# Facial Recognition Based Attendance System Using Opencv



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# Facial Recognition Based Attendance System Using Opencv

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LBPH,
Haar cascade.

**ABSTRACT**

Taking attendance is one of the critical tasks that need to be completed every day in businesses, schools, colleges, and organizations. Most of the time, it is done by hand using methods like calling someone by name or roll number. The main aim of this project is to design an automated attendance system based on face recognition technology, intended to supersede the current manual procedure. This project satisfies the time management requirements as well as the requirements for updating the attendance system. This device is placed in the classroom and is used to train students' data, including name, roll number, class, sec, and photo. An OpenCV is used to extract the photos. The student can approach the machine before the commencement of the relevant class, and it will start taking photographs and comparing them to the eligible dataset. The device automatically records attendance by identifying faces using both the Haar cascade algorithm and the LBPH (Local Binary Pattern Histogram) Algorithm. It then compares the histogram data to a pre-existing dataset. An Excel spreadsheet is created and updated hourly using data from the relevant class instructor.

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## INTRODUCTION

The previous attendance management system suffered from significant shortcomings, primarily revolving around data accuracy, time efficiency, and accessibility. Firstly, the system's reliance on manual recording opened avenues for inaccuracies, as attendance could be marked by proxies without institutional awareness, compromising data integrity. For instance, a scenario where one student signs in for another undermines the system's reliability for analytical purposes. Moreover, enforcing stricter measures to address this would entail considerable human resources and time, rendering it impractical.

Secondly, the system proved excessively time-consuming, with each student requiring approximately a minute to sign their attendance on multi-page lists. This inefficiency resulted in only around 60 students being processed per hour, severely hampering productivity.

Lastly, the lack of accessibility for concerned parties, such as parents eager to monitor their child's attendance, further highlighted the system's limitations. Parents lacked means to access such crucial information, underscoring the need for system evolution to enhance efficiency, data accuracy, and accessibility for legitimate stakeholders.

Today, many institutions use automated systems for creating attendance records. RFID technology and biometric techniques are two examples of such systems. Despite being automatic and more advanced than the conventional method, it is unable to meet the time constraint. The pupil must stand in queue to receive attendance, which is time-consuming. The approach can also be used in other teaching or exam contexts. activities for which presence is necessary. With this system, traditional student identity, such as calling the student's name or confirming the student's identification cards, may not only be the continuous process of instruction, but it can also cause anxiety in students during examination times. Furthermore, pupils must register in the database. to be acknowledged. The user-friendly interface allows for immediate enrollment.

## LITERATURE SURVEY

To create an efficient task system, researchers have tested and analyzed various factors related to camera-based total item detection, identification, and distance estimates. This study particularly focused on the photo identification phase and analyzed it thoroughly.

The majority of the research articles have concluded that CNN is the most widely used technology for photo identification. Although some tactics were found to be effective, others had obstacles. The authors of this paper suggested a way to integrate facial recognition technology with MATLAB GUI and the basic component analysis (PCA) method, utilizing the Eigenface database. This will automate the attendance system. The device initiates by capturing a student's picture, preprocessing it, and then applying the Eigenface database. Subsequently, it compares the captured face image with an Eigenface image. Attendance is recorded when the similarity distance score falls below the threshold value of 0.3. The results are saved in a Microsoft Excel sheet that is integrated with the MATLAB GUI. The preliminary face database has ten pictures of each of the fifteen individuals with varying positions and instructions.

The authors of this research have used face verification and radio frequency identification (RFID) to design and execute a classroom attendance system. The students are identified through their RFID cards, and for further identity confirmation, a face recognition method called the Rapid Adaptive Neural Network Classifier (FANNC) has been included. The classifier's ability to recognize human faces has been tested and taught. Each student needs to take seven pictures with different head postures for their images to be recognized by the classifier. The facial recognition system was tested on six different student images, and for the front face, it was accurate up to 98% of the time[3].

