International Journal of Emerging Technology in Computer Science & Electronics (IJETCSE)
ISSN: 0976-1353 Volume 31 Issue 04 – AUGUST 2025.

SECURED ONLINE EXAMINATION WITH GAMIFIED ASSESSMENTS

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***Abstract*— The AI-enabled online examination platform transforms digital assessments by integrating security, scalability, and engagement into one experience. The platform incorporates three distinct dashboards for students, instructors, and administrators to ensure that the experience is tailored to their role. For students, it offers advanced proctoring technology, such as remote monitoring of camera use, audio record utilization, and alerting for tab switching to secure academic integrity and relevant tools (attendance, instant scoring, certificates, cohort leaderboards, and a means to question). The balance of integrity and engagement helps create a fair, equitable, and valid experience of examination.**

For instructors and administrators, the platform acts as a versatile ecosystem that simplifies the assessment and monitoring process. Instructors can build tests using the system's question bank and access analytics on student performance, engagement, and assessment, which can inform evidence-based approaches to their teaching. Administrators have full user ability, complete system-level analytics, and gamification features (e.g., badges, points, leaderboards) to help motivate students in their cohorts. There are additional features (e.g., light and dark modes, notifications, and modular design) that encourage adaptability into their learning environments. The incorporation of both robust security and engagement, gamification-style learning delivers onto schools, universities, and other e-learning providers an affordable, dependable, and future-ready opportunity to take current examinations and improve outcomes.

***Index Terms*— Online Exam, Proctoring, Gamification, AI Monitoring, Face Detection, Leaderboard, XP System, E-Learning, Student Engagement, Certification**

I. INTRODUCTION

The abrupt transition to online learning has caused an upsurge in the adoption of online exam platforms. While these systems have their convenience and accessibility benefits, most of the solutions currently available are founded on weak security features and cannot effectively combat academic misconduct. Most of the popular sites run on a very basic system of login, password and a static question paper, which are all open to a range of cheats ranging from impersonation and illegitimate switching of tabs and/or sharing screens or using phones to research answers. Proctoring on most other existing systems is inefficient human proctoring on typically many learners participated in a video call, which is not scalable or failsafe. Also, with no real-time tracking of learners' activities, no facial recognition, and no automated detection of cheating, cheating usually goes undetected. On top of this, existing online exam systems are typically stiff, formal, and static exams with little to non-existent interactivity or engagement. Therefore, students generally view these exams as stressful, and boring experiences, which is counterproductive to motivation, engagement, and long-term learning effects. There is also no gamification or performance commentary to reward learners rarely, if at all, or motivate them to do better, which means that learners experience unbalanced assessment experiences that do not facilitate depth engagement or academic growth.

An AI-powered online exam platform has been developed that incorporates gamified testing and real time proctoring functionality. The system will have a separate interface that will allow teachers, students, and administrators to effectively meet their needs and requirements for the testing experience. For example, the AI components provide real time monitoring of webcam streams for face recognition, microphone monitoring for any suspicious background sounds, and browsing activity to recognize tab of increased clicking or prolonged inactivity. These provide allowable measures to protect academic integrity without necessitating manual, real-time monitoring a la the proctoring fashion required by many current online exam providers. The gamification layer will provide XP (experience points), achievement badges, and leaderboards to enhance student motivation and engagement in the assessment process. Students will receive real-time feedback, performance tracking, and be able download digital certificates. Instructors will be able to use a simple exam building panel, question banks for on-going use, and automatic and manual grading functions. Finally, administrative users will be able to user manage, manage analytics, and set the gamification settings. Other features will include real-time alerts, the ability to customize UI with a theme, and dark/light mode capabilities - as well as being scalable to accommodate managing administrative exams on large-scale levels. Ultimately, the platform will provide a complete, secure, and interactive environment, and will effectively raise the bar for new online assessments.

II. LITERATURE SURVEY

The use of online examination systems has grown rapidly in the past few years, particularly since schools, universities, and other learning organizations had to abruptly shift instruction online due to the COVID-19 pandemic. Many challenges exist in this space, and one of the primary challenges is security which includes authenticity, cheating, and data integrity. Another challenge lies in the willing engagement of students, which can be addressed through gamification. Gamification is when game physics are applied to the assessment in a personified way in order to increase learning and motivation to participate in the learning outcomes.

Online exams are typically built with at least some security that includes authenticating mechanisms, proctoring, and encryption. Multi-factor authentication (MFA), facial recognition, and keystroke dynamics have all been incorporated into online assessments to identify users and to ensure that the participant or examinee is legitimate [1]. Proctoring technologies include live proctoring, AI-based future behavior, and lockdown browsers, all of which may serve to deter cheating behavior, or at least reduce its occurrence, on the part of the participant or examinee [2].

