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Research and Implementation of Big Data Technology Laboratory Equipment Reservation Management System

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Abstract. At present, the laboratory management system of most universities lacks functions and expansibility, so it cannot be adapted to laboratories with high degree of customization. Based on the analysis of the past experience of the laboratory management system in colleges and universities, this paper explores the construction of a comprehensive system suitable for the appointment management of laboratory equipment in colleges and universities. The system adopts Java Web related technology, Web database interaction technology and B/S architecture to form a modular structure with complete functions and flexible management. The construction of the system has realized the standardization, process and integration management of university laboratories, and promoted the effective utilization of university laboratory equipment in colleges and universities.

1. Preface

In recent years, colleges and universities have made great progress in the scale of running schools, but there are still problems such as lack of sharing mechanism and weak safety awareness. Therefore, in laboratory management, a series of laboratory management systems to improve the overall management level of the laboratory [1-3]. When establishing the laboratory management system, colleges and universities should use mature Internet systems such as the Internet of things to realize the comprehensive informatization of the laboratory equipment management in colleges and universities [4]. How to manage and use instruments and equipment more reasonably and establish a good equipment management system are urgent problems to be solved in the equipment management of colleges and universities [5]. This paper summarizes the current status of laboratory equipment management in colleges and universities, and draws on the experience of the existing laboratory management system, combined with the specific needs of the laboratory, explore the construction of laboratory equipment reservation management system suitable for college laboratory management.



2. Analysis of the situation

Laboratory information management system (LIMS) is the application of modern management ideas and computer technology in laboratory management and control [6]. From foreign studies, Jonathan Turner in Using the Open Network Lab, laboratory system design to demand as the goal, the system be able to meet the needs of Using personnel, function modular and network resource sharing. Some universities in China have established laboratory management network, but most of the systems can only complete the functional experimental course arrangement [7-10]. In order to solve the problems such as lack of information sharing mechanism, lack of innovative management system [11-12], it is necessary to design and establish a system which with strong openness, innovative management mode and the ability to fulfill the daily teaching needs of colleges and universities [13-16].

3. Demand analysis

3.1. Functional Requirements Analysis

By analysis, the system should have the following functions: (1) support user registration and login, and modify personal information; (2) support basic laboratory equipment management and laboratory personnel management; (3) supporting practical teaching management and daily teaching activities; (4) support laboratory equipment open reservation; (5) support data parameter management of laboratory assets, implementation of laboratory data storage, statistics and reporting functions; (6) Support system management. Fig.1 shows the overall design of system.

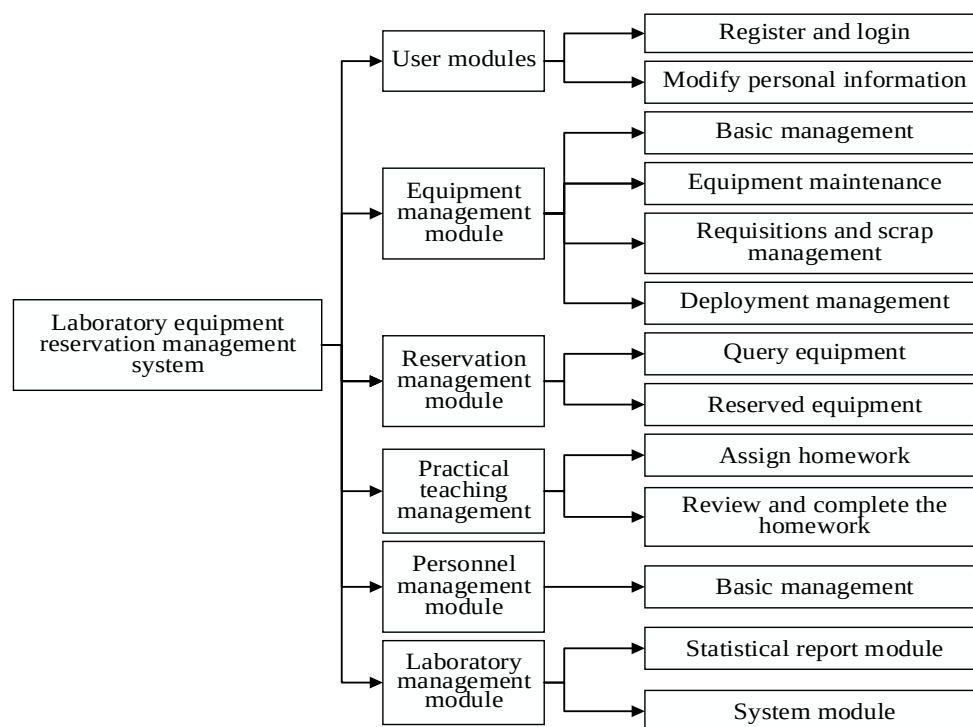


Figure 1. Overall design of system.

