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INTELLIGENT PROCTORING SYSTEM USING REAL-TIME FACE RECOGNITION ANDEYE-TRACKING

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Abstract - *Nowadays, online exams are common, but it is not easy to monitor students properly. our paper presents an Intelligent Proctoring System that monitors candidates in real time using a webcam. In our project, the system checks whether a face is present and also tracks head movement and eye direction to identify events such as absence, multiple faces, and abnormal viewing behavior.*

Based on these observations, a risk score is calculated to indicate the level of suspicious activity during the exam. The system is simple and can run using a normal webcam without extra setup. The results show that it can effectively identify abnormal behavior and support fair online examination processes.

1. INTRODUCTION

Today, many exams are conducted online, but monitoring students is still difficult. Although students are asked to keep their webcam on, simply recording video is not enough to identify suspicious activities such as looking away, leaving the screen, or the presence of multiple persons.

For this problem , we developed an Intelligent Proctoring System that monitors candidates in real time using a webcam. The webcam video is taken and checked frame by frame in our system to detect face presence, head movements, and eye gaze direction. The main focus of the system is on head movement detection, along with gaze tracking under suitable lighting conditions.

The system identifies events such as no face detected, multiple faces detected, and gaze directions like left, right, and center. Based on these observations, a risk score is calculated to indicate the level of suspicious behavior during the examination. Events like absence of the candidate and multiple face detection contribute to a higher risk score.

The system displays face count, gaze direction, and risk score on the screen. which helps in analyzing candidate behavior effectively. The system is simple, works with a standard webcam, and does not require any additional hardware.

Overall, this approach provides a practical solution for monitoring online exams and helps in identifying abnormal behavior more effectively than basic video-based monitoring.

2. LITERATURE SURVEY

Many research papers are available in this area of AI-based online proctoring systems, focusing on monitoring candidate behavior using computer vision techniques.

T. Singh et al.(2024) proposed a multi-modal proctoring system that combines facial recognition, head pose estimation, mouth tracking, and audio analysis to detect suspicious activities.[3]The system shows improved accuracy by using multiple inputs such as video and audio. However, the inclusion of multiple modalities increases system complexity and may require higher computational resources, making it less suitable for lightweight and real-time applications.

Vishal Molawade et al.(2023) developed an AI-based online exam proctoring system that uses face recognition and object detection techniques like YOLO to identify activities such as mobile phone usage and multiple persons in the frame. [1]While the system improves automation in monitoring, it mainly focuses on object detection and does not give detailed attention to gaze direction or continuous behavior tracking.

S. Essahraoui et al. (2025) presented a deep learning-based approach that integrates facial recognition, gaze tracking, and object detection to detect cheating behavior. [4]The system achieves better accuracy by combining multiple features. However, such approaches can be computationally expensive and may not perform efficiently in real-time environments with standard hardware.

From the existing literature, it is observed that many systems either focus on complex multi-modal approaches or require high computational resources. In contrast, our proposed system focuses on a lightweight and practical solution using a standard webcam. [2] It emphasizes head movement detection along with gaze direction and introduces a risk score mechanism based on events such as no face, multiple faces, and gaze deviations. This makes the system more suitable for real-time usage while still effectively identifying suspicious behavior during online examinations.

3. PROPOSED MODEL

In this project, we developed an Intelligent Proctoring System to monitor students during online exams using a webcam. The system works in real time and checks the candidate's behavior throughout the exam.
The system captures video continuously and processes it frame by frame. First, it detects whether the candidate's face is present. If no face is detected or if more than one face appears, the system considers it as suspicious behavior.
Next, the system checks where the candidate is looking. It uses facial landmarks to estimate the direction of the eyes. If the candidate looks away from the screen for a longer time, it is marked as a possible violation.
To avoid false alerts, the system does not react immediately. It uses simple time rules. For example, the face must be missing for a few seconds before it is counted, and looking away is only considered if it continues for some time.
Finally, all these activities are combined to calculate a risk score. This score gives an overall idea of the candidate's behavior during the exam.
The system is simple, works with a normal webcam, and can be used easily for real-time monitoring in online examinations.

