Design and Implementation of Intelligent Medical Mobile Collaborative Office Approval System

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Abstract: Medical affairs approval system is a hot issue in the field of smart medicine. The existing medical affairs approval process is unscientific and opaque, and the approval process is slow, resulting in untimely supply of medical resources. To address this issue, a design and implementation method of a smart medical mobile collaborative office approval system is proposed. Based on the Internet big data information collaboration method, it provides heterogeneous fusion and integration of smart medical mobile collaborative office approval data, strengthens the global efficiency of information data analysis and decision-making, and considers improving data security and privacy protection. The system provides multi-level and multi-type user permissions. The test results show that the proposed method improves the efficiency of medical emergency approval, reduces the approval process, and increases the transparency of the approval process.

Keywords: Smart Medical; Cooperative Office; Approval System; Big Data

1. Introduction

In 2019, the official website of the National Health Commission issued a clear message stating that medical institutions should carry out the construction of smart hospitals in a scientific and standardized manner, including "smart medicine" for medical personnel, "smart services" for patients, and "smart management" for hospitals. The medical affairs approval system is one of the key issues in the field of intelligent management, and it is also an important breakthrough in the construction of hospital administrative information. After investigation and analysis, there are a large number of businesses that require approval in the daily operation of the hospital, requiring patients, departments, and organ management departments to apply for and approve them level by level, such as: purchase request, special drug control, reduced free approval, and so on. The characteristics of the data involved in medical affairs, such as the particularity of the data, the variety of schedules, and the complexity of various application and approval processes, have led to issues such as unsystematic and poorly organized approval processes, and the slow progress of medical resource acquisition and approval, resulting in the untimely supply of resources needed for patients to seek medical treatment. This has increased the difficulty of hospital management, reduced work efficiency, and greatly reduced the quality of medical services.

In response to this problem, the country follows the pace of the times, encourages the combination of medical reform policies and the "Internet plus" industrial mode, and strives to meet the growing medical needs of the people, reduce the difficulty of medical institution management, and promote the high-quality, efficient and high-level development of medical services in China. In order to comply with the development of the times and the needs of information technology, medical departments need to actively carry out electronic information reform in the weak areas of their work. The smooth implementation of the proposed development project will provide important reference significance and broad market application prospects for the smart medical mobile collaborative office approval system based on the B/S architecture. It is committed to improving the efficiency of emergency application approval for medical institutions, continuously improving the proportion of automated office in hospital office, providing a good atmosphere for the hospital work environment, and addressing the root cause of the cumbersome approval process.

2. Research Status

The team has made research ideas clearer by querying and learning the results of similar research. This section presents and analyzes the current research situation.

2.1 Research Status

The smart medical mobile collaborative office approval system is a new way to effectively handle medical affairs. Medical personnel conduct real-time and online approval, leaving behind the traditional paper-based office, facilitating leaders to handle the issuance and approval of various transactions, and improving work efficiency. The following is an analysis of the current research situation in this field from both the academic and business perspectives.

In the Wanfang Data Knowledge Service Platform, a total of 9 papers were retrieved through the search keyword (medical+approval system) over a period of time (2015-2022), including 2 directly related papers.

In the CqVip data platform, a total of 16 papers were retrieved through the search keyword (medical+approval system) over a period of time (2018-2022), including 6 directly related papers.

On the CNKI service platform of CNKI, 17 papers were retrieved through full-text search (medical)+keyword search (approval system), including 4 directly related papers.

Huang Xianghao [1] PHP technology based on the ThinkPHP framework, coupled with MySQL database technology, enables timely sharing and exchange of approval information among various departments of the hospital, improves the efficiency and quality of hospital office staff, and ultimately achieves electronic operation of the approval process, providing convenience for medical personnel to submit the approval process. Shengtianjin [2] has sorted out various medical businesses that require approval and integrated them into a unified electronic approval information platform, authorizing them to be used by personnel at different management levels, achieving electronic approval, simplifying procedures, facilitating patients and medical personnel, standardizing various approval procedures, making them searchable and controllable, and reducing vulnerabilities. Kong Deming [3] has established an intelligent approval database. Combined with the hospital management information system, laboratory information system, and electronic medical record system, we have conducted system process reengineering, and successfully developed and enabled the medical insurance intelligent audit information system. Li Fei [4]'s implementation of the hospital OA office automation system helps hospitals sort out their existing management models, optimize the approval process, and achieve interconnection through the network. This can significantly reduce hospital office costs, improve work efficiency, and is an important step towards achieving paperless hospital approval. Xue Wenyan [5] has established an inpatient approval system, applying a three-layer C/S structure to this system, increasing software reliability, high cohesion, low coupling, and high security. Shi Yaxian [6] proposes to integrate hospital heterogeneous systems to achieve seamless integration of medical transaction approval mechanisms in clinical information systems and OA systems. This approval mechanism facilitates medical personnel, optimizes the transaction approval process, and provides managers with a traceable and supervised approval platform.

