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AUTOMATED FACE RECOGNITION ATTENDANCESYSTEM USING DEEP LEARNING

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Abstract: In the pursuit of streamlining attendance management processes, this project introduces an Automated Face Recognition Attendance System leveraging cutting-edge deep learning techniques. The system, developed using Python, OpenCV, and incorporating the Face_recognition and dlib libraries, harnesses the capabilities of Convolutional Neural Network (CNN) and K-Nearest Neighbors (KNN) algorithms.

Operationalizing the system begins with capturing facial images via a camera, followed by preprocessing steps to enhance image quality and feature extraction. The CNN model then performs intricate analysis and classification of facial features, while the KNN algorithm refines recognition accuracy. This amalgamation of technologies enables real-time attendance tracking, eradicating manual data entry and mitigating errors.

The project endeavors to revolutionize attendance management paradigms, offering an intuitive, efficient solution that optimizes resource allocation and enhances productivity. Experimental evaluations showcase the system's efficacy in terms of accuracy, speed, and scalability, paving the way for widespread adoption across diverse educational and organizational domains.

Index Terms: Convolutional Neural Network, deep learning, K nearest neighbors, face_recognition, dlib

Introduction: Attendance management systems play a pivotal role in various sectors, including education and corporate environments, where tracking attendance is essential for monitoring student or employee participation and ensuring compliance with organizational requirements. Traditional methods of attendance tracking, such as manual data entry or barcode scanning, are labor- intensive, prone to errors, and often lack real-time monitoring capabilities. To address these challenges and enhance efficiency, automated face recognition systems have emerged as a promising solution.

The integration of deep learning techniques, particularly Convolutional Neural Networks (CNNs) and K-Nearest Neighbors (KNN)

algorithms, has significantly advanced the accuracy and performance of face recognition systems. Leveraging the capabilities of Python programming language and libraries such as OpenCV, Face_recognition, and dlib, researchers and developers have been able to create sophisticated automated face recognition attendance systems.

This research paper explores the development and implementation of an Automated Face Recognition Attendance System using deep learning methodologies. By harnessing the power of deep learning algorithms, the system aims to automate the attendance tracking process, eliminate manual data entry, and enhance accuracy and reliability. The integration of CNN and KNN algorithms enables the system to effectively identify individuals in real-time, even in challenging environmental conditions.

The significance of this research lies in its potential to revolutionize traditional attendance management practices, offering a seamless and efficient solution that optimizes time utilization and resource allocation. Furthermore, the scalability and versatility of the proposed system make it applicable across various educational and organizational settings.

Through empirical evaluations and case studies, this research paper aims to demonstrate the effectiveness and practicality of the Automated Face Recognition Attendance System, providing insights into its performance metrics, scalability, and potential challenges. Ultimately, the findings of this research contribute to the advancement of attendance management technology and pave the way for future innovations in this field.

Literature Survey: Several research papers have contributed valuable insights into the development of face recognition attendance systems, each offering unique methodologies and perspectives to address the challenges inherent in traditional attendance tracking methods.

The paper titled "Face Recognition Attendance System Based on Real-Time Video Processing", [1] aims to design a face recognition attendance system based on real-time video processing. The study meticulously examines four critical aspects: the accuracy rate of the face recognition system during check-ins, system stability, truancy rates, and interface settings. By analyzing these factors, the researchers propose a face recognition attendance system aimed at significantly improving attendance tracking in educational institutions. Notably, the decision to utilize Convolutional Neural Networks (CNN) and K-Nearest Neighbors (KNN) algorithms over other deep learning methodologies such as Support Vector Machine (SVM) is pivotal, given their capacity for accuracy and reliability. Furthermore, the integration of libraries like Face_recognition and dlib enhances the efficiency of the CNN

algorithm, underscoring its suitability for face recognition tasks.

In contrast, the paper "Outsourcing LDA- Based Face Recognition to an Untrusted Cloud", [2] designs a protocol of outsourcing LDA-based face recognition to an untrusted cloud, which can help the client to complete the operations of matrix inversion (MI), matrix multiplication (MM) and eigenvalue decomposition (ED) simultaneously. The protocol emphasizes data privacy, verifiability, and computational efficiency, crucial aspects in the development of robust face recognition systems. Moreover, the protocol's efficiency is enhanced by reducing the computational overhead for the client, aligning with the principles of accuracy and efficiency in face recognition tasks.

