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EMERGING TRENDS IN EDUCATION AND CUTTING EDGE SOFTWARE DEVELOPING TECHNOLOGY MEET IN DISTANCE LEARNING WEB APPLICATION "YOU TEST ME"

MAŠA SRETENOVIĆ
Malloc Corporation, Belgrade Developing Team, masa.sretenovic@mallocinc.com

KATARINA MIRKOVIĆ
Malloc Corporation, Belgrade Developing Team, katarina.mirkovic@mallocinc.com

DANILO SRETENOVIĆ
Malloc Corporation, Belgrade Developing Team, danilo.sretenovic@mallocinc.com

LAZAR TRŠIĆ
Malloc Corporation, Belgrade Developing Team, lazar.trsic@mallocinc.com

JELENA BANJANAC
Malloc Corporation, Belgrade Developing Team, jelena.banjanac@mallocinc.com

ZORAN KUKOLJAC
Malloc Corporation, Toronto, Canada, zoran@mallocinc.com

Abstract: *Throughout several years students and professors have been interviewed and their opinions, experiences and preferences have been gathered in order to set the base for developing an IT solution that will answer to their demands, and that will serve as a perfect tool for distance learning, which will be inevitable in the future. YouTestMe web application is designed to improve and ease e-learning systems by providing, among variety of features, the automatic test generation based on a selection of available criteria.*

Keywords: *e-learning, test, automatization, web application, integration, question pools, criteria, customization*

1. INTRODUCTION

Information Communication Technologies (ICT) are taking pace with rapid development, with the strive to impact education among learners in a way that they become highly satisfied. Usage of technology spans across all academic areas with the increasing popularity of information technology that is evolving rapidly towards betterment with increased capabilities every day. Educationalists are interested in knowing how technology would create a variation and flexibility for the students in the classroom. The purpose of using e-learning is to create a learning platform with combination of the existing knowledge and Information Communication Technologies (ICT). Huge positive trend of growth in Information Technology that is user friendly, accessible, automatized and reliable was recorded. In fact, predictions say that by 2019, 50 percent of all college courses will be taught online.

On the other hand, McArdle&Bertolotto (2012) said that traditional e-learning methods could be boring due to the lack of interaction between students and teachers. [1] Today USA and Europe utilize 70 percent of world's e-learning market. [2] According to *The Chronicle of Higher Education*, a prominent online magazine source of educational information, higher learning institutions have announced a nearly 25 percent increase in online enrollment over the past four years - the highest percentage recorded to date. [3] Based on these facts and several researches that take into consideration the trends that exist in current educational market, we have developed a user friendly, accessible, reliable, automatized and customized solution in order to respond to the existing demand.

After analyzing the existing softwares with core in creating tests and quizzes, we came to the fact that most of them were developed using old and now outdated technologies that make them harder or impossible to adjust to different systems and conditions. If the adjustment is possible, it is costly and complicated. According to these findings, we identified that there is a gap between the modern software developing technologies and the ones used, and space for improvement in this field.

YouTestMe web application was encouraged by the emerging trend of e-learning and distance learning which has been implemented in almost every prestigious university in the world. The purpose of the software is to enable both students and professors to have an efficient, easy, and improved way of learning, testing and

evaluating. The application is consisted out of various types of authorized users, different courses and classes, tests sections and question pools. YouTestMe is not applicable just for educational purposes. The biggest advantage of this application is that it is a testing platform that does not limit the user in any way. On the contrary it is designed to be adjustable to any system weather its for the governments', companies' or educational institutions' purposes, expandable to receive a large number of users or features and customizable to any special need or request of the user.

2. RESEARCH

For the past years we have been conducting a research with the intention to find out what are the requests of the students when it comes to teaching and learning.
One of the researches was reaching 73 students through internet and also personally through interviews.

Table 1: The respondents' opinions regarding the use of e-education system.

