AUTOMATIC ATTENDANCE MARKER USING AI

A Project Report

Submitted to the APJ Abdul Kalam Technological University

in partial fulfillment of requirements for the award of degree

Bachelor of Technology

in

Computer Science and Engineering

by

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DEPARTMENT OF COMPUTER SCIENCE AND ENGINEERING

LBS COLLEGE OF ENGINEERING KASARAGOD

KERALA

December 2023

LBS COLLEGE OF ENGINEERING, KASARAGOD

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This is to certify that the report entitled **AUTOMATIC ATTENDANCE MARKER USING AI** submitted by **VAISHNAV P** (KSD20CS108), to the APJ Abdul Kalam Technological University in partial fulfillment of the B.Tech. degree in Computer Science and Engineering is a bonafide record of the project work carried out by him under our guidance and supervision. This report in any form has not been submitted to any other University or Institute for any purpose.

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I hereby declare that the project report **AUTOMATIC ATTENDANCE MARKER USING AI** , submitted for partial fulfillment of the requirements for the award of degree of Bachelor of Technology of the APJ Abdul Kalam Technological University, Kerala is a bonafide work done by me under supervision of Dr. Sulphikar

This submission represents my ideas in my own words and where ideas or words of others have been included, I have adequately and accurately cited and referenced the original sources.

I also declare that I have adhered to ethics of academic honesty and integrity and have not misrepresented or fabricated any data or idea or fact or source in my submission. I understand that any violation of the above will be a cause for disciplinary action by the institute and/or the University and can also evoke penal action from the sources which have thus not been properly cited or from whom proper permission has not been obtained. This report has not been previously formed the basis for the award of any degree, diploma or similar title of any other University.

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VAISHNAV P

Abstract

An automated system for managing attendance that uses an algorithm for face detection and recognition is shown in the suggested model. Face recognition is the process of recognizing human faces based on their distinctive traits or attributes. The technology that is expanding the fastest right now is face recognition. This system aims to create an automated system that tracks student attendance by employing facial recognition technology for individuals present during tutoring hours as opposed to conventional approaches. The major goal is to fully automate, simplify, and ease the attendance marking and management system. Image processing techniques are used in this work to perform facial recognition. When the processed image and the already-stored record match, the database appropriately records attendance. The processed picture is utilized to compare to the already-stored record, and the database is subsequently annotated to reflect the match. This technique minimizes workers' workload and saves time compared to the current traditional system for recording attendance. Four modules were used to implement the suggested system: image capture, group photo segmentation, face identification, face comparison and recognition, and database update for attendance.

Acknowledgement

I take this opportunity to express my deepest sense of gratitude and sincere thanks to everyone who helped me to complete this work successfully. I express my sincere thanks to Dr. Anver S R, Head of Department,Computer Science and Engineering, LBS College of Engineering Kasaragod for providing us with all the necessary facilities and support.

I would like to express my sincere gratitude to the Dr. Vinod George, department of Computer Science and Engineering, LBS College of Engineering Kasaragod for the support and co-operation.

I would like to place on record my sincere gratitude to our project guide Dr. Sulphikar , Associate Professor, Computer Science and Engineering, LBS College of Engineering for the guidance and mentorship throughout this work.

Finally, I thank my family, and friends who contributed to the succesful fulfilment of this seminar work.

VAISHNAV P

Contents

Abstract i

Acknowledgement ii

List of Figures vi

1 INTRODUCTION 1

1.1 Motivation 1

1.2 Problem Statement 2

1.3 Approach and Methodology 2

1.3.1 Data Collection Method 2

1.3.2 System Development Method 3

1.4 Scope 3

1.5 Outline 3

2 LITERATURE REVIEW 5

2.1 Paper 1:HOG and Cloud Computing based Face Recognition for Attendance Monitoring 5

2.2 Paper 2.Automated Attendance System Based on Face Recognition Using Opencv 6

2.3 Paper 3:Trunk Branch Ensemble Covolutional Neural Networks for Video -Based Face Recognition: 7

2.4 paper 4: Face recognition attendance system based on real-time video processing: 8

2.5 paper 5: An automated classroom attendance system using video based face recognition: 9

2.6 paper 6: Smart Attendance System using OPENCV based on Facial Recognition 10
2.7 Paper 7 : Smart Attendance System using Deep Learning 11
2.8 Paper 8:Face Recognition Using LBPH Descriptor and Convolution Neural Network. 12
2.9 Paper 9:AttenFace:A Real Time Attendance System Using Face recognition. 13
2.10 Paper 10:Attendance system based on Face Recognition using Eigen face And PCA algorithms 14

3 PROJECT OVERVIEW **15**
3.1 ADVANTAGES 15
3.2 CHALLENGES 16
3.3 FEASIBILITY ANALYSIS 17
3.3.1 TECHNICAL FEASIBILITY 17
3.3.2 ECONOMIC FEASIBILITY 17
3.3.3 OPERATIONAL FEASIBILITY 18
3.4 Algorithms 18
3.4.1 The Local Binary Patterns Histogram (LBPH) 18
3.4.2 Frontal Face Haar Cascade Algorithm 19

4 SYSTEM DESIGN **21**
4.1 Introduction 21
4.2 Machine Learning Model 22
4.2.1 Dataset 22
4.2.2 CNN 23
4.2.3 LBPH 23
4.3 System Architecture 23
4.3.1 Preprocessing 23
4.3.2 Image detection 24
4.3.3 Image Classification 24

5 THEORETICAL BACKGROUND **26**

5.1 CNN 26

5.1.1 Convolution Layer 27

5.1.2 Pooling Layer 27

5.1.3 Fully Connected Layer 27

5.2 LBPH 28

6 METHODOLOGY **29**

6.1 Data Collection 29

6.2 Face Detection 29

6.3 Face Recognition 30

6.4 Attendance Marking 30

6.5 Maintenance 30

7 RESULT **31**

8 CONCLUSION **33**

9 REFERENCE **34**

List of Figures

3.1 Haar Cascade Algorithm 20
3.2 Hierarchical Detection 20

4.1 System Architecture 24

5.1 CNN Architecture 26
5.2 Convolution Layer 27

7.1 Face Recognition Model 31
7.2 Face Recognition 32
7.3 Unknown Face Recognition 32

Chapter 1

INTRODUCTION

Introducing an innovative solution for streamlined attendance tracking, our automatic attendance marker employs cutting-edge face recognition technology to effortlessly manage multiple faces within a given environment. Revolutionizing traditional attendance systems, this advanced system utilizes sophisticated facial recognition algorithms to accurately identify and mark the attendance of individuals without the need for manual input. Designed for efficiency and precision, the system ensures a seamless and secure process, enhancing the overall experience for both administrators and attendees. With its ability to handle multiple faces simultaneously, our solution represents a significant leap forward in attendance management, promising a reliable and convenient tool for diverse settings, from educational institutions to corporate offices. Embrace the future of attendance tracking with our intelligent and user-friendly face recognition system.

