

ДЕРЖАВНИЙ УНІВЕРСИТЕТ
ІНФОРМАЦІЙНО-КОМУНІКАЦІЙНИХ ТЕХНОЛОГІЙ
НАВЧАЛЬНО-НАУКОВИЙ ІНСТИТУТ ІНФОРМАЦІЙНИХ ТЕХНОЛОГІЙ
КАФЕДРА КОМП'ЮТЕРНОЇ ІНЖЕНЕРІЇ

КВАЛІФІКАЦІЙНА РОБОТА

на тему: «Проектування веб-системи управління бібліотекою /
Design of web-based library management system»

на здобуття освітнього ступеня бакалавра
зі спеціальності 123 – Комп'ютерна інженерія
(код, найменування спеціальності)
освітньо-професійної програми Комп'ютерна інженерія
(назва)

*Кваліфікаційна робота містить результати власних досліджень.
Використання ідей, результатів і текстів інших авторів мають посилання на
відповідне джерело*

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**ДЕРЖАВНИЙ УНІВЕРСИТЕТ
ІНФОРМАЦІЙНО-КОМУНІКАЦІЙНИХ ТЕХНОЛОГІЙ**
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Ступінь вищої освіти бакалавр

Спеціальність 123 – Комп'ютерна інженерія

Освітньо-професійна програма Комп'ютерна інженерія

ЗАТВЕРДЖУЮ

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«____» _____ 2024р.

**ЗАВДАННЯ
НА КВАЛІФІКАЦІЙНУ РОБОТУ**

Пен Цзяхао

(прізвище, ім'я, по батькові здобувача)

1. Тема кваліфікаційної роботи: Проектування веб-системи управління бібліотекою /
Design of web-based library management system

керівник кваліфікаційної роботи Дмитро РОЗМАЇТИЙ,
(Ім'я, ПРІЗВИЩЕ, науковий ступінь, вчене звання)

затверджені наказом Державного університету інформаційно-комунікаційних технологій
від «27» лютого 2024р. № 36

2. Строк подання кваліфікаційної роботи «03» червня 2024р.

3. Вихідні дані до кваліфікаційної роботи: IntelliJ IDEA, Tomcat8.0, MySQL _____

4. Зміст розрахунково-пояснювальної записки (перелік питань, які потрібно розробити)

1. Система логіну користувача _____

2. Система управління бібліотекою _____

3. Система управління членами _____

5. Перелік ілюстративного матеріалу: *презентація*

6. Дата видачі завдання «27» лютого 2024р.

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1	Збір даних	28.02.2024-22.03.2024	
2	Обробка матеріалу	23.03.2024-05.04.2024	
3	Аналіз системи	06.04.2024-10.04.2024	
4	Дизайн системи	11.04.2024-30.04.2024	
5	Впровадження системи	01.05.2024-03.05.2024	
6	Тестування системи	04.05.2024-08.05.2024	
7	Розробка презентації	09.05.2024-11.05.2024	
8	Передзахист	14.05.2024-17.05.2024	
9	Здача в деканат	25.05.2024-03.06.2024	

Здобувач(ка) вищої освіти _____
(підпис)

Цзяхао ПЕН
(Ім'я, ПРІЗВИЩЕ)

Керівник кваліфікаційної роботи _____
(підпис)

Дмитро РОЗМАЇТИЙ
(Ім'я, ПРІЗВИЩЕ)

РЕФЕРАТ

Текстова частина кваліфікаційної роботи на здобуття освітнього ступеня бакалавра: 38 стор., 11 рис., 13 табл., 11 джерел.

Мета роботи – спроектувати веб-систему управління бібліотекою

Об'єкт дослідження – проектування веб-системи

Предмет дослідження – веб-система

Короткий зміст роботи:

Система керування бібліотекою може розкривати інформацію про стратегію книжкової індустрії, щоб люди могли легко та швидко зрозуміти цікавий вміст порівняно із загальною системою книжкової індустрії. Цей веб-сайт є відносно вичерпним веб-сайтом для обміну інформацією, який може задовольнити потреби користувачів у багатьох функціях, пов'язаних із книжковою індустрією.

Ця система має на меті створити невеликий практичний веб-сайт для книжкової індустрії. З основною лінією рекомендації змісту відповідної системи управління книгами, ця система детально представляє логічний метод та ідею дизайну побудови системи керування книгами та реалізована за допомогою механізму шаблонів JSP, фреймворку Spring і технології бази даних MySQL. У процесі впровадження цієї системи основним програмним забезпеченням розробки платформи є ідея тощо.

Веб-сайт в основному надає туристам і користувачам різні рекомендації, стратегії пошуку інформації, онлайн-перегляд, керування книгами, огляд вмісту книжкової індустрії, а також надає користувачам і туристам підтримку веб-сайту, включаючи керування користувачами, інформацію про книги, запозичення книг, повернення книг, інформація про замовлення, відкриття членської картки, інформація про поповнення рахунку, інформація про відрахування комісії, керування вмістом, зворотній зв'язок щодо процесу тощо.

КЛЮЧОВІ СЛОВА: Система управління бібліотекою, JAVA, MySQL, SSM

ABSTRACT

Text part of the master's qualification work: 38 pages, 11 pictures, 13 tables, 11 sources. *The purpose of the work* to design a web-based library management system.

Object of research – web system design

Subject of research – web system

Summary of the work:

With the rapid development of Internet technology, the networking of various book industry information presents an increasingly diversified trend. The network is closely related to our daily life. In daily life, the library management system is also expanding its own market through the network. The library management system can reveal the information of the book industry strategy, so that people can easily and quickly understand the interest content compared with the general book industry system. This website is a relatively comprehensive information sharing based website, which can meet the needs of users for many functions related to the book industry.

This system is to develop a small sharing and practical website for the book industry. With the main line of recommending the content of the relevant book management system, this system introduces in detail the logical method and design idea of building the book management system, and is realized by using JSP template engine, spring framework and MySQL database technology. In the implementation process of this system, the main platform development software used are idea and so on. The website mainly provides tourists and users with various recommendations, information search strategies, online browsing, book management, content review of the book industry, and provides users and tourists with website maintenance, including user management, book information, book borrowing, book return, order information, membership card opening, recharge information, fee deduction information, content management, process feedback, etc.

KEYWORDS: Library management system, JAVA, MySQL, SSM

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INTRODUCTION

With the rapid development of world technology, computer technology is becoming more and more mature. The form of people's exploration of knowledge has gradually changed from books to electronic books, which shows that people's desire to obtain knowledge through books is constantly increasing. However, there are still some factors that restrict the development of library management. Therefore, only by integrating such information resources to a certain extent can we better promote the development of the library management industry. Because the Internet has the characteristics of fast, convenient and efficient querying of book industry information, it can provide a better platform for searching library management system information.

The book industry is an important industry in the development of the national economy and plays a certain leading role in the development of the entire national economy and society. The book industry has many unique contents, which are the industry foundation for shaping a civilized image. However, these resources have not been fully utilized, and there is no real professional channel to promote them. Just through simple paper promotion. However, the research on specific library management systems has not been followed up.

In the early related development, through long-term exploration of the content of these books, a wide range of book information and services were provided for people in the book industry, including book information, book borrowing, and book return, which not only provided people with travel Convenience has also brought huge economic development to the book industry.

Although library management websites are developing rapidly, there are still many websites with insufficient data content. Not only do library management websites have a lot of synchronicity, they are also complex. The query speed is slow and resource scheduling is difficult. Therefore, the book management website not only needs comprehensive book industry information, but also needs a reliable platform to improve the efficiency of book resource utilization.