Issues surrounding the use of e-education tools and implementation of e-tests	Disagree (%)	Neutral (%)	**Agree (%)**
Possibility for students to test their knowledge before the actual exam	7	10	**82**
Possibility for students to receive the results of their performances right away	5	19	**76**
A mix-up between the traditional and Online teaching would provide students more help and support	10	14	**75**
Frequent testing is very important for student's quality education	8	11	**80**

The research result was the following: the students were ranking as highly appreciated possibility to test their knowledge effectively before the actual exam and receiving the results of their performances along with the feedback about the right answer. One of the dissatisfactions of the students was the time needed for the tests to be evaluated, and regarding that they would value real time results. On the other hand professors (or their teaching assistants), are swamped constantly with numerous tests, first to compose and print and later to examine and evaluate. Therefore, great amount of time is spent and it dictates a slower tempo when it comes to how frequent students can be tested. Other researches which were taken into consideration also pointed out the positive attitudes of the university teaching staff towards the use of e-learning system. [4] One of the results of the research was related to the large number of students who are in the same time studying and working, or having some other time-taking activity such as a sport or music engagement. Their physical presence on the faculty is less frequent and distance learning becomes the only way in which they can remain active as a student. Another research was taking place in the past years, and it was dedicated into finding and developing the best combination of IT solutions that will make the application reach top quality when it comes to functionality, performances and safety. Company's branded *GDAO* technology, [5] and company's own software for manipulating with data, *DB Analyzer*, harmonized perfectly with industry strength relational database. As a result we decided to create a distance learning web application which will meet both students' and professors' needs and requests, and will change the tempo of interaction between them.

Our idea was to encourage more frequent testing by making a convenient, functional and flexible virtual environment for the tutors that would drastically shorten the time spent on students' evaluation and allow them more focus on activities such as lectures, scientific papers, researches, etc. Considering the nature of the application, it answers perfectly to the needs of an educational institution in the test generating field. Among numerous features it allows automated quiz generation based on various criteria such as number of questions, different levels of difficulty, last occurrence, necessity of appearance, frequency factor etc.

That opens the possibility for ad hoc tests and quiz uniqueness for every student (with the same defined criteria for all). The automatization based on criteria selection, is a feature with which we wanted to enable the test creators to, with the least time end effort, generate tests which are precise in difficulty level, adequate and fit for purpose. This feature has been enabled with the implementation of *question pools* which represent a unique way of data storage. We were aware that the distance learning trend is emerging, but is not omnipresent yet. Therefore we did not exclude the traditional way of test taking and teaching. YouTestMe web application allows the generated tests to be converted into .pdf files and printed, while classes and courses administration are done by using YTM software.

3. BRIEF APPLICATION OVERVIEW

Below is logical model of the application. It depicts the examination process for commercial pilot license as required by Federal Aviation Regulations.

Application accepts various feeds in forms of questions, questions pools, quizzes, examination rules, scheduling, student information, etc. It provides various reporting to examiners, government regulators and administrators. The core of the system is "YouTestMe" software consisting of the various modules such as Web User Interface, Quiz generator and Reporting engine. The system provides three types of users: *Administrator*, *Professor* and *Student*, and each of them has its own role and limitations.

