MOBILE DEVICE SUPPORTED ONLINE EXAMINATION SYSTEM APPROPRIATE TO DISTANCE LEARNING

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Abstract

In modern life information technology has entered into almost every area of people's daily lives and become an important and undeniable part of business, educational and personal life. Thus, technological innovations that became widespread in political, economic, institutional and cultural fields are also being widespread in the educational field. Until recently the existing technical shortcomings, the problems of real-time operation of systems, the difficulty and expensiveness of providing the necessary system were making it almost impossible to apply these technological innovations to education and examination systems.

At the present day, studying in various schools and courses in order to fulfill the needs of life, improve ourselves and our lives is essential for us. Eventually exams are administered in various ways to measure people's level of education, practical and theoretical knowledge and abilities. In traditional education system, trainers and learners should adapt to each other in terms of time and venue and they have to fit in the same place at the same time. This particularly leaves learners in the lurch in their personal life and force them education priority scheduling. Despite this situation, it makes impossible to receive training for working people and people with disabilities and also makes it difficult for learners to develop themselves.

Web-based learning and online examination systems are able to deliver the required web content to user on all devices with web browsers such as desktop computers, tablet computers and even some televisions. Because of high sales and maintenance fees, deficiency of existing properties on fulfilling the needs of the institution, inability of adding new features of commercial systems make it disadvantageous to use them. In the open source systems, obligation for institution to pay to developer company for eliminating the problems that may occur in using process, insufficiency of technical documentation and difficulties on developing a software for these reasons, these systems are also not preferred. The goal of our work is to develop an institution-specific, user-friendly web-based online examination system that minimizes operating costs, allows institution to add new features easily by expert teams, meets the needs of the institution, integrates the current learning management system. We have developed our application in accordance with the requirements of the Distance Learning Center of Kirikkale University using the contemporary software (Asp.NET MVC5, Angular JS, Bootstrap, Microsoft SQL Server 2014) techniques.

Keywords: Online Examination, Distance Learning, Web-based Examination, Learning Management System.

1. INTRODUCTION

The purpose of the measurement and evaluation activities carried out to evaluate the success of students is not only to measure their success, at the same time it allows reviewing and improving provided education and used measuring tools to enhance their learning method according to the obtained results. For developing learning method, in addition to the traditional measurement and assessment methods, a number of different alternatives assessment instruments are used [8]. Traditional evaluation methods consist of exams that is done in the real environment using paper and pencil with the question types of multiple choice, true/false, short-answer and open-ended questions. Examples of alternative training methods are performance evaluation, problem-based learning methods. The rapid development of information technology has led online training models and online examination system in which a significant portion of learning systems obtaining the important role in the field of education. Online examination system is an effective method that allows measuring and evaluating students' knowledge level, distribute the exam content to required users using internet and facilitates analysing and reporting. In addition, these systems are defined as systems that provide ability to teachers and lecturers to apply exam to students concurrently and asynchronously by creating a virtual test space. However, traditional methods are applied as the preferred method for assessing the results of the online and offline exams [9]. In this paper, we focused on web-based online examination system that satisfies the requirements of examination which is most important part of assessment and evaluation processes of education. Online examination system that we developed, unlike previous works, allows creating various types of examinations, to enrich them with various types of questions and to use more effective multimedia contents. These features allow evaluating of students' knowledge from different perspectives.

The rest of the article is as follows: Section 2 presents the related work that was instrumental in the development of our work. Section 3 describes general information about web-based online examination systems. Section 4 presents general architecture of our web-based online examination system, user roles and structure of the generated database. Section 5 shows the creation of test and exams, the preparation of questions and realization of these applications. Section 6 presents conclusion of paper and the future works.

