AUTOMATED ATTENDANCE SYSTEM USING DEEP LEARNING

PROJECT

Submitted in partial fulfilment
of the requirements for the degree of

B.Sc Honours (Data Science)

by

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CERTIFICATE

This is to certify that the PROJECT WORK entitled

"AUTOMATED ATTENDANCE SYSTEM USING DEEP LEARNING"

submitted by **Ms. NEERAJA GOLI**,

bearing the Hall Ticket No. **107220546035**

in satisfactory manners as partial fulfilment of the sessional requirements

leading to the award of the degree in

B.Sc Honours (Data Science)

during the academic year 2022-23

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DECLARATION

I hereby declare that the project work presented, **"AUTOMATED ATTENDANCE SYSTEM USING DEEP LEARNING ,"** is original and has been carried out by myself under the supervision of **Mrs.K. PADMA PRIYA**, Assistant Professor, Department of Computer Science, Bhavan's Vivekananda College of Science, Humanities and Commerce, Hyderabad, India. All prior work upon which this project is built is cited at appropriate places. I further declare that this work has not been submitted in part or full for the award of any degree of this or any other university.

NEERAJA GOLI
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To My Beloved Parents

Mr. JAGADEESH GOLI

&

Mrs. USHA RANI GOLI

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ABSTRACT

AUTOMATED ATTENDANCE SYSTEM USING DEEP LEARING

Nowadays Educational institutions are concerned about the regularity of student attendance. Mainly there are two conventional methods of marking attendance which are calling out the roll call or by taking student signs on paper. They both were more time consuming and difficult.

Hence, to resolve this problem, a smart and auto attendance management system is being utilized. But authentication is an important issue in this system. The smart attendance system is generally executed with the help of biometrics. Face recognition is one of the biometric methods to improve this system. Being a prime feature of biometric verification, facial recognition is widely being used in several such applications, like video monitoring and CCTV footage system, an interaction between computer & humans. By utilizing this framework, the problem of proxies and students being marked present even though they are not physically present can easily be solved.

The main implementation steps used in this type of system are face detection and recognizing the detected face. Our objective is to propose a model for implementing an automated attendance management system for students of a class by making use of face recognition technique. This model will be a successful technique to manage the attendance and records of students. After face recognition, attendance reports will be generated and stored in an Excel format.

The system is tested under various conditions like illumination, head movements. After vigorous testing, overall complexity and accuracy can be calculated. The Proposed system proves to be an efficient and robust device for taking attendance in a classroom without any time consumption and manual work.

KEYWORDS: Attendance, Face recognition, Excel, Classroom

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Abbreviations

CNN - Convolution Neural Network

HOG - Histogram of Oriented Gradient

SVM - Support Vector Machine

LBPH -Local Binary Patterns Histograms

FRT - Face Recognition Technology

GUI - Graphical User Interface

ReLU- Rectified Linear Unit

DL- Deep Learning

OpenCV- Open Source Computer Vision Library

IDE- Integrated development environment

Chapter 1

Introduction

Introduction

Attendance maintenance is a significant function in all the institutions to monitor the performance of the students. Every institute does this in its own way. Some of these institutes use the old paper or file based systems and some have adopted strategies of automatic attendance using some biometric techniques.

A Facial recognition system is computerized biometric software which is suited for determining or validating a person by performing comparison on patterns based on their facial appearances. Face recognition systems have upgraded appreciably in their management over the recent years and this technology is now vastly used for various objectives like security and in commercial operations. Face recognition is a powerful field of research which is a computer based digital technology. Face recognition for the intent of marking attendance is a resourceful application of attendance system. It is widely used in security systems and it can be compared with other biometrics such as fingerprint or eye iris recognition systems. As the number of students in an educational institute or employees at an organization increases, the needs for lecturers or to the organization also increase the complication of attendance control. This project may be helpful for the explanation of these types of problems. The number of students present in a lecture hall is observed, each person is identified and then the information about the number of students who are present is maintained.

An attendance system using face recognition is a technological solution that automates the process of marking attendance in schools, universities, or organizations. It works by capturing the image of a person's face and using facial recognition algorithms to match it with stored data. The system is efficient, reliable, and eliminates the need for manual attendance marking. Face recognition being a biometric technique implies determination if the image of the face of any particular person matches any of the face images that are stored in a database. This difficulty is tough to resolve automatically because of the changes that several factors, like facial expression, aging and even lighting can affect the image. Facial recognition among the various biometric techniques may not be the most authentic but it has various advantages over the others. Face recognition is natural, feasible and does not require assistance.

The face recognition attendance system involves capturing the image of the

person's face and comparing it with the stored images in the database. The system then matches the images and generates an attendance report for each individual. This approach eliminates the need for manual attendance management, thereby saving time, minimizing errors, and reducing costs associated with traditional attendance systems.

One of the significant benefits of a face recognition attendance system is that it helps to maintain accurate attendance records, which can be used for various purposes such as payroll, performance evaluation, and compliance purposes.
Additionally, the system provides real-time updates, enabling managers to monitor attendance in real-time, thus allowing them to make timely decisions. The system can be integrated with various devices, including cameras, smartphones, and computers, to enable efficient attendance management.

Moreover, the face recognition attendance system offers a more contactless and hygienic method of taking attendance, which is especially relevant in today's world where contactless technologies have become the norm. It also reduces the risk of transmission of infectious diseases.

The expected system engages the face recognition approach for the automating the attendance procedure of students or employees without their involvement. A web cam is used for capturing the images of students or employees. The faces in the captured images are detected and compared with the images in database and the attendance is marked.

1.1 BACKGROUND

Earlier facial recognition technology was considered as an idea of science fiction. But in the past decade, facial recognition technology has not only become real — but it’s widespread. Today, people can easily read articles and news stories about facial recognition everywhere. Here is the history of facial recognition technology and some ideas about its bright future.

Facial recognition technology along with AI and DL technology are benefiting several industries. These industries include law enforcement agencies, airports, mobile phone manufacturing companies, home appliance manufacturing companies, etc.

Nowadays even retailers are using AI-based facial recognition technology to prevent violence and crime. Airports are getting better-secured environment, mobile phone makers are using face recognition to bring the biometric security feature in the devices.

➔ **Getting into the history of facial recognition**

The world believes that Woodrow Wilson Bledsoe was the father of facial recognition. In the 1960s, Bledsoe created a system that could organize faces' photos by hand using the RAND tablet. The tablet is a device people could use to enter vertical and horizontal coordinates on a grid with the help of a stylus that released electromagnetic pulses. People used that system to manually record the coordinate areas of facial features like eyes, nose, mouth, and hairline.

The manually recorded metrics could be later saved within a database. And when the new photograph of an individual was entered into the system, it was able to get the most closely resembled image via database. During this period, face recognition was untouched by technology and computer processing power. Still, it was the first and foremost step taken by Bledsoe to prove that face recognition was a practical biometric.

21 Facial Markers for enhanced accuracy in the 1970s- It was in the 1970s when Harmon, Goldstein, and Lesk made the manual facial recognition system more accurate. The three used 21 facial markers including lip thickness and hair colour, to detect faces automatically.

Eigen faces - Sirovich and Kirby started using linear algebra to the issue of facial recognition in 1988. The approach they used was called the Eigen face approach. The rendering began as a search for low-dimensional facial images representation. The team was able to prove that feature analysis on collected pictures in the database could form a set of basic features.

They were also able to explain how less than a hundred values could be used to code a face image precisely.-

In 1991, Pentland and Turk worked further on the Eigen faces approach by finding ways to detect faces within images. Pentland and Turk's work was the first automatic face recognition attempt. They used technological and environmental factors for their approach. Hen in the 1993-2000s period, DARPA and NIST released the FERET program to encourage the commercial facial recognition market. In 2002, law enforcement officials applied facial recognition in critical technology testing.

Social Media 2010 to present

When 2010 started, Facebook started using a facial recognition feature that helped detect people with featured faces in the photos updated by Facebook users. While the update created hype in the media industry — Facebook stayed very low key since there was no apparent negative impact on website popularity and usage.

Largest biometric installation at the airport

In 2011, the Panama government and US Secretary of Homeland Security Janet Napolitano partnered and authorized a pilot program of the Facial Recognition platform. The pilot program was called, Face First, and it was used to cut down illicit activities at Panama's Tocumen airport. The first attempt garnered success, and the Face First expanded into the north terminal facility. The technology implemented at Tocumen became the largest biometrics installation at the airport.

Adopted in the military for dead bodies

In 2011, U.S. law enforcement and military professionals used face recognition for the identification of dead bodies. With this technology, the military was able to confirm the identity of Osama Bin Laden.

Law enforcement adoption of facial recognition in 2014

Law enforcement agencies came forward to adopt mobile face recognition in 2014. The technology became inevitable for the retail industry in 2017.

The future of Face Recognition

Governments across the world are increasingly investing their resources in facial recognition technology, especially the US and China are the leaders in the facial recognition market. The government of the USA has decided to enhance airport security with a facial recognition

system for identification and registration of visitors. The US has several states that have allowed law enforcement to run searches within the database – these searches include details of a driver's license and ID photos. The facial recognition and resulting search techniques can be also used in police checks.

China is already running several projects of facial intelligence when the other countries are still in its planning phase.

The whole world is using this technology and reaping many benefits. In India, banks are using this facial recognition technology to prevent fraud at ATM's. It is also used for reporting duplicate voters, verification of passport and visa, driving license, etc.

The future of facial recognition is promising.

The technology is expected to grow and will create massive revenues in the coming years. Surveillance and security are the major industries that will be intensely influenced by technology. Schools and universities and even healthcare are also planning to implement the facial recognition technology on their premises for better management. Complicated technology used in facial technology is also making its way to the robotics industry.

1.2 OBJECTIVE

Our primary goal is to help the lecturers, improve and organize the process of track and manage student attendance and absence. Additionally, we seek to:

- To identify the face segment from the video frame.
- To extract the useful features from the identified face.
- To classify the features in order to recognize the identified face.
- To record the attendance of the identified students.
- Providing a valuable attendance service for both teachers and students.
- Reducing manual process errors by provide automated and a reliable attendance system uses face recognition technology.

