



Research on Interactive English Grammar Learning System Based on Android Platform

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Abstract. With the science and the Internet industry, China's industrial, agricultural, national defense, and scientific and technological construction has also made steady progress. Since the China's education industry has also undergone earthshaking changes, and is rapidly developing towards the standardization and modernization of the education industry. However, in the of society new standards and for learning mode and quality. The combination of information technology, interactivity, and autonomous learning reflects that there are still shortcomings in education development in China. In terms of autonomous learning, it is still based on the Web, lacking flexibility, and the management of user learning quality still needs to be strengthened. This research aims to develop. The researchers are mainly interested in the following aspects of the project: developing mobile applications for students can help them learn English grammar. This application should be user-friendly and easy to use. So that students can use it easily without any problems or confusion. It should also have a good interface design to make users feel comfortable using the application. It must provide various grammatical features, such as words, phrases, sentences, etc., so that they can study and practice these grammatical facts. The main purpose of this research is to develop an adaptive, self-learning, interactive EFL (English as a Foreign Language) grammar learning system for the Android platform. Students studying in universities in Japan or other countries will use the application to improve their English through their own learning habits.

Keywords: Interactive system · Online learning algorithm · Android · Mobile learning

1 Introduction

The continuous progress of society and technology has led to the great of mobile and mobile intelligent terminals. Due to various needs, people are increasingly inseparable from both. Learning is also an eternal topic. In today's society, learning is even more a lifelong undertaking. However, due to limitations of time, location, and other reasons, it is impossible for people to learn every knowledge and sit in the teacher like students [1]. In the process of communicating with each other, people will think more about the

matters they communicate, and exchanging the knowledge they have learned is bound to enable them to better understand and master the knowledge discussed. In order to facilitate people to learn knowledge more efficiently, a mobile interactive autonomous learning system was designed and implemented [2].

In today's society, one of the indispensable tools is the phone. The emergence of this tool has changed people's lifestyle. Previously, television, radio, and newspapers were the main ways for people; Nowadays, with just one mobile phone, people can access almost all the information they want through the mobile internet, greatly facilitating people's lives. The rise of the mobile internet has enabled people to access information no longer limited to fixed terminal devices, and people can access information through the internet anytime and anywhere [3].

This article develops an interactive English grammar learning system based on the Android platform and explores its application in English learning. The system uses an interactive learning mode and provides users with personalized English grammar learning services. The learning mode includes three parts: basic teaching, interactive teaching, and test evaluation. Among them, the basic teaching mode provides systematic learning opportunities for beginners by showcasing English grammar knowledge points. The interactive teaching mode incorporates a gamified learning approach, allowing students to gain a deeper understanding of English grammar knowledge in the game [4]. The test evaluation mode evaluates students' mastery level through exams, providing feedback and suggestions for students. In the experiment, we applied the system to English grammar learning and established an effective experimental method to evaluate the effectiveness of this learning system. Research has shown that users who use this system exhibit a higher level of mastery of English grammar and a stronger motivation to learn English grammar.

Through this study, we can draw the following conclusions:

- (1) Interactive learning has a significant effect on improving English grammar proficiency, and gamified education can bring better learning outcomes.
- (2) The Android platform provides rich mobile device resources, which can provide a better user experience in learning, which is also more in line with the learning needs of modern young people.
- (3) Based on students' learning data, more personalized educational services can be designed to achieve more effective English grammar learning outcomes.

In short, the development and improvement of mobile platform technology have provided more possibilities for learning English grammar. The research and practice of this learning system can guide the development of future mobile education and provide higher quality services for English learners [5]. Moreover, this study also provides reference for extending such learning systems to other language learning domains and curriculum domains.

