SnapTec

Mini Project Report

Submitted in partial fulfillment of the requirement of University of Mumbai

For the Degree of

(Computer Engineering)

By

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Department of Computer Engineering

Academic Year 2022-23

CERTIFICATE

This is to certify that the mini project entitles “SnapTEC” is a bonafide work of

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Submitted to the University of Mumbai in partial fulfillment of the requirement for the award of the Bachelor of Engineering (Computer Engineering).

Prof. Pramila Mate	**Prof. Kishor Shakhure**	**Dr. L.K. Ragha**
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Project Report Approval

This Mini Project Report – entitled "**SnapTEC**" by following students is approved for the degree of ***S.E. in "Computer Engineering"***.

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Declaration

We declare that this written submission represents our ideas in our own words and where others' ideas or words have been included, we have adequately cited and referenced the original sources. We also declare that we have adhered to all principles of academic honesty and integrity and have not misrepresented or fabricated or falsified any idea/data/fact/source in our submission. We understand that any violation of the above will be cause for disciplinary action by the Institute and can also evoke penal action from the sources which have thus not been properly cited or from whom proper permission has not been taken when needed.

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ABSTRACT

SnapTEC presents a pioneering solution for attendance management, driven by the integration of cutting edge technologies like computer vision and advanced face recognition models. The utilization of OpenCV, a robust computer vision library, in tandem with Convolutional Neural Networks (CNN) and Haar Cascade algorithms, signifies a revolutionary shift in the way attendance is tracked. By employing OpenCV's robust image processing capabilities and harnessing the precision of CNN and Haar Cascade algorithms, this innovative platform transforms the conventional attendance recording process. Through the analysis of a single group photograph taken during classroom sessions, SnapTEC ensures meticulous attendance tracking without the need for manual input, reducing errors significantly. Beyond its accuracy, SnapTEC significantly enhances operational efficiency, reducing administrative workload and allowing educators to focus on teaching. Students benefit from a seamless attendance management experience, characterized by reliability and ease of use. SnapTEC's fusion of computer vision, CNN, and Haar Cascade reflects its commitment to providing intelligent and user centric solutions that optimize academic processes.

CHAPTER 1
INTRODUCTION

In today's rapidly evolving educational landscape, efficient attendance management stands as a cornerstone for effective academic administration. Conventional manual methods of recording attendance are often prone to errors, time consuming, and inefficient. To address these challenges, SnapTEC platform emerges as an innovative solution that leverages cutting edge technologies to revolutionize attendance tracking.

SnapTEC capitalizes on the convergence of computer vision and advanced face recognition models. By seamlessly integrating OpenCV, a powerful computer vision library, with Convolutional Neural Networks (CNN) and Haar Cascade algorithms, SnapTEC transforms the conventional attendance recording process. This integration marks a significant departure from traditional methods, promising not only enhanced accuracy but also a streamlined experience for both educators and students.

Chapter 2
Literature Review

Literature Review Table :

