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## Research and Development of Intelligent Learning Aided Software

Fu Li Chen, Yue Feng Chen\*, Yin Qiao Peng, Bi Feng Guo, Wei Tao He

*Faculty of Mathematics and Computer Science, Guangdong Ocean University, Zhanjiang, 524000, China*  
*School of Electronics and Information Engineering, GuangDong Ocean University, Zhanjiang 524088, China*

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### Abstract

With the development of modern mobile intelligent technology and the popularity of the Internet, online learning mode has been accepted widely. However, there remains many problems make the users learn in low efficiency. This paper introduces the introduction and development of intelligent learning aided teaching model. According to the problem mentioned, we analyze the relevant cases to find out the reasons and develop an intelligent learning aided software which integrates knowledge with practice based on JavaEE architecture. The software addresses the problem of learners' inefficient learning, weak hands-on ability and inability to apply the knowledge to practice which is significant to online learning's future improvement.

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### 1. Introduction

With the increasing recognition of online education [1], the global online education market has entered a new stage of development. The successive entry of Internet giants such as Amazon and Google into the online education market has affected the entry of startups, Internet enterprises and venture capital. As the modern mobile intelligent technology developing, the popularity of the Internet and the diversity of learning methods make the online learning model accepted. The number of schools and enterprises across the country using student-aided software to assist teaching is on the rise. But at present, most of the online education methods are relatively rigid and users' learning

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\* Corresponding author. Tel.: +0-000-000-0000 ; fax: +0-000-000-0000 .

*E-mail address:* [yuefengch71@126.com](mailto:yuefengch71@126.com)

efficiency is not high. An online learning program therefore is needed to improve users' learning efficiency as well as learning interest.

The intelligent learning aided software Knowledge and Practice mainly provides users with a complete knowledge system framework and reasonable practical training so that users can understand the whole knowledge system framework and their future learning trends before learning, letting users deepen their understanding of knowledge through practice in the learning process [2]. We carry out the background development of the software based on the traditional B/S architecture [3], the RESTful style interface [4] and nginx for the management of static resources [5]. The knowledge tree is mainly developed by referring to tree framework of H5 [6] and using the JSTree.js control. In terms of platform operations, we implement RBAC control through Spring Security [7] and single sign-on through Spring Security and Oauth2 [8].

The course provided by software Knowledge and Practice presents the knowledge structure of the whole course in a mind mapping [9], and it takes the real and achievable case as the root of the mind mapping, allowing the users to pass root node of the mind mapping to probably know what tasks or jobs they can do after having the course. The child nodes of the mind mapping are composed of the knowledge content and real practice cases needing to complete the parent node so that the process of users learning is the process of completing the whole case, which can greatly stimulate the ability of improving the learning efficiency of the users.

In the software users can enter the course and browse the knowledge system framework when searching for the corresponding learning courses. Through the knowledge system framework, they can decide whether the course is what they need. If with a certain foundation and ability, users can find the starting point of the current learning through this knowledge system framework easily.

During the learning process, the users can review and summarize the knowledge through the practical cases of the child nodes on the course mind mapping to improve the learning efficiency.

In summary, we draw on the advantages of the current online education platform, combining our proposed reverse learning thinking to develop an intelligent learning aided software which integrates knowledge and practice to solve the shortcomings of current online education.

## **2. Description of Research Work**

### *2.1. The Conditions Around the World*

Although online education in China has developed rapidly in recent years, it remains infancy compared with western developed countries. The number of American college students participating in online education continues to grow, and the proportion of institution of higher education is increasing [10]. However, the online education mechanism in America is similar to that in China, mainly based on online knowledge source sharing, but it works without considering how to improve the efficiency and quality of students' learning, making it prone for students to lack of motivation in the learning process.

### *2.2. Direction of the Research*

This paper mainly studies the demand, development and operation of the intelligent learning aided software Knowledge and Practice. In the requirement analysis of it we study that the main reason for online learners' low efficiency in learning is that they always read a lot of documents, watch many videos without operating practical case in time. Thus, we solve this problem by integrating knowledge with practice through combining the course and practical case. The main users of the software are students and educators. Nowadays, the educational system of most universities in China is web version. The webpage has a cross-platform nature, both the windows system and the macOS system can run the software well on the own device. In order to better connect with the university educational system and improve the applicability of software we decide to develop a web version of the software. And for the later operation and promotion, we research and develop the third-party support that can be compatible with current courses on other online platforms.

