

Design and research of a new type of wrong question collection APP in the E era

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Abstract

The rapid popularization and development of mobile Internet and other mobile intelligent terminal devices have changed modern society and people's daily life. Due to the epidemic, students have to take online classes at home, and traditional learning methods can no longer meet people's needs for acquiring knowledge. Making a process-based and network-based error-collection APP has practical application value and social benefits. The article is based on the research on the functional requirements of English wrong questions, and comprehensively uses various technologies of the current mobile Internet, such as calling Baidu text recognition API for text recognition, calling the iFLYTEK API for speech recognition, and using Ebbinghaus Forgetting Curve Algorithm when generating wrong questions. Using the Java programming language and based on the SQLite database, an English error-collection APP with three roles of teachers, students and parents is implemented on the Android system.

Keywords

English error-collection; App; Text recognition; Speech recognition; Ebbinghaus forgetting curve algorithm.

1. Introduction

There is no doubt that accumulating wrong questions will improve students' grades. At present, the accumulation of wrong questions is mainly carried out in the form of handwritten records. This method is not efficient, and because the records are not electronic versions, they cannot be consulted at any time and cannot support AI teaching. Therefore, it is necessary and practical to develop a set of mobile Internet-based English error-collection.

2. Functional requirements

According to the user role, the main functions of English error-collection can be classified as follows:

Teacher function module:

View personal information, log out and modify personal information. Teachers can enter the main interface of the APP through the login interface of the mobile APP. The main interface has a navigation bar. Through the navigation bar, you can enter the personal information interface to view personal information, log out, and modify your personal information.

Enter the wrong questions into the wrong question bank, so that students can view the wrong questions on the main interface

Generate test paper, students can answer the paper

Check the student's answer sheet

Student function module:

View personal information, log out and modify information. Students also enter the main interface of the student role APP through the login interface of the English Error Cut APP on their mobile phones. Like teachers, they can enter personal information through the navigation bar to view personal information, log out and modify their personal information.

Wrong entry. Students who have their own mistakes can also enter

Generate test papers, complete the exercises and conduct self-examination

Check the wrong questions in the wrong question bank. Students can view the wrong questions in their own wrong question bank, which will be presented in the form of a list. Clicking one of the wrong questions will display the detailed information of the entire wrong question.

Answer questions.

Generate answer records

When students enter wrong questions, they can enter wrong questions through three aspects of text recognition, voice recognition and text input. The way of entering wrong questions is more convenient and more diverse.

Parent function module:

View personal information, log out and modify personal information

Check the student's test time and test scores

Check the record of wrong questions in the exam

3. System design and implementation

3.1. Selection and implementation of OCR text recognition

OCR text recognition on the Android side is a recognition technology that can recognize image text. At present, the common OCR on the market are as follows, as shown in Table 1.

Table 1: OCR recognition on the market

Character recognition technology	Development company	recognition accuracy	Price to use
IFLYTEK voice recognition	iFlytek	extremely high	Free for less than 60 seconds
Baidu Voice Recognition	Baidu	high	free
Tencent Voice Recognition	Tencent	high	free
Ali Voice Recognition	Ali	high	free

Considering the above table, Baidu OCR technology is considered. Baidu OCR supports multiple languages, its recognition rate can reach more than 95%, and it can be called for free within 50,000 times a day, which is in line with the development requirements of this project.

There are two main methods for Baidu's OCR to perform text recognition on locally uploaded images.

The first method: import the Android SDK for text recognition

The first step: log in to your Baidu account and create a general text recognition application.

Step 2: Download the text recognition SDK provided by Baidu platform and import it into the Android Studio project.

Step 3: Obtain the local absolute path of the token and the image to upload the request parameters and return the recognized text.

The second method: call directly using the api provided by the official documentation.

3.2. Selection and Implementation of ASR Speech Recognition

Android-side ASR speech recognition is a recognition technology that can recognize speech input. The general principle is to input the sound through the mobile phone, and the speech recognition process mainly includes several parts of speech signal preprocessing, feature extraction, and pattern matching. At present, the common speech recognition on the market are as follows, as shown in Table 2.

