PROJECT WORK

ON

"Face Recognition Based Attendance Monitoring System"

FOR

THE AWARD OF BACHELOR OF TECHNOLOGY

By

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AT

DEFENCE ELECTRONICS RESEARCH LABORATORY, HYDERABAD-05

Under the esteemed guidance of

EXTERNAL GUIDE
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This is to certify that YELLU SIRI **(**20B81A05A6**) of** **CVR College Of Engineering** has undergone project training from 09-01-2024 to 30-04-2024 in the Defence Electronics Research Laboratory, Hyderabad-05. The project "**Face Recognition Based Attendance Monitoring System**" is a record of the bonafide work undertaken by him towards partial fulfillment of the requirements for the award of the Degree / Masters Degree of B.Tech. He has completed the assigned task satisfactorily.

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DECLARATION

I hereby declare that the results embodied in this dissertation titled **"Face Recognition Based Attendance Monitoring System"** is carried out by me during the year 2024 in partial fulfillment of the award of B.Tech (Computer Science and Engineering) from **"CVR College Of Engineering".** I have not submitted the same to any other university or organization for the award of any other degree.

YELLU SIRI

ACKNOWLEDGEMENT

DLRL PROFILE

DEFENCE ELECTRONICS RESEARCH LABORATORY (D.L.R.L) was established in the year 1962 under the aegis of Defence Research and Development Organization (DRDO), Ministry of Defence, to meet the current and future needs of tri services Army, Navy and Air force equipping them with Electronics Warfare Systems.

DLRL has been entrusted with the primary responsibility of the design and development of Electronic Warfare Systems covering both Communication and RADAR Frequency bands.

DLRL consists of large number of dedicated technical and scientific manpower adequately supported by sophisticated hardware and software development facilities. Computers and dedicated Workstations are extensively used for, design and development of sub-systems. Main software required for various types of applications is developed in-house. The quality assurance group is responsible for quality assurance of software developed for Electronic Warfare Systems.

DLRL has number of supporting and technology groups to help the completion of the projects on time and to achieve a quality product. Some of the supporting and technology groups are Printed Circuited Board Group, Antenna Group, Microwave and Millimeter Wave Components Group, Mechanical Engineering Group, LAN, Human Resource Development Group etc. apart from work centers who carryout system design and development activities.

Long-Term self-reliance in Technologies / Systems has been driving principle in its entire development endeavor to make the nation self reliant and independent.

In house Printed Circuit Board facilities provide faster realization of the digital hardware. Multi layer Printed Circuit Board fabrication facilities are available to cater for a high precision and denser packaging.

The Antenna Group is responsible for design and development of wide variety of antennas covering a broad electromagnetic spectrum (HF to Millimeter Frequencies). The Group also develops RADOMES, which meet stringent environmental conditions for the EW equipment to suit the platform.

The MMW Group is involved in the design and development of MMW Sub-systems and also various Microwave Components like Solid State Amplifier, Switches, Couplers and Filters using the latest state-of-the–art technology.

The Hybrid Microwave Integrated Circuit Group provides custom-made microwave components and super components in the microwave frequency region using both thin film and thick film technology.

In the Mechanical Engineering Group the required hardware for EW Systems is designed and developed and the major tasks involved include Structural and Thermal Engineering.

The Technical Information Center, the place of knowledge bank is well equipped with maintained libraries, books, journals, processing etc. Latest Technologies in the electronic warfare around the globe are catalogued and easily accessible.

The Techniques Division of ECM wing is one such work center where design and development of subsystems required for ECM applications are undertaken. ESM Work Centers design and development of DF Rx, Rx Proc etc. for various ESM Systems using state-art-of-the technology by employing various techniques to suit the system requirements by the end users. All the subsystems are designed and developed using microwave, and processor/DSP based Digital hardware in realizing the real time activities in Electronic Warfare

Most of the work centers are connected through DLRL LAN (Local LAN) for faster information flow and multi point access of information critical to the development activities. Information about TIC, stores and general administration can be downloaded easily.

The Human Resource Division play a vital role in conducting various CEP courses, organizing service and technical seminars to upgrade the knowledge of scientists in the laboratory.

DLRL has been awarded **ISO 9001:2015** certification for Design and Development of Electronic System of assured quality for Defence Services; utilizing advanced and cost effective technologies & systems on time. DLRL shall comply with the requirements of quality Management System with a focus on its continual improvement.

Abstract

In educational and organizational settings, attendance tracking is a critical task, often prone to inefficiencies and inaccuracies. To address this, we present a Face Recognition Based Attendance Monitoring System, offering a robust and automated solution. Leveraging Tkinter for the graphical user interface and OpenCV for facial detection and recognition, our system provides an intuitive platform for administrators to manage attendance seamlessly.

The system begins by capturing facial images of individuals for registration, utilizing the Haar cascade classifier for face detection. These images are then processed and stored, forming the basis for training the face recognition model. Through the implementation of the LBPH (Local Binary Patterns Histograms) Face Recognizer, the system learns to accurately identify individuals based on their facial features.

Upon registration, users have the option to set up a secure password for access control, ensuring the integrity of the system. Administrators can easily add, modify, or remove student or employee profiles as needed, facilitating effortless management of the system's database.

