iJRASET
International Journal For Research in Applied Science and Engineering Technology

INTERNATIONAL JOURNAL FOR RESEARCH

IN APPLIED SCIENCE & ENGINEERING TECHNOLOGY

Volume: 14 **Issue:** IV **Month of publication:** April 2026

DOI: https://doi.org/10.22214/ijraset.2026.81334

www.ijraset.com

Call: 08813907089 | E-mail ID: ijraset@gmail.com

International Journal for Research in Applied Science & Engineering Technology (IJRASET)
ISSN: 2321-9653; IC Value: 45.98; SJ Impact Factor: 7.538
Volume 14 Issue IV Apr 2026- Available at www.ijraset.com

AI-Based Smart Examination Platform

Ayush Kumar, Abhijeet Tripathi, Kartikey Kumar Tripathi, Mr. Pranav Rai, Rupesh Yadav, Rishabh Verma
Department of Computer Science & Engineering, BBDNIIT, Lucknow, India

Abstract: ***The rapid growth of digital education and remote learning has increased the demand for secure, scalable, and intelligent online examination systems. Traditional exam platforms face challenges such as impersonation,cheating,lackofreal-timemonitoring,andinefficientevaluation.ThispaperpresentsanAI-Powered Online Examination System integrating facial recognition, behavioural analysis, automated proctoring, and instant result generation. Built on Python/Django with a Docker-deployed architecture, the system supports 100-200 concurrent students, enforces tab-switch limits, and delivers a fully paperless examination experience. A live deployment has been achieved at a production-ready URL, validating the system's real-world applicability.***

Keywords: Online Examination, Artificial Intelligence, Remote Proctoring, Face Recognition, E-Learning, Computer Vision, Django, Behavioural Analysis.

I. INTRODUCTION

With the increasing adoption of online education globally, conducting examinations remotely has become a necessity for academic institutions, certification bodies, and recruitment organizations. Conventional examination methods require physical presence, manual invigilation, and extensive logistical arrangements — all of which are time-consuming and resource-intensive.

Online examination systems offer flexibility and accessibility; however, they also introduce significant challenges related to academic dishonesty, identity verification, and real-time monitoring of candidate behaviour. ArtificialIntelligence(AI) hasemergedasapowerfulsolutiontoovercomethesechallengesbyenablingautomatedsurveillance,identityverification,andintelligentanalysisofcandidateactivities.

ThispaperpresentsafullyimplementedAI-PoweredOnlineExaminationSystemthataddressesthese limitations through computer vision-based proctoring, automated evaluation, and a scalable three-tier user architecture. The system has been deployed in a production environment and validated under real-world conditions.

II. LITERATURE SURVEY

A. OnlineExaminationSystems

Early online examination systems focused on digitising the delivery and submission process through web-based interfaces. Kumar et al. observed that while such systems improved accessibility and reduced administrative workload, they lackedadequate security mechanisms to prevent cheating and impersonation — most relying solely on username-password authentication, which proved insufficient for high-stakes examinations. Subsequent research introduced timer-based exams, randomised questionbanks,andbrowser lockdowntechniques,yetproxytest-takingandtheuseofexternaldevices remained largely unaddressed.

B. AI-BasedRemoteProctoring

Sharma, Jain, and Patel (2021) proposed an automated proctoring system using webcam-based monitoringandmachinelearningalgorithmstoobservecandidatebehaviour,significantlyreducingthe need for human invigilators. Deep learning models — particularly Convolutional Neural Networks (CNNs) — have since become the standard for real-time video analysis. These systems can detect suspicious activities such as frequent head movement, abnormal eye gaze, and the presence of unauthorised individuals. Researchers highlight, however, that false positives and varying environmental conditions remain open challenges.

C. FacialRecognitionandIdentityVerification

Facial recognition is a core component of secure online examination systems. Studies employ techniquesrangingfromHaarCascadeclassifiersandLocalBinaryPatternHistograms(LBPH)todeep learning face embeddings.

Patel et al. established that deep neural networks outperform traditional methodsundervaryinglightingconditions.

©IJRASET: All Rights are Reserved

Continuousfacialauthentication—verifyingthecandidate's face throughout the exam — has been proposed to prevent impersonation, though privacy concerns and computational overhead remain significant issues.