3.2. System Architecture

The system is divided into five parts: presentation layer, business logic layer, domain object layer, database access layer and database layer. And system uses Java Web related technology, Web database interaction technology and B/S architecture, and MS SQL database development and design in the internet environment. Fig.2 shows the architecture diagram of system.

4. Systematic design

4.1. Major Functional Module Design

4.1.1. Laboratory Management Module. The laboratory management module including statistical module and system management module. The statistical report module can automatically generate statistical reports, which can be reported by the administrator; in the system module, the administrator can issue an announcement to update the laboratory management dynamics in real time.

4.1.2. Laboratory Equipment Management Module. The equipment management module can manage laboratory equipment assets, establish relevant information bases at the same time, and make detailed records of the early selection and installation of laboratory equipment. Make the schedule for the use of laboratory equipment, and register the maintenance and scrap of equipment. Fig.3 shows flow chart of equipment management.

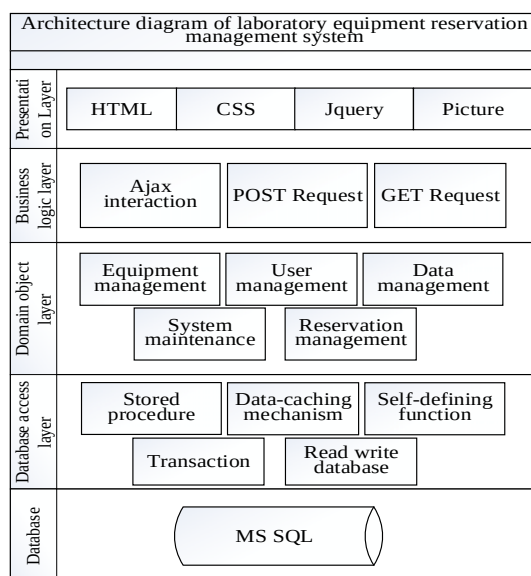


Figure 2. Architecture diagram of system.

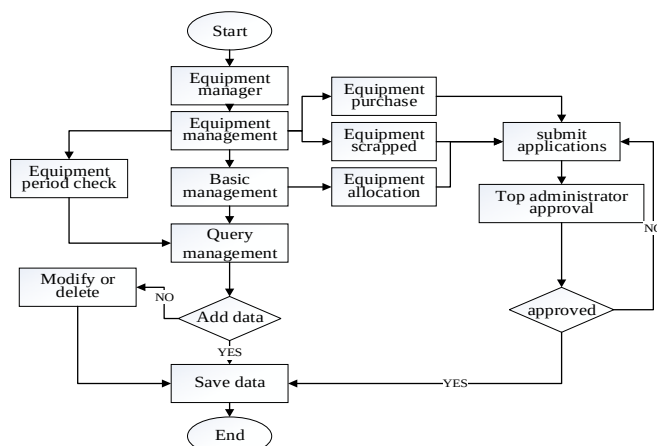


Figure 3. Flow chart of equipment management.

4.1.3. Reservation Management Module. The user needs to submit a reservation application for the reservation of the equipment, after the application is approved by the administrator, the system will send a notification to the user, and user can make a reservation operation. User cannot reserve the device without approval. And user can complete the feedback after using the device. Fig.4 shows flow chart of reservation management.

4.2. Database Design

Based on the design principle of database table, the database of laboratory equipment reservation management system is constructed. In this system, there are many data tables, so we have listed five data tables that achieve the main functions: User table, Userdetail table, LabEquipment table, EquCheck table, EquApply table. The specific description of the database device table is as follows: (1) User table: it is used to store the basic information of users, where userID is the primary key. (2) Userdetail table: it is used to store the user details, where the primary key is also the userID. The userID in the user details table is added as the foreign key. (3) LabEquipment table: it is used to store the basic information of equipments equID is the primary key. (4) EquCheck table: mainly register the information checked during the equipment period. Where the equID primary key is associated with the equID primary key of the device table. (5) EquApply table: record information related to device reservation. Where the equID

primary key is associated with the equID primary key of the device table and the userID is associated with the primary key of the user table. Fig.5 shows database description.

