International Journal for Innovative Engineering and Management Research
PEER REVIEWED OPEN ACCESS INTERNATIONAL JOURNAL
www.ijiemr.org

xx

COPY RIGHT

ELSEVIER SSRN

IJIEMR Transactions, online available on 25th Dec 2023. Link :http://www.ijiemr.org/downloads.php?vol=Volume-13&issue=Issue4

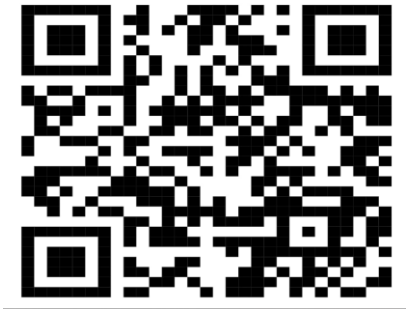
10.48047/IJIEMR/V13/ISSUE 04/52

TITLE: Student Attendance Based on Face Recognition Using Machine Learning

Volume 13, ISSUE 04, Pages: 450-464

Paper Authors **Dinesh G. Jadhao*1, Gaurav N. Gorle*2, Bhavana V. Dahake*3, Pradeep P. Raut*4, Neha S. Sarode*5,Prof. P. D. Thakre*6**

USE THIS BARCODE TO ACCESS YOUR ONLINE PAPER



To Secure Your Paper As Per UGC Guidelines We Are Providing A Electronic Bar Code

International Journal for Innovative Engineering and Management Research
PEER REVIEWED OPEN ACCESS INTERNATIONAL JOURNAL
www.ijiemr.org

Student Attendance Based on Face Recognition Using Machine Learning

Dinesh G. Jadhao[*1], Gaurav N. Gorle[*2], Bhavana V. Dahake[*3], Pradeep P. Raut[*4], Neha S. Sarode[*5], Prof. P. D. Thakre[*6]
[*1,2,3,4,5]Final Year Student, Computer Engineering Jagadambha College Of Engineering & Technology Yavatmal,India
[*6]Guide, Computer Engineering Jagadambha College Of Engineering & Technology Yavatmal, India.

Abstract: This Absrtact introduces a student attendance system integrating face recognition technology and machine learning algorithms. Its purpose is to streamline attendance monitoring within educational institutions by precisely identifying and tracking students through their facial characteristics. The system operates through several stages, encompassing data acquisition, preprocessing via convolutional neural networks (CNNs), and the training of a classifier or similarity metric. In the Attendance tracking phase, student faces are captured using camera or webcam, and these images are then compared with preprocessed facial features stored in the database. Subsequently, the system records the attendance of recognized students accordingly.

Keywords: Face recognition, Attendance Monitoring, Video surveillance system

I. INTRODUCTION

Recent technological advancements have significantly impacted various aspects of society, including the field of education. Among these innovations, the integration of face recognition technology with machine learning algorithms has gained traction in educational institutions for automating attendance tracking processes. Conventional methods of recording attendance, such as manual entry or barcode scanning, are often laborious, error-prone, and time-consuming. In contrast, face recognition-based attendance systems present a streamlined and effective alternative that not only improves accuracy but also reduces administrative burdens..

This paper aims to investigate the utilization of face recognition technology combined with machine learning algorithms to develop an automated attendance system tailored for educational environments. Leveraging artificial intelligence, this system seeks to precisely identify and monitor students based on their distinct facial features, thus eliminating the necessity for manual attendance procedures. The incorporation of machine learning algorithms allows the system to continually enhance its accuracy and adaptability to diverse environmental conditions, ensuring consistent performance across various settings.

The reliance on paper-based methods for collecting attendance information has led to data inaccuracies, logistical challenges, and incomplete research findings. These issues include: time-consuming processes, where each student is interrupted by the rotating register paper, resulting in disruptions and human errors affecting lecture productivity; illegible signatures; and attempts by students to deceive the system by falsely registering absent classmates, complicating the identification of habitual non-attendees.

II. LITERATURE REVIEW

S.T. Gandhe[1], introduces a method for recognizing individuals using their faces through various experiments. This system verifies a person's identity by scanning their face as a biometric measure. It proposes various uses such as identification systems, access control, and document management.

Riddhi Patel [2] presents an overview of face recognition and delves into its methodology and operation. The summary includes a comparison of various face recognition techniques, emphasizing those that demonstrate high efficiency in handling illumination variations and diverse environmental conditions.

