Enhancing Online Exam Integrity: A Case Study of the University of Wisdom Land in Myanmar

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Abstract

The COVID-19 pandemic and the 2021 political issue have caused significant disruption to campus-based exams in Myanmar, the diaspora students unable to finish their degrees. To facilitate academic continuity, this research was to determine detailed user requirements through surveys with 51 students and 11 invigilators, and to use these findings to develop an online proctoring system that integrates lightweight multi-models to identify overt and covert cheating actions in real time. The system design includes multi-module: user authentication through one-time password (OTP) code and facial recognition; real-time detection that streams camera, microphone, and system log information; object detection to flag prohibited items; voice detection for spoken responses; face persistence to ensure that only one authorized face is visible; and active window monitoring that prevents copy, paste, multi-tab and multi-app. A mixed-methods pilot was conducted with 20 students and 14 invigilators who each took a 15-minute essay test. Quantitative data was collected through a post-exam questionnaire using 5-point Likert constructs. The teacher group rated a high mean score (4.50) with low variance (0.77), while the students rated with a mean of 4.12 and standard deviation of 1.41. The system indicates a high and balanced accuracy metrics with F1-score of (91.41%) which confirms high reliability in both detecting cheating and preserving legitimate activity. Qualitative results emphasize the strengths of the proposed system, including cost-effectiveness and fairness with less bias. The results of this research indicate that the AI-based multi-modal proctoring system can be used as an academic integrity solution for online exams.

Keywords: AI-assisted real-time proctoring, online exam integrity, distance education, educational technology, online assessment

Introduction

The coronavirus outbreak has brought about massive changes to the conventional educational sector, affecting the process of teaching and assessment across the world. Muzaffar et al. (2021) described that online exams became essential during and after the pandemic for several interrelated reasons grounded in maintaining educational continuity, ensuring safety, and adapting to emergent remote teaching modalities.

As highlighted by Gomersall and Floyd (2023), who examined the experiences of Myanmar students navigating the dual shocks of the COVID-19 pandemic and political instability, online learning platforms became the sole avenue for accessing education when physical schools were closed, and movement was restricted. To counter the extreme disruption caused to education by this shift, a rapid process of technological revolution is necessary to ensure access to educational opportunities and international connections (Aung Tun, 2022). Since there are roughly 5.4 million people in Myanmar who need immediate educational help, the focus of the Myanmar Education Cluster (2025) is that crisis-affected and at-risk children and young people continue to receive quality education, keeping in mind the mental well-being of the young people. Consequently, there is an urgent need for resilient proctoring systems that can adapt to such environmental volatility without compromising academic integrity or fairness. Although online education has enhanced access to education, it has also unveiled some existing problems in the process of assessment, particularly in those institutions that conduct paper-based tests.

The University of Wisdom Land (UWL) is one of the prominent monasteries, established in 2020 by Ashin Dr. Nandamarlabhivamsa, with a Buddhist studies certification courses that has 43 regional exam centers (University of Wisdom Land official resources). Since UWL lacks a mechanism for conducting exams online for Myanmar citizens living abroad, there is a substantial challenge in accessing education for such people. The three main interconnected root causes of the problems related to the assessment integrity of the university include technical constraints, integrity threats, and assessment flaws. These causes generate adverse effects, including student inequity, damage to institutional reputation, and operational burden for staff.

This study concentrates on the integrity-threat dimension because it directly threatens the credibility of exam results and erodes stakeholder trust. Given this context, the present research seeks to design, implement, and evaluate an ethical, AI-driven real-time proctoring framework that verifies examinee identity, detects cheating behaviors through multimodal computer vision and audio analysis, and routes flagged events to human proctors for final adjudication. The overarching goal is to provide UWL with a cost-effective mechanism that restores confidence in its certification process and enables inclusive participation of diaspora students.

Literature Review

A web application for identity verification was developed and implemented by Shkodzinsky and Lutskiv (2022) using the algorithm for face detection and photo fixation to provide precise identity verification at a distance in a Learning Management System (LMS). Such an approach helps meet the important requirement for controlling the security of information using the framework for designing the target system due to the analysis of already existing algorithmic approaches. Moreover, the system architecture of the tool is mostly related to obtaining a picture of the candidate using the camera when they take part in the exam and verifying the individual's identity automatically (Shinde, 2022). For countries like Myanmar,

implementation of such an online platform is one of the key elements in harnessing cutting-edge technologies to transcend organizational gridlock and develop the international connections required for creating a robust, post-rentier education sector.

