iJRASET
International Journal For Research in Applied Science and Engineering Technology

INTERNATIONAL JOURNAL FOR RESEARCH

IN APPLIED SCIENCE & ENGINEERING TECHNOLOGY

Volume: 13 **Issue:** III **Month of publication:** March 2025

DOI: https://doi.org/10.22214/ijraset.2025.67994

www.ijraset.com

Call: 08813907089 | E-mail ID: ijraset@gmail.com

International Journal for Research in Applied Science & Engineering Technology (IJRASET)
ISSN: 2321-9653; IC Value: 45.98; SJ Impact Factor: 7.538
Volume 13 Issue III Mar 2025- Available at www.ijraset.com

Camera (Webcam) Based Facial Attendance System Using Machine Learning

Pushkar Sawlani[1], Aaryan Mohanani[2], Yash Chawla[3], KaushikMali[4], Saroj Desai[5]
[1, 2, 3, 4, 5]*Automation & Robotics, Vivekanand Education Society's Polytechnic Chembur*

Abstract: ***In the current digital landscape, facial recognition technology plays a crucial role across various sectors. It stands as one of the most prevalent biometric techniques, utilized for purposes like security, authentication, and identification, among others. While it may not match the accuracy of iris and fingerprint recognition, its non-invasive and contactless qualities make it highly appealing. Additionally, facial recognition systems are beneficial for tracking attendance in educational settings and workplaces. This project aims to create an attendance system that harnesses facial recognition technology to overcome the inefficiencies and challenges of traditional manual attendance methods, which can be slow and prone to proxy attendance. Consequently, the need for such a system is on the rise. The proposed solution involves four primary phases: creating a database, detecting faces, recognizing faces, and updating attendance records. The database will consist of images of students in the classroom. Face detection will utilize the Haar-Cascade classifier, and face recognition will employ the Local Binary Pattern Histogram algorithm. Faces will be identified and recognized from live video feeds in the classroom, with attendance records emailed to the appropriate instructors at the conclusion of each session.***

Keywords: Face Recognition; Face Detection; Haar-Cascade classifier; Local Binary Pattern Histogram; attendance system;

I. INTRODUCTION

The traditional method of taking attendance in schools and colleges can be quite tedious, adding extra pressure on faculty members who must manually call out student names, often consuming about five minutes of the entire session. This process is time-consuming and creates opportunities for proxy attendance. In response, many institutions have begun employing various alternative techniques for marking attendance, such as Radio Frequency Identification (RFID) [3], iris recognition [4], fingerprint recognition, and more. However, these queue-based systems can also be time-consuming and intrusive.

Face recognition has emerged as a significant biometric feature due to its accessibility and non-intrusiveness. Systems relying on face recognition are generally unaffected by different facial expressions. The face recognition system falls into two categories: verification and face identification. Verification involves a 1:1 matching process, comparing a facial image against template images, while identification is a 1:N problem that matches a query facial image against several templates [1].

This system aims to create an attendance marking solution based on face recognition techniques. In this approach, an individual's face will be used to record attendance. Currently, face recognition technology is gaining popularity and is widely implemented. In this paper, we propose a system that detects students' faces from live classroom video streaming, marking attendance if the detected face matches one in the database. This new system will require significantly less time compared to traditional methods.s.

II. LITERATURE SURVEY

In [3], authors introduced an automated attendance system model. This model utilizes face recognition paired with Radio Frequency Identification (RFID) to identify authorized students and track their entry and exit from the classroom. It maintains an accurate record for every registered student and logs attendance data specific to each course, providing necessary information as required. The paper in [4] features a designed and implemented attendance system leveraging iris biometrics. Initially, participants registered their details along with a unique iris template. During roll call, the system automatically recorded attendance by capturing images of each attendee's eye, recognizing the iris, and matching it against the established database. This prototype was web-based. Authors in [5] presented an attendance system that uses facial recognition technology. They implemented algorithms such as Viola-Jones and Histogram of Oriented Gradients (HOG) features in conjunction with a Support Vector Machine (SVM) classifier. They accounted for various real-time scenarios, including scaling, illumination challenges, occlusions, and pose variations. A quantitative analysis was performed based on the Peak Signal to Noise Ratio (PSNR) values and was executed using a MATLAB GUI.

In [6], the research focused on identifying the most effective facial recognition algorithm (Eigenface and Fisherface) from Open CV 2.4.8 by analyzing the Receiver Operating Characteristics (ROC) curve, which was then integrated into the attendance system. The experiments showed that the Eigenface algorithm yielded superior results compared to Fisherface, achieving an accuracy rate between 70% and 90%.

