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Sketch Based Criminal Identification System

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ABSTRACT: The Sketch-Based Criminal Identification System is designed to assist law enforcement in accurately identifying criminals based on sketches provided by eyewitnesses. Traditional criminal identification methods rely heavily on manual comparisons, which are time-consuming and prone to errors. This system leverages advanced techniques in image processing and machine learning to compare hand-drawn sketches with a database of criminal images efficiently. It provides a user-friendly interface for uploading sketches and retrieving potential matches, reducing the time required for investigations and improving accuracy. The system also emphasizes security and privacy, ensuring sensitive data is protected. Overall, it aims to modernize the criminal identification process, making it faster, more reliable, and accessible to law enforcement authorities.

I. INTRODUCTION

The motivation behind developing “**The Third Eye**” stems from the need to enhance the speed and accuracy of criminal identification systems. In many real-world cases, law enforcement agencies rely on sketches or partial facial information provided by witnesses, which may not always lead to successful identification. This creates a gap between available evidence and effective investigation.

To bridge this gap, there is a strong need for an automated system that can intelligently analyze facial features and match them with a database. By leveraging advanced deep learning models like FaceNet and tools such as DeepFace, this project aims to assist authorities in identifying suspects quickly and accurately. The idea is to reduce human effort, minimize errors, and provide a reliable technological solution for forensic investigations. In this modern age, the overall crime rate is increasing day-by-day and to cope up with this the law enforcement departments too should find ways that would speed up the overall process and help them in bringing one to justice. One such way can be using face recognition technology for identifying and verifying the criminal.

The traditional approach here is to use the hand-drawn face sketches drawn by forensic sketch artist to identify the criminal, modernizing this would mean using the hand-drawn sketch and then matching them with the law enforcement departments database to identify the criminal. Using this approach would result in the various limitations with latest technologies and even would be time consuming as there are very few forensic sketch artists available when compared to the increasing crime ratio. Thus, there is a need for creating an application which would not just provide a set of individual features like eyes, ears, mouth, etc. to be selected to create a face sketch that would help in finding the criminal much faster and efficiently.

II. EXISTING SYSTEM

The existing systems used for criminal identification mainly rely on manual methods and traditional techniques. In most cases, law enforcement agencies depend on eyewitness descriptions to create facial sketches of suspects. These sketches are then compared manually with a database of known criminals, which is a time-consuming and inefficient process.

Some systems use basic image processing techniques, but they lack advanced intelligence and accuracy. These systems often fail when there are variations in lighting, facial expressions, or image quality. Moreover, traditional methods require significant human effort and expertise, making them less reliable and prone to errors. In many cases, the identification process is delayed due to the absence of automated tools that can quickly analyze and match facial features. The lack of integration between databases and recognition systems further reduces efficiency.

III. PROPOSED SYSTEM

This is a standalone application that allows users to construct an accurate composite face sketch using predefined facial feature sets. These features can be resized and repositioned based on the description provided by the eyewitness, making the sketch creation process flexible and user-friendly.

Moreover, the constructed composite sketch can be matched with the law enforcement database using deep learning techniques, ensuring fast and efficient identification of suspects. The system can also process hand-drawn sketches, making it compatible with traditional methods while enhancing them with modern AI-based recognition capabilities.

IV. METHODOLOGY

The methodology of the proposed system explains how different modules work together to provide an effective **Sketch-Based Criminal Identification System**. The system is divided into several modules, each responsible for specific functionalities.

i. Data Collection

This module is responsible for collecting facial images and criminal records from reliable sources such as law enforcement databases. The data includes images, personal details, and identification features. The collected data is preprocessed and stored in a structured format to ensure accuracy and efficiency in further processing.

ii. Big Data Processing

This module allows users (such as police officials) to upload or draw a sketch of a suspect using the system interface. The sketch can be created using predefined facial components or uploaded as an image. This module ensures that the input sketch is clear and suitable for comparison.

iii. Image Processing Module

This module processes the input sketch by applying image preprocessing techniques such as noise removal, edge detection, and normalization. It converts the sketch into a feature representation that can be compared with stored images in the database.

