



# The Development and Deployment of an Online Exam System: A Web Application

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## **Authors' contributions**

*This work was carried out in collaboration among all authors. All authors read and approved the final manuscript.*

## **Article Information**

DOI: 10.9734/AJRCOS/2023/v16i2335

## **Open Peer Review History:**

This journal follows the Advanced Open Peer Review policy. Identity of the Reviewers, Editor(s) and additional Reviewers, peer review comments, different versions of the manuscript, comments of the editors, etc are available here: <https://www.sdiarticle5.com/review-history/100098>

**Method Article**

**Received: 28/03/2023**

**Accepted: 31/05/2023**

**Published: 05/06/2023**

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## ABSTRACT

The rapid advancements in computer technology and the internet's acceptance in every aspect of our lives, particularly in recent years, have made students and instructors vital in the teaching and learning sector. Web-based studies have also brought about advances in the education area, and numerous applications have become widespread in this field. In this paper, we suggested an online test multiple-choice question assessment system for students called the Online Exam System (OES). This system may be used by any university, college, or institution that has a computerized education system. The OES can be used by teachers to administer quizzes. The system will calculate the participant's performance based on his response, and the following question will be created based on the participant's performance. After the examination, the system will display the results and offer feedback based on the participant's request. Administrative control over the entire system is available. A teacher has authority over the question bank and is responsible for creating test schedules. Therefore, the project will be very helpful for the beginner and mid-level programming learners. And also, will give a proper guideline to the students who are willing to learn programming and introduce the users with competitive programming and problem-solving skills.

*Keywords: Online exam system; internet applications; PHP; MySQL; CSS; HTML.*

**2010 Mathematics Subject Classification:** 53C25, 83C05, 57N16.

## 1. INTRODUCTION

Computer technology is advancing at a rapid pace, and it is now being employed in virtually every industry. The use of computer technology, particularly web-based applications, has become a requirement for making education delivered continuous and growing it also in the education sector. Computer technology, particularly internet applications, have begun to be employed in every sector of education in this respect. Many teaching and learning institutions across the globe use online technology to conduct their test activities and studies [1]. In this paper, we present the Online Exam System (OES), a web-based intelligent multiple-choice-question assessment system for assessing pupils. It is a method that allows students to take an exam from anywhere in the globe, with no interaction between pencil and paper, but rather between computer and human person. The questions differ from student to student for the same exam while they are taking it at the same time. Teachers can utilize the OES to evaluate pupils in an effective, efficient, and flawless manner. Any university, college, school, or educational facility can utilize this method to administer examinations to its students. It is now one of the more efficient and successful techniques of evaluating faraway pupils. One of the primary advantages of our system is automatic marking, which eliminates the need for professors to examine the answer script like they would in a manual test. It saves a teacher's important time. Students, on the other hand, can score based on

their merit level, and it will provide feedback on whatever side a student is poor in. Due to the challenges of rising class numbers and the need for more efficient and effective means of assessing remote students [2], the usage of online test systems has grown in popularity in recent years. It is because of the growing popularity of distance education. In the past this assessment technique was widely used to evaluate students and remains popular among both students and teachers. However, there are several recurring challenges associated with this method that we encounter regularly. Some of these issues are as follows.

- I. The manual approach necessitates the use of pens/pencils and paper. The instructor must devote time to script checking.
- II. Students must wait for their results until the teacher has completed script checking.

These are the most prevalent issues with the manual exam method, which alternated each time a quiz was given. Because of these factors, the popularity of the manual method is dwindling, and online test systems have taken its place. The web-based test method is becoming increasingly popular these days. As technology spreads across the world, automated systems will eventually take the place of manual systems [3]. Currently, large institutes are having great success with their online quiz systems [4]. With the passage of time, the online quiz has piqued the curiosity of both faculty and students. People in major cities and companies are realizing how

much better and more efficient the online quiz system is [5]. This system has recently been introduced into the technological world. However, this method has several flaws. If this system has an intelligent component, it will be ideal.

The issues that may arise with a web-based quiz system. The main objectives of this Online Exam System are:

- I. Responses by the candidates will be checked automatically and instantly.
- II. Online exam system can reduce the hectic job of assessing the answer given by the candidates manually.
- III. It will reduce paperwork to be Online Exam System.
- IV. The result can be shown immediately to the students, reducing the anxiety.

