International Journal of Advance and Innovative Research
Volume 13, Issue 2: April - June 2026
ISSN 2394 - 7780

AN AI-POWERED FACIAL RECOGNITION SYSTEM FOR AUTOMATED STUDENT IDENTIFICATION AND ATTENDANCE MANAGEMENT

[1]Himani Sharma, [2]Smriti Verma, [3]Harsh Yadav and [4]Sanjana Varyani

[1]Student, Dept. of Computer Science and Engineering, Poornima Institute of Engineering and Technology, Email: imhimani004@gmaail.com
[2]Assistant Professor, Dept. of Computer Science and Engineering, Poornima Institute of Engineering and Technology, Email: smriti.verma@poornima.org
[3]Student, Dept. of Computer Science and Engineering, Poornima Institute of Engineering and Technology, Email: hy161204@gmail.com
[4]Student, Dept. of Computer Science and Engineering, Poornima Institute of Engineering and Technology, Email: varyanisanjana70@gmail.com

ABSTRACT

It should be noted that there is a need to implement a highly effective student identification system within educational institutions, demonstrating how ineffective traditional attendance systems can be, such as physical registers or ID cards.

Within this paper, we suggest a new system of student identification that uses artificial intelligence technologies and has the potential to transform existing student attendance systems. The new student identification system that we propose uses artificial intelligence, specifically computer vision or machine learning technologies, to identify student faces through the use of cameras.

Our proposed student identification system has been developed using artificial intelligence technology, particularly computer vision or machine learning technology to recognize the faces of students using cameras. Our proposed student identification system has been developed using programming languages such as Python or OpenCV with the aid of other enabling technologies like machine learning algorithms or database management systems.

Our proposed student identification system has proven its efficiency through experimental outcomes using artificial intelligence technology. Our proposed student identification system marks an important milestone in the advancement of smart education through artificial intelligence technology.

INTRODUCTION

Over the last few years, many educational institutes have increasingly become keen on utilizing digital technology that will help increase efficiency within their processes and create an enabling academic environment. One of the challenges that most educational institutes face today is about the best way they can identify and track their students. While most educational institutes follow the traditional approach of maintaining an attendance register and identity cards, such practices are often viewed to be not only ineffective but also error-prone. Moreover, the problem of proxy attendance also affects the reliability of the process.

The recent developments in technology especially in artificial intelligence and computer vision fields have made the practice of automated identification systems a very popular one. Among different types of identification techniques used, facial recognition technology is known to be very efficient due to the unique facial characteristics of individuals. With machine learning and image processing tools, a highly efficient system can be designed.

The objectives of this research are to propose a system for student identification via facial recognition by means of artificial intelligence. It would be capable of taking a photo of the student via a camera, recognizing their faces by means of computer vision, and matching the face with the student's data in the database. The student will then be marked present.

The purpose of this research is to develop a system that not only enhances the procedure of identifying students in an efficient manner, but it also has significant implications for the creation of a smart campus through the utilization of various technologies including Python, OpenCV, and machine learning. Not only does it enhance the procedure of managing attendance in an efficient manner, but it also has significant implications for the creation of a smart campus through the utilization of various

ISSN 2394 - 7780

technologies including Python, OpenCV, and machine learning.

RELATED WORK

There exist the following types of approaches regarding the existing research for the identification of students and attendance tracking:

RFID Based Attendance Systems: The identification of students is done through RFID cards. The RFID system involves the students carrying an identification card to attend classes using RFID technology. In the RFID system, attendance of the students is marked through the RFID readers. However, there are issues associated with the use of RFID technology. Students are able to mark attendance using someone else's RFID card. The other issue regarding RFID technology is that its implementation requires more money than that for biometric technology.

Biometric Fingerprint System: This technology uses fingerprints of the student for identification purposes. Fingerprint technology has an advantage over RFID technology in terms of accuracy. It also does not allow identification frauds. However, the fingerprint technology has some issues. Firstly, each student must provide his/her fingerprint in order to mark attendance. The second issue with this technology is that sometimes students might have damaged fingerprints that will affect attendance marking.

