Hindawi
Wireless Communications and Mobile Computing
Volume 2022, Article ID 6898098, 10 pages
https://doi.org/10.1155/2022/6898098

Research Article

Design and Implementation of Financial Management System Based on Computer Network Technology

Jianwei Yan

Finance Department, Kunming Medical University, Kunming, 650500 Yunnan, China

Correspondence should be addressed to Jianwei Yan; yanjianwei@kmmu.edu.cn

Received 13 July 2022; Revised 3 September 2022; Accepted 8 September 2022; Published 22 September 2022

Academic Editor: Jun Ye

At present, financial management systems have been applied in many universities. University's usage of the financial management system to achieve ideal results in formulating financial plans, strengthening financial control, and improving the efficiency of financial management. The healthy and long-term development of a university is inseparable from scientific financial management methods. With the rapid development of computer technology, the use of financial management tools is an effective way to improve the quality of financial management. The article applies computer network technology to the financial management system. The main functions of the financial management part and the accounting management part of the system are set as data recording and data statistics display. The financial management system combines the financial management of the university with the informatization of the industry, which realizes the computerization of accounting, and replaces the traditional manual financial mode. The results show that the average response time, data throughput per second, and number of requests per second of the transformed system are higher than those of the untransformed traditional system, and the ratio is about 5% higher. This shows that the financial management system constructed by the computer network technology can play a certain role in the operation of the university.

1. Introduction

Data management system is a comprehensive information management system that uses information technology to manage modern university. Data management systems are widely used in enterprises, government units, schools, and other fields. By utilizing IT and network technologies, it can support the most advanced university management solutions, integrate all internal and external information sources, and provide systematic management for decision-making, management, and evaluation of business development. Among them, the financial management system is an important unit, which can predict, make decisions, and manage the development of the university based on the distribution and statistical data analysis of students and teachers, funds, and information. With the advent of the "Internet Plus" era, all kinds of university are facing the challenge of the information tide, and the competition among university is becoming increasingly fierce. Internet plus has had a significant impact on industry, education, medical care, and other fields. The university adopts advanced financial management system, which can realize the efficient management and control of financial information. Therefore, it is necessary to improve the efficiency of financial management, reduce management costs, and improve the accuracy and consistency of financial information.

For the financial management system, domestic and foreign experts have a lot of research. Based on the balance between the interests of the shareholders, Sherquzieva discussed the role of dividend policy in the financial management system of joint-stock companies, which are aimed at improving the investment attractiveness of joint-stock companies. Scientific advice and practical advice on the effective dividend policy of joint-stock companies were provided [1]. Qian analyzed the construction and implementation of financial management system in e-commerce. It mainly introduced database technology, B/S structure, and the main content of MVC model. At the same time, the main content and business research methods of the financial management system were explained [2]. Malikov proposed an algorithm

to construct a university management system, which determined the financial goals of the university, configured the financial management subsystem, and supported the information of the financial management system. Besides, the financial management rules were formulated and implemented to present the financial goals of the university as a next-level three-tier model [3]. Although his research is relatively comprehensive, the accuracy rate needs to be improved. Kondratenko et al. discussed some features of developing adaptive financial management systems in domestic firms. A multivariate model was proposed that allowed a detailed study of the interdependence of features, the closeness of the relationship between variables, and so on. It was concluded that developing an adaptive financial management system in a university can help improve the financial performance of the university [4]. The limitation of their research is that it is theoretically strong and lacks practical operation methods. These studies provide some reference for this paper, but the financial management system used is too backward and cannot reflect the latest advanced technology. Therefore, computer technology is introduced to improve the relevant system.

For the use of computer technology in the system, based on the big data Internet technology and research on the related technologies of agricultural product brand e-commerce recommendation system, Tong proposed a hybrid collaborative filtering method for agricultural product brand strategy recommendation combining explicit and implicit. The research results found that the system cannot only help users to quickly recommend agricultural products that meet their needs in the massive information but also provide more similar information for users to identify [5]. Xiaojuan studied the integrated management system of mobile data network security and discussed in detail the research and implementation of the security event management mechanism. The proposed event management can be regarded as an extension of the concept of network management, enriching the content of network management functions [6]. Mammadov et al. proposed the structure of a computer-aided design management system (CADMS). The system provided high performance, flexibility, versatility, and project program accuracy. Algorithm support was developed to manage the computer-aided design process of the FMS to enable an integrated computer-aided design process [7]. But the shortcoming of his research is that the scope of application is too narrow. These algorithms connect the computer and the system very well and provide support for the experimental computer network transformation of the financial system in this paper.

This paper combines the computer system with the financial management system of the university. On the basis of expanding and unifying the existing system, combined with the existing technology, the overall framework and module functions of the financial management system are analyzed and designed in detail, and the specific implementation process and interface are given. The experimental results show that the average response time of the system after the improvement of the computer network is about 4.3 s, and the data throughput per second is about 8150, which is about 5.7, which is higher than that of the system before the transformation.

