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SMART COLLEGE SYSTEM

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Abstract: **A prototype of a smart college system is developed. It provides a real time Deep Learning based surveillance system at the surroundings of any college to find out the criminal (if any).And this system will generate an alarming message to inform the proper security person. This Deep Learning based system would also activate a Face Detection & Recognition system for the students, college teachers and college employees at the entrance. So that only the genuine registered persons will be allowed without restriction. The teachers and employees attendance will be marked automatically. And there will be a Deep Learning based automatic Smart Attendance System for every student in every classroom.**

Keywords: **Surveillance, Facial recognition, deep learning, MTCNN, Deep face**

I. INTRODUCTION:

Modern educational environments are changing quickly, and to meet the challenges of administrative efficiency and campus security, advanced technologies are desperately needed. These demands are frequently not met by traditional systems, especially when it comes to automated attendance tracking and real-time monitoring. This paper presents a prototype of a Smart College System that aims to improve operational efficiency and security in educational institutions by integrating state-of-the-art Deep Learning techniques. This prototype's real-time Deep Learning-based surveillance system, which makes use of complex algorithms to continuously monitor the college environment, is its main innovation. Through the use of models like DeepFace and MTCNN (Multi-task Cascaded Convolutional Networks), the system is able to recognize and detect people, including those who might pose a threat. The system sends out immediate alerts to the relevant security personnel when it notices suspicious activity, allowing for efficient and timely responses. The Smart College System includes a Face Detection and Recognition module at the college entrance in addition to surveillance. This module uses the DeepFace and MTCNN frameworks to authenticate staff, faculty, and students, allowing access to only those who have registered. By preventing unwanted access and preserving a seamless and effective entry process, this improves security.

Teachers, staff members, and students can all track their attendance automatically with this system. While students' presence in classrooms is tracked by a Deep Learning-based Smart Attendance System, faculty and staff have automatic attendance tracking upon arrival. The purpose of this paper is to illustrate the Smart College System prototype's viability and efficacy. An important development in the use of deep learning for educational management is the combination of DeepFace and MTCNN technologies, providing a robust solution to contemporary challenges in college environments.

II. RELATED WORK:

1. "An approach for smart office automation that uses Faster R-CNN for face recognition integrated with IoT technology was presented by Rajeshkumar et al. in their 2023 paper. The system uses cutting-edge facial recognition technology to identify people in order to improve security and automate a number of office tasks. The study establishes a standard for comparable applications in smart environments by demonstrating how well deep learning and IoT can be combined to create reliable automation systems."
Because deep learning can improve security through real-time monitoring, its integration into surveillance

2.The work of Policepatil and Hatture offers a thorough analysis of face liveness detection methods, an essential component of face recognition systems designed to discern between genuine and fraudulent faces. The research delves into diverse techniques and innovations employed to thwart spoofing attempts, underscoring the significance of liveness detection in augmenting the security and dependability of biometric systems. This research is a useful tool for comprehending the difficulties and developments in the field of face liveness detection."

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3.In order to automate and simplify the process of managing attendance in educational settings, Aishwarya et al. (2021) created a smart attendance system that makes use of deep learning. Convolutional neural networks (CNNs) are used by the system for facial recognition, which enables it to precisely identify and log the presence of students in a classroom. The authors draw attention to the system's real-time functionality, which lowers the possibility of proxy attendance and lessens the administrative load related to conventional approaches. Through the use of deep learning techniques, the system enhances attendance tracking accuracy and efficiency. The research offers a scalable solution that can be used across different institutions to improve attendance management, demonstrating notable advancements in the application of AI in educational technologies."

III. PROPOSED FRAMEWORK:

There are three separate sections in our proposed framework.

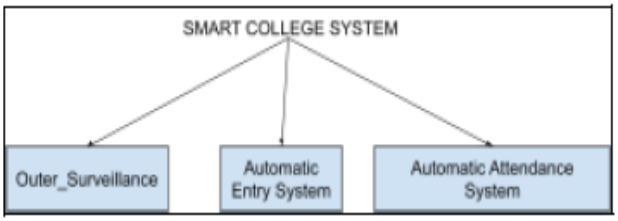

Fig 1: Block Diagram of the Proposed System

systems has been thoroughly studied. A deep learning-based surveillance system that could recognize questionable activity and notify security staff was presented in a study by Liu et al. (2018). The objective of the suggested system, which is to identify criminals in a college setting, is comparable to this strategy

Fig 2: Screenshot Of the Output of Proposed

Framework

After clicking the 'Let's Start' button, 3 separate threads will be opened and all these will work simultaneously

IV. WORKING PRINCIPLE:

OUTER SURVEILLANCE:

Picture Acquisition: To take pictures in real time, the college has positioned a number of cameras in strategic locations. The system receives these images continuously for processing.

