VIRTUAL COURSES & LAB PORTAL

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Abstract: This paper presents the implementation of a portal dedicated to the academic activities for a specific subject. The portal, designed and developed in TYPO 3, is meant to create a virtual space for learning. The student can attend courses, view slides and run the labs in a virtual environment.

Keywords: portal, TYPO 3, distance learning.

1. PORTAL STRUCTURE

1.1. Why a CMS?

A Content Management System (CMS) is software that runs on a server. Usually being a database application, a CMS facilitates publishing and managing the content.

Advantages of using a CMS:

- **Decentralized Management.**
  Usually based on a common web server. Editing can be done anytime, anywhere.
- **Specially designed for non-technical editors.**
  Individuals with medium text-processing abilities can easily create and add content. HTML knowledge in not required.
- **Configurable access restrictions.**
  Users have permissions and roles assigned that prevent them from accessing content that they are not allowed to change.
- **Design Consistency is maintained.**
  Due to the fact that content and design are stored separately, content from all authors is presented with the same design.
- **Navigation is generated automatically.**
  Menus are generated automatically based on content from the database, making menu broken links impossible.
- **Content is stored in a data base.**
  Centralized storing means that multiple website points can reuse content, and format it according to the user's needs (web browser, mobile phone/WAP, PDA, Printer).
- **Dynamic content.**
  Ordinary extensions like forums, polls. Virtual stores, search engines and news management are usually already implemented. A good CMS allows for user defined extensions.
- **Daily updates.**
  It is not necessary to involve web designers or programmers for daily website updates – you have the control.
- **Cooperation.**
  Encourages frequent updating, enforces editor's responsibility by auditing the presented content through logs and promotes cooperation between authors.
- **Content Scheduler.**
  Content publishing can be controlled by means of time or availability linked to the website's user account.

After a detailed study of existing CMS's, TYPO3 has been selected due to its superior features compared to other CMS's (PLONE, MAMBO, etc).

1.2 HTTP Server

The server that has been used in the implementation is the Apache HTTP Server, which has, at this moment, the largest number of implementations on the Internet. It is a stable and robust solution, free and Open Source, and is continually being developed.

Considering the range of modules and features available, Apache is certainly suited for the application, but the choice was made not only based on this features, but also on the fact that it is free, easy to use, stable and most importantly – successfully used on most internet servers.

1.3 Database server

The TYPO3 system uses, besides the Apache server, a MYSQL server for the database. The system comes with a PHPMyAdmin visual interface that facilitates working with the database.

MySQL is the most popular Open Source system for managing relational databases. A database is a structured collection of data.

A relational database stores data in the form of multiple tables, having the advantage of being faster and more flexible. MySQL Database Server is free, fast, stable and easy to use. These are the main advantages that led to choosing this solution as a database server.

1.4 The programming language used

The TYPO3 system is written in PHP. Aside from the system's core, the TYPO3 programmers can create their own extensions to add functionalities to the already existing functions of TYPO3. These extensions are also written in PHP and are easily integrated in the system through an extension named "Extension Kickstarter"

PHP is a „server-side" language, meaning that it is being executed on the server, and for this reason the website users do not have access to the source code. The PHP code is interpreted not compiled. Before sending the page to the requesting browser, the PHP server interprets and executes the PHP code that comes in between the <?php...?> or <?...?> tags.

Continuing the same orientation, PHP is also free and Open Source
.
The advantage of using the PHP language is that it provides a wide range of choices for the Operating System and for the Web Server. Regarding stability, PHP has the feature of compatibility between older and newer versions, despite the fact that new versions are released in rather short time intervals and come

with important new facilities, which constitutes a very important advantage.

Being written in C and C++, PHP is very fast, compensating the fact that it is an interpreted language and not a compiled language. The 5th version brings a very important feature: Object Oriented Programming. Up to PHP 5 this feature was not present at all, but starting from this version, the programmer has the freedom of choosing between Object Oriented Programming and procedural programming, or a combination of the two.