- Increasing privacy and security which student cannot present him or his friend while they are not.
- Producing monthly reports for lecturers.

1.3 PURPOSE AND SCOPE

The purpose of an attendance system using face recognition technology is to automate the process of taking attendance in a classroom or workplace. Traditional methods of attendance taking, such as calling out names or using a sign-in sheet, can be time-consuming and inefficient. By using face recognition technology, the system can quickly and accurately identify each individual in the room and record their attendance. Some potential benefits of using a face recognition attendance system include:

a) Improved accuracy: With face recognition technology, attendance can be recorded automatically and with high accuracy, reducing the risk of errors or fraud.
b) Time-saving: A face recognition attendance system can save time and streamline the attendance taking process, which can be especially helpful for larger classrooms or workplaces.
c) Enhanced security: Face recognition technology can also be used to enhance security by ensuring that only authorized individuals are allowed to enter a certain area.
d) Data management: A face recognition attendance system can generate reports and provide real-time data on attendance, making it easier for administrators to track attendance trends and identify patterns.
e) Cost-effective: Implementing a face recognition attendance system can be cost-effective in the long run, as it eliminates the need for manual labor and reduces the potential for errors that can lead to financial losses.

Chapter 2

Review of Literature

REVIEW OF LITERATURE

In this paper Singh, Akash [1]they developed an automated student attendance system based on face recognition. They used video framing and HOG algorithm to detect and segment faces. For Pre-processing they used techniques such as scaling, median filtering, and conversion of color image to gray scale are applied to enhance image quality. They used CLAHE algorithm to improve contrast and developed in Python by accesses the camera through a user-friendly interface to match faces with images in the database. Upon successful identification, the system records the name and time of the person in the attendance sheet.[1] Rudrasinh Ravalji, Nilaykumar Shah[2] In this paper they proposed an automatic attendance management system using facial recognition technology to improve the efficiency and accuracy of attendance marking. The current attendance system is inefficient and inaccurate due to uncertainties and difficulties in maintaining attendance data. The proposed system uses facial recognition to uniquely identify individuals, and attendance is automatically marked and stored in a database system. The system is hosted on a Raspberry Pi server and can be accessed through an online platform, providing convenience to authorities.SACHIN WAKURDEKAR1 , UTKARSH NAGPURE2 [3] An automated attendance system using facial recognition technology has been developed to make attendance marking and management secure, effective, time-saving, straightforward, and simple. The system captures pictures at scheduled class times, uses facial detection and identification technology to identify students, marks them as present, and updates attendance records with the corresponding subject and time. The system is built using Python language and various libraries such as OpenCV, NumPy, Har-cascade classifiers, and LBPH..Supriya Patil, ,Atharva Tillu[4]In this paper they aimed to develop an automated student attendance management system using face recognition, which is less difficult, cost-effective, and more efficient than the traditional approach. The system utilizes a camera mounted in front of a classroom to capture images of the entire class, and then uses facial recognition technology to detect registered faces from the database. If a registered face is identified in the captured image, the attendance register is marked as present, otherwise absent. This system eliminates the need for manual work from the users, making it faster and less intrusive.T. Nagamani, S. Logeswari, [4] This project focuses

on creating an automatic attendance system using machine learning techniques for face detection and recognition. The system involves four main steps: creating datasets using a webcam, training the dataset to create a trainer.yml document, performing face recognition, and updating attendance in a CSV or Excel file. They used HaarCascade for an effective technique to produce a simple and accurate system. Bharti Karare, Vedant Nisar[5] this project is to build a face recognition-based attendance monitoring system for educational institution to enhance and upgrade the current attendance systemduring the attendance taking session, faces will be compared against the database to seek for identity. When an individual is identified, the attendance will be taken down automatically saving necessary information into an excel sheet. At the end of the day, the excel sheet containing attendance information regarding all individuals are saved by the respective faculty. Arpit Singh, Saumya Bhatt[6]In this paper they studied facial recognition, by cutting-edge machines which can be programmed to recognize faces in ways that are impossible to imagine. CNN and deep learning algorithms are used to detect and identify individuals in live or recorded surveillance feeds. In this study, they presented a real-time system. The VGG Face deep learning neural architecture serves as the foundation for the proposed integrated real-time database system. Their model is retrained using transfer learning on a smaller original tailored dataset consisting of 7500 images of 26 distinct people. Face recognition with anti spoofing eye blink detection,AIP Conference Proceedings 2482, 020006 (2023) [7] In this paper they used biometric face recognition system which is used in everyday life, from opening smartphones to taking attendance. An attempt to deceive the system is the issue that plagues almost all biometric systems, including face recognition. To prevent spoofing, they used a live detection feature. Observing human movements like blinking is one way to tell that something is alive. A facial recognition system will be classified using Thresholding and SVM after a blink detection system based on Eye Aspect Ratio values is tested in this study.

In this article Adil Mahmood, Sefer Kurnaz[8]thyey have taken perfect information from images into account. In order to match faces in this situation, they used a variety of image reconstruction mechanisms. Pre-processing image enhancement is required in the proposed approach. The best facial features, such as the eyes, cheeks, face area, and lips, are extracted following the stage of image segmentation and reconstruction. The operation they carried out for the fractal model and the wavelet transform. The LSTM neural network, also known as the MPM-LSTM, is then

improved using the Moore Penrose Matrix to train and test the system. The experimental findings demonstrate that the proposed method performs better than current techniques. Smriti, Janhavi Joshi[9] - In this paper they studied Face recognition technology which is a reliable and productive image processing application that has found its way into the technical field, particularly in attendance marking systems. This system matches a student's biometric facial measurements to their face, eliminating the need for time-consuming pen and paper attendance marking. Unlike the traditional method, this system stores attendance records securely in an Excel sheet in the computer's database, reducing the risk of manipulation. This system has been tested under various parameters such as illumination, distance, and head movement to ensure accuracy and productivity. In this project Bussa, Shruti Bharuka[10] aimed to automate the attendance marking process using face recognition technology. The system uses OpenCV-based algorithms to capture, detect, and encode the face of an individual. The training database consists of authorized student's images, which are stored as a database with respective labels. The system then uses the LBPH algorithm to extract the facial features and compare them with the training data to identify the student. The attendance is marked and stored in a spreadsheet, which is then converted into a PDF file. They Nandkishor Satpute1 , Nima[11] mentioned that different lighting and head poses are often the problems that could degrade the performance of face recognition based student attendance system.This same online attendance marking system is based on face recognition and the dlib concept. This project aims to eliminate attendance flaws caused by traditional methods. The project was designed as a touch-free system to protect students from contagious diseases, specifically COVID'19. Calculating the starting and ending times of students entering the class allows you to easily determine the overall attendance for a class. A customized attendance report has been generated automatically, allowing the faculty to save time when taking attendance in the classroom. In the future, this work could be advanced and applicable to all domains. Additionally, 3-D images can be used in the future to improve accuracy . They used Dipti Kumbhar[12] real time computer vision algorithms in automatic attendance management systems This paper introduces a new approach in automatic attendance management systems, extended with computer vision algorithms. The Proposed system uses real time face detection algorithms integrated on an existing LMS which automatically detects and registers

students attending on a lecture. The system represents a supplemental tool for instructors, combining algorithms used in machine learning with adaptive methods used to track facial changes during a longer period of time. They advanced their Debadrita Ghosh[13] technology and science Knowledge has made a huge difference in today's world Almost all sides, technical equipment, machine learning, Algorithms and other aspects play a big role in this. Almost all regions of the world , Include this with that in mind; this study was developed by us. Including facial recognition, facial recognition and features extract. This research is based on real-time face recognition for marking attendance as it can help a lot by institutions and other departments. There is no physical here Supervisor participation is required. The system Complete the process based on Better Internet Connectivity and better lighting. With additional features Add with student details Email her parents. The company is over Python 3.7.6, OpenCV 3.4. and anaconda Navigator (Anaconda3). The proposed arrangement is tested in various light intensities and conditions.

Vishe, A., Shirsath[14] The education system is improving with the introduction of smart classrooms, but the method of manually marking attendance remains outdated and time-consuming. To address this issue, an automated attendance management system can be implemented using biometric processes, specifically face recognition. This project aims to develop a technique for marking attendance without human intervention by using a camera installed in the classroom to capture images and recognize faces using existing data. Additionally, an image-based face live ness detection technique is proposed to distinguish live faces from 2-D paper masks. The accuracy of the system will be enhanced using various algorithms to exploit frequency and texture information. The final attendance report will be generated after updating the information. The key technologies involved in this project are image processing, face recognition, CCTV camera detection, AI, and machine learning.