During operation, the system tracks attendance in real-time by analyzing faces captured by a camera. Upon recognition, attendance records are automatically updated, along with timestamps and dates, providing a reliable record for future reference.

The graphical user interface offers an intuitive experience, featuring interactive elements such as buttons for capturing images, saving profiles, and taking attendance. Additionally, a treeview widget displays attendance records in a structured format, enhancing user accessibility.

The system incorporates features for data security and privacy, including password protection and adherence to best practices for handling biometric data. Moreover, error handling mechanisms ensure robustness and reliability, minimizing the risk of system failures.

In conclusion, our Face Recognition Based Attendance Monitoring System offers a comprehensive solution for attendance management, combining advanced facial recognition technology with user-friendly interface design. By streamlining the attendance tracking process, the system enhances efficiency, accuracy, and overall organizational effectiveness.

The successful implementation of this project was guided by the expertise of Shri ARC Murthy, Scientist-F and Shri BV Manikanta Sai, Technical Officer - A, whose insights significantly contributed to its realization. This endeavor represents a novel approach to secure communication, offering a practical solution for individuals and organizations seeking enhanced privacy in their digital exchanges.

PROJECT REPORT

Contents :

Introduction :

In today's dynamic educational and organizational landscapes, the demand for efficient attendance monitoring systems has never been greater. Traditional methods, reliant on manual data entry or card-based systems, are increasingly seen as cumbersome, error-prone, and susceptible to manipulation. As institutions and businesses strive for greater accuracy, automation, and security in attendance tracking, the integration of cutting-edge technologies becomes imperative.

The Need for a Face Recognition Based Attendance Monitoring System:

Recognizing these challenges, there arises a compelling need for a modern, robust, and reliable solution – the Face Recognition Based Attendance Monitoring System. By harnessing the power of facial recognition technology, this system offers a transformative approach to attendance management. Gone are the days of manual attendance registers and time-consuming verification processes. Instead, administrators can now rely on the seamless and accurate identification of individuals through their unique facial features.

Face Recognition Based Attendance Monitoring System:

A Modern Approach to Attendance Management

At the heart of this system lies a sophisticated combination of software and hardware components. Tkinter, a Python library for creating graphical user interfaces, provides an intuitive platform for users to interact with the system effortlessly. Complementing Tkinter is OpenCV, an open-source computer vision library, which serves as the backbone for facial detection and recognition.

The Synergy of Technology and Efficiency:

The synergy between Tkinter and OpenCV empowers the Face Recognition Based Attendance Monitoring System to deliver unparalleled efficiency and accuracy. Through Tkinter's user-friendly interface, administrators can effortlessly navigate through various functionalities, from enrolling new individuals to tracking attendance in real-time. Meanwhile, OpenCV's advanced algorithms enable swift and precise facial detection and recognition, ensuring reliable identification even in diverse lighting conditions and facial orientations.

Moreover, the integration of facial recognition technology minimizes the risk of fraudulent activities such as buddy punching, where individuals falsely record attendance on behalf of others. By accurately verifying the identity of individuals based on their facial features, the system enhances security and accountability, fostering a culture of trust and integrity within the organization.

TheFace Recognition Based Attendance Monitoring System represents a paradigm shift in attendance management. By harnessing the power of facial recognition technology, it offers a modern, efficient, and secure solution to meet the evolving needs of educational institutions, businesses, and organizations. With its seamless integration of Tkinter and OpenCV, this system paves the way for enhanced productivity, accuracy, and transparency in attendance tracking.

Project Objectives:

1. Develop a user-friendly graphical interface using Tkinter for seamless interaction with the attendance monitoring system.
2. Implement facial detection and recognition algorithms using OpenCV to accurately identify individuals in real-time.
3. Create a database management system for storing and managing student or employee profiles, including their facial images and identification information.
4. Enable the system to capture and store facial images for registration purposes, ensuring a streamlined enrollment process.
5. Design a robust attendance tracking mechanism that automatically records attendance based on facial recognition, reducing manual efforts and minimizing errors.

Problem Statement:

Traditional attendance monitoring methods are often labor-intensive, error-prone, and susceptible to fraudulent activities such as buddy punching. Manual processes, such as paper-based registers or barcode scanning, lack efficiency and reliability, leading to inaccuracies in attendance records. Additionally, these methods are not well-equipped to handle variations in attendance patterns or address security concerns associated with identity verification.

Face Recognition Based Attendance Monitoring System:

In response to the limitations of traditional attendance monitoring methods, the Face Recognition Based Attendance Monitoring System offers a modern and efficient solution. By leveraging facial recognition technology, this system aims to revolutionize attendance management in educational institutions, businesses, and organizations. Through the seamless integration of Tkinter for user interface design and OpenCV for facial detection and recognition, the system provides a comprehensive platform for automating attendance tracking processes.

Facial recognition technology has emerged as a reliable biometric authentication method, capable of accurately identifying individuals based on their unique facial features. In the context of attendance monitoring, this technology offers several advantages, including enhanced accuracy, real-time tracking, and reduced administrative burden. By eliminating the need for manual data entry or barcode scanning, the system streamlines the attendance tracking process and minimizes the risk of errors or fraudulent activities.

