DESIGN, DEVELOPMENT AND IMPLEMENTATION OF AN INTERACTIVE LIBRARY MANAGEMENT SYSTEM FOR

KAMPALA INTERNATIONAL UNIVERSITY

BY

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DECLARATION

We hereby declare that this dissertation titled 'The design, development and implementation of an interactive library management system for Kampala international university' is our original work and has never been submitted to any university or college for any award. Where the works of others have been cited, acknowledgement has been made.

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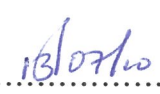
APPROVAL

This dissertation has been submitted with my approval as the supervisor.

Ms Margaret Kareyo

Signature .... Date.... 13/07/20 ....

DEDICATION

We dedicate this work to our beloved mum Ms Monica Waichungo, who helped us reach this step in our educational careers and also gave us the courage and moral support during the writing of this report.

ACKNOWLEDGEMENT

ABBREVIATIONS AND DEFINITIONS

4GL   Fourth Generation Language

DBA   Database administrator

DBMS   Database management system

DFD   Dataflow Diagrams

ILS   Integrated Library System

ISBN   International Standard Book Number

LMS   Library Management System

MIS   Management Information System

SQL   Structured query language

OPAC   Online Public Catalog Access

OS   Operating System

SDLC   System Development Life Cycle

SVG   Scalable Vector Graphics

VB   Visual Basic

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ABSTRACT

The purpose of this study is to develop a Library Management System that will aid the librarian in obtaining, organizing and managing library resources. Our LMS will be implemented as a centralized VB standalone application which will be able to establish a communication link between the user and the database. The librarian will therefore be able to record all the necessary information pertaining to the library including; adding members to the library, and recording the books' movement at ease.

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CHAPTER I

INTRODUCTION

1.0 Genera l introduction

Since the invention of paper and the printing press, books have played a major role in the shaping of our lifestyles. But with the increasing number of books in circulation and the burgeoning amount of book information (e.g. the book author, books borrowed etc), there emerged a need for an efficient way of managing the data. Therefore, libraries started using the card catalog system to index their holdings. However, this method was not very efficient.

With the advance of computer technology in the recent past, researchers developed a new system that could handle all the complicated data at ease. This system came to be known as a Library Management System (LMS). The LMS gave the librarian complete hands on the management of the library making it easy to keep track of all the book movements and transactions. In today's day and age, Library management software is becoming not only a tool to manage book titles and authors but also its content. This has literally made the LMS become a necessity for libraries with a need for an efficient management system.

1.1 Background of study

Kampala International University (KIU) is a fully chartered private institution of higher learning which commenced operation in October 2001. It's located in Kansanga, a suburb of Kampala. KIU is 3 km from Kampala city and 2 km from the shore of lake Victoria which is the second largest fresh water lake in the world.

This project is designed to capture, store, process and retrieve useful information about the users, books and the relation of the two through the librarian in Kampala International University. It will lead to better utilization and responsibility on library resources.

1.2 Scope of the project

1.2.1 Geographic scope

Though there are many universities and schools that the researcher could choose from, the researchers decided to choose Kampala International University as their case study concentrating more on the main campus in Kampala. This decision was mainly influenced by the university's well stocked library which has several departments with a diverse collection of books. The University's proximity from our residential area was also a factor to consider.

1.2.2 Content scope

The study addressed what is involved in the management process of a library and what impact it has. Benefits of good library management system were also looked at. The project also identified the problems that the library staff faces and specified different ways of minimizing them.

1.2.3 Time scope

The time devoted to this project was (approximately 16 - 17 weeks) which was evenly distributed between four units including; requirement, system analysis, system design and the coding stage.

1.3 Objectives of the study

1.3.1 Main objective

To develop a fully functional library management system that would help in the day-to-day running of the new KIU library

1.3.2 Specific Objectives

i.   To develop an application that would keep track of all the book movements (issues and returns)

ii.   To design a system that increases library security by restricting unauthorised users from accessing library resources.

iii. To develop an application that will be able to detect overdue books and fine the person accordingly.

1.4   Statement of the problem

Libraries offer a diverse array of information resources –both in electronic and print formats-. The librarian is solely responsible for managing the data which proves to be a challenging job resulting to loss of books and other important materials. The main reason given by the librarians for such incidences is due to the use of poor management strategies in the library.

1.5   Research Questions

The study tried to answer the following questions

i.   What challenges does the staff face in managing the library?

ii.   What are the impacts of the LMS on the library performance?

iii. How do you update the books collection repository in case of new purchases?

1.6   Conceptual framework

In this system, the librarian has complete control of all the activities present including managing the user accounts. Before the members can use the library, they have to register with the librarian whereby he/she creates the user accounts for each respective member. Each resource borrowed by a member is therefore noted down on their accounts for easier future references.

In order to implement the above mechanism, the following functionality had to be designed and implemented.

- A user interface developed using Visual Basics 9.

- A database implemented using Microsoft SQL Server 2005.

The diagram below explain better the relationship between the user, librarian, UI and the database

| User | Librarian | User Interface | Database |
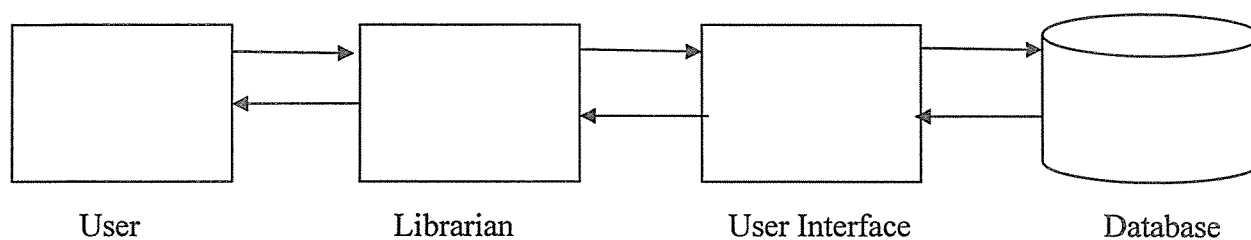
1.7 Significance of the project

The significance of the intended research will be:

i. The study will help KIU automate all the library's activities including cataloging, circulation, acquisition and producing statistical reports thereby saving time.

ii. The study will help the KIU library to maintain an accurate record of all the books present in the library.

iii. It will be important because it will contribute to the researcher fulfilling one of the requirements of the award in Bachelors Degree in Computer science.

iv. It will also enable the researchers to acquire additional knowledge and experience on the field through first-person participation.

1.8 Limitation of the study

The following are constraints which may hinder the research study.

i. Lack of enough fund; the fund provided for this study may be insufficient for the continuation of the project.

ii.   Lack of cooperation; some of the staff may not cooperate fully during my research study.

iii.   False data; some of the respondents may give false information which may have a negative impact on the project.

CHAPTER II

LITERATURE REVIEW

2.0 Introduction

This chapter was designed to discuss the literature review concerning a library management system. It constitutes the review of related literature, proposed theory and principle of the study, and views of other researchers about the field.

2.1 Library

The word *library* owes its origin from the Latin word *liber*, which means "book". **Concise Oxford dictionary** defines a library as a building or room containing a collection of books and periodicals for use by the public or the members of an institution. This term has however come to refer to "a collection of useful material for common use" depending on the field being talked about. For example, in computer science, a library is a collection of subroutines or classes used to develop software. While in electronic design, library often refers to a collection of cells, macros or functional units that perform a common operation.

Microsoft Encarta (2008) defines a library as a collection of books and other informational materials made available to people for reading, study, or reference. Generally, the term library refers to a collection of literary documents or records kept for reference or borrowing and the structure under which they are housed.

2.1.1 Functions of a library

The main task of a library is to collect, organize, preserve and provide access to books, journals and other sources of information. Besides that a library is also responsible for

i. Circulation: handling of user accounts and the issuing/returning of books

ii. Order materials and maintaining the materials' budgets.

iii.   It is also responsible for cataloguing and processing new materials and de accessioning already used materials.

2.2 Library catalog

A library catalog is a register of all bibliographic items found in a library (http://en.wikipedia.org/wiki/library_catalog). A bibliographic item can be any information entity that is considered library material. Book cataloging is of great importance in sorting of materials in a library. Traditionally, this was achieved by the use of a Card catalog system.

Until recently, the card catalog system had been used to sort materials in the library for generations. They were originally written in manuscript list and arranged in predefined methods which included:

i.   **Author Catalog** – Entries are sorted alphabetically according to the authors' or editors' names of the entries

ii.   **Title catalog** – Entries are sorted alphabetically according to the title of the entries

iii.   **Dictionary catalog** - A catalog in which all entries (author, title, subject, series) are interfiled in a single alphabetical order

iv.   **Keyword catalog** – Entries sorted alphabetically according to some system of keywords.

v.   **Systematic catalog** – Entries are sorted according to some systematic subdivision of subjects

The card catalog system is however being phased out in favour of the modern online public catalog access (OPAC). Besides OPAC, LMS is also referred to as the modern equivalent of the card catalog. An LMS simplifies the cataloging procedures by providing a search interface to the library catalog thereby increasing its efficiency.

