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AUTOMATED ATTENDANCE MANAGEMENT SYSTEM USING FACE RECOGNITION ALGORITHMS

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Abstract - *In this era of digitalization and modernization, various technologies are developed or enhanced which makes humans able to reach new heights of development. Biometrics is one of these technologies which is capable of making a huge revolution in human society.* ***Biometrics*** *can be used for security, authentication, identification, data accumulation and has got many more advantages. There are a number of biometrics developed or proposed by humans such that Iris biometrics, Fingerprint biometrics, Facial biometrics, and many more.* ***Facial biometrics*** *is the technology that has the huge potential and upper hand on the other proposed biometrics. Despite having low accuracy as compared to iris and* ***fingerprint biometrics*** *it is still widely used at places where a large number of people accumulated because of its easy implementation and non-invasion behavior. Face biometrics use facial features as a data-set for* ***detection*** *and* ***recognition*** *purposes simply by using cameras placed at public places and webcam in laptops and mobiles. Face biometrics can be used at various places like schools, colleges, offices, airports, railway stations, and at any place where* ***attendance*** *or* ***monitoring*** *is required. With the help of facial biometrics, we are trying to propose a system that records the attendance of the students in the classroom environment automatically and it will provide the facilities to the faculty to access the information of the students easily like name, registration number, Enrolled subjects, CGP, attendance, and many more details. This system aims to build a* ***class attendance system*** *that uses the concept of face biometrics as an existing attendance and monitoring system that is time-consuming and cumbersome to maintain and there may be chances of proxy. The proposed system consists of four major phases- generate the dataset , Train the data , face detection and recognition , and attendance updation.*

1. INTRODUCTION

Humans recognize a person's face with the help of his eyes and temporal lobe where eyes capture the images of the face and the temporal lobe responds to the particular features of the captured face. This is how humans recognize a person[1]. In order to recognize a face with machines, facial recognition technology[2] was introduced. Facial recognition technology has various applications[7]. The attendance system using facial recognition is one of its applications. During the period of the Covid-19 pandemic where everyone has to work and attend the classes from home, the facial recognition attendance system[3] proves to be quite useful for attendance and monitoring purposes. Although there is already various attendance marking systems that are developed using different technologies like Radio Frequency Identification (RFID)[4], Iris recognition[5], fingerprint and palm recognition[6], and so on. But the conditions that arise from pandemic favors facial recognition over these technologies. Facial recognition has always remained a major focus of research because of its easy implementation and non-invasive nature. Manual marking of attendance is a very time-consuming and tiresome task in many schools and colleges. Manually marking the attendance of students takes 7-10 minutes of the entire session and in this method, there are also some chances of proxy attendance whereas facial recognition automatically marked the attendance and reports to its respective faculty with detailed information. Facial recognition also comes in handy when faculty members or teachers need the data regarding a particular student then instead of searching all the files and documents, they can use face recognition technology to get the required information. We tried to demonstrate, how face recognition can be used for effective attendance management to automatically record the presence of an enrolled individual within the respective venue. This system also maintains a log file to keep records of the entry of every individual concerning a universal system time. The database is created by the images of the students in class. Face detection and recognition techniques[8] are mostly performed using Haar-Cascade classifier, Local Binary Pattern Histogram algorithm, and convolutional neural network (CNN) respectively using python, open-cv, and dlib. We are also using Keras so the system can easily predict the gender and emotional state of a person without human interference. Faces are detected and recognized from live streaming videos of the classroom. This attendance system consumes comparatively less time than the manual attendance method. The use of face recognition for the attendance marking is the smart and effective way of the attendance management system.

2. LITERATURE REVIEW

2.1 Attendance system based on Radio Frequency Identification (RFID)

This system[4] proposed the concept of how radio frequencies are used to detect the authorized students and counts as they get in and get out from the classroom .This system also keeps the data of every student registered for a particular course in the attendance log and provides necessary information according to the need . RFID tags and readers are used in this system where tags use radio waves to communicate their identity and other information to nearby readers.

2.2 Attendance system based on Iris-biometrics

This system[5] was implemented using iris-biometrics . Initially, users have to submit their details in the login panel alongside their iris templates. At the time of attendance, the system automatically took class attendance by capturing the eye image of each user, recognizing their iris, and searching for a match in the created data log.

2.3 Attendance system based on Face Recognition Technique

The idea of taking attendance through the face recognition technique[8] seems quite effective as compared to the traditional way of marking attendance. Because there are so many disadvantages in manual marking attendance like inefficiency, inaccuracy, time-consuming and cumbersome. That is why facial recognition attendance comes into the picture because they are much more efficient, accurate, non-invasion, and time-saving. In this system, images were captured through a camera or CCTV cameras in classes for attendance purposes. The captured images go through two major processes – face detection and face recognition. Face detection was done by using different methods for face detection like Ada-Boast, SQMT, LBP, and SNOW classifier method. Once the face was detected face recognition methods like Histogram of Oriented Gradient features (HOG) , Haar-Cascade, and convolutional neural network (CNN) come into the picture, and attendance alloted to recognized individual.

