Design and Implementation of Computer Aided Equipment Management Information System

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Abstract. Enterprises can use information management systems and use computers as an aid to improve their management level. This paper takes the implementation and application of enterprise equipment management information system as the background, and combines the special equipment management situation of the enterprise unit with different user needs to complete the design and implementation of computer-aided equipment management information system. First, this article uses J2EE to implement various functions of the system, select a SQL Server database, and use it to store information. Secondly, in order to be able to manage the equipment online, this article chooses the B/S mode. Finally, the design of the system is completed and implemented through related technologies. Through computer-assisted information management of equipment management, equipment management level and work efficiency can be improved, equipment management can be scientific, standardized, and digitized, and ultimately the modern management level of the enterprise can be improved.

Keywords: Design and Implementation; Computer Aided; Equipment Management; Information System
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1 INTRODUCTION

The traditional manual device management mode is inefficient and cannot meet the requirements for device management in practice, and its disadvantage is that it will easily cause confusion in device management. Therefore, the use of computer-aided management equipment can make up for the shortcomings of traditional manual management equipment, and is an inevitable trend of enterprise equipment management. To improve the efficiency of equipment management, to introduce information technology and computer-aided management into equipment management, and to build a reasonable and efficient management information system to improve the management level of enterprises, it has become an urgent need [1-2].

Equipment refers to the long-term use of the enterprise in the production. It is a general term for labor data and material data and can maintain its original physical form and function to the greatest extent [3]. Reasonable use of equipment technology and economic methods, integrated equipment management, engineering technology and financial management and other means to maximize the cost-effectiveness of equipment life cycle, and ultimately maximize the comprehensive benefits of equipment assets [4]. Sun et al. [5] based on the analysis of the basic principles of the three-tier structure, according to the system requirements, given the applicable application components, and the design and implementation of the structure of the equipment management information system based on the three-tier model. Adela et al. [6] put forward the viewpoint of system, pointing out that business process and process innovation have become an important principle of modern enterprise MIS construction. At the same time, the process characteristics of enterprise equipment management are analyzed, and the basic functions of a process-based equipment management information system and its operating platform are introduced. Mehdi et al. [7] conducted a systematic analysis and innovative research on the current status of equipment management with a heavy machinery industry company as the background, proposed specific goals for equipment management information, and designed a hybrid structure based on B/S and C/S. This solution is not only a set of management software design, but also an innovation in equipment management. Li et al. [8] the medical equipment management information system is an indispensable part of hospital management now, and its reasonable development and application are embedded in the hospital information system to form a dynamic whole-process management.

Therefore, based on the above analysis, this article takes the implementation and application of the enterprise equipment management information system as the background, and combines the special equipment management situation of the enterprise unit with different user needs to design and implement a computer-aided equipment management information system. First, this article uses J2EE to implement various functions of the system, select a SQL Server database, and use it to store information. Secondly, in order to be able to manage the equipment online, this article chooses the B/S mode. Finally, the company's current business processes were combed to meet the needs of users. The system's logical design, interface design, functional module design, and database design were completed and implemented through related technologies. Through computer-assisted information management of equipment management, equipment management level and work efficiency can be improved, equipment management can be scientific, standardized, and digitized, and ultimately the modern management level of the enterprise can be improved.

2 RESEARCH ON RELATED TECHNOLOGIES

2.1 Choice of Development Mode

At present, there are two widely used development models: B/S and C/S [9]. However, the difference between the two is obvious. The main reason is that the former is responsible for creating the Web system, while the latter is mainly responsible for the creation of a stand-alone system. Among them, the structure of B/S mode is shown in Figure 1.

From Figure 1, we can know that the B/S structure is mainly composed of three layers, which are the presentation, data, and function layers [10].

Compared with the C/S mode, the B/S mode has its own advantages. Specifically, we can summarize its main advantages as follows.

1) B/S mode is easier and more convenient to operate. Moreover, its scope of application is wider. A system created in C/S mode can only be applied in a local area network. Nevertheless, systems built in B/S mode do not have this limitation. When the server and the PC can be connected to each other, the system can be accessed smoothly. Not only that, you only need to install a browser in B/S mode. C/S is more complicated, and a client must be installed. In summary, B/S mode is more convenient and quick to use.