Recent studies have identified a new automated proctoring system that makes use of the You Only Look Once (YOLO) model and computer vision technologies. The system worked by applying the multimodal technology of analyzing visual and audio information from the camera and microphone. This included behavioral analysis, including face orientation and mouth detection, and real-time audio monitoring. Additionally, Mediapipe technology is used in this system to ensure important functions such as face spoofing. Face spoofing detects when a candidate uses still images or videos to cheat in the proctoring process. Object detection and counting in the environment where the exam is being taken is achieved by making use of pre-trained YOLO weights (Singh et al., 2024). Finally, concerning the practical implications of the model for enforcement and operations, the use of the latter guarantees fair testing by automatically shutting down the examination in case a mobile phone is spotted or if there is more than one individual in the room or no one at all in 10 seconds.

In addition, the facial analysis process employed a two-detector approach that integrates MediaPipe Face Mesh and OpenCV Haar cascades, following the multimodal face mesh approach that increases landmark precision under different lighting conditions (Khabbachi et al., 2024). The identification procedure is carried out using the dlib based face recognition library, which was tested to offer accurate 68 landmarks detection in Gopalakrishnan et al. (2022). By reusing these proven convolutional neural network (CNN) and transformer style architectures, the prototype inherited the strong detection performance documented in the cited works while adapting them to a real time, client side inference pipeline. Ahmad et al. (2021) utilised deep learning and biometric methods, including Histogram of Oriented Gradients (HOG) for face detection and OpenCV for identity verification. To prevent the use of static photos for cheating, the system incorporated eye-blinking detection, while the YOLOv3 model identified prohibited physical objects like mobile phones and textbooks. Evaluation using the FDDB and LFW datasets demonstrated high performance, achieving 97% accuracy in face detection and over 99% in face recognition for smaller groups.

The current research conducted by Tweissi et al. (2022) measured the technical performance of the AiAP model in ensuring academic integrity in online examinations relative to human standards., By employing manual analysis of 244 online exams from a university located in the Middle East, the researchers assessed five indicators of surveillance, such as eye tracking, voice detection based on LSTM models, screen violation using Safe Exam Browser, face recognition by Google Vision API, and eye movement detection. The results of this experiment indicated that there was a statistically significant distinction between the human and AI decisions, which led to many more violations reported by the AiAP technology with 30% (74 of 244) incorrect decisions. Considering the accuracy problems and possible violations of students' rights and equality, the researchers suggested that the AI proctoring cannot be considered sufficient alone but requires the use of human supervision as well.

System-level event monitoring further strengthens reliability. Sokout et al. (2020) analyzed the developed mouse tracking application along with the developed Moodle plugin in a blended course mid-term (20%) examination for the purpose of detecting and identifying the potential cheaters. The model was able to correctly predicted 94% of the students who committed any unlawful acts during the online mid-term examination, which makes it possible to intervene early and prevent illegal actions.

Mutukundu et al. (2025) suggested an AI-powered proctoring tool that relied on a secure MERN stack (MongoDB, Express.js, React, Node.js) framework and leverages TensorFlow.js, along with the COCO-SSD algorithm, for behavior and environment monitoring. The methodology focused on a multi-layered monitoring approach that includes facial recognition, eye tracking, and object detection to identify unauthorized aids such as mobile phones or additional faces. The system design incorporated automated security features like JWT-based authentication, browser lockdowns, and screenshot logging triggered by predefined violation thresholds. Experimental results demonstrated high technical efficacy, with an average face detection accuracy of 95% and a rapid object detection latency of 30ms. According to the results of a survey of academicians in higher education, the use of an AI approach allowed for reducing cheating up to 70% when compared to regular online examinations without proctors.