Face Detection: The system uses Multi-task Cascaded Convolutional Networks (MTCNN) to detect faces in images after it receives them. Because MTCNN can withstand a wide range of facial angles and lighting conditions, it is the model of choice. Each detected face's bounding box is identified by the network, enabling precise cropping of the facial region.

Face Recognition: The system employs the DeepFace framework to carry out face recognition after faces have been identified. The identified face is contrasted with pictures of well-known criminals from a reference database. DeepFace ensures high matching accuracy by extracting distinct facial features using deep convolutional neural networks

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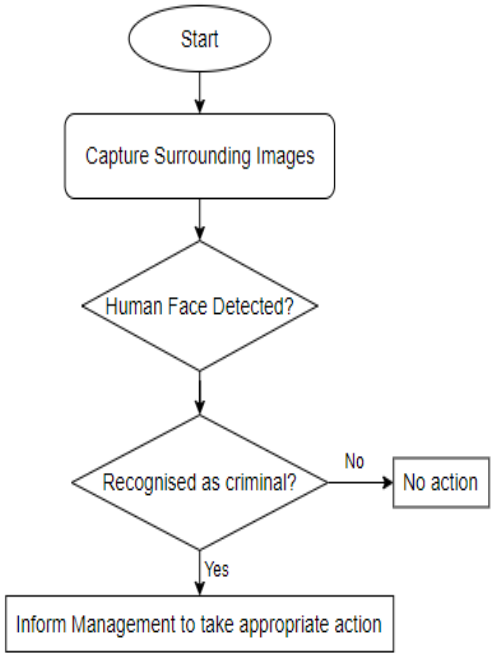

Fig 3: Flow Chart of Outer Surveillance System .

Real-Time Comparison: The detected face and the photos in the criminal database are compared in real-time by the system. Pre-trained models that have been refined for facial recognition applications are used in this comparison. The system sends out an alert if a match is discovered, giving the authorities the information they need to take quick action.
Output and Alerts: The system not only sets off alarms but also saves the identified faces along with
related information in an output folder for later examination.

FOR ENTRANCE:
Face Detection: The system uses strategically positioned cameras to take pictures of people's faces as they get closer to the entrance.
Face Recognition: After the photos are taken, they are processed and compared to a database of people who have already been given permission. Even in difficult situations, the system recognizes faces accurately thanks to its sophisticated Deep Learning models.

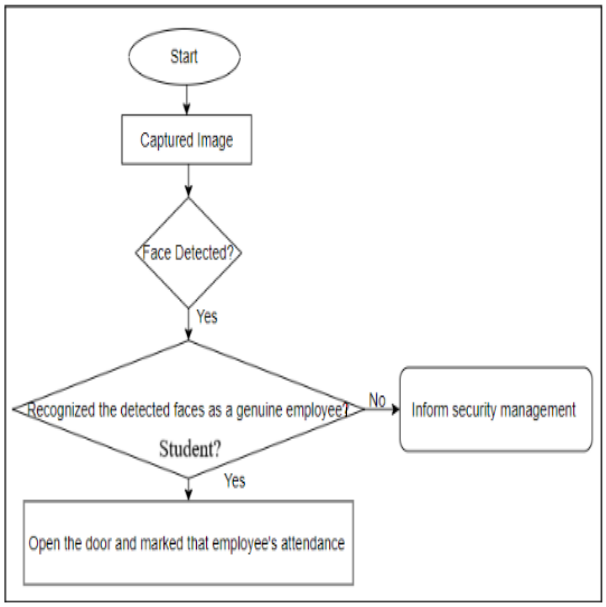

Fig 4: Flow Chart of the Entry System

Liveness Checking: Following facial recognition, a liveness check is performed to confirm that the identified person is real and not a spoof (such as a picture or video clip). By taking this step, the recognized face's authenticity is guaranteed.
Access Control: The person is given access without the need for additional manual verification if their face passes both the recognition and liveness checks. The system can issue an alert or refuse access if any step is not completed, making sure that only legitimate.

