Design of Laboratory Open Sharing Informationization Platform Based on B/S Architecture Model

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Abstract. Laboratories, as key sites for scientific research and experimentation, have been driving scientific and technological development. In the laboratory, researchers perform a variety of experiments to analyze. These experiments generate a wealth of data and knowledge. However, laboratory management and data sharing have always been a challenge in laboratory operations. In this paper, the open management system of university laboratories based on B/S architecture is designed and implemented by combining the business management process of laboratory opening, data structure design and standardized management, and introducing the idea of management open mode. Through the intelligent management of laboratory teaching, it greatly improves the scientific, standardized management of the laboratory and the utilization rate of the laboratory.

Keywords: Laboratory opening, management system, design, B/S architecture pattern

1. Introduction

Laboratory is the main place for experimental teaching and scientific research. The level of laboratory construction and management directly reflects the overall teaching level of colleges and universities[1]. National Experimental Teaching Demonstration Center for Clothing Design and Engineering of Dalian Polytechnic University has constructed nearly more than twenty experimental teaching spaces in recent years, such as Clothing Digital Series Laboratory, Intelligent Flexible Clothing Laboratory, Virtual Reality (VR) Laboratory and so on. The functions of these experimental teaching spaces can fully meet the demand for the use of experimental teaching in different professional directions on campus. These experimental teaching spaces form an ecological closed-loop operation mode of experimental teaching from theory to practice, from cognition to research, from classroom to laboratory, and from offline to online.

In recent years, the operation and management of the laboratory of the National Demonstration Center, with the increasing strengthening of professional cross, the laboratory also reflects a wide range of specialties, a wide range of instruments and equipment, the number of students involved in the large number of experimental forms and rapid changes in the content of the new features. These characteristics make it more difficult to build the system, daily management, open operation, maintenance and guarantee of the laboratory. With the increase of experimental

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courses and the number of students, the laboratory management information data is more and more complicated, the traditional manual management mode can not adapt to the needs of modern teaching management[2-3].

This paper designs and develops an open lab management system based on B/S architecture through detailed business requirement analysis, utilizing ASP.NET and database management technology. The commissioning of the system makes the laboratory management more informatized and intelligent. It effectively improves the utilization efficiency of experimental sites, instruments and equipment, and provides a broad innovative space for the cultivation of college students' hands-on ability[4].

2. Materials and Methods

2.1. B / S architecture pattern research methodology

B/S architecture (Browser/Server Architecture) is a common web application architecture in which applications are made available to users through a web browser. Research methods in this area include(Table 1):

Table 1 B / S architecture pattern research methodology

Web Application Development	The researchers carried out the design, development and performance optimization of the web application to ensure user-friendliness and efficiency.
Front-end Technology	Researchers have conducted extensive research on HTML, CSS, JavaScript, and front-end frameworks such as React and Angular to deliver modern user interfaces.
Back-end Development	Researchers focus on server-side performance, database design, and API development to support Web applications.
Mobile Compatibility	With the popularity of mobile devices, researchers have also studied how to make B/S applications compatible and responsive on mobile devices.

2.2. Research Methodology of Laboratory Informatization Management

Laboratory informatics management refers to the area of applying information technology to laboratory management. Research methods in this area include(Table 2):

Table 2 Research Methodology of Laboratory Informatization Management

Data management and storage	Modern laboratory management requires effective data management and storage solutions. Researchers have conducted studies on data storage, backup, database design and data management systems.
Laboratory automation	Researchers have extensively studied automation technologies such as experimental equipment control, experimental automation and experimental process management to improve experimental efficiency.
Laboratory information system	The researchers studied laboratory information systems, including laboratory information management systems (LIMS) and laboratory information systems (LIS). This laboratory information

	system will be used for data tracking, experiment planning, and sample management.
Laboratory Safety	Studies on laboratory safety cover the storage and management of laboratory substances, the safety of chemicals and biological samples, and the safety training and instruction of laboratory staff.

2.3. Research on the design of an open and shared management platform for laboratories

Open sharing platforms are systems designed to facilitate the sharing of resources, data and knowledge. Research methods in this area include(Table3):

Table 3 Research on the design of an open and shared management platform for laboratories

Open Science	The Open Science movement has attracted widespread attention, emphasizing the open sharing of scientific research results, data and methods to promote transparency and reproducibility in scientific research.
Open Educational Resources	In the field of education, Open Educational Resource (OER) platforms, which provide free learning materials, have attracted extensive research and implementation.
Open Data Platform	Open data platforms such as data repositories, data integration and data sharing protocols have been extensively researched to facilitate open sharing and reuse of data.
Collaboration and sharing models	Research on cooperation and sharing models is also part of the Open Commons platform and involves research on crowdsourcing, collaboration and knowledge sharing.