### 3. Implementation and Key Technologies

#### 3.1. Knowledge Tree Creation Tool

The knowledge tree creation tool is mainly for instructors to create courses. It provides educators with tree tools, node function tools, course information compiling tools, etc. The educators can view the course list they designed and enter the list to edit the existing courses or create new courses. In the process of creating or editing the course, the tree tool is provided to enable the educator to save the current course, change the node styles, edit the node courses and withdraw the node operations. The toolbar of node function pops up when right-clicks the node. It provides functions for adding a child knowledge node, deleting the current knowledge node, entering the knowledge editing, changing the node style, and adding the node associations. These tools allow educators to diverge a complete practical case into multiple dependent knowledge points, which in turn can continue to diverge into multiple child dependency points until there is no need to diverge. Then the educators fill the contents of each node. The practical case is the root node of the whole tree and its node is the corresponding courseware information. This kind of “reverse” courseware allows students to know more clearly how many parts of the practical case they can complete through the current course learning. This goal-oriented learning-driven curriculum model promotes students' motivation. In addition, educators can also provide multiple practical cases in the future, making them a multi-faceted development course.

### 4. Design and Implementation of the Software Based on JavaEE Architecture

#### 4.1. Module Design of the Software

From Fig.1 we can see the Intelligent Learning Aided Software Knowledge and Practice is mainly composed of Course Platform Module, Teaching Module, Learning Module, Teaching Material Providing Mutual Aid Module and back-end management module. Among them the Teaching Material Providing Mutual Aid Module is used to cooperate with 3rd party software to obtain corresponding information to facilitate the service provision of our software. The back-end management module is for platform operation.

Knowledge and Practice is an online service product. It mainly aims at satisfying the users' effective use of their spare time. It enables users to learn the technical skills needed in society in their spare time, expands their knowledge and improves their technical skills, so that the users can have a foothold in society. At the same time, it also provides a teaching platform for educators where educators can publish their courses to the platform for users to learn.

We use Maven tools to manage the JavaEE framework package, SpringBoot framework to configure the project, SpringMVC framework to interact with the front-end, back-end business of the software, and Spring Security framework for rights management. Finally, we use Mybatis framework and Mysql database to perform data interaction (see Fig. 3).

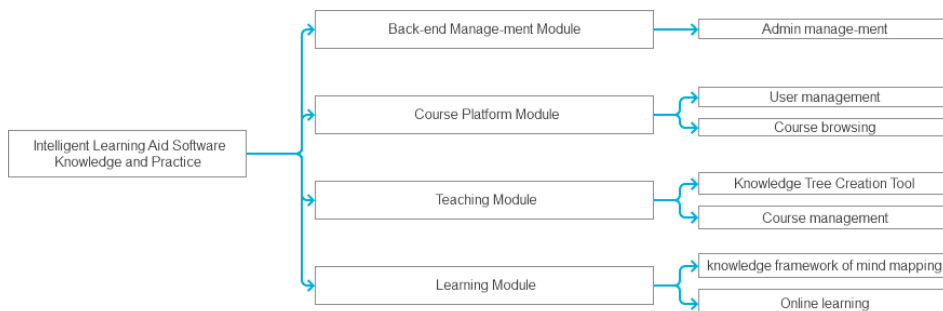


Fig.1. Module divisions of Knowledge and Practice

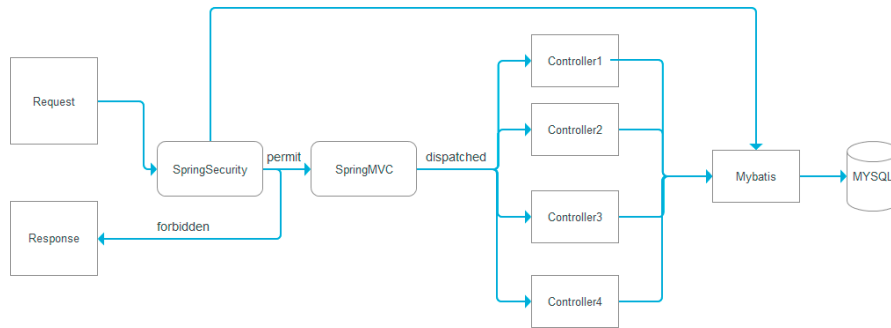


Fig.2. JavaEE Architecture

#### 4.2. Course Platform Module

The Course Platform allows educators to publish teaching courses as well as students to browse, search and acquire courses. Educators can categorize and publish their own courses according to the field of knowledge and skills. They can also summarize or elaborate their own courses. After the release, they can interact with students to maintain and improve the course enthusiasm by modifying or updating the course. The platform will set up a ranking according to the number of students in the course, namely, the more people in the same knowledge and skills areas learn, the higher the ranking, the higher the flow of students obtained.