## 2. LITERATURE REVIEW

P. Hua and colleagues presented and implemented a Web Services-based Online Training and Exam System. The system comprises five modules: System Management Module, Item Bank Management Module, Online Training Module, Online Exam Module, and Statistical Analysis Module. Then there's the

design idea [6]. M. A. Sarayrih [7] created and launched a web-based Online Exam System software at Sur University College with extra security features using biometric devices, network protocol, and object-oriented paradigms to improve online examination systems. A web-based Turkish automated short answer grading system (TASAG) is created in [8] this article to score test questions and generate online examinations for automatic short-response question scoring. TASAG is the first program of its sort for the Turkish language, which makes this research unique. This [9] article aims to present a new digital examination system based on the Visual Studio (MSVS) of Microsoft; this system is the only such system a diversity of applications, but it also has interactive questions and answers interface. This [10] research aimed at introducing and assessing the effectiveness of a large online high-level test for dentistry students at the end of the semester COVID-19. This study describes an attempt to use mobile technology to ease test management and performance evaluation tasks in the context of a learning process [11,12], citema. In [13] this article, the online exam system was created using the C# language tool, .NET technology, and SQL Server 2005 database technology.

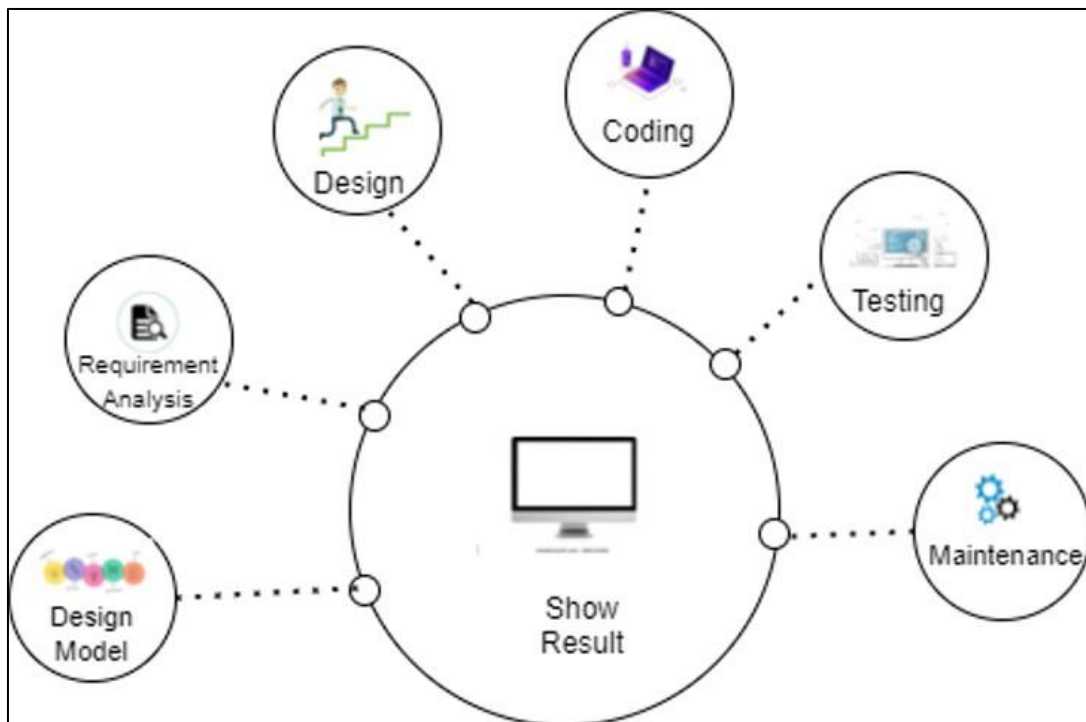
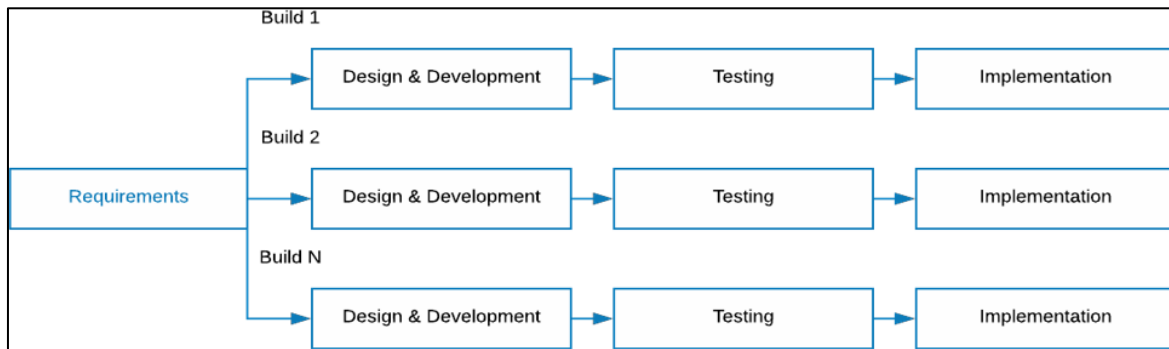