2 Related Work

2.1 Software Technology - Thrift RPC Framework

Before introducing Thrift, let’s explain RPC (Remote Procedure Call). RPC is a computer communication protocol that enables inter process communication across hosts. In short, machine A calls a function or interface on machine B. It is like calling a function or interface on machine A itself. When A initiates the call, A’s process is suspended, and the called process on machine B starts executing. After the execution is completed, the result is returned to A. The RPC framework shields the underlying transport method (TCP/UDP), serialization, and deserialization, allowing users to focus on core function development [6].

RPC is divided into client and server sides. The complete remote call process is as follows: First, the client initiates a remote call, converts the function call into a message through the client agent, and then sends the data to the server through a socket. When the server receives the data, it parses the message and converts it into a local function call, obtains the local call result, converts the function return result into a message, and sends it to the client, The client receives and parses data to obtain the results of remote calls [7]. The above call process and working principle are shown in Fig. 1.

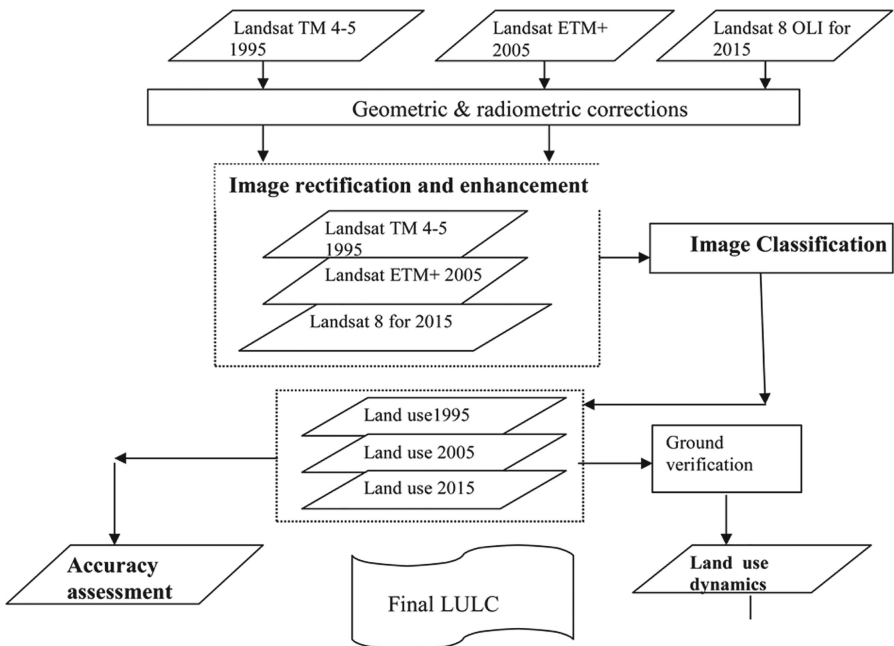


Fig. 1. RPC Schematic Diagram

Currently, there are several mainstream RPC frameworks:

Thrift: Facebook’s open source cross language framework, supporting over 20 programming languages such as Java, Python, and C++;

GRPC: A high-performance framework developed by Google based on HTTP/2 and Protobuf, supporting three languages: C, Java, and Go, with strong serialization and deserialization capabilities;

SOFA RPC: Ant Financial Services is a high-performance and highly scalable Java RPC framework that has been developed within Ant Financial Services for over a decade and five generations [8];

Thrift defines RPC interfaces and data types based on IDL (Interface Definition Language), and then generates code for the relevant language through a compiler. The data types supported by Thrift include basic types, structure types, container types, exception types, and service types to meet daily development needs. When defining interfaces, it is not necessary to consider language factors, which has great versatility and extensibility [9].

Thrift defines the transmission and communication protocols between the client and server, which are generally divided into text protocols and binary protocols. Generally, binary protocols are used to save bandwidth and improve transmission efficiency. Binary data transmission is adopted, which has a smaller volume compared to XML (Extensible Markup Language) and JSON (JavaScript Object Notation), and lower interface call latency. It has significant advantages in high concurrency and large data volume transmission scenarios. Sometimes text protocols are also used, which need to be selected based on specific usage scenarios [10].

