"Face Log"
(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 operation of Image processing owing to its use in numerous fields. Identification of candidate in an organization, college or school for the purpose of attendance is a use of face recognition. The Face recognition system basically consists of two phases such as namely face detection and face recognition. This Attendance Management System can do the daily activities of attendance marking and analysis with reduced human interactions. User does not wait in queue as attendance of multiple people can be recorded at once by simultaneous recognition of faces of multiple people at a time. According to current situation of covid- 19 we proposed this system for precluding infection due to contact and to maintain social distancing. In this project, by using OpenCV library facial recognition-based attendance management system developed the attendance results will be stored in the database.*

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

I. INTRODUCTION

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

In this attendance management system, we are giving two special modes for attendance recording. The 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 one is critical mode i.e. single recognition mode, which is used for recording attendance of single user at a time, to ensure social distancing is followed in the campus. The All rights regarding to attendance management system are given to admin only.

II. METHODOLOGY

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

- Face detection
- Data gathering
- Training dataset
- Face recognition
- Attendance Management

A) Face Detection

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

How the face detection works

First the image is imported by providing the location of the image for detecting the face, then that image is transformed from RGB to the Grayscale because it is easier to detect the faces in the grayscale format. 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 should quickly detect the objects and faces present in image or at real time. The next step is to use the Haar-Like features algorithm. This algorithm used for finding the location of the given human faces present in a frame or image. a rectangle box will be drawn in the area of interest where it detects the face of person.

Data Gathering: -

The Data gathering is the process of collecting multiple images of faces of user and storing it with the particular id for that person. This collection or bundle of multiple images of face of each user is called as Dataset. This is required for training the algorithm so it recognise face properly.

How to gather the data

First Create a folder named 'Faces' to store these images. Then During recording of new user, 100 images of face of user are recorded by taking snapshots through the camera of system. The Face will get detected 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 the grayscale image because it is easy to detect face and then save it into 'Faces' folder with name as "User. <user id>. <Sample Number>.jpg"

Training Dataset

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

How training of the gathered data 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 the recogniser/trainer.yml file. This data will be used during face recognition.

B) Face Recognition

The Face detection detects any face in the image. Face recognition on the other hand tells us whose face it is if that face was previously stored in dataset. In Face recognition attendance system 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, by returning the user's id and an index, which will show how confident the recognizer is with the given match.

How the recognition works

Before the recognition, it is required to detect a face in the image captured by camera, using haarCascade classifier. It will detect multiple faces in single image which means attendance of multiple people will be recorded at same time. Having detected a face or faces the recogniser predicts whose face it is by using the data in trainingData.yml file. This file is loaded at the start of the recognition. The predict () method of the LBPHFaceRecognizer inOpenCV, will take as a parameter a captured portion of face to be analysed and will return the probable owner, indicating its id and how much confidence the recognizer has is in relation with this match. Note that the confidence index will return "zero" if it

will be considered a perfect match. And if the recognizer could predict the face, we put his name and fetched from database using its id given by recogniser. If person is not matched, "unknown" labelwill appear on the scanned face

III. LITERATURE REVIEW

ArunKatara et al. in 2017 mentioned some disadvantages of RFID (Radio Frequency Identification) card systemas wll as fingerprint system and iris recognition system. The RFID card system is implemented due to its simplicity. the disadvantage is that However, user tends to help their friends to give attendance as long as they have their friend's ID card. The fingerprint system is more effective but not efficient because it takes more time for the verification process so that the user has to line up and perform the verification one by one. However, for the face recognition system, the human face is always exposed and contains less information as compared to the iris. Iris recognition system in which it contains more detail might invade the privacy of the user. sometimes Voice recognition is available, but it is less accurate and can't be trusted compared to other methods. Hence, the face recognition system is should be suggested to be implemented in the faculty attendance system.

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

[2] 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

[3] 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.

[4] 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.

[5] 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.

IV. PREREQUISITES

4.1 Terms

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

The use of face recognition, a dataset containing multiple images of faces of each student, staff is required. These images are recorded when the administrator adds a 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) it is a library of programming functions mainly aimed at real-time computer vision, it is used for processing of image also called as image processing.
- Numpy: The Numpy is an open-source numerical python library, in which used for scientific computing and also to perform number of the mathematical operations on arrays.
- Tkinter: Tkinter is the standard GUI library for the python, it provides fast and easy way to create an GUI application.

