Ai-Powered Facial Recognition Software For Investigation And Suspect Tracking

KW-10

OVERVIEW

The Criminal Investigation and Tracking System is an advanced technology solution designed to transform video footage into valuable and easily exploitable information. The system workflow begins with users importing videos from various sources. Using AI and machine learning, the software identifies and digitizes objects in the video, extracting detailed data such as vehicle information (location, type, brand, color, license plate, category, seat count) and human attributes (position, clothing color, hat, etc.).

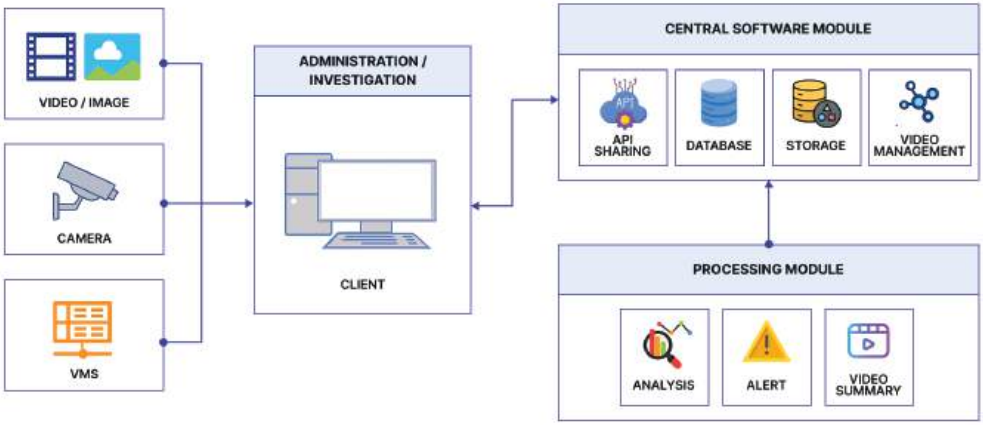
The processed data is stored in a structured, secure database, ensuring integrity and confidentiality. With an intuitive user interface, users can search, filter, and analyze information based on multiple criteria. Functions such as keyword search, data grouping, and report generation provide both an overview and in-depth insights.

A key advantage of the system is its automation of video analysis, which significantly shortens investigation time. It is particularly valuable for security, law enforcement, and research agencies, offering an efficient and accurate solution for video-based information analysis and retrieval.

KEY OBJECTIVES

- Provide investigative and suspect-tracing tools using video and image sources collected from multiple locations, employing face recognition, behaviour analysis, human appearance /body-shape recognition, license plate recognition, and vehicle-type identification
- Support criminal investigation and suspect-tracing workflows by delivering fast, automated, and highly accurate results for persons of interest.
- Predict movement trajectories and determine subject locations to plan surveillance, coordinate apprehension operations, monitor targets, and enhance command-and-control effectiveness.
- Create investigative case files and generate operational reports.

SYSTEM ARCHITECTURE

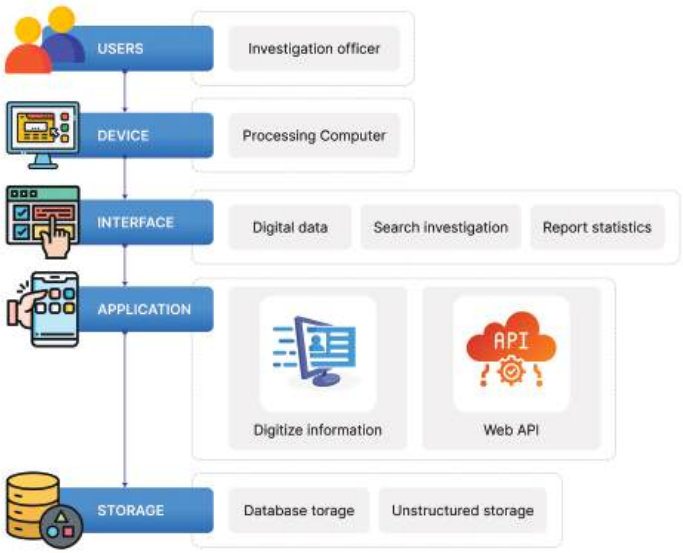


System Architecture Diagram of the Criminal Investigation and Tracking System

Requirements for Video Streams Used in the System

- Minimum resolution: Full HD
- Minimum frame rate: 20 frames per second (fps)
- Video must be free from glare and backlight issues
- Image must be clear, sharp, and well-lit to ensure visibility of objects
- Minimum pixel size requirements for each object type:
  - *Vehicle: at least 100×100 pixels*
  - *License plates: at least 70×70 pixels*
  - *Faces: at least 24×24 pixels*