Students can search for the corresponding courses according to their own learning target and knowledge domains learning or collecting the courses they are interested in. The platform will also push the corresponding courses on the students' homepage according to each student's learning situation, which can help them save time of the users from searching courses. In addition, the platform works with experts in the relevant knowledge areas to develop a better learning planning system for students to use.

#### 4.3. Teaching Module

In terms of teaching, our software provides a teaching module for the aiding course. The teaching module provides educators with a tool to create knowledge and skills tree (see Fig. 3). Educators can diverge knowledge and skills points according to specific goals and compile courses more conveniently. The knowledge skill tree creation tool is mainly composed of mind mapping tree module, course import module and course toolbar module, which makes it convenient for the educator to design the course and integrate the knowledge system framework into the mind mapping.

Mind Mapping Tree module mainly provides the operation functions of Mind Mapping Tree, such as adding, deleting and modifying nodes. The Course Import module mainly provides the classification and uploading functions of knowledge resources. The knowledge resources are divided into three categories, word documents, powerpoint documents and video resources. Educators choose different resource types according to their own needs, and then upload them to the corresponding mind mapping tree nodes. Educators can also selectively upload additional resources such as after-school exercises.

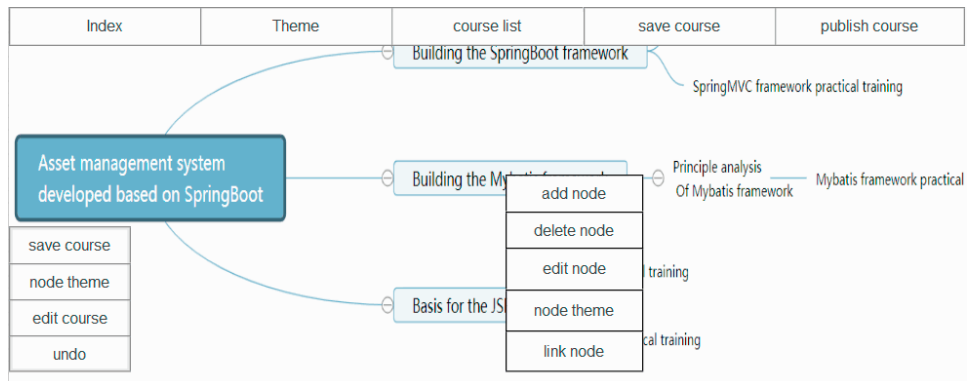


Fig.3. Knowledge Tree Creation Tool

#### 4.4. Learning Module

In the aspect of learning, our software takes the user's goal as the learning entrance, letting the user start from knowing what he wants to do and what he will be able to do. Then according to the goal, diverging the courses into the corresponding and needed knowledge system. It can stimulate the user's interest in learning and indirectly improves the user's hands-on frequency. Because it tells the user the way to achieve his goal, in other word, it lets the user understand what he needs to learn to realize the goal. The characteristic of the software, knowledge as the help while use as the main, deepens user's knowledge learning impressions, thereby improves the user's learning efficiency [11]. Students can also raise their own questions during the course or supplement the course's inadequacy to help educators improve the course gradually.

The learning module is mainly for conveniently helping the user to learn better. The module consists of the course knowledge system framework overview module, knowledge learning module, note-taking module and after-class practice module.

Because mind mapping can effectively improve students' memory ability [12], our curriculum knowledge system framework overview module is mainly presented to students in the form of mind mapping.

The course knowledge system framework overview module mainly provides an overview function of the course knowledge framework mind mapping tree issued by the educator. Users can select the mind mapping tree node according to their own needs for learning. The knowledge learning module provides the user with the function of getting resources for learning while the note-taking module mainly allows the user to record the corresponding information while learning to facilitate later viewing. Users can directly view the notes written by others or share their notes for others. The after-class practice module is to provide users with optional additional practice homework.