FOR AUTOMATIC CLASSROOM ATTENDANCE:
Face Recognition and Detection: The system has sophisticated face recognition and detection features. Modern image processing techniques, like MTCNN (Multi-task Cascaded Convolutional Networks), are used to identify faces in real-time video streams. The same face detection algorithms are used to find and identify faces in static images that have already been taken.
Real-time video feeds from classroom cameras are captured by the system, which uses live image processing to identify and classify students as they enter. Real-time image processing makes sure that attendance tracking is done instantly and accurately
Previously Captured Image Processing: The system is capable of processing previously captured images in addition to processing images in real time. With the help of photos taken at different times for verification and attendance marking, this feature enables flexible attendance recording.

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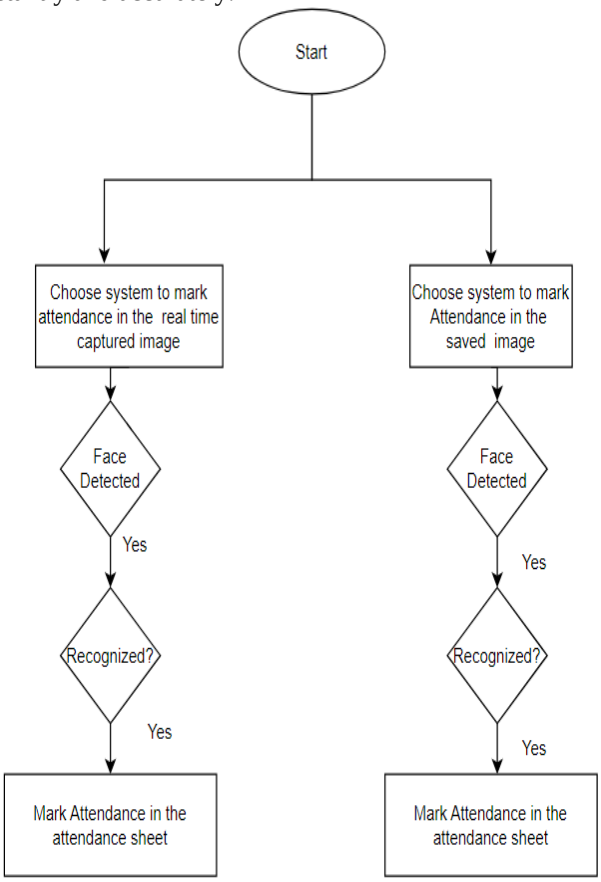

Fig 5: Flow Chart of the Automatic Classroom Attendance System

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V. ALGORITHMS:

For Face Detection:
MTCNN pre trained model: A pre-trained deep learning model called MTCNN (Multi-task Cascaded Convolutional Networks) is intended for effective and precise face detection. Through the use of a three-stage process that gradually improves face localization and landmark prediction, it accomplishes joint face detection and alignment.

For Face Recognition:
Deepface pre trained model: Facebook developed DeepFace, a pre-trained deep learning model for face recognition. By mapping face photos to a common feature space and employing a deep neural network for reliable identification under a range of circumstances, it achieves high accuracy.

For Liveness Detection:
Convolutional Neural Network: Convolutional neural networks are used in CNN-based liveness detection to discern between real and fake faces by examining texture, motion, and other biometric indicators, providing reliable and accurate face recognition.

VI. EXPERIMENT & RESULT:

FOR OUTER SURVEILLANCE:
Data : We used dummy images to test the 'OUTER SURVEILLANCE' framework. Pictures were taken from Google to depict various people in a college surrounding. After that, the photos were placed in a designated folder in order to be processed

Fig 6: image.jpg (Source google)

Fig 7: image1.jpg (Source google)

image.jpg and **image1.jpg** were taken from google and placed in the **'Dummy_Data_Outer_Surveillance'** folder

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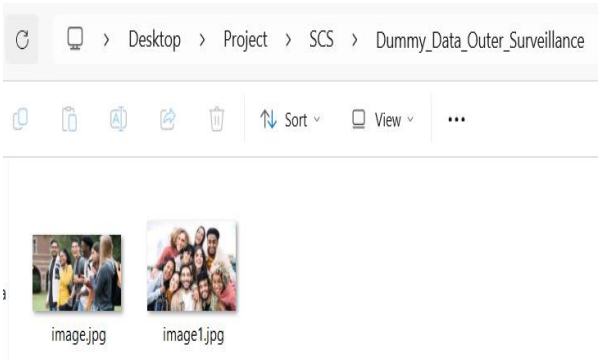

