

Managing Students' Records through an Information system based on Web Technology, applied on the Electronics Department of the Technological Educational Institute (TEI) of Athens

I. DARADIMOS, M. KAITSA, I. STAVRINOS, D. TRIANTIS, I. STAVRAKAS

Department of Electronic Engineering
Technological Educational Institute of Athens
GR 12210, Athens
GREECE

Tel: +30-210-5385370

<http://noc.ee.teiath.gr>

Abstract: Modern technologies have been widely used to simplify bureaucratic systems as they ensure irreproachable and accurate operation. Web technologies and databases are the most common tools that assist on this perspective. An information system based on web technologies has been designed and implemented in order to increase flexibility and reduce man-hours of the administrative staff work concerning students' applications reply and registration renewal applications at the Electronics Engineering Department of the Technological Educational Institute (TEI) of Athens. The system enables students to fill out the registration renewal application for each new semester, while it contains filters and rules that check the validity of the application. Concurrently it provides the students the ability to access their record any time of the year through the web and check for module marks etc. Finally, indexing and finding has become an easy task to perform.

Key-Words: Electronic registration, student registration renewal, managing student records, web based database services, PHP, MySQL.

1 Introduction

New technologies have become a seductive way to solve several problems that rise from bureaucracy.

World Wide Web (WWW) is a valuable tool that has been used for applications with user friendly interfaces that can be shared through Internet and serve applications like electronic voting, bank transactions, membership applications, etc [1,2]. From the nature of such applications interconnection of WWW services and databases become necessary.

A major issue that engineers have to face when designing Internet / Intranet applications is the security of the system. Various security protocols like ssh, SSL, https, etc [3] have been introduced for ensuring data transactions. Heavy record sets of various organizations have been recently digitized, enabling users and administrative staff to easily perform searches, indexing and querying in large databases. Such an application has been designed and implemented in order to store and update students' records at the Department of Electronic Engineering of the Technological Educational

Institute (TEI) of Athens. This system has been tested and evaluated for the past four years and has proven that it can significantly minimize human errors, process time and cost.

One of the most time and effort consuming tasks, the student's registration each semester, has been dramatically improved by the use of the web based registration and information system that has been developed. The student's registration is subject to several rules that usually vary from one department to another.

The core system is based on the technologies offered by Linux Apache MySQL PHP (LAMP) combination. User interface is straightforward and simplifies the registration process without confusing the student with useless, for this task, information [3-5]. In addition, the system can be integrated to the existing internet services and authentication schemes of the department by the use of Lightweight Directory Access Protocol (LDAP), thus simplifying the access to the service and reducing the administration load [6].

The Linux server that has been used is tailored to

the needs of the registration system, taking under consideration performance, data integrity and security.

The security issues [7] that rise when using internet have been addressed by employing user authentication schemes, Secure Socket Layer (SSL) protocol [8], as well as the use of mechanisms to handle intrusion attempt detection and suppression, as well as Denial Of Service (DOS) [9-12]. The information provided by the system, besides the registration process, includes summarized and extensive grade information for the students. At the same time lists of registered students are available for each theoretical and laboratory course that can be utilized by the administration office and the faculty in order to provide more efficient course schedules, book lists, statistical information etc.

The entire system is based on a flexible programming model that allows easy modification of its operation in order to cover the needs of each department. In addition, an administration interface has been introduced in order to simplify common maintenance tasks.

2 Description of the system

The system is based on the existing method of students' registration renewal application. According to that method the maximum course hours a student is entitled to, are up to 47hours per week. Though, the students of the last semester are entitled up to 57hours per week. All courses are obligatory up to the 5th semester, and then the student must choose among two available directions of study. In addition, there are courses that are prerequisite of others as well as courses that are elective, and the student must select at least one course from a group of 3 or 4 courses.

The system consists of the students interface and the administrator interface.

2.1 Student's interface

Student's interface enables users to perform registration (see Fig. 1) for the following semester in a way that is simplified, straightforward and easy to use. All courses are displayed including the necessary information and all options next to their title. By the use of a single button the student submits the registration form. In the event that an error occurs, the student is prompted to correct the registration form, which is displayed with all the previously submitted courses preselected. This offers the advantage to the student not to fill out the registration form from the scratch.