Fig. 1. Workflow of web application development



**Fig. 2. Linear sequential model**

### 3. METHODOLOGY

We followed six steps in the development of this OES system. Fig. 1 depicts the procedure that we followed during the development process. During the coding process, we employed XML, HTML, and CSS in the design part. We utilized JAVA and JavaScript to implement this idea. We utilized local storage to store the data.

#### 3.1 Designed Model

The Incremental model has been determined to be the most appropriate for the Software Development Life Cycle (SDLC) approach and will be used. This model has an advantage over the Linear Sequential Model (LSM) in that it inherits the LSM's quality while excluding its rigidity [14]. Furthermore, the Mechanism Iteration model's feedback process will be available in the incremental model [15]. Another aspect that influenced the decision to choose this approach was the limited time available to create an initial functional version of the system [16]. The entire methodology is shown in Fig. 2.

#### 3.2 Requirement Analysis

During this phase, all potential system needs are identified and recorded in a requirement specification document. The process of obtaining and analyzing requirements has been accelerated and is now mostly focused on software [17]. Understanding the nature of the program to be created, as well as the information domain for the software, necessary function, behavior performance, and interface. Other criteria include the type of database required and traffic control capability.

#### 3.3 Software and Hardware Requirements

**Operating System:** Microsoft Windows XP Professional SP3/Vista SP1/Windows 7 Professional /Windows 10 installation

**Processor:** 800MHz Intel Pentium III or equivalent

**Memory:** 512 MB

**Disk space:** 750 MB of free disk space

**Django:** Django is the most well-known and established Python web development framework. It makes it easy to create better Web apps in less time and with less code. Django is a clever and efficient way to build websites. Actually, it is based on python programming language. Python is much simple but more secure for any kind of web application. So, Django is becoming a more popular framework and widely used one in recent years.

**Sublime Text:** sublime text is a proprietary cross-platform source code editor that includes a Python API (API). It natively supports a wide range of programming and markup languages, and new features may be added under open licenses. Sublime Text is made up of unique components, resulting in unrivaled responsiveness. Sublime Text raises the standard for performance with a strong, proprietary cross-platform UI toolkit and an unrivaled syntax highlighting engine. Sublime Text has a bespoke UI toolkit that is geared for speed and elegance while utilizing native capabilities on each platform.

#### 3.4 Design

It entails translating the SRS requirements into a logical structure that can be implemented in a computer language. The design phase produces a design document, which serves as an input for all following SDLC stages.