Fig 8: 'Dummy_Data_Outer_Surveillance' folder

Face Detection:
The MTCNN model was used by the system to process each image in order to identify faces. The system cropped and saved the facial region for every face it detected, saving it to a specific output folder.
In this case, the MTCNN detected faces are cropped and saved in the **detected folder.**

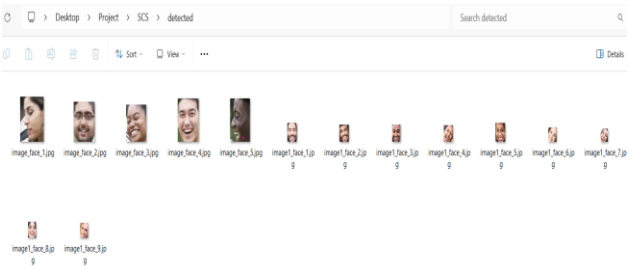

Fig 9: detected folder

Face Recognition:
Using the DeepFace framework, each cropped face was compared to the reference criminal database. An alert was generated and the identity of the recognized individual was logged if a match was found.
In this case **'Criminal Database'** folder is used.It contains dummy criminal images.

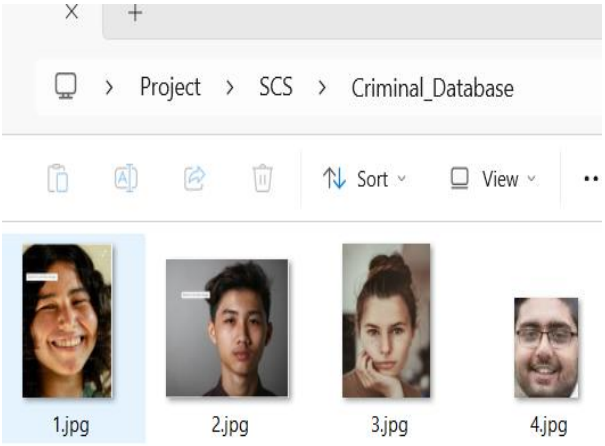

Fig 10: Criminal Database

Output:

```
image.jpg
C:/Users/ANKITA/OneDrive/Desktop/Project/SCS/
Dummy_Data_Outer_Surveillance\image.jpg
face_filename image_face_1.jpg
Saved
C:/Users/ANKITA/OneDrive/Desktop/Project/SCS/
detected\image_face_1.jpg
No match found for face 1 in image.jpg
face_filename image_face_2.jpg
Saved
C:/Users/ANKITA/OneDrive/Desktop/Project/SCS/
detected\image_face_2.jpg
Recognized 4.jpg
ofC:/Users/ANKITA/OneDrive/Desktop/Project/SC
S/Criminal_Database
withimage_face_2.jpgofimage.jpg
face_filename image_face_3.jpg
Saved
C:/Users/ANKITA/OneDrive/Desktop/Project/SCS/
detected\image_face_3.jpg
No match found for face 3 in image.jpg
face_filename image_face_4.jpg
Saved
C:/Users/ANKITA/OneDrive/Desktop/Project/SCS/
detected\image_face_4.jpg
No match found for face 4 in image.jpg
face_filename image_face_5.jpg
Saved
```

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```
C:/Users/ANKITA/OneDrive/Desktop/Project/SCS/
detected\image_face_5.jpg
No match found for face 5 in image.jpg
image1.jpg
C:/Users/ANKITA/OneDrive/Desktop/Project/SCS/
Dummy_Data_Outer_Surveillance\image1.jpg
face_filename image1_face_1.jpg
Saved
C:/Users/ANKITA/OneDrive/Desktop/Project/SCS/
detected\image1_face_1.jpg
No match found for face 1 in image1.jpg
face_filename image1_face_2.jpg
Saved
C:/Users/ANKITA/OneDrive/Desktop/Project/SCS/
detected\image1_face_2.jpg
No match found for face 2 in image1.jpg
face_filename image1_face_3.jpg
Saved
C:/Users/ANKITA/OneDrive/Desktop/Project/SCS/
detected\image1_face_3.jpg
No match found for face 3 in image1.jpg
face_filename image1_face_4.jpg
Saved
C:/Users/ANKITA/OneDrive/Desktop/Project/SCS/
detected\image1_face_4.jpg
No match found for face 4 in image1.jpg
face_filename image1_face_5.jpg
Saved
C:/Users/ANKITA/OneDrive/Desktop/Project/SCS/
detected\image1_face_5.jpg
No match found for face 5 in image1.jpg
face_filename image1_face_6.jpg
Saved
C:/Users/ANKITA/OneDrive/Desktop/Project/SCS/
detected\image1_face_6.jpg
No match found for face 6 in image1.jpg
face_filename image1_face_7.jpg
Saved
C:/Users/ANKITA/OneDrive/Desktop/Project/SCS/
detected\image1_face_7.jpg
No match found for face 7 in image1.jpg
face_filename image1_face_8.jpg
Saved
C:/Users/ANKITA/OneDrive/Desktop/Project/SCS/
detected\image1_face_8.jpg
No match found for face 8 in image1.jpg
```