iv. Feature Extraction and Matching Module

This module extracts important facial features from both the sketch and stored images using machine learning algorithms. It compares the extracted features to find similarities and identify possible matches. The system ranks the results based on similarity scores.

v. Database Management System

This module manages the storage of criminal records and facial images. It ensures efficient data retrieval and secure storage. The database is regularly updated with new records and maintained for accuracy.

vi. Result Display Module

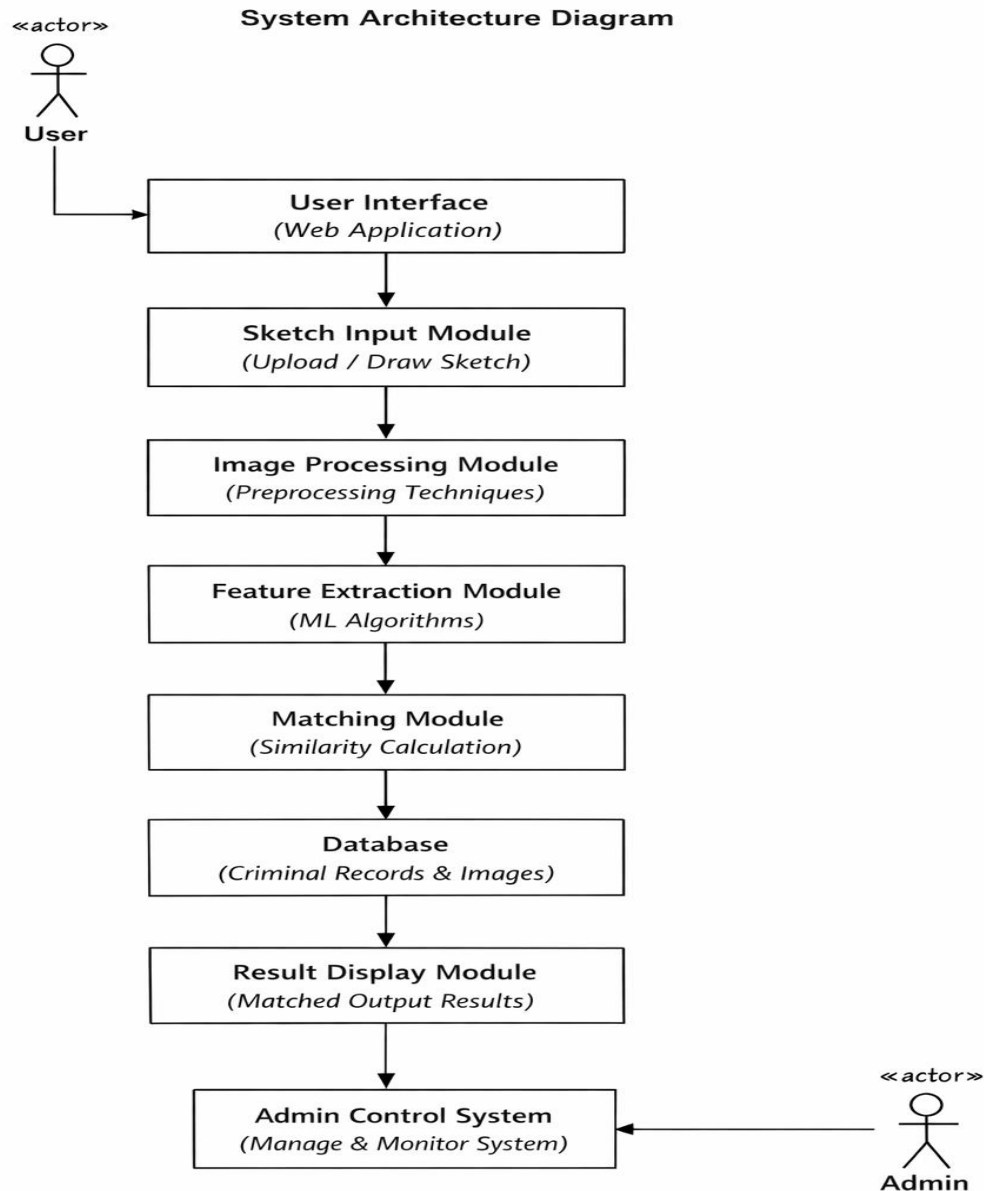
This module displays the matched results to the user. It shows the most similar criminal records along with details such as name, ID, and past records. This helps authorities in quick identification and decision-making.

vii. Admin Control System

This module allows the admin to manage the entire system. It includes adding or removing records, monitoring system performance, validating data, and ensuring security. It maintains the smooth functioning and reliability of the system.

