

Offline Automated Invigilation System With Gmail Alert Integration

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Abstract - Examinations play a crucial role in evaluating students' academic performance and integrity. Traditional invigilation methods depend heavily on human supervisors, which often leads to limitations such as fatigue, bias, and inability to continuously monitor large examination environments. To overcome these challenges, this project proposes an Offline Automated Invigilation System with Gmail Alert Integration that detects examination malpractice using computer vision and machine learning techniques. The system works in real-time through webcam video monitoring and identifies suspicious activities such as mobile phone usage, abnormal head movements, and unethical eye gaze patterns. Detection is performed locally without requiring continuous internet connectivity, making it suitable for rural and low-network regions. Whenever malpractice is detected, the system captures visual evidence with timestamps and stores it securely in local storage. Once internet connectivity becomes available, the system automatically sends Gmail alerts with attached evidence to the examination controller for quick action. By integrating YOLO-based object detection, Haar Cascade-based eye tracking, and head movement analysis, the proposed system improves monitoring accuracy, reduces human dependency, and enhances examination fairness. This solution is cost-effective, scalable, and reliable for modern academic institutions.

Key words : Automated Invigilation, Offline Proctoring, Computer Vision, Cheating Detection, YOLO, Haar Cascades, Eye Tracking, Head Movement Detection, Gmail Alerts, Machine Learning.

1. INTRODUCTION

Examinations are one of the most important methods used to evaluate students' academic knowledge, skills, and learning outcomes. However, maintaining academic integrity during examinations is a major challenge for institutions due to the increasing number of malpractice incidents. Traditional invigilation systems rely on human supervisors to monitor candidates, which becomes difficult in large examination halls due to limitations such as fatigue, lack of continuous attention, bias, and delayed response to suspicious behaviour.

With the rapid development of Artificial Intelligence (AI) and Computer Vision, automated invigilation systems have emerged as a reliable solution for detecting cheating behaviours. Modern proctoring systems use video surveillance and machine learning models to monitor

candidates and detect activities such as unauthorized object usage, abnormal head movement, eye gaze deviation, and collaboration attempts [1]. Many existing solutions are designed for online examinations and require stable internet connectivity for cloud-based processing and remote monitoring [2].

However, internet dependency makes such systems unsuitable for rural or low-connectivity regions. In such cases, an offline invigilation system becomes essential to ensure uninterrupted monitoring and evidence recording. Therefore, this project proposes an Offline Automated Invigilation System with Gmail Alert Integration that performs detection locally using computer vision models such as YOLO for object detection and Haar Cascade for eye tracking. The system also stores evidence locally and sends automated Gmail alerts whenever connectivity is available, ensuring timely communication and quick intervention.

1.1 Motivation

The main motivation behind this project is to overcome the limitations of manual invigilation and online proctoring systems. Manual monitoring requires more manpower, becomes inefficient in large exam halls, and often fails to detect subtle cheating behaviours. Similarly, most AI-based proctoring systems require continuous internet access, which is not feasible in many institutions. Hence, an offline intelligent invigilation system is needed to provide reliable monitoring, reduce cheating, and improve examination fairness.

1.2 Problem Statement

Traditional invigilation depends on human supervisors, which leads to challenges such as limited monitoring capacity, subjectivity, delayed detection, and high operational costs. Online proctoring solutions require stable internet and cloud connectivity, making them unsuitable for offline environments. Therefore, there is a need for a system that can detect suspicious behaviour locally, store evidence securely, and send automated alerts when internet access becomes available.

1.3 Scope of the Project

The scope of this project includes the development of an offline invigilation system that can be deployed in classrooms, labs, and examination halls. The system is

scalable for multiple candidates and can be enhanced further by integrating additional modules such as voice detection, multiple-face detection, and exam session reporting. The proposed system aims to support both small and large examination environments while ensuring accuracy, reliability, and integrity.

2. PROPOSED SYSTEM

The proposed Offline Automated Invigilation System with Gmail Alert Integration is designed to ensure examination integrity by continuously monitoring candidates using a webcam and detecting suspicious activities using machine learning and computer vision techniques. The system operates primarily in offline mode, where all video processing, behaviour analysis and evidence recording are performed locally without requiring continuous internet connectivity. This makes the solution suitable for institutions located in rural or low-network regions.

