it in real time. Teachers can also initiate a microphone connection in the live broadcast room, and randomly select student users in the live broadcast room to conduct one-to-one real-time online teaching with them. [5] In case of poor picture during the live broadcast, students can click the switch line on the right for debugging, and teachers can use the accelerator function of the system to refresh the room to ensure the smooth operation of the teaching process. [6] The system also provides a screen recording function for student users. Students can record the teacher's live teaching according to their own situation, so as to facilitate the later review. The screen recording code is shown in Figure 4.

```
def record_audio():
    p= pyaudio.PyAudio()
    #Create an input stream
    stream = p.open(format=FORMAT, channels=CHANNELS,
                    rate = RATE, input=True,
                    frames_per_buffer=CHUNK_SIZE)
    wf = wave.open(audio_filename, 'wb')
    wf.setnchannels(CHANNELS)
    wf.setsampwidth(p.get_sample_size(FORMAT))
    wf.setframerate(RATE)
    while allowRecording:
        #Read the data from the recording device and write directly to the wav file
        data = stream.read(CHUNK_SIZE)
        wf.writeframes(data)
    wf.close()
    stream.stop_stream()
    stream.close()
    p.terminate()
```

Figure 4. Key code of screen recording

The system will launch a questionnaire survey to the students from time to time, and get the most popular teaching live room with the student's support rate, and then push it to the homepage of the system for display. The survey chart is shown in Figure 5.

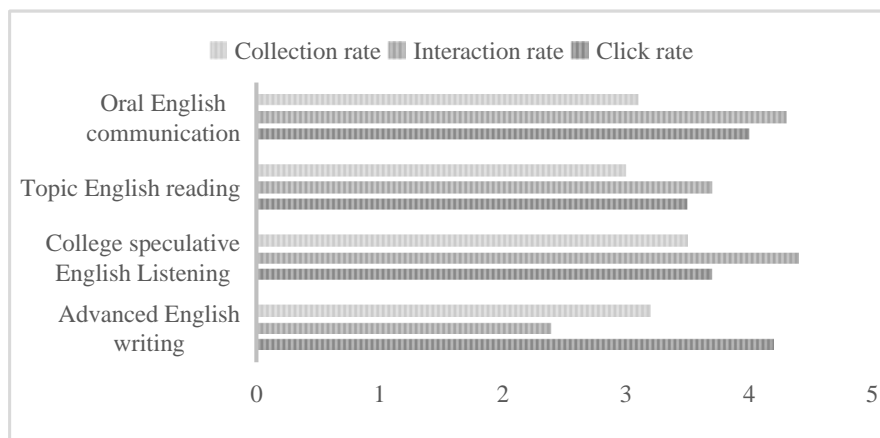


Figure 5. Survey of the support rate in the teaching live broadcast room

3.2 Online training module

In this module, it is mainly divided into the following modules: speech writing training, oral expression training and listening training. With the help of streaming media technology, the system sets the training session in the module as a live interactive room, that is, the system will automatically assign interactive rooms to students after they participate in the corresponding training. [7] Rooms are divided into round table type, group type and one-to-one communication type. Users need to choose the room type before assignment, and different types will be equipped with different training contents and communication environments. For example, in a round-table interactive room, the system will assign communication topics for students to communicate with. In the group interactive room, the system will generate two or more groups of students, set different questions for them to discuss, and finally appoint representatives to report the results of the group discussion. [8] In this module, students can communicate with other students by means of the real-time wheat-connecting function provided by the system, thus forming a brisk English communication atmosphere and growing together with their partners. Teachers mainly play the role of supervision and guidance in this module. Teachers should randomly join the interactive room for spot checks to ensure the authenticity of students' training. With the help of the activity function of the system, teachers and users can hold English speech contests from time to time and invite students to participate. The theme of the competition will be selected in the student voting, as shown in Table 1.

Table 1 Speech topic voting situation

Competition name	Modern education	Science and technology	Business contacts	Environmental protection
Agree	332	468	550	670
Oppose	228	369	214	153

3.3 Extracurricular extension module

The opening of English speech course can provide a real oral training environment for students, and cultivate students' logical thinking ability and innovative consciousness in the process of communication. In order to broaden students' knowledge level, extra-curricular extension modules are set up systematically. In this module, students can choose what they are interested in to learn. In the reading section, students can accumulate writing words by browsing foreign works. In the video section, students can choose famous foreign speech videos, BBC documentaries or classic clips of popular American TV shows to exercise their listening ability and learn standard pronunciation. [9] At the end of the study, students also need to submit their learning experience in English to deepen their learning experience. Learning experience upload code is shown in Figure 6.

```
<title>File upload</title>
</head>
<body>
  <form enctype="multipart/form-data" action="test.jsp" method="post">
    Name:<input type="text" name="username" /><br>
    File:<input type="file" name="myfile" /><br>
    <input type="submit" value="Submit"/>
  </form>
</body>
</html>
```

Figure 6. Learning experience upload code

3.4 Comprehensive evaluation module

English speech course is a practical course that combines listening, speaking, reading and writing. There are many changes in the training process, and the traditional outcome evaluation can't accurately evaluate students' training. Therefore, this system has innovated the evaluation method, combining the process evaluation with the summative evaluation to ensure the accuracy of teaching evaluation. Online teaching can't guarantee the effectiveness of students' learning, and students' users are prone to the bad behavior of hanging up in the system and not really entering the module to start learning. This system derives a monitoring function, which records the user's activity level and speaking frequency. When the student user stays in the interactive room for a long time without any operation, it will be judged as dropped, which is not included in the study time. In this system, the final score of student users is calculated by AHP, which combines qualitative and quantitative analysis. Total grade of students = average grade+final grade+teacher's grade. The final total score calculation formula of students is shown in Formula 1, where O represents the usual score, P represents the final exam score, J represents the teacher's score, and C represents the final score, i represents the degree score of different assessment points, and l is the evaluation confidence. [10]

$$\sum_i [(O_i + J_i) \times 60\%] + (P \times 40\%) = C \quad (1)$$

4 CONCLUSIONS

English speech is the comprehensive embodiment of language skills, thinking ability and communication ability. The Web-based interactive online teaching system for English speech is designed to improve English majors' language literacy and professional ability and develop their potential. The system provides a real oral communication environment for students, breaks through the limitation of time and space in English speech teaching, and provides convenient conditions for the implementation of teaching. Through systematic training, students can effectively improve their language skills and thinking ability, and enrich their international vision and spiritual connotation. In the follow-up research, we will further expand the extensibility and applicability of the system, and make the system function more perfect.

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