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## **Face detection and recognition system to monitor students during online examinations using Machine Learning**

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### **ABSTRACT :**

The pandemic has revolutionized education, shifting to online platforms and changing how assessments are conducted. Monitoring student attendance is crucial for effective learning, and online exam portals now utilize face recognition technology for this purpose. These systems track students' movements through webcams, analyzing gestures and postures to detect any malpractices. Despite advancements, face detection still faces challenges like varying lighting, noise, scale, and pose. This study aims to improve face recognition accuracy by integrating Support Vector Machine (SVM) and Eigenface algorithms. The Eigenface approach extracts facial features via facial vectors, while SVM classifies and detects faces effectively. By combining these methods, we enhance the speed and reliability of face recognition in online exam monitoring.

**Keywords:** Computer Vision, Realtime, Face Recognition, Machine Learning, Technology in Education.

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### **Introduction**

Due to its applicability in different domains of life face recognition is a very fast growing area of research. In daily life, to receive information and interpret it and to identify familiar faces, face recognition is used. It is prevalent due to its simplicity and performance. In the last few years tremendous research has been carried out but still there are many challenges related to face recognition. In covid time it becomes challenging to identify a mask wearing face. This paper aims to provide an overview of some of the well-known facial recognition algorithms and techniques used in research. Initially face recognition was implemented using Principal Component Analysis, Linear Discriminant Analysis, Support Vector Machine, Adaboost but nowadays to improve the quality deep learning is used.

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### **Problem Statement**

Addressing the Challenges of Online Examinations: A Comprehensive Approach

The shift to online examinations has brought about numerous benefits, including increased accessibility and flexibility. However, it has also introduced new challenges, particularly in maintaining the integrity and fairness of the exam process. One of the primary concerns is the issue of academic integrity, particularly cheating and impersonation.

#### **The Risks of Cheating and Impersonation**

Cheating and impersonation are significant concerns in online examinations. Students may use various methods to cheat, including:

Collusion: Working with others to complete the exam

Plagiarism: Submitting work that is not their own

Impersonation: Taking the exam on behalf of someone else.

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### **III. Working**

#### **Technologies Used:**

- Python: For developing the face recognition algorithm and backend server.
- Flask: For serving the webcam feed to a web interface.
- OpenCV: For capturing and processing picture frames from the webcam.
- My Sql: for storing the data of student.
- HTML/CSS/JavaScript: For designing and interacting with the web interface.

**System Architecture:****1. Frontend (User Interface)**

- Built with HTML, CSS, JavaScript
- Separate login pages for Admin & Student
- Student Dashboard (Start Exam, View Profile)
- Admin Dashboard (Manage Students, Upload Faces, Monitor Exams)

**2. Backend (Server & API)**

- Built using Django/Flask (Python) / Node.js (Express)
- Handles:

**3. User Authentication (JWT-based login for Admin & Student)**

- Face Recognition API (KNN Algorithm)
- Exam Management API (Start, Submit Exam, Fetch Questions)

**4. Database**

- PostgreSQL / MySQL / MongoDB
- Stores:
  - User Data (Admin, Student)
  - Student Face Embeddings (for recognition)
  - Exam Data (Questions, Answers, Results, Timestamps)

**5. Machine Learning (Face Recognition)**

- Uses Face KNN Algorithm (trained on stored student images)
- Library: OpenCV + dlib + face\_recognition (Python)
- Process:
  - Admin uploads student photo → System extracts face embeddings → Stores in DB
  - Student logs in → System captures live image → Compares with stored embeddings
  - If match found → Allow login & start exam