2. Construction Method of Financial Management System

As an important part of the university's development, the finance department must budget, manage, and analyze all aspects of the university's operations [8, 9]. In addition, the financial department also needs to be responsible for fund management and appropriation cashier work. In order to improve the level and efficiency of financial management, it is an urgent problem to use the latest popular computer technology and efficient resources to build a comprehensive university financial management system that serves users [10, 11].

After the university uses the financial management system, the timely exchange of financial data is realized, the cooperation between departments is deepened, the financial management of the university is strengthened, and the operation of the university is more smooth and efficient. At the same time, it has financial loopholes and the risk of being hacked. This is the main role of the financial management system. Therefore, when designing the reformed system, first of all, the purpose of system development should be clarified according to the actual needs of the university. Then, the main functions of the system are determined around the system development purpose, and then, the main function modules are divided with the function realization as the center, and then, each function module is designed [12]. Each module of this system is independent at first, and the coupling is low. Therefore, in order to speed up the development progress, the synchronous development mode can be adopted [13].

By considering the code redundancy and system adaptability and stability in the system development process, the system architecture is designed in the sense of scalability, with three elements: presentation layer, logic layer, and data. The multilevel design allows each logic level to be independent of itself, which makes the system more flexible and easier to maintain [14]. The main users of the program are the university's financial personnel. Combined with actual accounting and needs, the program is divided into five parts, including financial management topics. The system modules are shown in Figure 1.

In this system, different system functions have corresponding module designs. Each part of the module is connected through the database to realize the whole process of data exchange. Each module has its own special structural characteristics to deal with corresponding different business [15]. The interception of data information by each module corresponds to the entire business processing process, and the acquisition of surrounding notifications is the result of analysis and processing in the IOC container and proxy class. During this process, the system performs permission detection on it to complete the corresponding log management function. The system usage diagram shows the corresponding functions of the roles in the system and plays a direct role in the system development process. The roles in

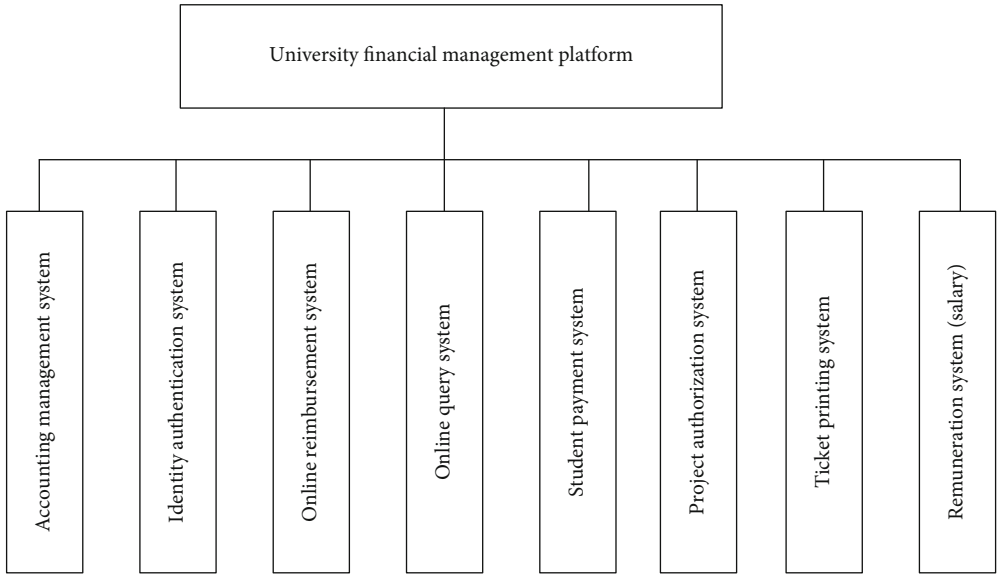

Figure 1: Financial management system module.

the program, the definition of permissions for each role, and the reasons for their assignment are described in detail [16]. The main roles involved in the financial management system are administrators, accountants, and cashiers [17]. As the university grows, the financial management system also needs to integrate operations. Examples used by system administrators are shown in Figure 2.

The operating system designed in this paper cannot only realize the management of financial work but also meet the aesthetic needs and usage habits of most people. The functional modules of the system are also designed to be very clear, and users can quickly grasp the operating functions of the system with the help of the instruction manual [18]. The system also suffers from occasional bugs that do not affect use. In addition, the system does not require high computer configuration. A normal work computer can run the system. Therefore, this paper believes that the system can meet the user's operational needs [19].

System design quality metrics include system security performance, response speed, system operation efficiency, and ease of use [20, 21]. When designing this system, the security of financial data is considered, which is the key to reflect the security performance of the entire system. Therefore, the system sets the corresponding operation authority for different users and also designs a strict examination and approval rules for the management of various assets. In addition, in order to facilitate the staff to quickly search for the required data, when designing the system, special attention is paid to the design of the system search function. The system can realize fuzzy search function by an adopting multifield method.

