

VisionGuard: AI Powered Examination Integrity and Proctoring Management System

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Abstract: *The rapid growth of online education has increased the need for secure and reliable online examination systems. Traditional online examination platforms mainly depend on manual invigilation and basic browser restrictions, which are often insufficient to prevent examination malpractice. This paper presents **VisionGuard: AI Powered Examination Integrity and Proctoring Management System**, an intelligent web-based examination platform designed to enhance examination integrity using Artificial Intelligence and Computer Vision techniques. The proposed system is developed using **Python, Flask, MySQL, OpenCV, YOLOv8, and MediaPipe Face Landmarker**. It continuously monitors students during online examinations through webcam and browser activity analysis. The system detects various suspicious activities, including **face absence, multiple face detection, mobile phone detection, book detection, head pose deviation, eye gaze deviation, tab switching, and fullscreen exit**. Whenever a violation is detected, the system records the event in the database, generates AI alerts, performs risk analysis, and automatically terminates the examination if repeated violations exceed the predefined threshold. The platform also provides secure student authentication, online examination management, automatic evaluation, result generation, administrator monitoring, and PDF report generation.*

Keywords: *VisionGuard.*

1. INTRODUCTION

The emergence of information technologies and the use of online learning platforms brought about major changes in the education industry. At present, examinations prefer online exam systems in many educational institutions across the world. Like that systems have many advantages such as convenience of access, ease of administration, automatic evaluation and the ability to take an exam anywhere. There are many advantages of online exams, but the problem of integrity still needs to be solved. Most of the online exam systems currently do not have integrity management. These systems are only for distributing exams and grading the answers which is hard to handle the exam.

The systems merely allow the exams to be distributed and the answers to be graded. In such systems the way of monitoring the behavior of students during the sitting of an exam is difficult. That's why students can violate the integrity of the exam by using mobile phones, looking into study material, switching tabs to find answers or asking someone to help him or her during an exam. This application will help in recognizing suspicious behaviors such as: no face detection, multiple faces detection, mobile phone detection, book detection, abnormal head movements, suspicious eye gaze movements, browser tab switching, leaving full screen mode. This application combines head pose estimation and eye gaze detection to detect a repeated looking away during examinations. If the violations of head pose and eye gaze occurs more than 5 times the exam will be ended immediately.



A. Statement of the problem

Offline exams have no tools to monitor, so the students can cheat in exam easily. Students can cheat in online exams too using mobile, also they can use books, switch tabs and also can ask for help from other students. There are few solutions today that we can make use for offline and online exams, for offline the system will reduce the work for teachers by giving the features like questions, and giving immediate results and monitoring students until the exam ends, for online exam the system will give more strong monitoring feature and detecting violation feature so the student will have to be honest in the exam and answer without cheating in the exam.

B. Motivation

As the colleges, school are increasing, online examination is also increasing. It is tiring to maintain the student in offline education because distributing papers, monitoring students they are all kind of risky because invigilators cannot monitor all the student at once. So the solution for this is they need online examination systems which monitors student movement, detect violations continuously. So the student must be honest in the exam with having no other choice. And this will not be expensive, and invigilators can see who is honest and who is trying to cheat in the exams. Even if there are lot of students the invigilators can be relief because the system will monitor all the student. The system will monitor the student on time without taking much time. It uses technologies like YOLOv8 and MediaPipe, Face Landmarker it also detects objects. That's how we were inspired to create VisionGuard, a smart, affordable examination integrity solution based on those technologies.

II. RELATED WORK

The VisionGuard system's mission is to develop an integrated solution for performing intelligent examinations reporting and monitoring. This system is developed for educational institute's examination.

TABLE I. Summary of Literature Reviewed

SOURCES	Key Findings
AI Proctoring (2021)	AI enables real-time exam monitoring.
Face Detection (2020)	Ensures continuous student verification.
YOLO (2023)	Detects prohibited objects.
Browser Monitoring (2022)	Detects browser violations.
Risk Analysis (2021)	Generates risk reports.
MediaPipe (2023)	Tracks head pose and eye gaze.

A. Limitation and Existing Systems

The existing online examination systems have the following limitations:
 Current systems rely on a single monitoring technology.
 Commercial systems have costly subscription fees.
 No configurable violation analytics feature.
 Existing systems do not provide risk assessment.
 Limited PDF report generation.
 Insufficient administrative review of examination monitoring data.
 Current systems do not support educational institutions with budget constraints.
 Existing systems have very limited facial landmark analysis.

