Facial Capturing Attendance Tracking System Using Computer Vision

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Abstract - Traditional attendance systems, such as manual roll calls and biometric methods, have drawbacks such as being time-consuming, prone to human error, and vulnerable to proxy attendance. Additionally, faculty members manually updating attendance in Excel increases workload and the risk of mistakes. The proposed facial recognition-based attendance system eliminates manual attendance entry and enables easy web-based access, providing an efficient solution for attendance management. Using webcams, the system ensures a contactless and effective process, reducing manual data entry through automatic attendance reports exportable in multiple formats. This lightens the faculty's workload while enhancing accuracy. The system employs HaarCascade for face detection and LBPH for face recognition to ensure high accuracy. It also provides real-time tracking, secure data storage, and web-based accessibility, making it scalable across multiple classrooms and departments. To enhance performance and scalability, the system is deployed on AWS cloud infrastructure, leveraging Amazon EC2 for hosting the web application, Amazon RDS for managing the MySQL database, and Amazon S3 for storing captured images securely, excel sheets and yml documents. By integrating these AWS services, the system ensures reliability, security, and seamless accessibility, making it a robust solution for modern attendance management.

***Key Words*:** Facial recognition, LBPH, Haar Cascade, Attendance System, Computer Vision, Face Detection, AWS

1.INTRODUCTION

Automation plays a critical role in enhancing efficiency across different domains, such as education and the corporate world. Conventional methods of attendance like manual roll call, punch cards, and RFID are time-consuming, prone to errors, and vulnerable to proxy attendance. New developments in computer vision and artificial intelligence have contributed to automated attendance systems that solve these drawbacks. The Facial Capturing Attendance Tracking System provides a contactless, efficient, and accurate means of attendance tracking. It applies Haar Cascade to detect faces and Local Binary Patterns Histograms (LBPH) to recognize faces, making identification real-time and accurate. To ensure smooth running, the system is designed for operation on generally available hardware like laptops, desktops, and mobile phones. One of the main strengths of this system is the eradication of the need for manual intervention in attendance tracking. Instructors do not have to manually input attendance data anymore since the system automatically takes note and updates reports, minimizing errors and enhancing data integrity. Moreover, attendance records can be safely stored and backed up for future reference. The system is very scalable and flexible, allowing it to be implemented in multiple classrooms, departments, and organizations. With a web-based user interface, administrators and faculty members can view attendance records on any internet-connected device, increasing convenience and accessibility. In combining facial recognition capabilities, the system offers a trustworthy and clear attendance tracking system devoid of proxy and enhanced overall dependability.

In this chapter Section 2 reviews previous studies on the comparison. Section 3 discusses Image Processing and Attendance Mechanism. Section 4 discusses System Architecture. Section 5 the results are being presented. Section 6 provides some conclusions from the findings of our work. Section 7 Future scope of the project.

2.RELATED WORK

Various methods have been tried for facial recognition-based attendance systems.[1] Gupta and Singh applied deep learning models to track attendance, with high accuracy but demanding high computational resources.[2]Kumar and Mishra applied Fisher Faces, which was effective for small environments but did not perform well for large datasets.[3]Banerjee and Khosla presented the approach employing HOG and SVM with lesser computation cost but also challenged with limitation under variable complex light.[4]Patel and Sharma employed Eigenfaces for real-time identification, which was light but prone to lighting and expression changes.[5] Chaudhary et al. attempted deep learning for massive student attendance, but it had greater resource requirements than the conventional approach.[6] Sharma and Gupta proposed CNN-based automated attendance, enhancing precision at the expense of higher processing needs.

In comparison to these current solutions, our Facial Capturing Attendance Tracking System meets efficiency, scalability, and computational feasibility. It uses Haar Cascade for rapid face detection and LBPH for lightweight, yet strong face recognition, providing high accuracy and being computationally efficient. Unlike deep learning methods, it does not use GPUs, thus being suitable for use in real-world institutions of learning. In addition, our web-accessible and

leveraging AWS services, our system benefits from high availability, reduced infrastructure costs, and seamless accessibility from any location. Additionally, automatic backups and security measures provided by AWS enhance data protection and system reliability.