Gupta, N., Sharma, P [15] - The Student Attendance mainframe structure is designed to manage student attendance records using face detection and recognition through open computer vision. This system aims to improve traditional attendance systems in universities by reducing time and resource consumption and preventing misuse. With the automation trend in the industry, the idea of moving from traditional attendance to a digital system using face detection and recognition methods has emerged. This is achieved by introducing an individual dataset into the

Student Attendance structure.The main objective of the system is to add and manipulate attendance notes of an individual, calculate the number of presentees and absentees based on the subject and the availability of the class, and generate automated documents or spreadsheets. The system is built using Python, a general-purpose programming language, and open computer vision concepts. The face detection system uses haarcascade, while LBPH model is used for face recognition. The system then trains individual student data and generates a spreadsheet that provides the number of students present in the classroom with an image or video capturing live.The Student Attendance mainframe structure aims to enhance the adaptability and performance of the attendance system while reducing the workload and the use of disposables. It provides an efficient and accurate way of managing attendance records, making it ideal for universities and educational institutions. By implementing this system, institutions can improve their attendance tracking processes, minimize time and resource consumption, and prevent the misuse of resources.[15] .In this project they Ibrahim Al-Amoudi, Rosdiyana Samad[16] proposes an automatic attendance system using face recognition, which is more efficient and convenient than traditional attendance methods used in schools and universities. The system consists of three parts: training, attendance system, and student profile system. The training stage involves capturing and storing the student's photo in a separate folder. The attendance system requires the lecturer to upload a photograph of the student, which the system automatically recognizes and stores in an Excel sheet. The student profile system allows the lecturer to retrieve the student's data by capturing their picture. The system uses a combination of two deep learning algorithms, MTCNN and FaceNet, to develop the face recognition system. Testing results showed 100% for face detection and 87.03% for face recognition. A. Rao, [17] To address the inefficiencies of traditional attendance marking in colleges, a new system called AttenFace is proposed. This system utilizes face recognition technology to track attendance in real time by analyzing snapshots of class taken from live camera feed. Attendance is granted based on the presence of students in multiple snapshots throughout the class duration. The face recognition algorithm runs independently for each class in parallel, ensuring scalability with the number of concurrent classes. The system is designed to be integrated with existing attendance tracking software and runs at 10-minute intervals to reduce computation. AttenFace also allows students to leave class for short periods without losing attendance and is

fully automatic with no need for professor intervention or camera setup. This one-stop solution for face-recognition-enabled attendance aims to prevent proxy and addresses all aspects. E. Indra et al[18] .Attendance tracking is crucial in any organization to improve performance. Various methods, such as using faces, fingerprints, iris, and sounds, are used for attendance systems. However, managing student attendance is a challenge, and traditional methods using paper and signatures are prone to errors and time-consuming. This study introduces a student attendance system that uses facial recognition patterns with the Haar-like features method, which overcomes manual system problems and minimizes fraud. The proposed model automates the Administration section, saving time and resources required to enter attendance data. Kar, N., Debbarma,[19]This paper proposes a system for automated attendance management in a classroom environment using face recognition technology. The authors describe how traditional manual attendance taking can be a time-consuming and difficult process, especially in large classrooms. The proposed system uses the Personal Component Analysis (PCA) algorithm for face recognition, which involves analyzing face images and computing eigenfaces, which are faces composed of eigenvectors. The system has five steps involved in its process, including initialization by feeding it a set of training images of faces, determining whether an image presented is a face at all, identifying the person, and maintaining a log file of clock-in and clock-out times for each individual. The authors also provide a brief overview of the history of face recognition technology, including early attempts to use semi-automated systems and more recent approaches using neural net principles. Overall, the proposed system offers a non-invasive and efficient method for attendance management in a classroom environment. They S. Lukas, A. R. Mitra[20] designed to automatically detect and identify each student as they enter the classroom, and record their attendance in a database. The technology used in the system relies on a camera that captures an image of the student's face, which is then processed using facial recognition algorithms to match it against a pre-existing database of student images. The system can also generate alerts to teachers if students do not attend class regularly, which can help improve student engagement and academic performance. The technology has the potential to improve accuracy and efficiency in recording attendance, while also reducing the time and effort required by teachers to manually track attendance. They have Tummala, N. S., & Sekhar[21] discussed two different approaches for face recognition - Principal

Component Analysis (PCA) and Geometric Approach.PCA is a statistical method that is commonly used for feature extraction in image processing. It works by finding the principal components of the data, which are the directions that capture the most variance in the dataset. In the context of face recognition, PCA can be used to reduce the dimensionality of the face images and extract the most important features. These features can then be used to compare and recognize faces.The geometric approach, on the other hand, uses the geometry of the face to recognize it. It works by analyzing the geometric relationships between facial features, such as the distance between the eyes or the angle of the jawline. These relationships are then used to create a mathematical model of the face, which can be used for recognition.The article discusses the implementation of both these approaches and compares their performance in terms of accuracy and speed. The results show that while PCA is faster, the geometric approach is more accurate in recognizing faces with variations in pose and lighting.Overall, this article provides valuable insights into different approaches for face recognition and their relative strengths and weaknesses. They used Handy, S. E., Lukas [22] Discrete Cosine Transform (DCT) and Hidden Markov Model (HMM) techniques. The system first segments the image and extracts DCT coefficients from 3x3, 5x5, and 10x10 matrices of the image features. These coefficients are then used to train the HMM to recognize the face image. The system also uses a histogram equalization algorithm for image normalization.The paper discusses the strengths and weaknesses of different face recognition approaches, including feature-based and brightness-based approaches. The DCT-HMM method is further tested through experiments involving small matrix sizes, non-normalized objects, and objects not in the database. The results show that the proposed method achieved 96.9% accuracy in recognizing face inputs, with the only failure due to training data configuration.The paper also explains the DCT technique, which is a transform coding method used in signal and digital image processing. It is derived from the Discrete Fourier Transform and is used to extract features from images. The paper highlights the importance of training data configuration in the performance of the system, while the number of DCT coefficients only affects its precision Aditya Rama MITRA, Samuel [23] This paper discusses the use of facial recognition technology to manage student attendance in a classroom setting. Traditional methods of keeping attendance records manually can be time-consuming, especially in classes with a large number of students. Automated

attendance systems can help reduce the administrative burden of faculty staff. The paper describes a feature-based approach for detecting key point features of the face, such as the eyes and mouth, and the use of the Principle Component Analysis (PCA) method for transforming the image into a certain model. The system uses two cameras placed in the classroom to capture images of students at all seats. The server is equipped with data of each class schedule and student enrollment, and the system has two main modules for proper functioning - admin and user. The admin module allows for the creation of space for new batches, updating subject if necessary, and sending notices, while the user module is responsible for making daily attendance and generating reports. The paper concludes with the results of experiments involving 19 students in a classroom setting, which showed a successful recognition rate of 85%.-- 2017 2nd International Conference on Computational Modeling,

Binyam Tesfahun Liyew1 , Prasun Hazari2[24]Facial recognition technology has two main stages: face detection and face identification. The first stage involves identifying and locating a face in an image, while the second stage includes feature extraction and matching the recognition result with a face database. The advantages of facial recognition technology make it a valuable tool for developing an automated student attendance system that can operate without any physical interaction from the user.Currently, most attendance systems require a manual process that can be time-consuming and prone to errors. The proposed system aims to provide a solution to these problems by integrating facial recognition technology into the attendance management process, which can be used during exams or lectures. This will save effort and time while improving the accuracy of attendance records.However, some limitations of facial recognition technology need to be addressed, such as accuracy, lighting conditions, and functionalities. The proposed system can take D. D. Nguyen, X. H. Nguyen[25] attendance automatically and continuously throughout the learning period, with the management department and parents being able to view the real-time status of student participation. The system consists of an embedded device with an attached camera sensor for recognition, which interacts with the Cloud server via IoT infrastructure. The Cloud server stores and provides data analysis devices for the administrator and parents. During roll call, the embedded device receives instructions from the Cloud server to replace old attendance data with new recorded data containing the characteristics and identifier code of the objects to be attended. The new data is sent from the Cloud server to the embedded device in the

respective classroom, which then compares it with the data collected in the classroom. Once the results are available, the embedded device interacts with the Cloud server to update the status of the students.The experimental results of the proposal system show that it achieves an accuracy rate of 89% per frame with a recognition speed of 82ms per face in the 4 - 15 meter range. As we know Face recognition is a powerful sub-domain of computer vision Indranath Sarkar *,Subhankar Pal[26] that is being widely adopted by businesses worldwide. Its applications are diverse and its usage is expected to increase significantly in the coming years. Although other identification methods like fingerprints and iris scans can be more accurate, face recognition has always been a major focus of research because of its non-invasive nature and because it is the primary method of person identification. Face recognition technology is evolving to become a universal biometric solution that requires minimal effort from the user.Biometric face recognition is used in three main domains: time attendance systems and employee management, visitor management systems, and authorization systems and access control systems.

Chapter 3

Methodology

METHODOLOGY

1. Import necessary libraries: In the first step, the required libraries for the project are imported. The libraries used in this project include cv2, face_recognition, os, numpy, datetime, pickle, time, and pyttsx3.
2. Load and encode the images: The images of the students are loaded from the directory using os library. Then, these images are converted to RGB format and their face encodings are generated using the face_recognition library. These encodings are stored in a list.
3. Create a function to mark attendance: A function is created to mark attendance of the students in a csv file. This function takes the name of the student as input and checks if the student has already been detected on the same day. If the student is already detected, it announces "face already detected". Otherwise, the current date and time are written in the csv file.
4. Capture images from the webcam: The project captures images from the webcam using the cv2 library. It also initializes the last detection time for all people and sets it to zero.
5. Detect faces and match with trained images: The captured images are processed to detect the faces present in the frame. These faces are then compared with the trained images using face_recognition library. The face with the closest match is identified and marked with a rectangle around it.
6. Mark attendance and update last detection time: If the matched face is recognized as a student, then the attendance of the student is marked using the markAttendance function. If the same student is detected again within 8 seconds, it will not be marked. Also, the last detection time for the student is updated.
7. Add delay between detections: To avoid continuous detections, the project adds an 7-

second delay between detections.

8. Greet the student: The project greets the student with a message depending on the time of the day. The pyttsx3 library is used to generate the voice output.
9. Display the output: Finally, the output is displayed in the webcam window. The name of the detected person and the attendance are displayed in the rectangle around the face. The webcam window is displayed using cv2.imshow() function. The loop continues until the user presses the 'q' key to exit the program.

Chapter 4
Modeling Techniques
(System Design)

MODELING TECHINIQUES (SYSTEM DESGIN)

- **Face Detection:** Face detection in attendance system using face recognition refers to the process of automatically detecting and locating human faces in images or video frames, and using the detected faces to mark attendance. The goal of face detection is to accurately and reliably locate faces in images and video frames, even in varying lighting conditions, pose variations, and occlusion. Face detector algorithms locate faces and draw bounding boxes around faces and keep the coordinates of bounding boxes. We have used the Haar Cascade classifier, which is implemented using the OpenCV library in the 'cv2' module.

- **Face Alignments:** Face alignment in attendance system using face recognition refers to the process of correcting the pose and orientation of detected faces in an image or video frame, so that they are aligned in a consistent way for further processing such as feature extraction or recognition.

