

Remote Exam Invigilation Tool

1. Project Overview

The Remote Exam Invigilation Tool is a web-based application designed to ensure the integrity of online examinations by remotely monitoring students through their webcams. The system enables real-time supervision, automated activity logging, and alert generation to assist proctors in detecting and addressing suspicious behavior during examinations. This solution is particularly suitable for educational institutions conducting large-scale online or hybrid assessments.

2. Objectives

- To provide a secure mechanism for conducting online examinations
 - To enable real-time monitoring of students using webcam feeds
 - To detect and log suspicious activities during exams
 - To maintain accurate attendance and proctoring records
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3. System Requirements

3.1 Functional Requirements

- Secure student and proctor authentication
- Online exam access through an exam panel
- Continuous webcam monitoring during exams
- Periodic webcam snapshot capture
- Real-time alert generation for suspicious activities
- Proctor dashboard for monitoring multiple candidates
- Automatic attendance tracking and log maintenance

3.2 Non-Functional Requirements

- Low-latency real-time video streaming
 - Secure and encrypted data communication
 - High availability during examination periods
 - Scalability to support concurrent users
 - Compliance with data privacy and security standards
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4. Technology Stack

Frontend

- React.js

Backend

- Spring Boot (Java)

Real-Time Communication

- WebRTC

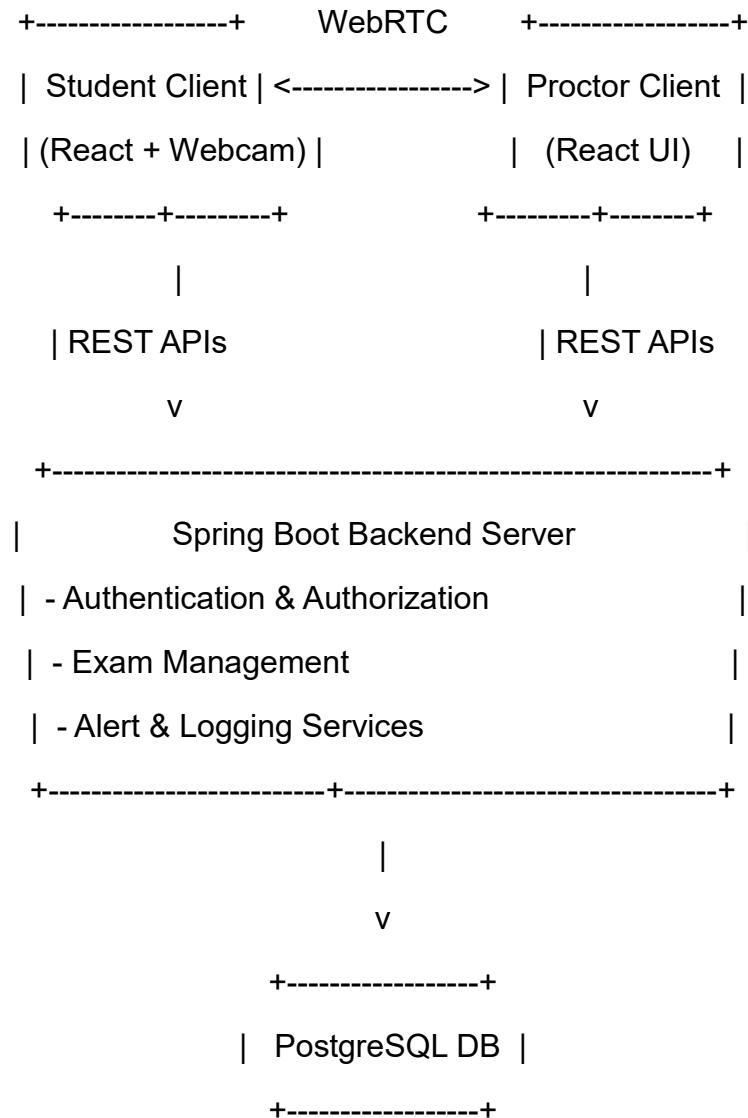
Database

- PostgreSQL

5. High-Level Design (HLD)

The system follows a client-server architecture integrated with real-time communication. The frontend handles user interaction and webcam access, while the backend manages authentication, business logic, alerting, and data persistence.