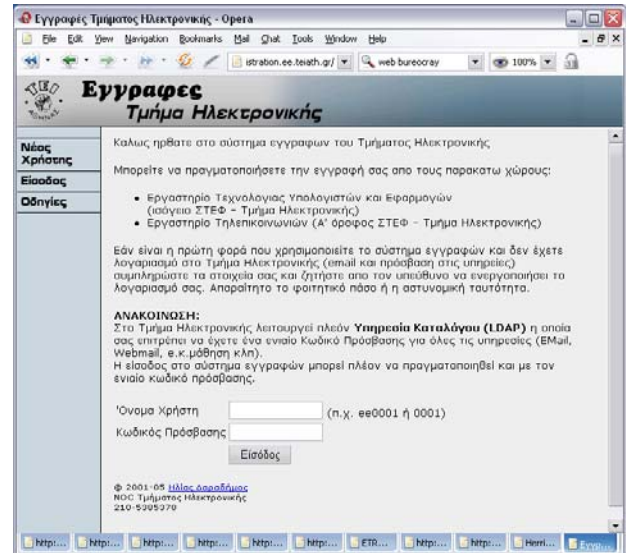


Fig. 1: Student's interface home page enabling user to login to the system, in order to enter the registration procedure.

2.2 Administration interface

The administration interface (see Fig. 2) provides easy access to the typical administrative tasks that have to be performed on the registration system. These tasks include user activation and modification, database synchronization, data integrity checks, system activation/deactivation, notification management and additional data output like name lists per theoretical course, per laboratory course or both.

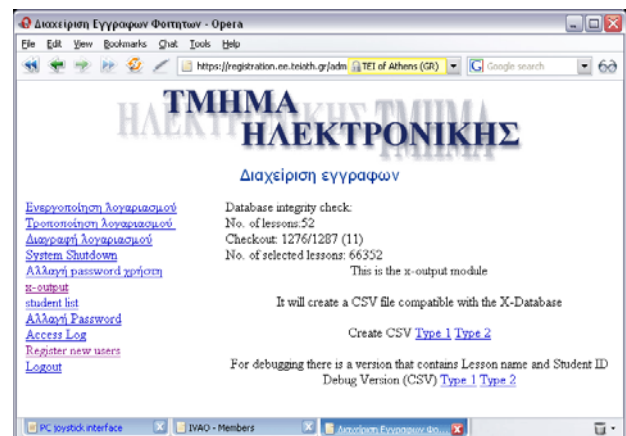


Fig. 2: Administrator interface introductory www page showing the administrator's options

The administration interface provides the following features:

- Registration data output in CSV format
- Students list for each laboratory course.
- Students list for each theoretical course
- User administration
- Data integrity checks

3 Technological aspects

In this section, a brief description of the used technology and concepts is presented, in order to provide the idea behind the system's design and implementation.

3.1 Web interface – programming (PHP)

PHP stands for PHP:Hypertext Preprocessor. It is a server side scripting language developed mainly for web applications, released under open source license. PHP can be highly integrated with HTML code and provides an extensive library for database connectivity. The registration system is built on PHP and utilizes the MySQL connectivity function for data transactions with the MySQL database [5].

3.2 Database system (MySQL)

MySQL is a Relational Database that is distributed under open source license. Several benchmarks place MySQL in the list of the top performing databases. Due to its performance benefits and the reliability, the MySQL database is ideal of web based applications [5].

3.3 Server system (Apache)

Apache web server is an open source project of The Apache Software Foundation. Apache is one of the most popular and upcoming web servers in the internet community that provides great flexibility and expandability without compromising neither performance nor security. Due to its ability to support server side scripting languages like PHP Apache was used as the web server of the registration system [3].

3.4 Security of the system

Security can be distinguished in two main sections. The first one is security against hacking activities [7,9-12] and the second one is precautions against physical damages, in order to avoid data loss.

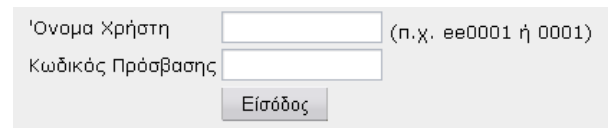
Our main concern was the security of the critical data, as well as data integrity of the registration system. To accomplish an acceptable level of security, the critical data that is stored at the databases of the administration office is not accessible from the registration system. The databases are synchronized manually under controlled environment. Concerning the security of the registration server and data, the use of Linux based operating system provides a robust implementation. In addition, to maintain data integrity, the worst case scenario was taken into account, which is the total and complete physical destruction of the registration server. As a

precaution, the databases are replicated to backup servers and an additional hourly data dump is performed to multiple secure locations. That way, in an event of hardware failure or even system breach, minimum data loss is accomplished.

4 Operation of the system

At the beginning of each registration period, all the necessary data is imported to the registration system from the administration office database, in CSV format, which is flexible and portable among different systems.