2) Low maintenance cost. In C/S mode, when updating the system, the client must be handled separately. As a result, the cost of maintaining the system has increased significantly. However, in the B/S mode, it is only necessary to update the server, which greatly reduces the maintenance cost of the system.

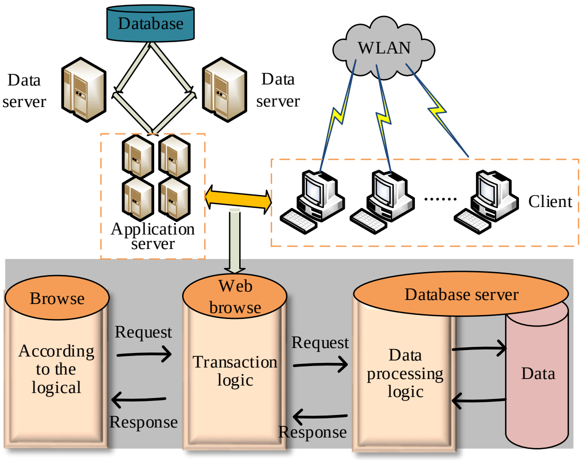

Figure 1: B/C three-tier architecture.

In summary, this thesis is a device management system created based on the B/S model. The purpose is to improve the quality of the system and better meet user needs.

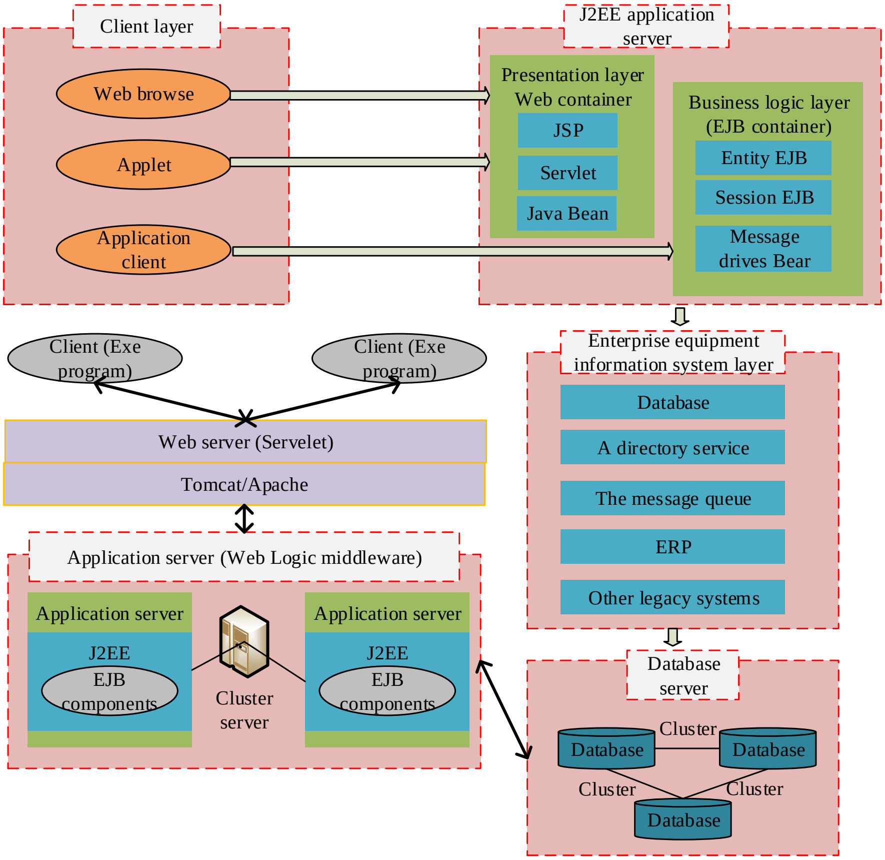

Figure 2: A four-tier structure diagram for J2EE.

2.2 Selection of Development Technology

JAVA technology has high security, and secondly, it has good portability [11]. Therefore, this article is implemented through JAVA technology.