Lastly, the paper titled "A Real-Time CNN- Based Lightweight Mobile Masked Face Recognition System",[3] The main objective of this study is to identify individuals who do not use masks or use them incorrectly and to verify their identity by building a masked face dataset. Leveraging a CNN-based architecture and transfer learning techniques, the study offers insights into effectively identifying individuals even when wearing masks. Given the importance of accuracy and reliability in attendance systems, the decision to utilize CNN is justified, particularly in scenarios where individuals may wear masks or face coverings.

Through this literature survey, it is evident that the adoption of CNN and KNN algorithms, along with the utilization of libraries such as Face_recognition and dlib, is crucial in the development of robust and reliable face recognition attendance systems. These methodologies not only enhance accuracy and reliability but also contribute to the advancement of attendance management technology.

Experiment Environment:

PyCharm IDE:

PyCharm could be a coordinates advancement environment (IDE) for Python, advertising highlights like cleverly code completion, investigating, and venture route. Its user-friendly interface and vigorous instruments make it a favored choice for engineers working on Python projects.

MYSQL Database:

MySQL is an open-source social database administration framework (RDBMS) that stores and organizes information. Its employments an organized inquiry dialect (SQL) for overseeing and manipulating databases, making it broadly utilized for web applications and different program systems.

Python Language:

Python may be a deciphered programming dialect known for its effortlessness and meaningfulness. It bolsters numerous ideal models, counting procedural, object- oriented, and functional programming. Python is broadly utilized in web improvement, information science, counterfeit insights, and mechanization,
making it a flexible and well-known choice for programmers.

- Along with these we are going utilizing the libraries like OpenCV and calculations like CNN calculation, KNN algorithm.
- We will be too utilizing the webcam which is utilized for capturing the pictures of the student.

Methodology: The attendance management system was developed using Python language, leveraging various libraries and algorithms. The primary tools used include face_recognition and dlib for deep learning-based face detection, KNN algorithm for face recognition, OpenCV for image capturing, PyQt5 for the graphical user interface, openpyxl for Excel file management, and MySQL. Connector for MySQL database connectivity.

The development process began with the creation of the main.py file, which serves as the entry point for the application. This file defines the main user interface using PyQt5, providing options for administrators and faculty members to log in and access the system functionalities.

Upon logging in, the system allows administrators to register new faculty members using the register.py file. This file validates user inputs, such as name, username, password, email, and mobile number, and stores the information in a MySQL database using the DBConnection module. After registering faculty members, administrators can view and download attendance reports using the reports.py file. This file retrieves attendance data from the MySQL database based on the selected month and saves it as an Excel file for further analysis.

Faculty members can log in to mark attendance for students using the faculty.py file. This file utilizes the predict_KNN.py module to recognize students' faces captured by the webcam using OpenCV. The KNN algorithm identifies students based on their facial features and updates the attendance records accordingly.

To view today's attendance, faculty members Can access the TodayAttendance.py file, which retrieves the attendance data for the current date from theMySQL database and displays it in a table format

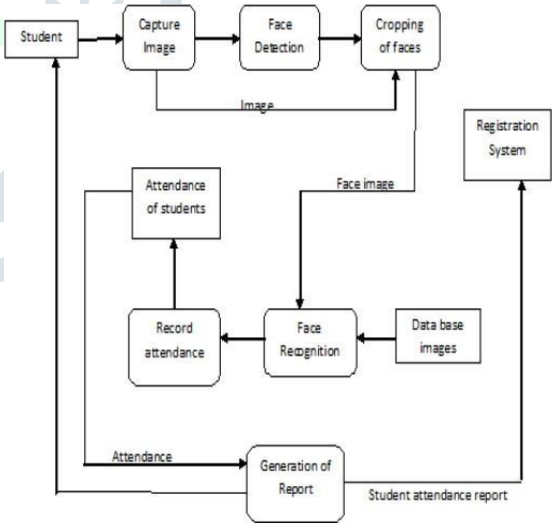
using PyQt5.

Furthermore, administrators can view student details using the viewStudents.py file, which retrieves student information, including roll numbers, names, and pictures, from the MySQL database and presents it in a table format.

