AI-DRIVEN MULTI-USER SYSTEM FOR MISSING PERSON RECOVERY

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Abstract: The increasing number of missing person cases has become a serious concern across many countries. Traditional methods used by law enforcement agencies and authorities rely heavily on manual monitoring of surveillance footage and public reports, which are time-consuming, inefficient, and prone to human error. Due to the vast amount of CCTV footage generated daily, it becomes extremely difficult to continuously monitor and identify missing individuals in real time. These limitations significantly delay the recovery process and reduce the chances of locating missing persons quickly. To address these challenges, this paper proposes "An AI-Driven Multi-User System for Missing Person Recovery", which utilizes advanced Artificial Intelligence, Computer Vision, and Deep Learning techniques to automate the detection and identification of missing persons from surveillance systems.

INTRODUCTION

Motivation:

The rapid advancement of Artificial Intelligence (AI) and Computer Vision technologies has opened new possibilities for solving complex real-world problems. One of the significant challenges faced by society today is the increasing number of missing person cases reported every year. Locating missing individuals is a difficult and time-sensitive task that requires efficient monitoring, identification, and response mechanisms. Traditional approaches rely heavily on manual investigation and human observation of surveillance footage, which is time-consuming and often ineffective due to the enormous volume of data generated by modern surveillance systems.

With the increasing deployment of CCTV cameras in public spaces such as railway stations, airports, shopping malls, and city streets, there is a large amount of visual data available that can assist in identifying missing persons.

Problem Statement:

The paper, "An AI-Driven Multi-User System for Missing Person Recovery," aims to develop an intelligent surveillance system capable of detecting and identifying missing persons from live CCTV feeds and recorded video footage. The system utilizes advanced computer vision techniques, including YOLO-based person detection and OpenCV-based facial recognition, to analyze video streams and detect potential matches from a database of missing individuals.

Objective of the Paper:

- To develop an AI –powered CCTV surveillance system for real-time detection and identification of missing persons.
- Implement face detection and recognition using OpenCV.
- Achieve real-time performance with minimal latency.
- Provide an interactive and user-friendly web interface using Stream lit.
- Store and manage missing person data securely using SQLite.
- Reduce false detections through verification before notification.
- Enable alert notifications for confirmed matches.

Scope:

The proposed AI-Driven Multi-User System for Missing Person Recovery incorporates several advanced features that enhance the efficiency of identifying missing individuals through automated surveillance analysis. These features distinguish the system from traditional monitoring methods and provide intelligent tools for real-time detection and investigation. The key features of the proposed system are described below

Paper Introduction:

Therefore, there is a need for intelligent systems that can automatically analyze video streams and identify individuals of interest. Artificial Intelligence and deep learning technologies have made significant advancements in image recognition and object detection. Modern algorithms can accurately detect human faces and compare them against stored databases with high precision. These technologies can be utilized to develop automated systems that assist authorities in identifying missing individuals in real time. By integrating facial recognition techniques with surveillance systems, the process of identifying missing persons can be significantly accelerated.

The proposed paper, "An AI-Driven Multi-User System for Missing Person Recovery," aims to develop an intelligent surveillance system capable of detecting and identifying missing persons from live CCTV feeds and recorded video footage. The system utilizes advanced computer vision techniques, including YOLO-based person detection and OpenCV-based facial recognition, to analyze video streams

and detect potential matches from a database of missing individuals.

The system provides a web-based platform where authorized users can register missing person cases, upload photographs, monitor camera feeds, and verify detected matches. Once a potential match is identified, the system records the detection event and can notify the concerned authorities. This automated approach significantly reduces the workload of investigators and increases the chances of locating missing individuals quickly.

BACKGROUND

Missing person cases represent a significant social issue worldwide. Every year, thousands of individuals are reported missing due to various reasons, including accidents, kidnapping, human trafficking, mental health issues, and voluntary disappearance. Locating these individuals requires extensive investigation efforts and coordination between law enforcement agencies.

Traditionally, missing person investigations rely on distributing photographs, broadcasting alerts, and manually reviewing surveillance footage. Although these methods can sometimes lead to successful recoveries, they often involve significant delays and require substantial human resources. With the widespread installation of CCTV cameras in urban environments, a large amount of video data is continuously generated. These surveillance systems provide valuable visual information that could potentially help locate missing individuals. However, manually monitoring such vast volumes of footage is not feasible.

Recent advancements in artificial intelligence and deep learning have made it possible to analyze video data automatically.

Facial recognition algorithms can detect and identify individuals from images and videos with high accuracy. These technologies have already been successfully applied in areas such as security surveillance, access control systems, and biometric authentication. By leveraging these technologies, it is possible to create automated systems that continuously monitor surveillance footage and detect missing persons without human intervention. Such systems can significantly improve the efficiency of search operations and reduce the time required to identify missing individuals. The proposed project builds upon these technological advancements to create an intelligent system that assists authorities in identifying missing persons quickly and efficiently.

