

Design and Implementation of an Android EPUB3.0 eBook Learning System

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Abstract. With the rapid development of mobile Internet technologies, mobile learning has become a new way of learning, which is playing an increasingly important role in classroom teaching and autonomous inquiry learning. EBook realizes the perfect combination of traditional learning resources and mobile learning, and it makes the reading and learning much more interactive and interesting. At present, there are a variety of eBook formatting standards, among which EPUB 3.0 is of great advantages and has a wide application perspective. With the advantages such as supporting interaction and rich media resources, EPUB3.0 can help improve the user experience and is particularly suitable for the production and publication of eBook. In order to promote the application of EPUB3.0 standard in education, an EPUB3.0 eBook learning system is designed and developed for Android operating system in this paper. The requirements analysis and design framework of the learning system are introduced firstly, and then the functions of each module are given in detail.

Introduction

With the rapid development of communication technology and the popularity of mobile intelligent terminal equipment such as tablet and mobile phone, mobile learning has become a new way of learning. As a new type of personalized learning mode, mobile learning is formed by the combination of mobile technology and digital learning technology [1]. In addition to the basic elements of digital learning, the most obvious feature of mobile learning is that learners can use any mobile terminal at any time and any place to learn.

How to display various type of learning resources on the mobile terminal and provide users with better reading experience are two major considerations for learning resources of mobile learning. The emergence of eBooks achieved the perfect combination of traditional learning resources and mobile learning modes [2]. However, there are dozens of different formatting standards for eBook at home and abroad, such as PDF、EPUB、CEB、PDG、LIT. Due to the lack of a unified standard, the problems of repeat development of eBook and other digital resource have become the bottleneck restricting the development of eBook Industry [3]. Therefore, to standardize the formatting standard and achieve the interoperability of eBook on different reading systems become the focus of education and digital publishing industry.

At present, the PDF format is widely used by many eBook publishers because it can truly reflect the original document format, font, layout and other elements such as images of an eBook on display terminals. However, with the rise of cross-media publishing, particularly the increasing popularity of eBook reading on mobile terminals, the drawbacks and disadvantages of PDF format gradually appear [4]. For example, PDF is a format which is lack of the logical structure of the document, which means that the data analysis and other increasingly complex application cannot be realized easily [5]. In particular, the ability of PDF in supporting the interactive resources and video and other rich media is weak. Therefore, from the perspective of the needs of mobile learning and future development direction, PDF is not an ideal eBook format.

Aiming at the deficiency of the existing eBook standards, the International Digital Publishing Forum released a free and open eBook standard — EPUB in 2007, to replace the previous open eBook standards. In May 2011, the third generation standard EPUB, i.e., EPUB3.0, was officially released. Rich media resources such as video and audio, Adobe Flash, JavaScript interactive resource can be easily embedded to enrich eBook content and presentation, which can greatly improve the eBook reading experience. Currently, the EPUB3.0 standard is beginning to receive more and more support and recognition from digital publishers, terminal vendors and platform developers, which will be destined to play an important role in the development of eBooks [6].

Since the history of EPUB3.0 is short, it has not been supported by most eBook readers. In particular, these existing eBook readers are not tailor-made for education and teaching, and the functions of eBook system are not consistent with needs and characteristics of education and teaching. Consequently, there is no eBook learning system which can fully meet the needs of the actual teaching and learning. In this context, under the guidance of education theory and based on the actual needs of education and teaching, an EPUB3.0 eBook learning system is designed and developed for android operation system in this paper. It should be noted that, in order to further study the relationship between the learning behavior and the learning effect, the function of collecting data of user learning behavior is adopted in this system.

Requirement Analysis

Practice shows that the application effect of eBook learning system is largely dependent on the change of students' learning styles and teachers' teaching methods during the teaching process [7]. On the one hand, a good eBook learning system needs to provide teachers with effective tools which can support a variety of teaching methods and teaching modes; on the other hand, eBook system should also provide students with more learning resources and more interactive means to enhance students' learning interests. According to the analysis of existing eBook readers, functions such as page turning, comments, notes and retrieval are indispensable for an eBook learning system. Beyond that, the following four key functional requirements are put forward and adopted in the design of our system in consideration of the deficiency of traditional teaching and the requirement of mobile learning.

