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Face Recognition based Advanced Attendance System using Machine Learning Local Binary Pattern Histogram and Open CV

Anmol garg

Abstract:
In the not-too-distant future, schools will convert from using the approach that is now being used to utilising an attendance system that is based on facial recognition; this technology may even wind up replacing biometric attendance systems. The purpose of this investigation is to come up with a novel approach to recording attendance that takes use of cv2 technology. Facebook also makes use of technology that can recognise faces, as can be shown by the fact that, as soon as you upload photos that you've previously tagged, it assigns names to the persons seen in those photos automatically. This demonstrates that facial recognition is used by Facebook. The software first searches the database for faces that contain distinguishing features, and then it encodes those features into a pattern image using those features. Python modules are what are utilised to accomplish the aforementioned. Following that, a technique for machine learning known as a classifier is used to the data in order to identify the individual's name. The method consists of a number of phases, such as the acquisition of an image, the analysis of facial traits and features, the application of face recognition, and the establishment of an attendance system. This thesis presents an automatic technique for logging in time and name for attendance based on high accuracy based algorithm Binary pattern histogram and opencv.

Keywords- *Face Recognition; Machine Learning; Attendance System; BPH*

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I. INTRODUCTION

1.1 Introduction:

Automation is the process of regulating machines and their operations using a range of technologies that are based on computer software. This process is accomplished via automation. In this day and age of rapid technological advancement, these advancements have shown that they have the potential to increase accuracy while also supporting us in elevating our level of life.

Taking attendance in today's modern society is a very necessary practise. In the majority of institutions, students' attendance rates are included towards their final grades. In most cases, attendance is collected with a sheet of paper that serves as both an attendance register for the students and a record of the students' personal information. After that, each student will affix their signature to the document to indicate that they were there on that specific day.

However, there are certain issues with using such a general approach. One contributor to the issue is the practise of students falsifying the signature of a close companion [1]. The procedure for taking attendance takes a very lengthy time and is fraught with many additional complications [2]. In order to address these issues, the implementation of an automatic attendance system is required. In order to tackle these issues, the project will provide an automated system based on facial recognition, which will be discussed in this article. It is a computerised system that will automatically record the attendance of each student in the corresponding database.

Barcode Readers, the Radio Frequency Identification System (RFID), and Bluetooth are all examples of technologies that may be quickly constructed and used for the purpose of automatically taking attendance of students. Even while the use of these technologies could assist to cut down on the amount of time it takes to take attendance, the machinery and gadgets that are required to do so are rather expensive and have a limited lifespan due to the fact that they are so easily damaged [3].

In addition to it, there are other methods, such as biometrics. The biometrics application proposal, on the other hand, focuses almost entirely on the application that will be utilised by the lecturer during the actual class period. Since of this, ultimately there will be disruptions in the classroom because the lecturer will have to stop teaching every time he or she lets late pupils into the room [4]. If biometrics are used, it would take much more time since the pupils will have to form a line in order to use the gadget [5].

The purpose of technology in the modern day is to disseminate vast quantities of knowledge that may be put to use in the development of new technologies. The field of machine learning is one of the most exciting areas of computer science because it enables computers to teach themselves by being given a series of datasets to examine, and it then produces results that are suitable for testing by making use of a variety of learning algorithms. This makes machine learning one of the most exciting areas of computer science. Attendance is seen as a crucial component in today's culture, not only for the learner but also for the educator working inside of an educational institution. This applies to both the student and the learner's educator. The advancement of technology that enables machine learning has made it possible to create a machine that is capable of automatically identifying the attendance and performance of students and maintaining a record of the information that has been acquired. Both the Automated Attendance System (AAS) and the Manual Attendance System (MAS) are two methods that may be used to keep track of a student's attendance in a classroom setting. The abbreviation for "Manual Attendance System" is "MAS." The abbreviation for "Automated Attendance System" is "AAS" (AAS). A method that is referred to as the Manual Student Attendance Management system is one in which a teacher who is addressing the particular subject matter is required to call the names of the students and manually record their attendance. When taking attendance manually, it is possible that the process may take a significant amount of time, that the instructor may overlook a student, or that students may need to respond more than once to questions about the absence of their classmates. Additionally, it is possible that the procedure may overlook a student. As a result, we find ourselves in a difficult situation when we take into consideration the traditional approach of determining who was present in the lecture hall. As a solution to all of these issues, we have come to the conclusion that an automated attendance system is the best option (AAS).

The typical way for keeping track of attendance is to make use of a piece of paper, on which the student's name and any other relevant information is written, along with any additional notes that may be necessary. This piece of paper will be used as the registration, and it will be passed around to each of the pupils [11]. As an example, the date that is written on the registration form will be filled in by the lecturer, and then the paper will be passed around to each of the students in the class. In order to make the most of everyone's time and make the most effective use of the lecturer's time, the lecturer would occasionally give out papers before beginning the session. There is also the possibility that the lecturers may take attendance by going around the room and calling out the names of each individual student. This is a different approach. Even if they are hushed, the lecturers or the instructor must be able to hear the students' answers if they are present in the room.

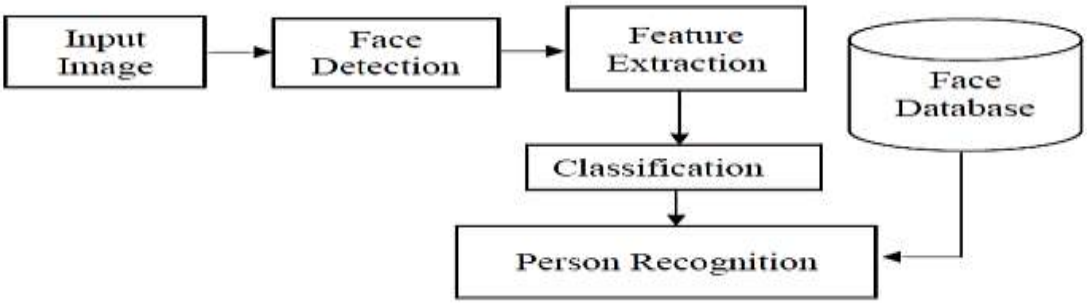

Figure 1.1 Face recognition system

Both of the processes that have been described up to this point have been put into practise on a significant scale for an appreciable length of time. On the other hand, when the normal or standard method of documenting attendance is used, issues often surface as a result. They have the potential to be time-consuming, especially in situations in which students are expected to answer when the speaker shouts out their names [12]. [Note: Due to the fact that it is possible that either the attendance sheet or the registration has been lost, it will be tough to maintain the attendance report up to date until it is time to write the report. While the traditional method is used, teachers or lecturers are required to precisely record the attendance of their pupils [13], but because of this, it is possible for mistakes to arise when the attendance is being graded. When any one of these circumstances occurs, there is a possibility that the data may be affected when the reports are generated.

