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Intelligent Attendance System Using Face Recognition in Smart Classrooms

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Abstract
By analysing patterns based on a person's facial features, a face recognition system is computer-based biometric software that may identify or verify a person. It can also record their presence in the classroom. An innovative use of the present system is to mark presence with facial recognition. The suggested approach includes an activity or liveliness detector that performs anti-facial spoofing in face recognition systems and can detect phoney faces. The model may convert text to speech and shout out each student's name to indicate their presence.

Keywords: Intelligent Attendance System, Face Recognition, Image processing, Haar Cascade classifier, Face Anti-Spoofing, Attendance Management.

1. Introduction

Every institution needs a robust and stable system for enrolling their students and every institution has its own way of doing this, some manually roll attendance using a single sheet. paper by calling their names during class time and some introduced biometric systems such as fingerprints, RFID card readers, Iris time attendance systems.[1] The conventional method of manually calling students by name is a time-consuming event. With the RFID card system, each student is assigned a card with the corresponding identity, but there is a risk of losing the card or having the card misused by unauthorized people for wrong attendance. While in other biometrics like fingerprint, iris or voice recognition, they all have their own errors and are not 100% accurate. Using facial recognition for attendance purposes is a smart way for attendance

management systems. Among other techniques, facial recognition is more accurate, faster and reduces the likelihood of authorized person participation.

Facial recognition allows for passive identification, which means that the person being identified does not have to take any action to determine their identity.

1.1 Facial attendance system

One of the most popular technologies and crucial aspects of computer vision is facial recognition. It recognises a person inadvertently from a still photo or movie reel. Because managing student attendance is so crucial, it is used to track both staff and student attendance in educational institutions. [2] When considering the standard method of attendance in the beauty room, which takes a while to roll in and is more difficult to manage, a number of issues come to mind. Therefore, it is advised to use automatic timekeeping. The involvement of academics in this research has emphasised the use of face repute and recognition through an open laptop with creativity and foresight without intervention, person card. The implementation has centred on the idea of transitioning from the traditional method of attendance to a virtual reputation and facial recognition technique employing utility mastery algorithms.

1.2 Objective

This system's goal is to create an automated system that uses facial recognition technology to track student attendance in place of the customary techniques. The major goal of this effort is to make the system for tracking attendance effective, time-saving, straightforward, and uncomplicated. The clever method of the attendance management system uses face recognition to track attendance. Compared to other systems, face recognition is more precise, quicker, and minimizes the likelihood of proxy attendance.

1.3 Benefits of Smart Attendance System

Real-time Tracking – Mobile devices and PCs help track employee attendance in an efficient manner.

Reduced Errors – Intelligent attendance systems can provide accurate data with minimal human intervention, reduce redundant errors and eliminate manual work.

Mass data management – Massive data can be managed and organized in detail in the database.

Enhanced Authentication and Security Intelligent Attendance System provides complete data confidentiality and control with secure access.

Reporting - Comprehensive reporting capabilities allow administrators to track employee logins and logouts, calculate attendance-based wages, view absence

lists and take necessary actions, and view employee personal information.

II LITERATURE SURVEY

2.1. Smart Attendance Monitoring System

A facial recognition-based attendance system for classroom environments proposed an attendance system that solves the manual methods of existing systems. This is a face authentication method for checking attendance. The system can also illuminate participants' facial expressions and poses.

2.2. Attendance System Using Face Recognition and Class Monitoring System

The author of Attendance System with Face Recognition and Class Monitoring System shows that different people/student faces from attendance recognition are uploaded to the database. This allows the automatic attendance system to recognize faces and reduce manual work. The system automatically recognizes students in the classroom and scores attendance by recognizing their faces. [3] The system is developed by capturing human faces in real time during class. Recognized faces are compared to reference surfaces in the data set and the faces that are present are marked. Finally, the absentee list is read out via a speech-to-speech system for confirmation. The system is then trained to classify the gender of students attending classes.

2.3. Automatic Attendance System Using Face Recognition

Implemented an attendance system for instructors and employees. The system uses Viola-Jones and her PCA algorithm for facial recognition. [4] The system takes two images of her with a digital camera. One from the class start time and the other from the class end time. Both images are processed by this system and play an important role in recognizing students using facial recognition. If a student is detected at both the start time and end time, the student's presence is recorded for that student.