V. SYSTEM ARCHITECTURE

System architecture defines the overall structure of a system and explains how different components interact with each other to perform the required tasks. It provides a high-level view of the system, showing the organization of hardware, software, data, and communication mechanisms. A well-designed system architecture improves performance, scalability, security, and maintainability. This architectural design helps in modular development, easy system upgrades, and effective management of resources. It also ensures that changes in one module do not affect other modules, making the system reliable and efficient.



The system architecture of the Sketch-Based Criminal Identification System represents how different components interact to process the input sketch and identify matching criminal records. The architecture is designed in a modular and layered manner to ensure accuracy, efficiency, and ease of use.

At the top level, the system consists of two main actors: the User and the Admin. The user (police or authorized personnel) interacts with the system to provide input, while the admin manages and monitors the system operations. The process begins with the User Interface, which acts as a bridge between the user and the system. It provides a web-based platform where users can upload or draw a suspect sketch. This interface is designed to be simple and user-friendly.

Once the sketch is provided, it is passed to the Sketch Input Module, which captures and prepares the sketch for further processing. This module ensures that the input is in the correct format.

The sketch then moves to the Image Processing Module, where preprocessing techniques such as noise removal, resizing, and normalization are applied. This step enhances the quality of the sketch and makes it suitable for feature extraction.

After preprocessing, the system enters the Feature Extraction Module, where important facial features are extracted using machine learning algorithms. These features represent unique characteristics of the face.

Next, the Matching Module compares the extracted features with those stored in the database. It calculates similarity scores and identifies the closest matches.

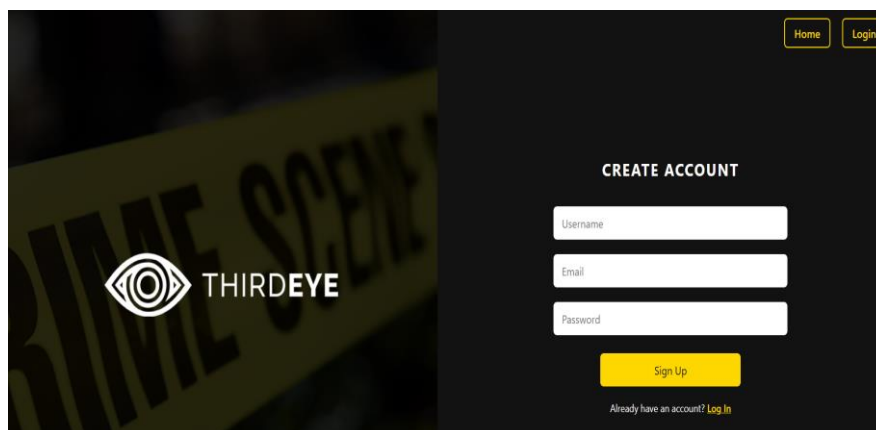
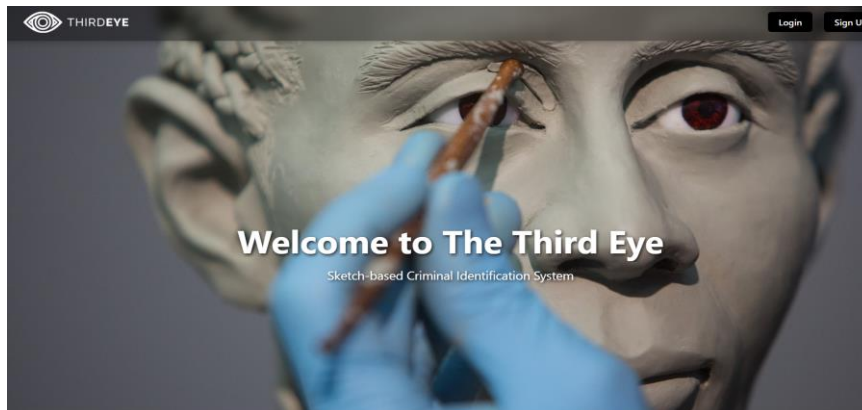
The Database stores criminal records along with facial images and related details. It plays a crucial role in retrieving relevant data during the matching process.