#### 4.5. Back-end Management Module

In terms of platform operation, we maintain and upgrade the platform through the back-end management module. This module mainly provides administrator management functions. We execute RBAC control through Spring Security and we implement single sign-on through Spring Security and Oauth2. Super administrators can generate administrators through this module, and empower administrators to operate, while administrators can perform audit management, report feedback management of tutorials and other operations through their own permissions.

Through the back-end management module, we can manage the platform operation of the entire project. Through the course platform module, users can search for the courses they need. In terms of teaching and learning, users can use the teaching module and the learning module to perform corresponding teaching and learning.

All in all, the division of the function modules is brief and clear, the high degree of aggregation of these function modules improves the independence of each module, and the low degree of coupling reduces the mutual influence and constraints between the modules thus improves the performance of the system as a whole.

## 5. Case Analysis

Here we will mainly introduce the case of course creation and the case of course learning.

### 5.1. Course creation case

First, we choose the field and classification of the course and improve the basic information of the course, such as introduction, course pictures, etc. Then we create the knowledge tree of the course, that is, the subject design of the course.

We establish the root node of the knowledge tree according to the teaching purpose of the course. The main of the teaching purpose is a concrete and achievable case completed by a knowledge system framework. We diverge the root node into several sub-nodes of the same level. These sub-nodes are generated to meet the teaching purpose. After perfecting these sub-nodes, further divergence is performed according to the knowledge framework of each sub-node, and the sub-knowledge points required for its sub-nodes are diverged. If subsequent descendant nodes cannot diverge, the descendant node becomes the basic knowledge point. The goal of each sub-node is to achieve the final teaching purpose. Therefore, in addition to the required knowledge content, each node also contains the corresponding sub-module content of the teaching purpose. When the user completes the module content that the node needs to complete. Not only does he learn knowledge, but achieves the teaching purpose.

After completing the knowledge system framework formed by diverging for teaching purposes, we need to add corresponding course content to all the nodes. The course types are divided into three categories, namely powerpoint, Word and video. Among them, we realize the online display of powerpoint by combining Jsp and Javascript [13]. We convert the word document and present it to the user as a resource file [14] by combining the OpenOffice and SWF Tools framework tools. As for video files, we use the webpage adaptive method to solve the video adaptive size problem [15]. At the same time, the teacher users need upload the sub-module content file of the teaching purpose, so that allowing the students to learn from the node while completing the teaching purpose. In addition, the teachers can appropriately some after-school exercises in the knowledge nodes to supplement teaching.

Teacher users can save the currently designed teaching courses at any time, edit the published teaching courses, and add new knowledge routes after the course is released. User-issued courses need to be approved by the administrator of the platform before they can be released. If there are violations in the future, administrators have the right to disable the course by removing the course from the shelf.

### 5.2. Course learning case

Student users confirm the knowledge fields and classifications they need to learn firstly, they can search related courses directly through keywords [16]. Then in the course they search, the users can compare the profile, knowledge system framework or user comment of the courses to select the learning courses they need.

After choosing the course, the users enter the knowledge system framework tree of the course and chooses knowledge nodes to study according to their own needs. In the course, students are advised to follow the course for practical operation, but it is not mandatory, and after-class practice is the same.

## 6. Evaluation and Future Improvement

At present, the software effectively improves users' learning efficiency and enthusiasm, enabling them to have a full understanding of what they are going to learn and how to achieve it before they start learning. It realizes the transformation of learning from manual and mechanized to planarity and informationalized, strengthening the communication between teachers and students and promoting the development of teaching. It is of great significance for self-study and learning resources sharing among students across the country. However, due to funding and current technology limitations, our software still has some problems to be solved and optimized. They are incomplete resource storage management scheme and slow reading speed.

Thanks to the rapidly developing era of information technology, new technologies have emerged one after another, the artificial intelligence algorithms will greatly enhance the current software. Therefore, in the future time,

through big data analysis, the first step we will record the courses that the users have learned to push the users to the advanced courses that meet the courses they have studied before. And for users who have already selected the learning plan, we use the artificial intelligence to record the user's learning status and formulate a learning plan that matches the user's learning. For the further step, the software will find out the relationship between adolescents' psychological status and their learning ability. Finally, the data from the academic achievement can reflect the potential psychological disorder of the student. Then solve the problems according to the symptoms, so as to maximize the learning potential of each student.

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