The main research content of this article:

- Based on the current mainstream JSP technology and MySQL database technology, integrating the current website design concepts, aiming at the existing problems of the current book management website, a feasibility study was conducted on the development of related book industry platforms;
- Fully analyzed the system requirements of the library management website, browsing of various information on the website, user registration and login, administrator's management of users and evaluation of the system;
- Describe in detail the relevant principles of library management system design, and elaborate on the operating environment of the library management system. This article focuses on the design of the system architecture, library management system structural logic and related databases. Finally, the relevant functional modules of the library management system are implemented and run.

After detailed analysis, this article focuses on the design and development of the library management system based on the system requirements. The content is as follows:

- Chapter 1 introduces the theory and technology in the system development process, including JSP and MySQL database;
- Chapter 2 analyzes in detail the feasibility of design and development of the library management system as well as the system functional requirements;
- Chapter 3 introduces the design principles and basis of the library management system, as well as the overall framework of the system;
- Chapter 4 mainly shows the interface implemented by the website, including website homepage, website login interface, management interfaces such as book information, book borrowing, book return, order information, membership, membership card opening, recharge information, deduction information, and backend interface;
- Chapter 5 conducts targeted testing of the entire system

1 SYSTEM TECHNOLOGY AND ENVIRONMENT

1.1 Choice of development environment

The development environment chosen this time is the Dell notebook that comes with the win10 system and supports the installation of many software. At present, this computer has been configured with Jdk1.8, Tomcat, Idea, MySQL and other necessary software for Java development. At the same time, E-R diagrams need to be designed during demand analysis, and UML design is adopted. Navicat for MySQL is directly used as the visual interface to create database tables, which facilitates more intuitive display of tables in the database.

1.2 Introduction to mysql

MySQL database is developed as an object-relational database management system. It supports most SQL standards and provides foreign keys, triggers for complex queries, and other functions such as SSM. At the same time, it can also be expanded in many ways.

SQL is a programming language for database query and programming, which can manage, update and query data. MySQL is an open source software with source code, which has the advantages of small size and fast speed. Navicat for MySQL is an ideal solution for managing and developing MySQL or MariaDB, supporting a single program that can connect to MySQL. Compared with other databases, MySQL database is very adaptable and can meet various situations. Its function is mainly reflected in the architecture of the storage engine, which separates the data to be processed from other system work and data storage. The role is primarily contained in the storage engine's

architecture, which separates the preparation of data for processing and processing from other system tasks and data storage retrieval. Based on business needs and actual needs, this architecture will select the appropriate storage engine for storage.

1.3 Jsp technology

JSP (Java Server Page) is developed by SUN Company. On the one hand, JSP technology is combined with traditional HTML code; on the other hand, it can also be expanded on the basis of original development. Through the implementation of JSP script code, developers can design the page and compile, convert and execute the code. This is actually a combination of HTML and Java technology. The separation between the presentation layer and the business layer is particularly important in project programming. Therefore, it is necessary to try not to display Java program code in Web pages. But in the face of increasingly complex requirements, the reality and presentation layers must meet a part of the complex functions to implement new technologies. Therefore, the JSP tag was born. At the same time, JSP itself can be regarded as a feature of the Java language, so if you use this language, you can also inherit the features of the Java language. JSP is only responsible for relatively simple display logic and does not put background processing functions into JSP. During the running process, JSP transmits the received data to the background. The related functions used are Get and Post. When the user clicks a hyperlink on the web page, JSP will pass a Get request to the server, and Post will Mainly for form operations.

1.4 Development tools

IDEA is a powerful enterprise-level integrated development environment. It is fully functional and supports multiple development languages such as HTML and CSS. IDEA is a widely popular software that has added quite a few private collections and JAVA open source application collections. It not only solves many open source code incompatibility problems, but also greatly promotes the cooperation efficiency of JAVA and JSP.

Tomcat is a free and open source WEB application server. Tomcat is extremely versatile and includes all the basic elements needed for daily monitoring of a Java application server. On this basis, it also provides the function of managing node operations. Ability to perform basic operational management of application servers, such as configuring data sources, deploying applications, and starting and stopping nodes.

2 SYSTEM ANALYSIS

2.1 Functional requirements analysis

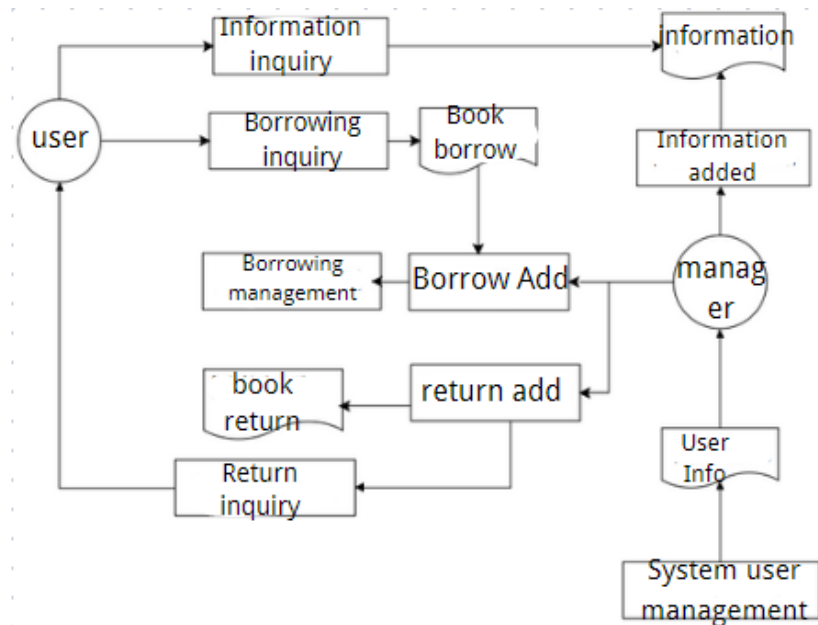
In the process of developing a library management system, system requirements analysis is an important step, and it is also a critical link in determining whether the quality of this website meets user needs. This chapter will start with system feasibility analysis and analyze the needs of the library management system in detail.

The book management system designed and described in this article is divided into two large modules according to the division of functional modules, namely the front-end module of the book management system and the back-end module of the website. The front-end module is mainly provided for tourists. Visitors can browse book industry information, my collections, and their own evaluations of book borrowing. When necessary, they can also search for book industry information of interest, etc. The backend is provided for administrators to maintain the library management system. This includes management of customers; management of customer evaluations of book borrowings launched by book industry websites; management of book returns; book information management; data traffic management; image management pages, etc.

2.2 Business process analysis

Overall business process: After the login page comes out, the account and password input boxes are provided. The user inputs and submits. The page will be submitted to the server for verification through Post or Get. After successful verification, log in to the system homepage, and then carry out book information, book borrowing, Operations such as book return; at the same time, the administrator needs to set at least one record in the

database initially, and receive input for verification when logging in. The administrator can only enter after successfully matching the identity information already in the database. The specific content is as follows As shown in Picture 2.1.



Picture 2.1 – System logic

2.3 Data flow analysis

2.3.1 0 layer data flow diagram

Match the values in the database based on the account data and password values provided by the visitor, thereby automatically determining the visitor's attributes, and then opening the corresponding operation interface based on the user's identity. The main content is shown in Picture 2.2.

2.4 System non-functional analysis

2.4.1 System security

The library management system designed in this article strictly controls the user's usage rights and should meet the following conditions:

- Users can only manage books or query book industry data after registering and logging in. Even if the user has published all irrelevant content to the content of the library management system, the administrator can delete it.
- Only after logging in as an administrator can you manage book industry information, manage user reviews, and review whether registered users are legal.