When collecting attendance using the general technique, one problem that can occur is that students might try to trick their teacher by signing for a buddy who was absent for the day [11].

1.2 Motivation:

Keeping track of students' attendance is an important function that is required at any institution for the purpose of monitoring the academic development of the students. This position is vital for the purpose of keeping track of students' attendance. When it comes to this particular issue, every institution manages it in its own one-of-a-kind way. Some of these businesses are still using antiquated systems that are dependent on paper

or files, while others have transitioned to using automated methods of attendance monitoring that make use of a variety of biometric technology. A computerised biometric software called a face recognition system is meant to detect or verify a person by making pattern comparisons based on their facial appearances. This comparison process is carried out on a computer. A system such as this is referred to as a face recognition system. The management of facial recognition systems has seen major developments in recent years, which has led to an increase in the accuracy of the system. As a direct consequence of these improvements, facial recognition technology is currently used extensively for a broad range of applications, including security as well as in the operations of commercial businesses. The field of research that focuses on facial recognition, which is a subfield of computer and internet-based digital technology, is a very fruitful area of study. An application of attendance systems that makes use of facial recognition as a method of tracking attendance is one that is both forward-thinking and helpful. It may be likened to other forms of biometrics, such as those that recognise fingerprints and irises, and it has a wide variety of applications in security systems. When there is a greater number of people attending an educational institution or working for an organisation, there is a corresponding increase in the amount of work required of the lecturers and staff members. This adds another layer of complication to the process of monitoring attendance.

1.3 Scope:

In real-world situations, following and monitoring human behaviour through video is a very active area of study. In human-computer interaction, it is critical to recognise and monitor end user expressions, emotions, and behaviour through real-time video streaming. It is necessary for such systems to monitor dynamic changes in human facial motions in real time in order to provide the needed reaction mechanism. Face recognition based attendance model is also important research scope category.

1.4 Objective:

The main objectives of this thesis are

- To do literature review on face recognition
- To implement LBH method with Opencv for face recognition based attendance system.

1.5 Outline of thesis:

The thesis is divided into 5 chapters, first is introduction about the facedetection its motivation, scope and objectives.

Second chapter presents the literature review of previous year papers. Third chapter consists of methodology and algorithm used. The fourth chapter consists of screens results. The fifth chapter consists of the conclusion and future scope.

II. RELATED WORKANDLITERATUREREVIEW

Yang et al. [1] The prospects for face recognition technology are quite promising, and there is a significant demand in the market for it. This is due to the introduction of the age of big data in the globe, as well as the economic value of face recognition technology. The purpose of this article is to develop, using real-time video processing as the foundation, a face recognition attendance system. This article focuses primarily on establishing four perspectives from which to evaluate the issues at hand: the accuracy rate of the face recognition system in the actual check-in; the stability of the face recognition attendance system with real-time video processing; the truancy rate of the face recognition attendance system with real-time video processing; and the interface settings of the face recognition attendance system that makes use of real-time video processing. Research is being done on a face recognition attendance system that is based on real-time video processing. The notion of an attendance system that is based on face recognition technology has been developed after conducting an analysis of the scenario involving these challenges. According to the findings of the experiments, the accuracy rate of the video facial recognition system may reach as high as 82%. The time needed to check in using the conventional way may be cut by around sixty percent when using the facial recognition attendance system. The phenomena of students departing early and skipping courses has significantly decreased as a result of the rate of students skipping lessons. Through the above experimental certification, the face recognition time and attendance system with real-time video processing is able to quickly complete the tasks of students in the time and attendance check-in system, eliminate the complex naming phenomenon, significantly improve the efficiency of class, and play an important role in guiding the development of the time and attendance system.

Sarangi et al. [2] The most difficult aspect of the virtual platform for students is the need that they attend a physical educational establishment. When done by hand, the process consumes a significant amount of time and work. Due to the absence of a reliable attendance system, there was also a significant amount of phoney attendance. The most significant factor in determining the identity of a human being is the face. As a result, the purpose of this research is to present author's work on an attendance system that employs a face

detection algorithm in real-time and makes use of the idea of frontal face recognition. In this study, author provide an effective method for haar cascade by making use of OpenCV, which is an open-source platform for doing image processing.

Dev et al. [3] The ability to recognise a person's face is one of the most fruitful uses of image processing and plays an essential part in the technological world. For the sake of authentication, notably in the context of taking attendance of students, recognising human faces is a current subject that has to be addressed. The practise of identifying students via the use of face biostatistics based on high definition monitoring and other computer technologies is the process that is referred to as an attendance system that uses face recognition. The construction of this system has the goal of successfully accomplishing the digitalization of the conventional method of recording attendance, which consists of calling out names and keeping records using pen and paper. The methods that are currently being used to take attendance are laborious and time consuming. Manual recording of attendance data makes it straightforward to falsify attendance statistics. Both the conventional method of recording attendance and the already in use biometric technologies are susceptible to being hacked by proxies. As a result, it has been suggested that this paper address each and every one of these issues. The suggested system takes use of many machine learning algorithms, including Gabor filters, KNN, CNN, SVM, Generative adversarial networks, and Haar classifiers. Following the completion of the face recognition process, attendance reports are going to be created and saved in excel format. The system is put through its paces in a number of different scenarios, such as with varying degrees of light and head movement, as well as with varying distances between the learner and the cameras. Following a battery of meticulous tests, the overall complexity and correctness are determined. The proposed system was shown to be an effective and reliable apparatus for recording attendance in a classroom without requiring any time investment or labour on the part of the instructor. The newly created technology is economical and requires a less amount of installation.

Raj et al. [4] In today's world, educational establishments are worried about the constancy of their students' performance. The low attendance rate among students is one factor contributing to the overall decline in their academic performance. There are a few different methods that your attendance may be marked, the most popular of which are to sign in or to have the students raise their hands. It took longer and presented a number of difficulties. From this point forward, the teachers will be expected to have access to a computer-based student attendance checking system that can assist them in maintaining attendance records. During this project, author made use of an advanced attendance tracking system that is based on facial recognition. author have suggested the incorporation of a "Smart Attendance System for Face Recognition" as one of the several apps that will be used for this purpose. The current solution incorporates face identification, which not only saves time but also eliminates any possibility of proxy attendance that may have existed as a result of the facial authorisation. This technique may now be used in a domain in which participation plays an essential element and the results will be just as expected. The Raspberry Pi, Open CV, and Dlib programming libraries run on Python are the fundamental necessities for this system. The LBPH face recognizer is used by the system that has been created to determine the identity of a person's face in real time. Both Eigen faces and Fisher faces are impacted by light, and it is impossible to guarantee completely ideal lighting conditions in the actual world. An enhancement to the LBPH faces recognizer so that author can get around this obstacle. By making a comparison between the picture from the test and the image used for training, this system can tell who is and is not there. The data pertaining to attendance is kept in an Excel file that is automatically brought up to date inside the system. GSM technology will be used to send an automated text message to the parent's phone number in the event that a pupil is absent from school. An Android application thatauthorbuilt using MIT's App Inventor is available for students to use in order to record and review their attendance.

