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Microservices-Based Examination Portal "Test Portal: Student Assessment Platform"

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Abstract: *The Online Test Portal is a web-based solution designed to support secure and efficient online assessments. Utilizing modern technologies like Docker for backend services, it guarantees both scalability and reliability. The portal integrates features such as remote proctoring with webcam verification, advanced machine learning algorithms for detecting fraudulent activity, and automated proctoring systems to ensure smooth exam monitoring. Core functionalities include user authentication, test creation and scheduling, real-time monitoring with AI-driven proctoring, result generation, and detailed analytics. The platform aims to deliver a user-friendly experience for both administrators and candidates, maintaining the integrity of online exams while providing in-depth reporting and analysis tools.*

Keywords: Cloud-based Examination Platform, Biometric Authentication in Exams, Virtual Exam Proctoring, Secure Online Test Management, Data-driven Exam Insights, Scalable Authentication Framework

I. INTRODUCTION

In the digital age of education, the online test portal emerges as a solution to the challenges of modern assessments, transforming how exams are conducted and evaluated. This project brings together advanced technologies to enhance the online learning and assessment experience, focusing on the key aspects of security, reliability, and adaptability.

This project addresses these key issues with:

a) Comprehensive user authentication processes to prevent unauthorized access and ensure test integrity.
b) AI-driven proctoring system that utilizes real-time monitoring and behavioural analysis to detect malpractice.
c) Scalable infrastructure that can accommodate large numbers of candidates without compromising performance.

Objectives and Deliverables:

a) Development of a secure and efficient online examination platform.
b) Implementation of real-time monitoring to maintain exam integrity.
c) Creation of a scalable system that can adapt to the needs of various educational institutions.

Case Study –

Use in Educational Institutions:

The platform can be particularly beneficial for universities and online learning platforms, where it can provide a secure, reliable, and scalable solution for conducting remote exams.

II. LITERATURE REVIEW

Driven by the growing demand for online education and digital assessment tools, online examination systems have significantly evolved. The progress in web technologies, along with the rise of remote learning, has contributed to the creation of diverse online exam platforms. These platforms are designed to meet the increasing need for secure, scalable, and efficient assessment solutions. Numerous research efforts have investigated novel methods for developing these systems, emphasizing enhancements in user experience, security measures, and overall system performance.

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A] A tabulated summary of the selected research papers is provided below for a concise comparison of their core contributions and technological choices:

Sr No	Paper Title	Published In	Authors	Summary
1)	The Research and Design of Online Examination System	2015 7th International Conference on Information Technology in Medicine and Education (ITME)	Zhang Yong-Sheng, Feng Xiu-Mei, Bao Ai-Qin	This study presents the architecture and implementation of a web-based online examination system using the B/S (Browser/Server) model. It utilizes the IDEA tool for development alongside a MySQL database. The system includes essential functionalities such as user login, security authentication, question bank management, test scheduling, result display, and announcements. The paper highlights the integration of web technologies to ensure a robust, secure, and flexible testing environment.
2)	A Study on Web-Based Online Examination System	International Conference on Recent Trends in Artificial Intelligence, IoT, Smart Cities & Applications (ICAISC-2020)	Anjali Choubey, Avinash Kumar, Ayush Ranjan Behra, Anil Raj Kisku, Asha Rabidase, Beas Bhadraf	This paper introduces a fully automated online testing system designed to comprehensively evaluate students while eliminating the need for physical exam centers. It emphasizes fast processing, reduced examination time, and accurate result generation. The system allows candidates to take exams anytime and anywhere, ensuring convenience and accessibility. The study underscores the transition from traditional pen-and-paper evaluations to paperless digital assessments.
3)	A Design of Continuous User Verification for Online Exam Proctoring on M-Learning	2019 International Conference on Electrical Engineering and Informatics (ICEEI)	Hadian S. G. Asep, Yoanes Bandung	The paper investigates the challenges of maintaining exam integrity in mobile learning (m-learning) environments. It proposes a proctoring framework that includes webcam-based monitoring, machine-learning-driven fraud detection, and behaviour analysis. The authors advocate for continuous user verification throughout the exam process to mitigate cheating and

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				enhance the reliability of online assessments. The work reflects the importance of integrating AI-based proctoring techniques in modern learning platforms.
4)	Secure Online Examination System Using Biometric Authentication	2018 International Journal of Computer Applications	Priya Sharma, Rohan Gupta	This research presents an online exam system integrating biometric methods such as fingerprint and facial recognition to enhance user authentication and secure exam integrity in remote testing scenarios.
5)	Design and Implementation of a Real-Time Online Exam System	2019 International Conference on Computing and Communication Technologies	Naveen Kumar, Shweta Singh	This research discusses the development of a real-time exam system with live monitoring, instant result processing, and a user-friendly interface to enhance exam administration and student engagement.