Table 2: Speech recognition on the market

Character recognition technology	Development company	Recognition accuracy	Price to use
Tesseract-ocr	Google	Low	none
Baidu OCR	Baidu	high	Free by the number of times
Tencent OCR	Tencent	high	Free by the number of times
Alibaba OCR	Ali	high	Free by the number of times

From the comparison results in the table, it can be seen that iFLYTEK's voice recognition is the industry leader. At present, iFLYTEK's voice recognition results are the most accurate. This time, it doesn't take more than 60s for iFLYTEK to cut APP voice input questions. Voice input of less than 60s is free, and you only need to create an iFLYTEK account and call the interface according to its official documents. Therefore, considering the overall consideration, we plan to call the iFLYTEK voice recognition API in this topic.

There are detailed integration steps in the msc development file under the decompressed doc folder at the Xunfei voice development integration address <http://www.xfyun.cn/>.

Get AppId

First register a developer account, add my app, and download the sdk (voice dictation).

After downloading, unzip the sdk, import the case into the project and run it to see the effect

Add the two jar packages under libs to the libs directory, and add other jar packages to the same path. The so file (interacting with c) is copied to the newly created jniLibs (L is capitalized) directory under the main path (don't forget to add the jar package), and the assert directory is copied to the main directory.

3.3. Database selection and demand analysis

At present, the most used databases on the market are MySQL^[1], SQL Server^[2], and SQLite. Their respective advantages are shown in Table 3 below.

Table 3: Database comparison

database	the platform	advantage	Applicable items
MySQL	Windows Linux	Process data fast and safe	Small and medium projects
SQL Server	Windows	Scalability and convenience	Enterprise project

SQLite

Mobile platform

Lightweight and flexible

Mobile terminal
project

By comparing the data in the table, SQL Server uses T-SQL statement, which is an enhanced version of SQL statement, which is suitable for enterprise-level projects and is not suitable for this project [3]. MySQL processes data fast, but MySQL cannot be embedded in mobile phones, so it does not meet the requirements of this project. The SQLite database is light and convenient, and can also be embedded in mobile phones, which is very convenient and meets the development requirements of this project.

SQLite is a lightweight relational database with fast computation speed and low resource consumption [4]. It's perfect for use on mobile devices. It not only supports standard SQL syntax, but also follows the ACID (database transaction) principle, no account is required, and it is very convenient to use [5]. SQLite is an open source small embedded relational database consisting of about 30,000 lines of ANSI C code [6]. It was originally released in 2000 and upgraded from version 2 to version 3 in 2004. It follows ACID features: atomicity, Consistency, isolation and durability, its characteristics are efficient, reliable, compact and practical.

In order to meet the functional requirements of the system, the following data items and data structures are obtained by comprehensively considering various data information involved in the system.

3.4. Data Items and Data Structures

Exam error questions: error question number, grade of error person, error time, semester of error question, error person, question source, test site, question type, question content, standard answer, options, answer analysis, answer analysis corresponding Picture, error reason analysis, picture corresponding to error reason analysis, type, answering time, wrong and right, and the answer filled in the test.

Answer questions: answer number, answer time, set of questions and scores

Entry of wrong questions: wrong question number, grade of error person, error time, semester of error question, error person, question source, test site, question type, question content, standard answer, options, answer analysis, answer analysis corresponding Pictures, error cause analysis, and pictures and types corresponding to error cause analysis.

User account: User ID, account number, password and type of user (teacher, parent and student).

User Information: User ID, User Avatar, User Nickname, School, Gender, Birthday, and Personal Signature.

Test paper: test paper number, test paper time, test paper type.

In order to realize the problem of user login and login role permissions, as well as modify the user's personal information, two necessary entities are required, namely user and role. There is a many-to-many relationship between users and roles. In order to simplify, it is divided into Two one-to-many relationships are established, and an intermediate entity user role is introduced. The corresponding E-R diagram is shown in Figure 1.