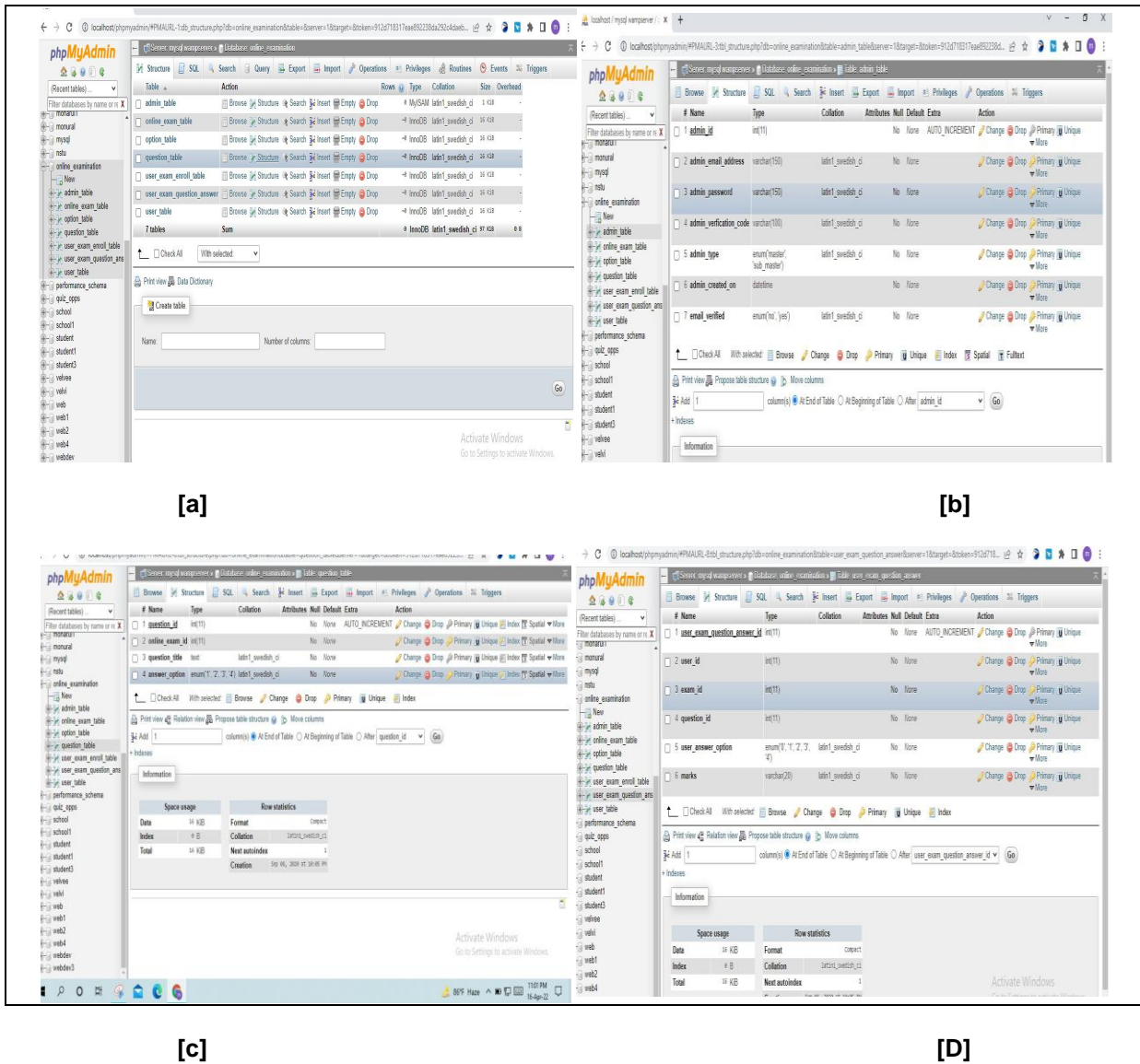


Fig. 3. (a) Database Table and Structure. (b) Admin Details Table. (c) Online Test Question Table. (d) Answer

This app's design is basic and user-friendly, with seven primary activities, namely:

- i) Register
- ii) Login
- iii) Course Enrollment
- iv) Leaderboard
- v) Admin Panel
- vi) Online Events
- vii) Recommendation

### 3.5 Coding/Implementation

As the project is web and based, we had to code this. For coding this we used PHP for back-end programming, for database storing MYSQL.

#### 3.5.1 XML

The Extensible Markup Language (XML) is a markup language that specifies a set of rules for encoding texts in a human- and machine-readable manner. XML's design goals stress simplicity, universality, and cross-platform usability. It's a textual data format with excellent Unicode compatibility for a variety of human languages. It was also created with the intention of storing and transporting data.

#### 3.5.2 HTML

HyperText Markup Language (HTML) is a markup language for creating a webpage.

Webpages are usually viewed in a web browser. They can include writing, links, pictures, and even sound and video. HTML was made by the World Wide Web Consortium (W3C).

### 3.5.3 HTMLCSS

Cascading Style Sheets (CSS) is an acronym for Cascading Style Sheets. Web designers that do not employ CSS in their website design and development are quickly becoming obsolete. And knowing CSS is perhaps as vital as knowing HTML - some would even argue that knowing CSS style sheet pertains to the page itself is more crucial. For years, style sheets have been utilized in document design. The component that is unique is the cascade. Like a river over a waterfall, a Web style sheet is meant to flow over a sequence of style sheets. One of the most powerful tools is CSS.