2.4. Classroom Attendance System Using Facial Recognition System

A new approach, 3D face models, has been introduced to identify student facial

recognition in the classroom. This can be used for the attendance system. Using this analytical study will help you reliably recognize students in your automated attendance system. Recognize faces from images or video streams, record their presence, and evaluate performance. [4] Here we use facial recognition algorithms to recognize faces. Processed images are compared to existing saved datasets and their presence in the database is flagged accordingly. It reduces the burden on employees compared to the conventional attendance scoring system.

2.5. RFID based attendance system

To record attendance, the RFID and ID card must be placed in a card reader-based RFID-based attendance system. RS232 is used to store recorded attendance from the database and connect the system to a computer. Unauthorized access issues arise from this system. Just like a hacker, they are allowed to use your ID card and infiltrate your organization. [5] RFID-based attendance systems are a great solution to overcome such challenges as they automate the student attendance process and enable teachers and parents to easily track and monitor student activities. It may become. In addition to managing student attendance, RFID attendance systems can also be used to track faculty or staff attendance and simplify the payroll process.

III METHODOLOGY

3.1 Block diagram explanation

Face recognition is the foundation of the suggested system. Whenever a pupil uses the camera-her module, an image or picture is taken and verified. Its presence is automatically counted once successful recognition and verification have been made. [5] The proposed block diagram for the automatic attendance system is shown in Fig. 1. The description of a system block diagram follows.

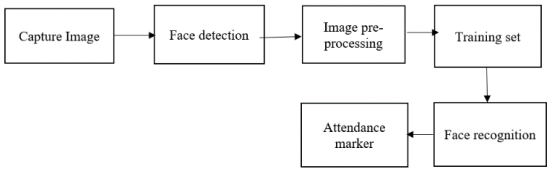


Fig. 3.1. Processed block diagram

3.1.1. Capturing the Image

A camera is installed at the entrance of the classroom to capture the perfect facial image of the student. Then proceed to the further process of facial recognition. OpenCV is a library of predefined functions for real-time computer vision tasks such as object detection and processing captured images.

3.1.2. Face Detection

This part implements face detection to help determine the captured image with the position and size of the student's face. [5] Images are captured from faces detected using the Haar Cascade classifier. Recognition is the process of finding faces in images. Face recognition, powered by computer vision, can detect and identify individual faces in images containing one or more human faces. Face data can be detected in both front and side profiles.

3.1.3 Image Preprocessing

There is a preprocessing requirement to enhance the input image to improve image quality. Convert the input image to a grayscale image using Color Image to Grayscale Conversion. [5] Color images often contain background noise, which reduces the accuracy of facial recognition and facial recognition systems. One way to fix this is to remove this unwanted color data from the color input image before running recognition on the clear grayscale version. The result is efficient, fast, and accurate processing of millions of facial images for applications.

3.1.4. Training Set

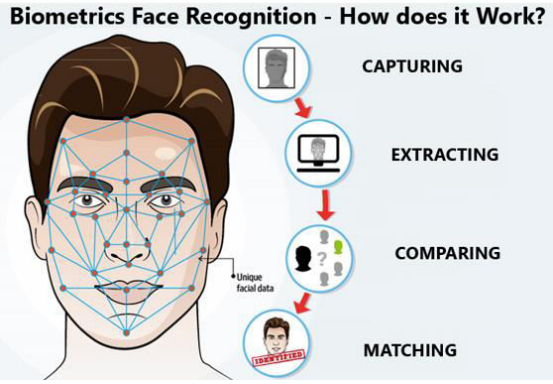
For the detection process, it compares the detected face with other similar faces. [6] The care algorithm uses faces from the training set to determine who should use it. When the algorithm recognizes faces, the training set is used for recognition.

3.1.5. Face Recognition

A key part of this system is facial recognition. [6] Face recognition A method of automatically identifying and assigning people from camera images and videos.

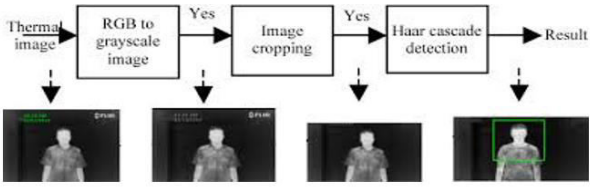
3.1.6. Attendance marker

A student is marked as present if the face is matched from the date folder. [7] In other words, we have collected a list of all students who were present in a class, and the remaining students are in that class and marked as absent. This is the next step.