These research approaches provide a broad perspective on the trends and potential application areas in the field of laboratory information management, B/S architecture patterns and open sharing platforms. This study aims to build on these areas and design an open and shared informatization platform for laboratories based on B/S architecture to meet the needs of laboratory management and research collaboration.

3. Results & Discussion

B/S Architecture (Browser/Server Architecture) is a client-server model of computing. The front-end interface of an application in a B/S architecture is provided to the user via a Web browser, while the back-end logic and data processing of the application resides on the server. Users can access and use these applications through a standard Web browser without having to install any local client software. The B/S architecture was chosen as the core architecture of the Laboratory Open and Shared Information Technology Platform because it offers advantages such as cross-platform accessibility, centralized management and maintenance, strong security, and user-friendliness, making it ideal for laboratory environments. This architecture will help improve laboratory management, data sharing and research collaboration(Table4).

Table 4 The Advantages of B/S Architecture

Cross-platform accessibility	Lab users may use different types of devices, including computers, mobile devices, and tablets.The B/S architecture ensures that users can easily access the platform regardless of what device they are using.
Centralized management and maintenance	Laboratory platforms may need to be updated and maintained frequently to meet changing needs. the B/S architecture allows the platform to be managed and maintained more efficiently by centralizing updates on the server without disturbing users.
Security and Privilege Control	Laboratory platforms can involve sensitive data, including experimental data and research results. the B/S architecture provides robust security and privilege control options to ensure data protection and compliance.
user friendliness	B/S architectures typically provide intuitive user interfaces that allow users to easily navigate and utilize the platform, thereby increasing user satisfaction.

Laboratory open sharing informationization platform design project architecture adopts B/S architecture, the server is developed in a multi-tier structure way, and the client follows the W3C standard to achieve seamless integration with the school campus informationization platform. The server side of this project uses the architecture of Hibernate+Spring+Freemarker to build the subsystems, and adopts the idea of cutter-oriented programming (AOP)[5]. It makes the system structure clear, makes the system easier to maintain and extend, and reduces the system coupling and improves the software maintainability.

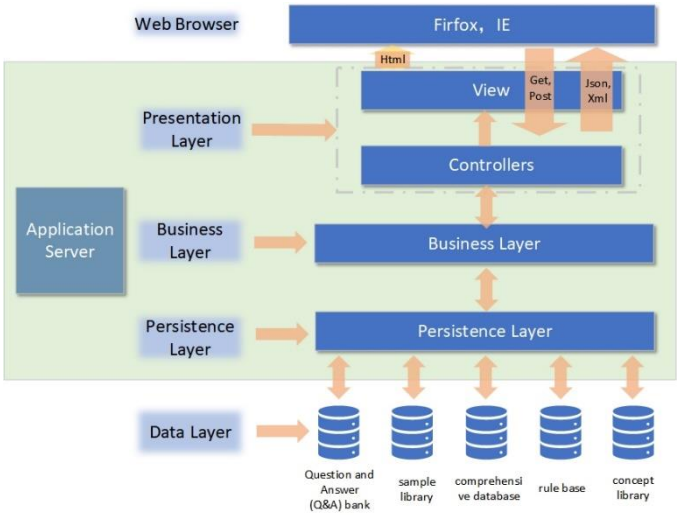

Figure 1 Multi tier architecture development mode

The system needs to be designed using a multi-tier architectural development model. Includes: persistence layer, business layer, and representation layer. The persistence layer is implemented using the Hibernate framework; the representation layer uses the MVC model2 pattern; the view (V) uses Freemarker; the controller (C) uses Spring, by using Spring to realize the MVC model2 pattern. It allows the display of system program data to be separated from the business logic and makes the modules easier to test.(Figure 1)

B/S architecture structure, a browser can run, the user can develop, information data encryption, can be associated with the database. (Figure 2)Browser refers to the Web browser, Web App server side and DB side constitute the so-called three-tier architecture[6].