Srivastava et al. [5] For the purpose of maintaining system control, authentication is a computer-based form of communication that plays a very significant function. Face recognition has developed into an extremely important component of biometric authentication and is now being used in a wide variety of applications. Some examples of these applications include video monitoring systems, human-computer interface, and network security. The purpose of this work is to discuss the development of an attendance system as well as the integration of facial recognition technology with an open source computer vision (OpenCV) algorithm. This programme will make the process of automating attendance easier, and it will make it possible for academic institutions to query student information by simply keeping a record of the times that students clock in and clock out of class.

Azhaguraj et al. [6] The topic of this study is the management of attendance using face recognition technology. The ability to recognise people's faces is quickly becoming one of the technologies with the broadest use and an essential component of computer vision. A person may be recognised instantly from a still photograph or a reel frame using this technology. Because it is extremely vital to properly manage the attendance of the students, it is used in the process of monitoring the attendance of students as well as the staff in an educational organisation. There are a few problems that come up when contemplating the traditional

approach to taking attendance in an elegance room. This approach takes a great deal of time to take the attendance, and it's also very difficult to keep up. These issues come up because of the fact that the conventional approach is difficult to keep up. The automatic attendance control mechanism is thus suggested as a solution. The participation of students in this project indicated the usage of face detection and face recognition achieved by open computer vision without the intervention of humans. There has been some discussion over the possibility of moving away from the traditional method of attendance and instead using virtual face reputation and detection tactics with the assistance of various device mastery algorithms. The method that is being presented will regularly recognise the pupil as soon as he arrives inside the elegance room and will record the attendance by use of detecting him. This will be completed. In preparation for this, a dataset of individualities has been compiled for the purposes of finding, recognition, and the recording of attendance. This notion is totally founded on desired motivation language, which is the medium through which the idea of open laptop vision is conveyed. According to the approach that has been provided, a digital camera will be kept on at all times inside the study room. This camera will take a snapshot, after which faces will be recognised on it, after which it will be identified with the database, and finally attendance will be taken. If the attendance is recorded as being absent due to being on leave, a notification may be sent to the students' parents informing them that they are absent due to being on leave. There are a variety of methods available for judging faces. In this case, haar cascade is used for face detection, while the LBPH variant is utilised for face recognition. Also included is the education of individual pupils.

Nath et al. [7] The field of face recognition is one that is both quickly expanding and fascinating as new applications are developed. A very large number of calculations for facial recognition have been created over a very lengthy period of time. In this research, author recognise faces using a HOG (Histogram of oriented Gradient) based face detector, which, in comparison to other machine learning techniques such as Haar Cascade, produces more accurate results. During the recognition phase, author first do preprocessing using CLAHE (Contrast Limited Adaptive Histogram equalisation), and then author use HOG, a method that is considered to be industry standard for the extraction of features. Both the test picture and the training images have HOG features extracted from them. And lastly, for the purpose of classification, author are use SVM (support vector machine). The HOG characteristics will be categorised using SVM. The noise, the contrast, and the lighting are all improved by the application of a preprocessing procedure. The findings of this study demonstrate both the liability and productiveness associated with improved facial recognition capability.

Banala et al. [8] In the realm of security authentication systems, recent years have seen an uptick in the use of facial recognition as an emerging new trend. Face recognition in contemporary FR processes enables the identification of whether or not the human being seen is authentic (live), hence preventing the honesty of the systems from being compromised by the display of a photograph of a real person. These newly established techniques of face recognition are the outcome of recent advancements in the field of computer vision as well as successful algorithmic approaches to machine learning. Both of these facets contributed to the development of these systems. This thesis offers a comprehensive analysis of the many factors that contribute to the success of facial recognition in real time. The algorithm for machine learning will be used in order to accomplish the objective of establishing a safety warning framework that is acceptable for the workplace. The Haarcascade classifier was used in order to generate four distinct classes for the goal of identifying different kinds of safety gear. In the end, the python open CV programme was used in order to identify the faces that were visible in both the still images and the videos. An technique that detects faces is employed first so that a check may be made on the many facial identifiers that are accessible.

Meenavathi et al. [9] The human face is distinguished from other human faces by its many individual characteristics. The first step in identifying a face is determining if it is a face or not, which is then followed by identification. Face recognition has traditionally relied on the comparison of various facial traits in order to identify individuals, a method that is both complex for bigger datasets and confusing in a variety of contexts. In order to enhance the precision and scalability Convolutional neural networks and machine learning-based Haar Cascade techniques are utilised in the proposed approach for face recognition and feature extraction, respectively, and then the face is classified using Euclidean distance and cosine transformation. The findings indicate that the job was carried out satisfactorily in identifying the face in an effective manner despite its many changes.

Hammadi et al. [10] Due to the vast number of practical applications that it has in biometrics, information security, law enforcement, and surveillance systems, face recognition is one of the most difficult fields in the study of image analysis and computer vision. It has been a topic of active research proposing solutions to several practical problems, which has given rise to a significant amount of research in recent times aimed at addressing the challenges of face recognition. These challenges can be attributed to factors such as illumination, emotion, occlusion, facial expressions and poses, all of which have a great influence on the performance of achieving efficient and robust face recognition systems. In order to get better results, numerous

researchers in this subject have implemented various strategies, each of which is exclusively dependent on the extraction of handmade characteristics. Recent advancements in deep learning and neural networks have made it feasible to produce promising results in a variety of domains, including pattern recognition and image processing, amongst others.

The use of deep learning algorithms speeds up the learning process and makes the job of creating data more manageable. To produce the best possible results and reach the highest possible level of accuracy, a great number of algorithms that leverage deep learning architectures have been created. Some algorithms start from fresh when designing their architectures, while others fine-tune already developed models to achieve optimum effectiveness in terms of generalisation power. The primary concerns of deep learning paradigms are the complexity of the algorithms, the augmentation of the data, and the minimising of loss. These designs have been analysed by us in terms of the complexity of the underlying algorithm and the experimental outcomes on the benchmark dataset. In this study, author provided a literature review of recent developments in research on machine learning for face recognition and their experimental findings on public datasets. author also discussed some of the challenges that remain in this field.

Kasar et al. [11] Face recognition from real data, capture images, sensor images, and database images is a challenging problem due to the wide variety of face appearances, the effect of illumination, and the complexity of the image background. Real data, capture images, sensor images, and database images can all be used. Image processing and biometric systems have a wide variety of applications, but one of the most useful and important of them is face recognition. In this article, author will be reviewing the techniques and algorithms for face recognition that have been developed by a number of researchers employing artificial neural networks (ANN). These techniques and algorithms have been used in the area of image processing and pattern identification. This article will cover how artificial neural networks (ANN) will be used for the facial recognition system, as well as how it is more successful than other approaches. There are a number of suggested approaches utilising ANN that provide an overview of face recognition using ANN. As a result, this investigation incorporates a comprehensive evaluation of studies and systems for face identification that are based on a variety of ANN techniques and algorithms. This research study examines not only the benefits and drawbacks of the aforementioned literature studies and systems but also the overall performance of a variety of ANN approaches and algorithms.

