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Long Paper

Foreign Trade Company Personnel Management System using SSM Framework

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Abstract

Purpose – The main purpose of this study is to design and implement an efficient, reliable, and safe personnel management system to improve the human resource management level of foreign trade companies.

Method – We chose the SSM framework (Spring + SpringMVC + MyBatis) as the development platform, taking full advantage of its comprehensiveness, maturity, and community support. The system includes an employee information management module, salary and benefits management module, performance evaluation module, and training record module. It also has a responsive design and supports multi-platform access.

Results – Through this study, we successfully designed, developed, and implemented a feature-rich personnel management system for foreign trade companies. The system improves employee information accuracy, employee satisfaction, and management

efficiency. It allows employees to easily access and manage their personal information while providing management with data on employee performance, compensation structures, and more.

Conclusion – Our findings indicate that it is wise to choose the SSM framework as a development platform as it provides a wide range of features and support that help implement the system's requirements. The personnel management system of foreign trade companies plays an important role in improving management efficiency, improving employee satisfaction, providing decision support, and ensuring data security.

Recommendations – Future research should focus on further optimizing system performance, improving user experience, exploring data analysis and prediction, implementing mobile applications, and enhancing data security and privacy protection. These improvements will help increase the functionality and value of your personnel management system.

Practical Implications – The personnel management system of foreign trade companies based on the SSM framework has extensive practical significance in practical applications. It can improve the competitiveness of foreign trade companies, reduce management costs, and ensure data security and compliance, thus providing strong support for the sustainable development of enterprises. This system also provides valuable experience and reference for research and applications in other similar fields.

Keywords – personnel management system, SSM framework, foreign trade companies, employee information management

INTRODUCTION

In the era of globalization, international trade has become one of the key factors for economic growth and prosperity in various countries. Foreign trade companies play an important role in this international trade ecosystem. As intermediaries, they promote the transnational flow of goods and services, build global supply chains, and promote international cooperation and business exchanges. However, foreign trade companies are facing an increasingly complex and competitive business environment, which requires them not only to have excellent business intelligence but also to efficiently manage and coordinate resources, especially in terms of human resources. Human resources are the core assets of any organization, and in enterprises such as foreign trade companies, efficient management of human resources is particularly important. Foreign trade companies need to manage employees from different cultural backgrounds, different skills, and different needs, while also coping with the constant changes in the global market. This requires a highly flexible and efficient personnel management system to ensure that

employee recruitment, training, performance evaluation, and salary management can work together seamlessly.

Traditional human resource management methods can no longer meet the needs of foreign trade companies in the modern business environment. The rapid development of information technology provides enterprises with new solutions, allowing them to better cope with challenges. In this context, this paper aims to introduce the design and implementation of a foreign trade company personnel management system based on the SSM (Spring + SpringMVC + MyBatis) framework. As a lightweight Java EE framework, the SSM framework has been widely used in many enterprise applications. It provides a flexible and powerful development platform that can help foreign trade companies build efficient and maintainable personnel management systems. This paper will deeply explore how to use the various features and advantages of the SSM framework to design and implement a fully functional personnel management system to meet the needs of foreign trade companies for human resource management.

This paper will first conduct a detailed analysis of the needs of foreign trade companies' personnel management systems, including requirements for employee information management, recruitment management, attendance management, performance management, etc. Then, we will introduce the basic concepts and core technologies of the SSM framework and how they are integrated with personnel management systems. Next, we will describe the system design and implementation process in detail, including database design, front-end interface design, back-end logic development, etc. Finally, we will discuss the testing, deployment, and maintenance of the system to ensure the stability and reliability of the system in actual operation. Through the research of this paper, we hope to provide an effective personnel management solution for foreign trade companies, help them better manage and optimize human resources, and improve the competitiveness and development potential of enterprises. At the same time, we also hope that this paper can provide valuable reference and inspiration for enterprise application development in other fields, and promote the application and development of information technology in the commercial field. The modernization of human resource management is one of the keys to the success of foreign trade companies, and we believe this paper will contribute to research and practice in this field.

LITERATURE REVIEW

People management is a critical component of the successful operation of any organization. In today's highly competitive business environment, foreign trade companies especially need efficient personnel management systems to help them with recruitment, training, performance management, and employee development. Research shows that effective personnel management systems can increase employee satisfaction, reduce employee turnover, and improve organizational performance (Anwar & Abdullah, 2021). With the rapid development of information technology, many organizations have adopted

computerized personnel management systems. These systems can provide more efficient, accurate, and reliable data management, thereby helping organizations better manage human resources (Haleem et al., 2022). In a globalized environment such as a foreign trade company, the application of information technology in personnel management is particularly important because it can support cross-border recruitment, cross-cultural training, and performance management of global employees. The SSM framework (Spring + SpringMVC + MyBatis) is a popular Java Web application development framework that combines the IoC (inversion of control) and AOP (aspect-oriented programming) functions of the Spring framework and the model-view-controller architecture of SpringMVC And MyBatis database access technology (Zhang et al., 2013). This comprehensive framework provides developers with powerful tools and techniques for building high-performance, scalable, and easy-to-maintain applications.

In the literature, there have been some studies focusing on the development and application of personnel management systems based on the SSM framework. Literature (Sun, 2021) introduces the personnel management information system designed and implemented based on the SSM framework. First, it outlines the significance of personnel management and then uses Spring, Spring MVC, MyBatis, and other technologies in the SSM framework to design and implement the system. The database is designed using a relational model. And implemented more than 20 information tables. The system implements functions such as batch import of information, real-time updating of personnel information, job transfer, entry and exit management, etc., ensuring data security. The system directory follows the hierarchical structure of Dao, Service, Controller, etc. The code example shows in detail the core process of querying and updating employee information.

The system was stress tested using JMeter. By using Spring IOC and AOP to achieve decoupling, and MyBatis for ORM mapping, a system with good performance, high scalability, and strong reconfigurability was obtained. The article also discusses the data management and scientific decision support issues faced by the construction of personnel management information systems and puts forward suggestions for further development, which has certain research and application value. Literature (Xue, 2022) introduces the design and implementation of an intelligent decision-making system for enterprise management based on data analysis. The system uses the Hadoop big data cluster for data analysis, collects information required by the enterprise through Flume, Kafka, Scrapy, Sqoop, and other tools, stores it in HDFS, then retrieves the data through the Hive tool, starts MapReduce for distributed computing and analysis, and extracts valuable data.

The system includes three functional modules: problem diagnosis, information collection and analysis, and prediction. The problem diagnosis module can check the existing problems within the enterprise, the information collection and analysis module can collect the information required for decision-making, clean and analyze it, and the prediction module can predict the development trend of the enterprise and market changes based on the time series algorithm. Finally, through Java language, the analysis

results are visualized and presented to business managers in the form of charts. This system has changed the traditional decision-making method of enterprises, provided more comprehensive and accurate data support, improved the scientificity and accuracy of decision-making, and provided effective assistance to enterprise managers in their decision-making. Literature (Wang et al., 2021) aims at the problems of complex client maintenance and poor compatibility in the existing personnel management system, using B/S architecture, J2EE multi-layer architecture, MVC design pattern, SQL Server 2008 database, and other technologies to design and implement a reasonable and easy-to-use system. Maintained enterprise personnel management computer system.

The system includes six modules: personnel management, organizational management, recruitment management, training management, salary management, and system management. It realizes enterprise information integration and convenient access and query of information database. The interface is simple and easy to operate. It has low investment and maintenance costs, high security, and good performance, which can improve corporate work efficiency and modern management levels; and the system operating performance was tested, and the results showed that the system throughput rate, transaction processing success rate, average response time and other indicators all reached good standards, low CPU and memory usage, indicate that the system has basic functions and ensures good performance, and is suitable for corporate personnel management, organizational management, recruitment management, training management, and salary management. These studies show that the SSM framework has many advantages in personnel management systems, such as flexibility, scalability, and high performance. It can help foreign trade companies better manage employee information, salary and benefits, performance evaluation, and training records. Although some research has focused on personnel management systems based on the SSM framework, there are still some opportunities for future research. This includes a deeper dive into the framework's performance optimization, user interface design, data security, and integration with other enterprise systems. In addition, you can also consider studying the application of artificial intelligence and big data analysis technology in personnel management systems to improve decision support and prediction capabilities.

Based on the above literature review, the personnel management system of foreign trade companies based on the SSM framework is a research field with important practical significance. This system can help foreign trade companies better manage their human resources and improve organizational performance. However, framework selection as well as system requirements and custom development must be carefully considered before implementation. Future research should focus on performance optimization, user interface design, data security, and integration with other technologies to promote further development in this field.

METHODOLOGY

System development of foreign trade company personnel management system based on the SSM framework mainly includes project demand analysis, system design, development process, and final implementation.

Demand analysis: Before developing the personnel management system of a foreign trade company, the first task is to conduct a detailed demand analysis. The goal of this stage is to clearly define the functional and performance requirements of the system to ensure that the system can meet the needs of the foreign trade company. Requirements analysis includes the following key steps:

(1) Demand collection: Collect relevant demand information by communicating with managers, HR professionals, and employees of foreign trade companies. This includes requirements for personnel management processes, employee information, salary and benefits management, performance evaluation, training needs, etc.