1.1 Motivation

Creating an automatic attendance maker using face recognition lies in the pursuit of efficiency and accuracy in academic and professional settings. Traditional attendance tracking methods can be time-consuming and prone to errors. This innovation not only saves valuable time for both educators and students but also reduces the likelihood of errors associated with manual systems. Furthermore, the use of face recognition enhances security measures, ensuring that attendance records are more reliable and tamper-proof. In overall this technology aims to enhance productivity, eliminate

tedious administrative tasks, and promote a more reliable and modern approach to attendance management.

1.2 Problem Statement

To develop an Automatic Attendance marker using AI for recognizing multiple faces at a time.The traditional methods of manual attendance tracking pose significant challenges in terms of time consumption, susceptibility to errors, and the potential for proxy attendance.

To address these issues, there is a pressing need for an automatic attendance marker using face recognition technology. This system aims to eliminate the inefficiencies associated with manual attendance by providing a seamless, accurate, and secure means of recording attendance through facial recognition.The development of an effective automatic attendance marker using face recognition technology will not only streamline administrative processes but also enhance the overall efficiency and integrity of attendance tracking in educational and professional settings.

1.3 Approach and Methodology

The proposed process begins with students entering the system for the first time. The pre-processing of the photographs is one of the primary stages in the methodology that follows

1.3.1 Data Collection Method

The primary goal of this effort is to totally automate, simplify, and ease the attendance marking and administration system. In this study, image processing methods are used to identify faces by their faces. When the processed image and the already-stored record match, the database records attendance in the appropriate way. This approach minimizes the effort of individuals and also saves time when compared to the current typical approach for recording attendance. This is accomplished through the use of four modules: video capture, photo segmentation, face detection, face comparison and

recognition, and database attendance update.

1.3.2 System Development Method

The experimental model is being used by the author as a system development technique to create this system. The purpose by means connecting the user's experimental model to technical knowledge is to clarify the user's requirements and conserve time due to the system's setup quickly.

1.4 Scope

Automated attendance marker system can find applications in diverse fields such as education, corporate environments, and event management. In educational institutions, it offers a reliable and efficient way to streamline attendance tracking, allowing educators to focus more on teaching. In corporate settings, it enhances workforce management by automating attendance recording and ensuring accountability. Additionally, the system can be implemented in various events and conferences to facilitate seamless check-ins. The scalability of face recognition technology makes it adaptable to different organizational scales, from small businesses to large enterprises. As the demand for efficient and contactless solutions grows, the scope for automatic attendance markers using face recognition is likely to expand, making it a valuable tool for improving administrative processes across various industries.

1.5 Outline

The solution under consideration uses face detection and identification algorithms to present an automated method for tracking and managing attendance. Face recognition is the process of recognising human faces by their distinctive traits or attributes. The fastest-growing technology right now is face recognition.In contrast to current methods, the aim of this system is to develop an automated system that tracks student attendance by using facial recognition technology for those who are present during lecture hours. The primary goal of this effort is to totally automate, simplify, and ease

the attendance marking and administration system. In this study, image processing methods are used to identify faces by their faces.The processed picture is utilised to compare to the already-stored record, and the database is subsequently annotated to reflect the match. This technique minimises the workload of workers and also saves time when compared to the current traditional system for recording attendance. The traditional method of recording attendance has limitations, including the inability to reuse the data from the attendance list. The lecturer must manually compute or type in information to determine the percentage of pupils who show up for class. This is also prone to human error; for instance, the lecture might be inaccurate.Less human involvement and the possibility of inaccuracy will be there with the technology-based attendance system.

Chapter 2

LITERATURE REVIEW

In literature survey some of the projects are explained. All these projects are on Automatic attendance maker using AI means how to manage attendance easily than previous old traditional methods. Many peoples try to improve Attendance marking in their own ways and these are some them.

2.1 Paper 1:HOG and Cloud Computing based Face Recognition for Attendance Monitoring

Sudha V,Kalaiselvi R,Jithenthiriya C K,Coimbatore, India(2023)

The main goal of this paper is to assist lecturers in developing and organizing the student attendance monitoring and management scheme. Besides, this study intends to Develop a useful attendance aid for both teachers and students and Enhance the privacy and confidentiality that students cannot show to themselves or their peers if they are not present.The main scope is easy to use. It saves time and effort because calling out student names and writing student attendance sheets take a lot of time and effort. It can recognize and distinguish several faces at the same time. The software, which uses video and image recognition, is a helpful alternative for students and teachers to recognize someone and keep track of attendance. This system actually marks the attendance of each student and teacher from video processing method. Here HOG(Histogram Oriented Gradients) algorithm is used for detecting the faces from video captured and CNN algorithm is used for face recognition . Once the

faces got recognised and matched with the trained image , the corresponding student's attendance got marked to the database.

2.2 Paper 2.Automated Attendance System Based on Face Recognition Using Opencv

Ashesh Kumar, Sumitra Samal, Manpreet Singh Saluja, Aaryan Tiwari, "Automated Attendance System Based on Face Recognition Using Opencv(2023)". Effective attendance is essential to the education process. Teachers and school administrators need to know how much time each student spends in the classroom. Because of this, many schools use automated attendance systems (AASs). These systems save time and space by enabling schools to register and track students without the need for physical identification cards or teachers.Biometric technology allows schools to verify student attendance by comparing their biographical data. Here it is uploading a class photo to the website and getting an instant attendance report would be helpful for busy teachers. The above method gives the best result. This is achieved using OpenCV for frame extraction and dlib for face detection.This method has higher accuracy in detecting multiple faces from one frame with a shorter response time.

2.3 Paper 3:Trunk Branch Ensemble Covolutional Neural Networks for Video -Based Face Recognition:

Ding, C., Tao, D. (2017). Trunk-branch ensemble convolutional neural networks for video-based face recognition. IEEE transactions on pattern analysis and machine intelligence, 40(4), 1002-1014.

