(RESEARCH ARTICLE)

Development of an online examination system for staff recruitment in Omani hospitals with automated grading and certification

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Abstract

This Paper aims to streamline the recruitment process by introducing a digital platform that automates key stages, particularly online exams. By shifting to an online system, time spent on administering and evaluating exams is reduced, minimizing administrative tasks and enhancing efficiency. This allows for faster decision-making and a smoother recruitment process for both recruiters and candidates. The platform will automate tasks like exam distribution and grading, while also incorporating security features such as identity verification and anti-cheating measures. It also automates scheduling and result analysis, reducing HR workload and improving overall productivity. The goal is to create a faster, more efficient, and fair recruitment process. This Idea aims to develop an online testing platform tailored to Oman's recruitment needs, enabling the creation, administration, and evaluation of online tests for various job roles across industries. The platform will generate performance reports, offering insights like average scores, question difficulty, and time spent on each question. It will integrate with existing HR systems for smooth data transfer and candidate tracking. The platform aims to make the recruitment process more cost-effective, efficient, and transparent, offering a faster, unbiased evaluation method. Candidates can take exams remotely and receive instant feedback, enhancing engagement and satisfaction. This approach creates a more efficient, secure, and candidate-friendly hiring process for both recruiters and job seekers in Oman.

Keywords: Recruitment Process; Digital Platform; Online Exams; Automation; Efficiency; Performance reports; Identity Verification; Anti-Cheating Measures; HR Systems Integration; Instant Feedback

1. Introduction

This paper seeks to transform the recruitment process in Oman by developing an online examination system that automates key stages, particularly focusing on assessments. Traditional recruitment methods are often burdened with time-consuming manual tasks such as exam management, grading, and scheduling, leading to inefficiencies and delays. The proposed digital platform aims to streamline these processes, reducing administrative workloads and enhancing overall efficiency.

The system will automate essential tasks like exam dissemination and grading, while also incorporating security features such as identity verification and anti-cheating measures. It will also handle scheduling and result analysis, providing HR teams with valuable insights into candidates' performance, such as average scores, question difficulty, and time spent on each question.

This system designed to cater specifically to the recruitment needs in Oman, the platform will support the creation, administration, and evaluation of online tests for a variety of job roles across different sectors. It will integrate seamlessly with existing HR systems, ensuring smooth data flow and candidate tracking, which enhances transparency

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and simplifies the process. Candidates will have the flexibility to take exams remotely and receive instant feedback, improving engagement and satisfaction. In summary, this research intends to create a quicker, more affordable, and unbiased recruitment process that serves both employers and candidates in Oman, providing a secure, streamlined, and easy to use hiring solution.

2. Review of Related Literature

This work discussed about an online examination system is a web-based platform for conducting exams via the internet or intranet. Developed using a Browser/Server framework, Microsoft Visual Studio 2008, C# 3.5, and SQL Server, it employs ASP.NET for web development and auto-grades multiple-choice questions. [1]. This research used a digital review system built on Microsoft Visual Studio (MSVS) for online exams, featuring a flexible application with professional interfaces for presenting questions and answers. When tested in a university environment, the system demonstrated an 80% improvement over traditional methods, boosting performance for both students and staff. [2]. This paper presents an online examination system that automates exam creation, distribution, and grading, reducing manual work and improving efficiency. The system supports multiple question formats and includes features like user authentication, secure environments, and real-time results. It offers faster processing, reduced administrative tasks, and enhanced security. Overall, it provides a modern, user-friendly solution for educational institutions to streamline their exam processes. [3]. The study by Jiang et al. (2020) introduces a web-based exam system designed to improve the efficiency and fairness of online assessments using technologies like PHP and Ajax. Key features include automated test generation, real-time scoring, and user management. Also used in large university courses, it reduces workload and enhances teaching and learning. The system shows strong potential for wider educational use. [4].

