Design of a Computer Aided System for Self-Learning Vocal Music Singing with the Help of Mobile Streaming Media Technology

Cuiping Xu [1*] and Yuekun Zhai[2]

[1]Department of Art and Sports, Huanghe S&T University, Zhengzhou 457000, China, xcp781219@163.com
[2]School of Music & Dance, Zhengzhou Normal University, Zhengzhou 457000, China, xingyue 1114@163.com

Corresponding author: Cuiping Xu, xcp781219@163.com

Abstract. Based on the constructivist teaching theory and UML modeling theory, this paper focuses on the characteristics of the computer aided system for self-learning vocal music singing, and combines the development of self-learning vocal music singing technology of voice mobile streaming media, discusses the relevant protocols and uses of traditional mainstream mobile streaming media technology, and compares the characteristics of traditional streaming media technology. This paper introduces a new technology, FMS (Flash Media Server), which not only has the ability of mobile streaming Media, but also has the ability of interactive application development. FMS is used to develop the application research on how to realize the self-study vocal music singing stream of synchronous transmission of sound mobile streaming media and the interactive Web vocal music self-study computer aided system. Introducing adaptive technology into the multi-stream concurrent transmission system, this paper proposes a self-learning self-adaptive transmission scheduling algorithm for vocal music singing based on the available bandwidth of multi-path mobile streaming media. It dynamically performs packet scheduling and path management through the ratio of the available bandwidth of the path, and analyzes and verifies it through simulation. The results show that the algorithm can effectively improve the system throughput and system utilization. The system is analyzed and designed through UML modeling, and the main functions and implementation methods of the system are studied, which is practical and innovative.

Keywords: Heterogeneous wireless network; Mobile streaming media; Adaptive transmission; Vocal singing; Computer aided system
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1   INTRODUCTION

Mobile streaming media technology is the product of network audio, mobile streaming media vocal music self-learning technology and mobile communication technology at a certain stage of development. It is a new streaming media technology produced after the integration of mobile network communication technology on the basis of fixed network streaming media. As an application of streaming media in wireless device terminal, it contains the general characteristics and performance of streaming media, that is, multimedia data transmission in the form of streaming media. Jiang [1] pointed out that Scherbaum needs to pre-download a portion of the multimedia content to be placed in the cache. While the client browser plays this portion of the cached content, the rest of the media content continues to be downloaded from the server to the client player in the background system. This allows users to play the multimedia content without having to wait for the entire content to be downloaded to a local terminal. This "play as you download" streaming technology greatly reduces download waiting time and storage space requirements.

Using mobile intelligent terminal and application software as learning carriers, people gradually become familiar with the use of intelligent products to receive information and share data at any time. However, in the literature on mobile intelligent education so far, there are few research results on self-study of vocal music education, let alone self-study application software of vocal music. Aiming at this situation, a vocal music class self-study based on mobile streaming media technology aided system can quickly with the help of system platform is rich in resources to the user's knowledge of vocal music, whether the user is a professional user or just begin to contact the vocal music study vocal music course of users, whether through professional learning of students in school or just interested in vocal music of users, Dan, X can be as a kind of vocal music learning platform [2], to find the information on vocal music class anytime and anywhere, can observe the teaching course, to summarize learning knowledge and learning methods, and to find more efficient way, in the system, users can also use social platform to communicate with other users as well as online teacher at any time, This way and the traditional teaching course, more interesting.

It is of practical significance to study vocal music autonomously, and the function operation of the system is also suitable for teachers and students with strong professionalism. And the system can be integrated with reality teaching, so that the system can better assist teachers in teaching. When the practical cases and literature and books about vocal music need to be updated and replaced in large numbers at the same time, the automatic information update of the system can be used to replace the educational materials at any time, so as to make the practical use of the vocal music auxiliary system more extensive. The research of this system can also provide the direction of digital education for vocal music educators.