(2) Requirements analysis and prioritization Analyze: The collected requirements and clarify the priority and importance of each requirement. Determine which features are required and which are optional, and develop a development plan accordingly.

System design: The system design phase is based on demand analysis to create the blueprint and architecture of the system. The following are key steps in the design process:

(1) Architecture design: Select an appropriate system architecture based on the SSM framework and consider the scalability, performance, and security of the system. Identify modular components of the system to better manage and maintain the system. The decision to choose the SSM framework (Spring + SpringMVC + MyBatis) as the development framework for the foreign trade company's personnel management system was carefully considered for the following reasons: First, the SSM framework is a comprehensive, mature, and widely used Java Web application development framework. It integrates the IoC (Inversion of Control) and AOP (Aspect-Oriented Programming) features of the Spring framework, the model-view-controller architecture of SpringMVC, and the persistence layer management of MyBatis (Zuo & Zhu, 2017). This framework provides a wealth of tools and libraries to meet the diverse needs of foreign trade companies' personnel management systems. Secondly, the SSM framework has a large development community and rich ecosystem, which means we can easily obtain development documentation, tutorials, third-party plug-ins, and community support, thus saving time and resources (Peng et al., 2020). This is an important advantage for project development and maintenance, as we can leverage the power of the community to solve problems and access the latest technology trends and best practices. Third, the modular design of the SSM framework enables each component of the system to be developed and maintained relatively independently, which improves the scalability of the system. We can easily add new features or make modifications without affecting the normal operation of

other modules. This is crucial for foreign trade companies to quickly adapt to changes in demand in a changing market environment. In addition, the SSM framework also focuses on performance optimization and security. It provides a series of optimization measures, including performance optimization of database access, support for caching mechanisms, and powerful security features such as authentication and authorization mechanisms (Zhao et al., 2023). This is critical for handling large amounts of employee data, complex queries, and ensuring data security. In addition, the SSM framework is suitable for small and medium-sized enterprises because it has a low learning curve and can quickly develop powerful applications in a short period. If the development team is already familiar with or has experience using the SSM framework, this option can leverage their skills and experience, reducing training costs and risks.

(2) Database design: Design the database structure, including data tables such as employee information, salary and benefits, performance evaluation, and training records (Coronel & Morris, 2019). Ensure database regularization and performance optimization. When selecting a database, you need to consider factors such as the project's specific needs, performance, data model, and budget. The personnel management system of a foreign trade company may need to handle complex employee information and queries, so a database system with good performance and scalability should be selected, and the differences between commercial databases and open-source databases should be weighed based on the company's size and budget. In addition, ensuring data security and compliance of the database are also very important considerations. The database adopts the MYSQL database. Based on the advantages of open source, free, efficient performance, easy to use, cross-platform, and rich in resources, choosing MySQL as the system database can reduce usage costs, achieve fast reading and writing speeds, facilitate integrated development with multiple languages, and simplify database management, to achieve multi-platform deployment and benefit from active community resources, so MySQL is an ideal choice to build the system database (Matallah et al., 2021).

(3) User interface design: Create an intuitive and easy-to-use user interface to support the operations of employees and managers. The interface should conform to the brand identity of the foreign trade company and provide necessary functional modules. Which user interface framework you choose depends on the size of your project, the skills and needs of your development team, and your budget. For foreign trade company personnel management systems, the project scale is small and time is tight, Bootstrap may be a good choice. The advantage of Bootstrap lies in its responsive design, rich UI components, and extensive community support, which allows developers to quickly build modern web interfaces, ensures a consistent user experience on various devices, and has rich documentation and community ecology system, making it easy to learn and use (Gaikwad, & Adkar, 2019).

System Development: The system development phase involves the process of coding, testing, and integrating various components. The following are the main steps in the development phase:

(1) Back-end development: Use Spring framework and MyBatis technology for back-end development to implement the core business logic of the system. Including functions such as employee information management, salary and benefit calculation, performance evaluation, and training records.

(2) Front-end development: Use SpringMVC and front-end technologies (such as HTML, CSS, JavaScript) to develop user interfaces to ensure user-friendliness and cross-browser compatibility.

(3) Testing: Carry out unit testing, integration testing, and system testing to ensure the functional integrity and stability of the system. Fix and debug discovered issues.

Implementation and deployment: After the system development is completed, it needs to be deployed to the server environment of the foreign trade company for use by employees and managers. The following are the main steps for implementation and deployment:

(1) Environment preparation: Prepare appropriate server and database environments to ensure smooth deployment and operation of the system.

(2) Data migration: Migrate existing employee data and related information to the new system to ensure data consistency.

(3) Training: Train employees and managers so that they can make full use of the new personnel management system. Provide necessary training materials and support.

(4) Officially launched: Put the system into use to ensure that employees can use the new personnel management system seamlessly.

System Maintenance: Once a system is put into use, ongoing maintenance and support are required to ensure system stability and security. This includes regular updates, bug fixes, and user support.

Through the above system development process, the foreign trade company's personnel management system based on the SSM framework will be able to effectively manage human resources, improve performance, and meet the needs of foreign trade companies. This system will provide a reliable and efficient tool for the company's human resource management, helping the company maintain a competitive advantage in global competition.

RESULTS AND DISCUSSION

System Analysis

We conducted a requirements analysis of the personnel management system of this foreign trade company from two perspectives: color division and function division. Excellent leaders need to appropriately delegate authority to subordinate departments. This foreign trade company's personnel management system is managed by the relevant network department of the company. The system can be divided into two roles: system administrators and foreign trade company employees. Based on the actual situation of the foreign trade industry and the division of system roles, this foreign trade company's personnel management system can be divided into the following functions: System Administrator: Employee Management Function, Department Management Function, Position Function, Title Bonus Management Function, Years of Service Bonus Management Function, Salary Item Management Function, Monthly Attendance Management Function, Salary Management Function, Graphic Display Function. Foreign trade company employees: Personal Information Management Function, Attendance Management Function, Salary Management Function, Comment Management Function.

System Role Use Case Analysis

Based on the requirements analysis of the personnel management system for foreign trade companies, we can divide the system roles into two roles: system administrator and foreign trade company employee. The system administrator is the highest authority in the foreign trade company's personnel management system, responsible for data management of employee information, department information, job information, professional title bonus information, seniority bonus information, salary item information, and monthly attendance information. Generally, only one system administrator account is set up. In addition, foreign trade company employees can manage their personal information and view their attendance information and salary details information.

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The system administrator of a foreign trade company performs business needs operations on the personnel management system of the foreign trade company based on the system administrator account authority. The basic data that the system administrator

needs to maintain include the following: employee information management, department information management, position information management, and professional title bonuses. Information management, seniority bonus information management, salary item information management, and monthly attendance information management. Among them, the system administrator can add information about newly hired employees and delete information about employees who have resigned, and can also edit basic information or employee photos; department information management can add and delete information about foreign trade company departments; position information Management, you can add position information that does not yet exist in the foreign trade company, delete existing position information in the foreign trade company, and modify the position information of the added foreign trade company; professional title bonus information management, you can add professional title bonus information and delete professional title bonus information ; Seniority bonus information management, you can add the seniority bonus information of foreign trade company employees, view the seniority bonus information of foreign trade company employees, delete the seniority bonus information of foreign trade company employees; Wage item information management, you can add salary item information and delete salary item information; Monthly attendance information Management, you can import employees attendance status for the previous month with one click, search for customized employees monthly attendance status, and support batch deletion function. The use case diagram of the system administrator is shown in Figure 1.

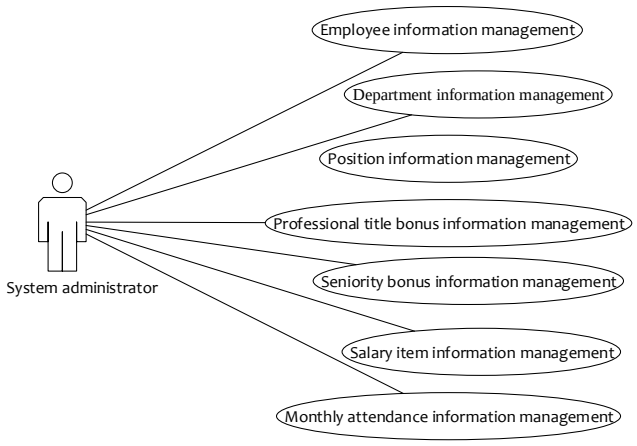

Figure 1. System Administrator Use Case Diagram.

The employees of the foreign trade company perform business requirements operations on the personnel management system of the foreign trade company based on the permissions of their employee accounts. This mainly involves filling in the employee's account and password on the personnel management system platform of the foreign trade company, logging in, and entering the personal center. The employee can modify their personal basic information, view their attendance information details, and view their salary information details. The employee use case can perform information operations, as shown in Figure 2.

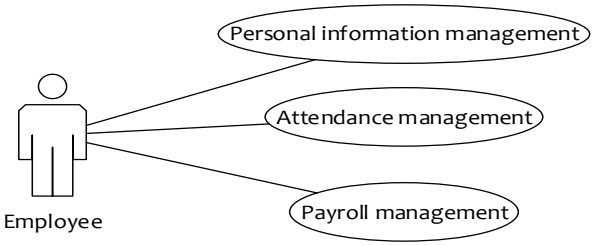

Figure 2. System Administrator Use Case Diagram.