This paper introduces a Convolutional Neural Network (CNN) framework for video-based face recognition (VFR) addressing challenges like image blur, pose variations, and occlusion. It employs artificially blurred training data to enhance blur-robust face representations and proposes a Trunk-Branch Ensemble CNN model (TBE-CNN) for robustness to pose variations and occlusion. The model efficiently extracts features by sharing convolutional layers. An improved triplet loss function is also introduced to enhance the discriminative power of the learned representations. Experimental results demonstrate the effectiveness of the proposed techniques, with TBE-CNN achieving state-of-the-art performance on popular video face databases and winning the BTAS 2016 Video Person Recognition Evaluation.

2.4 paper 4: Face recognition attendance system based on real-time video processing:

Yang, H., Han, X. (2020). Face recognition attendance system based on real-time video processing. IEEE Access, 8, 159143-159150.

This article discusses the bright prospects and market demand for face recognition technology in the era of big data. It focuses on designing a face recognition attendance system based on real-time video processing, addressing key aspects such as accuracy, stability, truancy rate, and interface settings.They have also used Gabor features plus Fisher based analysis method on orthogonal basis to become a linear discrimination method. Through experimental data, the proposed face recognition attendance system achieves an 82percentage accuracy rate, reduces check-in time by about 60percentage, and significantly lowers the truancy rate. The real-time video processing enhances efficiency, eliminates naming complexities, and plays a crucial role in guiding the development of attendance systems.

2.5 paper 5: An automated classroom attendance system using video based face recognition:

Raghuwanshi, A., Swami, P. D. (2017, May). An automated classroom attendance system using video based face recognition. In 2017 2nd IEEE International Conference on Recent Trends in Electronics, Information Communication Technology (RTEICT) (pp. 719-724). IEEE.

This paper explores the application of video-based face recognition in education, focusing on automating attendance recording. It highlights the limitations of traditional methods and the advantages of face recognition's noninvasive nature. The process involves capturing student faces through video or camera devices, employing the Viola-Jones algorithm for face detection, and utilizing Principal Component Analysis (PCA) and Linear Discriminant Analysis (LDA) for face recognition. Eigenfaces, representing relevant image features, aid in comparing input images with the training set. The training set comprises five images per person with different poses, and varying its size yields different experimental results. The proposed system effectively registers attendance in an Excel sheet, providing a modern alternative to traditional attendance methods in educational settings

2.6 paper 6: Smart Attendance System using OPENCV based on Facial Recognition

Sudhir Bussa,Shruti Bharuka,Ananya Mani,Sakshi Kaushik,"Smart Attendance System using OPENCV based on Facial Recognition(2020)".

This is an automatic attendance marking system which uses LBPH for face dectection and face recognition process.Opencv and other python libraries like pandas,Idle are used to Impement this system.It is one of the simplest algorithms for face recognition. The local features of the images can be characterized by this algorithm.Using this algorithm, considerable results can be obtained.This paper features the most productive Open CV face recognition method accessible for Attendance Management. The system has been implemented using the LBPH algorithm. LBPH excels other algorithms by confidence factor of 2-5 and has least noise interference. The implementation of the Smart Attendance System portrays the existence of an agreement between the appropriate recognition rate and the threshold value. Therefore LBPH is the most authentic and competent face recognition algorithm found in Open CV for the identification of the students in an educational institute and marking their attendance adequately by averting proxies.

2.7 Paper 7 : Smart Attendance System using Deep Learning

Mrs. K .Vignesh, Dr.A.M.Abirami,Pullari Manideep,Kovvuru Vasu,K Rakesh,Setti Vishnu Vardhan , Tamilnadu, India(2023).

This study has designed and developed a facial recognition-based attendance management system for educational. The manual attendance management system consumes more time and is difficult to maintain. This will be replaced by automatic attendance management system.One of the natural traits that may be utilized to distinguish one person from another is face recognition. Hence, this study utilizes an approach based on Convolutional Neural Networks (CNN) for face recognition. Here, the face recognition dataset is trained to the proposed CNN model.For face detection LBPH (Local Binary Pattern Histogram) algorithm is used in this system. Using the Open CV face recognition approach, an input image will be processed and a face will be detected and then a spreadsheet will also be utilized to record attendance. As soon as a person is recognized, the essential information gets stored in an excel spreadsheet, and finally the attendance will be recorded. A report containing the attendance data will then be sent to parents at the end of each school day. Moreover, the student's attendance information is sent to their parents via SMS.Additionally, this study recommended sending the parents a summary of the student's grades as well as attendance information. The primary objective of this study is to keep students and staff safe and fully present in class, as well as to eliminate the manual attendance marking method and save time.

2.8 Paper 8:Face Recognition Using LBPH Descriptor and Convolution Neural Network.

V.Betcy Thanga Shoba1,Dr. I. Shatheesh Sam,TamilNadu, India (2018)

Face Recognition is an exigent problem in Biometrics and Computer Vision.To create strong and distinct features, increase the inter-personal variations and decrease the intra-personal variations simultaneously remains a demanding problem in facial recognition. In this paper, the researcher explains how to improve the ability of face recognition system using Local Binary Pattern (LBP) for feature extraction and Convolution Neural Network (CNN) for classification of the images.The correspondence between the trained images helps CNN to converge faster and achieve better accuracy.There is a great improvement compared to other traditional methods too. To evaluate the accomplishment of this new method, it is found that higher face recognition accuracy can be achieved with less computational cost. The proposed framework is tested on the Yale dataset and achieved an accuracy of 98.6 regions called cells and then LBP histograms are brought out from all such region and then concatenated into a single feature vector. This feature vector forms the feature representation of the face and also calculates the similarity measure between the images. To enhance the face recognition, Convolution Neural Network is used for classifying the images. Classification is the assignment of features of the face images to a group that have the images of other face image objects that all have the same particular characteristics in common. CNN identifies successively larger features in a set of layers.

2.9 Paper 9:AttenFace:A Real Time Attendance System Using Face recognition.

Ashwin Rao ,Hyderabad(2022).

This is an IEEE paper published on 2022 by Ashwin Rao ,Hyderabad.The technology used here is PCAfor multiple Face Recognition .It is implemented by calculating eigen faces.PCA works by capturing most important data (principal components).It works by capturing the snapshot of entire class during 10 min interval.A student will be marked present if he is present atleast of ‘n’ snap shot.This threshold can be decided by the professor.AttenFace’s snapshot model provides a method to continuously track attendance throughout the class duration while avoiding the computationally epensive process of face recognition in video.Simultaneously ,it should ensure that students must remainin class for a minimum amount of time to receive attendance,solving the issue of students leaving class after manual attendance.This makes the system equally efficient but morerobust than existing solutions for face recognition ,which do not run continuously during the whole class but rather involve asingle verification before or after the class.