Hou (2018) developed an online exam system using ASP.NET to address the limitations of traditional testing in the digital age. Built on a B/S architecture, the system enables flexible and efficient online assessments. It supports the growing trend of digital education by streamlining exam processes. This approach modernizes evaluation methods with scalable and user-friendly technology.[5]. The study aimed to develop an online examination system using ERDs, case diagrams, and object-oriented design to model system processes. It utilized MYSQL for the database, MD5 for encryption, and PHP for database interaction. The system offers a secure and efficient way for students to take exams, addressing previous limitations like data security and confidentiality. After testing, the system met all required specifications. [6]. Educational institutes face challenges in traditional assessment methods, such as cheating and bias. Blockchain offers immutability and traceability, ensuring secure and transparent evaluations. While several blockchain-based assessment models have been proposed, no systematic review (SLR) exists. This paper explores existing models, identifies research gaps, and proposes a new blockchain-based assessment model to improve online examination evaluations.[7].

This article reviews 66 studies from 2014 to 2020 on introductory programming courses (IPC), identifying methods to improve teaching, assessment, and course content. It evaluates tools for IPC processes and explores topics like collaborative learning, cognitive assessments, and performance prediction. A new taxonomy for IPC research is proposed, along with guidelines for instructors. The review also highlights open research issues for future IPC studies. [8]. This paper discussed about the Digital technology, which has transformed assessments, yet paper-based exams remain widely used due to their accessibility and reliability. This ongoing use calls for automated evaluation systems to reduce educator workload and improve efficiency. An AI-based system was developed to assess various question types with high accuracy. It achieved 99.89% accuracy for multiple-choice, 99.91% for matching, and 95.40% for short-answer questions. [9].

This article talks about the computer vision which enables machines to interpret visual data, making it useful for automating paper-based test grading. Large institutions still rely on manual grading, which is time-consuming. An automated system was developed to scan and analyze test images, identifying key areas like multiple-choice sections. It verifies results using the test's predefined template structure. [10]. Pen ink analysis plays a crucial role in verifying the authenticity of handwritten documents. While traditional methods rely on destructive techniques, this study introduces a novel, non-destructive approach using scanned images in the visible light spectrum. The method extracts both global statistical and local motif textural features from ink to differentiate between pens, using the absolute difference between word-pair features as input to a binary classifier. Among several tested models, the random forest classifier delivered the best performance, surpassing existing techniques in pen ink discrimination. [11 - 13].

This paper provides an overview of convolutional neural networks (CNNs) and their applications in pattern recognition tasks such as image classification and object detection. [14]. This article proposes efficient shallow learning models as a viable alternative to deep learning, showing they can achieve comparable performance with reduced complexity and resource use. [15]. This study introduces an improved version of the LeNet-5 CNN architecture for enhanced image

recognition performance in computer vision applications.[16]. This paper presents a method using Progressive ADMM to achieve extremely low-bit quantization in deep neural networks without sacrificing accuracy, improving model efficiency. [17].

Lu et al. (2021) Presents an automatic scoring system for handwritten exam papers using the YOLO (You Only Look Once) object detection algorithm to identify and evaluate answers efficiently. [18]. Eltahir et al. (2022) Explores the implementation of electronic exams (e-exams) during the COVID-19 pandemic in higher education, highlighting challenges and effectiveness through a quantitative study. [19]. Gorgani & Shabani (2021) proposes a hybrid method combining FMEA, QFD, and k-means clustering to improve fairness in online exams during the COVID-19 pandemic. [20].

