

# The Design and Implementation of the Book Management System

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## Abstract

At present, small-scale libraries in my country still adopt manual management. On the one hand, readers cannot understand the library collection situation in real time through the Internet, which reduces readers' interest in library borrowing. On the other hand, manual management is inefficient and error rate is high. This paper designs a simple and practical book management system. The front-end display interface is based on HTML and EasyUI. Visual interfaces such as login and system main interface are designed. The back-end part is designed based on Java language, SSM framework, MySQL5.5 database, Tomcat 6.x server, etc. to realize the logic writing and data storage, and discuss in detail the technology, system design and system realization required to write a library management system.

## Keywords

Java; SSM Framework; Library Management System.

## 1. Introduction

The library management system is a very typical system in the information management system. Now all large libraries have used a powerful library management system, but the current situation is that a small number of small and medium-sized libraries still use traditional book management methods. Readers To find the books you want, you still need to go to the library shelf to find the books, so you don't know whether the library has the books you want, and it takes a lot of time to find the books. As for library managers, they must not only browse through the borrowing records and return records, but also check the library card and register the borrowing information. Moreover, many libraries do not stipulate the number of books to be borrowed, and a large number of books may lead to the loss of library books. Obviously, traditional book management methods have low retrieval efficiency, poor confidentiality, and cumbersome borrowing process, which affect readers' borrowing experience. It is cumbersome, time-consuming, labor-intensive, low-efficiency, and high error rate for library managers to find historical records. In summary, traditional book management methods are no longer suitable for the current fast-paced lifestyle. A library management system can not only retrieve books and the remaining quantity on the Internet, but also use database technology to register borrowing information. Based on network technology, it has perfect functions, convenient and fast, and there is a lot of room for development in practical applications. Therefore, it is necessary to develop a corresponding management system.

## 2. Development Tools

### 2.1. Java

The core idea of the Java language is that everything is an object. The Java language removes the cumbersome and difficult to understand programming methods such as pointers and multiple inheritances in the C language, which greatly simplifies the difficulty of programming, and is cross-platform. For example, the same set of programs written in the Java language can be executed on the Linux system or can be executed on the Linux system. Execute on Windows.

Java language is by far the most popular language, and there are countless tools with Java language as the core, which greatly simplifies the difficulty of development and reduces the cost of development and subsequent maintenance.

## **2.2. HTML, CSS, JQuery, EasyUI, Ajax**

In Java Web programming, HTML language is used to write front-end Internet pages. It is called hypertext markup language. It does not need to be compiled like Java, and the code can be executed directly in the browser; CSS can make the interface become It is more elegant and gives users a very good visual experience; JQuery is a framework based on JavaScript language, and its core idea is "write less and do more". Developers using this framework only need a small amount of work. Ideal functions can be developed, and JQuery can cooperate with CSS to make dynamic web pages; EasyUI is actually a product developed by JQuery, which encapsulates HTML and CSS inside, so that developers can directly take them during the development process Products for use; Ajax is a product developed with JQuery, and it is now widely used. For example, when viewing a map on a web page, every click or sliding operation is actually a request to the server, while the traditional request response process Generally, the entire web page needs to be refreshed, but with this technology, only a part of the entire page is required to change the interface, and the user feels that it responds in a timely manner, and there is no blank period of data transmission between networks.

## **2.3. SSM Frame**

### **2.3.1. Spring Frame**

In today's Java Web network programming, the Spring framework is one of the most commonly used frameworks. It hosts other frameworks such as Struts2, Hibernate, Spring MVC, and other frameworks that interact with the front-end or database. The most commonly used functions of using the Spring framework are IOC and AOP. Using IOC to inject the Java objects produced by the Spring framework into another object, its essential meaning is to reduce the strong coupling relationship between Java objects, which is more conducive to Java garbage Recycling makes the programs written by developers more efficient and concise; AOP is an aspect-oriented project, which is actually a thing manager. AOP can ensure that a thing is executed successfully or fails.