According to the functional requirements of the university financial system and the characteristics of personnel use, the network topology diagram of the following system is designed [22, 23]. Through this network architecture idea, each application server can be connected to the core switch quickly and effectively, and then, the secondary switches on each floor can distribute data to The physical location of each financial department is then connected to each specific business computer client; considering the security of the network, a firewall is finally set between the core switch and the school router to achieve the security policy on the hardware, outside the router and the public network. Direct connection is convenient for data exchange and remote access. This networking method is simple, fast, efficient, and safe. It cannot only meet the daily work of financial personnel but also facilitate system administrators to solve network failure problems in a timely manner. It is a mature network program, as shown in Figure 3.

3. Platform Implementation

(1) In financial management, payroll accounting is an important module. Payroll accounting is important because it involves the financial income and expenses of an entire unit. There are many factors involved in labor, and employee wages are directly included in the financial budget, so the requirements for accuracy are high. By designing the salary management module, monthly salary reports can be generated for employees to view and use, which is conducive to improving the efficiency of salary management and maximizing cost savings. From the overall function point of view, the salary management module needs to have the following functions: (1) staff management—enter, modify, and delete the basic information and salary data of employees; (2) payroll management—adjust the basic salary and variable salary, and generate the final payroll report; (3) salary adjustment—adjust the working years, positions, and other information, and confirm the amount of relevant subsidies; and (4) salary inquiry—provide salary information inquiries

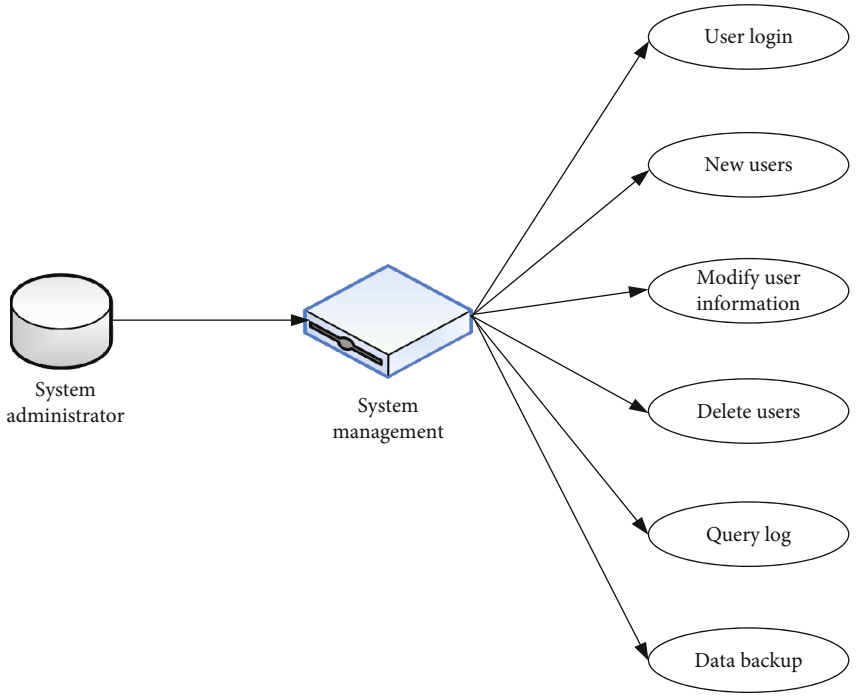

Figure 2: Example diagram of system administrator.