3. Methodology

3.1. Flowchart for Creation of Online Examination for Staff Recruitment in Oman

Figure 1. outlines the process of creating an online examination system for staff recruitment which begins on the Index page, that introduces the website and provides navigation options for new candidates to register or existing candidates to log in. New candidates proceed to the registration page, where they create an account and are then redirected to the login page. On the login page, registered candidates enter their credentials, which are verified at a decision point to determine if login is successful. If successful, candidates are granted access to the Main page otherwise, they remain on the Login page to retry or return to registration page. The Main page serves as the central hub, allowing candidates to access various sections including the Exam page, Result page, Leaderboard page and Certificate page. Before taking the exam, candidates visit the Instructions page to review guidelines, after which they proceed to the Exam page to complete their test. Upon finishing the exam, they are directed to the Result page to view their scores. From there, candidates can return to the Main page, check the Leaderboard page to compare rankings with others, also can access the Certificate page to view or download a certificate if they have passed.
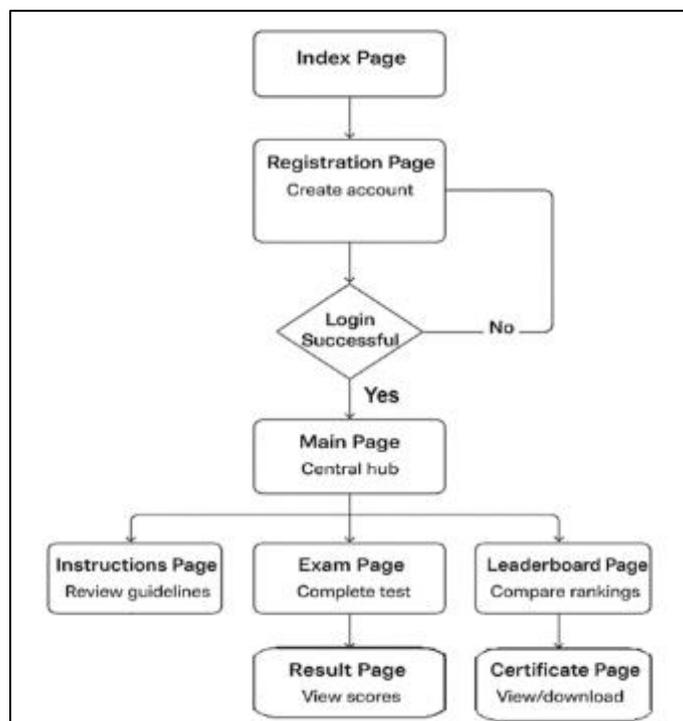

Figure 1 Flowchart for Creation of Online Examination for Staff Recruitment in Oman

3.2. Software used

Figure 2. illustrates a web development workflow involving three main tools. First, Visual Studio Code is used to write and edit the source code of the web application. Then, XAMPP is used to set up a local server environment, allowing developers to preview the site's functionality as the project were hosted online. Finally, the site is opened in a web browser to view how it appears to candidates and test the interface and performance.
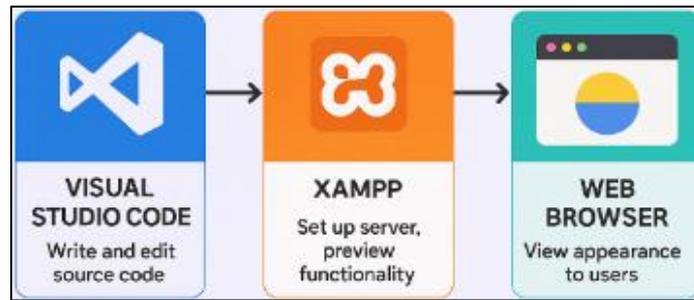
Figure 2 Web Development Workflow Using VS Code, XAMPP, and Browser

4. Results and discussion

4.1. Login and Navigation Workflow of an Online Examination Application

Figure 3 illustrates the Login and Navigation Workflow of the proposed Online Examination Application. The process begins at the Index Page, which serves as the entry point of the system. This page briefly outlines the objectives of the platform and provides two navigation options: Login and Registration.

On the Registration Page, new candidates are required to create an account by entering their personal details and then clicking the Register button. Candidates who already possess an account can directly proceed to the Login Page by selecting the Login link.

The Login Page requires candidates to enter their unique User ID and Password. If the entered credentials are invalid, the system generates an error message indicating "Incorrect ID or Password." Once the correct credentials are provided, the candidate successfully gains access to the Main Page.

The Main Page acts as the central navigation hub of the application. It provides four links leading to the following sections:

- Exam Page
- Answer Page
- Leaderboard Page
- Certificate Page

Initially, these pages remain inaccessible until the candidate completes the examination.

On the Exam Page, the candidate is presented with a set of multiple-choice questions related to the specific workplace or job role for which they are applying. Upon completing the exam and submitting responses, the system automatically redirects the candidate to the Answer Page. This page displays the candidate's score and clearly indicates whether they have passed or failed. In addition, it provides detailed feedback by showing the correct answers for all questions attempted incorrectly. A navigation button at the bottom of the page allows the candidate to return to the Main Page.

