Develop and Implementation of Laboratory Document Management System

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Abstract: Based on the daily document management requirements of College Students' laboratory, this paper proposes a laboratory document management system based on RBAC, JSP, jQuery, MySQL and other technologies through the analysis of the present situation of laboratory document management. The function of the system includes laboratory user management, authority management, course management, grade management and document management and so on. It is more conducive to the future function expansion of the system by using modular design ideas. The realization of the system further improves the information level of modern laboratory management, and has good application value.

1. Introduction

With the rapid development of information technology today, along with the continuous deepening of higher education system reform, higher requirements are put forward for the information management level of university laboratory. The traditional methods and means of laboratory document management have various disadvantages, such as the difficulty of storage of various paper documents and low efficiency of daily document management. The realization of electronic information management of laboratory documents has become the primary problem that needs to be solved in the development of university laboratories [1-2].

Using advanced information technology to develop network information processing system is an effective measure to deepen the reform of university education system. It can not only process laboratory documents in information, but also provide data support for the development of laboratory practice teaching. It is of great practical significance to do a good job in the information filing of daily documents in the laboratory, which can make the laboratory management more scientific and standardized [3-5].

On the one hand, the design and implementation of the laboratory document management system can optimize the allocation of laboratory resources and maximize the benefits. On the other hand, it can also realize the information management of laboratory documents and further improve the comprehensive management level of the laboratory [6]. By using the Internet and information technology, the laboratory document management system can effectively optimize and integrate the laboratory resources and teaching practice data, so as to enhance the support and service function of the system and further improve the overall training quality of talents in colleges and universities.

2. Key Development Technologies

In the process of system development, it involves many computer network technologies, such as JSP, jQuery, RBAC and MySQL, etc. The following is mainly a simple introduction to the key technologies.

2.1. JSP

JavaServer Pages (JSP) is a dynamic Web page technical standard developed by Sun Corporation

[7]. JSP technology USES the Java language as a scripting language to service HTTP requests from users and can work with other Java programs on the server to handle complex business requirements. JSP embeds Java code and specific changes into static pages and uses static pages as templates to achieve dynamic generation of part of the content. JSP introduces an XML tag called "JSP Actions" to invoke the built-in functions. In addition, you can create JSP tag libraries and then use them just as you would use standard HTML or XML tags. Tag libraries can enhance functionality and server performance without being limited by cross-platform issues [8].

2.2. EasyUI + jQuery

jQuery EasyUI is a set of UI plug-ins based on jQuery. The goal of EasyUI is to help Web developers create a rich and beautiful UI interface more easily [9]. JQuery is a fast, small, feature-rich JavaScript libraries. It leverages an easy-to-use API (available in a variety of browsers) to make things like HTML document traversal and manipulation, event handling, animation, and Ajax easier, while being both versatile and extensible, optimizing HTML document manipulation, event handling, animation design, and Ajax interaction.

2.3. RBAC

RBAC is role-based Access Control (Role-based Access Control), including three main roles, permissions, and users. The user can be assigned to a Role, and associated roles and permissions, The Role of different permissions can free configuration. In this case, if there is a new permission assignment scheme requirement, you just need to customize a new role and configure the target permissions to assign the user to that role [10]. This approach greatly simplifies the complexity of authority management. Roles are created to perform various tasks, users are assigned corresponding roles based on their responsibilities, and users can easily switch from one role to another. Roles can be given new permissions based on new requirements, or they can be restored from roles based on actual needs. Relationships between roles can be built to cover a wider range of objective situations.

2.4. MySQL

The database used in this system is the relational database MySQL, which uses the SQL language is the most commonly used standard language for accessing the database. MySQL database has the advantages of small size, fast speed, low overall cost of ownership, open source code, support for a variety of operating systems and development languages, excellent performance and stable service, etc. It is widely used and is the preferred website database for the development of small and medium-sized websites [11].