2.4.2 Interface requirements analysis

Interface design plays an irreplaceable role in the entire design. In the library management system, good design can give people a pleasing feeling, which has become an overall important indicator for evaluating the quality of the library management system. The beautiful and simple interface can provide users with better operations and improve work efficiency at the same time. The user interface is an important window and platform for the backend to communicate with users. Therefore, in the process of developing a library management system, we should focus on the following aspects:

- *Output design part.* Output is to generate valuable book information after background processing of the book information input by the user.
- *Input design part.* In the process of program design and website development, we should try our best to reduce the amount of input and simplify it to achieve the purpose of reducing errors.

2.5 System feasibility analysis

Analysis of technical feasibility. In the library management system, we use the B/S architecture. This system is still the mainstream of development. Its architecture maintenance and upgrade methods are simple and easy to understand, have good scalability, open standards, and low cost, and can well demonstrate the needs of users. come out.

Economic feasibility:

- The system development cycle is short;
- System development cost is low;
- Short deployment cycle;
- System maintenance is easy.

3 SYSTEM DESIGN

3.1 The overall principles and basis of the design

The library management system generally follows the guiding ideology of "Introduction to Software Engineering" and follows the following principles, using the agile development model to iterate the project layer by layer.

- First of all, in terms of practicality, the library management system greatly meets the needs of each user in actual operations, and comprehensively and fully considers the convenience and practicality of users' data processing at different levels.
- Secondly, in this book management system, this paper stores a large amount of data in the database, which can facilitate managers to access book information, book borrowing, book return, order information, membership, membership card opening, and recharge information of the library management system. , manage the content of deduction information.
- Then, during the coding process, a relatively secure network structure was adopted to ensure the reliability and security of the library management system.
- After that, the library management system code must be maintainable in terms of technological advancement.
- Finally, cheaper equipment should be used as much as possible while meeting the functional requirements of the overall library management system.

3.2 Overall framework

The library management system should have the following functions for ordinary users: online registration, online login, searching for book industry content, online book

management, evaluation of book information displayed on the website, book borrowing, and book return, etc.

For administrators, the specific functions they have are online login, management of registered users, management of book information, management of book industry content, modification of traffic data, etc.

Book information management. Users with relevant permissions can query, add, modify, and delete book information, and can also perform separate data items such as book number, book name, book type, Picture , author, price, quantity, location, and book details. Operation, set parameters such as data type.

Book borrowing management. Users with relevant permissions can query, add, modify, and delete books, and can also check the book name, book type, quantity, borrowing time, return date, remarks, membership number, name, ID card, mobile phone, Data items such as whether to review and review responses can be operated individually, and parameters such as data type can be set.

Book return management. Users with relevant permissions can query, add, modify, and delete books for return, and can also review the book name, book type, quantity, return time, return content, membership number, name, ID card, mobile phone, and whether to review , audit replies and other data items can be operated individually, and parameters such as data types can be set.

Order information management. Users with relevant permissions can query, add, modify, and delete order information, as well as order number, book name, book type, price, quantity, total price, purchase date, membership number, name, mobile phone, etc. Data items are operated individually and parameters such as data type are set.

Member management. Users with relevant permissions can query, add, modify, and delete members. They can also perform individual operations on data items such as member numbers, passwords, names, genders, avatars, ID cards, and mobile phones, and set parameters such as data types.

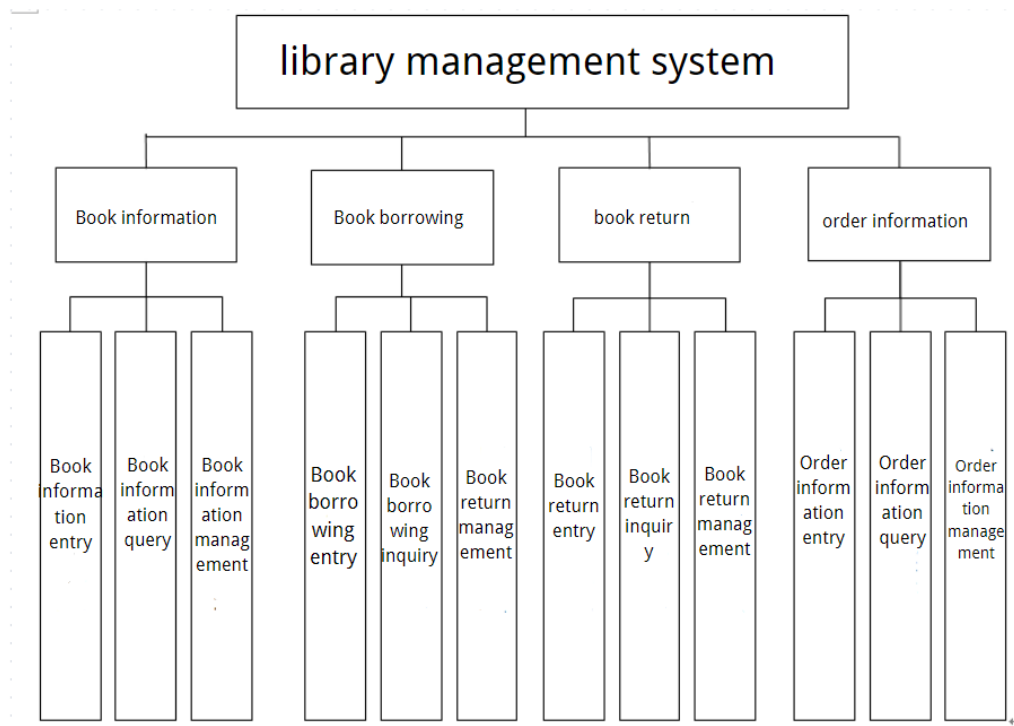
Member card opening management. Users with relevant permissions can query, add, modify, and delete member card opening operations. They can also perform

individual operations on data items such as card number, membership number, name, amount, and processing time, and set parameters such as data types.

Recharge information management. Users with relevant permissions can query, add, modify, and delete recharge information. They can also perform individual operations on data items such as card number, membership number, name, amount, recharge date, and whether to pay, and set parameters such as data types. .

Deduction information management. Users with relevant permissions can query, add, modify, and delete deduction information, and can also perform individual operations and settings on data items such as card number, membership number, name, amount, refund date, and deduction instructions. Data type and other parameters.

In general, the library management system mainly includes book information, book borrowing, book return and order information. Each module can be divided into three small modules. The specific system core function structure diagram is shown in Picture 3.1.



Picture 3.1 – Library management system

3.3 Database Design

3.3.1 Design of database-related conceptual structures

As the core of the library management system, the database is an extremely important carrier for storing data. It can perform a series of operations such as adding, deleting, changing, and searching data with the support of the database system. A better database design can make the entire library management system simpler and more convenient for subsequent writing of the library management system. It is also of great help to the operability and quality of the entire library management system. In the development of a library management system, the design of the database is the center of the entire system, and all business operations are inseparable from it. A good database design can make development easier and save a lot of developer time. If the design of the database does not meet the business scenario, it will lead to a series of complex operation steps. Therefore, the design of the database needs to be standardized. It is not necessary to follow the standards of the first paradigm and the second paradigm, but when designing the database, it is necessary to design a database that meets business needs based on the actual situation.

Database writing and design consists of planning, requirements design analysis, logical design, and conceptual design. After the system requirements analysis is completed, it is necessary to have a deep understanding of the establishment of the entire library management system, and then the database tables need to be designed according to the requirements in the relevant work plan. If the data table design is not reasonable enough, it will most likely make it difficult for managers to develop, and the complex design will make some system services of the library management system relatively large and cumbersome. Post-maintenance is not only expensive, but also requires some programmers who understand the project. Therefore, good database design is the first step in system development.

