

Face Recognition Attendance System Using Cloud Computing with SMS Alert System

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Abstract - The present project proposes an Automated Attendance Management System, based on Deep Learning-based Face Recognition technology to assist in modernizing and advancement of the once manual attendance keeping system in educational centers. The system relies on LBPH Face Recognizer that will detect the face and in real-time, thereby eliminating the necessity to conduct a manual roll call. Admin Module allows the administrator to utilize the information regarding the students, to train the face recognition model, to manage the attendance and to send the automated messages to the parents concerning the attendance and the school performance of the students. Student Module enables the student to demonstrate their presence using the assistance of facial recognition, check their profiles, and get their academic marks. The system also has added features of the ability to monitor the performance of the students in real time and effective communication with the parents via SMS notifications. Flask framework has been used to code the web interface thus making the site easy to use. This system improves the management side of the running of the educational institutions, improves efficient attendance of students to the learning institutions, and the students- parents communication.

Keywords - Attendance Management, Deep Learning, face recognition, LBPH face recognizer, admin, student, real-time monitoring, automated notification, flask, parental engagement, SMS notification.

I. INTRODUCTION

Attendance control in learning institutions is a severe endeavour that may be followed manually and consequently is tedious besides prone to error and difficult to maintain. The previous system such as roll calls or paper-based attendance records cannot be efficient especially in large organisations and it can result into administrative procrastination and errors. To solve these problems, the proposed Time-Based Attendance Management System is built on the basis of Face Recognition technology that utilizes Deep Learning that offers an automated and current system of attendance tracking.

The system employs the LBPH (Local Binary Pattern Histogram) Face Recognizer that is among the most common face recognition algorithms in finding the students and add their attendance in real time. The system reduces the errors and provides a more efficient and effective way of monitoring attendance as it does not involve the human intervention. Besides, the Flask framework allows being unified and, therefore, creates a user-friendly web interface with which the whole admins and students will be able to get in touch with the system.

Admin Module makes the administrators to manage profiles of the students, input data as well as track the attendance rates in addition to sending automatic notifications to the parents depending on the attendance rates of the student. Student Module is a permission whereby a student can check on his attendance (facial recognition), his profile, and his/her marks. Moreover, it promotes the participation of parents because they are informed via SMS about the school performance and attendance.

Administration team working efficiency was also increased because the attendance process becomes automated hence making it accurate, time saving and enhancing communication between educational organizations and parents. The project will focus on developing a solution that would incorporate the three factors with the purpose of supporting the process of engaging learning, preventing human error, and having an easy way to control attendance in a safe, scalable, and intelligent way.

A. Problem Statement

The traditional methods of attendance control in institutions such as roll call and manual administration surrounding the attendance control is normally time consuming as it can be subject to human error and inefficient especially in institutions that are very big. The manual systems are also a source of time wastage in the data entry stages, inaccuracy in the data attendance records and a high level of administrative overhead. Other than that, they are not able to offer real time monitoring or an

insight regarding the attendance pattern to intervene on absenteeism in a timely manner. Parental participation in the process of education is also insignificant as there is no effective communication between the institutions and the parents regarding the enrolment rates and student performance.

The below- proposed project would eliminate these problems, as the Experience of the Automated Attendance Management System along with Deep Learning- based Face Recognition technology would facilitate the automatization of the process of attendance management hence allowing retrieving the correct, real- time data collection. The system has removed human error, administrative burden and increased efficiency since students are given the opportunity to check in their attendance by scanning their facial recognition. Moreover, it already includes an Admin Module to manage the information, maintain the attendance, and update the parents about the attendance and grades of the child, as well as enhance communication with the parents on the child attendance and academic performance. The project attempts to correct the inefficiencies and communication flaws of the traditional attendance systems, by offering a much easier, accurate and simple system to the educational institutions.