3. Analysis of System Roles and Functions

Through the user roles and functions, users using the system will be distinguished with different roles, and finally determine the specific obligations and rights that all kinds of users should enjoy, in order to achieve the authority management of RBAC. In order to achieve higher scalability and flexibility, the system adopts the RBAC authority management mode, where users, roles, permissions, user roles and role permissions can be set freely by the system. By default, this system assigns users of three roles, including laboratory administrator, teacher and student. The main functions are as follows:

(1) Role of laboratory administrator: the first class user of the system, the advanced user, responsible for the overall operation and maintenance of the system. The lab administrator has the highest permissions on the system, and he can assign permissions to other users or roles. The main functions of lab manager include system management, user authority management, course management, document management, grade management and log management. The flow chart of administrator user function is shown in Figure 1.

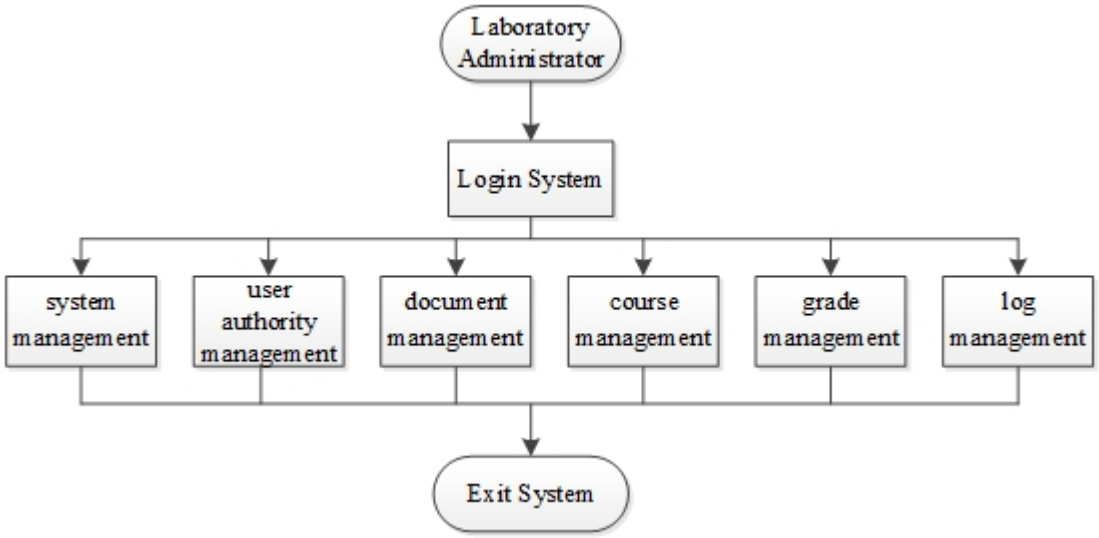

Figure 1. Flow chart of administrator function

2) Teacher role: the second category of users of the system, whose main functions include updating personal information, student information management, course management, course experiment information management, viewing students' course selection information, uploading and downloading course experiment report, and experiment result management, etc. The teacher user function flow chart is shown in Figure 2.

