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Review on Student Activities Monitoring System

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Abstract: A Student Activities Monitoring System (SAMS) is designed to track and manage the academic and extracurricular activities of students in an educational institution. The system aims to provide a comprehensive overview of student performance, participation, and progress in various activities. It captures data on class attendance, assignment submissions, exam results, and involvement in sports, cultural events, and other co-curricular activities. By automating the tracking process, the system allows for real-time monitoring, ensuring that both students and teachers can access up-to-date information about a student's overall performance and engagement. The system helps teachers and administrators make informed decisions regarding student development, while also allowing students to self-monitor their progress. Additionally, SAMS can generate reports for parents, offering insights into their child's academic and extracurricular growth. By centralizing all student activity data, the system enhances communication, fosters accountability, and supports personalized learning and development.
Keywords: Student Performance, Activity Tracking, Real-time Reporting, Attendance Management. Extracurricular Monitoring etc.

I. INTRODUCTION

The Student Activities Monitoring System (SAMS) is an innovative solution designed to track, manage, and analyze the academic and extracurricular activities of students in an educational environment. The primary goal of this system is to provide a comprehensive and real-time overview of each student's progress, engagement, and performance across various aspects of their academic life.

The system works by collecting data from multiple sources, including class attendance, assignment submissions, exam results, and participation in extracurricular activities such as sports, clubs, and cultural events. This data is then processed and stored in a centralized database, making it accessible to students, teachers, and administrators for monitoring and analysis. By having a digital record of all student activities, SAMS enables better decision-making and improves communication between all stakeholders.

One of the key features of the Student Activities Monitoring System is its ability to automate attendance tracking. Traditional methods of attendance management can be time-consuming and prone to errors, but with SAMS, attendance is recorded in real-time through various methods such as biometric scanning, RFID, or facial recognition technology. This ensures accurate and efficient tracking, reducing the risk of human error.

In addition to academic tracking, SAMS also focuses on monitoring extracurricular activities. It allows teachers and administrators to log and assess student participation in various co-curricular activities, offering a holistic view of student engagement. For example, sports coaches can record the progress of athletes, while cultural coordinators can track the involvement of students in arts and drama. By doing so, SAMS promotes a balanced approach to student development and encourages active participation in both academic and extracurricular spheres.

The system also facilitates communication with students' parents. Real-time notifications can be sent to parents about their child's attendance, performance in exams, participation in activities, and overall progress. This helps keep parents informed and engaged in their child's educational journey, fostering a collaborative approach to student development.

SAMS provides valuable insights through detailed reports and analytics. Teachers and administrators can access reports on student attendance trends, performance analysis, and participation patterns. This data can be used to identify students who may be struggling academically or socially, enabling timely intervention and support.

The Student Activities Monitoring System is a versatile tool that enhances the management and monitoring of students' academic and extracurricular activities. It not only simplifies administrative tasks but also contributes to the overall development of students by encouraging engagement, improving communication, and fostering a holistic learning environment.

II. PROBLEM IDENTIFICATION

The problem identified in traditional student monitoring systems is the lack of real-time tracking and comprehensive management of both academic and extracurricular activities. In conventional methods, attendance tracking is often manual or based on outdated systems, leading to errors, delays, and inefficiencies. Additionally, student participation in extracurricular activities is rarely recorded systematically, resulting in a fragmented view of student engagement and development. Teachers and administrators often face difficulties in accessing accurate and up-to-date information, which can hinder their ability to make informed decisions regarding student progress.

Communication with parents is limited, and parents may not be well-informed about their child's academic performance or involvement in non-academic activities. The absence of a centralized and automated system for monitoring students' overall progress contributes to missed opportunities for timely intervention and support. Therefore, there is a need for a more integrated, real-time solution for monitoring student activities effectively.

III. LITERATURE SURVEY

Recent studies in student monitoring systems highlight the increasing use of technology for real-time tracking of academic and extracurricular activities. Facial recognition and biometric systems have been integrated for efficient attendance management, minimizing errors and time consumption. Systems like RFID and web-based platforms have also been implemented for better data accessibility and communication with parents. Literature suggests that automated systems improve administrative efficiency and offer a holistic view of student engagement. However, challenges remain in ensuring data accuracy, privacy concerns, and the integration of various monitoring aspects, such as academics and extracurricular participation, into a unified platform [4].

