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*Research Article*

# Mobile Education System Based on Genetic Algorithm

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In order to solve the problems existing in the current mobile education system, this paper proposes a method of mobile education system based on genetic algorithm. By analyzing the research status of mobile learning and the theory and application mode of mobile learning, this method explores the combination of mobile learning theory and application mode and China's traditional primary and secondary education mode, then puts forward a mobile teaching model suitable for primary and secondary education, and builds a mobile teaching system on this basis. The results show that, through the analysis, it is found that most of them remain at about 10%. In practice, the occupation is slightly increased only when multiple people teach, but it also belongs to an acceptable normal level, which can meet more complex functions in the future. The function of mobile learning platform needs to be expanded. For example, mobile learning forum can provide learners with a platform for communication, discussion, and sharing learning materials.

## 1. Introduction

In today's world of education, human ability to learn has shifted to movement and mind. In the context of long-term digital education, educational scientists have focused on the theory and application of technology in mobile learning. Until now, the research of mobile learning has gained theoretical benefits. From a technological point of view, this has provided many examples of successful education. In the age of mobile internet, mobile education, a powerful addition to the traditional online education method, takes advantage of all the advantages of mobile and creates a convenient, learning environment for students Learn anytime, anywhere. With the continuous improvement and improvement of wireless network technology, the cost of smart devices of mobile phones has been reduced, and the performance has been faster. More and more users are using mobile devices to turn computers into multitasking devices, and mobile training has become more and more popular [1]. As mobile learning is closely related to government-sponsored lifelong learning, it is important to have research on the use of mobile learning.

Over the years, with the advancement of computer science, multimedia technology, and network communication technology, there have been major changes in people's lives and access to information. As information technology improves, people have access to age data. People's desire for information and knowledge is growing. Access to knowledge is not limited to newspapers and magazines. The rapid growth of the economy has led to people reeducation, and lifelong learning has become a model in society [2]. This has led to the development of information technology and the dissemination of the concept of lifelong learning, which has laid a solid foundation for improving network learning. Modern network learning is a study that takes place in digital signal using computer networks and multimedia technology (Figure 1). The basis of the training materials is the platform and the content. The platform creates virtual classrooms for teachers and students, which the classroom uses as a way to deliver learning content. This is an important indicator of the quality of online learning platform, whether it can provide good education and feedback. Conference workshops are usually conducted in "network video" or "online homework" and other formats. This form of regular training has few interactions and one type. It is difficult for teachers to receive feedback from students, which results in a disruption of the curriculum and does not meet current needs of the learning network [3].

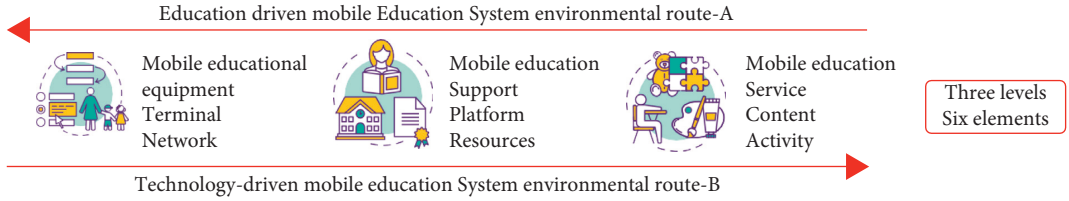


Figure 1: System environment route of mobile education.

In recent years, as the Internet of Things has evolved, smart devices have gradually gained the capacity to accommodate the needs of people to make video and voice calls, join video chats, and play hands-on games whenever and wherever they want games. Thanks to the revolution of smart terminals to replace nonsmart terminals, PDA devices can meet people's needs, and mobile instruction is a benefit. Compared to traditional network browsers, mobile browsers have flexible transition time management, more instructions, and interactive instructions. In the future, online mobile training will be a form of online training.