Redrowthu et al. [12] author do believe that there is a lot that can be done by both the police officials and the people to reduce the crimes in states, which is why author use smart surveillance to find the criminal who is hiding from the police and roaming around in public places. It is obvious that the number of crimes that are being committed in each of the states in this country is growing at an alarming rate. This detector is suitable for usage in a wide variety of public settings, including shopping malls, movie theatres, and any other populated venues. Faces are identified by a mixture of face recognition and verification techniques, both of which are carried out by cameras installed in public areas. The face recognition is carried out on the photos that have been taken, and after that, the system validates that face by using a face classification approach that makes use of a convolution neural network that is built into the system. The system that is being evaluated demonstrates an accurate performance when it comes to recognising faces while staying within the required parameters. Following the successful facial recognition, it next searches a criminal database to validate the identified face. If the criminal is observed, the police will be notified in the control room with an alert such as "criminal sighted," and the operators in the control room will then transmit the information to the police station that is closest to the criminal so that they may apprehend him. The authorities will get a detailed snapshot of the offender, together with the area where he was observed and details on the offence he committed.

Mehta et al. [13] People are continuously submitting images of themselves together with their friends and family on different social media platforms such as Facebook, Instagram, Twitter, Google+, and so on. This may be attributed to the rise in popularity of social media in today's society. What if they want to see all of the images in a certain format, such as photos that include a certain person? In this study, author provide a tagging method for the discovered faces. This extends the notion of Multiview Face Detection using Convolution Neural Networks (CNN) that was utilised by Farfade et al. author make use of a tool called Deep Dense Face Detector for the purpose of face recognition. This tool employs a singular model that is based on deep convolutional neural networks. The Local Binary Patterns Histograms (LBPH) approach is used to identify each and every face that has been discovered. The performance of the method is evaluated based on a number of metrics including precision, recall, and F-measure. When it comes to labelling the faces that have been successfully spotted, an accuracy of 85% may be attained.

Mohra et al. [14] Deep learning has become a very useful strategy in recent years as a result of the widespread implementation of convolutional neural networks (CNNs) that are fed massive amounts of image data from databases. Because of the importance of this system in a wide variety of applications, including security systems, mobile authentication, access control, and banking with ATMs, author's goal is to improve the Face Recognition system by using Deep Neural Networks. In order to achieve face recognition performance that

is comparable to that of humans, author will make use of a convolution neural network. In order to achieve greater recognition accuracy, the CNN technique learns features in a discriminatory manner rather than through handcrafting. The learned face representations are extremely helpful for face recognition, and they are also able to reconstruct images of faces in their frontal perspectives. author propose a deep neural network model with 15 layers to learn discriminative representation. With this model, author are able to obtain and outperform the state-of-the-art methods on the ORL (Olivetti Research Laboratory face database) and YTF face databases.

Selitskaya et al. [15] This work investigates an issue with face recognition that is caused by considerable variances in face photos. These variations might be the result of different positions, different facial emotions, different haircuts, or different cosmetics. Existing artificial neural networks (ANN) have attained a high recognition accuracy that is equivalent to or even better than human recognition. However, when there are significant variances present, the techniques used by existing ANN are still inadequate. author begin by presenting a new benchmark data set of face photos called BookClub creative makeup data. This data set contains photographs of faces with a variety of makeup, haircuts, and occlusions. After that, author investigate how well ANNs function in various environments. In author's research, the identification accuracy has fallen when the test photos comprise unseen varieties of the cosmetics and occlusions, which is similar to what would happen in a situation that takes place in the real world. author demonstrate that not only may cosmetics and other occlusions be used to hide a person's identity from ANN algorithms, but they can also be used to spoof an incorrect identification. This is possible because of the way that ANN algorithms work.

Tiwari et al. [16] As part of this body of work, author's team suggests developing a Live Attendance Marking System for institutional use. Through the use of this technology, the department will be able to automatically record the attendance of students based on the recognition of their faces. Face detection and identification algorithms are at the core of this system, which means that it is able to instantly identify a student anytime that student walks in front of the camera module.

After the recognition has taken place, the individual's attendance record in the database will be instantly updated. The article provides a comprehensive analysis of the model's fundamental architecture as well as all of the algorithms that it employs. Furthermore, in order to analyse and improve the performance of the system, a large number of the filter functions are utilised. These functions enable the capacity to record and identify pictures even in dimly illuminated and otherwise uninteresting environments. This article also provides the method to guarantee that a student can only record their attendance once per day and proposes how to implement it.

In comparison to more conventional methods of taking attendance, the live attendance system is much more effective in terms of both time savings and the management of the database.

Aware et al. [17] In today's world, educational institutions are more worried about the consistent attendance of students. Even in the midst of a pandemic, attendance remains a significant challenge for educational institutions like schools and universities. Roll call and having students check in on paper are the two most common traditional approaches of recording attendance. In general, shouting out the roll call is also an option. They both required much more effort and time to complete. As a result, there is a need for a computer-based student attendance management system that would aid the teaching staff in automatically keeping attendance records. With the help of 'TKINTER' and 'PYTHON,' author were able to successfully create an automatic attendance system for this project. author's plans to develop a "Automated Attendance System Based on Face Recognition" have been presented to the team for consideration.

Madhu et al. [18] The process of taking attendance and noting it down is one of the most laborious tasks in any business. As part of this project, author came up with the idea of developing an automated attendance management system that would solve the problem of recognising faces in biometric systems when they are exposed to a variety of different real-time conditions, such as illumination, rotation, and scaling. This model consists of a camera that takes input images, an algorithm that can extract a face from those input images, encode it so that it can be recognized, mark attendance in a database, and convert the information into a PDF file all in one convenient package. The image is captured by the camera and then transmitted to the server, where it is processed to identify individual faces and determine the number of people present. Histogram of Oriented Gradients was the analysis tool that author employed (HOG). The HOG with LBPH (a type of machine learning algorithm for classification) approach to recognise HOG descriptors of people is one of the most well-known and widely used "person detectors" currently available. It has also been quite successful.

Mishra et al. [19] Since the beginning of time, research into facial recognition has been one of the most popular and active fields. Face recognition is a challenging issue to resolve, which is precisely why so many academics are interested in studying it. Face recognition technology has several real-world applications, one of which is the automated attendance system. author are aware that author are able to recognise a person just by seeing his or her face; hence,author are attempting to design an automated attendance system that is based on facial recognition. In this particular piece of research, author made use of a high-definition camera, and author's

model makes use of the footage that was acquired by the camera in order to identify and locate human faces. author are able to identify pupils who are now present in the classroom thanks to this method, and their attendance is being recorded in a database. In this article, author will provide a user interface that will assist the instructors in marking the students' attendance from their respective computer screens using the information provided by the students.