2.3 Information system

In our rapidly changing world, the notions of environment and emergence of communication and control are fundamental to the understanding of what an information system really is. One scholar, (*Steven Alter*, 2004), defines an information system as a system that uses information technology to capture, transmit, store, retrieve, manipulate or display information used in one or more business processes. (*James A. O'Brien,* 2006) further adds on to describe an IS as an organized combination of people, hardware, software communications network and data resources that collects, transform and disseminates information in an organization. An IS is also described as an arrangement of people, data, processes, information, presentation and information technology that interact together to support and improve day to day operations in business as well as support the problem solving and decision making needs of an organization and users (*Jaffrey l. Whitten et al*).

We can therefore define an information system as a means by which people and organizations, utilizing technologies, gather, process, store, use and disseminate information. It should however be noted that the use of an IS necessitates the integration of theories from other disciplines relevant to the domain field. These fields may include economics, psychology, linguistics, learning, not forgetting our field of study, management just to mention a few. This explains the existence of the different information systems today e.g. Geographic information system, Expert systems, automated information system, Library management systems among others.

2.4 Database

A database is defined as a collection of data stored in a standardized format, designed to be shared by multiple users (Jerry Post, 2001). An Encarta dictionary (2008) defines a database as a systematically arranged collection of computer data, structured so that it can be

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automatically retrieved or manipulated. *Martin et al* (1999) also defines a database as a shared collection of logically related data, organized to meet the needs of an organization

2.4.1 Database management system

DBMS is a software that defines a database, stores the data, supports a query language, produces reports, and creates data entry screens *(Jerry Post, 2006)*. A DBMS consists of software that organizes the storage of data. It controls the creation, maintenance, and use of the database storage structures of social organizations and of their users. Martin et al (1999) further note that a DBMS works with the operating system and modifies data to make it accessible in a variety of meaningful and authorized ways. In large systems, a DBMS allows users and other software to store and retrieve data in a structured way.

From the above definitions, we can define a DBMS as a system in which related data is stored in an "efficient" and "compact" manner. By "efficient", we mean that the data can be easily accessed and "compact" means that the data stored occupies less space on the computer memory.

2.4.2 Components of a DBMS

A DBMS includes four main parts:

i)   **Modelling language** - It defines the schema of each database hosted in the DBMS, according to the DBMS database model. The four most common types of models include: Hierarchical model, network model, relational model and object model.

ii)   **Data Structures** – These includes fields, records, files and objects present in a database. Data structures are optimized to deal with very large amounts of data stored on a permanent data storage device

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iii)   Database query language – It allows users to interactively interrogate the database, analyze its data and update it according to the users privileges on data. It also controls the security of the database

iv)   **Transaction engine** – It is concerned with such things as data isolation and consistency in the driver cache and data volumes by coordinating with the storage engine.

2.4.3 Functions of a DBMS

i.   **Database Development**: used to define and organize the content, relationships, and structure of the data needed to build a database.

ii.   **Database Interrogation**: can access the data in a database for information retrieval and report generation. End users can selectively retrieve and display information and produce printed reports and documents.

iii.   **Database Maintenance**: The user can add, delete, update, correct, and protect the data in a database.

iv.   **Application Development**: used to develop prototypes of data entry screens, queries, forms, reports, tables, and labels for a prototyped application. Or use 4GL or 4th Generation Language or application generator to develop program codes.

2.5 System development lifecycle

This refers to a logical process used by a systems analyst to develop an information system. Computer systems are complex systems often linking several systems supplied by different software vendors. To manage these complexities, several methods were created; waterfall model, spiral model, incremental model.

Despite the level of complexity, all SDLC methods share the following fundamental stages:

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i) **Requirement analysis** – A detailed analysis of the users' needs is carried out and a detailed functional requirement is produced

ii) **System design** – The detailed requirements are transformed into detailed system design document. This stage mainly focuses on how to deliver the required functionality.

iii) **Implementation and unit testing** – This stage involves the implementation of the system into a production environment.

iv) **Integration** – The different components making up the system are combined and tested as a whole to ensure that the system requirements have been met.

v) **Operation and maintenance** – This is the final stage of the SDLC. It describes information on how to operate and maintain the information system in a production environment. It includes post implementation and in-process reviews

CHAPTER III

RESEARCH METHODOLOGY

3.0   Introduction

This section explains the research methodologies which were used during the time of study. It concerns details of the project design, methodology, data collection instruments, sampling strategies, research procedure and analysis strategies that were applied in the course of the study.

3.1   Research designs

The study used both qualitative and quantitative methods. Through these methods, the researcher was able to better understand and get a clear picture of how a library is run. This research designs also helped the researcher to get in-depth information relating to the study including the requirements necessary for the project.

3.2   Sampling techniques

Simple, random and purposive sampling was applied to select the sample population for this study. Only respondents that met the purpose were picked. These respondents were chosen from the library staff and the student body.

3.3   Sample size

The sample size that was used by the researcher consisted of 50 respondents. In which 10 were library staff members and the rest students.

3.4   Sources of data

The researcher employed both primary and secondary sources of data in his research study

- Primary sources: The Researcher got first hand information through interviews, Observations and Questionnaires.

- Secondary sources: Other sources of data included text books, journals and the internet.

3.5   Methods used for data collection

The following are the methods of data collection that were used:

3.5.1 Interviews

We conducted multiple interviews, both structured and informal (with and without a written guideline and set of questions), in two different phases of the research: during the experiment and post-analysis. By doing this we were able to assemble and analyze the respondents' views of the LMS. Most of those interviews were however noted down for easier referencing.

3.5.2 Observations (non-obtrusive and intervening)

Much of the preparatory work that built motivation and lead to the topic selection, as well as the framing of the research questions, was based on extensive observation, in what concerned an outstanding processes in decision-making and in-person participation. Observation was further carried out during the project design to better understand the system requirements.

3.5.3 Questionnaires

The questionnaires of closed and open-ended questions were distributed to all concerned persons. This method of data collection gave the respondents ample time to fill the questionnaires with the correct information freely. The information collected using this data collection method was mainly used to facilitate coding and data analysis.

3.6   Data analysis

The collected data was processed and analyzed by means of categorizing, manipulation and summarized to obtain answers for the research questions.

Some of the methods that were used included:

i.   Data flow diagrams

ii.   Class diagrams

iii.   Flow charts

3.7   System Design

System development life cycle (SDLC) was used to develop the Library Management System. The stages in system design include requirement collection and analysis, system design, implementation and unit testing, integration and system testing, and finally operation and maintenance.

3.8   Development

The library management system was d eveloped using Visual Basics 9 as the front end program and Microsoft SQL Server 2005 as the back end. VB was used to design the user interface which provides a communication link between the user and the database. The database on the other hand was implemented using SQL Server 2005.

Other resources that were needed to carry out this project are outlined below

i)   A computer

ii)   Windows based OS (preferably XP and above)

iii)   Microsoft Visual Studio 2008

iv)   Inkscape – Program for creating scalable vector graphics (SVG)

CHAPTER IV

SYSTEM ANALYSIS AND DESIGN

4.1   Introduction

Having clearly understood the problem, collected and analysed data and hence identified the

system requirements, the next important phase is system design. In this phase, all the key

issues identified previously are carefully considered. Detailed system analysis is then carried

out on this issues to examine the system in terms of inputs, outputs, and the processes

involved.

Since most of the errors emanate from this area, a well planned system design should be

carried out to eliminate future system failures. This chapter therefore entails the various steps

involved in system design during the system development.

4.2   Analysis of the current system

The current library management system at KIU is a manual system. All the transactions

performed at the library are noted down on files which are then archived together in a safe

place.

4.2.1 Strengths of the current system

- It cannot be affected by power failures.

- All the transactions performed can be retrieved relatively easy.

- It very easy to implement.

4.2.2 Weakness of the current system

- A lot of paper work is needed hence higher maintenance cost.

- The manual system is relatively slow and cannot satisfy the growing number of

  students.

- Inconsistency of data as it is moved from one location to another

- Possibility of data loss if the original files are misplaced since there are no backup copies.

4.3 Analysis of the proposed system

Due to the numerous loss of library resources and the time wasted while serving students, there was need to design and develop a system which could curb these weakness.

The proposed system will run a database management system (DBMS) accessible from a well designed graphical user interface. It will furnish a generic solution to the problems of persistent data storage, data integrity, security, and the overall speed of operations. It will provide backup facility to facilitate recovery.

4.4 Benefits of the proposed system

- It will be relatively cheap to maintain since no other hardware or equipment needs to be bought after it has been implemented. Although the initial price of implementation may be high because of buying new hardware, the overall price of maintenance is minimal.

- It operates at a much faster rate than the manual system since all the data is stored under one location and accessing it using the computer is fast.

- Since all the data is stored under one database, data inconsistency is eliminated when moving the information because you'll only have to move the database.

- The new system will support backup its data. This will increase the system's reliability by enabling data recovery in case of a disaster.

4.5 Requirement Analysis

A library database needs to store information pertaining to its users, its employees, and the media it contains e.g. books, journals or magazines. Books will be identified by their ISBN, and the users by their registration numbers or staff ID. In order to allow multiple copies of the

same book, each media item will have a unique ID number so that they can be stored under the same address.

The library users will be required to provide their personal information including their name, sex, phone number, e-mail address and a passport photograph when signing up for a library card.

Borrowing of books will require a library card, as will requests to put media on hold. Each library card will have its own fines, but active fines on any of a user' cards will prevent the user from using the library's services.