1. Strong cloud service support

Cloud service platform can provide a strong backstage support for the system, so that tremendous amount of eBooks, learning resources and other data can be stored on the platform, and it support simultaneous access at any time by large number of users. In addition, cloud service platform can store tremendous amount of digital resources and the user's learning behavior data.

2. The whole process record of learning behavior

The whole process record of learning behavior is a complete collection of all learning activities and learning behavior information of any user in the whole learning process, including three stages, i.e., pre-class, in class and after class. The recorded data could be useful source for the future learning behavior research.

3. Learning behavior detection, feedback and visualization

It is well known that the traditional teaching is more of a one-way communication, where the teacher is the dissemination of the knowledge and the student is the recipient, and the biggest drawback of it is the teachers cannot get the feedback information from students effectively, thus

affecting the quality of teaching and learning [8]. Through statistical analysis of learning behavior information, learners' learning attitude, learning effect can be analyzed from overall aspects, and the learning trajectory and growth process of learners can be displayed in a visual way, which can help to study the relationship between learning behavior and learning results. At the same time, it can help teachers find the problems during the teaching and learning process, and help teachers to modify teaching content and teaching strategy.

4. Support multiple learning models

In order to better meet the needs of practical teaching and make full use of eBooks' potentials, more functions and means should be putted into eBook learning system to support a variety of teaching modes, such as flipped classroom, personalized learning and inquiry learning.

Implementation of Learning System

Framework of eBook learning system.

As shown in Fig. 1, the system framework is designed based on the above design requirements, which includes four modules: cloud service, management platform, eBook reader and learning behavior record. In the learning process, students' learning behavior and learning activity information is recorded automatically, which is the foundation for the personalized learning in the future. As the figure shows, the learning behavior recording function is tightly combined with the modules of management platform and reader.

