

Design and Implementation of Clinic Appointment Registration System

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ABSTRACT

Clinic Appointment Registration System is an important way to see a doctor, and it's also a preliminary tool for storage and management of clinic medical records. This new system was developed using Visual Studio 2008 and C#.NET as the development environment and tools and Microsoft Access 2003 as the database to store the medical data based on Browse/Server (B/S) model. The system consists of several data operation functions including appointment registration, data management (e.g. addition, deletion and searching), data backup and recovery, etc., thus, achieve key research objectives.

Keywords: Clinic Appointment Registration System; C#.NET; B/S Mode

1. Introduction

Clinic appointment registration system has been one of the key barriers for hospitals to improve their service quality. Especially for those high-level comprehensive hospitals with a large amount of outpatients, outpatient congestion is a common phenomenon. Online appointment registration system to see a doctor has been implemented and is getting popular in some developed countries. The technology for making an online appointment is getting mature. Domestically, only a few hospitals are in the pilot phase in trying the online registration system.

The project is to follow the software life cycle, through stages of demand analysis, system design, system implementation, system testing and maintenance, to design and develop an outpatient appointment registration system based on B/S model. It provides learning programs for the experimental teaching courses of "Medical Informatics" and "Hospital Information System" for students majored in computer science focused on medical informatics in our school. It can also be used in medium and small hospitals as an outpatient appointment registration system.

2. System Requirements Analysis

Demand analysis is the first stage of software development. It is a process of discovery, refinement, modeling, specification and review. The demand analysis is directly related to product quality of software, and subsequently poses significant impacts on the design and implementation phases. In general (of software development), the

demand analysis includes both functional requirement and technical requirement analyses [1].

2.1. Functional Requirements Analysis

There are two sets of functions for an online appointment registration system based on B/S model. The first set of functions are online registration functions including register and login, selection of department, date, doctor and other online booking registration functions. The operation flow chart is shown in **Figure 1**.

The second set of functions are data management functions allowing the database administrator to add, delete, inquire, modify, restore and backup data backup. In addition, deletion, inquiry and modification are the basic operations of database management. They can effectively maintain the consistency of the database to meet the actual need. The data backup and restore can greatly enhance the security of the system. Even if in the situation of data loss, the system can be restored to the previous version. The data management structure is shown in **Figure 2**.

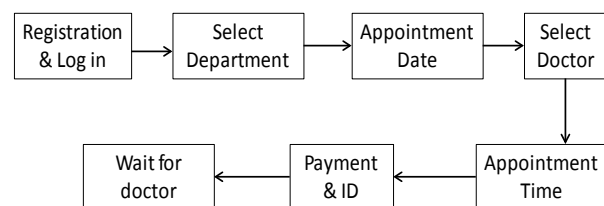


Figure 1. System flow chart for online appointment registration.

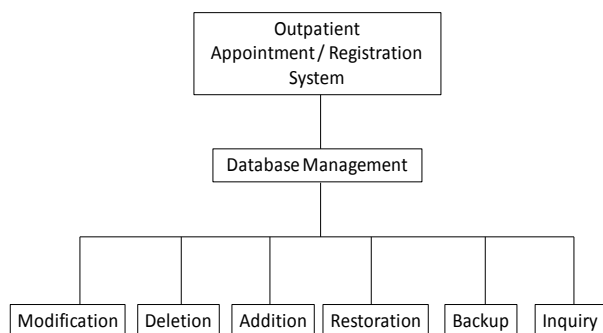


Figure 2. Data Management organization chart.

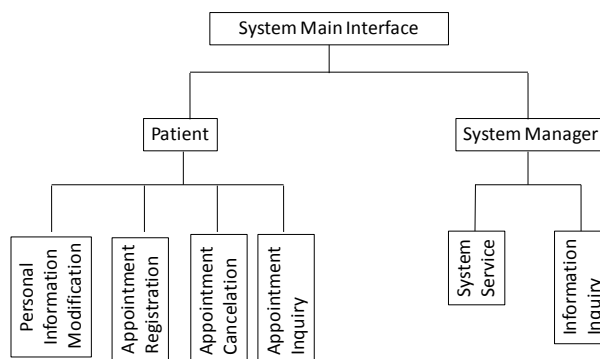


Figure 3. System function structure.

2.2. Technical Requirements Analysis

In software development, the system architecture is determined by the functions required. The system architecture determines system development model, development environment and development tools. Taking into account the system security and simplicity, our system uses B/S structure as the system development model, Windows Server 2003 as operating system, Visual Studio 2008 as development environment, C#.NET as development platform and development tools, and framework 3.5 as the system framework [2,3]. Back-end database is Microsoft Access 2003 with SQL Server database interface to facilitate data transfer and post-data analysis and data mining.