The system focuses on detecting common malpractice behaviours such as unauthorized object usage, abnormal head movements, and suspicious eye gaze deviation. Whenever any suspicious event is identified, the system captures the frame as evidence, stores it in local storage with proper timestamps, and maintains a log for future verification. Once internet connectivity becomes available, the system sends automated Gmail alerts to the controller of examinations or authorized invigilators along with the captured evidence, enabling quick action. The proposed system reduces dependency on manual invigilators, improves monitoring accuracy, and provides a cost-effective and scalable solution for modern examination environments.

2.1 Offline Monitoring and Real-Time Video Processing

The system continuously captures live video from a webcam installed in the examination hall. Each frame is processed in real time using OpenCV-based video capture methods. The system performs offline analysis of frames by applying preprocessing operations such as resizing, noise reduction, and conversion to grayscale when required. This ensures efficient processing on standard hardware while maintaining high accuracy in detection. Offline processing enables uninterrupted monitoring even in environments where internet connectivity is unavailable or unstable.

2.2 AI-Based Malpractice Detection

The proposed system integrates multiple AI-based detection modules to identify unethical behaviours during examinations. Unauthorized object detection is performed using the YOLO algorithm, which is capable of detecting prohibited items such as mobile phones in real time. Head movement detection is used to identify suspicious rotations or frequent directional changes that may indicate

communication with others. Eye movement detection is implemented using Haar Cascade-based eye tracking, where continuous gaze deviation is treated as suspicious behaviour. By combining these detection mechanisms, the system ensures reliable monitoring and reduces the possibility of cheating going unnoticed.

2.3 Evidence Logging and Local Storage

Whenever malpractice is detected, the system captures the corresponding frame and stores it securely in local storage. Along with the captured evidence, metadata such as date, time, detection type, and candidate identification details are recorded. This evidence-based approach ensures transparency and provides valid proof for administrators during post-examination verification. Local storage also allows the system to operate independently without relying on cloud services, making it suitable for offline environments.

2.4 Gmail Alert Integration and Notification Mechanism

The proposed system includes an automated Gmail alert module that sends notifications to authorized personnel when suspicious activities are detected. Since the system is designed for offline functionality, alerts are not dependent on continuous internet connectivity. Instead, the system stores the alert information locally and automatically triggers Gmail notifications once internet access becomes available. Each alert contains a detailed description of the detected malpractice, timestamp information, and attached evidence images. This ensures timely communication, reduces manual reporting workload, and enables immediate intervention to maintain examination discipline.

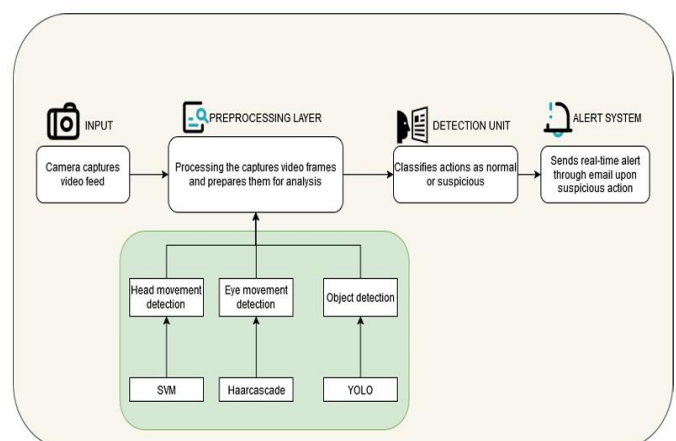


Fig. 1 System Architecture of Offline Automated Invigilation System

3. METHODOLOGY

This chapter describes the implementation methodology of the Offline Automated Invigilation System with Gmail Alert Integration. The system is implemented using Python along with computer vision and machine learning libraries to detect examination malpractice in real time. The methodology is designed in a modular way so that each component such as video capture, preprocessing, detection, evidence logging, and alert generation can work independently and can be integrated efficiently. The system is capable of functioning offline for continuous monitoring, while Gmail integration is activated only when network connectivity becomes available.

3.1 Video Capture and Frame Acquisition

The first stage of implementation involves capturing real-time video from a webcam installed in the examination environment. OpenCV is used to access the camera and continuously read video frames. These frames act as the primary input for all detection modules. The system ensures continuous monitoring by processing frames sequentially without interruptions. The captured frames are passed to the preprocessing stage to improve detection efficiency and accuracy.

