

An e-Examination for the Future Generation

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Abstract

Objective: To overcome the shortages of the existing online examination system, an advance e-examination system is designed with two new features i.e., Live Video Recording and voice answer submission system. **Methods/Statistical Analysis:** To check the insufficiency in the existing system, an online survey has been conducted for different age groups. Based on the response from the survey, the two advance features are added. This advanced system is designed in such a way that it will be helpful and convenient for both examiners and examinee. **Findings:** After implementation of the live video recording system, the examiner can take exam from anywhere and check the video to find if the candidate has tried for malpractice. Also, the candidates who are not able to type the answer can submit their answer by recording their voice. These two features will be convenient for both. **Application/Improvement:** The proposed system is experimentally tested on server and the results shows that the advanced online examination system is better than the existing online examination system.

Keywords: Database Design, e-Examination, Live Monitoring, Security Mechanism Design

1. Introduction

Online examination has expanded rapidly and has become an important trend for assessment. Apart from the educational institutions, it is also of use to all levels of companies. It assists the teacher in making the test plans and executing it in a careful and smart way. Also it helps companies to take examinations and interviews for their recruitment, which saves time and facilitates judicious judging.

Within the examination system, the administrator can create exams, manage subjects and questions, assign students or group of students to the created test and share the link to the assigned students or group of students. This is one part of the online examination system which is in existence.

Taking into account the development of advance version of the existing online examination system, some additional features are added to the web application. The advanced online examination system provides users to record the live video during the examination. This will really reduce the cost of conducting examinations and candidates can give exam from their home also.

Also the option to submit voice answer is plus point to

those candidates who have poor typing speed. Candidates can log into the system during the exam time either in the campus network or at their own place, appear in the test and then submit the test. Voice answer submission will really help them.

2. Existing Online Examination System and Its Insufficiency

Series of the large scale online examination system have been continuously introduced by some small and large companies. All these systems are developed in various platforms with almost similar features. All these systems have already been put into use. But the feature of all these online examination system is that they are limited to only taking examinations.

- The system only focuses on taking professional examinations, and there is not any option for blind students appearing in online test.
- The system only focuses on taking examination at allotted centers which incurs expenses for the examiners or the examination conductor.
- The system only focuses on submitting written

answers. There is no option to submit voice answer for the students who have poor typing speed.

- The system has no option to do online calculation and candidates need to carry separate calculator for that.

To overcome these shortcomings⁴, and also to meet the demand of digital era, the paper will design and develop an advance online examination system.

3. Survey Report for the Success of Project

Before designing and developing this research paper, a small, online survey has been conducted to make the advance online examination system successful.

The questionnaire of the survey is set so that a clear response can be recorded to make this project succeed. In the survey, the main aim is to determine if live video recording during the exam and voice answer submission will be convenient or not.

In the survey, 75% of the participation is of the people of age group 16-25 years. In this age group, almost all are from the college or university or company employees. This is the age group who is going to get the benefit of this advance online examination. So their participation in survey is more important. In this age group, 93% of the participants are those who have the knowledge of computer and internet. Out of 93% participants who have the computer/internet knowledge, only 72% participants thought that conducting online examination is better than paper based examination. For live video recording during the examination time, 66% participants find it helpful and convenient. But for voice answer submission option, only 31% of the participants find it beneficial.

After that the second most number of participants was from the age group 26-32 years. All the participants from this age group were either doing job or running startup or any firms. They contributed 14% of their participation in the survey. All the participants from this age group have 100% computer knowledge but only 78% of them were in favor of online examination system. For live video recording option, 71% of the participants find it helpful and convenient. Like in the previous case, this age group also has shown lack of interest in the voice answer submission option. Only 28% of them find it convenient.

Another two age groups also participated in the survey. They are 'Under 15 years' and 'Above 32 years'.

Their respective participation in the survey is 1% and 10%. Out of them, all are having computer/internet knowledge and have experience with online examination system. 80% of participants of age group above 32 years found live video recording during the examination helpful and convenient. And 30% of the participants found voice answer submission option convenient.

These two new features, i.e., live video recording and voice answer submission are the most important updates of this advance online examination. If we take an average of the above survey report, 74% of the total participants find the live video recording helpful and convenient. But only 29.6% of the participants have positive response for the voice answer submission.

4. System Design

4.1 Design of the System Logic Structure

The architecture of online examination system mainly includes the C/S or B/S types⁴. Here B/S architecture is adopted because it has achieved good result and realized the system demand of "Thin Client". So the logic structure of the advance online examination system has three layers. The first layer is "The Client Side", the middle layer is the "Applying Server" and the basement or third layer is the "Data Layer". Client side will be in view architecture, server side will come in controller architecture and data layer will come in model. MVC architecture gets automatically created once we create a new project on visual studio.

We can divide the solution code into different layers. But overall the basic role of architecture remains the same. The model contains the definition of the domain classes. Controller helps in communication of front layer or view layer with the model layer. The following Figure 1 is the basic architecture of the advance online examination software.