  The goal of face alignment is to ensure that the detected faces are in a standard pose, and that important facial features such as eyes, nose, and mouth are in a consistent spatial configuration relative to each other. This is important for accurate face recognition, as small variations in pose or orientation can significantly affect the performance of face recognition algorithms.

  There are several techniques that can be used for face alignment,

including landmark-based methods and 3D modeling-based methods. Landmark-based methods involve detecting the face and used them to align the faces. 3D modeling-based methods use 3D models of the face to estimate the pose and orientation of the face, and then align it with a standard reference frame. It uses the face_locations function to locate the face(s) in the frame and the face_encodings function to generate a 128-dimensional face encoding for each face.

➔ **Feature Extraction:** Feature extraction is the process of analyzing an individual's face and identifying key unique facial features that can be used to create a digital representation or template of their face. In an attendance system using face recognition, this process is essential in identifying and matching individuals accurately.

Once these unique facial features are identified and extracted, they are used to create a unique biometric template for each individual in the attendance system. When a person's face is captured by the system, their unique template is compared to the templates in the database, and a match is made based on the degree of similarity between the extracted features.

Overall, feature extraction is a critical component in the face recognition process, as it ensures accurate identification and matching of individuals, and minimizes the risk of false positives or errors.

The face recognition library uses deep learning techniques to extract facial features from images and compare them with other facial features to recognize faces. Specifically, we used the ‘face_recognition.face_encodings()’ method to extract the facial features and ‘face_recognition.compare_faces()’ method to compare

the features and recognize the faces.

➔ **Face Recognition:** Face recognition is a biometric technology that uses an individual's facial features to identify and verify their identity. In an attendance system using face recognition, this technology is used to accurately identify and track the attendance of individuals in a particular location.

The process of face recognition involves capturing an image of an individual's face and analyzing it to identify unique facial features. These features are then compared to a database of known faces to determine if a match is found. If a match is found, the identity of the individual is confirmed, and their attendance is recorded in the system.

The face recognition system uses algorithms and techniques such as feature extraction, pattern recognition, and machine learning to accurately identify and match individuals.

The face recognition algorithm used in this code is the one provided by the face_recognition library. It’s a pre-trained CNN to extract 128-dimensional face embedding’s from facial images, which are then used for face recognition and face clustering tasks. The CNN is based on the ‘ResNet-34’ architecture and was trained on a large dataset of faces to achieve high accuracy in face recognition tasks.

4.1 MACHINE LEARING ALGORITHMS USED

A) HOG algorithm is a computer vision technique used for object detection in images. The HOG algorithm calculates the gradients of an image using different filters to determine the direction and magnitude of intensity changes in small regions of the image. These gradients are then quantized into orientation bins and their magnitudes are added to histogram bins according to their orientation. The resulting histogram represents the distribution of edge orientations in the image.

HOG algorithm uses these histograms to extract features from an image that can be used to detect objects. To detect an object, a sliding window approach is used, where a window of fixed size is moved over the image at different positions and scales. For each position and scale, the HOG features are computed within the window and are used to classify whether an object is present in the window or not using a machine learning algorithm.

Figure 4.1 Image of HOG Algorithm

B) CNN – A Convolutional Neural Network is a deep learning algorithm that is designed to analyse and process images, videos, and other multi-dimensional data. CNNs are modelled after the way the human brain processes visual information. The network consists of multiple layers of neurons, with each layer learning different features of the input data. The first layer of the network is typically a convolutional layer, which applies a set of filters to the input image to extract various features, such as edges and corners. The output of the convolutional layer is then passed through a non-linear activation function, such as the ReLU, to introduce non-linearity into the network.

The next layer is typically a pooling layer, which reduces the spatial dimensions of the output of the previous layer. This helps to reduce the computational complexity of the network and prevent overfitting. The pooling layer can use different operations such as max pooling or average pooling.

After the pooling layer, there may be additional convolutional and pooling layers, with each layer learning increasingly complex features of the input image. The final layers of the network are typically fully connected layers, which perform a classification task based on the features learned by the earlier layers.

During training, the network adjusts the values of the filters in the convolutional layers to minimize the difference between the predicted output and the true output. This is done using back propagation, where the error in the output is propagated back through the network and used to update the weights of the neurons.

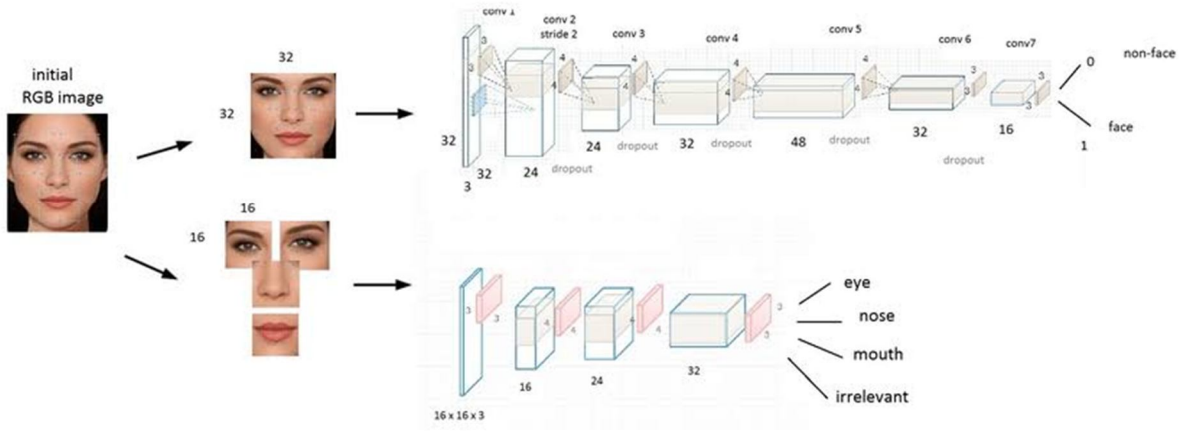

Figure 4.2 Image of CNN Algorithm

4.2 FRONT END

1. **Python** is a high-level object-oriented programming language. It was created by Guido van Rossum in 1991 .Python is a very popular programming language and can be used for various purposes. It is widely used for web development, software development, mathematics and data analysis, system scripting, etc. Python is a multi-purpose programming language that works on different platforms like Windows, Linux, Mac, Raspberry Pie, etc. Python is popular than other programming languages because it has a simple syntax than other programming languages. It runs in an interpreter system. In this thesis, we used Python for web development. This project demonstrated how Python is used for an effective and reliable web application

2. **OpenCV** is an open-source machine learning and computer vision library, it is a cross-platform library and is free to use. Intel launched OpenCV to advance CPU-intensive applications. It was developed in C++. It provides bindings for Java and Python programming languages. It runs in different operating systems such as Linux, Windows, OSx, etc. It focuses mainly on video capturing, image processing, and analysis. It has face detection and objects detection features. OpenCV can be used to read and write images .and capture and save videos.
3. **Dlib** – This is a modern C++ toolkit that contains machine learning algorithms and tools for creating complex software in C++ to solve real-world problems. It is an open-source library that is used in a wide range of applications, including image processing, computer vision, and robotics. Dlib provides a variety of algorithms, such as machine learning algorithms,

optimization algorithms, and signal processing algorithms, which can be used to solve various tasks. Overall, dlib is a powerful library that provides a range of algorithms and tools for solving complex problems in various fields. Its C++ implementation makes it fast and efficient, which is especially important in real-time applications such as computer vision and robotics.

4. **Datetime** – This module is a built-in module in Python that provides classes for working with dates, times, and time intervals. The module provides a wide range of functions and classes that can be used to manipulate and format dates and times, calculate time differences, and perform time zone conversions.
5. **CV2** – This module is a computer vision library for Python that is used to manipulate and process images and videos. It is a Python wrapper for the OpenCV library, which is a popular computer vision library used for image processing, object detection, and machine learning.
6. **Numpy** - NumPy, which stands for Numerical Python, is an open-source Python library that is widely used for scientific computing and data analysis. It provides support for large, multi-dimensional arrays and matrices, as well as a large collection of high-level mathematical functions that operate on these arrays. NumPy is built to be fast and efficient, making it a popular choice for scientific computing tasks that involve large data sets. NumPy is often used for mathematical operations such as trigonometric, statistical, and algebraic functions, as well as linear algebra operations such as matrix multiplication, inversion, and decomposition. It also provides signal processing and Fourier transform functions, random number generation and simulation capabilities, and data analysis and manipulation features.
7. **Microsoft Excel** - Microsoft Excel is popular spreadsheet software developed and distributed by Microsoft Corporation. It is used for storing,

organizing, and manipulating data in a tabular format. Excel allows users to create, edit, and format spreadsheets that contain tables of numerical data, as well as text and other data types. Excel is equipped with a variety of functions and tools that allow users to perform mathematical and statistical calculations, create charts and graphs, sort and filter data, and perform other data analysis tasks. It also allows users to perform tasks such as merging cells, inserting images, and creating conditional formatting rules to enhance the visual appeal of the spread sheet.

8. **Pickle** - The pickle library in Python is a module that allows for the serialization and deserialization of Python objects. Serialization is the process of converting an object's state into a byte stream, while deserialization is the reverse process of creating an object from a byte stream. The pickle library is used to save and load objects in a way that can be easily stored and transmitted. The pickled objects can be stored in a file or transferred over a network. The pickle library can be used to save and load complex objects, such as lists, dictionaries, and user-defined classes.
9. **pyttsx3** - It is a Python library used for text-to-speech conversion. It provides a simple interface for converting any text into speech in a variety of voices and languages. pyttsx3 is a cross-platform library that works on Windows, macOS, and Linux, and supports both Python 2 and 3. It provides a range of configurable parameters to customize the speech output, such as the voice, speech rate, volume, and pitch. It also provides call back functions for monitoring and controlling the speechs output.

4.3 BACK END

1. Image dataset: We collected a dataset of images of people's faces that will be used for attendance. This dataset has different variations in pose, illumination, and expressions to ensure that the face recognition algorithm can recognize people under different conditions. In the image dataset we have stored 50 images of the students of our class with their names. We performed training and testing to mark their attendance in real-time.

