

A Web Based Registration system for Higher Educational Institutions in Greece: the case of Energy Technology Department-TEI of Athens

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Abstract: This paper presents a system utilizing PHP open source scripting language to create dynamic web pages that communicate interactively with existing databases, held in reserve in Educational Institutions, regarding student's registration for individual courses at any current semester. The student's application is evaluated on line, according to given complex restrictions regarding previously passed courses, pre-requisites to subject-clusters, total allowed registration hours and separation in the direction of studies in case of multiple directions courses. Furthermore the student can write any comments in free text concerning his records. The proposed system is simple, easily configurable and highly secure.

Key-Words: web-based registration, PHP, JavaScripts, dynamic web pages, open-source code

1 Introduction

The use of World Wide Web (WWW) as a means of electronic communication between students and the administration office in Educational Institutions can serve effectively and securely both sides in a very attractive and widely acceptable way. Existing databases regarding student's personal data, grades, course registrations etc can be continuously updated through dynamic web pages, giving the advantage of interactive communication to the user and minimising the administrative work.

A very interesting aspect of such an electronic communication is the registration to the various courses that the student intends to attend each semester. Such a registration should obey to certain rules, which generally are different for each department of the Educational Institute. Relevant work has been done to such web-based applications using conventional programming languages like C++ but requiring a time-consuming coding scheme [1]. Current trends, regarding different knowledge areas, are towards open source code applications [2].

Our work is based on the design of PHP dynamic web pages that communicate interactively with existing databases [3]. Regarding the open source code, the main work is based on PHP scripts and JavaScripts [4]. The design of registration forms is user friendly and the student needs no course identification codes in order to complete the registration process.

A Windows Server 2000 has been used running an Apache open source web server and the existing databases are in Microsoft Access format. It is apparent, that our work can be easily extended to open source database formats, such as MySQL.

Security problems invoking internet use are usually overcome by using the Secure Socket Layer (SSL) protocol. In the proposed model, the basic idea regarding security is that the designed dynamic web pages communicate with front-end databases, held on the server side, that contain no critical student's data. The main back-end databases are held on separate individual systems and information transfer between the front and back end systems is automated. This system minimises the potential risks from internet attacks and it can be used together with Apache SSL to eliminate such risks.

The system has also the capability to provide information concerning the students who are eligible to have certain books for the courses attended according to the rules of the Institution.

Our system can be easily extended to the automatically electronic provision of certain documents to the student upon his electronic application. Moreover, the proposed system capabilities can be extended to support mobile communications connection [5], sending SMS notification about dynamically elaborated events to the academic society (staff and students).

2 Registration model

In our model we have adopted the regulations of studies holding for the Technological Educational Institutions in Greece. The course structure is divided into 8 semesters. The current rules regarding student's studies are the following:

Each student is permitted to attend a maximum of 45 class hours per week. However students who have reached the last semester of studies are able to attend up to 55 class hours per week. Each department may adopt a separation in courses giving specialty to several different knowledge areas called directions of studies. In this case the course structure includes common core and specialization courses obligatory or/and elective for all students.

From a certain semester, usually the fourth or fifth semester, the student has to choose a specific direction of studies. Furthermore there are groups of elective courses from which a minimum course number must be attended successfully. Moreover, several basic courses are considered to be as prerequisite for others more specialised. These courses form a chain and may include three or even four courses.

The registration of each student is subject to all the above rules, which must be strictly manipulated by our system. This is accomplished by using both PHP scripts and JavaScripts, specifically:

- PHP scripts refer to the server side and their main purpose is to create dynamic web pages and connect them to the front-end database.
- JavaScripts refer to the client side where the manipulation of the registration rules is taking place and the validation of each registration is checked on-line, thus releasing significantly the server.

Special care has been taken on security matters referring to PHP scripts [6], more specifically there is no way to bypass the login screen and open an intermediate form.

3 System architecture

A potential danger regarding web communication is the possibility of hacking students records reserved in the Educational Institutions. This can be avoided in many ways such as the use of secure web pages using the SSL protocol or the implementation of complex operational systems with high cost.

In our system we propose the isolation of the main database files (back-end database) from the database files directly exposed to the web through

dynamic web pages (front-end database). The information contained in the front-end database is the minimum required for registration. Furthermore the front-end database is completely isolated from the back-end since they are reserved in different physical systems. Thus there is no possibility for an internet attack to harm critical data regarding student's records. The system architecture for the implementation of the above procedure is depicted in Fig. 1.