The work referenced in [7] proposed a classroom student attendance system utilizing facial recognition through a combination of Discrete Wavelet Transforms (DWT) and Discrete Cosine Transform (DCT). These algorithms were employed to extract facial features, followed by classifying these features using Radial Basis Function (RBF). This system achieved an accuracy rate of 82%.2%.

III. PROPOSED SYSTEM

All students in the class must register by providing the required details, after which their images will be captured and stored in the dataset. During each session, faces will be detected from the live streaming video of the classroom. The detected faces will be compared with the images in the dataset. If a match is found, attendance will be marked for the corresponding student. At the end of each session, a list of absentees will be emailed to the faculty member responsible for the session. The system architecture of the proposed system is outlined below.

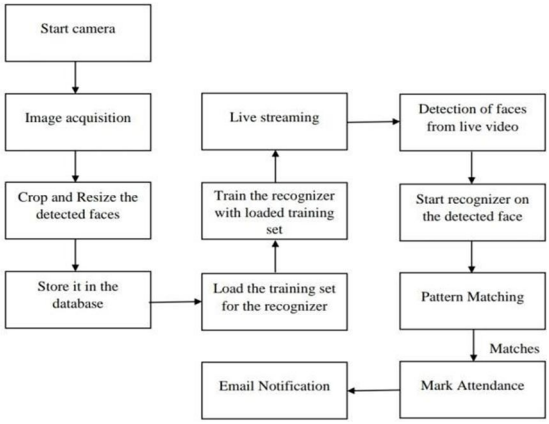


Fig.1. System Architecture

A. Dataset Creation

Images of students are captured through a webcam. Multiple images of each student are collected, showcasing different gestures and angles. Afterward, these images undergo pre-processing, where they are cropped to isolate the Region of Interest (ROI) for the recognition process. The next step involves resizing the cropped images to a specific pixel size. Subsequently, the images are converted from RGB to grayscale format. Finally, these images are saved in a designated folder, named according to the respective students.

B. Face Detection

Face detection is carried out using the Haar-Cascade Classifier with OpenCV. Prior to detection, the Haar Cascade algorithm must be trained to identify human faces, a process known as feature extraction. The training data for Haar Cascade is found in an XML file named haarcascade_frontalface_default. The Haar features illustrated in Fig. 2 will be utilized for feature extraction.

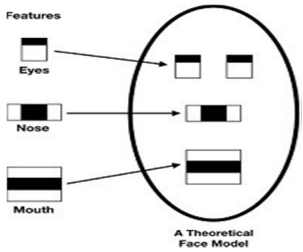


Fig.2. Haar Features

We utilize the detect MultiScale module from OpenCV to draw rectangles around faces in images. This module includes three parameters: scaleFactor, minNeighbors, and minSize. The scaleFactor indicates how much an image should be downscaled at each scale. The minNeighbors parameter specifies the minimum number of neighboring rectangles that a candidate rectangle must possess. Higher values typically result in fewer detected faces but improve detection quality. The minSize parameter defines the smallest allowable object size, defaulting to (30,30) [8]. In our system, we set scaleFactor and minNeighbors at values of 1.3 and 5, respectively.

C. Face Recognition

The face recognition process comprises three stages: preparing training data, training the face recognizer, and making predictions. The training data consists of images from the dataset, each assigned an integer label corresponding to the respective student. These images are used for face recognition. The face recognizer implemented in this system is the Local Binary Pattern Histogram (LBPH). Initially, we collect the local binary patterns (LBP) for the entire face. These LBPs are converted into decimal values, and histograms are generated. Ultimately, one histogram is produced for each image in the training data. During the recognition phase, the histogram of the face being recognized is calculated and compared with the precomputed histograms, returning the label of the best match associated with the respective student [9].

D. Attendance Update

After face recognition, the identified faces are marked as present in an Excel sheet, while others are marked absent, and a list of absentees is emailed to the corresponding faculty. Faculty members receive a monthly attendance report at the end of each month.nth.

IV. RESULTS AND DISCUSSIONS

Users can interact with the system through a GUI, where they are presented with three primary options: student registration, faculty registration, and attendance marking. For student registration, individuals must fill in all required details on the registration form. After clicking the register button, the webcam activates automatically, and a window appears (see Fig. 3), which starts detecting faces within the frame. It continues to capture photos until 60 samples are obtained or until CTRL+Q is pressed. These images will then be pre-processed and saved in the training images folder.

Faculty members need to register using their assigned course codes and email IDs in the faculty registration form. This step is crucial as the list of absentees will ultimately be sent to the corresponding faculty members.

