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Application for measurement and analysis of the behavior of students during a course using the UWE (UML-Based Web Engineering) methodology

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Abstract. The Academic Computer Systems Department of the Autonomous University of Baja California Sur has been implemented as one of the strategies to reduce dropout and failure rates, measure and analyze the academic performance of each of the students during the courses, to identify factors that may influence academic performance. This requires having a tool that facilitates the teaching record each student's work during the course, and that this information is available throughout the course period. This paper describes the development of a web application that allows the teacher to keep track of the activities within the classroom, in an efficient, easy, convenient, anywhere Internet access is presented. This application concentrates in one place the information regarding the academic performance of students by providing access to reliable and timely information to the decision maker.

Keywords: Web application, UWE.

1 Introduction

The academic performance of college students is an essential factor in the study of the issue of quality in higher education, because it is an indicator that an approach to the educational reality [1]. The study and analysis of the academic performance of students constitute a powerful tool to build indicators to guide decision making in higher education. One of the most important challenges in the teaching-learning process turns out to be the measurement of student achievement because when it comes to evaluate it and how to improve it, the factors that may influence it are discussed in greater or lesser degree, usually consider, among other socioeconomic factors, range of curricula, teaching methodologies used, the difficulty of using a customized education, previous concepts with students, as well as the level of formal thought thereof [15 ].
Each college determines its own evaluation criteria to obtain a weighted average (rating) of the subjects that the student attends. Among the aspects that are generally considered to measure the academic performance of each student in a particular course work, assignments, tests, class participation are, among others. School attendance refers to the student’s presence in the lessons. In research conducted with college students, it was found that motivation is associated with attendance, and that the absences of the lessons are related to problems of repetition and drop to studies. The more support, better grade, attendance is one of the most significant variables influencing student achievement. In the Academic Department of Computer Systems (DASC), studies for the academic track students has found that a significant percentage of students do not regularly attend classes, causing this that their academic performance is not desirable, as Consequently problems of repetition and / or dropout occur. That is why the DASC has been implemented as one of the strategies to reduce failure rates and dropout consider attendance as part of the evaluation criteria of students. The educational programs offered at DACS are based on competency-based education model, which considers the evaluation of the student in addition to knowledge and skills, attitudes and values should include. That is why teachers keep track of attitudes and values present in each of the students in a course. Having the registration of each of the activities is a recurring task. Traditionally registration is done manually or through the use of an electronic spreadsheet. The process the information generated is a big problem if the registration is done on paper. To generate new information from these data, a great team and a lot of time in the search for the required data is needed. Another problem is human error. Furthermore, the process information from spreadsheets becomes a problem because of the different formats that can be handled for each of the subjects. This paper describes the development of a web tool that allows teachers to keep track of each of the activities of their students in the subject of an efficient, easy, and convenient way from anywhere (classroom, laboratories, health presents convention halls, etc.), including the record of attendance for each session, and qualitative assessment of attitudes and values. This system will concentrate in one place the information regarding the academic performance of each student in each subject, to allow access during the course of the decision maker.

2 Theoretical Framework

A brief description of the modeling methodology and the various web technologies and protocols that were selected for the development of the web tool is presented in this section.
2.1 WEB application

It is a software system based on technology and standards of World Wide Web Consortium (W3C), which provides Web-specific resources, such as content and services through a user interface such as a Web browser. [6]. The application is developed in a language that can be executed by Web browsers. The architecture of a Web application is usually structured as an application of three layers: 1) The client application, 2) Application Server, and 3) Data server.

2.2 UML-based Web Engineering

The UML-based Web Engineering (UWE) is a proposed methodology focused on modeling Web applications based on semantic extension of UML using stereotypes, and new diagrams to model specific aspects of Web applications. Integrates concepts of UML and OOHDM (Hypermedia Design Model Object Oriented) [7] methodology. UWE has adapted to the new features of the web systems and transactions, customizations and asynchronous applications, on the other hand has evolved to incorporate techniques software engineering and aspect-oriented modeling languages and new processing to improve design quality. [11] Its development process is based on three main phases [9], which are shown in Figure 1.

![Fig. 1. Main phases of UWE.](image)

- **Requirements phase.**- Treated differently information needs, the needs of navigation, adaptation needs and user interface as well as some additional requirements. Work focuses on the study of the use cases, generating glossaries and prototyping UI.
- **Analysis and design phase.**- UWE distinguishes between conceptual design, user modeling, navigation, presentation, adaptation, architecture, detailed design of the classes and the definition of subsystems and interfaces.
- **Implementation phase.**- UWE includes implementation of the architecture, the structure of the hyperspace, the user model, the user interface, the adaptive mechanisms and tasks related to the integration of all these implementations.

2.3 Web technologies

For the development of applications using Web technologies is required, some of which are listed and briefly discussed:

- **HTML** (HyperText Markup Language) is a markup language defined as standard. This standard was developed by the World Wide Web Consortium (W3C). It is based
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on SGML (Standard Generalized Markup Language). It is used for developing websites, and is understood as a system to sort and label various documents in a list [4].

**PHP** (HyperText Preprocessor) is a programming language designed for creating dynamic web pages with features that facilitate the design and programming. Based on the syntax of C, but more simple, taking the web development needs [12]. The language of PHP can work tightly with virtually all databases, allowing to handle connection and communication with the database.

**JavaScript**: Interpreted programming language. It is mainly used in form client side, implemented as part of a Web browser enabling improvements in the user interface and dynamic Web pages [4].

**CSS**: The cascading style sheets, or CSS acronym, is a language used to define the presentation semantics (the look and formatting) of a document written in HTML structured or XML (and by extension in XHTML) [4].