Anil Kumar Sao and his team [3] introduced a template matching algorithm for face recognition, aiming to overcome the pose challenge in face recognition. Initially, facial images are represented in edge view. Subsequently, template matching is employed on the image. The approach based on edginess represents the image in one dimension. Person identification is then conducted based on the matching score.

Traditional methods of attendance tracking, such as manual entry or barcode scanning, have limitations in terms of accuracy, efficiency, and security. Face recognition-based attendance systems offer a promising alternative by automating the process of identifying and monitoring students based on their facial features. These systems leverage advancements in machine learning algorithms to continually improve accuracy and adaptability across various environmental conditions.

International Journal for Innovative Engineering and Management Research
PEER REVIEWED OPEN ACCESS INTERNATIONAL JOURNAL
www.ijiemr.org

III. METHODOLOGY

The smart digital monitoring for attendance monitoring system mainly focuses on the matching of individual and unique features in the face of the individuals.

Attendance System:

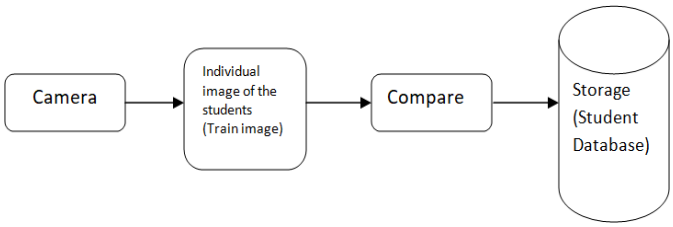


Fig 1*: Block diagram showing the processes involved in attendance monitoring*

Individual images of each student is captured and stored in the database called "Train images". These images are to be captured with a camera having good resolution and with proper illumination. On each day the capturing of the images in the class is done. This image will be a group image of many individuals. This image is stored in another folder called "Test image". Now for the marking of attendance Train images are compared with the Test images.

The modeling of human body, level of details to implement a student attendance system based on face recognition using machine learning, several steps need to be followed. Firstly, data collection is essential, where a dataset of facial images of students is gathered. It's crucial to ensure diversity in lighting conditions, angles, and facial expressions to make the model robust. This dataset is then divided into training and test images. Following data collection, preprocessing steps are undertaken to ensure uniformity and eliminate noise. Common preprocessing techniques include resizing, normalization, and grayscale conversion.

Next, relevant features are extracted from the facial images using techniques such as Principal Component Analysis (PCA), Local Binary Patterns (LBP), or Convolutional Neural Networks (CNNs). These features are vital for accurate recognition. After feature extraction, a machine learning model is trained using the extracted features and corresponding labels (i.e., student identities). Popular algorithms for face recognition include Support Vector Machines (SVM), K-Nearest Neighbors (KNN), or deep learning approaches like Convolutional Neural Networks (CNNs).

Once the model is trained, its performance is evaluated using the test images. Metrics like accuracy, precision, recall, and F1-score are used to assess its effectiveness.Upon successful evaluation, the trained model is deployed in the classroom environment. A camera system is set up to capture images of students during attendance time.
Face detection algorithms are then utilized to identify and localize faces within the captured images. Common techniques include Haar cascades, Histogram of Oriented Gradients (HOG), or deep learning-based methods like Single Shot MultiBox Detector (SSD) or Faster R-CNN.

After detecting faces, the trained face recognition model is applied to predict the identity of each face based on the extracted features and compare them with the faces in the training dataset. Based on the recognized identities, attendance for each student present in the classroom is marked. Attendance records are stored in a database or spreadsheet for further analysis.To ensure continuous improvement, the face recognition model is periodically updated and refined to improve its accuracy and robustness. Additional data may be collected to account for variations in appearance or environmental conditions. This iterative process helps maintain the system's effectiveness over time.

