

Attendance Management System Using Face Recognition

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Abstract: The purpose of this project is to build attendance management system based on face recognition, Face recognition is an important application of Image processing owing to its use in many fields. Identification of candidate in an organization for the purpose of attendance is an application of face recognition. Face recognition procedure basically consists of two phases, namely face detection & face recognition. This Attendance Management System can perform the daily activities of attendance marking and analysis with reduced human intervention. User is not required to wait in queue as attendance of multiple people can be recorded at once by simultaneous recognition of faces of multiple people. According to current scenario of covid-19 we proposed this system for preventing infection due to contact and to maintain social distancing. In this project, by using OpenCV library facial recognition based attendance management system is developed the attendance results will be stored in the MySQL database.

Keywords: OpenCV, Image processing, Face Detection, Face Recognition

1. INTRODUCTION

The proposed system is designed for automating the attendance of the organization and reduces the flaws of existing manual system. First the data of user is added manually by administrator. While doing so, system captures images of user. These images are dataset for recognition. The system is trained on this dataset. After that, when user comes in front of camera his face will be detected and compared with dataset. If matched with any face in dataset then ID and Name will be shown in real time, and attendance will be recorded in database as well as in excel sheet.

In this system we are introducing two special modes for attendance recording. First one is normal mode i.e. multiple recognition mode, which is used for recording attendance of more than one user at the same time. And second is critical mode i.e. single recognition mode, which is used for recording attendance of single user at a time, which ensure that social distancing is followed in the campus. All rights regarding to system are given to admin only.

2. METHODOLOGY

The proposed system is designed using these python modules: Opencv, numpy, pillow, Tkinter, openpyxl, os, sqlite database etc. The major steps of the project are:

1. Face detection
2. Data gathering
3. Training dataset
4. Face recognition

A) FACE DETECTION

Face Detection is the first and important step for face recognition, and it is used to detect faces in the images. Here we worked, on OpenCV for Face Detection, as OpenCV comes with a trainer as well as detector.

How face detection works

First the image is imported by providing the location of the image for detecting, then that image is transformed from RGB to Grayscale because it is easy to detect faces in the grayscale. The next step is image segmentation, it is used for contour detection or segments the multiple objects in a single image so that the classifier and quickly detect the objects and faces present in the image. The next step is to use Haar-Like features algorithm. This algorithm used for finding the location of the human faces present in a frame or image. a rectangle box will be drawn in the area of interest where it detects the face.

B) DATA GATHERING

Data gathering is the process of collecting many images of faces of user and storing it with particular id for that person. This collection of images of face of each user is called as Dataset. This is required for training the algorithm to recognise face.

How to gather data

Create a folder named 'Faces' to store these images. During recording of new user, 100 images or samples of face of user are recorded by taking snapshots through the camera. Face will detect as discussed above and then the image will be cropped according to coordinates, height and width provided by the face detector. This cropped image is then converted to its grayscale image and save it into 'Faces' folder with name as "User.<user id>.<Sample Number>.jpg"

C) TRAINING DATASET

For training above gathered data, all user data from dataset is loaded and trained. This is done directly by a specific OpenCV function, the LBPH (LOCAL BINARY PATTERNS HISTOGRAMS) Face Recognizer, included on OpenCV package. The result will be a .yml file that will be saved in a directory.

How training is done

First each image in dataset is converted into array of pixel values. Such arrays are combined together. With those arrays as input, recogniser is trained. After training the data is stored in recogniser/trainer.yml file. This data will be used during face recognition.

D) FACE RECOGNITION

Face detection detects any face in image, if there is one. Face recognition on the other hand tells us whose face it is if that face is previously stored in dataset. In this project to mark an attendance image with face of user is captured by the camera and if this person had his face captured and trained before, the recognizer will make a prediction, returning user's id and an index, which shows how confident the recognizer is with this match.

