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Innovative Design of an Intelligent Discipline Inspection and Supervision Platform in the Big Data Era

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Abstract As information technology advances rapidly and the big data era emerges, the discipline inspection and supervision work in universities is encountering new opportunities and challenges. The conventional methods of discipline inspection and supervision can no longer meet the demands of modern university governance. Therefore, it is essential to enhance work efficiency and transparency through the application of information technology. By optimizing the workflow of discipline inspection and supervision, the requirements for core functional modules such as the management of integrity files, the processing of complaints and reports, and the dissemination of publicity and education are clarified. The design of a multi-layer architecture based on the J2EE framework enables efficient functional integration and standardized data management. This paper provides a detailed description of the database design and proposes a solution to achieve functional completeness and data structure simplicity through a limited number of core data tables. During the implementation, the integration of lightweight frameworks such as Spring, Hibernate, and Struts fully leverages the strengths of each framework, thereby improving the development efficiency and performance of the system. This research offers theoretical support and technical guidance for the informatization and intelligent transformation of discipline inspection and supervision work in universities, holding significant practical importance.

Index Terms Intelligent Platform, Discipline Inspection and Supervision, Big Data, J2EE, MySQL

I. Introduction

Nowadays, the world has entered the era of information technology, and e-government and big data platforms have been widely used in anti-corruption and management of public officials in some developed countries. Using modern scientific and technological means to prevent and punish corruption is an inevitable trend for anti-corruption work to keep pace with the times [1]. Promoting the development of information technology is an inevitable choice for the modernization of China's governance capacity. We must pay attention to practical, theoretical and institutional innovation in anti-corruption work, strengthen the use of modern scientific and technological means, especially information technology, and strive to improve the ability to effectively prevent and control corruption. The way of management by means of information technology is accepted and recognized by more and more people, and the network brings people a more convenient way of working. Discipline inspection and supervision departments actively improve the level of anti-corruption and promote the informationization of anti-corruption, which is an important way to build a scientific system. On the one hand, drawing on the experience of supervision in developed areas, on the basis of using a series of technical means such as comprehensive collection and comprehensive comparison, making full use of existing achievements, through the integration of information resources and business data, linking with the actual work of discipline inspection, based on big data technology, establishing a discipline inspection and supervision platform to improve the level of network supervision [2]. On the other hand, the convenience and interaction of discipline inspection and supervision platform have broken the dilemma of "public information" in the past to a certain extent. Citizens and law enforcement officers can supervise each other, promote information transparency and promote the implementation of civil rights. With the advent of the era of information-based big data and the deepening of the reform of the supervision system, in view of the new situation of combating corruption and promoting honesty, colleges have explored the use of modern information technology to develop a comprehensive information management system and establish a big data platform for discipline inspection and supervision. It is of great significance to realize the standardized inquiry of information resources, the analysis and tracking of problem clues, the prevention and control and early warning of clean government risks, and the promotion of the information construction of discipline inspection and supervision, which is the general trend of discipline inspection and supervision in colleges, and also the urgent need to strengthen the source of anticorrosion [3].

II. Related Theories and Technologies

II. A.Big Data

The size of the general index data set of big data exceeds the ability of common software to collect, store, apply and analyze. The characteristics of big data can be generally summarized as follows: 1) The amount of data is huge. The scale of big data is mainly manifested in the huge volume, the rapid growth of data, the size of data sets exceeding TB, or even up to PB, which requires specific technology to achieve collection, acquisition, analysis and other applications [4]. 2) Various types of data. The types and formats of data are diverse, generated in different types, and come from different data sources, including data from social media, sensors or systems. From the relationship of data, it includes structured, semi-structured and unstructured data, such as text, pictures, audio, video, transaction vouchers, etc. 3) Data value density is low. The amount of big data is particularly huge. Not all of the big data is useful, but the value is high but the density is low. It needs to be mined and analyzed. Generally, it is difficult to analyze the massive data in a short time. Therefore, mining the value of data requires “panning for gold in the sand”. 4) that data process speed is high. Big data has the characteristics of high-speed, the speed of data growth, processing, access and so on is very fast and changing all the time, and the data creation is real-time and fast processing. For some sensitive types of data, we must analyze them in real time to form answers and pay attention to the timeliness of data processing in order to produce business value, otherwise it is meaningless [5].

