Project Features

**Offline Exam Cheating Detection**

**Real-Time Monitoring Workflow**

1. **CCTV Integration**
   * **Hardware**: High-resolution CCTV cameras installed in exam halls.
   * **AI Processing**:
     + **YOLOv8** detects prohibited objects (phones, notes) and suspicious gestures (e.g., hand signals, note-passing) in real-time[1](https://journal.esrgroups.org/jes/article/download/7480/5132/13709)[5](https://thinkexam.com/blog/real-time-cheating-detection-ai-solutions-for-monitoring-online-exams/).
     + **MediaPipe** analyzes body posture and micro-movements (e.g., frequent head turns)[1](https://journal.esrgroups.org/jes/article/download/7480/5132/13709" \t "_blank).
   * **Edge Computing**: Process footage locally (using **NVIDIA Jetson**) to reduce latency and avoid cloud dependency[5](https://thinkexam.com/blog/real-time-cheating-detection-ai-solutions-for-monitoring-online-exams/)[7](https://eklavvya.com/Content/docs/online-exam-cheating-detection/).
2. **Environmental Sensors**
   * **Audio Analysis**: Condenser microphones detect whispers or device noises via **PyAudio ML pipelines**[1](https://journal.esrgroups.org/jes/article/download/7480/5132/13709)[4](https://proctortrack.com/blog/article/6-ways-to-improve-computer-based-in-classroom-exam-security-proctoring-aid-for-teachers).
   * **RFID/Bluetooth Scanners**: Identify unauthorized devices in the vicinity[4](https://proctortrack.com/blog/article/6-ways-to-improve-computer-based-in-classroom-exam-security-proctoring-aid-for-teachers).
3. **Proctor Dashboard**
   * **Real-Time Alerts**: Flags anomalies (e.g., "Phone detected at Desk 12") on a dashboard using **WebSocket**[5](https://thinkexam.com/blog/real-time-cheating-detection-ai-solutions-for-monitoring-online-exams/).
   * **Heatmaps**: Visualize high-risk zones based on historical cheating data (**OpenCV + clustering**)[4](https://proctortrack.com/blog/article/6-ways-to-improve-computer-based-in-classroom-exam-security-proctoring-aid-for-teachers" \t "_blank).

**Example Scenario**:

* A student hides a phone under their desk.
* YOLOv8 detects the phone shape → Proctor receives an alert with desk number → Invigilator intervenes.

**Can It Work in Real-Time?**

* **Yes**, with edge-optimized models (e.g., YOLOv8 Nano) and low-latency hardware (Jetson Nano).

**Online Exam Cheating Detection**

**Real-Time Monitoring Workflow**

1. **Pre-Exam Setup**
   * **Biometric Authentication**: Face recognition via **DeepFace** or **AWS Rekognition**[5](https://thinkexam.com/blog/real-time-cheating-detection-ai-solutions-for-monitoring-online-exams/)[7](https://eklavvya.com/Content/docs/online-exam-cheating-detection/).
   * **Environment Scan**: 360° webcam sweep to check for unauthorized materials[7](https://eklavvya.com/Content/docs/online-exam-cheating-detection/).
2. **During the Exam**
   * **Gaze/Head Tracking**: **MediaPipe** or **L2CS-Net** flags off-screen glances[1](https://journal.esrgroups.org/jes/article/download/7480/5132/13709)[5](https://thinkexam.com/blog/real-time-cheating-detection-ai-solutions-for-monitoring-online-exams/).
   * **Browser Lock**: Blocks alt-tab/right-click using Chrome extensions (**chrome.tabs API**)[4](https://proctortrack.com/blog/article/6-ways-to-improve-computer-based-in-classroom-exam-security-proctoring-aid-for-teachers" \t "_blank)[7](https://eklavvya.com/Content/docs/online-exam-cheating-detection/).
   * **Keystroke Analysis**: **PyAutoGUI** detects rapid answer bursts (e.g., copy-paste patterns)[1](https://journal.esrgroups.org/jes/article/download/7480/5132/13709" \t "_blank).
   * **Audio Monitoring**: **Silero VAD** identifies background voices or device sounds[1](https://journal.esrgroups.org/jes/article/download/7480/5132/13709)[5](https://thinkexam.com/blog/real-time-cheating-detection-ai-solutions-for-monitoring-online-exams/).
3. **Proctor Dashboard**
   * **Live Feed**: Displays candidate’s webcam, screen, and AI flags (e.g., "Multiple faces detected")[5](https://thinkexam.com/blog/real-time-cheating-detection-ai-solutions-for-monitoring-online-exams/" \t "_blank)[7](https://eklavvya.com/Content/docs/online-exam-cheating-detection/).
   * **Automated Reports**: Generates post-exam summaries with timestamps of flagged events[7](https://eklavvya.com/Content/docs/online-exam-cheating-detection/).