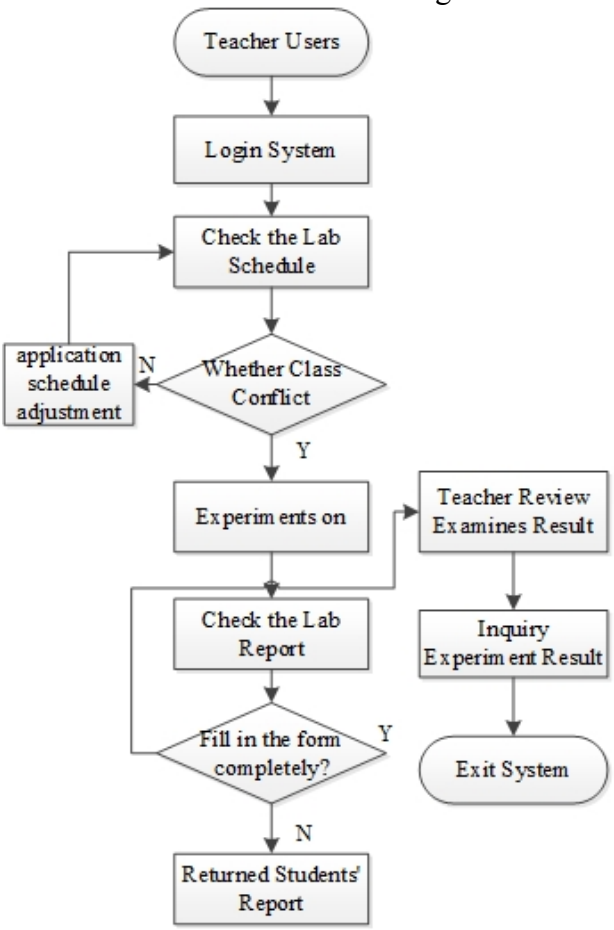

Figure 2. Flow chart of teacher function

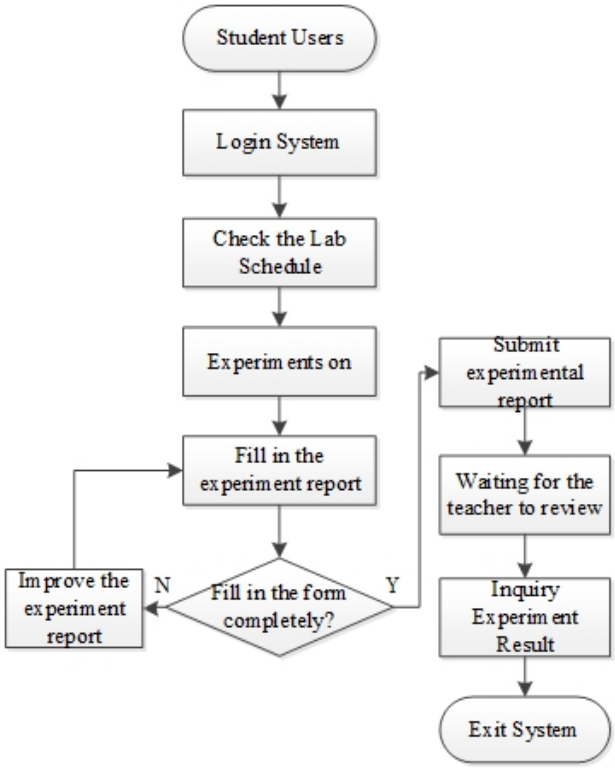

Figure 3. Flow chart of student function

(3) Student role: the third type of user of the system, whose main functions include updating personal information, managing personal experiment reports, viewing course information, viewing experiment scores, etc. The student user function flow chart is shown in Figure 3.

4. System Design and Implementation

4.1. System Design Principles

During the design and implementation of the laboratory document management system, the principles of practicality, safety and stability, openness and standardization, expansibility and maintainability should be observed, as shown below:

(1) Principle of practicality

The design and implementation of the laboratory document management system should truthfully reflect the functional requirements of teaching and follow the principle of practicality to design and choose the most valuable feasible scheme.

(2) Principle of security and stability

In order to ensure the safety and stable operation of the system, the isolation and protection of information data and the effective sharing of data resources should be considered in the development and design of the laboratory document management system. The issues involved mainly include password authentication, privacy protection of the application for users, platform security, data security, etc.

(3) Principles of openness and standardization

The laboratory document management system can interconnect with clients and servers, so that it can accept various mainstream browsers, develop data interface and cross-platform migration, etc.

(4) Principles of scalability and maintainability

With the development of the cultivation scheme of professional talents and the construction of laboratory, the system function modules will inevitably change. The extensibility and maintainability of the system design architecture greatly reduces the maintenance difficulty and cost when adding or modifying functional modules.

4.2. The System Overall Design

This system by adopting the idea of structured and modular design, and combining with the laboratory actual demand could be divided into several functional modules. The system on the function between each function module are independent of each other. However, the information is interconnected, which makes the functional modules communicate and cooperate with each other, thus realizing some requirements of the overall function of the system.

The functional modules of the laboratory document management system include: course management module, authorization management, user management module, grade management module and file management module, etc. The laboratory document management system functional structure chart is shown in Figure 4.