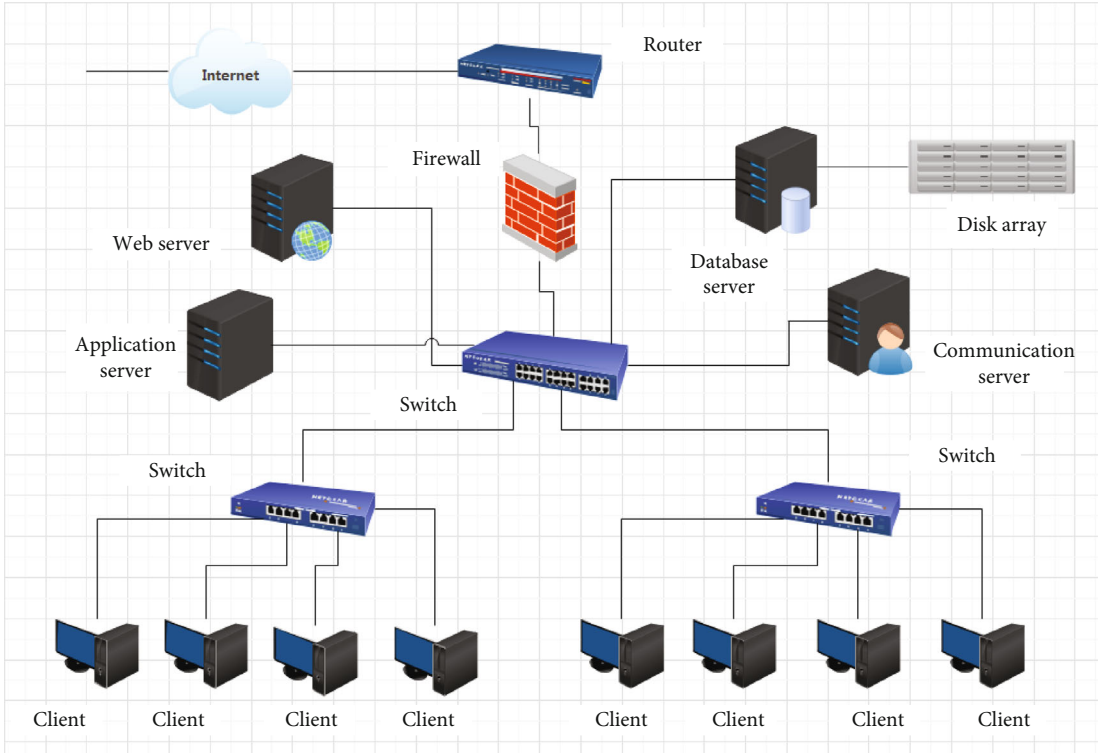

Figure 3: Network topology of financial management system in colleges and universities.

(2) Fixed assets are an important part of asset management, which will directly affect the efficiency of production and operation. The designed asset management module should include the following functions: (1) asset class—categorize, aggregate, and query asset classes; (2) the way of increase and decrease—add, modify, and delete fixed asset information; (3) usage status—record the usage status,

and mainly accrue depreciation; (4) card management—evaluate usage; and (5) provision management—depreciation is accrued according to the specified accounting period

(3) There are accounting processing system, accounting subjects, voucher entry, modification, review, and query (see Figure 4)

(4) In the identity authentication system, the design of the identity authentication system adopts a hierarchical structure, which is mainly divided into a data layer, authentication channel layer, and authentication interface layer and is divided into multiple functional modules, the most important of which are identity authentication module and authority management module. Include the kinds of roles defined for the user (e.g., normal user, advanced user, and admin user). Because the identity authentication system involves user privacy, the security design should be strengthened

(5) The online reimbursement system enables the reimbursement person to fill in the "reimbursement form" online and print it

(6) An online inquiry system can realize project inquiry, salary inquiry, etc.

(7) There are student payment system, import, maintenance, modification of student information, and docking with WeChat payment data (see Figure 5)

(8) In the project authorization system, the project leader can authorize and manage various projects

(9) In the payment platform system, manage charging items; you can view, reverse, import lists, view details, and restart items (see Figure 6)

The financial management system can combine the actual financial management needs of university to achieve efficient financial management. The financial management system has the characteristics of planning, control, and information consistency and has played an irreplaceable role in finance and operation and financial supervision. At present, many universities have used modern financial management systems, and only some small and university or private university use the manual management mode. In addition, most government units, enterprises, and institutions also use modern financial management systems. The traditional manual financial management method has a huge workload, and the efficiency of data record search is low, and it cannot provide statistical and analysis functions for financial management.

This paper believes that the financial management system of such university should have the function of enhancing the decision-making ability of the university leadership. University financial data can provide data support for university leaders to make correct decisions, and the system should have a good expansion function.

The system environment in the design and testing of this system has chosen the Microsoft operating system. This is because compared with the Linux operating system, it is easier to build a running environment in the Microsoft operating system, but if the Microsoft operating system is used directly, there are also many problems. For example, system security performance is not as good as Linux, and there is lack of some functional options. Therefore, this paper uses the Microsoft operating system and the inherited software package together to complete the construction of the operating environment of the system. In most cases, the system testing and operational requirements can be met. The specific hardware environment is shown in Table 1.

In the aspect of improving system reliability, the first is to carry out redundant design of network equipment and adopt the mode of multidevice and multichannel to ensure that after a single device fails, the user's request can still be transmitted to the service system. At least, it is necessary to ensure that the key network links have backup links, so as to ensure that the failure of one network device does not affect the normal operation and access of the entire system. The application server adopts a cluster mechanism, which also ensures load balancing and avoids a single point of failure. Moreover, it provides customers with a capacity expansion mechanism that can grow linearly according to the capacity growth and can achieve the goal of increasing the user capacity of the linear system by increasing the number of application servers.

The system development software environment requires Microsoft Windows 7 operating system to deploy the PC, SQL SERVER2008 is used as the background database for development, IE8 is used as the browser for testing, RAM is 8GB, and Microsoft Visual Studio 2010 is used as the development platform. The specific software development environment is shown in Table 2.

The software system is also designed for redundancy. The authentication, authorization, and billing modules of the system service platform support cluster deployment from the model and use the Cluster mechanism of WebLogic to realize the concurrent operation of the system. By using JNDI technology to achieve information synchronization between multiple systems, even if a single system fails to work normally, another system can still handle the user's request. Moreover, the synchronization of this information is real time, and the user does not feel the abnormality caused by the local fault during the use.