3.2 Frame Preprocessing

In the preprocessing stage, the captured frames are prepared for analysis to reduce computational complexity and improve detection performance. The preprocessing operations include resizing the frame to a standard dimension, reducing noise using filtering techniques, and converting the frame into grayscale whenever required for Haar Cascade detection. This step ensures that the system can run efficiently on standard computers without requiring high-end GPU hardware. Preprocessing also enhances feature extraction quality, which directly improves the accuracy of object detection, eye tracking, and head movement detection.

3.3 Malpractice Detection Using AI Models

The detection stage is the core implementation of the proposed system. In this stage, the pre-processed frames are analysed using multiple computer vision and machine learning models. YOLO is used for real-time object detection to identify unauthorized objects such as mobile phones. If a prohibited object is detected, the system marks it in the frame and captures the image as evidence. Head movement detection is performed using face detection and facial landmark tracking techniques to estimate head orientation. Abnormal head rotations and frequent movements are classified as suspicious behaviour. Eye movement detection is implemented using Haar Cascade classifiers and landmark-based eye tracking methods to analyse gaze direction. If continuous gaze deviation is detected beyond

the allowed threshold, the system considers it as unethical behaviour and triggers an alert.

3.4 Evidence Logging and Gmail Alert Generation

Whenever suspicious activity is detected, the system automatically captures the corresponding video frame and stores it locally along with timestamp details. The evidence is saved in a secure folder or local database to maintain traceability for future verification. The alert information is also recorded locally, ensuring that no suspicious activity is missed even in offline conditions. When internet connectivity becomes available, the Gmail integration module is activated and automatically sends alert emails to the controller of examinations. Each email includes the type of malpractice detected, date and time information, and the captured evidence image as an attachment. This implementation ensures timely notification, reduces manual reporting workload, and improves the overall reliability of the invigilation process.

4. RESULTS AND PERFORMANCE ANALYSIS

This chapter presents the results obtained from the implementation of the Offline Automated Invigilation System with Gmail Alert Integration. The system was tested using real-time webcam video streams under different examination-like scenarios to validate its capability to detect malpractice activities. The performance evaluation was mainly focused on mobile phone detection, head movement detection, and multi-student monitoring. The system successfully detected suspicious behaviour and displayed bounding boxes with confidence scores for detected objects and persons. Evidence frames were captured automatically and stored locally with timestamps for verification. The results demonstrate that the proposed system can effectively identify unauthorized object usage such as mobile phones and can also detect suspicious head movement patterns that may indicate cheating or communication attempts. The system produced reliable outputs in real time with minimal delay, showing that the detection modules work efficiently in offline mode. The generated outputs prove the system's practicality for real examination environments and support the objective of reducing manual invigilation dependency.

4.1 Mobile Phone Detection Result

The first experimental test case was conducted to verify the YOLO-based object detection module. During the test, a mobile phone was introduced in front of the camera while the student was seated. The system successfully detected the mobile phone and also identified the student as a person. The detected objects were highlighted using bounding boxes along with confidence values. The mobile phone detection result confirms that the proposed system can reliably identify prohibited devices during examinations and capture the evidence instantly.



Fig. 2 Mobile Phone Detection using YOLO with Confidence Score

4.2 Suspicious Head Movement Detection Result

The second experimental test case was conducted to validate the head movement detection module. In this test, the student intentionally rotated the head sideways repeatedly to simulate suspicious behaviour such as copying or communication with another candidate. The system successfully tracked the face and identified abnormal head rotation, and the candidate was marked as suspicious. This output demonstrates that the proposed system can monitor candidate behaviour effectively and flag unethical actions in real time.

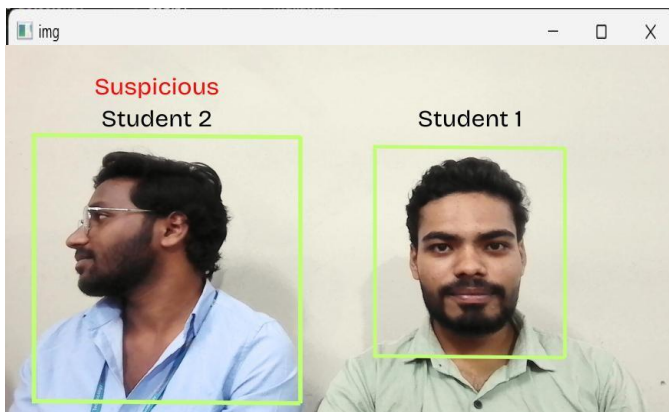


Fig. 3 Suspicious Head Movement Detection Result

4.3 Discussion on System Performance

The experimental results indicate that the system performs efficiently in real-time environments with offline processing. YOLO-based object detection provides accurate detection of mobile phones with high confidence scores. The head movement module successfully identifies abnormal face orientation changes, which are commonly associated with malpractice. Since all processing is performed locally, the system does not depend on continuous internet

connectivity, making it reliable for rural and low-network examination environments. Evidence capturing and local logging provide transparency and support decision-making for invigilators.