4.5 System design

4.5.1 E-R Model

It is clear that the physical objects from the previous section – the users and media details– correspond to entities in the Entity-Relationship model, and the operations to be done on those entities – holds, checkouts, and so on – correspond to relationships. However, a good design will minimize redundancy and attempt to store all the required information in a as small space as possible. To achieve this, a detailed ER diagram was designed as shown below.
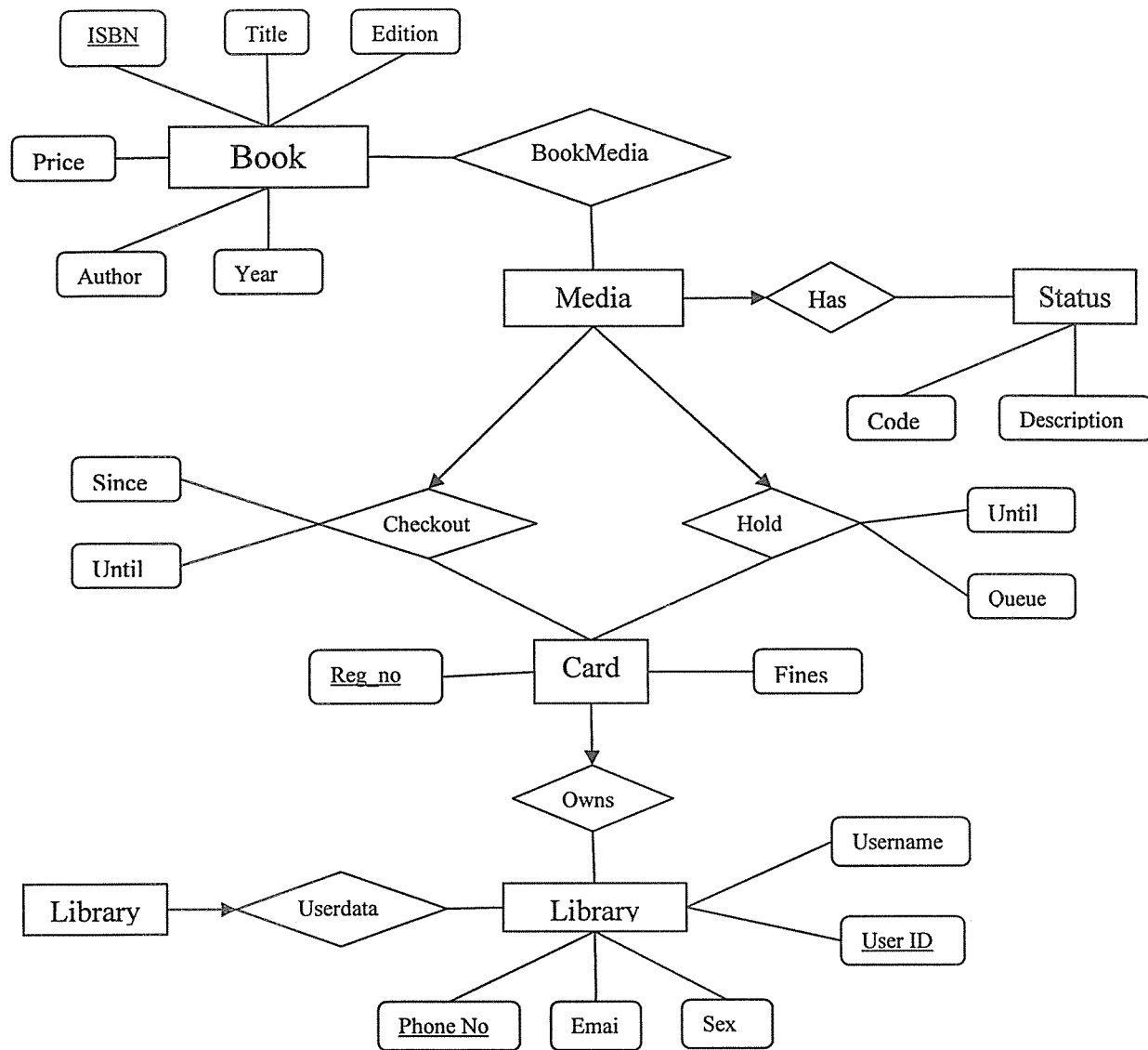
Figure 4.1: ER Diagram

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Notice that the information about books and videos has been separated from the Media entity. This allows the database to store multiple copies of the same item without redundancy. The Status entity has also been separated from Media in order to save space. The Hold relationship stores the entry's place in line (denoted by "queue"); it can be used to create a waiting list of interested users. The Librarian entity is functionally an extension to Customer, so the Librarian must have a customer associated with it. The librarians will therefore be responsible for performing all the administrative functions, such as checking media in and out and updating the customers' fines.

4.5.2 Flow charts
This is a diagram that represents the sequence of operations in a process. There are different ways of specifying processes in a system including:

- Structured English

- Decision tables

- Flow charts

The researcher however, preferred the use of flow charts over the other methods. This is mainly due to the simplicity of flow charts.

This system consists of several individual processes that when integrated together, they form a coherent system. Below are some of the processes that are found in this project.
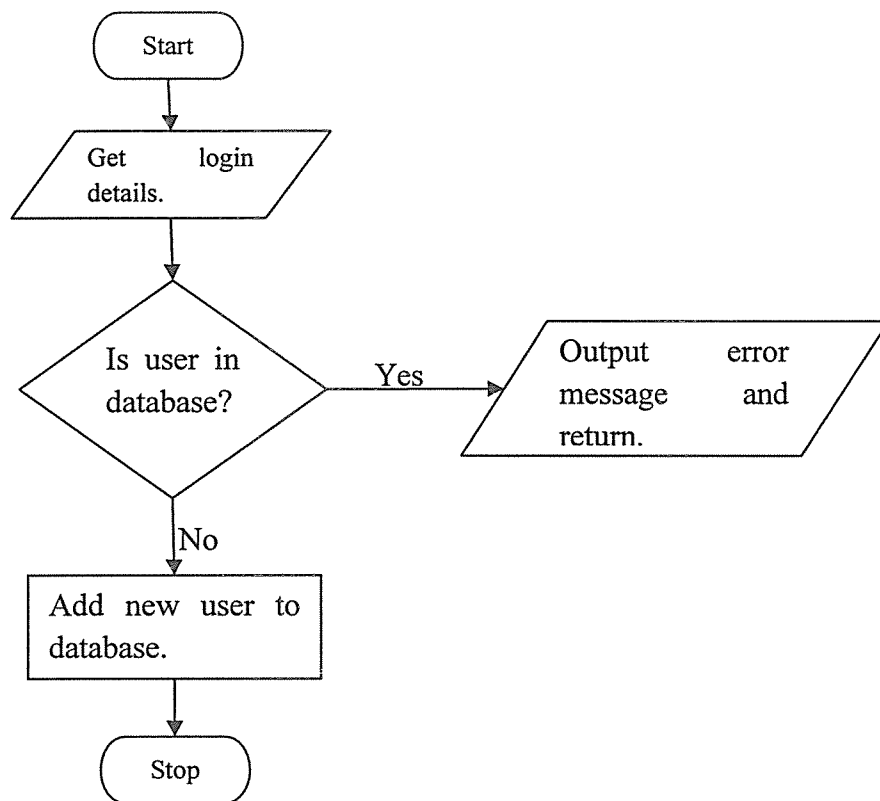
Figure 4.2: Add new member
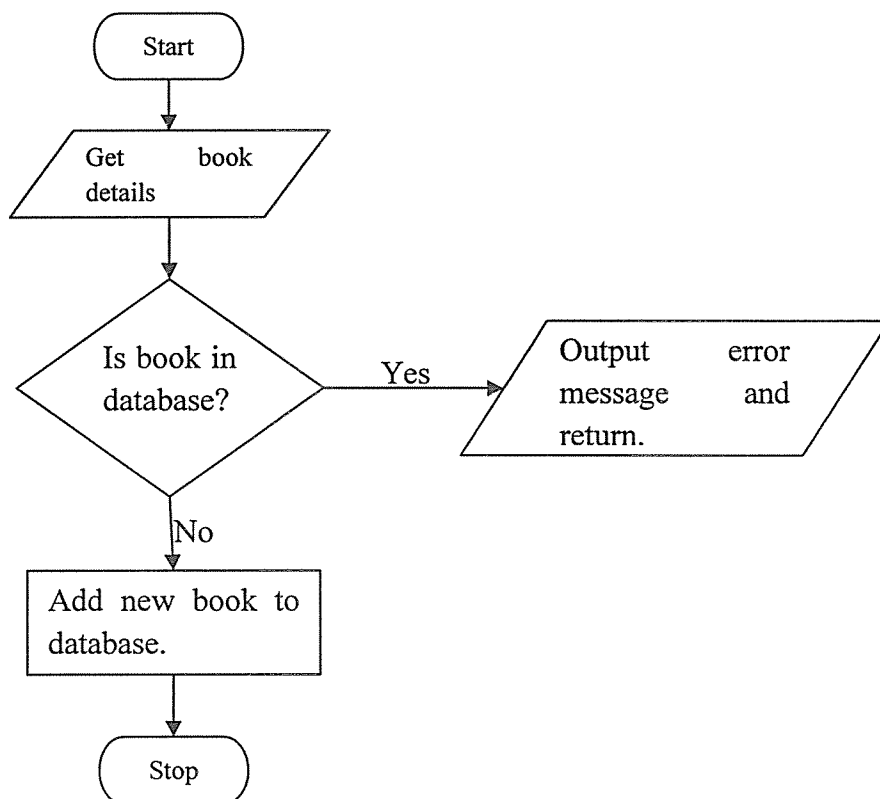
Figure 4.3: Add book in database

