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Article

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Automated System for Exam Management

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Abstract

The exam process is a core procedure in every educational organization. Some exam organizers have a large population of examinees that need to be managed with limited resources in a specified time schedule. The expected population of exam attendees can only be predicted at a maximum level, which results in organizational issues. Whenever the population is underestimated, there is confusion and irritation;, when they are overestimated, there is a waste of resources.

This automated system was developed to provide an online timely seat reservation for students. The application presents available seats from which the student selects their preference. As a result, the lecturer can predict the actual number of students who will be taking the exam and the organization of the exam is much more efficient in terms of time and resources.

The application was developed and installed in an Apache server of the Applications of Artificial Intelligence, Data, and Signal Management Lab of the Technological Education Institute of Western Macedonia. Its implementation is based on an MySQL database that contains the examined courses, the possible examinees, the available rooms with their ground plan of possible seats, the examiners, and other necessary data for ensuring access to information and information integrity. The application was developed using the yii2 framework, which fully satisfies the needs of the application.

It is estimated that the utilization of the application can significantly reduce the time spent seating students, save an estimated 20% of resources, prevent the participation of ineligible examinees, and provide data for future analysis.

The system can be extended to a mobile app and can be further improved with additional applications such as SMS notifications, the verification of the ID of students by adding their photo in the database, etc.

Keywords: Informatics System for Exam Management, Knowledge and Information Management System, Research and Development, Technological Innovation

JEL classifications: M15, O32

Introduction

The exam process, especially in situations with a large number of examinees such as national exams, course exams in third level institutions and ASEP (Supreme Council for Civil Personnel Selection] selections, demands effective and timely organization that should be as efficient as possible.

For example, in second-level final exams in Greece, the structure of the exam centers consists of the allocation of examinees to exam rooms, their seat placement following a specific rule (usually alphabetical), placing an information sticker on each desk with the examinee's information, the creation of lists with the full information of the examinees per exam, and the scheduling of the required number of supervisors per exam room. The students, in turn, especially on their first day, are urgently looking for their allocated seat, causing delays and irritation in an already stressful situation where all the participants agree that peace and quiet should prevail.

Today's new technologies, in combination with their complete penetration in the age and educational level of our target group, carry hope for solving the problem.

The application presented here concerns the capability of reserving an exam seat (desk) per examinee student a few days before the arranged date of the exam. The application suggests a more effective structure of the exam procedure with the goal of improving both the environment and the mood of the exam, and to offer the capability of a better system for the organization carrying out the exam.

This article presents the application as part of a larger information system of exam management. The application allows students, via the Internet, to declare their interest in taking the exam and reserve a seat in the room of their choice. In this system, each examiner can select the exam rooms, according to the number of the students, and when they are filled with a predetermined percentage, the system adds new seats or new rooms. The process is completed a day before the exam date so the examiners know the exact amount of students participating and can determine the necessary resources and manpower.

Current state of affairs

The current process for third -level institution semester exams in Greece is summarized as follows. Some days before the start of the exam period, the exam schedule is announced. This includes the duration of the exam, its date and time, the lecturer, and the exam rooms. The lecturer has a list of students that qualify for examination and based on this they estimate the number of photocopies of the tests that are needed. They also know the number of supervisors assigned to the exam. At the time of the exam, the examinees crowd the entrances of the exam rooms in order to identify their preferred seat. If the number of students is large, this happens simultaneously in multiple rooms. Sometimes the allocated rooms aren't enough, and more are required, resulting to the examiner urgently looking for other available spaces or even placing examinees in rooms where another exam is being conducted. This results in potential lack of supervisors. Alternatively, if the number of participating students is

overestimated, the students will be unessecraily dispersed over a number of rooms and it takes time to rearrange them so that less rooms and supervisors are being used. This results in unused reserved rooms and surplus supervisors that could be used for other exams (Davenport & Prusak,1998).

This situation is problematic and has the following drawbacks.