After the needs of library management system users are confirmed in the needs analysis stage, the business needs to be straightened out based on relevant demand descriptions, followed by the design of database tables. When designing data tables, it is necessary to combine the actual requirements of the business scenario rather than simply and blindly following the database specifications.

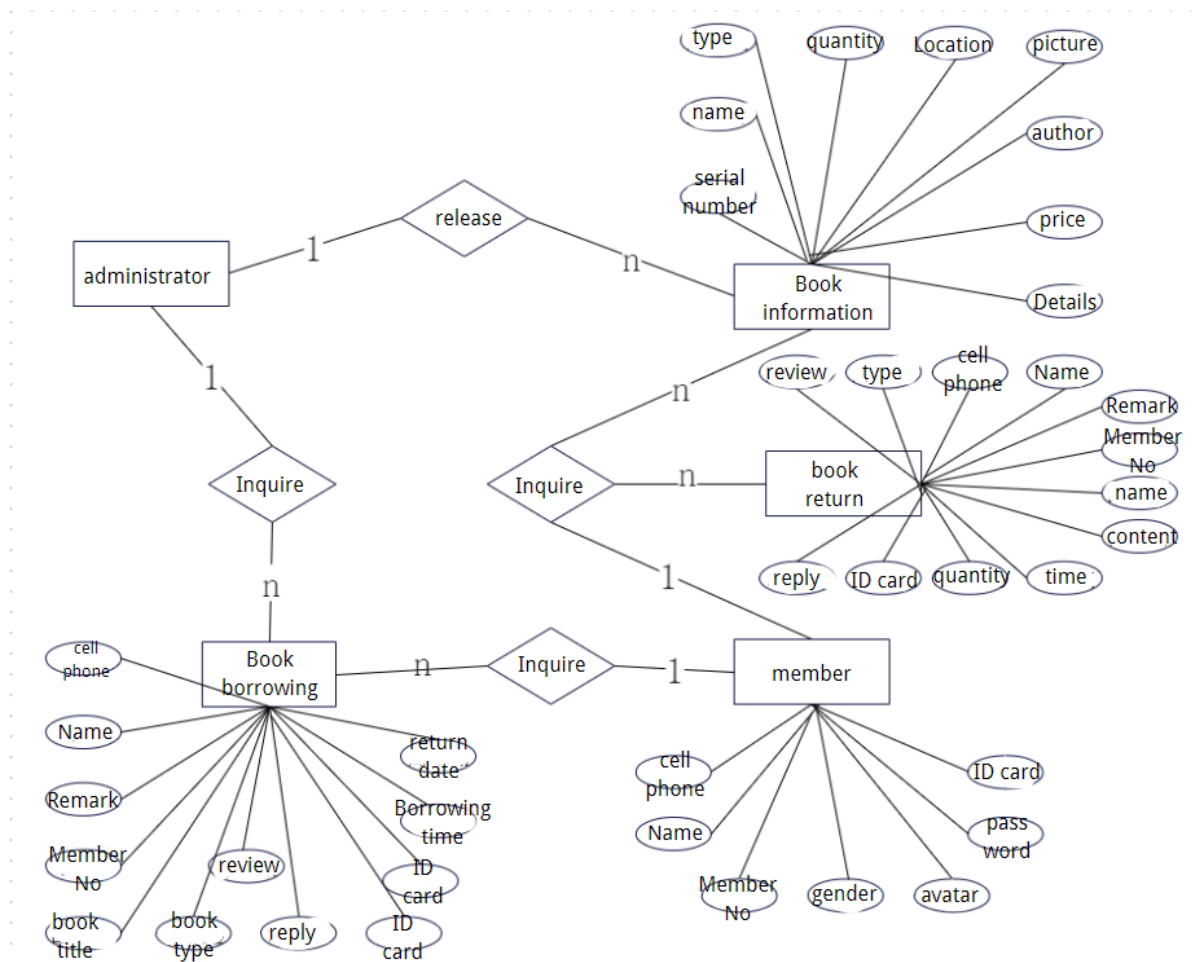
To build a corresponding database according to system requirements, you first need to classify and plan the data, roughly construct a suitable structural model, consider various necessary attributes in the model, and consider the relationship between each object, and design according to the concept. , get the following E-R diagram of the system.

The overall E-R diagram of the system mainly shows that after the administrator releases book information online, members can query the book information. Members can send requests to the administrator through registration. After the administrator approves, the user can borrow and return books. The book information includes book number, book name, book type, Picture , author, price, quantity, location, book details and other data. item.

Book borrowing includes data items such as book name, book type, quantity, borrowing time, return date, remarks, membership number, name, ID card, mobile phone, whether to review, review reply and other data items.

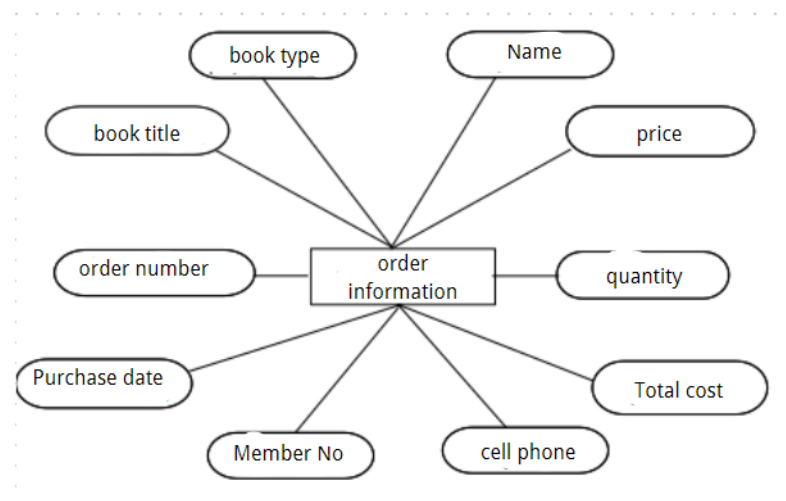
Book return includes data items such as book name, book type, quantity, return time, returned content, membership number, name, ID card, mobile phone, whether to review, review reply, etc.

Member information includes membership number, password, name, gender, avatar, ID card, mobile phone and other data items. The specific overall E-R is shown in Picture 3.2.



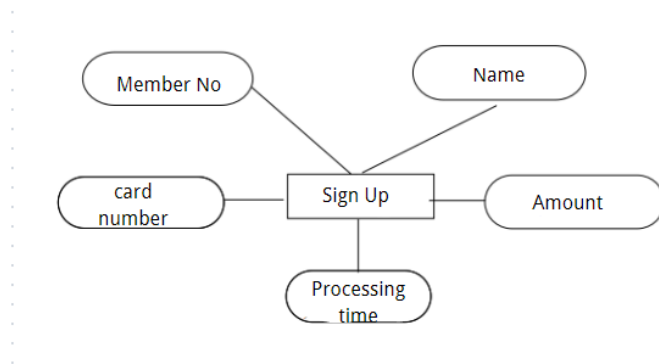
Picture 3.2 – The overall E-R diagram

The order information E-R diagram includes order number, book name, book type, price, quantity, total price, purchase date, membership number, name, mobile phone and other data items, as shown in Picture 3.3.