The research by Patil et al. (2025) presented an AI-powered online proctoring system designed to preserve academic integrity by monitoring student behavior in real-time through computer vision. The proposed solution involved the OpenCV library and MediaPipe framework to track 468 facial landmarks and 21 hand key points, utilizing threshold-based logic to detect deviations in eye gaze and hand presence. Specifically, an alert is triggered if a student's gaze deviates more than 25 degrees from the camera axis for more than three consecutive frames, or if hands move beyond 80% of the frame boundary. A critical design feature was the automated evidence capture, which logs screenshots with timestamps upon violation and terminates the exam session after six warnings. Experiments were performed on twenty volunteers, and the proposed system was found to be efficient in detecting eye and hand movements with a F1 score of 91.4% and 93.7%, respectively. These findings suggest that the proposed multi-modal approach offers a scalable, low-overhead solution for maintaining fairness in remote examinations.

User perception of AI-driven proctoring influences adoption. Nasruddin et al. (2022) demonstrated that during the pandemic, secondary school students' acceptance of online tools was heavily influenced by UX design and emotional well-being. This highlights a gap in current literature, the need for data engineering solutions that explicitly account for these human-centric variables to ensure equitable access in developing regions.

Methodology

The present study employed a cross-sectional, descriptive survey to obtain empirical evidence regarding the demand for, and trust in AI-driven online-exam proctoring among current and prospective students at the University of Wisdom Land (UWL). The questionnaire was disseminated electronically through UWL's alumni list, social-media groups, and personal networks of the principal investigator.

Requirements Gathering

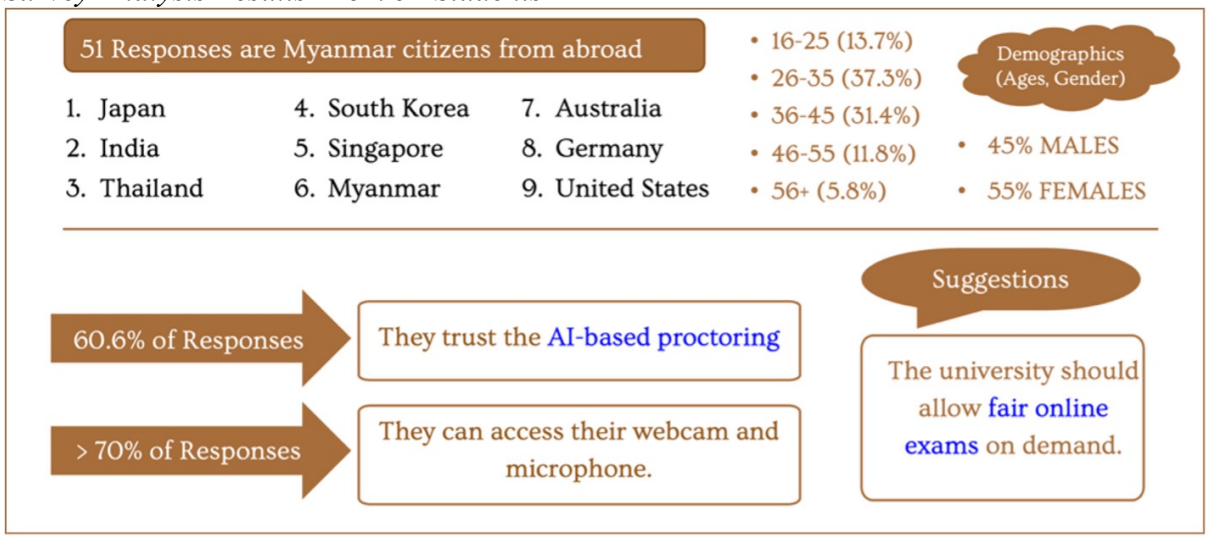
A total of 51 valid responses were received from individuals residing in nine countries. Of these respondents, 51 were students and 11 were teachers or invigilators. The sample was composed of 45% male and 55% female participants, ranging in age from 16 to 66 years; the majority were aged 26-35 years (Figure 1). Regarding technological readiness, above 70% of the student cohort reported having access to both a webcam and a microphone, and 60% indicated willingness to sit the exam from home using an online platform. From the teacher's perspective, 55 % reported having observed suspicious cheating during prior examinations, underscoring the need for robust detection mechanisms. Moreover, 64 % of teachers stated that

their university had requested them to administer an online exam, reflecting the growing demand for remote assessment solutions. In addition, 73 % of examiners expressed a preference for organizing exams to be taken from home via an online platform, highlighting the importance of a web-based, home-compatible architecture.