3.2. Face Detection using Haar cascade classifier

Paul Viola and Michael Jones propose an effective object recognition method, the Haar Cascade Classifier. [7] This is a machine learning based approach. From this, a cascade process analyses positive and negative images. It is then used in other images to detect objects. The face detection algorithm here uses many positive and negative face images because there are no faces to analyse for the classifier.



There is another kind of hair feature that analyzes the features present in the image. Subtracts the sum of pixels in white areas from the sum of pixels in black areas in each operation from an image of a 24X24 window and returns an integer value. This determines the verification of the corresponding function.

3.3. Face recognizer using local binary pattern histogram

This algorithm creates a new histogram of the given input image and compares it with other created histograms. [8] The comparison finds the best matching histogram and returns the associated histogram label. A 3X3 window is moved around the image for the histogram to detect faces. As each local part of the image is moved, the central pixel is compared to neighboring pixels. If the intensity value of the adjacent pixel is less than or equal to the centre pixel, the value is 1, and 0 otherwise. Then under the 3X3 window, read the values 0 or 1 clockwise and get a binary pattern like 11000011. This pattern is local to the region of the image. We get a list of local patterns after we recognize the whole image.

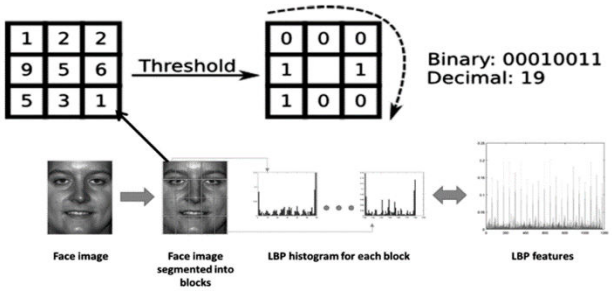


Fig.3.4 Local binary pattern histogram

pyttsx3

This Python text-to-speech library can be used. It is compatible with Python 2 and Python 3 and operates offline, unlike competing libraries. Calling the pyttsx3.init() factory method gives an application access to pyttsx3. engine

instance. The text-to-speech function is quite simple to use. A text-to-speech library that works on all platforms is called pyttsx. This text-to-speech library's key benefit is that it operates offline. This library can be used to expand functionality by including speech results. I therefore make an effort to acknowledge and welcome students to my class by using this library. Our smart attendance system's function is another advantage.

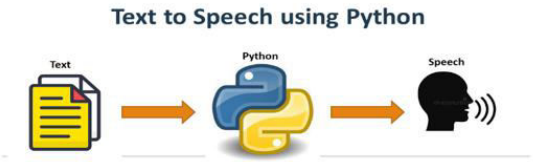


Fig 3.5 pyyttsx3 module

Attendance Management

Student attendance is monitored using attendance management. a programme for keeping data and records about students. A spreadsheet can be used to manually record staff hours for time and attendance management. [9] This gives school or university administrators an effective tool for maintaining thorough and precise data of pupils for use in surveillance systems.

Fig 3.6 Attendance Management

IV. RESULT AND DISCUSSSIONS

4.1. Face Detection using Haar cascade classifier

In order to recognise faces in pictures or live recordings, object identification algorithms like the Haar Cascade Classifier are used. The algorithm makes use of edge- or line-detection techniques. To train the algorithm, a large number of positive images with faces and a large number of negative images without faces are provided. The cascade portion comes next. [9] To determine whether facial features are present, a subset of all 6000 features is once more run on the training photos. In doing so, it makes an effort to identify facial traits and determine whether the training photos above are identical.