3. IMAGE PROCESSING AND ATTENDANCE MECHANISM

Section 3.1 discusses the image capture and preprocessing techniques used in this system. Section 3.2 provides details on the model training process using the LBPH algorithm. Section 3.3 describes the attendance recognition and marking mechanism, while Section 3.4 explains the attendance management system and integration with Excel for report generation.

3.1 Image Capture and Preprocessing:

Haar Cascade is an object detection algorithm used in OpenCV. It is a machine learning-based approach where a cascade function is trained from a large set of positive and negative images. The algorithm employs Haar features to determine the likelihood of a specific point being part of an object. Boosting algorithms are used to produce a strong prediction from a combination of weak learners, and cascading classifiers are applied to different subsections of the input image. Haar features are simple rectangular filters that can detect edges, lines, and changes in texture.

- OpenCV's Haar Cascade classifier is used for face detection.
- Captured images are converted to grayscale for efficient processing.
- Each student's images are stored in the **persons directory** for training (300 images per student).

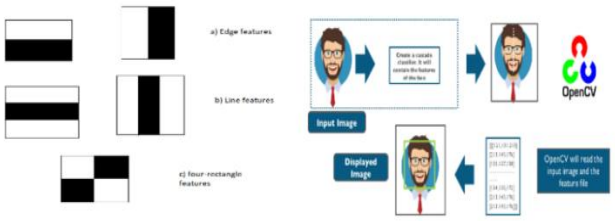

Fig-1: Haar Cascade Face Detection Process

3.2 Model Training with LBPH Algorithm:

The **Local Binary Patterns Histogram (LBPH)** algorithm is a texture-based method used for facial recognition. It analyzes pixel intensity differences in a face's neighborhood to create a unique representation. The process begins with the Local Binary Patterns (LBP) step, where each pixel in a 3×3 grid is compared with its surrounding eight neighbors. If the neighboring pixel value is greater than or equal to the center pixel, it is assigned a value of 1; otherwise, it is given 0. These binary values form an 8-bit number, which is converted into a decimal value to describe the pixel's texture. Next, the image is divided into small regions (e.g., 8×8 blocks), and a histogram is created for each region, capturing the frequency of different LBP patterns. These histograms are then combined into a feature vector, which serves as the face's unique representation. During the recognition phase, the LBP histogram of the input face is compared to stored histograms from the training dataset. The system identifies the closest match and recognizes the individual, storing the trained model in a .yml file for future predictions.

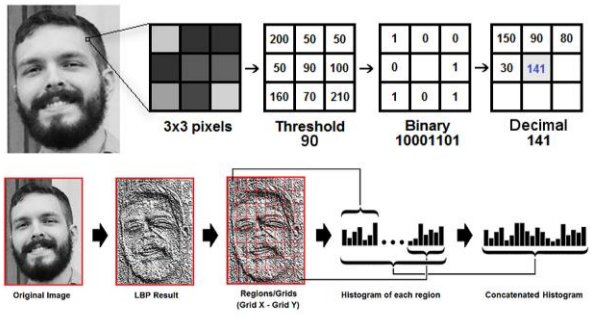

Fig-2: LBPH Training and Facial Recognition Workflow

3.3 Attendance Recognition and Marking Mechanism:

The Attendance Recognition and Marking process utilizes the trained LBPH model for real-time facial recognition. When a student's face is detected and successfully recognized, their attendance is automatically marked as "P" (Present) in both the database and the corresponding Excel sheet. Students who are not recognized during the attendance session are automatically marked as "A" (Absent) to ensure accurate tracking.

3.4 Attendance management system and integration with Excel for report generation:

Attendance Management and Excel Integration, attendance data is systematically stored in Excel files, ensuring organized record-keeping. Each attendance sheet includes essential details such as Roll Number, Name, and Date-wise attendance status (P/A) for every student. Faculty members can conveniently access, export, or view attendance reports through the web-based interface, providing an efficient and user-friendly attendance management system. Amazon S3 for securely storing attendance reports and captured images. AWS ensures scalability, reliability, and seamless access, enhancing the overall efficiency of the system.