System feasibility analysis

The personnel management system of a foreign trade company based on SSM was developed on the Windows 10 operating system, using development tools such as Eclipse 2018-12 (4.10.0) and Navicat Premium 15 (Alizadehsani et al., 2022). The technical feasibility analysis of this system mainly considers the following aspects: from the perspective of the maturity of frameworks and components: this system uses SSM as the technological architecture for the backend, i.e. Spring + SpringMVC + MyBatis, which has good scalability, flexibility, and ease of maintenance. Spring provides powerful dependency injection and aspect-oriented programming support, SpringMVC provides a good request distribution and processing mechanism, and MyBatis provides a good ORM framework and flexible SQL mapping mechanism. The combination of these technologies can achieve efficient, stable, and flexible operation of the system. From the perspective of database design: database design is a crucial part of the development of software systems. A reasonable database design can ensure the correctness, integrity, and security of system data. In the personnel management system of a foreign trade company, the design and management of data such as employee information, assessment indicators, and assessment results are required. MyBatis provides a good ORM framework and flexible SQL mapping mechanism, which can easily map Java objects to the database, thus achieving rapid data access and management (Shiyong et al., 2020). From the perspective of system security: the personnel management system of a foreign trade company needs to ensure the security of system data and the confidentiality of user information. The system should adopt a secure login mechanism to achieve user identity authentication and permission management. At the same time, data encryption, anti-SQL injection, and other technologies should be used to ensure that the system's data is not illegally obtained or tampered with. The personnel management system of a foreign trade company based on SSM has high technical feasibility, and the use of this technological architecture can achieve efficient, stable, and flexible operation of the system. At the same time, the design of the database and the security of the system also need to be fully considered to ensure the correctness, integrity, and security of the system's data. Ultimately, the technical feasibility of the system needs to be verified through actual development and testing.

Based on SSM, the personnel management system of a foreign trade company has good maneuverability, mainly in the following aspects: user-friendly interface, easy to use, complete functions, rigorous permission management, reliable security, and stable data processing. Among them, the front end of the system adopts the popular Bootstrap

framework, which gives the whole system a good UI experience, user-friendly interface, and easy operation. At the same time, the system adopts Ajax technology, which can achieve refreshless submission and more convenient operation. The system covers all aspects of performance appraisal of foreign trade company employees, including employee information management, appraisal index management, and appraisal result inquiry. At the same time, the operation process and function modules of the system are designed to be very clear and easy for users to understand and use. The system adopts strict permission management to ensure the security and reliability of the system. In the system, different roles have different permissions, and fine-grained control can be carried out on permissions to ensure the data security and management compliance of the system. The system uses the MyBatis framework to achieve data access, which can interact with the database quickly and improve system performance through caching and other technologies. At the same time, MyBatis has good stability and reliability, which can effectively ensure data consistency and integrity. In summary, based on SSM, the personnel management system of a foreign trade company has good maneuverability and can provide users with efficient, easy-to-use, secure, and reliable performance appraisal management services.

System design

System design is the process of defining and organizing the components and modules of various systems to achieve the desired objectives and requirements of the software system. System design aims to ensure the efficiency, reliability, maintainability, scalability, and security of the software system. In this article, the system design will be discussed in detail from two aspects: system structure design and database design, regarding the design of the personnel management system for a foreign trade company.

System structure design

The overall detailed design function structure and each function module of the personnel management system of a foreign trade company is shown in Figure 3.

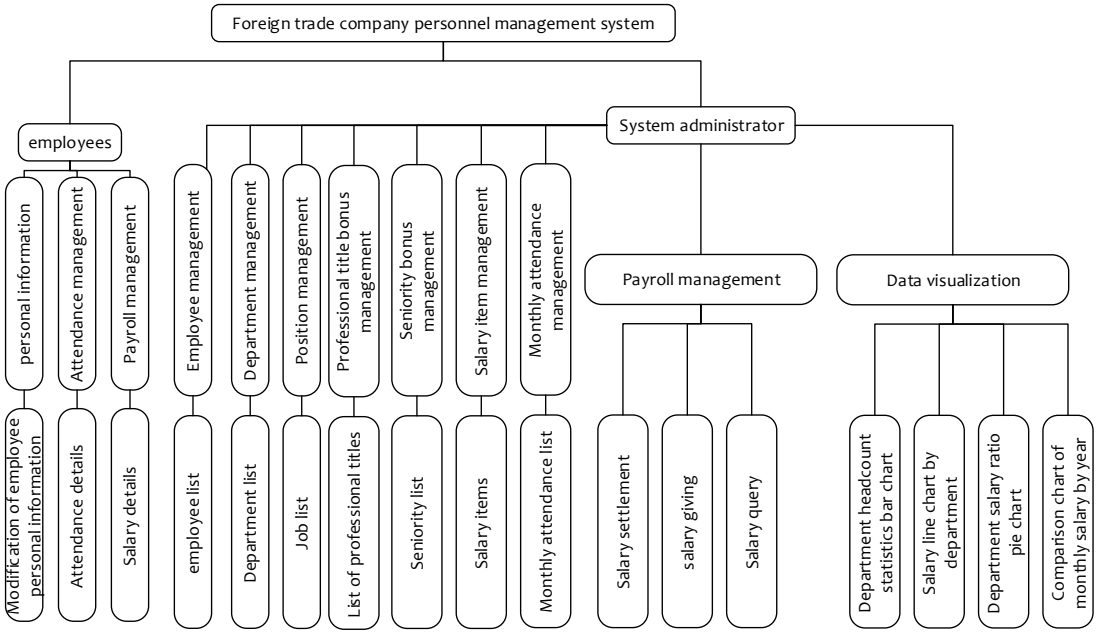

Figure3. Overall design structure diagram.

Employee function module: After employees successfully log in by entering the correct employee account number, password, and verification code on the employee login page, the page automatically jumps to the personal homepage. On the employee's homepage, foreign trade company employees can modify, upload, save, and do other operations on the employee's personal information through the personal homepage. You can view the employee's attendance details for a specific year through the personal homepage, and you can also view the employee's salary details for a specific year.

Employee personal information: Employees can modify the employee's mobile phone number, email address, emergency contact, emergency contact phone number, and home address. After the modification is completed, click Save Modification and the system will save the employee's personal information just modified.

Employees can check their attendance details: Employees can check their attendance details, such as: how many days of sick leave they took in a month; how many days of personal leave they took in a month; how many hours of overtime they worked in the company on weekdays and weekends; how many times they were late in a month; How many times did you get off work early in a month; How many days did you miss work in a month; How many days did you go out on business trips in a month. The employee selects the year to be queried and clicks Query and the system queries the personal attendance details required by the employee.

Employees can view salary details: Employees can view their salary details, such as payable wages, basic wages, various types of subsidy wages, various types of bonuses, and five insurances and one fund. The employee selects the year to be queried and clicks Query and the system queries the personal salary details required by the employee.

System administrator function module: The system administrator enters the system administrator's account, password, and verification code on the system administrator's exclusive login page to log in. The page jumps successfully to the homepage of the system administrator module. Through the administrator's homepage Employees can be added, deleted, updated, and queried through employee management, and the employee's job number, name, gender, password, ID number, birthday, department, position, professional title, education, entry date, basic salary, mobile phone number, Email address, emergency contact person, emergency contact phone number, and home address can be modified. Add, delete, update, and query departments through department management, and you can also modify the department name and department notes. Through position management, you can add, delete, update, and query positions, and you can also modify the position name, job description, and job subsidies. Through professional title management, you can add, delete, update, and query professional titles, and you can also modify the name and subsidy of the professional title. Through seniority management, you can add, delete, update, and query seniority, and you can also modify the name and subsidy of seniority. Through salary item management, you can add, delete, update, and query salary items, and you can also modify the lateness penalty, early departure penalty, business trip allowance, full attendance bonus, catering subsidy, and transportation subsidy of the salary item. Through monthly attendance management, attendance can be imported, the attendance Excel file that has been written can be imported with one click, and the employee attendance information that has been imported into the personnel management system of the foreign trade company can be modified. Through salary management, you can settle the wages of foreign trade company employees; determine whether to pay the wages of foreign trade company employees; can query the salary details of relevant foreign trade company employees. Through the chart display module, you can intuitively see the department headcount of the foreign trade company, the salary situation of each department of the foreign trade company, the departmental salary ratio of the foreign trade company, and the comparison of monthly wages in previous years.

Salary management module: Administrators can count various types of leave days, various types of overtime hours, various types of non-attendance days, etc. in the salary settlement function and calculate the corresponding salary details, various subsidy details, and various bonus details. and details of five insurances and one housing fund. In the salary payment function, you can view the corresponding salary details, various subsidy details, various bonus details, and five insurance and one fund details for all foreign trade company employees or employees of foreign trade companies with specific conditions, and pay wages. In the salary query function, you can view the corresponding salary details, various subsidy details, various bonus details, and five insurance and one fund details for all foreign trade company employees or employees of foreign trade companies with specific conditions.