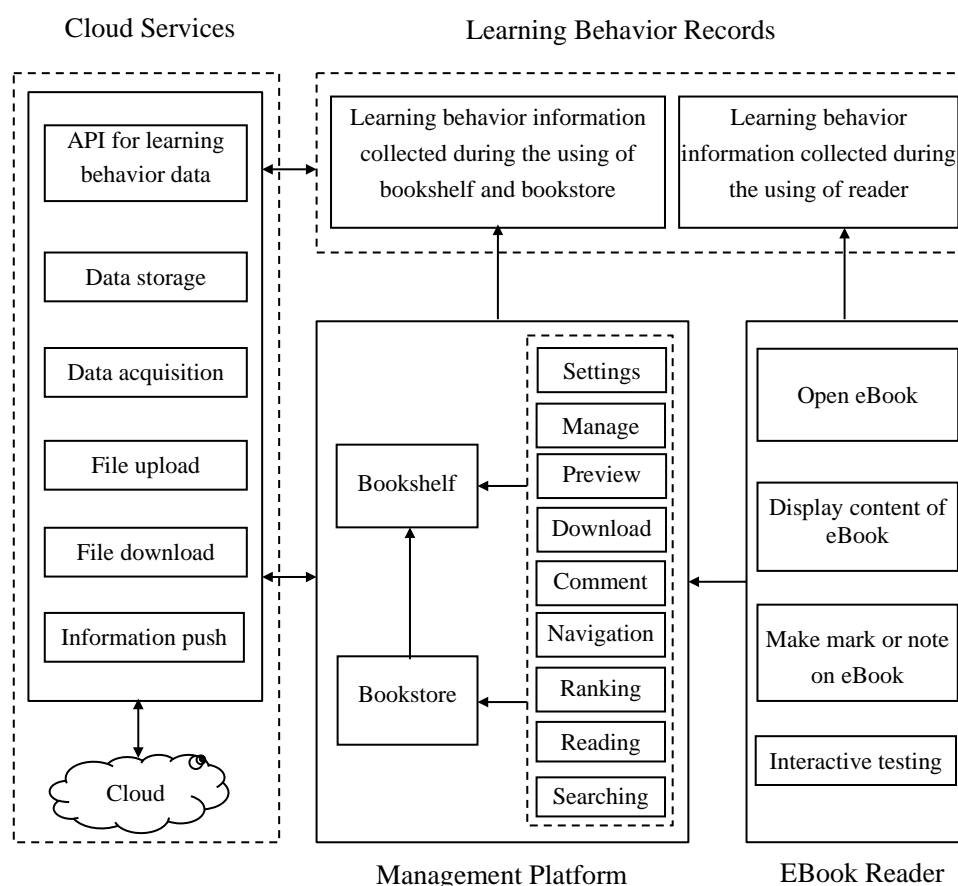


Fig. 1 Framework of eBook learning system

Cloud service is the basic of this learning system, which provides the foundation and prerequisite for realizing other three modules. API for learning behavior data defines the standard of learning behavior recording, and provides the corresponding APIs to store user's learning behavior data. Data storage and data acquisition provide a series of APIs to store and access the data. File upload and download are services for eBook upload and download. Information push provides teachers with the ability to select books from bookstore and push the selected books to the student.

Management Platform involves a series of functions in using book store and bookshelf, including attributes setting, bookshelf management, ranking, navigation and searching on bookstore, eBook previewing, reading, downloading and commenting. The data collected in the management platform can be used for future analysis, and it can help provide data synchronization among mobile devices.

EBook Reader is the core function and main component of learning system. It realizes the function of extraction and analysis of EPUB3.0 eBook, from which the text, pictures, video, Adobe Flash and interactive multimedia resources can be displayed. With the help of reader, user can view the book catalog, flip the pages and read the content of eBook just like the traditional way. Furthermore, eBook reader allows for bookmarking, highlighting, annotations of text and other interactive learning behavior.

Learning behavior records is to collect the learning behavior data of learners during the whole learning process, main part of which are interactive information generated in using the eBook reader. The statistical results of the collected data can be presented in visual form such as graphs, and the user can view the statistical results at any time to have a general view of his or her learning process.

User Interface and Function Realization.

Considering the differences between teaching and learning needs, the system provides teachers and students with different version. According to the functional requirements of teachers and students, the functions of eBook learning system can be divided into three parts, i.e., common functions, student-specific functions and teacher-specific functions, as shown in Fig.2. In order to provide a consistent user experience, interface and operation mode are similar in teacher version and student version. The three parts of functions are described as follows.

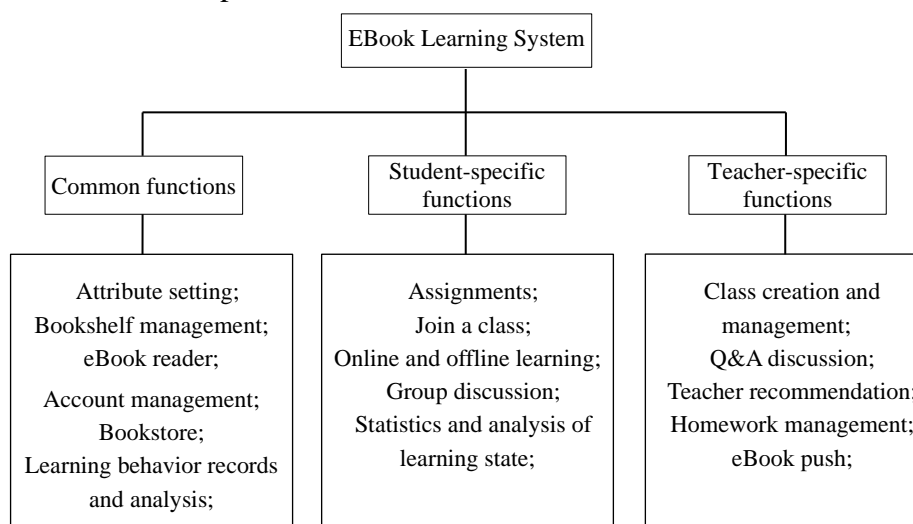


Fig.2 Function of eBook learning system

Common Functions.

