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Library Management System Development Using Java Swing On Eclipse Platform

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Abstract.
As colleges continue to advance their information and modernization efforts, many are upgrading to digital library management systems. The library, being the central information hub on campus, plays a vital role in disseminating knowledge and cultural values. The development quality of libraries directly influences teaching effectiveness. In the 1990s, as enrollment increased and technology rapidly developed, students' desire to learn new knowledge and skills also grew. Classroom instruction alone could not fulfill this rising demand, and traditional library management approaches became outdated. To better meet these needs, we examined how to optimize library management by shifting to automated systems, which are more aligned with the needs of both colleges and students.

Keywords: Java; Library management system; Database design; Books; Management

Introduction

With the rapid progress in computer technology, its extensive use across various fields has become clear. Modern information technology has driven libraries toward automation, networking, and digitalization. As collections grow and the demand for information rises, traditional manual management methods reveal many flaws, especially slow processes for borrowing and returning books, which no longer satisfy the needs of today's information-driven society. This has notably affected library operations, leading to a shift toward adopting new information management techniques to boost efficiency, reduce staff workload, and lower error rates. These improvements also give readers more time to choose and enjoy books. An effective book management system, as a typical information management solution, leverages existing technological tools to enhance management efficiency. This paper outlines the development process, including feasibility analysis, requirement analysis, system design, database design, and testing. The system largely fulfills the needs of small library management and successfully achieves its design objectives.

Introduction to Java

Java was created by a team led by James Gosling at Sun Microsystems. Initially named Oak in 1991, it was developed for embedded consumer electronics. Renamed Java in 1995, it was redesigned to support Internet applications. Java programs can be embedded in HTML pages, downloaded via web browsers, and enable animations and interactions for web users. Its free availability, simplicity, cross-platform compatibility, object-oriented features, and other advantages have led to its rapid adoption in the industry, making it the most widely used programming language. Java's versatile capabilities are not limited to web applications; it also supports the development of standalone applications. As an inherently object-oriented language, Java offers powerful programming features, suitable for various applications, beyond its initial web-centric purpose. a strict procedural language, Java was designed from the beginning to be object-oriented.

Library Management System Requirements Analysis

To develop a straightforward yet comprehensive book inventory management system, we conducted in-depth discussions with library staff to analyze fundamental inventory functions. Based on the initial construction phase's core ideas, we first established a basic library inventory management system. Overall, this system should support inventory management, book borrowing and returning functions, essential management capabilities for library staff, and quick query and retrieval options for users.

Based on the overall functions of library inventory management information system, the functions of the system are divided into several aspects. The inventory management system is divided from the point of view of functions, including library storage, library management, book circulation management, statistical query function, the corresponding functional requirements were shown in Fig. 1.

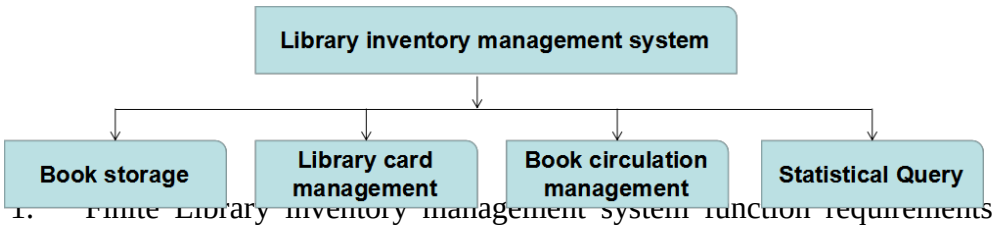


Figure 1. Finite Library inventory management system function requirements map Book

storage function is the basis of the library inventory management system, through this function to achievethe storage operation for all books, mainly for the new purchased books, therefore, books need to provide basic information on books, including this book name, bar code, author, classification number, category name, shelf number, press, publication date, storage date and book price and other information. In the process of storage it should be provided the add, delete, revoke and other functions, to achieve the process of storage changes and other operations.