2.2 Android Application Construction Principle

Android platform is a Open-source model mobile device platform based on Linux operating system, which uses Java programming language and is a popular mobile operating system. Developing applications based on the Android platform requires following certain building principles, which include the following parts:

(1) Android system architecture

The Android platform system architecture can be divided into four layers, namely, the application layer, the application framework layer, the Android runtime layer and the Linux kernel layer. The application layer contains all visible application components for users, the application framework layer implements a set of APIs for building applications, the Android runtime layer provides Java virtual machines and various core Java classes, and the Linux kernel layer provides the core functions of the operating system [11].

(2) Application development process

Developing Android applications requires understanding the Java programming language, Android SDK, Eclipse development environment, and following a certain development process [12]. This process includes five stages: requirements analysis, design, development, testing, and release.

(3) UI interface design

UI interface design is crucial in the development of Android applications. The basic elements of UI interface design include layout, controls, styles, themes, etc., which

should be implemented through the use of resource files provided by Android to ensure the aesthetics, usability, and stability of the interface.

Overall, building applications based on the Android platform requires mastering the system architecture and APIs of the Android platform, using Java programming language, and utilizing development tools such as Eclipse and pre written Android class libraries to complete the construction of the application [13]. At the same time, the exquisite and beautiful UI interface design is also an important aspect that should be taken seriously, providing a good user experience for the development and use of subsequent applications.

The Android application is written in Java language, and the construction process of the application is shown in Fig. 2.

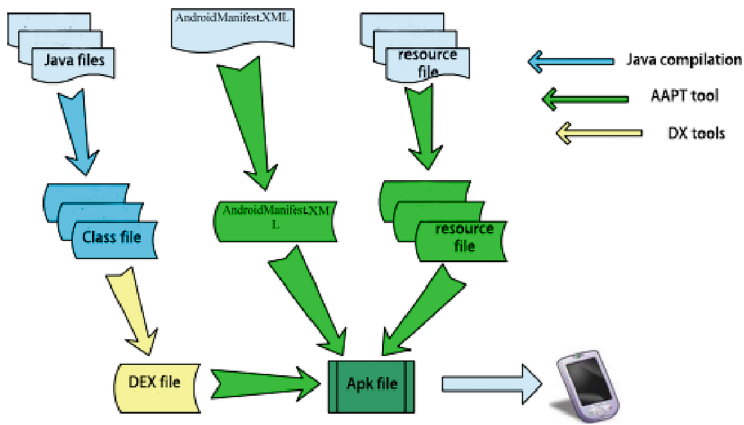


Fig. 2. Android application construction process

3 Interactive System Platform Modeling

The modeling of interactive system platforms refers to establishing mathematical models of the interactive system platform and its related elements for analysis, simulation, and optimization. The interactive system platform consists of multiple components, such as input devices, output devices, central processing units, memory, etc. [14]. The model should provide a detailed and comprehensive description of these components. In addition, the model also needs to consider various practical application scenarios, such as different workloads and working environments.

In the modeling process, it is necessary to determine the structure and components of the system platform, establish Use case diagram diagrams, class diagrams, etc. using UML, analyze the system application scenarios and user needs, and determine the evaluation indicators and optimization objectives of the system model [15]. According to the purpose of modeling and the actual situation of the system, various methods can be used to build models, such as simulation methods based on physical process models, statistical analysis methods based on data, and optimization methods based on Cybernetics.

By establishing an interactive system platform model, it is possible to predict the performance of system operation, evaluate system stability, optimize system design, and provide important support for practical applications. In the process of establishing the model, it is necessary to strengthen consideration of user experience and human-computer interaction, in order to construct a more comprehensive and practical model. At the same time, the process of establishing the model also needs to consider the actual deployment conditions and resources, in order to promote and apply the model.