D. BehaviourAnalysisandCheatingDetection

Behavioural analysis plays a crucial role in identifying malpractice. Kumar et al. used gaze tracking algorithms to identify off-screen glances indicative of cheating. Advanced systems combine multiple indicators — face absence, multiple faces detected, audio disturbances, and tab switching — to generate a per-candidate risk score. Singh, Mehta, and Yadav (2022) demonstrated that multi-modal analysisimprovesdetectionaccuracy,albeitatthecostofincreasedsystemcomplexityandprocessing requirements.

E. AutomatedEvaluationandResultProcessing

Automated evaluation systems aim to reduce manual grading effort and eliminate human bias. Objective-type questions are evaluated with rule-based techniques, while NLP-based models have been explored for subjective answers. Singh et al. showed that AI-based evaluation can achieve accuracy comparable to human examiners for structured answers; however, fully automated grading ofdescriptiveresponsesremainsanopenresearchproblemduetolanguageambiguityandcontextual interpretation.

F. IdentifiedResearchGap

Despite these advances, existing literature reveals a clear gap: most systems are tested in controlled laboratoryenvironments,lackunifiedscalable architectures,anddonotintegrateallsecuritylayers — proctoring,behaviouralanalysis,andautomatedevaluation—intoasingleproduction-readyplatform. Privacy and ethical concerns related to continuous video monitoring are also frequently noted. The proposed system directly addresses this gap.

Author(s)&Year	Contribution	Limitation
Kumaretal.	Web-basedexamdelivery, accessibilityimprovements	Nosecuritybeyondlogin credentials
Sharma,Jain&Patel(2021)	Webcam-basedMLproctoring system	Falsepositives,environmental variability
Author(s)&Year	**Contribution**	**Limitation**
Patelet al.	Deepneuralnetworkface recognition	Privacyconcerns,compute overhead
Kumaretal.	Gazetrackingforoff-screen detection	Single-modal,limitedaccuracy
Singh,Mehta&Yadav(2022)	Multi-modalAIbehaviour analysis	Highcomplexity,scalability issues
Smithetal.(2021)	AI-basedremoteproctoring (IEEE Access)	Nofull-stackimplementation reported

Table1:SummaryofRelatedLiterature

III. METHODOLOGY

A. SystemArchitecture

The system follows a client-server architecture. The client side handles user interaction, webcam capture, and browser-level monitoring. The server side performs AI-based proctoring analysis, data persistence, and result processing. Five major modules constitute the system:

1) UserAuthenticationModule—Verifiescandidateidentityusinglogincredentialsandwebcam-captured facial recognition at session start.

2) AI-BasedProctoringModule—Continuouslymonitorscandidatesthroughwebcamand microphone using computer vision algorithms.

3) ExaminationManagementModule—Handlesquestionpapercreation,scheduling, configurable time windows, and bulk CSV upload.

4) BehaviourAnalysisModule—Detectsanomaliesincludingmultiplefaces,unusualhead movements, and browser tab switching.
5) AutomatedEvaluationModule—Assessesobjective-type(MCQ)answersinrealtimeand generates instant results upon submission.

B. Technology Stack

Layer	Technology
BackendFramework	Python3.13withDjango4.2
Database(Production)	PostgreSQL
Database(Development)	SQLite
WebServer	Gunicorn(multi-threaded)
Frontend	HTML5,TailwindCSS,JavaScript
AI/ProctoringEngine	BrowserMediaDevicesAPI+HTML5Canvas
Containerisation	Docker
DeploymentPlatform	Railway(cloudproduction)

Table2:TechnologyStack

C. AIProctoringPipeline

Theproctoringpipelineoperatesasfollows:

- Atlogin,thestudent'sfaceiscapturedviawebcamtoestablishabiometricbaselineforthe session.
- Duringtheexamination,thewebcamframeisanalysedevery4secondsusingthe MediaDevices API and Canvas element for face presence detection.
- Awarningpopupappearseachtimenofaceisdetected.After4cumulativewarnings,the exam is automatically submitted.
- Browsertab-switchingismonitoredviathePageVisibilityAPI.Thesystemenforcesa maximum of 4 tab switches before triggering auto-submission.
- Randomsnapshotsofthecandidate'swebcamfeedaresavedtotheserverevery25seconds for post-exam administrative review.