The authors aimed to modernize the outdated manual attendance system with a digital alternative integrating facial recognition technology. MATLAB software was utilized to deploy the principal component analysis (PCA) algorithm for the face recognition module. Upon successful facial authentication, the code was transferred to an embedded hardware device via a Microcontroller PC, which was also linked to a servo motor for unlocking the door. Testing indicated the system's heightened sensitivity to variations in background and head orientation[4].

**OBJECTIVE:**

To precisely recognize the faces of the students. to automatically record attendance. To cut down on the time and labor needed for manual attendance to give teachers and students access to a useful system of attention. It cuts down on time loss and offers flexibility. A proxy will not be an option

The following results are anticipated to meet the goals

1. To identify the facial segment from the video frame.
2. To take the identified face and extract its useful traits.
3. To categorize the characteristics to identify the discovered face.
4. To document the designated student's attendance.


**Fig-1: Block diagram**

**EXISTING SYSTEM**

Over the past two decades, computer-based facial recognition has witnessed significant advancements. Notably, various algorithms have been developed to a degree where computers can rival human accuracy in facial recognition. To develop our solution, it's imperative to analyze the mechanisms behind facial recognition, evaluate existing algorithms, and explore the diverse applications of this technology.

Regrettably, Sinha, Strovsky, and Ussell have presented nineteen key insights into human facial recognition, highlighting numerous techniques employed by individuals in identifying faces. Their findings underscore the intimate connection between the study of human facial recognition processes and the artificial algorithms utilized in facial recognition systems. Remarkably, facial recognition in the human brain occurs in just 1 millisecond.

## PROPOSED WORK AND ALGORITHMS

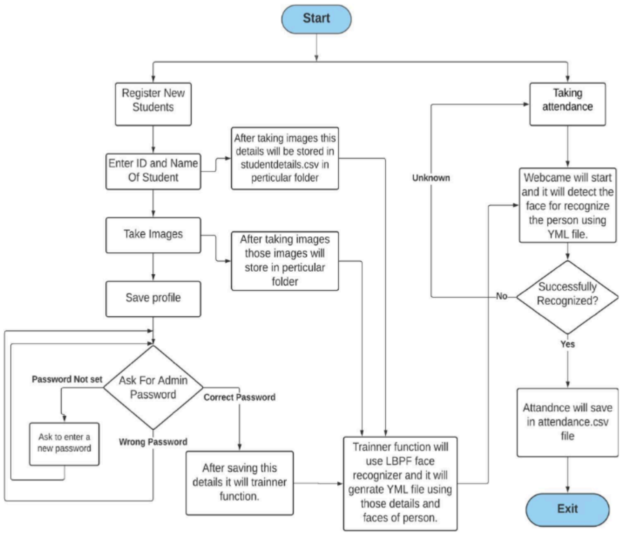


**Fig-2: System Architecture**

Every student in the class must register by providing necessary information, followed by capturing their photos to include in the dataset. The system will then identify faces from the captured images and compare them to pictures in the dataset. Upon finding a match, the system will record the student's attendance. The proposed system is tasked with photographing each student's face and storing it in the attendance database. It's crucial that the photograph captures every facial feature, including the student's posture and sitting position

**Algorithms**

1. **Haar cascade Algorithm**:

In this machine learning approach, a cascade function undergoes training using a substantial dataset comprising both positive and negative images. Positive images depict instances where the target object is present, while negative images showcase its absence. Subsequently, this trained cascade function is utilized to detect objects in additional images. Thankfully, OpenCV offers pre-trained Haar cascade algorithms, conveniently categorized (e.g., faces, eyes, etc.) based on the images utilized during training.