	A	B	C	D	E	F
1	Name	Rollno	)7-03-25(3)			
2	Meghraj A	21671A05	P			
3	Boorela U	21671A05	P			
4	R.vasanth	21671A05	A			
5	k.Archana	22675A05	A			
6						
7						
8						

Fig-3: Sample Excel Attendance Report

4.SYSTEM ARCHITECTURE

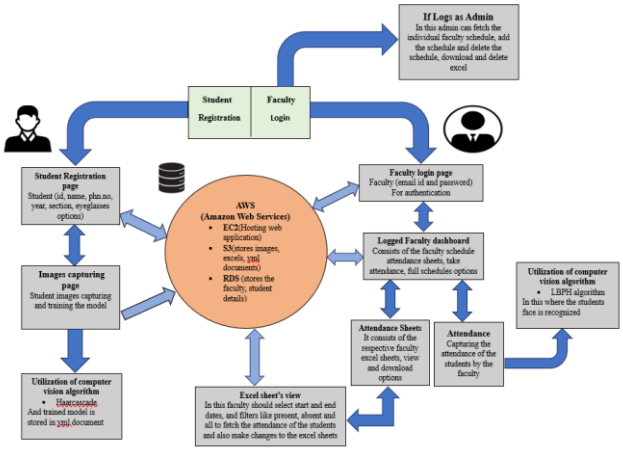

Fig-4: System Architecture

The Facial Capturing Attendance Tracking System provides an efficient, contactless attendance management solution using computer vision. The system is developed using HTML, CSS, and JavaScript for the frontend, ensuring a responsive and user-friendly interface, while the backend is built with Flask, enabling seamless web-based operations. To enhance scalability, security, and performance, the system is deployed on AWS cloud infrastructure, leveraging Amazon EC2 for hosting the web application, Amazon RDS for managing the student and faculty details, and Amazon S3 for securely storing captured images, excel sheets, yml documents.

The Admin Section allows administrators to fetch, add, and delete faculty schedules while managing attendance records stored in Excel. In the Student and Faculty Sections, students register with essential details, including ID, name, phone number, year, section, and eyeglass preference to ensure accurate facial recognition. Faculty members log in through email and password authentication for secure access.

The Image Capturing Module utilizes Haar Cascade for face detection, capturing and storing images to train the recognition model, which is then saved as a YML file. Attendance records are efficiently managed through an Excel Sheet View, allowing faculty to filter data by date and status (present/absent) and make modifications if needed. The system employs LBPH (Local Binary Pattern Histogram) for facial recognition, ensuring accurate and reliable student identification during attendance marking. Faculty members can easily capture attendance and generate Excel-based attendance reports for review and download.

The Faculty Dashboard provides an intuitive interface for faculty to view schedules, manage attendance sheets, and take attendance efficiently. By integrating AWS cloud services, the system ensures high availability, security, and seamless data access from any location. Additionally, automatic backups and data protection features in AWS enhance system reliability. This solution streamlines attendance tracking while improving security, accuracy, and data accessibility, making it a scalable and effective attendance management system for educational institutions.

5.RESULT:

Section 5.1 presents the web application interface, detailing the faculty login, admin page, student registration, capture, and attendance dashboard. while Section 5.3 discusses the integration of attendance data storage and export functionalities.