### **2.3.2. Spring MVC Frame**

Spring MVC is a popular framework for information interaction with the front-end, which essentially encapsulates Servlet. First, the user sends a request to the server through the Http protocol from the front-end interface. The server will hand the request to the core controller in Spring MVC. The core controller will find the corresponding Handler according to the requested URL, and then execute the Handler. Later, the results will be fed back to the front-end interface, and the interface that the client sees at the end is the feedback of the execution result of Spring MVC.

### **2.3.3. Mybatis Frame**

Mybatis is a persistence layer framework developed based on Java language. It is a typical ORM framework that can map specific tables in the database to Java objects. In this way, when users want to add specific tables in a database, Delete, modify, and query only need to execute the method of the corresponding Java object, which is very concise and powerful. In order to realize the decoupling of various levels in development, it is divided into the presentation layer, the business layer and the persistence layer. The persistence layer is also the layer that actually interacts with the database. All book information, administrator information, and reader information in the library management system are written into the database through the Mybatis framework for persistent storage.

## 2.4. MySql Database

MySQL is actually a warehouse for storing data. It is an open-source relational database that supports a common structured query language that is SQL syntax for queries. MySQL 5.5 is the database version of this system.

## 2.5. Tomcat Server

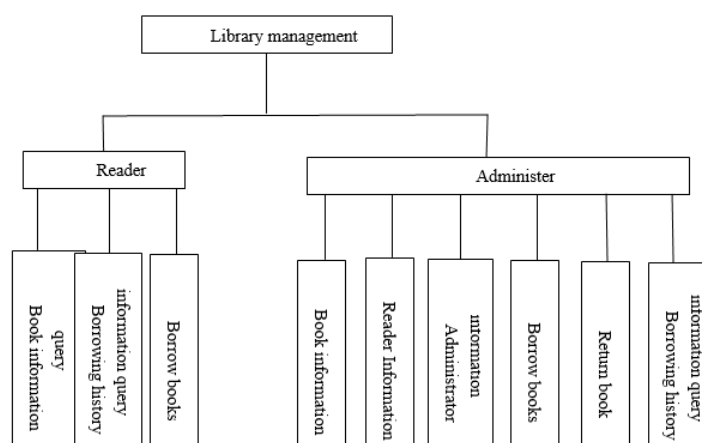
Tomcat is a lightweight Web server and a container for JSP and Servlet. When the user starts the Tomcat server, the Servlet object in the server will be initialized and instantiated. The execution process of the Servlet is that the client first sends the request information to the server. The Tomcat container will generate Request and Response objects, and the container will find the appropriate Servlet according to the URL. And allocate threads for access; the service method will decide whether to call the doPost method or the doGet method according to the request of the HTTP protocol. After the doPost or doGet method is executed, the container will respond to the server through the Response object, and then the container will destroy the Response, Request and access thread. All URL configurations are configured in the web.xml file. This design uses Tomcat6.x as the server part of the system.

## 3. Library Management System Design

### 3.1. Demand Analysis

Nowadays, the library management system has become an indispensable part of library managers and readers. The traditional method of library management has extremely cumbersome borrowing procedures and extremely low efficiency. As for the fast-paced lifestyle and efficiency in everything, the traditional book management method needs to be reformed. The book management software can solve this problem.

Readers are most concerned about whether the library has the books they want, whether the books they want to borrow can be borrowed as they want, whether the balance is sufficient, what books have been borrowed, and whether they are returned. So for readers, the summary is as follows: 1. Book borrowing, 2. Book balance, 3. Borrowing history, 4. Fee balance, 5. Borrowing time. For librarians, they can be both readers and administrators. From the reader's perspective, I don't need to repeat them. The administrator's concerns are related to their daily work, that is, the daily increase and decrease of books in the library. Information, modification of book information, etc., reader information addition and modification, book return, administrator information addition and modification, so for the administrator, the summary is as follows: 1. All members borrowing history, 2. Book information maintenance, 3. Reader information maintenance, 4. Administrator information maintenance.