### 3.5.4 HTMLJAVA

Java is a general-purpose, concurrent, object-oriented, class-based programming language with a runtime environment (JRE) that includes the JVM, the Java platform's cornerstone. Java is a free programming language that runs on all platforms. To mention a few things, Java allows us to play online games, communicate with people all over the globe, calculate mortgage interest, and see photos in 3D.

### 3.5.5 HTML java script

JavaScript is the HTML and Web programming language. JavaScript is utilized in places other

than web pages. JavaScript is used in many desktop and server apps. The most well-known is Node.js. Some databases, such as MongoDB and CouchDB, employ JavaScript as their programming language as well.

### 3.5.6 PHP

PHP is a server programming language that may be used to create dynamic and interactive Websites. PHP is a popular, open-source, and cost-effective alternative to rivals such as Microsoft's ASP.

### 3.5.7 MYSQL

MySQL is a free and open-source relational database management system (RDBMS) that uses SQL to handle data in the database. MySQL has APIs for the programming languages C, C++, Eiffel, Java, Perl, PHP, and Python. In addition, OLEDB and ODBC providers exist in the Microsoft environment for MySQL data connectivity. There is also a mysql.NET Native Provider, which provides native MySQL to.NET access without the requirement for OLE DB. Because of its speed and dependability, My SQL is most often used for Web applications and embedded applications, and it has become a popular alternative to proprietary database systems. MySQL is compatible with UNIX, Windows, and macOS. MySQL AB creates, supports, and markets MySQL.

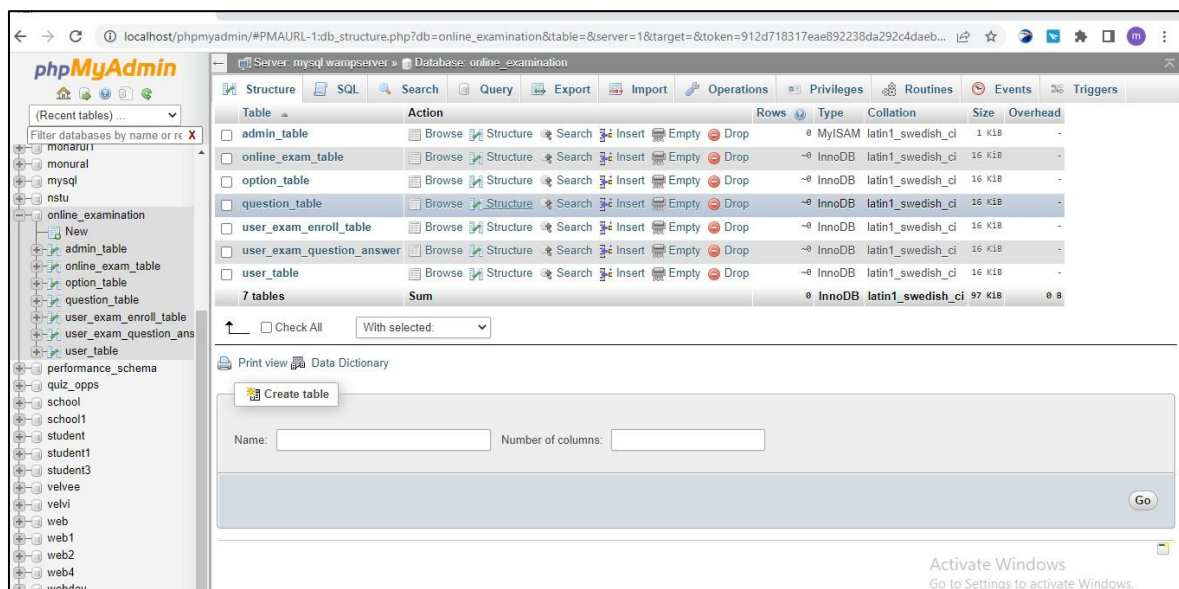


Fig. 4. MySQL Database where all information is stored

### 3.6 Testing

It contains error detection in the application. The testing process begins with a test strategy, which identifies test-related tasks such as test case development, testing criteria, and testing resource allocation. During the design phase, the code is tested and mapped to the design document. The testing step produces a test report including problems discovered while testing the program. The project was not tested on real hardware, as well as an emulation or software environment. Each of the project's constituent tasks has been tested.