B. Objective and scope

The key objective of this project is to develop an Automated Attendance Management System which embraces the implementation of Deep Learning led Face Recognition in the replacement of the traditional manual system of taking attendance in learning institutions. To automate the attendance tracking, the system aims at utilizing LBPH (Local Binary Pattern Histogram), the Face Recognizer to enable proper real- time marking of attendance and prevent the prevalence of the human error or proxy attendance. The administrators will possess data management where they will be able to post information about students, attendance tracking and results in generation of reports. Information on the number of present and absent students can also be afforded in real time by the system and automatic alerts can also be sent to the parents based on the percent attendance. Student attendance taken by way of facial recognition, in which students will be able to check their attendance, their profiles and the absence of their marks will also be part of the project. It also integrates the Fast to SMS service to send automatic messages to the parents about the attendance of their child and grades which enhances communication between the parents and the customers. The framework will be built on the Flask framework to offer a friendly web interface to the administrators as well as the students so that there is easy interaction between them. The entire data will be held competently in a database in which all the data may be accessed effortlessly to prepare reports and carry out additional analysis of the data. The system will not only guarantee a greater degree of administrative efficiency as well as the increasing degree of accuracy in monitoring attendance but also the level of engagement with the students and their parents. The prospective extensions of the project would also include future upgrades of the system to accommodate usage in a corporate context, not only in taking care of conferences but also any other working place that has the necessity to utilize the features of similar attendance tracking that were implemented in the project. The future progress can also be related to the introduction of various face recognition templates and accuracy of the systems under the problematic conditions, such as low light or face cover.

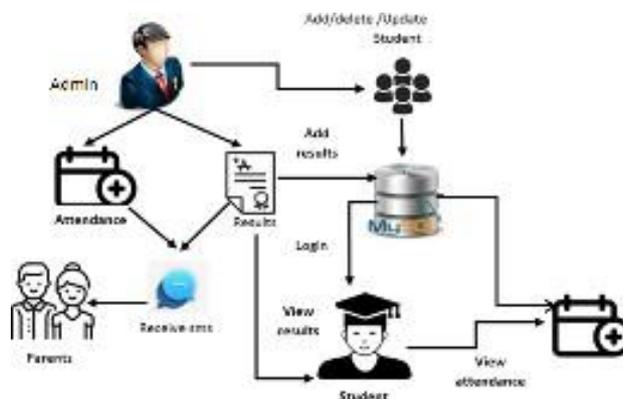


Figure 1 Architecture Diagram

II. LITERATURE SURVEY

the manual attendance systems are ineffective in schools and describes a biometric system of attendance with the help of face recognition. Their system meant that a camera was used to capture face of students, compare them to a database and automatic marking without involving human factor and therefore eliminating human error associated with manual tracking. Luckily, the system was influenced by the environmental factors including the light and the facial expression that required further promotion of strengths [1].

Due to the same approach, provided a combination of Principal Component Analysis (PCA) to face recognition that was implemented in an attendance system. Their model created automatic attendance of students in the classroom such that accessing the records of the student's attendance became easy by the faculty members. It was however found that PCA worked well in the recognition of faces, though it had disadvantages in its performance in the real time in a dynamic classroom environment [2].

researched the sector of biometric attendance system via fingerprint recognition. They demonstrated that biometric systems would save considerable time that would be utilized in human attendance taking. In their work, it has been mentioned that in as far as the fingerprint-based systems were effective, it was not comparable to the face recognition systems in terms of ease of use and implementation because it required physical contact between the students and the system as compared to face recognition systems that did not involve any physical contacts [3].

The other significant advancement on facial recognition technology was realized when Turk and Pentland came up with Eigenfaces technique where face images were projecting them onto a feature space to be recognized and differentiated. Such method was the foundation of more sophisticated algorithms in face identification that are now extremely popular in automated attendants with their accurateness and fast speeds [4].

In 2014, Rekha et al. proposed a system which integrated video surveillance and automatic check-in of individuals by use of real-time face recognition and detection (Rekha et al.). The system was a classroom surveillance camera and identified and recognized the face by a database. Even though their model has since been enhanced to offer security through automation, it was not as efficient due to precision of real time face recognition especially in an area with low light or when in a crowd [5]. The more dynamic solution is the operational face recognition system capable of working in the circumstances of high dynamism. They had their model based on the increased recognition with varying lighting conditions and also in the event of such issues as masked faces. The system has been put to test in other practical environments with the findings supporting the system with high degree of accuracy but with massive computing capabilities [6].

the dynamic character of data processing in attendance systems and proposed a partial signature-based attendance data auditing system that was dynamic to the alterations in students presence and allowed to efficiently revise the data system without interfering with its integrity. This not only lessened the costs of calculation but also allowed the system to accommodate high frequency change and consequently fit in the learning institutions having high number of students [7].