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```
        ┌─────────┐
        │  Start  │
        └─────────┘
             │
             ▼
   ┌───────────────────┐
   │    Check user     │
   └───────────────────┘
             │
             ▼
         ╱╲
        ╱  ╲                    No      ╱─────────────────────╱
   ╱ Does user exist? ╲  ─────────────▶ ╱ Return  "User  doesn't ╱
        ╲  ╱                           ╱ exist" message and return. ╱
         ╲╱                          ╱─────────────────────╱
             │
           Yes
             │
             ▼
   ┌───────────────────┐
   │ Delete user account. │
   └───────────────────┘
             │
             ▼
   ╱─────────────────────╱
  ╱ Return  "User  Deleted" ╱
 ╱ message.                ╱
╱─────────────────────╱
             │
             ▼
        ┌─────────┐
        │  Stop   │
        └─────────┘
```
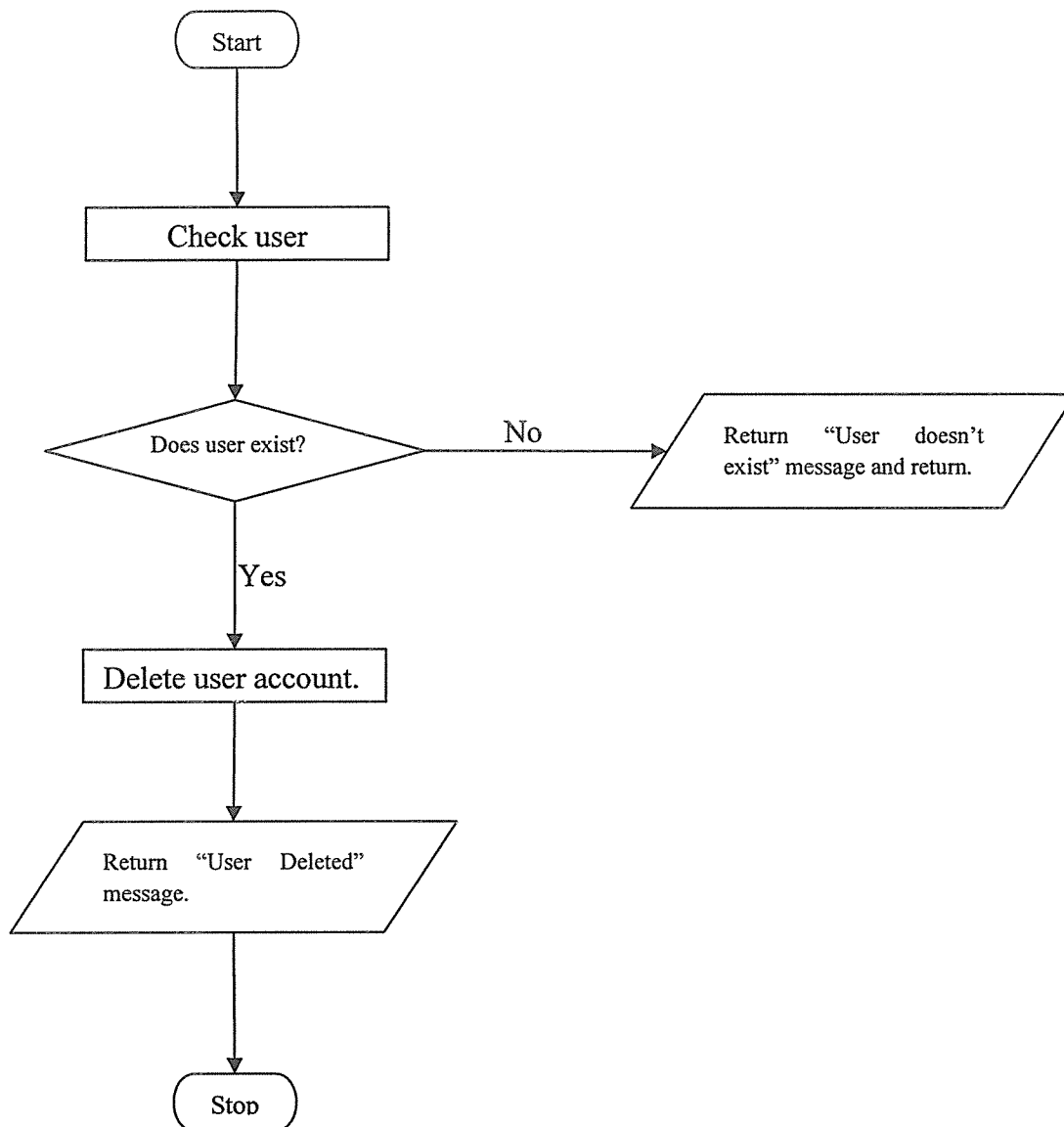
Figure 4.4: Deleting user accounts

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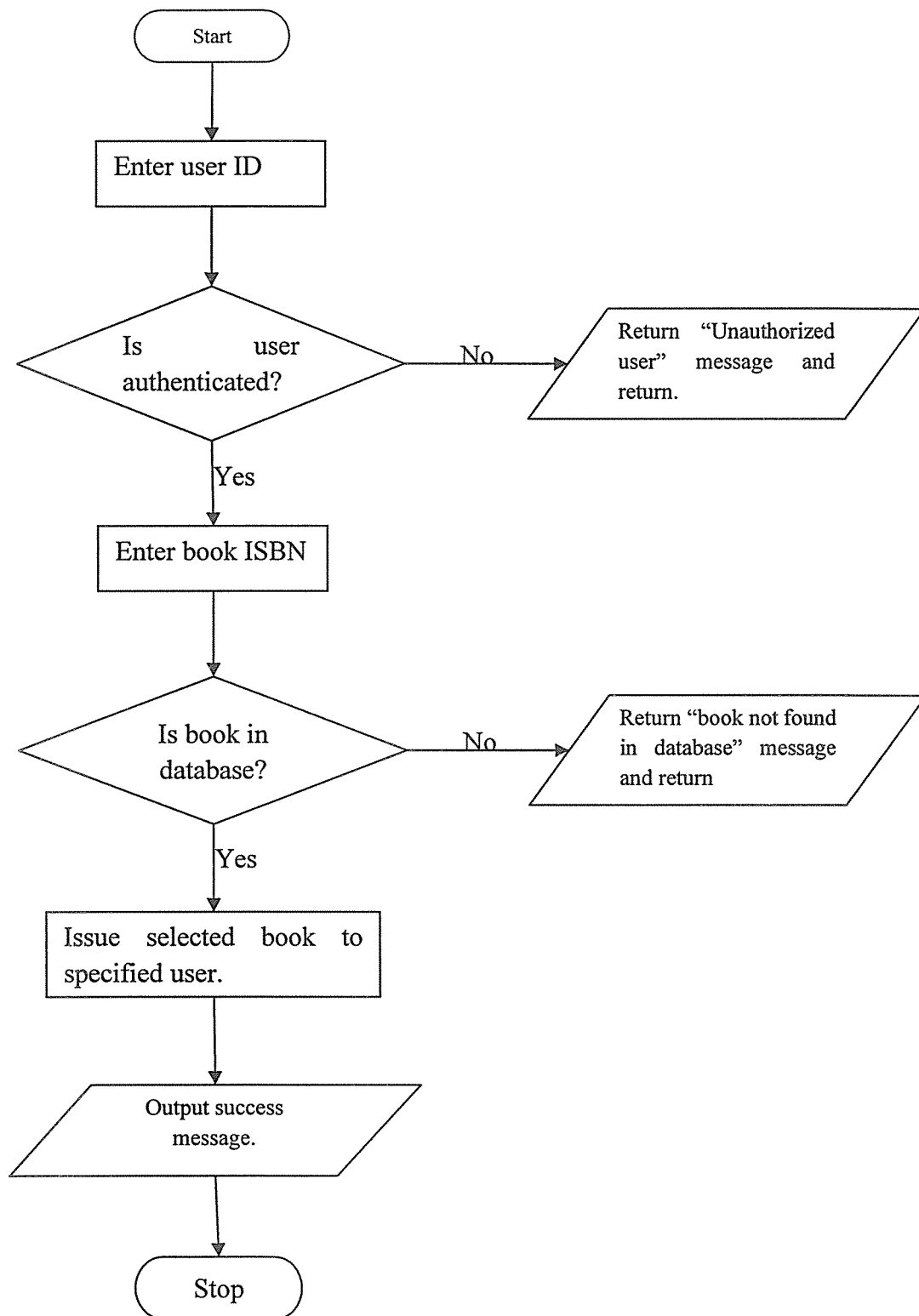
Figure 4.5 :Issue book
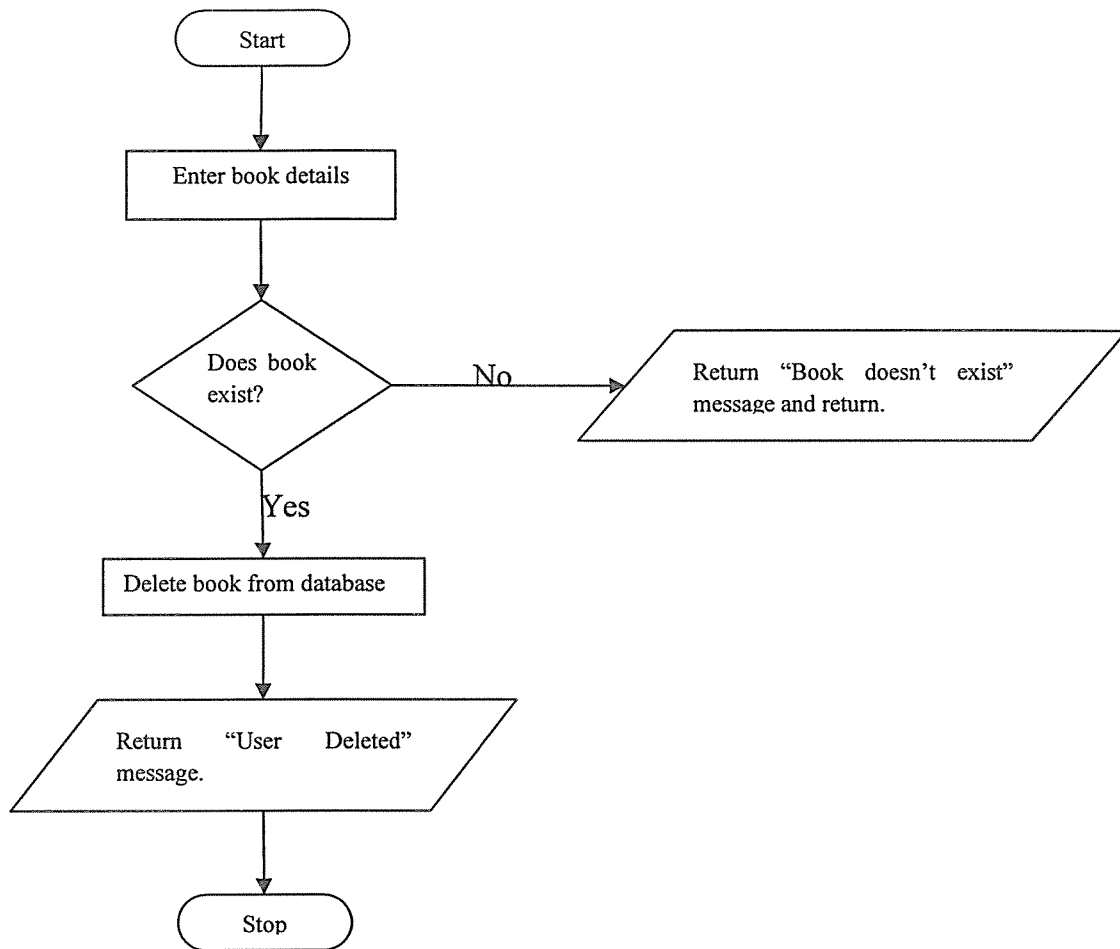
Figure 4.6: Deleting books from database

4.5.3 Class diagram
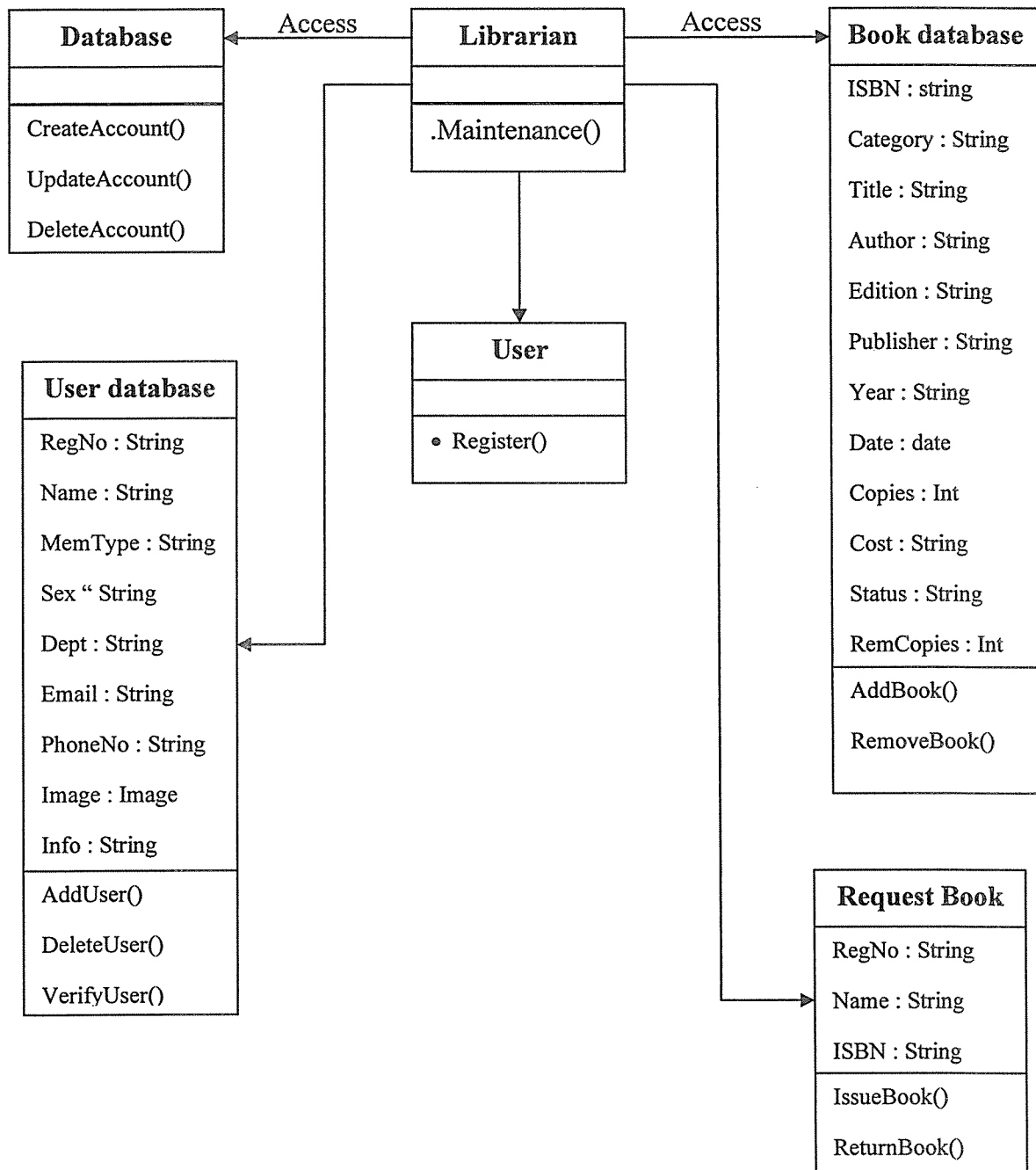
Figure 4.7: Class diagram

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4.6 Database design

This system is expected to provide a suitable communication link between the user and the database. To ensure for an efficient system, it is important to design a database that is free from data redundancy and errors.

Since the system is to be used in a library, it must be able to store the media available in the library and also information pertaining to the library users. This made it necessary to create two separate tables to accommodate this information.

4.6.1 Relational database design

After coming up with an Entity-Relationship model to describe the library system, we took advantage of the special relationships found in the design, and condensed the information to 3 tables. This new design combines some entities and relationships into common tables to form a compact and efficient database representing the whole system.

Database schemas

Books(ISBN, Category, Title, Author, Edition, Publisher, Year, Date, Copies, Cost, Status, RemCopies)

Members(RegNo, Name, MemType, Sex, Dept, Email, PhoneNo, Image, Info)

IssueReturn(MemId, Name, BookISBN, Title, IssueDate, ExpectedDate, ReturnDate)

4.6.2 Physical database design

ATTRIBUTE	DATA TYPE	DESCRPTION
RegNo	nvarchar(20)	Store the students registration number or the staff ID. This is the primary key of the relation
Name	nvarchar(50)	Name of the library member
MemType	char(10)	Representsthe membership type of the library. Ie. Student or staff
Sex	nchar(7)	Gender of the library member.
Dept	nvarchar(20)	School department under which the library member falls under.
Email	nvarchar(20)	The e-mail address of the user
PhoneNo	nvarchar(20)	The phone number of the library user.
Image	image	Store a passport photograph of the user if available.
Info	nvarchar(MAX)	Store any additional information of the user.

Table 4.1: Members relation

ATTRIBUTE	DATA TYPE	DESCRIPTION
ISBN	nchar(20)	Books unique identification
Category	nchar(30)	Represents the book's subject category
Title	nvarchar(50)	The book's title.
Author	nvarchar(50)	Represents the author of the book.
Edition	int	The book's edition.
Publisher	nvarchar(50)	Stores the name of the book's publisher
Year	nchar(4)	The year that the book was published
Date	smalldatetime	The date that the book was added in the library
Copies	int	The number of books bought for the library.
Cost	int	The price of a single copy of the specified book.
Status	nchar(10)	The condition which the book is in.
RemCopies	int	The number of books remaining in the library

Table 4.2: Books relation

ATTRIBUTES	DATA TYPE	DESCRIPTION
MemId	nvarchar(20)	Identification code of the library user
Name	nvarchar(20)	The name of the library user.
BookISBN	nvarchar(50)	The ISBN of the borrowed book.
Title	nvarchar(50)	The title of the borrowed book.
IssueDate	smalldatetime	The date when the book was borrowed.
ExpectedDate	smalldatetime	The date when the book should be returned.
ReturnDate	smalldatetime	The actual date when the book is returned.

Table 4.3: IssueReturn relation

4.8 GUI Design

The first step in designing the GUI was to choose a means of accessing the database. After evaluating various options, we settled on using the Visual Basics 9. The simplicity of VB 9 as compared to VB 6 and other programming languages was an important factor to consider, as it allowed us to develop a suitable user interface using the additional plug-ins and the simple syntax that it has. By using VB 9 we could separate the application logic from the DBMS as well as from clients. In addition to simplifying operations on the database, it also makes extending the functionality of our system easier. When adding a new feature or improving an existing one, we will not need to change the entire database; it will only be necessary to modify the VB portion of the code associated with it.

CHAPTER V

IMPLEMENTATION TESTING AND EVALUATION

5.1 Introduction

Once the design was complete, the development entailed two broad phase: Back-end and User Interface. The back-end comprised database application whereas the user interface comprised the application that the users would use to interact with the database. For the database, Microsoft SQL Server 2005 was used while Visual Basics 9 was used to develop the user interface.

This chapter generally describes the step involved in the implementation process. That is, development and implementation of a suitable user interface, program testing, then finally, a description of the system change over.

5.2 Graphical User Interface

5.2.1 User registration