2.10 Paper 10:Attendance system based on Face Recognition using Eigen face And PCA algorithms

Priyanga Wagh,Jagruti Chaudhari, Roshani Thakare and Shweta Patil (2021).

This is IEEE paper pubished on 2021 by Priyanga Wagh,Jagruti Chaudhari, Roshani Thakare and Shweta Patil of Sandip Foundation's S.I.T.R.C. uses pca riigen faces for face recognition. In the process of this face recognition system is divided into various steps, but the importantce steps are detection of face and recognition of face. Firstly, to mark the attendance of students, the image of students' faces will be required. This image can be snapped from the camera device, which will be placed in the classroom at a suitable location from where the whole classroom can be covered. This image will act as input to the system. For the effective face detection, the image needs to be enhanced by using some image processing techniques like grayscale conversion of image and histogram equalization . To identify the students sitting on the last rows neatly, the histogram equalization of image needs to be done. After enhancing the image quality, the image will be passed to perfonn face detection. In the face detection step, we need to use the various algorithms like Ada-Boost algorithm, neural networks, support vector machines, etc. the efficiency of Ada-Boost algorithm is most effective of all these. Therefore we will use this algorithm for detecting faces ofstudents by using the haar feature classifiers and cascade concepts of Ada-Boost algorithm. To recognize the faces is the next task to be done after detecting faces of students from image. For face recognition, there are various techniques available like Eigen face, PCA and LDA hybrid algorithm, etc.

Chapter 3

PROJECT OVERVIEW

The proposed project aims to implement an automatic attendance marker using face recognition for multiple faces in educational settings. Leveraging use of HOG and CNN for face detection and recognition respectively,system will efficiently capture and identify the faces of multiple individuals simultaneously. With a scalable and modular architecture, the system will seamlessly integrate with existing attendance management systems, ensuring real-time tracking and recording of attendance in classrooms or group settings. The project addresses challenges such as privacy concerns through adherence to regulations, emphasizes user-friendly interfaces for administrators, and conducts comprehensive testing for performance and scalability. This automated solution not only improves the efficiency of attendance tracking but also enhances security and reduces the administrative burden associated with manual methods, providing a robust and adaptable system for educational institutions.

3.1 ADVANTAGES

Efficiency in Group Settings: Face recognition for multiple faces enhances efficiency by marking the attendance of an entire group simultaneously, reducing the time required compared to individual or manual methods.

Real-time Tracking: The system allows real-time tracking of attendance for multiple individuals, providing instant and up-to-date information on their presence. Non-Intrusive: Face recognition is nonintrusive and does not require physical contact, making it a comfortable and convenient method for individuals in group settings.

Accurate Identification: Advanced algorithms ensure accurate identification of multiple faces simultaneously, minimizing the risk of errors or misidentifications.

Scalability: The system is scalable to accommodate varying group sizes, making it suitable for different educational or organizational settings.

Reduced Administrative Burden: Automation of attendance for multiple faces reduces the administrative burden associated with manual tracking, allowing educators or administrators to focus on other responsibilities.

Minimized Human Intervention: Automation reduces the need for manual intervention, minimizing the chances of errors, manipulation, or fraudulent activities associated with traditional attendance methods.

Integration with Existing Systems: Seamless integration with existing systems, such as databases or attendance records, facilitates a smooth transition to automated face recognition for attendance tracking.

3.2 CHALLENGES

Privacy Concerns: Implementing facial recognition raises privacy issues, as it involves capturing and processing individuals' biometric data. Safeguards must be in place to ensure compliance with privacy regulations and protect users' rights.

Accuracy Issues: Face recognition systems may face challenges in accurately identifying individuals, especially in diverse group settings with variations in facial features, lighting conditions, and facial expressions.

Security Risks: Facial recognition systems can be susceptible to security risks, such as unauthorized access or manipulation of the system. Ensuring the robustness of the security measures is crucial.

Cost of Implementation: Implementing and maintaining a reliable face recognition system can involve significant upfront and ongoing costs, including the purchase of high-quality cameras, software development, and system maintenance.

Ethical Considerations: Ethical concerns regarding consent, data storage, and potential misuse of facial data need careful consideration. Clear guidelines and ethical standards should be established and adhered to.

Environmental Factors: Variations in lighting conditions, camera angles, and other

environmental factors can affect the performance of face recognition systems, leading to reduced accuracy in some situations.

Data Security and Storage: Storing facial data securely is crucial to prevent unauthorized access or data breaches. Establishing robust data security measures is essential to address potential vulnerabilities.

User Acceptance: Resistance or reluctance from individuals to adopt facial recognition technology for attendance tracking can pose a challenge. Ensuring transparent communication about the technology's purpose and benefits is essential for user acceptance.

3.3 FEASIBILITY ANALYSIS

3.3.1 TECHNICAL FEASIBILITY

From a technical standpoint, implementing an automatic attendance marker using face recognition for multiple faces is feasible. The availability of robust face detection algorithms like,Histogram of Oriented Gradients (HOG), Viola-Jones and advanced recognition techniques such as Principal Component Analysis (PCA) and Linear Discriminant Analysis (LDA) supports accurate and efficient identification of multiple individuals simultaneously. The system's architecture, designed for scalability, ensures compatibility with existing systems and hardware. Technical challenges, such as variations in lighting conditions and facial expressions, can be addressed through rigorous testing and algorithm optimization. Additionally, continuous advancements in facial recognition technology contribute to the feasibility of the project from a technical perspective.

3.3.2 ECONOMIC FEASIBILITY

The economic feasibility of the project involves assessing the costs associated with development, implementation, and maintenance against the anticipated benefits. While there might be initial investments in high-quality cameras, software development, and hardware infrastructure, the long-term economic benefits include reduced administrative costs related to manual attendance tracking. The automation of the

attendance process minimizes the need for manual labor, leading to potential cost savings over time. A cost-benefit analysis considering initial investments, ongoing operational costs, and expected returns will provide a comprehensive understanding of the economic feasibility of the project.

3.3.3 OPERATIONAL FEASIBILITY

The operational feasibility of the automatic attendance marker using face recognition for multiple faces centers around its practicality and usability in real-world scenarios. The system's user-friendly interface for administrators and end-users, along with seamless integration with existing attendance management systems, enhances its operational feasibility. The scalability of the system allows it to adapt to varying group sizes and dynamic environments, making it suitable for educational institutions with changing rosters. Adequate training programs and support mechanisms will ensure a smooth transition to the new system. Considering these aspects, the project demonstrates strong operational feasibility, aligning with the needs and workflow of educational settings.