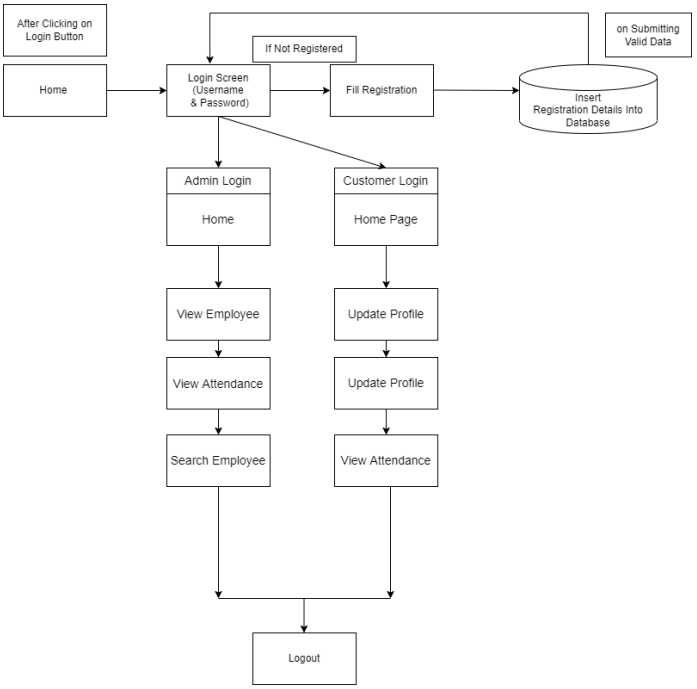


Fig 1: System Architecture

In the system architecture for face recognition attendance using machine learning, each component plays a crucial role in enabling the overall functionality of the system. The Data Collection Module collects students' facial images, either by taking pictures with cameras or accessing existing image datasets. The Preprocessing Module prepares these images for analysis by resizing, normalizing, and converting them to grayscale to ensure consistency. The Feature Extraction Module extracts essential characteristics from the preprocessed images, like facial patterns, using techniques such as PCA, LBP, or CNNs. The Model Training Module then uses these features to train a machine learning model, employing algorithms like SVM, KNN, or CNNs to recognize faces. The Model Evaluation Module assesses the trained

model's performance using metrics like accuracy and recall, ensuring it works effectively.

The Deployment Module integrates the model into the classroom, setting up cameras and linking the face recognition system to the attendance process.The Face Detection Module identifies and locates faces in images, using algorithms like Haar cascades or deep learning methods like SSD.The Face Recognition Module . predicts the identities of detected faces by comparing their features with those stored in the training dataset.The Attendance Marking Module records attendance based on recognized identities, maintaining timestamps and student information for records.The Continuous Improvement Module continually updates and refines the system, enhancing its accuracy and effectiveness over time based on feedback and performance evaluation.Together, these modules create an efficient and accurate face recognition attendance system for educational environments.

