Design of Information Security System Based on JSP Technology and Reinforcement Model

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Abstract. Aiming at the security and secrecy of network test question bank, this paper puts forward an information security secrecy system suitable for test question bank. The system has the functions of identification, security enhancement, information encryption and data backup and recovery. Finally, black-box and white-box tests are carried out to test the function and performance of the system, which proves that the system meets the design requirements.

Keywords: JSP technology · Reinforcement model · Test library · Security system

1 Introduction

The security of the test question bank only refers to the protection of the test question bank to prevent the leakage, change or destruction of the test questions due to illegal use. Therefore, schools should pay full attention to the security of the test question bank. Carefully analyze the potential safety hazards and put forward safety requirements of all aspects.

In view of the security and confidentiality of the network examination database, this paper puts forward an information security system suitable for the network examination database. The innovation of this system is to use JSP technology to ensure that the system has the functions of identity recognition, security enhancement, information encryption and data backup and recovery.

2 Design of Information Secrecy System for Test Question Bank

It has become the consensus of the education experts that the examination questions are collected and managed automatically and standardized by using the examination questions database system. The standardization and automation of test questions is beneficial to the improvement of teaching quality and the making of correct decision. Therefore, many colleges and universities have developed and put into use various test question database management systems, which have achieved considerable results and are welcomed by teachers and students. However, the protection undertaken with respect to the security and confidentiality of the system is seriously inadequate [1, 2]. Some managers

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lack the awareness of security risks and believe that students are not yet capable of attacking systems. Therefore, we do not pay attention to the improvement of technical skills and the collection of related information. For this reason, this article on the relevant issues for discussion.

2.1 Technologies Related to Test Bank System

2.1.1 JSP Technology

JSP is a technical standard for dynamic web pages. Add Java program snippets and JSP tags to the traditional HTML page files (*.html, *. htm), and have a JSP page (*. jsp). When a Web service encounters a request to access a JSP Web page, it first executes a snippet of the program, and then returns the result in HTML format to the client. The program fragment has the function of operating database, redirecting webpage, sending email and other dynamic webpage. All programs are executed on the server side, and only the results of program execution are transmitted to the client through the network. The requirements for the client side are lower [3].

Characteristics of JSP technology:

Platform adaptability; program execution is efficient; JavaBeans enhancements can be used to save development time; JSP-based applications are easier to maintain and manage;

2.1.2 Database and Related Technologies

A database is the basic framework of an information system, which fundamentally changes the way many companies and individuals work. With the development of database technology for many years, many powerful and easy-to-use database systems have emerged, which enable users to create and apply databases without the knowledge of developing efficient systems. The database platform shall have the online processing capability to support a large number of users, the mass data storage capability, the fast retrieval capability, and the response capability of a large number of concurrent users [4]. The storage and conversion of data between heterogeneous database platforms involves the following technologies:

(1) Data exchange technology
By using communication network and data exchange technology, the automatic data exchange between computer information systems is realized. Includes Web XML, RDF, SOAP, WSUI, XML, Xquery, and more.

(2) Data linking technology
The digital campus uses the database management system which is independent of the foreground and the background. The background database management system manages and maintains the database independently. Common data linking techniques are: ADO, ADO. NET, DAO, DB2 Connector, JDBC, ODBC, OLE/DB, etc. [5].

(3) Data storage technology
In order to realize data sharing, it is necessary to store and transmit data according to certain standards. The commonly used data standard technology includes: EDI,

Namespaces, XLINK, XML and so on; Data transmission technology: XSLT and so on; Data type: DTD and XML Schema and so on.

(4) Data warehouse and data mining

Digital campuses require data unification (such as aggregation and aggregation) from heterogeneous data sources across various application systems to produce high-quality, pure and integrated data. Data warehouse extracts, preprocesses, transforms, integrates, annotates and aggregates the original data and reorganizes them into a semantically consistent data store. The query processing in the data warehouse does not affect the processing on the local data source. The data warehouse supports information processing, provides queries and basic statistical analysis, and reports using cross-tables, charts, or graphs, and enables multidimensional data analysis and OLAP (online analytics processing). Support for data mining, including identifying hidden patterns and associations, discovering new knowledge, constructing analytical models, classifying and predicting, and using visual tools to provide mining results, achieve the reuse of data and information, and enhance the information value of the original data [6]. Such as office systems, JOLAPOLAP, XBRL, etc.

