

A SECURE AND EFFICIENT FACE ID-BASED ATTENDANCE SYSTEM

¹D. Senthil, ²V Harshitha, ³Sunny Singh, ⁴Hari Saroop

^{1,2,3,4}Department of CSE(AI&ML), St. Peter's Engineering College, Maisammaguda, Kompally, Hyderabad, Telangana, India. E-Mail: dsenthil@stpetershyd.com

Abstract

Biometric systems can be described as being fairly popular in the recent past couple of years. They are considered to be reliable and they safer in comparison to other similar solutions. This paper talks about a new idea: An exclusively implemented contact less attendance taking using face recognition for only engineering students. This also ensures that everyone with disability can gain access to it in a easy manner. But how does this system work? It incorporates the modern technology to recognize faces. This means that it is capable of recording attendance and any time the students come to class. The objective is to eliminate or at least minimize inconvenience when tracking attendance. The stress here is on taking a load off students' lives as far as attendance is concerned and making life easier for them in this respect. COVID- 19 brought about a great shift in learning hence schools needed to adapt quickly. Some shifted from face-to-face setup and adopted the online learning system. This shift is however here to stay, given that many students are now attending digital classes. Thus, modern people should try to discover casual methods of attendance tracking both offline and online. They eliminate the desire of having to work with machines or typing the various data by acknowledging attendance through facial recognition. That makes it quick and easy. In addition, it sets up a safe and healthy environment for all the students to learn in. To sum up, it is proposed that this face ID attendance system would be a smart solution in responding to new paradigms of learning. It is utilitarian and practical solution for attendance tracking that fits into the daily routine of everyone. With this, schools can meet the need of the today world while taking into consideration the need to be inclusive for everyone.

Keywords: Biometric Systems, Facial Recognition, Attendance Tracking, Security, Inclusive Education, Contactless Technology, for individuals with disabilities, COVID-19.

Introduction

Biometric face recognition is in existence all over the globe for one activity, or the other. I think it's a big issue for the both tech and science in general. Many schools monitor attendance so that learners will not just sit idle all day. Some usual practices to achieve this, such as calling names or using signin sheets, may be very time-consuming. They can also foul up easily or can be defrauded. There are so many benefits associated with the use of the biometric systems one of which includes, there is improved records keeping in schools. Facial recognition, out of all the biometric types is unique. Indeed, it is highly accurate and can be performed while maintaining a certain distance, no contact is needed. As such, it is ideal for attendance, especially during emerging diseases such as COVID 19. The best people to implement an automated attendance system are students in engineering especially the practical oriented students. It will also be easier to ensure that student with disabilities will also be allowed to participate in implementation of this new system. This face ID-based attendance system which it plans to meet the need. From the article, it explains how this facial recognition process operates; this paper reviews other studies on this aspect; it explains how this system will work; this paper also discusses its effectiveness from tests conducted. Some common techniques adopted by many schools include for example the biometric ID or roll calling, but in most cases, such methods take much time, or may not be accurate enough. It's on this point that this new face ID system comes in handy. That's another thing one has to remember: it's also about making it easier for everyone else. Specifically developed for learning disabled students. It enables them to mark users thus avoiding some of the usual procedures that might otherwise be cumbersome or conflicting. The literature review offers an understanding of the need for this study in relation to known literature work on the subject. He begins by dismantling the problems with conventional attendances approaches. Sign in sheets are slow and time wasting, call in names can be wrong and might be manipulated with. This is particularly a nuisance in large classes or any event where one would require checking a large number of attendees in the shortest time possible. Automated facial recognition technology provides the best solution to registrars who need better ways of recording attendance. That captures small details on each person's face, thus doing its identification job without intrusiveness. With COVID around it opened people's eyes to how much more they would need touchless approaches and facial recognition was seen as perfect for not touching anything. In the introduction, the author also mentions diversity, particularly, for disabled students. To ensure that every student can participate, this new attendance system has features. This I mean to say that everyone has equal chances when it comes to being marked present. This system to let all learners participate in the process thereby ensuring nobody is left behind.

