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Efficient Attendance Tracking System: Face Recognition And Reporting Via Opencv

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Abstract: A person's face represents their identity. The development of image processing tools has resulted in a significant shift in the approaches used to exploit this physical property. Every school, college, and library takes attendance. The professor calls on each student by name and logs their attendance in the traditional manner. The process of recording attendance takes time. This is a time-wasting exercise for every lecture. We're going to employ an automatic procedure based on image processing to prevent these losses. One of these pieces of software allows for the identification of individuals within organizations or colleges in order to track attendance. One major problem with computer-based communication is authentication. One significant area of biometric verification that has been applied extensively is human face recognition. The regular tasks of attendance marking and analysis are carried out with less human interaction when an attendance management system is used. We are utilizing a face detection and identification technology in this new method. Accurate attendance depends on face identification, which separates faces from non-faces. Facing recognition for recording the student's attendance is the other tactic. For this system, OpenCV has been utilized. The OpenCV module, which connects to the camera, transforms the picture into RGB format. This format is then translated to neural networks that have already been trained using the HOG technique to identify face pixels. This system provides a time-efficient, efficient method of managing the attendance system with vast scalability for future needs. The gadget automatically detects attendance, the histogram data is compared to an existing dataset, a Haarcascade classifier is used to detect faces, and the Local Binary Pattern Histogram (LBPH) Algorithm is used to distinguish faces in the image. Every hour, an Excel spreadsheet is generated with information from the relevant class instructor.

Keywords: LBPH, OpenCV, HaarCascade classifier, image processing, and face recognition.

I. INTRODUCTION

With the use of facial recognition technology, computers are now able to recognize individuals based only on their facial traits. A facial recognition system takes pictures of faces with a camera and compares them to databases of faces belonging to people it is familiar with. The computer can identify who was there when the picture was taken if it discovers a match. Face recognition and an attendance system are combined in a smart attendance system. With the exception of manually entering students' attendance, it functions similarly to a conventional attendance system. If a student misses a class, the system has the ability to remind them. One method we can guarantee student attendance is by doing this. With this software, pupils' attendance in class can be automatically recorded. It accomplishes this by taking an image of each student in the room and

comparing it to a database of attendance records. Because it removes the need for teachers to manually record student attendance, this approach is perfect. Additionally, it removes the dangers involved with gathering handwritten documents. It also shortens the time needed to confirm students' attendance. By putting in place an automated system for tracking student attendance, institutions can save time and money. By doing this, administrative staff members have more time to devote to other crucial duties, like filing papers and grading assignments. Moreover, facial recognition software aids in the identification of chronic absentees in schools. They are able to do this with students. In the first instance, it facilitates teachers' prompt identification of absent students. The face recognition algorithm will keep track of attendance by identifying each student's face apart from the other objects and marking them as present. All of the students' images will be pre-fed into the system, and using this pre-feed data, the algorithm will identify the students who are there and compare their features to previously saved images of them that are stored in the database.

II. PROBLEM STATEMENT

Using biometric traits, multiple research teams have attempted to build an automated attendance system in recent years. For this assignment, students will use a range of postures, gestures, and accessories while seated in columns in a classroom.
A significant component of the daily classroom assessment is attendance. The teacher normally checks it at the start and conclusion of class. The challenge with facial recognition-based attendance systems is identifying faces while employing high-definition video and other information technology to take attendance. The idea behind face recognition is to enable a computer system to locate and identify people's faces inpictures with accuracy and speed. Several methods and algorithms have been created to enhance facial recognition capabilities. Deep learning has received a lot of attention lately for computer vision applications. The human brain is capable of automatically and instantaneously identifying several faces. However, it is extremely challenging to do all of the challenging tasks on a computer equivalent to a human brain.

III. PROPOSED SYSTEM

The project's recommended method is to track attendance by using facial recognition software. The computer senses faces and records streams into image format. An Excel spreadsheet will be used to track attendance, and the recognized faces will be connected to the student database. The mobile phones of the parents and students should receive the SMS.
The suggested system's system architecture is shown below.