II. B.J2EE Technology

J2EE architecture is used to develop Web applications in this paper. It is a very mature underlying architecture, which can process business and transactions in a distributed way, encapsulate some functional components for common use according to operational specifications and technical guidelines, and provide external service interfaces for them to call, which can significantly reduce the low coupling of programs. The J2EE architecture is shown in Figure 1.

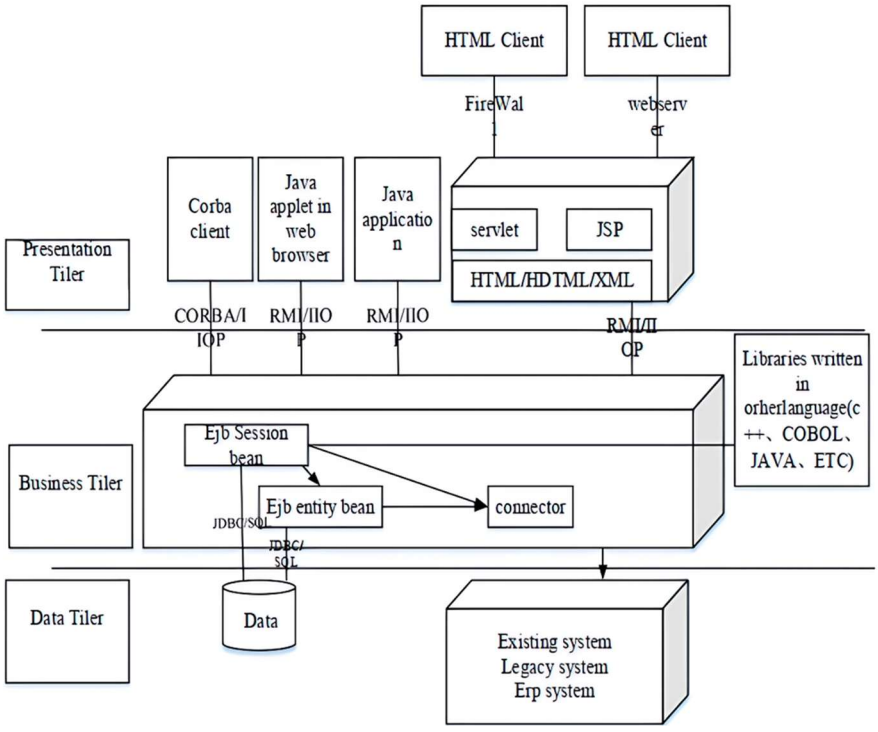

Figure 1: J2EE application architecture

In the J2EE architecture, the user can access the client browser, input the address of the application system to enter the system for business management operations, and form a remote HTTP request. The server can execute the relevant foreground code, analyze the request address, permission and other contents, confirm the legitimacy of the request, then jump into the business processing class of the EJB/Java container, analyze the method called by the incoming request, execute the business logic processing method line by line, and execute the JDBC code if the database needs to be accessed [6]. The query condition is encapsulated in the form of a parameter and passed to the method, and then the query result data object is returned. The data will be queried out through the Jsp page.

Servlet engine is responsible for controlling the jump process, which can reasonably control the direction of business flow, and finally output business data to the specified page. J2EE platform can provide EJB components and web components, which have different functions. EJB components are responsible for logic processing, validity verification, data encapsulation and transmission, while the latter is responsible for outputting various control contents through JSP pages [7]. J2EE client can output all kinds of small plug-ins or small programs, which can be displayed on the page, and generate Servlet objects through compilation and interpretation. The database side can output data to the web server to improve the efficiency of business data management.

II. C.MySQL Technology

Database is the core of the whole system design, which is used to store user data. Reasonable data structure design can reduce the space occupied by data storage, facilitate management and query, and improve system efficiency. MySQL is the most popular relational database management system and one of the best RDBMS (Relational Database Management System, relational database management system) application software in web application. MySQL is a relational database management system. A relational database keeps data in separate tables instead of keeping all the data in one big warehouse, which increases speed and flexibility. Because of its small size, high speed, low total cost of ownership, especially the characteristics of open source, the development of small and medium-sized websites generally chooses MySQL as the website database. There are root users and normal users in MySQL database, and different users are given different operation permissions. In MySQL 5.5, five different operation permissions are provided for database users: global level, database level, table level, column level, stored procedure and function level (specify stored procedure and function), and the permissions decrease in turn [8]. Structured Query Language, SQL, developed by IBM St. John's Research Laboratory for its relational database management system, SYSTEMR. SQL is easy to learn, simple in structure and powerful in function. It has been widely used since it was introduced. Large database management systems such as SQL server, Oracle and Sybase, and database development systems such as PowerBuilder and Visual Foxporo all support SQL as a query language.