5. CONCLUSION

This project successfully developed an Offline Automated Invigilation System with Gmail Alert Integration to improve examination security and reduce malpractice. The system effectively monitors candidates in real time using a webcam and detects suspicious activities such as mobile phone usage, abnormal head movement, and unethical eye gaze patterns using computer vision and machine learning techniques. Since all detection and evidence logging are performed locally, the system works reliably even without continuous internet connectivity, making it suitable for rural and low-network environments.

The system also captures and stores evidence with timestamps, ensuring transparency and accountability during post-examination verification. When internet access becomes available, automated Gmail alerts with attached evidence are generated, enabling invigilators and administrators to take immediate action. Overall, the proposed solution reduces human dependency, improves monitoring accuracy, supports scalability for large examination halls, and provides a cost-effective approach for maintaining academic integrity.

6. FUTURE ENHANCEMENT

The proposed Offline Automated Invigilation System with Gmail Alert Integration can be further improved by adding advanced features to enhance accuracy, scalability, and real-time monitoring capabilities. In future, the system can be extended to support multiple camera inputs for covering large examination halls more effectively. Additional cheating detection modules such as voice detection, lip movement analysis, and hand gesture tracking can be integrated to identify collaboration or communication attempts more accurately. The eye tracking module can be enhanced using deep learning-based gaze estimation models to improve precision under different lighting conditions and camera angles. The system can also be upgraded with candidate face recognition for automatic student identification and attendance verification. For better evidence management, a secure local database with encryption can be implemented along with an admin dashboard to review suspicious events and generate detailed examination reports. Furthermore, SMS or mobile push notifications can be added along with Gmail alerts to ensure faster communication in critical situations. These enhancements will make the system more robust, intelligent, and suitable for large-scale institutional deployment.

REFERENCES

- [1] R. S. Saini and S. Dutta, "A Review on Automated Proctoring System using Artificial Intelligence," *International Journal of Computer Applications*, vol. 182, no. 44, pp. 1–6, 2019.
- [2] A. Gupta, P. Jain, and R. Kumar, "Online Examination Monitoring System using Computer Vision and Machine Learning," in *Proc. International Conference on Intelligent Computing and Control Systems (ICICCS)*, 2020, pp. 1120–1125.
- [3] J. Redmon, S. Divvala, R. Girshick, and A. Farhadi, "You Only Look Once: Unified, Real-Time Object Detection," in *Proc. IEEE Conference on Computer Vision and Pattern Recognition (CVPR)*, 2016, pp. 779–788.
- [4] J. Redmon and A. Farhadi, "YOLO9000: Better, Faster, Stronger," in *Proc. IEEE Conference on Computer Vision and Pattern Recognition (CVPR)*, 2017, pp. 7263–7271.
- [5] P. Viola and M. Jones, "Rapid Object Detection using a Boosted Cascade of Simple Features," in *Proc. IEEE Conference on Computer Vision and Pattern Recognition (CVPR)*, 2001, pp. 511–518.
- [6] G. Bradski, "The OpenCV Library," *Dr. Dobb's Journal of Software Tools*, 2000.
- [7] V. Kazemi and J. Sullivan, "One Millisecond Face Alignment with an Ensemble of Regression Trees," in *Proc. IEEE Conference on Computer Vision and Pattern Recognition (CVPR)*, 2014, pp. 1867–1874.
- [8] N. Dalal and B. Triggs, "Histograms of Oriented Gradients for Human Detection," in *Proc. IEEE Conference on Computer Vision and Pattern Recognition (CVPR)*, 2005, pp. 886–893.
- [9] C. Cortes and V. Vapnik, "Support-Vector Networks," *Machine Learning*, vol. 20, pp. 273–297, 1995.
- [10] A. Rosebrock, "Practical Python and OpenCV: An Introduction to Computer Vision," *PyImageSearch*, 2018.