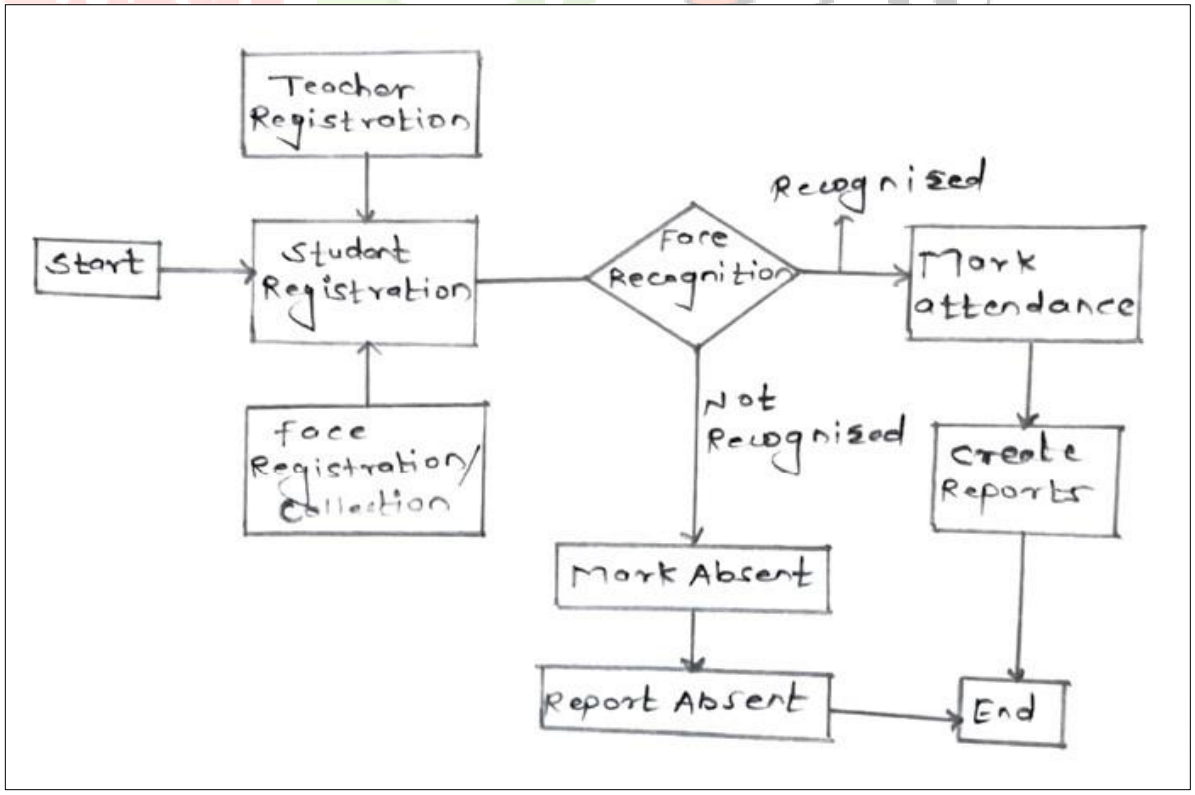
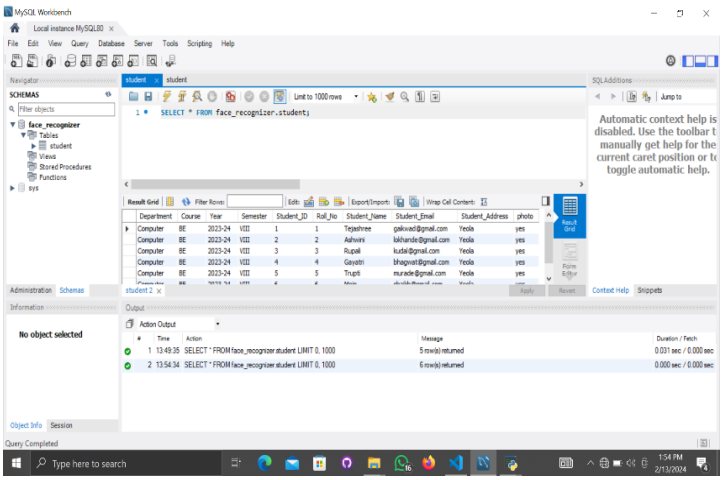


