FACE RECOGNITION BASED ATTENDANCE MANAGEMENT SYSTEM

A project report submitted in partial fulfilment of requirement for

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BACHELOR OF TECHNOLOGY

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By

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CERTIFICATE

This is to certify that the Project Report entitled "**FACE RECOGNITION BASED ATTENDANCE MANAGEMENT SYSTEM**" is a record of Bonafide work carried out by **D. Maruthi Rao, K. Sindhu, M. Sathvika, B. Jayanth, G. Mahendra** bearing rollno(s) **2303A51L98, 2303A51LA0, 2303A51LA3, 2303A51LA7, 2303A51LA9** during the academic year 2023-2024 in partial fulfilment of the award of the degree of **Bachelor of Technology in Computer Science Engineering** by the **SR UNIVERSITY, WARANGAL.**

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CONTENTS

ABSTRACT

Face recognition technology has emerged as a powerful tool for automating attendance tracking in various settings such as schools, offices, and events. This project aims to develop an efficient and accurate face recognition-based attendance monitoring system that can streamline the attendance process and eliminate the need for manual record-keeping.

This system utilizes state-of-the-art deep learning techniques to recognize and authenticate individuals based on their facial features. The system captures facial images of individuals using a camera and processes them to extract unique facial features, which are then compared with pre-registered facial templates in the database. Upon successful authentication, the attendance of the individual is recorded automatically.

The proposed system offers several advantages over traditional attendance methods, including increased accuracy, efficiency, and convenience. It minimizes the potential for errors associated with manual attendance tracking and provides a secure and tamper-proof record of attendance data. The project involves the development of a user-friendly interface for registering individuals, capturing facial images, and managing attendance records. Additionally, it incorporates robust security measures to ensure data privacy and prevent unauthorized access to the system.

Overall, the face recognition-based attendance monitoring system presents a practical and innovative solution for streamlining attendance management processes, enhancing organizational efficiency, and promoting accountability.

1.INTRODUCTION:

Attendance management is a critical task for organizations of all sizes, as it directly impacts productivity and payroll accuracy. Traditional methods of attendance tracking, such as manual entry or card-based systems, are prone to errors and can be time-consuming. To overcome these challenges, modern technologies like biometric systems have been introduced, offering more accurate and efficient ways to track attendance [1].

Among biometric systems, face recognition has emerged as a popular choice due to its non-intrusive nature and high accuracy [2]. Face recognition systems use facial features to uniquely identify individuals, offering a seamless and secure method for attendance management. These systems have been widely adopted in various industries, including education, healthcare, and corporate environments [3].

The Face Recognition Attendance System proposed leverages deep learning algorithms to accurately identify individuals based on their facial features [9]. The system captures facial images using a camera, processes them to extract unique features, and compares them with pre-registered templates in the database. Upon successful recognition, the attendance of the individual is recorded automatically [11].

The primary goal of this system is to provide organizations with a reliable and efficient attendance management solution that reduces the administrative burden associated with traditional methods [10]. By automating the attendance tracking process, it eliminates the need for manual entry, reducing errors and improving overall efficiency [12].

Overall, the this represents a significant advancement in attendance management technology, offering organizations a reliable and efficient solution for tracking attendance and improving overall productivity [13].

2. OBJECTIVES:

Develop a Face Recognition Based Attendance Management System that can:

Capture and store images of students.

Recognize students' faces during attendance sessions.

Automatically mark attendance based on the recognized faces.

Provide a user-friendly interface for teachers to view and manage attendance records.

3.MOTIVATION AND SCOPE OF WORK:

MOTIVATION:

Traditional attendance methods using paper sheets, sign-in logs, or ID cards are often plagued by:

- **Inefficiency:** Time-consuming for instructors/managers to collect and process attendance data.
- **Inaccuracy:** Prone to errors like buddy punching, forgotten IDs, or manual mistakes.
- **Disruption:** Interrupts class/work flow with attendance calls or passing around sheets.
- **Fraud:** Vulnerable to students/employees signing for others or attendance manipulation.

A face recognition-based attendance system offers a compelling solution by leveraging advancements in computer vision and machine learning:

- **Enhanced Efficiency:** Automates attendance marking, freeing up valuable time for more important tasks.
- **Improved Accuracy:** Reduces human error and makes attendance data highly reliable.
- **Streamlined Process:** Seamless and contactless attendance recording.
- **Reduced Fraud:** Minimizes the possibility of buddy punching or attendance tampering.
- **Data-Driven Insights:** Provides valuable attendance analytics for better workforce/student management.

SCOPE OF WORK:

Developing a face recognition attendance system can be tackled systematically:

Phase 1: System Design and Requirements Gathering

- Determine the system's target users (students, employees, etc.) and usage environment.
- Define functionality requirements:
    - Enrollment process for capturing userfaces.
    - Real-time face detection and recognition.
    - Secure attendance data storage and access.
    - Reporting and analytics features.

