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FACE RECOGNITION ATTENDANCE MANAGEMENT SYSTEM

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ABSTRACT

The Face Recognition Attendance Management System is an innovative solution developed to eliminate the need for manual roll calls. This system provides a quick and accurate replacement of traditional attendance methods by applying computer vision techniques such as Convolutional Neural Networks (CNN) and Haar Cascade. The system captures images, detects faces, and matches them with pre-stored images for automated attendance recording. Future enhancements include cloud integration and mobile app support for real-time monitoring.

Keywords: Face Recognition, Attendance Management, CNN, Opencv, Machine Learning, Deep Learning.

I. INTRODUCTION

Attendance Management System using Face Recognition Based on cutting-edge face recognition technology, the face recognition attendance management system is a creative and astute solution that automates the attendance marking procedure. The system scans a person's face in real time using a camera or webcam and extracts the results from a saved dataset using technologies like CNN, Dlib, and OpenCV. To increase recognition accuracy, the data set is organized into named folders that contain multiple person representation images. The system saves the user's name and timestamp in a CSV file after identifying a face. By removing the mistakes and inefficiencies seen in conventional attendance systems, it contributes to the revolution of the manual attendance method. The system can handle huge datasets and various users because it is designed to scale up, making it appropriate for usage in event management, workspaces, and educational institutions. In addition to offering potential for future development into features like cloud and mobile app support, this project presents an efficient use case for computer vision in eliminating manual labor.

A. Motivation:

The application face acknowledgment participation the executives framework has been created chiefly to dispose of the constraints and inadequacy of standard participation frameworks. Conventional methods like using ID cards or taking attendance manually are cumbersome, manipulatable and to some extent susceptible to human error. Due to these challenges, there is a need for a reliable and automated solution that provides accuracy, efficiency, and convenience. Led by IT, this program uses facial recognition technology to revolutionize the way students take attendance. Detects and identifies people in real-time through a webcam, acting as a remote person verification without any human verification or in-person interaction. The model is implemented such that it works nicely if the dataset is structured with all the photos in the specific folder name, further minimizing the chance of false recognition. This feature captures attendance automatically and stores it in a.CSV file (with the name and time stamps), switches on the webcam, detects faces and match them with the pre-stored images. The necessity to update attendance monitoring and make it more safe and effective is what inspired this project. Because it can manage several users at once and function well under changing conditions, this system also solves the scalability issue. In addition to saving time, the system's automation of the attendance process lays the groundwork for future integration of more sophisticated capabilities like cloud storage and support for mobile applications. Because of this, it is a useful tool for companies, educational institutions, and other organizational setups.

B. Objectives

- To Using real-time face recognition technology, the at tendance marking procedure will be automated. Accurate identification of individuals will be ensured by comparing their faces to a pre-saved dataset.
- Enhance security and accuracy using CNN and OpenCV.

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- Automate attendance tracking and storage.
- Ensure real-time processing and scalability.
- To minimize the need for manual intervention, decreasing errors and saving time.

II. LITERATURE SURVEY

Several studies have been conducted on face recognition for attendance management:

- Explores deep learning methods for facial recognition.
- Implements cnn-based attendance tracking.
- Discusses real-time face detection and classification.
- These studies highlight improvements in face recognition but lack real-time implementation considerations.

III. METHODOLOGY

The system follows these steps:

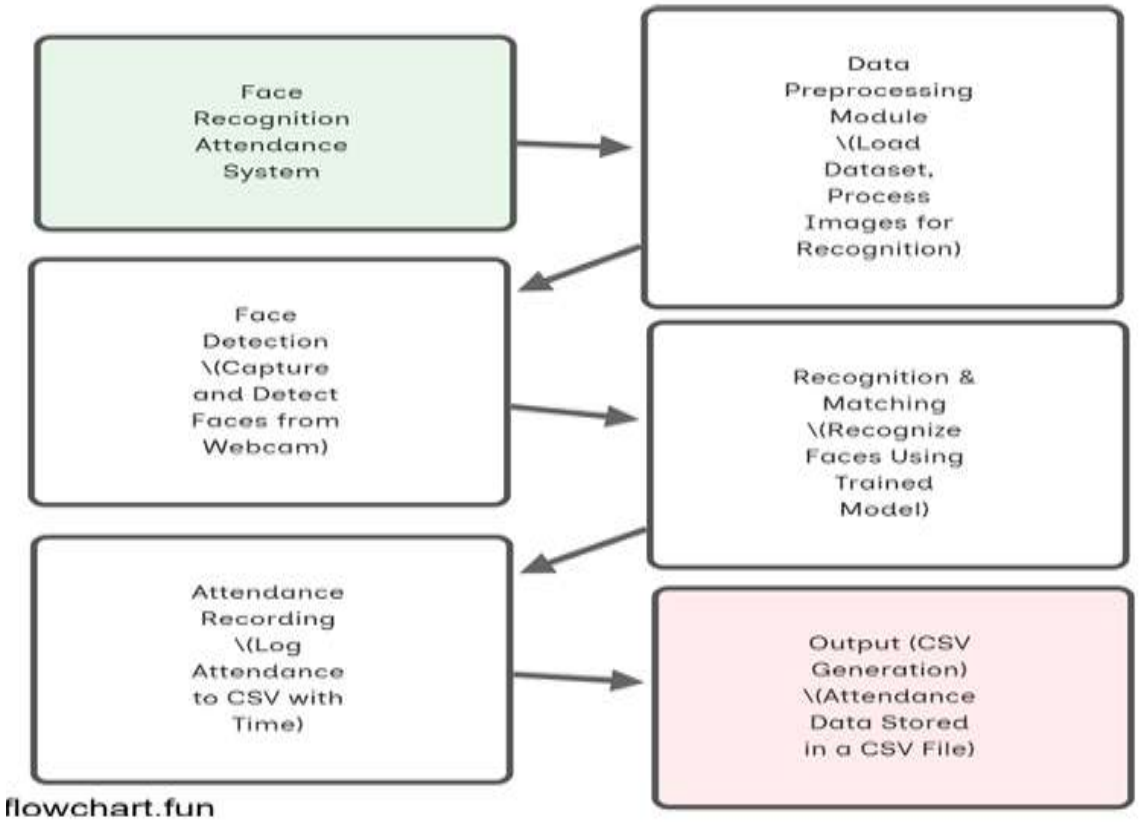

Figure 1: System Architecture of Face Recognition Attendance System.

Algorithm 1: Face Recognition Attendance Process
1: Initialize camera and load dataset.
2: Capture image and detect faces using OpenCV.
3: Extract facial features using CNN-based model.
4: Compare detected faces with stored dataset.
5: If a match is found, mark attendance and log time.
6: Store attendance data in a CSV file.
7: Display recognition result and update UI.

A. Dataset Preparation

The dataset consists of multiple images of each individual stored in a structured manner to enhance recognition accuracy.

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B. Face Detection and Recognition

OpenCV and Dlib libraries are used for face detection, while CNN-based models handle face recognition. The architecture, modules, data flow, and system interactions are all specified in the system design. The architecture, module breakdown, and essential elements of the Face Recognition Attendance Management System are covered in detail in this section. The Face Recognition Attendance Management System's sequence diagram shows how the administrator, student, and system interact. The administrator starts the procedure by uploading a dataset of student photos and initializing the system. These photos are encoded by the system for facial recognition. The system records a live frame of a student's face, recognizes it, and compares it to the encoded data that has been stored. When a match is made, the student's name, status, and timestamp are recorded in a CSV file along with the attendance. Later on, the administrator might examine the attendance record. This process guarantees smooth automation, precise attendance recording, and less need for human involvement.

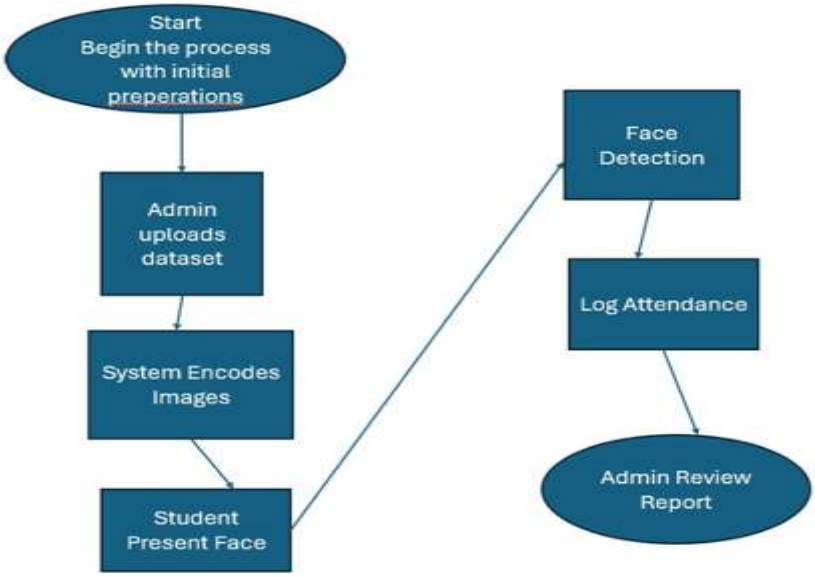

Figure 2: Face Recognition Process Flow

C. Diagram of the Use Case

By describing the interactions between the three main entities—Student, Admin, and System—the use case diagram illustrates the functional flow of the Face Recognition Atten dance Management System. Every entity carries out distinct tasks that support the general functioning of the system.

