IJARSCT
International Journal of Advanced Research in Science, Communication and Technology
International Open-Access, Double-Blind, Peer-Reviewed, Refereed, Multidisciplinary Online Journal
ISSN: 2581-9429
Volume 6, Issue 9, May 2026
Impact Factor: 8.2

Image-Based Identification of Criminals & Missing Children

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Abstract: *The increasing number of criminal activities and missing children cases has created a need for faster and more reliable identification systems. This project presents an image-based identification system that uses facial recognition techniques to detect and identify criminals and missing children from images and live video streams. The system employs Haar Cascade algorithms for face detection and OpenCV-based image processing for feature extraction and recognition. Captured facial images are compared with stored records in the database to find matching identities. When a match is detected, the system generates notifications to assist authorities in quick action and investigation. The proposed system aims to improve identification accuracy, reduce manual efforts, and support public safety through automated real-time monitoring and recognition..*

Keywords: Face Recognition, Haar Cascade, OpenCV, Image Processing, Criminal Identification, Missing Children Detection, Facial Feature Extraction, Real-Time Surveillance.

I. INTRODUCTION

The rapid growth of digital surveillance systems and image processing technologies has significantly improved the field of public safety and criminal investigation [1]. Traditional methods used for identifying criminals and locating missing children mainly depend on manual verification, eyewitness reports, and police records, which are often time-consuming and less accurate [2]. Due to the increasing number of missing person cases and criminal activities, there is a strong need for an automated and intelligent identification system [3].

Facial recognition technology has emerged as an effective solution for recognizing individuals using facial features extracted from images and video streams [4]. Image-based identification systems use computer vision and machine learning techniques to detect and recognize faces with high accuracy [5]. Among various approaches, the Haar Cascade algorithm is widely used for real-time face detection because of its speed and reliability [6]. OpenCV libraries further enhance image preprocessing, feature extraction, and recognition processes [7].

The proposed system focuses on identifying criminals and missing children using facial recognition techniques. The system captures images through cameras or uploaded photographs, detects faces, extracts facial features, and compares them with records stored in the database [8]. When a matching face is identified, the system generates notifications to assist law enforcement authorities in taking immediate action [9].

This project aims to develop a reliable, efficient, and user- friendly system that can improve identification accuracy, reduce human effort, and support faster investigation processes [10].

II. PROBLEM STATEMENT

The identification of criminals and missing children is a major challenge for law enforcement agencies due to the limitations of traditional manual investigation methods, which are often slow, labor-intensive, and prone to human error. In many cases, delayed identification reduces the chances of locating missing children and tracking criminal suspects effectively. Existing systems may also struggle with handling large image databases, real-time monitoring, and accurate face matching under different lighting and environmental conditions. Therefore, there is a need for an

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automated image-based identification system that can efficiently detect and recognize faces from images or live video streams using facial recognition techniques, enabling faster identification, improved accuracy, and timely notification to authorities for enhanced public safety and investigation support.

III. OBJECTIVES

- To develop an image-based system for identifying criminals and missing children using facial recognition techniques.
- To implement the Haar Cascade algorithm for accurate and real-time face detection from images and video streams.
- To compare detected facial features with stored database records for reliable identification and matching.
- To generate automatic notifications and alerts when a matching face is identified in the system.
- To improve public safety by reducing manual investigation efforts and increasing the speed and accuracy of identification processes.

IV. LITERATURE SURVEY

Zhao and Chellappa (2003) presented an advanced face recognition framework in their paper on facial analysis and recognition techniques. Their work focused on improving facial feature extraction and classification methods for accurate human identification. The system achieved better recognition performance under controlled conditions. However, variations in lighting, facial expressions, and pose reduced the overall accuracy in real-world environments.

Turk and Pentland (1991) introduced the Eigenfaces method for human face recognition using Principal Component Analysis (PCA). Their approach reduced computational complexity and enabled efficient face matching using facial feature vectors. The method became widely used in early facial recognition systems. However, it was highly sensitive to illumination changes and image quality variations.