III. Demand Analysis of Intelligent Platform for Discipline Inspection and Supervision

III. A. Functional Requirements

In the work of discipline inspection and supervision, the core work is the declaration of honest and clean government archives, the registration and handling of complaint reporting information, and the release of educational information [9]. Therefore, in the process of information platform development, we should focus on sorting out these core work needs.

Integrity file declaration business. The declaration information of clean government archives includes personal information of employees, information of spouses and children, position and income information, which adopts the principle that all employees should be filed, one person, one file, and the archives information should be updated in time, one year first instance, one year report, and the archives information is managed by the discipline inspection and supervision department of colleges [10]. In the use of the information platform, the trade union registers its own account information, and after the declaration business starts, the employees log on to the system within the prescribed time, verify the information, and submit it to the relevant personnel for review. The discipline inspection and supervision personnel will supervise and review the information of the applicant in a unified way [11]. After the review is passed, it will be filed and kept. If the review is not passed, the system will return it to the applicant for verification and correction. Finally, the whole work will be completed after the review is passed.

Publicity and education information release business. Discipline inspection and supervision information platform should also regularly publish publicity and education information, convey educational instructions from superiors, and play the role of information dissemination and exchange. Publicity and education information released through the platform can be timely conveyed to workers, and worker’s unions can browse and learn through the information platform. In daily work, the publicity and education information published includes work notice, rules and regulations, clean government model, cultural construction, work dynamics and other information. The use of information platform greatly improves the efficiency of information transmission, but also more conducive to the parallel promotion of work. Information release personnel are generally discipline inspection and supervision staff, upload through the background of the system, and release after the administrator's review. Generally speaking, the educational information published includes the title, the specific content of the information and the related annex information.

Complaint reporting, registration and audit business. When users need to report information, they can not only use the traditional offline way, but also through the advanced discipline inspection and supervision information platform. In the title bar of the system, a complaint reporting module is specially set up so that users can easily find

the entrance. Users need to fill in and submit their own report information in detail [12]. After receiving the report information, the administrator will conduct a strict audit to judge the authenticity and validity of the information. The audit results will be clearly displayed in the system, which can be divided into two situations: acceptance or rejection. If the result of the complaint report shows that it is not accepted, the administrator must clearly inform the user of the specific reasons for the rejection, so that the user can understand the situation and take appropriate measures. If accepted, users can log on to the system at any time to check the progress of the incident, and the system will update the relevant information in real time to ensure that users can grasp the dynamics in time, so as to improve the transparency and fairness of complaint reporting [13].

Complaint reporting and handling business. When the complaint reporting information is accepted, the next step is to handle the complaint reporting business, which can be completed through the discipline inspection and supervision information platform. The accepted complaint reporting information service will have its own case number. After acceptance, the service personnel will classify the event according to the information content. If the handling personnel cannot handle the case, they will transfer it to handle it. Otherwise, they will handle it directly and continue to track it, and record the result of the event handling in time and upload it to the system. The whistleblower can check the business processing results at any time through the system, which will provide detailed records, including processing time, processing personnel, processing measures and final processing results, so that the whistleblower can clearly understand the handling of the case, so as to enhance the trust and satisfaction of the discipline inspection and supervision work.

III. B. Performance Requirements

The system needs to be object-oriented and component-based, so that it can be extended flexibly. The system needs to be able to support 5 million records and 50 GB bytes of data per year. The system shall be able to provide continuous operation for 24 hours a day for a week, and ensure that the mean annual failure time is < 1 day and the mean time to repair is < 30 minutes. The system shall have strong system security and a certain degree of disaster recovery capability. The stability and reliability of a computer system is measured by the mean time between failures. The system availability classification is shown in Table 1.

