

Research and Development of Website Framework in Provincial Elaborate Course of Theoretical Mechanics

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Abstract—Elaborate course website is one of the important contents of the elaborate course construction. In order to develop and maintain a good quality course website, we have to combine multimedia technologies with Web technologies, to make a reasonable framework for the website, to choice reasonable software tools for the development, to focus on the online teaching system, and to often maintain and update the website. With Visual Studio, Dreamweaver, Fireworks, and Flash software tools and Microsoft Access database, the paper builds up a complete website development environment, and achieves the foreground user interface and background management systems for provincial elaborate course of theoretical mechanics. The Website features have the abundant course and teaching information resources, online exams, interactive, online discussions, tutorials, and announcement. Teachers can use the convenient and efficient background systems to bring about all network resources of the elaborate course and the website update.

Keywords—*theoretical mechanics; elaborate course; website framework; foreground user interface; background management*

I. INTRODUCTION

Elaborate course website is the window of construction and evaluation for the elaborate course, the fine platform for network learning courses, the media for teacher and student interactive exchanges of the course and the role of radiation and demonstration of the elaborate course. The elaborate course website plays a very important role in the review, inspection process [1].

Elaborate course website is based on Internet network infrastructure, and built up Internet-based education and learning environment by programming. Its foreground is user interface and the course information, and its background is the program codes, related database, electronic courseware, multimedia and others [2, 3]. Good website framework and program design is the basis of website features while good interface is the prerequisite to play a role in website features.

Many universities are now widely to use dynamic website technology for elaborate course website. Developers apply dynamic server page (such as ASP, PHP, JSP, etc.) to background system programs, and graphics (such as Photoshop, Fireworks), animation (such as Flash, Director), webpage (such as Dreamweaver) and other development tools to foreground interface [4].

In recent years, national, provincial and university elaborate courses are increasing year by year, and there are many problems [5, 6].

- Most colleges develop elaborate course website in initial stage, and to take an independent development pattern. As a result, the existing resources are poor sharing, and developers have a lot of duplication of effort.
- Parts of elaborate course website have few of website features. There is inadequate in assessment, online discussions, answering questions, and teaching activities, and not suitable for students to construct learning environments.
- There are few of background management features. Teachers can not modify and update website content at any time online, and even each operation requires technical assistance.

II. DESIGN REQUIREMENTS

The website development of theoretical mechanics is to meet the need for our college to apply provincial elaborate course and to build its website, in which there are the curriculum contents and network resources. The website system should be a user-friendly interface and the management platform easy to maintain, expand and update.

Design requirements are to establish efficient, practical, safe, stable and easy to maintain website framework. All course information should be placed into the database, and the relevant web pages automatically updated [7].

With background management systems, teachers can perform routine maintenance on the website, lively update course contents, and upload files only through a browser. System administrators can dynamically add, delete, and modify columns according to actual needs at any time.

Set the audit system. The information will be reviewed before publishing it, and the operating records are reserved.

Provide with database maintenance function, including data maintenance, backup and import and so on.

III. SYSTEM FUNCTIONS

The website system is divided into foreground web pages and background management system. With ASP.NET dynamic website technologies, the maintenance of foreground dynamic web pages is achieved by background management systems. The web contents of all columns are instantly derived from the background database, and displayed by the browser for Internet users to browse. With the background management platform, system administrators manage the website contents by the browser.

A. Foreground User Interface

The framework of foreground user interface is shown in Fig. 1, including seven top columns.

Each top column has many sub-columns. For example, the column of course introduction has five sub-columns, course demands, course syllabus, teaching methods, teaching plan and curriculum evaluation; and the column of learning garden has four sub-columns, self check, submission exercises, online examination and course feedback.

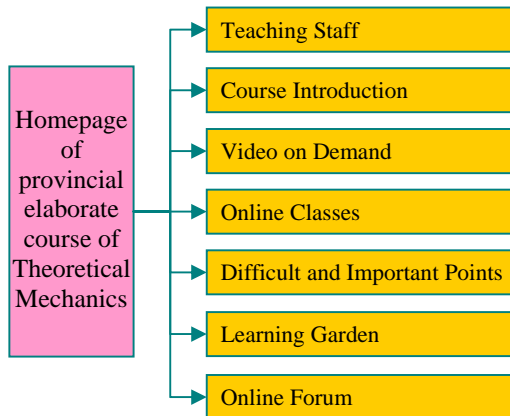


Figure 1. The framework of foreground user interface

1) User Functions for Teachers

It provides teachers with teaching activity platform for teachers to publish teaching resources, to interact with students online, to evaluate student achievement and to check teaching effectiveness after class. It includes four functional modules:

- a) *Course resource management.* To release and modify the course lesson plans, coursewares, animations, videos, problems and other teaching resources.
- b) *Teaching activity management.* To make notices, to assign and correct homeworks, and to view and analyze student test results.
- c) *Online communication.* To post or reply to topics, to respond to student questions, suggestions and opinions.
- d) *View system usage.* Such as the website statistics of user access, the result analysis of online survey questions.