```
face_filename image1_face_9.jpg
Saved
C:/Users/ANKITA/OneDrive/Desktop/Project/SCS/
detected\image1_face_9.jpg
No match found for face 9 in image1.jpg
Processing completed.
```

It can be noticed from that **image_face_2.jpg** detected from **image** saved in the of the **detected** folder is matched with **4.jpg** of the **Criminal_Database folder**

FOR ENTRY SYSTEM:

Data: Rather than taking a live image, the system loads a previously saved image 'image.jpg' from local storage**.**

Fig 10: image.jpg

Face Detection Using MTCNN: The system recognizes faces in the loaded image by using the Multi-task Cascaded Convolutional Networks (MTCNN) model. Bounding boxes surrounding the detected faces are identified by the model.

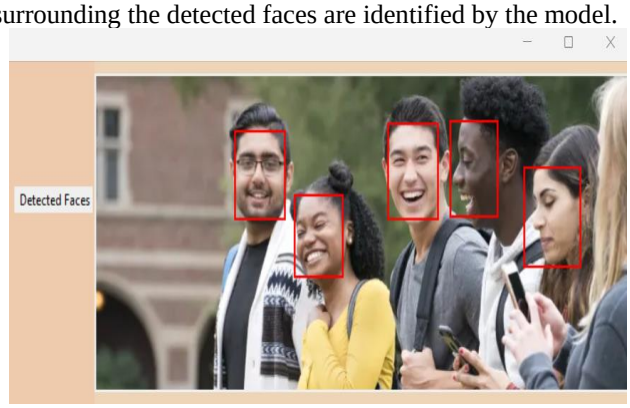

Fig 11: Detected Faces in image.jpg

Cropping and Saving Faces: The identified faces are extracted from the source image and stored as distinct files. The subsequent stages of recognition and liveness checking employ these cropped images.

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Fig 12: Cropped Faces

Face Recognition Database Comparison: Using the DeepFace library, the system compares each face it detects to an image reference database. This database includes pictures of people who are authorized (e.g., employees, students).

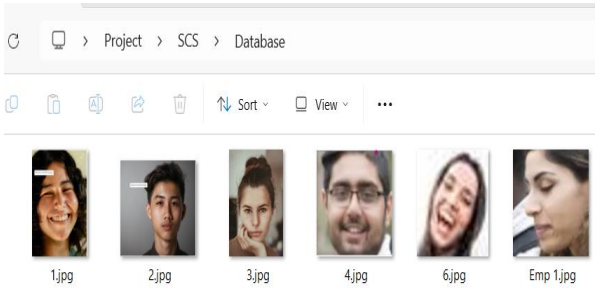

Fig 13: Reference Database Folder

Recognition: There should be a match between the identified person's face and an image in the database, the system identifies them.

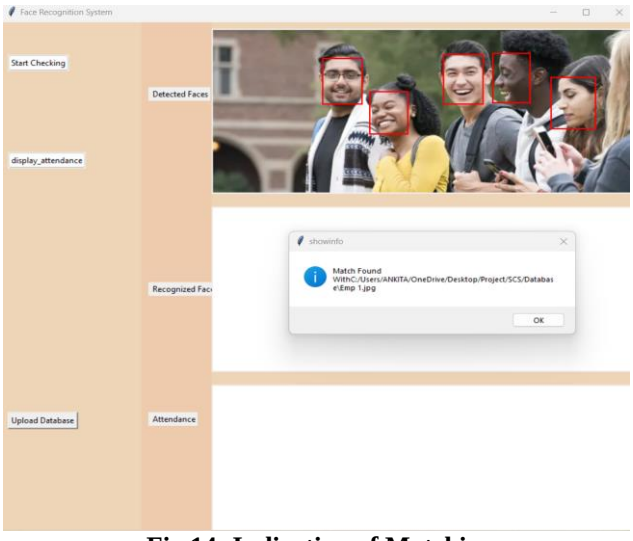

Fig 14: Indication of Matching