5.1 Web Application Interface:

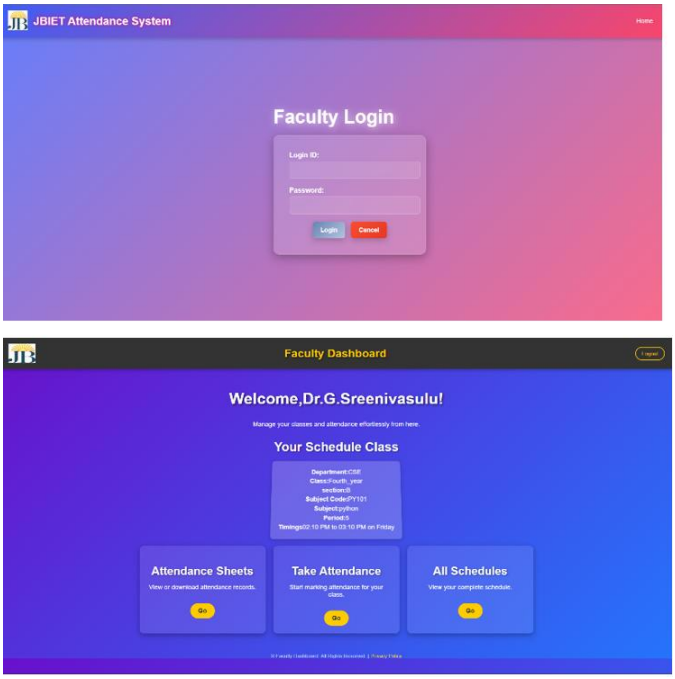

Fig-5: **Faculty Login Page** (By providing the login and password the faculty can logged in) and **Dashboard** (Each individual faculty can find their respective class schedules, excel sheets and attendance dashboard options).

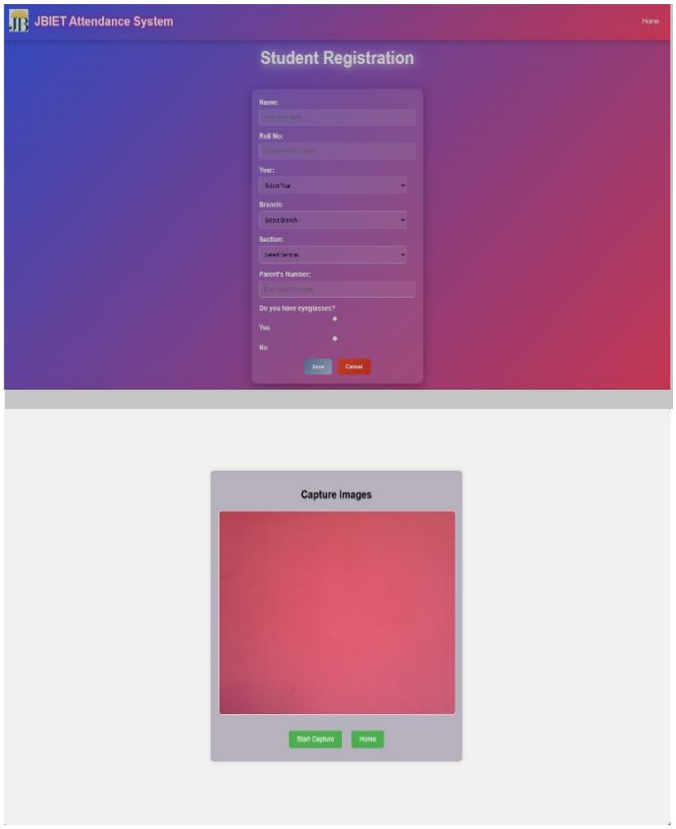

Fig-6: Student Registration page where the student enters the respective details (name, branch, rollno, year, section) and after this the student visit the next page that it **captures the images** of the students and trains the model) .

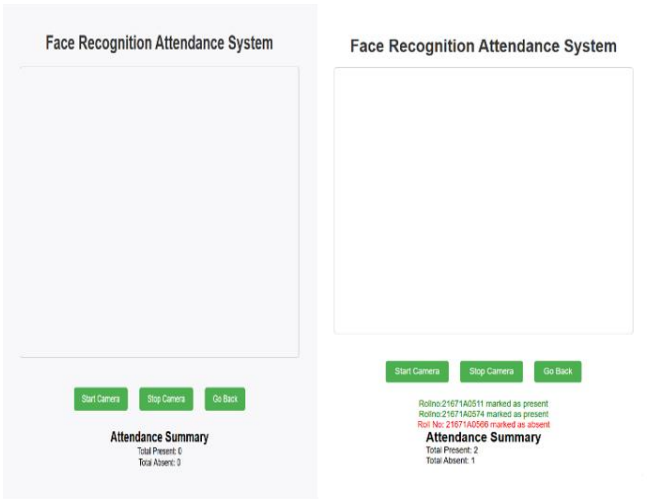

Fig-7: The **Attendance page** where the faculty take the attendance of each individual student and get the summary of the total absent and present count of class.