2   RELATED WORKS

Because of science and technology driven economy, science and technology and economic cause and the transformation of education mode in the form of a closed loop each link push forward each other. As an innovation of information-based teaching mode, mobile teaching project has been researched and applied not only in the United States, but also in many European countries [3]. Based on the previous PEP plan, the main task is to analyze and study the possibility and application mode of using mobile devices to perform vocal music in K-T2 classes. The researchers take the needs of students and teachers as the starting point to explore the application of mobile devices at the micro level. Sun [4] has an important guiding significance for the follow-up research on the specific application mode of mobile learning in basic education. The Palm mobile phone installed with Classroom Wizard software is provided for the vocal music group students in grade 7 and grade 8 of the school. The Palm mobile phone can be used for rapid communication between

teachers and students as well as between students. Teachers can also use the software to provide test questions for students, and students can quickly submit answers by using mobile phones. Teachers give scores according to the vocal music training content submitted by students, and carry out targeted teaching and personalized teaching according to the scoring results , the goal is to research on the current education environment were analyzed, and the data and information of informatization development, and development platform, of course, also include mobile education platform, in the process of mobile education showed the ability of top, by observing the learning mode and characteristics of young people, Neokleous [5] devised a aimed at different age stages of WAP site study. Young people can apply education to reality by learning skills related to daily life. The learning contents are not only rigid knowledge points, but also Lee add interesting elements to make the learning process less monotonous [6]. Then I put this learning mode into practice. It became a bigger project. There are many practical actions in the process of learning mobile intelligence. Xun [7] should be transformed into an electronic library, and the use of mobile data equipment should be increased, so that all teachers and students can borrow mobile devices to realize fast access to mobile information resource. It can be seen from this that mobile learning has obtained certain research results, and the focus of education is gradually placed on the direction of digital education. As an important way of digital education, mobile education has not only been widely recognized, but also is considered to be an important direction of education mode for a long time in the future.

There is another form of system software APP, which is developed with students as the center, to meet the online reading needs of students, and to experience the different experiences brought by mobile learning through the mobile terminal platform. Sun [8] used mobile technology products for learning, the key is how to reasonable use of the mobile platform, in the mobile phone, tablet and mobile equipment as the foundation, under the support of mobile applications development constantly, among them, including many famous mobile learning programs, and advancing with time, and there are many other education software developed, The trend of blowout. Different types of learning and education software also meet the learning needs of most people [9]. Mobile learning is also a topic that is widely discussed in the education industry at present, and there are a lot of literature resources. Through the research of these literature and materials, this paper finds that the promotion of social digitalization and the continuous optimization of digital products, In addition, the progress of science and technology of real questions has led to more novel mobile applications, which have brought new research directions for mobile learning [10], and its successful application effect has also provided a series of theoretical support for future research and development of new products.

In addition, mobile product education APPs based on mobile streaming media also attract a lot of scholars to study and research. Searching on CNKI and other websites with keywords, we can see that the learning of mobile streaming media mobile learning platform probably includes the following aspects: the design of educational software of mobile streaming media system, and the development of mobile streaming media education system for professions. The design of software systems for Chinese and English learning is also a more extensive research direction. All these materials have a certain guiding significance for the vocal self-study assistant system based on Android technology, and also provide a certain theoretical basis for the specific design steps of the system.

3 RESEARCH ON COMPUTER AIDED TECHNOLOGY OF VOCAL MUSIC SINGING BASED ON MOBILE STREAMING MEDIA TECHNOLOGY

3.1 Architecture Design

The architecture of this system is shown in Figure 1. The network layer is mainly the channel of data communication. The wireless signal sent by the user through the mobile terminal is transmitted to the WAP gateway through the mobile communication network, and then enters the