- **Face Recognition-Based Systems:** Face recognition systems make use of cameras to identify the students based on their facial features. They are non-invasive. Nonetheless, despite having all these benefits, some of the problems faced by such systems include changes in light conditions, changes in facial expression, etc.
- **Attendance Management Using Mobiles/Clouds:** Modern attendance management systems take advantage of mobile phones to manage attendance data effectively. Nonetheless, they are still not completely automated, meaning that there might be errors in human operation.
- **Limitations of Existing Attendance Management Systems:** These systems have several shortcomings, including opportunities for proxy attendance, dependency on specialized equipment, among others.
- **Research Gap:** It is necessary to design an intelligent, automated, and precise attendance management system to track student presence in real-time and minimize human interference. The proposed AI-based face recognition system would help fill this research gap through the application of machine learning, computer vision, and database techniques to develop a student attendance management system.

Problem Statement

There are a number of difficulties associated with managing the attendance and ID verification process in the current education system owing to an increased number of students and administrative activities. The conventional method of taking attendance based on ID card verification is still being used. Nevertheless, these practices suffer from a number of drawbacks.

Proxy attendance is the major disadvantage of the traditional approach. That is, a student may substitute another one. As a result, the attendance data is not always reliable. Another problem related to conventional methods lies in a lot of time being wasted by the teacher in the classroom.

RFID cards and biometric fingerprint recognition technologies are the available technological solutions in the area; nevertheless, they have a number of disadvantages. For instance, proxy cards may be used within RFID-based attendance registration systems. Moreover, in fingerprint verification systems, a student should physically place his/her finger on the sensor.

Thus, there is a need to develop a smart, automated, and accurate student identification system with minimal human intervention. The proposed AI-based student identification system using facial recognition technology is expected to overcome the existing problems in student identification systems and make student identification more accurate and efficient in academic institutions.

Proposed Methodology/ Materials & Methods

It can be seen that the proposed model has provided a clear idea about the architecture of the artificial intelligence system used to automatically identify students and keep track of their attendance records.

ISSN 2394 - 7780

This entire methodology consists of computer vision, database management, and real-time processing. The whole methodology is divided into five parts.

A. Dataset Description

An exclusive dataset is utilized in this model, which will be developed during the design phase. There is no exclusive dataset available in this case, and therefore student face recognition data must be collected for this model.

- **Student Facial Dataset:** The suggested database comprises pictures of students who have enrolled into the college or university with the help of a webcam or camera connected to the computer or any other machine. Students are provided with several pictures based on several circumstances. Pictures taken of each individual student have all the information related to students, including their names and IDs.

The suggested database has been organized in a systematic manner, where pictures of different students have been stored in different folders.

B. Dataset Characteristics

The collected dataset exhibits the following characteristics:

1. **Image Variability:** The images are taken under varying lighting conditions and from different directions, which helps in making the model more robust.
2. **Class Representation:** Each student represents a class in the dataset, making it a multi-class classification problem.
3. **Real-Time Data Collection:** The data collection process is in real-time using cameras, making it a realistic scenario.
4. **Challenges:** There might be variations in lighting conditions, background noise, and facial expressions, which need to be properly preprocessed.

C. Preprocessing and Data Augmentation

Before the commencement of the training process for the machine learning model, a series of operations is applied to the dataset for better performance and accuracy.

1. **Image Preprocessing:** The images collected during the process are converted to grayscale if necessary. The images are then resized to a specified pixel size for uniformity. Various operations for noise reduction are applied for better image quality.
2. **Face Detection:** The machine learning algorithms based on OpenCV for face detection using Haar classifiers are used for detecting the faces in the images.
3. **Normalization:** The pixel values for the images are normalized for better performance during the machine learning process.
4. **Data Augmentation:** To increase the accuracy of the machine learning algorithm for better performance in real-world scenarios, data augmentation is done for the images.

These preprocessing steps ensure that the dataset is clean, consistent, and suitable for accurate face recognition.

D. Face Recognition Model

The system employs machine learning techniques for facial recognition and identification.