After completing the examination, the remaining sections become accessible. The Leaderboard Page displays a ranking table featuring the top five candidates. Finally, the Certificate Page automatically generates a personalized certificate containing the candidate's name and score. This certificate is made available in a PDF format, which candidates can easily download for future use.
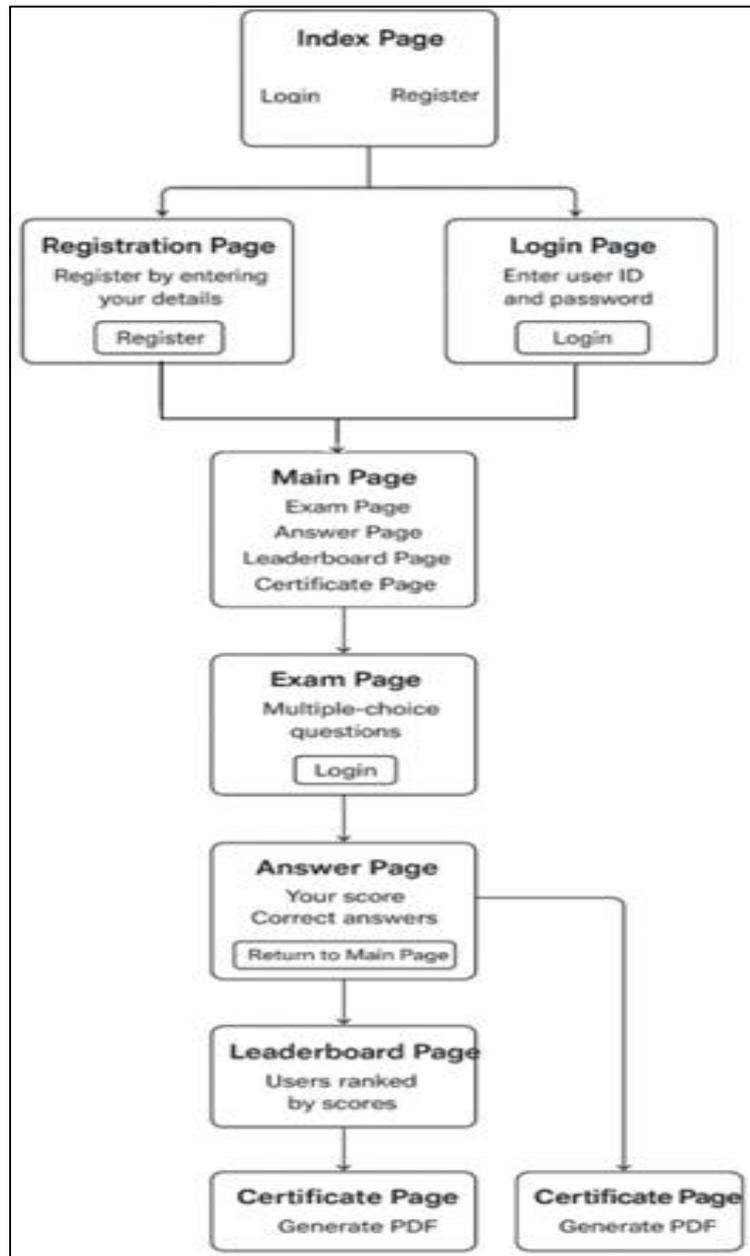
Figure 3 Login and Navigation Workflow of an Online Examination Application

