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Face Recognition Based Attendance System

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***Abstract—** Maintaining regular attendance is an essential thing but traditional attendance management methods can be faulty and time-consuming for administrators. Therefore, Automatic Face Automatic Recognition (AFR) is easier way to monitor attendance. Automatic Face Recognition technologies have brought many improvements in the changing world over the years. Face recognition-based attendance system is the process of recognizing the face to accept attendance using facial biometrics. Computer vision make use of cameras, sensors, and algorithms to recognize and examine visual data, encompassing images of individuals among other elements. This perspective can offer many advantages. It has three advantages over manual attendance management. First, it is faster and more accurate which means that it would take less time and effort to track who has come to school. Second, we could establish real-time attendance and find students that are always late or leave before the classes are finished. Third, we could generate analytic reports on attendance and detect any problems. During the arrival, faces would be recognized, and if that face would be from the database the information would be automatically saved to the Excel sheet.*

I. INTRODUCTION

All organizations need to maintain a track of an attendance either manually or automatically. Calling names or signing on papers are the traditional methods are both time consuming and error inclined. Face recognition technology has come out as a critical tool in security, keeping track of an attendance system as well as in identifying individuals in real time to mark their attendance in real time without consuming time. The system makes use of python library and artificial intelligence to identify as well as verify each and every individual. This planned attendance system has the capacity to enhance the effectiveness of current attendance systems and contribute attendance management more cost-effective for organizations of varying sizes. This technology prioritizes the low-cost, less time consuming and automated attendance system.

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II. LITERATURE SURVEY

A. ***Face Recognization Smart Attendance System Using Deep Transfer Learning.*** *(Higher Colleges of Technology, Abu Dhabi, UAE 2021)*

In the paper, deep learning technique is used to automate attendance system. The above paper presented, focuses mainly on a facial recognition attendance system based on deep learning and convolutional neural networks. The proposed approach in the paper consists of five stages: data collection, data pre-processing, data augmentation, CNN training and validation, and system testing.

B. ***Face Recognization Smart Attendance System Using Machine Learning and location identification.*** *(Bharathiar University, Coimbatore, Tamil Nadu, India 2023)*

The paper talks about maintaining a regular attendance is necessary but at the same time it's hard to use traditional methodologies such as taking manual attendance on paper, circulating sheets to sign, or calling out names. These methods are both Tiring and error prone. Hence using machine learning algorithms are perfect way to answer these problems.

C. ***Library Attencence System Using YOLOv5 and Face Recognization*** *(ResearchGate Conference Paper 2021)*

In the proposed system the issues faced in library and by officials in library are highlighted and solved using yolov5. YOLOv5 (You Only Look Once) is a deep learning object detection model. The primary use of YOLOv5 is for real-time object detection in images and videos. YOLO uses an Artificial Neural Network (ANN) methodology for object detection within images. It helps in automating attendance reducing load of the administrators in the library.

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PROPOSED METHOD

The hardware components utilized in our face recognition-based attendance system play a pivotal role in its functionality and effectiveness. Below, we provide detailed information about the specific cameras integrated into our system:

1. Registration Camera (RPi Camera 2, Version 2):
The primary camera employed for candidate registration purposes is the RPi Camera 2, Version 2. This camera model is renowned for its compatibility with Raspberry Pi systems, compact form factor, and superior image quality. During the enrollment process, it captures 100200 high resolution images of each candidate, facilitating the creation of a comprehensive dataset specific to individual candidates. These images are then utilized for accurate facial recognition during subsequent attendance tracking sessions.

2. Inference Camera:
The secondary camera utilized in our system is a high-resolution IP camera, as detailed previously. This camera is strategically positioned within the local area network (LAN) of the educational institution or facility where our system is deployed. It plays a crucial role in real time inference and candidate detection during attendance tracking sessions, leveraging advanced facial recognition algorithms for seamless and efficient attendance recording.

The integration of the RPi Camera 2, Version 2, for candidate registration and the IP camera for real time inference ensures the accuracy, reliability, and scalability of our face recognition-based attendance system across diverse operational environments.

Computation and Hosting Infrastructure:

Our face recognition-based attendance system relies on the Raspberry Pi 5 Model B for computation and hosting. This choice offers several benefits:

1. Raspberry Pi 5 Model B:
We utilize the Raspberry Pi 5 Model B as our main companion computer due to its compact size, strong processing capabilities, and connectivity options. It efficiently handles tasks like image processing, facial recognition, and attendance tracking.

1-Raspberry Pi 5 Model B

2. Self-Hosting:
Our system is entirely hosted on the Raspberry Pi 5 Model B, eliminating the need for external servers. This setup simplifies deployment and management while ensuring data privacy and reducing latency.

3. Scalability and Flexibility:
The Raspberry Pi ecosystem allows for easy scalability and adaptation to varying needs. Whether deployed in a single classroom or across an entire campus, our system can accommodate different workloads and user populations effectively.