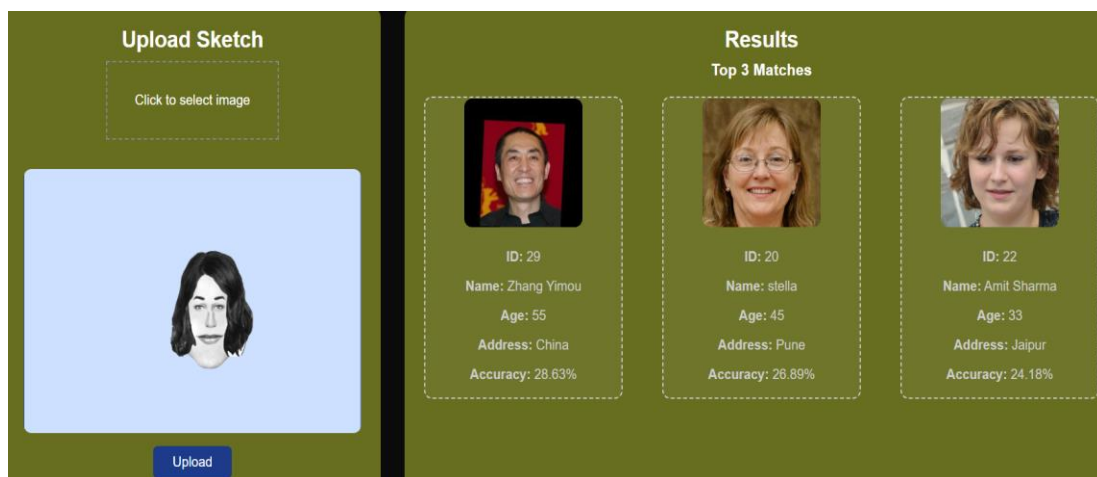
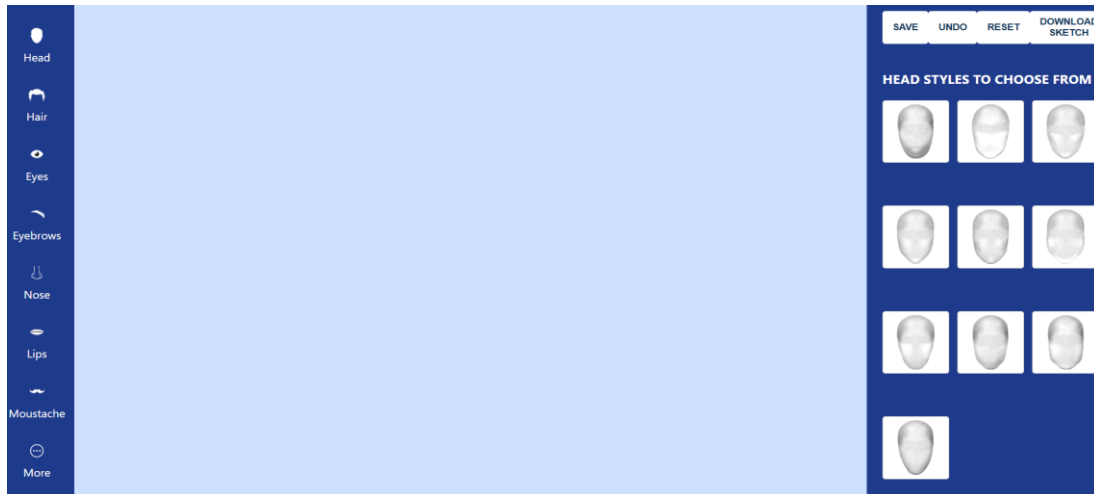
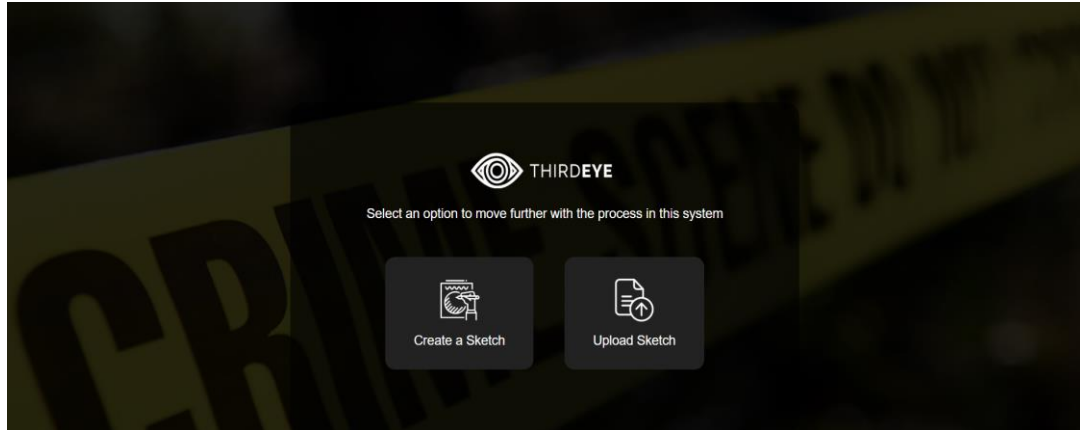
The results are then displayed through the Result Display Module, which shows the matched records along with details such as name, ID, and previous history. This helps authorities in quick identification.