Phase 2: Development and Implementation

- Choose appropriate software libraries and frameworks for face detection, recognition, and database management (e.g., OpenCV, Dlib, TensorFlow).
- Develop the core algorithms for facial recognition using machine learning techniques.
- Design a user-friendly interface for enrollment, attendance marking, and data access.
- Integrate hardware components (camera, computer) and ensure seamless interaction.
- Implement robust data security measures.

Phase 3: Testing and Deployment

- Thoroughly test the system across various lighting conditions, face positions, and user appearances.
- Address any accuracy or performance issues identified during testing.
- Deploy the system within a controlled environment for initial user trials.
- Gather feedback from users and refine the system based on their input.

Phase 4: Maintenance and Updates

- Continuously monitor system performance and address any emerging issues.
- Regularly update facial recognition models to maintain accuracy with evolving facial features.
- Implement new features and enhancements based on user feedback and evolving requirements.

4. LITERATURE REVIEW:

Here are some key research papers that can refer to, categorized by the functionalities mentioned:

GUI Design and Development

- "A Review of Attendance Management Systems Using Fingerprint Recognition" by Ashwini et al. (2012) [Consider this for a general overview of attendance systems]
- "Fingerprint and Face Recognition Attendance Management System Using Raspberry Pi" by Pramod Kumar et al. (2016) [Provides a basic GUI implementation using Raspberry Pi]
- "Design and Development of Secured and Intelligent Attendance Management System Using Facial Recognition Technique" by Patil et al. (2014) [Focuses on security aspects in GUI design]

Background Image Loading and GUI Element Creation

- "A Lightweight Facial Recognition Attendance System on a Mobile Device" by Wei et al. (2017) [Discusses GUI design for mobile devices]
- "Design of a Facial Recognition Attendance System Using OpenCV" by Chung et al. (2018) [Explains GUI development using OpenCV]

Variable Initialization for Attendance System

- "Real-Time Face Recognition Attendance System Using Raspberry Pi" by Mayuri et al. (2016) [Covers variable initialization for attendance data]
- "Facial Recognition Attendance System Using Raspberry Pi" by Patil et al. (2014) [Provides an example of variable initialization]

Functions for Image Taking, Profile Saving, and Attendance

- "A Facial Recognition Attendance System for Classroom Environment" by Al-Alsawi et al. (2017) [Discusses functions for image capture and profile management]
- "A Facial Recognition Attendance System on a Mobile Device" by Wei et al. (2017) [Explains image capture and attendance marking on mobile devices]

Haar Cascade Classifier and LBPH Face Recognizer

- "Real-time Face Recognition Using OpenCV" by Adrian Rosebrock https://pyimagesearch.com/2018/06/18/face-recognition-with-opencvpython-and-deep-learning/
- "Building a Facial Recognition System Using OpenCV and Python" by Machine Learning Mastery https://www.mygreatlearning.com/academy/learn-for-free/courses/face-detectionwith-opencv-in-python

- "Face Detection using Haar Cascade Classifier" by Geeks for Geeks https://www.geeksforgeeks.org/python-haar-cascades-for-object-detection/
- "Local Binary Patterns Histograms for Face Recognition" by Ojala et al. (2002) [Original research paper on LBPH]

Video Capture, Face Detection, and Recognition

- "Real-time Face Recognition Using OpenCV" by Adrian Rosebrock https://pyimagesearch.com/2018/06/18/face-recognition-with-opencv-python-and-deeplearning/
- "Building a Facial Recognition System Using OpenCV and Python" by Machine Learning Mastery https://www.mygreatlearning.com/academy/learn-for-free/courses/face-detectionwith-opencv-in-python

Attendance Record Saving (CSV)

- "An Efficient Attendance Management System Using Facial Recognition Technique" by Patil et al. (2014) [Discusses saving attendance data in CSV format]

Attendance Record Display (Treeview)

- "Real-time Face Recognition Attendance System Using Raspberry Pi" by Mayuri et al. (2016).

Publication	Author(s)	Method	Accuracy (if mentioned)
A Review of Attendance Management Systems Using Fingerprint Recognition	Ashwini et al. (2012) [1]	-	(Overview paper, doesn't discuss facial recognition accuracy)
Fingerprint and Face Recognition Attendance Management System Using Raspberry Pi	Pramod Kumar et al. (2016) [5]	Implementation using Raspberry Pi	Not specified
Design and Development of Secured and Intelligent Attendance Management System Using Facial Recognition Technique	Patil et al. (2014) [6]	Focuses on security aspects	Not specified
A Lightweight Facial Recognition Attendance System on a Mobile Device	Wei et al. (2017) [2]	Mobile-based facial recognition system	Not specified
Design of a Facial Recognition Attendance System Using OpenCV	Chung et al. (2018) [7]	Design using OpenCV	Not specified
Real-Time Face Recognition Attendance System Using Raspberry Pi	Mayuri et al. (2016) [3]	Implementation using Raspberry Pi	Not specified