Al-Muhaidhri et al. [20] In elementary schools, secondary schools, colleges, and universities, an attendance system was established so that students might be held accountable for their academic performance and achieve their full potential in terms of knowledge acquisition. There are traditionally two methods that are used to keep track of which pupils are present in a given classroom.

The first way is to shout out the students' roll numbers, and the second way is to have them sign their names on a piece of paper that is taped to their roll number.

Because of this, there was a pressing need to develop this system in such a manner that it could become user-friendly, less time consuming, and more effective. This is an automated system that will aid the teaching staff in taking attendance of the whole class in a manner that will not cause any disruptions or waste any time. The concept has a wide range of potential applications, one of which is facial recognition; using it will help save time, effectively identify attendees, and remove the possibility of proxy attendance.

III. FACE RECOGNITION USING MACHINE LEARNING

3.1 Introduction:

The last few years have seen a rise in interest in the study of facial recognition, which may be attributed to the increased desire for improved levels of security as well as the fast proliferation of mobile devices. In any case, this enthusiasm has been a welcome development for researchers in the field. Of any event, the sudden surge in interest has been a very positive turn of events. Face recognition has the potential to be used in a great number of different spheres, some of which include, but are not limited to, access control, identity verification, surveillance systems, security systems, and social media networks.

Access control may be used to govern almost anything, including private offices, computers, telephones, automated teller machines, and a variety of other things. Facial recognition, on the other hand, is getting some momentum as a possible replacement for passwords and fingerprint scanners as a result of developing technology in computers as well as more sophisticated algorithmic approaches. At present moment, the typical mechanism for allowing input does not use facial recognition in the great majority of these forms. Since the attacks on the World Trade Center and the Pentagon on September 11, 2001, there has been a heightened focus on the establishment of security measures to ensure the protection of innocent people. These measures aim to prevent harm from coming to individuals who are not responsible for it. These precautions are being taken in large part with the intention of warding off future assaults on civilian targets. Airports and other public areas, such as border crossings and ports of entry, have the potential to become safer places to be as a result of technological advancements in facial recognition, especially in circumstances in which it is necessary to verify the identification of a specific person. Because of this, it's possible that, in the long term, assaults of this kind will become irrelevant and unnecessary. If there are offenders who are still at large, an argument may be made for the installation of surveillance technology for the same reasons. The search for these people may benefit from the use of security cameras that are equipped with software that is able to recognise faces. There is a probability that this will be the case. Alternately, these same surveillance systems may also be used to assist in determining the locations of individuals who have gone missing. However, in order to do so, it is necessary to have reliable facial recognition algorithms as well as a fully established database of faces. In order to determine the locations of individuals who have gone missing, it may be possible to use these surveillance systems. On the other hand, this is something that is possible thanks to the aid provided by these monitoring systems. As a final point of interest, software that is capable of facial recognition has just recently begun to make its way into programmes that run on social networking sites like Facebook. Users of these programmes are encouraged to tag their friends on pictures that they have uploaded, provided that their friends are visible in the photographs.

It shouldn't come as much of a surprise to hear that algorithms for face recognition have the potential to be employed in a wide variety of settings. In fact, it should come as no surprise at all. The stages of "facial recognition," "feature extraction," and "training a model" are the processes that, in general, need to be done in order to accomplish this goal. Face recognition is the first phase, followed by feature extraction, and then training a model.

The OpenCV method is a well-liked choice in the face detection subfield of computer vision. After having first been used to extract the feature pictures into a large sample set by first extracting the face Haar features contained within the image, the AdaBoost method is then used as the face detector. This occurs after it has first been used to extract the feature pictures into a large sample set.

3.2 Machine Learning in Face Recognition Attendance System:

The method that we are going to use for face recognition is a pretty simple one; nonetheless, in the event that you are dealing with a challenging issue, you may want to look into this. Let's find out how contemporary facial recognition software works, shall we?

The objective here is to train a deep neural network to identify individuals based on their faces and output those faces. This indicates that the neural network has to be trained so that it can automatically recognise the various aspects of a face and generate numbers based on those features. The output of the neural network can be thought of as an identifier for a particular person's face; if you pass in different images of the same person, the output of the neural network will be very similar or close, whereas if you pass in images of a different person, the output will be very different. The output of the neural network can be thought of as an identifier for a particular person's face.

Many issues have been resolved with the assistance of machine learning by selecting an appropriate machine learning algorithm, providing the necessary data, and obtaining the desired outcome. It is not necessary for us to construct our own neural network. A trained model data library is available to us, and it may be used. It does exactly what we need it to do, which is to output a bunch of numbers (face encodings) when we pass in the image of someone's face; comparing the face encodings of faces from different images will tell us if the face of someone we are looking for matches the face of anyone else for whom we have images.

On the other hand, the installation and use of a facial recognition library known as face recognition is significantly simpler. This would come in handy at some time throughout this process.

The following are the actions that we are going to take:

Find: Locate people's faces in photographs
Find and modify different face traits in photographs. This is the landmark.
Compare: Locate people's faces in photographs

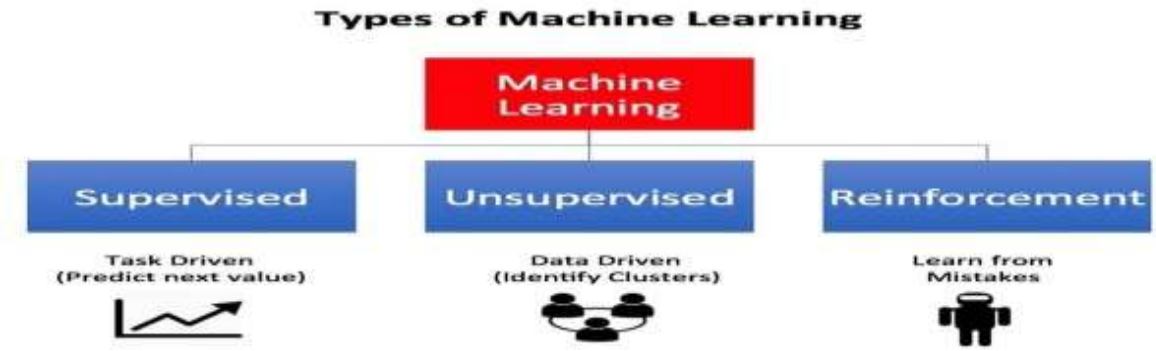

Figure 3.1: Machine Learning types

The above figure shows types of machine learning algorithms.

