

Contactless Attendance System based on Face Recognition using OpenCv

Shubham Kadam¹, Sagar Khedkar²

¹Student M.Tech, Department of Electronics Engineering, Walchand College of Engineering, Sangli, Maharashtra, India

²Professor, Department of Electronics Engineering, Walchand College of Engineering, Sangli, Maharashtra, India

Abstract - Automated unique finger impression examination has been broadly adopted form of biometrics for decade, crossing more applications. This includes marking staff presence at work environments, character enlistment at government workplaces and also entry authentication at various places. Whilst thumb impressions via a biometric framework has been regularly used in order to confirm an individual, these practices possess been suspended in order to mitigate physical contact and forestall the spread of Covid-19. Here we attempted to present a contactless attendance system based on face recognition that takes automatic attendance in an association premises, working environments, and so on. The proposed framework basically is categorized in two stages i.e., Face detection plus Face recognition. Viola-Jones algorithm is utilized to identify the faces from the current frame. Face detection algorithm absolute goal is to determine whether there is any face in an image or not. After detection of face, we utilized a face recognition idea to perceive the understudies/workers, where the Local Binary Pattern algorithm is used to identify the employee or understudies features to perceive the unique ID. After successful authentication in real time the entries of person along with the time is updated in the database. Finally after data processing the attendance a month to month report of every person alongside their arrival time, departure time, and absolute time spent in grounds just as late banners are brought up in the report if the up-and-comer is late in the working environment.

Key Words: Haar Cascade, Local Binary Pattern, PyQt, OpenCv, Raspberry Pi 4B

1. INTRODUCTION

Human face recognition has been a leader and strikingly viable framework in biometric confirmation for some applications, for example, door control, video monitoring framework, network security, and human PC interactions. Typically the interest and moment period of scientific studies in this discipline are exceptionally demonstrative from its in addition to intricacy, thus unavoidably turning into a predominant form of biometric authentication. Inside the momentum establishing in the Covid-19 outbreak contactless attendance systems are turning out to be progressively critical to generating buildings more long

lasting to the propagate of infectious virus in supplementing social separating and sanitization methodology for disease anticipation. Biometric frameworks dependent on fingerprints scanning are unhygienic particularly given the current Covid-19 circumstance. This evokes the requirement for contactless attendance framework. Associations (educational or something else) are anxious about the habitualness in attendance these days. The general performance of the representatives/understudies is essentially controlled by their discernment in addition to presence at typically the premises.

With typically the continuous innovative work in the discipline of pattern recognition and computer vision, for instance, the applications like biometric affirmation, face and unique mark (finger) recognition, face-mask identification (particularly through the COVID-19 pandemic) are vital in addition to critical in carrying out and dealing with the e-attendance frameworks. To conquer the above challenges, a Contactless Attendance system is proposed in a productive way. This framework is implemented on the entry of the classroom which records the understudies' attendance naturally although entering the class, by recognizing their faces. The arrival time and departure time of the understudies are additionally recorded habitually. In light of this estimation, the total time in the premises or the total time of the understudies inside the workplace can be easily deliberated. There is no way of giving phony attendance as every understudy needs to record their facial character. The proposed framework expects to accomplish dependability, availability and security in a proficient way. This system not just assists you with remaining more organized while expanding your attendance efficiency yet it additionally helps keep your representatives, staff and working environments more secure during a worldwide pandemic.

2. LITERATURE REVIEW

There are many research articles accessible in the past on attendance management systems by utilizing different biometrics for instance unique finger impression, iris and a lot more for carrying out mechanized attendance framework. The composing review gives synopses of information about the past exploration and how each examination executes the attendance management system by utilizing face recognition.

S. Kakarla et.al [1] a completely unique CNN architectonics for face recognition structure is proposed including the way toward gathering face information of understudies. This paper authoritatively presents the work of CNN in Face Recognition and adaption of CNN in attendance posting. Likely it is exhibited that the proposed CNN architectonics gives 99% accuracy. Further, the proposed CNN structure is used to develop a "Smart Attendance Management System (SAMS)", which is an online application, to provide attendance of understudies using face recognition, continuously. The future degree of the paper is to manufacture a solid application for smart attendance management, for more number of understudies, dynamically.