Database design

Database conceptual design is to conduct some conceptual level analysis and design of the database before proceeding with the database design. It mainly defines the entities, attributes, relationships, and constraints of the database. The main purpose is to establish a database that can meet the needs of the application system. A database structure that is efficient, reliable, and easy to maintain. Database conceptual design usually includes the drawing of entity relationship diagrams (E-R diagrams) and the preparation of data dictionaries (Lopes et al., 2021). As the first step in database design, it has an important impact on the stability and performance of the system. The table structure relationship diagram of the foreign trade company personnel management system designed in this paper is shown in Figure 4.

Figure 4. Foreign trade company human resources management system database table structure diagram.

System implementation

Employee functional modules of the system

Effect of employee login interface on system homepage. The employee of a foreign trade company enters the employee login interface of the foreign trade company's personnel management system and can input their account, password, and correct verification code for login, as shown in Figure 5.

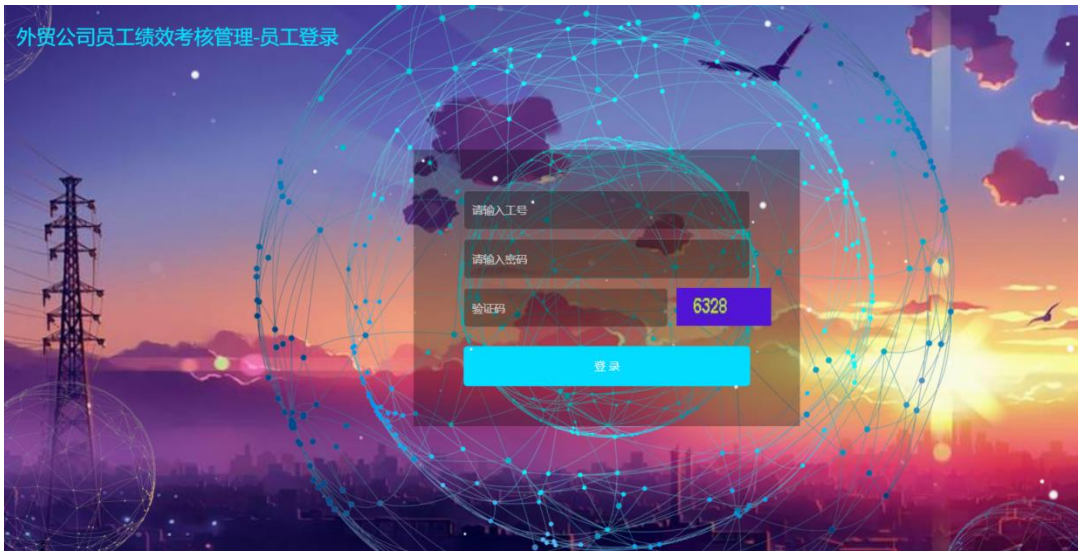

Figure 5. Employee Login Interface.

Employee homepage interface effect. The staff of a foreign trade company logs in to the personnel management system employee login page. After successful verification, they can enter the employee's homepage. On the employee's homepage, they can see the welcome logo and current time. They can choose to use personalized information, attendance management, salary management, comment section, and other special features on the employee's homepage, as shown in Figure 6

Figure 6. Employee Homepage Interface.

Employee personal information function interface. After entering the personal homepage, the employee of the foreign trade company clicks on the personal information to enter the personal information function page. On this page, the employee can modify or view their personal information, including five items that can be modified: mobile

number, email address, emergency contact person, emergency contact person's phone number, and home address, as shown in the screenshot of Figure 7.

Figure 7. Employee personal information function interface.

Employee attendance management interface design. After entering the personal homepage, the employee of the foreign trade company clicks attendance management to enter the attendance management function. On this attendance details page, the employee of the foreign trade company can view the attendance details information for a specific year, such as sick leave, personal leave, overtime on weekdays, overtime on weekends, overtime on holidays, the number of late arrivals, etc., as shown in Figure 8.

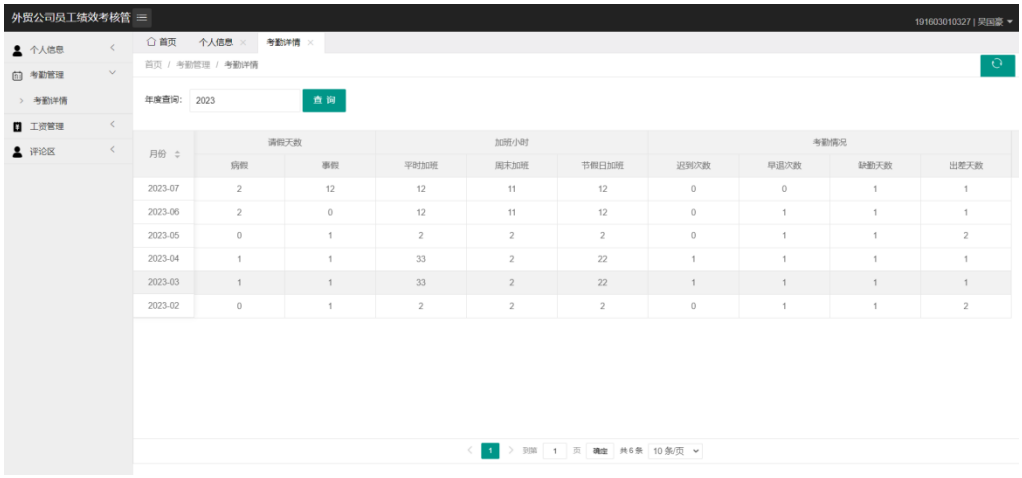

Figure 8. Employee attendance management interface.

Employee Salary Management Function Interface Effect. After entering the personal homepage, the employee of the foreign trade company clicks on the salary management to enter the salary management function. On the salary details page, the foreign trade company employee can query the salary details information of the employee for a specific

year, such as due salary, basic salary, other salary, allowance, bonus, five insurances, and one fund, etc., as shown in Figure 9.

Figure 9. Employee Salary Management Function Interface.

Employee comment area interface effect. After entering the personal homepage of employees in a foreign trade company, clicking the comment section can enter the comment section feature. In the comment details page, employees of the foreign trade company can comment anonymously or honestly, and also reply to other people's comments, as shown in Figure 10.

Figure 10. Employee Comment Area Interface.

System Administrator Function Module of the System

System administrator login interface effect. The system administrator of the foreign trade company's employee personnel management system can enter the dedicated login page for system administrators, enter the correct system administrator account, password, and verification code to log in, and enter the administrator account, as shown in Figure 11.

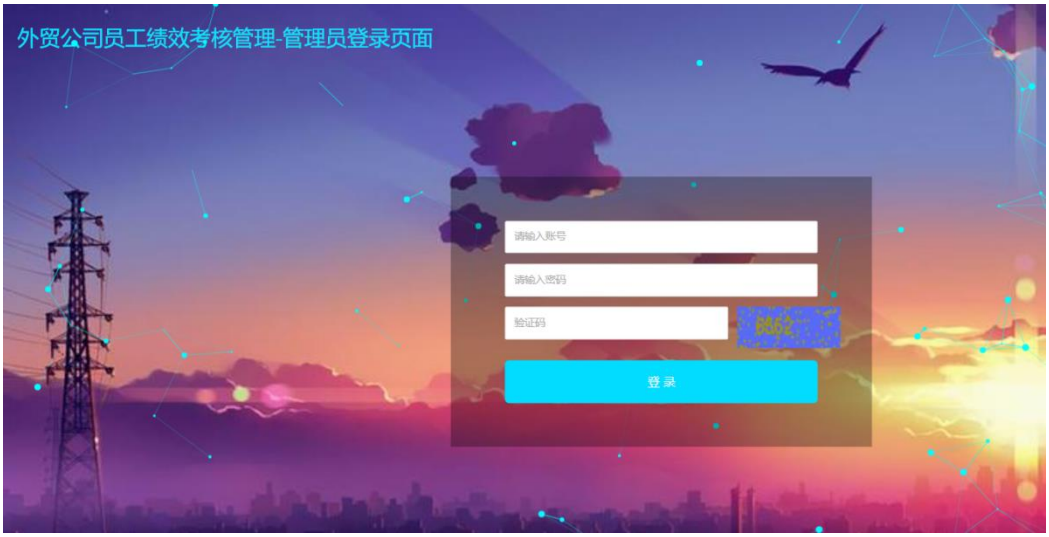

Figure 11. System administrator login interface.

System administrator homepage interface effect. After the system administrator completes the login verification, they can access the system administrator homepage. On the system administrator homepage, the system administrator can select the desired functions for use, such as employee management, department management, position management, and so on, as shown in Figure 12.