Figure 4.3 Image dataset

2. Attendance File: This file marks or store the attendance automatically in a file with '.csv' extension or in excel file. Whenever any student face is recognized, the attendance file marks the attendance of that particular student with proper name, date and time in the excel sheet. The file typically contains a record of the date, time, and the individual's name or ID who were present in class. The file can be updated in real-time as individual's attendance is recorded, and the attendance data can be visualized and exported for further analysis.

Name	Time	Date
yaswanth	14:10:45	10-04-2023
shiva	14:10:53	10-04-2023
madhav	14:11:00	10-04-2023
neeraja	14:11:08	10-04-2023
advaith	14:11:15	10-04-2023
akhila	14:11:23	10-04-2023
manasa	14:11:30	10-04-2023
praneeth	14:11:37	10-04-2023
yasaswini	14:11:44	10-04-2023
mitali	14:11:51	10-04-2023
bhavana	14:11:59	10-04-2023
rahul	14:12:06	10-04-2023
bhanu	14:12:13	10-04-2023
teja	14:12:20	10-04-2023
mohan	14:12:27	10-04-2023
varsha	14:12:34	10-04-2023
jyothi	14:12:45	10-04-2023

Table 4.1 Attendance file

2. Face Detection: This code is a Python program that uses OpenCV and face_recognition libraries to detect faces in real-time using a webcam. The program loads a set of known images from a directory and encodes their facial features into a list. Then, it continuously captures frames from the webcam and detects faces in each frame using face_recognition's face_location() and face_encodings() functions. The program then compares the detected face encoding with the set of known encodings using face_recognition's compare_faces() function. If the detected face

matches a known face, it marks the attendance of that person in a CSV file with their name, date, and time. The program draws a rectangle around the detected face and displays the name of the person above the rectangle. The program uses pyttsx3 library to convert the text message "Face detected" into speech and announce it using the computer's speakers. The program adds a 7-second delay between detections to avoid detecting the same face multiple times. If the 'q' key is pressed, the program terminates the webcam and closes all windows.

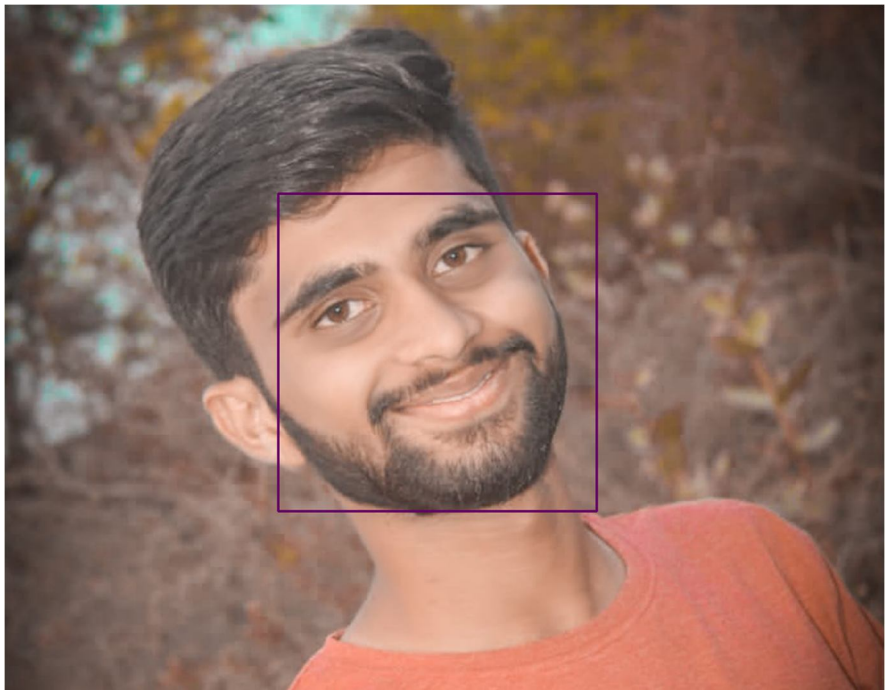

Figure 4.4 Face Detection

4. Face Positioning: the face_locations() function from this module is used to detect the location of faces in each frame of the webcam video stream. The face_locations() function returns a list of tuples containing the coordinates of each face detected in the image. The tuples contain four integers that represent the top, right, bottom, and left coordinates of the bounding box for each detected face. These coordinates are in the format (top, right, bottom, and left).In the code; the returned face locations are

stored in the variable faces_in_frame. Then, the face_encodings() function is used to compute the face encodings for each face detected in the image. The resulting face encodings are stored in the variable encoded_faces.The code then uses a for loop to iterate over both the encoded_faces and faces_in_frame variables simultaneously, using the zip() function. For each detected face, the code checks if it matches any of the faces in the training set using the compare_faces() function from the face_recognition module.

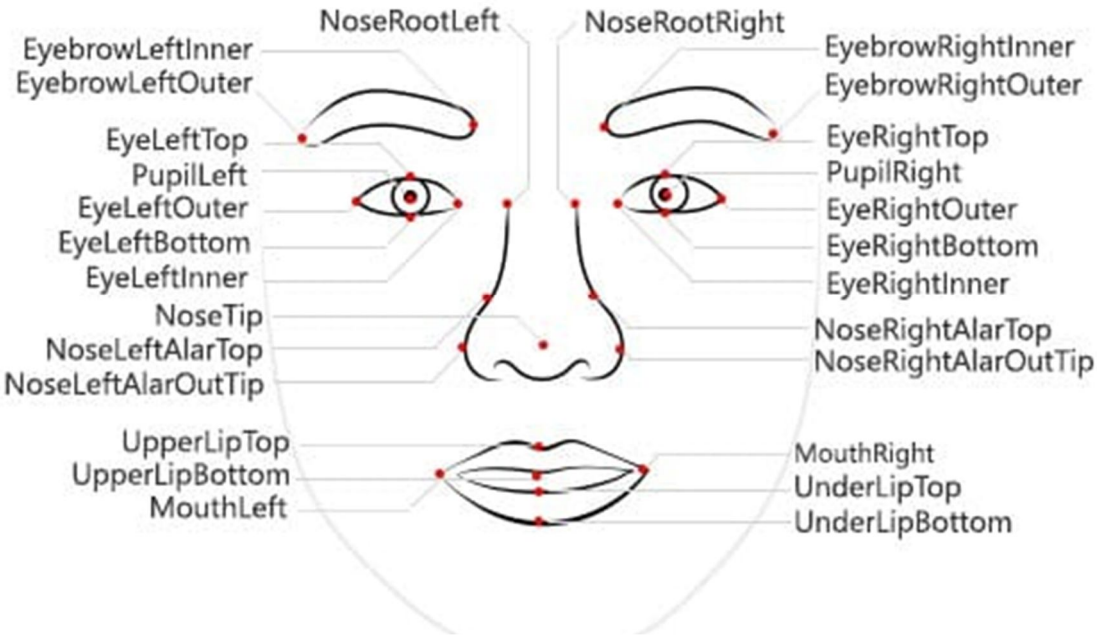

Figure 4.5 Face Positioning

5. Face Encoding: The findEncodings() function takes a list of images as input, and then calls the face_encodings() function for each image to generate the face encoding. The generated face encodings are returned as a list of 128-dimensional vectors. the face encoding generated by the face_encodings() function is a crucial component of the face recognition process as it allows for accurate comparison and matching of faces.

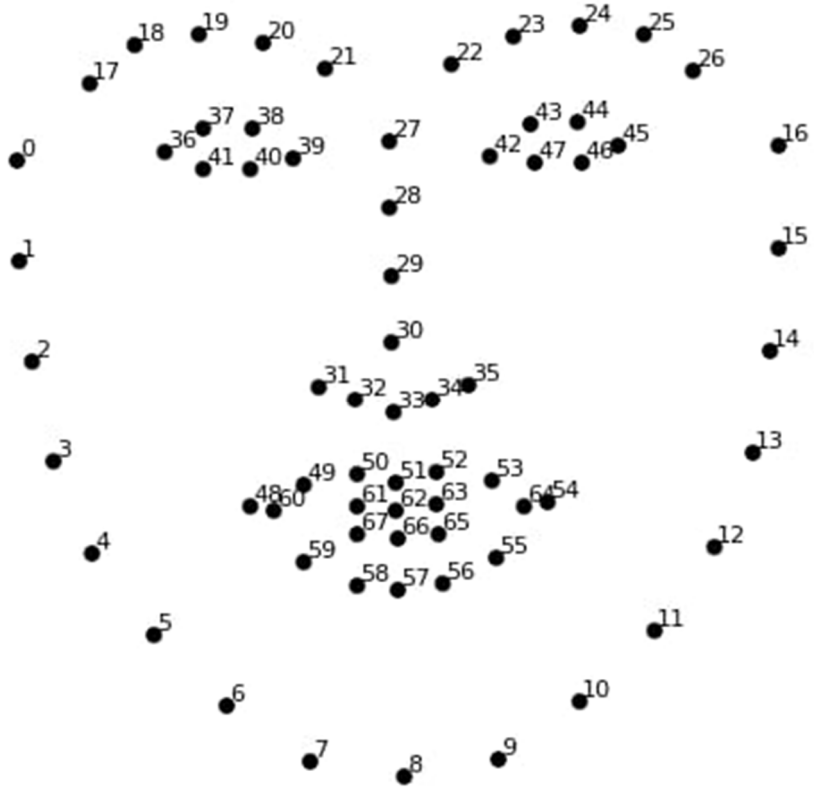

Figure 4.6 Face Encoding

6. Face Recognition: he above code is for a face recognition system that captures live video stream from a webcam, detects faces in the frames, compares them with the known faces in the dataset and marks attendance if a known face is detected. The attendance details are stored in a CSV file.

   The code uses the OpenCV and face_recognition libraries for image processing and face recognition. The dataset of known faces is stored in a directory, and the code reads all the images from that directory to create a list of known face encodings using the findEncodings function.

   The markAttendance function writes the attendance details to a CSV file with the name of the person, date, and time.