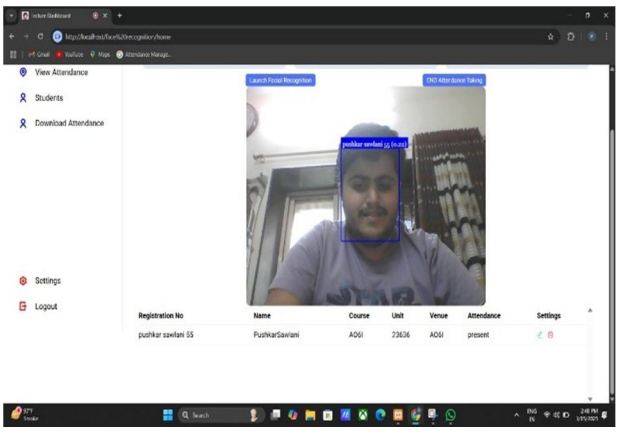


Fig.3. Face Detection

The relevant faculty members are required to input their course code during each session. The camera will then start up automatically after the course code has been submitted. Two registered students are identified in the face recognition window in Figure 4, which would have displayed "unknown" if they hadn't registered. Pressing CTRL+Q will exit the window, update the attendance in the Excel sheet, and mail the names of the absentees to the appropriate faculty.

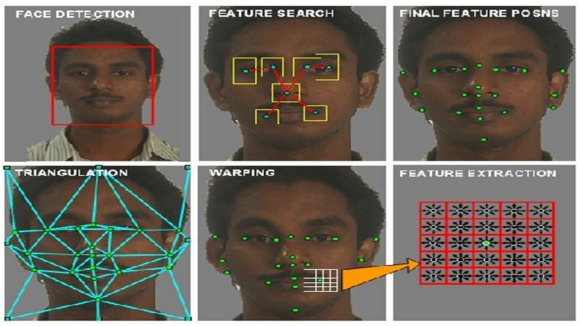


Fig.4. Face Recognition

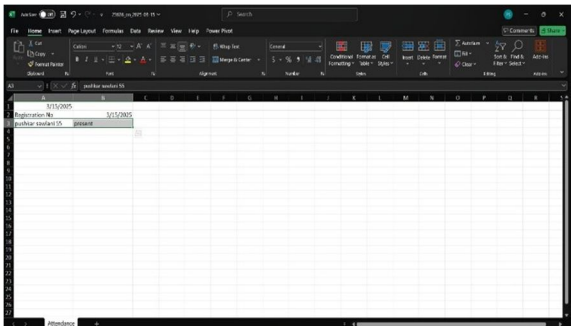


Fig.5. Attendance sheet

Following the recognition procedure, the attendance sheet is updated as shown in Fig. 5. Absent students are marked as "0," while recognized students are marked as "1." The faculty email address will receive an email containing the list of absentees.

