iJETRM
International Journal of Engineering Technology Research & Management
Published By:
https://www.ijetrm.com/

AI – BASED EXAM PROCTORING SYSTEM

Authors:
Srushti Bhogate
Pradnyesha Alai
Sakshi Shirke
Disha Sankneniwar

Project Guide:
Mrs. Rajeshwari Kodulkar

Department of Information Technology, Dr. D.Y. Patil College of Engineering, Akurdi, India.

ABSTRACT:
In recent years, the demand for online examinations has surged, driven by the growth of e-learning and remote assessments. Ensuring examination integrity has become a primary concern, especially when face-to-face proctoring is not feasible. AI-based proctoring systems present a solution by using advanced image processing and machine learning to monitor candidates in real-time. This research paper explores a proctoring system incorporating face detection, eye tracking, head-pose estimation, and mouth opening detection, all of which are essential for detecting suspicious behaviors. Leveraging tools such as OpenCV, TensorFlow, and Python, this system provides a comprehensive solution for academic integrity in remote examinations. The proposed system continuously monitors students' behavior, ensuring transparency and fairness by identifying and flagging any potentially unauthorized actions.

Keywords:
AI-Based Proctoring, Online Exam Integrity, Face Detection, Eye Tracking, Head Pose Estimation, Mouth Opening Detection, OpenCV, TensorFlow, Computer Vision in Education

I. INTRODUCTION:

As online examinations become more prevalent, maintaining the same level of oversight as in-person exams is essential to deter cheating. An AI-based proctoring system allows for remote, real-time monitoring of students by detecting and flagging suspicious behaviors. Face detection, the core feature, identifies and locates the student's face in the camera feed, serving as the basis for further analysis. Eye tracking helps determine if a student is focused on the screen, an indicator that they are not referencing unauthorized material. Head pose estimation detects if the candidate is looking away from the screen or consulting off-camera resources. Mouth opening detection further strengthens the system's capabilities by identifying verbal interactions that could indicate cheating. Together, these features provide a layered, robust proctoring system that enhances the credibility of online assessments.

The need for reliable online proctoring has led to the adoption of technologies such as computer vision and deep learning. Tools like OpenCV and TensorFlow are fundamental to this system, enabling real-time facial feature detection and behavioral analysis. By continuously monitoring candidates, these technologies enable automatic detection and logging of any potential examination misconduct, allowing for fair assessment practices in remote settings.

Technology Used

This proctoring system is built using several key technologies that enable accurate and real-time monitoring. **OpenCV**, a widely-used open-source computer vision library, provides the tools necessary for detecting and tracking facial features. It facilitates real-time video processing, which is essential for continuously monitoring candidates throughout the exam. **TensorFlow**, a machine learning framework, powers the deep learning models used in eye tracking, head pose estimation, and mouth opening detection. **Python** serves as the primary programming language due to its versatility and compatibility with various libraries, offering a straightforward way to integrate OpenCV, TensorFlow, and other essential tools.

Each of these technologies plays a crucial role in the proctoring system. OpenCV is responsible for initial facial detection and landmark tracking, which establishes the candidate's position and alignment relative to the screen. TensorFlow

iJETRM
International Journal of Engineering Technology Research & Management
Published By:
https://www.ijetrm.com/

enables training and deploying machine learning models that can identify subtle behaviors, such as eye movements or mouth opening. Python's libraries for data handling and computation.

II. Review Of Related Literature:

The authors in [1] conduct a systematic review of various e-learning technologies, analyzing their effectiveness in fostering student engagement and participation in online learning environments. It highlights key factors influencing engagement and provides recommendations for educators.The authors in [2] propose an intelligent career guidance system that utilizes machine learning algorithms to analyze student profiles and suggest appropriate career paths. The system aims to assist students in making informed decisions about their future careers based on individual strengths and interests.

In [3], comprehensive meta-analysis evaluates the impact of online learning platforms on student performance. The findings indicate that online learning can significantly improve academic outcomes, particularly in subjects where interactive components are included. The paper discusses the implications for educators and institutions. This case study in [4] investigates the role of interactive learning environments in enhancing student engagement. It presents qualitative data collected from student surveys and interviews, demonstrating that interactive features such as gamification and collaborative tools lead to increased participation and satisfaction in learning activities.

The authors in [5] introduce an innovative AI-powered career counseling system that employs chatbot technology to provide personalized career advice to students. The system leverages natural language processing to engage users in meaningful conversations and offers tailored guidance based on their skills and interests.

III. Proposed System:

The proposed AI-based proctoring system is designed to address challenges in online exam integrity by integrating four key features: face detection, eye tracking, head pose estimation, and mouth opening detection. **Face detection** is the foundational feature that identifies and localizes the candidate's face in real-time, allowing other components to function accurately. Using OpenCV, the system first detects the candidate's face within the video feed, and landmarks such as eyes, nose, and mouth are tracked to ensure the face remains in view throughout the exam. This step is crucial for establishing the user's identity and setting up subsequent tracking capabilities, ensuring that the candidate stays in the correct position during the exam.