**Figure 1.** The functional module diagram of the library management system

### 3.2. System Function Module

According to the analysis of the needs of library services, the system function module diagram shown in Figure 1 is designed. It can be concluded that the design of system functions is mainly aimed at two groups, namely readers and administrators. For readers, the functional modules that need to be designed include the system login verification function, the book balance query function, the borrowing history query function, and the online borrowing function; for the administrator, the basic function module for the reader must be provided first, and the entire library must be available for both readers. It is also the record function of the book return system for the administrator, the function of querying all the borrowing history information in the history, and the function of adding, modifying and deleting the information of readers, books and administrators.

### 3.3. Feasibility Analysis

The system uses the front-end HTML+CSS+EasyUI+jQuery+Ajax technology, and the back-end logic code is written in a combination of SSM framework and Java language. The server uses Tomcat 6.x and the database uses MySQL 5.5. Many systems now use these The combination of technologies is therefore feasible.

### 3.4. Login Interface Design

The so-called login interface is the Internet webpage that you usually see to enter the account and password. You can log in to the system only after logging in. The main function of the login interface is for login verification. For example, if an unregistered reader or administrator enters the account and password, If you cannot jump to the main page through the login page, if you have not registered or the account password is entered incorrectly, the account or password error will eventually be displayed.

Reader login interface After logging in to the library management system, the reader's main interface has links to online borrowing books, querying the remaining amount of books, and borrowing history; after the administrator logs in to the main page of the system, there are links to realize the functions of ordinary readers, as well as additions and modifications. , Delete the function link of the book, add, modify, and delete the jump interface link for reader information, the jump interface function link for the query of the library's borrowing history and the management of the book return status.

### 3.5. Database Table Design

First of all, the MySQL database is a relational database. A major feature of the relational database is that it conforms to the three paradigms. The purpose of the three paradigms is to reduce the data redundancy of each table. Analyzing its system requirements, we can know that the underlying table of a system cannot be stored by only one table, nor can the information be stored in the table at will. In order to reduce the space occupied by the data, it is necessary to design a system that meets the three major requirements.

#### 3.5.1. Design of Reader List and Administrator List

The system faces two major user groups, namely readers and administrators. Therefore, there must first be a reader table and an administrator table. The basic data of the reader is to be persisted in the database, and the information is closely related to the reader. There are accounts, passwords, names, ID numbers, phone numbers, balances, and information related to the administrator. In addition to the basic information of the readers mentioned above, considering that the system functions need to have a password retrieval function, the administrator table also needs to have a "secret "Guarantee" field, which is, the reader table and the administrator table with the structure of Table 1 and Table 2 are designed.

**Table 1. Reader list**

Column name	Chinese description	Data type	Length
ID	Reader table primary key	INT	11
ACCOUNT	Reader login account	VARCHAR	20
PASSWORD	Reader login password	VARCHAR	20
NAME	Reader's name	VARCHAR	20
ID_CARD_NUM	ID number	VARCAHR	20
TELEPHONE	phone number	VARCHAR	20
BALANCE	Loan balance	DECIMAL	(6,2)

**Table 2. Administrator list**

Column name	Chinese description	Data type	Length
ID	Administrator table primary key	INT	11
ACCOUNT	Administrator login account	VARCHAR	20
PASSWORD	Administrator login password	VARCHAR	20
NAME	Administrator name	VARCHAR	20
ID_CARD_NUM	ID number	VARCAHR	20
TELEPHONE	phone number	VARCHAR	20
BALANCE	Loan balance	DOUBLE	\
GET_PASSWORD	Secret security	VARCHAR	20

### 3.5.2. The Design of the Book List

Since it is a library management system, the book table is indispensable. For the book table, the first information required is the name and book category. Considering that readers and administrators need to know the number of books left in the library, a "book balance" field is needed. Readers need to know where the books are when borrowing books. Location, so a "book location" field is needed, that is, to design the book table, as shown in Table 3.