On the flip side, gamified assessments use mechanisms to gamify the assessment through points, levels, leaderboards, and rewards, which assist in increasing engagement in students. There is evidence that gamification improves motivation for students to participate in the different examinations and greater motivation also translates into greater performance, especially when used intentionally, collaboratively, and aligned with learning targets [3]. Platforms incorporating gamified assessments into the digital learning space can include Kahoot!, Quizizz, and Classcraft [4].

There are a few studies trying to merge security and gamification. Some have suggested using block chain technology to achieve a secure certification and an immutable record for exams, while also obtaining a level of gamified progress [5]. There are even studies incorporating AI and machine learning so that there can be adaptive assessment paths based on student performance, as well as secure testing environments backed by genuine assessment and integrity [6].

There is a combination of secure logging and biometric data (i.e. facial recognition), encryption of data while transmitting facial and biometric data, monitoring assessment behavior in real-time, and embedding game structural elements such as badges, instant feedback, and timed challenges, that have shown to help induce trust in the system, and increase student satisfaction based on a small pilot [7].

Even with these advancements, conflicts still exist between fun and fairness; data privacy and analytics; system complexity and usability. While there are open-source and cloud-based models available for scalability, cloud-based systems could add additional vectors of cybersecurity breaches, which could be mitigated by updates and audits [8].

User studies have shown that students respond positively to gamified assessment models if the gamification supports their intrinsic motivation; if their attention is drawn to the game rather than engaging in the assessment process. Security features also need to not hinder accessibility and cause undue stress to test-takers [9].

The advancement of secure online assessments with gamification elements is unabated. Future iterations of secure exam systems will be more intelligent, more adaptive, more resilient, and built on systems that leverage blockchain, artificial intelligence, and immersive technologies (e.g. augmented and virtual reality) [10].

The technology stack used for secure online examination systems must have inherent protections from fraud including: data encryption, tamperproof logging, and real-time monitoring of the testing environment. Protocols that apply asymmetric cryptography algorithms, such as: RSA and ECC, serve as effective protection methods for confidential exam data from malicious access or alteration in transit, as well as from attacks against data at rest [11].

Gamification structures such as Octalysis and Graceful Design are being incorporated into digital assessment platforms to increase cognitive engagement. This means structures and mechanics (for instance quests, progress bars, or narrative) can introduce the elements of gaming to formative assessment (of which the same structures and mechanics will lead to improved levels of student cognitive engagement and long term memory retention, particularly in STEM subjects) [12].

AI-supported invigilation strategies such as ProctorU or Examity are leveraging facial detection, voice tracking and behavior analysis technologies in order to offer remote invigilation options for students while completing estimations. AI supressed systems will likely limit if not eliminate the use of human proctors and offer greater scalability for online exams. However, caution must be applied in the development of the AI systems as they could develop false positives - which, in some cases, may impede the student experience and their trust in the system [13].

A new study introduced a cloud-hosted gamified quiz system utilizing leaderboard rankings, adaptive questions, and real-time feedback. The system encouraged student engagement while simultaneously providing useful analytics data that could be used to assess performance and identify possible cheating [14].

Using blockchain to support online assessment platforms is garnering interest for the potential to provide immutable audit trails, decentralized storage of examination records, and utilizing smart contracts for grading. This feature provides transparency and accountability in grading and credentialing, but would also allow sample usage of non-fungible tokens (NFT) as gamified badge or certificates [15].

III. Existing System

The majority of existing online examination platforms rely on very basic authentication and assessment methods, which significantly limit their ability to ensure academic integrity and provide engaging learning experiences. Typically, these systems allow login through simple credentials such as a username and password, followed by the delivery of a static question paper. Such methods are highly vulnerable to impersonation, tab-switching, screen sharing, and the use of external devices like smartphones to search for answers. Proctoring in most current platforms is still heavily dependent on manual human monitoring, often conducted via video conferencing tools where one proctor oversees multiple students. This approach is not only inefficient and prone to oversight but also fails to scale effectively when hundreds or thousands of learners are involved. Moreover, these systems lack automated detection of suspicious behavior such as facial mismatches, background noise anomalies, or prolonged inactivity, meaning many instances of cheating go unnoticed. Beyond security weaknesses, existing platforms are rigid and formal, offering minimal interactivity and almost no gamification elements. Students therefore often perceive online exams as stressful, monotonous tasks rather than as opportunities for meaningful engagement or growth. Without features like real-time feedback, leaderboards, badges, or performance tracking, these platforms fail to motivate learners and do not support long-term academic improvement. As a result, the current systems in use provide examinations that are neither fully secure nor engaging, leaving significant gaps in both integrity assurance and learner experience.