2. RELATED WORK

Nowadays, web-based online examination systems are considered as an important resource for university education system and worldwide important certification exams. Considering previous studies about online examination systems until today, it is determined that spent time in different examination environments by students and their performance depend on the exam types and the variety of questions. In the study presented in 2006 by Sampson [13], author argues that the usage of different types of questions in the exam system would affect the results favorably and it would be useful for evaluating the skills of individuals with limited literacy skills. In their works, Shen et al. [15] emphasized the importance of adjustments and updates in accordance with feedbacks from students for the proper execution of online exams. Zhang [21] showed that it causes rapid increases on the number of students in online education and examination system. They associated the reason of this increase with the time and space independence of study. In most of these studies, the theoretical model on test systems is given with the application approaches. The examination architecture developed by Jin and Ma [6] is solely based on students' and teachers' feedbacks and assistance. They emphasized the importance of these feedbacks that received during reporting and analysis processes for the smooth running of the examination systems. Crisp and Ward [3] revealed the importance of the usage of online examination systems to collect a large number of feedbacks of students effectively. Aimin & Jipeng [1] included intelligent approaches for providing random choices through linear algorithms to the online examination system architecture in question selections and application preparing process. Bilayer examination system proposed by Mustakerov and by Borissov [12] provides a crucial advantage of flexible adjusting approach during testing process. Furthermore, researchers defined that their improved system is appropriate for the usage of formal and informal assessment process. Online examination system architecture presented by Hang [5] contains automatic scoring, updating question pool, flexible question design and system security features. Tugrul Tasci et al. [17] proposed architecture of intelligent agent-supported integrated online examination system. Yagcı Mustafa et al. [11] offered an online examination system structure with multimedia support and updatable database formation. Some of the most important features of the examination system are emphasis on data security and easy usage interface.

After reviewing all the important features and disadvantages of these studies, we improved following web-based online examination system. Our purpose is to develop reliable, practical and advantageous online examination system in terms of time and resources, also to support distance education and to ensure the application of the exams with effective way.

3. WEB-BASED ONLINE EXAMINATION SYSTEMS

Web-based online examination systems are the most important and advanced representatives of the online exam, which has an important place in education. To quickly delivering data to users, online examination systems use the web browsers, so exams can be applied at anytime and anywhere where there is an available internet connection. In this way of distribution of questions and exams, significantly reduces time spent on the evaluation of exams and additional expenses. These properties allow the implementation of surveillance and orientation methods that are important part of the evaluation of the students but ignored because of long spent of time. Furthermore, if this acquired time is spent to correct the detected problems in the education system, it will provide an important contribution on improving the teaching and learning processes. One of the most important features of a web-based online examination system is also its design in accordance with modern education and training needs [4]. Besides this, the elimination of existing restrictions in terms of time and space provides participating more students to education and exams [7,21]. Fig. 1 shows general structure of web-based online examination systems.

Examinations that are made by traditional methods, causes too much loss of time and resources. In real world environments, preparation of questions, test and exam papers, distribution to students, the realization of the applicaitons and exams are the most important operations. In the environments that created by web-based online examination systems, for realization of examinations, teachers just spend time to create the questions. All other operations are performed by the system and will not cause any loss of time.
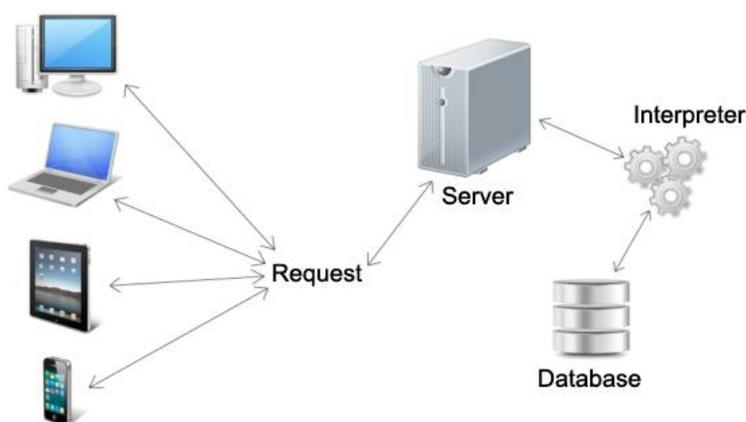

Fig 1. Working scheme of web based online examination system

It avoids the expenses of resources and waste of time. In addition, these systems allow flexibility to students in terms of time. Usage of various question types increases the success on the students' results [19]. One of the most important causes of preference of these systems is significantly reduction of expenses for creation of exams and evaluation of results.