Table 2.1: Literature Survey Table

B] Detailed Analysis and Observations:

Web-Based Architecture and Functionality: Early systems like the one developed by Zhang Yong-Sheng et al. used basic B/S architecture and focused primarily on question bank management and exam scheduling. While effective, such systems lack modern AI-driven proctoring and adaptability for mobile learning environments.

Automation and Accessibility: Choubey emphasized fully automated test processes with minimal manual intervention. The approach reduces administrative overhead and enables students to take exams remotely. However, security and user authentication remain basic in their implementation.

AI-Powered Proctoring: Hadian S. G. Asep introduced machine learning and webcam-based surveillance to enhance the integrity of examinations. This contribution is particularly important in m-learning contexts where students use mobile devices. The paper underscores the need for real-time behaviour analysis and continuous user verification.

C] Comparative Analysis

Feature / System	**Paper 1 (ITME)**	**Paper 2 (ICAISC)**	**Paper 3 (ICEEI)**
Web-Based Architecture	✓	✓	✓
Automated Grading	✗	✓	✓
AI-Based Proctoring / Webcam Monitoring	✗	✗	✓

Table 2.2 Comparison of Key Features Across Surveyed Systems Table

The literature review reveals that although significant progress has been made in online examination systems, there is still scope for improvement, especially in scalability, security, and real-time monitoring. These insights have directly influenced the architectural and functional decisions of our proposed Test Portal project. By integrating microservices, Docker, and AI-based proctoring, this project aims to deliver a secure, flexible, and intelligent assessment platform that addresses the gaps identified in current systems.

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III. PROPOSED METHODOLOGY

To develop a secure, scalable, and efficient ***Test Portal: Student Assessment Platform***, we propose a microservices-based architecture. The methodology ensures modular development, exam integrity, user privacy, and high system performance.

Data Management and Preprocessing-

1. Student Data Handling:

Students sign up and verify their identities through a secure platform that includes email verification and password recovery options. Real-time form validation ensures accuracy in data like names, roll numbers, and subject preferences.

2. Exam Content Management:

The question bank is dynamic and organized by subject, topic, and level of difficulty.
Administrators can schedule exams and assign them to specific student groups or sessions.

3. Data Storage:

A secure cloud-based database (e.g., MongoDB or PostgreSQL) stores student records, question banks, and exam results. Data is protected through encryption both when it is being transmitted and while it is stored.

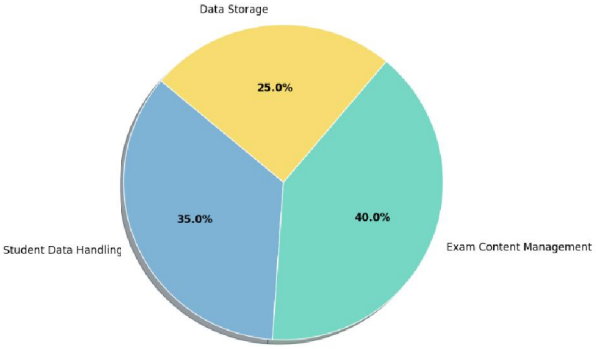

Figure 3.1 Distribution of Data Management and Preprocessing Tasks

B) Exam Integrity and Anti-Forgery Mechanisms-

1. Cheating Prevention:

Automated plagiarism checkers (e.g., Turnitin API) are integrated to evaluate written answers. AI-based proctoring solutions monitor student behaviour through facial recognition and activity tracking during exams.

2. Forgery Detection (Optional):

For handwritten responses, image normalization and digital signature verification can be employed using image processing techniques.