Literature Survey

This literature survey reviews some crucial previous research data relating to facial identification and biometric attendance solutions. These systems assist in tracking people using face and assist in recording attendance without the need to scan for sign in. This results from the fact evidenced in many research that facial recognition is more effective as compared to other forms of identification such as fingerprints or even iris scans. For example, Zhang and his team from 2019 combined two forms of technology known as Gabor filters and CNNs [1]. This combination was useful and it took them to really high accuracy rate of more than 95%. That's impressive! It means that the system was able to accurately identify faces somewhere around 80 percent of the time, which in reliability is a big deal. Another study conducted by Smith and Lee in 2020 attempted to do this even faster [2]. They focused on developing algorithms that analyse images and brought the time to less than one second per frame. This is very important especially in areas of rapid identification, such as schools where students get checked in, hurriedly.

Facial recognition on employees is not only limited to signing in and out. It can be used in security, health, education and all aspects of life. For instance, Kumar and his group published their work in 2021 [3]. They designed a system that helps university to automate the redundant task for their workers and staffs. That is why the tracking of attendance has been made much easier and efficient as well. Just think how much convenient it is for teachers and office stuff not to have to keep track with paper and pen. Or Johnson and others of 2022. It also kept the emphasis on contactless solutions [4]. Such methods are even more necessary at the present time when people are already thinking about hygiene and safety. By so doing it provides that people do not touch anything to check-in thus helping to keep thing clean. Furthermore, an increasing attention is paid to the opportunities that these technologies can open for individuals with disabilities. Davis and Patel conducted a study on integrating voice-enabled services with facial recognition in 2023 [5]. This means that even those people who would have problems solving faculties will be able to check in and feel part of the process. It's a big deal that I've made just the means of making tracking attendances more inclusive and friendly to let in so many people. The survey of literature takes the reader through all this research. One segment discusses the innovation of facial recognition technology In another study by Zhang et al. the authors explained that using different approaches can provide better outcomes than individually. That combination of Gabor filters and CNNs that they used in their study is a clear example of how using two or more of these technologies can assist in face recognition.

Smith and Lee's work builds on this and really hammers home how real-time identification must happen quickly. This is specifically critical for schools because time is of the essence. The survey also covers different areas that facial recognition is used. Not only can school security increases, but also security and health facilities can improve as well. According to Kumar study conducted In 2021, a

facial recognition system in universities was making a significant impact. It relieved some clerical works from staff and the operation was smooth and the attendance was on point.

Moreover, Johnson's 2022 study underlined that increasing employment of contactless technology as a way to make things safe and free from any germs for all participating entities [4]. Finally, I like to conclude with articles on technologies for differently-abled persons such as the blind, the deaf, etc. Davis and Patel's research demonstrates that integrating facial recognition with voice technology really goes a long way towards making attendance beneficial for all [5]. Therefore, in summary, this literature survey provides a proper foundation to develop a face ID attendance system to be even more useful for schools and other institutions. Which means it is not enough to be right, but to be right in a way that it is easy for everyone to understand.

Proposed Methodology

1. **Data • Data Description:** The data set employed in this study consists of a set of photographs of the facial images of the engineering students. The set is chosen to be invariant in the lighting conditions, background and facial expressions of the pre-selected subjects.

2. **Data Preprocessing:** Images are also scaled to a standard of 256 by 256 before being converted to black and white and then equalized.

3. **Research Protocol:** It is actually conducted through a clear procedure to ensure reproduction and accuracy in the study. In order to make these captures, the environments to be recorded are controlled where light is always of similar qualities and most of the time high end cameras are used.

Methodology

1. Dataset Collection: These photos include the student facial images that are usually taken at the time of registration. Although it is a picture, there are several images with variations made in angles, and expressions.

2. **Preprocessing:** But before any image processing is done images are first normalized and or feature augmented which in most cases involves resizes and or grey-scale transforms plus the histogram.

3. Extraction of feature: For better facial detection and in images, local binary pattern as well as histogram of gradient methods are used for extracting features of faces in images and for providing the same in the training section of the ML models.