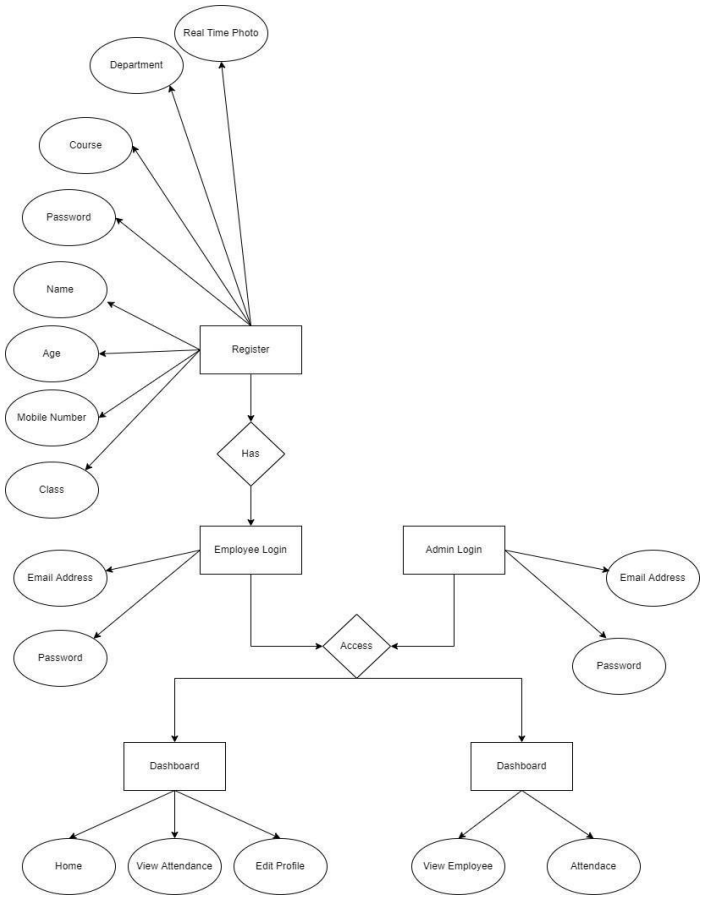


Fig. 2 : E-R Diagram

In the realm of face recognition systems, an Entity-Relationship (ER) diagram (Fig. 2) serves a distinct purpose, primarily focusing on delineating the structure of the data implicated in the face recognition process. Such a diagram acts as a visual representation illustrating the database's organization, detailing entities like students, images, attendance records, and models, alongside their attributes and interrelationships. Through this modeling, the ER diagram aids in comprehending the data architecture, elucidating how various elements are interconnected and how they function within the system. Moreover, the ER diagram helps in integrating disparate system components, depicting the interactions between modules such as image capture, face detection, recognition, and attendance marking. Furthermore, it plays a crucial role in database design and optimization by guiding the creation of efficient schemas, ensuring optimal storage and retrieval of facial images and attendance data. Additionally, the ER diagram facilitates the visualization of data flow and relationships within the system, shedding light on how information moves through different stages of the face recognition process. As a documentation tool, it assists in system maintenance and upgrades by providing a reference for understanding the database structure, aiding in modifications, feature enhancements, and integration with other systems. Overall, an ER diagram in the context of face recognition systems is indispensable for designing, comprehending, and refining the database architecture to support seamless and effective face recognition capabilities.

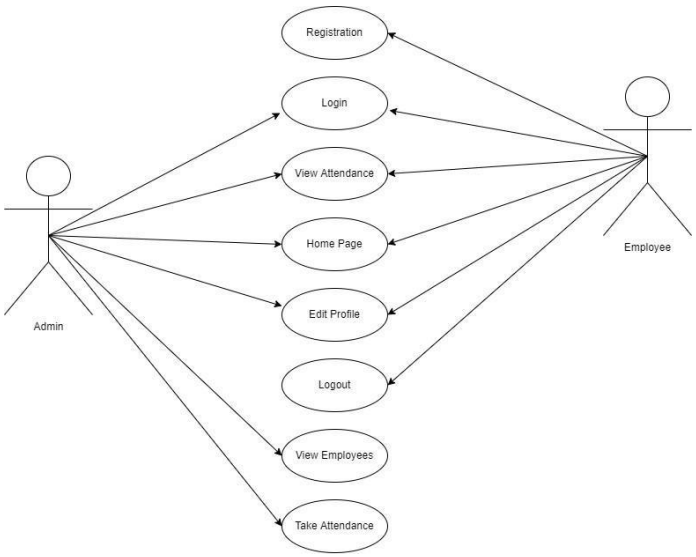


Fig. 3 Use Case Diagram

A Use Case Diagram (Fig. 3) for a face recognition attendance system using machine learning provides an overview of its functionalities and interactions among various actors and components. Actors include students, whose attendance is tracked, and administrators responsible for system management. Use cases encompass capturing facial images, preprocessing them for quality enhancement, training the machine learning model, recognizing faces, marking attendance, managing data in the database, and monitoring system performance. Actors interact with multiple use cases, and there may be dependencies between use cases. The system boundary defines its scope, while extensions accommodate additional functionalities like error handling or maintenance. Overall, the diagram illustrates how the system captures, recognizes, and records attendance using facial recognition technology, depicting essential processes and relationships

among actors and components.