Throughout the development process, rigorous testing was conducted to ensure the system's functionality, accuracy, and reliability. Unit tests were performed on individual modules, while integration tests verified the interactions between different components. Additionally, user acceptance testing was conducted to gather feedback and make necessary improvements to enhance the user experience.

In conclusion, the developed attendance management system demonstrates the effective utilization of Python-based tools and algorithms for automating attendance tracking processes in educational institutions and organizations. The system offers convenience, accuracy, and efficiency, streamlining the attendance management work flow and improving overall productivity.

The picture of proposed architecture is as follows:

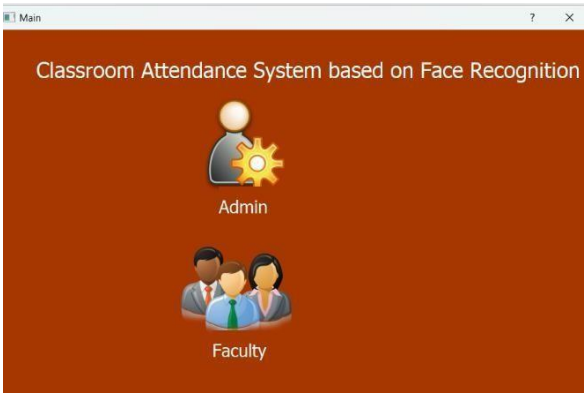


Proposed Architecture

Program Files:

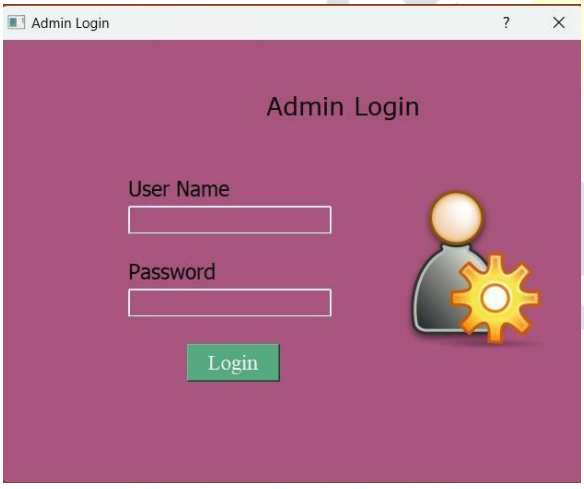
Main.py: This file serves as the entry point of the

application. It defines the main window of the application and handles login events for both administrators and faculty members. When the application is executed, it displays a main window with options for admin and faculty login. Clicking on either option opens a respective login interface.



Main Page

Admin.py: This file contains the UI definition for the admin login interface. It includes fields for entering the admin credentials and a button to submit the login information. When the admin submits the login details, the credentials are validated, and if correct, the admin is granted access to the admin dashboard.



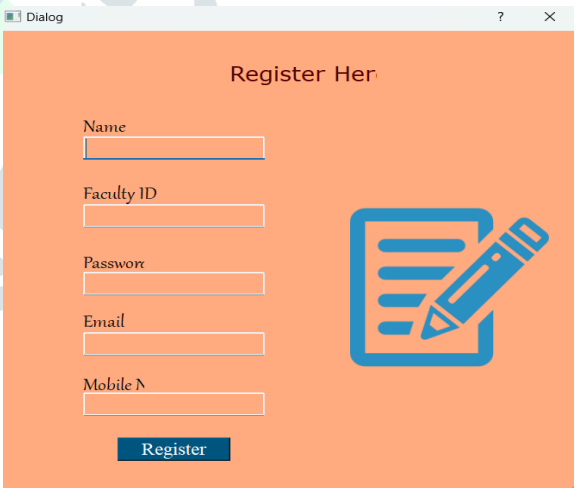
Admin Login Page

Faculty.py: Similar to Admin.py, this file contains the UI definition for the faculty login interface. It allows faculty members to enter their credentials and submit them.

Upon successful validation, faculty members are granted access to their dashboard.