Liveness Model: The system uses a liveness detection model to confirm whether a face is that of a real person after it has identified one. This is done to stop photo- or video-spoofing attacks.After processing the face image, the liveness model provides a score that indicates how real the face is. The face is deemed real and attendance is recorded if the score is higher than a predetermined level.

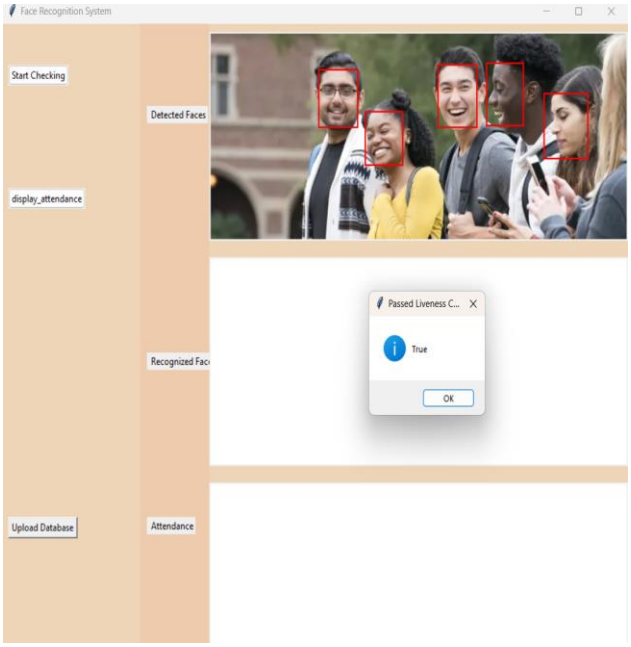

Fig 15: Indication of Passing Liveness

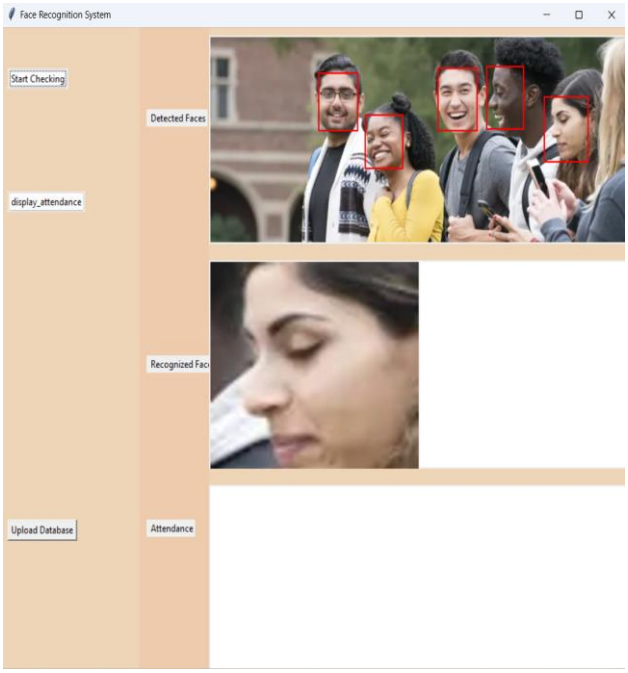

Fig 16: Recognized Image

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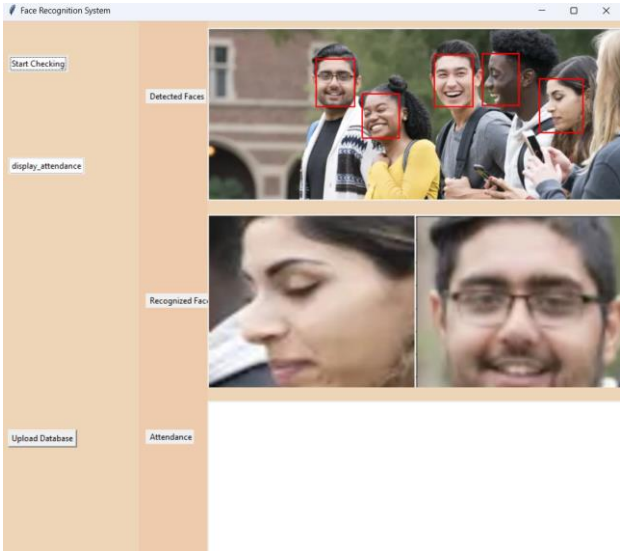

Fig 17: Recognized Image

Attendance Marking Date and Time Logging: The system logs the name of each identified and authenticated (real) face in addition to the current time and date. This data is kept in a CSV file that is divided into categories according to the person's employment status.

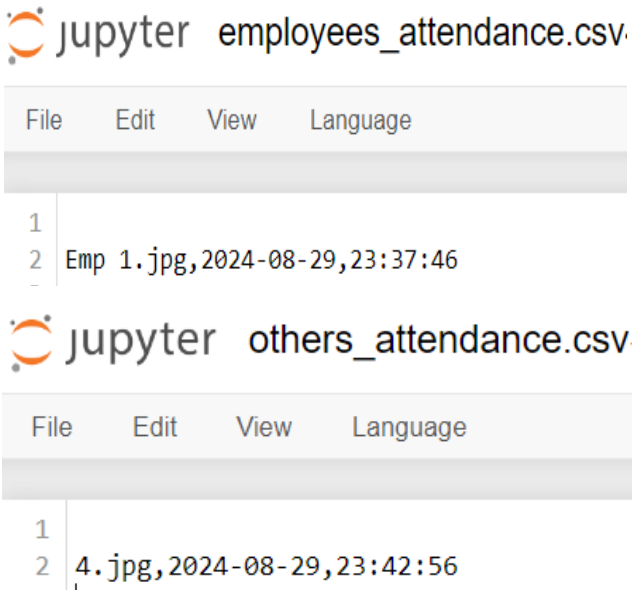

Fig 18: Marked Attendance in the CSV file

Output and Display: The system can also show the associated attendance records and faces that have been identified on the user interface.

AUTOMATIC ATTENDANCE:

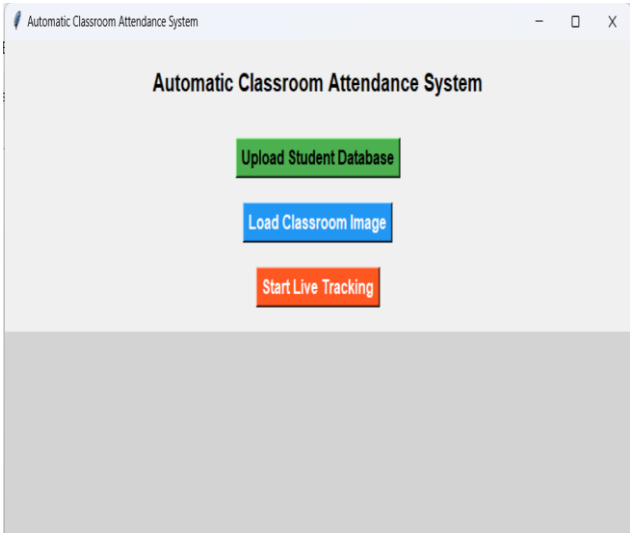

Fig 19: Dashboard of the Automatic Attendance System

There are two modes:
Live Tracking Mode: In this mode, a camera records live video, the system continuously recognizes and detects faces, and it dynamically updates attendance. In classrooms, this mode is especially helpful for real-time monitoring**.**

Processing of Static Images: Users can also load a static image of a classroom to be processed by the system. This feature can be used to process images taken at different times and is helpful when live tracking is not possible.
In our case we choosed the static image processing option and we used the below given static Image

Fig 20: BBA.jpg