For a user to use the library facilities, he must first register with the library. First he/she has to provide all the necessary information that is obligatory. If a user provides the correct information at registration time, then the system allows him/her to create an account. Otherwise, an error is generated and the user can not be registered as a new user. To add to the security, a digital image of the students will be taken and stored alongside the other information. This will ensure that only the students with a library account can borrow books.

5.2.2 Addition of books

This is accomplished by a very important form in this application. This form simply requests for all the books details including: title, author of the book edition, copies bought among others. This information is then stored in the database where it is easily accessible.

When an authenticated user requests for a book, the application first makes a quick sweep across the database to determine if the requested book is available before issuing the book. The availability of a book depends on two main factors:

- If the book has ever been saved in the database: if not, then the application raises a "Book not found in the database" error.

- If the number of remaining copies is more than zero: if not, then the application displays a "Book is currently unavailable" message

Figure 5.3.2.-1: Addition of books

5.2.3 Issuance of books

When a library user wants to borrow a book from the library he has to provide his members ID number to the librarian. The librarian then enters the ID number into the form. The application performs a background check against the database to see if the user is authenticated. If the user is registered, his information (name and image) is displayed on the screen. The librarian can then compare the user against the image for security purposes.

If a positive identification is made, the librarian then enters the ISBN of the book that the user wants to borrow. The application then looks up in the database again to see the availability status of the book. If the book is available, then the user is issued the book.

Figure 5.4.3.-1: Issuance of books

5.2.4 Reports

This module deals with the generation of both textual and graphical reports. This module has been used in several occasions to generate reports of the various items in the application which include books report and the users report.

An example of a report used is a book report generated to show the books that are currently available in the database. This report displays detailed information of all the books including; the book title, author edition among other details. A screen capture of the book report is shown below.

Figure 5.5.4.-1: Book Report

Books Report

Books Report

ISBN	Category	Title	Author	Edition	Publisher	Year	Date	Copies	Cost	Status
000-234	Computer Studies	Principles for statistics	Dr. John Garang	2	Kinya	209	5/8/2009 12:00:00 AM	30	30000	available
000-987	Computer Studies	Programming fo dummies	Prof Jeff Swiss	5	McGraw Hill	2006	12/12/2005 12:00:00 AM	50	20000	available
00123	computer	system analysis	anthony ndegwa	2	qwerty	2010	12/12/2009 12:00:00 AM	2	2000	available
002-567	Religion	The true way	Bishop Joseph kigoja	1	Nserk	2010	6/21/2010 12:00:00 AM	50	10000	available
009-820	computer studies	Cisco	Prof Jose DeFacto	5	McGrawHill	2010	6/21/2010 12:00:00 AM	25	10000	available
010-351	Religion	The way to Islam	Sheikh Abdul Faisal	6	Kinya	2010	9/6/2008 12:00:00 AM	15	15000	available
100-012	Business	Principles in E -Commerce	Prof. Joni Nsereko	5	Kinya	2007	6/21/2010 12:00:00 AM	25	15000	available
12300	physics	Fundamental in Physics	Erick Mwangi	6	qwerty	2010	5/12/2010 12:00:00 AM	2	3500	sold
123-345	Computer studies	Operating systems	Mark DeMaria	3	McGrawHill	2010	6/10/2010 12:00:00 AM	35	15000	available
509-385	Computer studies	Programming in VB	Dr. Gonzalez	4	McGraw Hill	2009	6/21/2010 12:00:00 AM	15	30000	available

5.3   Software testing

This refers to the exhaustive and thorough evaluation of a system so as to determine if it yields the desired results under known conditions. During the implementation phase, a series of system testing was carried out to ensure that the application was running efficiently.

5.3.1   Unit testing

This process involved testing the individual components of the system to see if they meet the requirements. The different forms in the application were tested to check whether navigation inside the form was possible. Additional tests were also carried out to verify that communication link between the form and the database was established and working as expected. All these tests were carried out using sample data.

5.3.2 System testing

After ensuring that all the individual components were functioning as expected, they were then integrated together to form a single system. A system test was then carried out on the system to validate that the system was functioning according to the expectations.

The system testing involved three major tasks:

- **Single run** – Testing the system over a single pass of data.

- **Cyclic test** – Testing the system over several cycles to ensure that the end of the period routines are met.

- **Clerical tests** - Tests all aspects of the interface between the end user and the system.

5.3.3 Modular testing

This is testing of programs individually and can be done by either desk checking or dry running.

5.4 System changeover

This is the final stage in system implementation. It involves shifting from one information system to another by phasing out the old information system in favour of the new and improved system. This changeover is necessary especially if the two systems cannot co-exist together thereby demanding for the adoption of the better system.