This platform is composed of four parts, which are the Web layer, customer layer, business layer, and EIS layer. In the system, the tasks undertaken by each layer are different. Specifically, the relationship between the four layers is shown in Figure 2.

3 DESIGN OF COMPUTER AIDED EQUIPMENT MANAGEMENT INFORMATION SYSTEM

3.1 System Architecture Diagram

A good system architecture can ensure the security and stability of the system. The system uses a three-tier architecture model based on B/S to provide services for users in different departments within the enterprise. The system uses JAVA language to develop the interactive interface and business processes. The business processes are published using the Tomcat application server. The database uses SQL Server to store data and completes access operations through JDBC. At the same time, the layered architecture can also meet the security requirements of the system. The three-layer architecture of the system is shown in Figure 3.

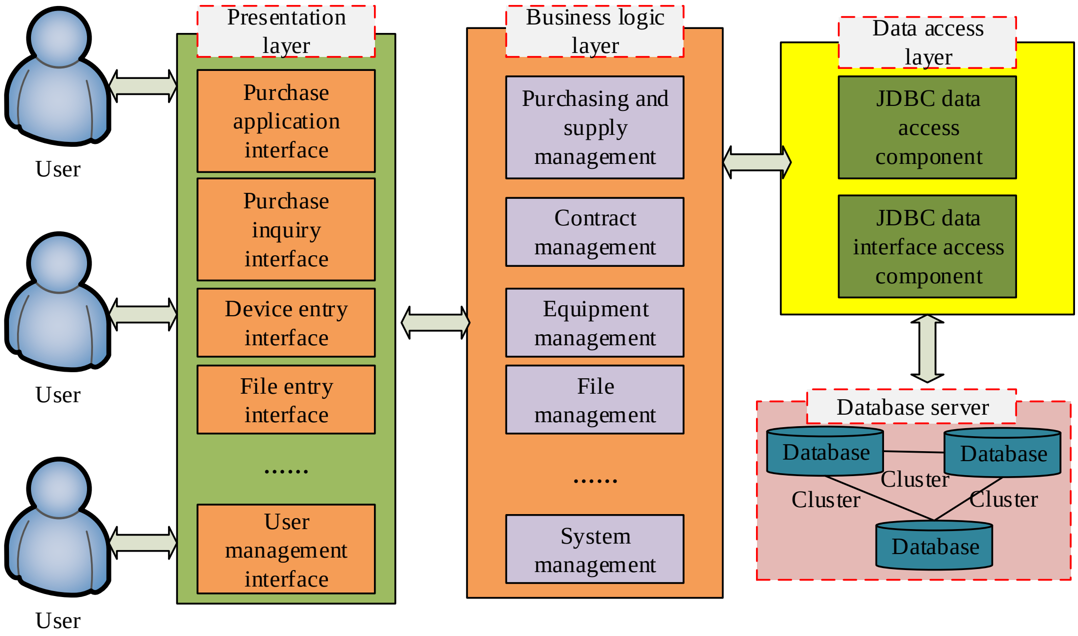

Figure 3: System architecture diagram.

Under this system architecture, the device management system can not only meet the internal network access, but also meet the needs of external mobile office. The system topology is shown in Figure 4 below.

Place the device management information system server in the DMZ zone. The translation of NAT addresses is completed on the firewall, so that the system can guarantee internal access while also satisfying employees' access outside the unit. The firewall restricts the ports. Except for service ports, all other ports are closed, reducing the risk of network attacks and ensuring the security of network systems.