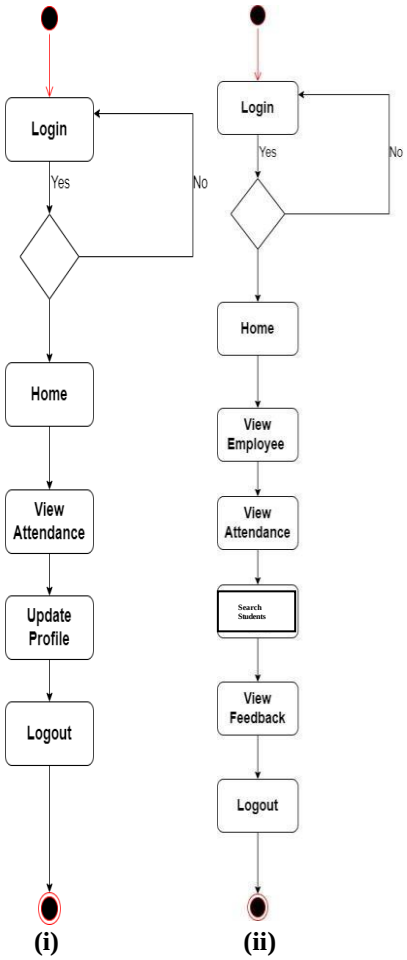


Fig. 4(i) Activity Diagram of User
Fig. 4(ii) Activity Diagram of Admin

In the face recognition attendance system based on machine learning, the activity diagram (Fig. 4(i))starts with the user approaching the attendance system. Upon arrival, the system proceeds to capture the user's facial image using cameras or similar devices. Subsequently, the captured image undergoes preprocessing by the system to enhance its quality and suitability for recognition purposes. Following this, the system employs machine learning algorithms to match the preprocessed image with the stored images in its database. At this juncture, a decision point arises: if the user is recognized, the system proceeds to mark their attendance and displays a confirmation message; however, if recognition fails, the system prompts an error message. Finally, the activity concludes with the user receiving either the attendance confirmation or the error message. This activity diagram illustrates the sequential steps involved in the interaction between the user and the face recognition attendance system, delineating the process from image capture to attendance marking based on machine learning technology.

In Fig. 4(ii) , The administrator begins their interaction with the system by logging in, where authentication safeguards against unauthorized access. Once access is granted, the admin dashboard becomes the central hub, providing a range of administrative functions from user management to system configuration. Administrators then choose tasks from this dashboard according to their objectives, which may involve managing student profiles, updating records, or adjusting settings. These tasks are executed by the system using machine learning algorithms, automating processes such as student enrollment updates and attendance record management. After task completion, administrators review the outcomes to ensure accuracy and data integrity. Insights gained from this review inform adjustments to system configurations, optimizing performance over time. In essence, administrators oversee authentication, task selection, execution, and outcome review, ensuring the smooth operation and ongoing enhancement of face recognition attendance systems.

IV. RESULT

In this part, we're going to share what we found out from using our face recognition attendance system. We used really advanced technology like facial recognition and machine learning to make this system. Our goal is to improve how we track attendance in schools. We're not just going to talk about it, though. We're also going to show you pictures of our system at work. These pictures will help you see exactly how our system functions. We picked out these pictures carefully to show you different parts of our project, like how we collect data, teach the computer to recognize faces, and keep track of attendance in real-time. These pictures help make our project more understandable. The pictures aren't just for show, though. They're also there to prove that our system works well. By showing you what the system looks like and how it measures accuracy and attendance, we want to make you trust that our system is effective. Plus, these pictures give you an idea of what it's like to use our system, which might make you more likely to want to use it yourself.

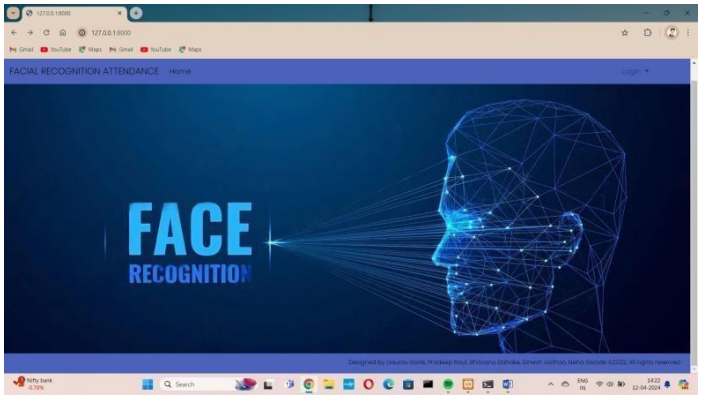


Fig. 5. Graphical User Interface Screen 1- Homepage

International Journal for Innovative Engineering and Management Research
PEER REVIEWED OPEN ACCESS INTERNATIONAL JOURNAL
www.ijiemr.org

In Fig 5, Our system features intuitive login options for both administrators and students, providing secure access to attendance data and personalized features. Administrators can easily manage attendance records and system settings, while students can conveniently view their own attendance history and receive notifications.