Ahonen and Pietikäinen (2006) proposed the use of Local Binary Pattern (LBP) features for robust face recognition. Their technique improved texture-based facial analysis and provided better recognition accuracy under different facial expressions. The method was computationally efficient and suitable for real-time systems. However, performance decreased when faces were heavily occluded or partially hidden.

Schroff and Philbin (2015) developed the FaceNet model, which used deep convolutional neural networks to generate highly accurate facial embeddings for recognition tasks. Their system significantly improved identification accuracy on large-scale datasets and became popular in modern face recognition applications. However, the model required large training datasets and high computational resources for effective performance.

Taigman and Yang (2014) introduced DeepFace, a deep learning-based face recognition system capable of achieving near-human-level accuracy. The model used deep neural networks and 3D face alignment techniques to improve recognition precision. Although the approach provided excellent accuracy, it required GPU-based processing and extensive training data, limiting its implementation in low- resource systems.

Parkhi and Vedaldi (2015) proposed the VGG-Face model for large-scale facial recognition using deep convolutional networks. Their approach enhanced feature extraction and improved matching accuracy across different facial poses and lighting conditions. The system demonstrated strong performance in surveillance and identification tasks.

Comparison Table

Author & Year	Method Used	Advantages	Limitations
Zhao and Chellappa (2003)	Facial feature extraction and classification	Improved face recognition accuracy	Sensitive to lighting and pose variations
Turk and Pentland (1991)	Eigenfaces using PCA	Reduced computational complexity	Poor performance under illumination changes
Ahonen and Pietikäinen (2006)	Local Binary Pattern (LBP)	Efficient texture-based recognition	Weak performance with occluded faces
Schroff and Philbin (2015)	FaceNet	High recognition	Requires large datasets and high

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	deep learning model	accuracy	computation
Taigman and Yang (2014)	DeepFace neural network	Near human- level face recognition	Needs GPU support and extensive training
Parkhi and Vedaldi (2015)	VGG-Face CNN model	Better feature extraction and matching	Large model size increases processing time

IV. WORKING OF SYSTEM

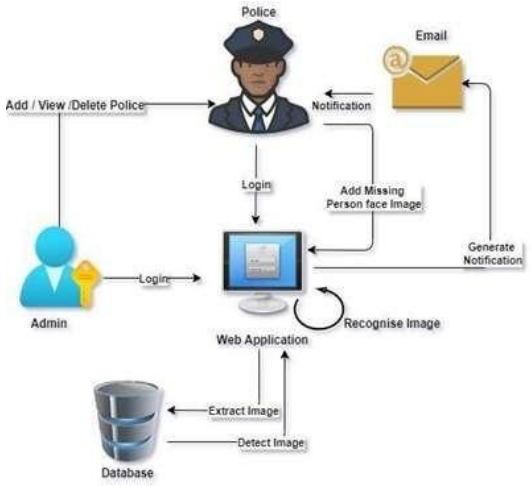

Fig 1: Design of the system

1. Admin Login and Management

The admin logs into the web application and manages police accounts by adding, viewing, or deleting authorized police users in the system.

2. Police Login

Authorized police personnel log into the application to access the criminal and missing child identification features.

3. Adding Missing Person Face Image

The police upload the image of a missing child or criminal into the system through the web application interface.

4. Image Detection and Extraction

The system processes the uploaded image using image processing techniques to detect and extract facial features from the image.

5. Database Comparison

Extracted facial data is compared with the images stored in the database using Haar Cascade and face recognition algorithms.

6. Face Recognition Process

The system recognizes and matches the detected face with existing criminal or missing person records available in the database.

7. Notification Generation

If a matching face is identified, the system automatically generates a notification containing the identification details.

8. Email Alert to Police

The generated notification and identification information are sent to the concerned police authority through email for immediate action.

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9. Result Monitoring
The police can monitor identification results and take further investigation steps based on the alerts generated by the system.