4.2. Entity-Relationship Diagram of an Online Multi-Domain Examination System

Figure 4. shows the Entity-Relationship Diagram (ERD) which represents a database for a multi-domain online examination or quiz system covering areas like airports, hospitals, banks, etc. The candidates table stores user information with user_id as the primary key, including details such as ID, password, firstname, full name, phone, email, and workplace. The answer table captures candidates' submitted answers, with ans_id as the primary key and user_id as a foreign key linking to the users table, storing details like exam type, redundant name fields (firstname, full name), answers to questions Q1 through Q15, and scoring data including mark, total marks, and passing status. Each domain (e.g., airport, hospital, bank) has its own question table (e.g., airport_q, hospital_q, bank_q) structured similarly with q_id as the primary key and fields for question number (q_num), question text, multiple choice options (choice_a to choice_d), and the correct answer. The relationship between users and answer is one-to-many, as a single user can have multiple answer records. While the question tables are not directly linked to the answer table, they are logically associated via the exam field in answer, which determines from which domain the questions originate. Overall, this design facilitates user registration and login, allows users to take quizzes in various domains, stores their responses and results, and supports separate question sets per domain.
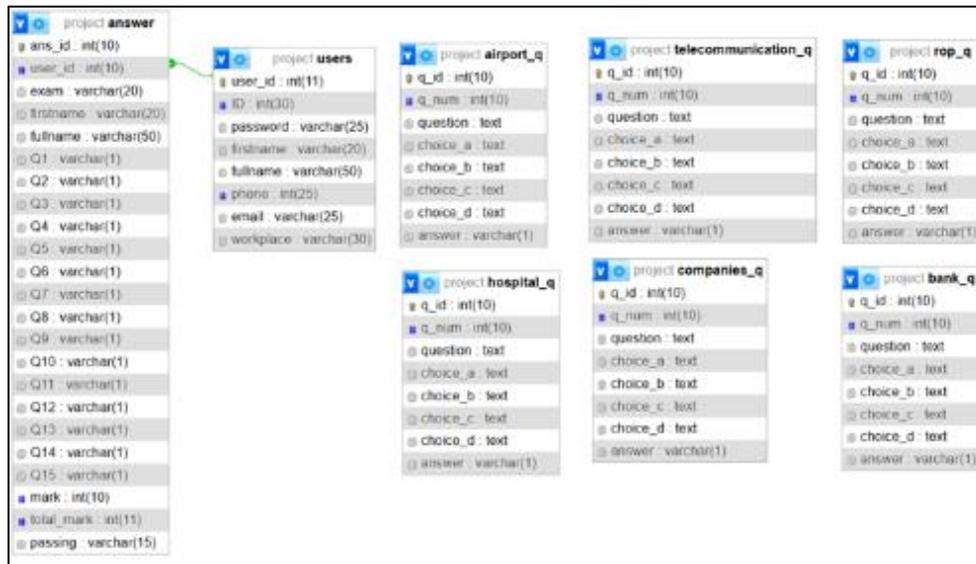
Figure 4 Database Design for Multi-Disciplinary Online Assessments done by SQL - Structured Query Language

4.3. Login Interface of the Online Examination System

Figure 5. displays a Login Page user interface (UI) designed for an online application, featuring essential components for user authentication. At the top, the page is titled "Login Page," clearly indicating its purpose. It includes two input fields, one for the candidate's National ID, which likely corresponds to the ID field in the candidates table of the database, and another for the password, mapped to the password field, with input hidden for security. A blue "login" button initiates the authentication process, where the backend checks the database for a matching ID and verifies if the entered password matches the stored one, if successful, the candidate gains access to the exam platform, otherwise, an error message is shown. Additionally, a clickable "Registration" link is provided, redirecting new candidates to a registration form to create an account.
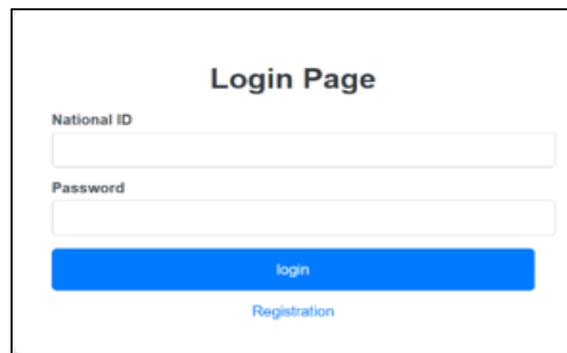