## 2. Literature Review

Since the birth of the term mobile learning, there have been many studies to evaluate the rationality of mobile devices in education and learning. Liu, S. and others believe that mobile learning, as a new learning mode, has attracted much attention all over the world. In recent years, a series of studies have been carried out abroad, including technical support, system architecture, platform implementation, and learning material production [4]. Liang et al. believe that these studies mainly test the effectiveness of mobile learning from the perspective of teaching and cognition; other studies try to demonstrate which way and which learning situation can achieve the efficiency of mobile learning [5]. Zare and Tavakolpour-Saleh believe that mobile learning research in China is mainly concentrated in the southeast and several famous universities. Compared with foreign research on mobile learning, the theoretical basis of mobile learning in China is only based on Situational Cognition [6]. In addition, Wang et al. believe that most of China's mobile learning research is based on a project or topic and does not involve well-known enterprises. Some parts are jointly studied by schools, governments, and enterprises, but the advantages of all parties have not been brought into play, and the R&D, application, and feedback have not formed a complete industrial chain. In addition, mobile learning in foreign countries is mostly based on mobile terminals such as PDA devices, which are usually provided by learning providers for learners. However, it is difficult for China to provide devices for learners alone in this regard, resulting in the insufficient utilization of some learning resources [7]. Yan et al. found that, in the field of University mobile learning, iCLASS (Aiban network) can be taken as an example. Aiban network introduces the concepts of social networking and community into mobile learning. Teachers can create class groups (similar to classes) on the platform. Taking class groups as units, teachers complete online tests, homework, and resource sharing for students [8]. Zhang believe that, in the field of primary and secondary schools, taking home school instant messaging as an example, through cooperation with the three operators of communication and schools, establishes an interactive relationship between schools and parents, pays attention to the role of parents in teaching activities, and facilitates parents to understand their children's school situation [9]. Zhang and Yu believe that although the rise of mobile education is expected with the strong participation of giant enterprises such as Netease and Tencent in the online learning industry, researchers still need to explore and practice, which mobile learning application model is more suitable for Chinese Education [10]. For genetic algorithm, Zhang quadratic equation approximation operators are combined with genetic algorithm to solve the function optimization problem [11]. Du mixed the genetic algorithm with bacterial foraging optimization algorithm [12].

## 3. Method

*3.1. Genetic Algorithm.* Genetic algorithm is an important part of the algorithm based on human and genetic functions for breeding, monitoring, and evaluation. Before researching, draw the solution into the solution area. The solution center is the public with a large number of binary options. Starting with the public representation of the solution of the problem, one of the problems we need to solve is to create a working force based on the purpose of the problem, measuring the people in the public as a function of exercise, and seek solutions from a variety of sources [13]. Keep the population size constant, and then carry out organized and random information exchange through specific genetic operation to generate the population representing the new solution set and evolving generation by generation, so as to eliminate some offspring. In this way, the population continues to inherit good quality. The bad characteristics are eliminated, and the new generation population is more adaptable to the environment than the previous generation, obtains individuals with better fitness values, and produces better and better populations. The population continues to move in the direction of the optimal solution, and the last generation population converges to the individual most adapted to the environment, and then the corresponding solution of the individual is considered to be the suboptimal solution or optimal solution of the problem.

To solve the problem, when using the genetic algorithm (GA), one must first consider the solution of being a person (public) in the public and encode the person that into the

notation of symbols (such as chromosome). It then follows the process of biological evolution, continually hybridizing and mutating humans. Every human being is examined according to the preconceived notions, and it is best to get a new population based on the evolutionary principle of survival. At the same time, we are looking for a consultant from the public to find solutions that meet the requirements. GA uses some coding techniques to create chromosomes: chromosomes are the key components of GA function. When doing GA, there are many people at all levels at the same time. The GA program develops individuals into groups of new species based on their ability to adapt to the environment. People who make good changes will become members of a new group. The adaptability is judged by the value of fitness function $f(x)$. The composition of fitness function $f(x)$ is closely related to the objective function and is often a variant of the objective function [14]. The genetic makeup of GA includes selection, competition, and transformation. Selection is the process of selecting people who are strongly modified by the current population to create new citizens. If many people are the same or descendants not the same as the previous generation, a new generation will be created by mixing [15].