3. System Design

3.1. System Functions Modular Design

According to business process, the system can be divided into two categories of users: the first users are those who want to make an online appointment. The second users are the hospital staff of internal administrators. Appropriate permissions are set in the system corresponding to the different user set. Overall system function structure is shown in **Figure 3**.

3.2. Database Design

Database design is an important part of software design. The database design is directly related to the merits of the program to achieve the efficiency and simplicity of data access. Under normal circumstances, the database usually adopts ER diagram (Entry-Relationship) to determine the link between the data structure and data tables [4]. In this system, the link between the data tables is realized by the field code of "patient's appointment ID number". According to requirement analysis and system organization chart, our system contains thirteen data tables including coding tables of department ID, doctor ID, doctor information, doctor schedules, outpatient registration ID list, etc.

4. System Implementation

System implementation includes the implementation of the functionalities of each module and the implementation of data backup and restoration. Here we will emphasize on introducing the implementation of data backup.

4.1. Data Backup

Data backup refers to storage of user data including files, databases, application programs and etc for data recovery. Despite a variety of protective measures embedded in the system to prevent data security and integrity from damage, data damage is inevitable because of the possibility of computer system hardware failure, software error, operator error, and malicious damage. Therefore, it is imperative to provide data backup and restoration mechanism to improve system security [4].

4.2. Database Backup to Achieve

The data backup and restoration system are mainly achieved through the wrapper class AccessBak.

AccessBak.cs Source code is as follows:

```

public class AccessBak
{
    public void Create(string mdbPath)
    {
        if(File.Exists(mdbPath))
            // Check if the database already exists
            {throw new Exception ("The target database already exists, cannot create ");}
            // You can add password, so the database can only be accessed with the password
            mdbPath = "Provider=Microsoft.Jet.OLEDB.4.0;Data Source=" + mdbPath;
            // Instance for creating a CatalogClass object,
            ADOX.CatalogClass cat = new ADOX. CatalogClass();
            //Use the Create method of CatalogClass object to create an ACCESS database
            cat.Create(mdbPath);}
            //Compress and repair the ACCESS database, mdbPath
  
```

```

as the absolute path for the database
public void Compact(string mdbPath)
{ if (!File.Exists(mdbPath)) // Check if the database al-
ready exists
{ throw new Exception("The target database does not
exist, can not be compressed");}
// Enter a name for the temporary database
string temp = DateTime.Now.Year.ToString();
temp += DateTime.Now.Month.ToString();
temp += DateTime.Now.Day.ToString();
temp += DateTime.Now.Hour.ToString();
temp += DateTime.Now.Minute.ToString();
temp += DateTime.Now.Second.ToString() + ".bak";
temp = mdbPath.Substring(0, mdbPath.LastIndexOf("\\")
+ 1) + temp;
// Definite the connection string for the temporary da-
tabase
string temp2 = Provider=Microsoft.Jet.OLEDB.4.0;Data
Source=" + temp;
// Define the connection string for the target database
string mdbPath2 = "Provider=Microsoft.Jet.OLEDB.4.0;
Data Source=" + mdbPath;
// Instance for Creating a JetEngineClass object
JRO.JetEngineClass jt = new JRO.JetEngineClass();
// Compress and repair the JetEngineClass object da-
tabase using CompactDatabase method
jt.CompactDatabase(mdbPath2, temp2);
// Copy the temporary database to the target database
(overwrite)
File.Copy(temp, mdbPath, true);
// Final step, delete the temporary database
File.Delete(temp);
public void Backup(string mdb1, string mdb2)
{if(!File.Exists(mdb1))
{throw new Exception("Source database does not exist
");}
try
{File.Copy(mdb1, mdb2, true);}
catch (IOException ixp)
{throw new Exception(ixp.ToString());}}
// Restore the database, mdb1 as the absolute path for
the backup database, mdb2 as the absolute path for the
current database
public void Recover(string mdb1, string mdb2)
{if (!File.Exists(mdb1))
{throw new Exception("Backup database does not exist
");}

```

```

try
{File.Copy(mdb1, mdb2, true);}
catch (IOException ixp)
{throw new Exception(ixp.ToString());}

```

Click the backup button in the database to activate the Click event. The database backup can be achieved as long as it is using an AccessBak method.

5. Conclusion

The system integrates technology advantages of Visual Studio 2008 and C#.NET development environment to design and develop an outpatient online appointment registration system. Since 2010, it has been used as an experimental teaching program for "Medical Informatics" and "Hospital Information System" classes for students majored in computer science with orientation of medical informatics in our school. It has led to satisfactory teaching accomplishment. Because of the inadequate teaching equipment, the functionality of online credit card payment cannot be implemented. We will continue to improve and develop the system with goals of suitable to be used in small and medium-size hospitals for managing their outpatient online appointment registration and to be used for managing outpatient medical records for data mining.

6. Acknowledgements

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