The following sections will delve into the architecture, functionalities, and features of the Face Recognition Based Attendance Monitoring System, highlighting its capabilities in capturing facial images for registration, training the recognition model, tracking attendance in real-time, and ensuring data security and privacy. Additionally, the user interface design and usability aspects will be discussed to demonstrate the system's user-friendly approach and its potential to transform attendance management practices.

Approach:

In developing a Face Recognition Based Attendance Monitoring System, the approach encompasses several key components aimed at achieving seamless functionality and accuracy.

A: User-Friendly Graphical Interface Development Using Tkinter:

The first aspect involves the creation of a user-friendly graphical interface using Tkinter. Tkinter, a standard GUI toolkit for Python, provides a range of tools and widgets to design an intuitive interface. Elements such as buttons, entry fields, and labels will be strategically placed to ensure easy navigation and interaction for users of varying technical proficiency.

B: Implementation of Facial Detection and Recognition Algorithms with OpenCV:

The system relies on the powerful capabilities of OpenCV for facial detection and recognition. OpenCV provides access to pre-trained Haar cascade classifiers for facial detection in images and video streams. Additionally, the LBPH algorithm will be utilized for facial recognition, allowing the system to accurately identify individuals based on their facial features.

C: Database Management System Development for Profile Storage:

To manage student or employee profiles efficiently, a database management system will be developed. A relational database schema will be designed to store essential information such as IDs, names, and facial images. CRUD operations will be implemented to enable seamless management of profile data, ensuring data integrity and security through proper indexing and access control mechanisms.

D: Integration of Facial Image Capture and Storage for Registration:

The system will incorporate functionality to capture and store facial images during the registration process. Utilizing camera capabilities, facial images will be captured and preprocessed to extract facial features. These processed images will then be securely stored within the database, associated with corresponding profile information.

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E: Development of a Robust Attendance Tracking Mechanism Based on Facial Recognition:

The core functionality of the system revolves around the development of a robust attendance tracking mechanism based on facial recognition. Algorithms will be developed to match captured facial images with stored profiles in the database. Upon successful identification, attendance will be automatically recorded, complete with timestamps and relevant metadata. The system will be designed to handle various scenarios, including multiple faces in the frame and challenging lighting conditions, ensuring accurate and reliable attendance tracking.

Implementation :

We are designing a web application to implement the Face Recognition Based Attendance Monitoring System. The software we used is Visual Studio Code, an open-source code editor developed by Microsoft. The technologies used are Flask, a micro web framework for Python, and SQLite, a lightweight relational database management system. The programming language used is Python, renowned for its simplicity and versatility in web development.

1. Face Recognition Attendance System Dashboard :

The graphical interface for a Face Recognition Based Attendance Monitoring System is designed to accommodate both existing users and new registrations. For registered users, the interface presents their ID, name, and offers options to record attendance, view attendance history, and exit the system. New users can input their ID and name, then proceed to capture images to create their profile. Additionally, the interface provides a count of total registrations thus far. Users interact with the system by selecting options and entering relevant information in the provided fields.

The below image shows the Dashboard page where the user needs to provide the username and id, after validating it allows to Take Images.

The Face Recognition Based Attendance Monitoring System incorporates a user authentication mechanism. It verifies user credentials, which can either be pre-defined or securely stored in a database. During login, the system checks the entered credentials against the stored values for authentication. Access is granted if the username and password match, while an error message alerts users to invalid credentials. This process ensures secure access to the attendance monitoring features.

2. New Registration - Enrolling in the System :

The below image shows the Dashboard which consists New Registration section which will enroll the users.


Enrolling in the System allows users to become part of the Face Recognition Based Attendance Monitoring System. To enroll, users must provide a unique ID and their full name in the designated fields. The ID serves as a distinct identifier, while the name should accurately represent the user.

