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STUDENT ATTENDANCE MONITORING AND TIMETABLE GENERATION USING MACHINE LEARNING

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Abstract **- The old method of marking attendance involves the lecturer providing an attendance sheet to the students for their signature or the teacher calling out students' names individually to mark them present. This old manual method is pretty hectic for teachers and students too. Since, after taking the signed attendance sheet from students, teachers have to manually keep track of every student in the logbook which turned out to a lot of time wastage, missing out student's presenters or students giving proxies for the absentees due to which logbooks can be easily manipulated or prone to errors also, wastage of pen and paper. To avoid this problem, we have developed a system which will monitor the attendance of students by identifying their faces via their facial features. While developing this system we have used a web Camera to capture multiple live images of students for face recognition, Viola-Jones Algorithm to achieve face detection which uses Haar Cascade classifier, Pre-processing which converts the image in grayscale, LBPH algorithm and deep learning algorithms like CNN (Convolutional neural networks) for feature extraction and last but not the least the input faces are then matched with the trained images in the database and once they match, the student will be marked as present and the ones who didn't match were marked as absent in the class. Accuracy of 85% and 95% was obtained by testing the model with ten different faces with different facial expressions, angle and lighting conditions for LBPH algorithm and CNN (Convolutional neural networks) respectively. For the Timetable we are using a genetic algorithm.**

Keywords**- Attendance tracking, Facial recognition, LBPH algorithm, Convolutional neural networks (CNN), Face detection, Timetable optimization, Genetic algorithm.**

1. INTRODUCTION

1.1 Project Introduction

Traditionally, marking attendance involves students sitting in a classroom and the teacher calling out the names of the students individually to mark their attendance. The attendance is usually marked with a pen and then stored in a logbook. The traditional attendance system has a lot of disadvantages: It is hard to keep records, it is time-consuming, error prone, and it wastes resources. Another system that is around is a biometrics system. A biometric system has three phases: registration phase, storage phase, and recognition phase. The registration phase involves capturing specific traits. Face recognition has numerous advantages over biometrics, as they require less action from users and multiple attendances can be marked at a time. The main goal of the paper is to implement an attendance system using facial recognition. Face recognition involves image capture through a web camera, face detection using the Vivian Jones algorithm, which uses a cascade classifier, pre-processing, storing the image in the database, feature extraction through LBPH algorithm, and CNN (Convolutional neural networks), then comparing it with the input given by the user, and if it matches, attendance will be marked; if it doesn't, attendance wouldn't be marked.ence, our proposed system aims to mark attendance automatically by means of face recognition. The teacher can monitor attendance easily.

The process of manually creating timetables for educational institutions is often complex, time-consuming, and prone to inefficiencies. This project introduces an automated timetable generation system designed to address these challenges. The system will leverage algorithms such as genetic, heuristic, and resource scheduling to produce optimized timetables that consider factors like teacher workload, subject priorities, and resource availability. This solution promises to streamline the timetable creation process, saving institutions valuable time and ensuring the effective allocation of resources. Timetable generation in educational institutions plays a pivotal role in ensuring the smooth functioning of academic activities. However, the manual creation of timetables is often a complex, time-consuming, and error-prone process that can lead to inefficiencies and conflicts. To address these challenges, automated timetable generation systems have emerged as innovative solutions that leverage advanced algorithms to streamline the scheduling process. Automated timetable generation systems utilize sophisticated algorithms such as genetic algorithms, heuristics, and resource scheduling techniques to create optimized schedules for classes, teachers, and resources. These systems aim to consider various essential factors like teacher workload, subject priorities, and resource availability to enhance efficiency and resource allocation within educational institutions.

The primary objective of implementing an automated timetable generation system is to alleviate the burdens associated with manual timetable creation. By automating the scheduling process, educational institutions can save time, reduce errors, and optimize the allocation of resources. These systems offer flexibility in adjusting schedules according to specific requirements while ensuring that constraints such as avoiding conflicts and maximizing resource utilization are met. In essence, automated timetable generation systems represent a significant advancement in educational management by providing a more efficient and effective way to create schedules that meet the diverse needs of students, teachers, and administrators. By harnessing the power of advanced algorithms and intelligent scheduling techniques, these systems contribute to enhancing productivity, reducing workload for faculty members, and improving overall operational efficiency within educational settings. Complex algorithms, such genetic algorithms, are essential for timetable optimization because they examine a large number of possible configurations and identify the most effective one based on predetermined goals and limitations. Genetic algorithms, in contrast to simpler techniques, take into account several variables at once, simulating the process of natural selection to iteratively progress towards the optimal solution. This method enables a thorough investigation of the solution space, which eventually produces better schedule results.