D. SecurityMeasures

BeyondAIproctoring,theplatformimplementsamulti-layeredsecuritymodel:

- CSRFprotectionblocksfakeformsubmissionsattheserverlevel.
- Eachstudentreceivesauniqueexamsessiontoken,preventingsessionhijacking.
- Server-sidevalidationpreventsduplicateexamsubmissions.
- Loginrate-limitingblocksaccountsafterrepeatedfailedauthenticationattempts.
- Inputsanitisationfiltersmaliciouscodefromallanswerfields.
- Questionsarerandomiseduniquelyperstudenttopreventanswersharing.

E. StudentExaminationFlow

Theend-to-endstudentjourneyisdesignedtobeintuitiveandrequiresnopriortechnicalknowledge:

- Authentication—Studentlogsinwithregisteredcredentials.
- IdentityCheck—WebcamcapturesfaceforAI-basedidentityverification.
- ExamSelection—Studentselectsanavailable,scheduledexamination.
- InstructionReview—Guidelines,duration,andattemptlimitsaredisplayed.
- AnswerQuestions—MCQsarepresentedwithalivecountdowntimer.
- Submission—Manualorautomatic(timerexpiry/warningthresholdreached).
- ViewResults—Marks,grade,anddetailedfeedbackdisplayedinstantly.

F. AdministratorandTeacherWorkflows

Theplatformsupportsthreedistinctroles.Administratorsmanageuseraccounts,courseassignments,andsystemapprovals,andhaveaccessto comprehensiveanalyticsandproctoringreviewdataacross all examinations. Teachers create and schedule examinations, compose or bulk-upload questions via CSV, set attempt limits and time windows, and review webcam snapshot evidence alongside student performancemetricsafter eachexam. Studentsregister,appearfor scheduledexams,receive instant results, and access their full attempt history.

IV. WORKING MODEL

A. OperationalOverview

The working model of the AI-Powered Online Examination System can be understood through three concurrent subsystems operating in real time during an active exam session:

Subsystem 1 — Exam Engine: Serves questions from a randomised, per-student question set. Maintains a server-synchronised countdown timer. Accepts and persists answer selections on each question navigation event. Enforces attempt limits defined by the teacher.

Subsystem2—ProctoringEngine:OperatesentirelyinthebrowserusingtheMediaDevicesAPI.Every 4 seconds, captures a video frame to a hidden Canvas element and analyses pixel data for face presence. Triggers warnings and enforces thresholds without requiring any server round-trip, minimising latency. Asynchronously uploads snapshot images to the server every 25 seconds.

Subsystem3—SecurityLayer:InterceptsbrowserfocusblureventsviathePageVisibilityAPItocount tab switches. Prevents CSRF attacks on all POST endpoints. Validates the unique session token on every answer submission request. Blocks re-submission if an attempt record already exists in the database.

B. DataFlowDiagram(Conceptual)

Actor	Action	SystemResponse
Student	Loginwithcredentials	Credentialverification;webcam face capture; session token issued
Student	Start exam	Randomised question set loaded;timerstarted;proctoring engine activated
ProctoringEngine	Faceabsencedetected	Warning issued; counter incremented;auto-submitat threshold 4
Student	Switchbrowsertab	Tab-switch counter incremented;auto-submitat threshold 4
ProctoringEngine	25-secondinterval	Snapshotuploadedtoserverfor admin review
Student	Submitexam	Answers evaluated; score computed;resultdisplayed instantly
Teacher	Post-examreview	Dashboard shows snapshots, warnings,tab-switchcountper student

Table3:SystemDataFlow

©IJRASET: All Rights are Reserved

V. RESULTS ACHIEVED

A. FunctionalResults

Thesystemhasbeensuccessfullyimplementedanddeployedinafullyoperationalproduction environment accessible at:
https://college-exam-platform-production.up.railway.app/
Allfivecoremodules—authentication,proctoring,exammanagement,behaviouranalysis,andautomatedevaluation—havebeenimplementedandverified.Thefollowingoutcomeswereobserved:

Feature	Status	Notes
AI-basedfacedetection proctoring	Implemented	4-secondwebcampolling;4-warning threshold
Automaticexamsubmissionon violations	Implemented	Faceabsenceandtab-switch limits enforced
Randomsnapshotevidence capture	Implemented	Savedevery25secondsserver-side
Uniqueper-studentquestion randomisation	Implemented	Preventsanswersharing between students
BulkCSVquestionupload	Implemented	Single-clickprocessingfor teachers
Instantautomatedresult generation	Implemented	Score,grade,andfeedback displayed on submit
Multi-role access (Admin/Teacher/Student)	Implemented	Distinctdashboardsand permissions per role
Duplicatesubmissionprevention	Implemented	Servervalidatesuniqueattempt token
Concurrentstudentsupport	Validated	Architecturesupports100-200 simultaneous users
Dockercontainerised deployment	Implemented	Production-deployedonRailway cloud platform

Table4:FeatureImplementationStatus

B. KeyAchievements

- Completepaperlessexaminationsystem—eliminatesprintingcostsandmanualevaluation delays.
- AIproctoringimplementedentirelywithoutanylicensedthird-partyproctoringsoftware,using only open browser APIs.
- Production-readyarchitecturevalidatedforrealcollegedeployment.
- Instantresultsuponexamcompletionremovethetraditionalwaitofdaysorweeksformarks.
- Comprehensiveproctoringreviewpanelgivesteachersdocumentaryevidence(snapshots, warning counts) for each student.

C. ChallengesandLimitations

While the system achieves its primary objectives, the following limitations were identified during implementation and testing:

- Facialdetectionaccuracydegradesinlow-lightenvironments,leadingtooccasionalfalse-positive warnings for legitimate students.
- Real-timewebcamprocessingreliesonbrowsercapabilitiesandmaybeaffectedbyolderor low-performance client hardware.
- Networklatencyinareaswithpoorconnectivitycancausesnapshotuploaddelays.
- ThecurrentMCQ-onlyevaluationenginedoesnotsupportdescriptiveorcoding-based assessments.
- Privacyanddataretentionpoliciesforstoredwebcamsnapshotsrequireinstitutional guidelines beyond the system's technical scope.

VI. FUTURE SCOPE

Futuredevelopmentdirectionsforthesysteminclude:

- Integration of lightweight on-device deep learning models (e.g., MobileNet-based face recognition)toimproveproctoringaccuracyunderadverselightingwithoutincreasingserver load.
- AdditionofNLP-basedautomatedevaluationfordescriptiveandshort-answerquestions.
- Blockchain-basedresultstoragetoprovidetamper-proof,verifiableacademicrecords.
- ExplainableAIdashboardsthatpresentproctoringdecisionrationaletransparentlyto administrators and candidates.
- Mobile-nativeapplicationsupportforAndroidandiOStoextendaccessibilitybeyonddesktop browsers.
- Privacy-preservingfederatedlearningapproachesfortrainingproctoringmodelswithout centralising raw video data.