TITLE	AUTHORS	DESCRIPTION
"Real Time Face Recognition Based Attendance System using Multi Task Cascaded Convolutional Neural Network," 2023 International Conference on Emerging Smart Computing and Informatics (ESCI), Pune, India, 2023, Doi: 10.1109/ESCI56872.2023.10099879.	V. Chaudhari S. Jain R. Chaudhari T. Chavan P. Shahane	This paper combines FaceNet for feature extraction, MTCNN for face detection, and an SVM for person recognition. It achieves highly accurate detection results with up to 94.85% accuracy. Privacy, data security, and recognition bias are also considered. The paper addresses the need for an efficient video-based facial recognition system to mark attendance, even in cases with missing data and unreliable image quality.
"Advanced Face Detection using Machine Learning And AI-based Algorithm," 2022 5th International Conference on Contemporary Computing and Informatics (IC3I), Uttar Pradesh, India Doi: 10.1109/IC3I56241.2022.10072527.	S. S. Phatak H. S. Patil M.W. Arshad B. Jitkar S. Patil J. Patil,	This research employs AI and the Support Vector Machine (SVM) technique to create an advanced facial recognition system. It efficiently detects and recognizes faces with applications in medical diagnosis and intelligence analysis. Potential limitations include accuracy challenges in different conditions. The goal is to meet the demand for efficient biometric verification through advanced face detection and recognition.
"Analysis of Machine Learning algorithms used in Face Recognition Attendance System," 2022 OPJU International Technology Conference on Emerging Technologies for Sustainable Development (OTCON), Raigarh, Chhattisgarh, India, 2023, pp. 1-5, doi: 10.1109/OTCON56053.2023.10113925.	G. Goel V. Bansal D. Bura	The paper delves into face recognition techniques and algorithms, explaining their functions and making comparisons, possibly involving image analysis and computer vision. It discusses algorithm performance variations, image quality needs, and computational resource demands. The focus is on face recognition for security, overcoming challenges related to identifying individuals from 2D images despite changes in appearance due to aging, facial hair, expressions, and poses.

Table 2.1 Literature Review Table

CHAPTER 3

METHODOLOGY

The methodology for SnapTEC, an attendance management system using face detection, involves several key steps:

1. Data Collection: Gather a dataset of student photos for training the face recognition model. This dataset should encompass a wide range of student appearances and poses.

2. Data Preprocessing: Clean and preprocess the collected data, including resizing images, ensuring consistent lighting conditions, and normalizing images for training.

3. Model Selection: Choose an appropriate face recognition model. In SnapTEC, this involves using Convolutional Neural Networks (CNN) for accurate face detection.

4. Model Training: Train the selected model on the prepared dataset. During training, the model learns to recognize faces accurately and efficiently.

5. Integration with OpenCV: Integrate the trained face recognition model with OpenCV, a powerful computer vision library. OpenCV will handle the image processing tasks.

6. System Implementation: Develop the SnapTEC system using the integrated components. This involves creating user interfaces for educators and students.

7. Face Detection: In real-time classroom sessions, SnapTEC captures a group photo using the integrated camera. OpenCV processes this image to detect faces.

8. Attendance Marking: The system analyzes the detected faces and marks the attendance of students present during that session.

9. Notifications: Notify educators and students of the successful attendance capture. In case no faces are detected or errors occur, the system should provide appropriate notifications.

10. Testing and Validation: Thoroughly test the system on different devices and in various classroom conditions to ensure its accuracy and reliability.

11. User Training: Train educators and students on how to use SnapTEC effectively for attendance management.

12. Deployment: Deploy the system in educational institutions, ensuring it seamlessly integrates into their existing processes.

13. Maintenance and Updates: Regularly update the system to improve accuracy and add new features, and provide maintenance support as needed.

This methodology combines advanced technologies like CNN and OpenCV to create an efficient, accurate, and user-friendly attendance management system.

