



Design & development of an Artificial Intelligence based attendance monitoring system for chemistry & chemical departments of educational institutions

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doi: 10.31838/ecb/2023.12.si6.294

Abstract

In this paper, we present the design & development of an Artificial Intelligence based attendance monitoring system for chemistry & chemical departments of educational institutions along with the simulated results. Attendance is critical to the success of any business or industry. As a result, most businesses and institutions require a system to track staff attendance. On the other hand, cloud computing technology is being utilized in the human resource management sector to store the information associated with their respective attendance. It may be an excellent option for processing and storing large amounts of data and improving management effectiveness to a desirable level in a feasible manner. Hence, this paper examines cloud infrastructures for employee attendance management in which the articles are categorized into three groups. The results show that cloud infrastructure has a significant and positive impact on the management of employee / staff / student attendance systems. The concept of artificial intelligence is used in order to monitor and maintain the attendance by capturing the motion pictures of the student when present to analyse the student data at what time the student has entered the class. When references operate properly, they help the people concerned and society by making workplaces more efficient, more effective and safer.

Keywords Attendance system, Human resource management, Cloud computing technology, Artificial Intelligence, Machine Learning, Deep Learning

1. Introduction

Ensuring regular attendance is crucial for maintaining educational reliability in all institutes. Traditionally, institutions have relied on manual methods to record student attendance, such as verbally calling out each student's name and checking their presence in the class. However, this process is time-consuming, prone to errors, and susceptible to students falsely marking attendance for their absent classmates [1]. Additionally, managing attendance for a large classroom becomes increasingly challenging. To address these issues, we have

developed a program that utilizes various techniques, including facial recognition technology, to automatically detect students in the classroom and mark their attendance by capturing their facial images. This system leverages the non-invasive and widely recognizable nature of facial features, as people primarily identify others based on their faces. By enrolling the unique facial features of each individual into a dataset, we establish a biometric structure that enables accurate identification and understanding of student presence [2]. The conventional approach of physically signing attendance sheets in a computer system for analysis has proven to be cumbersome, error-prone, and vulnerable to students signing on behalf of their absent peers, rendering it ineffective [3]. In contrast, the utilization of a facial identification and recognition system offers a faster and more efficient method of capturing student attendance accurately. Moreover, this approach provides secure, reliable, and easily accessible records that can be utilized by administration, parents, and students themselves for various purposes [4].

2. Scopes & Objectives

The process of facial recognition can be divided into two main stages: pre-processing, which includes face detection and alignment, and recognition, which involves feature extraction and matching. In the initial stage, the goal is to determine whether there are human faces present in a given image and identify their locations [5]. This stage produces patches that contain each detected face in the input image. To create a more reliable and easily adaptable face recognition system, face alignment is performed to normalize the scales and orientations of these patches. Once the face detection step is complete, the human face patches are extracted from the images. Subsequently, these face patches are converted into vectors with fixed coordinates or a set of landmark points [6]. The final step in the process is face identification. For automatic recognition, a face database needs to be constructed. Multiple images are captured for each person, and their features are extracted and stored in the database. When an input image is provided, face detection and feature extraction are performed, and the extracted features are compared with each face class in the database and stored accordingly [7].

3. Proposed Methodology & Block Diagram

The program is built on the python programming language. The libraries required are first downloaded under the python. The libraries used in this project are tkinter and OpenCV. The tkinter is the library used to generate the graphical user interface, and the OpenCV is used to access the web camera that is used to capture the image of the student. All the import files from these libraries are imported. Then, the program is created based on the three steps of the algorithm mentioned below [8]:

- Data Collection for Training: Collect facial data, specifically face images, of the individuals you wish to identify.
- Training the Recognizer: Provide the collected face data, along with the corresponding names or labels for each face, to the face recognizer for the purpose of learning and training.
- Recognition: Introduce new faces of the individuals to the trained face recognizer and observe whether it can successfully recognize and identify them.

These steps are also the above mentioned steps for OpenCV libraries. Then the tkinter is introduced into this program for the development of the GUI. This happens in three steps after the library files are imported [9]:

- Creating the main window
- Adding the no. of widgets to the main window
- Apply the event trigger on the widgets.

After the program is completed then the program is ready to run. Let the program and a new window opens, this window contains the GUI, through which the webcam is accessed. The window contains three steps written. The steps mentioned are as follows [10]:

- Image capture button
- Model training button
- Attendance marking button

The first step of the process is capturing the image of the student. In order to do this the student is required to enter the following credentials- college ID and name of the student. Then the step one button is pressed in order to open the webcam and the student face is captured. The second step includes the training the AI. This is done by pressing the step 2 button [11]. The images captured are trained upto 60 frames. These images are captured in black and white. This is done to ensure that the skin colour of the student is not captured as most of the population in class can have the same shade of the skin. Therefore, this effect is negated and the edges of the face, the whole measurements of the face, etc all these data is being trained in to the AI. After this, the remaining process is done. The AI ready to identify the face of the individual [12]. The step 3 button is pressed in order to do this. When the AI recognises the face the name of the student and the college ID is visible on the screen. Then the student details are recorded in the excel sheet called student details as shown in the Fig. 1 [13].