1.2 LITERATURE SURVEY

The paper likely explores the development and implementation of automated attendance systems utilizing face recognition technology, particularly focusing on the utilization of K-Means algorithms for this purpose. Face recognition is a branch of computer vision that involves identifying or verifying individuals based on facial features. K-Means is a popular clustering algorithm used in machine learning for partitioning data into distinct clusters. The authors likely discuss the methodology, algorithms, and techniques employed in designing and implementing the automated attendance system. They may describe the process of collecting facial data, pre-processing images, training the K-Means clustering model, and recognizing faces in real-time scenarios. Additionally, the paper may discuss the system's accuracy, efficiency, and any challenges encountered during development and deployment. Furthermore, the paper may discuss the potential applications and implications of automated attendance systems in various fields, such as education, workplaces, or security. It may also address ethical considerations regarding the use of facial recognition technology and privacy concerns associated with biometric data collection. This paper likely contributes to the advancement of automated attendance systems using face recognition technology and provides valuable insights into the application of K-Means algorithms in this domain. It may serve as a reference for researchers, practitioners, and policymakers interested in biometric authentication systems and machine learning applications. This paper likely presents a novel approach to implementing a smart attendance system leveraging face recognition technology and utilizing OpenCV (Open-Source Computer Vision Library). Face recognition is a biometric technology that identifies or verifies individuals based on their facial features. OpenCV is a widely-used open-source library for computer vision tasks, making it suitable for developing such systems. The authors likely discuss the design and implementation of the smart attendance system, including the process of capturing and processing facial images, training the face recognition model using OpenCV, and integrating the system into an attendance management framework. They may also detail the algorithms and techniques used for face detection, feature extraction, and matching. Furthermore, the paper may discuss the system's

performance metrics, such as accuracy, speed, and scalability, as well as any challenges encountered during development and deployment. Additionally, the authors may explore the potential applications and implications of the smart attendance system in various contexts, such as education, workplaces, or security.This paper likely contributes to the advancement of attendance management systems using face recognition technology and provides valuable insights into the practical implementation of such systems using OpenCV. It may serve as a reference for researchers, practitioners, and developers interested in biometric authentication systems, computer vision, and artificial intelligence applications. The paper likely introduces a novel approach to enhancing attendance management systems through the incorporation of two-level authentication mechanisms leveraging deep learning techniques. Attendance management systems are used to track and manage the presence of individuals, typically in educational or organizational settings. Deep learning techniques involve training neural networks with large datasets to learn complex patterns and representations. The authors may discuss the design and implementation of the two-level authentication system, which likely involves a combination of biometric and behavioral authentication methods. Biometric authentication utilizes unique physical characteristics such as facial features, fingerprints, or iris patterns, while behavioral authentication analyzes patterns of behavior such as typing dynamics or mouse movements. Deep learning techniques are likely employed to develop robust and accurate models for biometric and behavioral authentication. These techniques may include convolutional neural networks (CNNs) for image-based authentication, recurrent neural networks (RNNs) for sequence-based authentication, or hybrid architectures combining multiple neural network architectures.

3. EXISTING SYSTEM

Attendance Method: Manual roll calls or paper-based sign-in sheets are likely used. The Student Attendance Management System module eliminates the need for pen and paper attendance recording. It lets teachers record students' attendance with one click from any mobile device or desktop computer. The Attendance and leave management mobile application module assist in tracking late-comers and early departures. Parents can view their children's leave requests and obtain complete attendance reports by accessing a report from their home using their mobile device or internet connection. The system enables hassle-free attendance and time tracking on-premise software only, allowing parents to focus on allowing their children to study and impart knowledge. Detention Prediction: No formal prediction system exists. Detention decisions are likely made reactively based on a set attendance threshold. Detention is a consequence in which students are required to remain in a presumably undesirable place for a specified amount of time outside of college hours. Typically, detentions are served after college. Instead of going home at the end of the day, the student reports to a designated classroom where he or she must sit at a desk for an amount of time generally ranging from 10 minutes to two hours, with an hour or less being typical. Communication: Students might receive notifications about poor attendance only after a significant period or through formal meetings with teachers or advisors.

