APPLICATIONS OF COLDFUSION TO INTERACTIVE TEACHING IN ENGINEERING COURSES

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Abstract

The present paper is written to demonstrate applications developed with CFML (ColdFusion Markup Language) for online interactive teaching in engineering courses through the World Wide Web. How to design such online interactivity with CFML for teaching engineering courses utilizing a web site is discussed. The interactive components including online assignments such as online homework, tests, quizzes, projects, etc. are designed for both faculty and engineering students who are teaching or taking engineering courses. The applications discussed in the present paper are very versatile and can be used for a variety of engineering courses offered by the department of civil engineering, such as Engineering Mechanics, Soil Mechanics, Material Mechanics, Continuum Mechanics, etc. The following points in the paper are emphasized: 1) design of the flow chart and site map for a website, 2) design of layout for each web page including main and sub-pages using HTML, 3) design of small relational database for use with the ColdFusion applications and 4) design of interactive functions using CFML that can link a user friendly web interface to the database described in the previous point.

In brief, this is an attempt to develop interactive applications using CFML pages in conjunction with HTML on the Internet or the Intranet with participation from both teachers and students. The online interactive teaching or learning provides an alternative way to pass knowledge and to enhance students' understanding of principles taught in engineering mechanics. Such applications also offer useful and innovative tools with flexibility and convenience to engineering faculty and students.

I. Introduction

Today, the World Wide Web provides the possibility of online teaching and learning in engineering courses (1-7). Currently, the technology of the Internet or Intranet allows students to "attend" courses and lectures. Although this provides convenience to the students, it does not provide an interactive media through which the students may actively learn. How to make the virtual class more interactive using multimedia tool to teach engineering principles in the future is the main task. The present paper presents a solution to this problem. It is to use ColdFusion and its applications to develop interactive online assignments. For instance, in Engineering Mechanics (CEGR304), a

total of thirteen quizzes, two comprehensive tests plus midterms and final exams are given.

ColdFusion (CF), launched in 1995 by Allaire Corporation, was the first Web application server available for Windows NT-based Web servers. It has grown from its modest beginnings to a wide level of industry acceptance due to it's powerful, yet easy-to-use environment in which web-based applications can be rapidly designed, prototyped, and deployed. It offers the simplicity of markup language syntax with server-side scripting security and flexibility. The capabilities of CF extend to working with databases, interacting with the Internet through FTP, e-mail, and HTTP, plus much more.

CF consists of mainly three components: CFML, CFAS (the ColdFusion Application Server), and CFS (the CF Studio). The language it self is CFML and its origins can be traced to GML (General Markup Language). The application portion consists of the Application Server and the Development Studio. The Application Server is the software necessary for the interpretation and execution of ColdFusion code embedded in HTML pages. It integrates itself into the web server application and essentially, CFAS becomes a portion of the web server. This provides dynamic security to CFML pages that are absent from static HTML pages. In addition, the tight integration allows ColdFusion to use less system resources of the web server (e.g., memory). CF Studio offers developers an IDE (Integrated Development Environment) delivering quicker development of CF pages. Regarding more detail information, one can search the related website by typing ColdFusion., and can find the free trail version of the ColdFusion software available on the internet.

Today, personal web severs have become popular than ever before. For example, Window 98 on the PC has the capability of running a piece of software called Personal Web Server which transforms a PC into a web server. The personalization of web severs allows an instructor to install the CF Application Server to his or her own PC, to develop interactive a program, and to run these applications individually. One of the many advantages of using CFML applications is that deployment of interactivity developed by CFML is independent of the system main server of the Internet or Intranet to which the PC belongs. The present paper is to demonstrate how to use CFML to extend the knowledge of HTML to develop interactive applications for online assignments (e.g., tests, examinations, quizzes, projects and homework).

II. Design of a User Friendly Interface with HTML

In terms of the user interface that will greet students, there are five distinct levels. The first and foremost is a page where students may select the course in which they are enrolled (Figure 1). The arrangement is simple and elegant consisting of several buttons each leading to the next page, their respective courses. The next page that the students will face is a login form (Figure 2). This is installed to ensure proper authentication in order to continue with the student's course of action. Authentication consists of entering the student's first name, last name, and a password. The password along with the first

and last name of the individual are compared to those stored in a database in order to be validated. If no matching triplet is found within the database, the student's identity has failed to be validated and is alerted to this fact. An opportunity to attempt login again is granted. Once validation is achieved, the student is allowed to proceed to the next level which is a simple HTML page that outlines the rules and regulations that are associated with taking a test online (Figure 3).