4.METHODOLOGY

Our Project Intelligent Proctoring System is designed to monitor candidate behavior in real time using a webcam. The system processes live video continuously and analyzes it to detect face presence, head movement, and gaze direction. The overall workflow consists of the following steps.

1. Video Acquisition

The system captures live video using a webcam through OpenCV. The video stream is processed frame by frame to enable real-time analysis of candidate behavior.

2. Face Detection

Face detection is performed using MediaPipe Face Detection[5]. Each frame is converted from BGR to RGB format and passed to the detection model. The system identifies the number of faces present and draws bounding boxes around detected faces. The face count is used to determine whether a valid candidate is present, absent, or if multiple persons are detected.

3. Facial Landmark Detection and Eye tracking

In our project specially For gaze estimation, MediaPipe Face Mesh is used to extract facial landmarks. Key landmark points around the eyes are identified, and the center position of the eyes is calculated. This position is compared with the center of the frame to determine gaze direction as LEFT, RIGHT, or CENTER. If no face landmarks are detected, the system identifies it as "NO FACE".

4. Event Detection Logic

The system defines specific rules to identify suspicious behavior:

- No Face Detection: If no face is detected continuously for more than 5 seconds, it is recorded as a suspicious event.
- Multiple Faces Detection: If more than one face is detected in the frame, it is immediately recorded as an event.
- Looking Away Detection: If the candidate looks left or right continuously for more than 3 seconds, it is considered as looking away.

Timers and flags are used to ensure that events are counted only once per occurrence.

5. Risk Score Calculation

At the end ,A risk score is calculated based on detected events using a weighted approach:

- No Face Event → Weight = 3
- Multiple Face Event → Weight = 5
- Looking Away Event → Weight = 1

The final risk score is computed as:

Risk Score = (No Face Count × 3) + (Multiple Face Count × 5) + (Looking Away Count × 1)

This score represents the level of suspicious behavior during the examination.

6. Real-Time Output Display

The system displays important information on the screen, including face count, gaze direction, and risk score. This helps in continuous monitoring of candidate behavior during the exam.

7. Summary Generation

At the end of the session, the system provides a summary including total counts of no face events, multiple face events, looking away events, and the final risk score.

The proposed methodology is lightweight, efficient, and suitable for real-time

5. RESULT AND DISCUSSION

The proposed Intelligent Proctoring System was tested in real-time using a standard webcam under different conditions to evaluate its ability to monitor candidate behavior. The system was able to process video frames continuously and detect events such as face presence, multiple faces, and gaze direction.

A. Test Case Analysis

To evaluate the system, different scenarios were created manually, including absence of the candidate, presence of multiple persons, and gaze deviations. The system successfully identified these events based on predefined conditions.

Test Case	Condition	System Output
No Face	Candidate leaves frame (>5 sec)	Detected and recorded
Multiple Faces	More than one face in frame	Detected immediately
Looking Left/Right	Gaze deviation (>3 sec)	Detected and recorded
Normal Behavior	Face present, gaze centered	No event detected