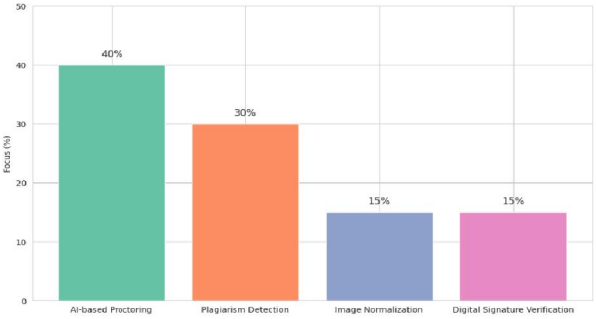

Figure 3.2 Breakdown of Exam Integrity Enforcement Measures

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C) System Architecture

1. User Interface:

- **Student Panel:** Provides an interactive exam screen with a countdown timer, MCQs, and descriptive questions. Students get early information about whether their submission contains copied material.
- **Admin Panel:** Enables exam creation, scheduling, user management, and report generation.

2. Backend Microservices:

The platform is divided into dedicated services:

- **Auth Service:** Manages user login and registration securely.
- **Exam Service:** Handles question management and scheduling.
- **Grading Service:** Automatically grades MCQs and evaluates textual responses.
- **Proctoring Service:** Ensures exam monitoring via AI.
- **Results Service:** Stores and displays results securely.

3. Deployment:

The system is deployed on cloud platforms like AWS or Azure with container orchestration (e.g., Docker + Kubernetes) for scalability. Load balancing distributes traffic to maintain high availability during peak times.

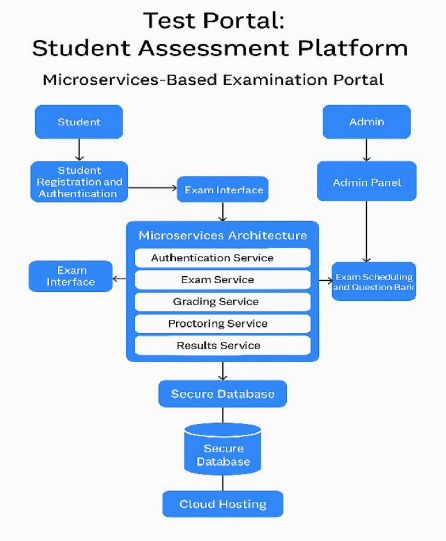

Fig 3.3 Proposed Block Diagram of our Proposed Working Methodology

Results –

a)

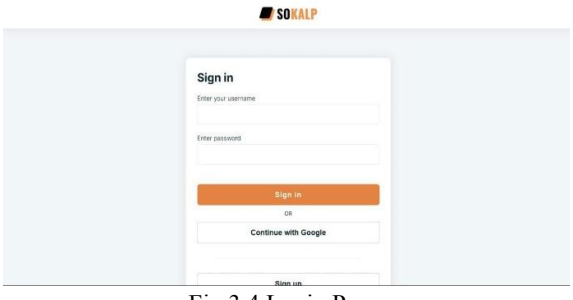

Fig 3.4 Login Page

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This page allows users to securely log into the portal using their assigned credentials. It ensures role-based access and acts as the entry point for all users.

b) The home page acts as the central dashboard where users are directed post-login. It displays relevant options based on the user's role (admin, instructor, student, or proctor).

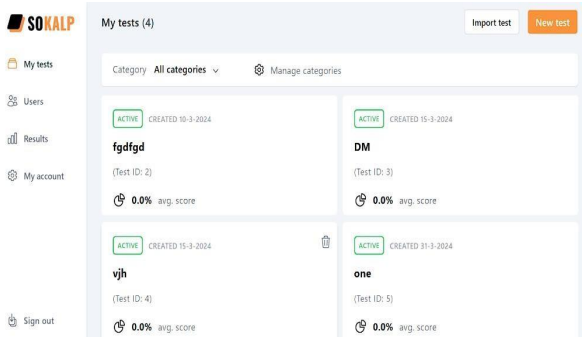

Fig 3.5 Home Page (Main)

c) This module allows the creation, editing, and deletion of test questions. It supports multiple types of questions and helps maintain a dynamic question bank.

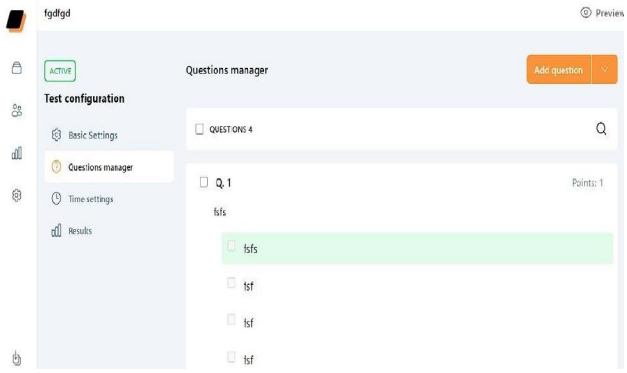

Fig 3.6 Question Management

d) Users can configure the start time, duration, and deadlines for tests. This ensures proper scheduling and prevents unauthorized access outside test windows.