2.1.3 PHP Technology

PHP (Hypertext Preprocessor): Hypertext preprocessor, an easy-to-learn and easy-to-use server-side scripting language, is one of the tools for generating dynamic Web pages. It is a scripting language that embeds HTML files. Most of its syntax is borrowed from C, JAVA, PERL language, and formed its own unique style; the goal is to allow WEB programmers to quickly develop dynamic Web pages. It is one of the hottest scripting languages on the Internet today, and with very little programming knowledge you can build a truly interactive Web site using PHP.

PHP is completely free, with unlimited access to the source code, and you can even add your own features to it. PHP runs on most Unix platforms, GUN/Linux, and Microsoft Windows.

PHP technical features:

In object-oriented programming, PHP provides classes and objects. Web-based programming requires object-oriented programming capabilities, while PHP supports constructors, extraction classes, and so on.

One of the most powerful and notable features of PHP is its support for a wide range of databases. You will find it incredibly simple to write database supported web pages in PHP. PHP and MySQL are the perfect combination right now. Users can also write peripheral functions to access the database indirectly. When users change the database they use, the programmer can easily change the code to accommodate this change.

In terms of adaptability to user platforms, PHP works well on Web servers such as Windows Linux and Unix, and supports general-purpose Web servers such as IIS Apache, allowing users to switch platforms without having to change their PHP code.

Run fast. PHP uses HTML built-in markup technology, and the interpreter itself runs as a module of the Web server, considerably speeding up runtime parsing, while the data submitted from the page form automatically becomes a variable in the program with the same form name, without manual assignment. Tests show that PHP parses four times

faster than traditional CGI programs when the Web site is heavily visited, making it ideal for large and medium-sized sites.

2.2 System Requirements Analysis

(1) Because the test questions correspond to specific objects, the system needs to be authenticated before it can be logged in.
(2) The authority of the system is generally divided into two types: administrators and students. Different identities use different permissions and functions.
(3) Administrators shall be responsible for the effective management of examination questions and students, and shall be responsible for the entry, update, modification and classification of examination questions.

2.3 System Architecture

Since the advent of computer technology, computer technology has generally undergone three computing models: the H/TComputer tier architecture (or host-terminal computing model), the Client/Server Computing tier architecture (or client/server computing model), and the Web Computing tier architecture (or Web computing model).

H/T Computer single-layer architecture refers to the architecture mode with the host terminal as the main terminal through which the user can directly use the computer and interact with the application program [7]. However, due to the complexity of mainframe maintenance and the low relative performance, the mainframe -terminal computing model has declined and withdrawn from the stage of history. With the appearance of PC and the maturity of network technology, the computing mode of distributed Client/Server two-tier architecture begins to develop and flourish gradually. Although the resource of PC is limited, the application program can not only utilize the local resource, but also utilize the resource of other computer effectively through network. C/S (Customer and Software Architecture) is widely used in enterprises and other local networks. Running program modules from various servers on the server, such as file servers, database servers, etc., while client programs.

Through access to server-side resources to achieve their own functions. The C/S model is still in use in many sectors, such as banking, postal and other sectors. But because it requires a large number of applications on the client side, is relatively expensive and complex to maintain, it is not suitable for today's Internet networks.

With the further development of network technology, the best way to build a Web application is to make it into a three-tier application, which subtly distinguishes its three components: user interface, computational logic and data storage. The three-tier application structure diagram for this system is shown in Fig. 1.

(1) Data layer
The data layer is at the bottom of the system. In the item bank system, the data layer mainly includes item bank, examinee information bank, user information bank, paper strategy information, paper bank and other information, they are stored in the database. The database is managed by the SQL Server 2000 database service program, which responds to and provides data services to requests from the logical layer.