2) User Functions for Students

It is convenient for students to learn courses, to share rich learning resources, to view personal achievements of the learning phases, and to exchange with teachers online. There is more autonomy and interactivity for students to participate in the process of learning activities. It includes three functional modules:

- a) *Learning activity module.* To understand course contents, to view and download teaching resources and to submit homework.
- b) *Online test module.* To immediately get answers and grade after the test. There are many problems. It consists of test problem database maintenance, test paper auto generating, checking, marking and analyzing.

c) *Online communication module.* To exchange between students and teachers online.

B. Background Management

Teachers and administrators can manage the website by browser. The framework of background management system is shown in Fig. 2, including five top columns.

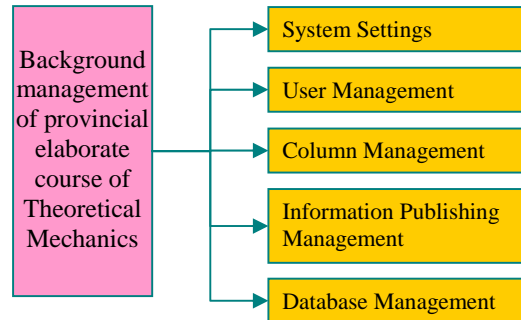


Figure 2. The framework of background management system

1) System Settings

To achieve the fundamental website management. It includes five sub columns: website configurations, system space management, log management, service probes and help functions.

2) User Management

To add, modify, and delete all types of users. The system administrators assign the privileges to other users to carry out different columns as different users.

3) Column Management

To create all columns of the website, to add, delete and modify some columns.

4) Information Publishing Management

To dynamically generate the navigation bar, pull-down menus in each column based on the database. To release information in each column, and to add, modify and delete them. With HTML editor, the administrators and teachers can edit course contents, from which the webpage is automatically generated.

5) Database Management

To implement the system database backup, restore, audit and compression features. It is effective to the assurance of database security.

The operating system is Windows 2003 Server, and the Web service is IIS.

C. The Course Knowledge Base

The key elements are as following:

- To divide the course contents into three parts: Statics, Kinematics and Dynamics;
- To divide each part into learning units according to chapters.

Statics includes four chapters: static axioms and force analysis of objects, coplanar system of forces, spatial system of forces and friction.

Kinematics includes four chapters: kinematics of point, simple motion of rigid body, synthesis movement of points and coplanar motion of rigid body.

Dynamics includes six chapters: basic equations of particle dynamics, momentum theorem, moment of momentum theorem, kinetic energy theorem, d'Alembert principle and principle of virtual displacement

Each learning unit includes six structure modules: basic concepts, knowledge networks, and the key and difficult teaching points, the most important parts of contents, typical examples and class discussion.

For example, while teaching and reviewing the key contents, we can use three modules: the basic concepts, the key and difficult teaching points, and typical examples. In the typical example modules, there are many demonstrations of engineering background and animations of structural members. In the most important parts of contents, we rearrange the contents of each chapter into several knowledge points. The specific contents between the knowledge points and the relevant modules are linked by jump buttons.

The knowledge networks include recall of knowledge, the most important parts of contents, refined analysis of problems, classroom summaries and exercises, seminars, homework and so on. We can organize the teaching contents based on the most important parts of contents, while students can study the knowledge step by step according to the order of contents which are the basic teaching contents of Theoretical Mechanics so that students have to know them.

The courseware system has the following abilities: to intuitively reflect a spatial three-dimensional teaching model, to demonstrate the backgrounds and animations of Theoretical Mechanics, and to strengthen the combination between theory and engineering practice.

Using advanced multimedia technology, we can make the teaching activity more vividly, arouse the interests of students and keep them motivated, teach more contents in classroom and improve the quality of teaching.

IV. KEY TECHNOLOGIES AND PROGRAMMING

The technical difficulties in background management development are how to access the database by ASP.NET pages, how to automatically generate web pages and how to ensure the system security.

A. The Key Technologies in Design and Realization of the System

1) The key Technologies for ASP.net to access the system database

The system database is Microsoft SQL Server 2008. We use ASP.NET technology to resolve some problems, such as database access, page realization, coding separation and component optimizing. ASP.NET access the system database through the built-in Database Access Component (DAC): ADO.NET (Active Data Object) [8].

ADO.NET is one of the best ways to access database, and a powerful programming model to access database. Most of the properties of the data sources can be directly programmed on the Active Server. It provides a simple programming model and the functions to process the data. It can make use of ODBC (Open Database Connectivity) or OLEDB (Object Linking & Embedding database) driver for

applications to access and manipulate databases. Its programming interface is simple. We use the VBScript and JavaScript scripting language to complete the database access and related data processing.

