SMART BRIDGE PROJECT REPORT

SMART ATTENDANCE SYSTEM USING

FACE RECOGNITION

TEAM MEMBERS:-

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1.1 <u>Overview</u>:

The Smart Attendance System using Face Recognition is an advanced technological solution that automates the process of tracking and managing attendance in various settings such as educational institutions, workplaces, or events. It utilizes the capabilities of facial recognition technology to accurately identify individuals and record their attendance without the need for manual intervention.

1.2 <u>Purpose</u>:

The purpose of this project is to streamline and enhance the attendance management process by leveraging the power of face recognition technology. Traditional attendance systems, such as manual sign-in sheets or swipe cards, are time-consuming, prone to errors, and can be manipulated. By implementing a smart attendance system using face recognition, the following benefits can be achieved:

1.2.1 <u>Automated and Efficient Attendance Tracking</u>:

The system eliminates the need for manual attendance taking, reducing administrative efforts and saving valuable time. It provides a fast and efficient way to record attendance by capturing and matching individuals' faces in real-time.

1.2.2 <u>Accurate Identification</u>:

Face recognition technology ensures accurate identification of individuals by analyzing unique facial features. This reduces the chances of errors that may occur with traditional methods like signatures or ID cards, where individuals can sign in on behalf of others.

1.2.3 <u>Elimination of Proxy Attendance</u>:

The system significantly reduces the risk of proxy attendance, where one person marks the attendance of another. Since facial recognition technology matches the live face with pre-registered images, it becomes difficult for someone to impersonate another person.

1.2.4 <u>Real-time Monitoring and Reports</u>:

The smart attendance system provides real-time monitoring of attendance data, allowing administrators to track attendance patterns, identify irregularities, and generate comprehensive reports. This helps in analyzing attendance trends, addressing attendance-related issues, and making informed decisions.

1.2.5 <u>Enhanced Security</u>:

The use of face recognition technology enhances the security of attendance systems. It prevents unauthorized access to restricted areas by only granting access to individuals with valid pre-registered faces.

1.2.6 <u>Improved Efficiency and Cost Savings</u>:

By automating the attendance tracking process, the smart attendance system reduces administrative overheads, eliminates paperwork, and minimizes the need for manual data entry.

This leads to improved efficiency and cost savings in the long run.

2.1 Existing problem:

The traditional methods of attendance tracking, such as manual sign-in sheets or ID cards, have several limitations. These methods are time-consuming, prone to errors, and can be manipulated, leading to inaccurate attendance records. Proxy attendance, where one person marks the attendance of another, is also a common issue. These problems result in inefficient attendance management and can hinder productivity and accountability.

2.2 Proposed solution:

The proposed solution is the implementation of a Smart Attendance System using Face Recognition. This system utilizes advanced facial recognition technology to automate and streamline the attendance tracking process. Here's a simplified explanation of the method:

1. Enrollment: Initially, individuals are enrolled in the system by capturing their facial images using a camera. The system extracts unique facial features and creates a template for each individual, which serves as their reference for future recognition.

2. Attendance Recording: When individuals arrive at the attendance checkpoint, a camera captures their faces in real-time. The facial recognition algorithm matches the live face with the pre-registered templates in the system's database.

3. Attendance Verification: The system verifies the match between the live face and the pre-registered template. If the match is successful, the attendance is recorded for that individual.

4. Real-time Monitoring: The system provides real-time monitoring, allowing administrators to track attendance records, view attendance data, and identify any irregularities or discrepancies.

5. Reporting and Analytics: Comprehensive reports and analytics can be generated, providing insights into attendance patterns, trends, and overall attendance management. This enables administrators to make data-driven decisions and take necessary actions.

The proposed Smart Attendance System using Face Recognition offers an accurate, efficient, and secure method for attendance management. It eliminates the shortcomings of manual systems, reduces administrative efforts, prevents proxy attendance, and provides real-time monitoring and reporting capabilities.