IV. IMPLEMENTATION AND RESULTS

4.1 Implementation:

The LBPH algorithm is used for the purpose of face recognition inside the aforementioned automated attendance management system that is being presented. The haar cascade is used by this system for both the detection of faces and the identification of faces that are found in an image. Figure 2 demonstrates that the Graphical User Interface (GUI) for this system was developed with the aid of the Python package known as Tkinter. Using Tkinter to create a graphical user interface (GUI) for a piece of software is the quickest and least complicated method accessible.

This system includes a variety of features, such as beginning to monitor persons entering the classroom, training the photos in the database and on the camera, and shooting photographs of students along with their information for the database. Other features include training the photos in the database and on the camera. Another one of the functionality choices allows you to train the photographs on the camera in addition to training them in the database. This technology begins the preliminary processing of the data in preparation for further analysis as soon as the pupils walk through the door of the classroom. It is able to do this by recognising the faces of pupils as they walk into the classroom on the video feed from the camera.

Open CV is an acronym that stands for "Open Source Computer Vision Library." This abbreviation refers to Open CV, which is a computer vision software library that may be downloaded for free and is suitable for usage in the context of machine learning. Open CV was developed to meet the requirements of computer vision applications and to promote the incorporation of machine perception into goods that are destined for the

commercial market. Open CV is a product that is licenced under BSD and has a simple interface, which makes it easy to use and alter the code. Open CV is available for free download. The library contains over 2,500 complex algorithms, including a comprehensive collection of computer vision and machine learning algorithms that are both standard and cutting-edge in their design and functionality. Additionally, the library contains algorithms that are both standard and cutting-edge in the design of their data structures. These algorithms can be used for the detection and recognition of faces, the identification of objects, the extraction of three-dimensional models of objects, the production of three-dimensional point clouds from stereo cameras, the stitching together of images for the production of a high resolution image of an entire scene, the finding of similar images from an image database, the removal of red eyes from images taken with a flash, the tracking of eye movements, the resizing of images, and the retouching of images. In addition, these algorithms can be It is compatible with a variety of operating systems, such as Windows, Linux, Android, and Mac OS, and it comes with interfaces in C++, Python, Java, and MATLAB. Open CV is primarily geared at the development of real-time vision applications that, if and when they become available, make use of MMX and SSE instructions. The creation of a CUDA and Open CL interface that is fully featured is making steady headway as development of the interface continues.

The Local Binary Pattern, often known as LBP, will be used in order to successfully fulfil the job of face recognition. LBP determines the values of the picture's pixels by first applying a threshold to the region around each pixel and then comparing that value to the value of the pixel that is located in the centre of the image. The result may be expressed as the binary number [24].

It is claimed that a bit pattern is uniform [25] if the bit pattern is circular and the binary pattern has no more than two bitwise transitions from 0 to 1 or the other way around. Additionally, the bit pattern must have a circular structure. Additionally, the binary pattern must be devoid of any bitwise transitions from 1 to 0, since that is not allowed. When calculating the LBP histogram, uniform patterns are used for the computation. This is done in order to ensure that different bins may be assigned to the uniform and non-uniform patterns in a separate manner.

In their article titled "Rapid Object Detection using a Boosted Cascade of Simple Features" that was published in 2001, Paul Viola and Michael Jones presented a practical method for the detection of objects that made use of the assistance of Haar cascade classifiers. This method was shown to be very effective. The goods could be identified using this way without any problems. An example of a technique that is based on machine learning is Object Detection. In this approach, a cascade function is trained using a large number of samples of both positive and negative photographs.

Now, let's take a closer look at these optimistic and pessimistic photos, shall we?

A trained classifier (more specifically, a cascade of boosted classifiers working with haar-like features) is a good example of a positive example since it is trained using a large number of instances of a certain object (such as a face or an automobile). Because of this, if you train your classifier using the aforementioned categories of variables, it will be able to recognise whatever you want it to find. For instance, if you want to be able to recognise faces, you will need to train your classifier by utilising a significant number of photographs that have such characteristics. This is the moniker given to the images that have been determined to be positive for detection since they include the target object.

In a similar vein, we wish to train the classifier using photographs that do not include the object whose identity we are attempting to determine. Images of this kind are often referred to as "negatives."

Let's imagine, for the purpose of example, that we wish to recognise faces; in this scenario, the image that does not include any faces is referred to as the negative image. In the same vein, the photographs are seen as being in a good light if they include a face or many faces.

After a classifier has been trained, it may be applied to the region of interest in an input image, at which point the classifier will provide an output value of 1 if it is likely that the area would display the object, and it will produce an output value of 0 otherwise.

We are going to concentrate on face recognition in this part. In order to train the classifier, the cascade function initially needs a considerable number of both positive photos (images that include faces), as well as negative photographs (images without faces). After that, it will be necessary for us to extract attributes from it. In order to do this, we make use of the Haar features, which are shown in the picture that can be seen further down on this page. They are indistinguishable from the convolutional kernel that we use in our work. It is asserted that each feature only has one value, which can be determined by subtracting the total number of pixels that lie within the white rectangle from the total number of pixels that lie within the black rectangle. This gives you the value of the feature.

The Local Binary Patterns Histogram method is used in order to achieve the process of face recognition (LBPH). It is a local binary operator, and it is one of the textural descriptors that has the greatest performance. Its foundation is in the local binary operator. There is an ever-increasing need for facial recognition technology as a consequence of the frenetic pace of contemporary living.

They find use in a wide number of applications, including as letting users into their cellphones, regulating who may enter buildings, and operating surveillance systems. In this article, we will use LBPH to extract features from an input test photo, and then we will match those features with the characteristics of faces that are kept in the database that is linked with the system.

In 2006, the Local Binary Patterns Histogram technique was proposed as a potential solution to the problem. It is built on top of the foundation provided by the local binary operator. In the subject of face recognition, it is put to significant use due to the simplicity with which it may be calculated and the selective power that it has. In order to accomplish this goal, the following steps need to be carried out: (1) the generation of datasets; (2) the collection of faces; (3) the identification of distinguishing characteristics; and (4) the classification of the faces.