Requirements for Video Streams Used in the System



System Model of the Criminal Investigation and Tracing Software

- Data Input:
  Users import videos from various sources into the system.
- Processing and Information Extraction:
  AI and machine learning technologies are used to recognize and digitize objects in videos, extracting details such as location, vehicle type, brand, color, license plate, and type for vehicles, and face, gender, and clothing color for people.
- Database Storage:
  Processed and digitized data is securely stored in the system's database.
- User Interface:
  Users can search, analyze, filter, and extract information through an intuitive interface.
- Advanced Features:
  The system supports advanced analytics, natural language–based search, and web API integration for communication with external systems.

CORE FUNCTIONS OF THE CRIMINAL INVESTIGATION AND SUSPECT TRACKING SYSTEM

FACE RECOGNITION AND SEARCH

1. Face Detection & Recognition

- Subject Identification (Listed and Unlisted):
  Detects individuals both within and outside predefined watchlists, which can be configured via the system interface or through API integration with external systems.

- Crowd Face Recognition:
  Detects individuals based on facial features, gender, and mask-wearing status (with or without mask).
- Age Variation Tolerance:
  Recognizes subjects whose current appearance differs by up to 15 years from stored database images.
- Recognition Accuracy:
  Achieves up to 95 % identification accuracy under standard image quality conditions.
- Face Angle Recognition Range:
  Supports facial recognition at the following orientation limits relative to the camera:

  - *Pitch (vertical tilt): ± 15°*
  - *Roll (head rotation): ± 180°*
  - *Yaw (horizontal turn): ± 90°*
- Minimum Detectable Face Size:
  Recognizes faces as small as 24 x 24 pixels, allowing analysis even from low-resolution sources
- Real-time face recognition with processing speed ≤ **0.05 seconds.**

2. Face Search & Display

- Allows identification and searching of faces from various video and image sources.
- Displays detected faces from uploaded images or frames extracted from video footage.
- Displays all faces that have appeared in the surveillance camera frames.
- Supports searching for faces using input images from external sources or video frames.

3. Database & Management

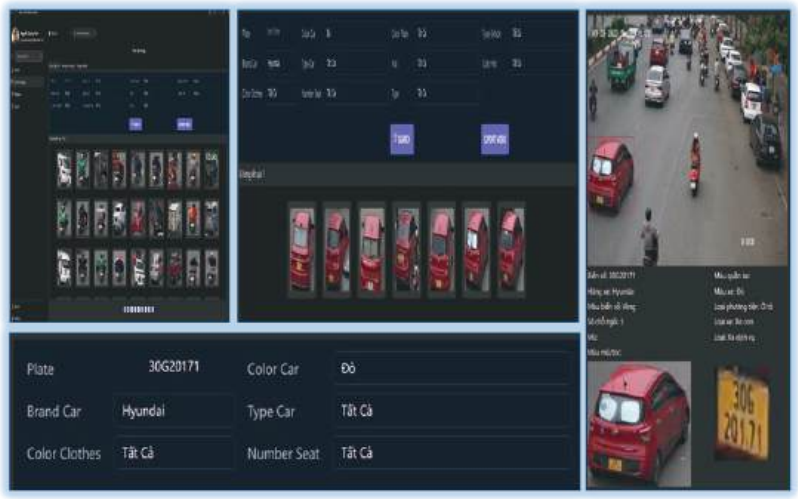
- Blacklist, Camera Group, and Subject Group Management:
  Provides tools to manage blacklists, camera clusters, and subject categories for organized monitoring.
- Database Updating:
  Allows continuous updates to the facial recognition database based on new images or identified individuals.

4. Surveillance & Alerts

- Real-Time Surveillance and Alerts:
  Support live monitoring and instant alerts when watch listed subjects appear in active camera feeds, enabling rapid response.
- Offline Video Analysis:
  Enables post-event investigation by searching, isolating, and tracing individuals within offline video archives.