**Table 3. Book list**

Column name	Chinese description	Data type	Length
ID	Books list primary key	INT	11
NAME	Book title	VARCAHR	20
PRICE	Book price	DECIMAL	(10,2)
CATEGORY	Books	VARCHAR	20
AMOUNT	Book balance	INT	11
LOCATION	Book position	VARCAHR	30

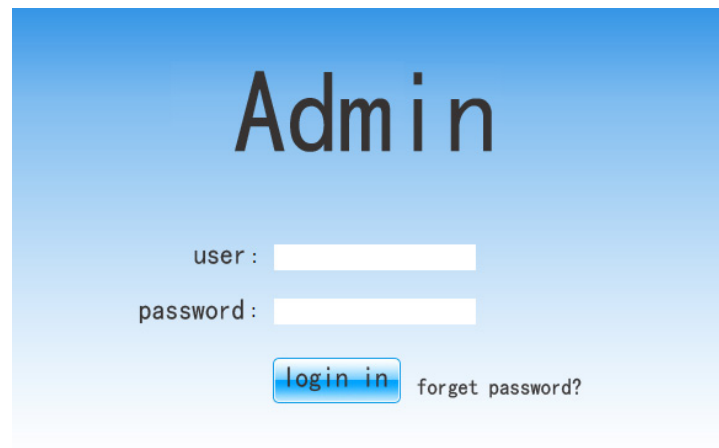
## 4. System Implementation

### 4.1. Login Page

#### 4.1.1. Login Verification Implementation

The source code of this system to realize login verification is shown in Appendix 1. After the reader enters the user name on the HTML page of Appendix 1, and clicks on the "Login" link as shown in Figure 2, Appendix 1 JQuery source code will be executed. The JQuery source code will extract the user name, The string of the two input boxes of the password, assign these two strings to two variables, and then transfer these two variables to Tomcat through the Post

request of Ajax technology through the Http protocol. After Tomcat receives the request, it finds Spring MVC according to the URL. The corresponding method inside is Appendix 1 Java source code. The Java source code will match the received account name and password with the data in the database through Mybatis. If the corresponding data is matched, the user's information will be encapsulated in the HttpSession object. And encapsulate the verification result into JSON format to respond to the requester, the Ajax of the requester will parse the response JSON format data, if it succeeds, it will jump to the main page, otherwise it will prompt "account name or password error" as shown in Figure 3.



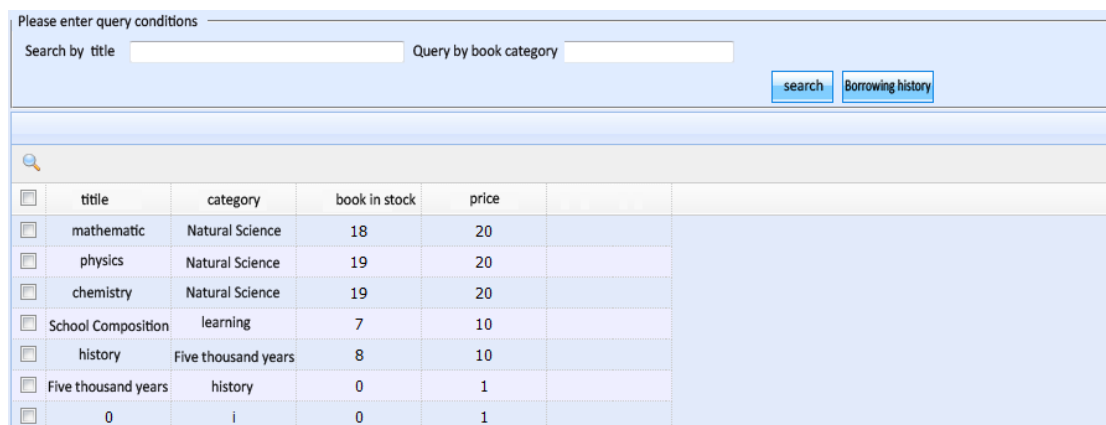
The image shows a login page for an administrator. It has a light blue background with a large 'Admin' title. Below the title, there are two input fields labeled 'user :' and 'password :'. Below these fields is a blue 'login in' button and a link that says 'forget password?'.

**Figure 2.** Administrator login page

## 4.2. Library Management System Homepage

### 4.2.1. Homepage Design

Figure 3 is the main interface for readers, where readers can borrow books online and view the borrowing history. Select a row of the book you want, and then click the "Online Borrowing" link to send the borrowed book information to the server. The server will persist the behavior data generated by the user to the borrowing history table through Mybatis, thereby realizing the borrowing of books. Since the library will pay a deposit and limit the number of borrowed books, three conditions need to be met for the book borrowing function: 1) The library book balance is greater than 0; 2) The reader balance minus the borrowing fee is greater than 50 (50 is Deposit); 3) Readers have not returned less than three books.