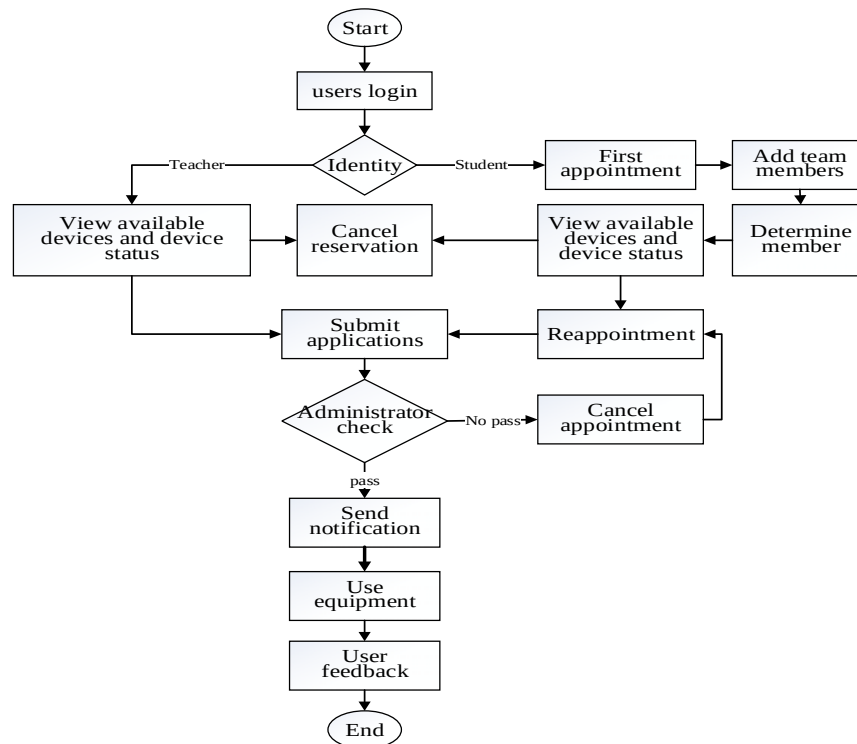


Figure 4. Flow chart of reservation management.

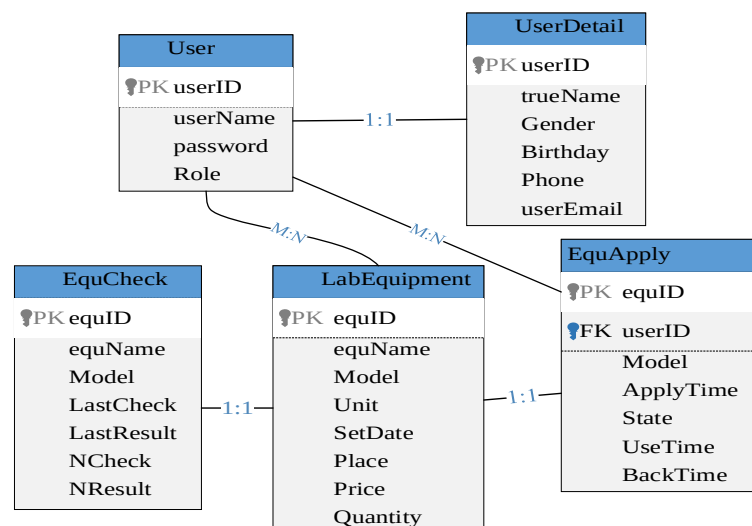


Figure 5. Database description.

5. Major function implementation

5.1. Realization of Laboratory Equipment Management

The administrator can manage laboratory equipment, carry out basic management of equipment, and manage the status of equipment requisition, warehousing, scrap, daily maintenance, as well as the allocation of equipment and corresponding management of laboratory consumables.

5.2. Realization of Laboratory Equipment Reservation

Teachers and students can make device appointment after logging into the system. Teachers can make reservations by themselves. Students need more than three people to make reservations. Users can view the device and the reservation time, and then choose it according to their own needs. In addition, administrators can review reservation applications and view all appointments status and today's appointments. Fig.6 shows today's reservation query.