Fig: Working Flow

Typically this process can be divided into four stages,

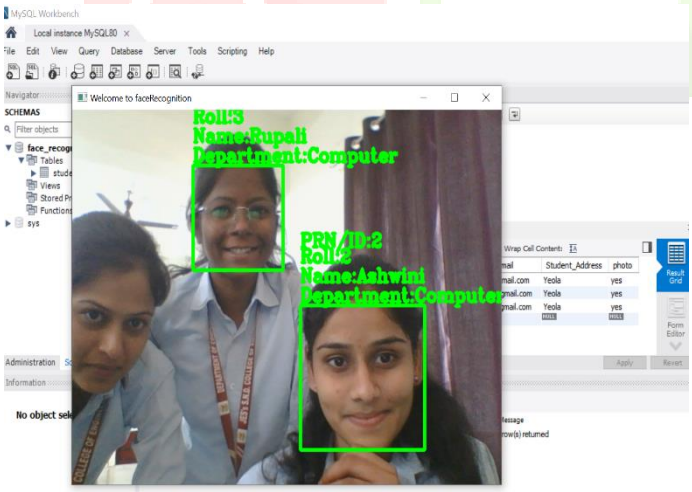
A. Creation of the dataset

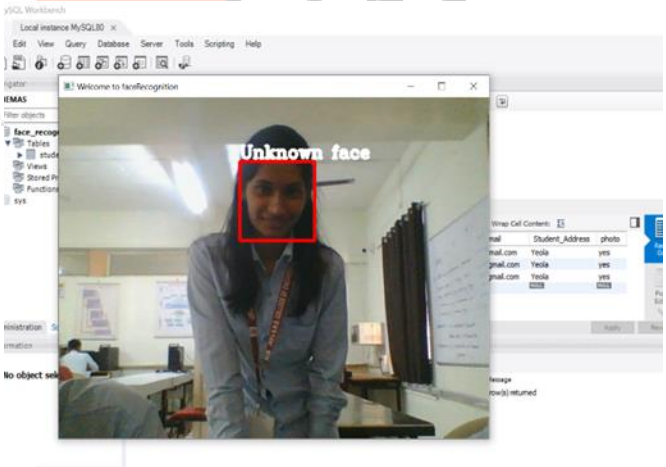
The students' photographs are taken with a webcam. A single student will be photographed several times from various angles and gestures. Pre-processed images are these. The images are cropped in order to establish the Region of Interest (ROI), which will then be used in the recognition process. Next, the clipped images need to be scaled to fit into a precise pixel spot. After then, grayscale copies of these RGB images will be created. Following that, a database will store these images and the name of the corresponding student.



B. Recognition of Faces

From HD video recorded photos, this system can identify faces in order to analyze and detect the face. Face detection, discussed in Section IV above, locates a face in an image by scanning different image scales and extracting the exact patterns that indicate the face. To construct the prototype, the A Haar-Like Feature function is utilized. OpenCV uses the Haar classifier facial detection to create a search window that pans over images and determines whether or not a certain area of the image resembles a face.





C. Extraction of Features

Detecting the edges or features from Face is known as face detection feature extraction. Many mathematical operations are used in this process. The sample is first turned to grayscale. The pixels are then separated into blocks. A tiny portion of the image appears in each block. The image is then inspected for variations in color intensity. These alterations suggest that a face is present. Lastly, the face's placement is ascertained by contrasting its dimensions and form with a predetermined template. Numerous applications, such as face detection, facial expression recognition, and Emotion recognition, make use of this technique. There are two steps in this process: verification and identification. This technique delve on two terms: verification application for facial recognition and identification to detect the face in real-time video. In the last stage of

face detection, the highest matching score from the previous stage is announced. The configuration will specify the behavior expected from the program.

D. Marking Attendance

The last stage of the system operations is attendance marking. At this point, record the student's attendance. If the development mentioned above is completed and a copy is appropriately recognized, the record will be marked as current in the system server; if not, it will be marked as absent. The name of the student, together with the day and time of attendance, are also included in the database. The cumulative attendance records for each student are then created using this information. If the student's attendance drops below a predetermined threshold, they are also informed.