**AJAX**: Asynchronous JavaScript And XML, is a Web development technique for creating interactive applications. These applications run in the user's browser while asynchronous communication with the server is maintained in background [13].

**jQuery**: is a JavaScript library. Simplify the form of interaction with HTML documents and adds interaction with AJAX Web pages.

### 3 Design and development of application

For the development of the tool UWE (UML-Based Web Engineering) methodology was used, applying the three main phases.

The tool is part of the integral system of DASC, which is called SIDASC and consists of five modules. Control Module Attendance and Evaluation requires the information generated in the capture module academic loads and class schedules. It also requires information of the Integrated Management Information SIIA named the institution, which provides data of students enrolled in each subject per semester. Figure 2 shows the general diagram of SIDASC and interconnection of the modules shown.

![Fig. 2. General diagram SIDASC](image-url)
Through the Control Module and Evaluation Assists the teacher can record each of the activities that are developed during the course for each student registered. The record of the activities can be performed through the web application or through the mobile application. In figure 3 shows the diagram representing the general idea of the tool.

![Fig. 3. Overview of the tool](image)

The tasks required for the automation of the registration process of assistance and evaluation are:

- Incorporate information from students enrolled in each course, from the SIIA.
- Manage the information regarding the registration process assistance and student assessment.
- Keep a record of attendance of each student per course.
- Keep a record of partial and final evaluations of the student in each course.
- Keep a record of evaluations of the attitudes and values of each student in each course.
- Keep a record of the assignment of each student computer in the computer labs.
- Generate reports and statistics current support and evaluation, as historical.

The fundamental requirements of the tool are illustrated in Figure 4, this shown the context of the tool through a use case diagram, which shows a set of cases, actors and relationships.

The actors interact with the system are:

**Administrator** - The person responsible for operating the system.

**Teacher** - The person responsible for capturing the attendance and evaluation system of students in their course.

**Student** - The person responsible for recording the equipment used in a laboratory session.

**SIIA** - It is the system that generates information concerning students, courses and teachers.

**SIDASC** - Modules that supply information to the system in terms of academic assignments, schedules, classrooms and teachers.

The use cases for the application are:

- **Assistance Check**. Allows record attendance of each session in the system.
- **Laboratories Check**. Register the use of a computer for each student in a computer lab during the session time.
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- **Activity Check.** Registers for each student ratings of various activities: evaluations, homeworks, papers.
- **Final Evaluation.** Registers for each student's final grades in the course.
- **Attitudes and values.** Registers for each student a qualitative assessment of the attitudes and values that were present for the student during the course.
- **Add students.** It allows the teacher to enroll students who are not enrolled in the course appear.
- **Generate reports.** Lets get various reports of the activities recorded during the course.
- **Import data from students.** System can incorporate information from the SIIA of the subjects currently enrolled a student with a teacher in a given period.
- **Send message.** Allows to send messages to teachers.

**Fig.4. Use cases for web tool actor.**

Figure 5 shows part of the model entity - relationship database that is used for storing information integral system of DASC.

**Fig.5. Entity-relationship diagram of the integral system.**
In the design phase to support the different models such as the methodology were made: Model Conceptual Model Navigation Model Presentation and Process Model. After the design phase proceeded with the implementation phase for the development tool PHP, JavaScript, Ajax, CSS and database handler was used MySQL.

4. Application

To show the operation of the tool, are shown some of the screens that are part of the tool.

![Logon Screen](image1)

Fig. 6: Logon Screen.

To enter the system is required to authenticate via a user account. In Figure 6 the logon screen is displayed. Once connected to the main system screen provides a list of courses that the teacher is assigned to a specific period. Once connected to the main system screen provides a list of courses that the teacher is assigned to a specific screen in this period are also shown, if any, custom or group administrator can send messages to each teacher. Figure 7 shows the screen where the course is selected by the teacher wants to work.

![Course selection screen](image2)

Fig. 7: Course selection screen.
When the teacher selects the course, the tool displays students who are registered in the course, which are shown with a green flag. If a student does not appear in the list, the teacher can submit it in the system, only to control its course, and is shown with a yellow flag. It also provides the different options that can be performed. In Figure 8 the screen where the teacher can record attendance per day is shown for each of the students.

In the event that the class is taught in a computer lab, a computer must be assigned to each student. Figure 9 displays where each of the students enters the control number is assigned equipment, and the system displays the teacher to the computer equipment in which the student is working, to record attendance class.

Fig. 8: Attendance record screen.

Fig. 9: Access control laboratories screen.
The tool allows the query behavior of assists for each of the courses. The consultation can be done monthly or global, and this query can be exported to a file in Excel format. Figure 10 shows the screen where the assistance abstract presents a course.

For the record assessments, teacher indicates the number of partial qualifications as well as the percentage and to assess aspects within each partial evaluation. In Figure 11 the rating of the first set to each of the students in a given subject is shown as well as the breakdown of the partial qualification.

Finally the system has the ability to obtain reports from both the behavior of subjects as the individual performance of each student. In Figure 12 we can see the behavior for each group, presenting a summary for each subject taught.
5. Conclusions

The application developed is a tool that facilitates the teacher control the activities of each course they teach, in an efficient, easy way, anywhere with internet access. The teacher can record for each student attending each class, test scores, jobs, internships, final grade, and assessments of attitudes and values. Through the application is concentrated in one place the information about the registration process and student assessment in each subject, and so the person responsible for the administration can obtain timely and reliable information to serve as a support to the decision making.

Having this tool allows to demonstrate the academic performance of each course as well as the behavior of each student during the school year. It also allows control of the hours dedicated classroom teacher against the advance-course in the school curriculum. Knowing the different factors affecting the academic performance of the student in a comprehensive manner, allows for both qualitative and quantitative results to promote a more comprehensive approach to decision-making.

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