How recognition works

Before recognition, it is required to detect a face in the image captured by camera, using the haarCascade classifier. It can detect multiple faces in single image which means attendance of multiple people at same time can be recorded. Having detected a face or faces the recogniser then predicts whose face it is by using data in trainingData.yml file. This file is loaded at the start of recognition. The predict () method of LBPHFaceRecognizer inOpenCV, will take as a parameter a captured portion of the face to be analysed and will return its probable owner, indicating its id and how much confidence the recognizer is in relation with this match. Note that the confidence index will return "zero" if it will be considered a perfect match. And at last, if the recognizer could predict a face, we put his name fetched from database using its id given by recogniser. If person is not matched, "No match" label is put on the face.

3. LITERATURE REVIEW

[1] ArunKatara et al. (2017) mentioned disadvantages of RFID (Radio Frequency Identification) card system, fingerprint system and iris recognition system. RFID card system is implemented due to its simplicity. However, the

user tends to help their friends to check in as long as they have their friend's ID card. The fingerprint system is indeed effective but not efficient because it takes time for the verification process so the user has to line up and perform the verification one by one. However for face recognition, the human face is always exposed and contains less information compared to iris. Iris recognition system which contains more detail might invade the privacy of the user. Voice recognition is available, but it is less accurate compared to other methods. Hence, face recognition system is suggested to be implemented in the faculty attendance system.

[2] In Wei-Lun Chao's paper on "Face Recognition" general ideas and structures of recognition, important issues and factors of human faces, critical techniques and algorithms and their comparison are discussed.

[3] A brief introduction to face recognition is given in presentation titled "Face Recognition a Tutorial" by FilaretiTsalakanidou. This presentation also covers various challenges in human face recognition, various techniques of face detection as well as face recognition

[4] The paper proposed by Zhao, W et al. (2003) has listed the difficulties of facial identification. One of the difficulties of facial identification is the identification between known and unknown images.

[5] In addition, paper proposed by Pooja G.R et al. (2010) found out that the training process for face recognition student attendance system is slow and time-consuming.

[6] PriyankaWagh et al. (2015) mentioned that different lighting and head poses are often the problems that could degrade the performance of face recognition based student attendance system.

[7] S.Aanjanadevi et al. (2017) and Wei-Lun Chao (2007) presented a few factors which cause face detection and face recognition to encounter difficulties. These factors consist of background, illumination, pose, expression, occlusion, rotation, scaling and translation.

4. PREREQUISITES

4.1 Terms

- **User:** The person whose attendance is to be recorded.
- **Administrator:** The person who will have privileges to add, delete and update the information about user.
- **Dataset:** Directory with grayscale images of user's face. These images will be recorded during registration.

For the purpose of face recognition a dataset containing number of images of faces of each staff is required. These images are recorded when administrator adds new record of user.

4.2 Tools Used

This project is developed in python3.8 with the help of Pycharm IDE.

- **Frontend:** tkinter, a module in python
- **Database:** SQLite
- **Backend:** OpenCV, Python

4.3 Module Used

- **cv2:** OpenCv (Open Source Computer Vision) is a library of programming functions mainly aimed at real-time computer vision, it is used for image processing.
- **Numpy:** Numpy is open source numerical python library, used for scientific computing and to perform number of mathematical operations on arrays.
- **Tkinter:** Tkinter is the standard GUI library for python, it provides fast and easy way to create GUI application.
- **Sqlite:** Sqlite is database software for local/client storage in application software.
- **OS:** OS module provides functions for interacting with operating system. It comes under python's standard utility modules.
- **Openpyxl:** Openpyxl is a python library used for reading and writing Excel file.
- **Pillow:** Pillow is python imaging library. It adds support for opening, manipulating and saving many different image file format.

4.4 General recommendations for facial recognition

1. Face recognition accuracy of the system heavily depends on the quality of a face image. Image quality during registration is important, as it influences the quality of the face template.
2. 32 pixels is the recommended minimal distance between eyes for a face on image or video stream to perform face template extraction reliably. For better result of face recognition recommended 64 pixels or more. Note that this distance must be native, not achieved by resizing an image.
3. Several images during registration are recommended for better facial template quality which results in improvement of recognition quality and reliability. So we are taking 100 images of frontal face of each user.
4. Additional registrations may be needed when facial hair style changes, especially when beard or moustache is grown or shaved off.
5. Persons wearing spectacles, face masks or respirators can be recognized without separate registration

4.5 System Specifications

Face recognition based attendance system is tested on the computer with following hardware and software specifications.