A. Arjun Raj et.al [2] a smart attendance structure subject to face recognition was executed. The structure executed using LBPH face recognizer to separate face of the individual ceaselessly. Raspberry Pi, OpenCv and DLib utilizing python are the fundamental requirements for this system. A message will be consequently shipped off their folks' number utilizing GSM. The maker also developed an Android Application using MIT application designer for attendance checking. The maker moreover gave assessment of various calculations for face recognition in which it's clearly communicates that LBPH procedure accomplishment rate is 98.5%. Inside the paper a table as for benefits and disservices of various approaches on face recognition is given. To execute the structure the creator required Raspberry Pi 3b module, pi camera, servo motor and database servers. By using LBPH calculation for face recognition the maker conquer the issue of different head directions and liberal obstruction.

N. Gupta et.al [3] understudy Attendance incorporated server structure is portrayed to manage the understudy's class attending documents using face detection and recognition through open computer

vision. For face detection framework the producer used Haar cascade and for face recognition LBPH model. A part of the python groups/modules using in the endeavor are Numpy, Tkinter, OpenCv, PIL, Pandas. The creator used face recognition library with KNN algorithm, which gives 97.35% of exactness rate.

B. Tej Chinimilli et.al [4] proposed automated attendance management system subject to Haar cascade for face detection and the LBPH algorithm for face recognition. Circumstances, for instance, face recognition rate, bogus positive rate for that and bogus positive rate with and without using a limit in distinctive unknown individuals are considered to survey the framework. The maker got face recognition rate of understudies as 77% and its bogus positive rate as 28%. The framework perceived understudies regardless, when understudies are wearing glasses or grown a facial hair development. Face Recognition of unknown individuals is practically 60% for both with and without applying limit regard. Its bogus positive rate is 14% and 30% with and without applying limit independently. Little dataset was the obstruction of the proposed framework. As per the maker an effort could be made in future to create a prevalent dataset that may basically give a more exact result.

3. CHALLENGES

Exactness - For a really consistent functioning entry control dependent on face recognition, exactness is fundamental. Reduce exactness pertains to a lot more manual associations and abrogates and more endeavors to obtain entrance even by authorized people

Speed - With regard to access control purposes, face recognizable proof must be performed inside a split second. In high-volume periods, for example, morning top hour, it has an immense effect if your platform upholds this component. Low speed would make bottlenecks, prompting burden.

Robustness - Processing high information throughput ought not to push the framework down to the brink of collapse, in any event, when it needs to deal with big number of encounters. A decent face recognition solution measures a raw video transfer straightforwardly without having recoding or pre-preparing. It identifies faces, endeavors to remember them, and sends suitable orders to the remainder of the framework. Numerous frameworks presently work

with still image based recognition, which takes up processing time and slows it down to less than real-time processing.

Simple Integration - Most associations, who need to add consistent access control based on face recognition, as of now possess various interlocking frameworks set up typically video management and data control frameworks with appropriate access control effectively tied in. All things considered, incorporating the face recognition solution into the current network ought not to be an issue.

4. PROPOSED SYSTEM

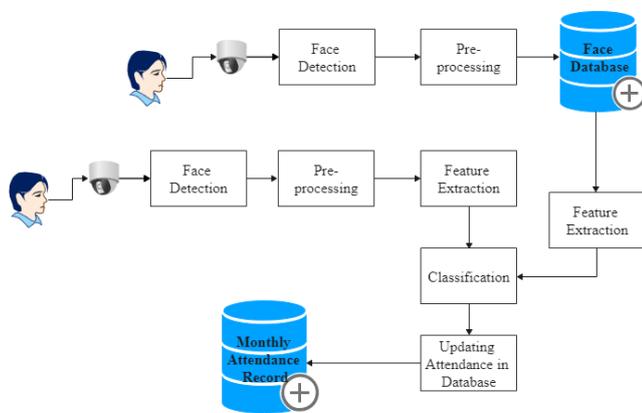


Fig -1: System Architecture

4.1 Image Capturing

In the initial phase the image is captured by means of camera. The camera is mounted at the entrance to capture the frontal image.