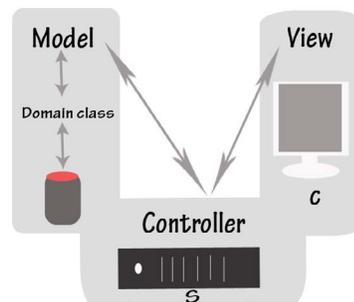


Figure 1. Architecture of e-examination.

4.2 Function Model Design

The overall function of the system is developed to realize a systematic, standardized and automatic advance online exam system. The function module is designed in three parts. The first part is the System Manage Module; the second is the User Module and third is the Exam Module. The user of the system (administrator/teacher/employer) can manage candidates, create the exam, assign candidates or group of candidates, check live recorded video¹⁶, listen to voice answer submitted, generate statistical reports and email results to the students. Candidates can login using credentials given by administrator via email and after successful logging in, they can do the online examination. System administrators can manage users.

- The System Manage Module - This module is mainly responsible for organization structure management, user management (user profile and user role), system column management and data information management.
- The User Module - This module mainly includes the management of test subjects, test management, designing of questions, managing students, managing invigilators and managing results and reports.
- The Exam Module - This module includes the main page of the online examination, where the candidates log in using given credentials for giving the exams. The invigilator is responsible for the process behind this module.

4.3 Steps of Online Examination Process

The admin of user module will create a unique link to take the online examination. The candidates can log in by clicking the link provided using given credentials (username and password). The candidates have to verify the identity as well using biometrics¹. When the examinees are successfully logged into the system, they will get their details and the examination details. After confirming and reading the instructions, the candidate can move on to the question page. At this stage, the timer starts for the allotted duration of the test. All the answers will be automatically saved on the server so that the candidate will not be losing any of the answered data. The user can use the calculator for calculation for numerical questions and also submit voice answer for any of the question, if he/she is poor in typing. The live video recording will be active throughout the duration of the exam and candidates have no control over that, in case of any intervention the exam will get automatically submitted. At the end, the candidates¹¹

need to submit the paper manually or it will be submitted automatically after the completion of time. After the paper has been submitted successfully, the feedback page will open, where the Candidates can give their feedback about the exam. After submitting the feedback, the marking progress starts. During the examination, the examinee is free to answer the questions randomly⁸. And during the conduction of the exam, the support team is available, in case of difficulties if any. The examinee can use the option available in the application to contact the support team. Examinee can submit the feedback after the completion of the exam. The progress is shown in Figure 2.

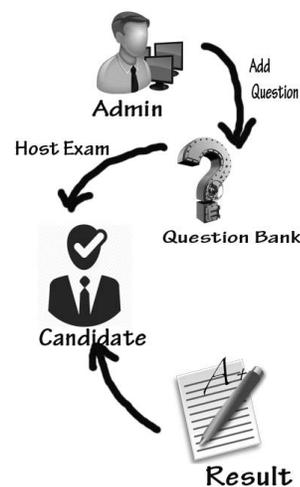


Figure 2. Exam process.

5. Database Design

5.1 Design of the Database

The core of storing all the data of the examination system is the database, and here MSSQL Server Database is used to design and realize the system database. To meet the system needs, mainly twelve tables are designed. They are Admin Table, User Table, User Activation Table, User Role Table, User Role Mapping Table, Subscription Table, Exam Table, Marks Card Table, Question Table, Answer Table, Answer Option Table and Video Table.

- Admin (Administrator) Table- The administrator is the super admin and has all the system privileges. This table is used to store the data of the landing page, customer's record, support, and feedback.
- User Table- This table is to store the data of all the users using the online examination system. The user includes super admin, customers, and the candidates.
- User Activation Table- Once the user register, the

server will send an account activation link to the user email address. The link will contain the unique string. This table has been used to store the unique activation link of the users.

- User Role Table- This table is used to store the role assigned to all the users in the system. It will contain different types of role, which we require for user authentication.
- User Role Mapping Table- User and role table is mapped on the user role mapping table. So we can trace the role of each and every user.
- Subscription Table- The subscription plan will be stored on the subscription table. So the customer can get the information of the plan and package.
- Exam Table- This table is used to store the information of examinees including their assigned exam number, name, gender, passwords, identification, etc. This table is also responsible for storing the data during the examination and the answers submitted by the candidates.
- Marks Card Table- This table is to store the post exam data i.e. result and statistical data of the candidate.
- Question Table- Question table is designed to store the information of the questions, including question number, question content, question type, question difficulty level coefficient^{10,13}, etc.
- Answer Option Table- This table is designed to store all the options of the questions. Suppose any specific question has four options, then all the options are stored in this table.
- Answer Table- This table is designed to store all the correct options for all the questions. This will be used for generating the exam result.
- Video Table- Video table is designed to store all the recorded videos during the examination. Since this advance facility is new, a separate table is there to store all the recorded video.

