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Face Recognition Attendance System using Haar Cascade Classifier and Local Binary Pattern Histogram Algorithm

Bharath S Pillai, Prof.Ganesh D

School of CS & IT, Jain (Deemed-to-be University), Bangalore, India

ABSTRACT: Traditional classroom attendance methods, like roll-call and sign-in sheets, are time-consuming and error-prone. This paper introduces a cost-effective solution leveraging Real-Time Face Recognition to efficiently manage student attendance. The proposed model, implemented in Python with OpenCV, uses Haar Cascade for face detection and LBPH for recognition, considering both positive and negative facial features for accuracy. The Tkinter GUI interface enhances user interaction, marking a departure from cumbersome traditional approaches and addressing the challenges of managing large student groups.

I. INTRODUCTION

Automation, defined as the control of machines and processes using computer software technologies, has significantly advanced in the modern era. These technological advancements not only enhance accuracy but also contribute to improving our overall quality of life. One notable innovation in automation is the implementation of an Automated Attendance system, replacing traditional attendance marking methods. The conventional paper-based approach proves to be time-consuming, especially as the number of individuals increases. This challenge is effectively addressed by the automated system, saving time and providing an additional layer of security by preventing attendance proxy.The primary goal of our proposed system is to establish a face recognition-based attendance system with a minimized false-positive rate in detecting unknown individuals. This is achieved by applying a threshold and storing their images. For face detection, we utilized Haar cascade due to its robustness, and for face recognition, the LBPH algorithm was employed, known for its resilience against monotonic grayscale transformations. Notably, our system goes beyond mere attendance tracking; it identifies and saves images of any unfamiliar person in the class, adding an extra layer of security for cases where their information is not in the database.

II. LITERATURE REVIEW

In a review of related literature (Section II), a study suggested an RFID card-based attendance system where the RFID tag draws energy from the reader. However, a drawback is the vulnerability to unauthorized access using a valid ID card. Other research explores biometric methods, such as fingerprint-based attendance in . This involves a biometric sensor for data extraction and database comparison, but the inconvenience of students needing to go to a specific location or passing a device during class is noted. Additionally, and employ iris-based attendance systems, but they face sensitivity issues to environmental factors.

On the other hand, a face recognition-based attendance system using Eigenface recognition was proposed in it. The method involves converting images into eigenfaces and comparing them with the database. Limitations include sensitivity to face background, head orientations, and the inability to recognize individuals wearing glasses or having facial hair. In contrast, our proposed approach overcomes these limitations by being insensitive to face background and orientations, successfully recognizing individuals even with a beard or glasses.

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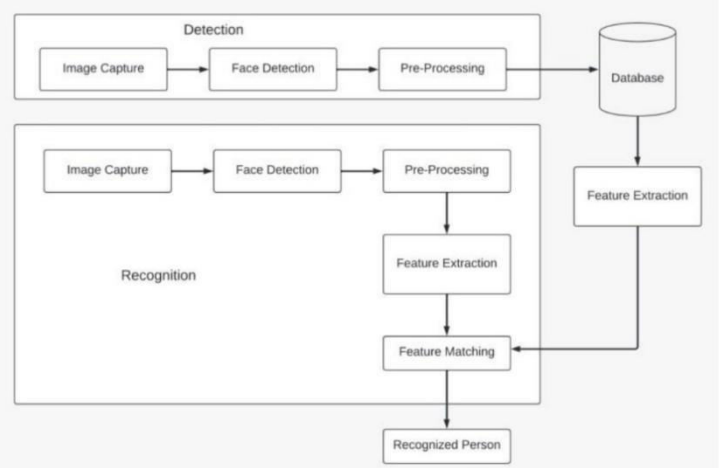

Fig.1 System Architecture

The examination of existing research reveals a substantial body of work on facial recognition technology, attendance systems, and their integration with Python-based solutions. These findings contribute valuable insights for the development of the proposed face recognition attendance system.The review delves into attendance systems, charting the evolution from manual methods to automated, biometric-based solutions. An analysis of the advantages and disadvantages of biometric technologies in attendance tracking is conducted, with a specific emphasis on facial recognition as a non-intrusive and user-friendly approach.