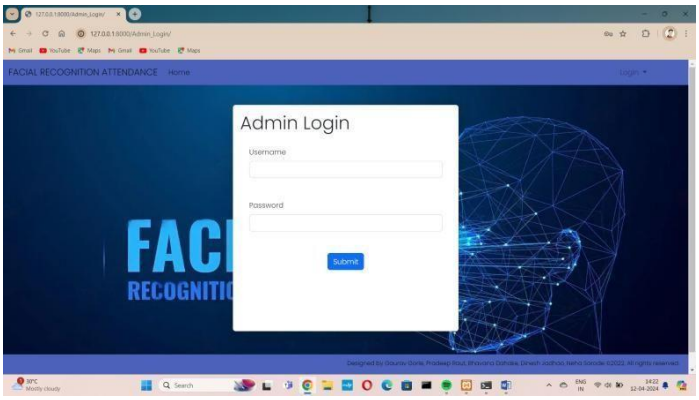


Fig. 6 GUI Screen 2- Admin Login

In Fig 6, Admin Login: Gain secure access to powerful attendance management tools. Take control of attendance records, customize system settings, and effortlessly oversee student attendance. With our user-friendly interface, managing attendance has never been easier. Log in now to streamline your Administrative tasks and optimize your institution's attendance tracking process. Soon after you entered the valid credential, you will get entered into admin dashboard. Fig. 7 shows the Admin Dashboard.

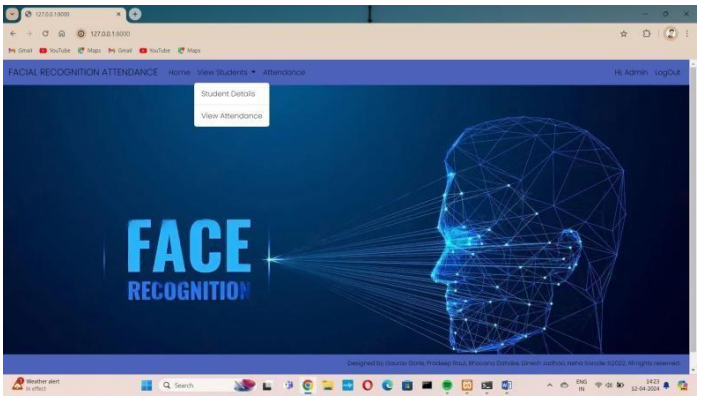


Fig 7. GUI Admin Dashboard

Admin play a pivotal role in ensuring the effectiveness of attendance management systems by overseeing critical aspects. They monitor attendance records across departments or groups, utilizing the data to identify trends and enforce attendance policies. Additionally, administrators configure and maintain the system, managing user accounts, access levels, and technical troubleshooting to ensure seamless operation. They also prioritize data security, implementing measures to protect sensitive information and adhere to privacy regulations. Administrators facilitate communication by distributing attendance-related updates and generating reports to offer insights into attendance trends and compliance. Overall, administrators are instrumental in fostering accountability, transparency, and efficiency in attendance tracking processes within organizations. In Fig. 8, the number of students which are registered through Registration Form are displayed.

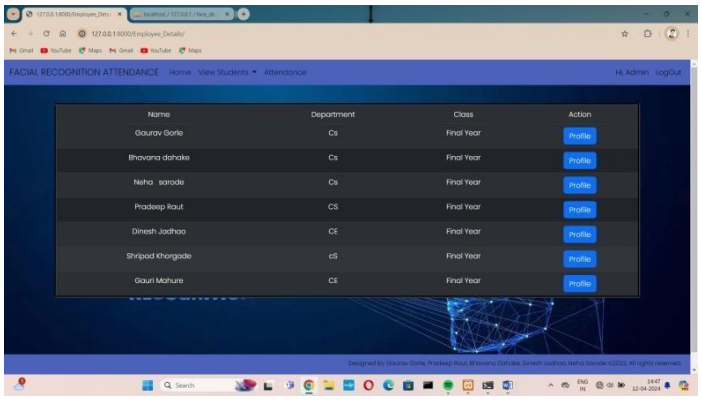


Fig. 8 Student Details

When administrators use face recognition technology to take attendance, they leverage advanced software systems that automatically identify and record individuals' presence based on their facial features. This method eliminates the need for manual entry or physical sign-in processes. Administrators typically utilize specialized attendance management software equipped with facial recognition capabilities. When individuals enter the designated area or access the system, their faces are scanned and compared against a pre-existing database of authorized individuals. If a match is found, the attendance record is automatically updated to reflect their presence. Fig 9 shows the marking of attendance.

Fig. 9. Attendance Marking

As each person's face is detected, the system analyzes facial features to identify them against a pre-existing database of authorized individuals. Upon successful identification, the attendance record is updated accordingly to indicate their presence. This process enables efficient and accurate attendance tracking without the need for manual input or physical sign-in

procedures.