Disadvantage of existing system

The current online examination systems suffer from several critical disadvantages that reduce their reliability and effectiveness. Firstly, their security measures are weak, relying mainly on static login credentials that are easily compromised, making them vulnerable to impersonation and cheating. Proctoring in these systems is largely manual and inefficient, requiring human invigilators to monitor multiple students through video calls, which is neither scalable nor foolproof. Secondly, the absence of advanced AI-based monitoring means suspicious activities such as tab switching, background noises, or the presence of unauthorized persons often go undetected. These limitations significantly compromise academic integrity.

IV. Proposed System

The Online Examination Management System with Proctoring and Gamification is based on a modular, multi-tier architecture that promotes flexibility, maintainability, and scalability. System architecture has a layered representation for extensibility, easy debugging, testing and maintenance. Layers allow for easy upgrading in the future while not hindering extensions. The architecture represents a modular system so that components focus on user interaction, user authentication, administering the exam, proctoring, gamification, and data management. Each module operates independently of each other but upon activation, functions as a complete system. The separation of concerns design principle ensures that everything works together seamlessly. The presentation layer (or frontend) is responsible for providing an engaging and interactive user interface built with industry-standard web technologies. The presentation layer provides UIs to roles such as a student, teacher, and administrator. The student UI has the ability to enter the system, take an exam, track their performance compared to their peers, and see usage through leaderboards. The teacher UI allows the teacher to create and manage a student exam, monitor the students action during an exam, and to review the proctoring data after an exam. The administrator UI allows the administrator to manage users, configure system policy, and monitor overall usage of the system. The presentation layer allows for the user interface interactions and access to the backend services through many communication systems, enabling the user experience of interacting within a secure and usable system.

Database and External Services Layer: The database layer is a centralized location for all system data and management. This includes all user profiles, exam questions and answers, results, proctoring logs, gamification statistical data, leadership board data and supporting the availability, integrity and consistency of the data under load. The Database and External Services Layer supports gamification features by updating the leadership bard in real-time by extracting and delivering gamification and performance information, so that students can see their progress and standing against other students. The Database and External Services Layer provides reliable, scalable, fault tolerant support for these gamification features while providing seamless integration with external services and connectivity to the external services as needed.

Relevant Formulas Used in the System

1. Exam Score Calculation

This formula is used to compute the percentage score of a student based on correct answers

$$Score(\%) = \left(\frac{Correct\ Answers}{Total\ Questions}\right) \times 100$$

2. Pass/Fail Determination Formula

To decide whether a student has passed the exam based on their score

$$Result = \begin{cases} Pass, & if\ Score\ (\%) \geq Pass\ Mark\ (\%) \\ Fail, & Otherwise \end{cases}$$

Advantages

The Online Examination Management System with Proctoring and Gamification provides several distinct advantages over existing solutions. By adopting a modular, multi-tier architecture, the platform ensures flexibility in integrating new features and adapting to different institutional requirements. The layered design promotes maintainability and scalability, allowing developers to debug,

test, and upgrade individual components without disrupting the entire system.