Table 1: System availability classification

Type	Standard (%)	Request
Fault-tolerant availability	99. 9999	Downtime less than 1 minute per year
Very high availability	99. 999	Downtime less than 5 minutes per year
High availability	99.9	Less than 8.8 hours of downtime per year
Availability of goods	99	Downtime less than 43.8 hours per year

The system will ensure the maintainability of the system from the server side and the client side. For the client, it is required to minimize the maintenance operation [14]. For the server side, it is mainly guaranteed from two levels, one is that the network, host and system software should provide corresponding maintenance tools; Second, the application system should provide a unified management interface, clear management wizard, simplify the difficulty of system maintenance, and provide a detailed system maintenance management operation manual. The construction of software system aims to improve work efficiency, not to increase the burden of relevant personnel, so ease of use in system construction is particularly important [15]. The system needs to provide users with a simple and easy-to-learn operation interface to support users to interact with the system. Under the condition of poor network environment, the availability of the system can be ensured, and the system function menu can be found quickly. Provide data backup and recovery functions, when the system crashes, it can recover and restore data in time. The system does not need too much training and can basically be applied.

IV. Design of Intelligent Platform for Discipline Inspection and Supervision

IV. A. Application Architecture Design

According to the current situation and demand analysis, the overall design of a comprehensive information platform for discipline inspection and supervision is shown in Figure 2. The overall composition includes six parts of design and implementation, namely, the basic hardware equipment layer, the data access layer, the data storage layer, the application layer and the human-computer interaction layer. The system is designed with a multi-layer architecture, and different levels are responsible for the corresponding work, which is easy to manage and maintain, and reduces the coupling between levels [16].

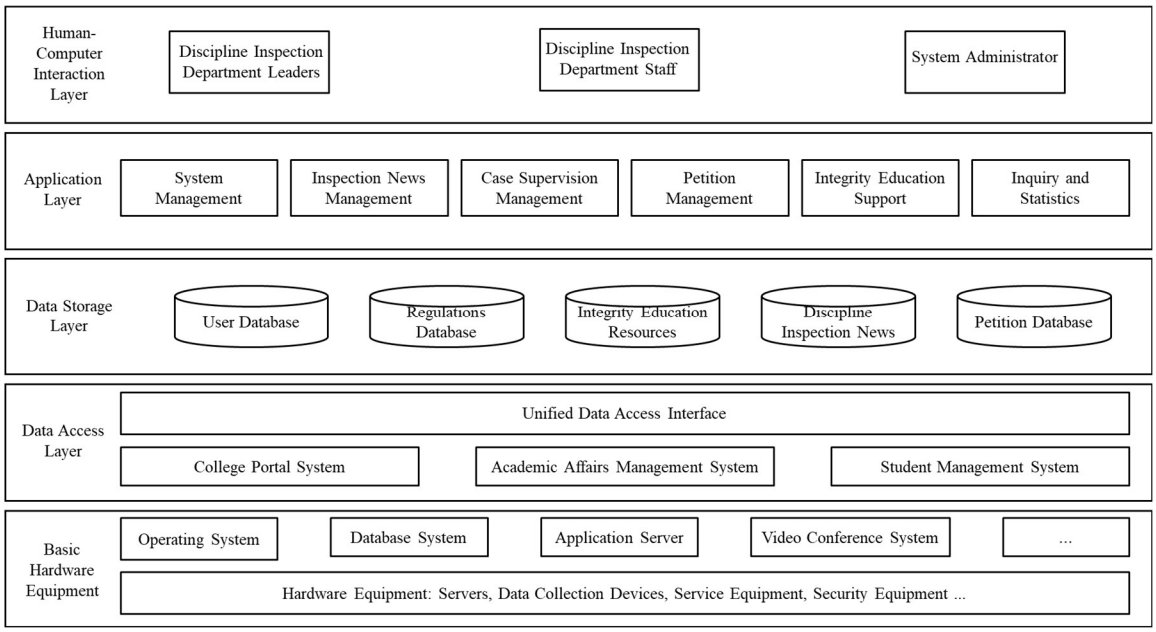

Figure 2: System application architecture

1) Base application device layer. The basic application equipment layer is the hardware foundation of the system, which mainly refers to the software and hardware platforms located at various grass-roots sites, including various system platform software, various servers and storage devices, network devices, large screen display systems and other computer hardware devices, providing the most basic support for the operation and maintenance of the whole system. At the same time, they are the physical basis for the operation and use of the whole system.