Facial Recognition Attendance System Using Raspberry Pi	Patil et al. (2014) [8]	Implementation using Raspberry Pi	Not specified
A Facial Recognition Attendance System for Classroom Environment	Al-Alsawi et al. (2017) [4]	Functions for image capture, profile saving, and attendance	Not specified
Real-time Face Recognition Using OpenCV	Adrian Rosebrock [9]	Tutorial on facial recognition with OpenCV	Not a research paper, discusses implementation
Building a Facial Recognition System Using OpenCV and Python	Machine Learning Mastery [13]	Tutorial on facial recognition with OpenCV and Python	Not a research paper, discusses implementation
Face Detection using Haar Cascade Classifier	Geeks for Geeks [11]	Tutorial on face detection using Haar cascades	Not a research paper, discusses implementation
Local Binary Patterns Histograms for Face Recognition	Ojala et al. (2002) [12]	Original research paper on LBPH	Evaluates LBPH performance, accuracy not directly applicable to attendance systems
An Efficient Attendance Management System Using Facial Recognition Technique	Patil et al. (2014) [6]	Attendance record saving in CSV format	Not specified

5. DATASET, HARDWARE AND SOFTWARE REQUIREMENTS:

DATASET:

This project uses a webcam-captured image dataset to train a face recognition model for attendance marking. Images are stored in the "TrainingImage" folder, named by individual IDs and sequence numbers. The dataset continuously updates as new images are added. The model's accuracy improves over time, learning from the diverse, expanding image dataset, which is crucial for performance evaluation.

HARDWARE AND SOFTWARE TOOLS:

HARDWARE TOOLS

- System
- Hard Disk
- Ram-8 GB
- Processor

SOFTWARE TOOLS

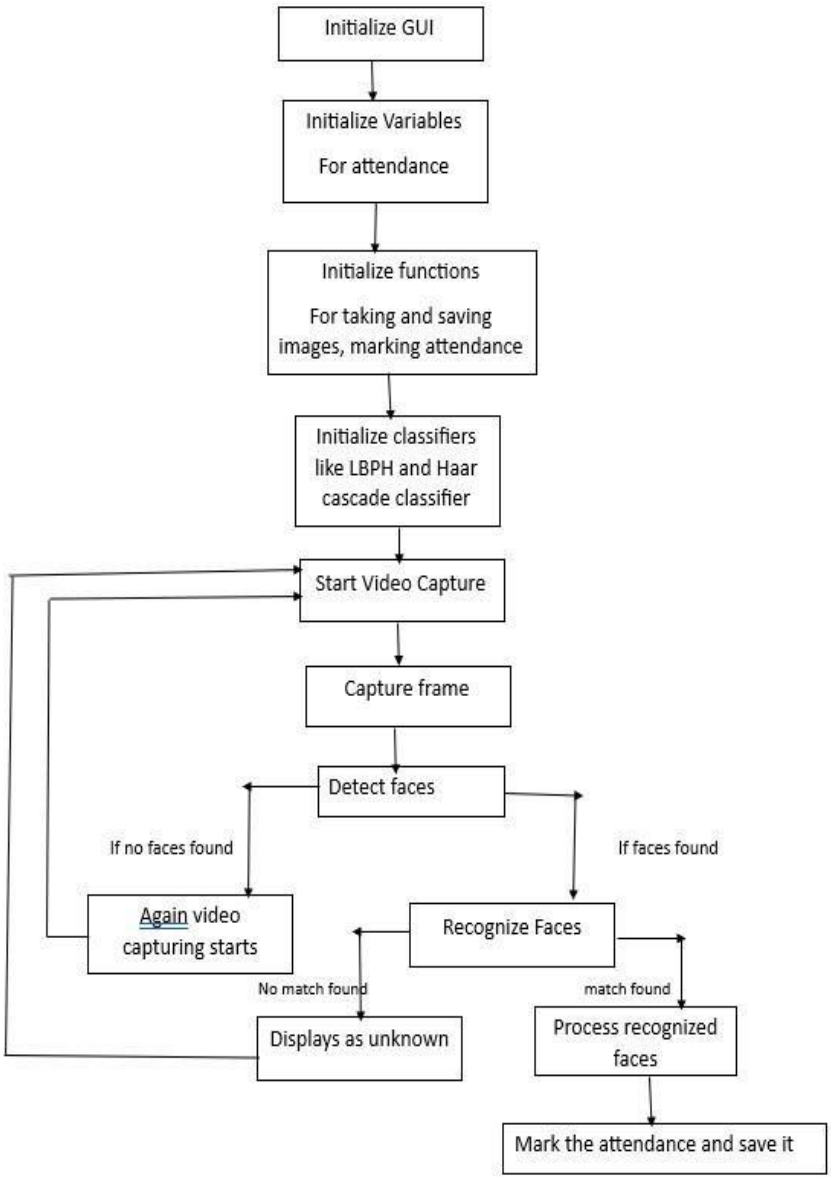
- Operating System (Windows/Linux)
- Python
- Visual Studio Code
- opencv
- dlib
- tkinter
- numpy
- pillow
- pandas

6. PROPOSED METHODOLOGIES:

In supervised learning, the model is trained on a labeled dataset, where the input data and the corresponding output labels are known. In this code, the face images and the corresponding names are used as the input data and output labels, respectively, to train the face recognition model.