In the development of B/S structure of the WEB application, ADO.NET has the following characteristics:

a) To independently create objects, which use different data interfaces to access the database. By batch process, data can be updated and written to the server only once.

b) To support the stored procedure with input and output parameters, and with return value. It can return multiple recordsets from batch process and the stored procedures. WEB servers for different applications can have different objects to complete.

The two primary components for ADO.NET to access and manipulate data are: .NET Framework data provider (within the dashed box in Fig. 3) and DataSet. .NET Framework Data Provider is designed for data manipulation. DataSet is designed for independent data access to any data source.

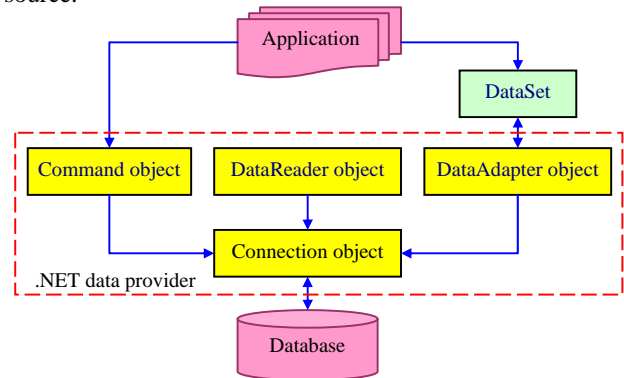


Figure 3. The framework of application to access data

2) The design of the system security

In the application system, the user information security is very important. Once the user password was stolen, the database system is in unsafe. By encrypting the user password, we can solve the problem. User password stored in the database is not clear text, but encrypted password. While processing user authentication, the login system encrypts the user password, then compares it with the user encrypted password stored in the database. ASP.NET supports the MD5 hash algorithm to encrypt a string. The user password is encrypted by MD5 and stored into the database to ensure the user information and database security.

B. The Design and Programming of Key Codes

1) The Program Design for Database Access

The implementation process for the system to access the database are as follows: (1) Browser requests an ASP page file from Web server; (2) The server interprets the page by the ASP.DLL, executes it on the server, accesses to the system database by the ODBC drive, and generates a dynamic page returned to the browser; (3) The browser displays the page on the client screen.

ASP.NET makes use of ADO object component to access the system database. Before accessing the database it

establishes a database connection by ADO Connection object, and configures the property of the connection string (ConnectionString). For the SQL Server database, usually it uses its special interface to access the database. After opening the database connection, it can use the execute method of Connection object to call SQL statements for a variety of operations [9].

There are four steps as following: to create a link to the database, or ADO Connection, to create ADO recordset; to operate the recordset and to close the data link connection.

2) *The Program Design for System Security Management*

The flowchart of the user authentication process is shown in Fig. 4.

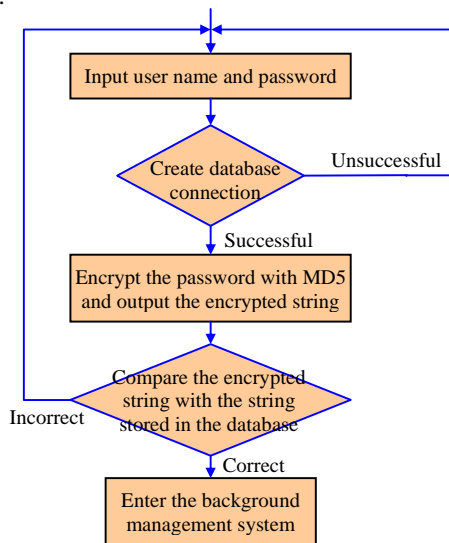


Figure 4. User authentication process of program implementation

If a user (teacher or administrator) management account is correct, he/she can access to the background system, add or modify the website information with a browser. The system supports multi-user management, and set the user extent of authority for different users.

The operations of each user on the website can be found in the background management system to ensure the website safety and to easily determine the operation responsibility for website operations. The certification authority ensures the system database security, and includes user identifiers, user authentication.

V. SYSTEM APPLICATION RESULTS

With the background management system, the elaborate course website has the following characteristics: simple construction, management and maintenance, safety, reliability and compatibility. It provides teachers with the website management tools that are easy to operate, dynamically to update and maintain. The system user interfaces are friendly and easy to use.

The test module has a unique characteristic in training students for autonomic learning, and shows a new teaching model of this course. With the advantage of animations and other multimedia measures, teachers write the courseware for student easy to understand and easy to learn.

VI. CONCLUSION

The website background management system provides teachers with convenient and flexible database management platform. With browsers teachers can release the course web pages. The system improves the efficiency of website management, so that teachers can be free from the web page design, and focus on the course quality through course construction and development. And the courseware provides a new way for students in our college to study and master the basic knowledge and the latest practical technologies. It plays an active part in the reform of education and teaching method, and opens up new trails to improve practical ability of students. The feedback information from students and teachers shows that the courseware is very well.

The further work is to add more and better background knowledge of practical engineering to the website, and to expand the test module with more and better exercises for classroom and homework.

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