iJRASET
International Journal For Research in Applied Science and Engineering Technology



# INTERNATIONAL JOURNAL FOR RESEARCH

IN APPLIED SCIENCE & ENGINEERING TECHNOLOGY

**Volume:** 12 **Issue:** IV **Month of publication:** April 2024

**DOI:** https://doi.org/10.22214/ijraset.2024.59809

www.ijraset.com

Call: 08813907089 | E-mail ID: ijraset@gmail.com

International Journal for Research in Applied Science & Engineering Technology (IJRASET)
*ISSN: 2321-9653; IC Value: 45.98; SJ Impact Factor: 7.538*
*Volume 12 Issue IV Apr 2024- Available at www.ijraset.com*

# Automated Facial Authentication Attendance System

Kajal Patel[1], Ms.Anamika Zagade[2], Mr.Deven Gupta[3]
[1]*Asst.Professor,* [2, 3] *Student, IT Dept, Pillai HOC College of Engineering and Technology, Mumbai, India*

***Abstract:*** ***This research paper introduces a novel approach to automate attendance tracking in educational institutions through the implementation of a Face Recognition-based attendance system using Python. Traditionally, attendance management has relied on manual processes, prone to errors and time-consuming activities such as roll-call or name calling. The primary objective of this project is to revolutionize attendance management by developing an automated system that utilizes facial recognition technology. By leveraging modern advancements in computer vision, this system aims to streamline the attendance-taking process, enhancing efficiency and accuracy while reducing administrative burdens.Implemented within the classroom environment, the system captures student information including name, roll number,admission number, class, department, and photographs for training purposes. Utilizing OpenCV for image extraction and processing.The workflow involves initial face detection using a Haarcascade classifier, followed by facial recognition utilizing the LBPH (Local Binary Pattern Histogram) Algorithm. Upon recognition, the system cross-references the captured data with an established dataset to automatically mark attendance. Furthermore, to facilitate easy record-keeping, an Excel sheet is dynamically generated and updated at regular intervals with attendance information, ensuring seamless integration with existing administrative processes. This research provides a practical solution for attendance management and also helps in broader discourse on leveraging emerging technologies for optimizing educational and organizational workflows.***

***Keywords: Face Recognition , OpenCV, Automatic system, Attendance, Haarcascade, LPBH, Face detection.***

## I. INTRODUCTION

In the fast-paced environments of schools and colleges, managing attendance records has long been a tedious and error-prone task. Traditionally, this process involved manually calling out names or checking off lists, which not only consumed valuable time but also left room for inaccuracies, such as proxy attendance or misidentification. However, with the massive advancements in technology, specially in the field of artificial intelligence and computer vision, there's been a growing interest in leveraging automated solutions to streamline administrative tasks and improve overall efficiency.

The primary aim of our project is to harness the capabilities of facial recognition technology to revolutionize the attendance-taking process. Unlike traditional methods, which rely on human intervention, our system utilizes the Haarcascade classifier and LBPH (Local Binary Pattern Histogram) algorithm, to analyze and identify unique patterns in individuals faces. This enables the system to automatically recognize and record attendance without the need for manual input.

The workflow of our system is carefully designed to ensure seamless operation. When a person enters the view of the camera, the system captures their facial data and processes it to extract key features. These features are then compared against a dataset of registered faces which was collected during registration, allowing the system to accurately identify individuals and mark their attendance accordingly. By eliminating the need for manual intervention, our system not only saves time but also minimizes the risk of errors, ensuring greater accuracy in attendance records.

The benefits of adopting our facial recognition-based attendance system are manifold. Firstly, it significantly reduces the administrative burden associated with manual attendance-taking, allowing teachers, administrators, or supervisors to focus their time and energy on more meaningful tasks. Secondly, it improves the overall accuracy of attendance records by eliminating common sources of error, such as illegible handwriting or mistaken identity. Additionally, our system offers scalability and adaptability, making it suitable for deployment in various settings, including classrooms, lecture halls, offices, and other communal spaces.

## II. LITERATURE SURVEY

This research introduces a deep learning-based facial recognition attendance system, leveraging transfer learning by utilizing three pre-trained convolutional neural networks (CNNs) trained in dataset.

©IJRASET: All Rights are Reserved 

As per the research in comparison to alternative methods, this system demonstrates exceptional performance with high prediction accuracy and reasonable training time.this approach holds potential applications in attendance and door access systems across various sectors, including government agencies, private organizations, airports, schools, and universities. Future extensions of this work could involve exploring additional pre-trained CNN models and expanding the dataset with more human facial images.The drawback of the paper is that it has limitations of the facial recognition system, such as its performance under challenging lighting conditions.[1]

This paper presents a systematic literature review on algorithms for class attendance, focusing on CNN and LBPH. Out of 30 articles reviewed, CNN emerges as the preferred choice due to its high accuracy and stability, though it requires extensive datasets. Despite similarities in implementation with LBPH, CNN's performance can be affected by external factors like face position and lighting. Future research could explore optimizing accuracy by pairing suitable face detection algorithms with recognition algorithms and investigating factors affecting both CNN and LBPH accuracy.The paper lacks their performance under varying environmental conditions[2] The paper describes the implementation of a barcode system for tracking student attendance and assets in a university setting. This system offers a convenient and cost-effective method compared to other technologies, simplifying the process and reducing time spent on data entry. It enhances efficiency by automating tasks and eliminating errors associated with manual methods. This system can be integrated to automatically capture and update attendance and asset tracking data, providing valuable information to instructors, students, and administration.The potential disadvantage of the described barcode system, is that it relies on physical barcode scanning, which may be susceptible to issues such as barcode damage, misplacement, or theft, leading to inaccuracies in attendance and asset tracking.[3]