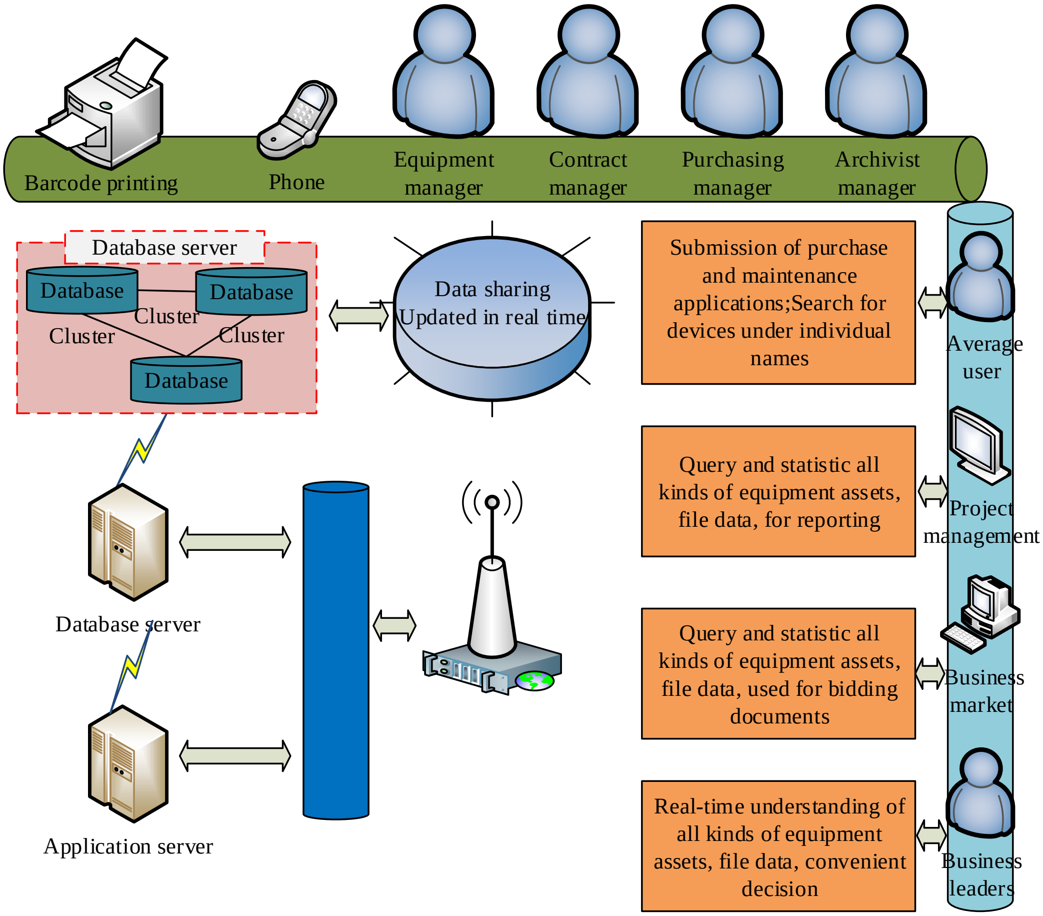

Figure 4: System complement diagram.

3.2 System Function Design

The main work of system function design is to establish the system module structure. In order to ensure the accuracy of the system data and the uniqueness of the source, it is necessary to establish a unified portal for basic data to realize data sharing, which can provide basic guarantees for system data processing, thereby improving the overall system availability. The detailed functions of the seven functional modules of the system are shown in Table 1 below.

Module name	Features
Common management module	Display the equipment list under the personal name to ordinary users; meet the daily equipment purchase application and equipment maintenance application.
Purchasing Management Module	Provides the functions of adding, deleting, or modifying and viewing purchase requisitions to summarize and match purchase requirements.
Contract Management Module	Enter contract-related content and manage contract execution progress.

Asset Management Module	Add, delete, modify, and check assets, and manage the daily circulation of assets, including borrowing, receiving, transferring, and equipment status.
Archive management module	Add, delete, modify and check archive records, and manage borrowing and return of archives.
Query Management Module	Generate reports in a fixed format to meet daily needs, and provide custom conditions to generate reports.
System Management Module	Add, modify, and delete system users and device categories; back up system data.

Table 1: System main modules.

(1) System login

As a security gateway to the application system, system login is indispensable. This layer of protection can ensure the normal users of the system and determine the use rights of logged-in users. System login is mainly used for identification, to ensure system security and to grant user permissions.

(2) Data interface design

System operation needs to input the original data of the equipment. If you rely on manual re-entry, the workload is too large to ensure the accuracy of the data. The new system provides a data import function to meet the import of external data.