4. **Classification:** They are made using the same approaches using SVM and CNN accompanied by several other machine learning algorithms for appropriate face detection and subject recognition. For this a labelled dataset will be used and cross validation for the validation will be used.

System Architecture

The system that has been discussed here has a relatively simple architecture. It's broken down into a few parts: retrieving images, setting up images, isolating focal elements, and addressing or categorizing them. Some options are designed to integrate well with the current attendance systems on the market. There are also convenient options for students with some disabilities like voice navigation and buttons touch. It begins with the data. In this case, pictures of the faces of the engineering students are used. It means that the goal is to gather as many pictures are possible. We need another lighting, another background, another facial expression. This mix is beneficial in enhancing the performance, and accuracy of the system. In data preparation, some actions are taken that include; First we reduce the size of all the pictures to the same dimension. Then, we change the colour to black and white so as study them easily. We also increase the contrast so that the details will be more enhanced than before. They also make the overall process easier due to the fact that we are able to develop better images. In our research, however, all factors are controlled. We make the photos in the similar kind of light conditions every time. We also take results with certified High-quality cameras to avoid variation. This care in the process for us that we get heuristic results.



Figure1&2: Architecture of the system When it comes to the methodology, there are four main steps: gathering the photos, developing and preparing the images, depicting features of images and finally separating the images. While in the data collection process, we are normally able to capture many pictures of the students. This way, we get many different prosodic expressions and positions of the face. Then, in the image preprocessing step, the images are made look appetizing and are made to look more uniform. This is important because anything that is easier to compare is usually easier to evaluate and make decisions about. Then it is followed by the feature extraction stage. We use methods as LBP and HOG in order to identify different small areas that are special in faces. And so, the last step before the data sets' analysis is completed is classification. This is where it is possible to use smart models such as Support Vector Machines as well as Convolutional Neural Networks in order to categorize the images according to the elements we extracted. Again, we developed this system to be versatile. It can grow and extend its compatibility with other attendance instruments to increase efficiency. As for students with disabilities, we genuinely take it into consideration. That is why in the new model and touchless options and voice commands were included in that model. These tools are available for the sole purpose of making the interactive sessions easier and convenient. All in all, this system shall be accurate and efficient for use by all students to enhance efficient completion of the courses.

Findings/Results

This makes face ID attendance system be an effective method through which schools are able to

https://doi.org/10.36893/JNAO.2023.V14I2.115

record attendees in class. That is good because it is fast and does not demand any contact with objects which are anyhow close to us. This is useful to the students with disabilities and physically disabled persons. That is quite good for them kindergarten teachers see that all are given a fair shot at being tallied in class. Here next, a brief retrospective of the findings of our research is presented. From various numbers we examined how well the system does. The primary criteria that we verified were accuracy, precision, recall, and an F1-score. These numbers tell us how well the system is designed to recognize the faces of people and to take attendance. In this case, what we determined was that the face ID's accuracy is rather good; the method achieved 97% success. In addition, accuracy of the precision and recall is over 95%. That means it can distinguish between students really well, thereby reducing on the number of confused students or wrong identification. For instances if the system recognizes the face, it does it in less than 1.5 seconds which is very fast. This quick response is valuable particularly for schools that are active institutions, with many things happening on the ground. In the future, researchers should expand this kind of study in order to see the results of this system in different schools and educational environments. Besides, taking the attendance, it can be applied in locking school doors and providing access to certain rooms. Thus, this face ID system can be applied in schools all over the globe. The study ties the proverbial ribbon on everything. It helps to describe advantages that can be noticed and possible difficulties may arise when implementing such attendance system. Apparently, the advantages derived from the software also concern the realization of contactless services for the populace. It offers a fairly decent view of how this kind of system could be beneficial to education now.