The structural design of an English grammar learning system should include the following aspects:

(1) Frontend interaction interface

The front-end interactive interface is an important component of the English grammar learning system, which should include diverse learning content and forms, allowing students to learn and test through interactive forms. The interface should meet the learning habits and psychological needs of learners, provide a convenient and fast interactive experience, and have considerable appreciation to reduce students' boredom.

(2) Background data processing and storage

The processing and storage of backend data is the core of arranging the entire system, including managing student information, collecting and storing student learning data, course settings, etc. The learning data of students is the foundation for comprehensive evaluation of their learning situation, and should be properly managed in a secure and confidential manner.

(3) Learning Model Construction

The construction of a learning model is the core content of an English grammar learning system. This model analyzes students' learning patterns through methods such as data mining and machine learning, recommends and provides content and emotional feedback, thereby better providing personalized guidance and assistance to students. Excellent model design can greatly improve the learning effectiveness of the system.

(4) Background management system

The backend management system is used to manage the English grammar learning system, including system operation, course configuration, teacher management, and student management. Among them, teacher management can achieve the addition, modification, deletion of course content, as well as the arrangement of tasks such as exams and photos. Student management is used to record students' personal information, learning progress records, etc., thus achieving comprehensive management and assistance for students' learning.

Solving the above problems can make it easier for users to accept English grammar learning effectively. Generally, the learning structure of English grammar based on interactive system platform is shown in Fig. 3.

The architecture and detailed design of an English grammar learning system should comprehensively consider the above aspects. Promoting educational informatization and achieving smart education has become a trend in the digital era. The implementation

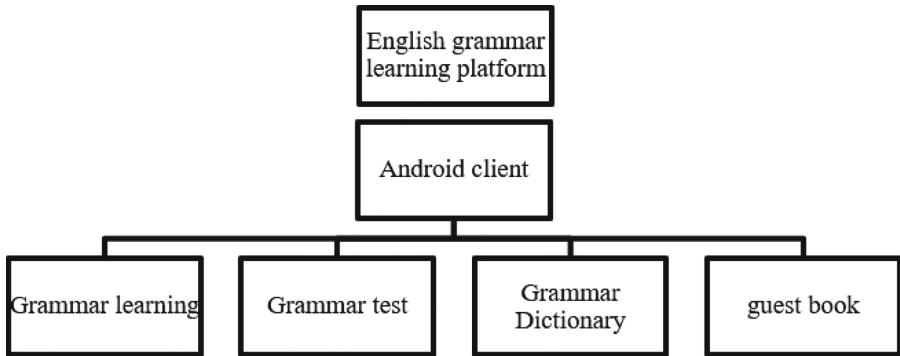


Fig. 3. The structure chart of English grammar learning system

of a comprehensive and cutting-edge English grammar learning system will bring more convenience to institutions, students, and teachers, while also providing better digital support for the construction of the education system.

The interaction between groups of learners is to provide them with a way to communicate through notes. Learners publish their learning experiences to other learners for viewing through notes. Learners can communicate with each other through the notes platform, thereby achieving the purpose of communication and learning.

The interaction between learners and teachers can also be conducted through notes, where teachers provide assistance to learners and provide targeted guidance based on their test results.

The interaction between learners and the system continues from the moment they log in to the system. The learner login system first completes the learning needs questionnaire provided by the system. The system obtains the characteristics of the learners from the questionnaire, and provides personalized learning materials to the learners based on these characteristics. In order to achieve miniaturization, the learning materials provided by the system are relatively fragmented. The granularity of these learning materials is minimized, and each fragmented content is tested. The system obtains existing test results for learners, recommending new learning content or knowledge that learners have not yet mastered.

The above three interaction methods can form a complete closed loop, in which good information interaction can be conducted, and a virtuous cycle can be achieved between various levels, which can provide learners with better quality services.