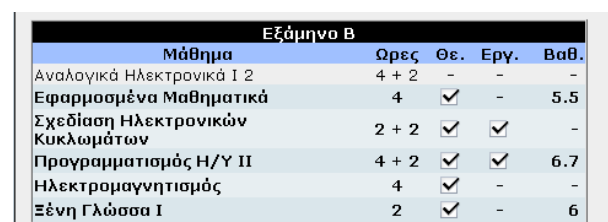
Once all the data is synchronized, the registration system is activated and can be accessed by the students in a 24 hour basis, from any computer that has access to the internet. Students may gain access by using the existing user account information that they use in the department. User login interface is displayed in Fig. 3.



The image shows a user login interface with two input fields and a button. The first field is labeled 'Όνομα Χρήστη' (Username) and has a placeholder '(π.χ. ee0001 ή 0001)'. The second field is labeled 'Κωδικός Πρόσβασης' (Access Code). Below the fields is a button labeled 'Είσοδος' (Login).

Fig. 3: User login interface. The user enters the username given by the Departmental NOC during the first registration.

In addition, there is a feature that permits the creation of an account only for the registration system, as to serve special cases, like students that have just transferred from another school and do not have yet an active student account on the department's services. Once the authentication is successful, a welcome screen provides all the necessary information for the registration procedure [4]. By selecting the registration form, the student is provided with a list that contains all the courses organized by semester. On each line, the course name and the class hours of the course are displayed. If the course is available for selection according to the rules, one or two check boxes appear next to it, depending whether it is theoretical, laboratory or both. Fig. 4 depicts a typical registration form for the second semester of studies, and clearly presents the laboratory and theoretical courses.



Εξάμηνο Β				
Μάθημα	Ωρες	Θε.	Εργ.	Βαθ.
Αναλογικά Ηλεκτρονικά Ι 2	4 + 2	-	-	-
Εφαρμοσμένα Μαθηματικά	4	<input checked="" type="checkbox"/>	-	5.5
Σχεδίαση Ηλεκτρονικών Κυκλωμάτων	2 + 2	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	-
Προγραμματισμός Η/Υ ΙΙ	4 + 2	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	6.7
Ηλεκτρομαγνητισμός	4	<input checked="" type="checkbox"/>	-	-
Ξένη Γλώσσα Ι	2	<input checked="" type="checkbox"/>	-	6

Fig. 4: Example of registration form corresponding to the second semester of studies.

Concerning the different directions, all the courses are available for selection, until the student chooses

a course belonging to one of the directions. When the student successfully attends at least one of the courses that belong to a direction, then the courses that are part of the other directions are not available for selection (see Fig. 5).

Εξάμηνο ΣΤ				
Μάθημα	Ωρες	Θε.	Εργ.	Βαθ.
Ενότητα Υπολογιστικά και Βιομηχανικά Συστήματα				
Συστήματα Αυτομάτου Ελέγχου II 2	4 + 2	-	-	-
Βιομηχανική Αυτοματοποίηση	4 + 2	-	-	-
Διαθητήρια & Διασύνδεση με Η/Υ	3	-	-	-
Δίκτυα Η/Υ	4 + 2	-	-	-
Σύνταξη Μελετών - Νόμοι και Ρυθμίσεις	2	-	-	-
Ενότητα Συστήματα Επικοινωνιών				
Δίκτυα Η/Υ	4 + 2	<input type="checkbox"/>	<input type="checkbox"/>	-
Σύνταξη Μελετών - Νόμοι και Ρυθμίσεις	2	<input type="checkbox"/>	-	-
Κινητές Επικοινωνίες	3	<input checked="" type="checkbox"/>	-	5.2
Ψηφιακές Τηλεπικοινωνίες 3	4 + 2	-	-	-
Οπτική & Οπτικές Επικοινωνίες	4 + 2	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	-

Fig. 5: Form for the selection of courses of the sixth semester where the student has successfully completed one of the courses of the direction.

Once the student has selected the courses that he/she wishes to attend, the registration form is submitted and checked for validity. In the event of an error, like excessive number of class hours, the student is prompted to alter the registration form. When the registration form is selected for a second time, all the previously selected courses appear preselected for convenience. Once the registration form is submitted successfully, there is an option that provides a hard copy. Each student may alter his/her registration form as many times as he/she wishes as long as this is done within the specified time limit which is usually a week. When the registration period is over, all the data from the registration system is extracted, by using the administration interface, which creates an output in CSV format that will be inserted to the administration office database. Students still have access to the system, only for retrieval of information regarding their grades and the classes they have chosen to attend (see Fig. 6). Under no circumstance can they alter any registration information.