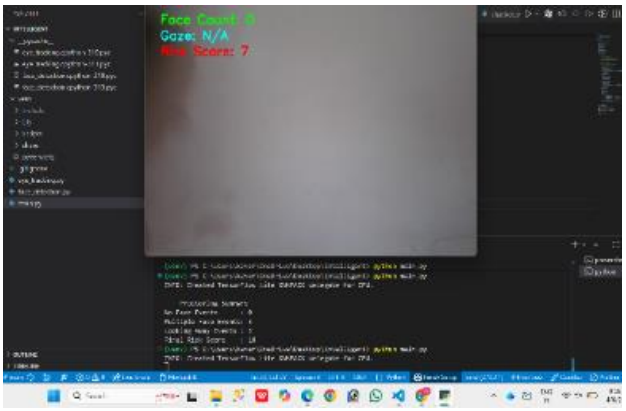

Fig -1: No face

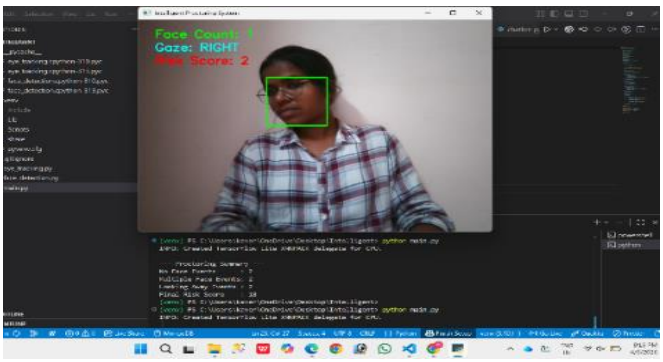

Fig -2 : Looking Right

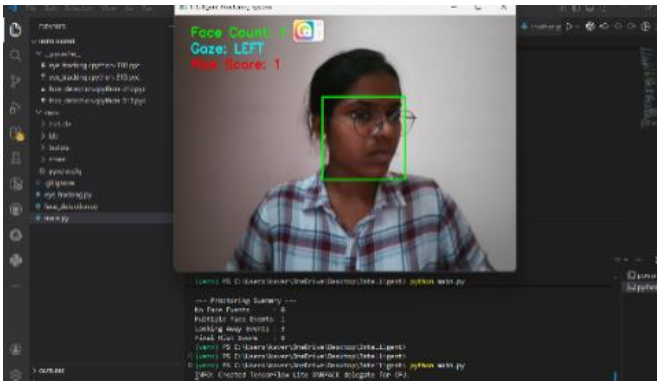

Fig -3 : Looking Left

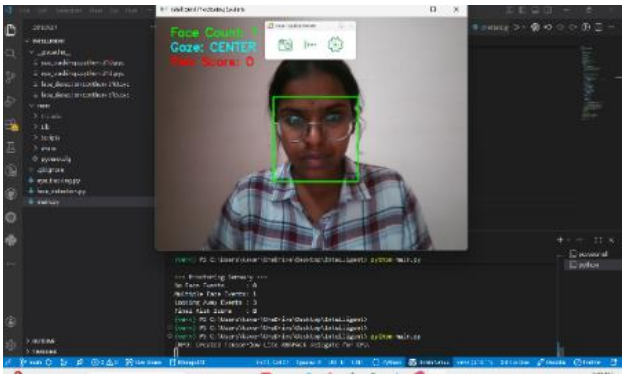

Fig -4 : Normal Behaviour

The results show that the system was able to correctly detect all defined test cases during execution.

B. Risk Score Behaviour

The system calculates a risk score based on detected events. It was observed that events such as multiple face detection and absence from the frame contributed more to the final score, while gaze deviations contributed less. This helps in distinguishing between critical and minor suspicious behaviors.

C. System Performance

The system performed smoothly in real-time with minimal delay. Face detection using MediaPipe was stable in normal lighting conditions and accurately identified the number of faces present. Gaze detection worked effectively when the face was clearly visible, but its performance was slightly affected in low lighting or when the face was partially occluded.

D. Observations

- The webcam is consistently detected face presence and multiple faces.

- Gaze direction (left, right, center) was identified correctly in most cases.
- The use of time-based conditions (5 seconds for no face and 3 seconds for gaze deviation) helped reduce false detections.
- Continuous frame processing allowed better tracking of behavior over time.

6. CONCLUSION

In this work, we developed an Intelligent Proctoring System to monitor candidate behavior during online examinations using a webcam. The webcam video in real time to detect face presence, head movements, and gaze direction, and identifies events such as no face, multiple faces, and looking away.

A key feature of the system is the use of a risk score, which represents the level of suspicious activity based on detected events. This makes it easier to analyze candidate behavior in a structured way instead of relying only on recorded video.

We team tested in different scenarios and was able to detect the defined events and generate meaningful risk scores. It runs in real time and works with a standard webcam, making it practical for real-world use.

However, the performance of gaze detection can be affected under poor lighting conditions or when the face is not clearly visible. These issues can be improved in future work by enhancing the robustness of the system.

Overall, the proposed system provides a simple and effective approach for improving the reliability of online examinations.

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