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Face Recognition System for Missing Person with Real Time Notification

Mrs. S. Elakkiya
Assistant Professor
Department of
Information Technology
M.I.E.T Engineering College
Tiruchirappalli, Tamil Nadu
elakkiyas81@gmail.com

S. Vishnupriya
Final Year
Department of
Information Technology
M.I.E.T Engineering College,
Tiruchirappalli, Tamil Nadu
vishnupriyasaravanan029@gmail.com

D. Keerthika
Final Year
Department of
Information Technology
M.I.E.T Engineering College,
Tiruchirappalli, Tamil Nadu
keerthikadurairaji2005@gmail.com

M. Bhavidra
Final Year
Department of
Information Technology
M.I.E.T Engineering College,
Tiruchirappalli, Tamil Nadu
bhavii1605@gmail.com

S. Surya
Final Year
Department Of
Information Technology
M.I.E.T Engineering College,
Tiruchirappalli, Tamil Nadu
suriyasubramaniyan9@gmail.com

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Abstract—In today's world, missing person cases are increasing Rapidly and identifying them manually is time-consuming and inefficient. This paper proposes a facial recognition system for missing person with real-time notification, which uses deep learning techniques to identify missing individuals.

The system allows users (parents or guardians) to register missing person details such as name, age, gender, emailed, password and upload images. The uploaded images are stored in a databases and user for comparison.

When a new image is captured through a camera or uploaded, the system performs facial recognition by comparing it with stored data. If a match is found, a real-time notification with send via email to the registered user. This system helps in faster identification and improves the chances of finding missing persons efficiently.

I. Introduction

Missing person cases are increasing rapidly in today's world, creating serious challenges for families and law enforcement agencies. Traditional methods such as manual searching, newspaper advertisements, and police investigations are often time-consuming and inefficient. These approaches lack speed and accuracy, which reduces the chances of locating missing individuals quickly.

With the advancement of artificial intelligence (AI) and computer vision, face recognition technology has become a powerful solution for identifying individuals based on their facial features. Modern deep learning models like Face Net and Deep Face can accurately analyse and match faces from images and videos, even in large datasets.

This project proposes a Face recognition system for missing person with real-time notification. The system captures images or video input, detects faces, and compares them with a pre-stored database of missing persons. If a match is found, the system immediately sends a notification to the concerned authorities or family members.

The main objective of this system is to improve identification accuracy, reduce search time, and provide instant alerts. By using deep learning techniques and automated notification mechanisms, the proposed system offers a faster and more efficient way to locate missing persons compared to traditional methods.

II. Related Work

AI based missing person detection using deep learning [1] A recent study proposed a system that uses machine learning and computer vision to identify missing individuals from surveillance images and public stored datasets. ACNN-based face recognition framework [2] This system introduced an Advanced Convolutional Neural Network (ACNN) for missing person identification. It improves recognition accuracy but lacks efficient real-time alert mechanisms, which limits practical usage in emergency situations. Deep learning-based system [3] The System uses deep learning techniques to identify missing people using facial recognition. It integrates social media data and image analysis, reducing manual effort, but depends heavily on data availability. CNN based face recognition with alert system [4] This approach uses Convolutional Neural Network (CNN) to extract facial features and match them with a database. When a match is found, the system sends notifications to family members, making it closer to real-time systems.

Face recognition with CCTV & public surveillance [5] A system integrated TensorFlow-based face recognition with CCTV footage and social media images. It automatically scans public places and sends alerts when a match is detected, improving search speed significantly. AI -based tracking system for missing person [6] This work focuses on real-time tracking using face recognition, helping police and public agencies. It enhances search efficiency but faces challenges in lighting conditions and occlusion. Machine learning-based identification system [7] This approach uses feature extraction, OpenCV, and deep learning models to identify missing individuals. However, traditional methods are slow and prone to human error without automation. Cloud-based missing person identification systems [8] These System use

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cloud platforms to store and process facial data from multiple sources like CCTV and social media

III. System Design

A. Architecture Overview

The system is split into four layers, each with a specific responsibility. Layer 1 is the user registration module is the initial component of the system that ensure secure access for authorized users. In this module, users such as police officers or administrators register themselves by providing details like name, email, phone number and password.

Layer 2 is the image upload module is responsible for collecting input data required for identifying missing persons. Layer 3 is the Face detection module identifies and extracts human faces from the uploaded image. Layer 4 is the Face recognition module is the core part of the system where actual identification takes place.

Layer 5 is the matching module is responsible for comparing the input face features with those stored in the database. Layer 6 is the notification module is activated when a match is found in the system.