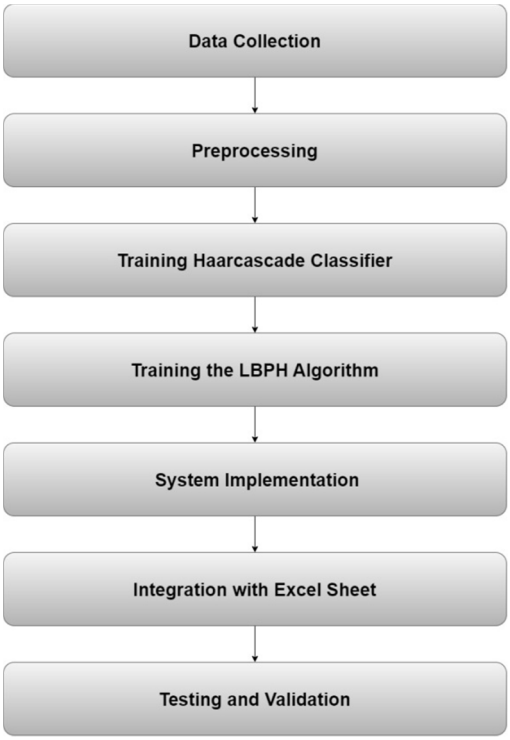
The paper highlights the implementation of facial recognition technology to automate various tasks, including attendance tracking, worker attendance management, and security applications such as identifying thieves from images. Specifically, the system includes an attendance system for lectures, sections, or laboratories, allowing lecturers or teaching assistants to record student attendance efficiently. This saves time and effort, particularly in lectures with large numbers of students. The facial recognition techniques employed demonstrate the potential for further applications beyond attendance tracking, including exam-related processes.This paper fails to address potential limitations related to the accuracy and reliability of facial recognition technology in varying environmental conditions, which are crucial considerations for implementing a robust attendance system in real-world settings.[4]

The paper presents a project emphasizing the significance of automation through face recognition technology. Implemented with OpenCV algorithm modules in Python, the project achieves a high accuracy rate of 99.38% and offers a straightforward command line utility for face recognition. Notably, the model distinguishes itself from generic algorithms by requiring only one image and avoiding grayscale conversion. Leveraging Raspberry Pi's built-in email functionality and IoT, the project demonstrates practical applications beyond face recognition. Future plans may involve further enhancing model accuracy and speed. The drawback of this paper is the absence of validation with existing face recognition attendance systems, which limits the assessment of the proposed system's effectiveness and performance in relation to established solutions.[5]

## III. METHODOLOGY

1) *Data Collection:* The first step in developing the facial recognition-based attendance system involved collecting a dataset of facial images. This dataset comprised photographs of individuals from various angles and under different lighting conditions to ensure robustness and accuracy of the facial recognition algorithm
2) *Preprocessing:* The collected facial images underwent preprocessing to enhance their quality and standardize them for analysis. This includes steps such as grayscale conversion to ensure consistency in the dataset.
3) *Training the Haarcascade Classifier:* The Haarcascade classifier was trained using the preprocessed facial images to detect faces within the images. This involved employing machine learning techniques to teach the classifier to recognize facial features and distinguish them from other objects or backgrounds.
4) *Training the LBPH Algorithm:* Following face detection, the LBPH (Local Binary Pattern Histogram) algorithm was trained using the detected facial images to recognize and differentiate between individual faces. This involved extracting facial features and encoding them into histograms for comparison and identification.
5) *System Implementation:* With the trained classifiers and algorithms in place, the facial recognition-based attendance system was implemented using Python programming language and relevant libraries such as OpenCV. The system was designed to capture live video feed from a camera, detect faces in the video frames using the Haarcascade classifier, and recognize faces using the trained LBPH algorithm.

6) *Integration with Excel Sheet:* The system was further integrated with an Excel sheet to store and manage attendance records. Upon successful recognition of a face, the system automatically updated the Excel sheet with the corresponding attendance status.
7) *Testing and Validation:* The developed system underwent rigorous testing and validation to assess its performance in real-world scenarios. This involved conducting experiments with diverse sets of facial images, varying lighting conditions, and different angles to evaluate the system's accuracy, reliability, and robustness.




System Flow

Algorithm used:

- *Haar cascade classifier*

The Haar cascade classifier algorithm partitions images into smaller regions termed Haar-like features, each representing distinctive patterns such as edges or textures. During training, it learns to distinguish between positive instances containing the object of interest and negative instances devoid of it. Through this process, the classifier refines its ability to detect the target object by analyzing intensity variations within the Haar-like features. Once trained, it scans images swiftly at various scales and positions, comparing intensity patterns to the learned models. When a match surpasses a specified threshold, the classifier identifies the region as containing the object. Renowned for its speed and effectiveness, the Haar cascade classifier is widely deployed in applications ranging from face detection to object recognition, showcasing its versatility and utility in diverse computer vision tasks. Nonetheless, achieving optimal performance often entails meticulous parameter tuning and access to comprehensive training datasets tailored to specific application domains.