A large majority voiced interest in incorporating AI-driven functionalities such as facial-voice detection and object recognition, demonstrating enthusiasm for advanced, automated monitoring features. Respondents also emphasized the urgency of implementation, recommending that a Fair Online Exam and Proctoring system be developed. Finally, 90% of examiners indicated a desire to review suspicious activity through log files, captured images, and audio recordings as evidentiary material, reinforcing the necessity for comprehensive evidence-logging and human-in-the-loop review capabilities.

Figure 1

Survey Analysis Results From 51 Students



Moreover, the proposed framework incorporates a simplified user interface to address the specific challenges identified in recent literature. As noted by Nasruddin et al. (2022), negative emotional responses and poor UX can lead to student disengagement. By reducing interface complexity, the system aims to mitigate this factor, thereby improving the overall reliability of the assessment process.

These findings provide a robust, context-specific empirical foundation for the design, implementation, and evaluation of an ethical, multimodal AI-driven proctoring system tailored to the unique constraints and expectations of UWL's geographically dispersed student body. The statistics above constitute the empirical grounding for the system-design requirements articulated in subsequent sections of the paper.

System Architecture

The UWL Online Proctoring System is built on a two-phase architecture comprising pre-exam and exam-time, as shown in Figure 2. This design integrates biometric authentication, device-access control, continuous multimodal monitoring, and secure evidence-logging. The system balances rigorous academic integrity safeguards with real-time processing capabilities, thereby addressing the empirical requirements identified in the preceding survey of students and invigilators at the UWL.

Pre-exam Stage

This stage implements a multi-factor authentication protocol designed to prevent impersonation, account sharing, and unauthorized access. This phase consists of sequential verification checkpoints that ensure only the registered examinee can initiate the examination session.

The process begins with a one-time registration phase, where new students create an account using their e-mail address and a strong password. Immediately after registration, the platform prompts the learner to activate the webcam and capture a high-resolution frontal facial image under consistent lighting. The image is stored in a local folder. Upon successful facial capture, a six-digit OTP is generated and sent to the student's e-mail. The student must enter the OTP within three minutes; successful entry confirms the enrollment and flags the biometric record as verified. For each exam session, the student logs in with their email and password, then grants the browser permission to access the webcam and microphone. A second biometric check compares the live webcam feed with the stored template using a deep learning model. The face verification uses the face_recognition library which calculates a face distance (Euclidean distance) between two 128-dimensional face encodings. After passing this check, a fresh OTP is emailed; entering the time-bound OTP unlocks the exam environment.