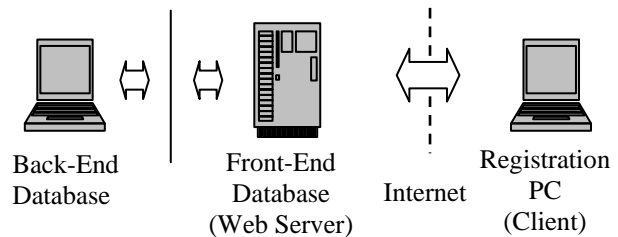


Fig. 1. Architecture of the system

4 Access to and Interaction with the system

Specifically written software manipulating the back-end database produces a subset of student's records, which holds the minimum required information for the registration process. This subset is transferred via ftp to the web server and represents the front-end database. Web-based registrations are held in the front-end database. The web server accepts registrations for a specific time period (usually one week) on a 24 hours basis. Then, the registration data are embedded automatically to the back-end database through developed software.

The login to the server requires the student's record number and the last four digits of his identity card. The login screen is depicted in Fig. 2.

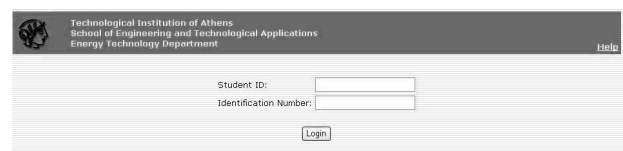


Fig. 2. Login screen

After login, registration details are defined in a screen as shown in Fig. 3. For each semester the courses not yet passed are displayed with adequate information regarding each course, specifically the special knowledge area, the type of course

(theoretical, laboratory or both) and the category of course (core, specialised or elective).

The student is allowed to attend separately the theoretical or laboratory part of the course. For each course checked, the total number of registration hours is displayed at the bottom of the screen. In case of pre-requisites to subject-clusters, if an intermediate course is not yet passed, the latter courses in the subject-cluster are not displayed at all. This technique does not allow to the students to bypass any pre-requisite course.

Moreover, when a student has not yet chosen a specific direction of studies, all courses are displayed for each semester regardless of the course direction. After a course selection that belongs to a specific direction, the student is automatically assigned to that direction and thereafter only courses of that specific direction are displayed.

Direction	Course	Theory	Lab	Final Lab Test	Course Type
Semester 1					
	MATHEMATICS I	<input checked="" type="checkbox"/> 9 hours			SS
	ENGINEERING DRAWING		<input checked="" type="checkbox"/> 6 hours	<input checked="" type="checkbox"/>	SS
Semester 2					
	MATHEMATICS II	<input checked="" type="checkbox"/> 5 hours			SS
	ELECTRICAL NETWORKS	<input checked="" type="checkbox"/> 4 hours			SS
Semester 3					
	MATHEMATICS III	<input checked="" type="checkbox"/> 4 hours			SS
	ELECTRIC MACHINES I	<input checked="" type="checkbox"/> 3 hours			SS
	MEASUREMENT SYSTEMS	<input checked="" type="checkbox"/> 2 hours	<input checked="" type="checkbox"/> 3 hours	<input checked="" type="checkbox"/>	SS
Semester 7					
	ENERGY SYSTEM OPTIMIZATION	<input checked="" type="checkbox"/> 3 hours			SS

Fig. 3. Registration details.

When all courses to be attended are checked in the registration form, the Register button saves that information in the front-end database. A new screen appears, as in Fig. 4, used for verification purposes.

Direction	Course	Theory	Lab	Final Lab Test	Course Type
Semester 1					
	MATHEMATICS I	<input checked="" type="checkbox"/>			SS
	ENGINEERING DRAWING		<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	SS
Semester 2					
	MATHEMATICS II	<input checked="" type="checkbox"/>			SS
	ELECTRICAL NETWORKS	<input checked="" type="checkbox"/>			SS
Semester 3					
	MATHEMATICS III	<input checked="" type="checkbox"/>			SS
	ELECTRIC MACHINES I	<input checked="" type="checkbox"/>			SS
	MEASUREMENT SYSTEMS	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	SS
Semester 7					
	ENERGY SYSTEM OPTIMIZATION	<input checked="" type="checkbox"/>			SS

Hours sum : 33

Fig. 4. Registration verification

This screen provides a button to reedit the registration form. Moreover, another button is provided for a hardcopy printout of the registration details. Furthermore, a comment entry window is provided through the Comments button. This button opens a screen as the one depicted in Fig. 5.