   The code runs an infinite loop that captures the frames from the webcam and performs face detection and recognition on each frame. It adds a

delay of 7 seconds between two consecutive detections to prevent repeated attendance of the same person.

When a face is detected, the code compares it with the known faces' encodings and marks attendance if a match is found. It then draws a rectangle around the detected face and displays the person's name on the screen.

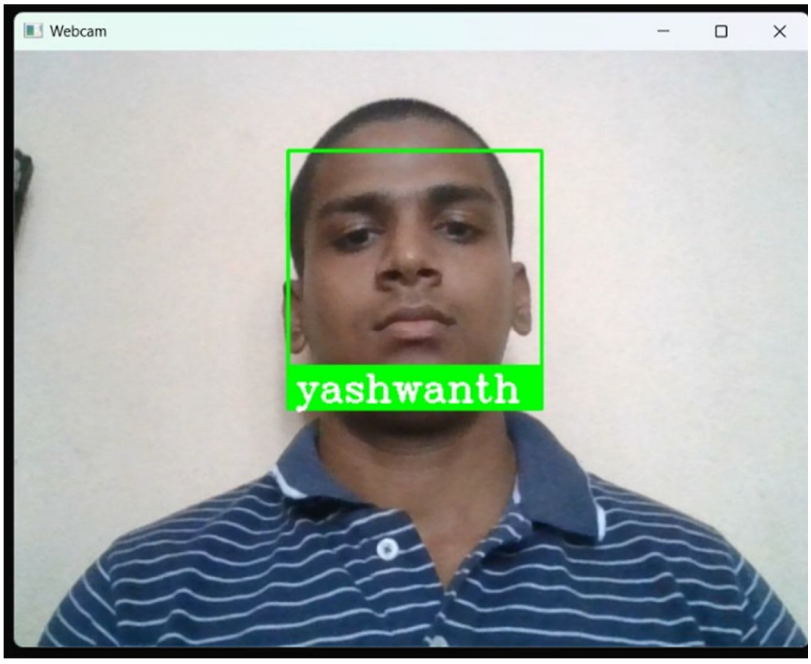

Figure 4.7 Face Recognition

7. Face matching: The face_recognition library is used to recognize and compare faces. Specifically, the face_recognition.compare_faces() function is used to compare the face encodings of the detected faces with the encodings of the images in the training dataset. The function returns a list of boolean values indicating whether or not the detected face matches any of the faces in the training dataset. If a match is found, the corresponding name is retrieved from the classNames list and attendance is marked by calling the markAttendance() function. Additionally, the face_recognition.face_distance() function is used to calculate the

distance between the detected face and each face in the training dataset, and the index of the face with the smallest distance is used to retrieve the name from the classNames list.

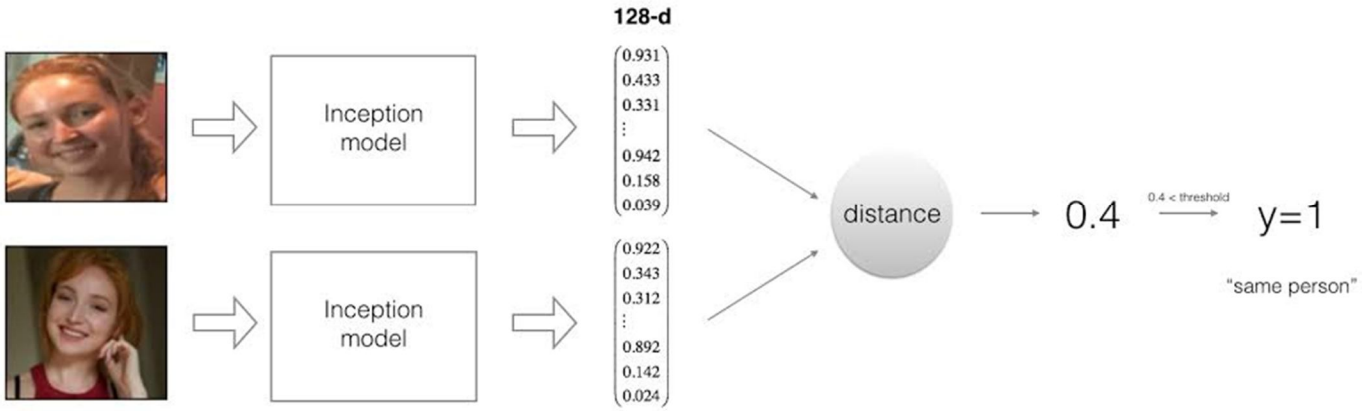

Figure 4.8 Face Matching

8. Attendance Marking: This code uses face recognition to mark attendance of students. It reads the images of the students from the specified directory, extracts facial encodings using face_recognition module, and stores these encodings in a list. It then uses these encodings to compare with the encodings of the faces captured from the webcam.

   When a face is detected in the webcam feed, it compares its encoding with the encodings of the students in the list. If there is a match, it marks the attendance of that student in a CSV file named "Face_Attendance.csv". The attendance is marked with the name of the student, the current time, and date.

   The attendance marking is done by the function markAttendance(name), which takes the name of the student as an argument and writes the attendance details to the CSV file using file handling operations.

4.4 SYSTEM REQIREMENTS:

There are specific prerequisites for each platform that run applications based on the Face Verification. Minimum requirements that the clients must have in order to run this program and acquire great outcomes are as follows:

Hardware Specification:

1. Processor: - 7th generation i5.RAM: - Minimum 4 GB.
2. Hard Disk: - 256 GB
3. Camera: - High quality.

Software Specification:

1. Platform: - Windows 8 or 10
2. Operating system - Window, Linux, Mac
3. Linux Language Used: - Python
4. Python libraries : OpenCV, Face recognition, Dlib
5. Frontend tools: - PyCharm IDE, or Visual
6. Studio Backend: - Database Directory, Attendance Excel Sheet.

Chapter 5

Implementation and Testing

IMPLEMENTATION AND TESTING

5.1 IMPLEMENTATION

A) Import the necessary libraries: The script imports OpenCV for video capture and image processing, face_recognition for face detection and recognition, os for directory handling, numpy for numerical computing, datetime for date and time handling, pickle for serialization, time for adding delay between detections, and pyttsx3 for text-to-speech conversion.

```
import cv2
import face_recognition
import os
import numpy as np
from datetime import datetime
import pickle
import time
import pyttsx3

from datetime import datetime, date
```

Figure 5.1 Necessary libraries

B) Define the image directory path: The path of the directory containing the student images is defined. Defining the image directory path refers to specifying the location where the images of the individuals whose attendance is to be taken are stored. In this project, the image directory path is a folder or directory on the computer where the images of individuals are stored. The images should be in a specific format, such as JPEG or PNG, and they should be named in a way that makes it easy to identify the individuals they represent.

Once the image directory path is defined, the face recognition algorithm can access the images and use them to train a model that can recognize the faces of the individuals whose attendance needs to be taken. This involves detecting facial features, such as the eyes, nose, and mouth, in the images, and using machine learning algorithms to extract features that are unique to each individual's face.

When the attendance system is deployed, it can capture images of individuals using a camera, compare the features of their faces to the images in the directory, and mark their attendance if their face is recognized.

C) Load the student images and encode their faces: The script reads each image from the directory, encodes the face using face_recognition.face_encodings(), and appends the encoding into a list. Loading the student images and encoding their faces is an important step in the process of implementing an attendance system using face recognition technology.

   Firstly, the system needs to be trained with images of the students who are expected to attend the class or event. These images are loaded into the system, and the system uses machine learning algorithms to analyze and encode the unique facial features of each student.

   Once the system has learned and encoded the facial features of each student, it can then recognize and identify them when they appear in front of a camera. This is done by comparing the facial features of the individual in the camera image with the stored facial features of each student in the system's database.

By accurately recognizing and identifying the faces of the students, the attendance system can automatically mark their attendance without the need for manual input. This helps to improve the efficiency and accuracy of the attendance-taking process, reducing the risk of errors and increasing overall productivity.

D) Define a function to mark attendance: The function takes the name of the student as input and writes it to a CSV file with the current date and time. Defining a function to mark attendance in the attendance using face recognition project refers to creating a block of code that can recognize faces in a given image or video feed and match them with a pre-defined list of attendees. This function can then automatically mark the attendance of each recognized individual in a database or spreadsheet. By creating this function, the attendance process can be automated and made more efficient, as it eliminates the need for manual entry or verification of attendance.

E) Initialize the video capture: The script initializes the webcam using OpenCV's VideoCapture() function. Initializing the video capture refers to setting up the video stream to capture frames from a camera or a video file. In an attendance using face recognition project, the video capture is usually used to capture frames of individuals entering a building or a room, and then these frames are processed using a face recognition algorithm to recognize the faces of individuals.

The initialization of the video capture is a crucial step in this process as it establishes a connection to the camera or the video file and enables the program to capture and process frames in real-time. Once the video capture is initialized, the program can start to capture frames and pass them to the face recognition algorithm to identify individuals.

F) Detect faces in real-time and mark attendance: The script reads each frame from the webcam, resizes it, detects faces using face_recognition.face_locations(), encodes the detected faces using face_recognition.face_encodings(), compares them with the encoded list of student faces using face_recognition.compare_faces(), and marks attendance of the corresponding student if there is a match.