Exam-Time Stage

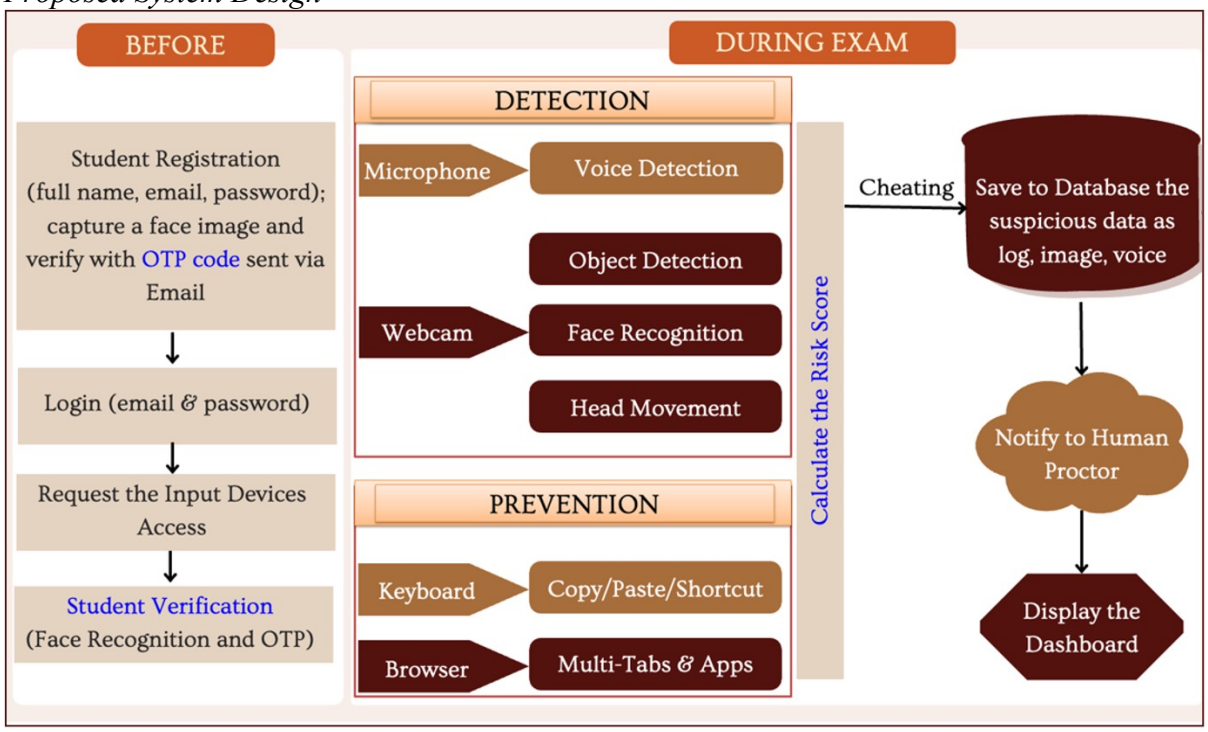
During the examination, the proposed system continuously detects and prevents cheating behaviors. The details of these services are described as follows.

The detection service operates continuously throughout the examination period, acquiring synchronized audiovisual streams from the examinee's webcam and microphone. Utilizes MediaPipe Face Mesh for facial landmark detection. This service handles face counting and position analysis to ensure the authorized student remains visible throughout the exam. Employs YOLO11m to identify prohibited items such as mobile phones, laptops, and books. The model processes frames at configurable confidence thresholds, flagging violations in real-time. Processes audio streams using NumPy and SciPy for Fast Fourier Transform (FFT) analysis. The service detects human voice patterns by analyzing frequency ranges (85Hz–3000Hz), formant structures, harmonic content, and temporal continuity to distinguish genuine conversation from background noise. Handles all image processing tasks using Pillow and OpenCV, including Base64 encoding/decoding, image resizing, annotation overlays, and compression for storage.

The prevention service enforces a controlled examination environment by restricting user interactions that could facilitate academic misconduct. When a student tries to copy or paste text using either the right-click context menu or keyboard shortcuts, the attempt counter is incremented, and an alert notifies the student that copying is not allowed. Each attempt is logged to the backend with a timestamp. The system monitors when a student switches to a different browser tab or minimizes the exam window. The event is logged with both a start time and an end time, allowing administrators to see exactly how long the student was away from the exam.

Figure 2

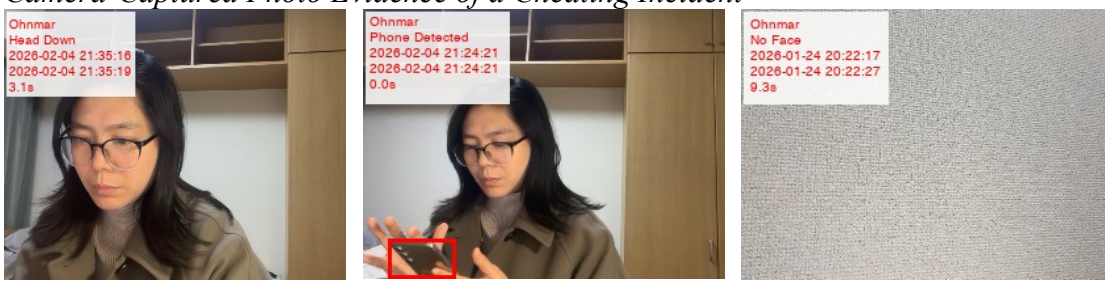
Proposed System Design



MySQL is the relational database for data, such as student records, exam sessions, and suspicious events, all of which are labeled with precise timestamps. The detection logs were systematically stored in the "suspicious_events" database table; each entry records the timestamp and type of suspected unethical activity (e.g., no_face, face_mismatch, phone_detected, head_down, copy, paste, voice_detected, etc.). Audio recordings are retained in WAV format and annotated screenshots of suspicious activities and corresponding facial images for verification are stored as media assets. All media files are systematically organized within a structured directory hierarchy under a designated media folder, facilitating efficient retrieval and auditability.