- **Model Approach**: For face recognition, the features are extracted and compared with existing data in the database. Local Binary Patterns Histogram (LBPH) or deep neural networks can be applied for this purpose.
- **Working Process:** For face recognition, an image is captured, and then the features are compared with the existing data in the database. If a match is found, the student is recognized, and attendance is marked.
- **Advantages:** The real-time responses, accuracy, and low computational demands are considered to

ISSN 2394 - 7780

be the advantages of this model.

E. System Integration and Attendance Automation

The system integrates all necessary components to ensure smooth operation. The components are as follows:

- **User Interface Module:** This module enables the administration to have a dashboard to operate the system for managing students and viewing attendance records.
- **Database Module:** This module stores all necessary information about students, facial data, and attendance records.
- **Recognition Module:** This module uses a trained model to detect faces in real-time using computer vision.
- **Attendance Module:** This module automatically records attendance once a face has been recognized.

The integration of all these components enables a smooth system for managing students.

F. System Workflow

The overall workflow of the system is as follows:

1. Image capture using a camera
2. Face detection using computer vision
3. Feature extraction from faces
4. Comparison with stored images
5. Student identification
6. Automatic attendance recording
7. Store data in database

This workflow ensures real-time processing and efficient attendance management.

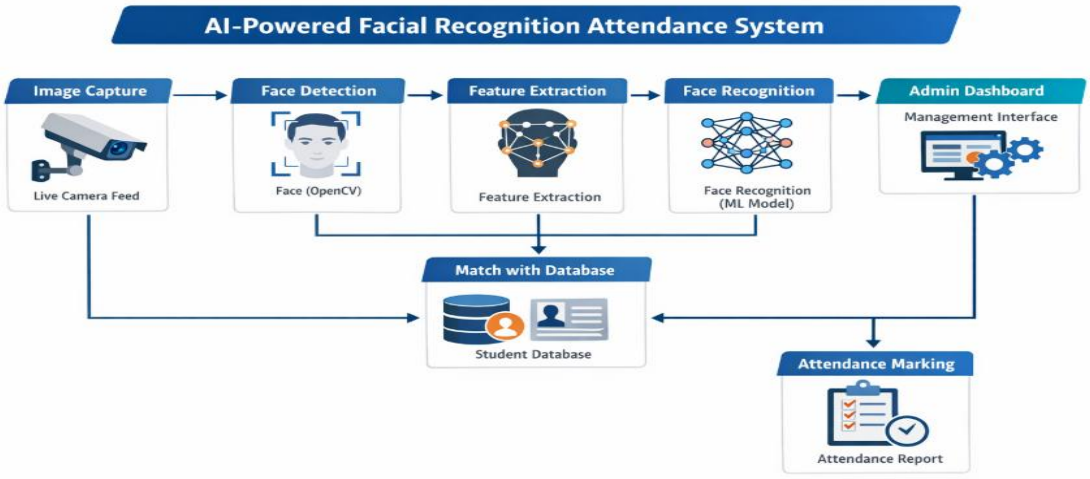
G. Evaluation Metrics

The performance of the system can be evaluated on the basis of the following metrics:

- **Accuracy:** Measures correct identification rate
- **Precision:** Evaluates correctness of positive identifications
- **Recall:** Measures ability to detect all valid students
- **F1-Score:** Harmonic mean of precision and recall

These metrics help assess system reliability, efficiency, and real-world applicability.

H. Diagram Requirement



ISSN 2394 - 7780

REVIEW OF LITERATURE

The idea of students' identification and attendance system management has received many changes due to the advent of technology. Various systems have been recommended to reduce the disadvantages of the traditional method. The important contributions to the system include the following:

Manual Attendance System Management:

The traditional method of attendance system management includes the process of roll call or manual method where the attendance system management is conducted manually by the instructor. Though the process is simple, it is time consuming and fails to provide appropriate means of record management.

RFID Technology Attendance System Management:

The RFID technology utilizes the RFID card system in which the card is issued to each individual student. When the student slides the card, the attendance is recorded. Though the process is automated, the problem of proxy attendance arises where students can swipe their cards on behalf of other students.