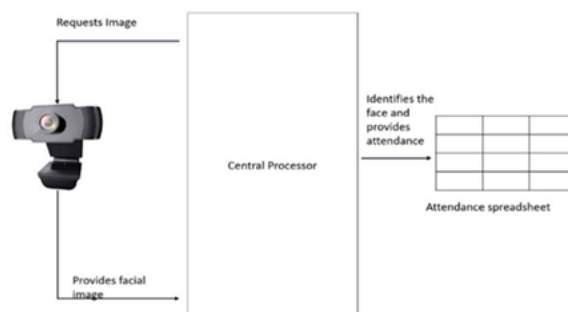


Fig. 1 : Block diagram of an attendance monitoring system

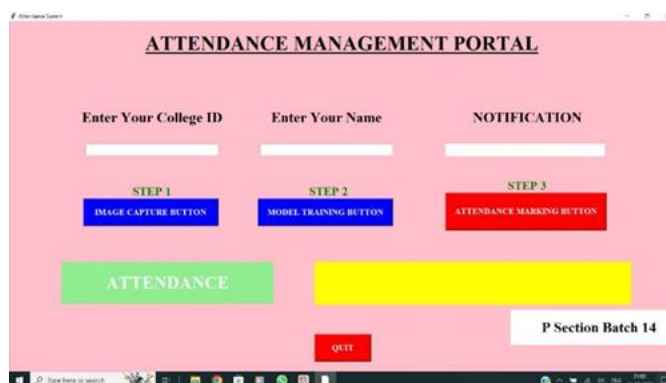


Fig. 2 : GUI developed for the chemistry & chemical engg. dept.

4. Simulation Results

This is the generated GUI that is generated when the program is run. This mainly contains three steps as mentioned in the methodology, the GUI is shown in the Fig. 2 [14].

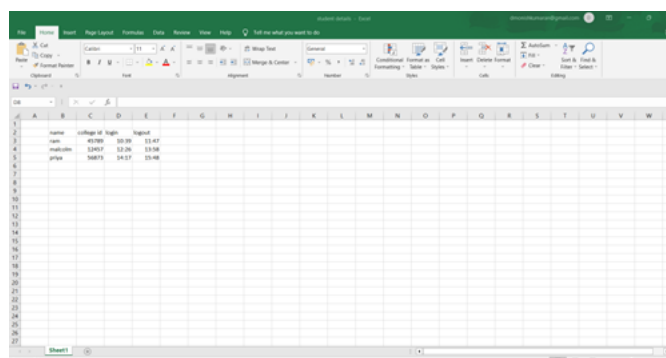


Fig. 3 : Attendance being stored in an excel file for the chemistry & chemical engg. dept.

This is the student details after the attendance has been taken by the trained AI. The student details collected includes the name, student ID, login time and logout time as shown in the Fig. 3 [15].

5. Advantages & Applications

In recent years, the concepts of face recognition and identification have gained significant popularity, particularly in the field of attendance monitoring systems. These technologies have found extensive applications in real-time security surveillance systems, allowing for immediate identification of individuals, as proposed by Shreyak Iyer et.al. [16]. Furthermore, face recognition and identification techniques have played a crucial role in crime detection and forensic analysis. In the United States, the Federal Bureau of Investigation employs facial recognition systems that utilize driver's license data to identify criminals. Similarly, in the UK, artificial intelligence-enabled cameras have been utilized to identify individuals involved in smuggling activities [17]. Face identification methods have also proven instrumental in enhancing the security of online payment systems, ensuring that only the authorized account holder can access their account. Moreover, these technologies offer protection for personal information stored on smartphones, preventing unauthorized access to sensitive data even in cases of theft. Consequently, face recognition has become a highly secure method used for unlocking mobile devices [18].

The utilization of face identification methods in advertising enhances responsiveness by creating more engaging and personalized advertisements for diverse users. In the digital realm, certain branded companies have already implemented automatic face identification techniques to tailor their campaigns according to the audience's interests. By scanning a user's face and analyzing factors such as age and gender, ads can be customized to align with individual preferences [19]. Furthermore, this system goes beyond demographic information and also identifies the expressions of individuals, allowing for an understanding of their emotions, such as sadness, happiness, or disgust. Based on these facial emotional features, ads can be displayed for products that resonate with the user's emotional state, resulting in a more targeted and effective advertising approach [20].