The financial management system of this paper is realized based on B/S mode. In the implementation process, the local client is developed through the browser, the tool used for browser development is Internet Explorer 7, and the plug-in install-IEtester is installed to test the compatibility of different versions.

Through careful analysis of the system requirements, it is determined that the incremental model is used to develop the system. Because the incremental model can be developed in units of incremental packages of a requirement, even at

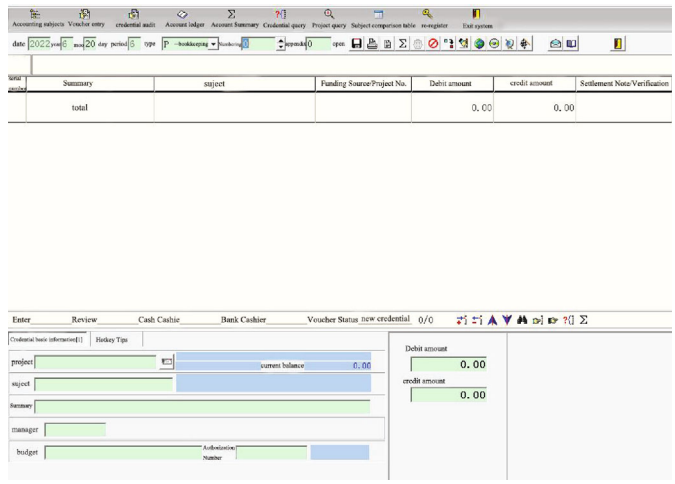

Figure 4: Accounting processing system.

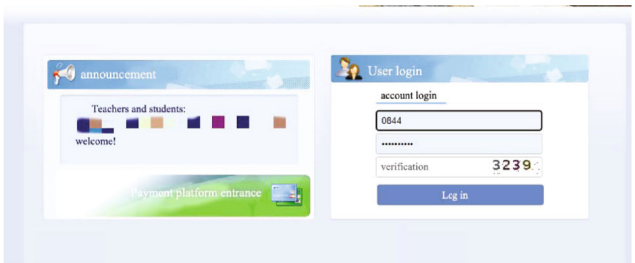

Figure 5: Student payment system.

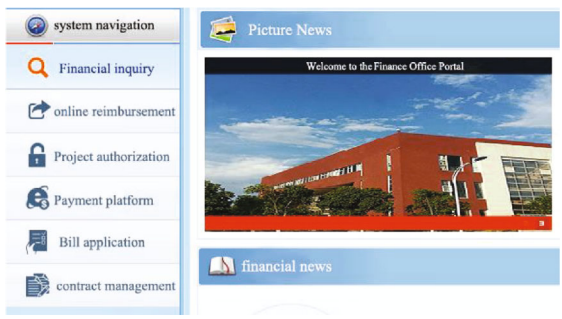

Figure 6: Payment platform system.

the beginning of the design, as long as a requirement incremental package is clarified, development can be started without waiting for all requirements to be constructed. Here, "a requirement incremental package" refers to the specific demand of a customer. As long as this incremental package is small enough, a certain incremental package may need to be further adapted to customer needs and changes. The impact is tolerable for the entire project development process. As a user, in the process of system development, there are many opportunities to modify the requirements, so that the final system can meet the actual needs of users to the greatest extent. Figure 7 shows a screenshot of the user login module implementation interface.

After completing the interface design of the form, the system further designs the business processing layer. Further analysis is carried out by taking the business layer of the credential management module as an example. First, a business type Voucher class for the module is created in the system, which realizes the proxy and interception of information processing more conveniently and quickly. Then, an interface class IVoucher class is created. In this process, the business that needs to be processed needs to declare the business processing method. Specifically, the main declaration methods include save, delete, and audit methods. These declarations implement their processing functions in the Voucher class, which facilitates data exchange in the database.

On the one hand, an IOC container can be used to form a target object that can inherit the IVoucher interface, which can act as a proxy IOC container in the future system work, and then complete the business class Voucher. On the other hand, it can also be used to add relevant information to intercept the associated operations. Only in this way, while exchanging information on the form interface, it is possible to carry out certain surrounding notification operations for the corresponding specific business. Once the operation of the form interface is completed, the button on the toolbar can be clicked to perform the corresponding functional operation and achieve the response of the related business at the same time.

Usually, the form of the table design in the database is mainly determined by the corresponding attributes of the data entity to be designed, and the specific setting of each attribute is also determined according to the corresponding field. At the same time, each field can also have its own attribute characteristics. The conceptual structure of the database refers to the logical structure form that can be automatically recognized by the system during the background movement of the system. This structure is different from the client's display database. It is the key point to connect the client and the background system. The rationality of its setting directly affects the stability of the system operation.

In the detailed design process of the system, it is necessary to decompose the entity classes into data classes and

Table 1: Hardware environment for system development.

Hardware name	Model and configuration	Usage time	Quantity
Host	Lenovo	The whole experimental process	1
Memory	8G	The whole experimental process	1
Hard disk	1TB	The whole experimental process	1
Network card	10/100 Mbps	The whole experimental process	1

Table 2: System software configuration.