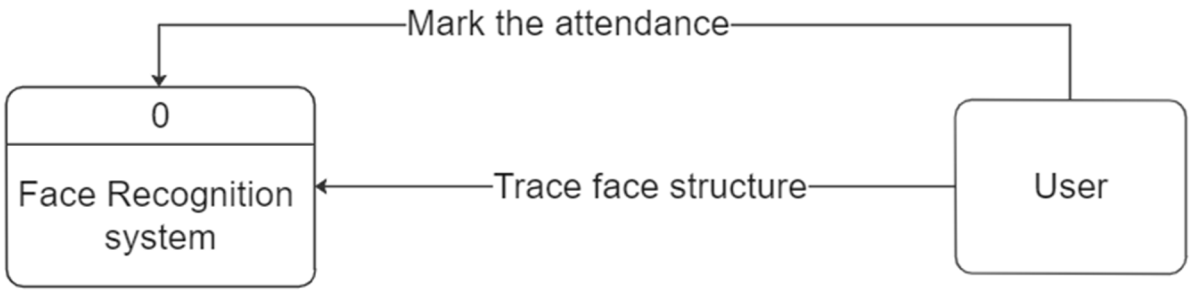

Figure 5.2 DFD Level - 0

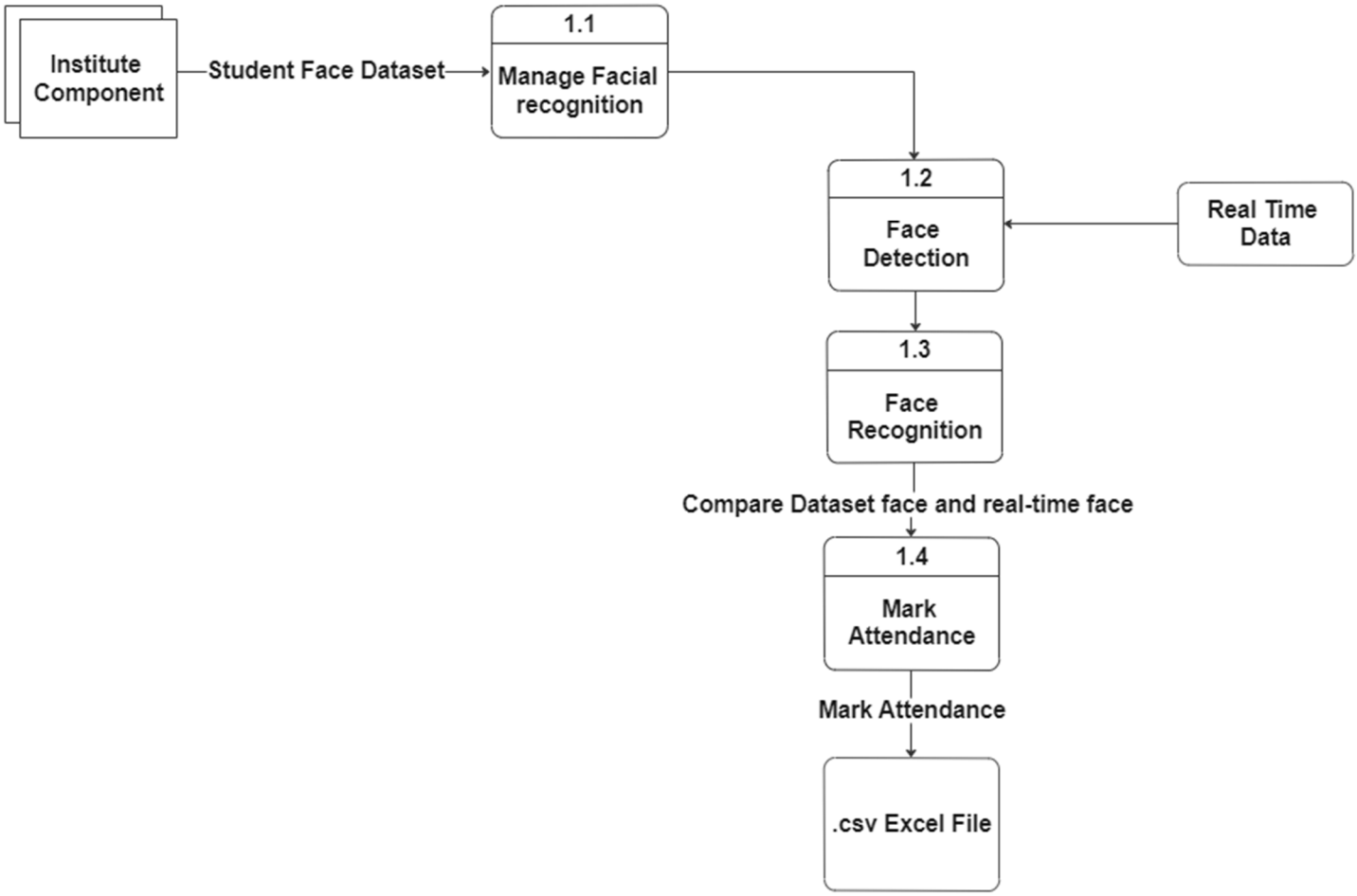

Figure 5.3 DFD Level - 1

G) Add delay between detections: The script adds a delay of 7 seconds between detections to avoid frequent attendance markings. The "Adding delay between detections" option is likely to refer to a setting that introduces a time delay between two consecutive detections of the same person's face.

This option can be useful in situations where the face recognition system is deployed in a busy or crowded environment, where people may be moving quickly or standing in close proximity to each other. By adding a delay between detections, the system can avoid mistakenly registering multiple detections of the same person's face within a short period, which could cause errors in the attendance records.

For example, if a student walks past the face recognition camera twice within a few seconds, without the delay between detections, the system may register two separate attendance records for that student, leading to inaccurate data. By adding a delay between detections, the system can ensure that each face is only detected and recorded once, even if the same person walks by the camera multiple times in quick succession.

H) Display the output: The script displays the webcam output with bounding boxes around the detected faces and the name of the corresponding student. In an attendance using face recognition project, "display the output" typically refers to the process of showing the user the results of the face recognition system. This output can include several pieces of information, such as:

A) The name or ID of the recognized individual

B) The time and date that the recognition occurred

C) Whether the recognition was successful or not

Any additional information or metadata associated with the recognition, such as confidence scores or images of the recognized face.

Displaying the output is an important part of the attendance system, as it allows the user to verify that the recognition is accurate and to take any necessary action, such as recording the attendance or following up with any unrecognized faces. The output can be displayed on a screen, printed on a report, or transmitted to a database or other system for further processing.

I) Exit the program: The script exits the program when the 'q' key is pressed. In an attendance using face recognition project, the "Exit the program" function typically refers to a command or button that allows the user to terminate the software application.

When the user selects "Exit the program," the application will stop running, and any processes or threads associated with it will be terminated. This action will close the attendance taking software, and the user will return to the main operating system or desktop environment.

It's worth noting that the "Exit the program" function should be used only when the user is finished using the attendance taking software, as it will not save any unsaved data or settings. If the user needs to save any changes or data, they should do so before exiting the program.

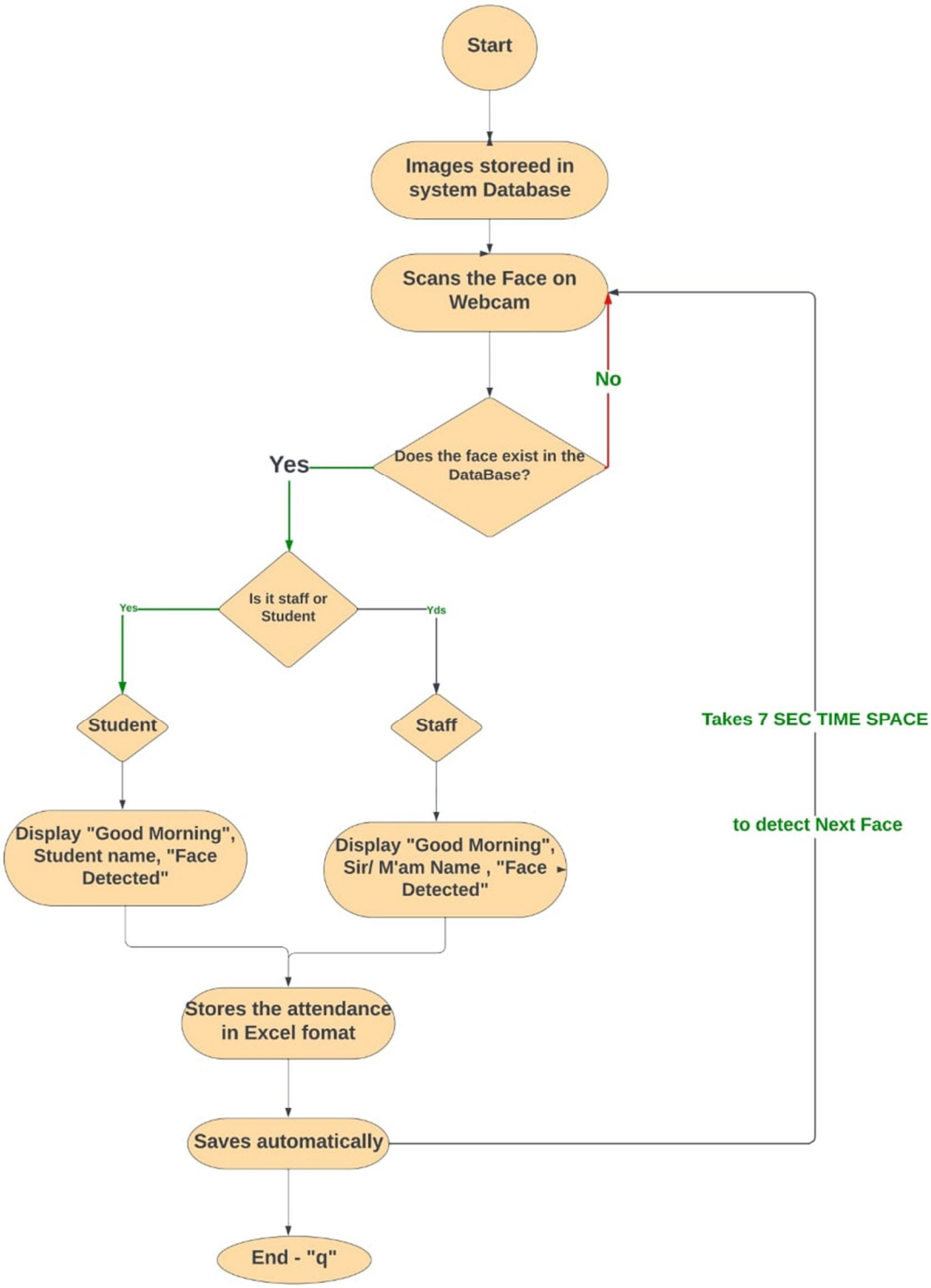

Figure 5.4 Flow Chart

5.2 TESTING

I. Prepare the student images: Create a directory containing the images of students with their names as filenames. Ensure that the images are clear and have only the face of the student. In an attendance using face recognition project, preparing the student images involves collecting and organizing a set of images for each student that will be used for facial recognition. This process typically includes capturing images of each student's face from multiple angles and under different lighting conditions to ensure that the facial recognition algorithm can accurately identify the student in various scenarios.