4.2 Face Detection

Face detection just means that a system is in a position to spot that there's human face present in an image or video. In the proposed system I even have to detect frontal faces instead of face looking sideways because the system is going to be implemented at the entrance. So for the same Viola Jones algorithm is implemented for face detection [5]. To overcome complex feature calculations Viola Jones developed Haar-like features.

Haar feature

Haar-like feature consider neighboring rectangular regions at a selected window during a detection window, sum up the pixel intensities region and calculates the difference between the two rectangle regions (black and white) for two-rectangle feature. For face detection Haar-like feature is therefore a group of two neighboring rectangular areas above the eye and cheek regions.

Integral Image

Rectangular features are often computed easily and rapidly using an intermediate representation for the image which is referred as integral image. The integral image method makes the calculations much less intensive and save a lot of time for any face detection model. The integral image at location x, y contains the sum of pixels above and to the left of x, y .

Adaboost

Each image sub window is related to 45,396 rectangle features, a number far greater than the number of pixels. Computing complete set is prohibitively expensive, albeit each feature is often computed very efficiently. To overcome the problem Adaboost algorithm is utilized which boost the classification performance by combining a collection of weak classification functions to form a strong classifier. The algorithm learns from the image we provide and determines the false positive and true negatives in the data; since one weak classifier cannot provide accuracy so strong classifier can be obtained with combination of two or three weak classifier.

Cascading

In order to achieve increased detection performance while radically reducing computation time. More efficient boosted classifier can be constructed where lot of the negative sub-windows are rejected while all positive instance are detected. Simpler classifiers are used to reject majority of sub-windows before more complex classifiers are brought up in action to achieve low false positive rates. A positive result from the primary classifier triggers the evaluation of second classifier which has also been adjusted to attain very high detection rate. A positive result from the second classifier triggers a third classifier whereas a negative outcome at any point leads to immediate rejection of sub window.

4.3 Face Recognition

Face Recognition describes a biometric technology that goes way beyond recognizing when a person face is present. It actually attempts to determine whose face it is. In the proposed system LBP method is implemented for face recognition or face descriptor. The basic methodology for LBP based face descriptor was proposed by Ahonen et.al [6]. According to the methodology proposed by Ahonen et.al the facial image is divided into local regions and LBP texture descriptors are extracted from each region

independently. The algorithm uses a concept called as sliding window, based on radius and neighbors parameters. The operator assigns a label to each pixel of an image by thresholding the 3×3 neighborhood of every pixel with the center pixel value and considering the result as a binary number.

4.4 Database of faces

As I am implementing biometric authentication system it is require storing the faces of the individual detected during the registration phase. In the proposed system the detected faces are assign a unique Id which should be the same during the real-time attendance. During the real time authentication the input image and the existing image Id must assemble the same number then only the attendance will be marked.

4.5 Month to Month report

Data processing the attendance entries on daily basis a monthly report is generated. Through entries of individual on that day a report comprising of arrival time, departure time and total time spend by the individual in the campus or workplace is determined. Also flags are raised if the individual has spent less time and left early from the premises. Through this the respective staff or the administrator can have a look on every individual performance on daily basis.

5. SYSTEM EXPLANATION

Login Page - The GUI is built using PyQt designer. Only administrator can do the manipulation of system as the system is bind with the security key. If you want to successfully login into the system knowing security key is must.