Figure 5 Candidate Login Page for Online Testing System

4.4. Main Dashboard Interface of the Online Examination System

Figure 6. depicts the Main Page (Dashboard) of an online exam system, which appears after a candidate successfully logs in, serving as the central hub for navigation. The page title "Main Page" is centered and bold, indicating its importance. It includes several navigation buttons, each linking to key system functions like "Exam Page" directs candidates to available domain-specific exams (such as Airport, Bank, Hospital), sourcing questions from the corresponding tables like airport_q, bank_q, etc. the "Result Page" shows individual exam outcomes by retrieving marks, total marks, and passing status from the answer table, the "Leaderboard List" ranks candidates based on their performance, likely using data sorted by marks and the "Certificate" section provides access to downloadable certificates for candidates who have passed. A "Log out" link positioned in the top-right corner allows candidates to securely end their session. This dashboard integrates with the candidates and answer tables to personalize the experience and ensure only authenticated candidates can access the system's core features.
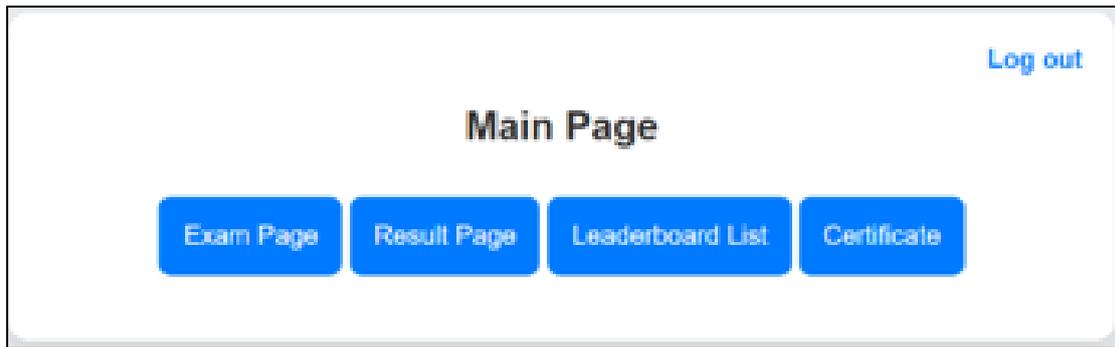
Figure 6 Central Control Page for Exam Navigation and Result Access

4.5. Online Examination Instruction and Conduct Guidelines Page

Figure 7. displays the Instruction Page of an online exam system, which outlines essential guidelines to ensure fair and informed participation. Titled "Instruction Page," it serves as a mandatory pre-exam read. The instructions emphasize time management, requiring the exam to be completed in a single sitting before the deadline, with no late submissions allowed. The question format specifies that all questions are displayed at once, each carrying equal weight, and users are permitted to review previous questions during the exam. The examination conduct rules enforce that only one attempt is allowed unless a valid reason (like a technical issue) is provided, and only the first attempt is considered valid. Academic integrity is stressed, forbidding cheating, collaboration, or seeking help, and content protection rules prohibit screenshots, recordings, or sharing of exam material. Additionally, no clarification about the exam content can be requested during the test. At the bottom right, a blue "accept" button likely confirms the candidate's agreement to these terms and initiates the exam. This page plays a critical role in ensuring participants understand the rules, promoting fairness and requiring informed consent before proceeding.
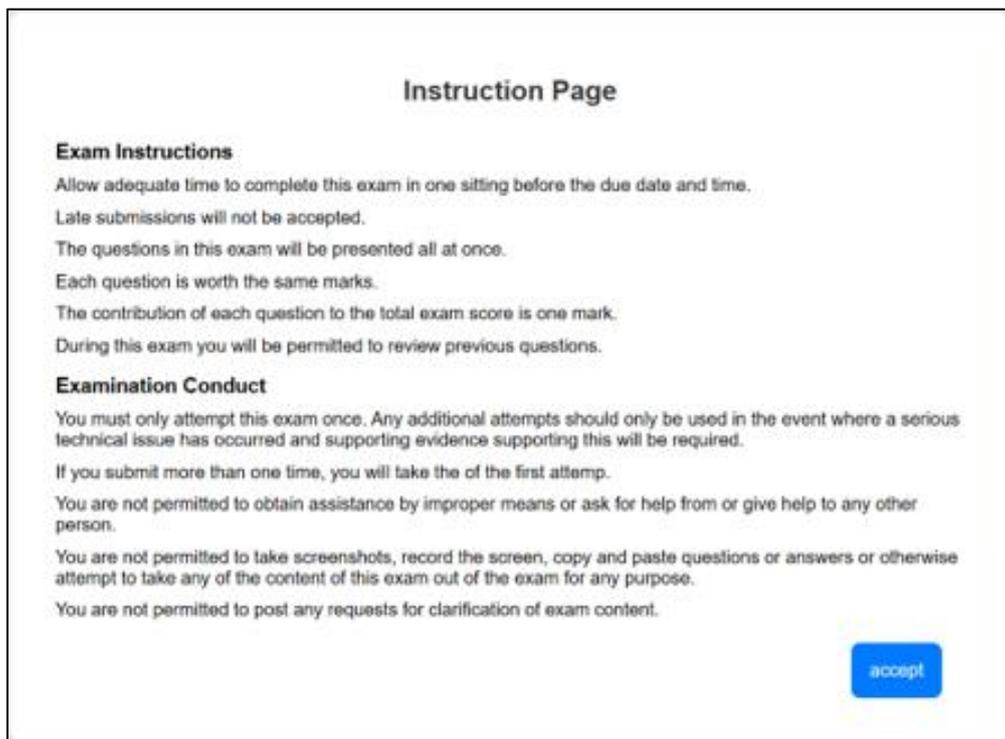