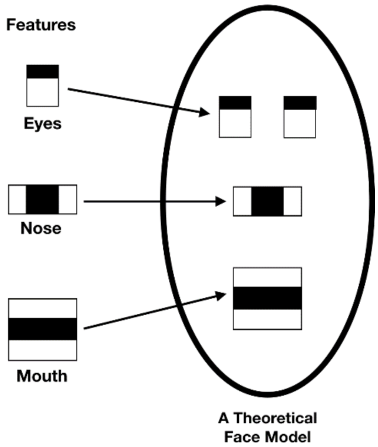


**Fig-3: Haar Features**

**LBPH Algorithm:**

The Local Binary Pattern Histogram (LBPH) texture operator is a simple yet remarkably powerful method. It assigns a binary value to each pixel in an image based on comparing its intensity with the surrounding pixels. Additionally, in certain datasets, combining LBP with the histograms of oriented gradients (HOG) descriptor has shown a notable enhancement in detection accuracy.

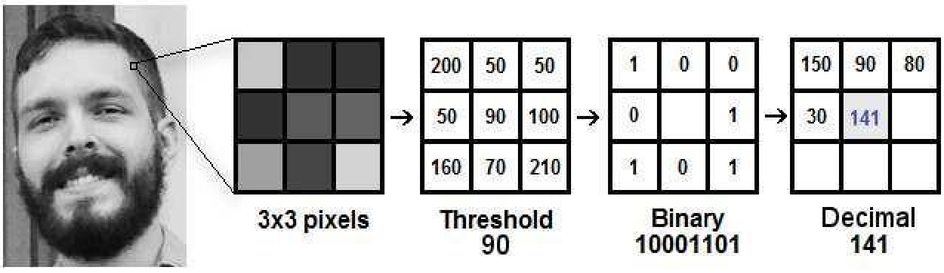


**Fig-4: LBPH Algorithm**

**IMPLEMENTATION STUDY**

**Modules**

**1. OpenCV:**

OpenCV stands as an expansive open-source toolkit catering to image processing, machine learning, and computer vision tasks. Compatible with various programming languages like Python, C++, Java, and more, OpenCV boasts versatility. Its capabilities span from recognizing faces and objects to deciphering human handwriting through the analysis of images and videos. The integration of additional libraries, such as NumPy, amplifies its functionality. OpenCV seamlessly incorporates the diverse range of operations achievable with

NumPy, further enriching its array of tools and functionalities.

With the aid of a vast array of OpenCV projects and applications, this course will assist you in learning the fundamentals to the advanced levels of image processing, including operations on images and videos.

**1. Tkinter:**

The Tk/Tk GUI toolkit's standard Python interface is provided by the tkinter package, sometimes known as the "Tk interface." Windows computers and the majority of Unix platforms, including macOS, support Tk and tkinter. You can verify that tkinter is correctly installed on your system by using the command line command python -m tkinter. This will create a window that shows a basic Tk interface.

**2. PIL Library:**

An older library known as PIL was forked to create the Python Pillow library. The Python Imaging Library, or PIL for short, was the first library that allowed Python to work with images. PIL only supports Python 2 and was deprecated in 2011. Pillow, as described by its creators, is a PIL fork that is friendly and supports Python 3, helping to keep the library alive. Python has multiple modules for handling images and carrying out image processing. You can use NumPy and SciPy to work directly with images by modifying their pixels. Other well-liked image processing libraries include Mahotas, scikit-image, and OpenCV. Compared to Pillow, several of these libraries are quicker and more potent.

**3. Time Module:**

To manage tasks involving time, Python has a module called time. We must import the module before we can use the functions it defines.

**4. Date Time Module:**

While Python does not inherently possess a distinct data type for dates, we can effectively manipulate dates by importing the datetime package and utilizing date objects.

**5. NumPy:**

"NumPy" is short for "Numerical Python," and it is a Python package that serves as the fundamental library for scientific computing. It includes tools for integrating other languages such as C and C++. NumPy also provides a robust n-dimensional array object, and it can help with tasks like random number generation and linear algebra. The NumPy array is another useful multi-dimensional container for storing generic data. To install NumPy for Python, type "pip install numpy" at the command prompt, and once the installation is complete, open your integrated development environment (IDE), such as PyCharm, and import NumPy as "np.".