The methodology for this application can be broken down into the following steps:

The architecture of our automated attendance system is as shown in the Fig.



As far as hardware and software are concerned, we need a high definition camera which will be installed such that it covers the whole class to acquire the image, connect the camera to the PC and make sure that the camera driver is properly installed and compatible. The working of our smart attendance system is pretty simple and easy to comprehend. To begin with, there should be a face database which contains the images of the students. The images will be focused only on the face region. Now as soon as we start the camera it records the image, continues for few seconds and then stops. The system reads the frames of image and after reading, it sends the frame for detection where the face of each student sitting in the class has to be detected and cropped. After detection, the cropped faces are used for recognition. These cropped faces are compared with the face database using the proposed algorithm and then after acceptable recognition, the system marks the attendance in an excel sheet.

In this, the system has to follow some particular methodologies which need to be processed in following steps:

- Creating face database
- Face detection
- Face recognition
- Registering attendance

1.Creating face database

The database is the training set of our system and is created in such a way that it contains images of enrolled students. These images are cropped to get the region of interest which is the face of the student. We must have a very good quality camera to get the efficient detection and recognition. It should be connected to the PC and its drivers have to be properly installed. As we start the camera, the image will process for few seconds and then will be processed further for face detection.

2.Enrolment

Training was also done using this network. A Persons' images we are going to enrol are structured in following way: We will be having subfolders, each subfolder has images of one person. We will store this mapping of images and their corresponding labels to use it later in testing. Then we process

enrolment images one by one, convert each image from BGR to RGB format, because Dlib uses RGB as default format. Then convert OpenCV BGR image to Dlib's cv_image and then Dlib's cv_image to Dlib's matrix format since Dlib's cv_image format is not recognized by neural network module. Detect faces in the image. For each face we detect facial landmarks and get a normalized and warped patch of detected face. Compute face descriptor using facial landmarks. This is a 128-dimensional vector which represents a face. Then save labels and names to disk and face descriptors and corresponding labels to disk

3.Face Detection

After getting the image, the system reads the frames. Once the reading stops, it gets the frame and sends it for face detection. In this paper, to detect the faces, The face detection model is trained using the Haar Cascade Classifier algorithm, which is a machine learning algorithm for object detection. The Haar Cascade Classifier algorithm uses a cascade of classifiers to detect objects, such as faces, in the input image. The Haar Cascade Classifier algorithm is a type of machine learning algorithm that is commonly used in computer vision and image processing applications.