2.4 Haar like features

Haar-like features [9] are digital image features used in object recognition. The difference in facial features is used to categorize subsections of an image. Haar features determine the likelihood of a certain point being part of an object . Haar features can be recognized by using cascading classifiers that run to boost the algorithms on different subsections of the input image.

3. METHODOLOGY

The proposed attendance system is designed to automate the attendance of the different organizations and reduces the flaws of the existing manual system. In this system , deep learning face recognition techniques are used to calculate and compare 128-d face features of a face . Once the faces are detected and recognize with the existing database, the system calculates the attendance of the recognized faces with their respective ids in real-time, and an excel sheet is generated and saved by the system automatically. This excel sheet contains detailed information about users. Initially, users have to create their login id and password through the login page if users have already an existing id then they can proceed with further process else users can register their IDs by providing their required details. During each session, faces will be detected from a live streaming video of the classroom. Detected faces will be compared with images stored in the database .If a face is recognized attendance will be marked for the respective students. At the end of each session, attendance details are automatically added in a log file. The architecture of the proposed attendance system is given below:

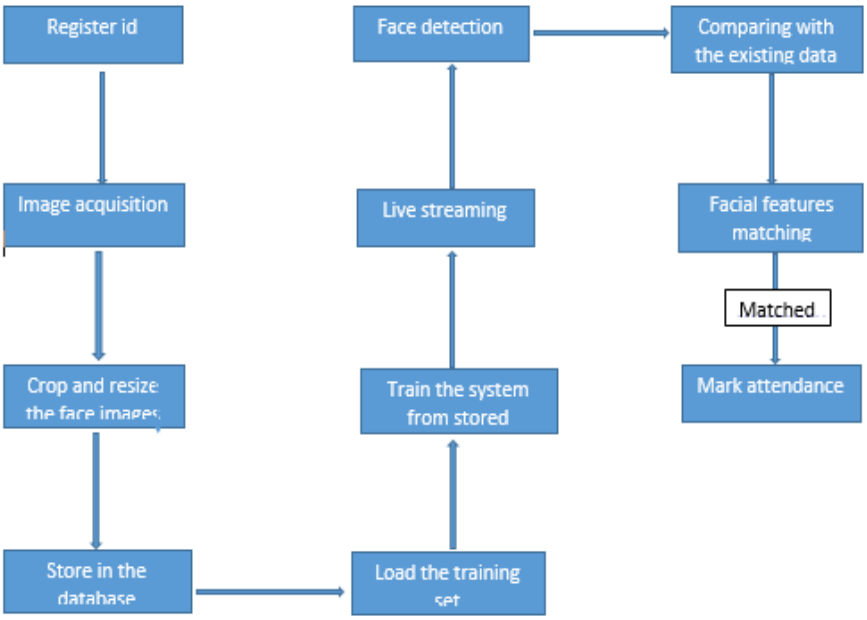


Fig -1: Block Diagram

This attendance system mainly divided into four stages:

3.1 Data Acquisition

Generation of the dataset is the foremost necessary of the proposed attendance system where images of the users are stored using a webcam or camera for face detection and recognition process. In the proposed attendance system number of images of every user are captured by using a webcam or a camera and these images are then stored in the particular folder which is the dataset of this system. The face recognition attendance system[10] requires the number of images instead of a single image because the system has to detect the face on live video streaming and also for higher accuracy. The information regarding users like Name, Registration number, Course name, and so on are collected while the registration process. The registered user's data and images used to create a dataset, deep learning apply to each face to compute 128-d facial features and store in student face data file to recall that face in the recognition process. The whole registration environment is created by using GUI. The created dataset is used to train the classifier.

Fig -2: Dataset for Classifier

3.2 Train the data

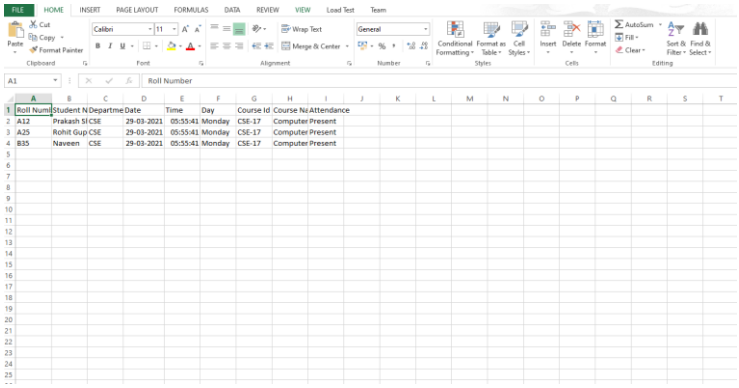
Collected dataset used to train the data. In training data stored images undergo resize and crop process to obtain Region of Interest [11] to determine the facial features of a face which is going to use in the recognition process. After the resize and crop process image positioning and encoding [10] starts where the system calculates the particular pixel position in images. These pixel positions are used to track the landmark of the faces and to position the images then these images will be converted from RGB to grayscale images. These grayscale images extract the facial features of the images. This is how the system trains the data.