**6. Pandas:**

Using its robust data structures, Pandas is an open-source Python library that offers high-performance data manipulation and analysis capabilities. Panel data is the word that refers to an econometric analysis of multidimensional data, hence the name Pandas.Panda's module is not included in the standard Python distribution.

**METHODOLOGY**

The student attendance system implementation revolves around face recognition. It initiates with image capture via a user-friendly interface, followed by preprocessing of captured facial images. Features are then extracted from these images, leading to subjective selection and classification for recognition. Extensive evaluation and computation are conducted on both Local Binary Pattern (LBP) and Principal Component Analysis (PCA) feature extraction methods for comparison purposes. Notably, LBP is enhanced in this approach to counter illumination effects. Additionally, an algorithm is developed to combine enhanced LBP with PCA, focusing on subjective selection to bolster accuracy. Further details on each stage will be illustrated in the subsequent diagram.

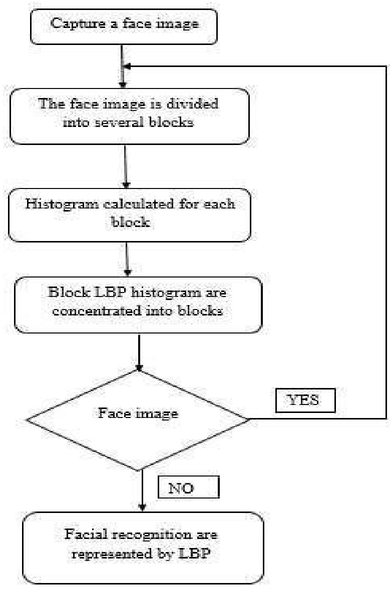


**Fig-5: Flow-chart of the methodology**

Face detection relies on the Haar Cascade algorithm, where a cascade function is trained using a multitude of positive and negative images. In this context, images containing faces are labeled as positive, while those without faces are labeled as negative. The features utilized for face detection are essentially data extracted from photographs, enabling differentiation between various images. During training, all images undergo evaluation against each algorithmic feature, with equal initial weighting assigned to each image. The optimal threshold for classifying faces as positive or negative is determined, although misclassifications and errors may occur. Features with the lowest error rates are selected, indicating their effectiveness in distinguishing between images with and without faces.