- **Attendance System using Fingerprint Scanning:** Biometric-based attendance systems involve the use of fingerprints to mark attendances. It has been noted that although it is secure in comparison to RFID based system but it involves physical touch. In case of many students, it may take time and it is also dependent on hardware.
- **Attendance System using Facial Recognition Technology:** Facial recognition-based attendance marking systems use facial recognition technology in which attendance is marked according to the face characteristics of the students. Facial recognition technology is non-invasive and offers automatic identification of persons. But still there were some problems with the existing facial recognition systems. Such as in some cases due to lighting issues and the process was not real-time based.
- **Latest Attendance Systems Using Cloud Computing:** The latest attendance systems have been introduced with the use of cloud computing technology. These latest attendance systems provide real-time data storage and retrieval capabilities but there is a problem of manual intervention or scanning of QR codes.

RESEARCH GAP:

There are a number of problems that have been addressed by the existing attendance systems because of the application of advanced technology. Nevertheless, there are some problems that have not yet been addressed by the existing attendance systems, such as the absence of real-time automation, the potential for proxy attendance, and the use of hardware-based devices. Hence, it is essential to develop an intelligent attendance system that uses the face recognition technique along with machine learning algorithms for developing an efficient student identification system.

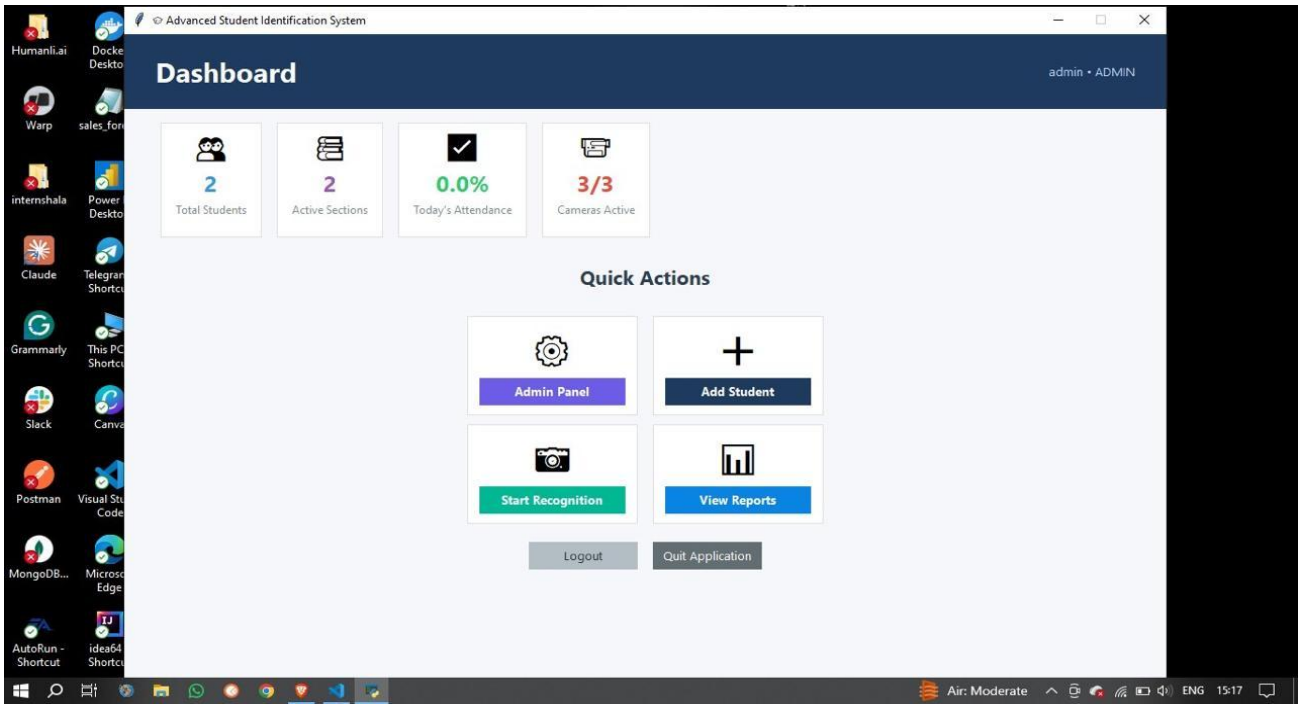
SYSTEM IMPLEMENTATION

Implementation of the System

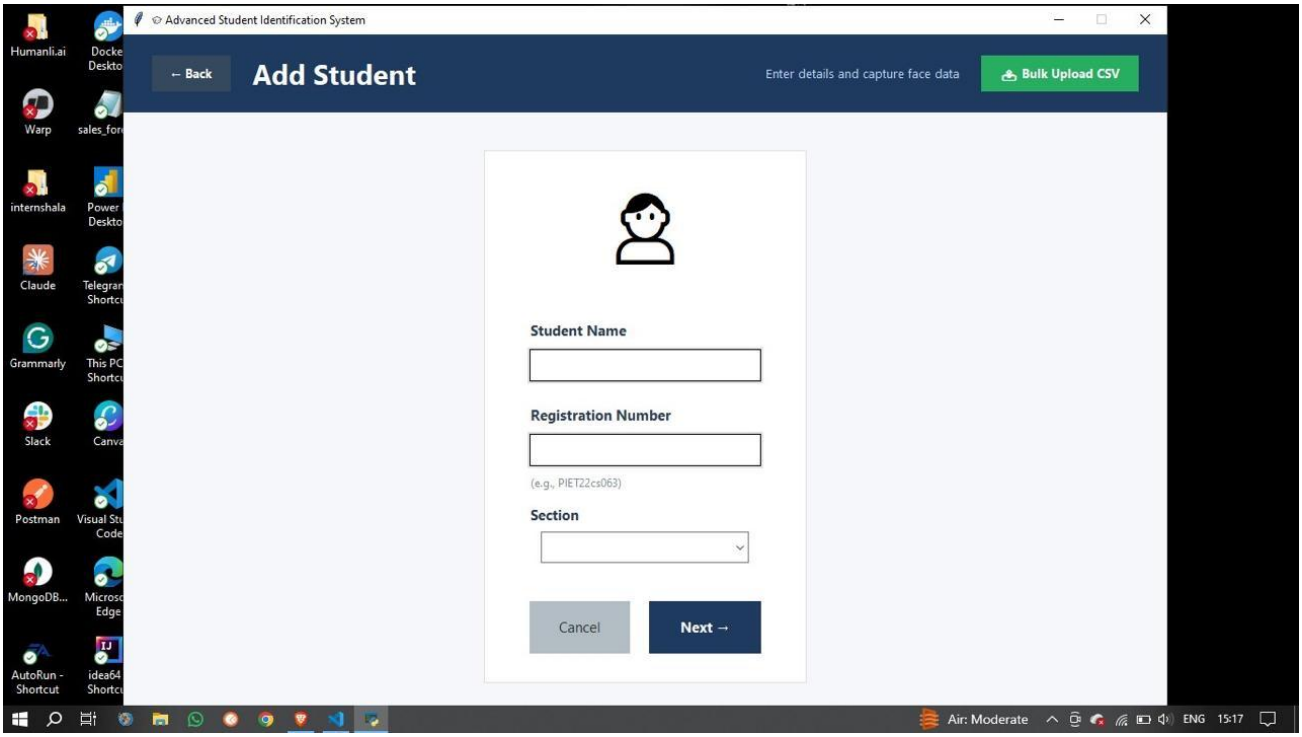
This will entail development of an AI-based Student Identification and Attendance System using technologies like computer vision, machine learning, and web-based technologies. The system will consist of several modules with different functionalities.

- **Admin Module:** The admin module will allow for control over the entire system functions such as the addition of students, section management, camera management, and viewing of attendance records.