V. SYSTEM DESIGN

System Overview
1. User Authentication Module
This module provides secure login access for both admin and police users. It verifies usernames and passwords before allowing access to the system features.
2. Admin Management Module
The admin manages the overall system by adding, viewing, updating, or deleting police user accounts and maintaining system records.
3. Image Upload Module
Police users can upload images of criminals or missing children through the web application for identification and verification.
4. Face Detection Module
The uploaded image is processed using the Haar Cascade algorithm to detect human faces from the image or video frame accurately.
5. Feature Extraction Module
After face detection, important facial features are extracted from the detected face for further recognition and comparison.
6. Face Recognition Module
The extracted facial features are compared with stored records in the database to identify matching criminals or missing children.
7. Database Management Module
The database stores facial images, user details, criminal records, and missing person information securely for quick retrieval and comparison.
8. Notification Module
When a matching face is detected, the system automatically generates notifications and alerts for authorities.
9. Email Alert System
The application sends email notifications containing identification details to police officials for immediate action and investigation.
10. Result Monitoring Module
Police authorities can view identification results, monitor notifications, and manage investigation activities through the web interface.

System Design
1. Input Layer
The system accepts facial images through uploaded photographs or live camera feeds. The input images are forwarded to the processing module for analysis.
2. Processing Layer
This layer performs image preprocessing, face detection, feature extraction, and face recognition using OpenCV and Haar Cascade algorithms.
3. Database Layer
The database stores all criminal and missing person records, including facial images and personal details, for identification purposes.

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4. Application Layer
The web application provides an interface for admin and police users to upload images, manage records, and view identification results.
5. Notification Layer
This layer generates notifications and email alerts whenever a face match is identified within the system.
6. Output Layer
The final output displays the identification result, matched person details, and notification status to authorized users.

VI. RESULTS

The proposed image-based identification system for criminals and missing children was successfully developed and tested using facial recognition and image processing techniques. The system effectively detected human faces from uploaded images and live camera inputs using the Haar Cascade algorithm. After detection, facial features were extracted and compared with records stored in the database to identify matching individuals. The system demonstrated good accuracy in recognizing frontal facial images under normal lighting conditions and generated quick identification results with minimal processing delay.

During testing, the application successfully identified stored criminal and missing person records and automatically generated notifications and email alerts for the concerned police authorities. The web application interface allowed smooth image uploading, user authentication, and result monitoring. The database management system efficiently stored and retrieved facial records for comparison. The overall system reduced manual effort in identification processes and improved the speed of investigation support. However, slight performance reduction was observed in cases of blurred images, low lighting, and partially covered faces. Despite these limitations, the system proved to be reliable, efficient, and suitable for real-time public safety and surveillance applications.

VII. CONCLUSION

The proposed image-based identification system provides an effective solution for identifying criminals and locating missing children using facial recognition and image processing techniques. The system successfully integrates the Haar Cascade algorithm and OpenCV tools for face detection, feature extraction, and recognition. By comparing facial images with records stored in the database, the application can quickly identify matching individuals and generate notifications for police authorities. The developed system improves the speed, accuracy, and efficiency of the identification process while reducing manual investigation efforts. It also supports real-time monitoring and enhances public safety through automated detection and alert generation. Overall, the project demonstrates the practical use of facial recognition technology in law enforcement and missing person tracking applications.

VIII. FUTURE SCOPE

The proposed system can be further improved by integrating advanced deep learning algorithms such as CNN, FaceNet, and DeepFace to achieve higher recognition accuracy under different environmental conditions. Future enhancements may include real-time surveillance integration with CCTV cameras for continuous monitoring in public places. The system can also be expanded with cloud storage and mobile application support to enable remote access and faster communication between authorities. Additional features such as age progression analysis, mask face recognition, multilingual support, and GPS-based location tracking can improve the effectiveness of missing person identification. Integration with national crime databases and smart city surveillance systems can further enhance security, investigation efficiency, and large-scale deployment capabilities.

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