## RESULTS

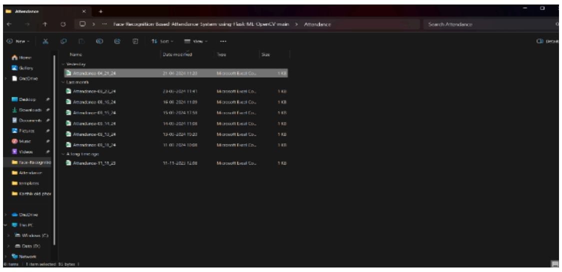

Fig- 6: Attendance before updating

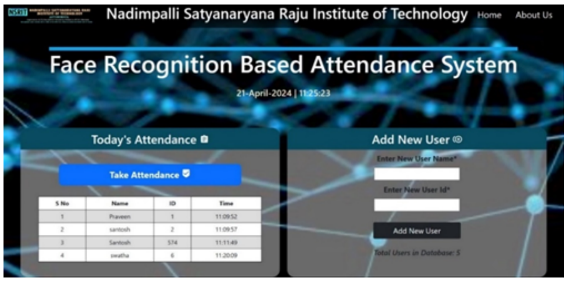


Fig-7: Project Interface

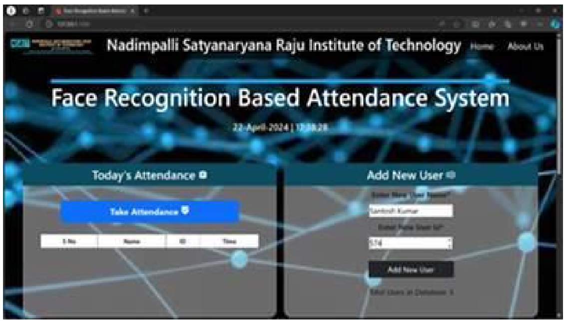


Fig-8: Registering the candidate

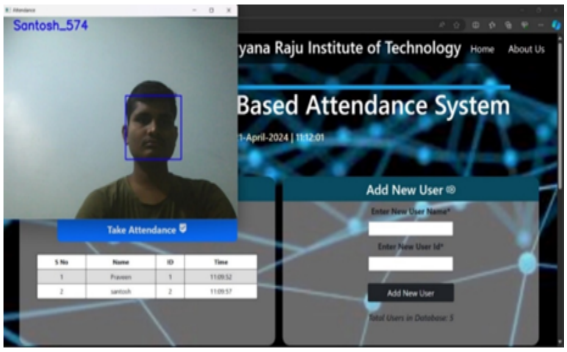


Fig-9: Predicted Result

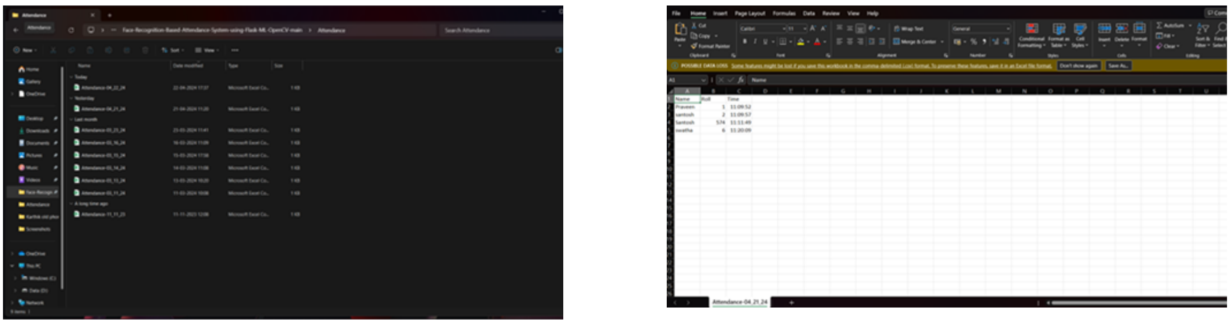

Fig-10: Attendance after updated

**Fig-11: Attendance marked in Excel sheet**

**CONCLUSION:**

The Automated Attendance System aims to rectify the errors inherent in traditional manual attendance methods by automating the process. This system is designed to be adaptable for use in various institutional settings, offering a correct and efficient alternative to outdated manual techniques, particularly in office environments. It ensures reliability, safety, and practicality without the need for specialized hardware, as it can be implemented using standard computer and camera equipment. By facilitating attendance tracking in lectures, sections, or laboratories, it streamlines the process for lecturers or teaching assistants, particularly beneficial in managing large class sizes. The Automated Attendance method addresses the limitations of manual methods, showcasing the application of image-processing techniques in educational settings. Its implementation not only improves efficiency but also enhances an institution's reputation.

**FUTURE SCOPE**

Future developments in facial recognition-based attendance systems with OpenCV have a great deal of promise. Further research and development can concentrate on improving accuracy using deep learning techniques, which will allow the system to consistently identify people in a variety of circumstances, including changing lighting and facial expressions. Faster attendance tracking and analysis will be possible because of real-time processing optimization, which will allow the system to manage massive volumes of data efficiently. The system's capabilities will be further enhanced by integration with artificial intelligence, which will enable it to adapt to and learn from fresh data, gradually increasing accuracy. It will be imperative to address privacy and security concerns, which calls for the use of strong encryption techniques and adherence to legal requirements. Investigating the integration of multiple biometric modalities, such as merging facial recognition with additional biometric modalities.

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