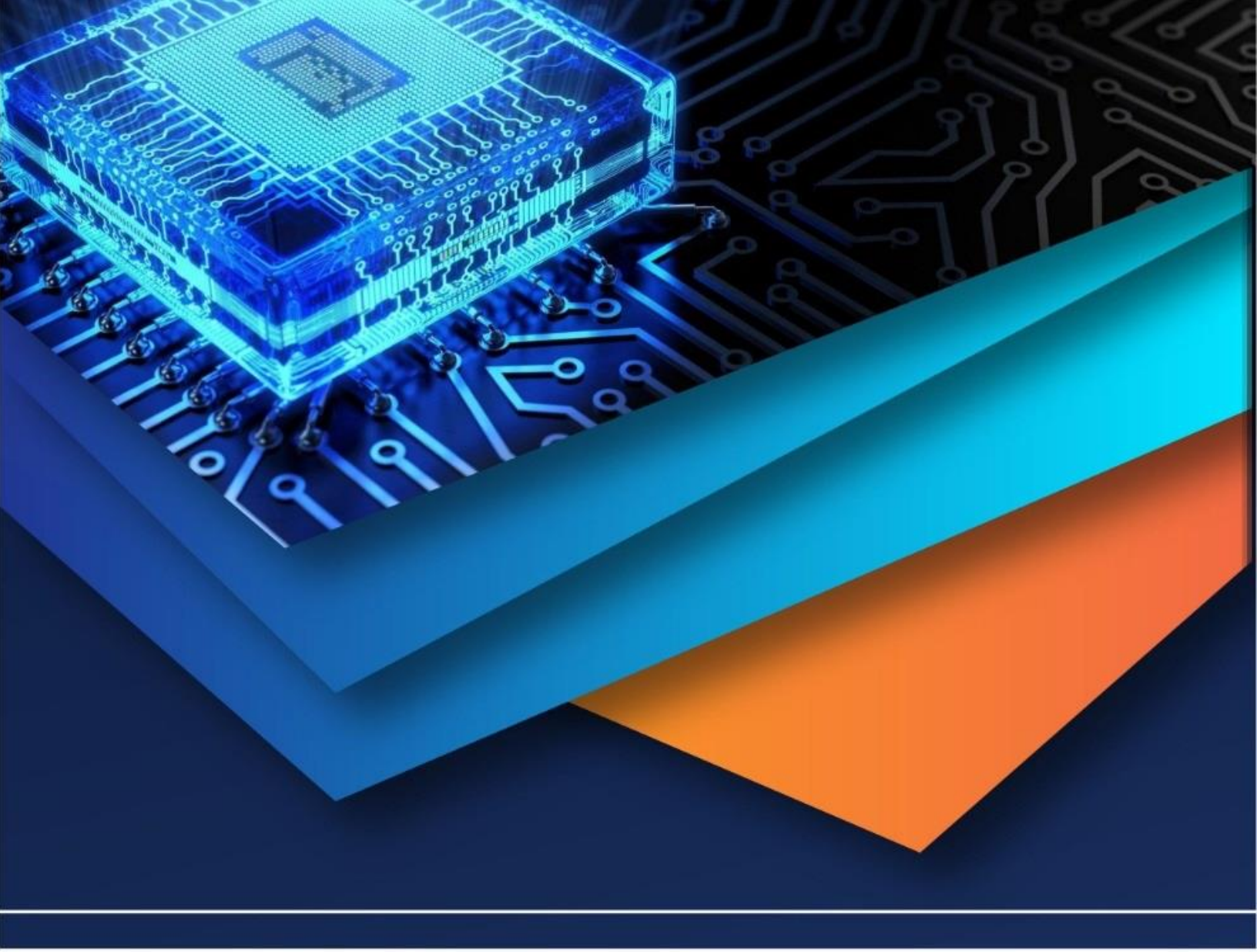
VII. CONCLUSION

This paper presented the design, methodology, working model, and results of an AI-Powered Online ExaminationSystemthatissecure,smart,andscalable. Byintegratingbrowser-basedfacialdetection, behavioural monitoring, multi-layer security, and automated evaluation into a unified Django-based platform,thesystemaddressesthecorelimitationsof bothconventionalpaperexaminationsandearlier generation online exam tools.

The system has been successfully deployed in a production environment, demonstrating real-world viability for institutional adoption. It eliminates the need for expensive third-party proctoring software, delivers instant results, and provides teachers with comprehensive post-exam review tools. While challenges related to low-light detection and descriptive answer evaluation remain, the proposed architecture provides a strong foundation for the next generation of intelligent, trustworthy online assessments.

REFERENCES

[1] J.Smithetal.,"AI-basedremoteproctoringsystemsforonlineexaminations,"IEEEAccess,2021.
[2] R.Kumaretal.,"Facerecognitiontechniquesforsecuree-assessment,"Springer,2022.
[3] S. Sharma, M. Jain, and A. Patel, "Automated online exam monitoring using computer vision," International Journal of Computer Applications, vol. 174, no. 8, pp. 22-28, 2021.
[4] P. Singh, R. Mehta, and K. Yadav, "AI-based behaviour analysis for cheating detection in remote exams," Elsevier Procedia Computer Science, vol. 198, pp. 314-321, 2022.
[5] Mr. Pranav Rai, Kartikey Kumar Tripathi et al., "AI-Powered Online Examination System," InternationalResearchJournalof ModernizationinEngineeringTechnologyandScience,Vol.07,Issue 12, December 2025, DOI: 10.56726/IRJMETS87706.
[6] DjangoProject.(2024).Djangodocumentation.https://docs.djangoproject.com
[7] Mozilla Developer Network. (2024). MediaDevices API. https://developer.mozilla.org/en-US/docs/Web/API/MediaDevices



10.22214/IJRASET

45.98

IMPACT FACTOR: 7.129

IMPACT FACTOR: 7.429

INTERNATIONAL JOURNAL FOR RESEARCH

IN APPLIED SCIENCE & ENGINEERING TECHNOLOGY

Call : 08813907089 (24*7 Support on Whatsapp)