

# Educational Process Management System

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## ABSTRACT

The important part of educational process for each university is the part related to organization of exams and assessment of students, for automation of which a special system (called IAMUniver) has been designed and implemented. Besides handling the process of examination, this system also automates some administrative parts of educational process, such as management of educational modules, information of students, etc. This system is now being used in the faculty of Informatics and Applied Mathematics on a test environment.

## Keywords

Education, exam, assessment, administration, management

## 1. INTRODUCTION

There are several approaches for the management of educational process of the university and particularly for the management of examination process:

- Manual approach, which implies all processes to be carried out manually by using papers.
- Semi-automated approach, which implies automation of some parts of educational process, but some stages of educational process still are being carried out manually by using papers.
- Fully-automated approach, which implies automation of all processes without any need of using papers.

Manual processing and usage of papers are the main drawbacks of the first two approaches: manual processing needs more human and time resources, the sheet of paper could be damaged or lost, the important documents could be easily falsified etc. Particularly the latter is evident in the process of examination, when keeping official student assessments in papers increases the risk of having unauthorized changes in assessments, which could not be easily detected. The system described in this work uses the third approach and has been designed in a way to avoid the abovementioned drawbacks.

## 2. ARCHITECTURE OF THE SYSTEM

The system has been designed as a client-server application and consists of the following layers (Fig. 1):

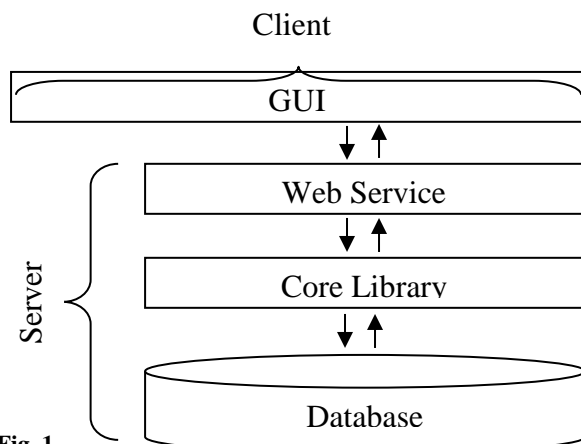


Fig. 1

- Database - is responsible for storing all data related to the educational process of the university.
- Core Library - is responsible for implementation of business logic of the educational process.
- Web Service - is responsible for interaction between client and server parts of the system.
- GUI - is the part of the system, which is directly used by end users for doing necessary operations according to their roles within the whole educational process.

Only the last layer (GUI) from the layers described above is running on client devices. The other three layers are running on the server computer. It is possible to have a separate server for the database layer.

### 2.1. Database Layer

The database layer is the relational database [1], which has been designed using Microsoft SQL Server [2]. In that database you can find tables for storing information about students, groups, faculties, lecturers, exams, assessments, educational modules and other data related to the educational process. Besides those tables, it contains also stored procedures and functions, which are used by the above layer for managing data stored in the database.

### 2.2. Core Library

This layer is represented by one .NET assembly [3], which contains all the necessary classes for implementing business logic of the university educational process. Implementation of business logic implies also validation of input data and permissions, handling of exceptional situations, possibility of transactional data manipulation and other important abilities needed by the web service. Core library uses database layer for storing/retrieving the data and is used only by the above layer.

### 2.3. Web Service

The interaction between the client and the server is provided by the web service, which has been developed using WCF Framework [4]. It gets the commands from the GUI, performs the appropriate operations using the core library and sends the results back to the client. Such design of the system allows the client GUI application to be developed for any platform, using any technologies without need of duplicating the business logic. The other advantage is the independence of the client part from business logic and database schema, i.e., once the interface provided by the web service has been established, any changes related to the implementation details of business logic or database schema will not lead to the changes in the client part and, vice versa.

### 2.4. Graphical User Interface

This is the client part of the system. The end users can see and interact only with this part of the system. The first GUI application has been designed and implemented as a desktop application for Microsoft Windows platforms using WPF framework [5]. This kind of approach allows the end users to get their work done from any machine on which the application can be installed and from which the web service

is available via network. GUI consists of several logically separated parts. The main sections are Students, Groups, Professions, Faculties, Lecturers, Queries, Modules, Curriculums, Exams and Workflows. Each section allows the end users to work with appropriate objects.

The sections Students, Groups, Professions, Faculties, Lecturers, Modules and Curriculums are very similar with their functionality and mainly offer the ability to create, edit, delete or view appropriate objects, which are necessary for the educational process.

The section Queries allows the users to create different queries against students, groups, exams, student assessments, modules, etc., and to retrieve necessary information related to the educational process by executing created queries.