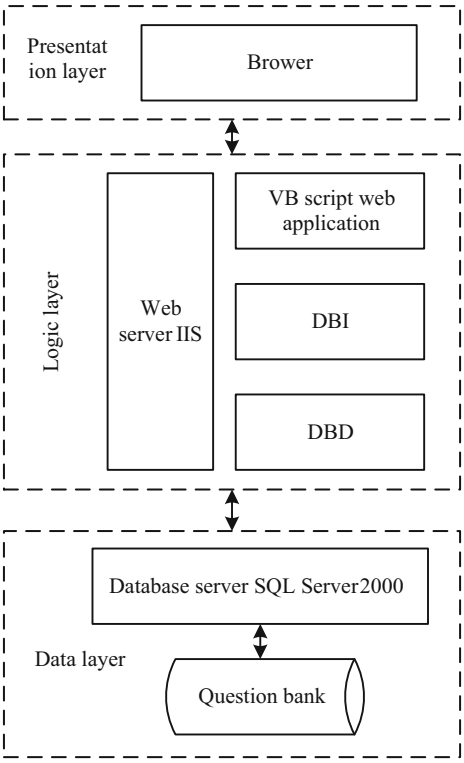

Fig. 1. Three-tier application structure diagram

(2) Logic layer
In the item bank system, the logic layer is mainly composed of Web service programs, which are called by the Web server to respond to the requests of clients (item bank construction members, system administrators, examinees, and invigilators) and serve the clients in accordance with the business rules (or business logic). There are many methods to developing Web program, this system is mainly based on ASP technology programming. Communication with browsers through IIS in ASP programs (output pages and collection parameters): communication with the SQL Server2000 database server through the DBI (Database Interface) module and the DBD (Database Driver) module, making data requests to the database server [8].

(3) Presentation layer
The presentation layer (Web browser) is located on the client side. The user makes a service request to the Web server of the test library system through the Web browser. The Web server authenticates the user and then transmits the desired home page to the client through the HTTP protocol. The client receives the incoming home page and displays it on the Web browser.

While the presentation layer is visible on the client side of the browser, it is essentially hosted on a Web server that sends the page content (often generated through a Web services program) to the browser.

2.4 Functional Module Division

2.4.1 Login Module

Login module includes login page, new user registration page and authentication of password. All users enter the system through this interface, and the system allows the user to perform specific actions based on the privileges previously assigned to the user. Different from the general software, the user login window of this software only allows registered users to log in, whether the new registered users can log in to the management interface can only wait for the examination administrator to review the success. In this system, the user is divided into three levels of authority, namely, the examination administrator, curriculum director, teacher. All users can only log on to the development system after creating and assigning permissions to operate, using a unified logon system that automatically identifies the user by user name and password and allows the user to perform the corresponding operation [9]. The user login module flowchart is shown in Fig. 2.

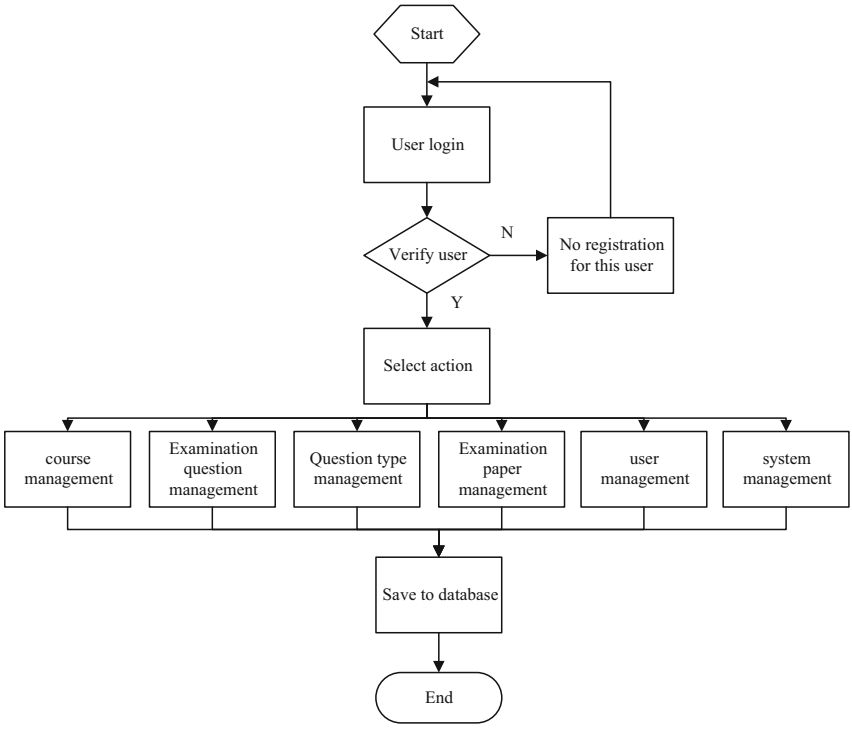

Fig. 2. User login module flowchart

In the login module, except that the examination administrator has the account and password in advance, other users must register as legal users before using the system. After the examination administrator examines the authenticity of their information, they may log into the functional module of the system with corresponding authority. The flowchart shown in Fig. 2 depicts that the user must first enter the login page to access the system. If the verification of the account and password indicates that the user is a registered user, the user may perform the corresponding functions by judging his/her authority; otherwise, the user may not use the system until the registration information is verified through the corresponding prompt information.