VEHICLE RECOGNITION AND SEARCH FUNCTION

- Capable of identifying and searching for vehicles based on the following attributes:
  - *Vehicle brand*
  - *License plate number*
  - *Plate color*
  - *Vehicle color*
  - *Vehicle type (motorcycle, car, etc.)*
  - *Vehicle category (government, service, civilian, etc.)*
  - *Vehicle seat number (4, 5, 7, etc.)*
  - *Motorcyclist Recognition:*
    - *Whether the rider is wearing a helmet or not*
    - *Helmet color*
    - *Clothing color of the rider*

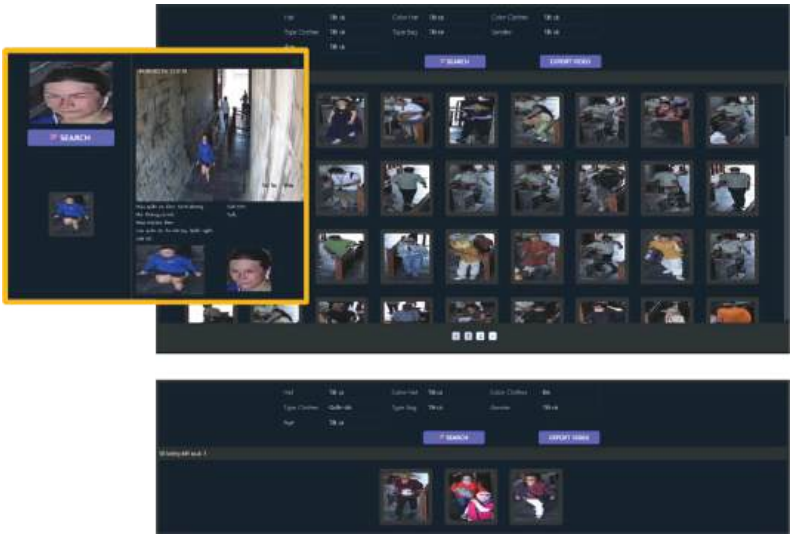


Identifying and Searching Vehicle

- Supports real-time monitoring and alerting for detected vehicles
- Enables search, area filtering, and tracking of vehicles from offline video streams

APPEARANCE-BASED PERSON SEARCH AND INVESTIGATION FUNCTION

- Capable of analysing, recognizing, and searching for individuals based on the following attributes:
  - *Gender*
  - *Estimated age*
  - *Pants color*
  - *Shirt color*
  - *Helmet status (wearing or not)*
  - *Clothing type (long shirt, dress, etc)*
  - *Mask-wearing status (with or without mask)*
  - *Cyclist detection*
  - *Hair length/color*
  - *Eyewear detection (with or without glasses)*
  - *Movement direction*



Search by Appearance

The search results return the subject's images, the time of appearance, and other associated metadata.

VIDEO SUMMARIZATION

- Supports simultaneous analysis of multiple video streams.
- Compatible with most of common video formats.
- Allows generating concise summary versions of original videos by skipping non-event segments and focusing on key and consistent elements of the original content.
- Objects appearing at different timestamps can be displayed within the same composite frame of the summarized video to maximize compression efficiency.
- Video summarization is based on object occurrences within the footage and supports detection of people and common vehicle types (bicycles, motorcycles, etc.).
- The events in the summarized video are defined as the appearance of moving objects within the camera's field of view. The objects include:

  - *Various types of cars*
  - *Motorcyclists*
  - *Cyclists*
  - *Pedestrians*

- In summarized video, object movement trajectory are displayed accurately to reflect actual movement paths.
- Support viewing detailed object information directly from the summarized video.
- Allows searching for objects using specific criteria, including:

  - *Vehicles: type, licence plate number, vehicle color*
  - *People gender, clothing color*

- Search results display the object's image, time of appearance, and other stored metadata details

MANAGEMENT

- Supports management and reporting features according to user operational requirements.
- Human object management:
  - *Minimum information includes full name, photo, ID number, occupation, residence, age, gender, height, hair color.*
  - *Relationships with other objects, including other people and associated vehicles.*
- Vehicle object management:
  Minimum information includes vehicle type, license plate number, color, size, photo, registration location, owner's ID, related objects, usage status.
- Reporting and activity mapping:
  - *Generates consolidated reports of investigation/tracing results for a specific object.*
  - *Creates activity maps for investigated or traced objects.*
- The user interface includes English, Vietnamese

3588 Benvoulin Road, Kelowna, BC, Canada.
info@kytratech.com
https://www.kytratech.com/
+1 (639)-997-5812