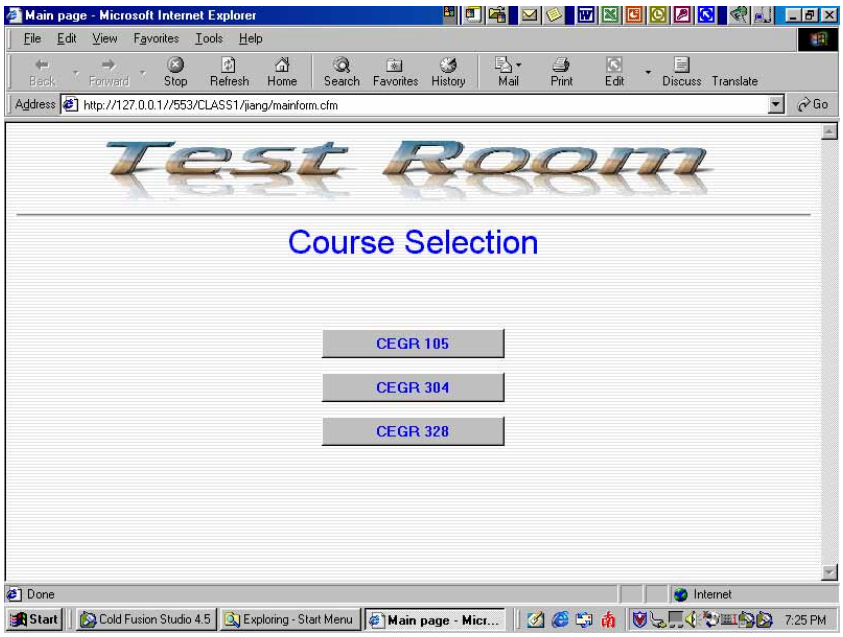


Figure 1. The main page of the Test Room

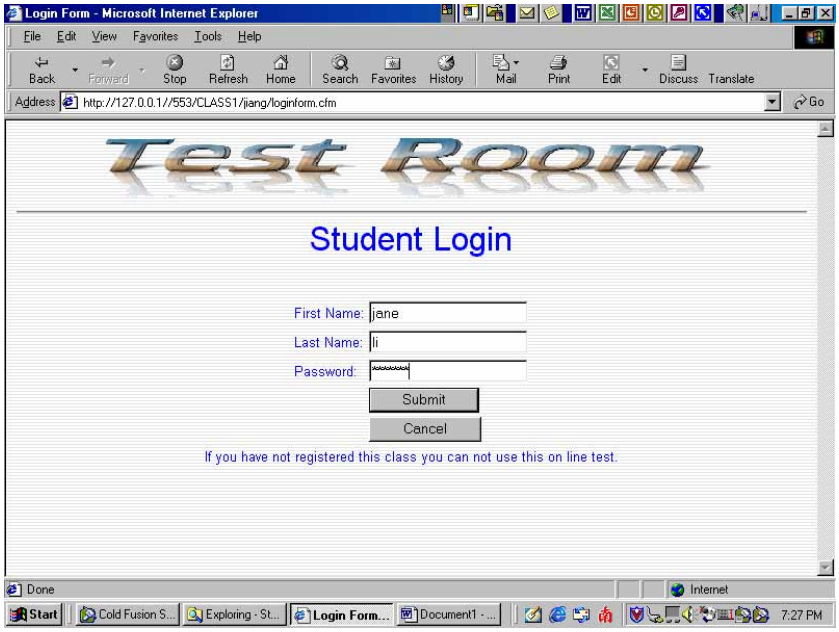