- *LBPH*

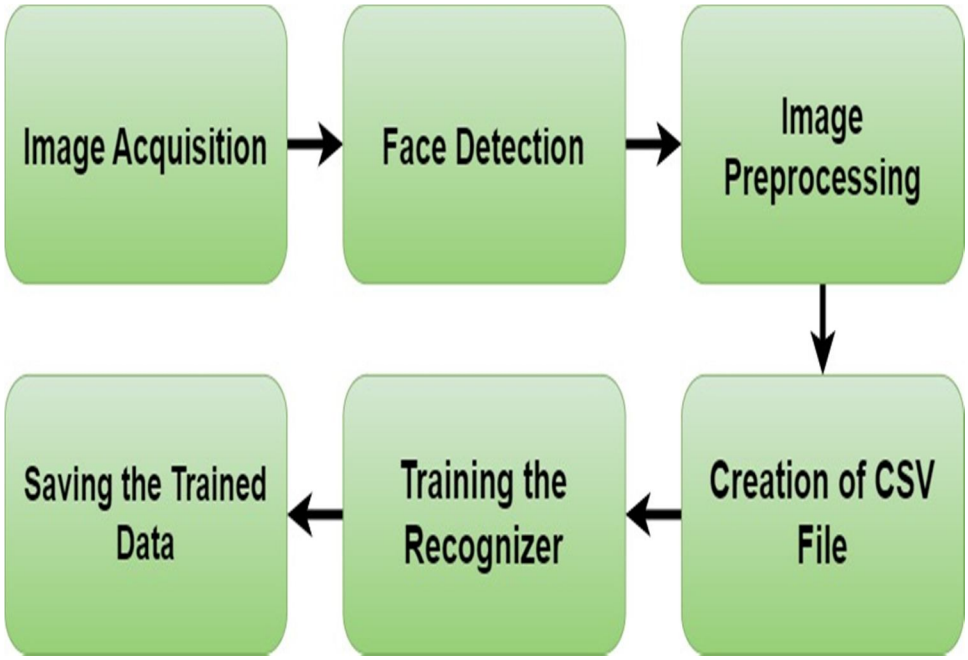
LBPH (Local Binary Patterns Histograms) stands as a prominent algorithm in the realm of computer vision, particularly renowned for its efficacy in texture classification and facial recognition tasks. It operates by partitioning an image into smaller, overlapping regions and extracting local binary patterns (LBP) from each region. These patterns encode information about the relationship between the intensity of a central pixel and its neighboring pixels, capturing textural details within the image. Subsequently, LBPH constructs histograms of these local binary patterns for each region, effectively creating feature descriptors that encapsulate the texture characteristics of the image. One of LBPH's notable strengths lies in its resilience to variations in lighting conditions and facial expressions, rendering it highly suitable for facial recognition applications where robustness is paramount. Moreover, LBPH demonstrates computational efficiency, making it feasible for real-time implementations across various domains.

©IJRASET: All Rights are Reserved | SJ Impact Factor 7.538 | ISRA Journal Impact Factor 7.894 |

Its versatility and effectiveness have led to widespread adoption in diverse fields, including security systems, biometrics, and image analysis, where accurate texture characterization is essential for successful outcomes.

## IV. PROPOSED SYSTEM

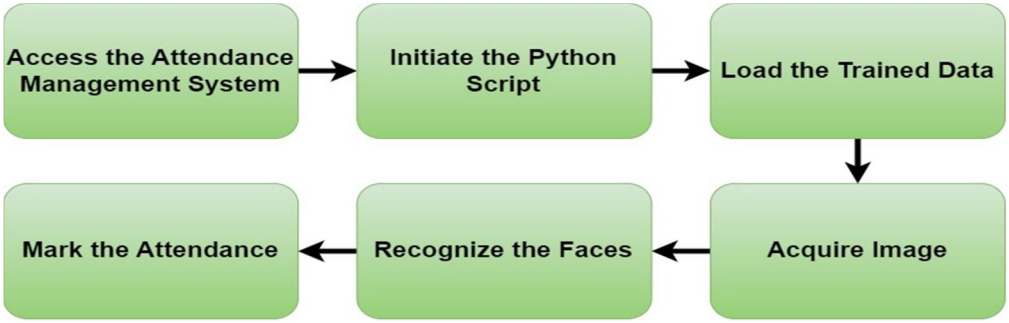
The proposed automated face recognition-based attendance system utilizes Haarcascade for face detection and the LBPH algorithm for recognition, facilitating efficient attendance tracking, enhanced accuracy, and time-saving benefits for educators, administrators, and students. The project entails two major steps: Registration and Attendance. During the Registration process, users input crucial information such as name, roll number, admission number, department, class, etc., and provide 60 photographs from different angles for each student, ensuring distinctiveness. This comprehensive registration process enables easy identification of individual students. Subsequently, in the Attendance process, the system marks the attendance of pre-registered students and logs the data onto an Excel sheet, including date and time stamps. This information serves as a valuable resource for teachers and administrators in their daily tasks and further processes.




Steps involved in the Registration process:

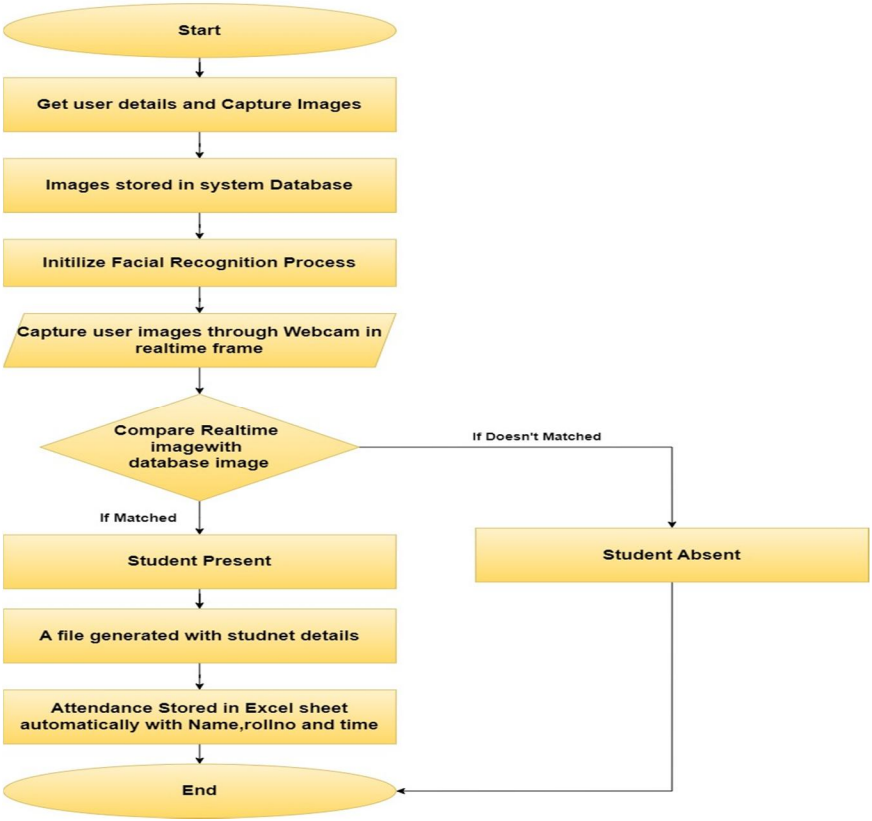
1) *Image Acquisition:* The first step is to acquire images of individuals whose faces need to be recognized. This can be done using a camera ,It's essential to capture images under different lighting conditions, angles, and facial expressions to ensure robustness in recognition.
2) *Face Detection:* Once the images are acquired, the next step is to detect faces within each image. Face detection algorithms, such as the Haarcascade classifier, are used to identify and localize faces in the images accurately. This step ensures that only the facial regions are extracted for further processing.
3) *Image Preprocessing:* Preprocessing is important step to standardize the images and enhance their quality for recognition. This involves converting collected images to grayscale to reduce computational complexity, and applying filters to remove noise
4) *Creation of CSV File:* After preprocessing, the facial images need to be organized into a format suitable for training the recognizer. This involves creating a CSV (comma-separated values) file where each row represents a unique face and contains the path to the corresponding preprocessed image along with a label or identifier for the individual.
5) *Training the Recognizer:* With the dataset prepared, the next step is to train the face recognizer using machine learning algorithms. Popular approaches include the LBPH (Local Binary Patterns Histograms) algorithm, the recognizer learns to extract features from the facial images and map them to corresponding identities.
6) *Saving the Trained Data:* Once training is complete, the trained recognizer model needs to be saved for future use. This includes saving the model parameters, such as weights and biases, along with any additional metadata required for inference. The saved model can then be deployed in real-world applications for face recognition tasks.

©IJRASET: All Rights are Reserved | SJ Impact Factor 7.538 | ISRA Journal Impact Factor 7.894 |




Steps involved in the Attendence process

1) *Access the Attendance Management System:* Users access the attendance management system through a user-friendly interface.
2) *Initiate the Python Script:* Within the attendance management system, users initiate the Python script responsible for the facial recognition-based attendance process. This script is designed to automate the attendance tracking procedure.
3) *Load the Trained Data:* The Python script loads the trained data, which includes the pre-processed facial images and corresponding labels of registered students. This trained data is essential for accurately recognizing faces during the attendance process.
4) *Acquire Image:* The system acquires images from a live video feed, the camera captures images of individuals present in the designated area.
5) *Recognize the Faces:* Using the loaded trained data, the system employs the Haarcascade classifier to detect faces within the acquired images. Once faces are detected, the LBPH algorithm is applied to recognize and match them with the registered students faces in the database.
6) *Mark the Attendance:* Upon successful recognition of a registered student's face, the attendance management system marks their attendance as "present" in the attendance records after pressing the key ‘p’ from keyboard. This marking is accompanied by a timestamp and date.




Flowchart.