E. Creation of Reports

After the attendance has been recorded, students can examine visual reports and summaries from their own attendance records. You can export bulk reports to an Excel sheet and download them from the dashboard as well.

IV. WORKING PRINCIPLE and ALGORITHMS

INPUT: Students' faces as they sit in a classroom.
OUTPUT: The attendance is automatically marked.
PROBLEM DESCRIPTION: Identifying faces and appropriately documenting actual students attendance.

The last stage of the system's operation is attendance marking. At this point, note the student's attendance. If the previously mentioned development is completed and a copy is appropriately identified, the record will be registered as current in the system server; if not, it will be logged as absent. The student's name, the day and time of attendance, and more data are also included in the database. The cumulative attendance records for each student are then created using this data. If the student's attendance drops below a predetermined level, they are also informed.

1. Start
2. Students are encouraged to enter their personal information in the student database to make verifications easier.
3. Set up a webcam in the teaching area. Students are visible on it.
4. OpenCV Face Detection.
5. The distribution of black pixels in a picture is converted into a binary code by the face recognition algorithm.
6. Proceed if the student's face is in the database.
7. Designate a person as present if they are identified and matched, and designate them as absent otherwise.

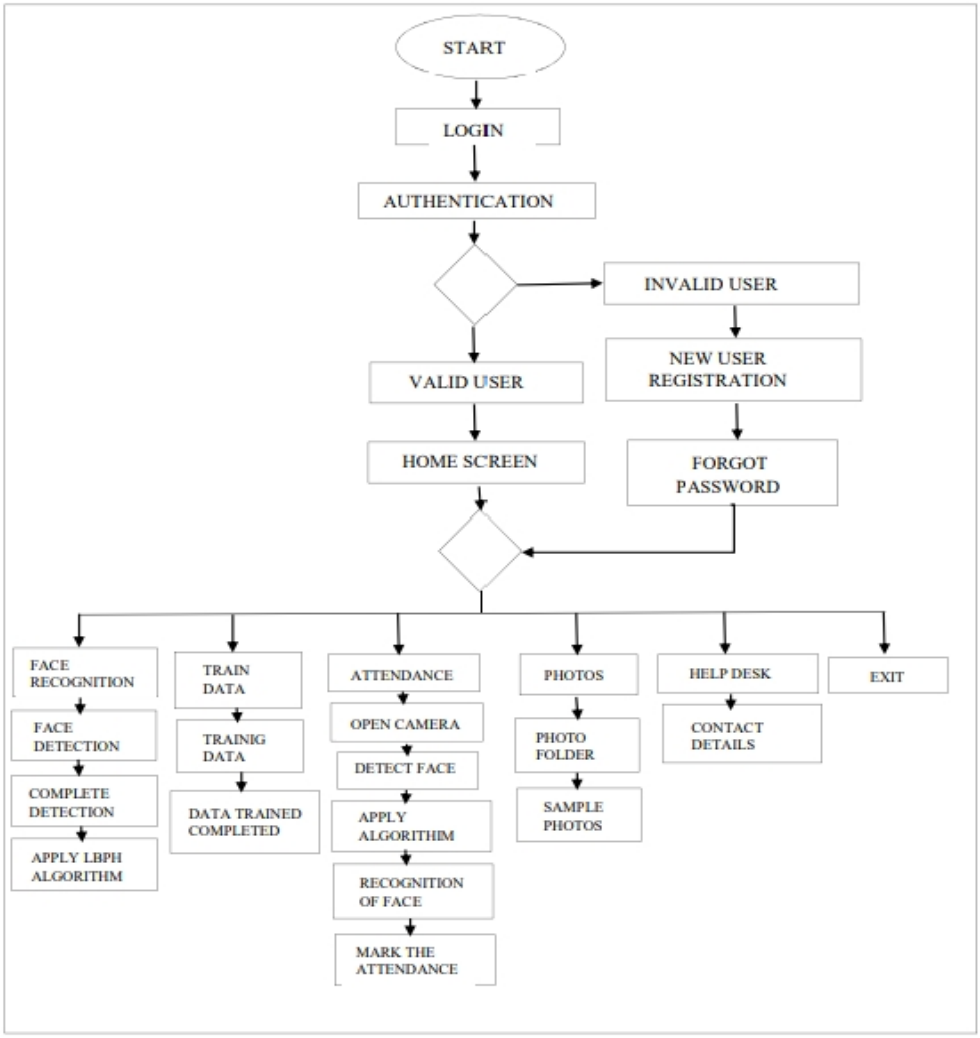


Fig: Flowchart

Algorithms:

A. Haar Cascade classifier Algorithm: This algorithm was developed by Paul Viola and Michael Jones and is useful for object detection. This algorithm is based on a machine learning technique that trains the classifier by using a large number of images, both positive and negative.

- Positive Images: We want our classifier to recognize this particular type of image.
- Negative Images: These are images that don't contain the items we want to detect, but instead contain something else.

This involves Four Stages that include:

1. Haar Features Calculation
2. Integral Images Creation
3. Adaboost Usage
4. Cascading Classifiers Implementation

1. **Calculation of Haar Features**: The first step is to compile the Haar features. In essence, Haar features are just calculations performed on neighboring areas at a specific place within a different detecting window. The computation mostly consists of adding the brightness of each pixel in each sector and in between the total differences computations. Due to the utilization of these integral images in which procedures are decreased, this becomes difficult with huge images.

2. **Creation of Integral Images:** Integral image creation minimizes computation. Rather than performing calculations at each pixel, it generates the sub-rectangles, which are then referenced by the array to determine the Haar Features. When it comes to object detection, the features of an object are the only ones that matter; most other Haar features are essentially useless.
3. **Adaboost Training:** Adaboost Training combines the "weak classifiers" to create a "strong classifier" that the object identification method can employ. In essence, this involves choosing features that are helpful and instructing classifiers on how to use them.
4. **Using Cascaded Classifiers:** It is dependent on the forecast. The classifier determines whether an object should be marked as positive or transferred to the next zone, indicating a negative result. Since the majority of windows contain nothing interesting, stages are designed to discard negative samples as fast as is practical.

B. Local Binarat Pattern Histogram-

By thresholding the surrounding pixels of each pixel in an image, the Local Binary Pattern (LBP) texture operator is a simple yet incredibly powerful approach that gives each pixel in the image a binary number.

How the LBPH Works:

Four parameters are used by the LBPH:

1. Radius: The circular local binary pattern is built using the radius, which represents the radius surrounding the core pixel. It is typically set to 1.
2. Neighbors: the number of sample points required to produce a circular local binary pattern. Keep in mind that the more sample points you offer, the higher the processing cost. It is typically set to 8.
3. Grid X: the number of cells in a horizontal arrangement. The more cells and tighter the grid, the higher the dimensionality of the resulting feature vector. It is typically set to 8.
4. Grid Y: the number of cells organized in a vertical fashion. The more cells and tighter the grid, the higher the dimensionality of the resulting feature vector. It is usually set to 8.

Training of the Algorithm: The algorithm needs to be taught initially. We need to use a dataset that has the faces of the people we want to identify in order to achieve this. For each photograph, we also need to provide an ID (which might be a number or the person's name) so that the algorithm can recognize the input image and give you an output. Every photo of the same individual needs to have the same ID. After creating the training set, let's look at the computing processes for the LBPH.