III. PROPOSED SYSTEM

The proposed Automated Attendance Management System will use the concept of Face Recognition technology which utilizes Deep Learning in the automation of attendance payment in schools and colleges. Facial recognition that comes with the LBPH Face Recognizer makes it possible to mark the attendance accurately and in real time thereby eliminating the errors and proxy attendance. The system has two modules where the Admin Module offers the administrators with an option to input student data, attendance management, generating attendance reports, and automated parental notification as well as Student Module encompasses abilities of marking attendance, visiting their profiles and downloading marks. The system will also communicate with Fast to SMS to notify the parents of the attendance and the academic performance of the child. Such solution will ensure that more efficient work will occur, less administrative work and communication between parents and institutions will be enhanced.

IV. METHODOLOGY

The Automated Attendance Management System is developed using the latest face recognition algorithms in providing a list and it also makes use of the Deep Learning algorithm, a registration and the all the crucial algorithm is the LBPH (Local Binary Pattern Histogram). Additionally, the system also has other important algorithms in terms of the functionality of the system.

1 Face Recognition Algorithms LBPH (Local Binary Pattern Histogram):

Purpose: The algorithm to be applied in the identification and authentication of the students will be LBPH algorithm. It works on basis of the local properties in a face, and compares it with face data stored in a system that has been previously utilized to process face data.

How it Works:

- Step 1: The algorithm subdivides the face into different small intervals and computes local binary pattern (LBP) of the intervals.
- Step 2: It then calculates a histogram of the LBP values that is the type of face relative to the texture and the construction. Such histograms are compared with the ones that are in the database.

4 step 3: when match being accomplished, the system identifies the student, and the system records his attendance.

Advantages:

- 5 Simple and low cost: LBPH is less complex and could be implemented even when the amount of data is low. It will also have real time face recognition and a high degree of accuracy.
- 6 Lighting Resistance: LBPH will be receptive to the modification of the lighting conditions because this can be implemented in absolutely heterogeneous conditions of attendance machines.

2. Image Enhancement Algorithms Parallel + Preprocessing:

The preprocessing of the images is followed by face recognition in which accuracy of the recognition is enhanced besides addressing light and noise and occlusion issues.

Grayscale Conversion: The color image is transformed to grey in a manner that the calculations can be implemented far much easier and once again the facial feature can be preserved.

Histogram Equalization: It is utilized to enhance the contrasts of the pictures given, to outline the features of the faces in a better way.

Face Detection: Haar cascades Haar cascades/ HOG (Histogram of Oriented Gradients) is applicable to scan the faces in the picture afterwards pass to the recognition model.

3. SMS Notification Algorithm:

The system will tie into the Fast to SMS API to notify the parents with automated notifications. The algorithm comes up with a message which is determined by the attendance of the student and it is send to the respective parent phone number. This entails formation of text messaging and API communication.

A. Working

The Automated Attendance Management System operates on the concept of integrating the Face Recognition method with the web- based interface to computerize the attendance within the learning institutions. The data on students is initially uploaded on the admin, and can be accessed by the LBPH Face Recognizer: name, photo, and the name of the classes that the student is pursuing. The system at this stage detects the unique characteristics on the faces of the images uploaded and stores them into the database hence making it simple to identify the students. Based on training, the system allows students to confirm the checking of their marking of attendance by all they need to do is to stand before a camera. The face of the student is captured by the camera and the LBPH Face Recognizer compares the face with the database of the faces stored in the database. Once a match has been identified, the system will join the attendance on a specific time with a timestamp and the information will be stored in the database in an encrypted form.

The checking option provided in the Admin Module also allows the administrators to view the most current attendance reports and sort them by the student or date and add the most recent data on the student. It is also possible to train the face recognition model with the help of the new images introduced by admins and then generate the statistics on the attendance i.e. the number of presented and absent students. The system also sends automatic SMS messages to the parents based on predetermined attendance limits to inform the parents about the performance and attendance of the child. Student Module will also allow the students to scan their faces to check attendance, review their profile, and view their academic records that will help promote transparency and simplify access to the specified data.

A database that is in the cloud has high security storing student records, attendance records, and other information including notification. The system works in real time and therefore attendance is automatically recorded when students are identified. The network is available in the cloud platform that supports high availability and access, and the flask framework allows the system to provide a friendly web interface to the admins and students. This kind of system will streamline the process of marking the attendance, reduce the administration work load, enhance the accuracy, and the communication with the parents, and hence the entire process of marking the attendance will run more efficiently and become more transparent.