Serial number	Name of software	Version	Use
1	Microsoft Windows	11	Operating system
2	SQL SERVER	2019	Database development
3	IE	8	Software support
4	Microsoft Visual Studio	2019	System development

Figure 7: Screenshot of the login interface.

then abstract the concrete data structure. The following takes the credential management module as an example to illustrate the data structure of the system. The university's projects may be distributed in different regions, and the rules for financial statements or auditing are different in each region, so template settings can be made according to specific financial formulations to meet the needs of different businesses.

According to the actual needs of the financial management system, this paper designs the system as a whole, puts forward the overall design goal of the system, and designs the system logic architecture. It includes the specific design of data access layer, business logic layer, and user presentation layer. The network structure of the system is shown through the network topology diagram, the functional structure of the system is described and displayed graphically, and the design of the system data table is shown.

4. System Performance

4.1. Response Time. The financial system before and after the system improvement is tested, and the number of tests is 50 times. The response time of the system before and after the improvement is compared, and the results are shown in Figure 8.

As can be seen from Figure 8, the average response time of the traditional financial management system is about 7 s, and the response time is not stable. In the 50 test time, there are 5 fluctuations, accounting for 10% of the total test time, and the fluctuation of the fluctuation is more than 50%. The average response time of the system after the transformation of the computer network is about 4.3 s. And during the test, the response time is basically stable, and the fluctuation is basically stable at about 15%. It can be seen that the financial management system designed in this paper is better than the traditional system.

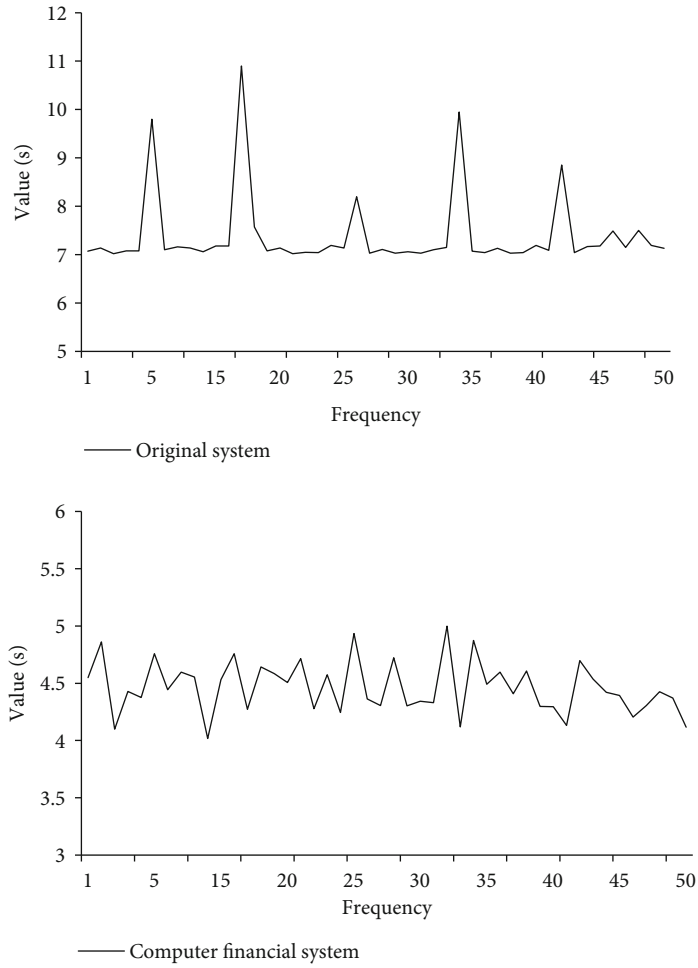

Figure 8: Response time.

4.2. Throughput per Second. Throughput is a limit indicator, that is, an indicator when network devices are fully configured on all ports and work at the highest wire speed of the ports. If the highway traffic system connecting different cities is used as an analogy, the throughput of a switch is equivalent to the sum of the traffic flow in and out of all cities in the system, that is, the sum of the bidirectional packet forwarding rates of all ports of the switch. The size of the throughput is mainly determined by the internal and external network port hardware of the network device and the efficiency of the program algorithm, especially the program algorithm. For a device that needs to perform a large number of operations, the low efficiency of the algorithm greatly reduces the communication volume.

Throughput is a metric when network devices are fully configured on all ports and operating at maximum speed. By taking highway links in different cities as an example, the modified result is equivalent to the sum of the inbound and outbound traffic of all cities in the system, that is, the sum of the bidirectional packet forwarding rates of all switch ports. The output size mainly depends on the application of the internal and external network ports of the network device and the performance of the system algorithm, especially the system algorithm. For devices that need to perform a large number of tasks, the poor performance of the algorithm can greatly reduce the amount of communication. This paper makes statistics on the throughput per second before and after the system improvement, and the results are shown in Figure 9.