Figure 3

Camera-Captured Photo Evidence of a Cheating Incident



Crucially, the system is designed as a decision-support tool rather than an automated adjudicator to ensure ethical integrity. Upon detecting anomalies, the system assigns a severity level to each incident and presents color-coded records with detailed event information on the admin dashboard. This triggers a mandatory human-in-the-loop verification protocol, where an administrator reviews the flagged media assets, audio segments, and behavioral logs. Final disciplinary actions are determined solely by human judgment based on this evidence, ensuring that the system does not automatically penalize students. This approach mitigates the risk of

false positives arising from technical glitches or environmental factors, thereby upholding fairness and due process in the assessment workflow.

Results and Discussion

The evaluation was carried out with a mixed-methods pilot study with 20 students and 14 invigilators, who each completed a 15-minute, ten-question essay exam delivered through the prototype AI-based proctoring platform online. This pilot study focused on a specific group in Myanmar to ensure the feasibility of the framework. The student was composed of 35% male and 65% female participants, ranging in age from 16 to 65 years; the majority were aged 26–35 years. A total of 527 suspicious cheating data points were extracted from the database and were left for classification. A post-exam questionnaire composed of five-point Likert items was filled out by participants, as well as semi-structured interviews to enable the collection of qualitative data. The Likert responses were analyzed using the system usability scale (SUS) and descriptive statistics (means and standard deviations), while the interview transcripts were coded using thematic coding.

Quantitative Findings

Student Feedback

According to Table 1, the student survey revealed that participants regarded the platform as easy to access with clear instructions, a usability is mean = 4.16 and std = 1.42, indicating that the system's design and responsiveness met most users' expectations. Perceptions of fairness and equality were also high with mean = 4.13 and std = 1.42. Students felt the AI-monitoring process was impartial and that they were treated the same as their peers. Comfort scores were slightly lower with mean = 3.98 and std = 1.37, reflecting that while the system generally did not interrupt the exam, a minority of respondents remained uneasy about being monitored. Satisfaction was strong with mean = 4.21 and std = 1.44, with most students indicating willingness to reuse the proctoring tool and to recommend it to other universities. Overall, the high SUS score is 4.13 and the positive Likert averages suggest that the prototype delivers a usable, fair, and satisfactory remote-exam experience, though modest improvements in perceived comfort could further increase acceptance.

Table 1
Mean and Standard Deviation Using System Usability Scale From Student Feedback

Construct	SUS Item	mean	std
Learnability	Q1. The system was easy to access and log in. Q2. The instructions were clear and understandable. Q3. The system interface was user-friendly. Q4. The system responded smoothly during the exam.	4.16	1.42
Fairness & Equality	Q5. The monitoring process felt fair. Q6. I felt that I was treated equally compared to other students.	4.13	1.42
Comfort	Q7. The system did not interrupt my exam unnecessarily. Q8. I felt comfortable being monitored during the exam.	3.98	1.37
Satisfaction	Q9. I am willing to use this online proctoring system again. Q10. I would recommend this system to other universities for their future online examinations.	4.21	1.44

Admin Feedback

In Table 2, the invigilators' survey shows that the participants regard the prototype as highly accurate and reliable (mean = 4.40, std = 0.80), indicating that the cheating detection results are perceived as trustworthy and that false positives are rare. The workload reduction dimension is most strongly supported (mean = 4.64, std = 0.68), confirming that the system markedly eases manual monitoring while still allowing a brief human review before reaching a final decision. The usability of the administrative tools is also rated very positively rated (mean = 4.62, std = 0.82); teachers find the generated reports useful, the dashboard user-friendly, and the evidence-review process convenient.