2.4.2 DBMS Security Hardening Module

General large database management system such as Oracle, Sybase, SQL Server itself will provide username and password identification, view, access control, audit, stored procedures and other management measures. So we can make full use of these management functions to enhance the security of test database.

First, users can be classified according to the requirements of different access rights. Users will be divided into different roles to manage, usually for the system maintainer role, the role of educational administrators, teachers and students role. Create different logged-in users and passwords under each role. Different role groups and special users are respectively authorized with different granularity and different operations by utilizing the system's flexible privilege control mechanism [10].

Secondly, the view can be used to classify the data conveniently, and the data of the same knowledge points can be used to classify the data of different levels of users in the outer model layer. In addition, by trying to hide the data to be kept secret from the users who have no access right, the security of the test database is improved. View in the establishment of the same time can give the internal data alias, so that the name of the database can be a good object to hide, to further avoid security risks [11, 12].

Third, unnecessary stored procedures should be removed, because some systems of stored procedures can easily be used to elevate permissions or damage. For example: xp _ cmd _ shell is the best shortcut to the operating system, data is left to the operating system's back door, which can be deleted with sp _ dropextendedproc and restored with the sp _ addextendedproc system procedure if needed [13].

Finally, the audit capability provided by the DBMS is another significant security measure that monitors the operations of individual users on the database. Auditing methods are divided into user auditing and system auditing. The audit system of the DBMS records all attempts to access its own database objects and the user name, time, operation code and other information of each operation. System audit is carried out by system administrators, whose audit content is mainly system-level commands and the use of database objects.

2.4.3 Maintenance Module of Question Bank

The maintenance of question bank includes searching, deleting, auditing, modifying and other functions. Question search can be based on the corresponding knowledge points included in the first question, specific search can choose the scope of filter questions, and

then according to the time of question entry, difficulty value, the question who, the type of quick sorting to find questions. The deletion function is that the subject experts delete the unqualified questions from the question bank after the preliminary examination or the examination analysis question parameter value modification. The examination function is divided into two circumstances: the examination questions just put into the database need to be checked and audited, and the analysis program needs to be reexamined after the use of the examination questions. The former must be checked by subject experts before it can be used in the examination; the latter, mainly because the difficulty value and differentiation value are so different from the normal value that it needs to be re-checked by statistical analysis program during the use of the question, and if there is indeed an error in the expert inspection, it may be deleted or modified before being used. The function of revision is that subject experts revise the wrong or imperfect test questions. For the convenience of the users, the status of the test questions is represented by an icon, and the interface elements such as the status bar and the prompt bar are used.

2.4.4 Test Database Data Encryption Module

There have been some achievements in the theoretical research and practical application of database encryption. If you can make full use of the shared resources and build up a large database of high quality tests, if that is the case, then proceed.

Encrypting the data items that represent the knowledge content in the test database is redundant. However, we must pay attention to the user name password encryption in the permission control. The identification of a user before entering the system, which determines the legal actions that can be performed in the system. The protection of system password files is the key, and there are many similar approaches.

2.4.5 Test Database Backup and Recovery Module

A backup of a database is the process of copying the database to a dedicated storage device. Backup can be divided into “physical backup” and “logical backup” two types. Physical backup refers to copying database files from one location to another. The files that need to be backed up include data files, archive redo logs, and control files. Logical backup is the use of tools such as EX-PORT to execute SQL statements to read out the data in the database, and then write to other file types. Database recovery refers to restoring the database itself, that is, restoring the database to a correct state or a consistent state after the database is paralyzed and inconsistent. Establishing strict database backup and recovery management mechanism is an effective means to ensure the security of database system in all networks. Database always inevitable system failures, once the system failure, important data is always inevitably destroyed.