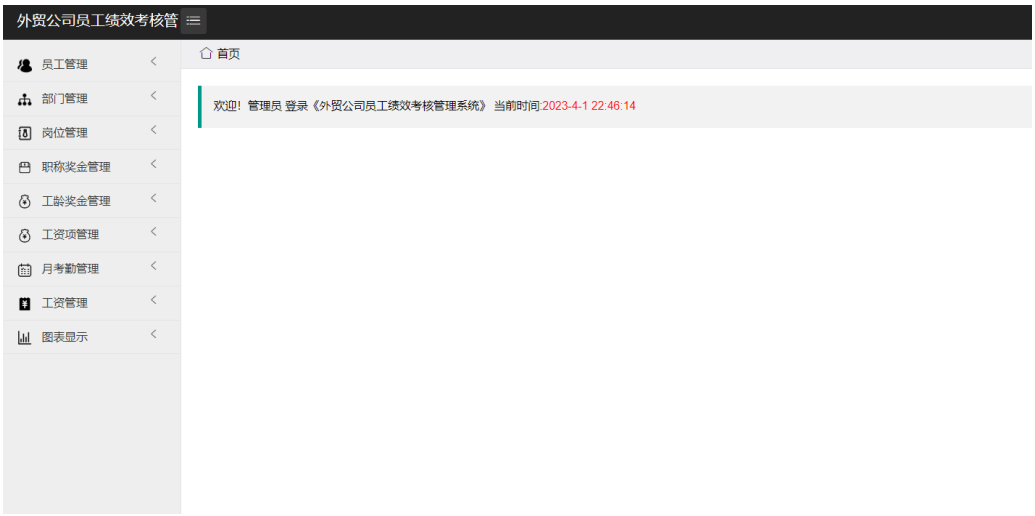

Figure 12. System Administrator Homepage Interface.

System administrator employee management interface effect. As a system administrator, after selecting the employee management page, you can search and view the employees of the foreign trade company by employee ID, employee name, and department. You can also add employees and batch delete selected employees, as well as modify all personal information for selected employees and change their account and password, as shown in Figure 13.

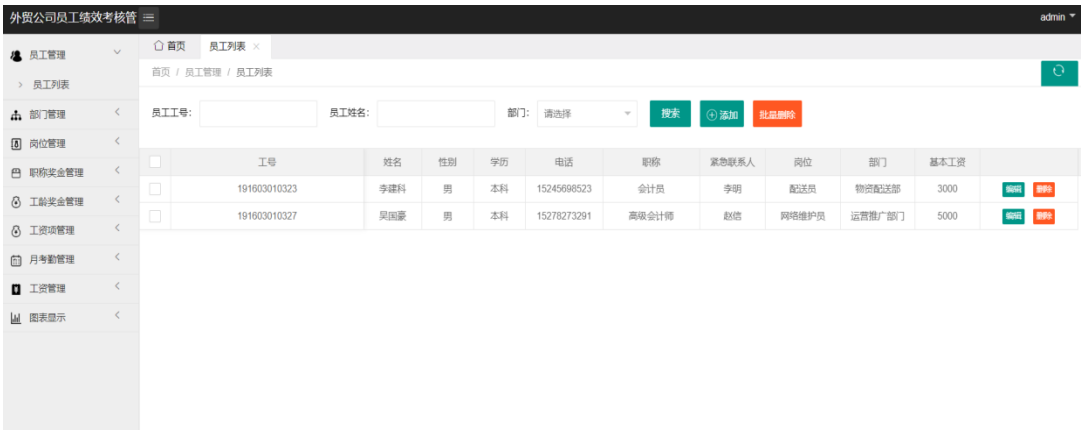

Figure 13. System Administrator Employee Management Interface.

System administrator department management interface effect. The system administrator selects department management on the administrator homepage and is taken to the department list page. On this page, the system administrator can add departments, edit the information of existing departments, delete existing departments, and search for keywords to find the department they need to query, as shown in Figure 14.

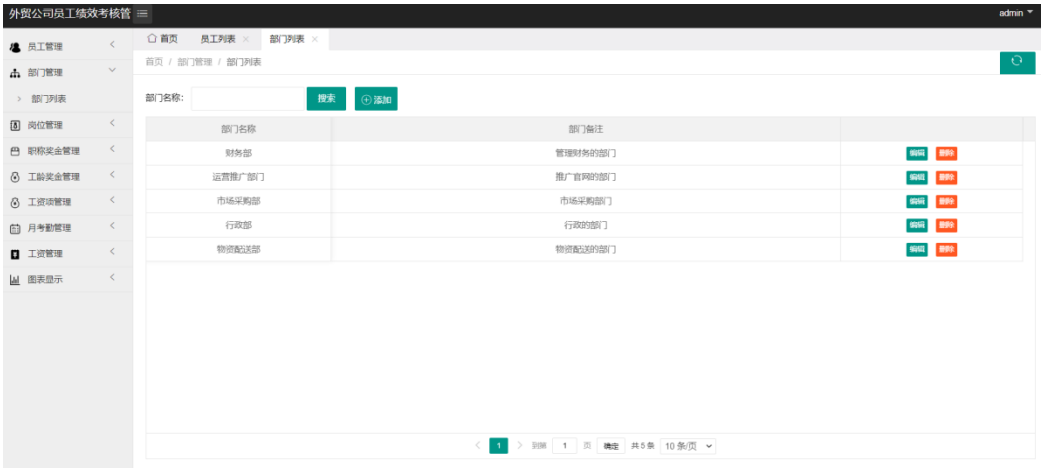

Figure 14. System Administrator Department Management Interface.

System administrator job management interface effect. The system administrator selects position management on the administrator homepage and enters the position list page. On the position list page, the system administrator can add positions, edit the information on existing positions, delete existing positions, and search for keywords to view the positions that need to be queried, as shown in Figure 15.

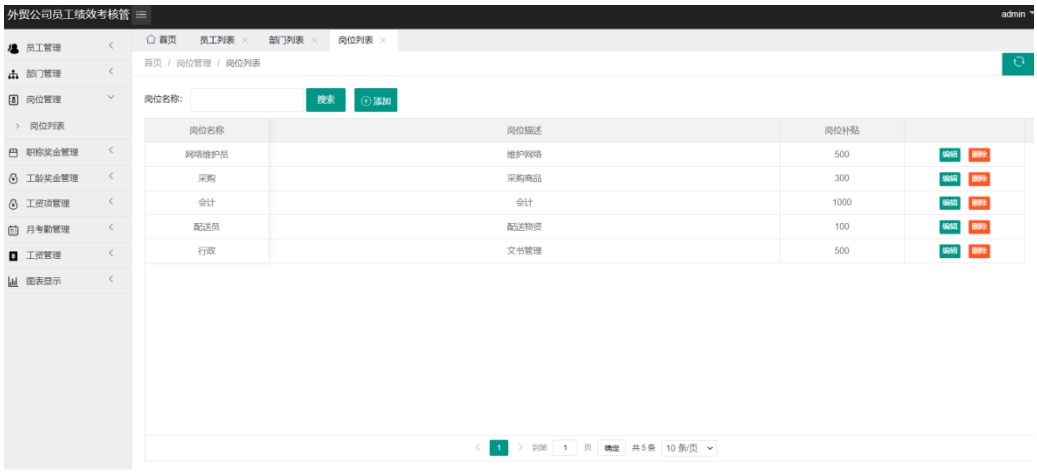

Figure 15. System Administrator Position Management Interface.

System Administrator Professional Bonus Management Interface Effect. The system administrator selects the title bonus management on the administrator homepage, enters the title list page, and can add titles, edit the information of existing titles, delete existing titles, and search for keywords to view the desired titles, as shown in Figure 16.

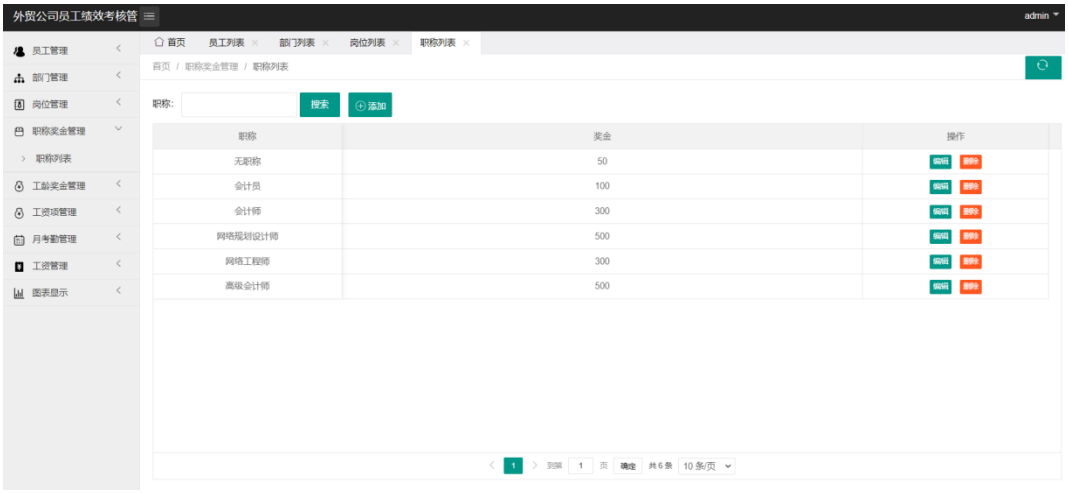

Figure 16. System Administrator Salary and Bonus Management Interface.