For example, there are two individuals A and B, with a length of 8:

$$\begin{aligned} A &= a1a2a3a4a5a6a7a8, \\ B &= b1b2b3b4b5b6b7b8. \end{aligned} \tag{1}$$

After hybridization, it may become $A'$ and $B'$:

$$\begin{aligned} A &= a1a2a3a4|a5a6a7a8, \\ A' &= a1a2a3a4|a5a6a7a8, \\ B &= b1b2b3b4|b5b6b7b8, \\ B' &= b1b2b3b4|b5b6b7b8. \end{aligned} \tag{2}$$

*3.2. Structure Analysis of Mobile Teaching System Based on Campus Network.* Cell phone learning is the process of teaching students and faculty to make communication with learning easier and more flexible using mobile devices as a connection: wireless, Internet, and multimedia technology. Many elementary schools now use Feixin to inform parents about their children's daily learning and homework. In contrast, cell phone use in colleges and universities is very low [16].

*(1) Hardware Composition Of Mobile Teaching System in Colleges and Universities.* The goal of mobile learning is to facilitate online learning using mobile devices and mobile communications. Teaching mobile phones to colleges and universities as part of the school network is not separate from existing campus schools. Instead, we need to rely on the rich scholars of existing schools and realize our role. The hardware consists of three segments: basic and Internet. Networking is a good resource for connecting mobile tutorials, school network training resource platforms, and mobile interface gateways. Second, the mobile interface platform. The platform includes telephone gateways, WAP gateway services, and other tools. Its main task is to complete the process of receiving and recording the information that students need and converting training data and mobile data. Third, the mobile network: the network consists of fiber optic cables, base stations, tower transmissions, and other cellular recovery network equipment.

*(2) Software Design of Mobile Teaching System in Colleges and Universities.* The research and development of mobile teaching system in Colleges and Universities based on campus network not only ensures the speed of mobile Internet access from hardware equipment, but also makes it possible to reduce WAP charges on campus, so as to accelerate the promotion of mobile learning in Colleges and universities. Through technical consultation and negotiation with relevant personnel of the mobile company, the hardware technology and conditions for realizing mobile learning in the campus network have been basically met under the existing technical conditions. In terms of software, the main goal is to convert the format of existing teaching resources into the following three forms of mobile phone software: first, text form. E-teaching plans or e-books and English teaching materials are basically accompanied by e-books with relevant contents. Teachers of other majors also provide students with relevant electronic materials or download addresses in teaching. At the same time, many mobile e-book making software tools also provide the conversion function from different format files to mobile e-book format [17].

Second, video form: a video explanation specifically for a course or a knowledge point. The mobile card playing software developed by e-learning Lab of Network College of Jiaotong University can play teaching videos. Learners can easily carry out mobile learning as long as they find the corresponding mobile video education content on the Internet and copy it into the memory card. At the same time, the video conversion software supporting different mobile operating systems can basically meet the conversion needs.

Third, small courseware: the development of interactive mobile learning software is the focus of mobile software development, such as the existing mobile software that can debug C program on mobile phone. The mobile software with simple interactive function developed by Java program is the key to expand the mode of mobile learning and mobile education. It is particularly important to further develop the University mobile learning system management software to realize the organic integration and efficient management of the above mobile learning resources in the campus network. The preliminarily constructed University mobile teaching software system includes three aspects: mobile software library, information (short message) center, and management center. Relevant research is the next research focus of this subject [18].

*3.3. Design of Mobile Learning System.* Through the analysis of the characteristics of learners and the careful planning of the project, the functional structure of the mobile learning

system client based on Android includes login verification, learning material management, learning material search, information push, user communication, image upload, multithreaded breakpoint continuous download, and other main functional modules.

The mobile learning system provides service functions such as registration verification, learning material management, learning material search, information push, user communication, picture transmission, multithreaded breakpoint continuous transmission and download, personal data, opinion feedback, system setting, help, and about the system. The following describes in detail the design of some main functional modules:

*3.3.1. Registration Verification.* The registration verification module is mainly to provide the user with the identity identification function and provide the identity identification function for the subsequent function modules. For example, the information pushed by the information push function can only be pushed to the registered user. Learners can query their scores according to their own identity and communicate with teachers and peers [19].