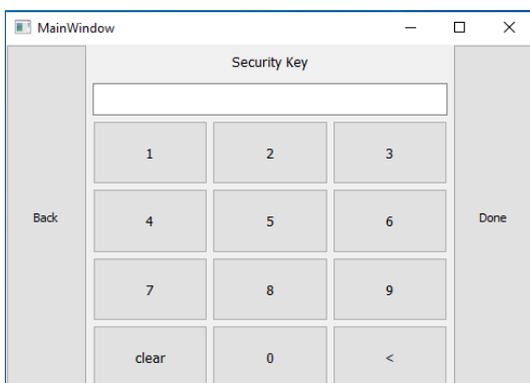


Fig -2: Login Interface

Main Page

After successful login the individual will be taken to the main page of the system comprising of Add face,

remove face and set security key button. The individual has to register only once for further authentication on daily basis. If the individual has not registered to the system earlier he can click the add face button. By doing this his face get registered and stored in the face database. Each individual face will be stored with some unique id (index). Consequently the unique Id assign to the individual face while registering his face in the system must assemble the unique id during authentication to mark the face as valid as well as attendance.

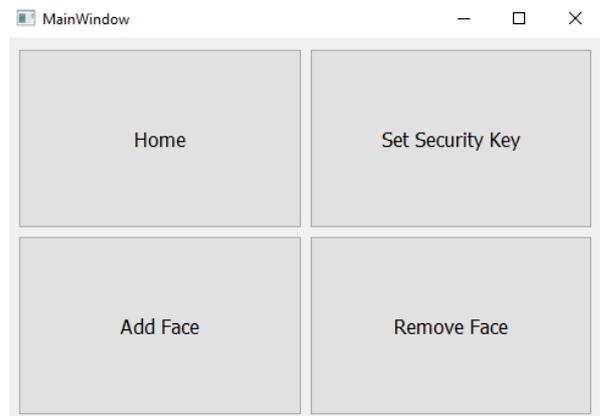


Fig -3: Main Page of System

During registration of new individual the face will be detected and marked as unknown. The unknown face detected will be marked with unknown label below the rectangle box.

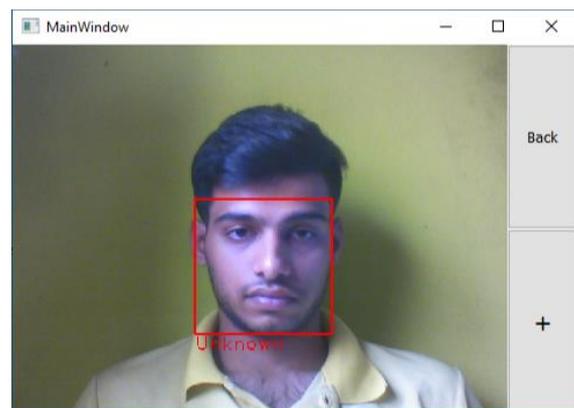


Fig -4: Unknown Face Detected

During real time authentication the recognized face is marked with a label below the rectangle box of the detected face with unique id allotted during the registration phase.