After entering the required information, users can proceed to capture images by selecting the "Take Images" option. This triggers the system to utilize face recognition technology to create and store the user's profile. Should users need to correct their name entry, they can easily clear the input field and make adjustments. Once the images are captured and the profile is saved, users can seamlessly utilize the system for attendance management purposes.
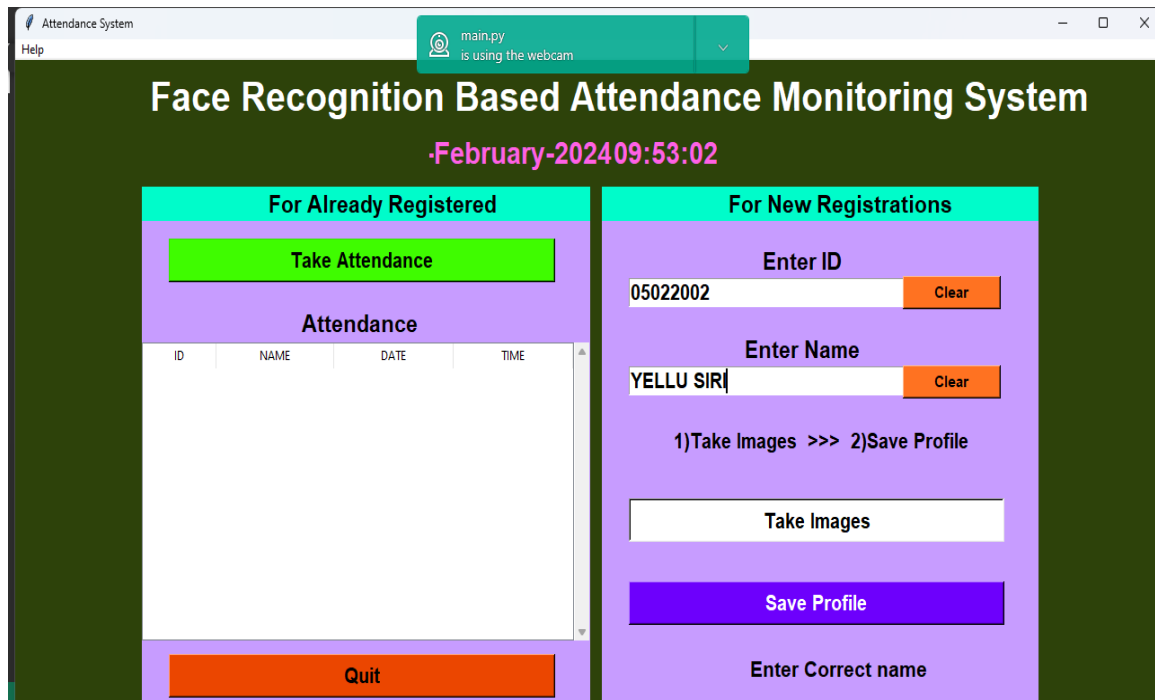
Clicking on "Take Images":

Upon clicking the "Take Images" option, users initiate the process of capturing facial images to create their profile. This action triggers the system to activate the camera for image acquisition. Users are then guided through the image capture process, ensuring that clear and accurate representations are obtained. Once the images are successfully captured, they undergo processing and are utilized to establish the user's profile within the system.
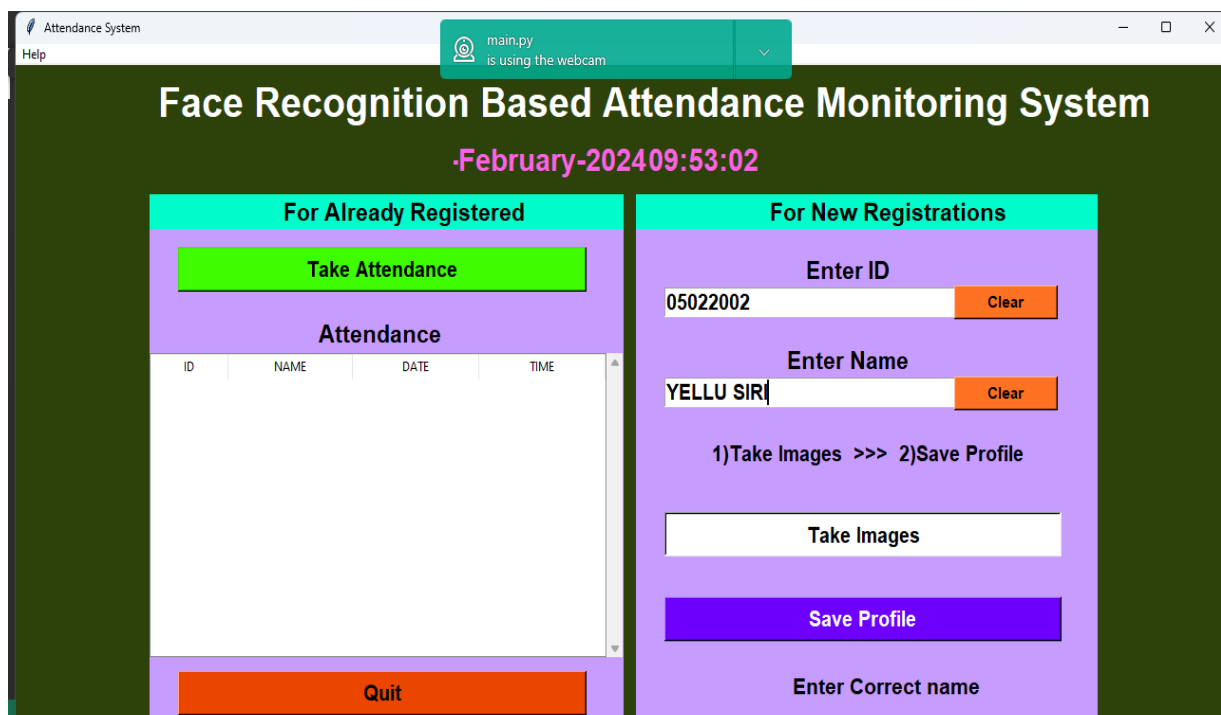
Profile Image Acquisition:

When users click on the "Take Images" button, the system enters profile image acquisition mode. This prompts the webcam to capture facial images of the user. The captured images are then utilized to generate the user's profile within the attendance system.
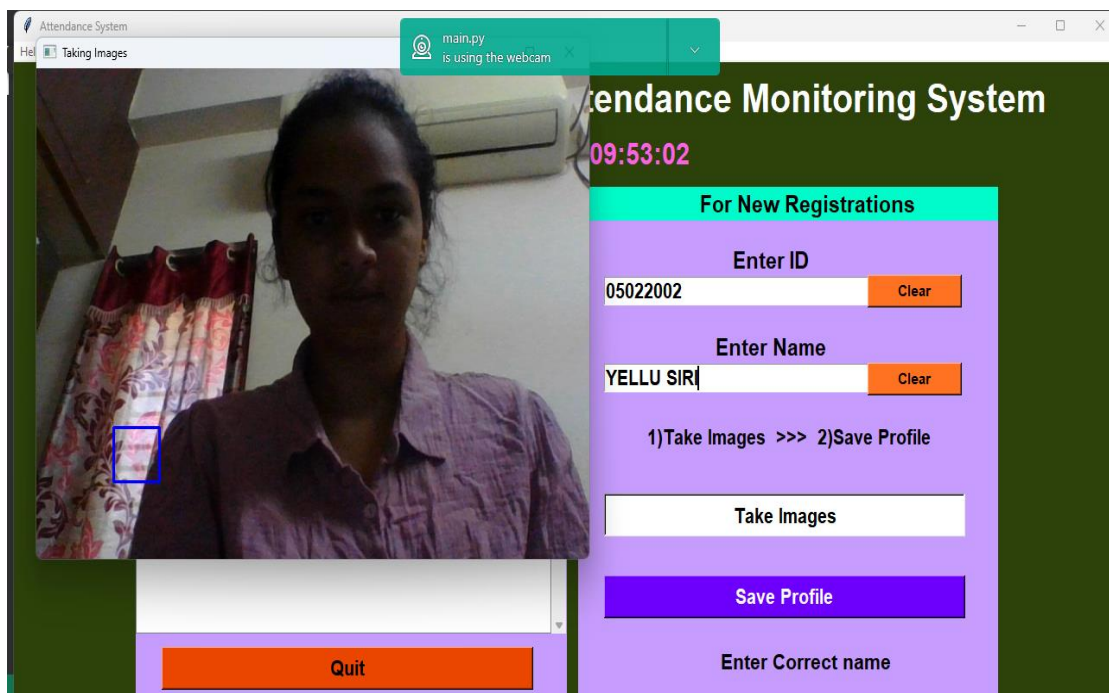

## Image Capture Confirmation:

The message "Images Taken for ID: 05022002" confirms successful image capture and storage for the individual with the specified ID. This occurs post-registration, where users enter their details and capture images. The system then saves these images to the individual's profile for future face recognition-based attendance. Additionally, users can take attendance, view reports, or exit theprogram.

Profile Saving Confirmation:

Clicking "Save Profile" in this attendance monitoring system saves the individual's information and images to the database. The system confirms successful image saving with a message like "Images Taken for ID: 05022002". Alongside the current date, time, and latest individual's name, users can manage attendance, view reports, or exit.

Password Entry Prompt:

"Enter Password" prompts users to input their password for authentication. Users can submit by pressing "OK" or exit with "X" or "Cancel".
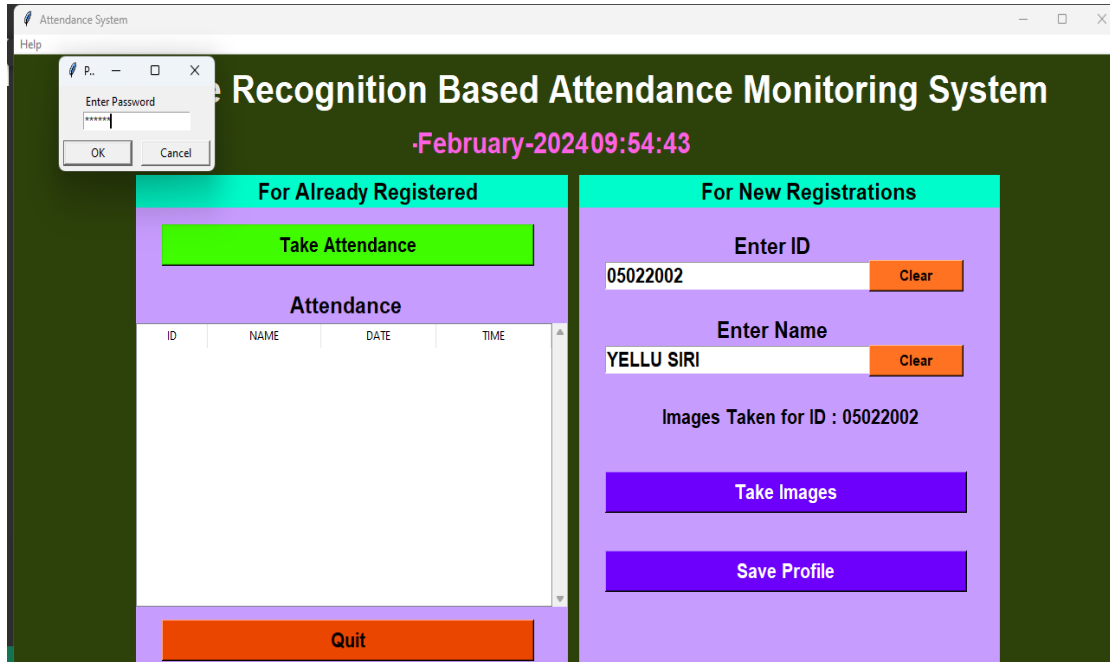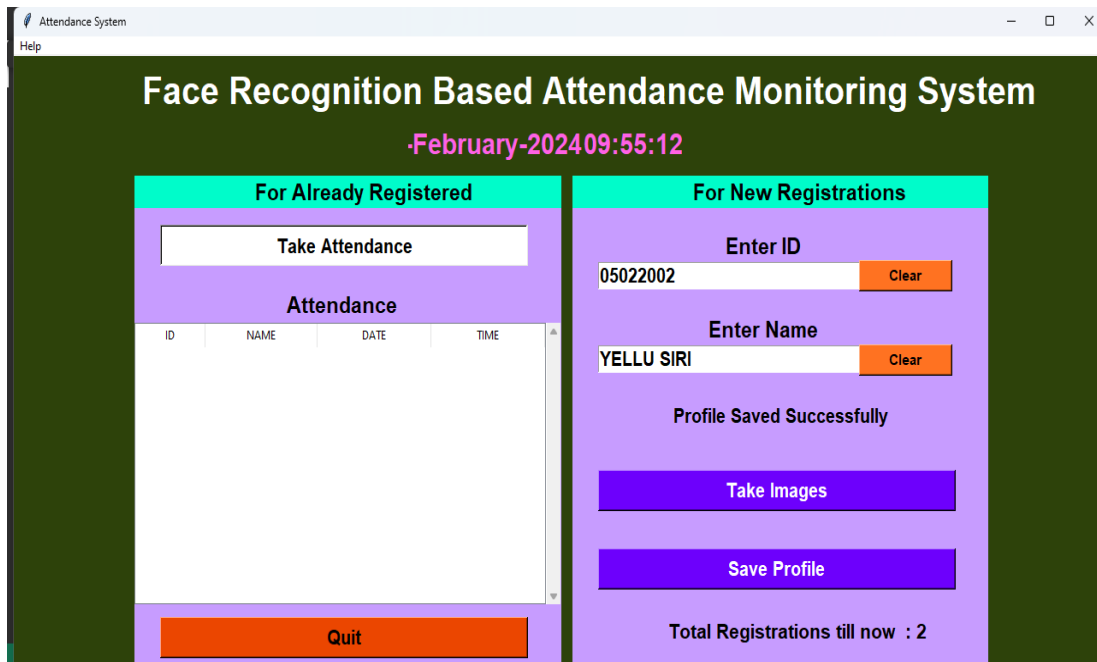

Registration Confirmation:

"Profile Saved Successfully" confirms successful registration of a new person in the system. It assures users that the information has been stored correctly, enabling them to use the attendance system effectively.
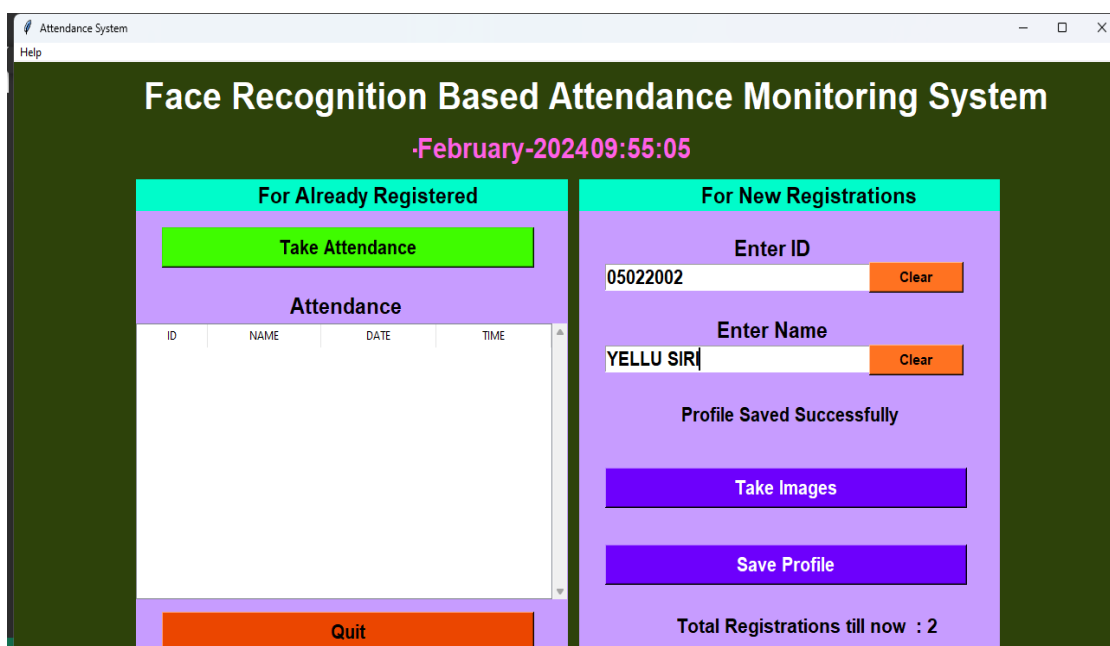
3. Attendance Tracking with Face Recognition :

After successful registration, users can initiate attendance tracking by selecting "Take Attendance." The system timestamps the attendance session and prompts users to position individuals for face capture. Matching faces against stored profiles, the system marks attendance accordingly. This feature streamlines attendance management, offering efficiency and accuracy over manual methods.