Fig. 5. Comment entry screen.

The student is able to enter in the supplied window any free text declaring problems that to his or her opinion concern its personal record therefore the administration office can examine these problems and make the necessary corrections.

Upon completion of the registration time period, all relative information is transferred automatically to the back-end database. Statistical reports are produced, concerning the number of registration hours, the number of registration courses and the number of courses not yet passed for each student. The reports produced are in portable document form (pdf files) as well as in worksheet form (excel files). As a part of this automation, all the above mentioned excel files are emailed to the head of the department for a final check of the whole procedure.

Finally, according to the Institute's regulation of studies, a second time period is given to the students in order to make any corrections regarding the original registration. This is made feasible through a two-way information transfer between the back-end and front-end database.

5 Implementation

In order to realise the above-mentioned concepts one should take into account both the utilisation of existing resources as well as take advantage of the latest advants in technology. The entire approach is based on the internet and in particular the use of internet browsers such as Netscape, Explorer etc, and the open source code.

Open source code is generally the modern trend in programming. Open source code used in this work regards PHP scripting language, JavaScripts and the Apache web server.

5.1 PHP

PHP (Hypertext Preprocessor) is an open-source server-side scripting language for creating dynamic Web pages. It is suitable for the development of Web applications and allows programmers to embed PHP commands right in the HTML page. The PHP code is placed in beginning and ending tags that allow the transport in and out of the PHP mode, which is executed on the server.

In our work, a significant part of the code is written in PHP and its purpose is to gather data and produce the dynamic content of pages. The PHP code implements the service logic in the Apache web server. Moreover, the PHP code supports multiple RDBMS (Relational Database Management Systems) and the ODBC (Open Database Connection) standards. The connection between PHP and Microsoft Access database is accomplished using ODBC. The functionalities of the registration, the connection, and the user's profile management, are written in PHP using the form of files or function files.

5.2 Apache

Apache has been the most popular web server on the internet since April of 1996. The February 2005 Netcraft Web Server Survey found that more than 68% of the web sites on the internet are using Apache, thus making it the most widely used web server.

Apache is based on open source multi-platform web server. The web applications are implemented in high-level languages as Java, Perl, C++, PHP.

In our work the PHP and JavaScripts are running on the Apache Web server.

5.3 JavaScript

JavaScript is a scripting language that offers interactivity in the web pages. The JavaScript code is written in an ASCII form-code text and is included into the HTML code. No compilation of JavaScript code takes place. JavaScript provides support for multilateral documents with frames.

In our work, JavaScript has been mainly used for specific calculations regarding the validity of the submitted data according to certain registration rules. Furthermore, JavaScript controls the opening and closing of secondary windows such as the Help window.

6 Evaluation

The total number of registered students in the department at the evaluation time was about 800.

Assuming a mean value of 10 lessons per student, a total of 8000 registration records are expected. In order to evaluate the whole system, several different cases were tested.

- Twenty PCs were concurrently used in a computer lab to enter registration data. Time responses were less than one second.
- Distant connections through PSTN telephone lines were made. Time responses were less than three seconds.
- An attempt was made to simultaneously enter registration data for the same student, from two different PCs. The server responded correctly saving the last submitted data.

The system has been in use in the Energy Technology Department of the Technological Educational Institution of Athens since September 2004, for two sequential semesters and any minor problems were evaluated and corrected during its first use.

Before the application of the web registration system, at least one person should be occupied for 10 working days, accepting manually the course registrations and without a complete check of the registration rules. In fact, only the total registration hours were checked. Another time period was also necessary for the corrections. The proposed system releases the staff from that work and simultaneously makes a complete on-line check of the registration rules. Moreover, contributes to a state of the art tool in web-based communications between the students and the administration office.

7 Statistical results

Various statistical results are obtained after the completion of the registration time period.

A statistical report concerning the number of registered students for each semester separately for males or females is produced as depicted in Fig. 6.