Database Conception Design

Based on the needs analysis above, the system design includes several database entities: book information, book classification, reader information, operator information, borrowing records, and inventory details. The book information, classification, borrowing, and inventory entities are interconnected, while the reader information entity is also related to borrowing records. Here are the E-R diagrams for key entities. The book information entity contains attributes such as book number, category number, title, author, translator, publisher, price, and publication date. The book number serves as the primary key, whereas the category number is a foreign key referencing the book category entity, which maintains an external key relationship. The E-R diagram for the book information entity is shown in Fig. 2.

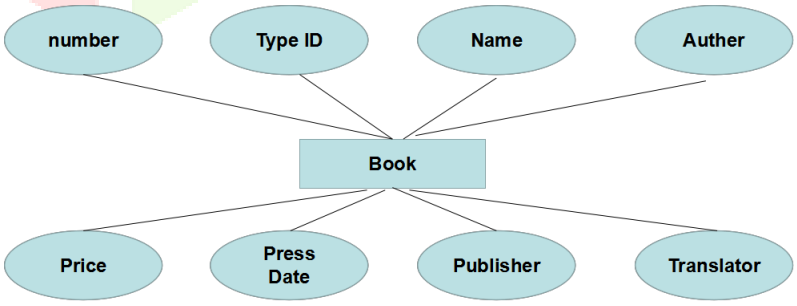


Figure 2. Finite Book information entity E-R diagram

System Overall Design

To meet the requirements of university library informatization, the system adopts Apache Tomcat and SQL Server. The system design follows the principle of separating business logic from the system, a common practice in the current software industry. The hierarchical implementation not only enhances the flexibility and scalability of the entire product but also improves the independence of system modules. If a module layer changes, it will not affect other layers, greatly improving the maintainability and flexibility of the overall product.

The system design begins with dividing the system into appropriate modules. Based on the needs of the file management system, the system is divided into three parts: file retrieval function module, file management function module, and system management function module.

(1) File retrieval module — Retrieve files based on conditions: search criteria include file name (fuzzy search), file level (exact search), and file description (fuzzy search).

(2) File management module — Manage files by department structure: department structures can be managed through system settings, including operations such as file uploading, viewing, and deletion.

(3) System management module - Primarily handles department management, user management, rights management, and file level management.

Design of the Partial Module of System

The system management module is the core of the entire system, and only the system administrator can perform its general operations. Staff members need to obtain administrator authority to access this module. The specific functional structure of the system management module is shown in Fig. 3, where the administrator can log in. The module consists of four sub-modules: department management, user management, rights management, and file level management.

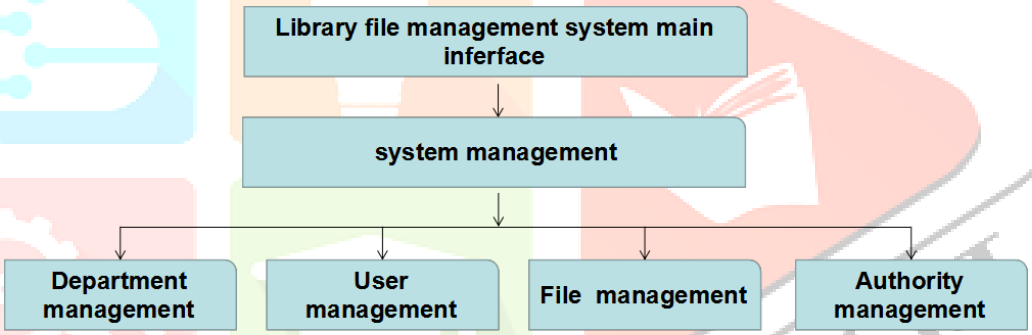


Figure 3. Finite The structural image of system management module

The Design of Privilege Management Module

The module is central to all functionalities, handling file and user permissions. It allows operations such as viewing (de-fault.jsp) and setting permissions (qxiant.jsp). Primarily, it manages user permissions, enabling you to set a user's permission level to read the file and specify viewable content. The source program's rights management module functions as follows:

```
strSQL=″update userlist set filejb= ′″+ filejb
+″′where user id=′″+userid+″′″;
sqlStm.t execute Update(strSQL);
strSQL=″update tree user set ischeck =′0′
where userid=′″+userid+″′″;
sqlStm.t execute Update(strSQL);
strSQL=″update tree user set ischeck =′1′
```

```
where userid='"+userid+"'and left(id,4) in("+isC+")";
qlStm.t executeUpdate(strSQL); strSQL="update
        tree users et ischeck ='1' where
userid ='"+ userid +"' and id in ("+isB+")"; qlStm.t
        execute Update(strSQL).
```