4.2 Flowchart/Algorithm:

Figure 4.1 and 4.2 shows the algorithm and data flow process

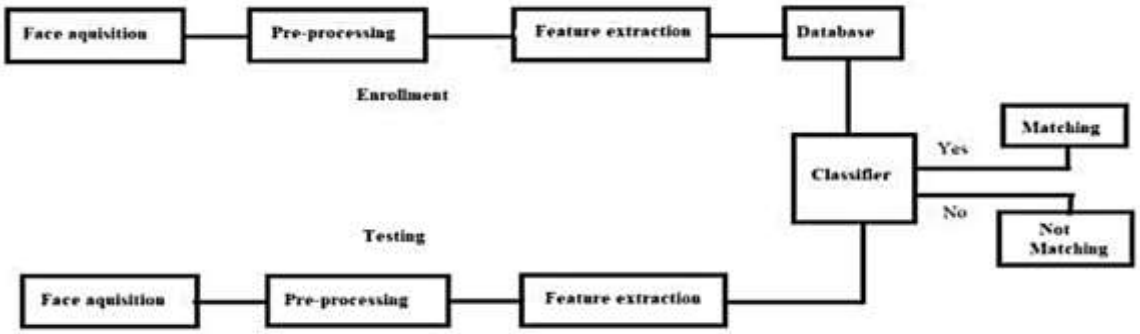

Figure 4.1: Algorithm Process

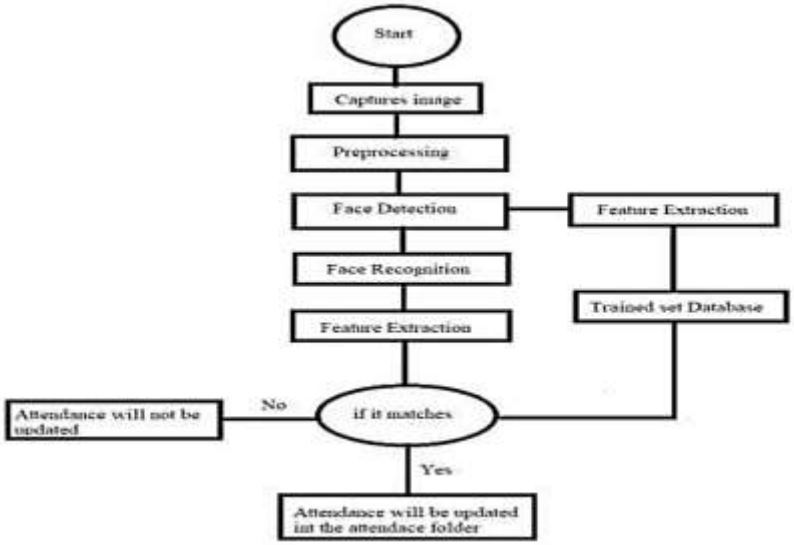

Figure 4.2: Flowchart

When we first launch the application, a dialogue box displays on the screen, asking us to input our user id and name, in that order. After providing the required information in the boxes labelled "name" and "id," the next action is to choose the "Take Images" option by clicking the relevant button. When you choose the Take Images option from the drop-down menu, the camera of the computer that is now working will open, and it will start taking images of the person. This ID and Name are both stored in a folder called Student Details, and the name of the file that contains them is Student Details.csv. The Student Details folder is located in the Documents section of the menu bar.

These sixty images are used as an example, and they are saved in a folder titled Training Image. You will get a notification that the images have been saved after the process has been completed successfully. In order to train the image samples that we have taken, we will need to click the Train Image button once we have taken some photo samples. Now training the machine to recognise the photographs just takes a few seconds,

which also results in the production of a Trainner.yml file and the storing of the pictures in the TrainingImageLabel folder. At the moment, each of the initial settings has been finished being implemented. After selecting Take pictures and Train images, the next step is to choose the Track images option, which is what really tracks the faces in the photographs. This option can be accessed by choosing Take photographs followed by Train images. In the event that the camera is successful in recognising the face of a particular student, the picture will include not just their identification number but also their name. Utilize the Q (or q) key located on your keyboard to dismiss this window. After closing the application, the attendance of each person will be recorded in the Attendance folder as a.csv file, complete with the person's name, id, the date, and the time; this information will also be displayed in the window. The file will be created with the person's name, id, the date, and the time.

4.3 Block Diagram:

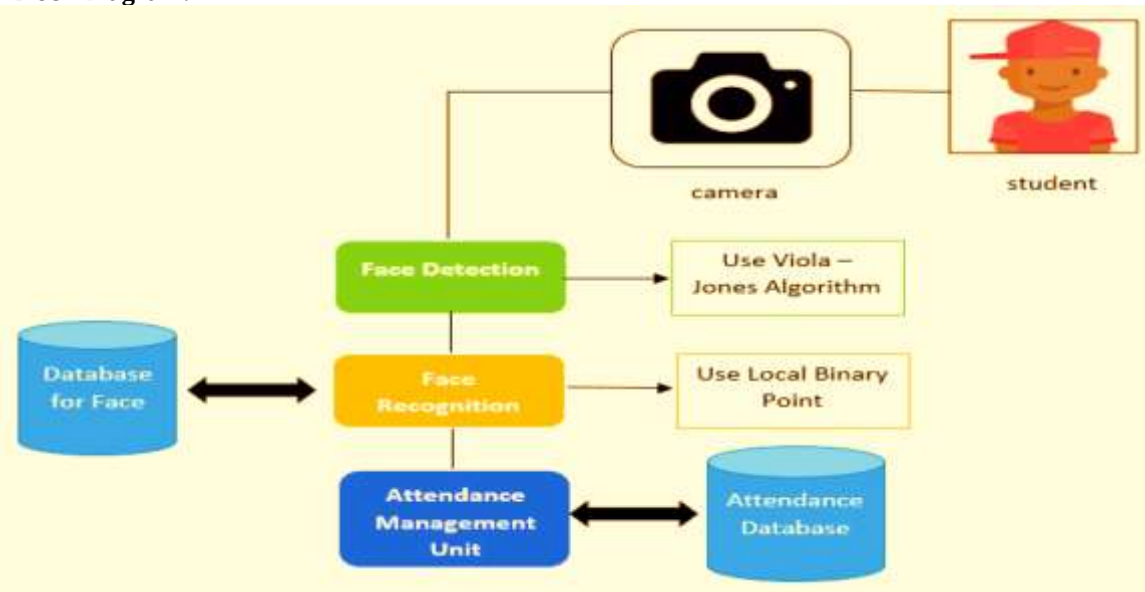

Figure 4.3: Block Diagram Final Model

Figure 4.3 shows the final block diagram.

4

.4 Screenshots/Results:

Figure 4.4: Main GUI

Figure 4.4 and 4.5 shows the main GUI and checking camera feature, the choice required can be entered in command window.