As can be seen from the comparison in the figure, the data throughput per second of the traditional university financial system is about 7900, and the ups and downs are about 10%. After the transformation, the data throughput of the system per second is about 8150, and the ups and downs are about 8%. It can be seen that the stability of the system transformed by the computer network is better than that of the original system, and the throughput per second is about 3% higher than that of the traditional system.

4.3. Number of Requests per Second. The performance of the system is mainly tested for response time, throughput per second, and number of requests per second, and the corresponding time and throughput have been tested. Here, the number of requests per second of the financial management system is also tested, and the results are shown in Figure 10.

As can be seen from the figure, the average data request per second of the original financial management system is around 5, and the highest is 7.6. The average number of

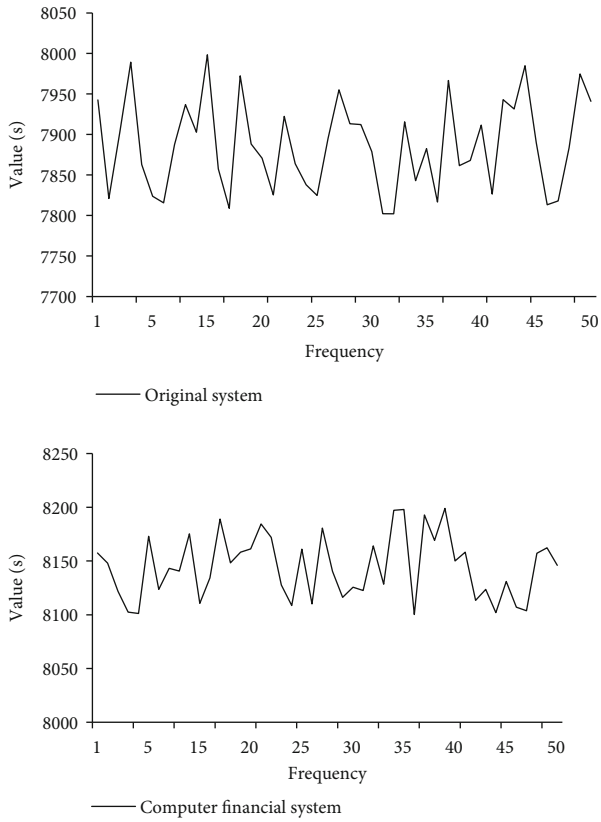

Figure 9: Throughput per second.

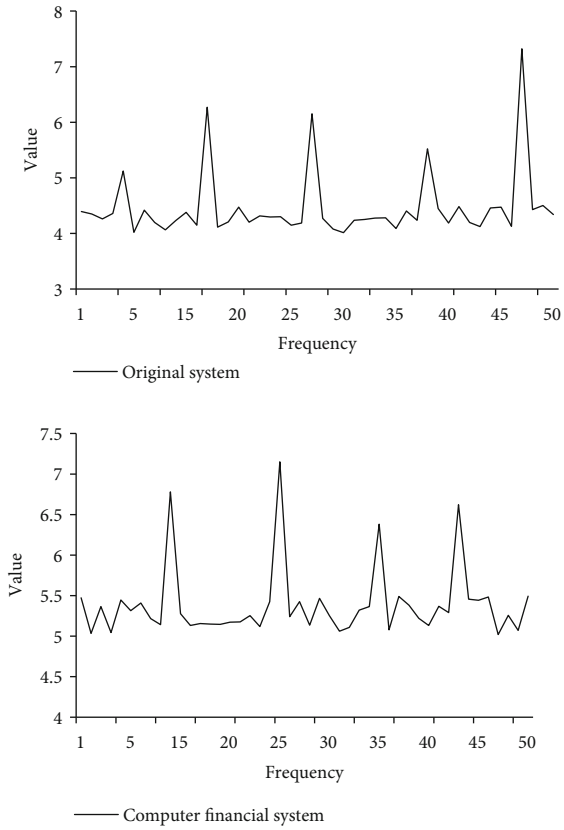

Figure 10: Number of requests per second.

requests per second for the financial management system constructed by computer network technology is around 5.7, with a maximum of 7.4. It can be seen that the average request volume of the system constructed in this paper is higher than that of the traditional financial system, while the highest request volume is slightly lower than that of the traditional financial system. Therefore, when universities choose a financial system, they need to choose different methods to build a financial management system according to their own needs, so as to achieve better results.

5. Conclusion

In the current era of information technology leading the industrial economy, Chinese university must make great efforts in informatization. By sorting, analyzing, and processing information, the useful content for the university can be obtained quickly. And the financial management system designed and implemented in this paper is to solve this kind of problem. This paper starts from the background of software engineering and system analysis and discusses the design and implementation of the system from the aspects of related theoretical technology, system requirement analysis, system design, and system test implementation. Aiming at the current overall development of the financial management system of university, the operation requirements that conform to the actual situation and follow the basic principles of developing cognition and combining with income are put forward. According to the process management and characteristics of university, the functional modules of the system are shared in detail. Of course, there are some downsides. The built financial management system does not have the functions of a complete system, and some functions cannot be clearly defined, which leads to the system design not using more advanced design techniques. After that, by analyzing different business conditions and financial management system information, comparing the compatibility and integration of different programs, improving the system service department, and making the system play a greater role.