wired network after the optimization of the WAP gateway. The business logic layer mainly encapsulates the business services of the learning system. It is responsible for analyzing and processing the service request to the white application layer, and then calling the corresponding database data information according to the request, and feedback the result to the application layer. The business logic layer of the system includes four modules: user verification, student space inquiry, teacher space and administrator space. The data service layer is mainly composed of several databases such as homework information management database, learning material management database, news material management database and so on.
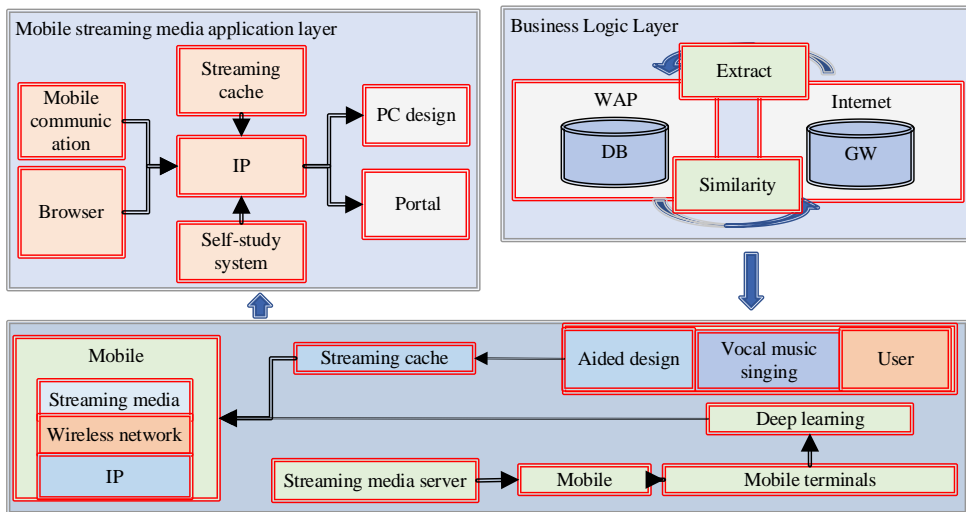

Figure 1: Vocal music singing architecture of mobile streaming media.

The complete streaming media business consists of streaming media server, streaming media client, Portal, user management system and cache server. Portal is a server that provides more convenient access to streaming media content, that is, users enter IP network through portal to access the content resources of streaming media server. At the same time, through the portal, the content provider (CP) publishes the content to the streaming media server and streaming media cache, and the portal provides an interface to authenticate the CP and publish the content. The management system is used to store user parameters and device function information to control how streaming media content is provided to users.

3.2 Simulation Model of Mobile Learning System for Vocal Music Singing Based on Streaming Media Technology

Taking Real System as the prototype and using Rational Rose unified modeling tool, the simulation model of mobile learning System based on streaming media technology is designed, as shown in Figure 2.

3.3 Self-learning Adaptive Scheduling Algorithm for Vocal Music Singing Based on Mobile Streaming Media Technology

The server side of streaming media includes three modules, including sub-stream management module, packet scheduling module and path condition monitoring module, and the receiver side includes two modules, cache management and flow control.
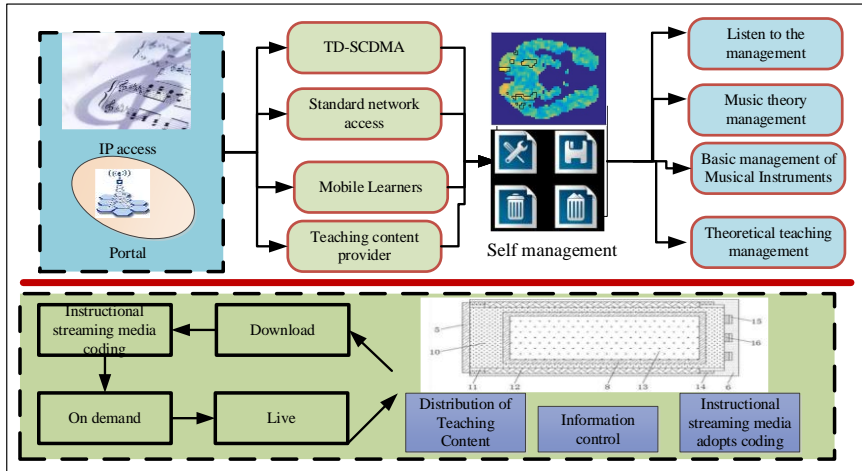
Figure 2: Simulation model of self-learning mobile learning system for vocal music singing based on streaming media technology.