3.1 DISADVANTAGES

Time-consuming: Manual attendance methods consume valuable instructional time. Prone to Errors: Paper records are susceptible to miscounts, lost records, or even deliberate manipulation. Lack of Insight: The system offers limited understanding of attendance patterns, making it difficult to identify at-risk students early. Delayed Feedback: Students may be unaware of their attendance standing until it's too late for them to improve.

4. PROPOSED SYSTEM

This face recognition system consists mainly of two parts. The first section is while enrolling a student into a course his/her face will be captured and stored in the database. In the second section, while a student is entering the class his/her face will be captured through a camera in the classroom and then recognized, and accordingly, the student will be marked absent or present. Face recognition system (e.gWeb camera) for quick and accurate attendance tracking. For Detention prediction, we use a Machine learning model that analyzes attendance data to predict the risk of detention. Automated SMS alerts are sent directly to students when the model flags them as potentially at-risk. It generates a Time Table automatically.

4.1 ADVANTAGES

Facial attendance saves time and ensures data accuracy. The ML model enables early detection of at-risk students, facilitating timely intervention. Instant SMS alerts allow students to know their attendance status and take necessary steps to improve it. The system provides educators with

valuable data on attendance patterns, helping them tailor support strategies. Integrated timetable generator to help teachers to generate classes.

5. SYSTEM STUDY

The system study for the project involves a comprehensive analysis of the existing manual attendance marking process and the proposed automated facial recognition system. The manual method, characterized by the use of attendance sheets and verbal calling of names, is identified as inefficient and prone to errors due to time consumption, potential for manipulation, and reliance on physical resources like pen and paper. To address these shortcomings, the proposed system utilizes advanced technologies such as facial recognition, employing a web camera to capture live images of students. The Viola-Jones algorithm with Haar Cascade classifier is employed for face detection, followed by pre-processing techniques to enhance image quality. Feature extraction is facilitated through algorithms like Local Binary Patterns Histograms (LBPH) and Convolutional Neural Networks (CNN), enhancing accuracy in facial recognition under various conditions including different facial expressions, angles, and lighting. The system achieves testing accuracies of 85% and 95% for LBPH and CNN algorithms respectively, ensuring robust performance. Additionally, the integration of a genetic algorithm for timetable management enhances efficiency in scheduling. Overall, the system study highlights the transition from manual to automated attendance marking, leveraging state-of-the-art technologies to streamline the process, minimize errors, and optimize resource utilization.

6.REQUIREMENTS SPECIFICATIONS

3.1 Software:

Chrome or Edge or Firefox
Programming language
PHP 8.0.2 or greater, Python 10
MySQL 8.0
Open CV, NumPy, Pandas
Visual Studio Code
Windows OS (Minimum windows 10)

3.2 Hardware:

Processor
Dual-core or higher
RAM - 2GB or more
Storage - At least 100GB
Display - Minimum 1024 x 728 resolution
Network Integrated Ethernet or Wi-Fi
Mouse and Keyboard
Standard peripherals
Web camera

4 TECHNOLOGIES USED

4.1 PYTHON

Python is a high-level, versatile programming language known for its simplicity, readability, and flexibility. Created by Guido van Rossum and first released in 1991, Python has grown to become one of the most popular languages worldwide, powering a vast array of applications across various domains, from web development and data science to artificial intelligence and automation.

4.2 MY SQL

MySQL is an open-source relational database management system (RDBMS) that is widely used for managing structured data. It is developed, distributed, and supported by Oracle Corporation. MySQL uses Structured Query Language (SQL) for managing, manipulating, and querying data within databases.

5. SYSTEM DESIGN

5.1 Face Detection

The proposed attendance monitoring system leverages cutting-edge technologies in computer vision and deep learning to automate the attendance-taking process, eliminating the inefficiencies and errors associated with traditional manual methods. The system utilizes a web camera to capture live images of students in the classroom, enabling real-time face recognition. The first step in the system design involves face detection, achieved through the Viola-Jones algorithm utilizing Haar Cascade classifiers. This algorithm efficiently locates faces within the captured images, providing the foundation for subsequent processing. Following detection, the images are pre-processed to convert them to grayscale, reducing computational complexity and enhancing the efficiency of feature extraction. Feature extraction plays a crucial role in the system's accuracy and reliability. To achieve this, the Local Binary Patterns Histogram (LBPH) algorithm is employed, allowing for the extraction of discriminative facial features. Additionally, deep learning algorithms such as Convolutional Neural Networks (CNNs) are utilized for further feature extraction, enabling the system to capture intricate facial characteristics with high precision.