(3) Data sharing design

The entered data flows in the system, and the data owner can perform operations such as adding, deleting, and modifying. Data users can reference these data as a source of processed data.

3.3 Database Design

Database storage is independent of its programs. Database systems organize data information in a certain data model for storage. Data flow diagram describes the transformation process of data flow from input to output from the perspective of data transmission and processing.

In the top-level data flow diagram, users need to submit applications and query information through the system. The administrator edits and maintains the basic data information of each post, and summarizes and prints the data that needs to be reviewed for leadership approval. Leaders complete the approval by offline means. The system administrator mainly implements the maintenance and backup of system and user data. The processing functions in the top-level data flow diagram of the system are further decomposed to obtain the first-level data flow diagram of the equipment management information system. The first layer of data flow diagram decomposes the system into six sub-functions: purchase management, contract management, asset management, file management, query management and system management.

4 SYSTEM TESTING

4.1 Function Testing

As shown in Figure 5, the function display of each function of the system. User authentication is the first pass to protect system security. First, the user logs in to their account. Through the system's main interface to complete the authentication of user permissions, so that users get the corresponding operating functions and enter different user interfaces. The establishment of the common management module is to meet the user's easy operation, and combines the functions of equipment purchase application, equipment maintenance application, and asset query list under the user's personal name into one functional module. The list lists the device list by default, which meets the user's real-time query to understand the personal device ownership. You can also choose to view the book materials in your personal name through the asset category drop-down list. The contract manager manages all contracts, and the manual contract list is difficult to meet the retrieval needs. The contract management interface implements contract entry management and execution progress management. Enter the contract for purchasing assets according to the system requirements, and monitor the progress of contract execution. The asset management module is the main part of the management system. This module mainly implements equipment information management, equipment circulation management, equipment maintenance management, and equipment inventory.