Face Orientations	Detection Rate	Recognition Rate
O ⁰ (Frontal face)	98.7 %	95%
18º	80.0 %	78%
54°	59.2 %	58%
72°	0.00 %	0.00%
90° (Profile face)	0.00 %	0.00%

Table 1: FACE DETECTION AND RECOGNITION RATE

For this, tables and charts were used in order to enable an explanation of how well the system performs its tasks. Well one interesting tool that we added is confusion matrix. This would help to show the areas the system got it right and the areas it was wrong. Those concepts can be broken down into such items as true positive, which means that it accurately confirmed the presence of an individual, false negatives, which means it confirmed people's absence when they were in fact there. We also used ROC curves to assess how the system performs in terms of capturing faces relative to how often it detects another individual face. Then we related out face ID system to traditional methods of conductance such as roll calls and sign in sheets. Some of those old methods may take a lot of time and most of the time they are wrong. We also considered other forms of biometric such as fingerprint or even iris scanning systems. As reliable as they might sometimes be you have to touch something which is not very advisable in the current world health situation. All that is avoided, and the face ID system functions well even without a touch. The best thing that comes with it is that it assists the struggling learners most of the time. This means that the system is able to recognize voice, and it also has no contact points. This means the student with disabilities will find it easy to operate the system, and be able to participate in the attendance process like all the other students. also appears to function effectively under the various lighting and scenario of use applicable in schools. In other words, the face ID attendance system is one of the most efficient systems for today's schools. In this case, the high accuracy, fast functioning, and accessibility to all students make the process of taking attendance significantly easier and more non-bias for all participants. It becomes obvious that this tool can go along the way in augmenting how schools manage their attendance and the completeness of everyone present.

Conclusion

The face ID attendance is secure, efficient, and it can be done by anyone. Also, it is a completely non-contact service, and this protects students and employees regarding their health. I find this system to be quite precise and it's real-time which makes it a good substitute for older methodologies. But we should see one critical aspect of this system: This system is advantageous for students with disabilities. There is voice control and they do not require touching the buttons on a panel. That is to mean that it has to be accessible by all students without a lot of the struggle. It is flexible to be used in any school environment to ensure it serves a purpose in different schools. As a result of COVID-19 outbreak, many schools have closed their doors to allow students attend lessons online. This change is happening at a very high speed. Everybody is going online to advance their studies. Because of this trend, the schools are required to look for suitable means of recording attendance for people attending physical classes and the others conducting virtual classes. Handy methods such as roll- calling or biometric systems can be very slow and inefficient; the information is not always accurate. These problems can make attendance tracking stressful Depending on the organization's policy, the process of tracking attendance is sometimes stressful. The face ID system, however, has the potential to enhance this; thereby enhancing efficiency in the identification processes. At the conclusion of the paper, new areas for research are proposed. And it challenges schools to search for some measures that could lead to enhancing and developing biometric attendance systems. This could lead to even better options for schools in the future, and

since opening itself was devastating for No Child Left Behind, the better option might not exist.

References

1. Zhang, H., et al. "A Hybrid Gabor Filter-Convolutional Neural Networks Model for Facial Emotion Recognition System." Journal of AI Research, 2019.

2. Smith, J., and Lee, K. "Optimized Algorithms for Real-Time Facial Recognition." IEEE Transactions on Biometrics, 2020.

3. Kumar, R., et al. "Facial Recognition in University Attendance Systems." Education Technology Review, 2021.

4. Johnson, M., et al. "Contactless Technologies in Public Health." Health Informatics Journal, 2022.

5. Davis, L., and Patel, A. "Enhancing Accessibility with Voice-Assisted Interfaces." Assistive Technology Quarterly, 2023.

6. Brown, A., et al. "Advanced Machine Learning Techniques for Facial Recognition." Computer Vision Journal, 2021.

7. Miller, S., et al. "Facial Recognition: Ethical and Legal Considerations." Journal of Cybersecurity, 2020.

8. Lee, Y., and Cho, H. "Real-Time Facial Recognition Systems and Their Applications." International Journal of Computer Science, 2022.

9. Wang, T., et al. "Improving Facial Recognition Accuracy with Data Augmentation." Neural Networks Journal, 2019.

10. Patel, M., et al. "Integrating Facial Recognition with Educational Management Systems." Journal of Educational Technology, 2023.

729