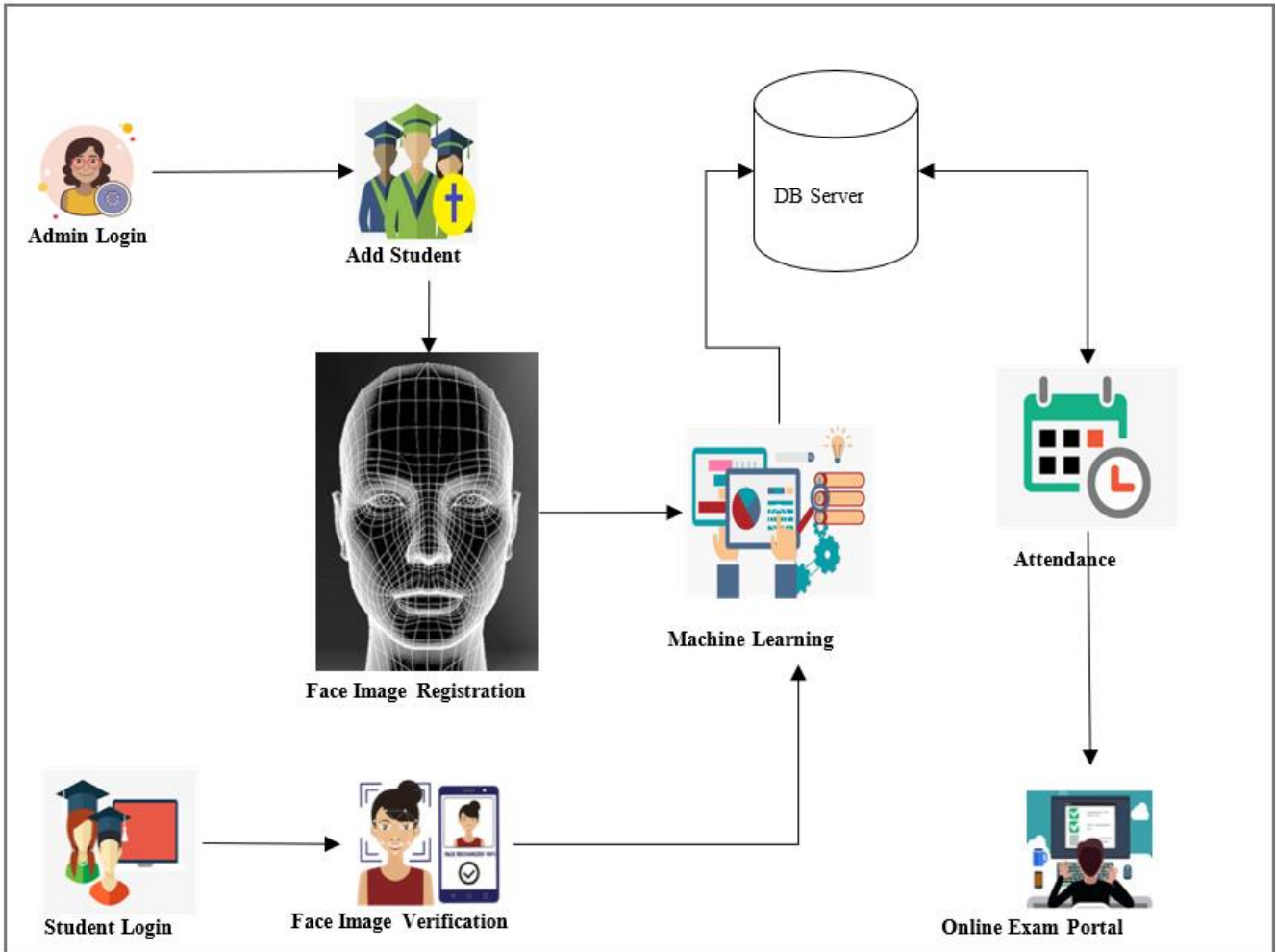
**6. Exam Module**

- Question Bank (MCQs, Text-based, Timed)
- Automatic start & submission based on login
- Security Features:
  - Face re-verification during the exam
  - Auto logout if face mismatch (optional)
  - Timer-based auto submission

**7. Hosting & Deployment**

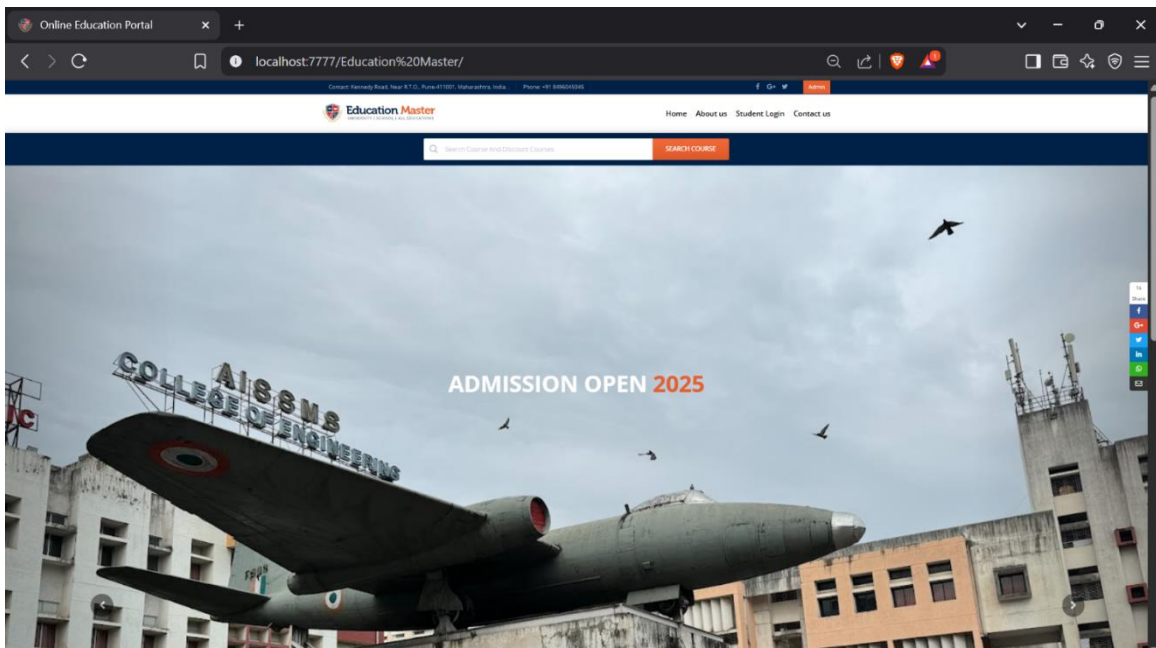
- Frontend → Deployed on Vercel / Netlify
- Backend → Hosted on AWS / Firebase / Heroku
- Database → Cloud SQL / MongoDB Atlas
- ML Model → Deployed using Flask/Django API