Figure 7 Instruction Interface Displayed Prior to Online Exam Commencement

4.6. Hospital Recruitment Exam – Online Examination Interface

Figure 8. showcases the Online Exam Page for the Hospital Recruitment Exam, a live test interface where candidates respond to multiple-choice questions. The page header includes the title "Online exam" and the subtitle "Hospital Recruitment Exam," indicating that the test content is sourced from the hospital_q table in the database. A "Log out" link

is positioned in the top-right corner, allowing secure exit from the session. The question format displays all questions at once, such as Question 1 involving a scenario with an N/G tube and four radio-button options like "Crush medication and dissolve in water" and "Do not administer and inform," and Question 2 focusing on proper wound cleaning techniques with a similar four-option format. Candidates can select only one answer per question, adhering to standard MCQ rules. These questions are dynamically pulled from the hospital_q table, utilizing fields like question, choice_a, choice_b, etc., while Candidate responses are likely recorded in the answer table under fields such as Q1, Q2, and so on. This interface is designed to facilitate recruitment or licensing exams for healthcare roles by ensuring questions are clearly displayed and easy to interact with.

Figure 8 Hospital Recruitment Exam – Candidate Question View

4.7. Hospital Recruitment Exam – Candidate Result and Answer Review Interface:

Figure 9. displays a post-exam feedback page for a candidate who has completed the Hospital Recruitment Exam within an online examination system. Titled "Hospital Recruitment Exam's Answers" this page serves as an answer review interface presented after submission. It features a score section stating, "Your Mark is 13 out of 15," followed by a message of "Congratulations You have Passed the Exam," indicating that the candidate's performance met the required passing threshold. A "Log out" link is available in the top-right corner for secure session termination. Below the score, a detailed question review section lists each question alongside all four multiple-choice options (a to d). For every question, the correct answer is displayed in green, while the candidate's answer is shown in red if incorrect. This feedback mechanism is backed by the system's integration with the database, where the candidate's submitted responses are stored in the answer table and the correct answers are pulled from the relevant subject-specific question table, such as hospital_q. The system then automatically evaluates the responses and generates this comparison to offer educational feedback, promote transparency in grading, and clearly communicate the candidate's final score and pass status.
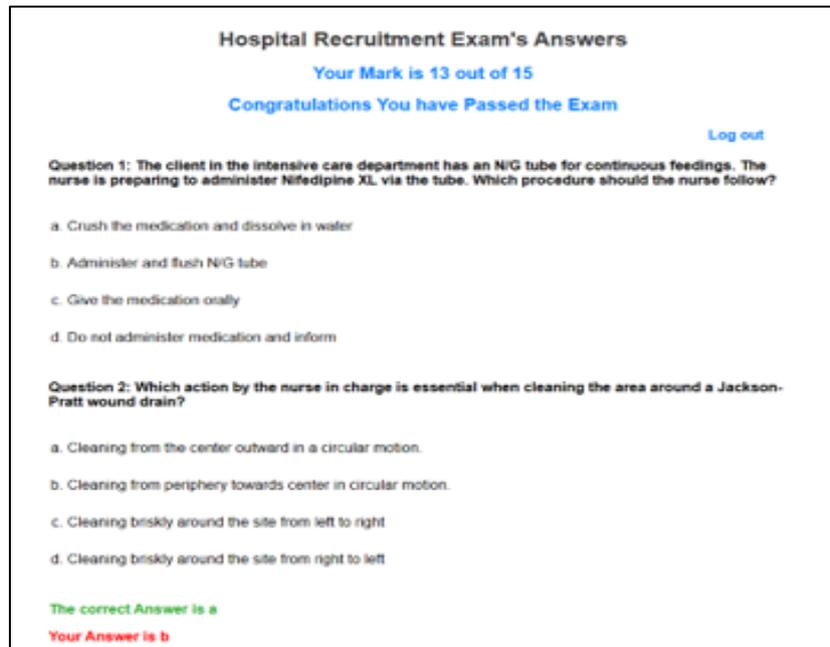
Figure 9 Result Display and Answer Validation Screen for Hospital Recruitment Exam