Table 2
Mean and Standard Deviation Using System Usability Scale From Admin Feedback

Construct	SUS Item	mean	std
Accuracy & Reliability	Q1. The system helps reduce academic dishonesty. Q2. The cheating detection results are accurate and reliable. Q3. Wrong cheating reports are minimal.	4.40	0.80
Workload Reducing	Q4. The system reduces manual monitoring workload. Q5. Human review is necessary before making final decisions.	4.64	0.68
Usability	Q6. Reports generated by the system are useful. Q7. The admin dashboard is easy to use. Q8. Reviewing exam evidence is convenient.	4.62	0.82
Trust in AI Decisions	Q9. I trust the AI-based detection results of the system.	4.21	0.89
Security & Privacy Balance	Q10. The system balances exam security and student privacy.	4.64	0.63

System Evaluation

For the evaluation of the system's performance, an automated data collection system was implemented. The detection logs were recorded systematically in a database table named "suspicious_events" during the pilot testing process. Each record in the table represents a particular incident at a certain timestamp in which the model has detected possible unethical activities like "no_face", "face_mismatch", "copy", "paste", and so on. The data related to suspicious cheating activities was analyzed for eight monitoring categories in Table 3.

The system showed absolute precision of 100% in detecting physical copy-paste attempts and multi-tab/multi-app behavior. Although the voice detection exhibited a lower recall of 77.94%, this indicates a conservative detection threshold, which ensures that only obvious acoustic cheating is recorded in the table, thus preventing false accusations. Moreover, the object detection also exhibited a lower recall of 76.56%, which indicates the limitations of the convertional pre-trained COCO dataset (Common Objects in Context). To improve the detection sensitivity and reduce false negatives, future versions of the system will include training the model on a customized, domain-specific dataset. From Table 3 and Table 4, with a total of 452 true positives (TP), the system achieved an overall precision of 93.20%, which indicates a low rate of false accusations with only 33 false positives and 52 false negatives. The recall of the system is that about 89.68% of the cheating attempts are detected. The F1-score of the system is that 91.41% balances the two aspects, which confirms that the multimodal

architecture provides high reliability in both cheating detection and maintaining legitimate activity.

Table 3

System Evaluation for Suspicious Cheating Behaviors

Detection category	No. of instances	* TP	* FP	* FN	Precision (%)	Recall (%)	F1-score (%)
No Face	64	46	6	12	88.46	79.31	83.64
Multiple Faces	16	12	2	2	85.71	85.71	85.71
Face Mismatch	16	12	4	0	75.00	100.00	85.71
Head Movement	149	124	17	9	87.94	93.94	90.84
Object Detection	68	49	4	15	92.45	76.56	83.76
Copy/Paste	86	86	0	0	100.00	100.00	100.00
Tab Switch/ Multi Apps	70	70	0	0	100.00	100.00	100.00
Voice Detection	68	53	0	15	100.00	77.94	87.60
Total	**527**	**452**	**33**	**52**			

Note. * TP - True Positive : Cheating correctly identified.
* FP - False Positive : Normal behavior incorrectly flagged as cheating.
* FN - False Negative : Cheating attempt missed by the system.

Table 4

Feature-Wise Accuracy for Suspicious Cheating Behaviors

Metric	Formula	Calculated Value
Precision	TP/(TP+FP)	93.20%
Recall	TP/(TP+FN)	89.68%
F1-score	2*((precision*recall)/(precision+recall))	91.41%

Note. * TP - True Positive : Cheating correctly identified.
* FP - False Positive : Normal behavior incorrectly flagged as cheating.
* FN - False Negative : Cheating attempt missed by the system.

Qualitative Insights

Cost Effectiveness

The interviewees repeatedly highlighted the financial burden imposed by conventional examinations. Thirteen participants (65% of the sample) mentioned travel expenses, accommodation, and the cost of printed question papers as major deterrents, especially for students residing in remote provinces. The proposed system can now be taken from a laptop without the need for physical venues. Participants also pointed out ancillary benefits of the digital approach: the system is eco-friendly, eliminating the consumption of paper and the carbon footprint associated with travel; it requires fewer staff, thereby cutting personnel costs; and it offers remote-testing options for overseas learners who cannot attend an exam canter in person. Collectively, these qualitative observations suggest that the AI-enabled online proctoring platform delivers a markedly more cost-effective and environmentally sustainable assessment solution compared with traditional exam administration.

