Online Test and Simulation Training Based on Three-tier Structure

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Abstract

This paper completes software system design and development of papers management, online test and simulation training based on three-tier structure, and focuses on the design and the realization of questions saving, randomly generation algorithm of questions in the network environment. Teachers can input and save questions at the same time. On-line test can be used for normal examination, and simulation training modules can provide students with opportunities for self-learning. Using system can improve the work efficiency of teachers and the quality of the examination.

Keywords: Three-tier structure, questions, on-line test

1. Introduction

At present, the traditional test methods are adopted by most colleges and universities. Teachers set questions for the examination according to the lecture contents, print papers, and mark and analyze the examination papers after the examination. There are some problems in the traditional test method, for example, it increases the workload of teachers and it cannot evaluate the results of teaching objectively, it cannot satisfy the college teaching requirements. Therefore, it is necessary to develop a test software system of three-tier structure with the function of management of questions bank, setting question automatically, simulation training, and on-line examination to solve the problems.

2. Main system functions

According to the requirements of online test and simulation training in colleges and universities, the system mainly includes the following functions:

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2.1. Question Management

The system can establish a question bank involving many courses related with a subject. The question structure can set automatically. The content display of tests includes a variety of font fonts, symbols, pictures, formula, and other plug-ins function. With various attributes such as text, key points, question type, the difficulty and the score, etc., it is convenient to inquire. Questions can be added in Internet environment simultaneously.

2.2. Exam Paper Management

There are two ways to generate the test paper, which are generating the test paper random and automatically and generating manually. After defining the scope and distribution of the papers, the system can set the questions of papers automatically, and users can adjust the questions manually. Papers should be saved as a default or user-defined template of specific word file or directly generated as PDF files.

2.3. Question Bank

The system can be used in the Internet environment and provide online examination, simulated training and exam analyzing functions. Online exam function is used in exams and simulated training is used in usual practices.

3. The General Design of the System

3.1. The Development and Runtime Environment of System

The system uses .net2005 as a development platform, SQLSERVER2005 as database. 3-tied technology was used. The client uses Windows XP, Internet Explorer(IE) etc., the server uses Windows2003, Internet Information Server (IIS).

3.2. 3-tier B/S Structure Design

Three-layer mainly includes: presentation layer, database access layer, business logic layer. Business logic layer is responsible for reading data from the database access layer, then transferring to user presentation layer. The Data Access layer is responsible to for inserting, updating data to the model. The model is a mapping for the table of the database. Every table of the database is corresponding to an entity class. The presentation layer, namely Web site project, is responsible for interacting with users. The data access layer (DAL) can only be accessed by business logic layer. The user sends the requests to the business logic layer by the presentation layer. Business logic layer completes business rules and logic, and obtains data access database by the data access layer, then displays data in the presentation layer in opposite sequence. The system includes DAL, BLL, WEB, Model projects. WEB project calls BLL, BLL project calls DAL, DAL project calls Model.

3.3. Database Design

System database includes tables of paper, question, question type, course, chapter of the course, answer, teacher, user, user roles, roles, student, role permissions and examination history etc.

3.4. Public Class Design

One of the classes is “Pagebase.cs”, which makes judgment whether the user logs in, and whether the user has access to this page. Other pages will inherit this base class. Base class described as follows:

```csharp
protected override void OnInit(EventArgs e)
{
    //Determine whether the user is logged in.
    if (Session["User"] == null)
    {
        string rootPath = ";//site root path
        string loginPath = ";//login.aspx path
        if (rootPath != "")
        {
            loginPath = rootPath + ";/login.aspx";
        }
    }
```

3.5. System Function

System includes such function pages as user login (login.aspx), question management (frmquestionlist.aspx), curriculum management (frmcoursetlist.aspx), chapters setting (frmchapterlist.aspx), paper management (frmpaperlist.aspx), online test management (frmexamlist.aspx), exam records (frmexamhistory.aspx), paper score management (frmscorelist.aspx), and examination of analysis (frmskaoshifensi.aspx) and so on.

4. Design and Implementation of the system

B/S three-tier structure is used in Web-based online examination system to establish question bank, and to generate test papers. Question preservation and paper generation algorithms are represented as followings.

4.1. Question Preservation

Firstly select relevant courses, relevant chapters, set question type, and then save the test questions to the questions bank. The algorithm is as follows:

protected void btnSave_Click(object sender, EventArgs e)
{
    int count = 0;
    string ID = "";
    if (Action == "add")
    {
        ID = TQuestionBLL.GetMaxId().ToString();
    }
    else if (Action == "edit")
    {
        ID = Request.QueryString["ID"].ToString();
        if (ID.IndexOf("," == 0)
        {
            ID = ID.Substring(1);
        }
        count = TQuestionBLL.ExecuteSql(SqlArr);
    }
    else
    {
        count = 0;
    }
According to the chapters, the difficulty level, question type, number of questions and other parameters, all the questions can be extracted from the question database.

The statements getting data sets is as follows:

\[
\text{ds = TQuestionBLL.GetList(}\text{" and a.ChapterID="} + \text{ChapterID} + \text{" and a.QuestionTypeID="} + \text{QuestionTypeID} + \text{" and a.Difficulty="} + \text{Difficulty}\text{);}\]

GetList is the method of TQuestionBLL business layer:

```csharp
public DataSet GetList(string strWhere)
{
    return dal.GetList(strWhere);
}
```

GetList is the method of data layer:

```csharp
public DataSet GetList(string strWhere)
{
    StringBuilder strSql = new StringBuilder();
    strSql.Append("select a.*,b.CourseID,c.UserID,(select CourseName from TCourse where CourseID=b.CourseID ) as CourseName,(select ChapterName from TChapter where ChapterID =a.ChapterID) as ChapterName,(select QuestionTypeName from TQuestionType where QuestionTypeID=a.QuestionTypeID) as QuestionTypeName, (select RealName from STeacher where UserID=a.UserID) as RealName ");
    strSql.Append(" FROM TQuestion a,TChapter b,TCourse c where b.CourseID=c.CourseID and a.ChapterID=b.ChapterID and a.QuestionTypeID=b.QuestionTypeID ");
    strSql.Append(" order by a.QuestionID desc ");
    return DbHelperSQL.Query(strSql.ToString());
}
```

The implementation of generating question randomly is as follows

```csharp
protected string GetQuestionID(string ChapterID, int Diffculty, string QuestionTypeID, int Num, int AttID)
{
    ds = TQuestionBLL.GetList(" and a.ChapterID=" + ChapterID + " and a.QuestionTypeID=" + QuestionTypeID + " and a.Difficulty=" + Diffculty);
    Random rdNum = new Random(); // Random number generating
    for (int i = 0; i < Num; i++)
    {
        tmp = rdNum.Next(0, ds.Tables[0].Rows.Count);                    if (arr.IndexOf(tmp) >= 0)
        //whether the random is used
        {goto redo;}
        else
        {arr.Add(tmp); //add random to the array
            tmpQuestionID += "," + ds.Tables[0].Rows[tmp]["QuestionID"].ToString();
        }
        if (tmpQuestionID != ")
            tmpQuestionID = tmpQuestionID.Substring(1);
    return tmpQuestionID; // getting the question id
}
```

5. Results

Figure 1 present the main interface of the program. User can select question type, input questions, answers, and save the information into the database.
6. Summary

This paper completes software system design and development of management of online test and simulation training based on three-tier structure. The algorithms of question preservation and generating questions randomly are described in detail. System developed by three-tier structure is developed and maintained easily. Now the system has been used, reducing the workload of teachers greatly and improving the quality of the examination.

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References

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