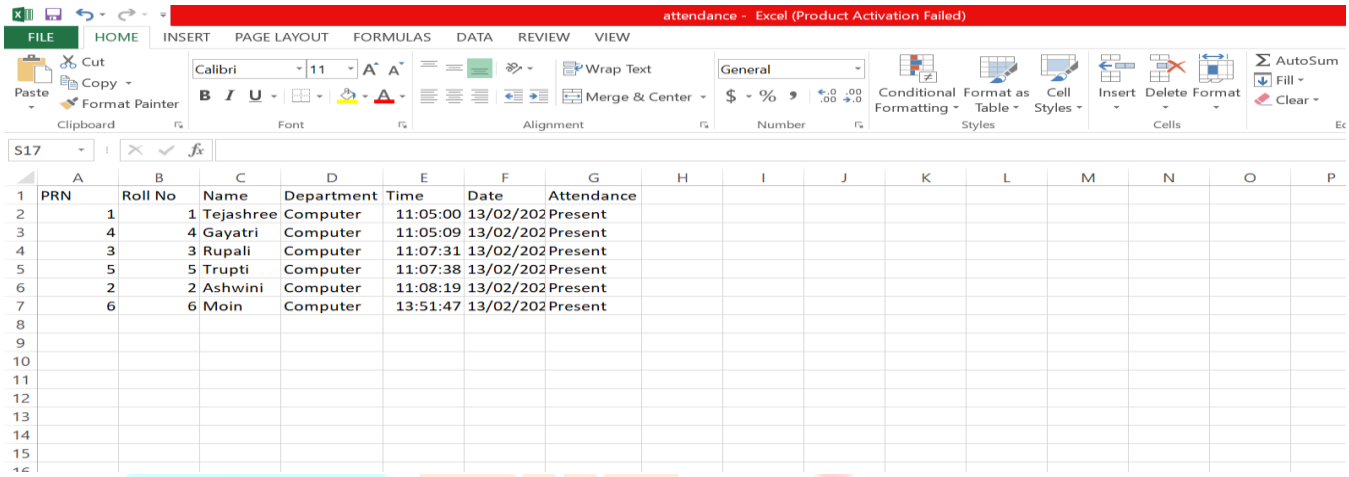
Using the LBP operation: The initial computational stage of the LBPH is to produce an intermediate image that, by emphasizing the face features, more accurately describes the original image. The algorithm does this by using the idea of a sliding window, which is dependent on the neighbors and radius parameters.

Extracting the Histograms: Using the image generated in the previous phase, we can now use the Grid X and Grid Y attributes to break up the image into several grids.

Face Recognition : The algorithm is already trained for the face recognition stage. One of the generated histograms represents each image in the training dataset. We repeat the earlier steps with the new image in order to produce a histogram that appropriately represents the input image.

V. RESULT AND DISCUSSION

Through a GUI, users can communicate with the system. Users will mainly have access to three module here: mark attendance, teacher registration, and student registration. In the student details form, students are expected to fill in all necessary information. Upon selecting the "Register" button, a window appears, triggering the webcam to begin automatically and begin identifying faces inside the frame. After then, it will begin taking pictures automatically until 25 samples are gathered or Enter is pressed. Following pre-processing, these photos will be kept in the training images folder. The faculty members are expected to fill out the faculty registration form with their email address and the appropriate course codes. This is significant since the corresponding faculties will eventually receive a list of those who are missing.



PRN	Roll No	Name	Department	Time	Date	Attendance
1	1	Tejashree	Computer	11:05:00	13/02/202	Present
4	4	Gayatri	Computer	11:05:09	13/02/202	Present
3	3	Rupali	Computer	11:07:31	13/02/202	Present
5	5	Trupti	Computer	11:07:38	13/02/202	Present
2	2	Ashwini	Computer	11:08:19	13/02/202	Present
6	6	Moin	Computer	13:51:47	13/02/202	Present

VI. ADVANTAGES

- **Time-saving:** By evaluating faces, the system can automatically record attendance, removing the need for human data entry.
- **Accuracy:** By comparing faces with preexisting data, face recognition technology guarantees accurate attendance records.
- **Anti-spoofing measures:** State-of-the-art algorithms are able to identify and stop spoofing efforts, including the use of masks or photos.
- **Real-time data:** Better monitoring and analysis are made possible by the system's ability to deliver real-time attendance data.

VII. CONCLUSION

Face recognition systems are one application of facial image processing that has gained relevance as a research issue in recent years. System implementations include things like person verification, video monitoring, crime prevention, and similar security measures. It is feasible to deploy face recognition technology in universities. Reducing mistakes associated with manual, traditional attendance recording is the aim of the Face Recognition Based Attendance System.

Automating and creating a system that benefits a company, like an institute, is the goal. The correct and effective way to take attendance in an office setting, which can take the place of outdated manual techniques. This approach is workable, dependable, and sufficiently safe. The suggested algorithm can identify several faces, and the system's performance is respectable.

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