Path condition monitoring module is responsible for monitoring the blade flow real-time available bandwidth of the size, the sub-flow management module according to the available bandwidth of each flow dynamic flow management, through comparing the available bandwidth and setting threshold to decide to increase or delete the sub-flow, subsidiary to the implementation flow of adaptive scheduling management, packet scheduling module according to the available bandwidth of each blade flow corresponding packet scheduling, Assign the appropriate number of groupings to each sub-stream. The receiving end includes two modules: cache management and flow control. The cache management module is used to reorder the received packets and adjust the size of the output queue appropriately. The flow control module is used to determine the delivery time of each sub-flow to the output queue and the number of packets, and to determine the size of the notification window.

(1) The hierarchical method is adopted to determine the level of network conditions and obtain the corresponding approximate range of SBR. After receiving the information from the sender and the receiver, the adapter server first determines the level of its network conditions according to their network conditions, that is, WS and WR values, and then obtains the corresponding SBR level according to the mapping in Table 1.

Ws	S1	S2	S3	S4	S5
S1	A	A	D	C	E
S2	B	A	E	C	E
S3	C	B	B	D	E
S4	D	B	C	D	D
S5	E	D	C	D	A

Table 1: SBR mapping table.

At the same time, set a SBR unit value for each level, the minimum unit that can be adjusted △ SBR, the value is different in different rate interval. Table 2 describes the whole process of sending bit rate adaptation.

```
1://Let Ws and Wr be current net<vork condition of sender and receiver;
2://Let CT be current video content type;
3://LetMOS andMOSl be the current and last QoE score fed back from users;
4: while (t==T}}MOS< 3)/*t denote the time of timer and T denote the period of adaptation*/
5:  get the level of sender bit rate Q by table II; /*Q level denotes a rate interval*/
6:  set SBRl= MIN (Q);
7: //Let 4,fBR be the unit sender bit rate of current rate level;
8: end while
```

Table 2: Self-learning adaptive scheduling algorithm.

After obtaining the exact value of S, the adapter server immediately notifies the sender to update the SBR to S. When the system is running, the adapter server will periodically decide the best sending bit rate according to the above steps and immediately notify the sending end to dynamically adjust the mobile streaming media's vocal music singing and self-study the sending bit rate.
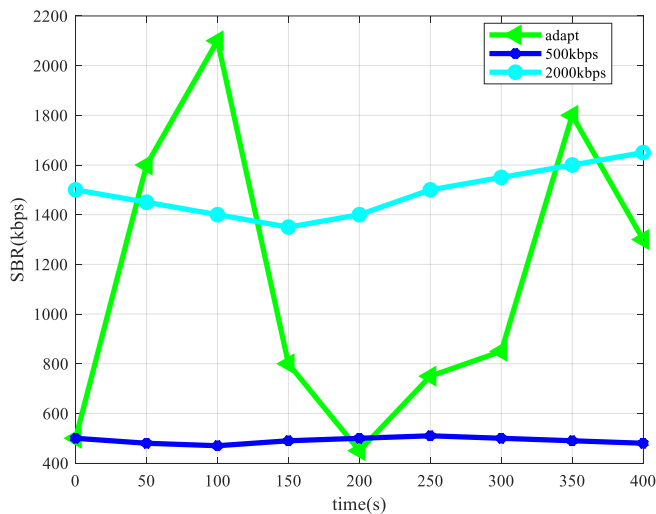
4.   Analysis of Experimental Results

Figure 3: Real-time SBR comparison under three conditions.