Since KIU library used the manual system to archive their library information, the changeover to the new system involved the manual transfers of important data to the new system by the librarian. To do this the librarian had to do some training on how to operate the system. After transferring all the data from the old system to the new system, the transition will have concluded and the system ready for running.

5.5 Evaluation of the system

If the new library application is implemented, it will have several positive impacts to the library including: The system will control data redundancy within the library thereby optimizing the performance. The system will also ensure data integrity within the organization since there will be only one single database to enhance security.

The Library will increase the efficiency and effectiveness in its operations, allowing it to feed the needs of the soaring population of students. To accomplish this, the system will be dedicated and expected to have a recovery plan in place in case of emergency.

To add to its security features, the system will only will permit only authorized users (administrators) to update the data in the database whenever it is necessary. This will be achieved by use of passwords and usernames. The system will be able to run on real time hence interaction with the user will be enhanced.

CHAPTER VI

RECOMMENDATION AND CONCLUSIONS

6.1 Introduction

The chapter explains the evaluation, recommendation and conclusion arrived at by the researchers. These recommendations are essential and the developers strongly feel they should be put in place for effective use of the system and general running of the system.

6.2 Recommendation

The researcher recommends that KIU should take full advantage of this information system to computerize all their Libraries. By doing this, they can be able to account for all the book transfers and also restrict access to unregistered users. In turn, loss of books will be minimal as all the book transfers are recorded. It can therefore be noted that the implementation of the new system will increase the librarys' performance as well as the security.

6.3 Future work

This project is a work in progress. We are submitting a grant with these preliminary findings to support this project and to expand upon the system. The portion of the existing library that needs the most immediate attention is the database of items. This database is very small at this time. We hope that this system will grow in the very near future to provide a valuable asset not only to the KIU library, but indeed other libraries around the country. Some of the specific areas where future versions of this system may evolve are described below.

As part of recommendation for future work is the improvement of the whole system as the library expands. Alongside library expansion, with the current sudden change of technology, there is a need to change with the times. Where applicable, the new system shall need to be upgraded for increased efficiency and reliability.

6.4 Conclusion

Although this system captured most of the libraries main requirements, not all the requirements here met. More work can be done on it to make a reality. The system developed was used as a demo on how efficiency in library management can be implemented and never captured all the requirements. A thorough fact finding process can be carried out to ensure that all the requirements are captured and a complete system implemented.

Due to these restrictions, the application is recommended for use in small libraries. Some modifications have to be done on the system for it to work efficiently in a large library.

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Appendix A

Work Schedule

| TASKS | 2009 | | | | 2010 | | | | |
	Sept	Oct	Nov	Dec	Jan	Feb	march	Apr	May
LITERATURE RIVIEW	■	■	■	■					
SYSTEM PLANNING					■				
REQUIREMENT						■			
ANALYSIS							■		
DESIGN							■	■	
CODING								■	■
TESTING									■

Appendix B

Budget

Item	Quantity	Cost per unit	Total
Photocopying		30,000	30,000
Printing		30,000	30,000
Flash disk	1	25000	25000
CD's	5	1000	5,000
Miscellaneous	20,000	25,000	25,000
Total			115,000

Appendix C

Questionnaire

Questionnaire:

Name: _____

Date: _____

We, Waichungo Ndegwa Anthony and Waichungo Eric Mwangi, third year computer science student, as part of our three years course, are undertaking a project in Library management system.

We kindly urge you to help us with the necessary information / data by filling this questionnaire.

Any information offered will be treated as confidential and it will be highly appreciated.

Thanks.

Waichungo Ndegwa Anthony   And   Waichungo Eric Mwangi

BCS/14418/71/DF   BCS/14417/71/DF

i.   How long have you used the current system?

    ………………………………………………………………………………………

    …

ii.   Can you give an overview of how the current system operates (system
    functionalities)?

    ……………………………………………………………………………………………………

    ……………………………………………………………………………………………………

    ……………………………………………………………………………………………………

    ……………………………………………………………………………………………………

    ………………

iii. What data is captured in the system and how is it captured?

    ……………………………………………………………………………………………………

    ……………………………………………………………………………………………………

    ……………………………………………………………………………………………………

    ……………………………………………………………………………………………………

    ………………

iv.   Is there any need to implement a new system?

    Yes ☐   No ☐

v.   If yes, what are the limitations of the previous system?

………………………………………………………………………………

………………………………………………………………………………

....

....

vi.   What changes do you recommend to the current system to overcome the limitations and efficiency issues you have highlighted above (if any)?

....

....

....

....

....

vii.   Give the system functionalities you would like included in the new system?

....

....

....

....

....

THANK YOU

Codes

Add new member form