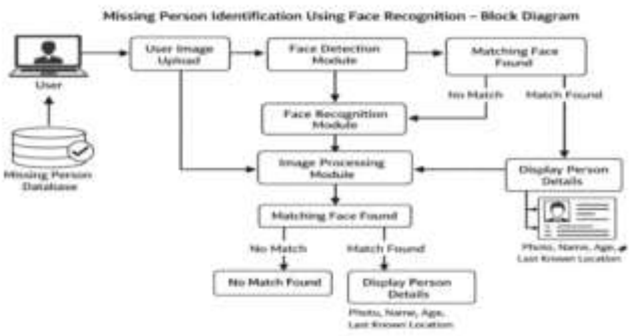

Fig. 1. Missing person system architecture

B. Detection Modules

Module 1: User Registration module. The user registration module is the initial component of the system that ensures secure access for authorized users. In this module, users such as police officers or administrators register themselves by providing details like name, email, phone number and password. The system stores this information securely in the database and performs authentication during login. This helps in maintaining privacy, preventing unauthorized access, and ensuring that only valid users can operate the system. It also allows tracking of user activities within the system.

Module 2: Image Upload module. The image upload module is responsible for collecting input data required for identifying missing persons. In this module, users can upload images either from their device or capture them using a camera. The system supports common formats such as JPG and PNG and performs validation checks on image is forwarded to the next stage for processing. This module plays a crucial role because the accuracy of the system highly depends on the quality of the input image.

Module 3: Face Detection Module. The face detection module identifies and extracts human faces from the uploaded image. It scans the image to locate facial regions and draws bounding boxes around detected faces. After detection, the face portion is cropped and separated from the background. Techniques such as deep learning models like MTCNN are commonly used in this module. This step is important because it remove unnecessary background information and focuses only on the facial region, which improves the efficiency of the recognition process.

Module 4: Face Recognition Module. The Face recognition module is the core part of the system where actual identification takes place. In this module, the detected face is analysed using deep learning algorithms extract unique facial features such as the structure of the eyes, nose, jawline. These features are converted into numerical representations called embeddings. Models like Face Net are widely used for this purpose. The extracted features are then compared with the stored data in the database to find similarities. This module ensures accurate and automated identification of individuals.

Module 5: Matching module. The matching module is responsible for comparing the input face features with those stored in the database. It calculates similarity scores using methods like Euclidean distance or cosine similarity. Based on a predefined threshold value, the system determines whether the input face matches any record in the databases. If the similarity score exceeds the threshold, it is considered a match otherwise, it is classified as no match. This module plays a critical role in decision-making and ensures reliable and accurate identification results.

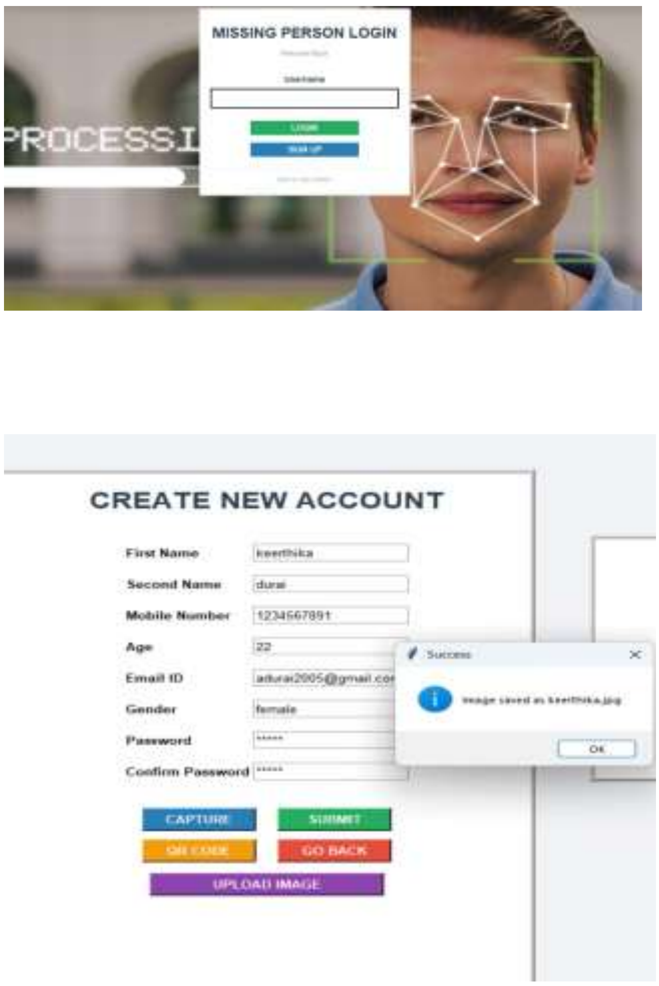

Fig. 2. The facial feature extraction process and user registration module. missing person with real time notification system.