There are three main user roles in the Wrong Questions App, and the corresponding three permissions are parents, teachers and students. Different roles have different permissions when accessing each page or operating each function module.

The corresponding specific functional modules also include the following entities: students, parents, teachers, wrong questions and test papers. There is only one relationship (R) between entities: owning. The E-R diagrams are shown in Figures 2 and 3.

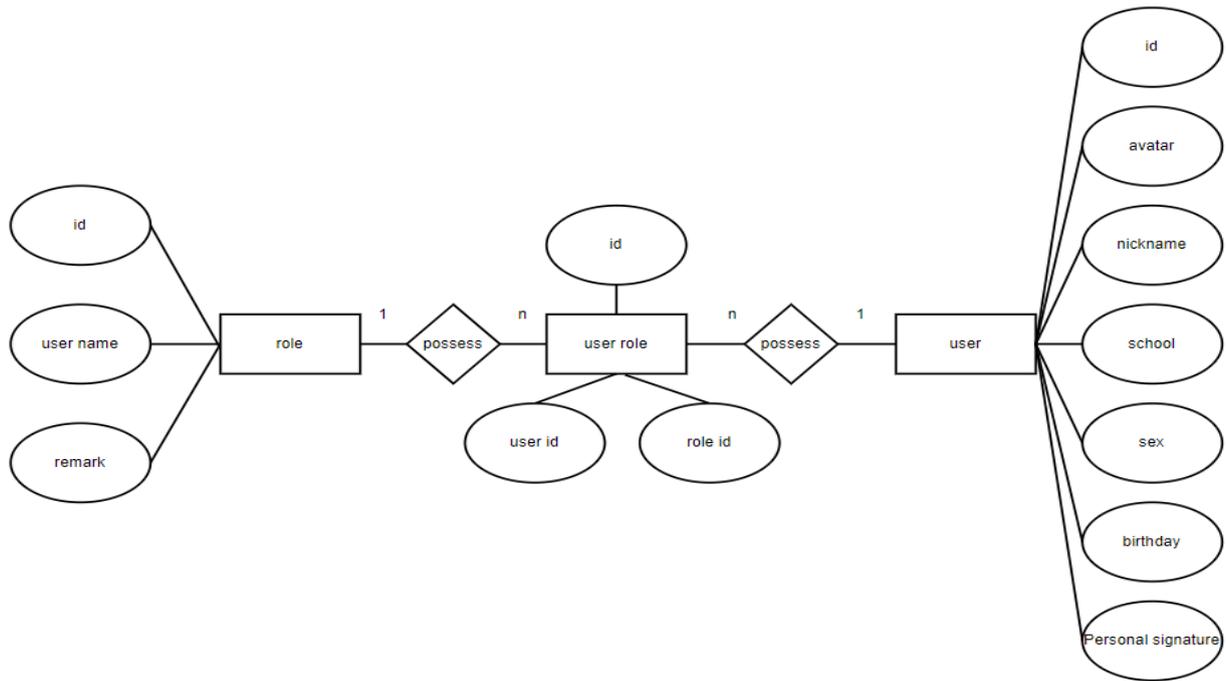


Figure 1: E-R diagram of user role related entities

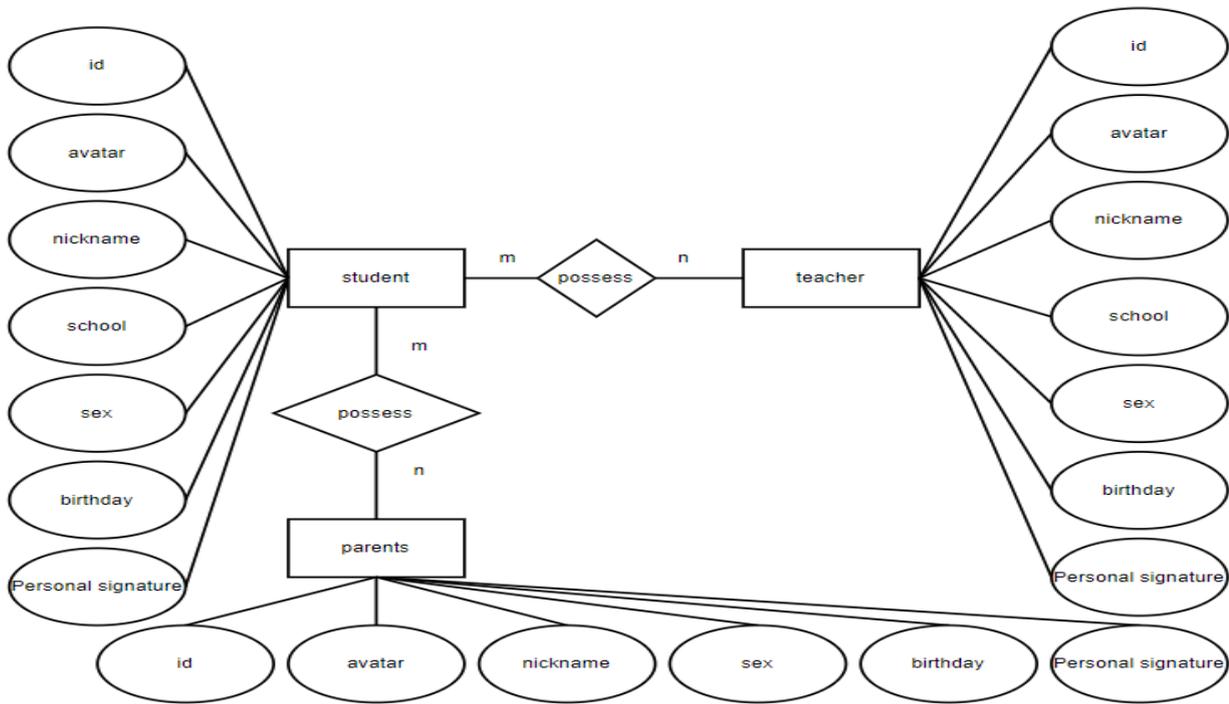


Figure 2: Overall E-R 1