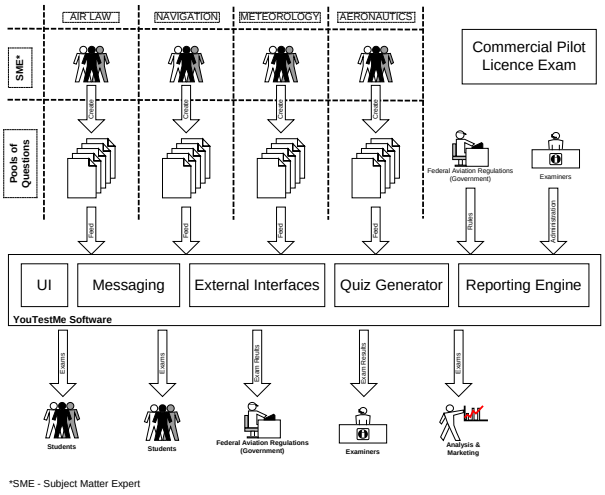

Figure 1: The logical model of application

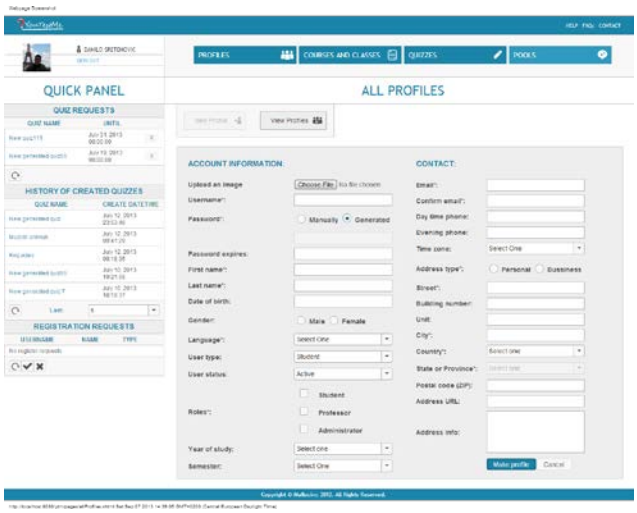

Figure 2: New profile creation

Administrator role

Administrator has the authority to access, customize, moderate and update every section of the application.

Professor role

Professor has the authority to access his own account and to maneuver within the personal profile.

He receives from the university *administrator* a network of courses and classes of which he is assigned as a tutor, but he also has a possibility to further customize his own sub networks (ex. Advanced students group, Distance studies groups, Master studies group, etc.).

The YouTestMe web application provides possibility for professors to create questions with defined right answers, the level of difficulty and if the question is obligatory, which are stored in the desired question pool. It is possible to create as many pools as necessary and to fill them with the questions related to the specific course or class (ex. Numerical Analysis question pool, Discreet Mathematical Structures question pool, etc.). If necessary, *Professor* can authorize access to a specific question pool to another user (ex. Teaching assistants, students, etc.).

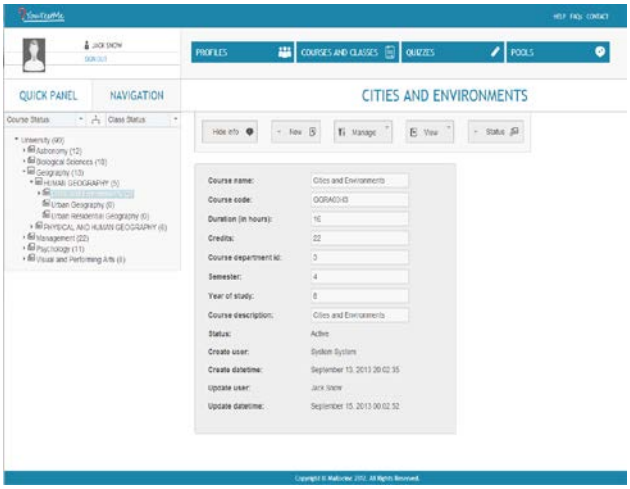

Figure 3: Management of courses

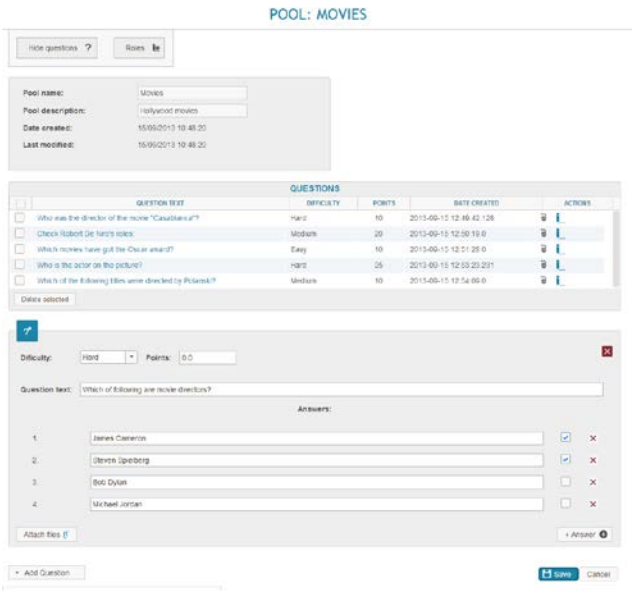

Figure 4: Question pools

He can also create and send timed tests to classes which are intended to participate in the selected courses (ex. If the test for a specific course is to be done at 9 AM for 1 hour, the professor does not have to be physically present, the test will automatically be available to students at 9 AM, and the session will expire at 10 AM).