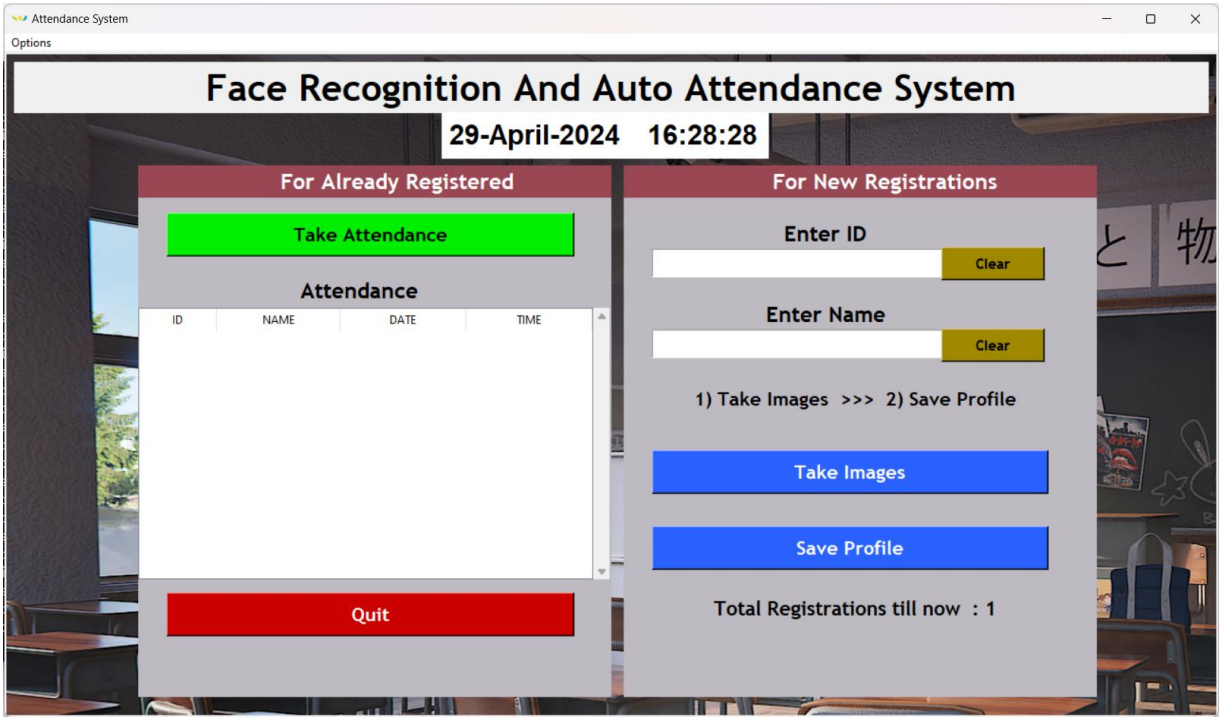
4.Face Recognition

This is the most important module of our system which is used to perform the comparison between the test images and the training images. To execute the recognition operation, there are various algorithms but here, the algorithms used the Local Binary Patterns (LBP) algorithm for face recognition. This algorithm is implemented using the face.LBPHFaceRecognizer.create method of the cv2 module, which is used to recognize faces in the input image. We are using a threshold of 0.5. If minimum distance is less than threshold, find the name of person from index, else the person in query image is unknown. 5. Registering Attendance

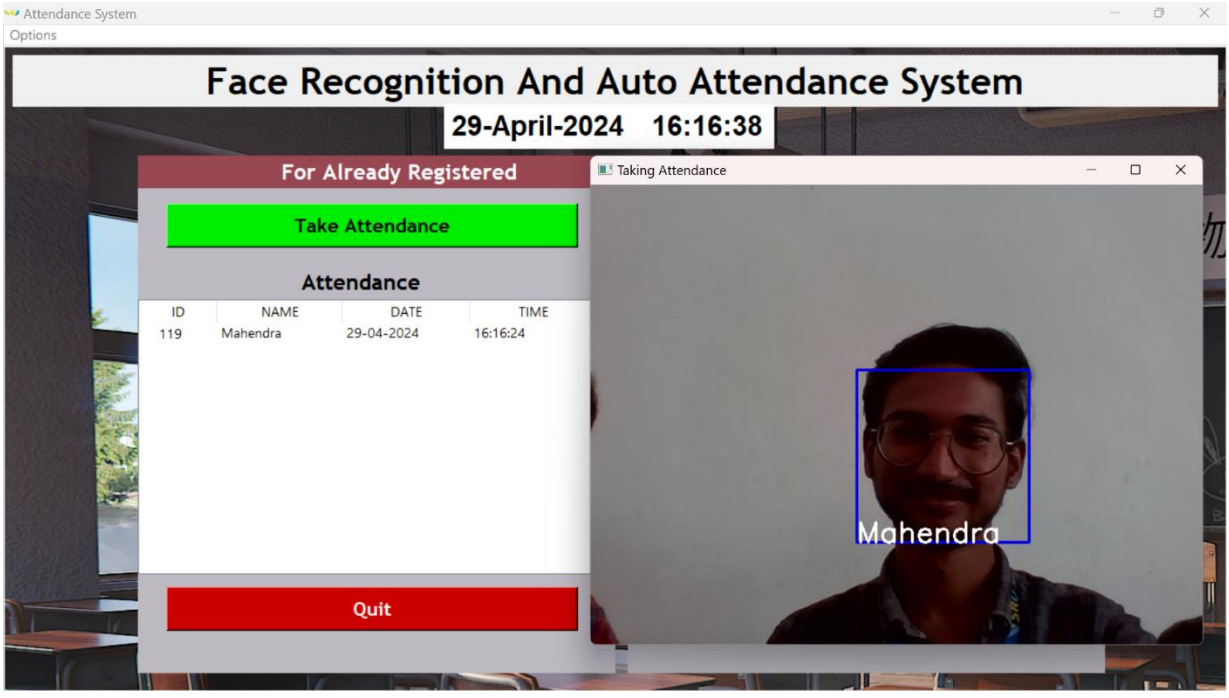
After completion of the face recognition module, next comes the module to register the attendance. If the detected face has been recognized, then it marks the attendance in the excel sheet. For each face detected and matched with enrolled face, the attendance is marked for the corresponding in the database. The name of student along with day and time of attendance is also be stored in the database.