### 3.7 Maintenance

It covers the implementation of modifications that software may go through throughout time, as well as the implementation of new needs once the program has been deployed at the customer's location [18]. The maintenance phase also includes dealing with any residual faults that may remain in the program after the testing phase is completed. The project's maintenance is low-cost and efficient since the user receives this program for free, and because this application is shared over a network, maintenance is a little more complex.

## 4. DATABASE DESIGN

The process of creating a comprehensive data model of a database is known as database design. This logical data model includes all the logical and physical design options, as well as physical storage characteristics, required to build a design in a data definition language, which may subsequently be used to establish a database. Each entity in a properly attributed data model has comprehensive characteristics [19,20]. The phrase database design can refer to many distinct aspects of the overall design of a database system. It is primarily and accurately regarded of as the logical architecture of the underlying data structures used to store the data. These are the tables and views in the relational model. Entities and relationships in an object database map directly to object classes and named relationships. However, the word database design may also refer to the process of creating not just the underlying data structures, but also the forms and queries that are utilized as part of the entire database application within the database management system (DBMS). The process of conducting database design typically comprises a number of phases that the database

designer will carry out. Typically, the designer must establish the relationships between the various data pieces and then superimpose a logical structure on top of the data based on these relationships. The name of the database designed for administrators is "admin panel," and it comprises five tables. Those tables contain data from the admin details, coding test, quiz test, random test, and interview question test. Admins can change this information from this page. Admin details table is the primary source of all data utilized in the web application's online events. This table is used to store admin information such as usernames and statuses. When an administrator need access to the admin panel in order to change the data in all other tables. The server verifies if the login and status are valid, or invalid.

Fig. 3 describe the process of Database design. The data for online tests is contained in the online test question table. Along with the question, there are four alternatives for each question, the correct answer, marks, time for a specific question, and the online test round number. The admin updates the REST APIs for online events using the data from this table. The response table is built around four distinct aspects. There are four of them: Question Id, Question Number, Correct Answer, and User Provided Answer. If the administrator wants to change the page, he or she may do so.

## 5. RESULTS AND SNAPSHOT

### 5.1 Snapshots of Admin Panel

This section includes the activities of all admins. First, by using the Email and Password, we established an admin. Then if this admin would want to raise the quantity of the admin. There are two fields for each admin. Email is one and password is another. Enrique's got all the Email. The admin will discover the admin home page following the login process. Five new features are on here, user can be enabled or disabled as well as removed. this page These include home, user management, questions added, list of questions and logout. When the admin logout this page, the page turns into Admin Login page again. Even if manage user has been clicked, we have found user list in a display. If an administrator wishes to create a quiz, he may do so by clicking on Add Ques. This will bring up a screen where he can enter four values: Question No, Question, Choice option, and Correct No. After entering the information, he or she must

save it by clicking the Add A Question button. If the administrator navigates to the Quiz list, he or she will see a list of all the Quiz that have been added. If the administrator wants to

remove a question from the list, he or she may easily do so by removing the selected question. Fig. 5 illustrates the process of admin panel.