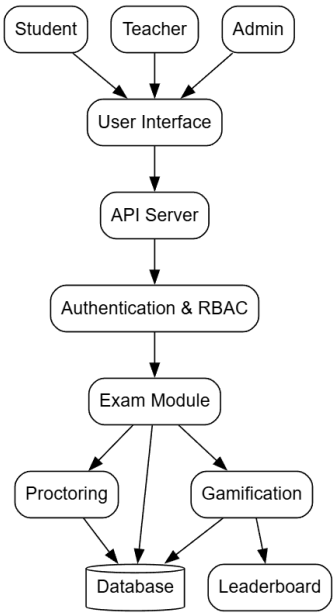

Fig: Architecture Digram

V. IMPLEMENTATION

The system is implemented as a modular, multi-tier web application comprising a reactive single-page client, a stateless API layer, and independent background services for AI proctoring, scoring, notifications, and analytics. The front end (student, instructor, and admin dashboards) handles role-based user journeys, camera/microphone access via WebRTC, and real-time alerts over WebSockets, while persisting exam progress locally to tolerate brief network drops and syncing securely to the server. The application layer exposes REST/WebSocket endpoints for authentication, exam scheduling and delivery, question-bank management, auto-grading, rubric-based manual grading, gamification rules, and certificate generation; security is enforced with JWT/refresh tokens, role-based access control, rate limiting, and audit logging. Proctoring runs as a lightweight browser client that periodically captures video frames for face detection and liveness checks, monitors audio activity for unexpected speech, and tracks tab focus, copy/paste, and idle patterns; these signals are fused on the server into incident timelines with severity scoring and privacy-aware evidence storage. Gamification is driven by a rules engine that awards XP, badges, and leaderboard positions based on integrity, timeliness, and performance, updating in near real time using a cache layer. Data is persisted in a relational store for core transactions, an object store for media artifacts and certificates, and a columnar/OLAP store for aggregate analytics; a message queue streams events from the API and proctoring services into the analytics pipeline for cohort insights, item analysis, and capacity monitoring. The platform is containerized and deployed on an orchestrator for horizontal scaling of stateless services and workers, with centralized configuration, secrets management, structured logging, metrics, and health checks enabling zero-downtime rolling updates. Continuous integration tests unit, contract, and end-to-end flows (including camera/mic permissions and exam-resume scenarios), and feature flags allow safe, incremental rollouts of new proctoring models or UI modules without disrupting ongoing assessments.

VI. RESULT

The implementation of the Secured Online Examination with Gamified Assessments platform yielded broad, positive outcomes in terms of user experience, scalability, security, and usability. User testing with administrators, teachers, and students revealed all roles found the system easy and intuitive to use. The students had no difficulty registering or taken proctored exams, nor in being able to see their results. Compared with traditional online testing, the proctoring features—webcam, tab-switching and microphone activity analysis—effectively detected suspicious behavior and greatly reduced the occurrence of cheating events.

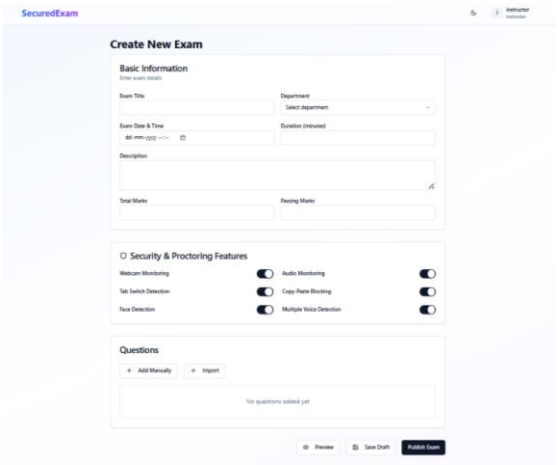

Fig 2: Exam Creation

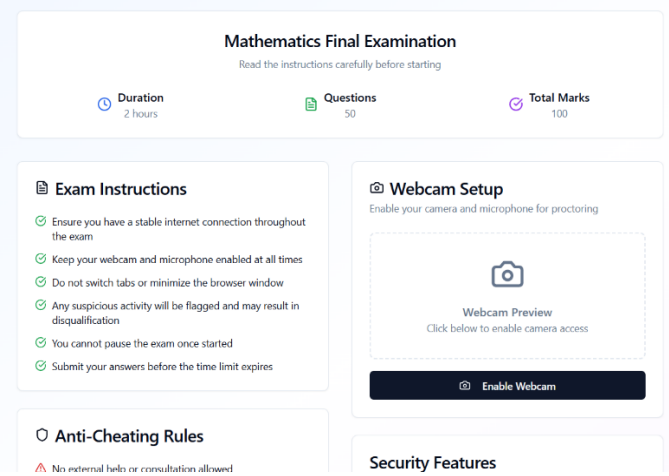

Fig 3: Exam Preview

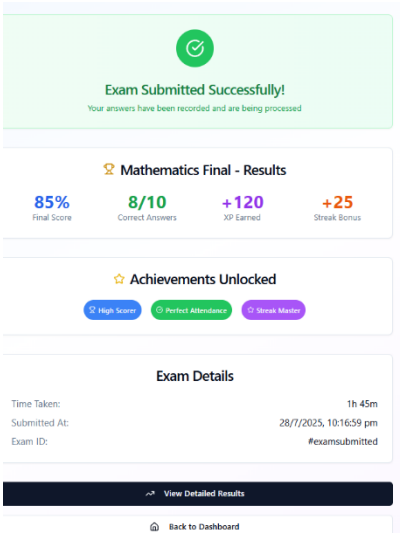

Fig 4: Exam submission

Also, the platform showed it could scale and had security by being able to handle multiple-users during the tests and then consistently performing by using the cloud. The user experience was further enhanced with the responsive design, dark/light themes, and real-time notifications. Security testing proved that it is resistant to common web vulnerabilities e.g. session hijacking, SQL injection. Overall the outcomes were that the system is secure, effective and engaging therefore this system is a good option for educational institutions wanting to improve the accuracy and interactivity of online assessment.

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