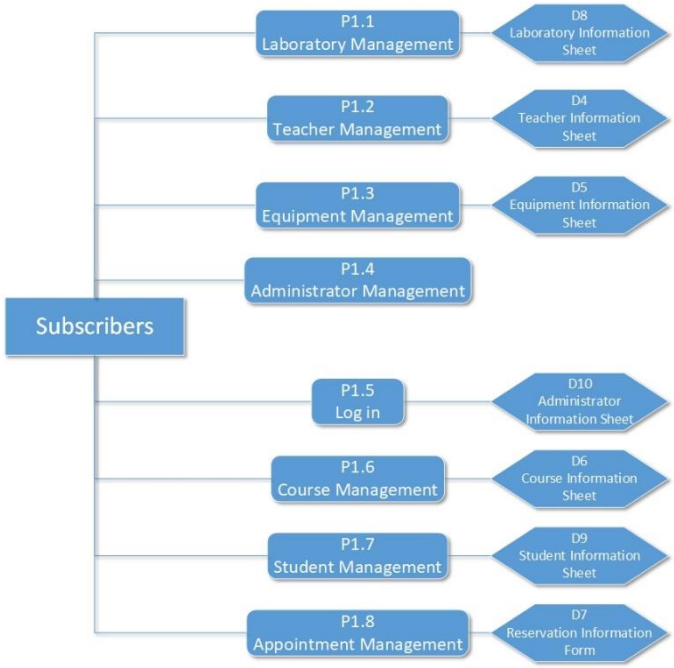

Figure 2 The data structure of B/S architecture

The system can not only collect and organize a large number of students' learning needs to provide students. The system can also assist the teacher to analyze and process the students' answers to the questions, and finally give a more reasonable score. PHP+My SQL has led the TIOBE rankings for the last 10 years. PHP+My SQL uses PHP for the frontend and My SQL for the backend development. It would be an exaggeration to say that PHP is all-powerful, but as a web development language, it can be written to work on any kind of server development. Based on PHP + My SQL open source, free, reliable and scalable, support for multiple operating systems and other characteristics, can greatly save the development of the funds used, is one of the most designers preferred language[7].

The Laboratory Open Sharing Informationization Platform not only improves the efficiency of equipment management, but also facilitates data sharing and collaboration, increasing user satisfaction and research efficiency. The platform's design principles, modular design, performance optimization and user-friendliness have all contributed to its success(Table5).

Table 5 Contribution of laboratory open sharing information platform

Design implementation		Efficiencies	
Build	The platform uses B/S architecture with front-end and back-end components. The	Equipment management	Researchers can easily reserve experimental equipment, check

	front-end provides device booking, data upload, data viewing and collaboration tools, while the back-end manages devices, data storage and user permissions.		equipment availability and maintenance schedules. Improved equipment utilization.
Modular design	he platform has modules for device management, data management, user rights and student training. Each module can be customized to meet laboratory needs.		
Data storage and management	The platform supports recording, uploading, sharing and version control of experimental data. Data is stored in a secure database with metadata and data formatting standards.	Data sharing and collaboration	Researchers can upload and share experimental data, and collaboration on collaborative projects is more efficient. Improved data quality and reproducibility.
User interface design	The user interface design follows the principles of user-centeredness, simplicity and consistency. The user interface provides intuitive navigation and search functions.	Customer satisfaction	User feedback shows that the user-friendliness and ease of use of the platform has been improved, and user satisfaction has increased significantly.
Performance optimization	The platform is performance tested and monitored with optimized strategies for response time, scalability and load balancing.	Research efficiency	Researchers are able to access experimental equipment and data more quickly, increasing research efficiency.

4. Conclusions

The operation of the open laboratory management system based on B/S architecture strengthens the intelligent and networked level of laboratory management and meets the individualized needs of experimental teaching in colleges and universities[8]. The application of this system realizes scientific and efficient networked management of venues, instruments and equipment, personnel arrangements, etc., and has achieved good application results in experimental teaching management.

The practical application and significance of this shared information technology platform is:

1. Improve the efficiency of laboratory management. The platform improves the efficiency of laboratory management and helps researchers better utilize experimental equipment and data resources through equipment management, data management and laboratory operation modules.

2. Promote the sharing and collaboration of scientific research results. The platform facilitates the sharing and collaboration of research results through data sharing and collaboration mechanisms that enable researchers to share experimental data, collaborative projects and research results more easily.

3. Improved user satisfaction. User interface design and performance optimization strategies help to improve user satisfaction and make it easier for users to use the platform, thus increasing the success of its real-world applications.

This study provides a feasible design of an open and shared informationization platform for laboratories. Its modularization, performance optimization and user interface design strategies are expected to play an active role in the field of scientific research by improving the efficiency of laboratory management and facilitating the sharing and collaboration of research results in practical applications.

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