

Design of the Database of Library Information

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Abstract

In this paper we designed a database of library information which is suitable for the higher vocational college library. It is with ASP.NET as interface programming language, SQL Server as DBMS to save database. It has realized the processing of book purchasing, book cataloging, book circulating, book retrieval and journal management automation. This system connects to the Internet to make the reader search information conveniently. It greatly improves the efficiency of library management and the utilization of books.

Keywords: *database, model, library management system*

1. Introduction

There are many secondary vocational schools upgraded to higher vocational colleges in recent years, along with upgrading of the school, expanding of the school-running model, the number of books and the scale is constantly expanding. How to build a proper library management system in the college is becoming more and more important. Most of the present library management systems are based on C/S structure suitable for the LAN. With the popularity of the Internet the shortcoming and the limitation of the old management system are growing obvious. It cannot satisfy the necessary any more.

This library network management system is based on B/S structure, using ASP.NET as interface programming language and SQL Server as DBMS to save database. By connecting to the Internet the system greatly improves the efficiency of library management and the utilization of books. It also greatly save the human and material resource. This paper mainly focuses on the analysis of the library network management system configuration and the design of the database.

2. System Configuration

To enable the system to play the best role, a good system configuration scheme is needed. System configuration scheme depends on the system throughput, the system stability and user maintenance ability.

2.1. Software Configuration

Software configuration includes the choice of database and operating system. The system selects SQL Server as DBMS to save database. Small library can use Access as DBMS to save database. The large library need to choose Oracle as DBMS to save database.

The choice of operating system is up to concurrent data access to the library database. According to our requirements we can choose Window 2000 Server as server operating system, Windows XP as a client operating system.

2.2. Hardware Configuration

Configuration of hardware mainly includes the client and server hardware configuration. Generally client requirement for hardware is relatively low. General computers are competent for the job. It is tolerable that you have a computer with 64M primary memory and 4GB hard disk as client, such as Pentium or AMD CPU. Requirement for key department computers is relatively high. It should be the computers with the advanced CPU and with the primary memory of at least 256MB, hard disk of more than 20GB. The administrator computers also need the advanced computer. Just like the computer for the key department.

2.3. Network Configuration

The library NMS is applied to the campus network. Some functions such as searching is also available through campus network which is connected to the Internet. The network configuration need to use fast mode, namely, the speed of more than 100mbps. It also needs professional library database server and application server.

3. Database Analysis

Developing system is based on the analysis of database. Database analysis work directly affects the database utility. Database analysis can be divided into two parts. One is the analysis of conceptual model, the other is a logical model analysis.

3.1. Conceptual Model Analysis

The conceptual model has the following characteristics:

(1) The conceptual model is the abstraction and generalization of the real world. It fully reflects the things in the real world and the relationship between things. It can satisfy user's data processing requirements.

(2) It is easy to understand because the conceptual model is concise, clear and independent. We can exchange the idea with the users who are not familiar with computer on the platform of conceptual model. It is a good way to make the users to join the design of the database to ensure the design work more reasonable.

(3) The conceptual model is easy to update. It is also easy to modify and expand when the application environment and application requirements change.

(4) The conceptual model is easily converted to the relation model, network model and layer model.

The powerful tool for Conceptual model is E-R model (entity relationship diagram). The E-R model is a problem-oriented conceptual model, which uses a simple graphical way to describe data of the real world. This description is not related to the data in the database and access way, much closer to people's way of thinking. In E-R model, information consists of entity type, entity properties and entity relationship.

The library NMS E-R diagram analysis is based on the UML system model. The database model is based on drawing E-R diagrams. The E-R diagram for the library NMS is shown in figure 1. This diagram is accomplished by the use of the PowerDesigner, which is the powerful database analysis tool provided by Sybase company.

