Daily Attendance Via Facial Recognition Using Cctv /Webcam Footage

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***Abstract*—Daily Attendance via Facial Recognition using CCTV/Webcam Footage is an automated system designed to record attendance accurately and efficiently without manual intervention. The system leverages computer vision and machine learning techniques to detect and recognize human faces in real-time video streams captured through CCTV cameras or webcams.**
The proposed system utilizes the OpenCV library for face detection and the Local Binary Pattern Histogram (LBPH) algorithm for face recognition. A dataset of registered individuals is created and used to train the recognition model.

***Index Terms*—Facial Recognition, OpenCV, LBPH, Machine Learning, Attendance system, CCTV**

I. INTRODUCTION

Attendance management is a fundamental requirement in educational institutions, organizations, and workplaces to monitor the presence and participation of individuals. Traditional attendance systems, such as manual registers and card-based methods, are time-consuming, prone to human error, and susceptible to proxy attendance. These limitations highlight the need for a more efficient, accurate, and automated solution. With the rapid advancement of computer vision and machine learning technologies, facial recognition has emerged as a reliable and contactless method for identity verification. Facial recognition systems analyze unique facial features of individuals and compare them with stored data to identify or verify a person. This technology has gained popularity due to its non-intrusive nature and ability to operate in real-time environments.

This project presents a Daily Attendance System using Facial Recognition based on CCTV/Webcam Footage, which automates the attendance process by detecting and recognizing faces from live video streams. The system utilizes OpenCV for face detection and the Local Binary Pattern Histogram (LBPH) algorithm for face recognition. A dataset of registered individuals is created and used to train the model, enabling accurate identification during real-time operation.

II. LITERATURE SURVEY

Facial recognition-based attendance systems have gained significant attention in recent years due to advancements in computer vision and machine learning. Various techniques and models have been proposed to improve the accuracy, efficiency, and automation of attendance systems.

Early research in face detection was dominated by the Viola-Jones algorithm (2001), which introduced a real-time object detection framework using Haar-like features and cascade classifiers. This method became widely popular due to its speed and efficiency in detecting faces in images and video streams, making it suitable for real-time applications such as attendance systems.

These methods relied on dimensionality reduction techniques like Principal Component Analysis (PCA) and Linear Discriminant Analysis (LDA). While effective under controlled conditions, they were sensitive to variations in lighting, pose, and facial expressions. The Local Binary Pattern Histogram (LBPH) algorithm emerged as a robust and lightweight alternative for face recognition. LBPH works by extracting local texture features from facial images and generating histograms to represent facial patterns. It performs well under varying lighting conditions and is computationally efficient, making it suitable for real-time systems and academic projects. Due to these advantages, LBPH is widely adopted in many attendance systems.

III. PROBLEM STATEMENT

Attendance management is an essential activity in educational institutions and organizations for tracking the presence and participation of individuals. Traditional attendance systems, such as manual registers and card-based methods, suffer from several limitations including time consumption, human errors, and lack of transparency. These methods also make it easy to perform proxy attendance, where one person marks attendance on behalf of another, leading to inaccurate records.

Existing biometric systems such as fingerprint or RFID-based attendance improve accuracy but require physical interaction, dedicated hardware, and user cooperation. These systems may cause delays, increase operational costs, and are not suitable for contactless environments.

Moreover, most current systems lack real-time automation and require manual supervision to operate effectively. There is a need for a system that can automatically detect and identify individuals without interrupting normal activities, while ensuring accuracy and reliability.

IV. PROPOSED SYSTEM

The proposed system is a fully automated attendance management solution that uses facial recognition technology to record attendance through CCTV or webcam footage in real time. The system eliminates manual intervention by automatically detecting, recognizing, and marking attendance of individuals as they appear in front of the camera.

The proposed system ensures:

- Automation: No manual attendance marking required
- Accuracy: Reduces errors and prevents proxy attendance
- Real-time processing: Immediate detection and recognition
- Contactless operation: Suitable for modern and hygienic environments

V. SYSTEM ARCHITECTURE

The system architecture of a Daily Attendance System using Facial Recognition with CCTV/Webcam consists of multiple modules that work together to automate attendance marking.

The process begins with a CCTV camera or webcam capturing real-time video footage. This video is processed using OpenCV, where individual frames are extracted. In each frame, a face detection algorithm (Haar Cascade) identifies human faces.

Once faces are detected, a face recognition module (LBPH algorithm) compares them with a pre-trained dataset stored in the system. If a match is found, the system retrieves the student's details from the database and marks attendance along with date and time.

The attendance data is then stored in a database (CSV/SQLite or cloud) and displayed through a web interface (Streamlit) for easy monitoring and management.

VI. METHODOLOGY

The methodology for a Daily Attendance System using Facial Recognition with CCTV/Webcam Footage involves a sequence of steps to automatically capture and record attendance.

Data Collection
Student face images are captured using a webcam/CCTV and stored as a dataset.

Pre-processing
Images are converted to grayscale and resized for better accuracy.

Model Training
The system trains a face recognition model using the LBPH algorithm and creates a trained file.

Live Video Capture
CCTV/webcam continuously captures real-time video frames.

Face Detection
Faces are detected in each frame using the Haar Cascade classifier.