3.4 Algorithms

3.4.1 The Local Binary Patterns Histogram (LBPH)

The LBPH algorithm extends LBP by applying it in a local neighborhood around each pixel in an image. For each pixel in the image, a local binary pattern is computed based on the intensity values of its neighbors. These local binary patterns are then used to generate a histogram for the entire image, capturing the distribution of different patterns. Finally, the histograms of different images are compared using distance metrics (e.g., Euclidean distance) to determine similarity or dissimilarity. Training and Recognition:

In the context of face recognition, the LBPH algorithm is trained on a dataset of face images. During training, LBPH generates histograms for each face image and stores them in a database along with corresponding labels (e.g., person's name or ID). During recognition, LBPH computes the histogram for a new input face image and

compares it with the histograms stored in the database to identify the closest match. Advantages:

LBPH is robust to changes in lighting conditions and facial expressions. It is computationally efficient and easy to implement. LBPH can handle grayscale images, making it suitable for real-world applications. Limitations:

LBPH may not perform well with occluded faces or significant pose variations. It relies on the local texture patterns of the face, which may not capture global facial features effectively.

3.4.2 Frontal Face Haar Cascade Algorithm

A feature-based object detection system called Haar Cascade is used to identify objects in photos. For detection, a cascade function is trained on a large number of both positive and negative images. The approach can run in real-time and doesn't call for a lot of computing. Since Haar Cascade only recognises objects with the same shape and size, it cannot be used to recognise faces. The cascade function and cascading window are used in the Haar cascade. Every window's features are calculated, and positive and negative values are assigned. Positive if it's possible that the window is a component of an object; otherwise, negative. Training-ready Haar Cascades The use of pre-trained haar cascade files makes implementation incredibly simple. We are also able to train our own haar cascade, but vast data is required for it. All popular haar cascades pre-trained files may be found in the OpenCV library's GitHub repository, where they can be used for a variety of object identification applications, such as: • Detection of human faces • Eye recognition • Automobile detection • Mouth/Nose detection • Body recognition • Detection of licence plates For object detection, Haar cascade saves its characteristics in an XML file, which may be opened directly in OpenCV. Using OpenCV to implement Haar-cascades : You only need to download the pre-trained XML file if you are using any of the previously trained object recognition algorithms available in the repositories given by OpenCV.

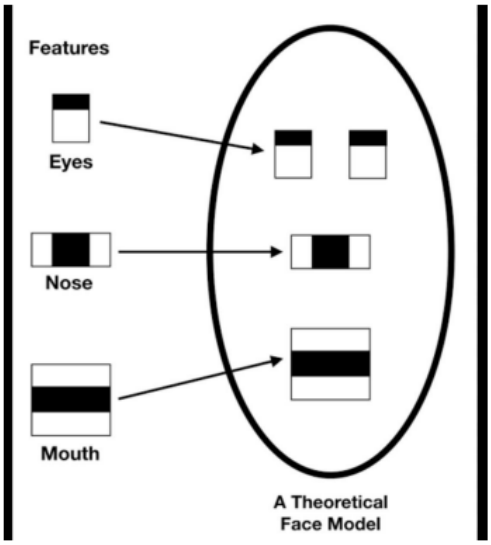

Figure 3.1: Haar Cascade Algorithm

Face Identification of Humans

Hierarchical detection The Haar cascade can detect numerous objects in a single frame in a hierarchical way,since it offers hierarchical detection. Let's say we need to recognise human faces . We must carry out these actions in order to continue with the assignment.

- Find faces
- Crop faces for each face
- Using the x, y, w, and h coordinates from the original image, build a bounding box around the faces.

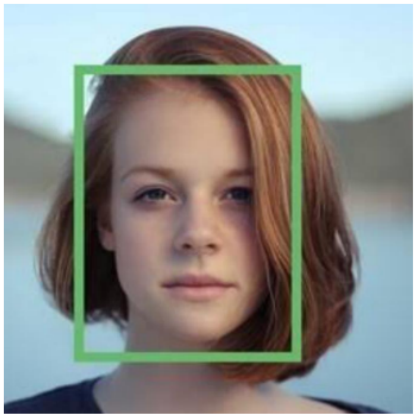

Figure 3.2: Hierarchical Detection

Chapter 4

SYSTEM DESIGN

4.1 Introduction

In the contemporary landscape of technological innovation, the fusion of artificial intelligence (AI) and computer vision has paved the way for groundbreaking solutions to traditional challenges. The project at hand, the ”Automatic Attendance Marker Using AI,” represents a pioneering endeavor to revolutionize the conventional method of attendance tracking through the integration of two formidable algorithms: Local Binary Ptterns Histogram(LBPH) and Convolutional Neural Network (CNN).

The core objective of this project is to design a robust and efficient system that not only automates attendance marking but also addresses the intricacies associated with variations in lighting conditions, facial orientations, and individual appearances. The system leverages the power of LBPH for feature extraction and CNN for deep learning-based facial recognition, resulting in a comprehensive solution capable of adapting to the dynamic nature of real-world scenarios.

The system design encompasses a meticulously crafted workflow, commencing with the real-time capture of facial images using cameras. These images undergo a preprocessing phase to enhance feature visibility, following which the LBPH algorithm is applied for extracting essential facial features. Concurrently, a CNN model, trained on a diverse dataset, performs facial recognition, learning and identifying unique patterns for accurate classification.

The integration of LBPH and CNN algorithms within the system design not only

fortifies its capability to handle variations in facial appearances but also contributes to its adaptability and precision. The marriage of these algorithms ensures a holistic approach to attendance monitoring, thereby reducing manual efforts and minimizing the likelihood of errors inherent in traditional methods.

This introduction sets the stage for a comprehensive exploration of the system's architecture, detailing the intricacies of LBPH and CNN algorithm integration, and highlighting the anticipated impact of this innovative solution on automating attendance tracking processes. As we delve into the system design, a closer examination of each component will elucidate how the Automatic Attendance Marker Using AI with LBPH and CNN Algorithm Implementation transcends the boundaries of conventional attendance systems, marking a significant leap toward efficiency and accuracy in attendance management.

4.2 Machine Learning Model

4.2.1 Dataset

The dataset for the machine learning model in the "Automatic Attendance Marker Using AI" project, implemented with the Local Binary Ptterns Histogram(LBPH) and Convolutional Neural Network (CNN) algorithms, is meticulously curated to ensure the model's versatility and robustness in real-world scenarios. Comprising a diverse set of individuals in terms of age, gender, and ethnicity, the dataset captures various lighting conditions, facial orientations, and expressions to enhance the model's generalization capabilities. Context-specific images, simulating environments like classrooms or offices, are included to contextualize attendance scenarios. With image augmentation techniques applied for variations and ethical considerations such as privacy and bias mitigation addressed, the dataset is sufficiently large, annotated with identity labels, and designed to equip the model with the capacity to recognize faces accurately across diverse and challenging conditions. This comprehensive dataset forms the foundation for training a powerful machine learning model, optimizing the "Automatic Attendance Marker Using AI" system for precision and adaptability in attendance tracking.