**Example Scenario**:

* A student alt-tabs to search for answers.
* Browser lock blocks the action → AI flags the attempt → Proctor reviews the screen recording.

**Real-Time Capability**:

* **Yes**, with lightweight models (e.g., MediaPipe) and WebSocket-based alerts.

**Teacher’s Monitoring Tools**

**Offline Exams**

* **Dashboard Features**:
  + Live CCTV grid with AI-highlighted anomalies.
  + **RFID Device Tracker**: Shows active unauthorized devices in the hall[4](https://proctortrack.com/blog/article/6-ways-to-improve-computer-based-in-classroom-exam-security-proctoring-aid-for-teachers).
  + **Audio Waveform Monitor**: Visualizes suspicious noise spikes[1](https://journal.esrgroups.org/jes/article/download/7480/5132/13709).

**Online Exams**

* **Dashboard Features**:
  + Multi-candidate view with gaze/activity heatmaps.
  + **Plagiarism Checker**: Compares answers against databases using **BERT**[1](https://journal.esrgroups.org/jes/article/download/7480/5132/13709)[7](https://eklavvya.com/Content/docs/online-exam-cheating-detection/).
  + **Stress Analytics**: Pulse estimation via webcam (PPG signals) to flag nervous behavior[1](https://journal.esrgroups.org/jes/article/download/7480/5132/13709).

**Key Technologies**

| **Component** | **Offline Exams** | **Online Exams** |
| --- | --- | --- |
| **Object Detection** | YOLOv8 (CCTV analysis)[1](https://journal.esrgroups.org/jes/article/download/7480/5132/13709)[5](https://thinkexam.com/blog/real-time-cheating-detection-ai-solutions-for-monitoring-online-exams/) | MediaPipe (gaze/pose)[1](https://journal.esrgroups.org/jes/article/download/7480/5132/13709)[5](https://thinkexam.com/blog/real-time-cheating-detection-ai-solutions-for-monitoring-online-exams/) |
| **Real-Time Alerts** | WebSocket + Jetson Nano[5](https://thinkexam.com/blog/real-time-cheating-detection-ai-solutions-for-monitoring-online-exams/)[7](https://eklavvya.com/Content/docs/online-exam-cheating-detection/) | Socket.IO + React[4](https://proctortrack.com/blog/article/6-ways-to-improve-computer-based-in-classroom-exam-security-proctoring-aid-for-teachers)[7](https://eklavvya.com/Content/docs/online-exam-cheating-detection/) |
| **Data Privacy** | On-device processing[5](https://thinkexam.com/blog/real-time-cheating-detection-ai-solutions-for-monitoring-online-exams/)[7](https://eklavvya.com/Content/docs/online-exam-cheating-detection/) | Blurred background (OpenCV)[7](https://eklavvya.com/Content/docs/online-exam-cheating-detection/) |
| **Hardware** | NVIDIA Jetson, CCTV cameras[5](https://thinkexam.com/blog/real-time-cheating-detection-ai-solutions-for-monitoring-online-exams/) | Webcam, Chrome extensions[4](https://proctortrack.com/blog/article/6-ways-to-improve-computer-based-in-classroom-exam-security-proctoring-aid-for-teachers) |

By combining **edge AI** for offline exams and **lightweight models** for online proctoring, both systems can operate in real-time with minimal latency. Teachers benefit from centralized dashboards that aggregate AI insights, enabling swift interventions.