The exploration extends to Python libraries such as OpenCV, Dlib, and Face_recognition for face detection and recognition. A comparative assessment of their features and real-world performance is carried out.Studies showcasing the integration of face recognition technology with graphical user interfaces (GUIs) through Python's Tkinter library are reviewed. The implementation of face detection using the Haarcascade Classifier, specifically the Haarcascade Frontal Face Classifier for identifying faces in webcam-captured images, is detailed.Model training involves the utilization of the LBPH (Local Binary Pattern Histogram) Face Recognizer, employing captured images and associated IDs to construct a face recognition model. Data storage encompasses the saving of captured facial images to designated directories, distinguishing between new registrations and training images for the LBPH Face Recognizer. Furthermore, CSV files store details about registered students, including their IDs and names.The implementation includes the creation of a user-friendly Graphical User Interface (GUI) with Tkinter, featuring buttons for image capture, profile saving, attendance recording, and application exit. OpenCV, a robust library for computer vision, is employed to capture webcam frames, convert them to grayscale, and implement Haarcascade for face detection in this project.

III. PROBLEM STATEMENT

The primary concern identified in the prior attendance management system revolves around the reliability of the collected data. This stems from the potential for attendance to be recorded by individuals other than the intended person, leading to inaccuracies and potential breaches of data integrity. Enforcing corrective measures within the institution could consume significant human resources and time, rendering it impractical. Furthermore, the system's second drawback lies in its prolonged completion time, as it takes approximately one minute for a student to sign their attendance on a name list. This inefficiency becomes evident as only around 60 students can register their attendance in an hour. The third issue pertains to the limited access of legitimate interested parties, such as concerned parents, to crucial information about their wards' attendance. To address these challenges and enhance overall efficiency, data accuracy, and accessibility for authorized parties, a comprehensive evolution of the previous system is imperative.

IV. EXISTING SYSTEM

Manual attendance tracking poses challenges due to its susceptibility to human error, time-consuming nature, dependence on manual entry or verification, susceptibility to manipulation, and the lack of real-time tracking capabilities. Biometric systems, whether based on fingerprint or iris recognition, face drawbacks such as high installation and maintenance costs, accuracy issues influenced by environmental factors, and concerns related to the privacy of stored biometric data. Voice recognition systems are hindered by environmental noise affecting accuracy, potential variations in voice due to factors like illness impacting recognition, and reduced reliability in noisy

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environments. QR code or barcode scanning, while efficient, demands physical presence and manual scanning, introduces risks of shared or replicated codes compromising accuracy, and may raise security concerns. Each attendance tracking method presents its own set of limitations, emphasizing the importance of carefully considering these drawbacks when choosing an appropriate solution for specific organizational needs.

V. PROPOSED SYSTEM

The envisioned automated attendance management system utilizes the Haar cascade for face detection and employs the LBPH algorithm for face recognition. The Graphical User Interface (GUI) depicted in Figure 2 is crafted using the Tkinter module in Python, recognized for its efficiency in creating GUI applications. This system offers functionalities, including capturing student images along with their details for the database, conducting image training both in the database and on the camera, and initiating the tracking of individuals entering the classroom. As students enter the classroom, the system identifies their faces through the camera, pre-processes the data for subsequent stages of processing. The sequential stages of the proposed system are illustrated in Figure 1, with detailed implementation for each stage elaborated in the following section. Developing a robust face recognition attendance system using Python involves utilizing Tkinter to create a user-friendly GUI for seamless interaction. Employ OpenCV for efficient image processing and face recognition tasks, ensuring a secure environment through password protection for new registrations. Manage student details through CSV files, facilitating convenient data storage. Implement an automated system to generate daily attendance records, complete with date and time stamps, providing a comprehensive overview. Display live attendance updates in a clear tabular format, enabling easy monitoring and enhancing the overall functionality of the system.