```vb
Imports System.Data.SqlClient
Imports System.IO

Public Class LibMembers
    Private ConnString As String = My.Settings.ProjectDBConnectionString
    Private FileName As String = ""

    Private Sub ComboBox1_SelectedIndexChanged(ByVal sender As
System.Object, ByVal e As System.EventArgs) Handles
tb_ComboBox1.SelectedIndexChanged
        If tb_ComboBox1.SelectedIndex = 1 Then
            Label3.Text = "Staff Id"
            GroupBox2.Visible = False
        Else
            Label3.Text = "Registration no"
            GroupBox2.Visible = True

        End If
    End Sub

    Private Sub LibMembers_Load(ByVal sender As System.Object, ByVal e As
System.EventArgs) Handles MyBase.Load
        tb_ComboBox1.Text = "Student"
    End Sub

    Private Sub cancel_Click(ByVal sender As System.Object, ByVal e As
System.EventArgs) Handles bt_cancel.Click
        Me.Close()
    End Sub

    Private Sub ChangePictureToolStripMenuItem_Click(ByVal sender As
System.Object, ByVal e As System.EventArgs) Handles
ChangePictureToolStripMenuItem.Click
        SelectPic()
    End Sub

    Private Sub PictureBox1_DoubleClick(ByVal sender As Object, ByVal e As
System.EventArgs) Handles pic_MemImg.DoubleClick
        SelectPic()
    End Sub

    Private Sub SelectPic()
        Dim OpenFileDialog As New OpenFileDialog
        OpenFileDialog.InitialDirectory =
My.Computer.FileSystem.SpecialDirectories.MyPictures
        OpenFileDialog.Filter = "JPEG
(*.jpg;*.jpeg;*.jpe)|*.jpg;*.jpeg;*.jpe|PNG (*.png)|*.png|GIF
(*.gif)|*.gif|All Files (*.*)|*.*"
        If (OpenFileDialog.ShowDialog(Me) =
System.Windows.Forms.DialogResult.OK) Then
            FileName = OpenFileDialog.FileName
            ' TODO: Add code here to open the file.
            'TODO: Copy image to applications location
            pic_MemImg.Image = Image.FromFile(FileName)
        End If
    End Sub
```

```vbnet
        Private Sub RemovePictureToolStripMenuItem_Click(ByVal sender As
System.Object, ByVal e As System.EventArgs) Handles
RemovePictureToolStripMenuItem.Click
            'TODO: Delete the image from the applications location
            pic_MemImg.Image = Nothing
            FileName = ""

        End Sub

        Private Sub save_Click(ByVal sender As System.Object, ByVal e As
System.EventArgs) Handles bt_save.Click
            If tb_MemName.Text = "" Or tb_RegNo.Text = "" Then
                MessageBox.Show("Please fill in the Mandatory fields marked in
Red", "TeLMS - Error", MessageBoxButtons.OK, MessageBoxIcon.Exclamation)
                Exit Sub
            End If

            If IsUserAvailable(tb_RegNo.Text) Then
                MessageBox.Show("The requested member already exists", "LMS
Error", MessageBoxButtons.OK, MessageBoxIcon.Error)
            Else
                AddNewMember()
            End If
        End Sub

        Private Sub reset_Click(ByVal sender As System.Object, ByVal e As
System.EventArgs) Handles bt_reset.Click
            ClearFields()
        End Sub

#Region "Access to Databases"
        Private Function IsUserAvailable(ByVal Reg As String) As Boolean
            Dim IsMember As Boolean
            Dim Database As New MyDatabaseFile
            IsMember = Database.IsAvailable("RegNo", "Members", Reg)
            Return IsMember
        End Function

        Private Sub AddNewMember()
            'Add the member to the Lib database
            Dim Sex As String = ""
            If SexMale.Checked = True Then
                Sex = "Male"
            ElseIf SexFemale.Checked = True Then
                Sex = "Female"
            End If

            Dim insrtQry As String
            Dim conn As SqlConnection = New SqlConnection(ConnString)
            Dim ImgBytes() As Byte
            If Not FileName = "" Then
                ImgBytes = PicToBytes(FileName)
                insrtQry = "INSERT INTO
Members(RegNo,Name,MemType,Dept,Sex,Email,PhoneNo,Info,Image)" + _
                "VALUES('" + tb_RegNo.Text.ToUpper() + "','" + tb_MemName.Text
+ "', '" + tb_ComboBox1.Text + "', '" + tb_Dept.Text + _
                "', '" + Sex + "', '" + tb_Email.Text + "', '" +
tb_PhoneNo.Text + "', '" + tb_AddInfo.Text + "',@Image)"
            Else
                insrtQry = "INSERT INTO
Members(RegNo,Name,MemType,Dept,Sex,Email,PhoneNo,Info)" + _
```

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```vb
                        "VALUES('" + tb_RegNo.Text.ToUpper() + "','" +
tb_MemName.Text + "', '" + tb_ComboBox1.Text + "', '" + tb_Dept.Text + _
                        "', '" + Sex + "', '" + tb_Email.Text + "', '" +
tb_PhoneNo.Text + "', '" + tb_AddInfo.Text + "')"

            End If

            Dim SqlCom As SqlCommand = New SqlCommand(insrtQry, conn)
            If Not FileName = "" Then
                SqlCom.Parameters.Add(New SqlParameter("@Image", ImgBytes))
            End If

            Try
                conn.Open()
                SqlCom.ExecuteNonQuery()
                MessageBox.Show("'" + tb_MemName.Text + "' has been added as a
Library member", "TeLMS- Update Successfull", MessageBoxButtons.OK,
MessageBoxIcon.Information)

            Catch ex As Exception
                MessageBox.Show(ex.ToString())
            Finally
                conn.Close()
            End Try

        End Sub

    Private Function PicToBytes(ByVal spath As String) As Byte()
        Dim fInfo As FileInfo = New FileInfo(spath)
        Dim numBytes As Long = fInfo.Length

        'Open FileStream to read file
        Dim fStream As FileStream = New FileStream(spath, FileMode.Open,
FileAccess.Read)

        'Use BinaryReader to read file stream into byte array.
        Dim br As BinaryReader = New BinaryReader(fStream)

        Dim dataa As Byte()
        dataa = br.ReadBytes(Int(numBytes))
        Return dataa
    End Function

    Private Sub bt_delete_Click(ByVal sender As System.Object, ByVal e As
System.EventArgs) Handles bt_delete.Click
        'delete the selected user from the database
        If IsUserAvailable(tb_RegNo.Text) Then
            Dim dlgConfirm As DialogResult
            dlgConfirm = MessageBox.Show("Are you sure you want to delete
this user", "TeLMS - Confirm", MessageBoxButtons.YesNo,
MessageBoxIcon.Question, MessageBoxDefaultButton.Button1)
            If dlgConfirm = Windows.Forms.DialogResult.Yes Then
                Dim conn As New SqlConnection(ConnString)
                Dim QryStr As String = "Delete from Members where RegNo='"
+ tb_RegNo.Text + "'"
                Dim Sqlcmd As New SqlCommand(QryStr, conn)

                Try
                    conn.Open()
                    If Sqlcmd.ExecuteNonQuery() <> 0 Then
```

```vb
                            MessageBox.Show("The selected user has been
deleted", "TeLMS - Message", MessageBoxButtons.OK,
MessageBoxIcon.Information)
                            ClearFields()
                    End If
                Catch ex As Exception
                    MessageBox.Show(ex.ToString(), "TeLMS - Error")
                Finally
                    conn.Close()
                End Try
            End If
        Else
            MessageBox.Show("The selected user doesn't exist in the
database", _
                            "TeLMS - User mismatch", MessageBoxButtons.OK,
MessageBoxIcon.Exclamation)
        End If
    End Sub
#End Region

    Private Sub ClearFields()
        tb_MemName.Text = ""
        tb_RegNo.Text = ""
        tb_Dept.Text = ""
        FineDue.Text = ""
        FinePaid.Text = ""
        tb_Email.Text = ""
        tb_PhoneNo.Text = ""
        tb_SearchPanel.Text = ""
        tb_AddInfo.Text = ""
        FileName = ""

        pic_MemImg.Image = Nothing
        SexMale.Checked = False
        SexFemale.Checked = False
    End Sub

    Private Sub Button4_Click(ByVal sender As System.Object, ByVal e As
System.EventArgs) Handles Button4.Click
        Dim A As Int16 = Shell("C:\WINDOWS\System32\calc.exe",
AppWinStyle.NormalFocus)
    End Sub

    Private Sub bt_Search_Click(ByVal sender As System.Object, ByVal e As
System.EventArgs) Handles bt_Search.Click
        If IsUserAvailable(tb_SearchPanel.Text) Then
            Dim MyArchive As New MyDatabaseFile
            MyArchive.SearchMembers(tb_SearchPanel.Text)
            tb_MemName.Text = MyArchive.name
            tb_RegNo.Text = MyArchive.regno
            tb_Dept.Text = MyArchive.dept
            tb_Email.Text = MyArchive.email
            tb_PhoneNo.Text = MyArchive.phoneno
            tb_ComboBox1.Text = MyArchive.memtype
            tb_AddInfo.Text = MyArchive.info
            pic_MemImg.Image = MyArchive.image

            If MyArchive.sex = "male" Then
                SexMale.Checked = True
            ElseIf MyArchive.sex = "female" Then
                SexFemale.Checked = True
```

```vbnet
                End If
        Else
                MessageBox.Show("User not found", "TeLMS - Message",
MessageBoxButtons.OK, MessageBoxIcon.Information)
            End If
    End Sub

    Private Sub tb_SearchPanel_GotFocus(ByVal sender As Object, ByVal e As
System.EventArgs) Handles tb_SearchPanel.GotFocus
        Me.AcceptButton = bt_Search
    End Sub

    Private Sub tb_SearchPanel_LostFocus(ByVal sender As Object, ByVal e As
System.EventArgs) Handles tb_SearchPanel.LostFocus
        Me.AcceptButton = bt_save
    End Sub
End Class
```