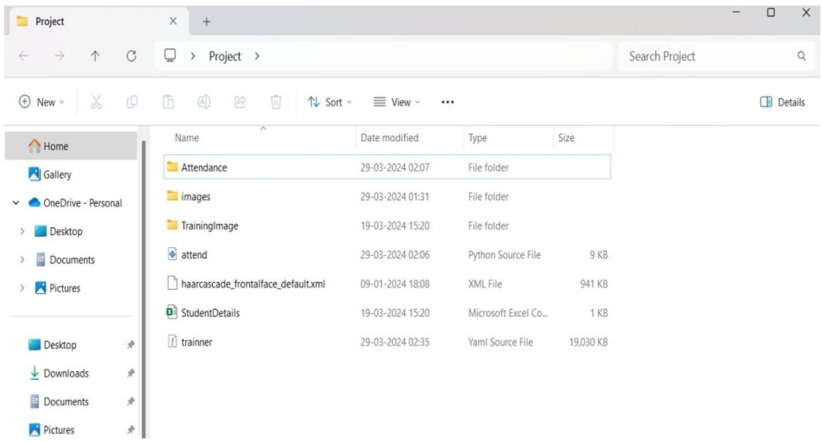
*A. Libraries Used*

1) *OpenCv:* The OpenCV (Open Source Computer Vision) Library is a versatile image processing library, offering a comprehensive set of tools for developing applications in computer vision, machine learning, and artificial intelligence. With functionalities spanning image and video manipulation, feature extraction, object detection, facial recognition, and machine learning algorithms, OpenCV simplifies complex tasks across desktop, mobile, and embedded systems.
2) *Numpy:* NumPy (Numerical Python) stands as a fundamental library in Python, particularly valued for its capabilities in numerical computing. Offering robust support for large arrays and matrices, NumPy simplifies various mathematical operations. Its high-level functions streamline tasks such as linear algebra, statistics, and general mathematics, while its efficient array operations and broadcasting contribute to accelerated numerical calculations.
3) *Tkinter:* Tkinter, a Python library, serves as a robust framework for building graphical user interfaces (GUIs). It offers a comprehensive set of tools and widgets, making it ideal for developing interactive desktop applications. Tkinter's versatility lies in its ability to seamlessly integrate with Python's standard library, allowing developers to create user-friendly interfaces with ease. Its simplicity makes it accessible to users of all skill levels, enabling rapid development of GUI applications. Despite its simplicity.
4) *Pandas:* The pandas library is a powerful tool for data manipulation and analysis in Python. It provides high-level data structures and functions designed to make working with structured data easy and intuitive. With pandas, users can easily load, manipulate, and analyze datasets of various formats, including CSV, Excel, SQL databases, and more. Its key data structures, such as DataFrame and Series, offer flexible indexing and powerful querying capabilities, enabling efficient data manipulation and exploration.

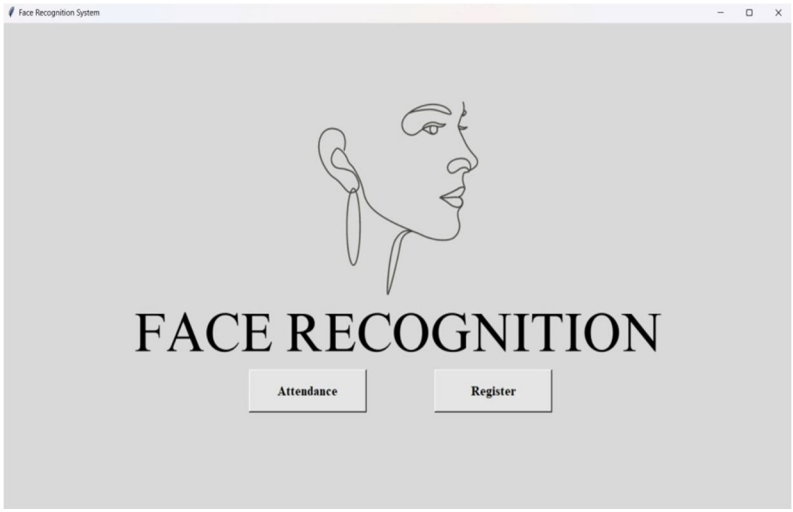
*B. Testing*

| SR NO | TASKS | INPUT | EXPECTED VALUE | ACTUAL VALUE | RESULT |
|---|---|---|---|---|---|
| 1. | User Registration | User enter Personal Information | Collected Data Stored in CSV File | Collected Data Stored in CSV File | PASS |
| 2. | Image Acquisition | User Face | Initiate Webcam & capture 60 Images of user | Initiate Webcam & capture 60 Images of user | PASS |
| 3. | Face Recognition | Store Images,CSV file data and live stream video | Details of user display on screen | Details of user display on screen | PASS |
| 4. | Multiple face Detection | Store Images,CSV file data and live stream video | Recognize multiple user in a single frame | Recognize multiple user in a single frame | PASS |
| 5. | Unregistered User | Store Images,CSV file data and live stream video | Display value as Unknown on screen | Display value as Unknown on screen | PASS |
| 6. | Mark Attendance And Excel sheet updation | Press ‘p’ from Keyboard | Automatically Attendance store in excel sheet with Details and time | Automatically Attendance store in excel sheet with Details and time | PASS |