System management staff longevity bonus management interface effect. The system administrator selects the service seniority bonus management on the administrator homepage, enters the service seniority list page, and can add, edit, delete, and search for service seniority information on the service seniority list page, as shown in Figure 17.

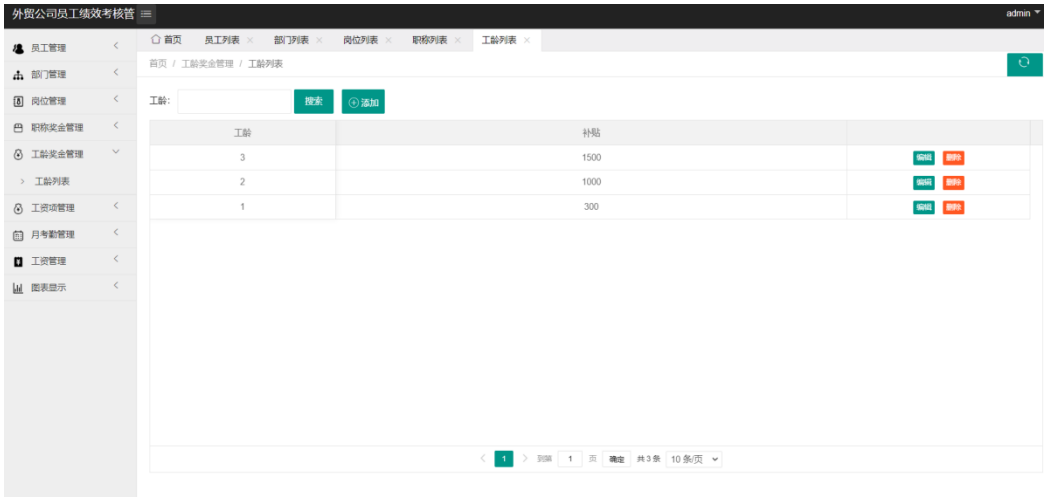

Figure 17. System management employee age bonus management interface.

System management employee salary item management interface effect. The system administrator selects the salary item bonus management on the administrator homepage and enters the salary item page. On the salary item page, the system administrator can set the penalties for lateness, early leave, business travel allowance, attendance bonus, catering allowance, and transportation allowance, as shown in Figure 18.

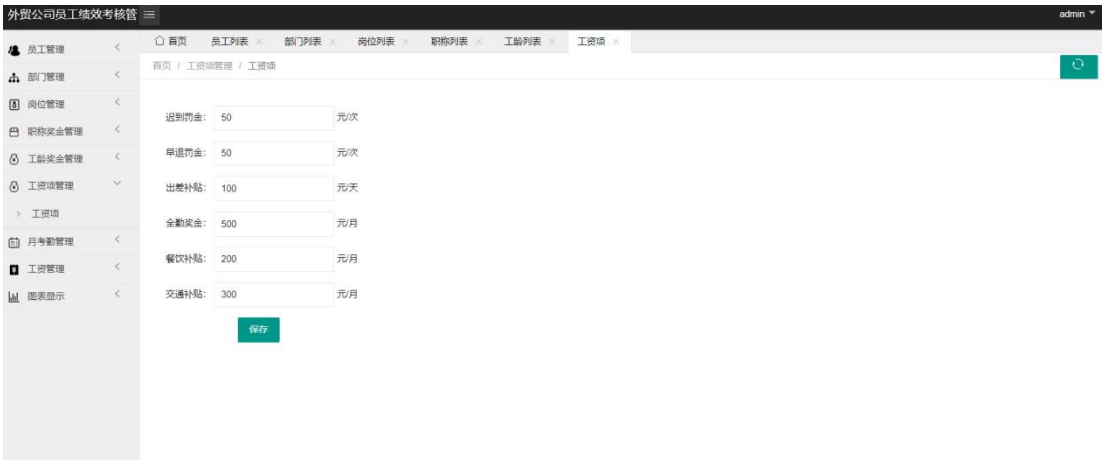

Figure 18. Management interface for employee salary item management in system administration.

System administrator monthly attendance management interface effect. The system administrator selects the monthly attendance management on the administrator homepage and enters the monthly attendance list page. On this page, the system administrator can import attendance sheets to add attendance information. They can also search and view the attendance information details of designated foreign trade company employees based on three conditions: employee ID number, department, and attendance month. In addition, they can modify existing monthly attendance information of

designated foreign trade company employees, and batch delete existing monthly attendance information of foreign trade company employees, as shown in Figure 19.

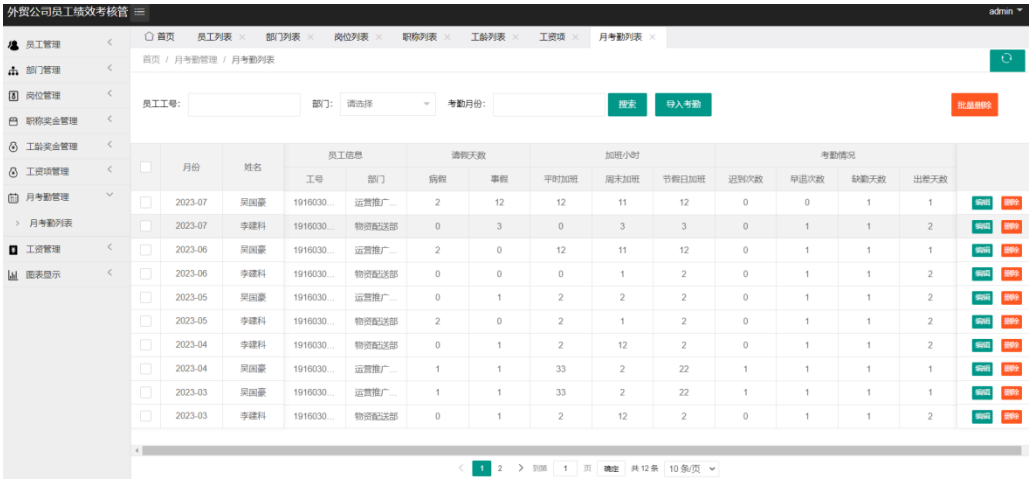

Figure 19. System Administrator Monthly Attendance Management Interface.

System management employee salary settlement interface effect. The system administrator selects salary management on the administrator homepage and enters the page for calculating employee salaries. On the employee salary settlement page, the system administrator needs to select the settlement method according to the requirements. If the administrator chooses to settle the salaries of all employed foreign trade company employees, enter the settlement time, choose the settlement, and after background calculation by the system, it will output the calculation results. In addition, the system administrator can also choose to settle the salary of employees of foreign trade companies in units. Select the desired settlement time and the identity code of the employee, and after background calculation by the system, it will output the salary results of that employee, as shown in Figure 20.

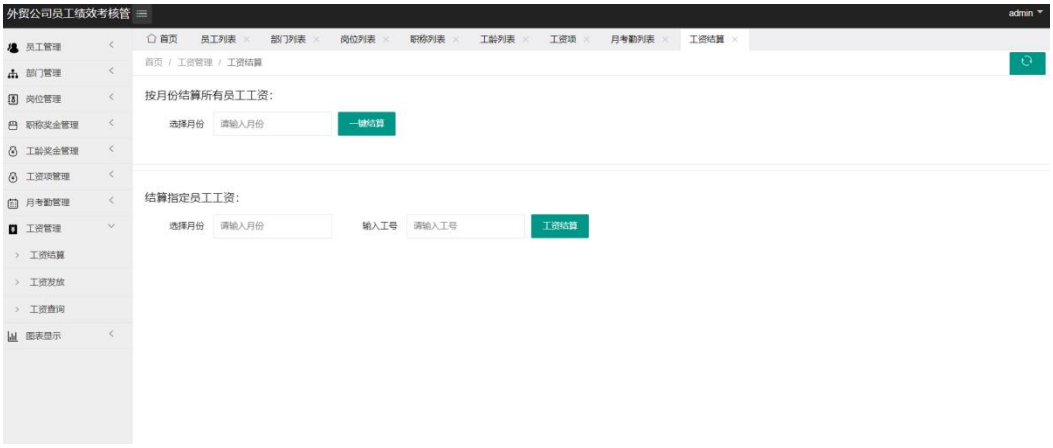

Figure 20. Salary settlement interface for system administrators.

The system management staff salary payment interface effect. The system administrator selects the salary management on the administrator homepage and enters the salary issuance page. On the salary issuance page, the system administrator can first search for the salary details of the specified foreign trade company employees by employee ID and issue salaries. They can also select multiple items to view bulk salary details information, and delete multiple items to remove bulk details information, as shown in Figure 21.