Our existing library system involves performing library related transactions manually by being physically present at the library with the help of employed librarians. This makes it a time taking process to borrow and return journals, books from the library.[3]Hence the automated LMS is introduced to minimize the effort of the borrower as well as the librarians as they do not have to write down all the transactions by hand. The LMS creates a computerized system with a database to store and retrieve data easily. This makes it easy to the user to add books, borrow books, return books and renew books from anywhere using this application.

Our proposed system has the subsequent benefits:

- User friendly graphical user interface
- Effortless access to stored data in the database.
- Minimizes the human errors.
- Fast and efficient way to retrieve information.
- Creates an alternative for physical records of data.

Admin: This module has the entire access to all other modules, admin creates the project, manages the students, teachers and guest entries, can add and remove any users if required. Basically this module has access to every part of the system, from creation of the project to any kind of updating.

Librarian: This module is for the Librarian to log in. Librarians can add or remove any entries to and from the library. They can also, if required view their entry as well. A student/faculty can act as a librarian if needed.

RESULTS AND ANALYSIS

A. Main Login Form:

This form provides the display buttons to log into Admin or Librarian portals.

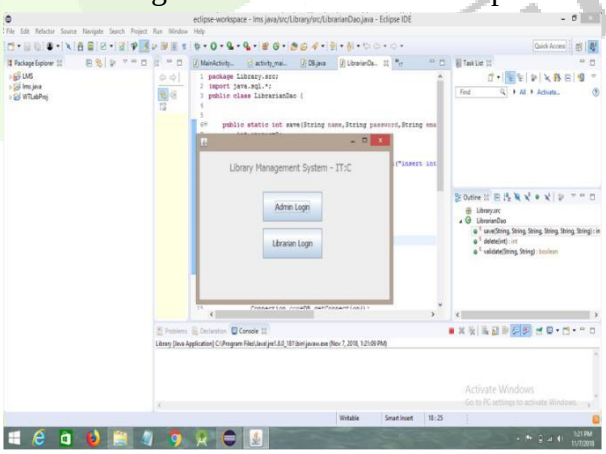


Fig.1- Main Login Form

B. Admin Login Form:

This form provides a login form for ADMIN section with responsibilities like adding, deleting a librarian.

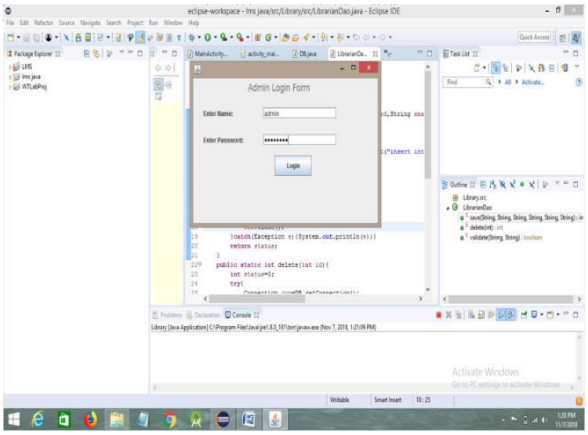


Fig.2- Admin Login Form

C. Add Librarian:

Form consists of fields like name, password, and email id, address and contact number to register a librarian i.e., adding a librarian to the system.

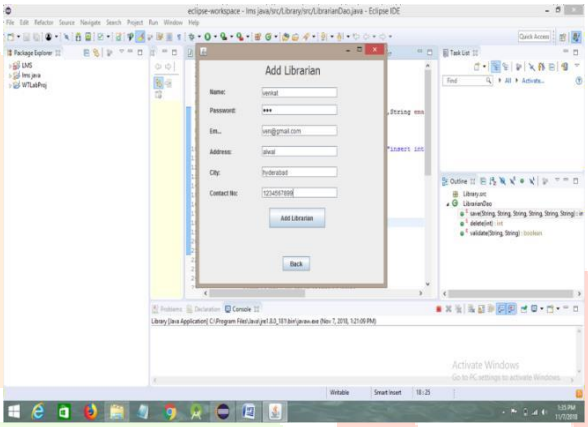


Fig.3-Librarian Registration Form

D. Librarian Login:

Login form for librarian with mandatory name and password fields.