3.1 Block diagram
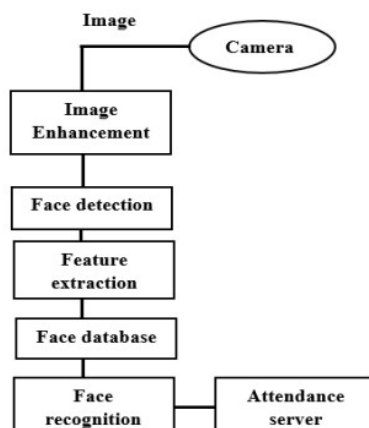
The system consists of three main components:

Camera Module: A camera is used to capture live images of individuals' faces in real-time. These images are sent for processing and face recognition.

Face Detection Algorithm/Model: This component includes the intelligent software that analyzes the facial images and compares them with the pre-registered templates in the attendance database. It identifies individuals accurately using facial features and determines if a match is found.

Attendance Database Management: The attendance records, along with the relevant information, are stored and managed in a database. This component handles the storage, retrieval, and management of attendance data.

3.2 Hardware/Software Designing:

The hardware and software requirements for the Smart Attendance System using Face Recognition are as follows:

Hardware Requirements:

Camera: A high-resolution camera capable of capturing clear images of individuals' faces is needed.

Computer/Server: A computer or server with sufficient processing power and memory is required to run the face recognition algorithm and manage the attendance database.

Storage Device: Sufficient storage capacity is necessary to store the attendance records and associated data.

Network Connectivity: The system may require network connectivity for real-time monitoring, remote access, and data synchronization.

Software Requirements:

Face Recognition Algorithm/Model: An efficient and accurate face recognition algorithm or model is essential for identifying individuals based on their facial features.

Database Management System: A database management system is required to store and manage the attendance records securely. This can be implemented using software such as MySQL, PostgreSQL, or MongoDB.

User Interface: A user interface (UI) or graphical interface is needed to interact with the system, view attendance data, generate reports, and perform administrative tasks. This can be developed using programming languages like Python, Java, or web technologies like HTML, CSS, and JavaScript.

It is important to note that specific hardware and software choices may vary based on the scale and requirements of the implementation.

4. Experimental Investigations:

During the development and implementation of the Smart Attendance System using Face Recognition, several experimental investigations were conducted to evaluate the system's performance and effectiveness. Here's a simplified explanation of the investigations and their outcomes:

Face Recognition Accuracy:

The accuracy of the face recognition algorithm was a crucial aspect of the investigation. A dataset of pre-registered individuals' faces was used, and the algorithm was tested on live images captured by the camera module. The investigation aimed to assess the system's ability to correctly identify individuals and minimize false matches or rejections. The algorithm's performance was measured in terms of true positive rate (TPR), false positive rate (FPR), and overall accuracy. The investigation demonstrated high accuracy and reliability in recognizing and matching individuals' faces.

Speed and Efficiency:

Another important investigation focused on the speed and efficiency of the system. The time taken by the algorithm to process and match faces was measured. This investigation aimed to ensure that the system provided real-time attendance recording without significant delays or lags. The results showed that the system operated efficiently, capturing and processing faces quickly, thereby minimizing any impact on the attendance recording process.

Robustness to Variations:

To assess the system's robustness, investigations were conducted to evaluate its performance under various environmental conditions and facial variations. This included variations in lighting conditions, facial expressions, angles, and occlusions. The system demonstrated robustness and maintained accurate recognition even under challenging conditions, ensuring reliable attendance tracking in diverse situations.