The system uses the Multi-task Cascaded Convolutional Networks, or MTCNN, to first identify faces in the input image or video feed.
After a face is identified, the DeepFace library is used by the system to compare each identified face with the photos in the student database. The student's name is identified and their attendance is recorded if a match is discovered.

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In our case we used the given database

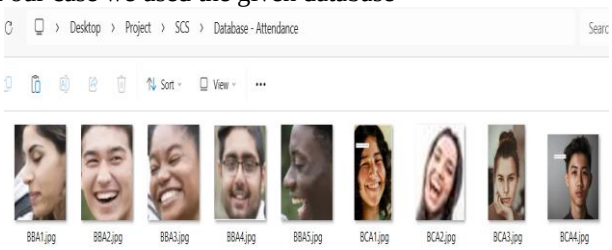

Fig 21: Database - Attendance

Here each student's photo will be preloaded with their department name along with their id.
Ultimate result
The Tkinter GUI offers a user-friendly interface through

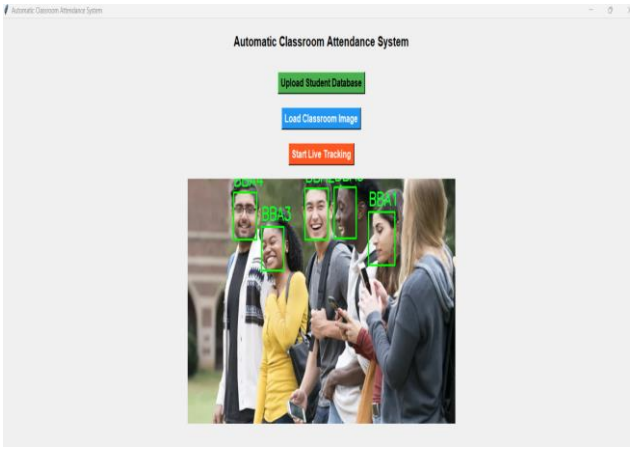

Fig 22: Attendance Marked Student

Each type of student (BCA, BBA, etc.) has their attendance tracked in a CSV file. Every entry has the pupil's Name, date, and time of recognition are all included in each entry for the student.

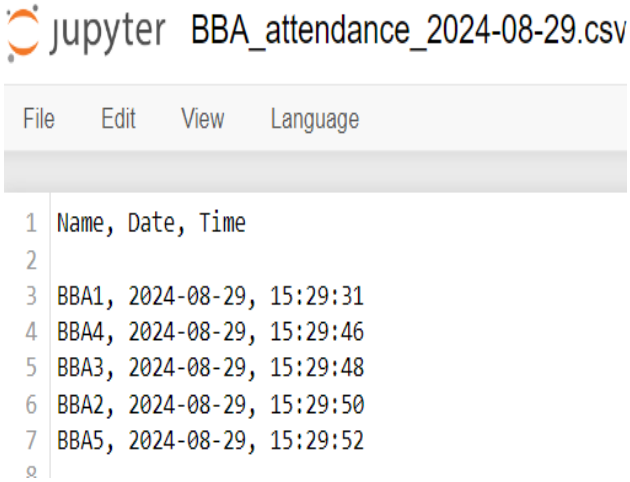

Fig 23: Attendance Marked in CSV file

It can be seen from the above images that all the BBA students are marked and saved in the csv file.

VII. CONCLUSION & FUTURE SCOPE:

The Smart College System prototype efficiently incorporates cutting-edge facial recognition and detection technologies to improve security and expedite attendance monitoring in educational settings. Through the use of DeepFace and MTCNN, the system can recognize people with high accuracy from a variety of images taken with different cameras. Through the verification of the recognized faces' authenticity, the liveness detection feature enhances the system's dependability even more.
which users can interact with the system, upload reference images, view attendance reports, and control various functionalities. The prototype shows the potential of combining machine learning with user-friendly applications for real-world scenarios, despite the current limitations and problems encountered.

Future Scope:
Real-Time Implementation: Using real-time video feeds instead of static images could greatly improve the usability and functionality of the system. Putting live surveillance features in place could result in more timely and dynamic monitoring.
Enhanced Accuracy: Adding more complex models or giving the system training data from a wider range of sources could lead to even greater gains in face recognition accuracy. This would facilitate handling changes in angles, lighting, and facial expressions more effectively.
User authentication: By incorporating extra layers of authentication, like multi-factor authentication, you can improve system security and thwart unwanted access.
Scalability: The system would be more appropriate for deployment in larger institutions or even across multiple locations if it could handle larger datasets and more extensive networks of cameras.
Systems: Combining the attendance system with other institutional systems, like student portals or academic records, may offer a more complete approach to student management and observation.
Enhancements to the User Experience: Adding more features to the GUI, like customizable reports, real-time notifications, and improved error handling, would make the system more effective and user-friendly.
Ethical and Privacy Considerations: For adoption to be more widely adopted, it will be essential to address ethical issues and make sure privacy laws are followed. Putting in place strong data security protocols

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