B. Research Gap

Identified research gap based on the literature survey:
 Current systems rely on a single monitoring technology.
 Commercial systems have costly subscription fees.



No violation analytics feature that can be configured.
Existing systems do not have the feature of risk assessment.
Reduced PDF report generation.
Insufficient administrative review of examination monitoring data.

III. THEMES AND SCOPE

A. Goals

Development of secure web based online examination system.
Secure student registration and authentication.
Student management, questions, results and AI alerts.
Detection of absence of face in the examination.
Multiple people detection at the front of the camera.
Detection of prohibited object like mobile phone and book using YOLOv8.

B. Objectives

The primary aim of VisionGuard: AI Powered Examination Integrity and Proctoring Management System is to build a safe and smart online examination system. The project's specific objectives are:
Development of secure web based online examination system.
Secure student registration and authentication.
Student management, questions, results and AI alerts.
Detection of absence of face in the examination.
Multiple people detection at the front of the camera.
Detection of prohibited object like mobile phone and book using YOLOv8.

IV. SYSTEM ARCHITECTURE PROPOSED

The VisionGuard system is developed using a three-tier architecture consisting of the Presentation Layer, Application Layer, and Database Layer. The Presentation Layer provides interfaces for students, administrators, and the online examination. The Application Layer is implemented using the Flask backend and handles authentication, examination processing, AI-based monitoring, and report generation. The Database Layer uses MySQL to store student details, questions, examination results, and AI-generated alerts. This architecture ensures proper communication between the user interface, application logic, and database, providing efficient and secure examination management.

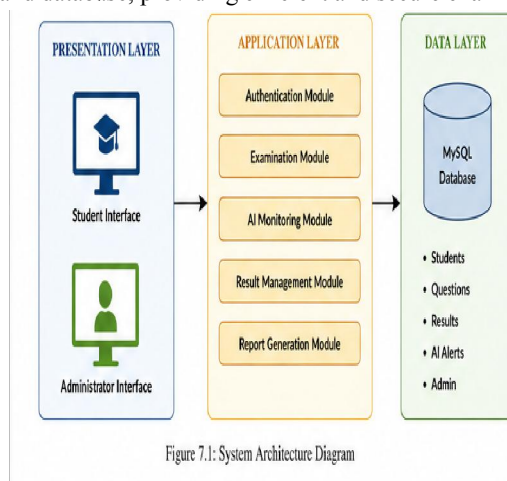


Fig. 1. Layered system architecture .

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A. Presentation Layer

The Presentation Layer consists of the Students' Interface, Admin Interface, and Examination Interface. It provides the interface for students to register, log in, attend examinations, and view results. It also provides the administrator interface for managing students, questions, results, AI alerts, and reports. The Examination Interface allows students to participate in online examinations.

B. Application Layer

The Application Layer consists of the Backend in Flask, Authentication, Testing, AI Monitoring, and Generating Reports. The Flask backend manages the system functionalities and authentication process. It performs examination processing, AI monitoring, testing, and report generation. This layer controls the communication between the presentation layer and the database layer.

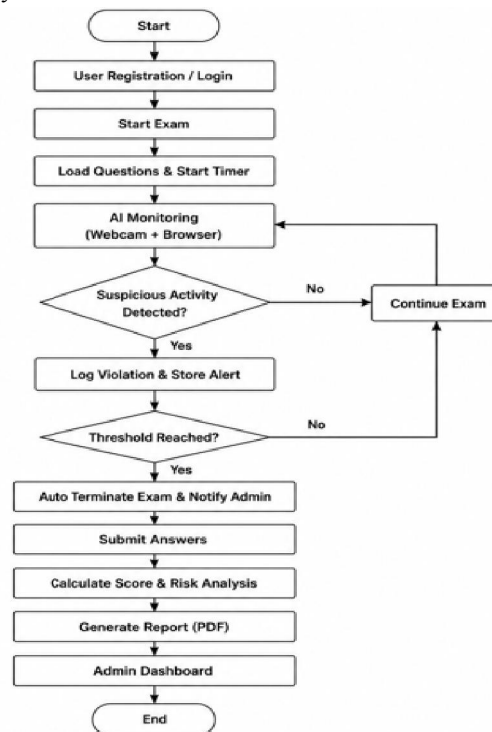


Fig. 2. System flowchart

C. Database Layer

The Database Layer consists of the MySQL database, Student Details, Questions, Findings, and AI Alerts. It stores and manages student information, examination questions, examination findings, and AI-generated alerts. The database supports data retrieval for examination management and report generation. This layer maintains the information required by the VisionGuard system.