Web-based online examination system facilitates the creation and application of examination processes for the academic staff [20]. In these systems, question pool grows quicker and examination results are evaluated effectively. In addition, online examination systems significantly reduced the measurement and evaluation errors conducted on student results. In previous online systems, it was observed that students had difficulties on adapting to the examination environment and paying attention, also students finished exams late. We notice that if web-based online examination system compared with examination made by traditional methods, it has been proven that it enhances the examination standards in the field of education.

4. GENERAL STRUCTURE OF THE DEVELOPED SYSTEM

The developed web based online examination system consists of three main parts. These are database, server and client parts. In this system, we used Microsoft Windows Server that commonly preferred by software developers. Microsoft Windows Server is an operation system that has stable working state and powerful technical support.

ASP.Net framework and C# language are preferred for the general structure of the web based online examination system. MVC architectural pattern, which is a vital property that has added to ASP.Net platform in recent years, is used to achieve more efficacious results. It is mainly formed of model, view and controller

parts. With this pattern, that is preferred in large-scale projects, there is provided a modular structure, system management is facilitated and new features can be easily added later if needed. The designed user interface is html based and supported by JavaScript based jQuery library. During the development of the software, in order to provide flexibility, AngularJS library is used which works client-side. Thus, It has avoided the use of conventional low-performance user interface components of ASP.Net and AngularJS supported HTML5 components are used that has high working performance. In the systems which are developed with conventional ASP.Net components, the server resends all of the web page content to the client each time the client makes a request. Therefore, large amount of data transfer is performed, which lowers the performance. However, in JavaScript-based structures, only the required data can be requested from the server and thus low data transfer can be achieved.

4.1 Created Database

Microsoft SQL Server is used in our system considering that it has high operating performance and a reliable structure as the database. MySQL and ORACLE databases can also be used to store data on this system. In the view of the ASP.Net is a product of same company with Microsoft SQL Server, we use Microsoft SQL Server as the database for the purpose of they can be more compatible with each other. The advantages of this database are stated below [16]:

a) This database has a long operating time.
b) Database tables have infinite row count that is limited by only hard drive capacity.
c) It supports 32767 user connections simultaneously.
d) There can be added over 2.000.000.000 tables.
e) This database has a high operating performance and dependable in use.
f) It supports multiple processors.

Relational table structure is used during preparing of database tables. This avoids the duplications of data. Besides, it reduces the workload during the development of the software, it lowers the use of system resources [10] and eliminates the logic errors. Apart from this, clients can connect to the web based online examination system by any web browser (Google Chrome, Internet Explorer, Mozilla Firefox, Safari, Opera) according to their needs.

4.2 User Roles

There are five types of users in the system: master, admin, question editor, teacher and student. System allows users to have multiple roles and be changed for any user later. All users use the same login page to enter the examination system. Then they will be met with dynamic menus and screens according to roles they have. The properties of the roles are stated below:

Master Role: This role established during the initial installation of the system and can be defined only for a single user. This user has all privileges on the system.

Admin Role: Users with this role can be created by the user in the master role. Also units and teachers which this user has authorization are defined by master user.

Question Editor Role: Question editors are users who prepare new questions to the digital question pool. Master or admin users have the authorization to define which question editor can prepare questions for which courses.

Teacher Role: Teachers set up tests with the questions from digital question pool and apply these tests as exam, quiz or practice test to students. Master or admin users define which teacher responsible of which courses.

Student Role: These users take the tests that teachers assigned them and answer questions, view scores and correct answers after application. They are also able to make feedbacks about assignments or questions in them.

Fig 2. New user form

5. EXAM
5.1 Creating Questions

Users who have question editor role can create new questions with various types for the digital question pool in the system. If user hovers the "Yeni Soru" (New Question) option under the "Sorular" (Questions) menu, list of the question types will be displayed that each one opens related question preparation form. These question types are categorized by "çoktan seçmeli" (single selection), "çoklu seçmeli" (multiple selection), "doğru/yanlış" (true/false), "sıralama" (sorting), "kısa cevap" (short answer), "açık cevaplı" (open ended) questions [14]. During the preparation of the questions except open ended type by the question editors, correct answer must be entered before saving it. Thus, after the exam finishes student answers can be automatically scored. On Table 1, supported question objects and types are compared for three different systems including our's.