2) Data access layer. The data access layer mainly establishes the direct contact between the business function layer and the data layer, and transmits the data of the data layer to the business logic layer for output after receiving the access request and authentication. The request command of the business logic layer will also be passed to the data access layer to initiate the data call request, which can provide a unified data access interface for users. The data access layer can improve the degree of data sharing, complete the data exchange and synchronization process, so that the system can respond to user requests faster and output business data more accurately. It can be interconnected with university portal system, educational administration management system and student management system [17].

3) Data storage layer. The data storage support layer is responsible for all kinds of data required and owned by the system, and can uniformly store and manage anti-corruption education resources, discipline inspection news, letters and visits, policies and regulations and other data.

4) Application layer. The application layer can safely store user information, discipline inspection policies, regulations, anti-corruption education resources, discipline inspection news, letters and visits data and other business data on the discipline inspection and supervision integrated information platform, and can provide data dump and backup mechanisms. In addition, cache technology should be used to improve the responsiveness of web page data.

5) Human-computer interaction layer. The human-computer interaction layer is mainly responsible for explaining the relationship between users and the application system. In the human-computer interaction layer, users will be divided into unified roles and authorized by means of user modeling, including the types of users such as university discipline inspection department staff, university discipline inspection department leaders and system administrators, so as to ensure that users, as external entities of the system, can interact with the system safely and efficiently [18].

IV. B. System Function Design

1) Whistle blowing and reporting. With the in-depth application of cutting-edge technologies such as artificial intelligence and big data, intelligent telephone guidance, automatic identification of reporting, identification assistance of real-name reporting and accusation, reminder of similarity comparison of duplicate pieces, screening assistance of reporting information, and information reply of multi-channel reporting acceptance and disposal will also become a reality. Reporting of letters and visits is an important window for discipline inspection and supervision organs to serve the masses and an important source of clues to problems [19]. Comprehensively improving the

informationization ability of reporting and acceptance will surely help the Party's self-supervision and mass supervision to better transform their institutional advantages into governance effectiveness. The function of supervision and reporting is responsible for receiving online reports of corruption violations from teachers, students and employees in schools, and can timely feedback the progress and results of handling to the informants. It mainly includes anonymous reporting and real-name reporting. After the report is successful, it will return to the report progress page [20]. The core personnel of the discipline inspection and supervision department can view all the reported information.

2) Acceptance of visits. The function of accepting visits is a key component of the intelligent platform for discipline inspection and supervision, and its core goal is to provide the public with efficient and convenient offline feedback channels to ensure that public demands can be responded to and handled in a timely manner. The visiting acceptance module of the platform adopts the way of online and offline integration to realize the whole process management of visitors, including registration, diversion, processing and feedback. When the masses go to the discipline inspection and supervision department, the staff can quickly input the visiting information through this module, covering the basic information of visitors (such as name, contact information, identity information), visiting time, visiting purpose and the main problems reflected [21]. Through the systematic registration process, the staff can efficiently sort out and classify the visiting items, providing a clear basis for follow-up processing. In addition, the platform also has real-time tracking and feedback functions. Visitors can inquire about the progress and results of their visits through the system, and discipline inspection and supervision departments can also give timely feedback to the masses through the platform, so as to protect the people's right to know and participate [22].

3) News inquiry. News query function is the core component of the intelligent platform for discipline inspection and supervision, and its main function is to provide users with timely, accurate and comprehensive information related to discipline inspection and supervision [23]. This function enables users to obtain the latest progress of discipline inspection and supervision work, detailed interpretation of policies and regulations, in-depth analysis of typical cases and the latest developments in the construction of a clean government culture in real time, thus effectively improving user’s awareness of discipline inspection and supervision work. In the design of the platform, the news query module realizes the efficient integration and management of information by integrating multi-source information, including the authoritative information released by the higher discipline inspection and supervision organs, the internal dynamics of the discipline inspection and supervision departments in colleges, and the social hot news related to discipline inspection and supervision [24]. Users can quickly locate the information they need through keyword search, classification screening and time sorting.