In order to better compare the vocal music singing quality and adaptation effect before and after adaptation, detailed tests were carried out for three situations of adopting fixed high bit rate (SBR=2000kbps), fixed low bit rate (SBR=500kbps) and adopting SBR adaptive strategy. The self-study data of vocal music singing of mobile streaming media in three situations are analyzed and statistically analyzed, and certain observers are selected to score the self-study data of vocal music singing of three segments of mobile streaming media respectively. The detailed comparison chart of the results is shown below. Figure 3 is the real-time bit rate comparison diagram of the transmitting end under three conditions. The SBR-adapt curve in the figure is the case of adopting the SBR adaptive strategy. For vocal music self-learning with mobile streaming media sent at a fixed bit rate, SBR will fluctuate slightly around the set value. SBR will be dynamically adjusted

according to the current network state or user feedback, and the adjustment range and step size are related to the parameters set in the policy.

Figure 4 shows the change of packet loss rate in the process of self-learning transmission of vocal music singing of mobile streaming media under three conditions, which can reflect the current network conditions to a certain extent. When the fixed low bit rate transmission is adopted, the packet loss is not generated in most of the time due to the sufficient bandwidth, and the fixed high bit rate is used, and the packet loss rate is basically controlled at the lowest value. When the bandwidth is insufficient due to the fluctuation of the network, and the rate of 1500kbps is still adopted to send the mobile streaming media for self-learning vocal music singing, which causes serious congestion of the link and leads to large packet loss. The image of self-learning vocal music singing of mobile streaming media appears Mosaic, which has a great impact on the user's viewing experience. When adopting the SBR adaptive strategy, the SBR can be adjusted in time when the network fluctuates, so as to keep the SBR within the maximum available bandwidth of the link, so as to control the packet loss rate within a low range, and provide users with the best self-study experience of vocal music singing of mobile streaming media as far as possible.
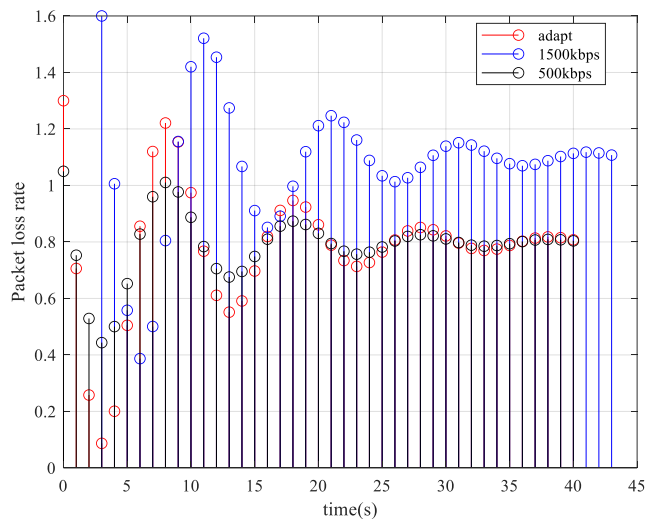

Figure 4: Packet loss rate in three cases.