Property	WizIQ	TAO	WTÇSS
Single selection question type	Yes	Yes	Yes
True/false question type	No	No	Yes
Open ended question type	No	Yes	Yes
Multiple selection question type	No	Yes	Yes
Sorting question type	No	Yes	Yes
Additional question types	No	Yes	No
Question categorization	No	No	Yes
Multimedia file support	No	Yes	Yes
Supports images on choices	No	Yes	Yes
Making questions inactive	No	No	Yes
Question confirmation mechanism	No	No	Yes
Question versioning	No	No	Yes

Table 1. Compare of question objects

The questions are divided into two parts, including question body and feedback area. There can be text

and/or multimedia file in the question body. Multimedia files should be in .jpg, .png, .gif, .mp3, .mp4 formats. Feedback area is configured in order to selected type of question dynamically. Image file supported choices can be added for multiple choice questions. Course should be selected before saving the question to system. In addition, one or more category tag can be added to make the question be easily found by teachers during the searching processes. New single selection type question form of our system is viewed on Fig 3.

Fig 3. New single selection type question form

When a question edited by question editor, a new question data will be created on database with updated info and the old one will become inactive. In this way of versioning, if the old version of the question is used in an assignment before, affection of retroactive data will be avoided. In the new uses of the question, only the updated version will be available.

5.2 Creating Tests and Assignments

Teachers prepare tests for the courses they responsible for from the digital question pool. New test form panel is viewed by "Yeni" (New) option under "Testler" (Tests) from the main menu. There are two ways to add questions to newly created test. Single questions can be searched from question pool with the panel that opens with "Soru Ekle" (Add Question) button. Question type, author editor, course and last update filters can be used to search and questions can be selected from the results list to add one by one question. The other way of adding questions is to use the random questions panel that opens with "Rastgele" (Random) button. Teacher sets filters and question number according to the needs, then system will add random stated number of questions that corresponds to filters. These two options can be used more than once in same test preparation. Point values and the order of the questions can be set by teacher. Test preparation form is shown on Fig 4.
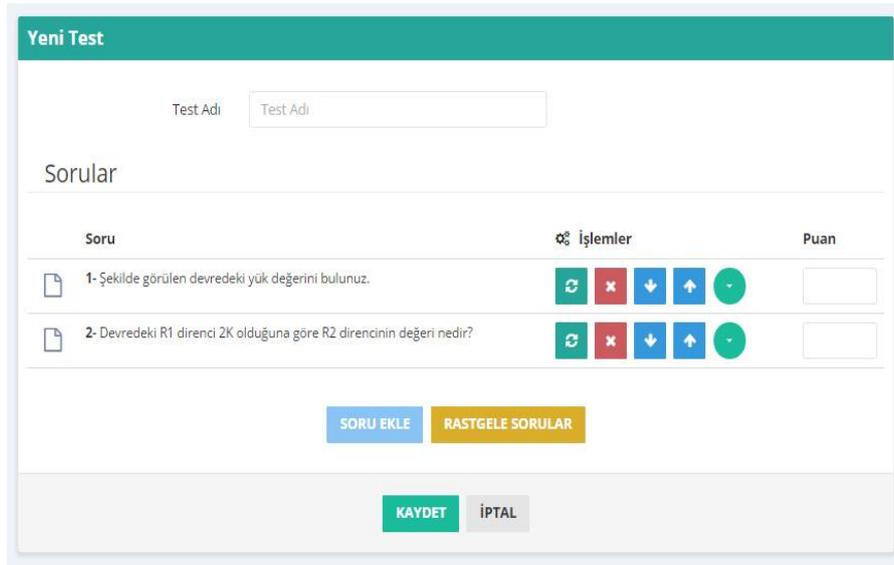
Fig 4. Test preparation form