The image shows the reader main interface. It has a search bar at the top with the text 'Please enter query conditions'. Below the search bar, there are two input fields: 'Search by title' and 'Query by book category'. To the right of these fields are two buttons: 'search' and 'Borrowing history'. Below the search bar, there is a table with the following columns: title, category, book in stock, price, and an empty column. The table contains the following rows:

	title	category	book in stock	price	
<input type="checkbox"/>	mathematic	Natural Science	18	20	
<input type="checkbox"/>	physics	Natural Science	19	20	
<input type="checkbox"/>	chemistry	Natural Science	19	20	
<input type="checkbox"/>	School Composition	learning	7	10	
<input type="checkbox"/>	history	Five thousand years	8	10	
<input type="checkbox"/>	Five thousand years	history	0	1	
<input type="checkbox"/>	0	i	0	1	

**Figure 3.** Reader main interface



Click "Borrowing History" to jump to the borrowing history interface through the URL, and you can see the user's own borrowing history information and the balance of the fee. Only logged-in users can jump to the borrowing history interface. When A clicks on "Borrowing History", the browser sends a request to the backend through JQuery and Ajax, because the user information that has successfully logged in and verified is placed in 4.1.1 In the HttpSession object of the server, the user information of the requested HttpSession object is matched with the user information in the HttpSession object of the login interface on the server side. If the match is successful, the jump will be successful, otherwise it will display "Please login first!!!" Complete the page jump.

### 4.3. Database Table Implementation

According to the design of the database table and the realization of the MySQL DDL language database table:

1) Reader list:

```
CREATE TABLE READER(  
    ID INT PRIMARY KEY AUTO_INCREMENT,  
    ACCOUNT VARCHAR(20),  
    PASSWORD VARCHAR(20),  
    NAME VARCHAR(20),  
    ID_CARD_NUM VARCHAR(20),  
    TELEPHONE VARCHAR(20),  
    BALANCE DECIMAL(6,2)  
);
```

2) Book list:

```
CREATE TABLE BOOKS(  
    ID INT PRIMARY KEY AUTO_INCREMENT,  
    NAME VARCHAR(20),  
    PRICE DECIMAL(10,2),  
    CATEGORY VARCHAR(20),  
    AMOUNT INT,  
    LOCATION VARCAHR(20)  
)
```

3) Administrator table:

```
CREATE TABLE ADMINISTRATORS  
ID INT PRIMARY KEY AUTO_INCREMENT,  
ACCOUNT VARCHAR(20),  
PASSWORD VARCHAR(20),
```

```
NAME VARCHAR(20),  
ID_CARD_NUM VARCHAR(20),  
TELEPHONE VARCHAR(20),  
BALANCE DECIMAL(6,2),  
GET_PASSWORD VARCHAR(20)  
)
```

## 5. Conclusion

The system is developed with Java language, HTML, CSS, etc. as front-end display, EasyUI and Ajax as the information interaction with the server, the SSM framework is used to realize the processing of business logic and the interaction of database information, Tomcat 6.x, as the server of the book management system Part, use MySQL 5.5 as the data persistence layer. This article first gives a brief introduction to the Java language and the development framework and technology used, and then explains the system design. First, the business requirements of the book management system are determined, and then the functional modules that the requirements should be completed are briefly introduced. This system has designed the library function on the reader terminal, but the administrator terminal did not design this borrowing module. This can not only meet the reader's demand for borrowing books without leaving home, but also free up the librarian and reduce Staff work pressure. There are still some unresolved problems in the design of this system. Nowadays, the database is mainly used as the storage unit of data, and the server is used as the load-bearing part of the program, that is, the processing part of the logic. Therefore, the transmission of data from the server to the database may be restricted by the network environment. With the continuous increase of library collections and the continuous increase of readers, the consumption of server resources, network resources and database resources will affect the system experience. The management of books once and for all is still facing many problems and increasing challenges.

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