Table I: Hardware and Software specifications

Category	Requirement
Operating System	Windows Window 7, 8, 10
Hardware configuration GPU	AMD Radeon HD 7600M series+ intel core i3 2370M @2.40GHz 2 cores, 4GB RAM, 1TB HDD
Database	SQLite
Camera Resolution	640x480 and above up to 1080p.
Frame rate	10 fps and above

4.6 Camera Installation

1. The camera installation should be Angular at a height of about 1.7 m facing the region where people can walk towards camera.
2. The camera installation should be generic IP cameras with good quality at Angular direction.
3. The illumination should be above 200 lux. If system is used indoors then good constant illumination should be maintained throughout the day. Light source should be used for this purpose
4. The height of installation depends on resolution. For detection the pixel distance between eyes should be above 60 pixels. For Face registration the pixels between eyes is above 100 pixels.

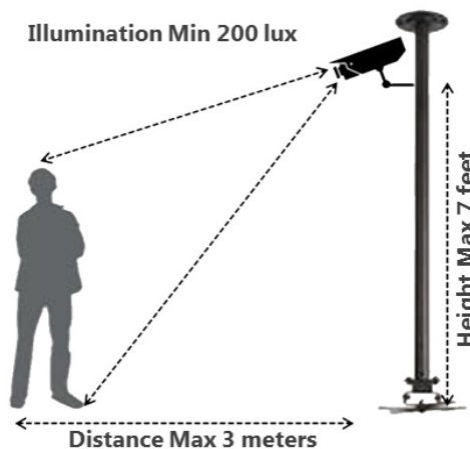


Figure 4.6.1: Camera Installation

Display such as LCD screen is needed below the camera so that user can see whether his/her face is being recognised or not without looking away from camera

5. IMPLEMENTATION:

Each user first needs to do registration. After registration, images of user's face will be captured by camera.

- **Capturing the image data:** The camera will be placed at the entrance of organization. The camera will capture images of user entering the organization.
- **Face detection:** Faces will be detected in the images captured by camera. If frontal face is visible in camera then that portion of image will be cropped and saved as new image in dataset folder.
- **Training:** For face recognition, training is required. Training is done on dataset images.
- **Attendance:** For recording daily attendance, start recognition button needs to be clicked. Once the button is clicked, camera will start capturing images at the entrance. If face appears in image, then it will be compared with dataset and if match occurred, the name and Id will be shown for that user. Time at which face appeared will be recorded in database as well as excel sheet

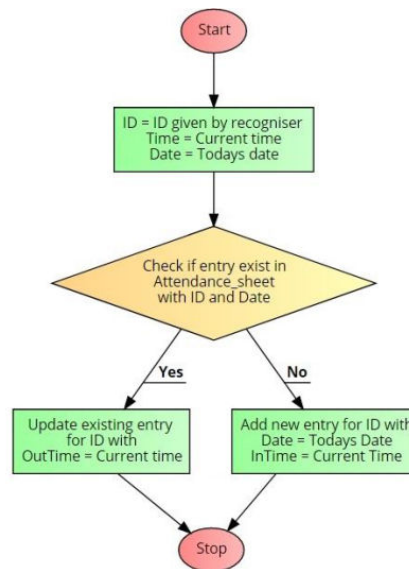


Figure 5.1: Flow chart for attendance recording process

6. SPECIAL MODES

We are proposing Attendance Management System Using Face Recognition with two special modes are multiple recognition mode and single recognition mode. Admin who handle the system have all the rights such as selection of mode for attendance, registration of new user, deleting entry of any user, updating any users information, keep the record of daily attendance etc.

i) Multiple Recognition Mode (Normal mode)

In multiple recognition mode more than one user can be recognized at the same time and attendance of multiple users will be recorded. Due to this mode of recognition time will be saved and attendance will be recorded with current time and date.

ii) Single Recognition Mode (Critical mode)

In single recognition mode attendance of only single user will be recorded at a time. If more than one user come in front of the camera, attendance will not recorded and system will give alert that “Please maintain social distancing”.