Face Recognition
Detected faces are compared with the trained dataset to identify individuals.

Attendance Marking
If a match is found, attendance is marked with date and time, avoiding duplicates.

Data Storage
Attendance records are stored in CSV, SQLite, or cloud database.

Display Interface
Results are shown on a web interface (Streamlit) for easy access and monitoring.

VII. IMPLEMENTATION

The implementation of the Daily Attendance System using Facial Recognition with CCTV/Webcam Footage involves developing and integrating multiple modules to achieve automated attendance marking.
The system is developed using Python with libraries such as OpenCV, NumPy, and Pandas, and a web interface is created using Streamlit. Initially, a data collection module is implemented to capture student face images through a webcam or CCTV and store them in a structured dataset with unique IDs.
Next, a training module processes these images by converting them into grayscale and training a face recognition model using the LBPH algorithm. The trained model is saved as a file (trainer.yml) for future recognition.
During execution, a real-time video capture module continuously reads frames from the CCTV/webcam. Each frame undergoes face detection using the Haar Cascade classifier to locate faces. The detected faces are then passed to the recognition module, which compares them with the trained dataset to identify individuals.

VIII. MODULES

1. Data Collection Module:
Captures student face images using webcam/CCTV.
Stores images in dataset with unique IDs.

2. Preprocessing Module:
Converts images to grayscale.
Resizes and normalizes images for better accuracy.

3. Training Module:
Trains face recognition model using LBPH algorithm.
Generates trained file (trainer.yml).

4. Video Capture Module:
Captures real-time video stream from CCTV/webcam.
Extracts frames for processing.

5. Face Detection Module:
Detects faces using Haar Cascade classifier.
Identifies face regions in frames.

6. Face Recognition Module:
Compares detected faces with trained dataset.
Identifies student based on confidence level.

7. Attendance Management Module:
Marks attendance with date and time.
Prevents duplicate entries.

8. Database Module:
Stores student details and attendance records
Uses CSV, SQLite, or cloud database.

9. User Interface Module:
Streamlit-based dashboard.
Allows capture, training, recognition, and viewing attendance.

10. System Integration Module:
Integrates all modules into a single working system.
Ensures smooth and automatic operation.

IX. TESTING

The system is tested using functional and real-time scenarios to ensure accurate face detection, recognition, and attendance marking.
Registered student faces are correctly recognized and attendance is marked.
Unregistered faces are identified as unknown and ignored.
Multiple faces in a frame are detected and processed properly.
When no face is present, no attendance is recorded.
Duplicate entries are prevented when the same student appears multiple times.
The system performs under low lighting with slightly reduced accuracy.
Blurred or unclear faces result in low confidence or no recognition.

Proper error message is shown if the camera is not working.
If the dataset is empty, the system shows a warning and does not recognize faces.
Attendance data is stored correctly with date and time.

X. RESULTS

The system successfully detects and recognizes faces in real time using CCTV/webcam. Attendance is automatically recorded with accurate date and time, and duplicate entries are avoided. Registered students are identified correctly, while unknown faces are ignored. The system performs efficiently with multiple faces and stores attendance data properly in the database.
Overall, the system is accurate, reliable, and fully automated for attendance management.

XI. APPLICATIONS

The system is used in schools and colleges for student attendance, offices and companies for employee tracking, and industries for workforce management. It is also useful in hospitals, coaching centers, hostels, and security systems for monitoring and access control.
It provides a smart, contactless, and automated attendance solution in various fields.

XII. LIMITATIONS

The system may experience reduced accuracy under low lighting conditions or when using poor-quality cameras. It can face difficulty in recognizing faces that are partially covered with masks, glasses, or changes in appearance. The performance heavily depends on a well-trained and updated dataset, along with proper camera placement and angle. Initial setup, data collection, and model training can be time-consuming. Additionally, fast movement, multiple faces in a frame, or blurred images may affect recognition accuracy. The system may also require regular maintenance and updates to ensure consistent performance over time.

XIII. FUTURE WORK

Future improvements can enhance the system's accuracy, scalability, and usability. Advanced deep learning models can be integrated to improve recognition under low lighting and different facial conditions. Cloud-based storage can be implemented for real-time data access and backup. The system can be upgraded to support mobile applications for remote monitoring. Integration with CCTV networks using IP cameras and real-time streaming can be enhanced. Additional features like mask detection, emotion recognition, and alert notifications can also be added.

XIV. CONCLUSION

The Daily Attendance System using Facial Recognition with CCTV/Webcam Footage successfully automates the attendance process by detecting and recognizing faces in real time. It eliminates manual effort, reduces errors, and ensures accurate record keeping. The system is efficient, reliable, and easy to use through a web interface.
Overall, it provides a smart, secure, and contactless solution for modern attendance management.

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This project is developed using knowledge from OpenCV and Python official documentation, which provide support for image processing and system implementation. Key concepts of facial recognition are based on research works such as the LBPH algorithm by Ahonen et al. and the Haar Cascade method by Viola and Jones. Additional guidance was taken from Streamlit documentation for building the web interface. Various research papers from IEEE and Springer were referred to for understanding real-world applications. Online tutorials, articles, and documentation also played an important role in designing, developing, and testing the facial recognition attendance system effectively.