Set training data sample: $\{z_i = (x_i, y_i)\}$, where the formula of the starting problem of C-SVC is expressed as follows:

$$\min \frac{1}{2} \|w\|^2 + c \sum_{i=1}^n \xi_i \tag{1}$$

The problem can be expressed as follows:

$$\min \frac{1}{2} aQa - ea \tag{2}$$

$$\text{sgn}(w\phi(x) + b) = \text{sgn}\left(\sum_{i=0}^n y_i a_i k(x_i, x) + b\right) \tag{3}$$

The training sample data is very large, and the data redundancy and repetition rate for processing and time waste for platform operation. as shown in Fig. 4.

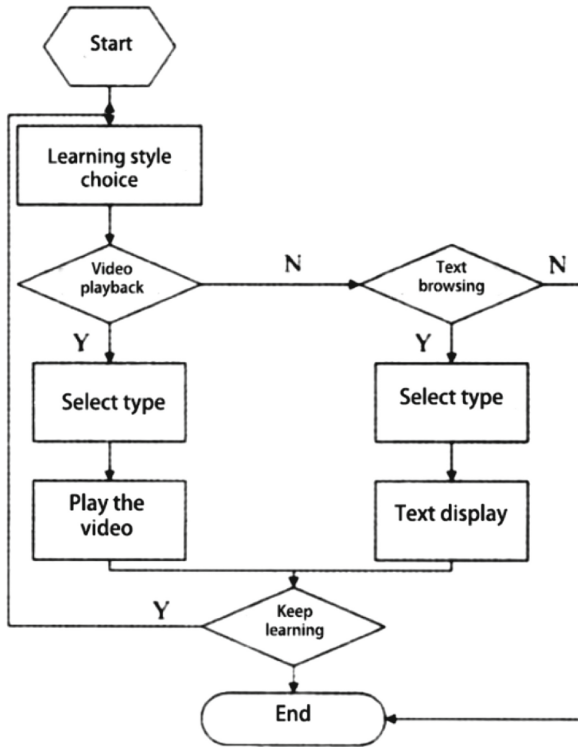


Fig. 4. Grammar learning flow chart

In the network architecture of a mobile interactive autonomous learning system, clients and servers are connected through Web services on the cloud, and the entrances to the server cluster are secured through firewalls. Connect a load balancing server at the entrance of the Web server, which can make priority response decisions based on the actual user volume and access traffic, thereby achieving high-performance and intelligent traffic management and achieving optimal server cluster performance. For access to functional services, due to the idea of designing a system Web Service, module calls are independent of the operating platform. Therefore, the Web server consists of a Web server cluster composed of Weblogic. Using different types of Web servers in combination can fully utilize the advantages of Weblogic. Some content download services can be placed on file servers, which can achieve faster download speeds, Put some security controls and content upload classes on the application server to fully utilize the security performance of Weblogic. Such a Web server configuration can fully utilize the respective advantages of the servers to achieve a partial traffic load balancing strategy. Due to the of content pages and images in the after years of use, it is necessary to use a dedicated file server to store media resources such as system images, document files, and so on. Moreover,

the servers in the server end all implement cluster configuration, mainly considering the load balancing of servers and the principle of dual machine backup.

4 System Implementation

The system combines advanced engineering management concepts and experiences and the actual situation of mobile interactive autonomous learning, utilizes the powerful processing and computing capabilities of computers, and utilizes Internet technology to stably and reliably transmit signals. It builds a standardized, integrated, and automated data processing platform that meets the needs of various schools. Theoretically, the more functions a system implements, the more connections and combinations between modules will be, and the greater the workload of designing test cases and testing phases will be. However, in the actual running process of an application software, the software errors that actually occur are only a small subset of the software error space set. Therefore, for the testing of an application software, as long as all combinations in the actual running process are considered and possible errors that may occur are identified, the testing purpose is achieved.