LITERATURE REVIEW

Related Work:

Dr. Nirmala H, Archana J " A Survey Of Integrating Deep Learning-Missing Person Detection Model Into CCTV Systems. ," International Journal of Advanced Computer Science and Applications, vol. 12, no. 5, pp. 345–352, 2024.

This paper presents an advanced AI-based systemfor real-time identification of missing persons using facial recognition and computer vision techniques. The system continuously processes live video streams from surveillance cameras and detects human faces using deep learning-based models. These detected faces are then compared with a pre-existing dataset of missing individuals to identify potential matches.

Mrs. K Sathiya Priya,KAsi Viswesawara Reddy, "VISION RESCUE" vol. 15, pp. 2765–2777, 2025.

This paper provides a detailed survey of existing methods and technologies used for missing person detection, with a particular focus on integrating deep learning techniques into CCTV surveillance systems. It explores how traditional identification methods are being enhanced through the use of artificial intelligence, enabling automated and continuous monitoring.

A Rasan Kumarl Akshitha, "Assisted Search for Identifying Missing Persons," International Journal of Research in Computer Science, vol. 10, no. 3, pp. 45–52, 2025.

This paper proposes an intelligent AI-assisted system that enhances the process of identifying missing persons by utilizing facial recognition and large-scale data analysis. The system is designed to handle multiple data sources, including CCTV footage, social media images, and public databases, enabling comprehensive and efficient search capabilities.

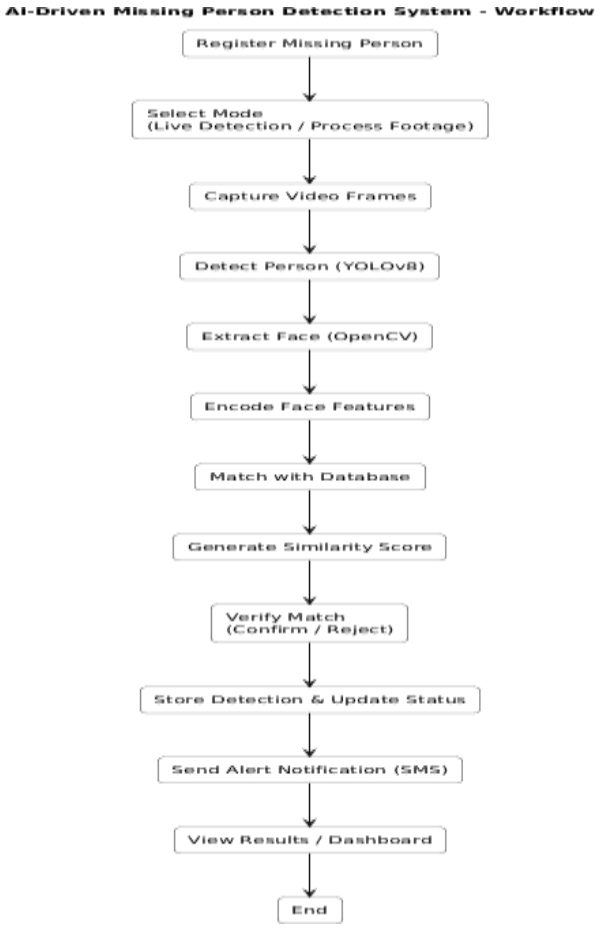
Existing System

Existing missing person identification systems primarily rely on manual surveillance and delayed investigation processes, requiring authorities to analyze CCTV footage manually. While some modern systems incorporate facial recognition technologies, they often depend on cloud-based infrastructure and centralized databases, raising concerns related to privacy, security, and data dependency, along with latency issues and the need for continuous internet connectivity. Traditional computer vision approaches and basic surveillance systems provide limited automation and struggle with accuracy in complex environments such as crowded areas, low lighting conditions, and varying camera angles. Although certain advanced AI-based solutions utilize deep learning models for detection, they often lack proper integration of real-time processing, automated alert mechanisms, and efficient data management. Furthermore, many systems are not scalable and fail to handle large volumes of surveillance data effectively. The proposed AI-Driven Multi-User System for Missing Person Recovery addresses these limitations by integrating YOLO-based real-time detection, facial recognition, and automated verification mechanisms into a unified and scalable platform for efficient and accurate identification.

Proposed System

The proposed system, "AI-Driven Multi-User System for Missing Person Recovery," aims to provide an efficient, intelligent, and automated solution for identifying missing individuals using computer vision and deep learning techniques. The system processes surveillance data in real time by utilizing YOLO-based person detection and OpenCV-based facial recognition**,** enabling accurate identification without heavy dependence on manual monitoring. By integrating video processing, facial feature extraction, database matching, and verification mechanisms, the system ensures reliable detection and reduces response time. The platform features a user-friendly web interface that supports missing person registration, live monitoring, verification of matches, and report generation. It also maintains a centralized database for storing records, facial encodings, and detection logs, ensuring efficient data management. Designed to be scalable and adaptable, the system can operate across multiple CCTV inputs and real-world environments such as crowded public spaces. This proposed system offers a robust and practical solution for improving public safety and enhancing the effectiveness of missing person recovery operations.