4.2.2 CNN

The Convolutional Neural Network (CNN) has emerged as a powerful and indispensable tool for face recognition tasks. Its unique architecture is designed to mimic the human visual system, allowing it to automatically learn hierarchical representations of facial features. In face recognition, a CNN excels at extracting intricate patterns and relevant features from input images, enabling it to differentiate between individuals with a high degree of accuracy. Through a series of convolutional and pooling layers, the network learns to identify low-level features such as edges and textures, gradually progressing to higher-level features like facial contours and expressions. This hierarchical feature extraction capability makes CNNs particularly effective in handling variations in lighting conditions, facial poses, and expressions—common challenges in real-world scenarios. The utilization of CNNs in face recognition systems has significantly contributed to the advancement of biometric technology, fostering applications in security, authentication, and automated attendance systems, as demonstrated in the context of the Automatic Attendance Marker Using AI project.

4.2.3 LBPH

The Local Binary Patterns Histogram (LBPH) is a popular algorithm used for face recognition. Here's a brief overview of how it works:

Local Binary Patterns (LBP): LBP is a texture descriptor that encodes the local structure of an image. It works by comparing the intensity of a central pixel with its neighboring pixels. By thresholding these comparisons, binary patterns are generated for each pixel.

4.3 System Architecture

4.3.1 Preprocessing

Here in this phase median filter/order statistics filter is used to remove those noises acquired by the image.

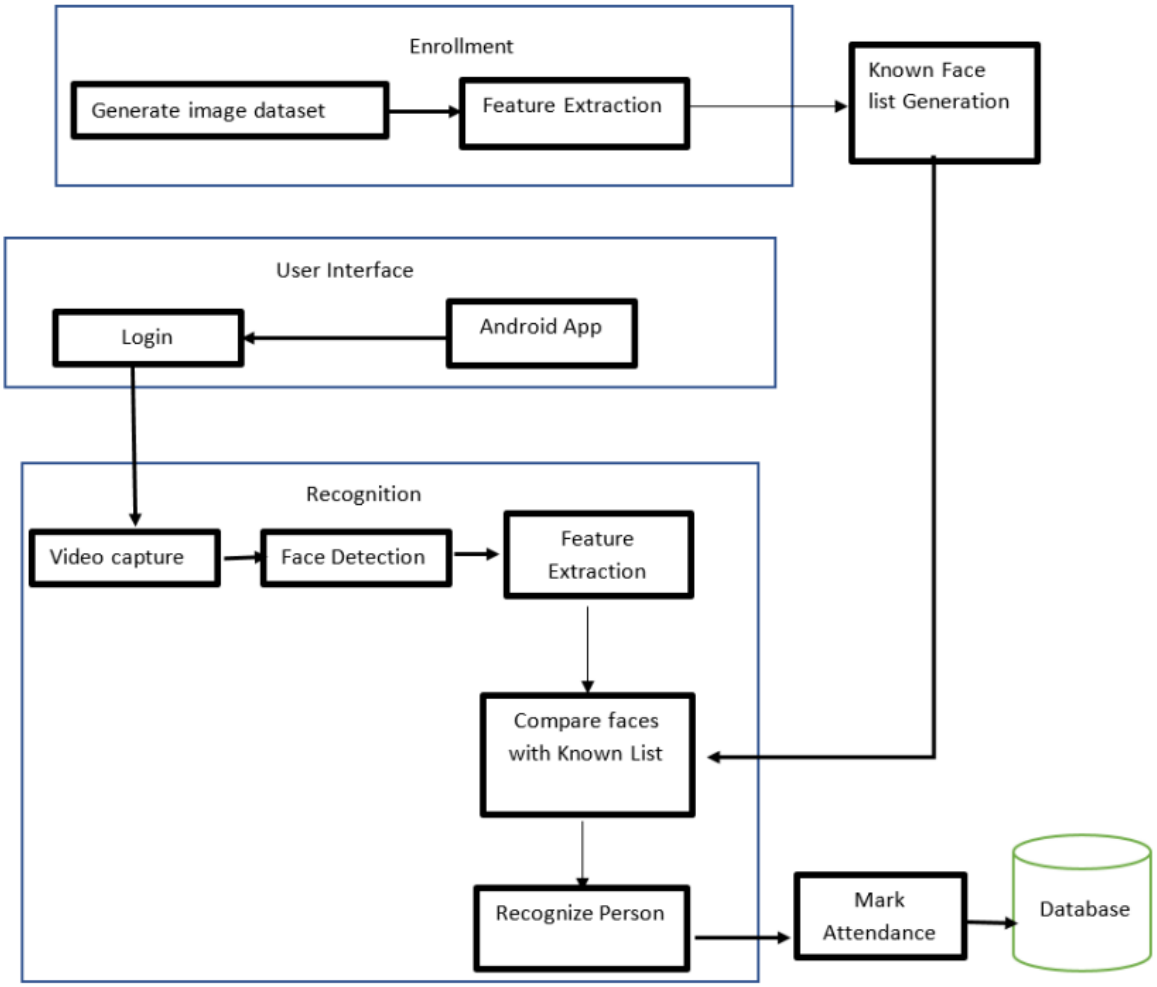

Figure 4.1: System Architecture

4.3.2 Image detection

Image detection is done by using HOG algorithm.It works by dividing an image into small, overlapping regions called cells and computes the gradient magnitude and orientation for each pixel in these cells. The gradient information is then used to create a histogram of gradient orientations for each cell. These histograms are further normalized to account for changes in lighting and contrast.

4.3.3 Image Classification

Here CNN algorithm is used for image classification.In Convolution Neural Network, the input is a set of images which are detected by LBPH algorithm.CNN layers have input layer, output layer and many hidden layers. The hidden layers have convolution

layers, pooling layers and fully connected layers. The convolution layer employs convolutional operations, where a set of learnable filters (kernels) slide over the input image, computing dot products to detect spatial patterns. These filters act as feature detectors, recognizing simple to complex patterns like edges, textures, or facial features. The convolutional layer introduces parameter sharing, reducing the number of parameters and enabling the model to generalize better. Additionally, it preserves the spatial hierarchy of features, allowing the network to recognize complex patterns hierarchically. The resulting feature maps are then passed through activation functions and potentially pooled to reduce spatial dimensions. The neurons in the fully connected layers have full connections to all activations in the previous layers.