- The exact number of students participating in each exam is unknown
- The space needed for the exam is unknown
- The necessary number of supervisors is unknown and they can't be allocated throughout the space in an ideal way
- The number of photocopies required for the exam tests is unknown
- A large amount of time is spent in seating the examinees, sometimes resulting in delays for the next exam taking place in the same room
- Due to the time pressure, instead of the peaceful environment needed for the exam process, irritation can arise
- There is no data collection and information from past exams is not used to create a better understanding of the needs of future exams (Laudon K. & Laudon J., 2009)
- Some of the students are not eligible to take the exam. This is identified only after correcting the exam; therefore, a seat was unnecessarily taken and human and material resources were wasted

The suggested automated seat management system promises to improve the situation and has the following advantages.

- It is possible to determine the exact amount of participating students
- It allows for scheduling of exam rooms and the required amount of supervisors
- The examinees are seated immediately and the exam process can start without delays
- Only the exact amount of tests needed are photocopied
- There is no friction and the environment of the exam process is peaceful
- The same room can be combined for the examination of two different courses, by placing the students in a predetermined way to ensure the validity of the exams
- The students who are not eligible to participate in the exam are not allowed to enter the room and take a seat
- Detailed data are recorded for the number of participants and the exact seating of each student. This information can be used as experience for production of knowledge (Walczak, 2005).

Design

The application was designed with the prospect of serving the current system of exam process. Also, the system was designed, at its current phase, to work independently from existing student systems.

The information required for using the application are taken from the course's secretarial office and are as follows.

1 The personal information of the students
2 The modules of the courses

3 The students who are participating in each module
4 The lecturers of each module
5 The available exam rooms
6 The floor map of each exam room with the seats available

The physical numbering of each seat, corresponding to the numbering system used on the website, is also needed.

The users of the application are:

1 The students
2 The lecturers
3 The secretarial office

Requirements

The EXAMPOS (Electronic EXAmination POSition) application includes a database, the forms for information input, the routines, and the applications that are comprising the whole exam system (Valacich, Joey & Hoffer, 2015).

The database was designed, created, and functions using MySQL, which is open source and widely used.

The database entities, the relationships that connect them, and their fields are available in Figure 1 (Silberschatz, Korth & Sudarshn, 2015).
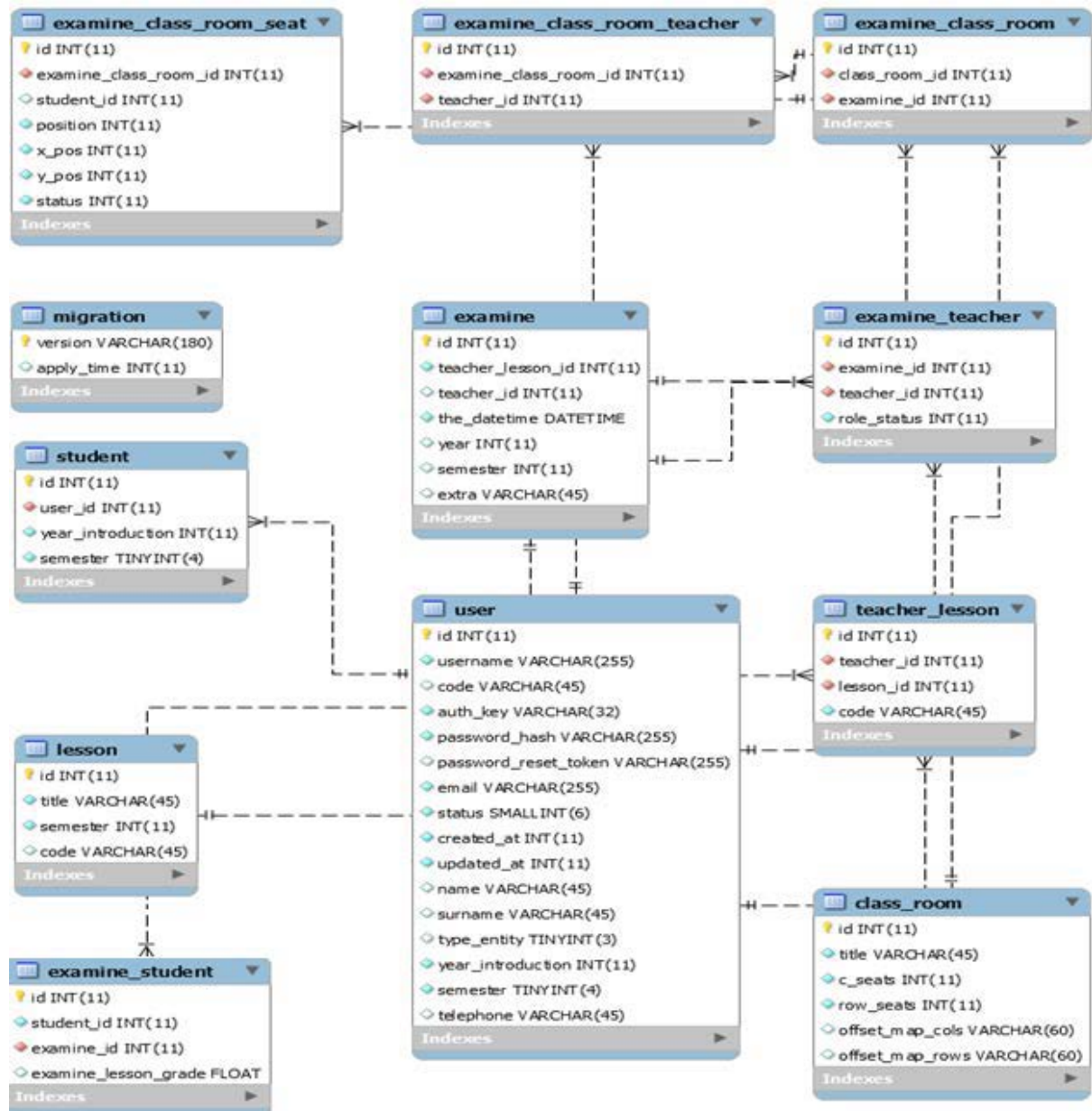
Figure 1. Diagram of Exampos entities