5.2 Face Recognition

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The extracted features are then compared against a database of trained images, representing enrolled students. This comparison is performed using sophisticated matching techniques, enabling the system to identify and authenticate students based on their facial features. Upon a successful match, the student is marked as present, while unmatched individuals are flagged as absent.

To ensure robust performance across diverse scenarios, the system undergoes rigorous testing with a variety of facial expressions, angles, and lighting conditions. This testing process evaluates the accuracy and reliability of both the LBPH algorithm and CNNs, resulting in reported accuracies of 85% and 95%, respectively.

The system's design seamlessly integrates state-of-the-art face recognition technologies, offering a reliable, efficient, and automated solution for attendance monitoring in educational settings. By leveraging the power of computer vision and deep learning, the system addresses the shortcomings of manual attendance-taking methods, paving the way for enhanced accuracy, efficiency, and convenience in classroom management.

5.3 MODULES

Face Recognition Attendance

Captures student images through a webcam, detects faces, and matches them against a stored database of student facial data to record attendance.

Data Collection Module

This module is responsible for collecting facial images of students using a webcam. It captures multiple images of students in real-time, ensuring variability in facial expressions, angles, and lighting conditions for robust training of the recognition model.

Face Detection Module

Utilizing the Viola-Jones algorithm with Haar Cascade classifier, this module detects faces within the captured images. It identifies facial regions and extracts them for further processing, ensuring accurate localization of faces despite variations in image conditions.

Preprocessing Module

The preprocessing module prepares the detected facial images for feature extraction and recognition. It typically includes tasks such as resizing images, converting them to grayscale to reduce computational complexity, and possibly applying techniques like histogram equalization for improving image quality.

Feature Extraction Module: This module extracts discriminative features from the preprocessed facial images. For example, the Local Binary Patterns Histogram (LBPH) algorithm can be employed to capture texture patterns in the facial regions. Feature extraction is crucial for encoding the essential characteristics of each face for recognition.

SMS Alert System

Sends automated SMS alerts to students when a student's attendance falls below a threshold or the prediction model flags them as at-risk. Integrate SMS functionality into the system.

Timetable Generator

It allows teachers to input constraints (subject preferences and class availability) and generates a feasible timetable Modeling the timetable problem and finding solutions.A simple web-based interface for teachers to interact with.

Centralized Web Application

Brings all the modules together in a unified web interface for easy administration. The web app would display attendance statistics, detention prediction results, and provide teachers with access to the timetable generator.

6 SCREENSHOTS

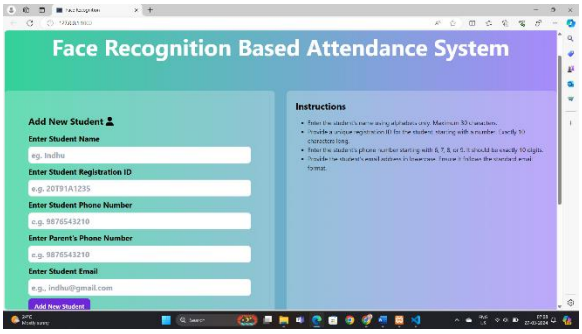

Fig1.face recognition

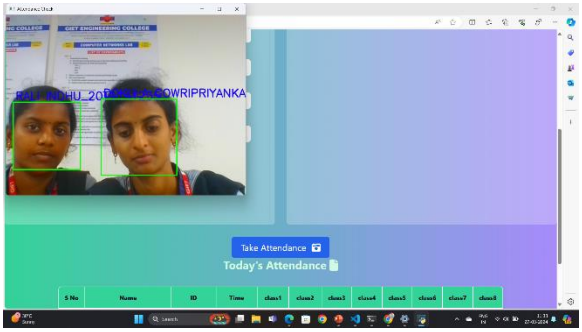

Fig2. Taking Attendance

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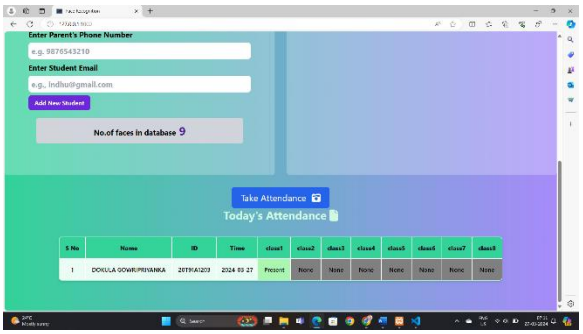