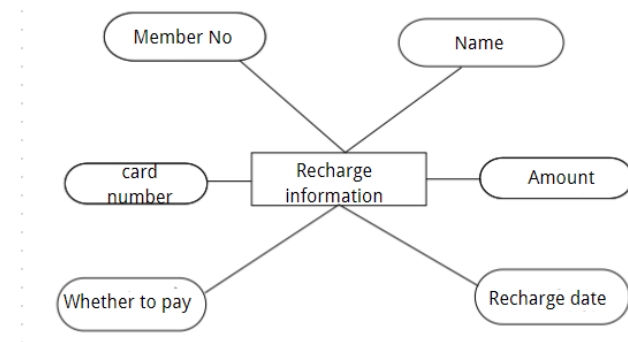
Picture 3.3 – The order information E-R diagram

The member card opening E-R diagram contains data items such as card number, membership number, name, amount, processing time, etc., as shown in Picture 3.4.



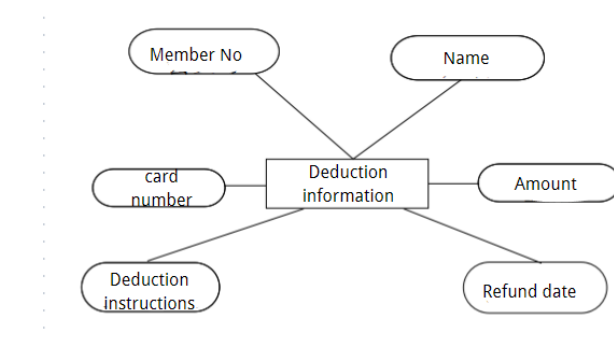
Picture 3.4 – The member card opening E-R diagram

The recharge information E-R diagram contains data items such as card number, membership number, name, amount, recharge date, whether to pay, etc., as shown in Picture 3.5.



Picture 3.5 – The recharge information E-R diagram

The deduction information E-R diagram contains data items such as card number, membership number, name, amount, refund date, deduction instructions, etc., as shown in Picture 3.6.



Picture 3.6 – The deduction information E-R diagram

3.3.2 Database physical structure design

The website database of the library management system consists of: data tables, including book information table, book borrowing table, book return table, order information table, membership table, member card opening table, recharge information table, and deduction information table.

In the database, the primary key in the database is used in the self-increasing general mode, and is used for one-to-one and one-to-many associations between tables. It does not create restrictions at the database level, mainly to ease the data storage compression and More flexibility and personality with control program associations. For large text, the type is used to store binary text, images are stored when the only image is placed on the server, the image, Picture , and can be referenced by an address.

In order to reflect the recharge information more intuitively, draw the recharge information table in the database, including field name, field type, size and maximum length. The main contents in the table are ID, card application time, card number, membership number, name, amount, recharge date, whether to pay, etc., as shown in Table 3.1 below.

Table 3.1 – Recharge information table (data structure)

Number	Field Name	Field Type	Length	Allowed to be empty	Comment
1	id	Bigint	20	NO	Primary key
2	addtime	DateTime	8	NO	Creation time
3	kahao	Varchar	200	-	Card number
4	huiyuanhao	Varchar	200	-	Member no
5	xingming	Varchar	200	-	Name
6	jine	Int	11	NO	Amount
7	chongzhiriqi	DateTime	0	-	Recharge date
8	ispay	Varchar	200	-	Whether to pay

Order information table: Mainly records order information including ID, time of each order, order number, book name, book type, price, quantity, total price, purchase date, membership number, mobile phone, etc. The specific performance is as shown in the table Shown in Table 3.2 below.

Table 3.2 – Order information table (data structure)

Number	Field name	Field type	Length	Allowed to be empty	Comment
1	id	Bigint	20	NO	Primary key
2	addtime	DateTime	0	NO	Creation time
3	dingdanbianhao	Varchar	200	-	Order number
4	tushumingcheng	Varchar	200	NO	Book title
5	tushuleixing	Varchar	200	NO	Book type
6	jiage	Int	11	NO	Price
7	shuliang	Int	11	-	Quantity
8	zongjiage	Float	0	-	Total cost
9	goumairiqi	DateTime	0	-	Purchase date
10	huiyuanhao	Varchar	200	-	Member no
11	xingming	Varchar	200	-	Name
12	shouji	Varchar	200	-	Cell phone

Announcement information table: mainly records announcement information to facilitate better communication with users, including ID, specific time, title, type, Picture , announcement content, release time, etc. The specific details are shown in Table 3.3 below.

Table 3.3 – Announcement information table (data structure)

Serial number	Field name	Field type	Length	Allowed to be empty	Comment
1	id	Int	20	NO	Primary key
2	addtime	DateTime	0	NO	Creation time
3	biaoti	Varchar	200	NO	Title
4	leixing	Varchar	200	-	Type
5	tupian	Varchar	200	-	Picture
6	gonggaoneirong	Longtext	0	-	Announcement content
7	fabushijian	DateTime	0	-	Release time

Member table: In order to facilitate the statistics of member information, a member table has been added. The specific content includes ID, specific time for membership, membership number, password, name, gender, avatar, ID card, mobile phone, etc. The specific field performance is shown in Table 3.4.

Table 3.4 – Member table (data structure)

Serial number	Field name	Field type	Length	Allowed to be empty	Comment
1	id	Bigint	20	NO	Primary key
2	addtime	DateTime	0	NO	Creation time
3	huiyuanhao	Varchar	200	NO	Member no
4	mima	Varchar	200	-	Password
5	xingming	Varchar	200	-	Name
6	xingbie	Varchar	200	-	Gender
7	touxiang	Varchar	200	-	Avatar
8	shenfenzheng	Varchar	200	-	ID card
9	shouji	Varchar	200	-	Cell phone

Member card opening form: mainly records the membership card opening. The fields that need to be filled in to apply for membership mainly include ID, time, specific time, card number, membership number, name, amount, processing time, etc. The specific table is shown in Table 3.5.

Table 3.5 – Member card opening table (data structure)

Serial number	Field name	Field type	Length	Allowed to be empty	Comment
1	id	Bigint	20	NO	Primary key
2	addtime	DateTime	8	NO	Creation time
3	kahao	Varchar	200	NO	Card number
4	huiyuanhao	Varchar	200	-	Member no
5	xingming	Varchar	200	-	Name
6	jine	Int	11	NO	Amount
7	banlishijian	DateTime	0	-	Processing time

Deduction information table: The main fields for recording deduction content include user ID, specific time, card number, membership number, amount, name, refund date, refund instructions, etc. The specific table is shown in Table 3.6.

Table 3.6 – Deduction information table (data structure)

serial number	Field Name	Field Type	length	allowed to be empty	Comment
1	id	Bigint	20	NO	primary key
2	addtime	DateTime	0	NO	creation time
3	kahao	Varchar	200	-	card number
4	huiyuanhao	Varchar	200	-	Member No
5	xingming	Varchar	200	-	name
6	jine	Int	11	NO	Amount
7	tuifeiriqi	DateTime	0	-	Refund date
8	koufeishuoming	Varchar	200	-	Deduction instructions

Book return table: Used to describe the field type, size, and maximum length of ID, specific time, book name, book type, quantity, return time, return content, membership number, name, ID card, and mobile phone. See Table 3.7.

Table 3.7 – Book return table (data structure)

serial number	Field Name	Field Type	length	allowed to be empty	Comment
1	id	Bigint	20	NO	primary key
2	addtime	DateTime	0	NO	creation time
3	tushumingcheng	Varchar	200	-	book title
4	tushuleixing	Varchar	200	-	book type
5	shuliang	Int	11	-	quantity
6	guihuanshijian	DateTime	0	-	return time
7	guihuanneirong	Longtext	0	-	Return content
8	huiyuanhao	Varchar	200	-	Member No
9	xingming	Varchar	200	-	name
10	shenfenzheng	Varchar	200	-	ID card
11	shouji	Varchar	200	-	cell phone
12	Sfsh	Varchar	200	-	Review
13	Shhf	Longtext	0	-	reply

Book borrowing table: Mainly used to describe book borrowing information. The table displayed in the database includes ID, attachment time, book name, book type, quantity, borrowing time, return date, remarks, membership number, ID card, mobile phone, etc. The type size and length of the field are shown in Table 3.8 for details.