Recorded attendance will be stored in the database as well as in the Excel sheet with date and time. As in both modes does not require touching anything so risk of germs transmission is also eliminated.

7. RESULTS OF SYSTEM IN DIFFERENT MODES

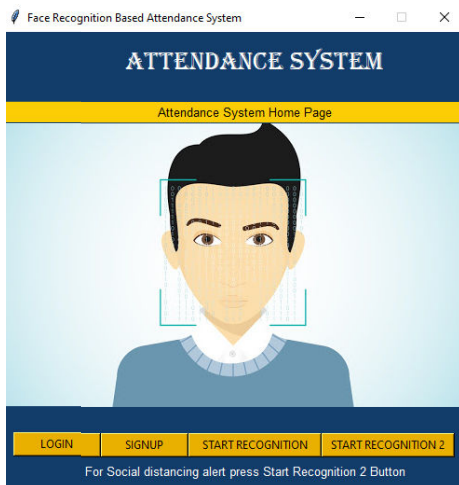


Figure 7.1: Home page for admin

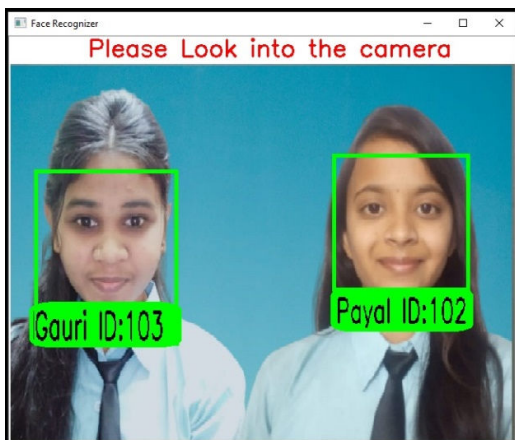


Figure 7.2: Normal mode
Multiple recognition at the same time

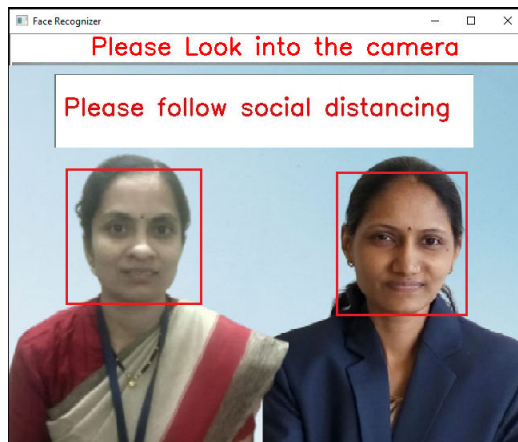


Figure 7.3: Critical mode
Alert message given by system while single recognition mode