Integrated Name and Face Identification in Attendance Tracking:

During attendance taking, the system combines name and face identification. Upon selecting "Take Attendance," the webcam activates, displaying live footage. Users position individuals for face capture, and the system compares the image against stored profiles. Upon a match, the person's name and ID are displayed, ensuring accurate attendance tracking. This integrated approach enhances accuracy and efficiency, mitigating errors associated with manual methods.
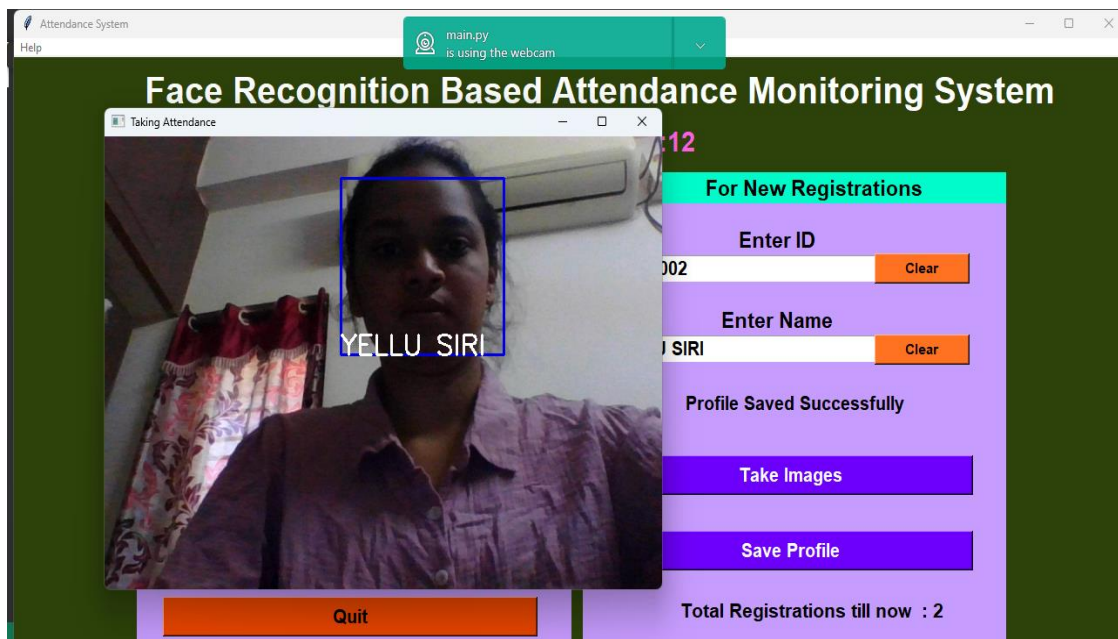
Attendance Recording in Face Recognition System:

The system stores IDs, names, dates, and times for attendance recording. Upon face recognition, attendance data including ID, name, date, and time is logged. The system maintains a record of registrations and displays total counts.
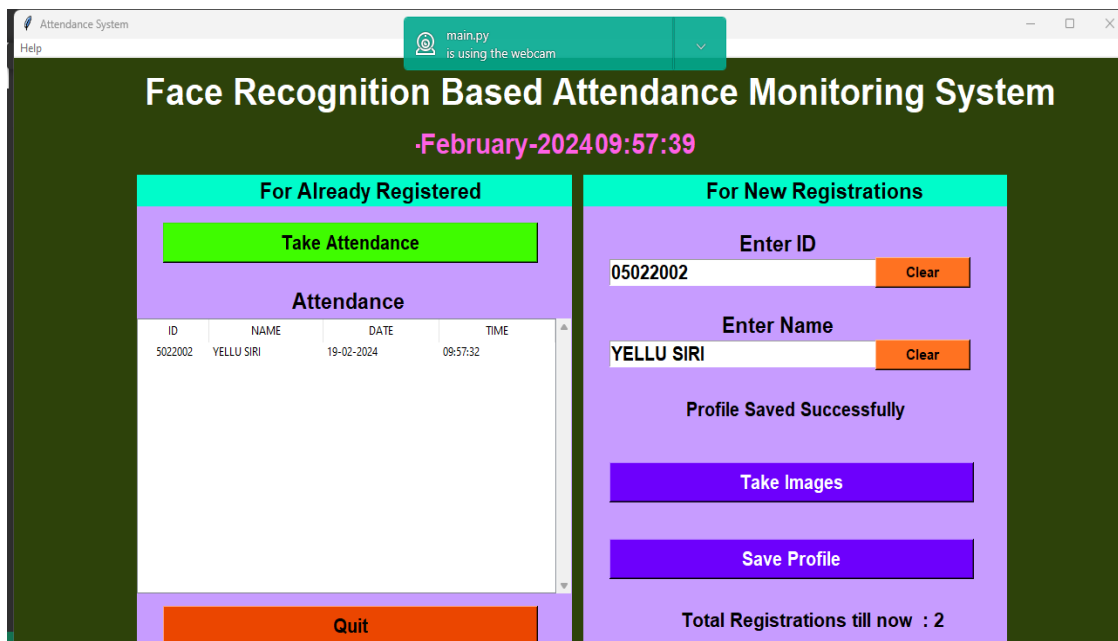
Conclusion :