Table 3.8 – Book borrowing table (data structure)

serial number	Field Name	Field Type	length	allowed to be empty	Comment
1	id	Bigint	20	NO	primary key
2	addtime	Timestamp	0	NO	creation time
3	tushumingcheng	Varchar	200	-	book title
4	tushuleixing	Varchar	200	-	book type
5	shuliang	Int	11	NO	quantity
6	jieyueshijian	DateTime	0	-	Borrowing time
7	guihairiqi	Date	0	NO	return date
8	beizhu	Varchar	200	NO	Remark
9	huiyuanhao	Varchar	200	-	Member No
10	xingming	Varchar	200	-	Name
11	shenfenzheng	Varchar	200	-	ID card
12	shouji	Varchar	200	-	cell phone
13	Sfsh	Varchar	200	-	review
14	Shhf	Longtext	0	-	reply

Book information table: used to record book information, including ID, attachment time, book number, book name, book type, Picture , author, price, quantity, location, book details. The type, size and length of these fields are specifically displayed in the database. See Table 3.9.

Table 3.9 – Book information table (data structure)

Serial number	Field name	Field type	Length	Allowed to be empty	Comment
1	id	Bigint	20	NO	Primary key
2	addtime	DateTime	8	NO	Creation time
3	tushubianhao	Varchar	200	-	Book number
4	tushumingcheng	Varchar	200	NO	Book title

Continuation of Table 3.9 – Book information table (data structure)

Serial number	Field name	Field type	Length	Allowed to be empty	Comment
5	tushuleixing	Varchar	200	NO	Book type
6	tupian	Varchar	200	-	Picture
7	zuozhe	Varchar	200	-	Author
8	jiage	Int	4	NO	Price
9	shuliang	Int	4	NO	Quantity
10	weizhi	Varchar	200	-	Location
11	tushuxiangqing	Longtext	200	-	Details

User table: records user information, mainly including: ID, account number, password, role, date, type, size, maximum length and specific content of each field. See Table 3.10 for details.

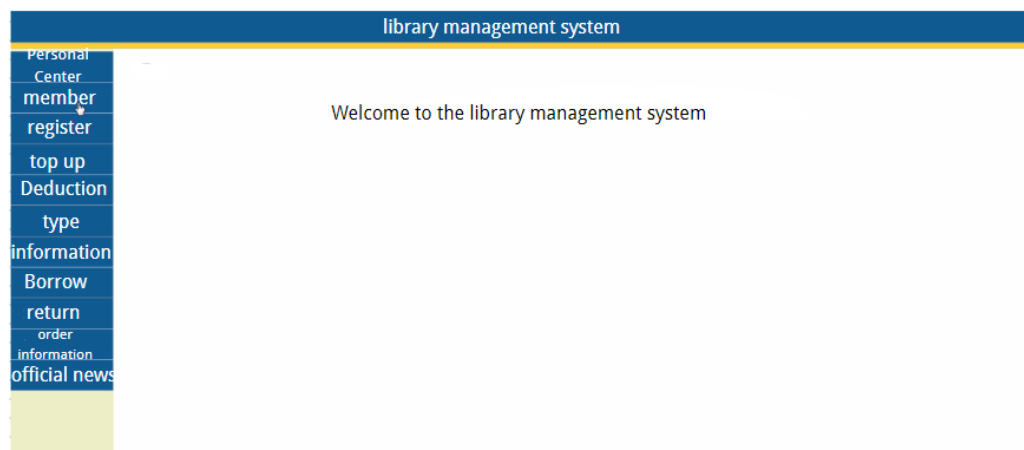
Table 3.10 – User table (data structure)

Serial number	Field name	Field type	Length	Allowed to be empty	Comment
1	id	Int	20	NO	Primary key
2	username	Varchar	100	NO	Username
3	password	Varchar	100	NO	Password
4	role	Varchar	100	-	Role
5	addtime	Timestamp	0	NO	Add date

4 SYSTEM IMPLEMENTATION

This library management system mainly uses JSP technology, the language used is JAVA language, and the development and architecture of the entire system is J2EE. In this way, the JDK in J2EE can be integrated into the IDEA environment, making it more convenient to call. Tomcat is the environment used to deploy servers. These two softwares are not only easy to use, but also free. When it comes to database management systems, MySQL is undoubtedly the best tool. For better operation, Navicat provides a visual interface.

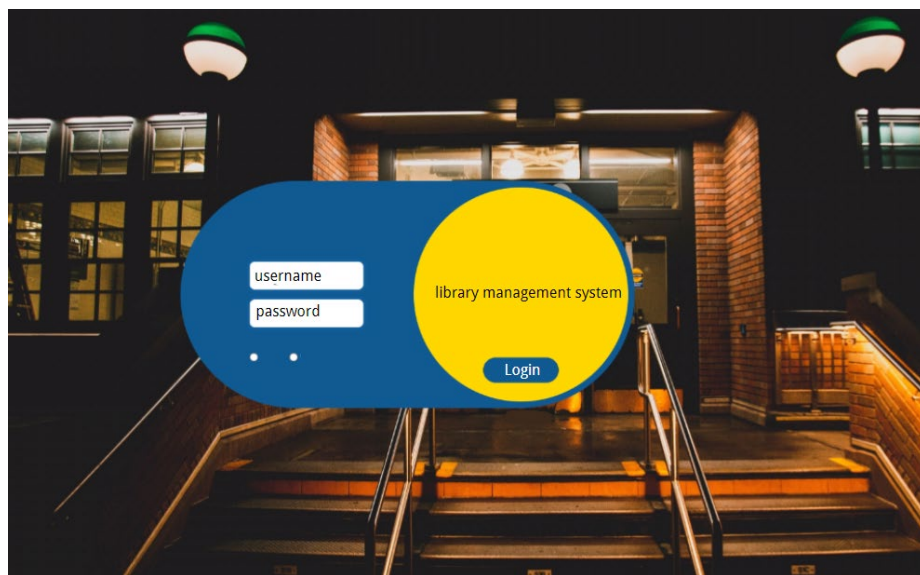
B/S structure, which is the browser/server structure. It is characterized by short development cycle and low cost. Users of the library management system only need a browser to develop client software independently. This can greatly shorten the program development cycle. Secondly, the system development cost is very low. Many free and open source WEB browsers can be used directly, and as ready-made client software, you can save purchase costs. Next, the traditional C/S system requires downloading and installing client software on each computer, which is very time-consuming and energy-consuming. At the same time, large-scale relevant users must be trained to solve problems in the use of the library management system. Finally, the convenience of operation and maintenance of the library management system makes relevant technical personnel basically do not need to perform special maintenance on the client. The homepage is shown in Picture 4.1.



Picture 4.1 – Homepage

4.1 Implementation of login module

After the user enters his or her account number and password in a fixed location, the system automatically identifies the information and determines whether it matches the existing data in the database. If the corresponding information can be found and corresponds to a unique data record value, the user can enter the system. If the information does not correspond, the user does not have the right to enter the system. The user login interface is shown in Picture 4.2 below.