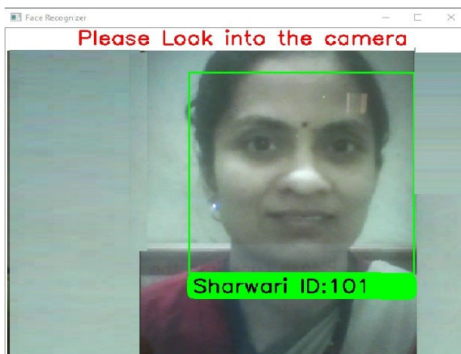


Figure 7.4: Successful recognition with Name and ID

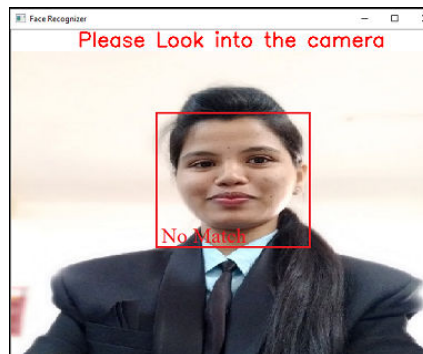
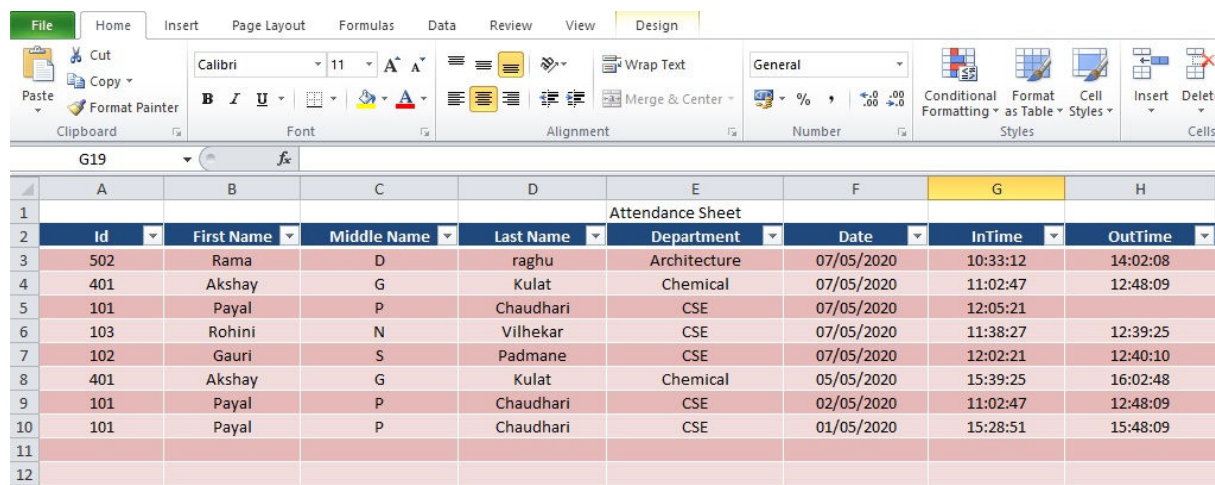


Figure 7.5: Not successful recognition shows no match label



	A	B	C	D	E	F	G	H	
1					Attendance Sheet				
2	Id	First Name	Middle Name	Last Name	Department	Date	InTime	OutTime	
3	502	Rama	D	raghu	Architecture	07/05/2020	10:33:12	14:02:08	
4	401	Akshay	G	Kulat	Chemical	07/05/2020	11:02:47	12:48:09	
5	101	Payal	P	Chaudhari	CSE	07/05/2020	12:05:21		
6	103	Rohini	N	Vilhekar	CSE	07/05/2020	11:38:27	12:39:25	
7	102	Gauri	S	Padmane	CSE	07/05/2020	12:02:21	12:40:10	
8	401	Akshay	G	Kulat	Chemical	05/05/2020	15:39:25	16:02:48	
9	101	Payal	P	Chaudhari	CSE	02/05/2020	11:02:47	12:48:09	
10	101	Payal	P	Chaudhari	CSE	01/05/2020	15:28:51	15:48:09	
11									
12									

Figure 7.6: Recorded attendance stored in excel sheet with date and time

8. EXPECTED OUTCOME

This system will reduce the time required for attendance as user just needs to look at the camera while entering the campus. User not required to wait in a queue to record attendance as multiple faces can be recognised simultaneously. After successful recognition attendance of particular user will be recorded in database and will be saved date wise to Excel sheet also.

9. CONCLUSION

Attendance management system using face recognition is designed to solve the issues of existing manual systems. To avoid proxy attendance, security of Dataset and Database is important. By this system manual attendance can be eliminated and time is saved. As this system does not require touching anything so risk of germs transmission is also eliminated.

Due to covid-19, it is required by government that social distancing must be followed in all organisations. If such systems are installed throughout the campus we can ensure that social distancing is followed everywhere in the campus.

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