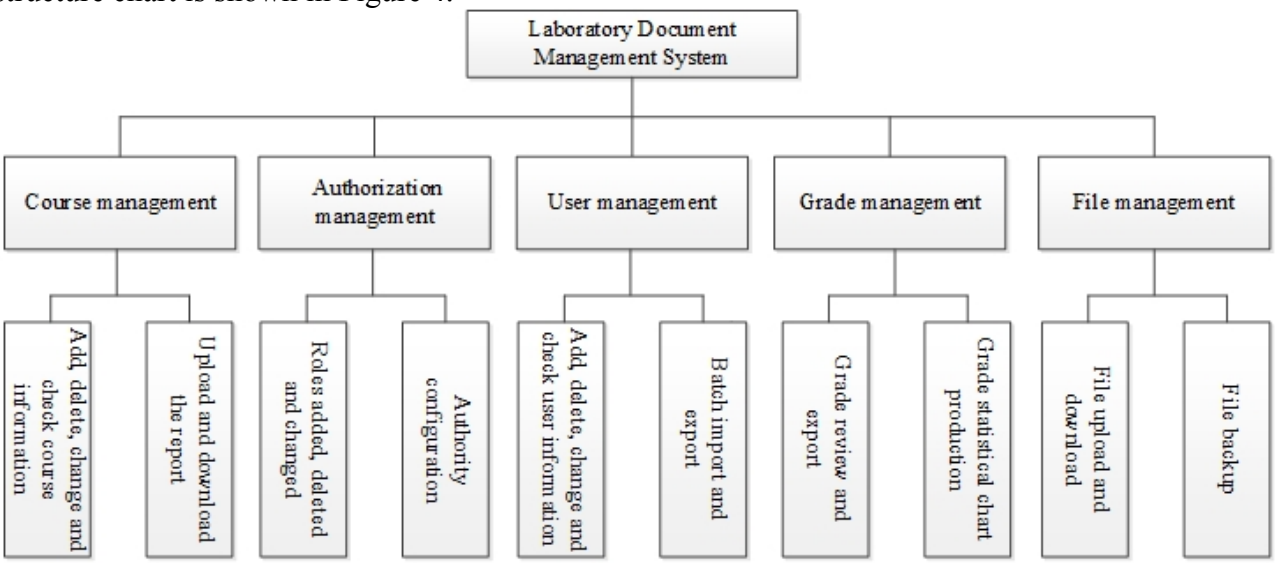

Figure 4. System functional structure chart

4.3. Course Management Module

The course management module is the basic function part of the whole system platform to meet the normal teaching practice needs of the laboratory and realize the existence value of the laboratory. This function module is responsible for the laboratory manager to input the course information into the system each semester, and arrange the course in the appropriate laboratory for teaching activities. The administrator has the right to find, add, modify and delete course information. Teacher users can view the course information and input or upload the experimental link information of the course according to the time of the system, and have the right to view, add, modify and delete the experiment of the course. Students can check the specific arrangement of courses in the lab this semester to ensure that they can finish the course on time. Meanwhile, they can download and upload the experimental report documents of the course, and timely complete the submission and feedback of the course assignments.

4.4. Authority Management Module

Authority management module is the foundation of the whole system platform and provides basic guarantee for the normal operation of other modules. The system has implemented RBAC permission control, and the administrator can complete the addition, deletion, maintenance and search of roles, configure the permissions owned by the roles, and check and verify the module information roles.

4.5. User Management Module

User management module is an important part of the system, which provides personal information data support for the normal operation of the system. This module realizes the functions of adding, deleting, maintaining and searching system users, as well as the configuration of users' role permissions and the update of users' personal information. In order to improve the usability of the system, the system also provides batch import and export function of user information.

4.6. Grade Management Module

The score management module is one of the core functions of the whole system platform, which can obtain the experimental scores of the course by associating students with the course. This module can be divided into two ways of showing achievements: list of achievements and statistics chart of achievements. The result list displays the result information of students' corresponding course in the form of list, and provides batch import and export function. Each course can also be visually presented to users in the form of graphs. This system uses echarts plug-in to generate the score statistics graph.

4.7. File Management Module

As the core function of the whole system platform, the file management module classifies, stores and backs up experimental documents related to the course. This function module can query, add, modify and delete experiment document report, and provide upload and download function for teachers and students at the same time.

5. Conclusion

The laboratory document management system adopts lightweight technical architecture design and implementation, which is suitable for the general operating environment requirements. Meanwhile, the system's powerful RBAC authority management module can realize the new authority processing requirements more efficiently. The realization of system function satisfies the daily document management requirement of university laboratory and greatly improves the level of university laboratory information management. The system adopts modular design idea, which is convenient for function update and extension in later period, and makes the system have a good life cycle.

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