Picture 4.2 – The user login interface

Due to the continuous increase in the number of people in my country's book industry and the number of book managers at this stage, a series of related information stored in this system is becoming more and more full. However, because the book industry does not pay enough attention to managers, the number of managers is actually very large. Scarcity. Therefore, if only one administrator can add, delete, modify, and check information in the database, management efficiency will be low. If you can add administrators to jointly manage the data in the database, then the management of users will become faster.

4.2 Implementation of book information module

In order to facilitate the smooth development of book information by administrators, a book information module should be added to this system to help administrators arrange a series of data in advance, so as to improve the efficiency of this module. Behind each book information, there should be functions to add, delete, modify, and check data items such as book number, book title, book type, Picture , author, price, quantity, location, and book details. The book information interface is shown in Picture 4.3 below.

图书编号	图书名称	图书类型	图片	作者	价格	数量	位置	操作
11111111111	图书名称1	图书类型1		作者1	1	1	位置1	查看 修改 删除
22222222222	图书名称2	图书类型2		作者2	2	2	位置2	查看 修改 删除
33333333333	图书名称3	图书类型3		作者3	3	3	位置3	查看 修改 删除
44444444444	图书名称4	图书类型4		作者4	4	4	位置4	查看 修改 删除
55555555555	图书名称5	图书类型5		作者5	5	5	位置5	查看 修改 删除
66666666666	图书名称6	图书类型6		作者6	6	6	位置6	查看 修改 删除

Picture 4.3 –The book information interface

4.3 Implementation of book borrowing module

In order to facilitate the smooth development of book borrowing by administrators, a book borrowing module should be added to this system to help administrators arrange a series of data in advance, so as to improve the efficiency of this module. Behind each book borrowed should be the book title, book type, quantity, borrowing time, return date, remarks, membership number, name, ID card, mobile phone, whether to review, review reply and other data items to add, delete, modify, check function exists. The book borrowing interface is shown in Picture 4.4.

图书管理系统	
个人中心	图书名称: 图书名称3
会员开卡管理	图书类型: 图书类型3
充值信息管理	数量: 3 <small>数量不能为空</small>
扣费信息管理	借阅时间: 2022-03-20 21:51:24
图书信息管理	归还日期: <small>归还日期不能为空</small>
图书借阅管理	备注: 备注 <small>备注不能为空</small>
图书归还管理	会员号: 2
订单信息管理	姓名: 刘静
公告信息管理	身份证: 440300199101010001
	手机: 13823888881
	<input type="button" value="提交"/> <input type="button" value="取消"/>

Picture 4.4 – The book borrowing interface

4.4 Implementation of book return module

In order to facilitate the smooth implementation of book return by the administrator, a book return module should be added to this system to help the administrator arrange a series of data in advance, so as to improve the efficiency of this module. Behind each book return should be the function of adding, deleting, modifying and checking data items such as book title, book type, quantity, return time, returned content, membership number, name, ID card, mobile phone, whether to review, review reply, etc. exist. The book return interface is shown in Picture 4.5.

Picture 4.5 – The book return interface

4.5 Implementation of order information module

In order to facilitate the smooth development of order information by the administrator, an order information module should be added to this system to help the administrator arrange a series of data in advance, so as to improve the efficiency of this module. Behind each order information, there should be functions to add, delete, modify and check data items such as order number, book name, book type, price, quantity, total price, purchase date, membership number, name, mobile phone and other data items. The order information interface is shown in Picture 4.6 below.

图书管理系统	
个人中心	图书名称: 海贼王 <small>图书名称不能为空</small>
会员开卡管理	图书类型: 漫画 <small>图书类型不能为空</small>
充值信息管理	价格: 220 <small>价格不能为空</small>
扣费信息管理	数量: 2
图书信息管理	总价: 440.00
图书借阅管理	购买日期: 2022-03-20 21:51:44
图书归还管理	会员号: 2
订单信息管理	姓名: 刘希
公告信息管理	手机: 13823888881
	提交 取消

Picture 4.6 – The order information interface

4.6 Implementation of membership module

In order to facilitate the administrator's smooth development of membership, a membership module should be added to this system to help the administrator arrange a series of data in advance, so as to improve the efficiency of this module. Behind each member, there should be functions to add, delete, modify, and check corresponding data such as member number, password, name, gender, avatar, ID card, and mobile phone. The membership interface is shown in Picture 4.7 below.

Picture 4.7 – The membership interface

4.7 Implementation of membership card opening module

In order to facilitate the administrator's smooth membership card opening, a member card opening module should be added to this system to help the administrator arrange a series of data in advance, so as to improve the efficiency of this module. After each member opens a card, there should be functions to add, delete, modify, and check corresponding data such as card number, membership number, name, amount, processing time, etc. The membership card opening interface is shown in Picture 4.8.

Picture 4.8 – The membership card opening interface

4.8 Implementation of recharge information module

In order to facilitate the smooth development of recharge information by the administrator, a recharge information module should be added to this system to help the administrator arrange a series of data in advance, so as to improve the efficiency of this module. Behind each recharge information, there should be functions to add, delete, modify, and check corresponding data such as card number, membership number, name, amount, recharge date, and whether to pay. The recharge information interface is shown in Picture 4.9.

图书管理系统							
个人中心	充值信息管理						
会员管理	<div> <div>充值信息管理 / 充值信息列表</div> <div> <div>卡号</div> <div>请输入卡号</div> </div> <div> <div>姓名</div> <div>请输入姓名</div> </div> <div> <div>查询</div> <div>批量删除</div> </div> </div>						
会员开卡管理		卡号	会员号	姓名	金额	充值日期	操作
充值信息管理		卡号1	会员号1	姓名1	1	2022-03-20 21:44:56	查看 修改 删除
扣费信息管理		卡号2	会员号2	姓名2	2	2022-03-20 21:44:56	查看 修改 删除
图书类型管理		卡号3	会员号3	姓名3	3	2022-03-20 21:44:56	查看 修改 删除
图书信息管理		卡号4	会员号4	姓名4	4	2022-03-20 21:44:56	查看 修改 删除
图书借阅管理		卡号5	会员号5	姓名5	5	2022-03-20 21:44:56	查看 修改 删除
图书归还管理		卡号6	会员号6	姓名6	6	2022-03-20 21:44:56	查看 修改 删除
订单信息管理		1647784123	2	刘静	250	2022-03-20 21:48:55	查看 修改 删除
公告信息管理	<div> <div>10</div> <div>条数据</div> <div>1</div> </div>						

Picture 4.9 – The recharge information interface

4.9 Implementation of deduction information module

In order to facilitate the smooth development of the deduction information by the administrator, a deduction information module should be added to this system to help the administrator arrange a series of data in advance, so as to improve the efficiency of this module. Each deduction information should be followed by card number, membership number, name, amount, refund date, deduction instructions and other data, and the functions of adding, deleting, modifying and checking can be realized. The deduction information interface is shown in Picture 4.10 below.

图书管理系统

个人中心

会员管理

会员开卡管理

充值信息管理

扣费信息管理

图书类型管理

图书信息管理

图书借阅管理

图书归还管理

订单信息管理

公告信息管理

卡号1647784123

会员号2

姓名刘新

金额250

金额不能为空

退费日期2022-03-20 21:49:3

扣费说明扣费说明

提交

取消

Picture 4.10 – The deduction information interface

5 SYSTEM TEST

5.1 Testing purposes

System testing is to discover problems in the system in a timely manner, and the process of testing is a process of discovering problems yourself. Only by testing various functions of the system multiple times can problems be discovered in time and targeted solutions can be made. During the testing process, you first need to test each function one by one to observe whether the system is running as expected. The more times you test, the more accurate the test results will be. This is because one or two system tests cannot fully discover the correctness of the system.