As shown in Figure 5, the default algorithm in two different conditions (RR) and the proposed algorithm is based on the available bandwidth (AB) mechanism has carried on the contrast, y coordinate for the throughput, abscissa to simulation time, you can see, AB algorithm has fluctuations in throughput at first, then to stabilize, with RR algorithm throughput has certain gap, Therefore, AB algorithm can effectively improve the overall throughput of the system. By comparing these two figures, it can be found that when there is background traffic, the throughput of the two algorithms will be affected to some extent and will decline to some extent. By observing the curve gap between the two algorithms, it can be seen that the decline range of AB algorithm is smaller than that of RR algorithm, which indicates that AB algorithm has better stability than RR algorithm.
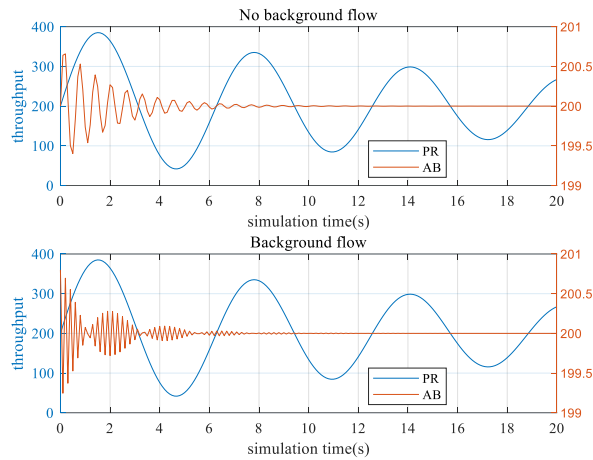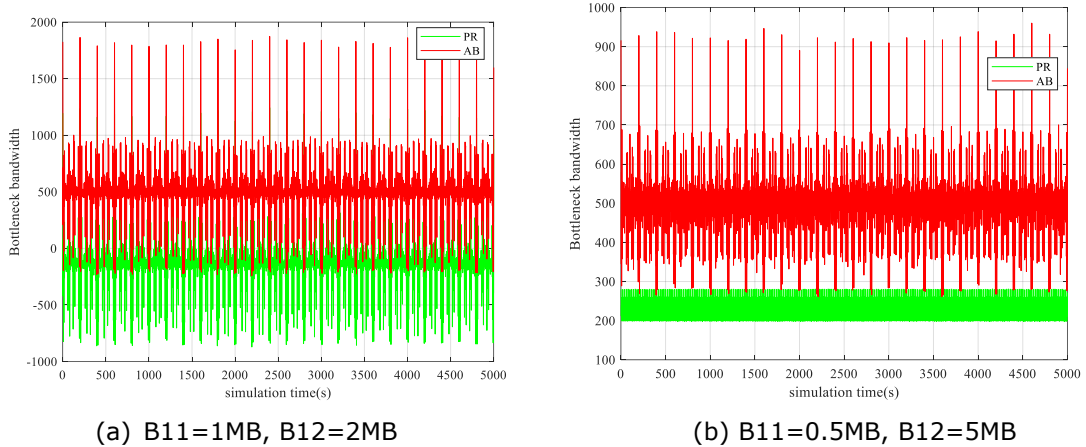
Figure 5: Throughput comparison in the two cases.


(a) B11=1MB, B12=2MB   (b) B11=0.5MB, B12=5MB

Figure 6: Comparison of output queue lengths under different bottleneck bandwidths. BT1 and BT2 are bottleneck bandwidths of two paths.

As shown in Figure 6, y coordinate for the queue length, horizontal to the simulation time, the output of the figure 6 (a) AB algorithm of queue length is slightly larger than the RR algorithm, in figure 6(b) AB output queue length significantly less than the RR algorithm, as in figure 6(a), path available bandwidth is larger, the data transmission of each path is sufficient to ensure no packet loss or low packet loss rate, And at this time due to AB algorithm throughput than the RR algorithm, namely unit time AB algorithm in the receiver to receive group than RR algorithm, so the AB algorithm in the receiver requires a larger group cache to store arrived, visible, the path difference is very small RR algorithm the average distribution of the desired output queue length less than AB algorithm, In addition, the cache overhead of RR algorithm is similar to that of AB algorithm in the case of no packet loss or small packet loss in the path. However, when the path difference is large, or the packet loss rate of the path is large, the packet loss rate and retransmission rate of the path with small bandwidth in RR algorithm are higher than that of other paths. Therefore, the receiving end needs a larger cache to store the out-of-order packets that arrive in advance by another path, while AB algorithm reduces its packet loss rate and

retransmission rate by transmitting a small number of packets on a path with a small available bandwidth, thus reducing the storage cost of out-of-order packets, as shown in Figure 6(b).