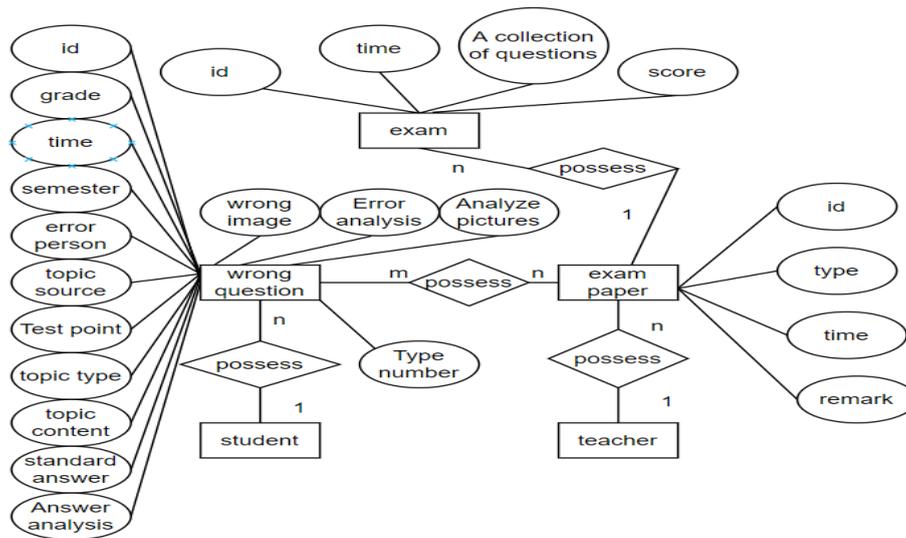


Figure 3: Overall E-R 2

3.5. Forgetting function

Quantitative analysis of the memory process and the number of things remembered based on observations of the Ebbinghaus forgetting curve, the amount of memory retained varies over time, starting very fast, gradually slowing down, until it finally tends to a stable value. As reflected by the curve, after a period of time, part of the memory acquired through learning is forgotten and part is kept in the mind, then, the part that is memorized is called memory retention. Later scholars proposed the retention function based on the curve [7].