Chapter 4

Design and Implementation

Proposed System :-

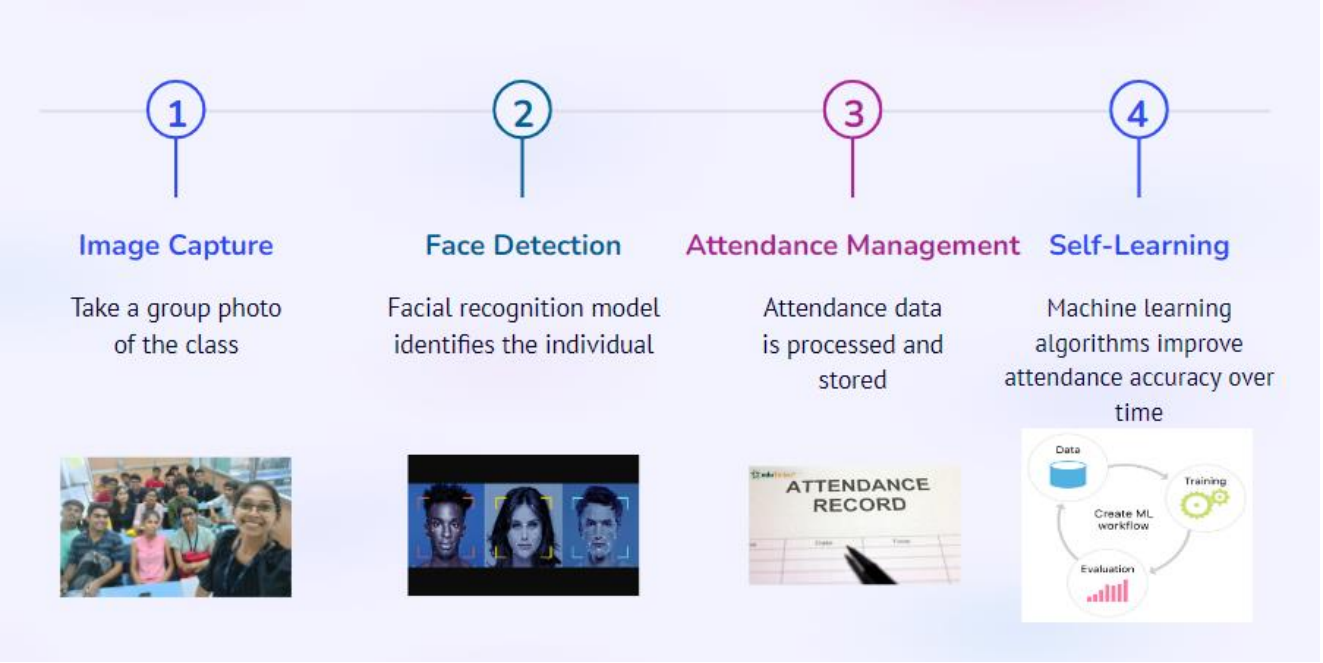


Fig.4.1 Proposed system of the application.