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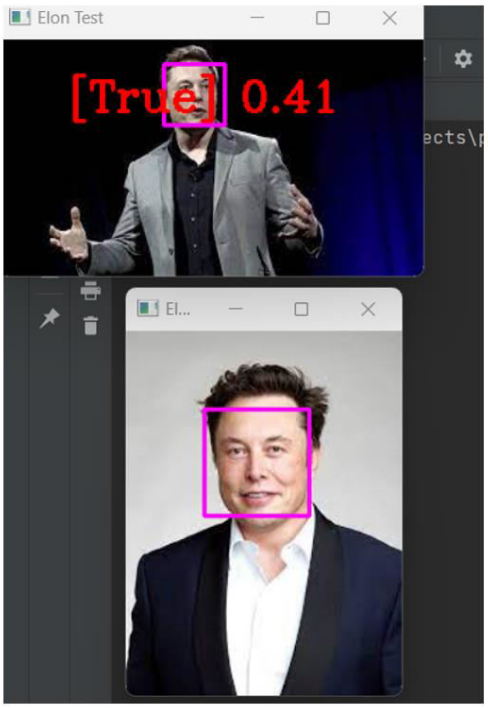

4.2. Facial Recognition

4.2.1 Face Detection

The camera finds images of faces, whether they are present alone or in a throng. [9] Then facial pictures are taken and examined. Through improvements in machine learning (ML), facial recognition has progressed from simple computer vision methods to increasingly complex artificial neural networks (ANNs) and related methods. Performance continues to increase as a result. It now serves as the foundation for other significant applications, including face tracking, face analysis, and face recognition. Applications' ability to carry out a variety of tasks is greatly influenced by facial recognition.

4.2.2 Face Analysis

The next step is to remove the face and analyse it. The computer programme examines the geometry of your face. [9] Important factors to take into account are the separation between your eyes, the depth of your eye sockets, the space between your forehead and chin, the curvature of your cheekbones, and the shape of your lips, ears, and chin. The objective is to identify facial characteristics that help people recognise your face as being yours.

4.2.3 Image to data conversion

The face capture process takes a person's face and transforms it into a group of data. The analysis of your face turns into a mathematical formula. The numerical code is called a face print. Each person's facial print is unique, just like thumbprints are.

4.2.4 Finding a match

Face recognition search technology has made great strides in recent years. [10] Combined with face recognition technology, the software can not only recognize faces in images, but also identify other images with the same faces and confirm identities in real time. I can do it.

Your face print is compared to a database of other known faces.

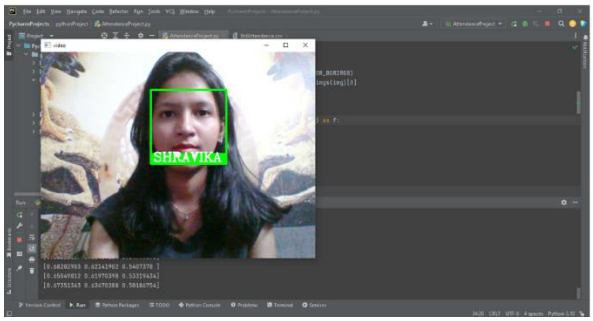

Fig 4.2 Face recognition using LBPH

4.3. Face Anti-Spoofing

Face spoofing prevention is designed to prevent a fake face from being recognized by replacing the authorized person's face with a photo, video, mask, or other substitute.

Print Attack

Attackers use pictures of people. The image is being printed or viewed on a digital device. Improving the resistance of iris biometrics to spoofing attacks is an important research topic. [10] Eye tracking and iris recognition devices have similar

hardware consisting of an infrared light source and an image sensor. This similarity makes it possible to run eye-tracking algorithms in iris-driven biometric systems. This study advances the state-of-the-art for detecting iris print attacks, in which a fraudster presents a real user's iris printout to a biometric authentication system. Iris print attacks are detected by analyzing captured eye movement signals using a deep learning model.

Replay/video attack

A more sophisticated method to trick the system, usually requiring a looping video of the victim's face. [10] This approach makes behavior and facial movements look more "natural" than keeping a photo of a person. A replay attack is a type of man-in-the-middle attack. It is of particular concern because it allows attackers to use encrypted data.

3D mask attack

This type of attack uses masks as a spoofing tool. This is an even more sophisticated attack than playing a video of your face. [10] Enables ways to deceive additional layers of protection, such as depth sensors, in addition to natural facial movements. In this step, the system tries to distinguish between real users and determine whether the provided samples presented to the application are real or fake. The example below demonstrates the verification of an image captured from an image or video. So, there is simply a category of spoofs.