Μάθημα	Θεωρία	Εργ.	Τελικός
Φυσική			
Ηλεκτρονική Φυσική			
Μαθηματικά	7	-	7
Ηλεκτροτεχνία			
Προγραμματισμός Η/Υ I			
Αναλογικά Ηλεκτρονικά I			
Εφαρμοσμένα Μαθηματικά	5.3	-	5.5
Σχεδίαση Ηλεκτρονικών Κυκλωμάτων			
Προγραμματισμός Η/Υ II	5.4	8	6.7
Ηλεκτρομαγνητισμός			
Ξένη Γλώσσα I	6	-	6
Αναλογικά Ηλεκτρονικά II			
Ψηφιακά Ηλεκτρονικά			
Θεωρία Κυκλωμάτων			

Fig. 6: Overview of the student's selections and grades

5 Evaluation

The registration system was first tested in February 2001. 60 students took part in this test run. During years 2001 and 2002, the system was evaluated and any problems that occurred were successfully shorted.

This system has the following advantages compared to the traditional in writing registration procedure:

- Registration process has become fast and error free. The previous system in order to function demanded the students' willingness to follow the registration renewal rules and the staff's awareness when checking the accuracy of the forms. This was a very slow process that required the thorough inspection of each application form.
- The new system enables students to register from any place in the world as long as Internet access is available, any time of day or night. According to the previous system, each semester's students had to visit the Department during a predefined two day period, from 9am to 1pm, in order to fill out the application form. During this time, numerous members of the staff were occupied as to ensure the smooth completion of the process.
- The new system automatically classifies the students according to their student id number in the respective curriculum they are obliged to follow.
- Changes of the curriculum are transparent to students, especially when replacing lessons with others. This procedure, after the last change of the Department of Electronic Engineering curriculum, proved to be a significant problem during registration period, causing repeated demands for clarification by students.
- Outside the registration period, students can access their records and check their grades, without having to occupy the the administrative staff.
- The system provides within seconds lists of students qualified to attend each lab course, regardless the number of applications. When the previous system was used, that feature was not possible because in order to generate the lab lists, all the application forms had to be entered to the administration computer by hand. That demanded the re-registration of to students for each lab course. Since there where usually two to three lab courses that were held at the same time, there was a situation where groups of 60 or more students were rushing from one lab to another in order to get their name on the list.

This system is applicable at any curriculum, of any Department of Educational Institution. Special attention was given in the accomplishment of the gradual integration with the administration office database, in order to be as smooth and trouble free as possible. A remaining problem is that the new students must first apply for a Departmental network account, a process not yet been included in the procedure of first registration for the Department of Electronic Engineering. Before the system was used, several tests were performed:

A load test was performed by utilizing 65 workstations within the department that submitted repeatedly registration forms. The average response time was 1-2 seconds per user.

Several attempts were made to alter the data and insert illegal values to the database. All of them were detected by the data integrity system.

Disaster recovery scenarios were tested, including security breach and hardware failure, aiming at the recognition of any weaknesses in the system.

After taking into account all the information provided by the tests, as well as by student feedback, the system has been fine tuned. The system is in active duty, serving the Department of Electronic Engineering of TEI of Athens from September 2001 until today, and handles an average of 1000 student registrations per semester.

6 Conclusions

The system presented provides benefits to both students and administration staff.

Students may perform their registration from virtually anywhere in the world, a feature that cannot be neglected since many students origin from different cities and countries. The registration process is more clarified, students are provided with all the necessary information to complete their registration and the entire process takes only a few minutes.

Concerning the administration staff, this system actually eliminates all the manual data entry that was done with printed application forms. This process that usually required months, now is completed within a few seconds and invalid applications are part of the past. The instant access to the registration data helps the department's administration in his task of proper planning of the resources needed each semester like books, notes or laboratory needs. Additionally, course specific information can be provided to the faculty so that the needs of each course can be covered.

The easy integration into the existing student

accounting system relieves both students and the Network Operating Center staff from the extra burden of maintaining multiple accounts for each service. Last but not least, the economical benefits are considerable, since waste of human hours and materials is drastically reduced. Finally, the implementation of the registration system provides the flexibility of adjustment to future needs.

*This work and its dissemination efforts have been funded by the Greek Operational Programme for Education and Initial Vocational Training (O. P. Education) under the action: 2.2.2. "Reformation of Undergraduate Studies Programs"

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