Ravi, S., & Kumar, P. (2021), This study discusses the use of facial recognition for real-time student attendance tracking. The authors demonstrate how face recognition improves accuracy and efficiency compared to traditional manual methods. The system reduces administrative workload and enhances the real-time monitoring process, offering insights into its implementation in educational institutions.

Chen, L., & Wang, Y. (2019), The authors propose a web-based system for tracking student activities, integrating attendance, grades, and extracurricular participation into a unified platform. This study highlights the benefits of real-time data processing and centralized management, emphasizing the system's role in improving communication between students, teachers, and parents.

Suresh, R., & Patel, D. (2020), This paper explores the use of biometric technology, specifically fingerprint and facial recognition, in student monitoring systems. The authors examine various case studies where biometric systems were used for academic and extracurricular tracking, concluding that such systems can lead to better engagement and participation but also raise privacy concerns.

Singh, V., & Gupta, M. (2018), This paper discusses the integration of the Internet of Things (IoT) in student monitoring systems, particularly in schools. The authors focus on how IoT devices can track attendance and other student activities in real-time, reducing errors and promoting better interaction with stakeholders.

Jones, A., & Taylor, B. (2022), In this study, the authors analyze how real-time monitoring of student activities impacts overall academic performance. They highlight the role of systems that track both academic and extracurricular activities in improving student development and provide a comprehensive review of the existing systems used in various educational institutions.

Kumar, A., & Singh, R. (2020), This research explores the use of artificial intelligence (AI) in automating student attendance and activity tracking in educational settings. The authors demonstrate how AI can analyze facial recognition data and integrate it with student performance metrics, providing a more accurate and dynamic tracking system. They suggest that AI-based systems can personalize student engagement by offering insights into patterns of academic and extracurricular activity.

Patel, S., & Sharma, P. (2019), This study focuses on the implementation of RFID and IoT technologies in student monitoring systems. The authors outline how RFID tags can be used to track student movement, attendance, and participation in different activities, creating a connected environment where real-time data is accessible by students, teachers, and administrators. The research emphasizes the security and privacy challenges associated with such systems.

Zhang, L., & Wu, T. (2021), This article investigates the use of mobile-based applications for tracking student activities in educational institutions. The authors discuss how smartphones and mobile apps can be leveraged to monitor attendance, assignment submissions, and extracurricular participation, offering both students and faculty real-time access to performance data. The research highlights the flexibility and accessibility provided by mobile-based platforms in modern educational settings.

Sivakumar, A., & Menon, K. (2018), In this paper, the authors explore the integration of biometric and facial recognition technologies to monitor student engagement. They analyze how these technologies can be used to assess not only attendance but also the level of engagement and participation in classroom activities. The study emphasizes the potential of facial recognition in enhancing personalized learning experiences.

Mohammad, R., & Alam, M. (2020), This paper focuses on using data analytics to evaluate student performance and activity levels. The authors discuss the potential of combining various tracking mechanisms, such as face recognition, academic performance data, and extracurricular activity logs, to generate insights that aid in student development. They argue that data analytics can help identify trends and areas for improvement in real-time.

Lee, H., & Lee, J. (2022), This paper presents a cloud-based system designed for student activity monitoring. The authors propose a centralized database where student data is stored and made accessible to various stakeholders, including teachers, parents, and administrators. They highlight how cloud computing facilitates seamless communication and reporting, offering a scalable solution for large institutions.

Tiwari, S., & Kumar, V. (2021), The research highlights the integration of smart technologies, including IoT, AI, and machine learning, in student activity management systems. The authors discuss how these technologies can improve real-time monitoring, enhance engagement tracking, and provide actionable insights to educators and administrators for student performance optimization.

These studies highlight the growing importance of advanced technologies such as AI, facial recognition, IoT, and cloud-based systems in improving student activity tracking and monitoring. Collectively, they suggest that such systems not only streamline administrative processes but also enhance student engagement and performance evaluation. However, challenges such as privacy concerns, data security, and the integration of various technologies remain key areas that require attention in future research and system development.