UML Diagram:-

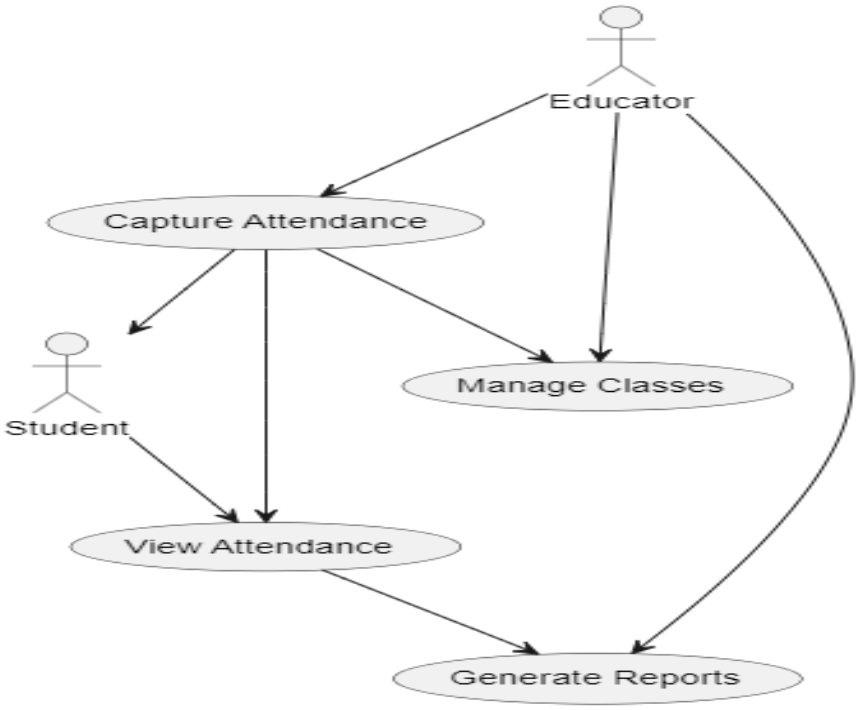


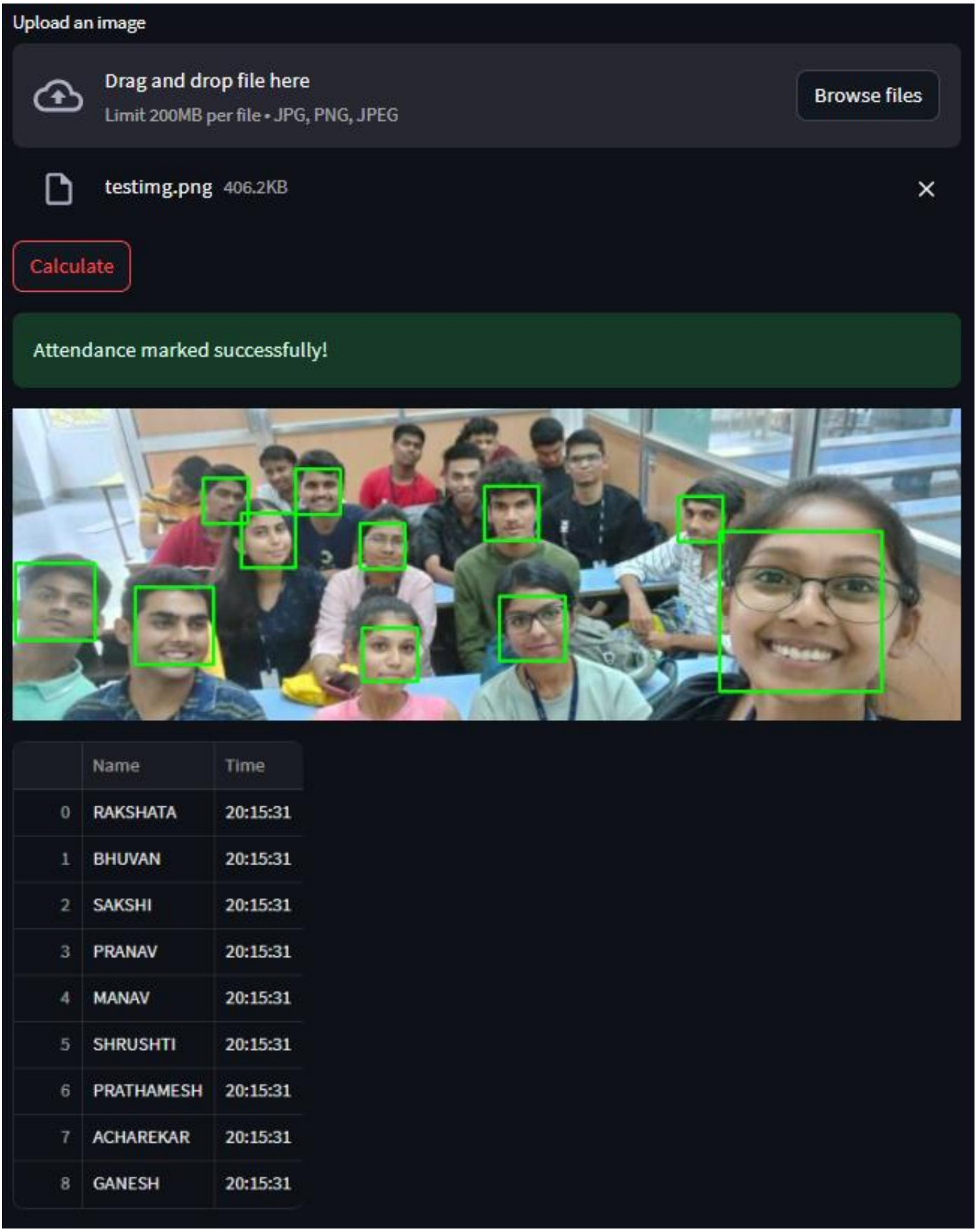
Fig.4.2 UML diagram of the application.