Once the images have been collected, they are typically pre-processed to improve their quality and remove any noise or distortions that could impact the accuracy of the facial recognition algorithm. This may involve resizing the images, adjusting the contrast and brightness, and removing any artifacts or background noise.

II. Run the script: Run the Python script in a Python environment that has all the required libraries installed.

III. Test the attendance marking: Position the webcam to capture the faces of students, and ensure that the lighting conditions are adequate. The script should detect the faces of students in real-time and mark their attendance. Testing the attendance marking functionality in an attendance using face recognition project involves verifying whether the system can accurately identify and mark attendance for individuals based on their facial features.

This process typically involves testing the system's ability to capture facial images of individuals in different lighting conditions, facial expressions, and camera angles, and verifying whether the system can accurately match these images with existing images in its database to mark attendance.

IV. Check the attendance file: Verify that the CSV file has been created and contains the name of the students and the corresponding date and time of attendance marking. Checking the attendance file in an attendance using face recognition project typically involves verifying whether a given individual's face has been correctly identified and recorded in the attendance file for a particular event or class.

In such a system, each individual's face is captured by a camera at the time of attendance and the image is then processed using face recognition algorithms to identify the individual. Once the individual has been successfully identified, their attendance is recorded in a database or file.

To check the attendance file, the system typically involves comparing the faces captured during the attendance process with

the faces recorded in the attendance file. The system checks whether the faces are a match and whether the attendance has been correctly recorded.

This process ensures that the attendance data is accurate and up-to-date, which is essential for tracking attendance and monitoring the attendance of individuals in a class or event.

V. Make sure all the required libraries are installed and the paths are correct.

VI. Move in front of the camera and check if the program can detect and recognize your face.

VII. Verify if the program is accurately marking your attendance in the CSV file.

VIII. Check if the audio output is working correctly.

IX. Test the program with multiple people and ensure that it can accurately recognize and mark attendance for each person.

X. Ensure that the program can handle multiple faces in the frame and can recognize all of them accurately.

XI. Check if the program is correctly implementing the 7-second delay between detections.

XII. Finally, check if the program is terminating correctly and releasing the webcam and destroying all the windows without any errors.

Chapter 6

Result and Discussion

Result and Discussion

This system aims to build an effective class attendance system using face recognition techniques. After recognition, it will mark the attendance of the recognized student and update the attendance record via face Id. It will detect faces via webcam and then recognize the faces. To find the accuracy of our system we tested the model by giving several images of 20 individual students and noted down the count of images which were recognized correctly. And we calculated the percentage of individual student attendance ratio by taking the ratio of recognized images and overall testing images of the students. After that we combined all the individual student attendance percentage to find the accuracy of the overall model, and we got an accuracy of the model as 85% .

Student Name	Image	Recogniton	Percentage
Aditya	6	5	0.83
Akhila	10	9	0.90
Bhavana	5	4	0.80
Hari Haran	4	3	0.75
Hemanth	3	3	1.00
Madhav	4	3	0.75
Manasa	8	8	1.00
Manikethan	5	4	0.80
Mitali	6	5	0.83
Neeraja	10	8	0.80
Nithin	6	5	0.83
Praneeth	9	8	0.89
Rahul	6	5	0.83
Sai Mohan	5	4	0.80
Shiva	8	7	0.88
Uday	4	3	0.75
Uudhhay	6	4	0.67
Varsha	4	4	1.00
Yasaswini	5	4	0.80
Yaswanth	10	9	0.90
TOTAL	124	105	0.85

Table 6.1 Model Accuracy

Chapter 7

Advantages and Drawbacks

7.1 Advantages:

a) Accuracy: Face recognition technology has a higher accuracy rate compared to traditional attendance methods like paper-based sign-in sheets and card-swiping systems. This is because it relies on unique facial features that are difficult to forge or duplicate.

b) Efficiency: The process of recording attendance using face recognition is fast and efficient. It eliminates the need for manual record-keeping, which saves time and reduces errors.

c) Contactless: Face recognition technology is contactless, which is especially important in the current COVID-19 pandemic era. This means that employees don't have to touch any devices or surfaces to record their attendance, reducing the risk of infection.

d) Security: Face recognition technology provides an extra layer of security to the workplace. It prevents unauthorized access and reduces the chances of employees clocking in or out for each other.

e) Cost-effective: Once the system is set up, attendance using face recognition project is cost-effective. It eliminates the need for paper-based record-keeping and reduces the need for additional staff to manage attendance records.

7.2 Drawbacks:

a) Privacy concerns: Some employees may be uncomfortable with the idea of having their faces scanned and stored in a database. This can raise privacy concerns, especially if the data is not handled securely.

b) Environmental factors: The accuracy of face recognition technology can be

affected by environmental factors such as lighting, camera quality, and facial obstructions like masks, glasses, or facial hair.

c) Cost of implementation: The initial cost of implementing a face recognition attendance system can be high, especially for smaller organizations.

d) Legal issues: There may be legal issues related to data privacy, especially if the system is not implemented correctly or if the data is not managed securely.

e) False positives and negatives: Face recognition technology is not foolproof and can produce false positives or negatives. This means that some employees may be incorrectly marked as absent or present, leading to confusion and potential disputes.

Chapter 8

Conclusion and Future Perspective

8.1 CONCLUSION

In order to obtain the attendance of individuals and to record the entry, the proposed system can be used. The system can widely be used in the institutions and organizations. The proposed system takes attendance of each student by continuous observation at the entry points. The result of our preliminary experiment shows improved performance in the estimation of the attendance compared to the traditional attendance marking systems.

This system is built to reduce the wastage of time and increase accuracy during the time of attendance marking via face recognition technique. This system works on the basis of different libraries which consist of different functions and it will be able to mark attendance by matching faces with template images stored in database i.e., face ID. It will detect face using webcam that is present in laptop and then recognition of face will take place. After recognition of face, system has to mark attendance in excel sheet with time and date.

Future scope of the system includes in the field of government offices, corporates, colleges, military, etc. for verification and detection of faces. From airports to banks and malls - the possibilities are endless! Facial scanning can be applied across all industries for improved efficiency across different segments within our workplace environment as well.

8.2 FUTURE SCOPE

Practically all academic institutions requireattendance record of students and maintaining attendance physically can be hectic as well as time consuming task. Hence maintaining attendanceautomatically with the help of face recognition will be exceptionally useful and less prone to mistakesor errors as compared to manual procedure. This will also reduce the manipulation of attendance record done by students and reduces time consumption too. The future extent of the proposed work can be, catching numerous definite pictures of the students and utilizing any cloud innovation tostore these pictures. This framework can be designed andutilized in ATM machinesto identify frauds. Also, the framework can be utilized at the time of elections where the voters can bedistinguishedby perceiving the face.

Chapter 9
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- https://github.com/ageitgey/face_recognition

➢ **Books**

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- Machine-based Intelligent Face Recognition
- Face Recognition in Adverse Conditions

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Appendix A

PYTHON CODE

```
import cv2
import face_recognition
import os
import numpy as np
from datetime import datetime
import pickle
import time
import pyttsx3

from datetime import datetime, date




path = "C:\\facerecog\\student_image"

images = []
classNames = []
mylist = os.listdir(path)
for cl in mylist:
    curImg = cv2.imread(f'{path}/{cl}')
    images.append(curImg)
    classNames.append(os.path.splitext(cl)[0])
def findEncodings(images):
    encodeList = []
    for img in images:
        img = cv2.cvtColor(img, cv2.COLOR_BGR2RGB)
        encoded_face = face_recognition.face_encodings(img)[0]
        encodeList.append(encoded_face)
    return encodeList
```

```
encoded_face_train = findEncodings(images)
def markAttendance(name):
    today = date.today()
    d1 = today.strftime("%Y-%m-%d")
    with open('Face_Attendance.csv','r+') as f:
        myDataList = f.readlines()
        nameList = []
        already_detected = False
        for line in myDataList:
            entry = line.split(',')
            nameList.append(entry[0])
            if entry[0] == name and entry[1] == d1:
                already_detected = True
                engine.say("face already detected")

                break


# take pictures from webcam
cap  = cv2.VideoCapture(0)
engine = pyttsx3.init()


# initialize last detection time for all people
last_detection_dict = {name: 0 for name in classNames}

while True:
    current_time = time.time()
    success, img = cap.read()
    imgS = cv2.resize(img, (0,0), None, 0.25,0.25)

    faces_in_frame = face_recognition.face_locations(imgS)
    encoded_faces = face_recognition.face_encodings(imgS,
faces_in_frame)
    for encode_face, faceloc in zip(encoded_faces,faces_in_frame):
        if current_time - last_detection_time > 8:  # add a 8-second
delay between detections
```

```
            faceDist =
face_recognition.face_distance(encoded_face_train, encode_face)
            matchIndex = np.argmin(faceDist)
            print(matchIndex)
            if matches[matchIndex]:
                name = classNames[matchIndex].upper().lower()
                y1,x2,y2,x1 = faceloc
                # since we scaled down by 4 times
                y1, x2,y2,x1 = y1*4,x2*4,y2*4,x1*4

                # check if the face has already been detected today
                if name in last_detection_dict and (current_time -
last_detection_dict[name]) < 8:
                    continue


                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)
                hour = datetime.now().hour
                engine.say(f"{name}, face detected")
                engine.runAndWait()
                last_detection_time = current_time
    cv2.imshow('Webcam', img)
    if cv2.waitKey(1) & 0xFF == ord('q'):
        break
```