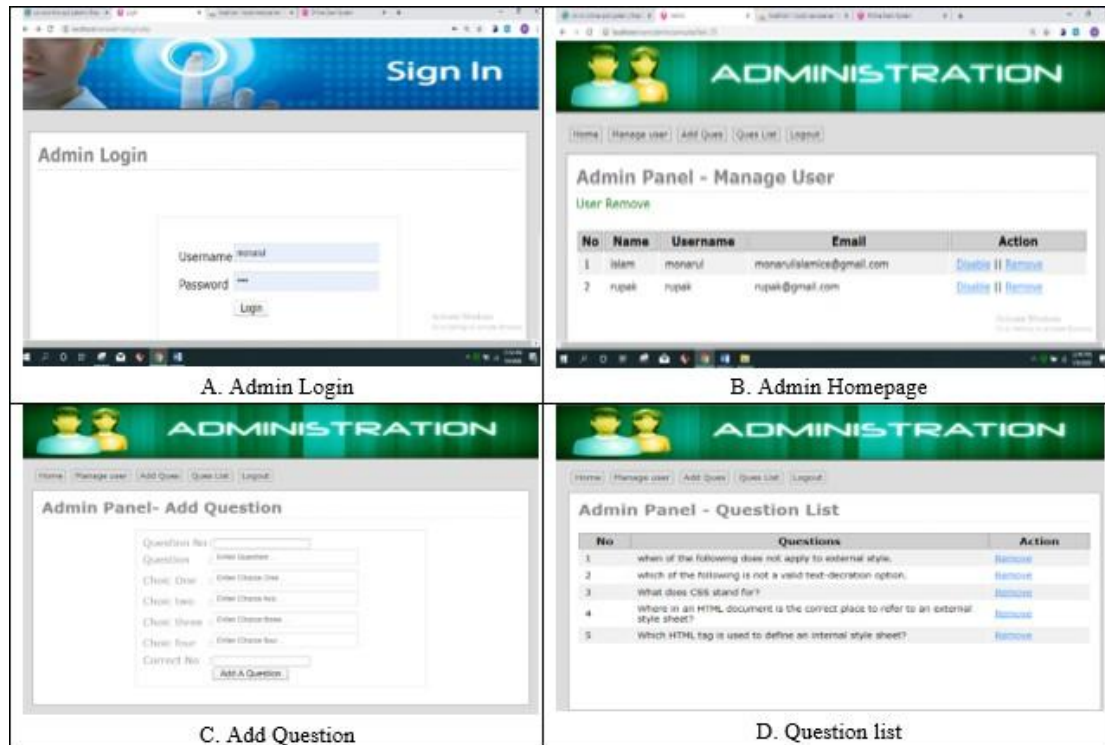


Fig. 5. Admin management system for login, registration and Add Question

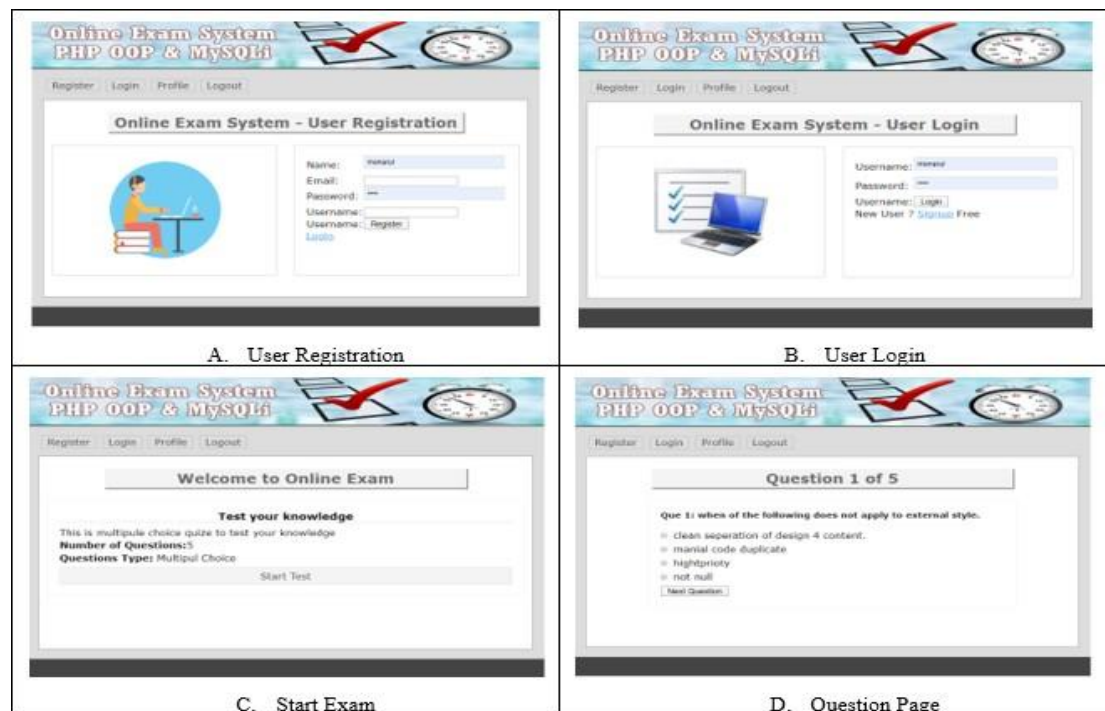
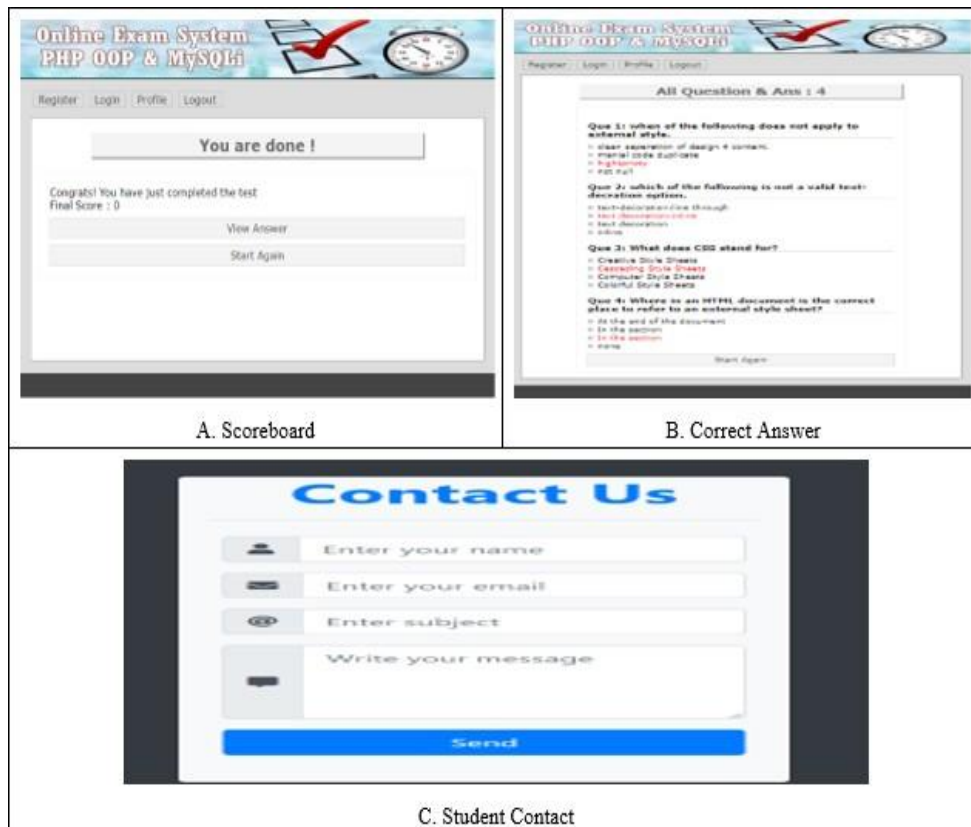