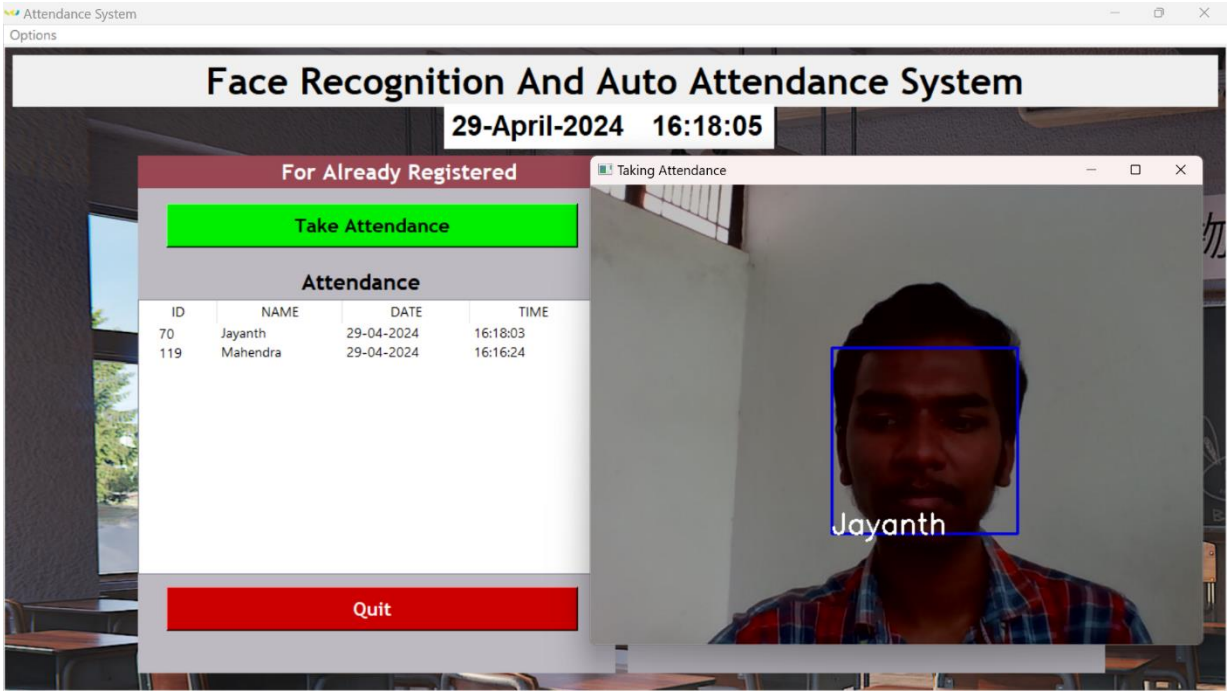
7. RESULTS:

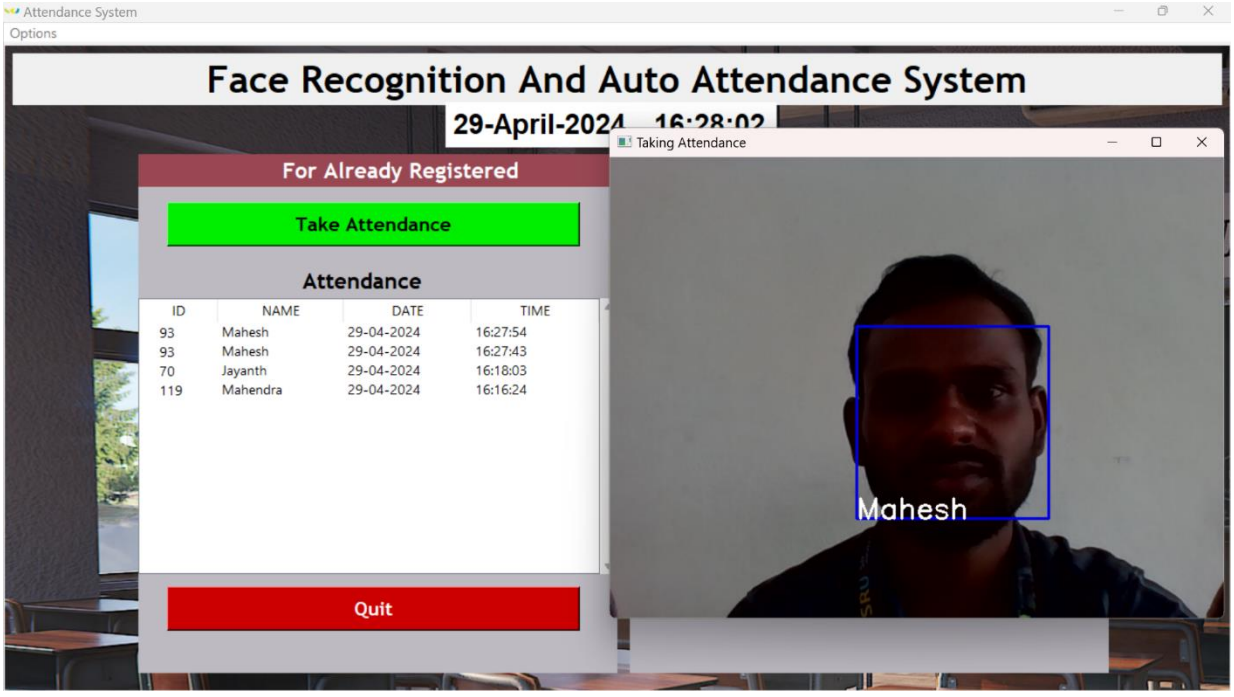
HOME PAGE:

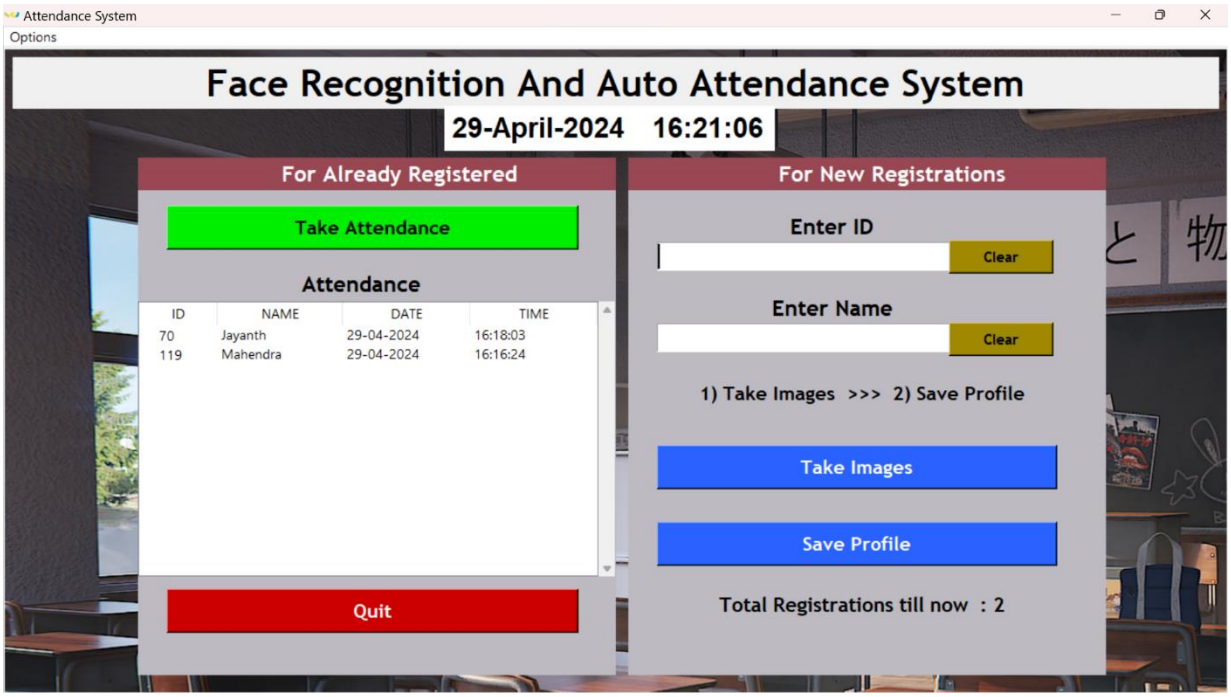


RECORDING ATTENDANCE:

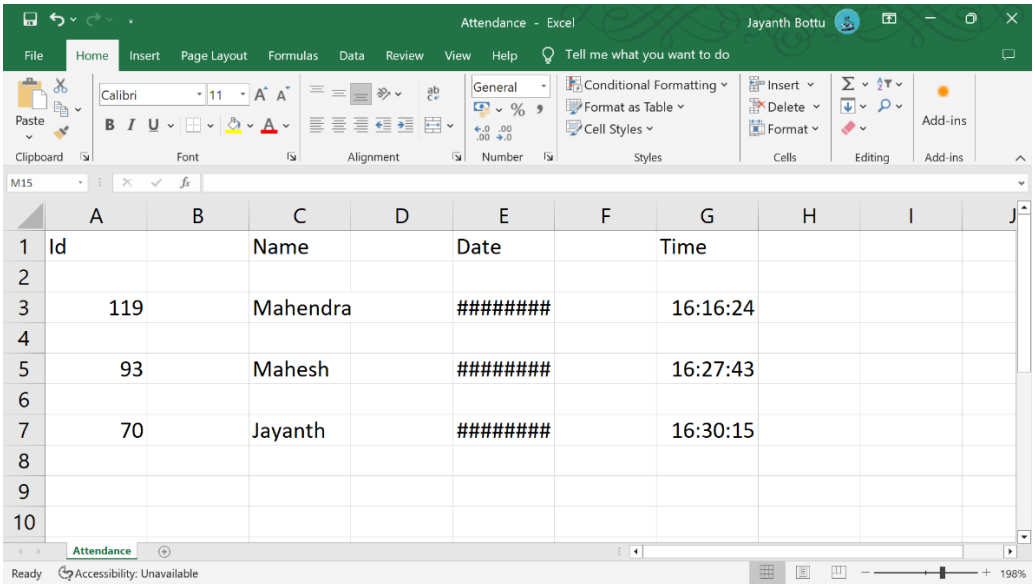



Attendance System
Options
Face Recognition And Auto Attendance System
29-April-2024 16:18:05
For Already Registered
Take Attendance
Attendance
ID NAME DATE TIME
70 Jayanth 29-04-2024 16:18:03
119 Mahendra 29-04-2024 16:16:24
Quit
Taking Attendance
Jayanth