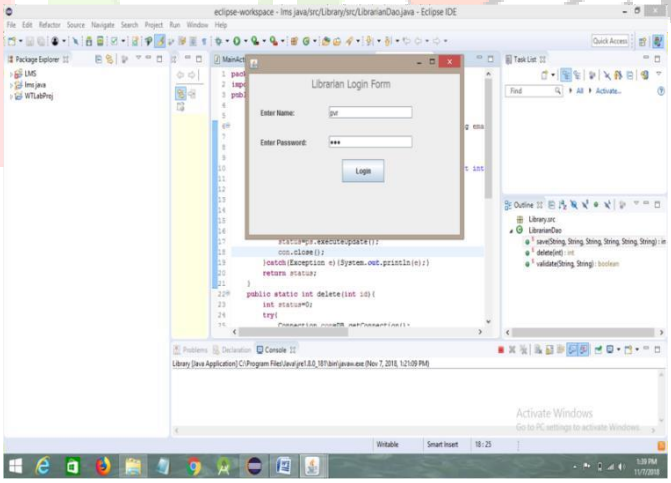
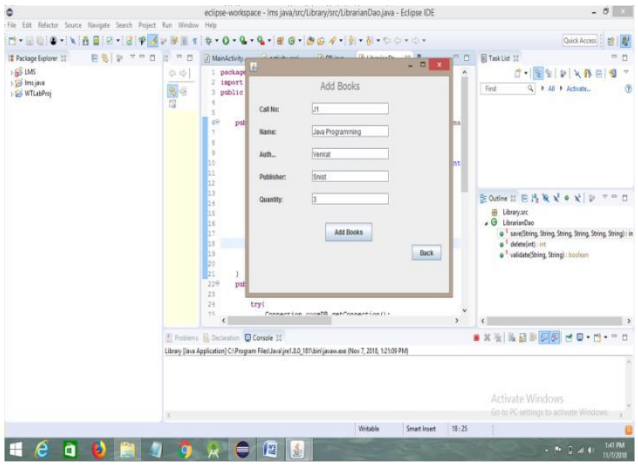


Fig.4-Librarian Login Form

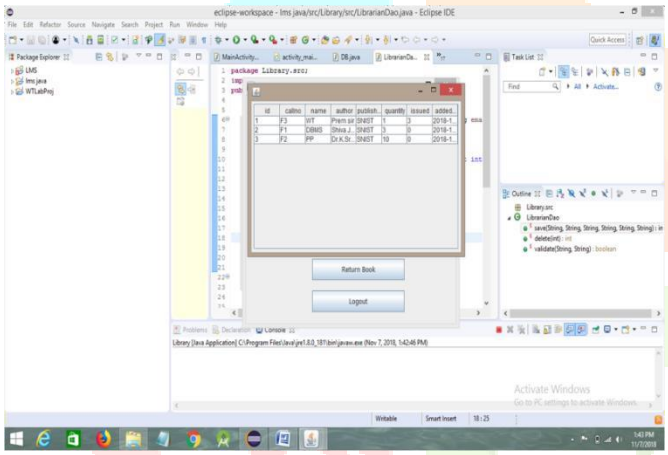
EAdd Books:

The add books form is used to add books into the library with the mandatory fields as shown below.



F.View Book

This is a display table that utilizes java GUI to create a window to display the books currently available in the library.



Conclusion

1.This paper details the development and implementation of a library management system. In the context of modern information management, combining computer technology, network technology, and databases, the library system has become a crucial part of university information infrastructure. The library now serves as an information center and hub, making digital development an urgent priority. The research focused on the following areas:

2.1. Analyzed the significance of the database system within the overall project design, highlighting Java's advantages and considering MySQL's features of small size, high speed, and low cost as solutions for creating a system prototype.

3.2. Examined the classification requirements of current library systems, dividing the system into modules such as administrator management and user management, with explanations of specific module functionalities.

4.3. Developed the library management system to enhance management efficiency, optimize human and resource allocation, and reduce operational costs.

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