To assign one of the tests as an exam, quiz or practice test to students, "Uygula" (Assign) button from the related row of tests list or from the test detail panel. First, assignment type should be selected from assignment panel. If "Sınav" (Exam) option selected, start time and duration info should be entered from fields that appeared. For the "Çalışma Testi" (Practice Test) option there is no need for time and duration info. If teacher prefers the system to automatically score the student answers at the end of the examination, "Otomatik Puanla" (Automatically Score) checkbox should be checked. The students to assign test is selected from "Uygulanacak Öğrenciler" (Students to Assign) panel. There can be selected a group of students who take same course, or a single student can be searched. "Oluştur" (Create) button creates the assignments. Teacher can list his/her own assignments from "Uygulamalar" (Assignments) option under "Testler" (Tests) from main menu. Assignment management and reporting operations can be made from assignment detail panel. On quiz assignments, teacher should start and finish the session manually.
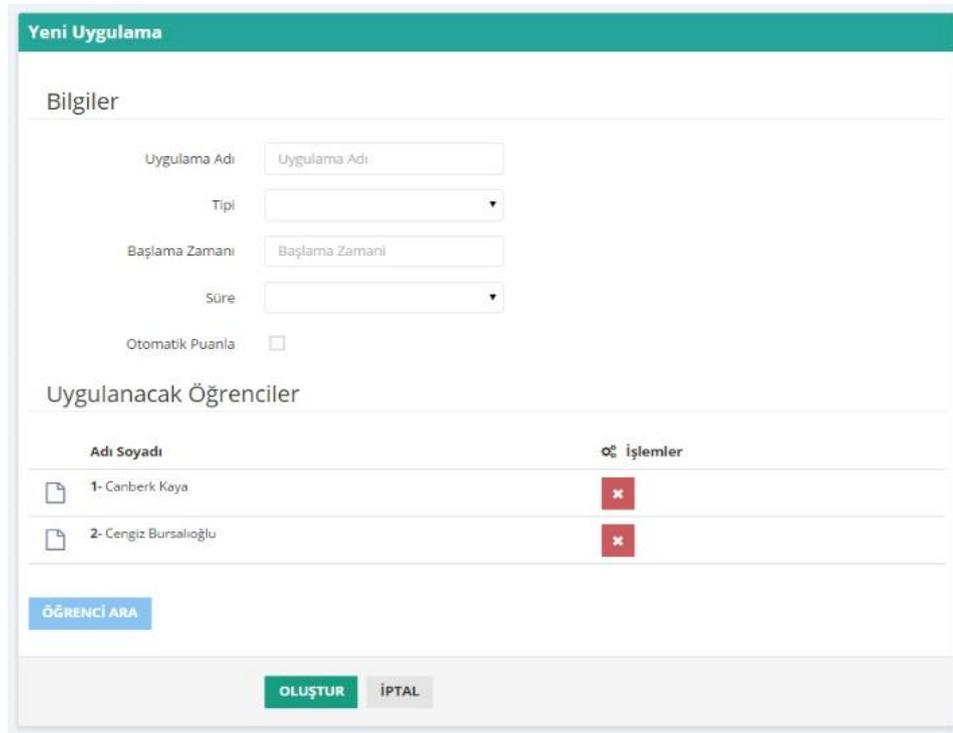
Fig 5. Assignment preparation panel

In Table 2, we compare test objects supported by the web-based online examination system that we

developed with the WizIQ and TAO applications. As we see from table 2, our examination system offers significant advantages for the creation of tests and exams.

Properties	WizIQ	TAO	WTÇSS
Containing questions can be searched by category and keywords	Yes (Limited)	No	Yes
Containing questions can be selected automatically	No	No	Yes
Re - applicability	Yes	Yes	Yes
Re - editable	No	Yes	Yes
Determining point value of the included questions	No	No	Yes

Table 2. Comparing test objects

5.3 Realization of Application

Students can reach the applications that assigned to their selves in the list on their own screen. They can follow an exam which is about to begin with the clock on top of the screen and with notifications. "Exam" type applications start automatically on the time that determined by the teacher. Before the start time, system notifies the students and teachers by electronic mail. On start time exam content is made attainable for the students' access. Students can follow the remaining time information from the top of the screen. After starting exam, students answer the questions individually and they can switch to any question (answered or unanswered) with the menu at the bottom of screen. In this panel, unanswered questions are highlighted in a different color. Until the end of examination time, students can return to any question and can change the answers of their selves. But after the examination finishes or the student finishes her/him exam, he/she cannot view the content of taken exam. Fig. 6 shows the student's question screen in the web-based online examination system.