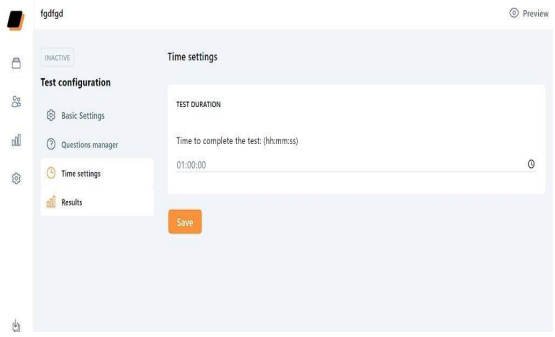

Fig 3.7 Time Settings

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e) This section shows the database view where user data is stored and managed. It includes information such as user roles, credentials, and activity logs.

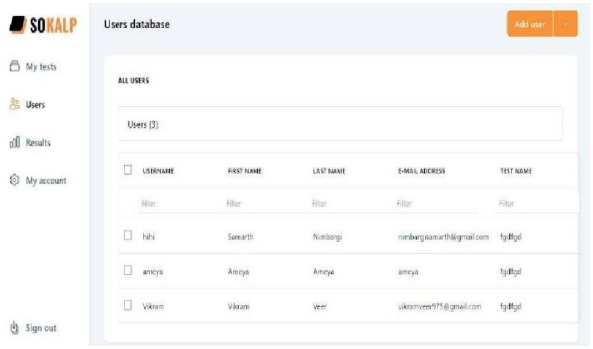

Fig 3.8 User Database

D) Access and Security Controls-

Security is enforced using SSL/TLS encryption for data transmission. Role-Based Access Control (RBAC) ensures restricted access to features based on user roles (admin, student, instructor).

Authentication is handled using secure token-based mechanisms such as JWT or OAuth.

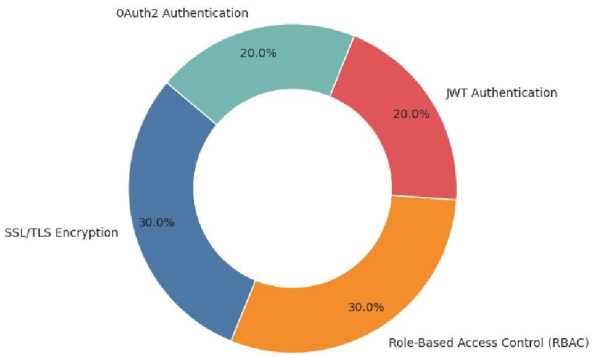

Figure 3.11 Security Layer Composition in User Access Control

E) Performance Evaluation

Performance is tracked using the following metrics:

- Response Time: Target load time under 2 seconds per page.
- Uptime: Ensuring 99.9% availability during peak hours.
- Accuracy & Feedback: Evaluation accuracy for auto-graded responses is continuously reviewed. Feedback is collected via post-exam surveys.

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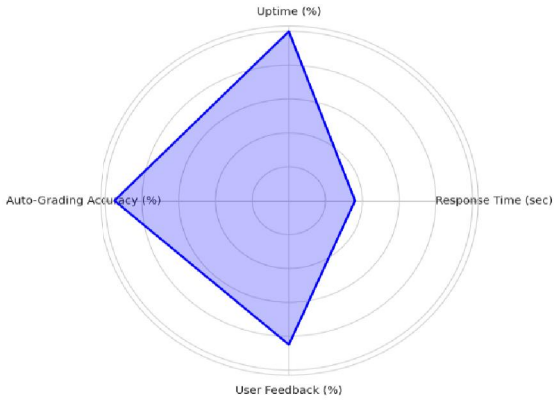

Figure 3.12 Comparative Radar Analysis of Key Performance Indicators

F) Testing and Results-

• Unit Testing: Each microservice is independently tested for core functionalities.
• Integration Testing: Validates interactions between UI, backend, and database.
• End-to-End Testing: Simulates the full exam flow from login to result publication.
• Feedback Loop: Feedback from students and faculty is reviewed bi-weekly to implement system improvements.

The methodology builds a reliable and scalable exam platform with strong focus on security and user experience. Integrated microservices operate cohesively to ensure seamless and efficient examination management.