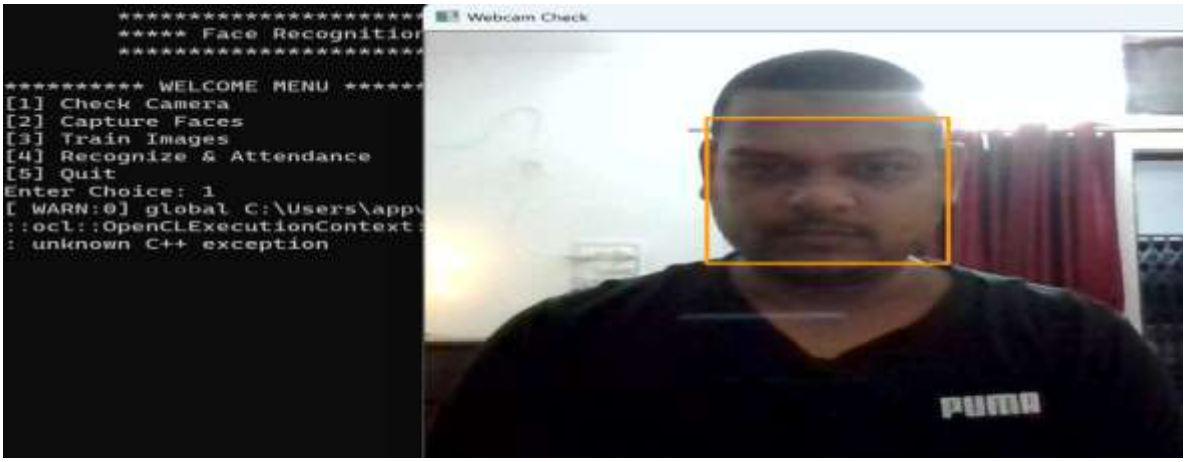

Figure 4.5: Check Camera

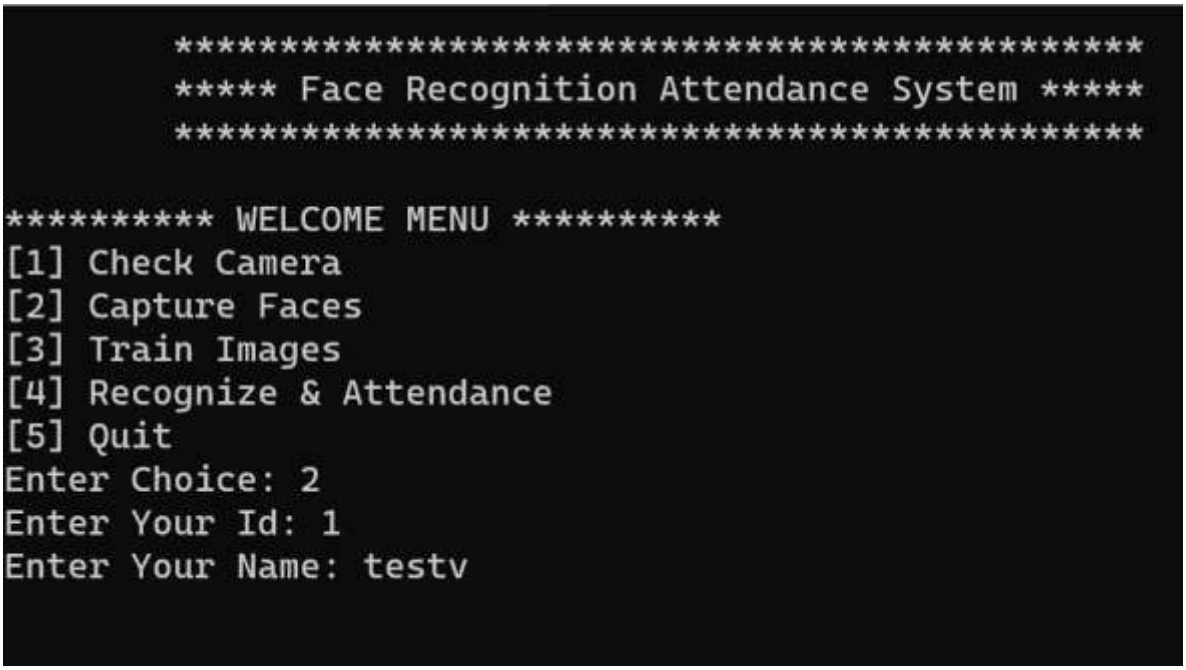

Figure 4.6: Train Image

Figure 4.6 shows train image, in which user needs to enter an ID that may be roll no. and name.

Figure 4.7: Taking train samples

Figure 4.7 shows the train image samples, about 50 image samples are taken and trained.

Figure 4.8: Recognition

Figure 4.8 and Figure 4.9 shows sample of recognized outputs, if the percentage is greater than 50% then it will be added in attendance marked sheet.

Figure 4.9: Recognition

Table 4.1 shows the data stored in excel sheet when trained properly.

Table 4.1: Student Details Stored in excel

Id	Name
2	vipin
3	demo1
1	testv
4	test2

Figure 4.10: Attendance sheet

Figure 4.10 and Figure 4.11 shows the attendance mark sheet and its contents.

	A	B	C	D
1	Id	Name	Date	Time
2	1	['Mubin']	11/22/202:	00:36:55
3	7	['Jonny']	11/22/202:	00:37:06
4	6	['Ajay']	11/22/202:	00:37:33
5	5	['Aksay']	11/22/202:	00:37:48
6	4	['Salman']	11/22/202:	00:37:56
7	3	['Tom']	11/22/202:	00:38:03
8	2	['Aamir']	11/22/202:	00:38:10

Figure 4.11: Attendance marking excel sheet

V. CONCLUSIONANDFUTUREWORK

5.1 CONCLUSION

Hence. This work implemented a procedure for the management and administration of attendance in order to keep tabs on the locations of the kids. It is helpful in reducing the amount of time and effort required, especially in instances in which a considerable percentage of students have already reported their attendance. Python is the language of code that is used throughout the whole implementation process of the system. In order to accurately record the attendance of the kids, methods using face recognition were used. This record of student attendance may also be used in other ways, particularly for the purpose of resolving difficulties pertaining to examinations, such as identifying who is attending the exams and who is not attending the exams. In addition, this record of student attendance can be utilised in other ways. In relation to this endeavour, there are still some other duties that need to be finished, such as putting the system into place in the different courses. Combining a camera and a computer to produce it is a method that is open to exploration.

In order for the system to be implemented correctly, the LBPH approach was employed. This allowed the system to operate as intended. The LBPH algorithm is better than those of its competitors because it has a high degree of accuracy and has the lowest amount of noise interference possible. The application of the Smart Attendance System demonstrates the existence of a consensus on the ideal recognition rate and the threshold value through its usage. This is the case because the application shows how the system works. As a result, LBPH is the most trustworthy and successful face recognition algorithm that can be discovered in Open CV. Because of this, it is the best option for identifying students at educational institutions, precisely tracking their attendance without the need for proxies, and eliminating the usage of proxies altogether.

5.2 FUTURE SCOPE

On the topic of face recognition, people often have opposing points of view. If you were to believe everything that you read in the media, you would get the sense that people typically look down on facial recognition technology and treat it with distrust. This would be the case if you accepted everything that you read. This could not be farther from the truth if someone tried to tell it to you.

Just like every other kind of technology, there are those who are sceptical about facial recognition. The bulk of the hatred and mistrust arises from the anxiety that facial recognition technology would invade our personal space and violate our right to privacy. This is the root cause of the most of the hostility and mistrust. A lot of people have begun to share the concern that once their face has been recognised and identified by facial recognition technology, identity thieves will be able to easily break into a database, steal their identity, and there will be no way for them to get it back again. These people have jumped on the bandwagon, which shows how widespread this concern has become. False information that has been widely disseminated via the media has contributed to the growth of this anxiety. Future enhancement can be including deep learning algorithms.

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