Figure 2. The sub-page of the login form for proper authentication

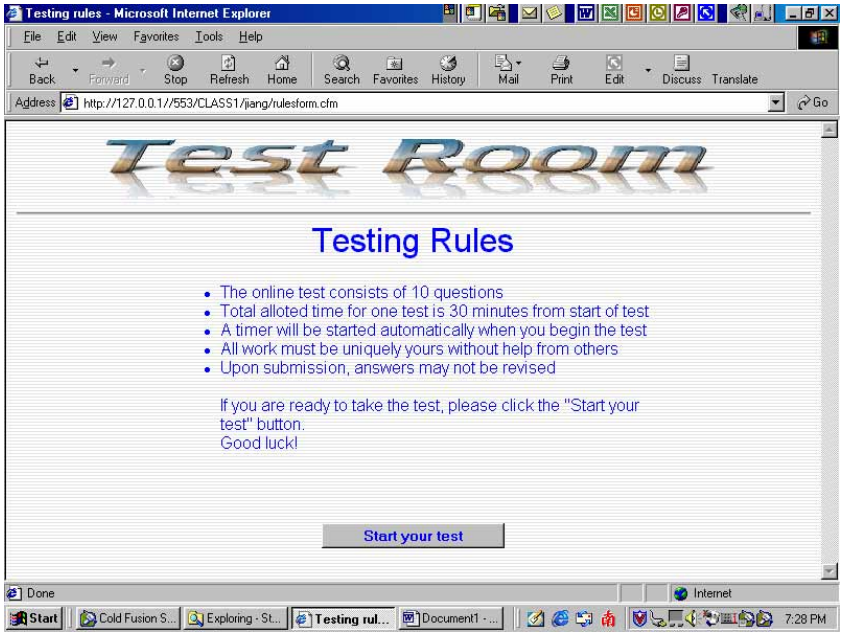
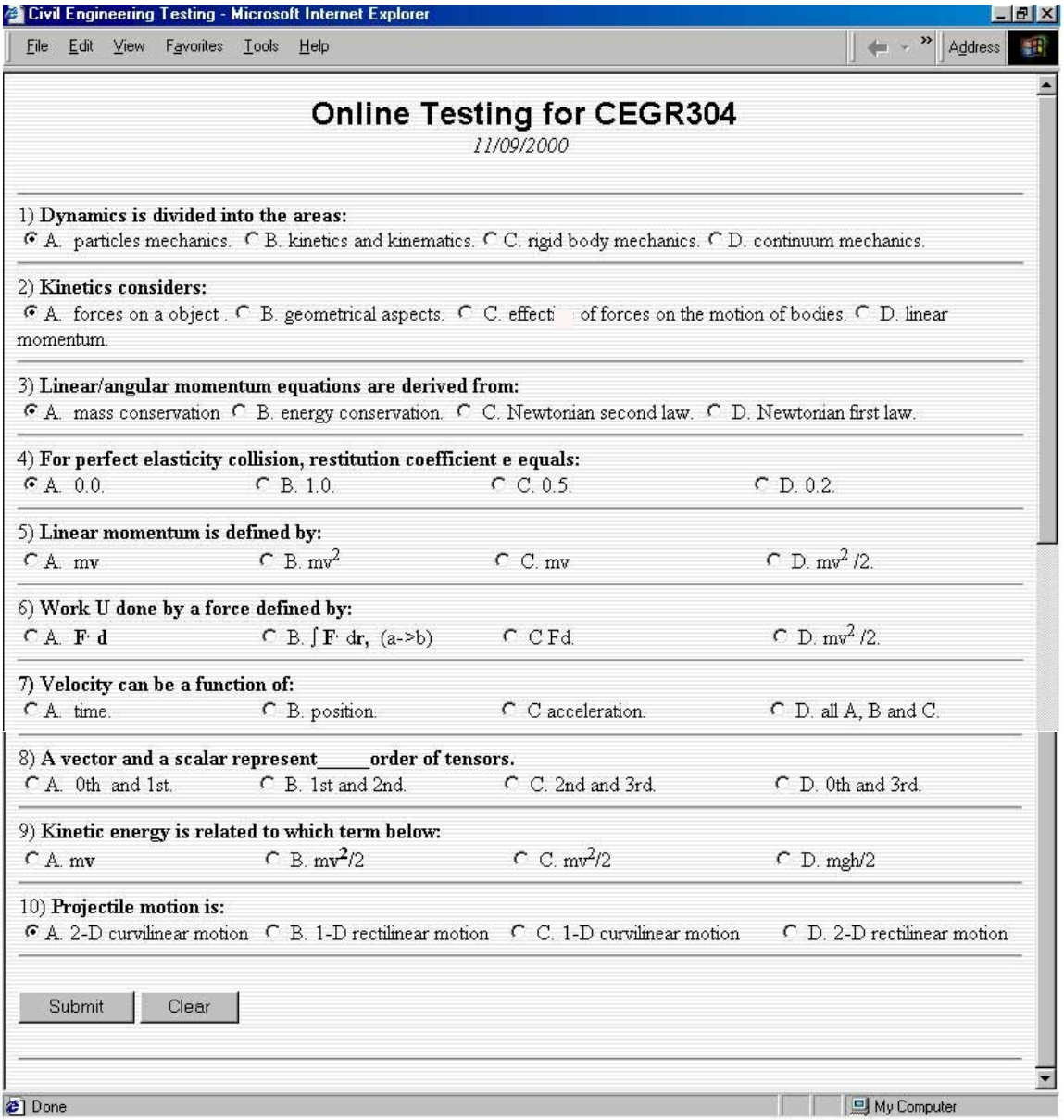