IV. PROPOSED ALGORITHM

Algorithm for Test Portal: Student Assessment Platform:

1) Start
2) User Login/Registration
• User logs in using credentials or registers for a new account.
• Validate credentials and authenticate user.
3) Exam Scheduling & Management (Admin)
• Admin can create, schedule, and assign exams.
• Exams are stored in the database.
4) Exam Interface (Student)
• Student selects an exam.
• Present questions to students along with a countdown timer.
• Capture responses (MCQs, short answers).
5) Proctoring
• AI-based proctoring monitors student's activities to ensure integrity.
• Real-time analysis of behaviour and facial recognition is conducted to ensure exam integrity.
6) Grading (Backend)
• Auto-grade MCQs based on correct answers.
• Essays and written answers are graded through an AI/ML system (if applicable).
7) Exam Results
• Show results to students either instantly or following administrator approval.
8) End

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PSEUDOCODE

Algorithm: Test Portal - Student Assessment Platform

```
START

// User Authentication
IF user is not registered THEN
Prompt user to register with email, password
Store user details securely in the database
ELSE
Prompt user to log in with credentials
IF credentials are valid THEN
Proceed to exam interface
ELSE
Show "Invalid credentials" message
END

// Admin Exam Scheduling and Management
IF user is admin, THEN
Display options to create, schedule, and assign exams
CREATE new exam with questions, time limits
STORE exam data in the database
END IF

// Student Exam Interface
IF user is student, THEN
Display available exams for the student
Student selects an exam to start
START countdown timer for the exam
Display multiple-choice and short-answer questions
Student submits answers

// Proctoring
IF exam is active THEN
ENABLE AI-based proctoring
Analyse student behaviour and facial recognition in real-time
Monitor any suspicious activities (cheating attempts)
END IF

// Grading
IF exam is submitted THEN
IF exam type is MCQ THEN
GRADE automatically based on answer key
ELSE IF exam type is written THEN
GRADE written responses using AI-based system
END IF

// Display Results
Display exam results to the student (Pass/Fail or grades)
Optionally send results to admin for review
END
```


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V. CONCLUSION

The development of the Test Portal: Student Assessment Platform demonstrates how digital transformation can effectively enhance the assessment process in academic environments. By integrating user-friendly interfaces with secure login systems, automated grading, and AI-enabled proctoring, the platform ensures transparency, accuracy, and fairness in student evaluations. The microservices-based architecture supports scalability and maintainability, allowing seamless management of exams and user data. This project not only streamlines the traditional examination workflow but also provides a foundation for future enhancements like adaptive testing and detailed performance analytics. Overall, the platform represents a practical and innovative step toward modern, accessible, and reliable digital education systems.

VI. ACKNOWLEDGMENT

We extend our heartfelt thanks to our mentors for their constant guidance and insightful feedback throughout this project. We are grateful to our institution for providing the necessary resources and a supportive learning environment. Special appreciation goes to our peers for their collaborative spirit and valuable input. This project stands as a result of collective dedication and teamwork. We are sincerely grateful for the platform this project provided to explore, innovate, and grow as learners and contributors.

REFERENCES

[1] Richards, M. (2016). Microservices: From design to deployment. O'Reilly Media.
[2] Nagin, A. (2018). Cloud native infrastructure: Patterns for scalable infrastructure and applications in a dynamic environment. O'Reilly Media.
[3] Chen, T. (2020). Cloud computing: Concepts, technology & architecture. Pearson Education.
[4] Lanouette, K., & Rees, M. (2018). A comparative review of plagiarism detection systems. Journal of Information Ethics, 27(2), 97–113.
[5] Pizzi, D., & Liu, W. (2020). Artificial intelligence for remote exam proctoring systems: A review. Journal of Educational Technology Systems, 48(1), 3–27.
[6] McKinney, D., & Zhao, H. (2019). AI proctoring: The future of online exam integrity. International Journal of Computer Science Education, 35(4), 56–72.
[7] Stallings, W. (2017). Cryptography and network security: Principles and practice (7th ed.). Pearson Education.
[8] Kennesaw State University. (2020). Understanding role-based access control (RBAC). Retrieved from https://www.kennesaw.edu/
[9] García-Molina, H., Ullman, J. D., & Widom, J. (2009). Database systems: The complete book (2nd ed.). Pearson Education.
[10] Morris, J., & Embley, D. (2018). Designing web-based exam management systems. Journal of Computer Science Education, 23(3), 190–205.