Currently, some hospitals almost all have internal OA systems, as well as relatively complete transaction approval systems. However, when approving, leaders need to log in to the computer from time to time for processing, and because the hospital data flow involves many doctors and patients' privacy, it is inconvenient to process online. Therefore, the system takes out the approval module separately. Relevant leaders at all levels can use mobile phones to timely process various forms for approval in different locations. Comparing the two systems that are widely used in the current market, the project advantages are shown in Table 1.

2.2 Research Status Analysis

Currently, the existing medical approval system is either a C/S architecture, with high approval costs and spatial constraints, which do not meet the requirements of intelligent medicine. At the same time, it involves an unsystematic and poorly organized approval process, and the slow progress of medical resource acquisition and approval, resulting in the untimely supply of resources needed for patients to seek medical treatment. The hospital data flow involves issues such as the privacy of many doctors and patients, resulting in increased difficulty in hospital management and reduced work efficiency.

Table 1. Project Advantages Comparison

Same domestic project type	Functional planning concept
Universal Medical OA Collaborative Office System	C/S architecture, emphasizing drug collection and management, and account collection and statistics. It can realize the organization and management functions of hospital personnel, as well as the scheduling and notification functions of daily work
Zhiming Collaborative Hospital OA Office System	The C/S architecture focuses on the management functions of hospital archives and documents, enabling online reservation and registration, with relatively complete statistical analysis.
The system to be developed by the project	The B/S architecture, which focuses on visualization and traceability of the medical approval process, has the following main advantages: (1) Clear service targets, mainly serving municipal/county level medical institutions. (2) Data security is ensured, with different roles assigned different management permissions, and data is isolated by role. (3) Visual analysis, which starts from the approval process and establishes a visual real-time progress view.

Greatly reducing the quality of medical services. In response to the above problems, this project will separately implement the mobile collaborative office approval module, which is based on the B/S architecture to achieve a seamless connection between the medical affairs approval mechanism in the clinical information

system and the OA system. It will synchronize the medical affairs approval that can only be conducted offline, explore a new model of the "smart medical" mobile collaborative office approval system, and strive to improve the efficiency of special application approval for medical institutions, By conducting statistics, clustering, and analysis on different approval content, and then summarizing and reporting, leaders at all levels can use mobile phones to log in from different places to timely process various forms of approval in the unit, achieving the root cause of solving the drawbacks of complex approval processes.

3. System Model

This section provides a brief introduction to the working principles of the application development logic and integration environment.

3.1 System Architecture

This product is a traditional web application with traditional functions. The application model adopts the classic MVC architecture for web application development, as shown in Figure 1.
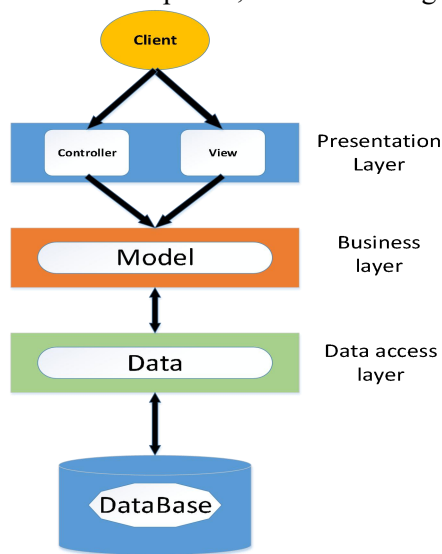
Figure 1. Schematic Diagram of MVC Architecture

When the client accesses the system, the client accesses the controller through accessing the web application portal file. The controller with the return template function returns the view template through the template engine (View), thereby realizing the interactive operation between the client browser and the server. During the interactive operation process, the

client browser sends asynchronous requests to the server controller by triggering JavaScript functions bound to HTML DOM events. The controller accesses and interacts with the database (MySql) through data pair model operations.

3.2 Development Environment

This application is developed based on ThinkPHP version 6.0.1.3. The server integration environment is the Apache+MySql+PHP server architecture deployed on the Windows operating system, known as the WAMP integrated environment. This integrated environment has high technical maturity and stable operation, providing a basic operating environment for efficient operation of office systems, and providing sufficient space for subsequent software updates,as shown in Figure 2.
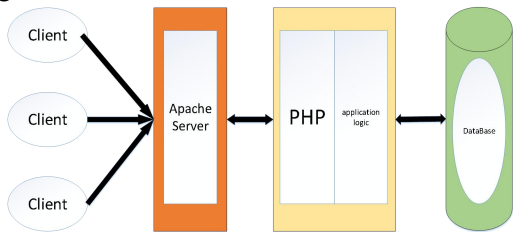
Figure 2. Working Model of AMP Server Integrated Environment

4. Functional Analysis

Based on the developed application, this section briefly analyzes and introduces the functions of each module of the application.