3.3 Face Detection and Recognition

Face detection is important as the image taken through the camera given to the system, face detection algorithm applies to identify the human faces in the images, the number of images processing algorithms are introduced to detect faces in images and also the location of that detected faces. Histogram of Oriented Gradients (HoG) and Support Vector Machine (SVM) algorithm are used in the proposed system. This algorithm used for face detection is a Deep Learning algorithm that can take in an input image, assign importance (learnable weights and biases) to various aspects/ objects in the image, and able to differentiate from others. In this system, detectMultiScale module used from OpenCV. This is required to create a rectangle around the faces in an image. It has got three parameters to consider- scaleFactor , in neighbors, minSize. Once the faces are detected in the given image, the next step is to extract the unique identifying facial feature for each image. Whenever localization of face occurs, the 128 key facial points are extracted for each image given input which is highly accurate, and these 128-d facial points are stored in the data file for face recognition. Scale-factor is used to indicate how much an image must be reduced in each image scale. Open-cv face recognition libraries are used for face detection in the proposed system. These libraries are C++ codes that bind for python. Open-cv uses machine learning algorithms to search for faces within a picture. The face recognition process is mainly divided into two steps – face identification and face verification. In face identification, the system compares a user's biometric images with the other enrolled images yielding a match or a non-match based on the local binary pattern (LBP) measurements, and in face verification user's biometric images compare with the user's template. After the verification process verified user's details start appearing on the screen. This whole process accuracy varies considering the primary three influencers- Pose, Illumination, and expression or 'PIE'.

3.4 Attendance Updation

The proposed system generates an attendance table that includes the name, roll number , date , day , and time respective to its subject id and then passes the data to python to store the table into an excel sheet automatically . Each sheet is saved according to the courses which are already enrolled by he administrator. It particularly stores information of every user either it is a single, multiple, known or unknown face appear in front of a camera or a webcam. The system works properly in all conditions. Wherever users enter into class (single /multiple) or appear in front of the webcam.



Roll Numb	Student N	Departme	Date	Time	Day	Course Id	Course Na	Attendance
A12	Prakash S	CSE	29-03-2021	05:55:41	Monday	CSE-17	Computer	Present
A25	Rohit Gup	CSE	29-03-2021	05:55:41	Monday	CSE-17	Computer	Present
B35	Naveen	CSE	29-03-2021	05:55:41	Monday	CSE-17	Computer	Present

Fig -3: Attendance excel sheet

4. ADDITIONAL FEATURES

The proposed system also able to predict the emotional state and gender of the face by using Convolutional neural network (CNN) facial recognition techniques. With the help of Open - Cv libraries, Keras, Tensorflow and deep learning algorithms his system can easily predict the emotional state and gender of the face that appears in front of the webcam.

5. RESULTS

The user can easily interact with the system using GUI. All information of the user is stored in the attendance sheet. This system is also able to detect and recognize multiple faces at a time properly . The proposed system automatically captures pictures randomly multiple times using a webcam. These images then will be pre-processed compares with the stored images in the training dataset. This makes the system proxy less and efficient compare to the manual way of marking attendance. All these processes do not require any physical contact or high equipment unlike in finger, Iris, and Radiofrequency biometrics thus the system is non-invasional which is necessary for the covid-19 pandemic. As we are using the HoG+SVM and LBP algorithm , this

system will provide an accuracy rate of more than 90% . This system also helpful to predict the emotional state and gender of the user by their own without any human interference.

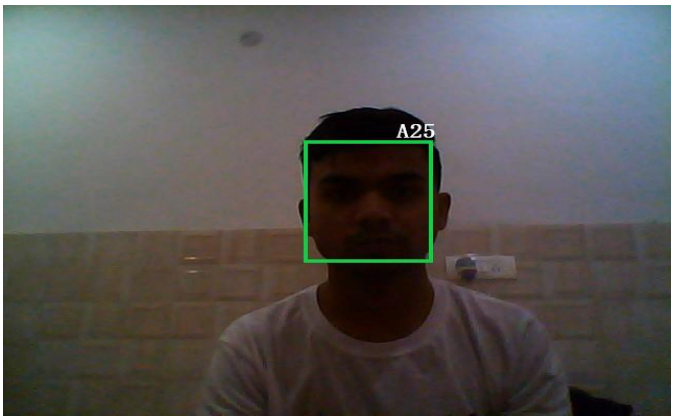


Fig -4: Detected and Recognized Face

6. CONCLUSION

This system aims to build an effective class attendance system using face recognition techniques and machine learning methods as compared to the manual system used in colleges, schools, and offices. The proposed system will be able to mark the attendance via face Id. It will detect faces via webcam and then recognize the faces. After recognition it will mark the attendance of the recognized user and update the attendance record with time and date. As it stored the entering time of every user it becomes easy for the faculty member to keep track of the time of the user.

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