4) Intelligence analysis. The intelligence analysis module has the ability to enhance the discovery, extraction, fixation and identification of evidence and the ability to break through difficult cases. After the case handlers approve the information to be queried according to the process, they upload the relevant documents and the data to be retrieved to the comprehensive information query and analysis platform. The comprehensive information platform and the data resource platform realize information exchange and sharing in the data layer to improve the efficiency of handling cases. At the same time, the application and security control mechanism of intelligence information should be established to ensure the safety and controllability of information application, realize the electronation and informatization of process management, control from all links, reduce the abnormal use of the system, facilitate the later log backtracking, query, statistics, summary and other work, and also exclude illegal evidence from the source. Through the conditions of name, ID card, mobile phone number, license plate number and social security number, the data of the data resource platform can be retrieved by one key, and the data can be collected from all the special lines of the respondents themselves, specific related persons and major social relations, thus forming the information of the respondents’ real estate, vehicles, relationship circles, activity trajectories and major events. Find clues to problems and generate personal comprehensive data reports to improve supervision, inspection, review and investigation.

5) Data visualization. Data visualization function is the key technical means of the intelligent platform of discipline inspection and supervision, and its core function is to display the complex data of discipline inspection and supervision intuitively in the form of charts, graphics and maps. It significantly enhances the scientificity and effectiveness of decision-making [25]. In the platform architecture design, the data visualization module integrates multi-source data, covering integrity files, complaint reporting information, case handling progress and integrity risk warning. Through the application of intelligent analysis and visualization technology, the platform can present the overall situation of discipline inspection and supervision work in colleges in real time, and provide comprehensive decision support for managers. The data visualization module supports multi-dimensional data analysis and interactive exploration. Users can choose different data dimensions to analyze according to their needs, and understand the details of the data through clicking, zooming and other interactive operations. This interactive design

not only improves the readability and ease of use of data, but also provides strong support for scientific decision-making of discipline inspection and supervision work.

IV. C. Database Design

As the basic data table, the user information table (Table 2) is used to store the user's personal information, including key fields such as user name, password, role, department and contact information. The database architecture revolves around two core data tables: the user information table and the discipline inspection and supervision information table, aiming to achieve functional integrity while maintaining the simplicity of the data structure, and to provide support for future system expansion. As the basic data table, the user information table is used to store the user's personal information, including key fields such as user name, password, role, department and contact information [26]. The user role field is used to implement role-based permission management and ensure that the user's operations in the platform are in line with their responsibilities. The design of user information table not only provides data support for the user management of the system, but also provides the basis for the data association of other functional modules.

Table 2: User Information Table

Field name	Data type	Whether it is a primary key	Required or not
user_id	INT	Yes	Yes
username	VARCHAR (50)	No	Yes
password	VARCHAR (100)	No	Yes
role	VARCHAR (20)	No	Yes
department	VARCHAR (50)	No	No
contact_info	VARCHAR (100)	No	No

The discipline inspection and supervision information table (Table 3) is the core data table of the system, which is used to store all kinds of information related to the discipline inspection and supervision work, such as integrity files, complaints and reports records, case processing progress, etc. By setting the information type field, the table can uniformly store different types of discipline inspection and supervision data, thereby simplifying the database structure, reducing the number and complexity of the table, and improving the consistency and query efficiency of the data. By associating the user ID field with the user information table, the system can efficiently query and manage the discipline inspection and supervision data related to the user.

Table 3: Discipline Inspection and Supervision Information

Field name	Data type	Whether it is a primary key	Required or not
info_id	INT	Yes	Yes
user_id	INT	No	Yes
info_type	VARCHAR (20)	No	Yes
title	VARCHAR (100)	No	Yes
content	TEXT	No	Yes
status	VARCHAR (20)	No	Yes
create_time	DATETIME	No	Yes
update_time	DATETIME	No	No

In the process of database design, the performance advantage of MySQL has been fully considered. As an open-source relational database management system, MySQL has become an ideal choice for the intelligent platform of discipline inspection and supervision in colleges because of its high performance, flexibility and low total cost of ownership. By optimizing the table structure and index design, MySQL can efficiently respond to user query requests and ensure the smooth operation of the system. At the same time, the open-source nature of MySQL provides flexibility for future extensions of functionality, allowing for adjustments to the database architecture without relying on commercial software.