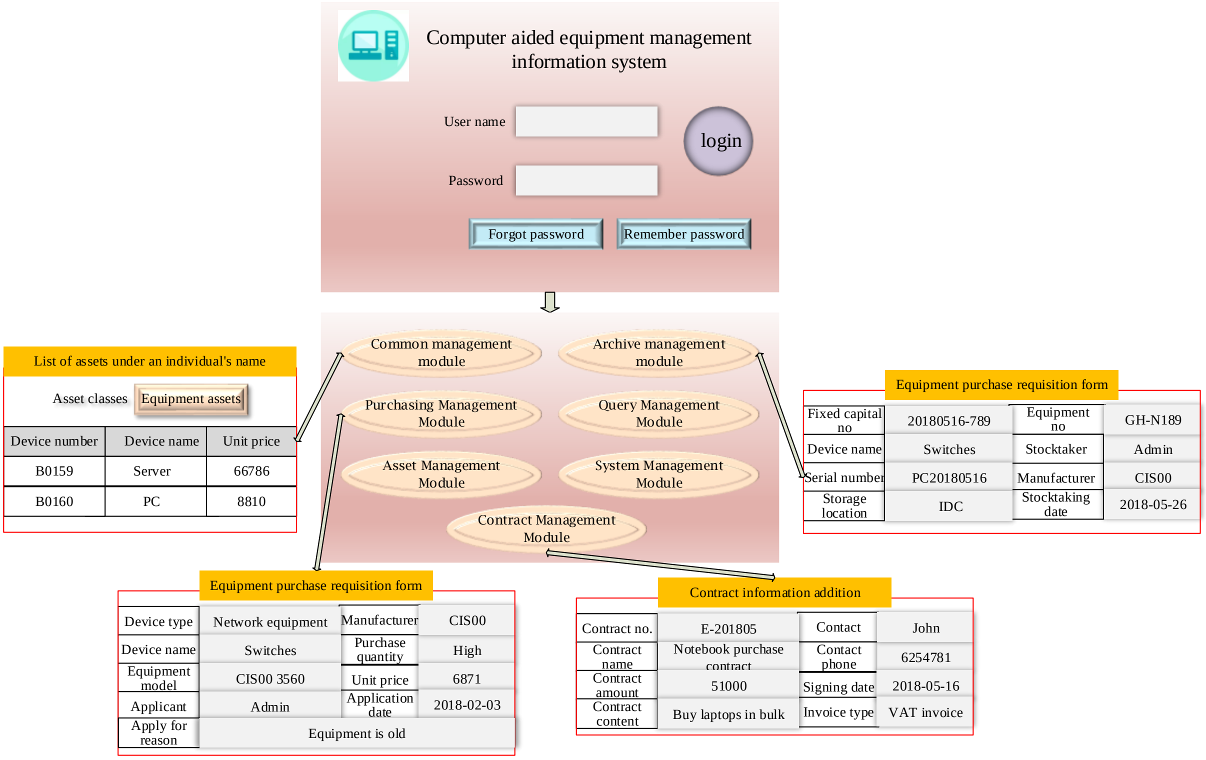

Figure 5: Function display of each function of the system.

4.2 Performance Testing

When the system is online with 200 users at the same time, the information query operation of device is performed to monitor the CPU, memory and other resources of the system. The performance test uses the HP Load Runner performance test tool to test and analyze the resource occupation of the system's 200 online users who complete information query operations of device.

The CPU and memory utilization of test results when 200 users are online are shown in Figure 6. Tests show that due to the Gigabit internal network environment, system access has little pressure on network bandwidth, and bandwidth utilization does not exceed 35%. The test scenario is that the query action mainly reads the disk, and the disk utilization is lower than 76.12%. When the system has 200 users, the CPU utilization is up to 28.3%, and the memory utilization is relatively stable. The test results performed well and met the requirements of the system design. The system function test is performed based on the test cases. The obtained results are consistent with the expected results. The performance indicators such as resource consumption pass the test within a reasonable range.

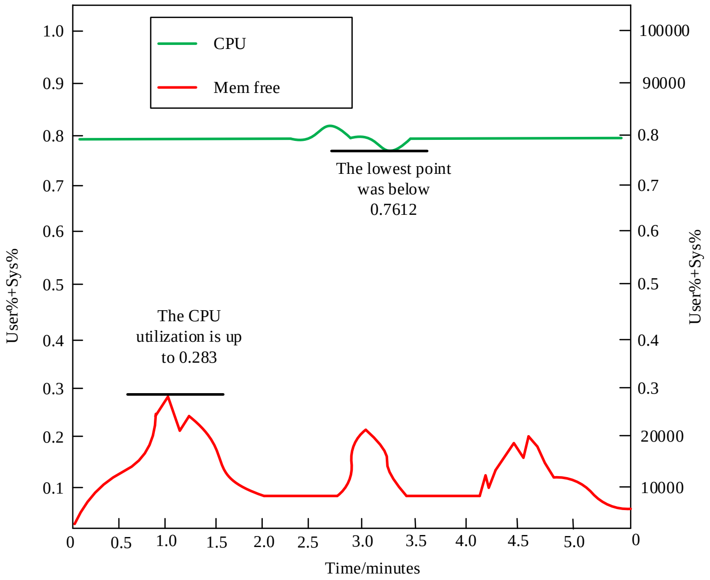

Figure 6: 200 User online test resource occupation.

By setting different load amounts, the average response time, CPU utilization, and request success rate of queries under different conditions are recorded separately. It can be seen from the test results that increasing the think time (that is, considering the actual request time) can increase the success rate of requests, reduce the CPU utilization, and reduce the average response time. Nevertheless, at the same time it will increase the actual response time, so the impact of the setting and value of the thinking time on the performance test indicators is worth studying. The request success rate and CPU utilization trend under different load conditions are shown in Figure 7 and Figure 8.

It can be known from Figure 7 and Figure 8 that if the actual request time is considered, the success rate of the system request can be greatly improved. On this basis, we can continue to consider the impact of different think times on system performance. In addition, the actual request time is not only related to the number of concurrent users and throughput, but also to the number of iterations.