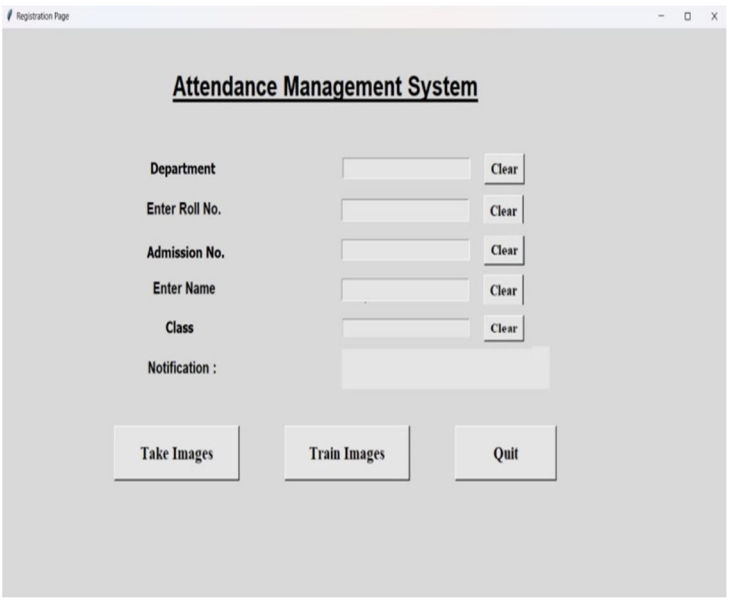
## V. RESULT



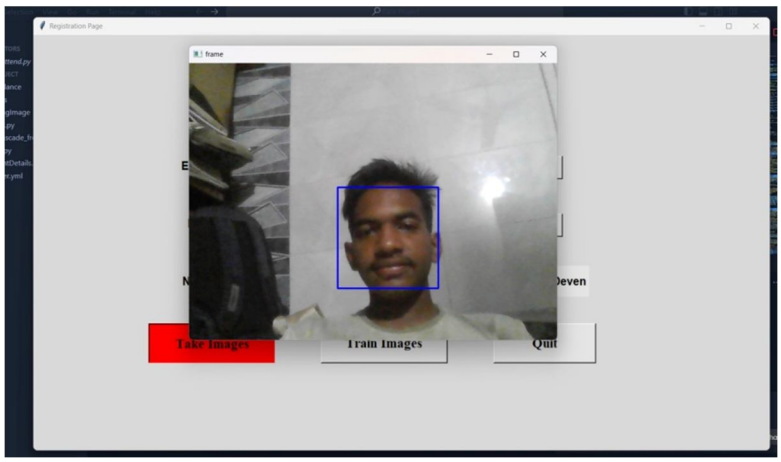

Contents of the Project



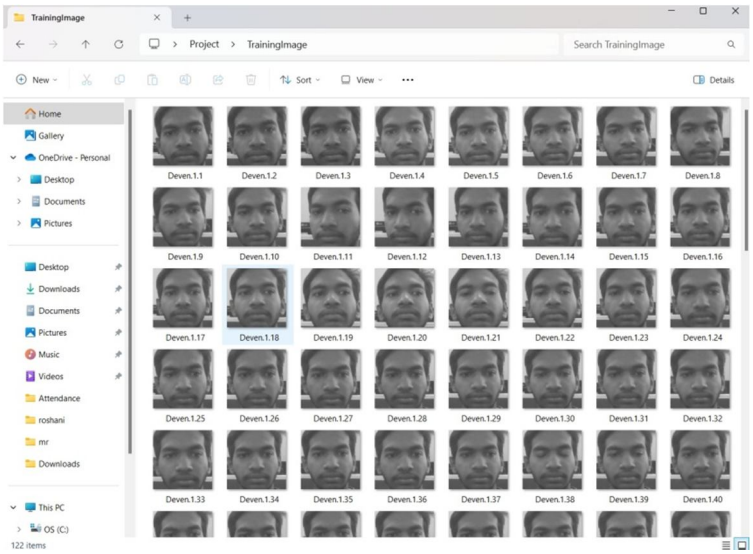

First page



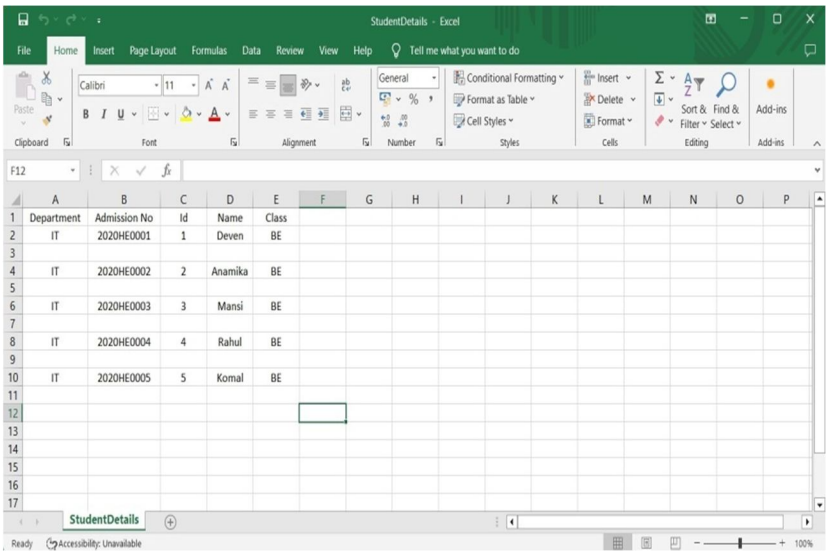

Create Dataset



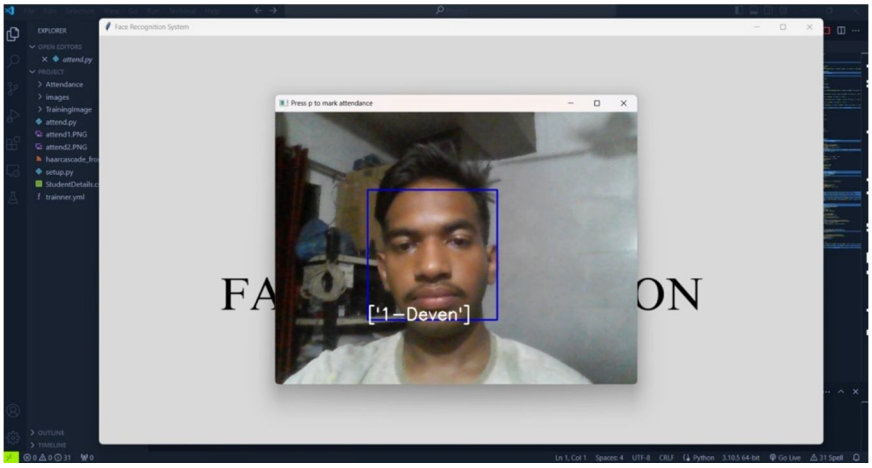

Dataset Capture



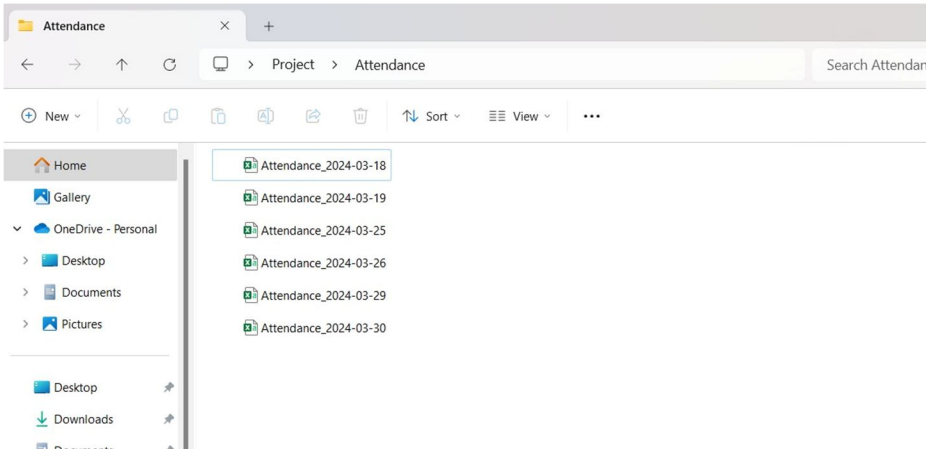

Database



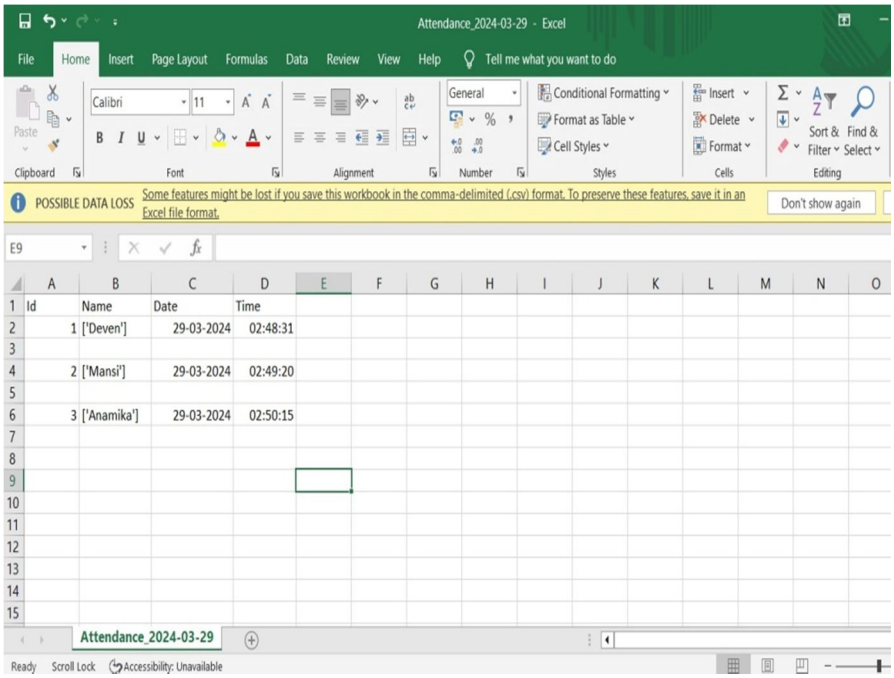

Student detail




Recognizer




Attendance Files




Excel File

## VI. CONCLUSIONS

The automated face recognition attendance system utilizing Haarcascade offers a multitude of advantages that significantly enhance attendance management processes in educational institutions and organizations. Utilizing facial recognition algorithms and diligently maintaining an Excel sheet of attendance data, this system optimizes attendance tracking, enhances precision, and efficiently manages time for educators, administrators, and students. The system's efficiency and accuracy ensure reliable attendance data, while its real-time tracking capabilities provide immediate access to attendance information for timely decision-making. It can be seamlessly integrated into existing infrastructure without requiring specialized training. Also, its compatibility with different operating systems ensures widespread accessibility and usability across various platforms.By automating attendance management tasks and reducing administrative burdens, this system not only improves operational efficiency but also promotes accountability among students and employees.