1.5 Database description

Due to the fact that the TYPO3 system has an impressive number of tables in its core, and almost each extension adds its own tables to the database, the database is too large to be detailed in this paper. For this reason, we will only describe a few tables that are especially important for the VLUPB portal.

The icons from Pic. 1 are described below.

- can edit a record directly from the frontend visual interface

- can delete a record directly from the frontend visual interface

- primary key

- Index

- Unique key

- Fulltext – can search the database using keywords.

These are a few of the created tables:

- Tables that store the website's users.
- *be_groups* and *be_session* tables maintain information about backend user groups and opened sessions. Using this features, the logged on users at a certain moment of time can be identified and pieces of information on this users can be retrieved from the database or processed.
- The fe_users table is probably the most important table and stores information about the website's frontend users.
- The *fe_sessions* table links the session of a certain user to the user's table through the *ses_id* field which is identical to the *uid* field from the *fe_users* table.
- A table created by the Catalog VLUPB Profesori extension is the catalog_prof table
  A table for the assistant teachers is created by the Catalog VLUPB Asistenti extension. This virtual register maintains the activity during the semester.

	Field	Type	Collation	Attributes	Null	Default	Extra	Action
☐	uid	int(11)		UNSIGNED	No		auto_increment	🖉✖📋📝🔽🔟
☐	pid	int(11)		UNSIGNED	No	0		🖉✖📋📝🔽🔟
☐	tstamp	int(11)		UNSIGNED	No	0		🖉✖📋📝🔽🔟
☐	username	varchar(50)	latin1_general_ci		No			🖉✖📋📝🔽🔟
☐	password	varchar(40)	latin1_general_ci		No			🖉✖📋📝🔽🔟
☐	admin	tinyint(4)		UNSIGNED	No	0		🖉✖📋📝🔽🔟
☐	usergroup	tinytext	latin1_general_ci		No			🖉✖📋📝🔽🔟
☐	disable	tinyint(1)		UNSIGNED	No	0		🖉✖📋📝🔽🔟
☐	starttime	int(11)		UNSIGNED	No	0		🖉✖📋📝🔽🔟
☐	endtime	int(11)		UNSIGNED	No	0		🖉✖📋📝🔽🔟
☐	lang	char(2)	latin1_general_ci		No			🖉✖📋📝🔽🔟
☐	email	varchar(80)	latin1_general_ci		No			🖉✖📋📝🔽🔟
☐	db_mountpoints	varchar(255)	latin1_general_ci		No			🖉✖📋📝🔽🔟
☐	options	tinyint(4)		UNSIGNED	No	0		🖉✖📋📝🔽🔟
☐	crdate	int(11)		UNSIGNED	No	0		🖉✖📋📝🔽🔟
☐	cruser_id	int(11)		UNSIGNED	No	0		🖉✖📋📝🔽🔟
☐	realName	varchar(80)	latin1_general_ci		No			🖉✖📋📝🔽🔟

Fig. 1. User storage table

2. THE TYPO 3 EXTENSIONS

TemplaVoila 1.1.1 Extension works together with the *CSS Styled Content* extension. After integrating the extension, a storage folder must be created and a *typoscript* template must be defined in order to instruct TYPO3 how to parse the static template.

Frontend User Registration Extension handles user registrations of new accounts for the website's users. The process is highly configurable and can be very complex if needed. A user must fill in a registration form that will be sent over email to the webmaster (if this workflow is picked up). The system will automatically generate an email that will be sent over to the user with an activation link. When the user clicks this link, his account will be activated and another message can be automatically generated and sent over to the webmaster. This is the default workflow, but this can be changed at any moment of time.

New front end login box Extension (Pic. 2.) handles the authentication mechanism for the users. The extension comes with an element that can be inserted in any page on the website. For the database connectivity it is necessary to specify a *sysfolder*,storage page that contains the *frontend* users. This page can be the website's global storage page, or a different storage page. In this way, two different areas in the portal can be secured independently using the same database and the same table to store the information about the users.

News Extension has its own news creation mechanism. News is created in the backend. In order to create a piece of news, one must access the page

that will hold the piece of news, create a news category and afterwards the news that belong to this news category, or different categories.