5.2 Create and Connect the Database

Microsoft visual studio 2015 has been used for the implementation of the application. web.config file used to set all the configuration code of the application which we are going to use during the development like database configuration, SMTP email settings, compiler version etc. So in this application the database connection code has been called from the configuration file. The database configuration code is named as connection string. Entity Framework has been used for database code with code

first which help to generate the database based on model code. The database diagram is depicted at Figure 3. The database connection string code looks as follows:

```
<connectionStrings>
  <add name="eExamContext" connectionString="Data Source=ADMIN-PC\SQLEXPRESS;Initial Catalog=eExam;Integrated Security=True;MultipleActiveResultSets=True" providerName="System.Data.SqlClient" />
</connectionStrings>
```

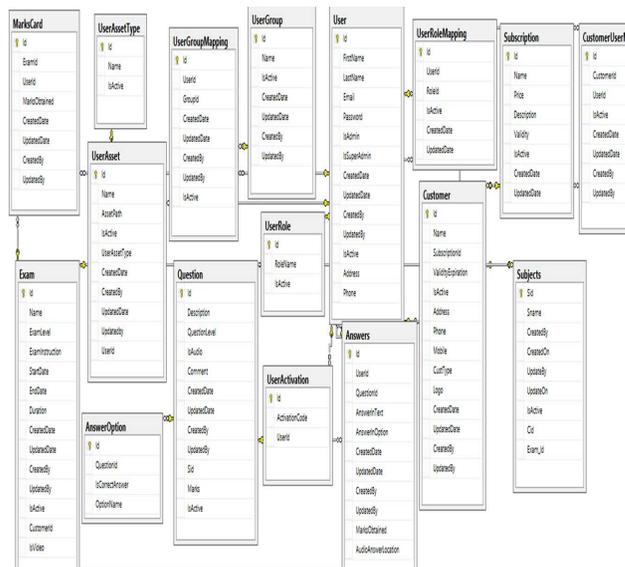


Figure 3. Database diagram.

6. Security Mechanism Design

The most important and sensible factor of online examination system is security.

- Data Transmission Security- The data transmission is based on the TCP/IP protocol^{5,9}. The three-way handshake in the TCP protocol can ensure the data integrity and reliability². All the test and answer packages are encrypted. To limit the data package, a time label is added to every data package which is to be used within the time permitted. The encryption of data here prevents all the security issues during the transmission of the data.
- System Data Security- The system can be used by different users but with proper authentication¹¹ and authorization. There is no other way to access the data without authorization. No authority has the right or the permission to access the data of

other authority. Hence every user is limited to the authorized functions³, so that the security of the data in the system is guaranteed.

- **Data Usage Security-** The users are allowed limited access to the data of the system. The system is shielded with the usage of all short keys to prevent cheating. The right click is disabled to prevent the user from accessing any other option. Every test package is encrypted with time and it is not possible to decrypt it. The test will be automatically submitted. The question and answer will be shuffled for every user. No two users will get the same pattern of question and answer. There is no option to minimize the screen. In case if accidentally minimized, the examination will be automatically submitted.
- **Monitoring System-** The advanced and new feature of this system is that it has live monitoring system. During the examination, each and every activity of the candidate will be recorded^{14,15} and stored in the database. With this advanced feature, the security during the examination will be very tight and the chances for cheating are very less. The implementation of monitoring system with video recording¹⁶ can be seen in Figure 4.

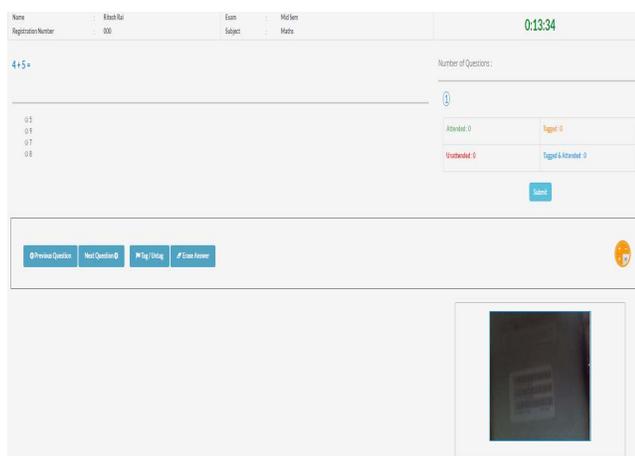


Figure 4. Live exam screen.

7. Conclusion

The advance online examination system designed in this paper is implemented using the ASP.NET technology, MVC5 architecture, and MSSQL Server database. The system has three-tier B/S architecture. The current situation and drawbacks in the existing system are given

in this paper at first. Then the logical structure and system function design of the advance online examination system are given. Then the analysis of the steps i.e., progress of the online exam based on the system has been taken out. The structure and design of the database tables are presented in this paper. The main critical work of the system is the security mechanism. The detailed information about the security mechanism is mentioned in this paper.

The system can be applied in many ways. It can be used by educational institutions to conduct institutional exams, entrance exams^{6,7}, etc. The companies (big, small or startup) can conduct entrance exam¹² and interview without allocating any centre. This advance online examination system has greatly reduced the workload of faculty/organization taking examinations. The advance features of submitting voice answer and listening to the question is very helpful to special candidates and also to those who has poor typing skills. The live recording of video is helpful in conducting a fair exam. By this way, the objective is achieved and existing system is updated with the advance version.

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