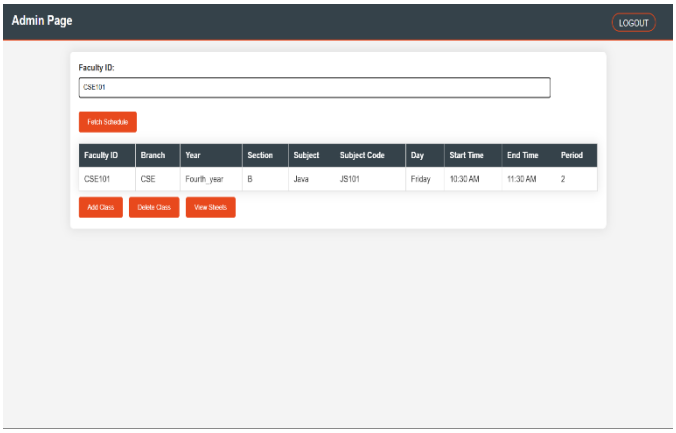

Fig-8: Admin page where the admin has the authority to fetch the schedule, add class, delete classes, view and download excel sheets of respective faculty.

5.2 Attendance Data Storage & Export

Attendance is **automatically stored in Excel.** The faculty can **download reports** in required formats.

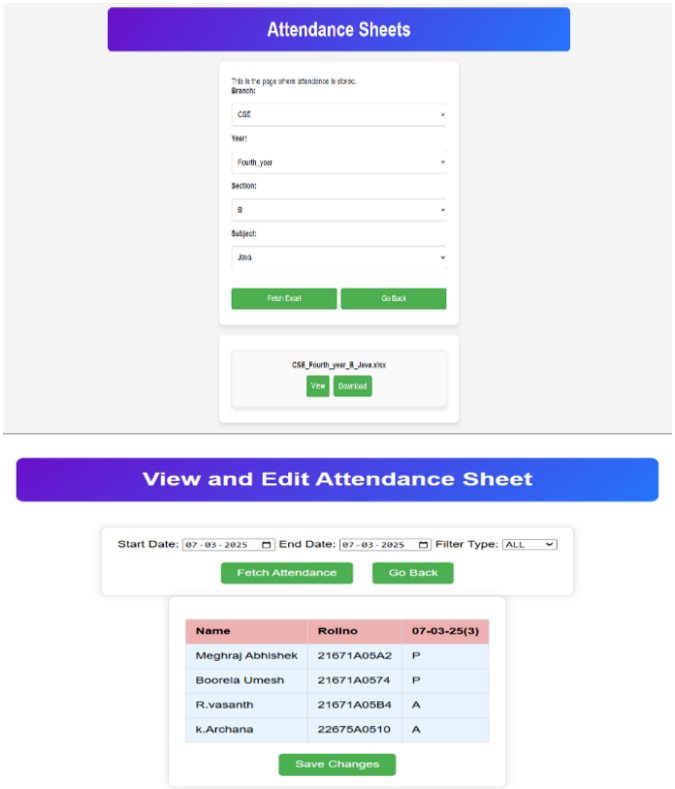

Fig-9: The respective faculty can identify the excel sheets according to their requirement and easily edit, maintain and download.

6.CONCLUSION:

This research introduces the Facial Capturing Attendance Tracking System Using Computer Vision, which improves attendance tracking through enhanced efficiency, accuracy, and security. Through the use of HaarCascade for face detection and LBPH for facial recognition, the system provides accurate identification while being computationally efficient. Our results show that this method effectively reduces manual labor, eliminates proxy attendance, and enhances data security. In addition, its light-weight implementation and modular architecture also render it an affordable, scalable solution for institutions of learning to update their attendance management systems. Additionally, the system leverages AWS cloud services, ensuring scalability, reliability, and secure data storage, making it a robust and efficient solution for modern attendance management.

7.FUTURESCOPE:

The deployment of a mobile app for students and faculty would allow real-time monitoring of attendance, instant alerts, and low-attendance alerts, increasing accessibility and participation. An automated attendance reporting system can also make record management easier by providing weekly, monthly, and semester-wise reports in PDF, CSV, or Excel formats and sending real-time notifications through email or SMS. AI-based predictive analytics can also analyse attendance trends, determining students

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