This test is mainly to test the operation of the library management system and the use of the backend database. Testing the operation of the library management system mainly tests whether the system login is smooth, whether the information in the database is complete, whether the links between each page are smooth, etc. The backend is mainly to test whether the management of personal information is normal, whether the management of various information in the book industry is available, whether the entry of each book management information is complete, etc..

5.2 Interface testing

Use the test method suitable for interface testing to test the interface of this system to see whether the interface is normal and usable.

First, test whether the text, interface design, interface status, etc. in each interface of the system meet expectations and whether the operation is normal.

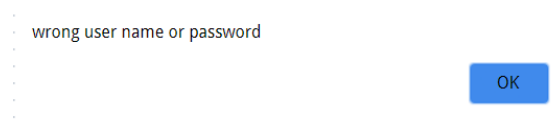
Secondly, test whether the various data in the database in the system are completely accurate, whether they can be changed fluently, whether they can be added, deleted, etc.

It is also necessary to test whether the security performance of the system is efficient, whether there are system vulnerabilities, and whether it needs to be modified and improved.

5.3 Function test

5.3.1 User login test

If the user tries to log in as "fly" and the entered password does not match the corresponding user name, the reminder box will prompt "Incorrect user name or password". If the user enters the account number but not the password, it will prompt The box will remind you "Password cannot be empty". Specifically shown in Picture 5.1.



Picture 5.1 – Error message

When the user logs in as "abo" and the password is the corresponding password, the reminder box will remind "Successfully logged in! "

5.3.2 Book Information Management Test

When testing the library information management module, a variety of appropriate testing methods should be used to conduct testing so as to achieve accurate testing. For example, if you try to enter wrong content in a key input field, the system will not be able to output the expected output normally. The test table is shown in Table 5.1.

Table 5.1 – Book information management test form

Specific functions	Add, delete, modify and check book information	
Purpose of Example	Is the modified information accurate	
Required conditions	Enter the interface	
input/action	Input	output
correct	A.Book number	A.Book number
Incorrect	1 Book number	Incorrect
correct	A.book title	A.book title
Incorrect	1book title	Incorrect
correct	A.book type	A.book type
Incorrect	1book type	Incorrect
correct	A.Picture	A.Picture
Incorrect	1Picture	Incorrect
correct	A.author	A.author
Incorrect	1author	Incorrect
correct	A.price	A.price
Incorrect	1price	Incorrect
correct	A.quantity	A.quantity
Incorrect	1quantity	Incorrect
correct	A.Location	A.Location
Incorrect	1Location	Incorrect
correct	A.Book details	A.Book details
Incorrect	1Book details	Incorrect

5.3.3 Book lending management test

When testing the book borrowing management module, a variety of testing methods should be adopted to continuously test. The number of tests determines the accuracy of the test. Of course, effective testing methods can achieve twice the result with half the effort. For example, if you try to enter wrong content in a key input field, the system will not be able to output the expected output normally. The test table is shown in Table 5.2.

Table 5.2 – Book Lending Test Form

Specific functions	Add, delete, modify and check book information	
Purpose of Example	Is the modified information accurate?	
Required conditions	Enter the interface	
Input/action	input	output
Correct	A.book title	A.book title
Incorrect	lbook title	Incorrect
Correct	A.book type	A.book type
Incorrect	A.book type	Incorrect
Correct	A.quantity	A.quantity
Incorrect	lquantity	Incorrect
Correct	A.Borrowing time	A.Borrowing time
Incorrect	lBorrowing time	Incorrect
Correct	A.return date	A.return date
Incorrect	lreturn date	Incorrect
Correct	A.Remark	A.Remark
Incorrect	lRemark	Incorrect
Correct	A.Member No	A.Member No
Incorrect	lMember No	Incorrect
Correct	A.Name	A.Name
Incorrect	lName	Incorrect
Correct	AID card	A.ID card

Continuation of Table 5.2 – Book Lending Test Form

Incorrect	lID card	Incorrect
Correct	A.cell phone	Acell phone
Incorrect	l cell phone	Incorrect
Correct	A.review	A.review
Incorrect	lreview	Incorrect
Correct	A.reply	A.reply
Incorrect	lreply	Incorrect

5.3.4 Book Return Management Test

When testing the book return management module, we mainly conduct a simple test on the book return function to determine whether the information modification is accurate. For example, if you try to enter wrong content in a key input field, the system will not be able to output the expected output normally. The test table is shown in Table 5.3.

Table 5.3 – Book Return Test Form

Specific functions	Add, delete, modify and check book information		
Purpose of Example	Is the modified information accurate		
Required conditions	Enter the interface		
input/action	input	output	
correct	A.book title	A.book title	
Incorrect	lbook title	Incorrect	
correct	A.book type	A.book type	
Incorrect	lbook type	Incorrect	
correct	A.quantity	A.quantity	
Incorrect	lquantity	Incorrect	

Continuation of Table 5.3 – Book Return Test Form

correct	A.return time	A.return time
Incorrect	1return time	Incorrect
correct	A.Return content	AReturn content
Incorrect	1Return content	Incorrect
correct	A.Member No	A.Member No
Incorrect	1Member No	Incorrect
correct	A.Name	A.Name
Incorrect	1Name	Incorrect
correct	A.ID card	A.ID card
Incorrect	1ID card	Incorrect
correct	A.cell phone	A.cell phone
Incorrect	1.cell phone	Incorrect
correct	A.Review	A.Review
Incorrect	1Review	Incorrect
correct	A.reply	A.reply
Incorrect	1reply	Incorrect

5.4 Test Results

The test of this system shows that after testing according to specific and correct methods, the system operation results obtained are roughly the same as expected, and can basically meet user expectations. In this entire system test, due to technical and time constraints, the framework of this system is not perfect enough, and the database data is not complete enough. Therefore, this system needs further modification and improvement

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SUMMARIZE

After several months of designing and writing the library management system, all the development knowledge I used was based on the professional experience accumulated in four years of university. At the same time, I also improved my personal coding skills in this field.

The development of the library management system not only used the knowledge learned during college, but also consulted many books on how to manage books. The relevant functions performed by the system are more in line with the real business scenarios of the contemporary book industry, and are very convenient for users to search for relevant information through queries. It also summarizes many useful development experiences to meet corresponding needs in the future. However, this system still contains many extended functions that need to be developed, as well as synchronization functions in the processing system. I will continue to sort out the library management system issues in my future studies, and then improve the functions of book information, book borrowing, book return, order information, membership, membership card opening, recharge information, and deduction information.

The library management system is generally rich in functions. Although there are still many problems in various aspects during the process of writing the code, with my unremitting efforts and the patient guidance of my instructor, I was finally able to complete it on time. After several months of development, I learned a lot about book information, book borrowing, book return, order information, membership, membership card activation, recharge information, and deduction information. Every time I develop the system's book information, book borrowing, book return, order information, membership, membership card opening, recharge information, and deduction information functions, I feel a sense of accomplishment. In this environment, I feel that my four years of hard work have not been in vain, and I am very relieved for this. After the development of the library management system is completed, the professional courses for undergraduate study have basically reached standardization. In addition, this design also cultivated my confidence

and motivation to overcome difficulties and move forward. I am very grateful for the gains that completing this design brought me. I will continue to work hard to make myself better in the days to come.

Finally, I hope that I can accumulate rich experience in the development of similar library management systems in the future, improve the corresponding functions of the system, and optimize the architecture so that the system can run smoothly in the configuration environment.

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**DEMONSTRATION MATERIALS
(PRESENTATION)**