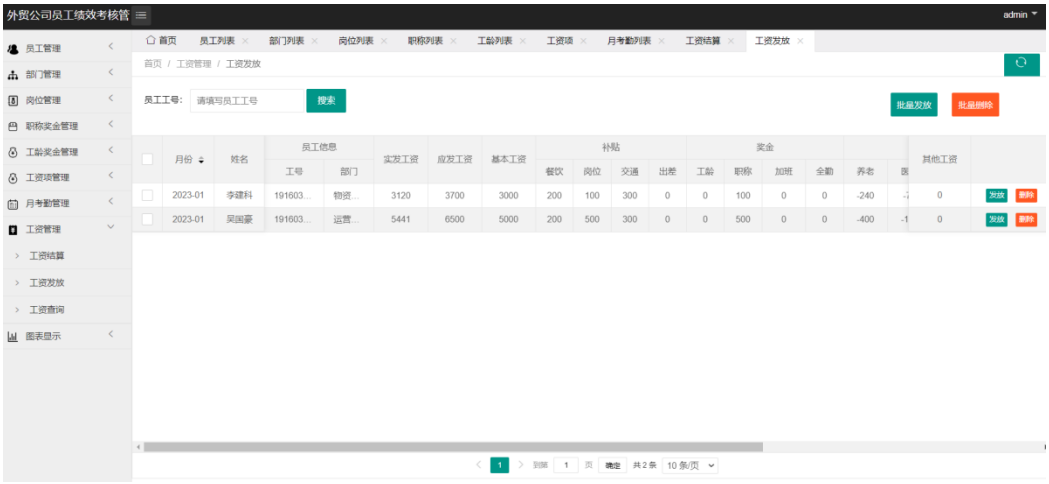

Figure 21. System management staff salary payment interface.

System management staff salary inquiry interface effect. The system administrator selects salary management on the administrator homepage and enters the salary inquiry page. On the salary inquiry page, the system administrator can query the salary details of specific employees by searching with employee ID, department, and month. They can also search for all employees of the foreign trade company without entering any conditions. After completing the salary inquiry, the system administrator can also export the salary statement. As shown in Figure 22.

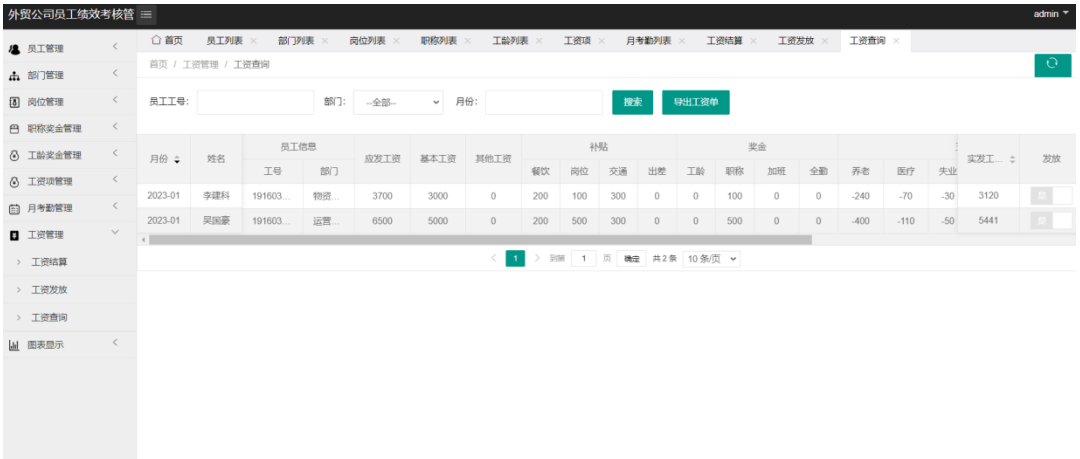

Figure 22. Salary inquiry interface for system administrators.

Effect of a bar chart for system administrator's headcount statistics in each department. The system administrator selects the chart display on the administrator homepage and enters the page for the departmental personnel statistics bar chart. On the departmental personnel statistics bar chart page, the system administrator can visually view the number of employees in each department of the foreign trade company, facilitating comparison of relevant data, as shown in Figure 23.

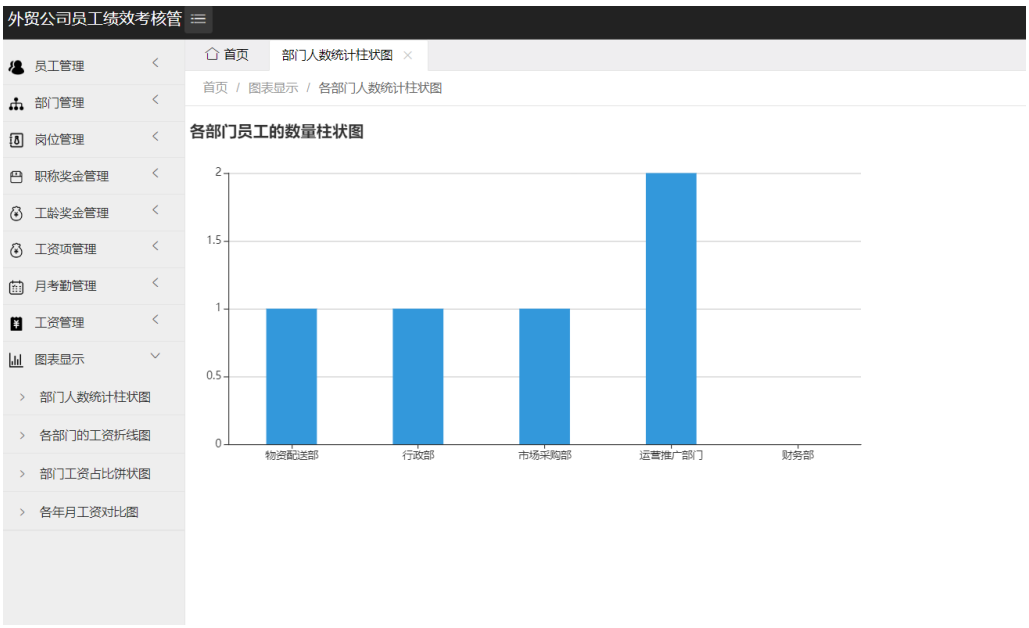

Figure 23. Bar chart interface for system administrator departmental headcount statistics.

Line chart of system administrator salaries across departments. The system administrator selects the chart display on the administrator homepage and enters the salary line chart page for each department. On the salary line chart page for each department, the system administrator can visually view the minimum salary, average salary, and maximum salary of each department in the foreign trade company, facilitating the comparison of relevant data, as shown in Figure 24.

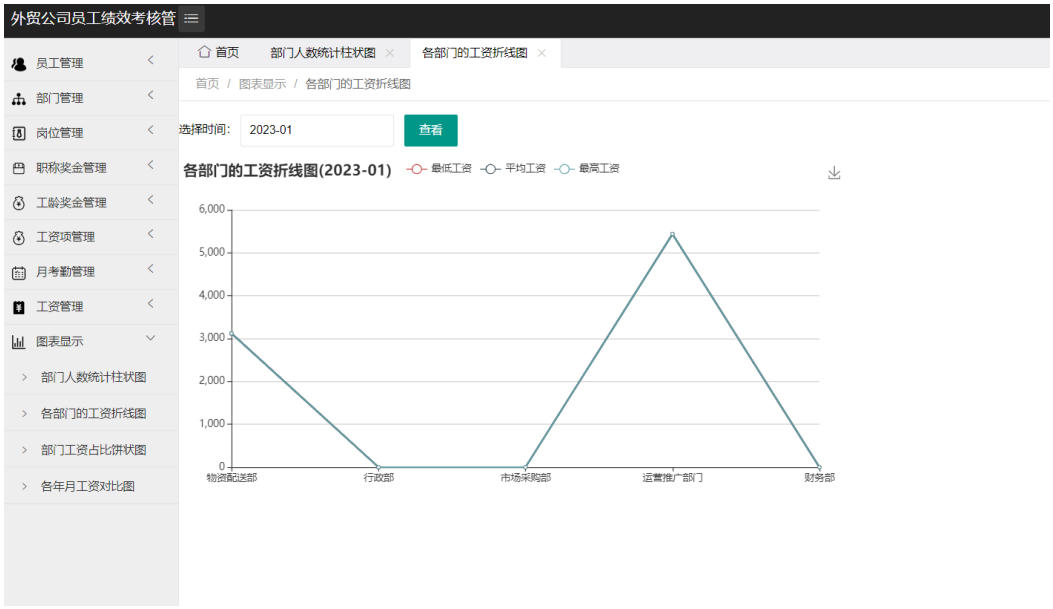

Figure 24. Salary Line Chart Interface for System Administrators in Each Department.

Pie chart of salary breakdown for system administrator department. The system administrator selects the chart display on the administrator homepage and enters the page of the department salary proportion pie chart. On the department salary proportion pie chart page, the system administrator can visually view the salary proportion situation of each department in the foreign trade company, facilitating comparison of related data, as shown in Figure 25.

Figure 25. Pie chart interface for the salary breakdown of the system administrator department.

System administrator salary comparison chart for each year and month. The system administrator selects the chart display on the administrator homepage to enter the monthly salary comparison page. On this page, the system administrator can visually review the company's monthly salary expenditure in the past three years for easy comparison of relevant data, as shown in Figure 26.