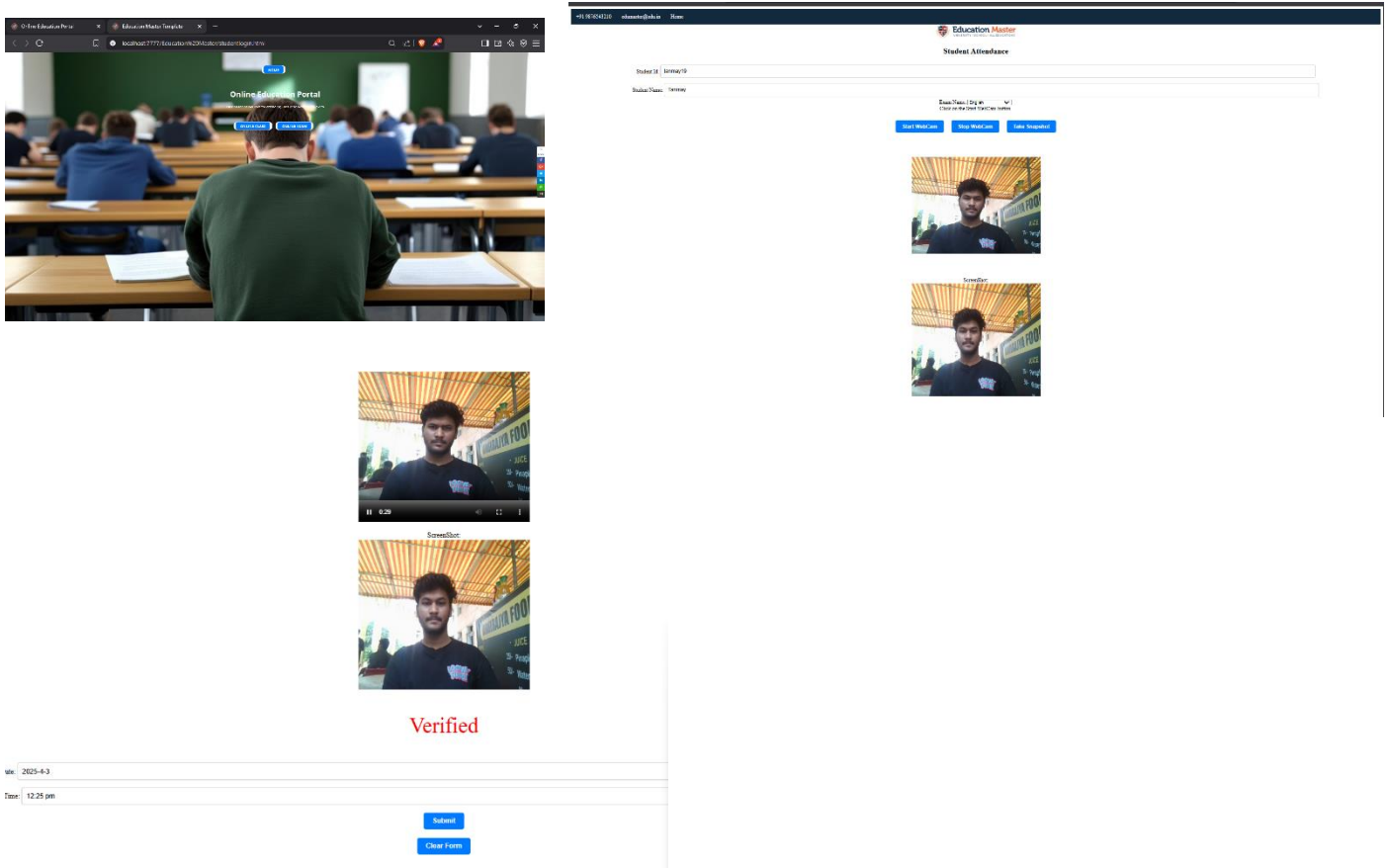
**Working of the Project:**



**IV. Outputs And Result**

**Website UI:**



**Face Recognition:****Outcome:****Admin Sign-In:**

Admin or a Teacher (as Admin) can only sign in to the admin page, where they can add a new student to their university with student's basic details and their recent photo which is sent to the *Python Coded Machine Learning Algorithm* for future face recognition in attendance system. Also admin can put on college events, seminars etc. The new students added are annexed to the DB maintained by the administrator.

**Student Sign-In:**

Students who are all added on by the admin can only sign in via Student Signin page. The students have to use their Student-Id and Password which is provided by admin while registration, to sign in their online class portal. In this online portal they can avail online class as well as online exam. The students need to plump for what they need.

**Attendance Update:**

After students picked up their choice, they are directed to the face verification page where their faces get captured by the live camera and compared with the trained *KNN Set* and their attendance is casted up. After successful verification the students are allowed to enter their class or exam as per their choice. If the student's pick is online exam, they have to complete the test within the timer runs out. After their allocated session is done, once again they are diverted to the face verification page to add a final touch to end up the attendance process.

**Exam Attendance Audit:**

After the exam gets wind up, their marks are updated and with the attendance report an analysis of student's willingness to attend exam online will be noted down and compared.

**IV. Conclusion and Future Scope****Conclusion:-**

The shift to online education and exams has brought new challenges, especially in tracking student attendance and maintaining academic integrity. Traditional methods of taking attendance and monitoring exams are often inefficient and prone to errors, making it clear that a more advanced solution is needed.

A face detection and recognition system powered by machine learning offers a reliable and efficient way to address these issues. By using techniques like facial embeddings and real-time recognition—along with tools such as the Python Face Recognition Library and the K-Nearest Neighbors (KNN) algorithm—this system ensures that only registered students can access online exams. This helps prevent cheating and impersonation, making the examination process more secure and trustworthy.