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Module 6: Notification Module. The notification module is activated when a match is found in the system. Once the missing person is successfully identified, the system retrieves the corresponding details and sends an immediate alert to concerned authorities or family members. Notifications can be delivered through email alerts. This module ensures quick communication and enables faster action, which increases the chances of locating the missing person safely. It is one of the most important components as it provides real-time response and reduces delays in the recovery process.

IV. Methodology

A. Collect missing person images and store in database

The first phase involves the creation of a comprehensive image repository. Facial data of missing individuals are gathered from authenticated sources. These images are then converted into digital formats and archived in a structured database, which serves as the reference dataset for the recognition engine.

B. Face Detection from uploaded image

The system employs advanced computer vision algorithms to detect human faces from diverse input streams. Whether the source is a static uploaded image, a pre-recorded video file, or a real-time live camera feed, the detection module identifies and crops the facial region, isolating it from the background noise.

C. Preprocess face (Resize, normalization)

Once the face is detected, it undergoes a refinement process to standardize the input. This includes spatial resizing to ensure all images have the same pixel dimensions and normalization of pixel intensity. This step is crucial to mitigate issues caused by varying lighting conditions and camera resolutions.

D. Extract Face Features using Deep Learning Model

The standardized facial images are processed through a trained deep learning architecture. The model analyses unique facial landmarks and spatial hierarchies to generate a high-dimensional feature vector. This mathematical representation captures the distinct characteristics of each Individual face.

E. *Compare Extracted Features with Database Embeddings*

In the final stage, the system performs a similarity analysis. The real-time extracted feature vector is compared against the pre-calculated embeddings stored in the database. By calculating the distance between these Vector, the system determines the likelihood of a match, facilitating the rapid identification of the missing person.