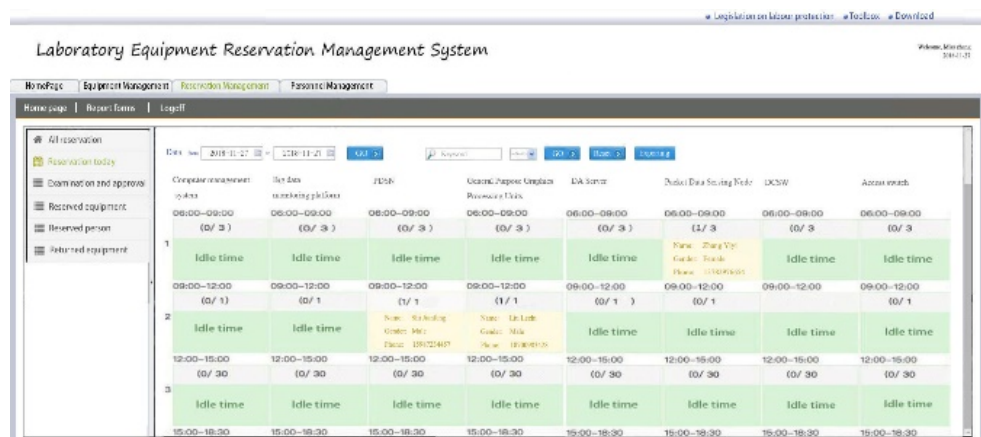


Figure 6. Inquiry of today's reservation.

5.3. Realization of System Management

The system management module mainly includes laboratory report management and system management. Systems management mainly includes systems security management and laboratory announcement management, and administrators can publish and edit lab announcements. Laboratory report management can provide real-time data report of the laboratory, upload statistical report and report analysis, and help superior leaders to understand the latest situation of the laboratory; Fig.7 is the data report and print upload diagram.

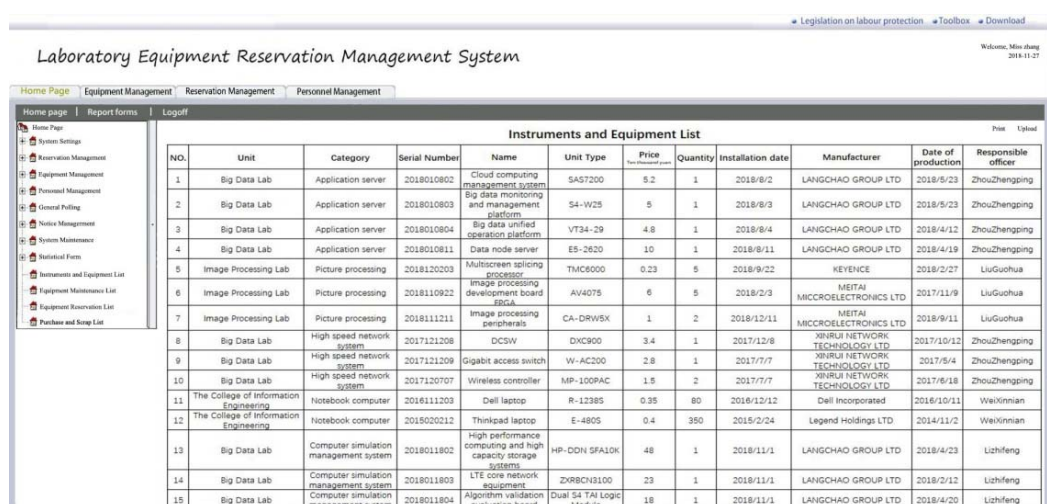


Figure 7. Data report and print upload diagram.

6. Conclusion

Laboratory equipment reservation management is an important tedious work, based on the analysis of the current situation and demand of the laboratories in colleges and universities, a laboratory equipment reservation management system suitable for colleges and universities has been developed and

implemented. And established a complete and highly effective laboratory equipment reservation management system, which improves the efficiency of the laboratory work of the university. Of course, this system still has some deficiencies to be improved and strengthened. In view of the continuous improvement of laboratory management requirements in colleges and universities, the laboratory equipment reservation management system should also be constantly adjusted and upgraded.

Acknowledgments

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