Professor has options when it comes to creating the tests. It can be done automatically by choosing the percentage of easy/medium/hard questions from the selected pools, by creating new questions that can be inserted into the pool if desired, or by mixing the existing with the new questions. Each time the test is to be generated, the user has the option to define the criteria based on which the questions will be chosen. The percentage of easy, medium, hard and advanced questions can be selected. It can be avoided to use questions that took place in recent

test by choosing the criteria that filters the questions that have recently been used. The *professor* can define if the answer to a referred question is single or multiple with the space for a written comment and an image. The questions can be set as single, multiple, true/false, gap fill, matching, numerical or essay. It is also possible to predefine the number of points associated with the question.

The YouTestMe web application saves professor's time when it comes to reporting and evaluating. Based on the predefined right answer and number of defined points for each question, the test is being evaluated automatically as soon as it is submitted. If the test includes essay questions which cannot be evaluated automatically, the application will evaluate all the others and require the number of given points for the essay answer to be entered manually, so the scoring and grading can be finalized. Both general score and individual scores for each test are being displayed along with many other reporting features (ex. class statistics, graphs, charts, etc.). The professor is the one who will define what will appear on the student's interface. Weather the student will receive his score, grade, feedback, or all of it. It is also possible for the professor to send test invitation that will appear on student's e-mail, or to share documents with a certain class or course.

Student role

Student has a personal account in which is kept the data of his previous results, and through his account all the tests enabled by the professors, are being available for taking.

The application provides possibility for the *student* to receive in details the result of the previously taken tests, within seconds after the submission.

Figure 5: Correct answers displayed to the student

Every *student* is a member of the network of courses and classes to which he has been assigned at by the *administrator* or the *professor* role.

He can also take a test generated from the pool authorized by the *professor*, from which he will just get the result, but his performance will not be recorded, just displayed. (ex. While preparing for the test, a student can take a preview test for practicing).

Other features

There are numerous possibilities for data manipulation such as import and export data (user details, questions, courses, classes, quizzes, etc) from and to spread sheets, or entire data base migration.

Application also has an export option that transforms the content into a .pdf file if the test is taken offline, and needs to be printed (ex. Printed tests or reports).

YouTestMe provides full mailing support - different kinds of notifications are directly sent to users e-mail, such as quiz requests, test results, personal details change, etc.

Technical specifications

YouTestMe software features industry strength, commercial relational database engine so the safety of data and performances are guaranteed. The software was developed with the use of Database Analyzer (DB Analyzer) [6] and Generated Database Access Objects Methodology (GDAO Methodology) which we have proudly created and developed. Database Analyzer Software uses knowledge and logic stored in the database design to generate a number of Java classes for each database Table and View, which help developer to manipulate their structure and data. It vastly improves software development productivity when it comes to the development of all Java components that access databases. Moreover, the generated code is uniform and well-structured with plenty of comments so maintenance of the code is very efficient. We had had the opportunity to successfully apply GDAO Methodology to various projects, which ensured the YouTestMe software to be developed faster, with excellent performances and easier maintenance once implemented. The application was built developed on Java platform [7] using *Java server faces JSF 2.0* with component suite *Prime Faces* as a front end framework. For reporting and export features application uses *Business Intelligence and Reporting Tools (BIRT).* [8] The system and the infrastructure are designed to respond to a large number of users accessing in the same time, therefore it is suitable for large universities as well as for smaller ones.

The application is completely adjustable for each institution according to the needs and size.