The mathematical function formula (1) of the Ebbinghaus forgetting curve is as follows.

$$b = \frac{100k}{(\log t)^c + k} \tag{1}$$

Among them: b represents the storage amount of memory (unit: %); t represents the time interval from memory cognition to the current moment (unit: min); c and k are two control constants. Ebbinghaus has repeatedly demonstrated through experiments and found that when $c = 1.25$ and $k = 1.84$, the forgetting function is most similar to people's normal forgetting law [8].

3.6. Software operation flow chart

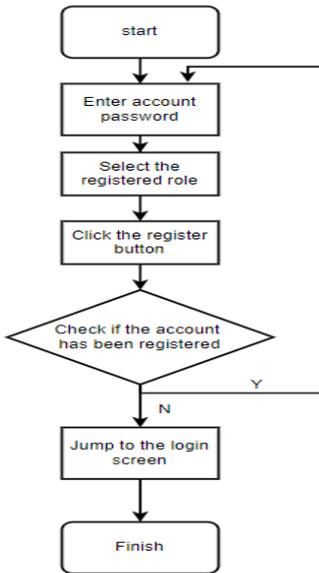


Figure 4: User registration process

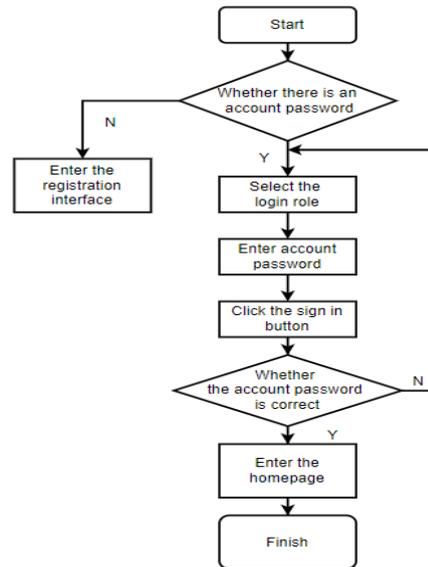


Figure 5: User login process

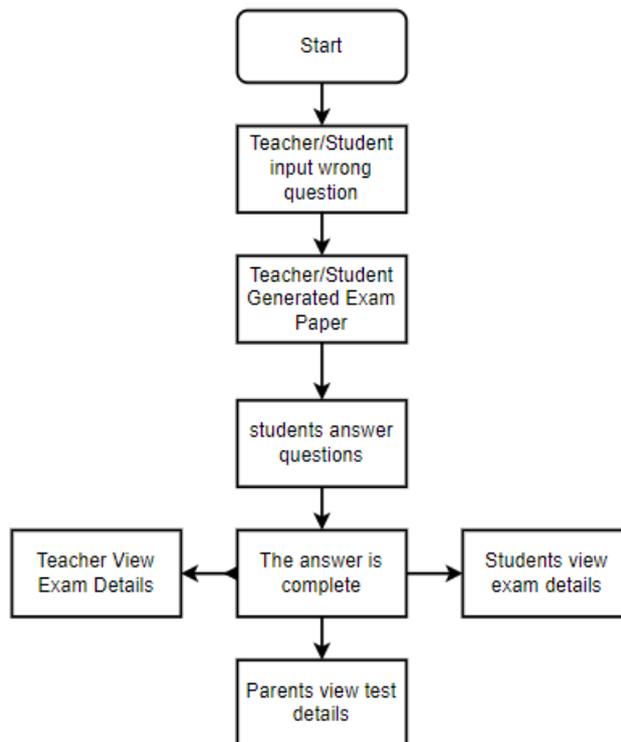


Figure 6: Student answering process

4. System test

OCR text recognition detection when entering wrong questions: mainly to test the accuracy of OCR text recognition to see if there are typos, missing words and other low-accuracy phenomena.