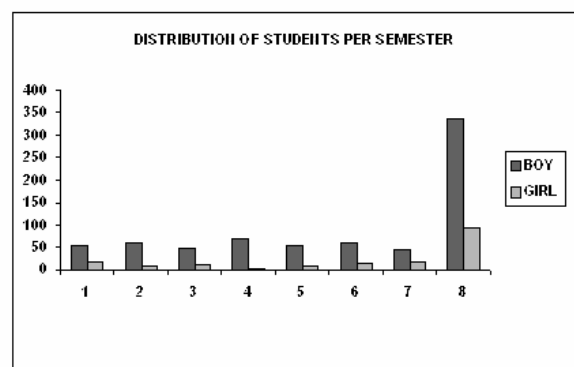


Fig. 6. Statistical results (registrations per semester)

Furthermore, reports concerning the number of registrations for each course, as depicted in Fig. 7 and Fig. 8 for theoretical and laboratory courses respectively, are produced. These reports are valuable for the distribution of class hours to the educational staff especially for courses involving laboratory courses. In fact, if the number of registrations for a lab exceeds a certain limit, the lab course must be split in more than one class. Since courses begin immediately after the end of the time period of the registration process, it is apparent that the use of internet is critical for the speed up of the whole procedure since the above reports are immediately available to the head of the department.

Distribution of Students in Theoretical Courses

11/5/2005

Semester A'

R.N. COURSE	PROFESSOR	STUDENTS	Inf. Test	No Test
1 MATHEMATICS I	PAPADHMAS	334	0	334
2 PHYSICS	NTRIBAS	265	0	265
3 ELECTRICAL TECHNOLOGY	XALARIS	382	0	382
4 MECHANICS	BOUTHOUNHS	446	0	446
5 INFORMATICS I	SAMARAKOU	456	0	456
6 FOREIGN LANGUAGE I	ELAIOPOULOU	94	0	94

Semester B'

R.N. COURSE	PROFESSOR	STUDENTS	Inf. Test	No Test
1 MATHEMATICS II	HITSOS	319	0	319
2 ELECTRICAL NETWORKS	ROLIOPOULOS	371	0	371
3 THERMODYNAMICS	TSILIGIRIS	357	0	357
4 FLUID MECHANICS	BALAVANDHS	350	0	350
5 INFORMATICS III	KONSTANTOPOULOS	315	0	315
6 FOREIGN LANGUAGE II	ELAIOPOULOU	18	0	18

Fig. 7. Statistical results (number of registrations per theoretical course)

Distribution of Students in Laboratory Courses

11/5/2005

Semester A'

R.N. COURSE	PROFESSOR	STUDENTS
1 PHYSICS		170
2 ELECTRICAL TECHNOLOGY		218
3 MECHANICS		189
4 INFORMATICS I		168
5 ENGINEERING DRAWING	PAPADOPOULOS	119

Semester B'

R.N. COURSE	PROFESSOR	STUDENTS
1 ELECTRICAL NETWORKS	DOULGERIS	152
2 FLUID MECHANICS		152
3 INFORMATICS III		245

Fig. 8. Statistical results (number of registrations per laboratory course)

8 Conclusions

We have presented a simple, reliable and quick-responding system for course registration, through the use of dynamic web pages, implemented and used in the Energy Technology Department of the Technological Educational Institution of Athens. The above-described system is very useful because the students can make their web-based registration from any PC having access to the internet, while

the administrative staff charged with this work so far is now released from this time-consuming procedure.

The potential risks of hacking students' records via web attacks are minimized through the isolation of the main database (back-end) and a secondary database (front-end). Submitted data are saved in the front-end database on the server side. As a second step, data are transferred to the main back-end database regarding all the students' records. The data transfer is two-way in order to permit registration modifications.

Moreover, the system allows a direct web-based communication between the students and the administrative office and could be further developed for electronic application of certain documents and their automatic web-based delivery. The system has also the capability to provide information concerning the students who are eligible to have certain books for the courses attended, according to the rules of the Institution.

State of the art in dynamic web page design techniques has been adopted in the proposed system. Moreover, the source code development has been mostly made by the staff of the Energy Technology department. Therefore the derived knowledge can be straightforwardly transmitted to the students through the existing informatics courses contributing a lot to the educational process.

The proposed system can easily be applied to any Departments of Technological Educational Institutions upgrading the management as concern as the administrative work. The only requirements are a web-server that must be maintained and a database format that must be compatible with PHP scripts. Nevertheless, this is common practice for all RDBMS formats.

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