Chapter 5

THEORETICAL BACKGROUND

5.1 CNN

Convolutional Neural Networks (CNNs) are instrumental in face recognition due to their ability to automatically learn hierarchical representations of facial features. In a CNN designed for face recognition, the initial layers typically function as feature extractors, detecting low-level features like edges and textures. As the network progresses through deeper layers, it learns to recognize more complex facial patterns and combinations of features.

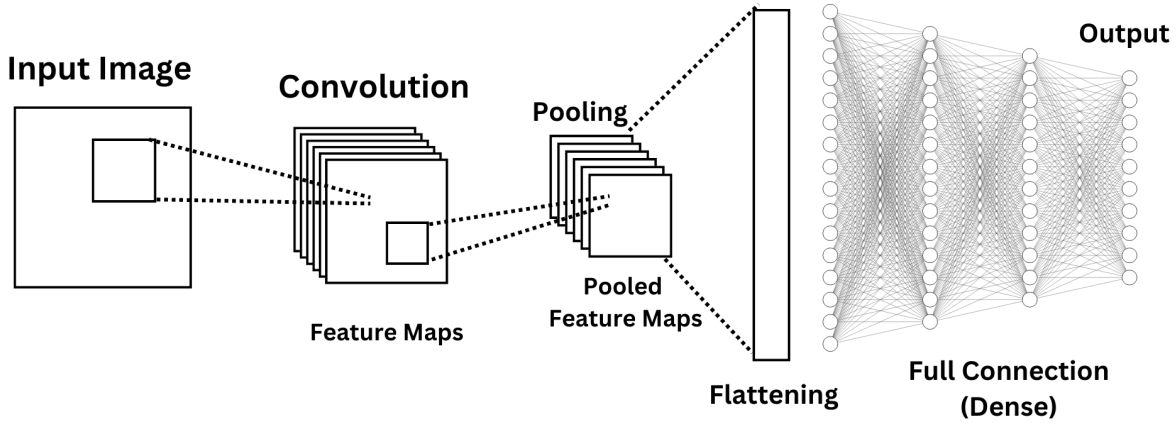

Figure 5.1: CNN Architecture

5.1.1 Convolution Layer

Using filters, the convolution layer scans the images one or more pixels at a time to create an activation map

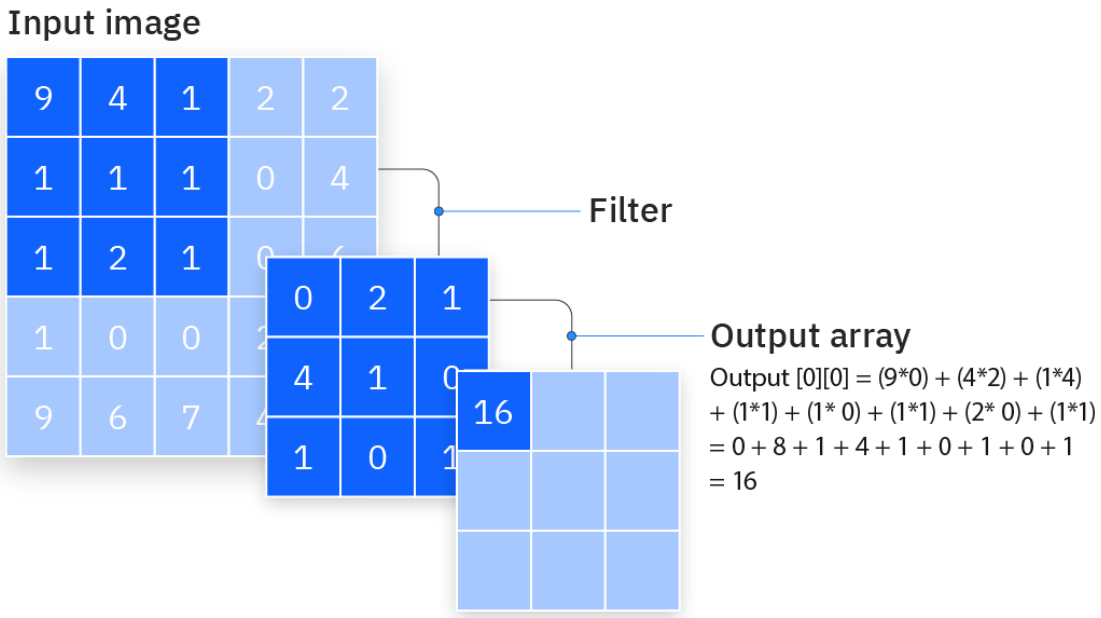

Figure 5.2: Convolution Layer

5.1.2 Pooling Layer

Pooling layers is also known as downsampling. It conducts dimensionality reduction, reducing the number of parameters in the input.The kernel applies an aggregation function to the values within the receptive field, populating the output array.

There are two main types of pooling are Max pooling and Average pooling.

5.1.3 Fully Connected Layer

In the fully-connected layer, each node in the output layer connects directly to a node in the previous layer.This layer performs the task of classification based on the features extracted through the previous layers and their different filters.

5.2 LBPH

Using Local Binary Patterns Histograms (LBPH) for face recognition in automatic attendance marking is a great idea. LBPH is robust to variations in illumination and facial expressions, making it suitable for real-world applications like attendance systems. It works by extracting local binary patterns from facial images and then creating histograms to represent each face. These histograms can be compared to recognize faces and mark attendance accordingly. However, keep in mind factors like image quality, camera angles, and database size when implementing such a system.

Chapter 6

METHODOLOGY

6.1 Data Collection

Collected student photos from roughly three classes to use in a comparison with images that were taken during real-time video processing to determine attendance. The produced database contains these gathered photos.

6.2 Face Detection

Finding the location of a person's face is what is meant by face detection. In other words, it is the process of identifying the face area in a video. After a human's face is detected, its facial features are retrieved and used for a variety of purposes, including face identification, facial expression recognition, surveillance systems, human computer interfaces, and more. Face detection is the first and most crucial phase in the application of face recognition. The rectangle on each student's face that is visible in the video source is marked at this stage to identify faces. The process then moves on to cropping each face that was identified from the window. Each resized image is given its own strand for the recognising process. The face recognition algorithm can only work after face detection. The process of detecting faces itself is complicated by factors including the environment, a person's stance, illumination, and more. The effectiveness of face recognition systems is always improved by a good and successful face detection algorithm.