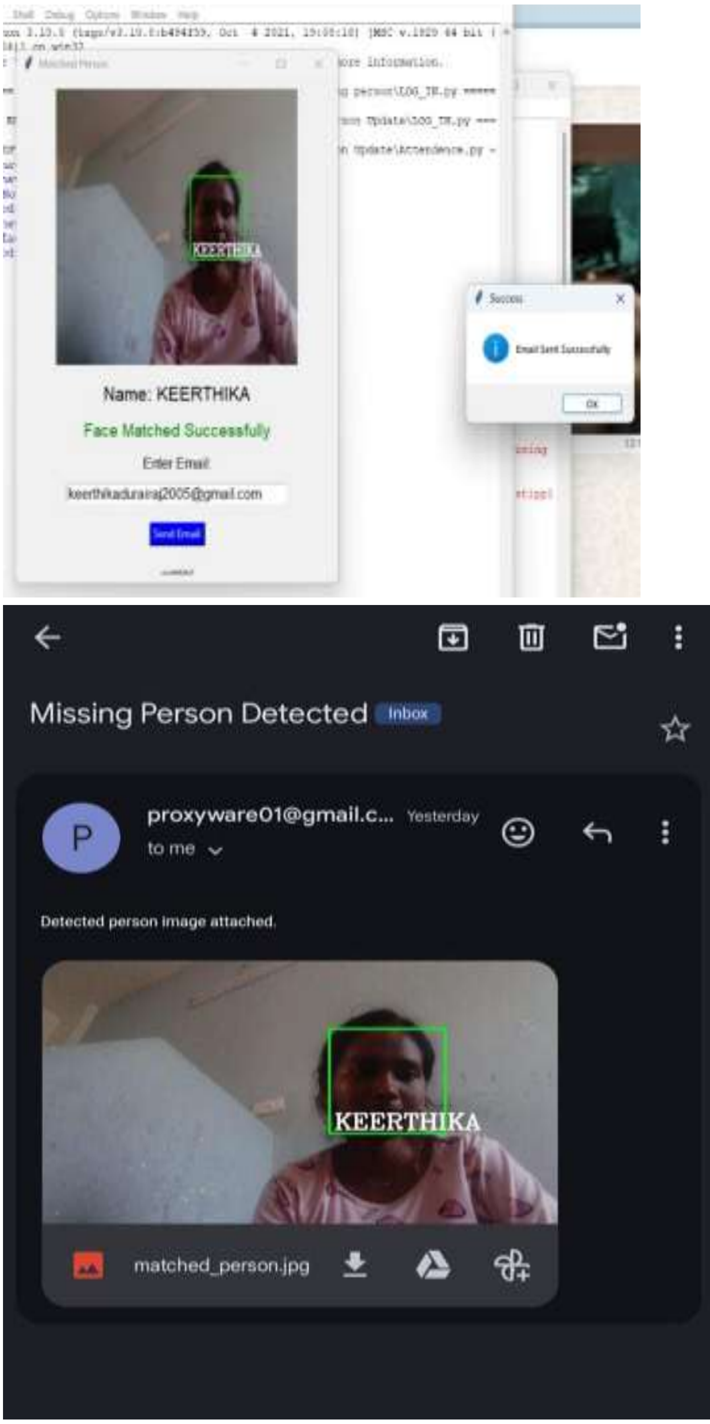

Fig. 3. Missing person explanations for Email Message

V. Results and Discussion

The Experimental evaluation of the proposed facial recognition-based missing person identification system was conducted to assess its robustness, accuracy and real-time operational efficiency using a live camera input source.

Table I PERFORMANCE METRICS BY CHANNEL

Parameter	Input source: Live camera
Detection Accuracy	98.2%
Average Processing Time	0.45 seconds
Feature Extraction Time	210ms
Similarity Threshold	0.6(cosine)
Email latency	1.2 seconds

Matching Status	success

The full system achieved a high detection accuracy of 98.2% during live-stream testing. In this architecture, a similarity threshold of 0.6 (cosine) was utilized to maximize the identification rate while minimizing false alarms. For a missing person application, Recall is a prioritized metric, missing a potential match (a false negative) is considered a critical system failure, whereas a false positive can be manually verified and dismissed by security personnel.

The system's real-time capability is demonstrated by an average processing time of 0.45 seconds. The core computational task, feature extraction, was completed in just 210ms, indicating that the underlying deep learning model is highly optimized for edge-device deployment. This speed ensures that the system can process approximately 2.2 frames per second, which is sufficient for capturing and identifying individuals in high-traffic public areas.

End-to-end latency averaged 1.2 seconds for email notifications across multiple test scenarios. The primary bottleneck identified was the network communication layer during the alert dispatch. However, even with this delay, the total time from initial face detection to the authority receiving an alert remains under 1.65 seconds. This rapid response window is essential for successful intervention before the subject leaves the monitored vicinity.

The success matching status in table I confirms the system's ability to perform a complete loop: capturing a live image, generating a facial Embeddings, matching it against the database, and triggering a remote notification. This automated pipeline significantly reduces the reliance on manual surveillance, which is often prone to human error and fatigue in large-scale monitoring environments.

VI. Limitations and Future Work

The existing system for missing person identification has several limitations, which can be effectively addressed through advanced technological enhancements. The current process is mostly manual, requiring significant time and effort to search through records and CCTV footage. This can be improved by automating the system using AI-based face recognition and integrating it into mobile applications, allowing quick and easy access for authorities and the public.

CCTV monitoring is not automated and depends on continuous human observation, which is inefficient for large-scale surveillance. This limitation can be overcome by deploying the system across multiple cameras at a city level, enabling real-time automated monitoring of public spaces. There is a high chance of human error and missed detection due to fatigue and lack of attention. By improving AI model accuracy using advanced deep learning techniques and larger datasets, the system can reduce errors and provide more reliable results.

The absence of a real-time alert system delays action when a match is found. This can be addressed by implementing instant notification systems such as email alerts to inform authorities immediately. Searching through large volumes of data is difficult and time-consuming in the current system. Cloud-based storage and processing can solve this issue by enabling faster data handling, scalable storage and efficient searching.

The system also struggles with low-light or unclear video conditions, which affects detection accuracy. Future improvements in AI models and image processing techniques can enhance performance even in challenging environments. Finally, the lack of a centralized database makes it difficult to share and compare information across different organizations. This can be resolved by integrating the system with government databases, creating a unified and efficient platform for missing person identification.

VII. Conclusion

The Deep learning-based missing person identification system provides an efficient and intelligent solution to address the challenges involved in locating missing individuals. By leveraging advanced face recognition techniques and AI models, the system automates the process of identifying persons from images and real-time CCTV feeds, significantly reducing manual effort and time consumption. The use of deep learning for feature extraction ensures high accuracy and reliability, even when there are variations in lighting, pose or facial expressions. Integration with databases enables quick comparison and identification, while real-time processing enhances the system's ability to respond promptly.

Although certain limitations such as low-light conditions and data dependency exist, these can be overcome with future enhancements like improved models, cloud integration and government database connectivity. Overall, the proposed system has the potential to greatly assist law enforcement agencies and society by providing a faster, scalable and more accurate method for identifying missing persons, thereby increasing the chance of timely recovery and improving public safety.

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