IV. METHODOLOGY

Facial recognition captures a face image using a computer, then extracts unique data points, creating a sample template. This template is compared against multiple reference templates stored in the system. If the sample matches a reference, the individual gains access or can electronically sign; otherwise, access is denied. This process ensures security by verifying identity based on facial features. The system streamlines authentication, replacing traditional methods like passwords. The accuracy depends on image quality, lighting, and the algorithm's sophistication. Regularly updating reference templates improves performance and accommodates changes in appearance over time. This technology finds applications in security, surveillance, and personalized user experiences.

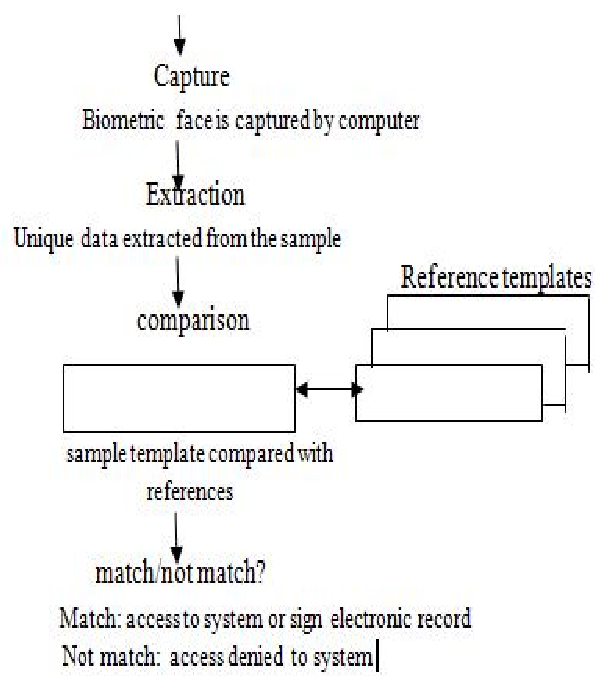

Fig.1 Process of the System

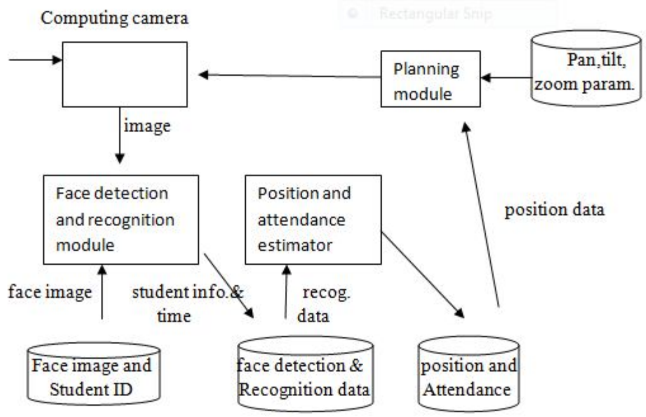

Fig.2 System Architecture

This system uses a computing camera to capture images, sending them to a face detection and recognition module. This module identifies individuals, comparing against stored data (student info & time) to generate recognition data. A planning module, informed by position data from the camera and recognition results, controls the camera's pan, tilt, and zoom. A separate position and attendance estimator uses both recognition and position data to log attendance. Data is stored in databases labeled "Pan, tilt, zoom param.", "Face image and Student ID", "face detection & Recognition data", and "position and Attendance". This setup enables automated attendance tracking and potentially other functions based on facial recognition and camera control.
The algorithm has two stages. First web camera takes image, detect the face and then compare with the stored or reference images. And second stage is if image will matched the attendance of student is marked then SMS is send to the student and their parents. Face detection and recognition module detects faces from the image captured by the web camera, and the image of the face is cropped and stored. The module recognizes the images of student’s face, which have been registered manually with their names and Seat No. in the database.