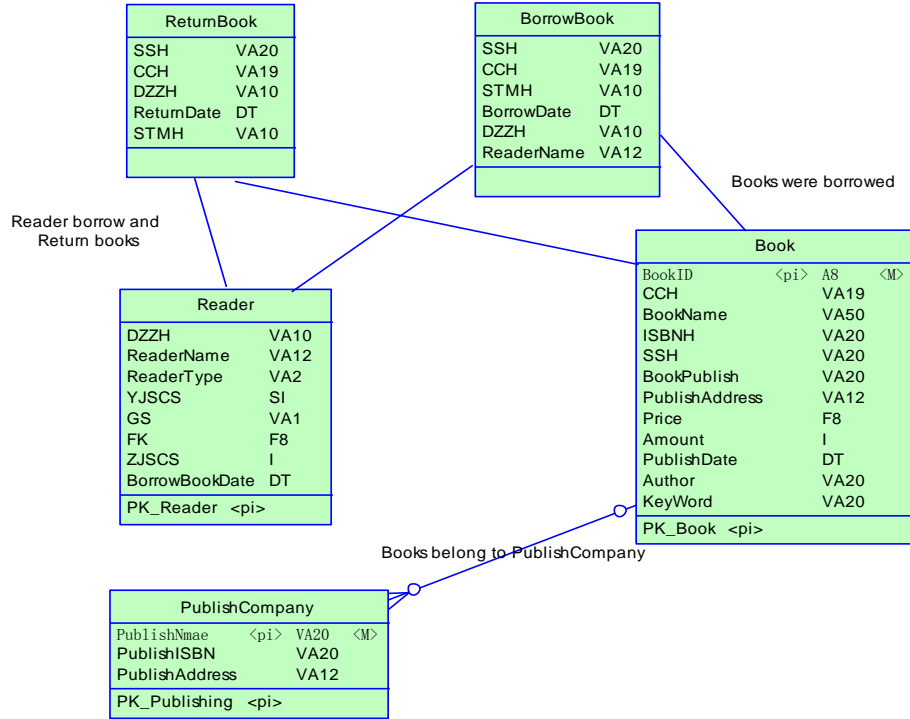


Figure 1. Entity Relationship of the Library NMS

PowerDesigner conceptual model simplifies the information between things in the real word into interaction relationship between entities. In PowerDesigner logical data model tables stand for entities, the table fields stand the entity properties and the relationship between the entities is converted into the relationship between the tables. The Logical data model is closely related with specific DBMS.

Indication for the diagram : SSH stands for book index number.CCH stands for property number.DZZH stands for reader card number.STMH stands for book bar-code number.YJSCS stands for the borrow times.GS stands for the loss report.FK stands for the fine.ZJSCS stands for the whole borrow times.

3.2.Logical Model Analysis

Conceptual model E-R diagram is an abstract expression of the user requirement, it is independent of any kind of specific data model, and thus cannot be supported by any specific DBMS. In order to be able to establish the final proper system, the conceptual model needs to be converted into a logical model to complete the design of the database logical structure. Database logic structure design is divided into two steps: First, convert the E-R diagram to the

entity-relationship model. Secondly, optimize the entity-relationship model. The specific steps: each entity is converted to a relationship (a data tables).The entity property is the data table properties (field in the tables).The primary key is the relationship.

The logic model diagram,namely that is the analysis of the fields and the tables, is based on the E-R diagram of the library NMS. After coming to the decision what fields and tables you need you can create a database model. The database model is shown in Figure 2.