During the first registration and verification, the push function shall be bound. This portal push function adopts Baidu push platform. When users use the mobile learning terminal software for the first time, they must carry out registration verification. Start the software for the first time to check whether there is an available wireless network. If there is an available network, then start binding Baidu push. After binding successfully, enter the mobile phone number for registration verification. After successful registration, obtain the verification code and enter the verification code to obtain the personal identification code.

*3.3.2. Learning Materials Management.* The learning materials management module includes the functions of collecting, downloading, and deleting learning materials (Figure 2). Learning materials can include any type of materials that can assist learning, such as audio and video courses, PPT, word documents, and web pages. Learners should analyze as little as possible according to the characteristics of complex and changeable learning environment. In order to facilitate learners' learning, the collection function is provided, and learners can add their favorite learning materials to their favorites. In order to facilitate learners to study offline, the download function is provided. In order to facilitate learners to manage learning materials, the function of deleting learning materials is provided. Unnecessary learning materials can be deleted [20].

*3.3.3. Multithread Breakpoint Continuous Download.* If the application has the function of continuous transmission or download, it should be realized by multithreaded breakpoints as far as possible. Using multithreaded breakpoints for continuous transmission and download has the following advantages: first, the download speed is faster because multiple download threads seize CPU resources at the same time. Secondly, users have a better experience. If users want to query information on the Internet during the download process, users can pause the download and improve the network speed. Third, there will be no waste of resources. If a file is not downloaded, it will be downloaded at the place where the breakpoint is recorded the next time it is started, instead of deleting and downloading the incomplete temporary file. The download software we often use is also realized by multithreaded breakpoints, such as thunder, express, and electric stove. If we want to download, the download software will download as fast as possible. If we want to pause the download during the download process, we can pause at any time. Applications with download function in mobile applications have also realized multithreaded breakpoint download, such as Baidu mobile assistant and 360 mobile assistant [21]. Therefore, the mobile learning system of this subject also realizes the function of multithreaded breakpoint download.

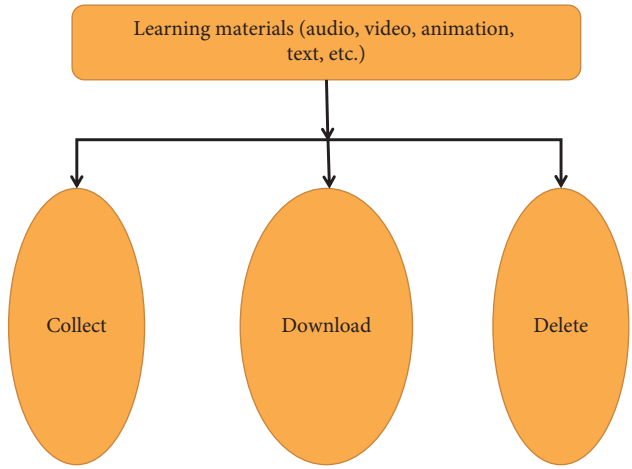


Figure 2: Learning material management function module.

*3.3.4. Information Push.* Previously, we have roughly analyzed the information push technology. The server actively sends information to the client. Information push brings us many benefits, such as high performance, low cost, and timeliness. Many applications use this technology. At present, quite popular WeChat, news client, and other applications use information push technology. When our mobile phone has a network, if the server has new information, it will send information to notify us in time. Therefore, this project also makes full use of the information push function to improve the user experience. Once the server has new learning materials, it will notify the user at the first time, or other important information that needs to be notified to the user in time can also be realized by pushing [22]. The functional architecture of information push service is shown in Figure 3.

*3.3.5. Learning Materials Search Engine.* A search engine is a system that collects data from the Internet based on a specific concept and computer, setting up and processing data, then providing data recovery services to users and disclose