A. Face Detection

Face detection has been regarded as the most complex and challenging problem in the field of computer vision, due to the large intra-class variations caused by the changes in facial appearance, lighting, and expression.
Such variations result in the face distribution to be highly nonlinear and complex in any space which is linear to the original image space. Moreover, in the applications of real life surveillance and biometric, the camera limitations and pose variations make the distribution of human faces in feature space more dispersed and complicated than that of frontal faces. It further complicates the problem of robust face detection. Face detection techniques have been researched for years and much progress has been proposed in literature.
Most of the face detection methods focus on detecting frontal faces with good lighting conditions. These methods can be categorized into four types: knowledge-based, feature invariant, template matching and appearance-based Any of the methods can involve color segmentation, pattern matching, statistical analysis and complex transforms, where the common goal is classification with least amount of error. Bounds on the classification accuracy change from method to method yet the best techniques are found in areas where the models or rules for classification are dynamic and produced from machine.

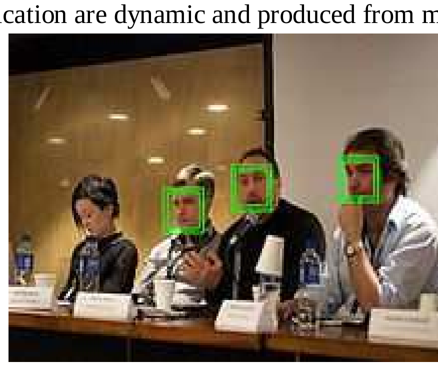

Fig.3 Face Detection

Face detection is a computer technology that determines the locations and sizes of human faces in arbitrary (digital) images. It detects facial features and ignores anything else, such as buildings, trees and bodies. Now we have ability to implement this feature on clientside by using jQuery Plugin which detects faces in pictures and returns theirs Co-ordinate. This Plugin uses an algorithm by Liu Liu.

B. Face Recognition

It includes feature extraction, where important information for discrimination is saved, and the matching, where the recognition result is given with the aid of a face database. Among the different biometric techniques facial recognition may not be the most reliable and efficient but it has several advantages over the others: it is natural, easy to use and does not require aid from the test subject.

Because the face detection and recognition database is a collection of images and automatic face recognition system should work with these images, which can hold large volumes of computer memory that is way it's necessary to investigate and develop a method / tool for optimal using volume of computer memory (that decrease image database volume) and implement quick face detection within database.

There are three main contenders for improving face recognition algorithms: high resolution images, three dimensional (3D) face recognition, and new preprocessing techniques. The FRGC is simultaneously pursuing and will assess the merit of all three techniques. Current face recognition systems are designed to work on relatively small still facial images. The traditional method for measuring the size of a face is the number of pixels between the centers of the eyes. In current images there are 40 to 60 pixels between the centers of the eyes (10,000 to 20,000 pixels on the face). In the FRGC, high resolution images consist of facial images with 250 pixels between the centers of the eyes on average. The FRGC will facilitate the development of new algorithms that take advantage of the additional information inherent in high resolution images. In the last couple years there have been advances in computer graphics and computer vision on modeling lighting and pose changes in facial imagery.

These advances have led to the development of new computer algorithms that can automatically correct for lighting and pose changes in facial imagery. These new algorithms work by preprocessing a facial image to correct for lighting and pose prior to being processed through a face recognition system. The preprocessing portion of the FRGC will measure the impact of new preprocessing algorithms on recognition performance.

The FRGC improved the capabilities of automatic face recognition systems through experimentation with clearly stated goals and challenge problems. Researchers and developers can develop new algorithms and systems that meet the FRGC goals. The development of the new algorithms and systems is facilitated by the FRGC challenge problems.

C. Eigenface

Eigenfaces are a set of Eigen vectors used in the computer vision problem of human face recognition. The approach of using eigenfaces for recognition was developed by Sirovich and Kirby (1987) and used by Matthew Turk and Alex Pentland in face classification. It is considered the first successful example of facial recognition technology. These eigenvectors are derived from the covariance matrix of the probability distribution of the high-dimensional vector space of possible faces of human beings.

1) Eigenface generation

A set of eigenfaces, that are created will appear as light and dark areas that are arranged in a specific pattern. This pattern is how different features of a face are singled out to be evaluated and scored. There will be a pattern to evaluate symmetry, if there is any style of facial hair, where the hairline is, or evaluate the size of the nose or mouth. Other eigenfaces have patterns that are less simple to identify, and the image of the Eigenface may look very little like a face.