Beyond security, this system also simplifies administrative tasks for educational institutions. Since it can be easily integrated into existing online examination platforms, implementation is straightforward. Additionally, educators can benefit from real-time insights into student participation and engagement, helping them identify students who may need extra support.

As digital learning continues to evolve, adopting intelligent systems like machine learning-based face recognition will be crucial in maintaining fairness and reliability in online education. These advancements not only address current challenges but also pave the way for future innovations, ensuring a secure and credible learning environment for students and educators alike.

#### **Future scope:-**

1. 1.Enhanced Real-Time Monitoring: Develop more advanced algorithms for real-time monitoring to detect cheating attempts instantly.
2. 2.Behavior Analysis: Implement machine learning models to analyze student behavior, such as eye movement, posture, and facial expressions.
3. 3.Emotion Detection: Integrate emotion recognition to identify stress or anxiety, which could indicate potential cheating or exam stress.
4. 4.Multi-Factor Authentication: Combine face detection with other biometric methods (e.g., fingerprint or voice recognition) for more secure identity verification.
5. 5.Adaptive Learning Models: Create adaptive algorithms that learn and improve from each exam session, enhancing accuracy over time.
6. 6.Anomaly Detection: Develop systems to detect unusual patterns in exam behavior, such as frequent screen switching or prolonged inactivity.
7. Accessibility Features: Incorporate features to assist students with special needs, ensuring fair and inclusive exam conditions.
8. 8.Speech Recognition: Integrate speech recognition to detect verbal cheating attempts or unauthorized communication.
9. 9.Scalability: Design scalable solutions that can handle large-scale online exams without compromising performance.
10. 10.Privacy-Preserving Techniques: Implement privacy-preserving methods to ensure that student data is protected and secure.
11. 11.Cross-Platform Compatibility: Ensure that face detection systems work seamlessly across different devices and platforms.
12. 12.Integration with Learning Management Systems (LMS): Integrate face detection with existing LMS for a more cohesive and streamlined exam process.
13. 13.Automated Feedback: Provide automated feedback to students based on their exam behavior and performance.
14. 14.Continuous Improvement: Regularly update and improve algorithms based on new data and emerging technologies.
15. 15.Global Standardization: Work towards global standards for online exam proctoring to ensure consistency and fairness across different regions.

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