In order to better meet the testing objectives and specifications of the mobile interactive autonomous learning system, the following plans are followed during the system testing process:

- (1) **Hardware configuration.** First, prepare the hardware device for running the application software, and configure the device to the correct operational networking state. The testing machine was undertaken by a computer with a Windows 7 operating system installed.
- (2) **Run the test.** Access the system on the device, send various data requests to the server through the client, and interact with the system under test in this way to simulate the user interaction of the system in a real environment
- (3) **Observation.** Record the system's response speed, response results, interface output, overall system smoothness, and other information.
- (4) **Review.** Based on the actual performance of the software running test cases, refer to the specification obtained during the requirements analysis and system design phase, analyze the problems that occur in the software, summarize and analyze them, and obtain the test results.

The comparison of the speed of the transmission of error messages, as shown in Fig. 5.

Through simulation analysis, the performance of the system can be comprehensively evaluated. By establishing a virtual platform, simulating the actual application scenarios of the system, conducting various tests to ensure the accuracy and efficiency of the system, optimizing the system's usage process and interfaces, and improving the user experience. Secondly, simulation analysis can improve the stability of the system. Through simulation and testing of the system, problems in model design are identified and corrected to avoid system failure and collapse caused by design flaws, thus ensuring system stability. Finally, simulation analysis can improve the reliability of the system. System failures often greatly reduce user experience, and simulation testing can identify

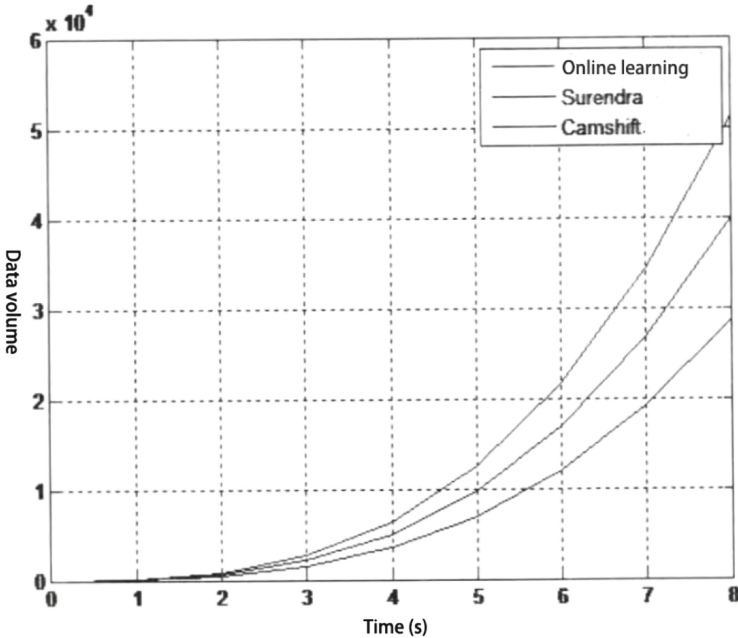


Fig. 5. Efficiency chart of three algorithms for data processing

vulnerabilities and potential problems in the system, repair and improve them, improve system reliability, and reduce user failure rates during actual use. It also has important guiding significance for subsequent system upgrades and optimizations.

The simulation analysis of an interactive English grammar learning system based on the Android platform is of great significance. Using simulation methods to test and optimize the system can effectively improve its performance, stability, and reliability, optimize the educational environment, improve learning effectiveness, and provide important technical support for the digital improvement of education.

5 Conclusion

The research on a research aimed at developing Android applications to teach and learn English grammar. This research paper will discuss this research and its development process in detail. The project is to provide users who English grammar or often need it with easy access to grammar information, because they study or work in different countries without native speakers of the language. It also helps them understand the ground rules. In we try to a mobile application that users learn English grammar by using various functions of Android phones. The main goal of the project is to provide a tool to help users learn and practice grammar rules to improve their understanding of grammar and communication skills. This will also help them understand how to use these grammatical structures in real life.

Acknowledgements. The research is supported by Program of Ideological and Political Construction of Foreign Language Courses and Professional Courses in Vocational Education in 2022, one of the stage achievements of “Empirical Research on Ideological and Political Teaching of Higher Vocational Public English Curriculum under the Background of New Liberal Arts”.

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