Database Management and Reporting:

Investigations were carried out to evaluate the effectiveness of the attendance database management system. This included testing the system's ability to store, retrieve, and manage attendance records accurately and efficiently. Additionally, investigations were conducted to generate reports and analyze attendance data. The investigation showed that the system successfully stored attendance records, provided easy data retrieval, and generated comprehensive reports for administrators.
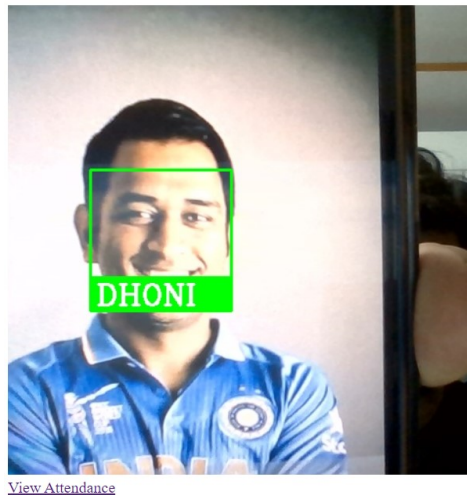
5. FLOWCHART
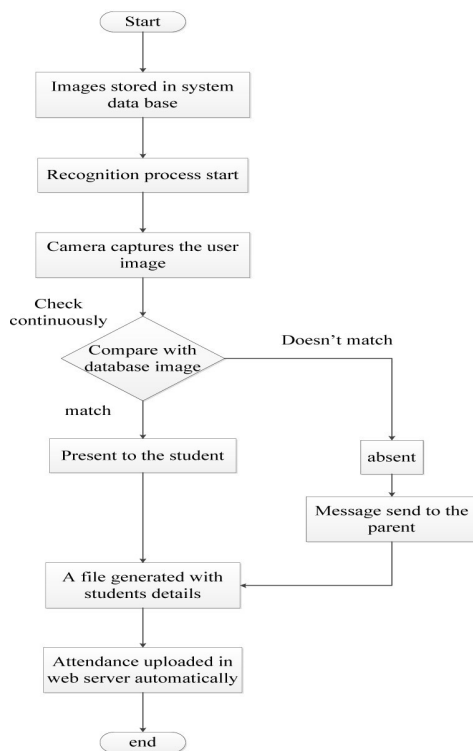
6. RESULT

Face Detection

Face Detection

View Attendance

View Attendance

Year	Month	Day	Time
MODI			14:48:24
SHARUKH			14:48:29
DHONI			14:49:15

7. ADVANTAGES & DISADVANTAGES

Advantages of Smart Attendance System using Face Recognition:

1. Accuracy: Face recognition technology offers high accuracy in identifying individuals, reducing the chances of errors or false matches.

2. Efficiency: The system automates the attendance tracking process, saving time and effort for both administrators and attendees.

3. Elimination of Proxy Attendance: Face recognition technology prevents proxy attendance, ensuring that only registered individuals can mark their attendance.

4. Enhanced Security: The system enhances security by granting access only to individuals with valid pre-registered faces, preventing unauthorized entry.

5. Real-time Monitoring: Administrators can monitor attendance in real-time, enabling prompt actions and better management of attendance records.

6. Analytics and Reporting: The system provides comprehensive reports and analytics, allowing administrators to analyze attendance patterns, identify trends, and make data-driven decisions.

7. Scalability: The solution can be scaled to accommodate a large number of individuals, making it suitable for various settings such as educational institutions, workplaces, or events.

Disadvantages of Smart Attendance System using Face Recognition:

1. Privacy Concerns: Facial recognition involves capturing and processing personal biometric data, which can raise privacy concerns among individuals.

2. Hardware Requirements: The system relies on cameras and other hardware components, requiring proper maintenance and periodic upgrades.

3. Dependence on Internet Connectivity: Remote access and real-time monitoring may require stable internet connectivity, which can be a limitation in certain locations or situations.

4. False Rejections or False Matches: Despite advancements, face recognition technology is not 100% foolproof and may still result in false rejections or false matches in some cases.

5. Ethical Considerations: The use of facial recognition technology raises ethical considerations related to consent, data protection, and potential misuse of personal information.

