**Literature Survey on Facial Recognition Systems for Proctoring**

**Paper 7: “Smart Artificial Intelligence Based Online Proctoring System”**

**Key Features:**

1. Multimodal Surveillance:

Blends emotion recognition, head pose estimation, and malicious object detection (phones, books, more than a single person) to monitor examinee behavior for online tests.

1. Robust Head Pose Estimation:
   1. Employs facial landmark detection (via dlib and OpenCV) for tracking head positions, introducing an additional layer of observation by way of departure from a neutral frontal position.
2. Object Detection Integration:
   1. Employs YOLOv3 pre-trained using COCO dataset weights to identify prohibited objects or other individuals within the test room to enhance cheating tools detection.

**Limitations:**

1. Model Generalization Issues:

Application of particular data sets (e.g., FER2013, COCO) may limit the system's performance for varying population differences, camera resolution, and illumination.

1. Complexity of Integration:

Products of individual module outputs (head pose, emotion, object detection) will add synchronization issues and greater likelihood of false alarm or missdetection.

1. Privacy and Ethics Issues:

End-to-end tracking of head movement and facial expression generates sensitive privacy issues and leads to disturbance or distress in users and consequently the whole examination process.

1. Scalability Problems:

The system may become hard to scale well in large exam environments with varying network conditions, at the expense of its robustness and reliability.

**Our Solution**

1. Enhanced Real-Time Processing:

WebRTC & WebSockets: Enable low-latency real-time video transmission and communication so detection is on time and does not add considerable latency to complicated processing pipelines.

1. Facial Analysis & Robustness Improved:

OpenSeeFace, Dlib, & OpenCV: These offer high-quality face recognition features tailored to different conditions. OpenSeeFace enhances face analysis accuracy while dlib and OpenCV enhance head pose estimation, all contributing to improved detection accuracy and lower false positives.

1. Seamless Integration & Scalability:

Docker: Packages the entire system step by step into containers for hassle-free deployment, upgrades, and scalability. This enables the solution to handle many simultaneous exam sessions without affecting performance.

1. NGINX:

Uses as a high-availability load balancer and reverse proxy to enable robust and efficient processing of incoming video streams and system requests even under full load.

**Paper 8: “ProctoXpert – An AI Based Online Proctoring System”**

**Key Contributions of the Paper:**

1. Detailed System Architecture:

Provides elaborate diagrams and data flow that describe an AI-based online exam proctoring system.

1. Multimodal Monitoring:

Combines biometric verification, gaze, head pose, lip blur, and mobile detection for ensuring examination integrity.

1. Real-Time Data Analysis:

Captures multiple streams of data (screen, keystrokes, user metadata) for real-time monitoring and post-exam review.

**Limitations:**

1. Environmental Sensitivity:

Low-resolution or low light conditions lead to performance degradation and result in higher error rates.

1. False Positives/Negatives:

Sophisticated multi-modal detection can lead to false alarms.

1. Scalability Problems:

Computational requirements are too high, and real-time processing is challenging with long exam sessions.

**Our Solution:**

1. Improved Accuracy:

Employing OpenSeeFace, Dlib, and OpenCV offers robust head and facial pose detection under adverse conditions.

1. Low-Latency Monitoring:

WebRTC & WebSockets support low-latency real-time communication to enable efficient coordination among detection modules.

1. Scalable Architecture:

Docker containerization with load balancing through NGINX enables a scalable high-performance system that is able to manage multiple concurrent exam sessions.