Data Availability

The data of this paper can be obtained through email to the authors.

Conflicts of Interest

The author declares that there is no conflict of interest regarding the publication of this work.

References

[1] I. Sherquzieva, "The role of dividend policy in the financial management system of joint-stock companies," *International Finance and Accounting*, vol. 2019, no. 3, pp. 22–22, 2019.

[2] J. Qian, "The construction and implementation of financial management system in electronic commerce," *Agro Food Industry Hi Tech*, vol. 28, no. 1, pp. 1415–1419, 2017.

[3] V. V. Malikov, "The algorithm for building a financial management system at the enterprise," *Business Inform*, vol. 3, no. 506, pp. 344–348, 2020.

[4] N. O. Kondratenko, M. M. Novikova, and N. Y. Spasv, "Developing an adaptive financial management system at an enterprise," *The Problems of Economy*, vol. 1, no. 47, pp. 78–84, 2021.

[5] Z. Tong, "Application of information system and computer internet technology in integration of geographical indication agricultural products," *Journal of Physics Conference Series*, vol. 1982, no. 1, pp. 012144–012146, 2021.

[6] X. Ma, "Research and implementation of computer data security management system," *Procedia Engineering*, vol. 174, pp. 1371–1379, 2017.

[7] J. Mammadov, I. Aliyev, G. Huseynova, and G. Orujova, "Algorithmic support for the management of the computer-aided design of flexible manufacture system and its equipment," *Cybernetics and Systems Analysis*, vol. 57, no. 6, pp. 950–958, 2021.

[8] V. Tkachenko, "Financial cycle controlling in the anti-crisis financial management system of the enterprise," *Modern Economics*, vol. 20, no. 1, pp. 296–301, 2020.

[9] X. T. Li, J. Wang, and C. Y. Yang, "Risk prediction in financial management of listed companies based on optimized BP neural network under digital economy," *Journal of Manufacturing Processes*, 2022.

[10] P. Handayati and M. Palil, "The village financial management system: a policy towards independent villages," *Jurnal Ekonomi dan Studi Pembangunan*, vol. 12, no. 1, pp. 1–9, 2020.

[11] M. Lai, "Smart financial management system based on data ming and man-machine management," *Wireless Communications and Mobile Computing*, vol. 2022, Article ID 2717982, 10 pages, 2022.

[12] S. Lin, "Financial performance management system and wireless sharing network optimization of listed university under BPNN," *Mobile Information Systems*, vol. 2021, no. 4, Article ID 3443189, 11 pages, 2021.

[13] B. V. Nabijonov, "Methodological foundations for the development of the financial management system," *Theoretical & Applied Science*, vol. 93, no. 1, pp. 246–250, 2021.

[14] H. Zhang, "A deep learning model for ERP enterprise financial management system," *Advances in Multimedia*, vol. 2022, Article ID 5783139, 11 pages, 2022.

[15] S. Samad, "Theory of planned behavior and knowledge sharing among nurses in patient computer management system: the role of distributive justice," *Management Science Letters*, vol. 8, no. 5, pp. 427–436, 2018.

[16] Y. Lu, Y. Wang, and R. Chen, "Design of enterprise financial information management system based on blockchain technology," *Security and Communication Networks*, vol. 2022, Article ID 2566615, 8 pages, 2022.

[17] X. Xu, "Optimal control method of power system based on computer aided technology," *Computer-Aided Design and Applications*, vol. 19, no. S4, pp. 102–112, 2021.

[18] X. Wang, "Mathematical model of quantitative evaluation of financial investment risk management system," *Mathematical Problems in Engineering*, vol. 2022, Article ID 2439549, 14 pages, 2022.

[19] Z. Xu, M. M. Kamruzzaman, and J. Shi, "Method of generating face image based on text description of generating adversarial network," *Journal of Electronic Imaging*, vol. 31, no. 5, article 051411, 2022.

[20] Z. Xu, G. Zhu, N. Metawa, and Q. Zhou, "Machine learning based customer meta-combination brand equity analysis for marketing behavior evaluation," *Information Processing & Management*, vol. 59, no. 1, p. 102800, 2022.

[21] Y. Yang, "Design and implementation of an accounting risk identification system for the financial industry based on computer technology," *Revista de la Facultad de Ingenieria*, vol. 32, no. 6, pp. 1–8, 2017.

[22] H. Li, C. Huang, and L. Gu, "Image pattern recognition in identification of financial bills risk management," *Neural Computing and Applications*, vol. 33, no. 3, pp. 867–876, 2021.

[23] X. Wang, Z. Ting, X. Wang, and F. Yili, "Harshness-aware sentiment mining framework for product review," *Expert Systems with Applications*, vol. 187, p. 115887, 2022.