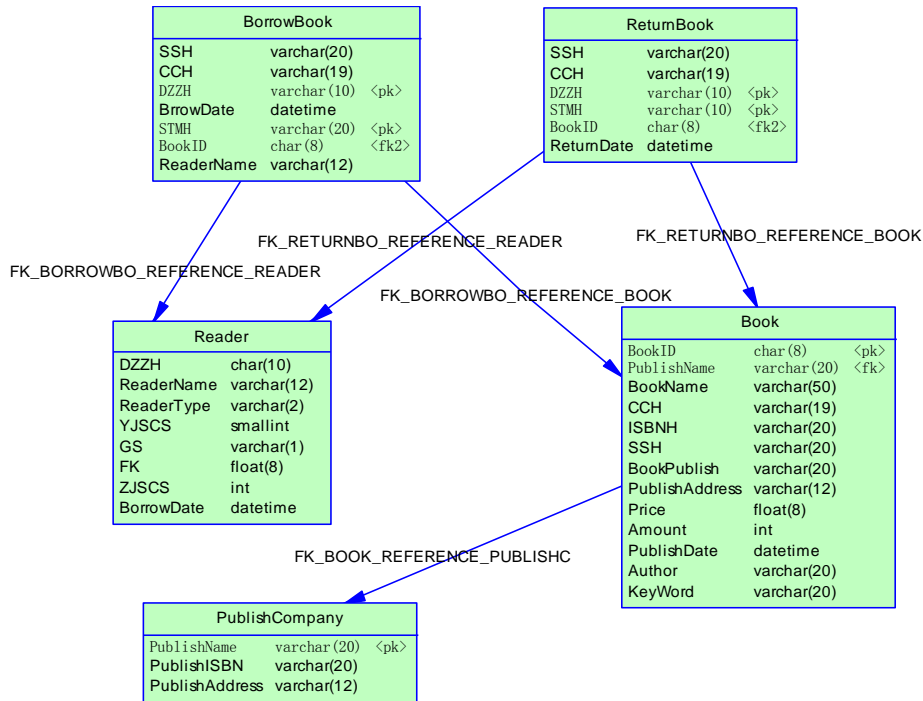


Figure 2. Database Model of the Library NMS

4. Database Design

Once you have the database model you can start the database design. First according to the various models, you can create different databases. Then go to the decision of the fields and the tables about those databases.

4.1. Create Databases

According to the analysis of the Library NMS, we mainly need some databases as following:

(1) Subscribing database, mainly used for the purchasing subsystem stores the information of the books. The librarian who is responsible for purchasing operates this subsystem.

(2) Cataloging database, mainly used for sorting and cataloging subsystem. And it is accessed only by the librarian responsible for cataloging. Cataloging database will need to create four tables:

① Catalog property number table, BMCCH, only contains a field, the field name “cch”. It’s structure is shown in Figure 3.

	列名	数据类型	长度	允许空
▶	CCH	nvarchar	10	✓

Figure 3. Catalog Property Number Table’s Structure

This table is mainly used for the property number of the latest book in the library. It is the last book property number. For example: 0202157, the property number of next new book start from 0202158.

② Catalog table, includes the information about category number, subcategory, category level, content, sort number and the placement. Parts of catalog table is shown in Figure 4.

LH	XL	JB	NR	ZCH	KZWZ
▶ A	A	1	马克思主义、列宁主义、毛泽东思想	1	1
G63	3	4	中等教育	319	<NULL>
TN915	<NULL>	1	<NULL>	3	<NULL>
D	D	1	政治、法律	1	1
G89	9	3	文体活动	71	<NULL>
H19	9	3	汉语教学	27	<NULL>
G	G	1	文化、科学、教育、体育	1	1
I0-03	-03	3	文学的方法论	1	<NULL>
I	I	1	文学	1	1

Figure 4. Parts of Catalog Table

③ Key words table, used to store the key words to make it easy to retrieve later.

④ New books table, used to store the information about cataloged books.

(3) Circulation database, mainly for circulation subsystem, including the readers table, circulating book table, category table of readers, a fine record table, return books record table, lent books record table, circulation statistic table and rule table.

① Readers table: used to store the readers’ information. Including: reader card number, name of the reader, class code, reader category, borrow times, loss, fines, total borrow times, last borrow date.

② Circulating book table: used to store the information for the circulating books. It includes index number, property number, bar-code number, reader card number, borrow date, renewals flag, borrow times, loss flag, loan flag and etc. Index number refers to combination of the book category number and the sort number. For example: TP312 / 6 is an index number. TP312 is for the category number and 6 for the sort number. The same category books have same category number. The property number is fixed to identify a book number. For a new book the property number and bar-code number are the same. We will assign a new

bar-code number to a book when the book bar-code damaged but not change the property number.

Because the circulating books table has no detail information about title, author, publisher, *etc.* So the circulating book table must associate with the books table.