In order to prevent the loss or damage of important data, the database administrator should back up the database as soon as possible, so as to maintain the integrity and consistency of the data in case of system failure. Therefore, the data backup module is introduced, that is, the index layer and the criterion layer are analyzed for each data C_i that needs to be backed up, and the corresponding sub index weights are allocated

according to the importance of the data. In this case, the input and output of the output layer are described as:

$$S_k = \sum_{j=1}^{m} u_{jk} D_j - \theta_k \tag{1}$$

$$Y_k = \frac{1}{1+e} - S_k \tag{2}$$

Where, u_{jk} is the connection weight of hidden layer neuron j and output layer neuron k, θ_k is the critical value of output node, S_k is the input of the k-th and output nodes, and Y_k is the output of output layer neuron.

In order to ensure that the administrator can use the existing data backup to restore the database to the original state.

2.5 System Testing

The principle of system testing is paramount, and the methodology should be guided by it. The basic principle of software testing is to test the product thoroughly from the user's point of view, find out as many bugs as possible as early as possible, and be responsible for tracking and analyzing the problems in the product, and raise questions and suggestions for improvement. Zero-Bug is an idea, and Good-Enough is the basic principle of testing.

2.5.1 Test Environment

(1) Software environment
This software can be run in Windows 2000 and all before the Windows NT architecture based on the computer. The test used a Windows XP system.
(2) USB KEY model
The USB Key used in this paper is ET199, developed by Beijing Jianshi Honesty Technology Co., Ltd.
(3) Computer hardware configuration
The hardware configuration of the computer used in the test is as follows:
CPU: Pentium (R) Dual-Core CPU E5400 2.70 GHZ. Memory: 2.72 HZ 2 GB. Hard disk capacity: 320GB.
(4) Environmental infrastructure

After the implementation of the system, this chapter builds the test environment. In this environment, assuming that there are test files on the monitored computer 1 and the monitored computer 2 need to be protected, the protection program of the system is installed on these two hosts. The host computer of employee 1 and the two monitored computers are in the same network segment, and the host computer of user 2 is from 192.168.1 network segment and connected by router and 192.168.3 network segment. Within the 192.168.3 network segment, each host can be connected to each other by a hub or switch. Two monitors are operated on 2, 1, 2, and 3 mainframes respectively to test the function and performance of the system.

2.5.2 System Functional Testing

Functional testing of the system is the most important part of the entire testing process. If the system is not functional, then other aspects of the system will be successful and the technology will not be of interest to customers. Common functional problems can be divided into two categories, one is the customer can not achieve the desired function, the second is to achieve the user does not need the function.

According to the features of the system, the use cases are designed in the following aspects: the test of the operation function of the system interface, the test of the user's permission, the test of the update function and the test of uploading the files. The testing contents of the system mainly include the query function, the document preview function, the data security function and the file sharing function. The functional test of the system is shown in the following aspects as shown in Table 1.

Table 1. System functional test results

Describe	Result
Open the system interface to see if it is friendly	ADOPT
Check whether the interface of the system can be switched correctly	ADOPT
Login test of normal and abnormal users	ADOPT
Different permissions are given to different users	ADOPT
You can input and modify various documents	ADOPT
It provides update and submit functions for document version problems	ADOPT
Query the required documents according to user rights	ADOPT
Parameter setting for specific system	ADOPT
It provides information release and reference function for the system	ADOPT

2.5.3 System Performance Testing

The performance of the system is one of the key factors affecting software product praise, a slightly higher load when the slow snail-like system users will not like. At present, the level of system performance has been considered as an important factor in the quality of software. What we mean by system performance testing is actually a test of the ability of a system to function properly when the system is under heavy load.

In the process of performance testing, not only professional performance testing tools are used to simulate high load, but also practical testing is carried out. The specific situation is as follows: 20 users are added into the system step by step in 20 s, and the maximum number of concurrent users is 2000. The system performance test results are shown in Table 2 below.

Table 2. System performance test results

Test cycle	System throughput (transactions/sec)	Network throughput (bytes/sec)
Single transaction (2)	2. 13	170842
Multiple transactions (1000)	3. 1	219610

Under this high load, the system can run normally for an hour, and then every 10 s to reduce the 10 user operating system can still run normally. Through the performance testing of professional tools and specific cases, the design of the system has fully met the requirements of users.

3 Conclusion

The security and confidentiality system of network test question bank is only an application of information system security and confidentiality. In order to prevent the information system from being threatened by tampering, damaging and stealing, it is necessary to strengthen and utilize the security measures of the database system itself, as well as the comprehensive application of network, system software, hardware, encryption and other technologies as well as moral laws and regulations. Only by improving the managers' awareness of potential safety hazards, can the teaching resources of network test bank play its due role.

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