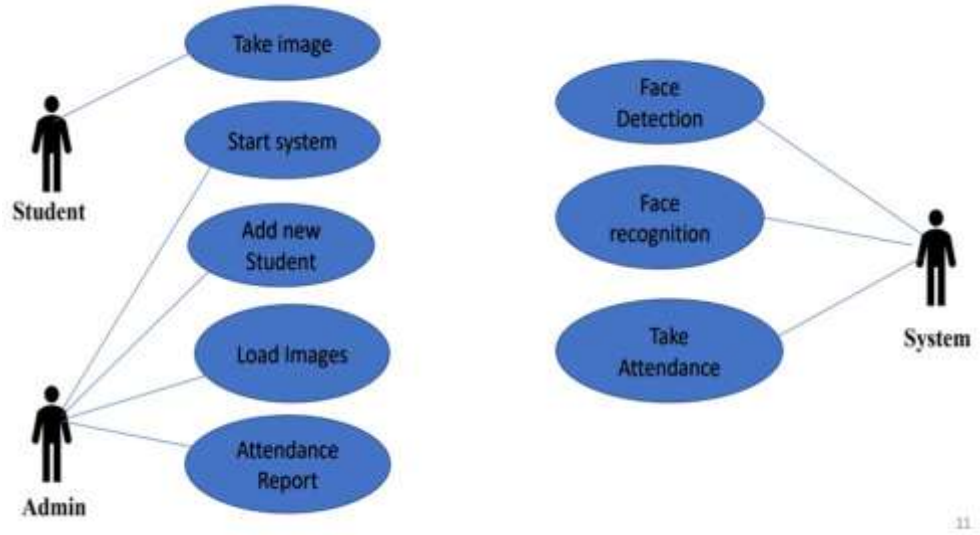

Figure 3: Use Case Diagram

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IV. IMPLEMENTATION DETAILS

A. Hardware and Software Requirements

A prerequisite Any system's engineering phase is essential because it establishes the requirements and capabilities the system must have. The specifications for the Face Recogni tion Attendance Management System have been meticulously outlined to guarantee effective operation, precision, and ease of use.

Hardware:

Webcam or camera module.

Multi-core CPU with GPU support for deep learning.

At least 8GB RAM for real-time processing.

Software:

Python programming language.

OpenCV, Dlib, NumPy, face-recognition library.

Pandas for attendance logging.

B. Configure and Bring in Libraries

Installing the required libraries is the first step. Use the following commands to install them if you haven't already:

pip install opencv-python

pip install opencv-python-headless

pip install dlib

pip install face recognition

pip install pandas

In your Python script, import the necessary libraries now:

import cv2 import dlib

import face_recognition

import pandas as pd

import numpy as np

from datetime import datetime

import os

1) Pre-processing Data: Encode and Load Faces:

This section manages the process of loading photos from a designated directory and encoding them for facial recognition. Load dataset images:

dataset path = "dataset"

known encodings = []

known names = []

for person name in os.listdir(dataset path):

person folder = os.path.join(dataset path, person name)

if os.path.isdir(person folder):

for image_name in os.listdir(person folder):

image_path = os.path.join(person folder, image_name)

image = face_recognition.load image file(image_path)

encoding = face_recognition.face_encodings(image)

if len(encoding) ¿ 0:

known_encodings.append(encoding[0])

known_names.append(person_name)

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C. Face Detection (using face_recognition)

The image is first converted to RGB format before the face detection program locates and reports the faces in the image. Then, faces in the image are identified using face_recognition.facelocations(), which returns the faces' locations (bounding box coordinates). The coordinates (top, right, bottom, and left) of a detected face are contained in each of the tuples that this method returns.

```
def detect faces(image):
rgb_image = cv2.cvtColor(image, cv2.COLOR BGR2RGB)
face_locations = face_recognition.face_locations(rgb image)
return face_locations
```