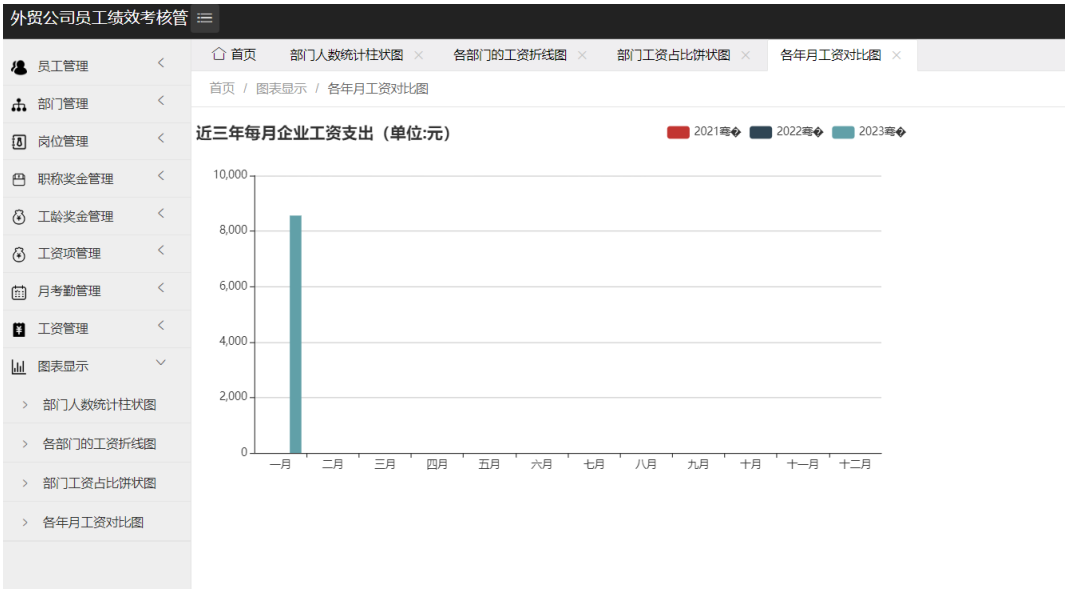

Figure 26. System Administrator Salary Comparison Chart Interface.

System testing

The system testing of the personnel management system for a foreign trade company based on SSM aims to evaluate the quality, reliability, and usability of the system to ensure that it meets user needs and expectations. It checks whether the system is designed and implemented according to user requirements and specifications and verifies whether the system operates as expected (Trautsch et al., 2020). This testing includes unit testing, integration testing, and system testing to ensure the correctness, completeness, stability, and reliability of system functions. It also includes aspects such as response time, throughput, and the number of concurrent users to ensure that the system can operate stably under expected loads. This testing includes stress testing, load testing, and capacity testing, which simulate and monitor the system to evaluate its performance and bottlenecks and optimize and adjust accordingly. Only through rigorous testing can a system better serve its users.

The design and implementation of the personnel management system for a foreign trade company based on SSM have been completed. After testing the system with the test cases for software system functions and following the test cases, the system has met the requirements in the task book and met the user's usage needs. During this test, according

to the role division, the functional testing of the foreign trade company employee role was first carried out, including testing of personal information functions, attendance management functions, salary management functions, and comment area functions. The functional testing of the system administrator role was also carried out, including testing of employee management, department management, job management, professional title bonus management, seniority bonus management, salary item management, monthly attendance management, and salary management functions. The system can achieve stable operation and expected results.

After a strict functional test of the system according to the post-test reality, some simple analysis was carried out. For the system homepage function, the page design is relatively simple without complex effects displayed, which gives users an obvious visual feeling and is relatively easy to use. The system's role design is reasonable and scientific, in line with the general needs of foreign trade enterprises, and conforms to mainstream design. No major errors occurred when users of all roles used this system.

CONCLUSIONS AND FUTURE RESEARCH

This paper is dedicated to the research and development of a foreign trade company personnel management system based on the SSM framework. Through systematic demand analysis, design, development, and implementation, we successfully built a powerful, high-performance, safe, and reliable personnel management system that can effectively support employee information management, salary and benefits management, performance evaluation and training Records, and other key human resource management functions. In this process, we chose the SSM framework as a development platform to take full advantage of its comprehensiveness and maturity, as well as its rich community support. The comprehensiveness and maturity of the SSM framework make it an ideal choice for the personnel management system of foreign trade companies. It provides a wide range of tools and libraries that support high performance, scalability, and security to help implement system requirements. Personnel management is crucial to the successful operation of a foreign trade company. With an effective personnel management system, companies can increase employee satisfaction, reduce employee turnover, and improve organizational performance.

In the future, we plan to improve and improve the following aspects to improve the performance and functions of foreign trade company personnel management systems, help companies better manage their human resources, respond to changing market challenges, and maintain competitive advantages. Further research and practice on how to optimize system performance to meet growing data demands and high concurrent access. Improvements are made in user interface design to provide a more intuitive and friendly user experience and improve system usability. Explore the application of artificial intelligence and big data analysis technology in personnel management systems to provide smarter employee management and decision support. Develop mobile applications that

enable employees to access and manage their personal information and work tasks on mobile devices.

PRACTICAL IMPLICATIONS

This system provides an overall solution for enterprise personnel management, which can improve work efficiency and modern management levels; the modular design makes the system structure clear and easy to maintain and expand; the use of B/S architecture and mature technology ensures the compatibility, security and performance of the system; reasonable database design supports personnel decision-making analysis; the main personnel management module implemented promotes daily personnel, organization, recruitment, training and salary management; simple and friendly user interface improves user experience; system investment and maintenance costs are low, providing An economical and efficient enterprise informatization solution; the system can be customized and integrated to adapt to different enterprise needs and improve reusability; overall, the system technically supports and promotes the quality of enterprise personnel management services, work efficiency, development pace and market competitiveness. improvement.

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DECLARATIONS

Conflict of Interest

The researcher declares no conflict of interest in this study.

Informed Consent

not applicable

Ethics Approval

not applicable

REFERENCES

Alizadehsani, Z., Gomez, E. G., Ghaemi, H., González, S. R., Jordan, J., Fernández, A., & Pérez-Lancho, B. (2022). *Modern integrated development environment* (ides). In Sustainable Smart Cities and Territories (pp. 274-288). Springer International Publishing.

Anwar, G., & Abdullah, N. N. (2021). The impact of Human resource management practice on Organizational performance. *International Journal of Engineering, Business and Management (IJEBM)*, 35-47.

Coronel, C., & Morris, S. (2019). *Database systems: design, implementation and management*. Cengage learning.

Gaikwad, S. S., & Adkar, P. (2019). A review paper on bootstrap framework. *IRE Journals*, 2(10), 349-351.

Haleem, A., Javaid, M., Qadri, M. A., Singh, R. P., & Suman, R. (2022). Artificial intelligence (AI) applications for marketing: A literature-based study. *International Journal of Intelligent Networks*, 119-132.

Lopes, J., Bernardino, M., Basso, F., & Rodrigues, E. (2021). Textual Approach for Designing Database Conceptual Models: A Focus Group. In *MODELSWARD* (pp. 171-178).

Matallah, H., Belalem, G., & Bouamrane, K. (2021). Comparative study between the MySQL relational database and the MongoDB NoSQL database. *International Journal of Software Science and Computational Intelligence (IJSSCI)*, *13*(3), 38-63.

Peng, Z., Liu, T., & Mai, L. (2020, August). Design and Implementation of Dormitory Management System based on SSM framework. In *2020 International Conference on Information Science, Parallel and Distributed Systems (ISPDS)* (pp. 321-325). IEEE.

Shiyong, X. I. O. N. G., Tianxiang, D. U., Rongzheng, Z. H. A. O., & Rongsen, W. U. (2020, March). Research on Mybatis mapper model based on SQL template. In *2020 International Conference on Computer Engineering and Application* (ICCEA) (pp. 502-505). IEEE.

Sun, Q. L. (2021). Design and implementation of personnel management information system based on SSM. *Destech Trans Econ. Bus. Manage*, 213, 104-114.

Trautsch, F., Herbold, S., & Grabowski, J. (2020). Are unit and integration test definitions still valid for modern Java projects? An empirical study on open-source projects. *Journal of Systems and Software*, *159*, 110421.

Wang, T., Li, N., & Li, H. (2021). Design and development of human resource management computer system for enterprise employees. *Plos one*, *16*(12), e0261594.

Xue, W. (2022, October). Design and Implementation of Enterprise Management Intelligent Decision System Based on Data Analysis. In *Proceedings of the International Conference on Information Economy, Data Modeling and Cloud Computing*, ICIDC 2022, 17-19 June 2022, Qingdao, China.

Zhang, D., Wei, Z., & Yang, Y. (2013, October). Research on lightweight MVC framework based on spring MVC and mybatis. In *2013 Sixth International Symposium on Computational Intelligence and Design* (Vol. 1, pp. 350-353). IEEE.

Zhao, L., Chen, S., Xu, Z., Liu, C., Zhang, L., Wu, J., ... & Liu, Y. (2023, November). Software composition analysis for vulnerability detection: An empirical study on Java projects.

In *Proceedings of the 31st ACM Joint European Software Engineering Conference and Symposium on the Foundations of Software Engineering* (pp. 960-972).

Zuo, Y., & Zhu, W. (2017). Aviation logistics information system based on SSM framework. In *2017 2nd International Conference on Computer Engineering, Information Science and Internet Technology (CII), DEStech Transactions on Computer Science and Engineering*, Sanya, China (pp. 533-538).

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