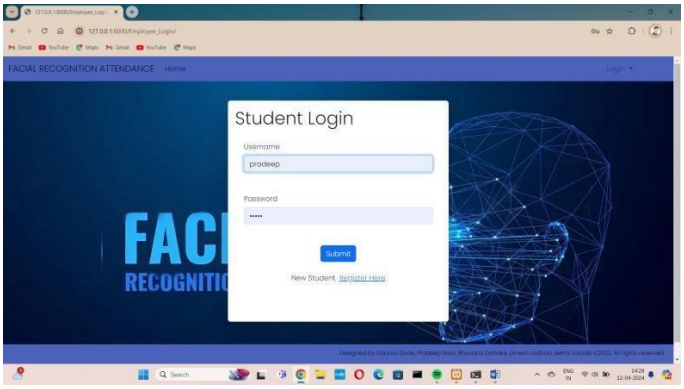


Fig. 10. Student Login

Figure 10. shows the Student Login, If you've signed up before, just log in to see your attendance and how you're doing in class. If you're new, sign up now to track your attendance easily! Just fill out the form with your name, student ID, email, and make a password. Once you're signed up, you can check your attendance and get notifications about it. Let's make attendance easy with our high-tech facial recognition system.

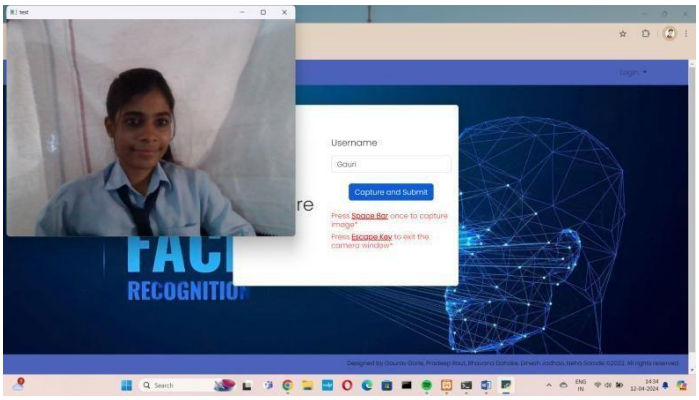


Fig. 11. New Student Registration

If you're new here, it's easy to sign up. You need to capture yourself first. Just fill out the form (Fig. 12) with your name, student ID, email, and create a password. Once you're signed up, you'll be able to check your attendance and get updates about it.

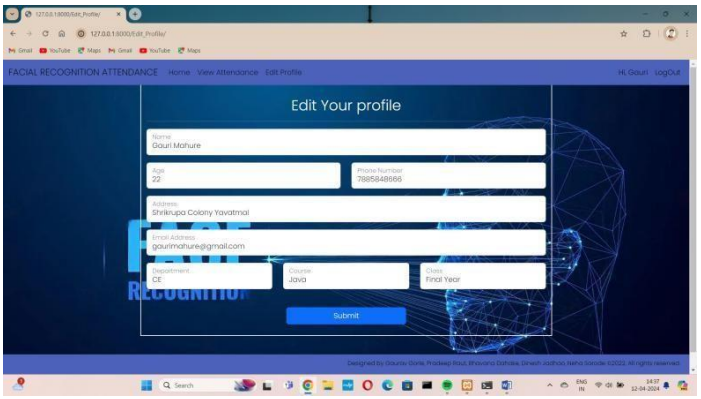


Fig. 12. Registration Form

Fig. 13. Student Details

Fig. 13 shows the details of student which is filled by the student at the time of registration . Students can easily Edit or Modify the details as per their need.