D. Face Recognition and Matching

By comparing observed faces with known face encodings (those that have already been loaded and encoded), this method can identify faces.

```
def recognize_faces(image, known_face_encodings, known_face_names):
faces(image, face locations = detect faces(image)
rgb_image = cv2.cvtColor(image, cv2.COLOR BGR2RGB)
face_encodings = face_recognition.face_encodings(rgb_image, face_locations)
recognized_names = []
for encoding in face encodings:
matches = face_recognition.compare_faces(known face encodings, encoding)
name = "Unknown"
if True in matches:
first_match_index = matches.index(True)
name = known_face_names[first_match_index]
recognized_names.append(name)
return recognized_names, face_locations
```

V. TESTING

The software development life cycle's (SDLC) testing phase is all about exploration and learning. Developers determine whether their programming and code meet customer requirements throughout the testing process. The outcomes of this stage can be utilized to lower the quantity of mistakes in the software application. The project team creates a test strategy before testing can start. Test scripts, which are instructions used by each tester to test the program, the types of testing, testing resources, how the product will be tested, and who should be the testers throughout each step are all included in the test plan. Consistency throughout testing is ensured via test scripts.

VI. RESULTS AND DISCUSSION

The system's accuracy is tested under different lighting conditions and facial expressions. Table I presents the recognition performance.

Table 1: Face Recognition Accuracy Under Various Conditions

Condition	Accuracy
Normal lighting	97%
Low lighting	85%
Partial occlusion	80%
Multiple faces in the frame	50%

A. Student successfully recognized

The Face Recognition Attendance System's operation is seen in the screenshot below. The system turns on the webcam to detect and identify faces in real time when the "Start Webcam" button is pressed. By comparing the

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identified face with the preloaded collection of photos, the system effectively identifies the person (for example, "K M Anil Kumar"), as seen in the image. A bounding box that highlights the face appears on the screen along with the recognized name. The precise use of the HOG-based face detection and recognition system is demonstrated by this procedure. In order to provide smooth and effective attendance monitoring, the system additionally records the identified person's attendance into a CSV file after recognition is finished. The project's primary objective of efficiently automating attendance management is reflected in this useful feature.

B. Student Unrecognized

The Face Recognition Attendance System can manage situations where a face is identified but not recognized, as seen in the screenshot below. If someone who isn't in the preloaded dataset shows up in front of the webcam, the system marks them as "Unknown." The label "Unknown" is shown, and a bounding box is drawn around the face. Maintaining accuracy and making sure that only people who are known are recorded into the attendance system depend on this feature. It also highlights how crucial it is to add additional people to the dataset as needed. The integrity of the system's records is also maintained by this function, which stops inaccurate information from being entered into the attendance log.

C. Attendance database

The system automatically logs the corresponding student's information into a CSV file when it recognizes a face. The technology compares the identified face with the preloaded collection of student photos during the recognition phase. The student's details, including name and USN (University Serial Number), are obtained after a match is discovered. In order to record the attendance, the system further records the current timestamp at the time of recognition. In addition to the student's name and USN, the attendance entry also provides the timestamp and the status "Present." A systematic and trustworthy attendance record is then ensured by appending this data to a file called attendance.csv. Attendance data may be easily stored in a CSV file, which makes it simple to inspect, download, or create reports for administrative use. This automated procedure ensures accuracy and efficiency in tracking attendance while doing away with manual labor.

VII. CONCLUSION

Using the Histogram of Oriented Gradients (HOG) algorithm for facial recognition and detection, the Face Recognition Attendance Management System offers a practical way to automate attendance procedures. By using a webcam to enable real-time face recognition, matching faces found with preloaded datasets, and precisely recording attendance in a CSV file, the system accomplishes its objectives. Systems operating on common hardware can benefit from the HOG-based method since it guarantees a good balance between computational economy and recognition accuracy. The project provides a user-friendly interface for smooth interaction and dependable attendance tracking, showcasing the usefulness of facial recognition technology. Although the system works effectively in controlled settings, outside variables like illumination or severe facial expressions can affect how accurate it is. Notwithstanding these drawbacks, the system is an effective and scalable solution for small to medium-sized use cases, setting the stage for upcoming improvements like cloud-based data integration or hybrid recognition models. All things considered, the project effectively illustrates how HOG-based facial recognition may be used to automate attendance tracking while using little resources Future improvements include:

- Cloud integration for centralized data storage.
- Mobile application for remote attendance management.
- Improved real-time accuracy with advanced CNN models.

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