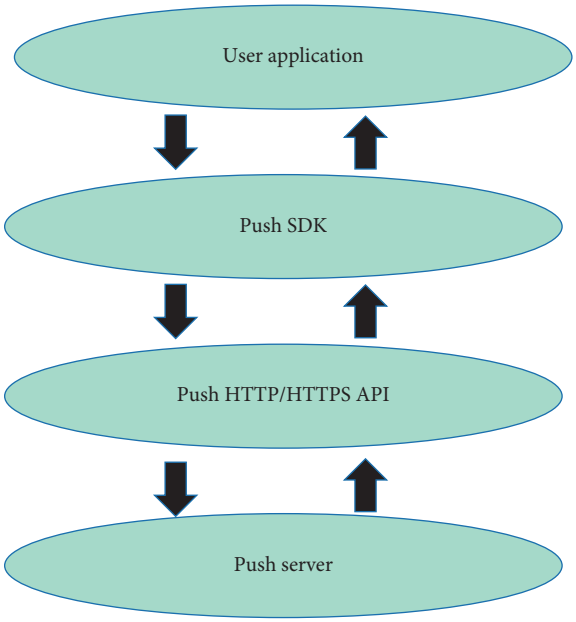


Figure 3: Functional architecture of information push service.

information affected by users. Now almost all websites provide search functions. For example, we often use Google search engine and Baidu search engine, and major enterprises continue to optimize their search engines. At the same time, we also personally feel the convenience brought to us by search engines. The position of search engine is self-evident. Therefore, the mobile learning system platform of this subject also provides users with a search function module. Users can quickly find the required learning materials by inputting keywords.

*3.4. Key Technologies of Mobile Learning System.* The full name of MVC is model, quality, and controller. MVC is a classic software design used to simplify organization and management, and to separate business logic and information. The composition of the frame is shown in Figure 4.

Model is a function or method used to encapsulate data and logically process data. View refers to the intuitive graphical interface used to display data. For example, the files in the layout folder in Android project are views. The controller is used to connect the model and view and control the synchronization between the data in the model and the view data display and the execution process of the application, such as processing the user's click event. The activity class in the Android project is the controller, which associates the view file (i.e., XML file) in the layout folder with the model (business logic class) to control the execution process of the program. MVC provides strong support for subsequent project expansion and modification. At the same time, it also improves the reusability of code modules, greatly reducing the coupling degree of the code, thus reducing its maintenance cost [23].

The so-called streaming media refers to the application of streaming transmission in the network (Internet) upload and input media formats that can be played in real time, such

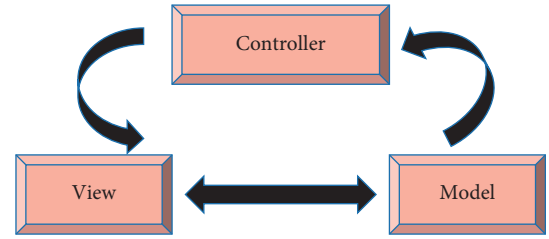


Figure 4: MVC architecture.

as audio, video, animation, and other media files. Therefore, streaming transmission technology is the most critical technology of streaming media. Streaming transmission refers to the application of special technology to compress and divide multimedia files such as audio and video into data packets and transmit data to continuous client computers in real time. Cache technology is the key technology to realize streaming transmission. Internet transmits data packets in the way of asynchronous transmission. Therefore, the data played in real time must be divided into multiple files and transmitted to the network. Because the network is dynamic, the path from each packet data may be different, and the time it takes for each packet data to reach its destination may be different. You can first receive the submission and then submit the submission first. Therefore, a caching system is used to resolve the effects of jitter and latency, and to ensure the accuracy of the data set before playback. In general, the cache responsible for broadcasting does not require large capacity, because the cache uses a ring-linked registry structure to store data: by deleting game content, the switch can reuse the empty cache interface for the next nonplayable cache details.

## 4. System Test Results

Performance measurements are intended to measure the performance of a terminal in an online training session when interacting with a terminal instructor. Timely responses to interactive information are relevant to the interview process and should be addressed. The experiments were divided into negative and positive. It only examines two-way interconnection of communication materials between faculty and student resources. Given the frequency of communication, the test uses interactive whiteboard devices as the target for the test. The large size of the interactive whiteboard synchronized data can explain the situation better than the playback synchronization training.

First, consider a two-way approach between teachers and students to change data without shutting down the Nagle algorithm, as shown in Figure 5.

After the Nagle algorithm is turned off, the round-trip time of interactive data transmission between teachers and students is shown in Figure 6.