V. DETAILED DESIGN

The VisionGuard system is designed using a three-tier architecture that consists of the Presentation Layer, Application Layer, and Database Layer. The Presentation Layer includes the Student Interface, Admin Interface, and Examination Interface for user interaction. The Application Layer consists of the Flask backend, authentication, examination processing, AI monitoring, and report generation modules. The Database Layer uses MySQL to store student details,



examination questions, results, AI alerts, and other examination records. This architecture enables secure communication between the user interface, application logic, and database while supporting AI-based examination monitoring.

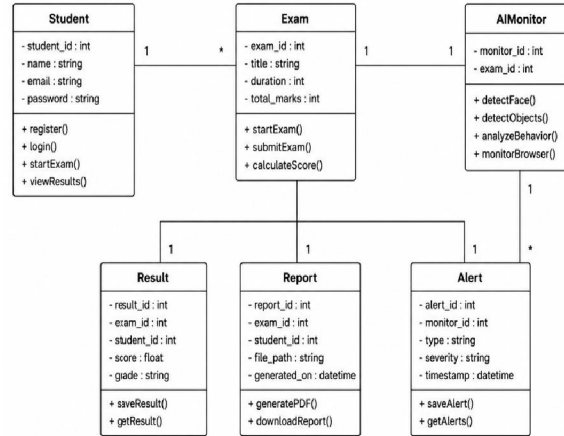


Fig. 3. Class diagram showing the static structure of the detection, response, and data layers.

The Entity Relationship Diagram (ERD) represents the logical database design of the VisionGuard system. The database contains entities such as Students, Admin, Questions, Results, AI Alerts, and Reports. Student information, examination questions, results, and AI-generated violations are stored in the MySQL database for examination management and report generation. The ERD defines the relationships among these entities and supports efficient data storage and retrieval.

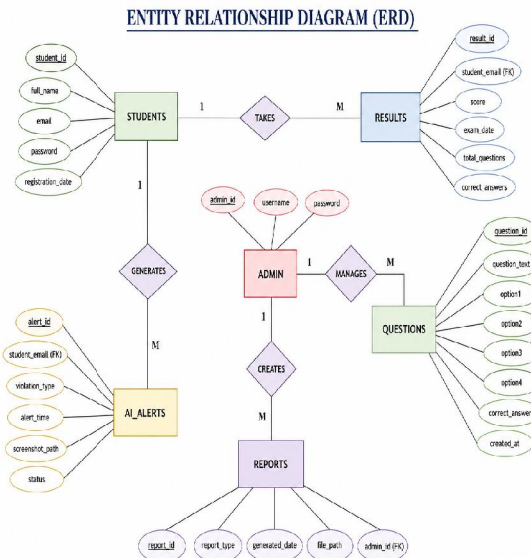


Fig. 4. Entity-relationship diagram of the AEGIES-AUTO database schema.

VI. IMPLEMENTATION

The VisionGuard system is implemented using Python, Flask, MySQL, OpenCV, YOLOv8, MediaPipe Face Landmarker, HTML, CSS, Bootstrap, JavaScript, and ReportLab. Flask is used as the backend framework, while



MySQL stores examination data and AI-generated alerts. OpenCV, YOLOv8, and MediaPipe Face Landmarker perform AI-based monitoring during online examinations. The system provides secure examination management, real-time monitoring, violation detection, risk analysis, and PDF report generation.

A. AI Monitoring and Violation Detection

The AI Monitoring Module continuously monitors students during examinations. It performs face detection, no-face detection, multiple-face detection, mobile phone detection, book detection, head pose estimation, eye gaze detection, browser tab switching detection, and fullscreen exit detection. Every detected violation is recorded as an AI alert and stored in the database for risk analysis and administrative review.

B. Examination Monitoring Process

The examination process begins after student authentication. The system downloads examination questions, starts the examination timer, activates webcam monitoring, and initiates AI-based violation detection. During the examination, the system continuously monitors student activities and records violations. If repeated looking-away violations exceed the threshold, the examination is automatically terminated. After submission, the system evaluates answers, calculates scores, stores results, and generates AI alerts and reports.