2-IP Camera Interfacing

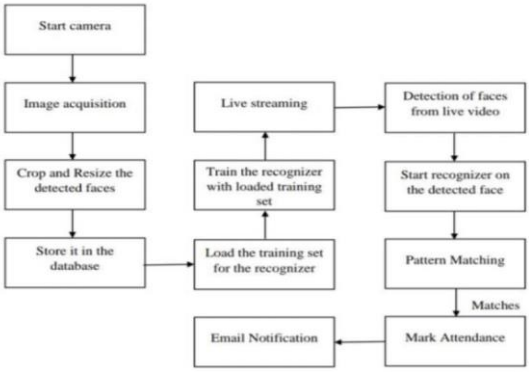
In conclusion, the Raspberry Pi 5 Model B serves as both the computational engine and hosting platform for our face recognition-based attendance system. Its versatility and reliability make it an ideal choice for embedded applications in educational and organizational settings.

Detection Algorithm:
The detection algorithm implemented in our face recognition-based attendance system is designed to accurately record candidate attendance while accounting for factors such as duplicate appearances and college schedule timings. The algorithm operates as follows:

1. Initial Registration:
When a candidate, who is already registered in the system database, appears in front of the camera, the system marks their attendance as "in time." This serves as the initial entry point for attendance tracking.

2. Duplicate Appearance Handling:
Subsequent appearances of the same candidate are carefully monitored to prevent duplicate attendance entries. If the system detects a candidate who has already been marked as "in time," any subsequent appearances by that candidate are disregarded for attendance recording purposes. This ensures that each candidate's attendance is recorded accurately, without duplications.

3. Time Based Attendance Determination:
The detection algorithm incorporates time-based criteria to



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distinguish between "in time" and "out time" attendance entries. Specifically, the system is configured to align with college schedule timings, such as the commencement of classes at 9:30 AM and the conclusion at 4:30 PM. Any candidate appearance before 12 noon is considered as "in time," while appearances after 12 noon are categorized as "out time." This time threshold helps in accurately capturing attendance based on the college's operational hours.

By adhering to these principles, the detection algorithm ensures precise and reliable attendance tracking, even in dynamic environments with varying candidate schedules and appearance frequencies. The integration of time-based criteria adds an additional layer of accuracy and relevance to the attendance recording process, aligning it closely with institutional requirements and operational norms.

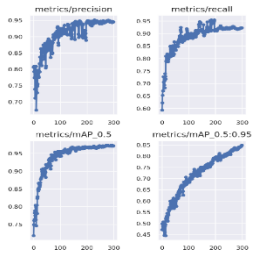
Future Scope: ROI Based Attendance System:
One potential avenue for future development of our face recognition-based attendance system involves implementing a Region of Interest (ROI)based approach. In this scenario, the entire classroom serves as the ROI, with the system tracking candidate presence within this defined area to determine attendance duration.

Functionality Overview:

The system utilizes OpenCV algorithms to establish the ROI, encompassing the entirety of the classroom space.
Upon entry into the ROI, the system initiates the candidate's intime, marking the start of attendance tracking.
As the candidate moves within the ROI, their presence is continuously monitored by the system.
Upon exit from the ROI, the system records the candidate's time, signaling the end of attendance tracking for that session.
The system calculates the difference in time between the intime and out time

Hardware Setup:

The primary computational unit for our system is the Raspberry Pi, chosen for its compact size, low power consumption, and robust computing capabilities. The Raspberry Pi is equipped with the necessary peripherals, including cameras for candidate registration and inference, to facilitate the face-recognition process.



3KPI vs

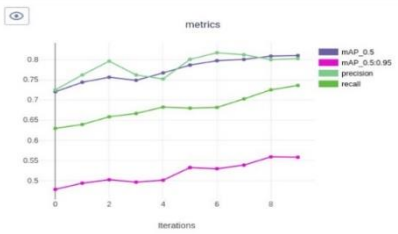
Remote Access and Viewing:
The system can be accessed remotely using tools such as VNC Viewer, enabling users to monitor and interact with the system's interface from a remote location. Once deployed on a network, such as a college server, the system can be accessed by authorized personnel using any device connected to the same network, including laptops and smartphones.

Security Measures:
Access to the system is protected by the credentials of the Raspberry Pi, ensuring that only authorized users can interact with the system and view attendance data. Additional security measures, such as encryption protocols and firewall configurations, may be implemented to safeguard the system against unauthorized access and data breaches.

Operational Considerations:
The deployment of the system on a network infrastructure allows for centralized management and administration, streamlining the process of system maintenance and updates.
Regular monitoring of system performance and attendance data ensures the continued reliability and accuracy of the face-recognition-based attendance system.

RESULTS

The project aims to improve the existing face attendance system by using Face recognition library of python. The development for this project has utilized Python libraries well-known for their efficiency and user-friendly nature. In this project, we have tried to banish the challenges faced by management. Challenges such as – not having proper track of attendance, proxy attendance, difficulty in taking manual attendance etc.
We have successfully implemented face detection for each individual in the class. Using facial recognition, we accurately record the login and logout times for students. The recorded in and out times are stored in a CSV file. Overall, the use of python packages has resulted in effective, efficient and cost-effective attendance system. This approach ensures superior accuracy in recognizing multiple faces within a single frame while maintaining a faster response time.



4- Model Performance Metric

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"Acknowledgment(s)" is spelled without an "e" after the "g" in American English.

As you can see, the formatting ensures that the text ends in two equal-sized columns rather than only displaying one column on the last page.

This template was adapted from those provided by the IEEE on their own website.

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