Through the interface test, function test, and performance test of the mobile teaching system, it is observed that the system can interact with the teacher normally, including the playing state of courseware and the synchronous operation of whiteboard [24]. At the same time, after students

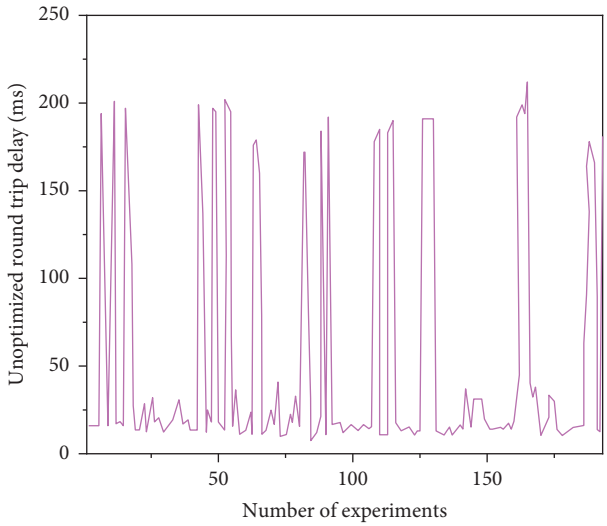


Figure 5: Nonoptimized round trip delay.

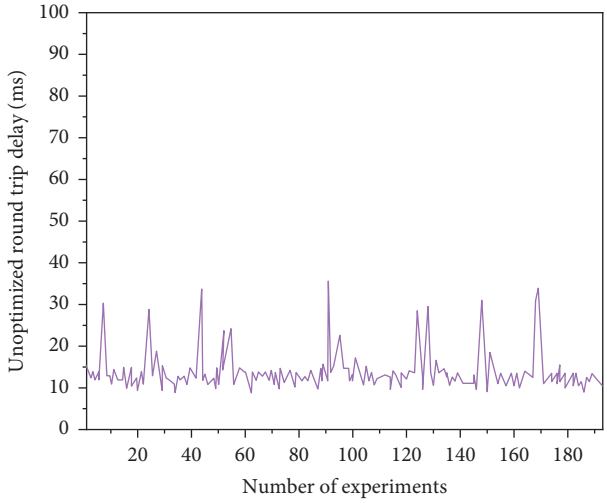


Figure 6: Optimized round trip delay.

apply for control permission and become controllers, local operations can be synchronized to teachers and other students.

Grab and analyze the mobile contract of the mobile teaching system through wires hark tool. After student A obtains the authorization, the synchronous data of student A is first sent by A to the teacher and then sent by the teacher to other students. At the same time, when student C joins the classroom halfway, first confirm the current classroom state with the teacher, and then synchronize the state, which is consistent with the design.

Through the comparison between Figures 5 and 6, before transmission optimization, the average round-trip time interval after the student terminal receives the confirmation after sending the interactive message is 48.6275 MS, and the round-trip time interval is unstable, with a long round-trip time interval of about 200 ms occasionally. The round-trip time interval after turning off Nagle algorithm for optimization is greatly shortened, with an average value of 14.219 ms. The round-trip time interval is relatively stable and basically maintained below 30 ms. The reduction of interaction delay is also felt in the actual interactive operation, especially in the process of painting operation [25], which shows that it has a significant optimization effect. When the mobile teaching system interacts with the teacher, the CPU occupation of the application system is low. Through analysis, it is found that most of it remains at about 10%. In fact, the occupation is slightly increased only when multiple people teach, but it also belongs to an acceptable normal level, which can meet more complex functions in the future.

## 5. Conclusion

Mobile learning is an activity that uses mobile devices to promote learning. This is a new level of literacy. The use of cell phones in education and teaching is a vision for the future to inform academics in colleges and universities. With the advent of high-speed mobile networking technology, education across the globe has surely become another new learning experience in the future after mobile learning. Students have access to personal information about their education anywhere in the school and at any time through any appropriate terminal equipment. Thus, the education and training of colleges and universities will lead to a new era.

This line provides mobile training with native training standards. The mobile learning experience is designed and implemented to meet the needs of teachers, students, and parents. However, due to its small size, the platform still has some shortcomings and needs for further study and needs to be further improved and expanded.

## Data Availability

The data used to support the findings of this study are available from the corresponding author upon request.

## Conflicts of Interest

The authors declare that they have no conflicts of interest.

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