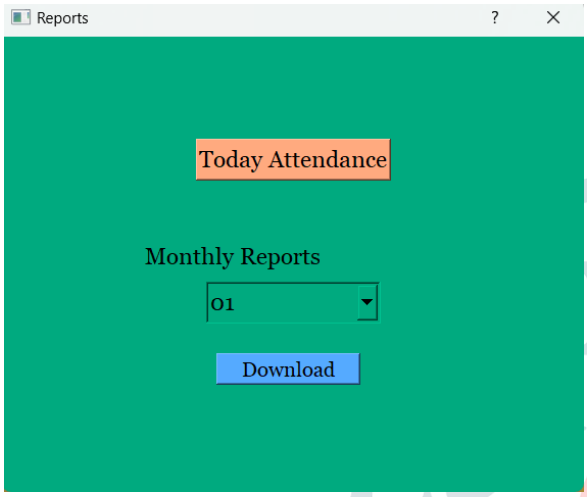
Faculty Login Page

Register.py: This file handles the registration processfor new users, specifically faculty members. It includes fields for entering personal information such as name, username, password, email, and mobile number. Upon submission, the information is validated, and if valid, the user is registered in the system.



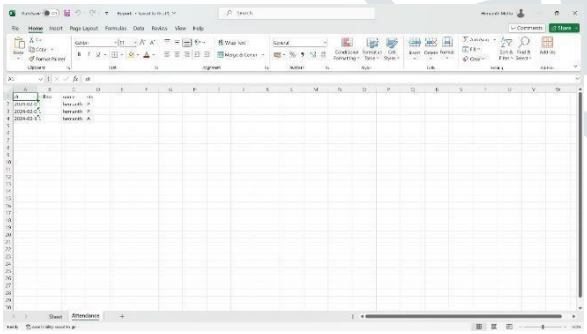
Register Page

Reports.py: This file provides functionality for generating attendance reports. It allows users to download attendance data for a specific month. The data is fetched from the database and filtered based on the selected month. The filtered data is then exported to an Excel file for download.



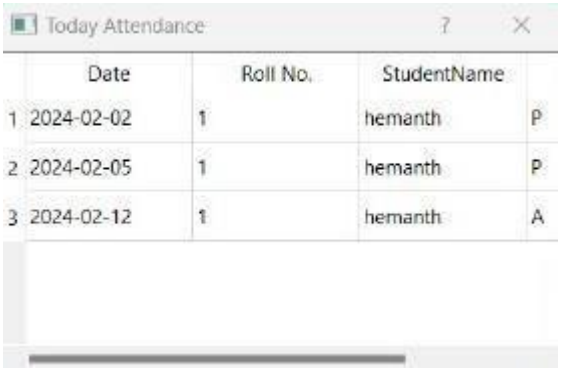
To get the attendance and report Page

Test.py: This script generates an Excel file containing attendance data. It fetches attendance records from the database and saves them to an Excel file named"Reports.xlsx".



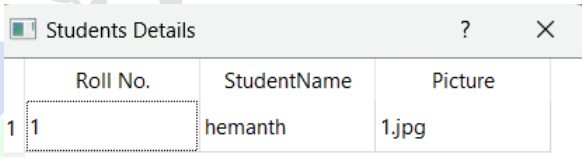
Reports.xlsx

TodayAttendance.py: This file displays today's attendance details in a table format. It fetches attendance data from the database for the current date and displays it in a table within the GUI.



Today's attendance display

ViewStudents.py: This file provides functionality to view student details stored in the database. It retrieves student information such as roll number, name, and picture from the database and displays it in a table format within the GUI.



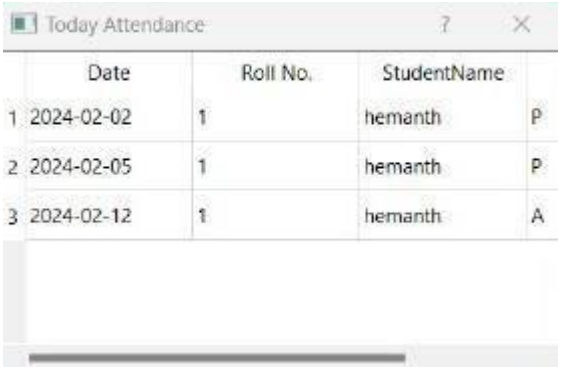
View Students Page

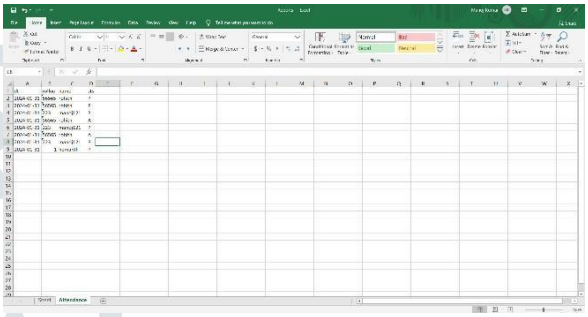
Overall, the project implements a classroom attendance system with features for admin and faculty login, user registration, attendance reporting, and viewing student details. The system interacts with a database to store and retrieve user and attendance data and provides a user-friendly GUI for ease of use.