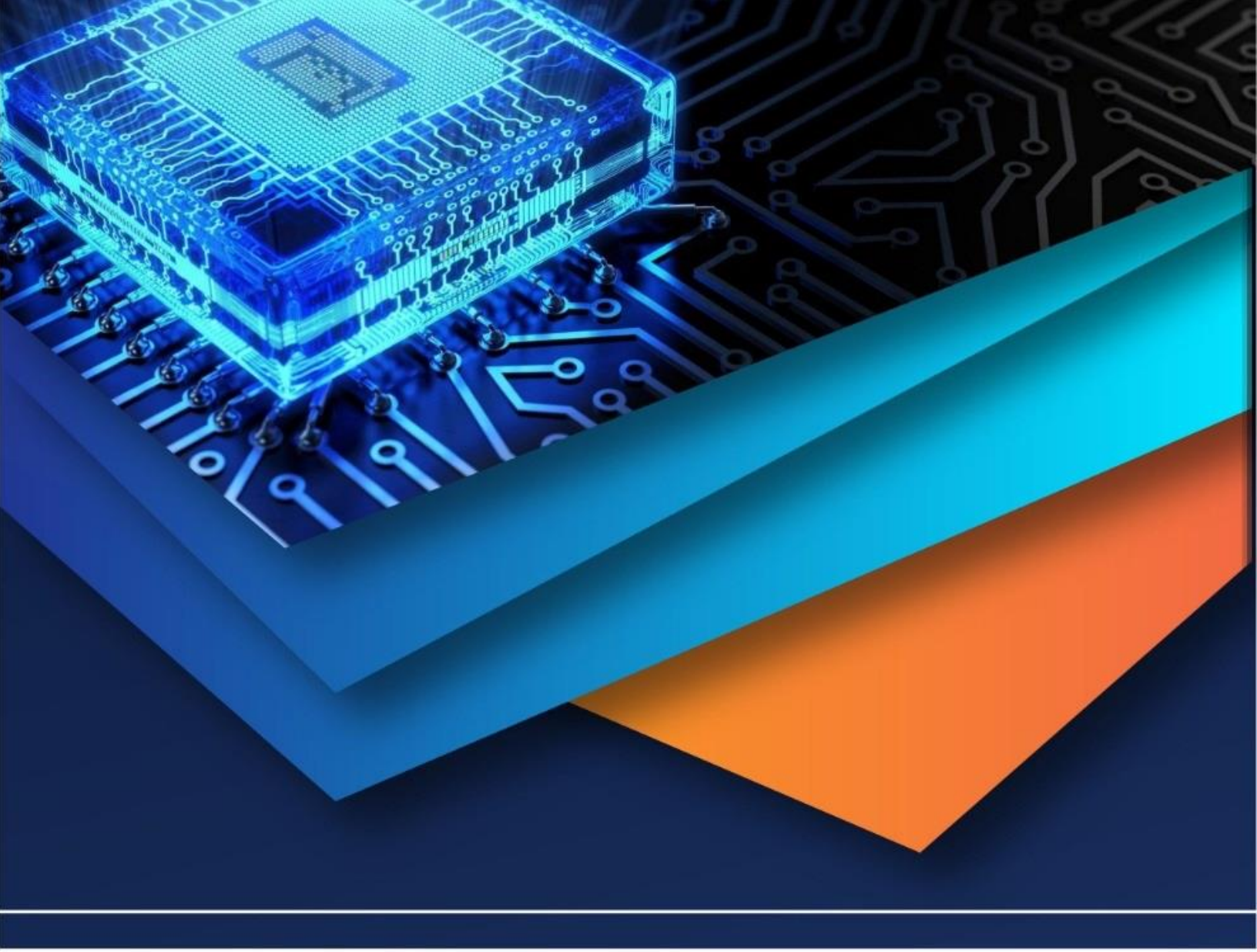
## VII. FUTURE WORK

Looking towards the future, there exists a vast scope for further advancement of the facial recognition-based attendance system described in this research paper. One avenue for future exploration involves the integration of machine learning techniques to enhance the accuracy and robustness of facial recognition algorithms. By continuously training and fine-tuning the system with larger datasets. Additionally, incorporating cloud-based storage and analysis capabilities can facilitate seamless scalability and accessibility of attendance data across multiple devices and locations. Furthermore, there is potential for incorporating additional biometric modalities, such as iris or fingerprint recognition, to offer alternative methods for attendance verification and further enhance security measures. Refining the system for mobile optimization and incorporating AI assistance represents an exciting avenue for future development. By combining these advancements, the system becomes more versatile and user-friendly, offering improved efficiency and productivity in attendance management.

## REFERENCES

[1] Khawla Alhanaeea, Mitha Alhammadia, Nahla Almenhalia, Maad Shatnawia “Face Recognition Smart Attendance System using Deep Transfer Learning” in 25th International Conference on Knowledge-Based and Intelligent Information & Engineering Systems.
[2] Andre Budimana, Fabiana, Ricky Aryatama Yaputeraa, Said Achmada, Aditya Kurniwan “Student attendance with face recognition (LBPH or CNN)” in 7th International Conference on Computer Science and Computational Intelligence 2022.
[3] Salah Elaskariab, Muhammad Imrana , Abdurrazag Elaskric , Abdullah Almasoudi “Using Barcode to Track Student Attendance and Assets in Higher Educational Institution” in The 12th International Conference on Ambient Systems, Networks and Technologies (ANT) March 23-26, 2021, Warsaw, Poland
[4] Divya Pandey, 2Priyanka Pitale, 3Kusum Sharma “Face Recognition Based Attendance System using Python)” in 2020 JETIR October 2020, Volume 7, Issue 10
[5] Rama Krishna, Joseph Chandu, Srikanth, Siva Niteesh, Kishore Reddy “Smart Attendance Monitoring System using Raspberry Pi” in INTERNATIONAL JOURNAL OF ENGINEERING RESEARCH & TECHNOLOGY Volume 12, Issue 03 (March 2023)
[6] M. A. Turk and A. P. Pentland, “Face Recognition Using Eigenfaces”in Proc. IEEE Conference on Computer Vision and Pattern Recognition, pp. 586– 591. 1991
[7] W. Zhao, R. Chellappa, P. J. Phillips, and A. Rosenfeld, “Face recognition: A literature survey,” ACM Computing Surveys, 2003, vol. 35, no. 4, pp. 399-458
[8] Bhumika G. Bhatt, Zankhana H. Shah “Face Feature Extraction Techniques: A Survey”, National Conference on Recent Trends in Engineering & Technology, 13-14 May 2011
[9] G. Yang and T. S. Huang, “Human face detection in complex background,” Pattern Recognition Letter, vol. 27, no.1, pp. 53-63, 1994
[10] M. Zulfiqar, F. Syed, M. J. Khan and K. Khurshid, “Deep Face Recognition for Biometric Authentication,” in 2019 International Conference on Electrical, Communication, and Computer Engineering (ICECCE), 2019
[11] N. Soni, M. Kumar and G. Mathur, “Face Recognition using SOM Neural Network with Different Facial Feature Extraction Techniques,” International Journal of Computer Applications, vol. 76, no. 3, pp. 7-11, 2013.
[12] Shrestha R, Panday SP. Face Recognition Based on Shallow Convolutional Neural Network Classifier. In: Proceedings of the 2020 2ndInternational Conference on Image, Video and Signal Processing; 2020. p. 25-32

©IJRASET: All Rights are Reserved | SJ Impact Factor 7.538 | ISRA Journal Impact Factor 7.894 |



10.22214/IJRASET

45.98

IMPACT FACTOR: 7.129

IMPACT FACTOR: 7.429

# INTERNATIONAL JOURNAL FOR RESEARCH

IN APPLIED SCIENCE & ENGINEERING TECHNOLOGY

Call : 08813907089 (24*7 Support on Whatsapp)