4. USE CASE EXAMPLE

The *professor* enters the account by using username and password. Next step is test creation. The *professor* can choose an option to create the test manually by entering each question without using question pools, with an option to save the created questions and insert them into the pool. Second option is to automatically generate test by choosing the pool or pools from which he would like to take questions from with the number of desired questions. If the *professor* decides that he wants to replace some of the questions offered by the application, it is possible to change it with a question from the pool, or

to enter a entirely new one. The third option, that we would like to emphasize is the semi automatic test generation. For example, the *professor* has chosen the semi automatic one. Based on available criteria he can choose to filter questions by the date of use, so if the question was on the last test the algorithm will skip it and choose from the questions which have not been recently included in the test. This will ensure that all the questions from the pool at some point appear on the test, and allow the test creator to control the repetition of questions.

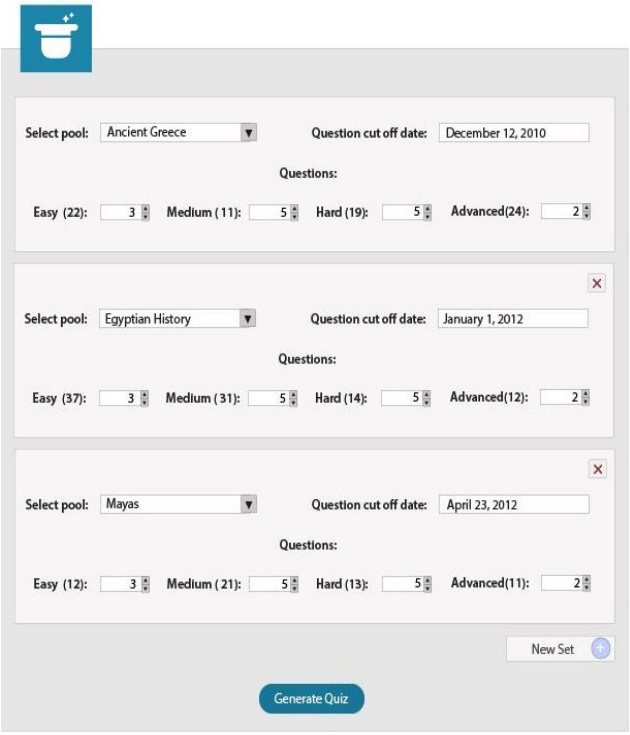

Figure 6: Test generation

The professor can also select the percentage of hard, medium and easy questions (once entering the question into the pool, there is a check box that will define the level of difficulty for the question). The variety of pools that can be separated one from another allows the professor to create a *must have questions* pool and each time when he creates a new test, selected number of those questions will appear. He can also define certain questions as *advanced*, so those questions can always be chosen to distinguish for example grade 10 from grade 9 or 8. Besides different criteria, the professor defines what will students receive along with the question. If the correct answer will appear as soon as the student gives the answer, and if students score and grade will appear on the screen automatically or not.

The result of criteria defining is a test that is automatically generated within seconds, but which is also answering to all of the specific requests that professor would pay attention when creating a test manually. Once test is generated the professor can modify if necessary, or simply share it to the selected student classes, or to the members of an entire course. When all of the tests are submitted, the professor receives detailed report on how the students have performed, individually or as a group.

5. CONCLUSION

It is obvious that we live in a digital era, which is yet to be expanded severely in the future. We are facing generations that are raised with computers instead of toys, therefore, as everything else is being digitalized, so is the education. [9] YouTestMe web application was created in order to preempt the moment when distance and online learning becomes core, and to set the base for the developing trend. Automatic and semi-automatic test generation was a concept that came out of the wish to meet all of the educators needs when creating tests and evaluating the students. Our goal was to keep the precision of manual test creating with all the specific requests for the test content and difficulty, but also to automatize the process and save valuable time of the educators, when it comes to both testing and evaluating. In this way students' satisfaction is increased as their interaction with the professor is more frequent and their time is also saved, since this application can provide them access to the test no matter where they are located at the time. The application is not meant to replace but to complement and enhance the existing learning management systems. The infrastructural ground enables it to fit perfectly into any educational institution, and along with their users, to serve as a tool for a better tomorrow.

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