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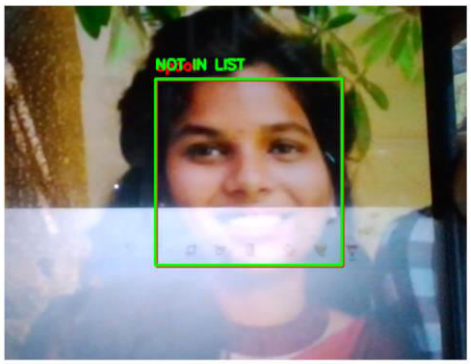

Fig 4.3 Face Anti-Spoofing

Accuracy refers to the fact that the results are based on images of some people used to train the model [11]. For unknown faces that are not included in the training data set, the application is made only with notes not in the list as follows.

Fig 4.4 Spoof attack

The automatic attendance system allows users to record attendance once per student.

[11] If the student remains in front of the webcam, the software will pop up a message stating that the student has already joined the class.

```
welcome to class SHRAVIKA
1/1 [==============================] - 1s 1s/step
['name']
SHRAVIKA
['name', '\n']
SHRAVIKA
['name', '\n', 'SHRAVIKA']
SHRAVIKA
SHRAVIKA already in class
1/1 [==============================] - 0s 42ms/step
['name']
SHRAVIKA
['name', '\n']
SHRAVIKA
['name', '\n', 'SHRAVIKA']
SHRAVIKA
SHRAVIKA already in class
1/1 [==============================] - 0s 47ms/step
```

Fig 4.5 Output screen

A simple Python script that detects faces and marks the presence of detected faces in an Excel spreadsheet. Libraries needed to export student data to an Excel spreadsheet are face recognition, opencv, openpyxl, datetime. If the encoding matches, the attendance is written to her CSV file mentioned above, along with the student's name and login time.

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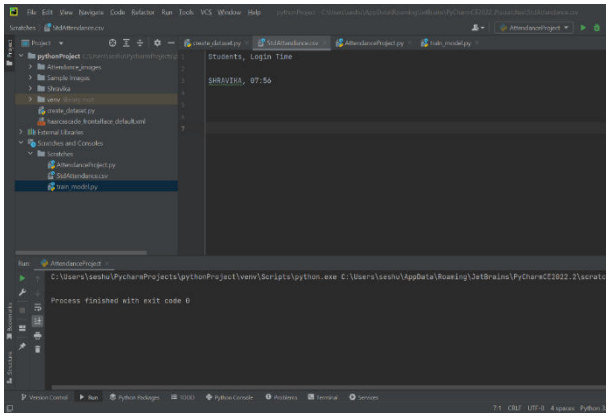

Fig 4.6 Output screen

After completing all of the aforementioned procedures [11], the application compares all faces in real-time to the database; if a match is made, the user exports an Excel file with student names and times. increase. The process for extracting the data to an Excel sheet is demonstrated here.

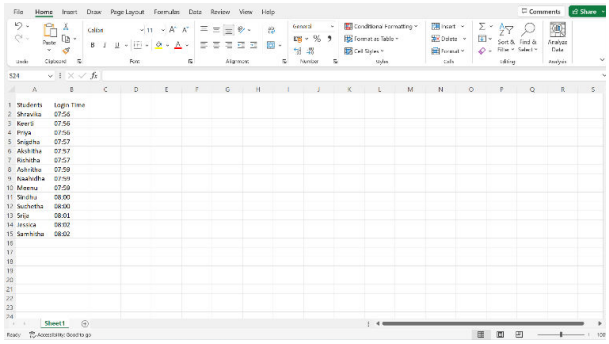

Fig 4.6 Attendance Management

V. CONCLUSION

We introduced an attendance management system for lectures and students. It helps save time and effort, especially when a large number of students and lectures are of interest. The entire system is

implemented in the Python programming language. The automatic attendance management system aims to solve the problems of manual methods of existing systems. Utilizing the concept of face recognition, we have implemented a system that marks the presence of a specific person by detecting and recognizing faces. These systems work well with different human facial expressions, lighting, and poses. These systems may not be able to recognize the faces of all students in the classroom, so there is room for improvement. We made the device portable so you can easily use it during your session without disturbing your class. There are future opportunities to create more compact ergonomics to make products easier to use and help create a healthier academic environment.

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