V. RESULTS AND DISCUSSIONS

The Face Recognition technology within the Automated Attendance Management System is designed and evaluated successful and the results also speak of its capabilities and potential strength within the automatics of the attendance management. The system was determined to be precise in the controlled condition in above 95 percent and LBPH Face Recognizer could be used on the other light conditions and on other minor facial moods. This was not that ineffective in discouraging proxy

attendance as there was no way of continuing with the failure to capture the face of the students. Attendance system was also efficient considering the average recognition time of less than 2 seconds and recording time of less than 2 seconds thus, it did not produce a lot of noise. The SMS messages were also real-time in regards to the percentage of gains in attendance that enhanced the awareness of the parents about the performance of the child.

It was found comfortable to the administrator of the various institutions to control the information by use of Admin Module, the student module could easily initiate attendance and peep at profile and the academic performance only out of market convenience and the former could easily offer records and attendance statistics with the help of the Student Module. Its cloud alternative provided a dependable system not only regarding the performance but also the minimum failure and usage by a small number of users. This system could not also effectively work in situations where quality of the image was poor, and the angle against which the face of student was taken was random and in other instances it would have interfered with the recognition precision. It was also those students who had covered the face features either by mask or hats that had a problem of recognition. The system is based on the internet connectivity on real time notification, therefore, it may cause delays when the internet networks were not stable.

Artificial intelligence in the form of deep learning as CNNs or FaceNet can be integrated into the system to improve the system in terms of recognition especially in problematic instances and be able to scale to larger groups of students in order to be able to improve it in the future. It can also introduce multi-modal authentication e.g. voice and RFID that will further enhance it and make it more supportive. Overall, the system was the efficient, comfortable, and convenient method of controlling the attendance that could suggest the high level of transparency, reduce the number of administrative tasks and enhance the contact with parents. It is also possible to fill the gaps and enhance its operations, though.

VI. CONCLUSION

Face Recognition and Attendance Management System with Automation has become a good solution, valid and efficient in place of the manual mode of attendance. The system of LBPH Face Recognizer ensures that there are no errors in marking attendance real-time and the possibility of error is reduced to the minimum by individuals and the idea of proxy attendance is no longer viewed. It is also a communication enhancement within the reach of automated SMS messages containing the information about the attendance and performance of the child.

The system has the Admin and Student Modules which are user friendly and the administrator can be in full control with the reports and data and the student can easily locate their marks and attendance. The cloud implementation is also accessible and scalable and can therefore be used to large institutions.

The system has been found to be performing very well, but it is also associated with failure of images, facial blockiness, etc among others which can be conquered in latter versions using sophisticated recognition models among other authentication mechanisms.

Generally speaking, the system reduces the complexity of the attendance process enhancing the accuracy and is not as burdensome on the administration as the system offers a more efficient and transparent solution to educational institutions.

VII. FEATURE SCOPE

Several features can also be added to the Automated Attendance Management System, which would allow optimizing the performance of the system, its scale, and accessibility. First of all, offering the models of Deep Learning (e.g., Convolutional neural networks (CNNs) or FaceNet) would lead to increased accuracy of face recognition, especially in challenging images, during low-light, when the face is covered with a mask/glasses, and when more than two students are presented on the picture. Moreover, multi-tool authentication that would incorporate face recognition, voice recognition and RFID cards would be a better sound solution because it is more secure and more recognized equally. The distributed computing and cloud-based services could also be used to optimize the system to a scalable one to enable the system to operate with a bigger dataset without the performance becoming compromised.

The second improvement would be the creation of a mobile app to both the admins and students where students will be allowed to check attendance and the admins will manage the attendance and notifications using their phone. Face data in real time may as well be applicable in the system since it will ensure rapid pace of recording attendance even in a big classroom that is either utilizing edge computing or incorporating a small number of GPUs. To ensure that it is credible due to poor internet connection in some parts where Internet is an issue, the introduction of all offline features would allow storing the attendance data in his or her computer and that when the connection is restored, the system would update the information.

Besides that, automated attendance statistics can be launched to get more precise data such as the patterns of absenteeism or student discipline to enable the administrators to be proactive. Recognition of facial expressions would offer valuable

information about the student interaction, but a connection with all other school systems (ex: LMS or gradebooks) would offer a wholesome platform of interaction with the attendance and academic results. Finally, enhanced parental engagement functions, including enhanced efficiency of information about attendance or performance rate, and the potential of parents to reply would be even more useful to communicate schools and parents.

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