Fig3. Attendance List

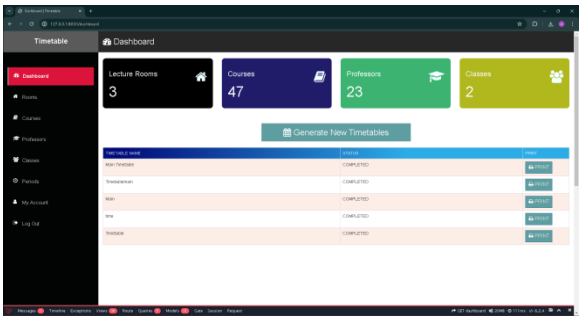

Fig4. Dashboard

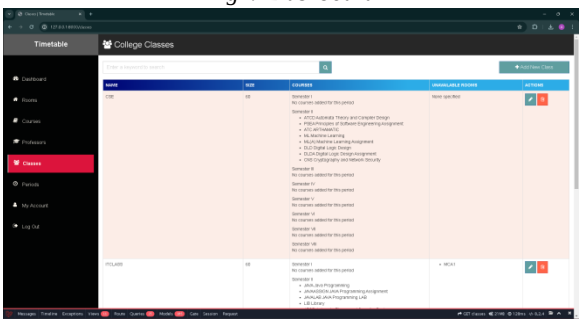

Fig5. Class Screen

Fig6 - Timetable

7 CONCLUSION

Integrating the attendance data with Learning Management Systems (LMS) presents a significant advancement in insights into student engagement. By connecting attendance records with learning platforms, instructors can track attendance patterns and identify students who may need additional support or intervention. This integration facilitates a more holistic approach to student monitoring and enables educators to tailor their teaching strategies to meet the individual needs of students. Expanding the machine learning model to incorporate additional behavioral factors beyond attendance could unlock even deeper insights into student success patterns. By analyzing various behavioral metrics such as participation, interaction with course materials, and communication patterns, educators can gain a more nuanced understanding of student behavior and learning outcomes. Personalized support is another key benefit of the proposed attendance monitoring system. By leveraging attendance data and other relevant information, the system can generate tailored recommendations and resources for students, helping them

stay on track and succeed academically. This personalized approach to student support enhances student engagement and contributes to overall academic success. Furthermore, raising awareness about the importance of good attendance is crucial for fostering a culture of academic achievement within the college community. By promoting the value of regular attendance and its impact on student success, college staff and community members can create a supportive environment where students are motivated to attend classes regularly and actively participate in their education. This collaborative effort builds a sense of community-wide expectation around the importance of attendance and sets students up for success in college and beyond.

8 FUTURE ENHANCEMENT

The proposed attendance monitoring system leveraging facial recognition technology presents a promising future scope for further development and enhancement. Firstly, advancements in deep learning algorithms and computer vision techniques can lead to improvements in accuracy and efficiency. Fine-tuning existing models or exploring newer architectures can potentially increase the system's capability to handle diverse facial expressions, angles, and lighting conditions with even greater accuracy. Moreover, the integration of additional biometric modalities such as voice recognition or fingerprint scanning could further enhance the security and reliability of the system. By combining multiple biometric identifiers, the system can offer a more robust authentication mechanism, reducing the likelihood of false positives or unauthorized access. Furthermore, extending the system beyond traditional classroom settings opens up new avenues for application. For instance, implementing the system in workplaces, conferences, or training programs can streamline attendance management and enhance security protocols. Additionally, exploring real-time monitoring capabilities can provide instant insights into attendance patterns, enabling proactive interventions to improve student engagement and retention. Additionally, the system's potential for integration with learning management systems (LMS) and student information systems (SIS) presents opportunities for seamless data exchange and holistic student monitoring. By connecting attendance data with academic performance metrics and behavioral indicators, educators can gain deeper insights into student learning outcomes and tailor interventions to support individual student needs effectively. The future scope for the proposed attendance monitoring system is vast, with opportunities for continuous improvement, expansion into new domains, and integration with existing educational and organizational systems. Through ongoing research and development efforts, the system has the potential to revolutionize attendance management and enhance overall educational outcomes.

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