High-Level Architecture Diagram



6. Low-Level Design (LLD)

Database Design

User Table

- user_id (PK)
- name
- email
- password
- role (Student / Proctor)

Exam Table

- exam_id (PK)
- exam_name
- start_time
- end_time

Proctor Log Table

- log_id (PK)
- user_id (FK)
- exam_id (FK)
- activity_type
- timestamp

Attendance Table

- attendance_id (PK)
 - user_id (FK)
 - exam_id (FK)
 - status (Present / Absent)
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7. Module Division (8 Modules)

Frontend Modules (3)

Module 1: Exam Panel Module

- Displays exam instructions and rules

- Controls exam start and submission

Module 2: Webcam Feed Module

- Handles webcam permission and access
- Streams live video using WebRTC
- Captures periodic snapshots

Module 3: Proctor Dashboard Module

- Displays live feeds of multiple students
 - Shows alerts and activity logs in real time
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Backend Modules (5)

Module 4: Authentication & Authorization Module

- Manages secure login and session handling
- Implements role-based access control

Module 5: Exam Management Module

- Creates and schedules exams
- Maps students to examinations

Module 6: Webcam Monitoring Module

- Receives webcam snapshots
- Validates stream continuity

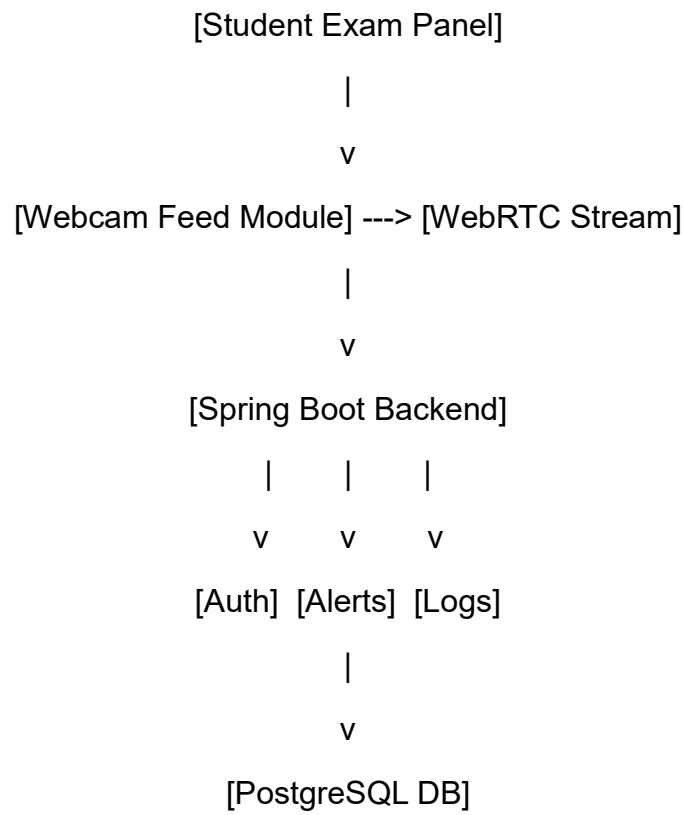
Module 7: Alert & Detection Module

- Identifies suspicious activities (camera off, face missing, etc.)
- Generates real-time alerts for proctors

Module 8: Logging & Attendance Module

- Stores proctoring events and alerts
 - Automatically records student attendance
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8. Module Interaction Diagram



9. Evaluation Criteria

- Effectiveness of webcam snapshotting mechanism
- Timeliness and accuracy of real-time alerts
- Reliability of attendance and proctor logs
- System performance under concurrent exam load

10. Assumptions

- Students possess functional webcams and stable internet connections
 - Each student attempts one examination at a time
 - Proctors are authorized to monitor assigned examinations only
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11. Conclusion

The Remote Exam Invigilation Tool provides a robust and scalable solution for conducting secure online examinations. Its modular architecture, combined with real-time monitoring and comprehensive logging, ensures examination integrity while allowing future enhancements such as AI-based behaviour analysis and facial recognition.