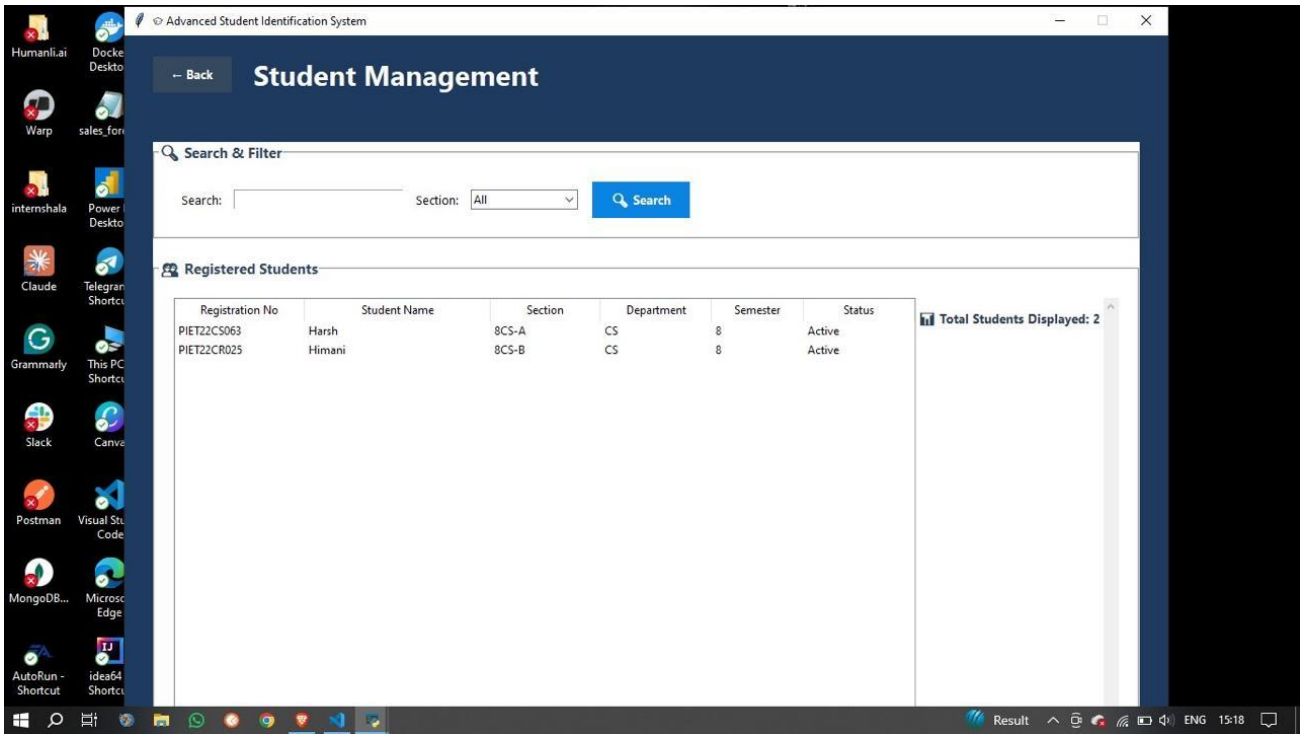
ISSN 2394 - 7780



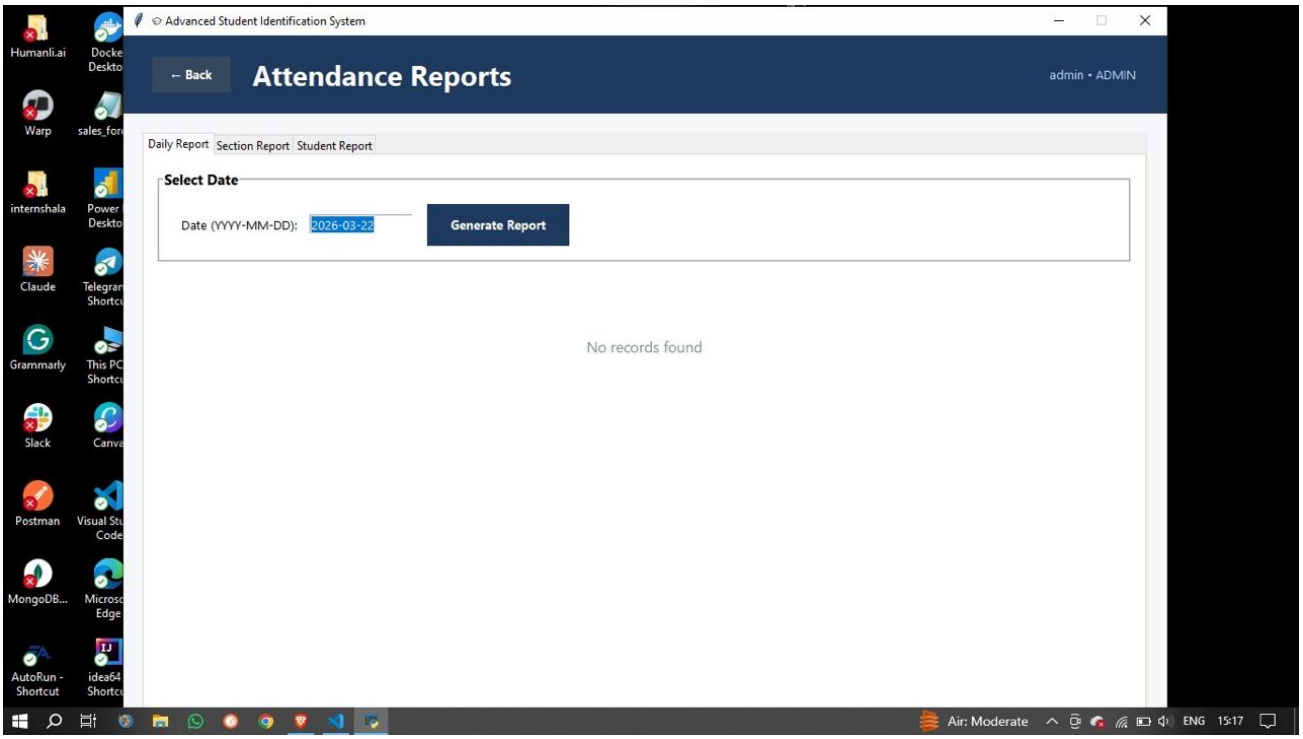
• **Student Registration Module:** This module allows for the registration of students in the system through the insertion of details such as the name of the student, registration number, and section. It also allows for the insertion of face data.