The section Exams is one of the important sections. Here lecturers and worker users can do operations concerning the process of examinations. The worker users can only create or view the exams. For each created examination a lecturer is assigned, which is the only user allowed to fill assessments for this exam. Also each exam has duration attached to it and the assessments for that exam should be submitted within that period. In the section Exams lecturer users can see all the exams attached to them for the current year. After selecting the necessary exam, the lecturer can see the list of students of that exam and available assessment options in front of each student (Fig. 2). After filling the assessments for each student, lecturer can save or submit them. System will not allow submission of assessments, if they are not filled for all students or if there are any validation problems. Assessments can still be edited after saving them, but will become “read only” after submission. It is also possible to change the submitted assessment if required. To accomplish such operation, the lecturer needs to send the assessment change request to the responsible user, who can approve or reject it. This process is implemented as a predefined workflow in the system.

Քանոնադրություն	Մասնակցություն	Մարտի 1	Մարտի 2	Մարտի 3	Մարտի 4
ԲԱՆԱԿԱՐԱՆ	Մարտի 1-ի արժեքները	0	2	0	2
Մասնակցություններ	Մասնակցություններ	1	2	1	2
Ցուցանիշներ	Մասնակցություններ	3	3	1	3
Պատասխաններ	Մասնակցություններ	3	2	1	3
Մասնակցություններ	Մասնակցություններ	4	3	2	4
Մասնակցություններ	Մասնակցություններ	3	3	2	3
Մասնակցություններ	Մասնակցություններ	2	2	2	2
Մասնակցություններ	Մասնակցություններ	3	4	1	0
Մասնակցություններ	Մասնակցություններ	3	1	2	3
Մասնակցություններ	Մասնակցություններ	4	2	2	3
Մասնակցություններ	Մասնակցություններ	0	1	2	2
Մասնակցություններ	Մասնակցություններ	4	3	2	0
Մասնակցություններ	Մասնակցություններ	7	3	3	6
Մասնակցություններ	Մասնակցություններ	1	2	2	7
Մասնակցություններ	Մասնակցություններ	3	3	2	8
Մասնակցություններ	Մասնակցություններ	3	4	2	9
Մասնակցություններ	Մասնակցություններ	3	1	1	0

Fig. 2

### 3. SECURITY

It is very important to take care about the security of whole data kept by the system and related to the educational process, which means, that the data must be accessed or changed only by authorized individuals. As mentioned above, the usage of web service makes impossible accessing the core library or database from client devices. So, the only method for viewing or changing data related to the educational process outside the server is through the usage of web service. Hence, web service must be configured so as not to allow unauthorized operations to be handled via the system.

#### 3.1. Authentication

This step is one of the important aspects of the security, which implies identification of the user, who uses operations of the web service. In our system the mechanism based on

username and password has been used for identifying the client. So, users are required to sign in to the system using their usernames and passwords before performing any operations in the system.

#### 3.2. Authorization

After identifying the person, who requests some web service operation to be carried out, server needs also to check whether that person is allowed to perform the requested operation or not. In our system this process is accomplished by using a role-based authorization mechanism. Users can have more than one role attached to them. System is using three predefined roles, but it is possible to add new ones. The predefined roles are the following:

- Worker role - users with this role have access to the administrative operations of the system, such as creating, editing or deleting logical objects, creating exams and assigning a lecturer and duration to them, approving or rejecting assessment change requests, etc.
- Lecturer role - users with this role can view logical objects related to them and work with their own exams. Each lecturer can view, fill assessments or send assessment change requests for the exams attached to them.
- Administrator role - users with this role are able to manage other users and their roles. The other important feature of the administrator role is the management of workflows. Users of this role also can view all the logical objects, but are not allowed to change or delete them.

#### 3.3. Data transfer

The two methods described above are useless when the information is open during the transfer and every third party can read and modify it. To handle this issue data must be transferred in encrypted form. In our system web service is configured so as to use https protocol for transferring data between the client and the server in a secure way.

#### 3.4. Data integrity

Even if there is no way to make unauthorized operations outside the server, there are still individuals (e.g., server administrators), who have full access to the server and to the database. So, they could manually change any data related to the educational process. To minimize the chance of having such unauthorized changes, some mechanisms have been implemented in the system, which will ensure integrity of important data (e.g. student assessments) and will automatically detect the unauthorized changes.

### REFERENCES

- [1] H. Garcia-Molina, J. Ullman, J. Widom, *Database Systems: The Complete Book, 2nd Edition*, Prentice Hall, 2008.
- [2] P. LeBlanc, *Microsoft SQL Server 2012, Step by Step*, O'Reilly Media, 2013.
- [3] A. Troelsen, *Pro C# 5.0 and the .Net 4.5 Framework*, Apress, 2012.
- [4] J. Lowy, *Programming WCF Services, 3rd edition*, O'Reilly Media, 2010.
- [5] C. Sells, I. Griffiths, *Programming WPF, 2nd Edition*, O'Reilly Media, 2007.