The system assigns various roles to its users, with different rights attributed to each role. Thus, the "users" table contains the students, the lecturers, and the main system administrator. The main system administrator has the rights of all users, the courses, the rooms, etc. The students are limited to the right to reserve a seat for an exam that they are eligible to participate in, and to receive notifications. The lecturer has the right to choose the exam rooms and receive notifications on the progress of the reservation for their courses only. The diversification happens in the field "type_entity" in the table "user" where the value 0 is used for students and 1 for lecturers (Deitel P. & Deitel H., 2008).

Development Tools

For the development of the application, the Java Development Kit, jdk-8u151-windows-x64 and Netbeans IDE 8.2 from Oracle were installed on a

local computer. To those, the plugin org-nbphpcouncil-modules-php-yii2-0.0.3.nbm was added to allow development of yii2 framework on Netbeans.

The most recent edition (2017) of Microsoft Visual C++ was installed and was followed by the installation of a Wamp server for online management (version wampserver3.1.0_x64), which contains the Apache server v2.4.27, the query language MySQL v5.7.19 and the programming language php up to v7.1.9.

For the design of the database, MySQL Workbench v6.2 CE of Oracle was installed. With the tool phpMyAdmin the database was created in the server.
Following that, yii2 framework advance version was installed and connected to the server database (Keck, 2015).

Using FileZilla v3.37.1, the remote installation and management in its current online form was performed on the server of the *Applications of Artificial Intelligence, Data, and Signal Management Lab* of the Technological Education Institute of Western Macedonia at the URL dspai.kastoria.teiwm.gr/exampos.

Use

The application is used through its menu selections. The menus are: (Efthimiopoulos, 2018)

- Login-Logout and Seat Reservation for students
- Login-Logout, Seat Reservation, and Teacher Admin for lecturers.

In both cases, if the user forgets their password, the application offers the option of changing it. The Teacher Admin option activates the following options.

- Exams
- Users
- Modules
- Rooms
- Register Exams to Rooms

In the Modules option, the lecturer can create a module, edit it, and delete it.

In the Exams option, they can set the date of the exam, edit, and delete it.

In the Rooms option, they can define the rooms and the seats that are offered as an option to students. The selected seats are displayed with a different color. At this point, it's worth mentioning that this option is offered to all teachers and with the required coordination, two examiners can utilize the same room and select the seats in a way to maximize use of the available space.