Fig. 6. The user interacts with the system by registering, login, and commencing the test





**Fig. 7. The system allows the user to see the Scoreboard, right answers, and comments about the Test**

### 5.2 Snapshots of User Panel

If a person wants to utilize this website, he or she must first create an account. For this, the user must register the webpage by providing their name, email address, password, and username.

When you click the register button, the login page appears automatically. The user must login on the user login page by entering their Username and Password. However, one restriction is that the user must login with the same Username and Password that he used previously. After logging in, a welcome page will appear. The user will be able to view how many questions are in this test, as well as the different sorts of questions. If the user wants to proceed, he or she must simply click the start button. The user can begin the exam from this page. During the exam, the user may only select one choice. Above, all description is described by Fig. 6.

The final score was displayed on the scoreboard, which is shown in Fig. 7. In this case, we've added two more options: correct answer and restart. The user can receive the right answer

and his or her submitted response by just clicking on the View Answer button. Aside from that, he/she can restart the exam by choosing Start Again. The right answers are shown in the following ways on the correct answer page. The right answers are highlighted in red. If an exam is required, the user must click the Star Again button. If a user requests an email after passing the exam, the administrator can send it to them. Admins can also post comments here.

### 6. CONCLUSION

Developing a web application for an online exam system offers significant advantages for both students and educational institutions. Firstly, it provides unparalleled accessibility and convenience, allowing students to take exams from anywhere with an internet connection. This eliminates the need for physical presence and provides flexibility, particularly for remote or geographically dispersed learners. Additionally, web-based exams are cost-effective and resource-efficient, eliminating the expenses associated with printing, distributing, and grading physical exams. The automation of grading

processes saves time and resources for institutions, enabling them to focus on other educational priorities. The major goal of the OES is to hold an online test to assist students in becoming self-paced learners and to familiarize them with the exam patterns of numerous competitive exams such as GATE, TOEFL, and different PSUs. The "Online Exam System" has been finished successfully. The system's aim has been met, and issues have been resolved. Exams may be handled quite easily by the user. Every question is saved in a local database. After successfully completing the exam, the user will receive the results and comments through email.

### COMPETING INTERESTS

Authors have declared that no competing interests exist.

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