V. CONCLUSIONS

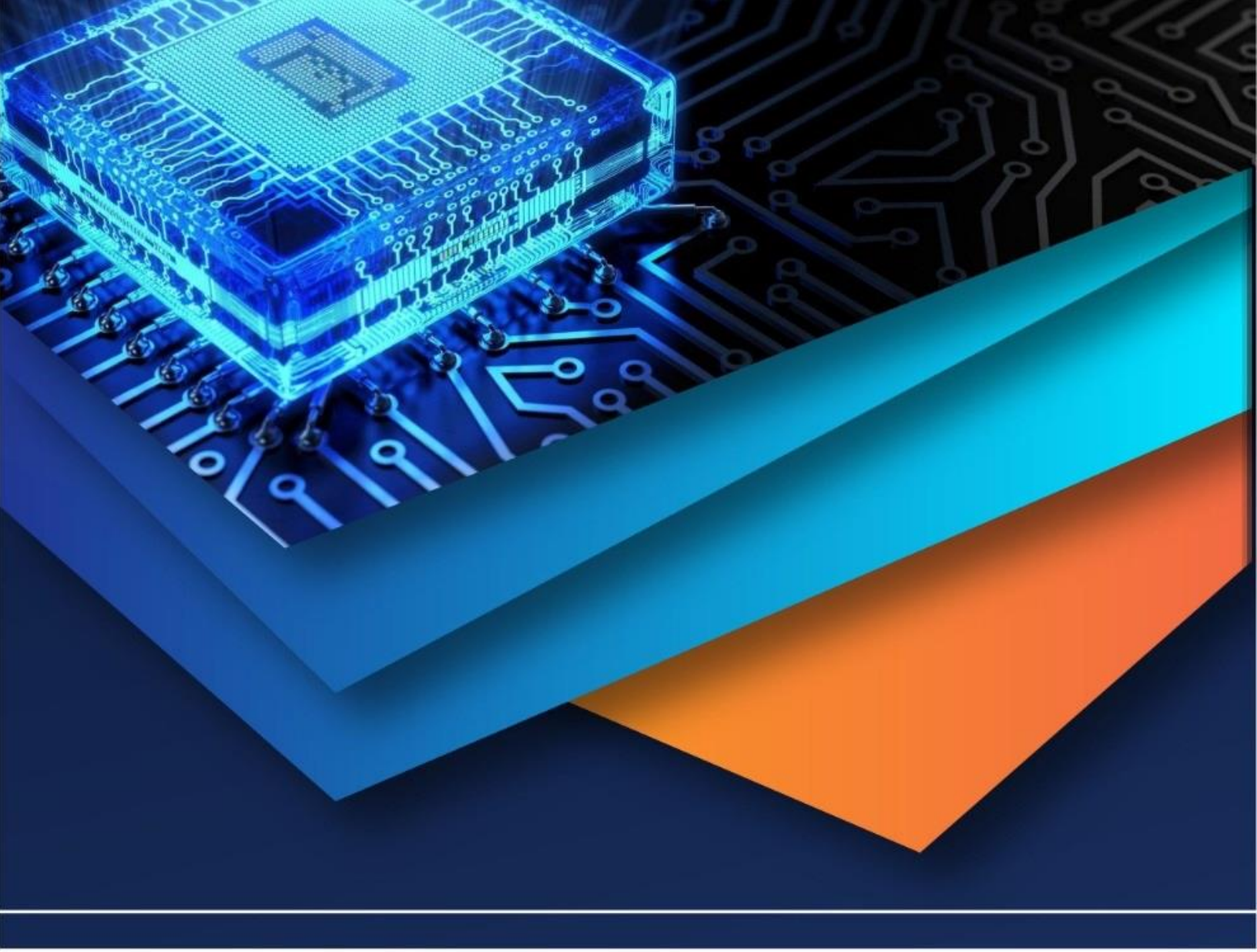
This project demonstrates a non-contact real-time attendance system utilizing JavaScript, Python, and PHP for effective face recognition. Future developments may include AI-based enhancements and mobile integration.

VI. ACKNOWLEDGMENT

We sincerely express our gratitude to VES Polytechnic, Mumbai, for providing the necessary resources and guidance to complete this project. Our heartfelt thanks go to our faculty mentors and project guides for their invaluable support and insights. We also appreciate our team members for their collaborative efforts in research, documentation, and testing. Lastly, we acknowledge the use of the LG Full HD 1080P Smart Webcam (VC23GA, Black) and the resources from Face-API.js, OpenCV, PHP, and MySQL, all of which played a crucial role in the development of this system.

REFERENCES

[1] Justadudewhohacks, "Face-API.JS Document", available: https://justadewohacks.github.io/face-opi.js/.
[2] OpenCv.org, “Open Source Computer Library”, “available: https://opencv.org.
[3] W3SCHOOLS, "PHP & MySQL Database Management", available: https://www.w3schools.com/php/.
[4] LG Electronics, "LG FULL HD 1080P Smart webcam (VC23GA) user manual": https://www.lg.com.
[5] God, C.S. et al., "Face Recognition System", International Journal of Engineering Research and Technology (IJERT), Vol. 9, no. 6, 2020.
[6] Sovitkar, S.A. & S. S. Kawathekar, “Comparative Study on Algorithms and Classifications based on Objects by recognizing people for automatic traffic systems”, 2020 International Conference on Innovation Mechanisms in Second Industrial Application (ICIMIA), IEEE, 2020.
[7] Zayeef, A.M. & R.J. CHAKMA, "Automatic visualization system based on awareness and perception for educational institutions using machine learning", Information and communication technology (ICTC), Springer, Singapore, 2023.
[8] NAGI, G. M., et al., “In real time in real time, the detection and recognition of a person in the automatic attendance system”, International review of computers and software, Vol. 7, no. March 2012.
[9] Rugtanom, S., et al., “Web applications and mobile systems for managing students and students based on mobile applications for visiting face”, 2021 1 Cymen, IEEE, 2021.
[10] Kakarla, S., et al.
[11] Nguyen-Tat, B. T. et al., “Attendance Management of Human Resources: Access to Development Science using Computer Vision and Face Recognition”, ArxIV Preprint Arxiv: 2405.12633, 2024.



10.22214/IJRASET

45.98

IMPACT FACTOR: 7.129

IMPACT FACTOR: 7.429

INTERNATIONAL JOURNAL FOR RESEARCH

IN APPLIED SCIENCE & ENGINEERING TECHNOLOGY