Eye tracking is another vital component that examines gaze direction to determine if the candidate is focused on the screen. This feature is particularly important, as diverted eye movement could indicate a candidate looking at off-screen material or other potential resources. By continuously monitoring the position of the irises, the system detects suspicious gaze patterns, which may suggest unauthorized behavior. TensorFlow-based models are used to enhance the accuracy of eye tracking, ensuring quick and reliable detection. This feature thus provides an additional layer of monitoring by continuously analyzing where the candidate's attention is directed during the exam.

Head pose estimation complements eye tracking by analyzing the orientation of the head, which helps in identifying any significant shifts in head position. By detecting deviations from a neutral, screen-facing orientation, the system can flag behaviors that may suggest the candidate is consulting off-screen resources. Using facial landmarks, the system estimates the candidate's head pose and identifies if they are looking to the side, up, or down frequently. This additional layer of monitoring ensures that candidates cannot easily glance away from the screen without being detected, thereby enhancing the reliability of the proctoring process.

Lastly, **mouth opening detection** monitors potential verbal interactions during the exam. By tracking the distance between the lips, the system identifies instances where the mouth opens, flagging the candidate for possible communication. This feature is particularly useful in preventing candidates from speaking to others during the test or attempting to vocalize answers. Real-time mouth tracking provides alerts when unusual mouth activity occurs, ensuring that any suspicious behavior is logged and can be reviewed post-exam. By combining these four features, the proposed system offers a comprehensive and automated approach to online exam proctoring, significantly reducing the risk of cheating and ensuring fair assessments in a virtual setting.

iJETRM
International Journal of Engineering Technology Research & Management
Published By:
https://www.ijetrm.com/