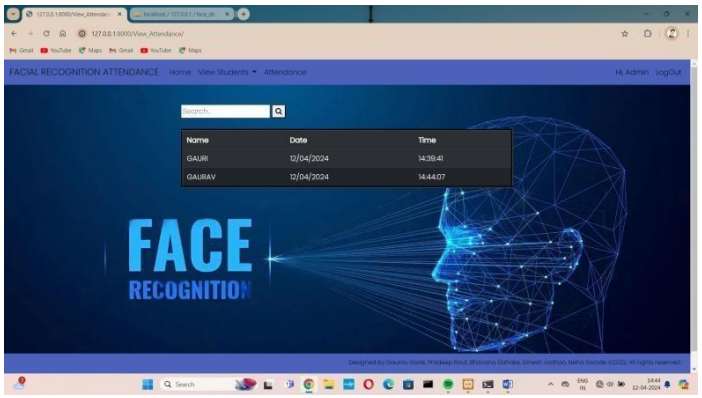


Fig. 14. Student Attendance

Admins keep an eye on students' attendance. They use our system to see who's here and who's not. It helps them keep things organized and make sure everyone is where they're supposed to be. With our system, admins can easily track attendance and keep everything running smoothly. Admins play a vital role in managing student attendance effectively. Using our system, admins can effortlessly monitor the attendance of students. This involves keeping track of who is present and who is absent from classes or events. By maintaining accurate attendance records, admins can ensure that students are attending their required sessions and fulfilling their academic obligations. This not only helps in maintaining discipline but also assists in identifying any potential issues or concerns regarding student attendance patterns. Admins watch over whether students show up for class or not. They use our system to keep track of who's here and who's not. This helps make sure students are attending their classes like they're supposed to. Our system makes it easy for admins to see who's attending and who might need some extra help. Furthermore, through our system, administrators have the capability to engage in conversations with students regarding their attendance records. This facilitates a platform for admins to provide valuable feedback and guidance, offering insights on strategies to enhance students' attendance habits and foster a

more consistent presence in their classes.

V. CONCLUSION

In conclusion, the integration of facial recognition technology into attendance monitoring represents a monumental advancement in academic and organizational management. Through cutting-edge algorithms and machine learning, these systems revolutionize attendance tracking with unparalleled efficiency and accuracy. By seamlessly incorporating facial recognition, administrative tasks are streamlined, reducing workload and eliminating manual processes. Furthermore, real-time access to attendance data empowers administrators to intervene promptly and offer personalized support to students. As we embrace these technological strides, facial recognition systems emerge as pivotal tools driving operational excellence and student success in educational and organizational settings.
Beyond its immediate benefits, the implementation of facial recognition attendance systems represents a larger trend of embracing technological advancements in education and organizational management. These systems serve as catalysts for operational optimization, driving institutions towards greater efficiency, productivity, and cost-effectiveness. Additionally, by providing a seamless and user-friendly experience, facial recognition technology enhances overall user satisfaction and engagement. As we keep using these new solutions, facial recognition attendance systems can change how education works. They can help create a culture where everyone is accountable and things are clear, leading to students doing better. Using technology like this doesn't just make things easier for schools, it also helps students learn and grow.

VI. REFERENCES

[1] S.T.Gandhe, K.T.Talele, A.G.Keskar"Intelligent face recognition techniques: A comparative study" published in IAENG International Journal of Computer Science.

[2] Riddhi Patel and Shruti B. Yagnik authored "A Literature Survey on Face Recognition Techniques," which was published in the International Journal of Computer Trends and Technology (IJCTT).

[3] Anil Kumar Sao and B. Yegnanaarayana "Template matching Approach for Pose Problem in Face Verification Speech and Vision Laboratory" Department of Computer Science and Engineering, Indian Institute of Technology Madras.

[4] X. Zhao, W. Zhang, G. Evangelopoulos, D. Huang, S. Shah, Y. Wang, I. Kakadiaris and L. Chen, "Benchmarking Asymmetric 3D2D Face Recognition Systems." Pattern Analysis and Machine Intelligence, pp. 218–233, 2013.

[5] Shailendra, M. Singh, M. A. Khan, V. Singh, A. Patil, and S. Wadar, "Attendance management system," in 2nd International Conference on Electronics and Communication Systems, ICECS 2015, 2015.

[6] S. Lukas, A. R. Mitra, R. I. Desanti, and D. Krisnadi, "Student attendance system in the classroom using face recognition technique," in 2016 International Conference on Information and Communication Technology Convergence, ICTC 2016, 2016.

[7] M. Shirodkar, "Automated Attendance Management System using Face Recognition," Int. Res. J. Eng. Technol., 2017.

[8] Sujata G. Bhele and V. H. Mankar "A Review Paper on Face Recognition Techniques" published in International Journal of Advanced Research in Computer Engineering & Technology (IJARCET).

[9] Nirmalya Kar, Mrinal Kanti Debbarma, Ashim Saha, and Dwijen Rudra Pal, "Study of Implementing Automated Attendance System Using Face Recognition Technique" International Journal of Computer and Communication Engineering, 2012.