Airport security has significantly enhanced due to the implementation of face identification systems. Airports, being bustling hubs with a higher risk of criminal and terrorist activities, have prompted several airlines to adopt these advanced technologies. These face identification systems are employed to expedite processes such as baggage screening and flight boarding, making them more efficient and time-saving. Additionally, the integration of Artificial Intelligence-based face authentication applications with surveillance cameras has proven instrumental in identifying potential terrorists or individuals engaged in malicious activities. By analyzing both unusual behaviors and facial expressions, these systems aid in recognizing criminals, ensuring the safety and security of airport premises [21].

The integration of Artificial Intelligence-enabled automatic face identification applications has opened new possibilities for diagnosing rare genetic diseases. These technologies have the potential to aid the medical industry in identifying illnesses that result in physical changes in appearance, such as widely spaced eyes or drooping ears. By incorporating face recognition scanning as a standard component of medical check-ups, genetic disorders like Disgorge syndrome, Angelman syndrome, Cornelia de Lange syndrome, and others that manifest gradual alterations in facial expressions can be promptly detected. This advancement paves the way for faster clinical diagnoses and treatment of various genetic diseases, revolutionizing the medical field through the implementation of facial recognition technology [22].

6. Outcome of the AI based attendance system

Enhancement of Security Level: Organizations recognize the need to secure their premises and monitor the entry of employees and individuals. Automatic face detection tools are employed in security surveillance systems to capture unauthorized individuals entering the premises. Instant alerts are generated, notifying the relevant personnel of the unauthorized access [11].

Straightforward Integration Method: The automatic face detection tools seamlessly integrate with the existing authentication code developed by organizations. This simplifies the coding process for accessing organizational data, making the method transparent and efficient [23].

High Accuracy Rates: One of the key advantages of face recognition technology is its high accuracy. The system provides reliable outputs without misunderstandings or errors in face detection. Authorized individuals

are accurately identified, eliminating the need for manual recognition by security personnel outside the organization's premises. By automating the identification process, organizations can achieve optimal accuracy levels while reducing the cost of employing additional staff for 24/7 camera monitoring. Automated face identification ensures highly secure and accurate data [23].

Elimination of Time Fraud: Automatic face recognition methods offer a significant advantage by providing a reliable time tracking and attendance system, effectively preventing time fraud among employees. The system ensures that every individual entering the premises is captured by the face recognition camera and matched with the database. This eliminates the possibility of colleagues favoring each other, as all individuals must pass through the entrance gate for verification. The system is particularly beneficial for employees who need to track hourly work, as their time is accurately recorded from the moment they check in. This eliminates the need for manual identity verification using smart cards and relieves the burden on business leaders to monitor employee attendance. Artificial intelligence-enabled face detection systems effectively combat time fraud and enhance operational efficiency [23].

7. Conclusions and Future Directions

In conclusion, the design and development of an Artificial Intelligence-based attendance monitoring system for chemistry and chemical departments in educational institutions offers several significant benefits.

Firstly, the system provides an automated and efficient method for capturing attendance, eliminating the need for manual processes that are prone to errors and time-consuming. This automation saves valuable time and resources for both students and faculty members.

Secondly, the implementation of Artificial Intelligence enables the system to accurately identify and track student attendance, ensuring a reliable and precise record of attendance data. This eliminates discrepancies and enhances the overall integrity of the attendance monitoring process.

Additionally, the system promotes a higher level of student engagement and accountability. By incorporating AI technologies, such as facial recognition, the system encourages students to actively participate in the attendance process, improving their attendance habits and overall commitment to their studies.

Furthermore, the AI-based attendance monitoring system enhances the security of educational institutions. By accurately identifying individuals, the system helps in preventing unauthorized access and ensures a safer environment for students and staff.

Lastly, the system provides valuable data and insights that can be used for administrative purposes. Attendance reports and analytics generated by the system can assist educational institutions in monitoring attendance trends, identifying areas of improvement, and making data-driven decisions to enhance the overall educational experience.

Overall, the design and development of an Artificial Intelligence-based attendance monitoring system for chemistry and chemical departments in educational institutions offers numerous advantages, including increased efficiency, accuracy, student engagement, security, and valuable data insights. It is a valuable tool for educational institutions seeking to modernize their attendance tracking processes and improve overall operational effectiveness. We are implementing an automated attendance system to reduce errors caused by manual attendance taking. By utilizing cameras to monitor classrooms and assess student engagement, we can mark attendance more accurately. The presence of an Artificial Intelligence-enabled method encourages students to pay attention, while also ensuring that faculty members consistently attend school or college. Unlike the previous practice of signing in manually, the system now automatically marks individuals as absent if they are not present. This encourages regular attendance among all members. The use of artificial intelligence makes the attendance monitoring system secure, accurate, and easy to manage for both students and faculty.

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