The test data is shown in Figure 7:

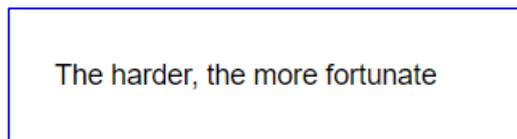


Figure 7

The OCR text test results are shown in Figure 8:

Figure 8

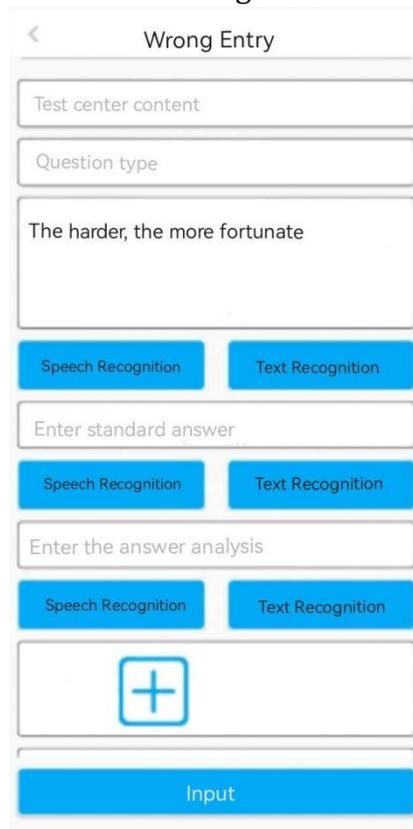


Figure 8

The tests of other functions are shown in Table 4.

Table 4: Other function test table

test function	Whether it passed the test
Register User Account	Yes
Login user account	Yes
View individual user information	Yes
Modify user avatar	Yes
Edit user personal information	Yes
Modify password	Yes
log out	Yes
Teacher wrong entry	Yes
Student wrong entry	Yes
Students check the details of the wrong entry	Yes

Teachers generate test papers based on test sites	Yes
The teacher generates the test paper according to the question type	Yes
The teacher randomly generated the test paper	Yes
Teachers generate test paper according to time	Yes
Students generate test papers according to test sites	Yes
Students generate test papers according to the type of questions	Yes
Students randomly generate test papers	Yes
Students generate test papers based on time	Yes
students answering questions	Yes
Students check answers	Yes
Teachers check students' answers	Yes
Parents check students' answers	Yes
Parents view student grades and time	Yes

The test results show that: the basic functions of the system are complete, basically meet the actual needs, and the system runs stably, and can achieve the expected results.

5. Conclusion

This paper mainly discusses the design and implementation of the APP in English from the basic technologies required for APP development, systematically expounds and analyzes the functional requirements of the APP in English, and analyzes the functions in the text from various aspects. Technical selection, detailed design of the database, and the realization of the basic functions of the English Error Chopping APP. Finally, the performance test of the system is carried out. The test results show that the APP has reached the pre-design requirements, and can basically meet the needs of primary and secondary school students for the accumulation of wrong questions, the management of wrong questions and the practice of wrong questions.

Through this APP, students, teachers, and parents can be truly linked online, and at the same time, it can cultivate the habit of using mobile phones to record wrong questions in time, so as to strengthen the accumulation of good wrong questions and redo them, so that learners can say goodbye to traditional paper and pencil storage. The disadvantage is that you can feel the unprecedented convenience and fast experience brought by technological development and mobile device upgrades.

At this stage, the APP only supports the learning of English subjects. After the system is launched in the later stage, it will also improve the collection and sorting functions of wrong questions in subjects such as mathematics, physics, and chemistry.

Acknowledgments

This research is supported by five projects: The demonstration construction projects of “Ideological and Political Course and Ideological and Political Course” in Yangtze University in 2021(No.41);The project of young people in the Education Hall of Hubei(No.Q20161311);The Yangtze Youth Fund(No.2015cqn53);The Yangtze University Students' Innovation and Entrepreneurship Training Program Project(No. Yz2021123).

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