Fig. 2. Screenshot of the output of the new front end login box extension

Besides attributes like title, content, etc. news can be scheduled to be published at a certain time, or set viewing permissions for users. For example, in the same news category, the assistant teachers can see news that is invisible to the students.

A piece of news can have images, files attached or external hyperlinks.

CHC Forum Extension consists of a forum that offers the students and teachers all typical facilities of a forum. *The CWT Community Extension* is a plugin that ads to the forum a *buddy list*, *private messages* and a *list of forum users*.

The forum is a collection of Categories, and in each Category, Discussion Threads can be defined. A Category can be visible for all users or only for certain user groups. This enables for teacher-teacher discussions without the possibility of a student finding out sensible information that he should not be able to access.

All forum elements are stored in the forum's *sysfolder* page. Each *Category*, *Conference*, *Group*, *Post*, *Message* or *Thread* can be viewed and/or modified in the backend, accessing the *Storage Folder* page.

WEC Flash Presentation Extension manages the virtual course section. It can be easily installed with the *Ext. Manager* and facilitates the creation of video and audio presentations. For the virtual course I have chosen the video presentation module.

In the Slides Images and Timings tab, slides (in .jpeg format for example) can be linked to the movie. Due to its reduced size, I have chosen the.flv format (Flash Video) for this course. The same movie, encoded in .avi format had 1GB, in mpeg2 format it had 130MB and in.flv format it only has 8MB. Changing the encoding can be done importing the .avi movie in Flash Professional 8 and exporting the file in.flv format (Flash Video).

References Extension (Catalog VLUPB Profesor) is an extension entirely developed for this portal. A TYPO3 extension is developed starting from another extension, called *Extension Kickstarter*. This extension takes care of the link to the database and enables the visual creation of database tables as well as settings related to the TYPO3 system and the options that the user will have when interacting with the extension.

The facilities offered up to this moment are: inserting new students and editing the information about already existing students.

Of course that only a user from the teacher users group can access this register. Once authenticated, the teacher can view the register with the status of each student, and a form through which he can update the existing information or add new information. Once filled in and submitted, the name is checked against the already existing names.

Fig.3. Virtual register

Catalog VLUPB Assistant Extension is also a completely developed extension especially for assistant teachers. It allows them to mark attendance during the semester and to give each student a final grade.

Fig.4. Register for assistant teachers

Catalog VLUPB Student Extension results from the Catalog VLUPB Profesor extension and allows a particular student to see his situation only, not being able to see the grades of his colleagues.

3. IMPLEMENTED MODULES WITHIN THE PORTAL

3.1 Virtual course module

Course pages from different subjects are designed to host downloading for students. Depending on the teacher's preferences, these materials can be distributed automatically for all website's users, or only for registered users. One can of course, combine the two possibilities.

The page that contains the virtual course can be subject of the same restrictions as above. In order to provide the easiest format in means of reusability, I have implemented this section with the *WEC Flash Presentation* TYPO3 extension. This extension takes as parameters one or two video files (low-resolution and high-resolution) and a number of slides, providing the possibility of synchronizing the slides with the video. Furthermore, the student can go beyond the simple role of beholder and can control both the slides and the video independently, or synchronize them.

In the *Teme de Casă (Homework)* section, students can directly upload their homework on the server. This feature is brought by the *File Upload* extension. On the respective page, visitors can view the homework in PDF format and are given the opportunity to log in, in order to be allowed to upload the homework.

Fig.5. The Homework Upload module

3.2 The Virtual Course module

The Virtual Course module is implemented using, the MYSQL database and Flash technology, along with PHP. The extension used to carry out this task is called *WEC Flash Presentation*. This extension takes as parameters a video file and a series of slides that must appear at a certain point in the timeline. The video course (the teacher's presentation) can be synchronized with the slides. The slides can present any kind of content – text and images. By changing the slides very fast, even the impression of animation can be achieved for the slides, if needed.

The extension is configurable by means of FlexForms. After introducing all necessary data, the extension generates an interactive flash movie that contains all the elements added in the Backend, presented in the Frontend.