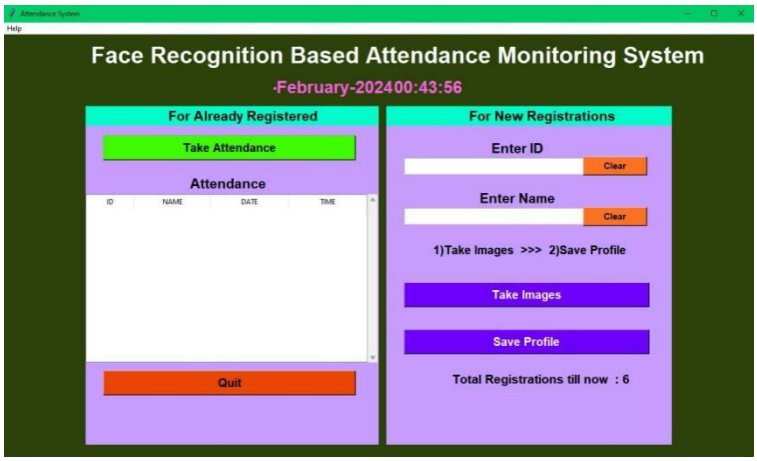

Fig.2. System GUI

VI. METHODOLOGY

We propose a cost-effective approach to record student attendance using face detection technology, which comprises four main stages: image acquisition, face detection, attendance registration, and attendance monitoring. Our solution, named IBAS (Image Based Attendance System), aims to enhance staff productivity and reduce workload, ultimately improving attendance record accuracy. While fingerprinting, retinal scans, and access cards are commonly used for attendance tracking, our paper advocates for face recognition as the primary strategy. We employ Haar cascades and the LBPH algorithm to identify faces within images, leveraging their speed and accuracy in face detection. Each user is associated with a separate Haar cascade, and positive photos containing faces are used to train the classifier for creating Haar cascade files. In our implementation, the face detection process involves acquiring video images, converting them to grayscale, and storing them for training. Subsequently, trained faces are identified in input images, and each face is assigned a unique student ID for dataset creation.

In the face detection stage, we apply the Viola and Jones algorithm, refined over time for real-time applications, and incorporate wavelet transforms to represent item shapes using wavelet coefficient subsets. Integral images facilitate the calculation of Haar features, and rectangle feature values are determined by variance differences between black and white regions. The database creation phase involves registering students by extracting their faces from photographs,

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converting them to grayscale, and labeling each with a unique ID. To enhance face recognition accuracy, faces undergo training under various conditions.

In the face recognition stage, faces stored in the dataset are recognized using a local binary pattern histogram (LBPH) technique. Trained classifier files are used to label the test dataset, and faces are identified using LBPH after initial face detection. Each recognized face is assigned a Student ID label to facilitate attendance tracking.

VII. CONCLUSION

In conclusion, the Face Recognition-Based Attendance System emerges as a compelling and cost-effective solution to the inherent challenges of traditional classroom attendance methods. By harnessing face detection technology across four key stages - image acquisition, face detection, attendance registration, and attendance monitoring - the system showcases a commitment to accuracy and innovation. The incorporation of Haar cascades and the LBPH algorithm underscores its dedication to efficient face recognition, addressing the limitations associated with manual attendance tracking. The refinement of the Viola and Jones face detection algorithm, along with the integration of wavelet transforms and integral images, enhances the system's ability to detect faces in real-time applications. The database creation process ensures a well-organized and labeled dataset, contributing to heightened face recognition accuracy under diverse conditions. In the face recognition phase, utilizing LBPH, the system adeptly identifies faces and assigns Student ID labels, streamlining the attendance tracking process. Not only does the proposed system minimize potential errors in attendance recording, but it also significantly enhances staff productivity and reduces workload burdens. By embracing automation and cutting-edge face recognition technology, this research contributes significantly to the ongoing endeavor to elevate accuracy, efficiency, and security in attendance monitoring systems, marking a substantial step forward in the realm of face recognition-based attendance solutions.

REFERENCES

[1] Jomon Joseph1, K. P. Zacharia, “Automatic Attendance Management System Using Face Recognition”, International Journal of Science and Research (IJSR), 2013.
[2] Ononiwu G. Chiagozie, Okorafor G. Nwaji, “Radio-frequency identification (RFID)based Attendance System with Automatic Door Unit”, Academic Research International(2012).
[3] O. Shoewu, PhD, O.A. Idowu, B.Sc., “Development of Attendance Management System using Biometrics.”, The Pacific Journal of Science and Technology(2012).
[4] A. Khatun, A. K. M. F. Haque, S. Ahmed and M. M. Rahman, ”Design and implementation of iris recognition based attendance management system”, 2015 International Conference on Electrical Engineering and Information Communication Technology (ICEEICT), Dhaka, 2015, pp.1-6.
[5] Ahonen, T.; Hadid, A.; Pietik¨ainen, M. Face Recognition with Local Binary Patterns. InProceedings of theAdvances in Visual Computing; Springer Science and Business Media LLC: Berlin, Germany, 2004; Volume3021, pp. 469–481.
[6] A. ¨Ozdil and M. M. ¨Ozbilen, ”A survey on comparison of face recognition algorithms,” 2014 IEEE 8th International Conference on Application of Information and Communication Technologies (AICT), Astana, 2014, pp. 1-3.
[7] Ahonen, Timo, Abdenour Hadid, and Matti Pietikainen. “Face description with local binary patterns: Application to face recognition.” IEEE transactions on pattern analysis and machine intelligence 28.12 (2006): 2037–2041.

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