ISSN 2394 - 7780

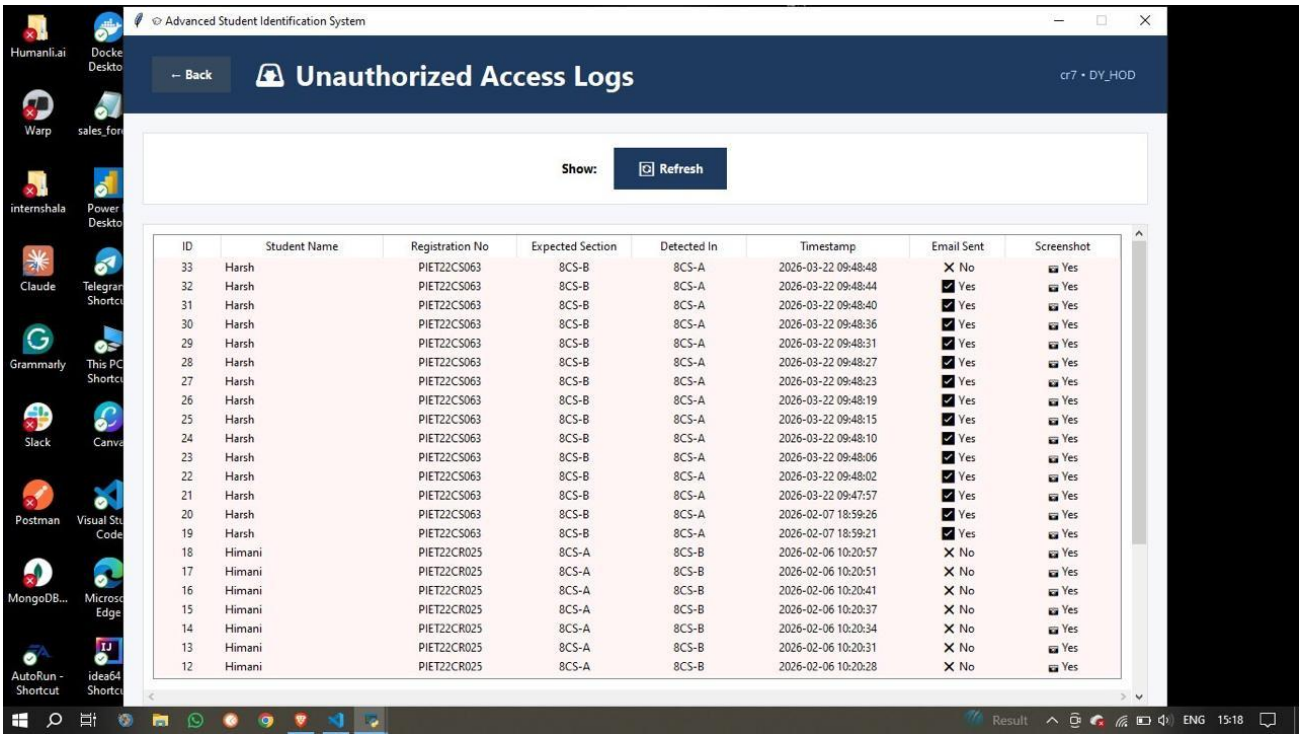


- **Face Data Capture Module:** The system has an option to take several pictures of the student's face via the use of a camera. These pictures are saved in the database for purposes of training.
- **Face Recognition Module:** The recognition of faces is done through OpenCV machine learning library. The system makes use of a camera to detect faces in real-time.
- **Attendance Management Module:** The system automatically logs attendance of a student whose face is detected. Duplicate attendance cannot be logged into the system.



- **Student Management Module:** This module allows for the management of all students who have been registered.

ISSN 2394 - 7780



The combination of these modules will lead to the formation of an automated system which is capable of identifying students and registering their attendance in real-time.

RESULTS AND DISCUSSION

The proposed approach of deploying an artificial intelligence-based student identification system was tested under controlled conditions. The results obtained through the use of such a system have shown improvement in performance as compared to traditional student attendance systems.

- **Accuracy:** The proposed system achieved a good level of accuracy regarding student identification under normal light conditions. The training of face data plays a major role in achieving better accuracy levels.
- **Time Efficiency:** The proposed system achieved reduced time requirements as compared to conventional attendance systems.
- **Automation:** The system aids in the automation of student attendance procedures without the involvement of any manual intervention.
- **Security:** Additionally, proxy attendance will not be allowed since facial recognition technology will be used in ensuring only the registered students can be recorded as being present.
- **Restrictions:** It is subject to lighting, camera quality, and the wide variation of the face.

These findings prove that the proposed system is very effective and ideal for use in modern learning institutions.

CONCLUSION

An intelligent system for face recognition is suggested in this paper that will be used in identifying students. An intelligent system for face recognition is discovered to be a promising system that could solve the problems faced by conventional student attendance systems. An intelligent system for face recognition is achieved through the use of computer vision technology and machine learning technology. An intelligent system for face recognition is revealed to be a valuable tool for creating intelligent student environments, and it is designed using artificial intelligence technology.

Future Scope

Even though the system is working efficiently, some of the improvements which may be implemented in the future are as follows:

ISSN 2394 - 7780

- Implementation of deep learning algorithm to increase accuracy
- Development of mobile applications for accessing remotely
- Implementation of cloud computing to scale up the process
- Capability to identify several faces at once in the crowd
- Connectivity with the system of the organization, such as ERP/LMS systems

Such advancements will definitely improve the efficiency of the system and will make its applicability even wider.

References

[1] R. S. Pressman, “Software Engineering: A Practitioner’s Approach,” McGraw-Hill, 2019.
[2] I. Sommerville, “Software Engineering,” Pearson, 2016.
[3] OpenCV Documentation, Open-Source Computer Vision Library.
[4] TensorFlow Documentation, Google LLC.
[5] Python Software Foundation, Python Documentation.
[6] IEEE Research Papers on Facial Recognition Systems.
[7] W3C, Web Standards Documentation.