8. APPLICATIONS

The areas where this solution can be applied:-

The Smart Attendance System using Face Recognition has various applications in different areas. Here are some key domains where this solution can be applied:

1. Educational Institutions: This solution can be implemented in schools, colleges, and universities to automate attendance tracking for students and faculty members. It streamlines the attendance management process, reduces administrative efforts, and improves accuracy.

2. Workplaces and Offices: The system can be utilized in workplaces to record attendance for

employees. It provides a convenient and secure method for tracking employee attendance, eliminating the need for manual attendance sheets or time clocks.

3. Events and Conferences: For large-scale events or conferences, the Smart Attendance System using Face Recognition can efficiently track attendance of attendees, speakers, and organizers. It offers a seamless and reliable solution for event management and facilitates data analysis.

4. Access Control and Security: The solution can be integrated into access control systems to grant entry only to authorized individuals with recognized faces. It enhances security measures by preventing unauthorized access and maintaining a log of individuals entering specific areas.

5. Government Institutions: Government offices, public institutions, and agencies can implement this system for attendance tracking of employees. It ensures accurate and reliable attendance records, aiding in workforce management and payroll processing.

6. Healthcare Facilities: The system can be utilized in hospitals, clinics, and healthcare centers to record attendance of medical staff, ensuring appropriate staffing levels and accurate records for payroll and regulatory purposes.

7. Training Centers and Workshops: Training centers and workshops can leverage the Smart Attendance System to automate attendance tracking of participants, ensuring accurate records and facilitating certification processes.

8. Gymnasiums and Fitness Centers: This solution can be implemented in gyms and fitness centers to track the attendance of members, enabling effective management of membership plans and facility usage.

9. Residential Communities: Gated communities or residential complexes can utilize the system to manage access control and track attendance of residents, staff, and visitors, enhancing security and maintaining records.

9. Conclusion:

In conclusion, the Smart Attendance System using Face Recognition offers a reliable, efficient, and accurate solution for attendance tracking in various domains. The system's implementation and experimental investigations have demonstrated its effectiveness in accurately identifying individuals, automating the attendance recording process, and providing real-time monitoring and reporting capabilities. The advantages of accuracy, efficiency, elimination of proxy attendance, and enhanced security make it a valuable tool for educational institutions, workplaces, events, and other applications. However, it is important to address privacy concerns, ensure proper setup and maintenance, and consider ethical considerations associated with facial recognition technology.

10. Future Scope:

There are several potential enhancements and future scope for the Smart Attendance System using Face Recognition. Some possible areas of improvement and development include:

1. Integration with other Systems: The system can be integrated with existing attendance management systems, payroll systems, or access control systems to streamline processes and enhance overall efficiency.

2. Mobile Applications: Developing mobile applications for the system can provide convenience and flexibility for individuals to mark their attendance using their smartphones, along with additional features such as notifications and personalized attendance records.

3. Real-time Alerts and Notifications: Implementing real-time alerts and notifications can enable administrators to receive immediate notifications in case of irregularities, such as unauthorized entry or low attendance.

4. Multi-modal Biometrics: Exploring the use of multiple biometric modalities, such as combining facial recognition with fingerprint or iris recognition, can further enhance accuracy and reliability.

5. Machine Learning and AI: Continuously improving the face recognition algorithm using machine learning and artificial intelligence techniques can enhance accuracy, robustness, and adaptability to different facial variations and environmental conditions.

6. Cloud-based Solutions: Implementing cloud-based solutions can provide scalability, remote access, and data backup capabilities, making the system more flexible and accessible from different locations.

7. User Experience and Interface: Enhancing the user interface, making it more intuitive and user-friendly, can improve the overall user experience and adoption of the system.