If teacher marks automatic scoring of the results option before the start of exam, all students can access the scores of their examination and view the questions and the correct answers at the end of the examination time. If teacher didn't select the automatic scoring option, he/she should trigger scoring manually at the end of the examination time.
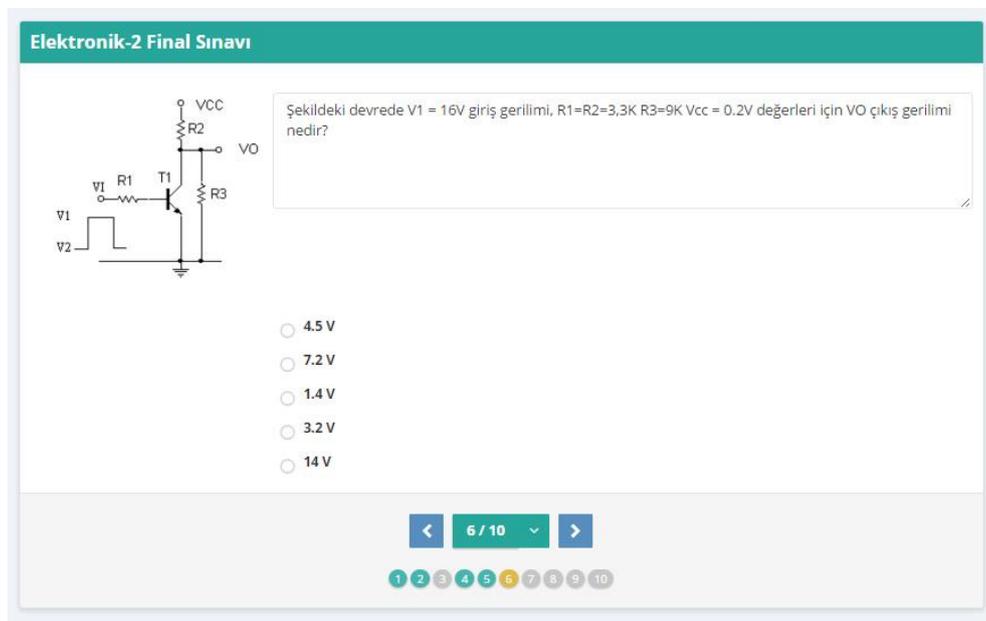

Fig 6. Student exam panel

If there are open-ended questions in the examination questions, automatic scoring option cannot be selected. Teacher should first score the open-ended question manually, then the other type of questions will be scored automatically.

Unlike the applications that in the "exam" type, in quiz applications, only the starting and finishing of quiz are made manually by teacher. There is not time limitation in the "practice test" type of applications. Students

answer the questions of practice tests that assigned to them at any time. After finishing the test, they can reach information about wrong and correct answers. Fig.7 shows the student's assignment list.

Fig 7. The list of assignment

5.4 Examination Data

In the applications made in the system, all answers given by the students to all exams, quizzes and tests are kept in the relational database. Reports of the average scores on the exam, the number of students who are successful and/or failed in the exam, general success rate of the answers to specific questions can be created and displayed with these collected raw data [6, 2]. Teachers can view the reports, related to their applications, from the application details screen. While admin users can reach the application reports units which they have authorization, master user can access all of the reports on the system.

6. CONCLUSION

This article is obtained from the "Web-Based Learning Management Systems for Mobile Devices" Scientific Research Project of Kirikkale University No. 2012/113. In this paper, we developed a web-based online examination system with multimedia file support, a user-friendly interface and updatable database structure that applicable over secure network and the internet, hold the data safely. This proposed system allows updating the questions in an easy way, reuse of them which used in previous exams, the creation of a large question pool. In this examination system, more effective assessments can be made by performing of data analysis. Furthermore, digital question pool that extends during the time, will simplifies the online examination that will be done in the future. Multimedia supported questions (video, audio, pictures), that can be added in the question pool by teachers, allow the assessment of the students in different and new ways. Developed online examination environment in this study supports questions with multiple selection, single selection, true/false, ordering, short-answer and open-ended types. The number of questions to be used in the examinations is not constant; it is defined depending on the teacher's request. While impossibility of returning to an answered question and changing answers causes problems in inflexible online examination systems, students can pass from a question to another one which they want during the examination in our developed system.

In the future works, we would work on the creation of more efficient, improved and secure system to measure the students' knowledge and creativity on more effective ways by adding a web-based interactive question types and improvement of security by using biometric recognition technologies and fingerprint recognition technology (PITT).

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