Fig -6: Authentication Successful



Fig -7: Real time authentication in good light condition

6. FLOWCHART

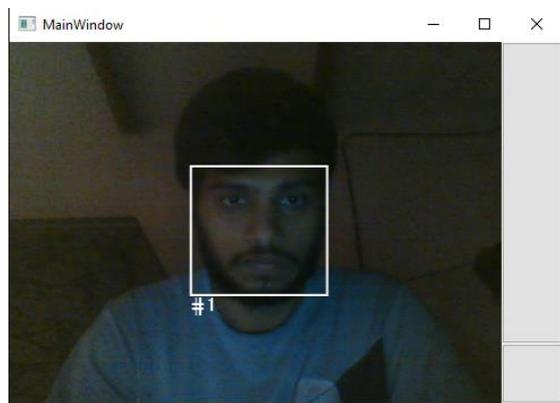
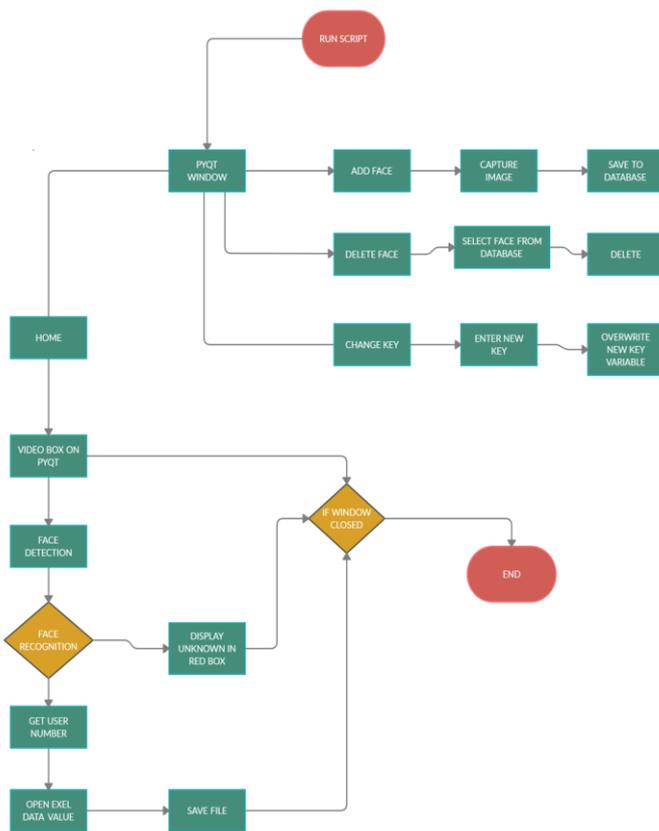


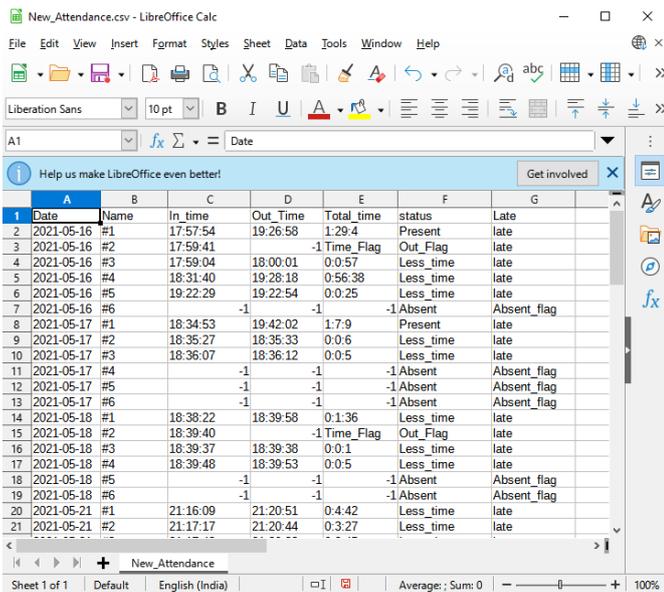
Fig -8: Real time authentication in poor light condition

7. RESULTS

Authentication in real time was done in different light conditions.

Monthly Report

A monthly report was determined from the daily entries of the individuals registered in the system. In time, out time and total time spent by the individual in the workplace or premises was determined by data processing. Also late flags, absent flags were raised if the individual was late to campus after 10 am and spent very less time as well as when he left early. The administrator will be able to keep look on every individual performance of every month or week through the report.