Figure 3. The sub-page for Testing Rules

The page depicted in Figure 3 includes a time limit, intellectual responsibility, and other notably important points. This would be the last instructional page prior to the actual quiz or test. Located under the last words of direction is the button that leads the student to the quiz or test in Figure 4. A timer linked to the server system time will be engaged upon continuing to the actual quiz or tests which constitutes the fourth level of the online testing process. After the student completes the online quiz, answers may be submitted via the "Submit" button located at the bottom of the page. Upon submission, the timer is checked for expiration. As with its paper and pencil counterparts, online quizzes submitted after the allotted time will not be accepted. This message, or one congratulating the student for finishing, will be the last page concluding the online testing process. The application is also designed to prevent multiple submissions of any single test by any individual. Test papers for three engineering courses are designed by the instructor, namely Introduction to CE (CEGR105), Engineering Mechanics (CEGR304) and Environmental Engineering (CEGR328). In this present paper, a sample test in Figure 4 for the Engineering Mechanics course is provided for demonstration purposes.



Civil Engineering Testing - Microsoft Internet Explorer

File Edit View Favorites Tools Help Address

Online Testing for CEGR304

11/09/2000

1) **Dynamics is divided into the areas:**
A. particles mechanics. B. kinetics and kinematics. C. rigid body mechanics. D. continuum mechanics.

2) **Kinetics considers:**
A. forces on a object . B. geometrical aspects. C. effecti of forces on the motion of bodies. D. linear momentum.

3) **Linear/angular momentum equations are derived from:**
A. mass conservation B. energy conservation. C. Newtonian second law. D. Newtonian first law.

4) **For perfect elasticity collision, restitution coefficient e equals:**
A. 0.0. B. 1.0. C. 0.5. D. 0.2.

5) **Linear momentum is defined by:**
A. mv B. mv^2 C. mv D. $mv^2/2$.

6) **Work U done by a force defined by:**
A. **F· d** B. $\int$ **F· dr,** (a->b) C Fd. D. $mv^2/2$.

7) **Velocity can be a function of:**
A. time. B. position. C acceleration. D. all A, B and C.

8) **A vector and a scalar represent_____order of tensors.**
A. 0th and 1st. B. 1st and 2nd. C. 2nd and 3rd. D. 0th and 3rd.

9) **Kinetic energy is related to which term below:**
A. mv B. $mv^2/2$ C. $mv^2/2$ D. mgh/2

10) **Projectile motion is:**
A. 2-D curvilinear motion B. 1-D rectilinear motion C. 1-D curvilinear motion D. 2-D rectilinear motion