3.3 The Register Module

The Register module is made up of three separated extensions: the first one features a Teacher's Register, the second one features an assistant

teacher's register and the third one provides a register for the students. The extensions are developed based on another extension provided by TYPO3 that allows for creating common elements to al extensions as database connection and a series of necessary php files. Developing the extension is achieved by modifying these .php files.

3.4 The download module

The purpose of this module is to provide additional materials on this portal. Once a need is expressed, this section will develop in respect to the needs of the teachers.

3.5 The news module

The engine of this module is provided by the well-known tt_news extension, in the TYPO3 community. Due to the fact that its features and usage is described in the *Mic Tutorial de Utilizare* chapter, I will focus on presenting a few configurable elements of this extension. The Constants table features 46 elements, some of the most interesting being listed below:

- show related news by category – if activated, the SINGLE viewing mode will show a list of other news from the same category.

- Date time Days to Archive – if activated, elements are automatically added to the archive after a set number of days

- show category rootline – shows the complete path of the category from which the piece of news is a part of.

3.6 The forum module

The forum available on the VLUPB portal is another extension developed in TYPO3, called CHC_Forum. It is implemented as a *frontend* plugin and it is especially developed for the academic environments.

The forum can be managed in the *Backend* – everything that is related to *Categories* and *Conferences*, user management and table maintenance. Due to the fact that the forum completely integrates in the TYPO3 system's core, the same user accounts that are used to secure for example, the Register section can be user automatically to log in on the forum.

Using other integrated extensions, the VLUPB Forum offers community features and includes an interface for creating a user's profile, for communicating with other users by means of private messages and create a buddy list, having the possibility of knowing when this friends are online.

The VLUPB Forum logs for each user the topics that have been viewed and the topics that are new, and marks them differently.

An interesting feature is the possibility of attaching files to the thread's posts. These files are verified against a list of allowed extensions and MIME types.

The auto-pruning feature of the forum allows for the automated deletion of posts older than a set interval of time.

3.7 The research module

This section is intended to present the research projects that are already completed, undergoing or just an idea yet.

The main page maintains a list of links to all the projects. A project page includes text elements for a brief description of the project and possible contact details, a *filelinks* element for providing extra files and an *Images* element for presenting a few images about the project.

3.8. The registering module

The website's users can log in many sections of the portal, depending on the context and needs. However, for the sake of standardization, this section offers the possibility of creating a new account, or log in on the website. For the registering module, the *Frontend User Registration* extension has been used.

3.9. The Virtual Lab module

This module is especially designed for experimenting of different hardware platforms highly available to the user.

The development boards are based on FPGA circuits and are powerful enough to allow for the implementation of any academic application. In the case of an especially resource-demanding project, the administrator can be alerted via email and he can connect several development boards. This will increase the resource level of the programming environment.

In picture 6 we can see the login interface of this module.

Once the user has logged in the virtual lab, the first idle board is assigned to him. In the new window, the user can upload the .BIT file directly on the development board.

In a few seconds he is presented with the result of the hardware implementation and can verify if his implementation is correct or not.

Fig.6. Authentication in the Virtual Lab module

Once the user has logged off, the hardware management module of the development boards resets the respective board so that the next user can test his hardware projects in default conditions.

The hardware management module shuts down the boards if they are not being used for more than 20 minutes.

The same hardware management module powers on the boards if somebody is trying to access a board that is powered off.

CONCLUSIONS

The purpose of this project is to provide both the teachers and the students with a working tool that will complement the time spent in the course and lab classes.

Due to the modular structure of the TYPO3 system based on extensions, adding a new module to the actual portal is very easy - even the dynamic menu is automatically updated with the new pages and contents.

One of the functionalities that can extend the Register module is adding graphics that would position the efforts and results of a student compared to his colleagues so that a student can evaluate his performance compared to his colleagues, without knowing their confidential grades.

Another enhancement can be brought to the register to make it easier to use in the production stage is the option of adding all the students in a single working step, by means of importing a file provided by the secretary office.

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