Add Book form

```vbnet
Imports System.IO
Imports System.Data.SqlClient


Public Class AddBook
    Protected ConnectionString As String =
My.Settings.ProjectDBConnectionString

    Private Sub bt_Cancel_Click(ByVal sender As System.Object, ByVal e As
System.EventArgs) Handles bt_Cancel.Click
        Me.Close()
    End Sub

    Private Sub bt_Reset_Click(ByVal sender As System.Object, ByVal e As
System.EventArgs) Handles bt_Reset.Click
        ClearFields()
    End Sub

    Private Sub AddBook_Load(ByVal sender As System.Object, ByVal e As
System.EventArgs) Handles MyBase.Load
        tb_Date.Value = Now().Date
        'bt_Saved.Cursor = Cursors.Arrow
    End Sub

    Private Sub bt_Save_Click(ByVal sender As System.Object, ByVal e As
System.EventArgs) Handles bt_Save.Click
        'Edit this code block later to make it neat by reusing code


        Dim tb_Status As String = ""
        Dim CostVal As Int16 = 0
        Dim YearVal As String = ""


        'Verify inputs
        If tb_ISBN.Text = "" Or tb_Author.Text = "" Or tb_Category.Text =
"" Or tb_Title.Text = "" Then
            MessageBox.Show("Please fill in the Mandatory fields marked in
Red", "TeLMS - Error", MessageBoxButtons.OK, MessageBoxIcon.Exclamation)
            Exit Sub
```

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```vb
        End If

        If (Not tb_Cost.Text = "" And Not IsNumeric(tb_Cost.Text)) Or (Not
tb_Year.Text = "" And Not IsNumeric(tb_Year.Text)) Then
            MessageBox.Show("Wrong inputs at 'Cost' or 'Year'", "TeLMS -
Error", MessageBoxButtons.OK, MessageBoxIcon.Exclamation)
            Exit Sub
        Else
            If Not tb_Cost.Text = "" Then
                CostVal = Integer.Parse(tb_Cost.Text)
            End If
            If (Not tb_Year.Text = "" And tb_Year.Text.Length <> 4) Then
                MessageBox.Show("Please Enter a valid 'Year'", "TeLMS -
Error", MessageBoxButtons.OK, MessageBoxIcon.Exclamation)
                Exit Sub
            Else
                YearVal = tb_Year.Text
            End If
        End If



        'Save into database
        'select ISBN from Books where ISBN='" + ISBN + "'"
        If IsBookAvailable(tb_ISBN.Text) Then
            MessageBox.Show("Book with current ISBN already exists", "LMS
Error", MessageBoxButtons.OK, MessageBoxIcon.Error)
            Exit Sub
        End If
        'Find value of Radio buttons
        If S_Available.Checked = True Then
            tb_Status = "Available"
        ElseIf S_Damaged.Checked = True Then
            tb_Status = "Damaged"
        ElseIf S_Lost.Checked = True Then
            tb_Status = "Lost"
        ElseIf S_Sold.Checked = True Then
            tb_Status = "Sold"
        End If


        'Will use external vb code
        Dim conn As New SqlConnection(ConnectionString)
        Dim InsrtQry As String = "INSERT into
Books(ISBN,Category,Title,Author,Edition,Publisher,Year," + _
        "Date,Copies,Cost,Status) VALUES('" + tb_ISBN.Text.ToLower() +
"','" + tb_Category.Text + "','" + tb_Title.Text + _
            "','" + tb_Author.Text + "',@Edition,'" + tb_Publisher.Text + "','"
+ YearVal + "',@tb_date,@Copies,@Cost,'" + tb_Status + "')"


        Dim cmd As SqlCommand = New SqlCommand(InsrtQry, conn)

        cmd.Parameters.Add(New SqlParameter("@Edition",
Integer.Parse(tb_Edition.Value)))
        cmd.Parameters.Add(New SqlParameter("@tb_date", tb_Date.Value))
        cmd.Parameters.Add(New SqlParameter("@Copies",
Integer.Parse(tb_Copies.Value)))
        cmd.Parameters.Add(New SqlParameter("@Cost",
Integer.Parse(CostVal)))
```

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```vbnet
        Try
            conn.Open()
            If cmd.ExecuteNonQuery() <> 0 Then
                MessageBox.Show("'" + tb_Title.Text + "' has been added to
the Database", "TeLMS- Update Successfull", MessageBoxButtons.OK,
MessageBoxIcon.Information)
                ClearFields()
            End If
        Catch ex As Exception
            MessageBox.Show(ex.ToString())
        Finally
            conn.Close()
        End Try
    End Sub

    Private Function IsBookAvailable(ByVal book As String) As Boolean
        Dim Available As Boolean
        Dim BookInDatabase As New MyDatabaseFile
        Available = BookInDatabase.IsAvailable("ISBN", "Books",
book.ToUpper())
        Return Available
    End Function

    Private Sub bt_Delete_Click(ByVal sender As System.Object, ByVal e As
System.EventArgs) Handles bt_Delete.Click
        If IsBookAvailable(tb_ISBN.Text) Then
            Dim dlgConfirm As DialogResult
            dlgConfirm = MessageBox.Show("Are you sure you want to remove
the book from the database?", "TeLMS - Confirm", MessageBoxButtons.YesNo,
MessageBoxIcon.Question, MessageBoxDefaultButton.Button1)
            If dlgConfirm = Windows.Forms.DialogResult.Yes Then
                Dim conn As New SqlConnection(ConnectionString)
                Dim QryStr As String = "Delete from books where ISBN='" +
tb_ISBN.Text + "'"

                Dim sqlcmd As New SqlCommand(QryStr, conn)
                Try
                    conn.Open()
                    If sqlcmd.ExecuteNonQuery() <> 0 Then
                        MessageBox.Show("The specified book has been
deleted from the database", "TeLMS Message")
                        ClearFields()
                    End If

                Catch ex As Exception
                    MessageBox.Show(ex.ToString(), "TeLMS Error")
                Finally
                    conn.Close()
                End Try
            End If
        Else
            MessageBox.Show("The specified book does not exist in the
database", "TeLMS- Book mismatch", _
                            MessageBoxButtons.OK,
MessageBoxIcon.Exclamation)
        End If
    End Sub

    Private Sub ClearFields()
        tb_Author.Text = ""
        tb_Category.Text = ""
```

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```
            tb_Copies.Value = 1
            tb_Cost.Text = ""
            tb_Date.Text = Now().Date
            tb_Edition.Value = 1
            tb_ISBN.Text = ""
            tb_Publisher.Text = ""
            tb_Title.Text = ""
            tb_Year.Text = ""

            S_Available.Checked = False
            S_Damaged.Checked = False
            S_Lost.Checked = False
            S_Sold.Checked = False
        End Sub
End Class
```