Stress Reduction

Many respondents (60% of the sample) described the heavy workload imposed on invigilators and faculty members as a major source of stress that undermines staff wellbeing. The respondents reported that extensive supervision causes fatigue, reduced concentration, and

consequently an increased risk of missing irregularities. The AI-driven proctoring system relieves the stress associated with the heavy workload by automating the process of routine monitoring, with downloadable manuals and demonstration videos that simplify preparation. Additionally, the system allows students to take the exam from the comfort of their homes, thus eliminating travel-related stress and anxiety, which in turn reduces the burden on both students and staff, thereby contributing to a healthier, less stressful assessment environment.

Bias and Fairness

The qualitative data revealed pervasive concerns about bias and subjectivity inherent in face-to-face examinations. Half of the participants explicitly cited no bias of the invigilators as an advantage of the proposed system, implying that the current manual process suffers from human prejudice. These accounts reveal a systemic lack of standardisation in invigilation practices, whereby personal relationships and discretionary judgement can affect exam integrity. The automated monitoring implemented in the prototype eliminates personal bias, reduces reliance on human proctors, and generates real-time alerts that are forwarded to administrators for immediate review.

Robust Integrity Framework

The interview data consistently argued that the traditional setting fails to reliably prevent or identify cheating. The 40% of respondents explicitly described the manual approach as easy to cheat and can't catch every cheater, indicating a systemic inability to enforce academic integrity. The proposed AI-driven system implements multiple preventive layers: an OTP-based login combined with strong password policies and face-verification to block impersonation; shortcut-key blocking to prevent copy-paste and key-logger attacks; and automated monitoring of head-movement, webcam feeds, and keyboard, mouse, and browser activities. Rather than flagging every micro-movement, the algorithm concentrates on significant behavioural anomalies, thereby reducing false-positive alerts. Detected events are streamed in real time to administrators, who receive concise summaries and can review the corresponding evidence files, such as annotated screenshots, audio clips, and activity logs, to make informed decisions.

The system was evaluated both on an individual feature basis and through an overall confusion matrix. While the system showed near-perfect performance in browser activity detection is 100%, the detection of unauthorized materials exhibited a slightly lower accuracy is 72% due to variations in lighting and device orientation. Moreover, the pilot evaluation shows that the online proctoring prototype can deliver a usable and workload-reducing assessment environment for both examinees and invigilators. Quantitative results (SUS = 4.13 for students, SUS = 4.52 for teachers) confirm that the system is perceived as reliable, secure, and user-friendly. Qualitative data further reveal that participants value the bias-free, cost-effective, and stress-reducing nature of the automated solution, while also recognizing its potential to enhance cheating prevention through multimodal monitoring.

Conclusion and Future Work

This research proposed and tested a functional online proctoring system powered by AI (React frontend, FastAPI backend, MySQL database) through a mixed-methods pilot study involving 20 students and 14 teachers at the University of Wisdom Land. The qualitative findings clearly

support that the AI-powered solution can overcome human bias, administrative overhead, stress for both examinees and invigilators, and improve cheating prevention capabilities.

However, there are still some limitations that need to be addressed, such as trust in AI outcomes, privacy concerns, and network stability in low-bandwidth settings. Although the system has a well-balanced accuracy metric with F1-score of 91.41%, the focus is still on optimizing the recall value of 89.68% to further reduce the number of unethical incidents going undetected and to ensure a more rigorous proctoring environment.

Future work will integrate the mobile-first, dual-camera, offline resilience, and automated essay scoring features to make the system more applicable in the developing countries. Moreover, the next logical step to improve the recall value would be to train the customized proctoring dataset. The small sample size and single institution context also constrain the external validity of the findings. By addressing these limitations, the proposed solution can evolve into a sustainable, equitable alternative to traditional invigilation, enabling continuous and high-integrity assessment in resource-constrained and geographically distributed higher-education environments.

Finally, it is imperative to highlight the specific context within which the study has been conducted. Since the host university was founded in 2020 and has never held any online exams before, the current system can be considered a pilot test for the adoption of the approach.

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