6.3 Face Recognition

In order to identify pupils in the classes and analyse the associated attendance execution, face recognition sections are deployed. When student photographs from the database module (which have already undergone testing) are transferred to the face detection module and are ready for use, the face recognition module will utilise these images and facial information to try to match them with student images from the database module. If there is a match between the image that was taken and the image in the database record, the student is confirmed to be present within the lecture hall.

6.4 Attendance Marking

The students attendance is noted when the face is recognised by matching the already retrieved student characteristic with the one that was extracted at the moment of performing attendance. Once the face has been associated with the image saved in the database, the computer system provides an attendance database with the individual's name, roll number, date, day, and time in addition to the corresponding subject id. Python then creates the most recent student roll numbers and returns them. After locating the students with the appropriate date and time, the attendance is updated in the database.

6.5 Maintenance

The professors enter their account and password to log onto the Android application.Faculty chooses the class and subject for which attendance should be taken after logging in. The camera records a video of the classroom for a predetermined amount of time (between one and two minutes) once the attendance button has been depressed. The camera stops taking pictures after this count. The recognised face is then added to the database after that. Through the Android application, both the professors and the students can view the attendance.

Chapter 7

RESULT

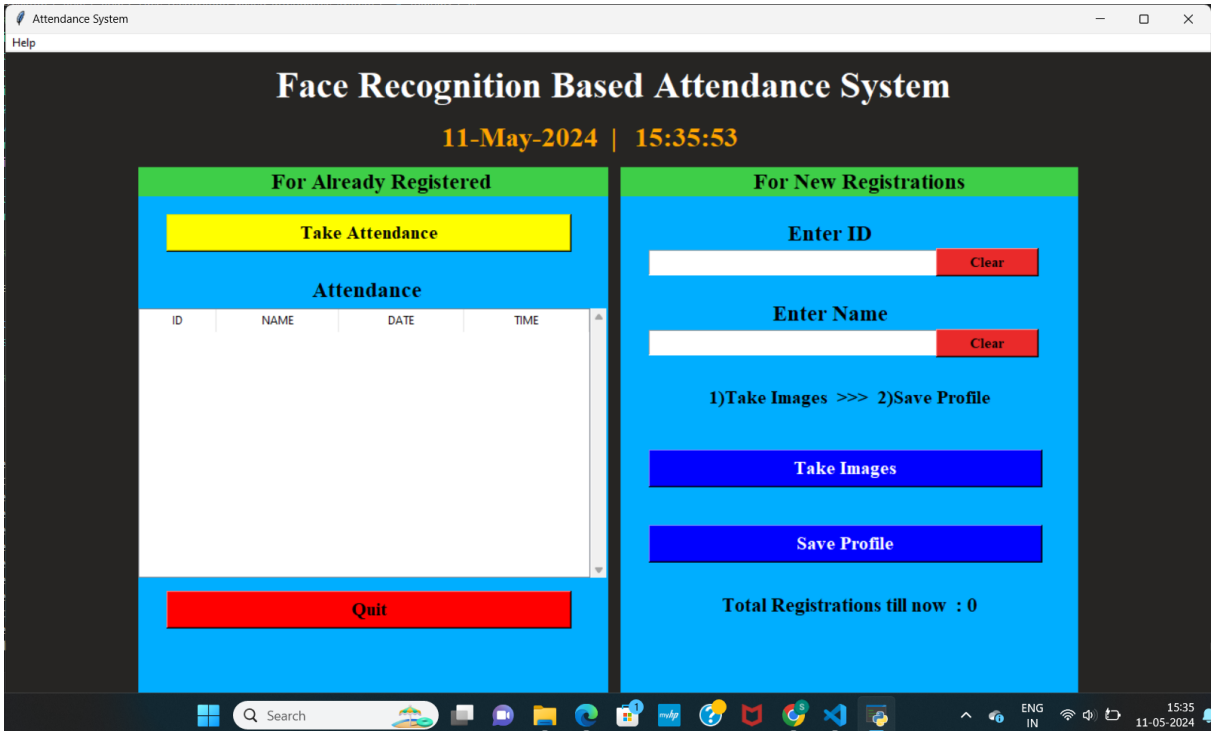

Figure 7.1: Face Recognition Model

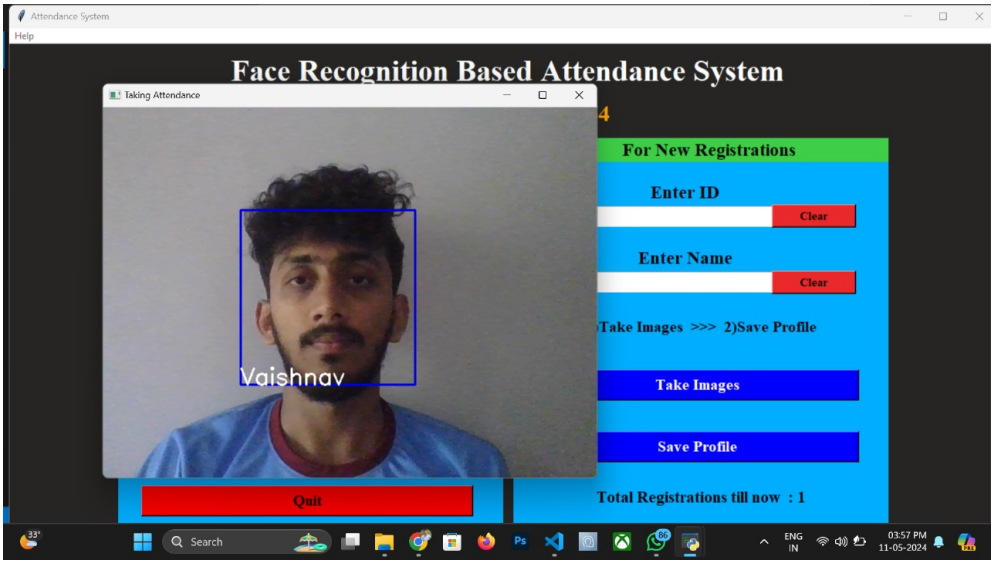

Figure 7.2: Face Recognition

Figure 7.3: Unknown Face Recognition

Chapter 8

CONCLUSION

Automating attendance marking through AI technology offers numerous advantages, including accuracy, efficiency, and time savings. By harnessing machine learning algorithms and computer vision, this project eliminates manual tracking, enhances data precision, and improves overall productivity for educational or organizational settings. The implementation of such a system not only simplifies administrative tasks but also lays the groundwork for more sophisticated applications of AI in various sectors, revolutionizing conventional methods of attendance management.

Chapter 9

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