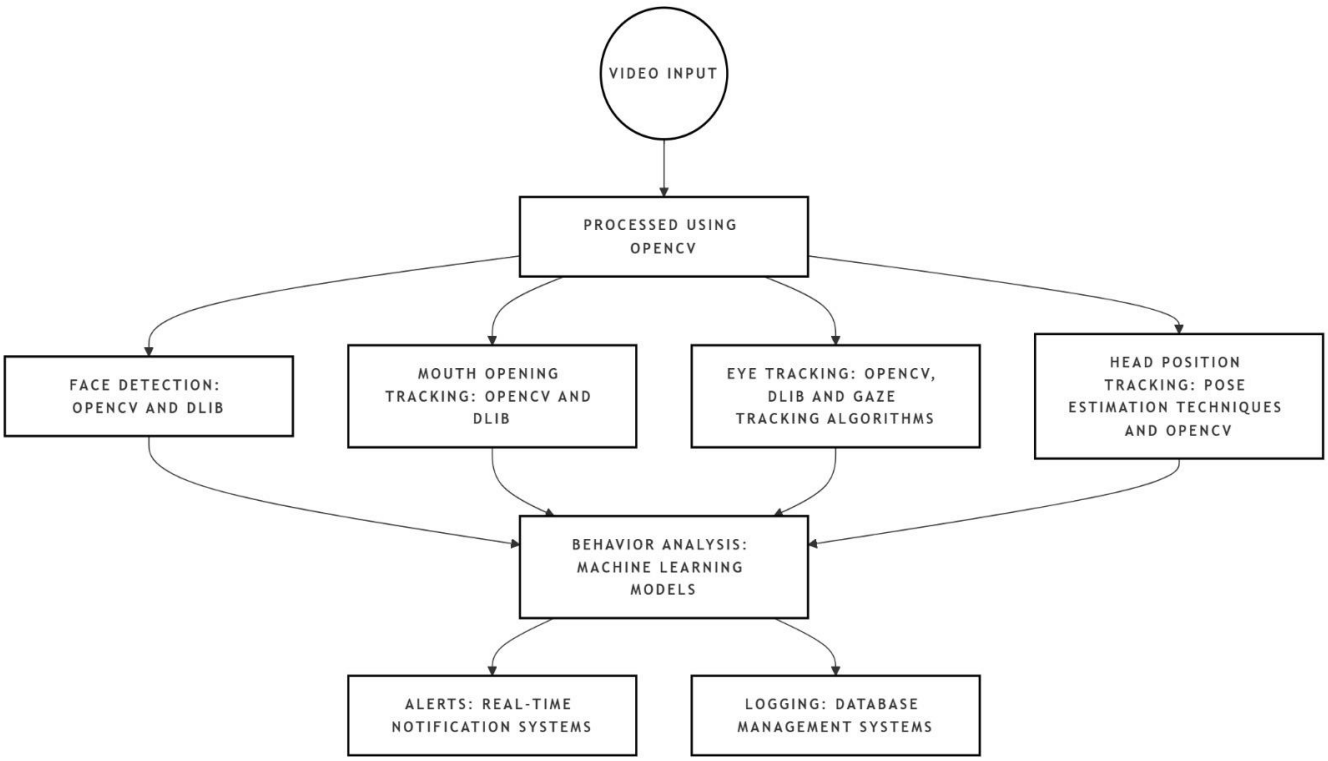

Fig 1: System Flowchart

IV. System Overview:

The AI-based proctoring system begins with **webcam input**, which captures a real-time video feed of the exam candidate. This input serves as the foundation for the entire proctoring process, as all subsequent modules rely on this continuous video stream. The system's first task is **face detection**, which uses OpenCV to identify and localize the candidate's face within each frame. Face detection is essential because it establishes the candidate's position relative to the camera, ensuring they are appropriately oriented and in view throughout the exam. If the system cannot detect a face, it logs an alert, as the absence of a face
could indicate that the candidate has left the examination area or is attempting to avoid monitoring.
Once the face is detected, the system activates the **eye tracking** module, which monitors the candidate's gaze direction. Eye tracking helps determine if the candidate is focused on the screen, a key indicator of exam integrity. TensorFlow models analyze the position and movement of the candidate's irises to ensure they are looking at the screen consistently. If the candidate's gaze deviates frequently or for extended periods, the system flags this as suspicious behavior, suggesting the possibility of unauthorized off-screen materials. This feature provides insight into the candidate's attentiveness and focus during the exam, helping ensure that they do not glance away frequently, which could indicate cheating.

iJETRM
International Journal of Engineering Technology Research & Management
Published By:
https://www.ijetrm.com/

In addition to eye tracking, **head pose estimation** plays a crucial role in the proctoring system. Head pose estimation assesses the orientation of the candidate's head by analyzing facial landmarks, such as the eyes, nose, and mouth, to determine whether they are facing the screen. A significant or frequent deviation from the standard forward-facing orientation can indicate that the candidate is looking off-screen, potentially consulting unauthorized resources. By monitoring the head's angle and movement patterns, the system ensures that the candidate remains properly aligned with the screen, reinforcing the integrity of the proctoring process.
Finally, the **mouth opening detection** module tracks the candidate's mouth movements to identify any instances of talking, which could indicate communication with others. Using facial landmarks around the mouth, the system calculates the distance between the upper and lower lips to detect mouth opening. If the mouth is open repeatedly or for an extended duration, the system flags this as suspicious activity. This feature is critical for preventing candidates from speaking to others or vocalizing answers during the exam. All suspicious activities are logged for post-exam review, allowing instructors to analyze potential violations. By continuously monitoring these features, the AI-based proctoring system offers a comprehensive solution to ensure academic integrity in online exams.

V. CONCLUSION:

The proposed AI-based exam proctoring system addresses the need for effective and automated monitoring of candidates during online exams. By integrating features such as face detection, eye tracking, head pose estimation, and mouth opening detection, the system provides a robust solution for upholding examination integrity in a virtual environment. Leveraging advanced technologies like OpenCV, TensorFlow, and Python, this system is capable of real-time behavioral analysis, which enables the detection of suspicious actions without requiring direct human oversight. Each feature plays a critical role in identifying common behaviors associated with cheating, and together, they form a comprehensive approach to securing remote assessments.The implementation of this system not only enhances the credibility of online exams but also fosters a sense of fairness among candidates by ensuring that all participants are held to the same standards. As online education and assessments continue to grow, the deployment of such AI-based proctoring systems will likely become essential in academic and professional testing environments. Future work can focus on enhancing accuracy and integrating additional features, such as lip reading and ambient sound detection, to further prevent dishonest practices. Balancing technological advancements with ethical considerations, this AI-driven solution exemplifies the potential of artificial intelligence to address contemporary educational challenges.

VI. REFERENCES:

1) OpenCV Documentation. *Computer Vision in Education and Proctoring*. Available at: https://opencv.org

2) TensorFlow. *Deep Learning Models for Image and Video Processing*. TensorFlow Documentation. Available at: https://tensorflow.org

3) Singh, R., & Tiwari, S. (2021). "A Review on AI-Based Online Exam Proctoring Systems." *International Journal of Artificial Intelligence and Applications*, vol. 12, no. 3, pp. 45-59.

4) Moin Shaikh. *Real-Time Exam Proctoring System*. GitHub Repository. Available at: https://github.com/MoinShaikh27/Real-Time-Exam-Proctoring-System

5) Apar Garg. *Intelligent Online Exam Proctoring System*. GitHub Repository. Available at: https://github.com/AparGarg99/Intelligent-Online-Exam-Proctoring-System

6) https://www.researchgate.net/publication/372261546_Online_Exam_Proctoring_System_Based_on_Artificial_Intelligence
7) https://www.ijraset.com/research-paper/artificial-intelligence-based-online-examination-proctoring-system