In addition, the path utilization ratio of multi-path parallel transmission and single-path transmission is also compared when the sender only needs to send a small amount of data. Set the bottleneck bandwidth to 5MB and L0MB respectively, and adjust the TCP initial sending window to 50. The path utilization tested with no background traffic is shown in Figure 7.
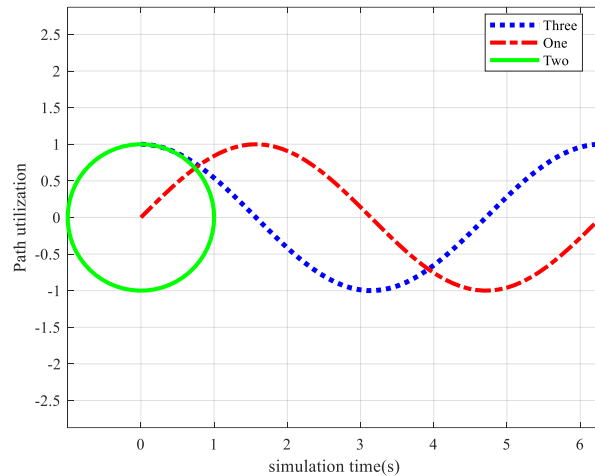
(a) B=5MB
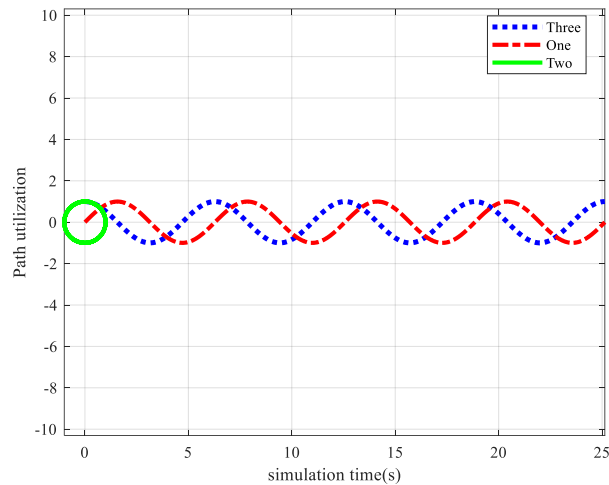
(b) B=10MB

Figure 7: Comparison of transmission schemes with different path numbers

As shown in Figure7 (a), due to the absence of background traffic, the amount of data needed to be transmitted per unit time at the sending end is reduced, and the amount of data allocated for each path is correspondently reduced. In addition, the available bandwidth of each path is the same, so each path is sufficient to transmit these packet data independently without parallel transmission on multiple paths. Instead multipath transmission in this kind of circumstance is not

play the advantages of the multiplex, but because only a small amount of data and make the path of utilization drops greatly, can be seen in the figure, the decision of AB algorithm only through a path transmission path utilization rate is higher than that of using two or three path utilization, and along with the increase in path, The overall utilization will go down even further. In Figure7 (b), the bottleneck bandwidth is set to 10MB, which further increases compared with Fig. (a). At this time, the bandwidth margin of each path also further increases, resulting in the reduction of path utilization. So MPTCP multi-path parallel transmission is more suitable for the need to send a lot of data or the path bandwidth is poor, can effectively improve the throughput of the system. In addition, it can be seen that the introduction of adaptive path management and scheduling in MPTCP is also very important, especially in the mobile network with dynamic bandwidth changes.

4   CONCLUSION

Based on the analysis of the research content of this paper, this paper focuses on the research and development of the video acquisition and video playback functions of the vocal music self-learning auxiliary system, and introduces the theory of video feature analysis and mobile streaming media technology. Through the realization of these system functions, the vocal music self-study auxiliary system becomes more free and convenient and fast. From the perspective of students, self-study of vocal music becomes more flexible and free, and they can choose a place they are familiar with to collect vocal music performance video, and sing in a more relaxed state can get better play; Moreover, I can choose to communicate not only with teachers, but also with people outside the school, which is of great help to the development of my thinking. For teachers, it is more convenient to work and live. They can choose to make online comments in the office or even at home, which can give more objective evaluation scores. For vocal music lovers outside the school can also get a more systematic study and comments free of charge. The innovation point lies in the realization of streaming media technology on the Android end to help vocal music learners to conduct independent vocal music learning in the network environment at any time, without being subject to environmental factors.

Cuiping Xu, https://orcid.org/0000-0003-4944-0077

Yue kun Zhai, https://orcid.org/0000-0003-1720-2461

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