Date	Name	In_time	Out_Time	Total_time	status	Late
2021-05-16	#1	17:57:54	19:26:58	1:29:4	Present	late
2021-05-16	#2	17:59:41		-1:Time_Flag	Out_Flag	late
2021-05-16	#3	17:59:04	18:00:01	0:0:57	Less_time	late
2021-05-16	#4	18:31:40	19:28:18	0:56:38	Less_time	late
2021-05-16	#5	19:22:29	19:22:54	0:0:25	Less_time	late
2021-05-16	#6		-1	-1	-1 Absent	Absent_flag
2021-05-17	#1	18:34:53	19:42:02	1:7:9	Present	late
2021-05-17	#2	18:35:27	18:35:33	0:0:6	Less_time	late
2021-05-17	#3	18:36:07	18:36:12	0:0:5	Less_time	late
2021-05-17	#4		-1	-1	-1 Absent	Absent_flag
2021-05-17	#5		-1	-1	-1 Absent	Absent_flag
2021-05-17	#6		-1	-1	-1 Absent	Absent_flag
2021-05-18	#1	18:38:22	18:39:58	0:1:36	Less_time	late
2021-05-18	#2	18:39:40		-1:Time_Flag	Out_Flag	late
2021-05-18	#3	18:39:37	18:39:38	0:0:1	Less_time	late
2021-05-18	#4	18:39:48	18:39:53	0:0:5	Less_time	late
2021-05-18	#5		-1	-1	-1 Absent	Absent_flag
2021-05-18	#6		-1	-1	-1 Absent	Absent_flag
2021-05-21	#1	21:16:09	21:20:51	0:4:42	Less_time	late
2021-05-21	#2	21:17:17	21:20:44	0:3:27	Less_time	late

International Conference on Reliability, Infocom Technologies and Optimization (Trends and Future Directions) (ICRITO), 2020. Available: 10.1109/icrito48877.2020.9197936 [Accessed 22 July 2021].

[4]B. Tej Chinimilli, A. T., A. Kotturi, V. Reddy Kaipu and J. Varma Mandapati, "Face Recognition based Attendance System using Haar Cascade and Local Binary Pattern Histogram Algorithm", 2020 4th International Conference on Trends in Electronics and Informatics (ICOEI)(48184), 2020. Available: 10.1109/icoei48184.2020.9143046 [Accessed 22 July 2021].

[5]P. Viola and M. Jones, "Rapid object detection using a boosted cascade of simple features", Proceedings of the 2001 IEEE Computer Society Conference on Computer Vision and Pattern Recognition. CVPR 2001. Available: 10.1109/cvpr.2001.990517 [Accessed 22 July 2021].

[6]T. Ahonen, A. Hadid and M. Pietikainen, "Face Description with Local Binary Patterns: Application to Face Recognition", IEEE Transactions on Pattern Analysis and Machine Intelligence, vol. 28, no. 12, pp. 2037-2041, 2006. Available: 10.1109/tpami.2006.244 [Accessed 22 July 2021].

[7]S. Chintalapati and M. Raghunadh, "Automated attendance management system based on face recognition algorithms", 2013 IEEE International Conference on Computational Intelligence and Computing Research, 2013. Available: 10.1109/iccic.2013.6724266 [Accessed 22 July 2021].

8. CONCLUSION

Faces with some tilted angle were not detected. Analysis in various environmental conditions was done. Authentication was successful in light variance (bright, dark). Finally after data processing the attendance a month to month report of every person alongside their arrival time, departure time, and absolute time spent in grounds just as late banners are brought up in the report if the up-and-comer is late in the working environment. The system enables the administrator to monitor individual working hours, late arrivals early departures and absenteeism. The Processing time was also up to the mark the system didn't took much amount of time to process the program for capturing and authentication process. Lastly a touch free Contactless attendance system was build successfully even to reduce attendance proxies by means of showing other individual image through camera can be restricted if the snapshot of the image in real time can be stored in separate database.

9. REFERENCES

[1]S. Kakarla, P. Gangula, M. Rahul, C. Singh and T. Sarma, "Smart Attendance Management System Based on Face Recognition Using CNN", 2020 IEEE-HYDCON, 2020. Available: 10.1109/hydcon48903.2020.9242847 [Accessed 22 July 2021].

[2]A. Arjun Raj, M. Shoheb, K. Arvind and K. Chethan, "Face Recognition Based Smart Attendance System", 2020 International Conference on Intelligent Engineering and Management (ICIEM), 2020. Available: 10.1109/iciem48762.2020.9160184 [Accessed 22 July 2021].

[3]N. Gupta, P. Sharma, V. Deep and V. Shukla, "Automated Attendance System Using OpenCV", 2020 8th