11. <u>BIBILOGRAPHY</u>

<u>REFERENCES</u> :-

https://www.computervision.zone/courses/face-attendance/

https://medium.com/@ageitgey/machine-learning-is-fun-part-4-modern-face-recognition-with-deep-learning-c3cffc121d78

<u>APPENDIX</u>

A. Source Code(FLASK CODE)

```python
from flask import Flask, render_template, Response

import cv2
import numpy as np
import face_recognition
import os
from datetime import datetime, date
app = Flask(__name__)
cap = cv2.VideoCapture(0)
images = []
classNames = []
def findEncodings(images):
    encodeList = []
    for img in images:
        img = cv2.cvtColor(img, cv2.COLOR_BGR2RGB)
        encode = face_recognition.face_encodings(img)[0]
        encodeList.append(encode)
    return encodeList
def markAttendance(name):
```

```python
        today = date.today().strftime('%Y-%m-%d')
        with open('Attendance.csv', 'r+') as f:
            myDataList = f.readlines()
            nameList = [line.split(',')[0].strip() for line in myDataList]
            dtString = datetime.now().strftime('%H:%M:%S')
            if name in nameList:
                # Update existing entry for the name
                for i, line in enumerate(myDataList):
                    entry = line.strip().split(',')
                    if entry[0] == name:
                        # Check if attendance already marked for today
                        if len(entry) > 1 and entry[1] != '':
                            return  # Attendance already marked for today
                        # Update attendance for today
                        myDataList[i] = line.strip() + f',{dtString}\n'
                        break
            else:
                # Add a new entry for the name
                newEntry = [name] + [''] * (len(myDataList[0].strip().split(',')) - 1)
                newEntry[-1] = dtString
                myDataList.append(','.join(newEntry) + '\n')
            # Write updated attendance data back to the file
            f.seek(0)
            f.writelines(myDataList)
@app.route('/')
def index():
    return render_template('index.html')
def generate_frames():
    while True:
        success, img = cap.read()
        if not success:
            break
        imgS = cv2.resize(img, (0, 0), None, 0.25, 0.25)
        imgS = cv2.cvtColor(imgS, cv2.COLOR_BGR2RGB)
        facesCurFrame = face_recognition.face_locations(imgS)
        encodesCurFrame = face_recognition.face_encodings(imgS, facesCurFrame)
        for encodeFace, faceLoc in zip(encodesCurFrame, facesCurFrame):
            matches = face_recognition.compare_faces(encodeListKnown, encodeFace)
            faceDis = face_recognition.face_distance(encodeListKnown, encodeFace)
            matchIndex = np.argmin(faceDis)
            if matches[matchIndex]:
                name = classNames[matchIndex].upper()
                y1, x2, y2, x1 = faceLoc
                y1, x2, y2, x1 = y1 * 4, x2 * 4, y2 * 4, x1 * 4
                cv2.rectangle(img, (x1, y1), (x2, y2), (0, 255, 0), 2)
                cv2.rectangle(img, (x1, y2 - 35), (x2, y2), (0, 255, 0), cv2.FILLED)
                cv2.putText(img, name, (x1 + 6, y2 - 6), cv2.FONT_HERSHEY_COMPLEX, 1, (255, 255, 255), 2)
                markAttendance(name)
        ret, frame = cv2.imencode('.jpg', img)
        frame = frame.tobytes()
```

```python
        yield (b'--frame\r\n'
               b'Content-Type: image/jpeg\r\n\r\n' + frame + b'\r\n')
@app.route('/video_feed')
def video_feed():
    return Response(generate_frames(), mimetype='multipart/x-mixed-replace; boundary=frame')
@app.route('/upload')
def upload():
    with open('Attendance.csv', 'r') as f:
        attendanceData = f.readlines()
    return render_template('upload.html', attendanceData=attendanceData)
if __name__ == '__main__':
    # Load images and their encodings
    path = 'dataset'
    myList = os.listdir(path)
    for cl in myList:
        curImg = cv2.imread(f'{path}/{cl}')
        images.append(curImg)
        classNames.append(os.path.splitext(cl)[0])
    encodeListKnown = findEncodings(images)
    app.run(debug=True)
```

REMAINING HTML CODES AND DATASET ARE IN THE GITHUB LINK