

# Explanation Documentation for Online Exam Cheating Detection System

## 1. Introduction

With the rise of online education and remote exams, maintaining academic integrity has become a significant challenge. This project aims to develop an **Online Exam Cheating Detection System** that monitors candidates using **computer vision, deep learning, and audio analysis** to detect suspicious activities during online exams.

## 2. Objective

The primary objective of this system is to detect and prevent cheating in online exams by monitoring candidates through their webcam and microphone. The system ensures fairness by identifying suspicious behaviors such as **face orientation changes, mobile phone usage, environmental changes, unauthorized sounds, and application switching**.

## 3. Technologies Used

- **OpenCV (cv2):** Used for video capture and image processing.
- **MediaPipe:** For facial landmark detection and tracking.
- **TensorFlow/Keras (MobileNetV2):** To detect mobile phones in the video feed.
- **PyAudio:** For real-time audio processing.
- **Win32 API / AppKit:** To detect application switching (Windows/macOS compatibility).
- **NumPy:** For numerical operations on audio and image data.
- **Time and sys modules:** For tracking session duration and handling process exits.

## 4. System Components

### a) Face Detection & Orientation Check

- Uses **MediaPipe FaceMesh** to detect facial landmarks.
- Checks if the candidate's face is facing forward.
- If the face is turned away for more than a predefined duration, it flags suspicious activity.

## **b) Phone Detection**

- Uses **MobileNetV2 (pre-trained on ImageNet)** to classify objects in the video.
- If a mobile phone is detected with a confidence above a certain threshold, it flags suspicious activity.

## **c) Audio Monitoring**

- Captures real-time audio using **PyAudio**.
- Computes volume level and flags any loud noises that exceed the threshold, indicating possible discussions.

## **d) Environment Change Detection**

- Compares consecutive frames using OpenCV.
- If significant changes are detected (e.g., another person entering the frame), it flags the activity as suspicious.

## **e) Application Switch Detection**

- On **Windows**, it uses **win32gui** and **psutil** to detect active applications.
- On **macOS**, it uses **AppKit** to track the active window.
- If a candidate switches from the exam window to another application, the exam is terminated.

## **f) Exam Timer & Monitoring**

- Displays a timer on the candidate's screen.
- If the exam duration is exceeded, the session ends automatically.
- If multiple suspicious activities occur, the exam is terminated.

# **5. System Workflow**

1. **Instructions Display:** Before the exam starts, instructions are shown on the screen.
2. **Face Detection Initialization:** The system begins face tracking and orientation monitoring.
3. **Audio & Video Processing:** The system continuously processes the webcam feed and microphone input.

4. **Suspicious Activity Detection:** If any rule violations occur, warnings appear on the screen.
5. **Exam Termination:** If multiple violations occur within a predefined threshold, the exam is automatically terminated.
6. **Logging & Reporting:** Suspicious activities are logged for later review.

## 6. Challenges & Solutions

Challenge	Solution
Low-light conditions affect face detection	Improved detection thresholds and preprocessing
False positives in phone detection	Optimized MobileNetV2 confidence threshold
High CPU usage due to real-time processing	Optimized frame capture rate and parallel processing
Variations in audio noise levels	Dynamic noise threshold adaptation

## 7. Future Enhancements

- **AI-based Behavioral Analysis:** Use deep learning to classify normal vs. suspicious behavior.
- **Cloud-based Monitoring:** Enable remote monitoring with real-time alert notifications.
- **Multi-camera Support:** Detect cheating attempts using multiple camera angles.
- **Integration with Exam Platforms:** Seamless integration with existing online exam software.

## 8. Conclusion

This **Online Exam Cheating Detection System** enhances the integrity of remote exams by leveraging **AI-driven monitoring**. The combination of **computer vision, audio analysis, and system monitoring** ensures a fair testing environment by detecting and preventing cheating attempts in real time.