4.1 Data Statistics Module

This module provides different types of data statistical analysis and data visualization functions for different user needs by collecting application data and staff data in the system database. The data statistical analysis module is shown in Figure 3.
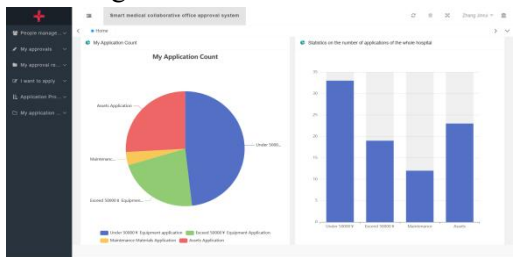

Figure 3. Data Statistics and Analysis Module

4.2 Application Module

The application module can design a simulated application form based on the HTML5 form component to submit the application and create an approval process. The simulation form has the characteristics of convenient modification and good compatibility with the system, and can be customized according to different application material requirements. The server will submit the application to the first approver through data analysis based on the company and form type, thereby realizing the application function, as shown in Figure 4.
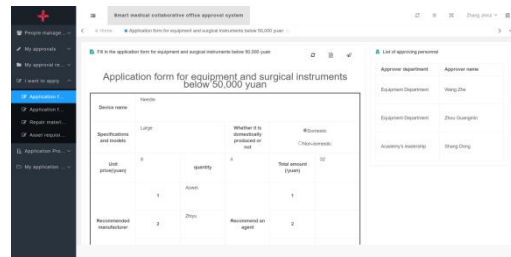

Figure 4. Application Module

4.3 Application Progress Module

In the application progress module, applications submitted by individuals can be found through various means, as shown in Figure 5. At the same time, it can support the reproduction of application content and visualization of application progress, as shown in Figure 6.
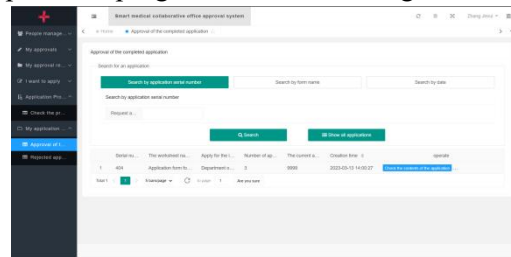

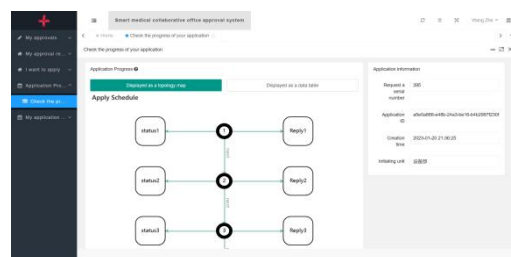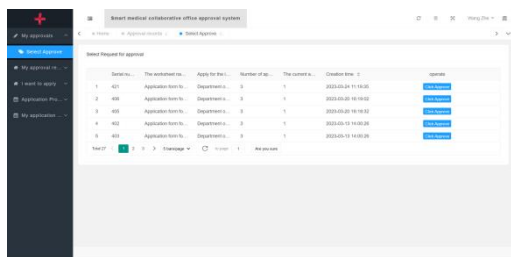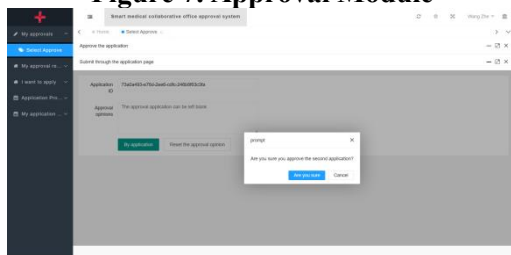**Figure 5. Application Progress Module**

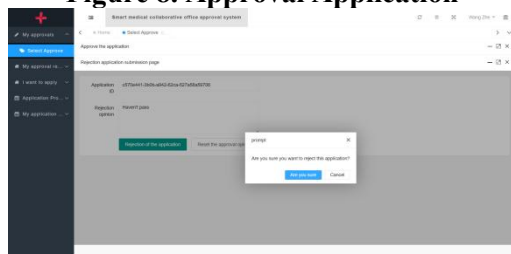**Figure 6. Visualization of Application Progress**

4.4 Approval module

Figure 7. Approval Module

Figure 8. Approval Application

Figure 9. Rejection of Application

The approval module is a proprietary function module for users with approval permissions. After an ordinary user submits an application, the data record of the application will be recorded as pending approval and automatically displayed in the approval module of the latest level of approval user, as shown in Figure 7. This module supports the display of application content, and supports filling in approval comments (as shown in Figure 8) or reasons for rejection (as shown in Figure 9) during approval. If it passes, it will be submitted to the next level of approval user. If it rejects, it will be displayed in the application record of the application initiating user, and the reasons for rejection will be displayed to achieve level by level approval.

5. Conclusion

The implementation of the method proposed in this article adopts the traditional web development mode, which has the characteristics of mature technology and stable operation. Therefore, the application function is reliable and can provide strong support for efficient approval work. As the application development process deepened its understanding of existing materials, while implementing the basic functions, the team also understood the drawbacks of the program's relatively single existing functions, program portability, and poor customizability. After that, it made a prospect for the subsequent application upgrade and expansion work, and made a preliminary plan for the system mailbox and user dialogue functions, with a view to enriching the application's functional types and increasing the system's customizability, Closer to the actual work needs in the medical system, and make efforts to effectively improve the work efficiency of medical institutions.

Acknowledgments

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