Figure 2 shows two different states, in α the room is used by one examiner while in β by two examiners of different courses. We can conclude that the first case uses only 34% of the available space while the second case uses 60%.
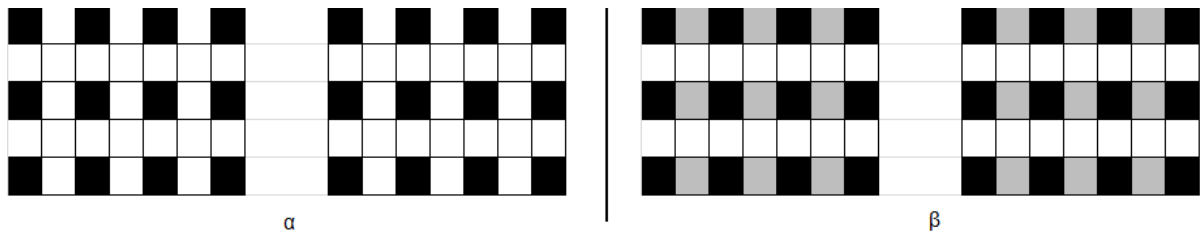
Figure 2. Room's seat selection (α) for one module in black seats and (β) for two modules, with the grey seats corresponding to the second module

In even more advanced cases, all available spaces can be covered if four modules are examined simultaneously. This arrangement results in saving human resources through reducing the number of supervisors required.

Through the option "Register Exams to Rooms", the examiner connects the rooms with the exam they have already created with the option "Exams". Initially, only the largest room is available for selection. When this room is 80% occupied, a second room is made available and so on. This tactic means that the fewest possible number of rooms will be used.

Using the same option, the examiner can offer access to specific students. This can be done by entering the qualifying students one by one, or by uploading a CSV file that contains the student ID numbers of all of the eligible students for the specific examination. This information is available to the lecturer from the secretarial office. This option ensures that ineligible students cannot reserve a seat and thus, cannot participate in the exam.

The option "Seat Reservation," offers the lecturer information on previous exams but is mainly used for the reserved seats in the upcoming exam. From the "Participation" option, the examiner chooses an exam, and the application displays the current seat selections. An hour before the scheduled time of the exam, the lecturer can print the selected seat reservations and post them outside the relevant rooms. By this process, the students who booked a seat enter the correct room and take their predetermined seat.

From the student's point of view, the application offers only the "Seat Reservation" option, which offers the same menu as the lecturer's. However, through the "Participation" option, and selecting the exam they are interested in, only the seats selected by the lecturer are displayed. From those preselected seats, the student can choose one and its color immediately changes and displays their name and surname on it. The examinee maintains the option of changing the originally booked seat before the deadline expires. In this case, the system makes the first seat available again and books the newly selected one.

Requirements

For the application's use, the following are required.

1 The numbering of available seats in each exam room in a way that corresponds to the application's setup
2 The adoption of the system by the lecturers and the students

3 The adoption and use of the process of preventing ineligible students from participating. This process will initially check if the students applying are eligible for the exam
4 The creation of an automated system of the eligible students in the database in combination with their seating selection

Future possibilities for the application

The Exampos application can be further improved and incorporated in other applications.

- The system currently sends a booking confirmation email to the registered student's email address, and can be developed further to include an automated reminder for the students who qualify for examination and still have not booked a seat.
- The database can be enhanced by adding photo files. With an automated recognition system that communicates online with the database, supervisors can read the QR codes of exam seats or the bar code of the student ID with a mobile phone, and thus view the student's registered photo and verify that the student is in the correct seat.
- If an automated exam review system is implemented, the data recorded in Exampos can be used to identify infractions/cheating.
- By analyzing the historical data registered in the system, groups of students that usually sit together can be identified. The examiner can potentially add limitations in the seat selection for those students (Haghighi & Jusan, 2012).

Conclusions

Exampos can prove very useful in improving the exam process and in saving human and material resources.

- The expected number of examinees is known
- The system blocks ineligible students from entering
- The exam rooms can be managed more efficiently
- The required number of supervisors can be arranged
- The exam process can start without delays
- There are no problems for upcoming exams in the same room
- The exact number of tests can be printed
- The environment of the exam remains calm
- The same space can easily be utilized by two or more different courses
- There is data recorded for each student's position
- The attendance sheet is automatically created and recorded.

Acknowledgements

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