- Sqlite: The Sqlite is database software for local/client storage in application software.
- OS: The OS module provides the functions for interacting with operating system. And it also comes under python's standard utility modules.
- Openpyxl: The Openpyxl is a python library used for reading and writing the Excel file.
- Pillow: The Pillow is python imaging library. It adds support for opening, manipulating and also saving many different images file format.

4.4 General recommendations for the face recognition system

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

4.5 System Specifications

The 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 i5 2370M @2.40GHz 2 cores, 8GB RAM, 1TB HDD
Database	Excel
Camera Resolution	640x480 and above up to 1080p.
Frame rate	10 fps and above

4.6 Camera Installation

- The camera installed should be Angular at the height of about 1.7 meter facing the area where people can walk towards the camera.
- The camera installed should be the generic IP cameras with good quality at Angular direction.
- The illumination should be above 200 lux. If the system is used indoors then good constant illumination should be maintained throughout the day. The natural as well as artificial Light source should be used for this system.
- The height of installed camera depends on the resolution of camera. For detection of the pixel distance between the eyes should be above 60 pixels. For Face registration the pixels between eyes should be above 100 pixels
- The Display such as an LCD screen is needed under the camera so that user can see whether his/her face is being recognised or not without looking away from camera.
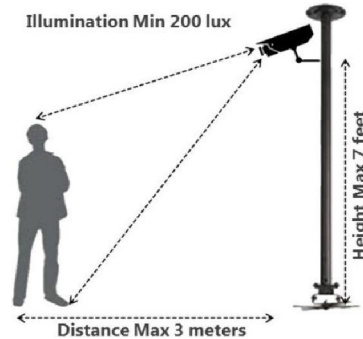
V. IMPLEMENTATION

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

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

VI. SPECIAL MODES

The Attendance Management System Using Face Recognition is with two special modes are multiple recognition mode and the single recognition mode. The admin who handles the system has all the rights such as selection of the mode for attendance, as well as registration of the new user, Deleting the entry of any user, updating any user's data, or to 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 or stored in database. Due to this mode of recognition time will be saved and attendance will be recorded with current time as well as date.

ii) Single Recognition Mode (Critical mode)
In the 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, the attendance will not be recorded.

VII. EXPECTED OUTCOME

This face recognition attendance system will reduce the time required for attendance as user or student just needs to look at the camera while entering the campus of school, college or organization. User may not require to wait in a queue to record attendance as multiple faces can be recognized all together simultaneously. After successful recognition of face attendance of particular user will be recorded or stored in database and will be saved date wise an also with time to Excel sheet also.

VIII. CONCLUSION

The manual attendance system was very time consuming; Attendance management system using face recognition is designed to solve the issues of the existing manual systems. To avoid proxy attendance of students or workers in organization or school or college, security of Dataset and the Database is important. By using this system manual attendance can be eliminated and time is saved. As this system does not require touching anything so risk of germs spreading is also eliminated.

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

IX. ACKNOWLEDGMENT

We would like to express our sincere gratitude to everyone who has contributed to the successful development and implementation of the Face Attendance System.

First and foremost, our heartfelt thanks go to our project advisors and mentors for their unwavering support, guidance, and expertise throughout the entire duration of the project. Their insights and encouragement have been instrumental in shaping the direction and success of our Face Recognition Attendance System.

We extend our appreciation to the development team for their dedication, hard work, and collaborative spirit. Each team member's unique skills and commitment have played a crucial role in the project's success.

Special recognition is due to the academic and research community in the fields of facial recognition, computer vision, and biometrics. The wealth of knowledge and advancements in these areas have served as a foundation for our Face Recognition Attendance System, influencing our design and implementation choices.

We would like to acknowledge the institutions and organizations that provided resources, access to relevant databases, and technical support, enhancing the robustness of our Face Recognition Attendance System.

To our friends and family, thank you for your continuous support and understanding during the project's development. Your encouragement has been a driving force behind our commitment to creating an efficient and reliable Face Recognition Attendance System.

Lastly, we extend our gratitude to the users and testers who provided valuable feedback, helping us refine and improve the system. Their input has been crucial in ensuring that the Face Recognition Attendance System meets the practical needs and expectations of its users.

This project has been a collaborative effort, and this acknowledgment is a testament to the collective dedication and support that have contributed to the success of our Face Recognition Attendance System.

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