In order to improve the data security and reliability of the system, the data backup and recovery mechanism is introduced in the database design. By backing up data on a regular basis, the system can quickly recover data when a failure occurs, ensuring the integrity and availability of the data. In addition, the authority management function of the database restricts the access to data according to the user role, which effectively prevents data leakage and illegal operation. With the performance advantages and open-source features of MySQL, the system

can be flexibly expanded in the future to provide continuous technical support for the discipline inspection and supervision work in colleges.

V. Implementation and Testing of Intelligent Platform for Discipline Inspection and Supervision

V. A. Realization

The integrated information platform for discipline inspection and supervision of a university mainly uses Spring3, Hibernate3, Struts2 and other lightweight frameworks to integrate development, each framework is open source, and can integrate them through configuration files to play the role and advantages of each framework. The development efficiency of the discipline inspection and supervision integrated information platform can be improved by using the foreground page tag library, the data persistence object and the control inversion container.

In the development of intelligent platform for discipline inspection and supervision in colleges, J2EE architecture is selected as the technical basis. With its mature technical framework and multi-functional components, J2EE architecture provides distributed processing capabilities for the system, and can effectively deal with high concurrency scenarios. At the same time, the component-based development method reduces the coupling degree of the system, improves the development efficiency, simplifies the maintenance process, and ensures the efficiency, stability and scalability of the system.

In the early stage of development, the system requirements are analyzed and planned in detail, and the business logic and data interaction process of each functional module are defined. Based on the hierarchical design concept of J2EE, the system is divided into presentation layer, business logic layer and data access layer. The presentation layer implements user interface rendering and user request processing through JSP page and Servlet technology, and dynamic page technology dynamically generates page content according to user permissions and operations, thus enhancing the system's interactivity and user experience. As the core of the system, the service logic layer is responsible for processing user service requests and data logic operations. EJB (Enterprise JavaBeans) components are used to encapsulate business logic and provide services through Java interfaces. This design improves code reusability and makes business logic clearer and easier to maintain. When dealing with complex business processes (such as complaint reporting audit, integrity file management), the transaction management mechanism ensures the consistency and integrity of data.

The data access layer realizes the interaction with MySQL database through JDBC technology. Efficient SQL sentence design and reasonable database index optimize the speed of data query and update. At the same time, data encryption storage and access control mechanism enhance the security and reliability of data. In the development process, the system performance optimization is realized by cache technology, which reduces the frequent access to the database and improves the system response speed.

V. B. Testing

The purpose of testing is to find out the possible errors and defects in the preliminary developed software through testing and spending a certain amount of time and manpower on the basis of the completion of the preliminary development of the software, and to improve these errors and defects so as to further optimize and improve the software. The principle of testing: try to ensure that the test can cover all aspects of the system as much as possible. All testing should be traceable to user requirements. Functional testing can be called black box testing, which is responsible for verifying various components of web pages, determining whether buttons can be clicked normally, whether links can jump to valid paths and pages, and whether input boxes can verify the validity of content types and lengths. The final purpose of the test is to ensure that the system interface is displayed normally, the function is used normally, and it conforms to the user's usage habits. You can test the buttons, links, and input boxes on the web page of the system, input various possible data, and view the output effect of the system, such as the response speed of the web page, the display effect of the page, and the prompt information for interaction with the user. Problems found in the testing process shall be timely fed back to the developers for verification. If there is any ambiguity, you can ask the demand personnel for confirmation. After testing, it is confirmed that the system functions and data meet the initial design goals, and it can be released online and run normally, achieving the design goals.

VI. Conclusions

The development and application of intelligent platform for discipline inspection and supervision is an inevitable choice for the discipline inspection and supervision work in colleges to adapt to the development of the times. This study has successfully designed and implemented an intelligent platform based on J2EE architecture, which integrates the core function modules of anti-corruption archives management, complaint handling and publicity and education release. Through the optimized database design and efficient development framework, the platform

realizes the standardized management of data and the high-performance operation of the system. The implementation of the platform significantly improves the efficiency and transparency of discipline inspection and supervision work in colleges, and provides strong technical support for the modernization of governance capacity in colleges. In the future, with the further application of big data analysis and artificial intelligence technology, the platform is expected to play a greater role in the early warning of clean government risks and the mining of problem clues, providing new technical empowerment for discipline inspection and supervision in colleges.

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