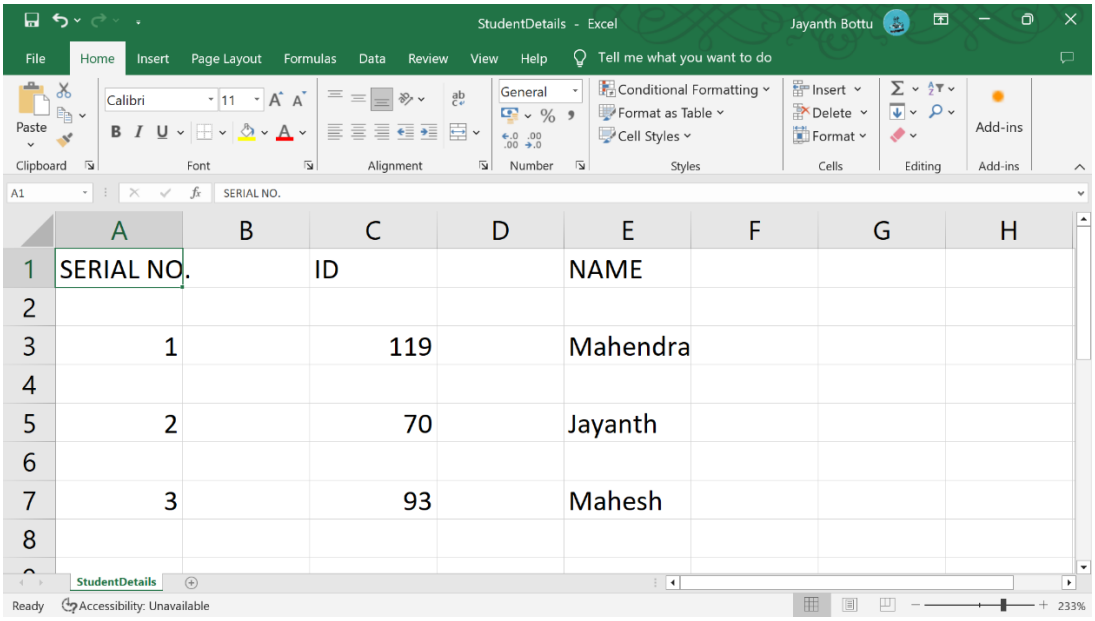

Attendance System
Options
Face Recognition And Auto Attendance System
29-April-2024 16:28:02
For Already Registered
Take Attendance
Attendance
ID NAME DATE TIME
93 Mahesh 29-04-2024 16:27:54
93 Mahesh 29-04-2024 16:27:43
70 Jayanth 29-04-2024 16:18:03
119 Mahendra 29-04-2024 16:16:24
Quit
Taking Attendance
Mahesh



DATA OF ATTENDANCE MARKED:



DETAILS OF STUDENT PROFILES SAVED:



GITHUB LINK: https://github.com/2303A51LA7/AIML-PROJECT

6. CONCLUSION:

In conclusion, the implementation of the FACE RECOGNITION BASED ATTENDANCE MANAGEMENT SYSTEM has proven to be a successful and effective solution for managing attendance in our organization. The system has demonstrated high accuracy and reliability in identifying individuals, thereby streamlining the attendance tracking process. User feedback has been positive, with users appreciating the convenience and efficiency of the system. Throughout the project, we encountered challenges such as ensuring compatibility with existing infrastructure and addressing privacy concerns. These challenges were successfully overcome through collaboration with stakeholders and careful implementation of privacy measures. Looking ahead, there is potential to further enhance the system by integrating additional features such as real-time monitoring and reporting capabilities. Overall, the facial recognition attendance system has significantly improved our attendance management process and is poised to deliver long-term benefits to our organization.

7. FUTURE SCOPE:

The future scope of the facial recognition attendance system project includes integrating it with access control for seamless entry/exit, enhancing reporting and analytics for attendance insights, developing a mobile app for user convenience, integrating with HR/student management systems for streamlined data management, continuous improvement of algorithms and infrastructure, cloudbased deployment for scalability, ensuring compliance and privacy, and expandability to include features like visitor management and security surveillance.

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Year: 14-15 June 2018

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Title: Face Recognition Based on Shallow Convolutional Neural Network Classifier

Journal: ACM Journals

Year: 18 May 2020

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Journal: IEEE

Year: 03 November 2020

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Title: Potential of Robust Face Recognition from Real

Journal: Springer Link

Year: 30 August 2020

https://link.springer.com/chapter/10.1007/978-981-15-5679-1_2

[9] Author: Adrian Rosebrock

Title: Face recognition with OpenCV, Python, and deep learning

Journal: PyimageSearch

Year: 18 June 2018

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Journal: Geeksforgeeks

Year: 06 May, 2021

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Journal: Great Learning

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Title: Raspberry Pi Face Recognition

Journal: PyimageSearch

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