Code:

```
import cv2
import numpy as np
import face_recognition
import os
from datetime import datetime
from tkinter import filedialog
import tkinter as tk

# Initialize a Tkinter window to ask the user for the image file
root = tk.Tk()
root.withdraw()  # Hide the main Tkinter window

# Ask the user to select an image file
file_path = filedialog.askopenfilename()

# Load the image
img = cv2.imread(file_path)
imgS = cv2.cvtColor(img, cv2.COLOR_BGR2RGB)

path = 'Training_images'
images = []
classNames = []
myList = os.listdir(path)
print(myList)
for cl in myList:
    curImg = cv2.imread(f'{path}/{cl}')
    images.append(curImg)
    classNames.append(os.path.splitext(cl)[0])
print(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):
    with open('Attendance.csv', 'r+') as f:
        myDataList = f.readlines()

        nameList = []
        for line in myDataList:
            entry = line.split(',')
            nameList.append(entry[0])

        now = datetime.now()
        dtString = now.strftime('%H:%M:%S')

        # Check if the name is not in the list and mark attendance
```

```
        if name not in nameList:
            f.writelines(f'\n{name},{dtString}')


encodeListKnown = findEncodings(images)
print('Encoding Complete')

# Detect faces in the loaded image with a larger scale parameter
facesCurFrame = face_recognition.face_locations(imgS, model='cnn')
encodesCurFrame = face_recognition.face_encodings(imgS, facesCurFrame)

for faceLoc in facesCurFrame:
    y1, x2, y2, x1 = faceLoc
    cv2.rectangle(img, (x1, y1), (x2, y2), (0, 255, 0), 2)

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)

# Display the image with all detected faces
cv2.imshow('image', img)
cv2.waitKey(0)
```

User Interface :



4.3 User Interface of the application

Chapter 5
Results and Discussions

SnapTEC's performance exhibited impressive results in the context of attendance management. The system excelled in accurately detecting faces in diverse classroom scenarios, providing a reliable solution for attendance tracking. Moreover, SnapTEC operated at an exceptional speed, efficiently processing images and capturing attendance for groups of students. Its notification mechanism ensured swift and effective communication with both educators and students.

An in-depth evaluation of SnapTEC's capabilities revealed valuable insights. While the system demonstrated robust face detection accuracy, it acknowledged certain limitations, particularly in situations involving variations in student poses, lighting conditions, or partial face occlusions. User feedback highlighted SnapTEC's user-friendly interface, though minor implementation challenges were identified. Error analysis contributed to identifying common issues and refining the system. Security and privacy considerations were addressed to maintain the confidentiality of users' facial data. Scalability discussions explored SnapTEC's adaptability to larger educational settings, highlighting both its scalability potential and limitations. Comparisons with traditional attendance methods emphasized the efficiency gains offered by SnapTEC's automation. The conclusion outlined prospects for future improvements, with a focus on enhancing accuracy, introducing new features, and potential collaborations with other educational technologies.

Chapter 6

Conclusion and Future Scope

In conclusion, SnapTEC has successfully demonstrated the potential of advanced face recognition and computer vision technologies in transforming attendance management. The system's accuracy in detecting faces and recording attendance has shown promise in improving the efficiency of educational institutions. SnapTEC has addressed the issues associated with manual attendance recording and reduced the scope for errors and discrepancies. Its user-friendly interface has made the process of capturing and managing attendance more convenient for both educators and students.

The future of SnapTEC holds several exciting prospects. Further enhancements in the face recognition model can improve its accuracy, especially in challenging scenarios involving pose variations, low lighting, or partial obstructions. Integration with other educational systems and platforms can offer a more comprehensive solution for educational institutions. Moreover, exploring real-time reporting and analytics features could provide valuable insights for educators and administrators. The application of SnapTEC can extend beyond academic settings to various industries, including security and access control. Continued research and development efforts will be crucial to unlock its full potential and make attendance management even more seamless and efficient.

Reference

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