Submit Clear

Done My Computer

Figure 4. The sub-page for Online Testing

III. Design of Interactive Applications with CFML

Of course, the working component of this CF application is the embedded CF code. It provides the real functionality behind the HTML forms. As mentioned before, CFML is derived from the outlines of GML and therefore permits a very steep learning curve for those who are even vaguely familiar with the syntactic structure of HTML or any other member of the markup language family. CF Application Server acts as an intermediate between the web server and the client, parsing and executing the CF code before being presented to the client end. This offers an edge over many CGI implementations in terms of execution speed, something you may be more concerned with under higher network load (i.e., many simultaneous visitors to your server). The flexibility and dynamic nature of ColdFusion allows more interactivity than possible with simple, static HTML pages. Instant alerts and enhanced security features are all elements that are important to a successful online testing resource. Additionally, the ability to track sessions allows for an easier implementation of the timer needed to time online tests. The secure login page and the actual quiz page are excellent examples of ColdFusion's value and fitness for online quizzes. Having a secure login exemplifies CF's ability to 1) conceal the database source, 2) properly access and use databases, and 3) correctly verify and authenticate users. All these points have to do with system security, data security, and data access. The importance of the first point should be immediately obvious. If any student may learn of the accessible location of the database, then he or she may be able to download that database thereby circumventing the security measures. Hence, proper concealment of the database is key in the security of the CF application. The main database employed is Microsoft Access Database, since Microsoft Access is a program that is easily accessible for those who have purchased Microsoft Office. This is a form of relational database whereby every table (set of data) can be related to one or more other tables. A relational database such as this offers a clear and organized arrangement of information extending from students' login information to contact information to quiz grades. Once properly hidden from prying mouse clicks, the database becomes a well-integrated part of the CF application. ColdFusion offers simple CF codes providing direct and easy access to the database, finally allowing proper user authentication.

IV. Summary and conclusion

Since the concept of a server has now been reduced to readily accessible PCs, online content has become more of a reality for educators. However, simplistic HTML has the potential to produce large disarray of information that proves to be of limited use. On the other hand, with the more dynamic environment offered by ColdFusion, an interactive and organized solution can be quickly formulated. This offers several advantages. The most important is overcoming the need for physical presence and rigid time scheduling. The flexibility that is offered by the incessant web environment is able to suit anyone's busy schedule. In addition, there is no central place where physical attendance is required. This may prove to be extremely liberating when a professor cannot be present to proctor a test or when a student cannot make the scheduled test time due to a prevailing emergency circumstance. However, though given this liberal scheduling, the

total allotted time is still the same as the traditional quiz or test (made possible by ColdFusion as described earlier). Here, we see that the versatility of online quizzes does not necessarily compromise the integrity of the testing environment. Physical presence and time are not the only flexible aspects that ColdFusion offers. Online test makers would also appreciate the variability of resources compatible with this setup. Unlike many commercial packages, there is no special software to be distributed to students. The only requirements that are required are a web browser and an Internet connection, both readily available resources. Since the final output of CFML is ultimately in HTML format for display at the client end, it is completely compatible with all system regardless of its browser software (e.g., Netscape of Internet Explorer), operating system (e.g., MacOS or Windows), or system hardware. The ease of use in addition to the universality of the CF application makes it ideal for online testing purposes.

In brief, CFML is an easily applied markup language due to its recognizable similarity to the popular HTML. CFAS consumes fewer system resources than many CGI based applications due to its integration with the web server software. Additionally, CF has a lower potential for a system security breach than do CGI applications since they are not treated as executables. Therefore, CF is a very suitable, stable, useful, and powerful tool for developing interactive teaching.

Bibliography

1. Holzer, S. M. & Andruet, R. H. (1998). Learning statics with multimedia and other tools, ASEE Annual Conference and Exposition, Seattle Washington, pp120-126.
2. Li, J. and Lee, Y. M. (1999). Teaching Mechanics with Multimedia Tools, the proceedings of the 1999 ASEE annual conference at Charlotte, NC. USA, June 20-24, 1999, CD-ROM, Session No. 1668.
3. Li, J. (1998). Teaching Engineering Mechanics with the Internet, Abstracts in Proceedings of Workshop of Reform of Undergraduate Mechanics Education, Pennsylvania State University, August 16-18, 1998.
4. Li, J. and Lee, Y. M. (1998). An Experiment of Teaching Engineering Courses with the Internet, in Proceedings of the 1998 Fall Regional Conference of Middle Atlantic Section of ASEE for Engineering Education, Howard University, Washington D.C., pp. 78-83.
5. Gramoll, K., Abbanat, R., & Slater, K. (1996). *Multimedia Engineering Statics*, Addison Wesley Interactive, Reading, Mass.
6. Gramoll, K., Abbanat, R., & Slater, K. (1996). *Multimedia Engineering Dynamics*, Addison Wesley Interactive, Reading, Mass.
7. Wilson, J. M. & Byron P. R. (1996). A multimedia model for Undergraduate Education, *Technology in Science*, Vol., pp. 315-387.

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