4.8. Shortlisted Candidates Leaderboard Interface

Figure 10. displays a user interface screen titled "List of Candidates Shortlisted", which presents the top five candidates who have been ranked based on their performance, likely in an online recruitment or qualification exam. The interface features a simple table format with two columns: Rank and Name, listing the names of the top 5 performers in ascending order from rank 1 to 5. A "Main Page" button is available at the bottom, allowing candidates to navigate back to the main dashboard. The "Log out" option in the top right corner provides an exit from the session, ensuring secure access.
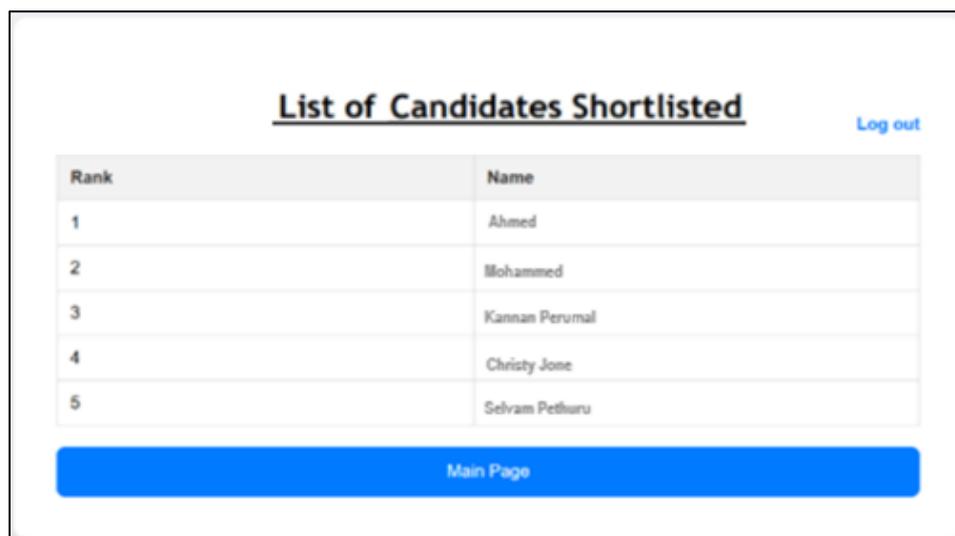

Figure 10 User Interface Displaying the List of Top-Ranked Shortlisted Candidates Based on Exam Performance

4.9. Certificate of Achievement for Staff Recruitment Exam

Figure 11. displays a Certificate of Achievement awarded to Mohammed for successfully passing the Staff Nurse Recruitment Exam with an impressive score of 75 out of 80 marks. The certificate formally recognizes his academic excellence and qualification in the recruitment process. It includes a date of issuance 2025-08-04 and has placeholders for signature, signifying its formal validity and authenticity. The design includes a gold decorative border and an official looking seal, enhancing the certificate's professional appearance.

Figure 11 Certificate of Achievement for Staff Nurse Recruitment Exam

5. Conclusion

The main objective of this research is to create an online testing platform that was especially suited for Oman's hiring procedure. This goal has been effectively accomplished, offering a simplified, effective, and safe platform for conducting staff hiring exams. The solution greatly minimizes the time and administrative load on HR employees by automating processes like planning, delivering, and grading examinations. Furthermore, incorporating security measures like identity verification and real-time monitoring assures a fair review process and reduces the likelihood of cheating. Among the innovations are automated grading and the use of random question banks, which increase efficiency and impartiality. The platform can also produce thorough performance reports for candidates, which help recruiters make well-informed judgments. Advanced testing methods, support for many question kinds, and improving user experience with immediate feedback and comprehensive analytics are some of the suggested enhancements. With future improvements set to further solidify its capabilities and contributions to the area of online assessments, the online examination system, taken as a whole, represents a substantial breakthrough in Oman's recruiting process, providing a more effective, equitable, and user-friendly option.

Compliance with ethical standards

Disclosure of conflict of interest

No conflict of interest to be disclosed.

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