Finally, the Admin Control System allows the admin to manage the entire system. The admin can update records, monitor system performance, validate data, and ensure smooth functioning.

Overall, this architecture ensures a systematic flow of data from input to output, enabling efficient and accurate criminal identification.

VI. RESULTS AND OUTPUT





VII. CONCLUSION

The project “The Third Eye – Sketch-Based Criminal Identification System” presents an innovative solution for identifying criminals using facial sketches and artificial intelligence. Unlike traditional methods that rely on manual comparison, this system automates the identification process by analyzing sketches and matching them with a database of criminal images.

The system utilizes advanced deep learning techniques through DeepFace and the FaceNet model to extract and compare facial features effectively. By incorporating OpenCV for image preprocessing and Flask for backend operations, the system ensures smooth processing and accurate results. The use of SQLite enables efficient storage and retrieval of criminal records.

The system was tested using various testing methods, including unit testing, integration testing, system testing, performance testing, and security testing, ensuring reliability and efficiency. It supports both hand-drawn sketches and digital images, making it compatible with traditional investigation methods while enhancing them with modern technology.

In conclusion, the project successfully achieves its objective of developing a fast, accurate, and user-friendly sketch-based criminal identification system. It has strong potential for real-world applications in law enforcement and forensic departments. With further improvements such as real-time surveillance integration and larger datasets, the system can be extended into a powerful tool for advanced crime investigation.

VIII. FUTURE SCOPE

The proposed sketch-based criminal identification system can be further enhanced to improve its performance and usability. One of the major improvements is the integration of real-time face recognition using CCTV cameras, which would allow continuous monitoring and instant identification of suspects in public areas.

The system can also be improved by increasing the size and diversity of the dataset. A larger dataset will help the deep learning model achieve higher accuracy and better matching results, especially when dealing with different lighting conditions, angles, and facial variations.

Another important enhancement is the development of a mobile application, which would enable law enforcement officers to use the system in the field. Additionally, integrating cloud technology can improve scalability, storage capacity, and remote accessibility of the system.

Furthermore, advanced deep learning models can be implemented to improve the accuracy of sketch-based recognition, especially for hand-drawn sketches. The system can also be extended to support multi-face detection and identification in a single image.

Finally, the system can be enhanced by improving security features such as data encryption and secure authentication mechanisms, along with a more user-friendly interface for better usability and efficiency.

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