③ The category table of readers: used to store the information about the readers. It includes readers' name (such as students, teachers, administrators, *etc.*), type code (every reader has a type code) and the reader type (different reader could have the same type code). Setting the reader type is easy to make the set of rules. Such as the teachers can borrow up to ten books. Students can borrow up to five books.

④ Fine record table: for storing fine record. It includes fields: the reader card number, name of the reader, fine reason, the amount of the fine, fine date, book title, book price, *etc.*

⑤ Return books record table: record details about returning. It includes fields: index number, property number, reader card number, borrow date, bar-code number.

⑥ Lent books record table: record details of the lented book. It includes fields: index number, book bar-code number, property number, borrowing date, reader category, reader card number, the reader name.

⑦ Circulation statistic table: statistics for the 22 categories of books.

⑧ Rule table: to make the set of rules, including fields: reader types, the number of lent books, borrow date, the count of renewal books.

(4) Library database: including books table, publisher table and table for books damaged or lost.

The difference: one kind of book is a record in book table. But a book is a record in circulating book table.

① Books table: including information of all the library books. Including: books' ISBN number, index number, property number, title, author's name, publisher, place of publication, unit price, number of copies, keywords, number of pages, the version number.

② Publisher table: for storing publisher information. It includes fields: ISBN number, publisher name, publishing place.

③ Table for books damaged or lost: used to store information about the lost or damaged books. Including field: Bar-code number, index number, property number, lent times, details (lost or damaged), date.

4.2. Create Viewers

We can create the following view based on Library NMS.

(1) In circulation database in order to display different types of readers corresponding to different lending rules we create a reader rules view.

The SQL syntax of the view is as follows:

```
CREATE VIEW dbo.dzgz  
AS  
SELECT dbo.DZZBK.ZBMC, dbo.DZZBK.ZBDM,  
       dbo.DZZBK.DZLX, dbo.GZK.TSJQ,  
       dbo.GZK.WYSJQ, dbo.GZK.KJSCS,  
       dbo.GZK.KJWYS, dbo.GZK.XJTS,  
       dbo.GZK.FJL  
FROM dbo.DZZBK INNER JOIN  
      dbo.GZK ON dbo.DZZBK.DZLX = dbo.GZK.DZLX
```

(2) In circulation database in order to get more information about the reader and the book we create a view to display the details about the reader and the book.

The SQL syntax of the view is as follows:

```
CREATE VIEW dbo.LTTSVW  
AS  
SELECT dbo.LTK.SSH, dbo.LTK.CCH,  
       dbo.LTK.TMH, dbo.LTK.DZZH,  
       dbo.LTK.JSRQ,  
       tsLib.dbo.tsk.SM, tsLib.dbo.tsk.DJ,  
       tsLib.dbo.tsk.TJ, tsLib.dbo.tsk.CDW  
FROM dbo.LTK INNER JOIN  
      tsLib.dbo.tsk ON  
      SUBSTRING(dbo.LTK.SSH, 1, 2) = SUBSTRING(tsLib.dbo.tsk.SH, 1, 2)  
      AND dbo.CheckBook(dbo.LTK.CCH, tsLib.dbo.tsk.CCH)=1
```

5. Conclusion

Based on the analysis of system configuration and the analysis of the database, the next step will be to the library network management system implementation. At present, this system has been put into operation and the system is running properly in our school. On the whole the system has achieved the desired purpose in the following way:

(1) To raise the library management level and work efficiency. Using the library network management system greatly increases the work efficiency. It can make the flow management easier to speed up the shelving, such as subscribing book, cataloging book, borrowing book.

Using bar-code in intermediate links speeds up the book borrowing and returning and simultaneously reduced the mistakes caused by hand input.

(2) Cataloging books according to Chinese Library Classification in this system, the data share is achieved with other libraries.

(3) You can do a book search on the Internet. The query way is simple and multiplex. Speeding up the query greatly increases the book utilization ratio.

Next we plan to create a digital library in order to optimize the use of digital resources.

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