(1) Attribute setting

Attribute setting supports user to personalize the attributes of the system. According to different learning situations and user preferences, attributes such as the font size, font color, background color, the brightness of the screen and content layout can be adjusted to construct a personalized reading environment. In addition, the user can also set the screen off time, sliding mode and so on.

(2) Bookshelf management

Bookshelf management help users to easily sort, search and read eBook on the bookshelf, with four main functions of display mode switch, book management, book sorting and local book management.

(3) eBook reader

EBook reader is the core function of the learning system, it's used to open and parse the eBook, so that the user can read the eBook just like a paper book. EBook reader provides a number of convenient tools the paper book does not have.

(4) Account management

User can login by inputting username and password on the terminal. After login, the learning record in current equipment will be synchronized with the information stored in cloud to ensure the continuity of learning. Moreover, the users can register, update and modify personal information.

(5) Bookstore

The bookstore has a large number of eBooks and learning resources that can be previewed and downloaded. The main functions of Bookstore are as follows:

- Navigation. In order to facilitate the user to view and browse eBooks, eBooks in bookstore are displayed according to some classification.

- Ranking. eBooks in the bookstore can be sorted by the times of previewing, downloading, commenting and collection according to all users' records. This function gives user an overall profile of the popularity of the eBooks, which could be also as reference and recommendation information.

- Theme. Theme is to organize related books based on certain topics (such as the senior high school entrance examination, college entrance examination or Band 4 English test).

- Search. The user can search eBook according to the book title, author and other keywords.

- Preview and Download. When clicking the title of an eBook, a new page will be displayed with information such as author, publisher, introduction, book catalog and other information of the eBook, and user can download the eBook that he is interested in.

(6) Learning behavior records and analysis

The data of the whole learning activities can be recorded, which can be used to track and demonstrate user's learning behavior and status, and after analysis, the data could be meaningful feedback of the teaching and learning.

Student-specific Functions.

Student-specific functions mainly center around learning related requirement, such as homework assignment, discussion, online learning and discussion. The sub-modules are described briefly as follows:

(1) Assignments

Students can view, complete and submit answer of assignments through this sub-module. The system will automatically remind user once there is a new assignment.

(2) Join a class

After the teachers create a class, students can apply to join the class.

(3) Online and offline learning

One major characteristics of mobile learning is learning at anywhere and anytime. In offline learning, the information of learning activities can also be recorded, which will be automatically synchronized with those in cloud once the terminal is connected to the network.

(4) Group discussion

User can initiate a group discussion. The users in the group can freely take part in the discussion. Meanwhile, the student can also ask teacher questions.

(5) Statistics and analysis of learning state

User's learning behavior data is processed and analyzed in this sub-module, and the results can be used as feedback and will be important components of user's learning archive.

Teacher-specific functions.

(1) Class creation and management

Constructing a class is the beginning and base of all other teaching activities.

(2) Q&A discussion

Teachers can set up a discussion group where students can share the ideas for given topics, and the teacher can also take part in the discussion. Moreover, one-to-one discuss between a teacher and student is also feasible in this system.

(3) Teacher recommendation

Some good eBooks or learning resources can be recommended to all students in the class or some designated students.

(4) Homework management

Teachers can assign homework or exercise to the students. At the same time, teachers can correct students' answer to homework and give comments to the answer.

(5) eBook push

This function provide teacher with convenient tool to send learning resources to students. For example, before the class teacher can send some materials to the students, so that students can preview the content to learn beforehand at home.

Conclusion

This paper introduces the design and implementation of EPUB3.0 eBook reader system for Android platform. Currently, the research of mobile learning and the development of related system are still in the early stages, and due to the limit of time, only a primary version of the leaning system is completed in this paper. In order to meet the growing needs of learners for mobile learning, there is still a lot of work to do. For example, the application of statistics and analysis of the collected learning behavior data in the system is still preliminary, big data analysis technology need to be adopted in the future development.

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