In the culmination of this project, leveraging a combination of cutting-edge technologies and advanced algorithms, we have successfully developed and implemented a comprehensive solution for attendance monitoring using face recognition technology. Our Face Recognition Based Attendance Monitoring System represents a significant advancement in attendance tracking technology. By combining encryption for confidentiality, facial recognition for accuracy, robust data storage, and a user-friendly web application for accessibility, we have created a comprehensive solution that addresses the diverse needs of modern organizations. The achieved results stand testament to the efficacy of the implemented solution.

Facial Recognition:
The integration of facial recognition technology serves as the cornerstone of our attendance monitoring system. Leveraging OpenCV for image processing and deep learning frameworks such as TensorFlow or PyTorch for training convolutional neural networks (CNNs), our system accurately identifies individuals in real-time. By implementing state-of-the-art facial detection and recognition algorithms, we ensure seamless and efficient attendance tracking without the need for manual intervention.

Data Storage and Accessibility:
In addition to encryption and facial recognition, our system boasts robust data storage capabilities. User images, details, and attendance records are stored securely in CSV format day by day, ensuring easy access and retrieval of historical data. This feature enhances the system's utility and provides valuable insights for administrative purposes.

User-Friendly Web Application:
We have prioritized user experience in the design and development of our web application. With a user-friendly interface powered by Tkinter, users can effortlessly navigate through the system, register new users, and access attendance records with ease. This intuitive interface enhances user satisfaction and promotes widespread adoption of the attendance monitoring system.

Future Scope :

As technology evolves, there are numerous avenues for enhancing the capabilities and functionalities of the Face Recognition Based Attendance Monitoring System. Here are some potential areas for future development and improvement:

Integration with Biometric Devices:

Expanding the system's compatibility to include biometric devices like fingerprint scanners or iris scanners can offer alternative methods for authentication and attendance tracking. This integration can provide users with more options and flexibility while ensuring secure and accurate identification.

Mobile Application Development:

Creating a mobile application version of the attendance monitoring system opens up new possibilities for accessibility and convenience. Users can easily mark their attendance or access records from their smartphones, eliminating the need for dedicated hardware and enabling seamless attendance management on-the-go.

Machine Learning Improvements:

Leveraging advancements in machine learning techniques, such as deep learning and neural networks, can lead to significant improvements in facial recognition accuracy and efficiency. Continuously refining and optimizing the algorithms used for facial detection and recognition can enhance the system's ability to identify individuals accurately under various conditions, including varying lighting and facial expressions.

Cloud Integration:

Integrating the system with cloud-based storage solutions offers scalability, flexibility, and data redundancy benefits. Storing attendance records and user profiles in the cloud enables seamless access from any location and device, simplifies data management, and ensures data backup and recovery capabilities.

Automated Notifications:

Implementing automated notification systems can enhance communication and accountability in attendance management. By sending alerts for absenteeism or tardiness to relevant stakeholders, such as supervisors or administrators, the system can facilitate prompt action and improve overall attendance monitoring processes.

Advantages of Face Recognition Based Attendance Monitoring System:

1**. Accuracy**: The system boasts high accuracy in identifying individuals based on their facial features, significantly reducing the likelihood of errors compared to traditional attendance methods.

2. **Efficiency**: With real-time facial recognition capabilities, the system streamlines the attendance tracking process, saving time and resources for both administrators and users alike.

3. **Security**: By employing facial recognition technology, the system enhances security measures by ensuring that only authorized individuals can access sensitive areas or records, thereby minimizing the risk of unauthorized entry or data breaches.

4. **Convenience**: Users can conveniently mark their attendance simply by appearing in front of the camera, eliminating the need for physical tokens, cards, or manual sign-ins, which enhances user experience and simplifies the attendance process.

5. **Data Insights**: The system generates comprehensive attendance reports and insights, offering valuable data for decision-making processes and enabling organizations to identify attendance trends and patterns over time. This contributes to better organizational management and strategic planning.

In summary, the Face Recognition Based Attendance Monitoring System provides a robust, efficient, and secure solution for attendance tracking, offering numerous benefits such as accuracy, efficiency, security, convenience, and actionable data insights. As technology continues to advance, the system holds the potential for further enhancements, driving improved organizational efficiency and productivity in the future.

Certificate

This is to certify that this project work titled "**Face Recognition Based Attendance Monitoring System**" is the work done by **YELLU SIRI,** under my supervision, and submitted in fulfillment of the requirements for the internship, during the period 09-01-2024 to 30-04-2024.

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Project Guide

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Scientist - F

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