2) To create a set of eigenfaces, one must:

- Prepare a training set of face images. The pictures constituting the training set should have been taken under the same lighting conditions, and must be normalized to have the eyes and mouths aligned across all images. They must also be all resample to a common pixel resolution ($r \times c$). Each image is treated as one vector, simply by concatenating the rows of pixels in the original image, resulting in a single row with $r \times c$ elements. For this implementation, it is assumed that all images of the training set are stored in a single matrix T, where each row of the matrix is an image.
- Subtract the mean. The average image a has to be calculated and then subtracted from each original image in T.

- Calculate the eigenvectors and Eigen values of the covariance matrix S. Each eigenvector has the same dimensionality (number of components) as the original images, and thus can itself be seen as an image. The eigenvectors of this covariance matrix are therefore called eigenfaces. They are the directions in which the images differ from the mean image. Usually this will be a computationally expensive step (if at all possible), but the practical applicability of eigenfaces stems from the possibility to compute the eigenvectors of S efficiently, without ever computing S explicitly, as detailed below.
- Choose the principal components. The D x D covariance matrix will result in D eigenvectors, each representing a direction in the $r \times c$ - dimensional image space. The eigenvectors (eigenfaces) with largest associated Eigen value are kept. Facial recognition was the source of motivation behind the creation of eigenfaces. For this use, eigenfaces have advantages over other techniques available, such as the system's speed and efficiency. Using eigenfaces is very fast, and able to functionally operate on lots of faces in very little time.

Unfortunately, this type of facial recognition does have a drawback to consider: trouble recognizing faces when they are viewed with different levels of light or angles. For the system to work well, the faces need to be seen from a frontal view under similar lighting. Face recognition using eigenfaces has bee shown to be quite accurate. By experimenting with the system to test it under variations of certain conditions, the following correct recognitions were found: an average of 96% with light variation, 85% with orientation variation, and 64% with size variation.

To complement eigenfaces, another approach has been developed called Eigen features. This combines facial metrics (measuring distance between facial features) with the Eigenface approach. Another method, which is competing with the Eigenface technique, uses 'fisher faces'. This method for facial recognition is less sensitive to variation in lighting and pose of the face than the method using eigenfaces.

A more modern alternative to eigenfaces and fisher faces is the active appearance model, which decouples the face's shape from its texture: it does an Eigenface decomposition of the face after warping it to mean shape. This allows it to perform better on different projections of the face, and when the face is tilted.

3) *Matching*

The newly acquired facial data is compared to the stored data and (ideally) linked to at least one stored facial representation. It facial recognition system is the Local Feature Analysis (LFA) algorithm. This is the mathematical technique the system uses to encode faces. The system maps the face and creates a faceprint, a unique numerical code for that face. Once the system has stored a faceprint, it can compare it to the thousands or millions of faceprints stored in a database. Each faceprint is stored as an 84-byte file.

The system can match multiple faceprints at a rate of 60 million per minute from memory or 15 million per minute from hard disk. As comparisons are made, the system assigns a value to the comparison using a scale of one to 10. If a score is above a predetermined threshold, a match is declared. The operator then views the two photos that have been declared a match to be certain that the computer is accurate.

Facial recognition, like other forms of biometrics, is considered a technology that will have many uses in the near future. In the next section, we will look how it is being used right now.

V. CONCLUSION

The Student Monitoring System using face recognition technology offers a highly efficient and accurate method for tracking student attendance and activities in educational institutions. By leveraging biometric data, such as facial features, the system automates the attendance process, reducing human error and administrative workload. The integration of continuous observation further enhances the accuracy of attendance estimation, as it allows for real-time monitoring and matching of students' facial images with stored templates. This system can be accessed through a web interface, making it flexible and easy to use across different network areas. Additionally, the system can send notifications to both students and parents, improving communication. The overall benefits include increased efficiency, improved accuracy, and enhanced security. However, challenges related to privacy and system implementation should be addressed for broader adoption. The system represents a modern, technology-driven solution to streamline administrative tasks in educational settings.

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