WORKFLOW



SYSTEM DESIGN

Introduction of Input Design:

In the proposed system, input refers to the raw data that is processed to detect and identify missing persons. The system accepts inputs in the form of images, video footage, and user-provided details such as name, age, gender, location, and contact information. During input design, consideration is given to input sources such as CCTV cameras, uploaded video files, and image inputs through the web interface**.** The quality of input data plays a crucial role in determining the accuracy of detection and recognition results. Well-designed input screens and forms in the system have the following properties:

- It should allow users to register missing persons and upload images efficiently**.**
- It should ensure accurate and complete data entry for reliable detection results.
- It should be simple, user-friendly, and easy to operate through the web interface.
- It should maintain consistency, clarity, and proper validation of input data**.**
- All these objectives are achieved by following proper design principles such as:
    - Identifying the required inputs (images, videos, and personal details)**.**
    - Understanding how users interact with the interface and input forms**.**

Objectives for Input Design:

The objectives of input design are –

- To design efficient data entry and input procedures for missing person registration.
- To minimize unnecessary input and reduce redundancy in data entry.
- To design effective methods for capturing input through images, videos, and forms**.**
- To develop user-friendly input screens and web interface components.
- To implement validation checks for ensuring data accuracy and preventing errors.

Output Design:

The design of output is the most important task of this system. During output design, the developers identify the type of outputs needed, such as detection results, verification status, reports, dashboard summaries, and alert notifications, and consider the necessary output controls and report layouts. The system generates outputs in the form of detected images, matched results, logs, and exported reports (CSV/Excel), which help users analyze and make decisions effectively.

Objectives of Output Design:

The objectives of input design are:

- To develop output design that serves the intended

purpose and eliminates the production of unwanted output.

- To develop the output design that meets the end user's requirements such as clear display of detection results and verification status.
- To deliver the appropriate quantity of output without redundancy.
- To present the output in appropriate formats such as dashboard view, tables, images, and reports, and direct it to the right user.

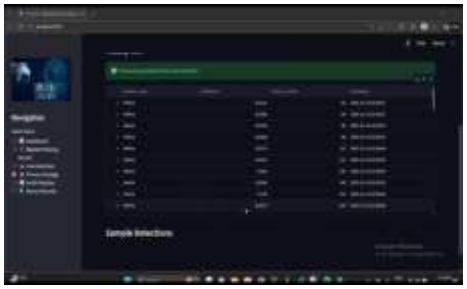
RESULTS

Result Reflect in Dashboard:

The results of the system are clearly illustrated, where key statistics such as total cases, pending verification, and verified matches are displayed.

Frames detected in Processed Footage:

The detection results during live processing are illustrated, which display multiple instances of detected faces along with corresponding confidence scores and timestamps.



Record Deletion:

The functionality for managing and removing stored records is illustrated, where users can view detailed information of a registered missing person. The interface displays attributes such as ID, age, gender, location, missing date, and contact details along with the person's image. Authorized users are provided with an option to delete records using the "Delete Record" button. This feature ensures that outdated or incorrect data can be efficiently removed from the system.

Match Verification:

The process of validating detected matches is illustrated, where the system presents a comparison between the registered photo and detected images from CCTVfootage. The interface displays detailed information such as name, age, gender, location, and contact details of the individual

Twilio SMS:

The alert mechanism of the system is illustrated, which shows the message received after the successful detection of a missing person. Once the system identifies a potential match, it automatically triggers an SMS alert using the Twilio service. The message typically includes essential details such as the detected person's name, time of detection, and verification status.

CONCLUSION

The AI-Driven Multi-User System for Missing Person Recovery successfully demonstrates an intelligent and automated approach for identifying missing individuals using modern Artificial Intelligence and Computer Vision technologies**.** By integrating YOLOv8-based person detection and OpenCV-based facial recognition**,** the system is capable of analyzing surveillance footage and identifying individuals appearing in camera feeds. The system processes video frames in real time, extracts facial features, compares them with stored records in the database, and verifies potential matches with high accuracy. This automated process significantly reduces the time and effort required for manually reviewing large volumes of surveillance footage.

FUTURE SCOPE

The AI-Driven Multi-User System for Missing Person Recovery can be further improved by incorporating advanced technologies and expanding its capabilities to address real-world challenges more effectively. One of the major enhancements includes integrating the system with large-scale surveillance networks, enabling monitoring across multiple locations such as public areas, transportation hubs, and city-

wide CCTV systems. This would significantly increase the chances of identifying missing individuals quickly. The system can also be enhanced by developing a mobile and cloud-based platform**,** allowing authorities to access detection results, receive alerts, and manage case data from anywhere. Cloud integration would enable centralized data storage, faster processing, and better scalability, especially when handling large volumes of surveillance data from multiple sources.

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