The purpose of system performance optimization is to improve the request success rate of user transactions. Considering only the average response time of the system, the load on the system is large, the success rate is low, and the CPU utilization is high. Although a larger load stress test can be performed on the system through simulation at this time, the user access characteristics that need to be considered when the system is actually running are ignored. Starting from the user's access characteristics, using the actual request time and user request success rate as the performance indicators of the optimized system can more accurately locate the optimization goal of the system, and reduce the cost of the optimized system to a certain extent. At the same time, in the process of analyzing user access characteristics, comprehensive consideration needs to be given to the system's average response time, think time, request success rate, and resource utilization to ensure the system is more stable and reliable.

5 CONCLUSIONS

In order to improve the efficiency of equipment management in enterprises and institutions, the comprehensive utilization rate, strengthen the standardization, information of equipment management, and meet the needs of production and scientific research, this paper establishes a computer-aided equipment information management system to realize the automation of equipment management and provide a practical tool for enterprise equipment management.

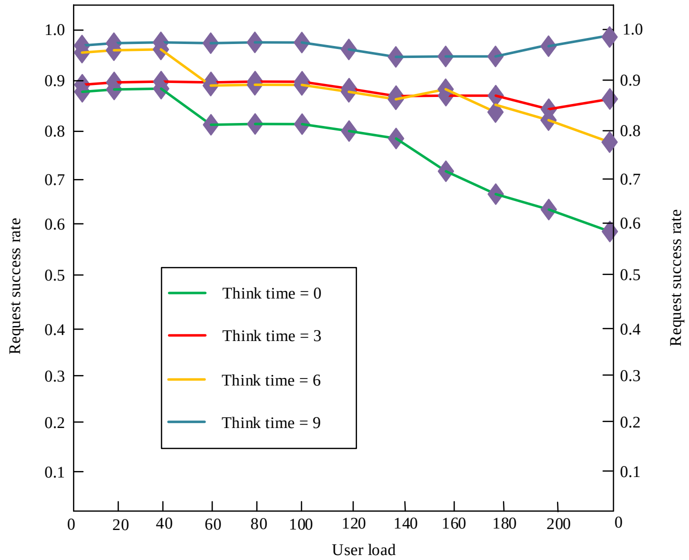

Figure 7: Relationship between load and request success rate at different think times.

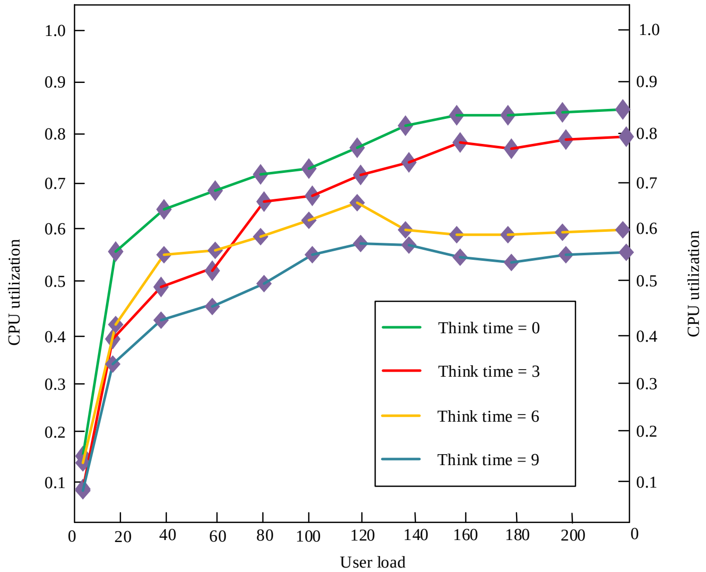

Figure 8: Relationship between load and CPU utilization at different think times.

On the basis of fully understanding the needs of the unit, a set of equipment information management system based on JAVA technology B/S architecture was designed, which simplified a series of daily tasks such as equipment procurement, contract management, equipment management, and file management, and improved work efficiency has brought obvious convenience to the unit's asset management. The development and application of equipment management information systems can greatly reduce the daily manual workload. Processing and processing of equipment data through information makes equipment asset management easier, and asset information data is more accurate and transparent. At the same time, it also ensures the correctness and uniqueness of the data, facilitates the data mining and processing of different departments, and provides important equipment data support for the production and decision-making of enterprises and institutions.

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