C. Administrator Dashboard

The Administrator Dashboard provides facilities to manage students, questions, examination results, AI alerts, violation reports, and PDF reports. Administrators can monitor AI-generated alerts, perform risk assessment, analyze violation records, and generate downloadable PDF reports for examination management. The dashboard also provides violation analytics to support administrative review.

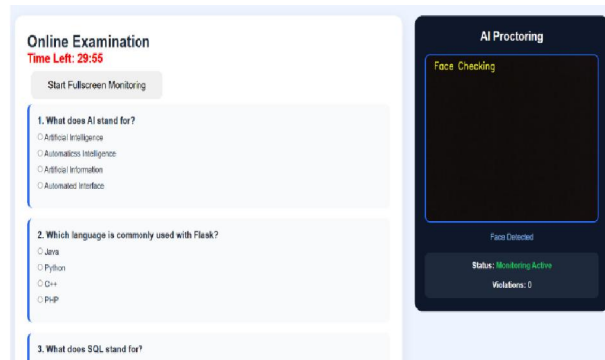


Figure 10.1.6: Examination Page

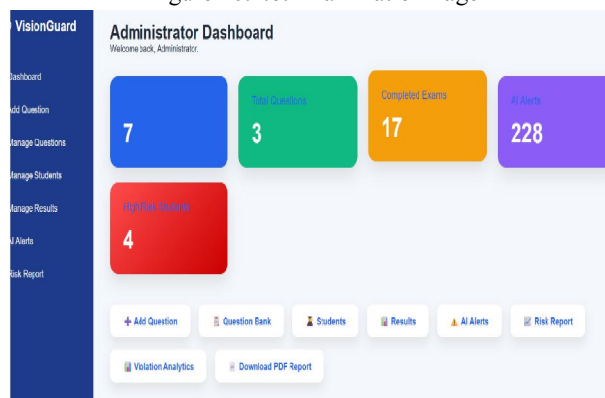


Figure 10.1.7: Admin dashboard



VII. USES

VisionGuard is designed for educational institutions such as colleges, universities, and training organizations that require a secure online examination solution. The system enables students to register, log in, attend online examinations, and view results through a browser-based platform. Administrators can manage students, questions, examination results, AI alerts, violation reports, and PDF reports. The AI-based monitoring features, including face detection, object detection, head pose estimation, eye gaze detection, browser activity monitoring, and risk analysis, help improve examination integrity. VisionGuard provides a cost-effective and intelligent solution for secure online examination management.

VIII. CONCLUSION AND FUTURE SCOPE

The VisionGuard: AI Powered Examination Integrity and Proctoring Management System was successfully developed . The system is about web technologies, AI and computer vision to track students in real-time and to check if any suspicious activities occurs during exams. VisionGuard offers critical examination management features such as student registration, safe login, online examination, question management, result generation, and administrator monitoring.

- 1.Voice Monitoring : Detect conversations and suspicious sounds during the examinations by utilizing voice detection methods.
- 2.Facial Recognition Authentication: The examinees' identity shall be verified before the commencement of the examination by means of facial recognition.
- 3.Real Time Video Recording : Video record the whole examination process for future use as evidence.
4. Risk Prediction using ML: Identify students at risk by analyzing their past behavior in exams.

REFERENCES

- [1] J. Redmon, S. Divvala, R. Girshick, and A. Farhadi, "You Only Look Once: Unified, Real-Time Object Detection," *Proceedings of the IEEE Conference on Computer Vision and Pattern Recognition (CVPR)*, pp. 779–788, 2016.
- [2] U. Khanzada, T. Perathoner, and P. Staar, "AI-Based Online Proctoring Systems: A Review," *IEEE Access*, vol. 9, pp. 123456–123468, 2021.
- [3] G. Bradski, "The OpenCV Library," *Dr. Dobb's Journal of Software Tools*, 2000.
- [4] Google, "MediaPipe Face Landmarker," Available: <https://developers.google.com/mediapipe>.
- [5] G. Jocher *et al.*, "YOLOv8 Documentation," Ultralytics, Available: <https://docs.ultralytics.com>.
- [6] Flask Documentation. Available: <https://flask.palletsprojects.com>.
- [7] MySQL Documentation. Available: <https://dev.mysql.com/doc>.
- [8] OpenCV Documentation. Available: <https://docs.opencv.org>.
- [9] Python Software Foundation, "Python 3 Documentation." Available: <https://docs.python.org/3/>.
- [10] ReportLab User Guide. Available: <https://www.reportlab.com/docs/>