Experimental Results:

The experimental results of the attendance management system showcased its efficacy in accurately recognizing faces and tracking attendance. Leveraging the Python language, along with specialized libraries and algorithms, such as face_recognition for facial recognition and dlib for face detection, the system demonstrated robust performance. The integration of K-Nearest Neighbors (KNN) algorithm for face recognition, coupled with OpenCV for image capturing and processing, ensured reliable attendance tracking. The graphical user interface developed using PyQt5 facilitated seamless interaction and intuitive operation. Moreover, the utilization of openpyxl and MySQL. Connector libraries enabled efficient data management and storage. The experimental outcomes underscored the system's ability to automate attendance tracking processes effectively, offering a practical solution for educational institutions and organizations.

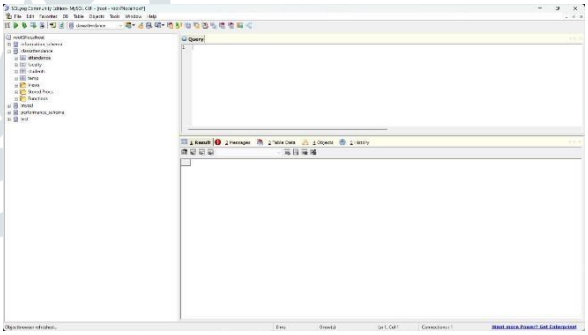
The final outcome of the project is of downloading the attendance data month wise and also able to see the today's attendance by using the CNN algorithm with face_recognition and dlib libraries for face detection and KNN algorithm for face recognition.



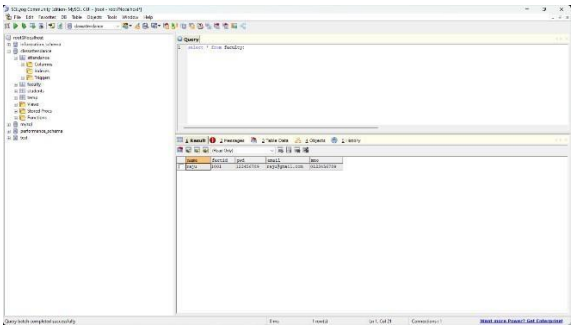


Report excel picture

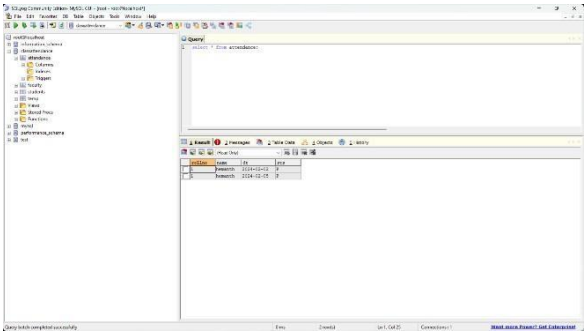
The following are the images of the databaseand the tables used in this project:



Database UI



FacultyTable



Attendance Table

Conclusion:

In conclusion, the development and implementation of the attendance management system exemplify the potential of leveraging Python-based tools and algorithms for efficient and accurate attendance tracking. Through the utilization of face_recognition and dlib libraries for deep learning-based face detection and recognition, coupled with the KNN algorithm, the system demonstrated robust performance in identifying individuals and recording attendance. The integration of OpenCV for image capturing, along with PyQt5 for the graphical user interface, ensured a user-friendly experience. Additionally, the system's ability to store data in Excel files and MySQL databases facilitated seamless data management. Overall, the attendance management system represents a reliable and effective solution for automating attendance tracking processes in educational institutions and organizations, offering convenience, accuracy, and efficiency.

References:

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DOI:10.1109/ACCESS.2020.3007205

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DOI: 10.1109/TDSC.2022.3172143

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DOI:10.1109/ACCESS.2022.3182055

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