

Intelligent Video Analysis System - Object Tracking



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Intelligent Video Analysis System
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01. Introduction

Introduction



Missing persons are on the rise every year

In 2022, the number of missing children reported under the age of 18 was **22,416**

In the past five years, around 20,000 cases have been reported every year, and **70 cases** are still **unsolved**

The number of elderly with dementia reported missing for recent five years amounts to **around 40,000**, and it is **increasing over time**

범죄유형	2016년		2017년		2018년		2019년		2020년	
	발생건수	발생예	발생건수	발생예	발생건수	발생예	발생건수	발생예	발생건수	발생예
전체 범죄	1,849,450	3,577.5	1,662,341	3,210.5	1,580,751	3,050.1	1,611,906	3,108.8	1,587,866	3,063.7
경제 범죄	25,765	49.8	27,274	52.7	26,787	51.7	26,476	51.1	24,332	46.9
경도 범죄	203,037	392.8	183,757	354.9	176,809	341.2	186,957	360.6	179,517	346.4
폭력 범죄	309,394	598.5	293,086	566.0	287,611	555.0	287,913	555.3	265,768	512.8
기능 범죄	312,577	604.6	302,466	584.2	344,698	665.1	381,533	735.8	424,642	819.3
중속 범죄	26,165	50.6	22,501	43.5	20,162	38.9	21,153	40.8	22,632	43.7
특별경계 범죄	65,025									
과잉 범죄	7,329									
보건 범죄	14,662									
환경 범죄	4,349									

Incessant crimes

The overall **crime rate** is **more than 3,000 cases a year**, indicating that citizens are **exposed to various crimes**


※ Crime rate = (the number of crimes × 100,000) / Number of residents registered in the year

구분	2017년	2018년	2019년	2020년	2021년
총계	2,733	2,706	2,652	2,771	2,404
서울	302	248	293	309	222
부산	151	143	151	135	94
대구	133	109	111	124	121
인천	129	121	134	176	141
광주	126	99	144	163	102
대전	145	88	72	68	74
울산	65	76	55	40	88
세종					
경기남부					
경기북부					
강원					

Incessant vehicle theft, criminal use of stolen cars

Vehicle theft occurs incessantly with **more than 2,400 cases a year**

Stolen cars are **criminally exploited** in many cases



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02. Need for

VISCOPER

Need for VISCOOPER

Issues

① When a child is missing, the probability of finding the child decreases dramatically with time

② The arrest rate of criminals is dropping every year, increasing citizens' exposure to crimes

③ Missing elderly with dementia are often found dead

④ If cars used for crimes are not found early on, various other criminal activities might follow

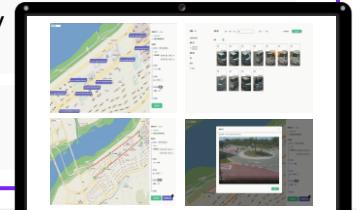
Solution


Central agencies and local governments need to establish a system to track missing persons, criminals and criminal vehicles (stolen cars) and arrest the criminals as soon as possible.

VISCOOPER

Enable to find missing persons, criminals and criminal vehicles (stolen cars) and arrest the criminals quickly.

- ✔ Set CCTV search target and range
- ✔ Retrieve the vehicle search results
- ✔ Generate the routes of cars being searched
- ✔ Check the footage of cars on the route generated
- ✔ Find missing children and elderly with dementia
- ✔ Track criminals and criminal cars





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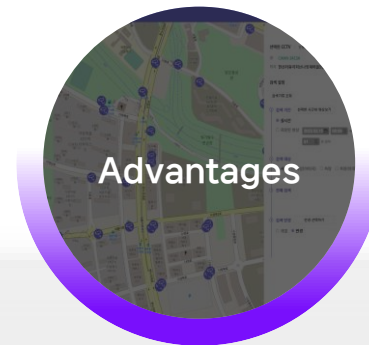
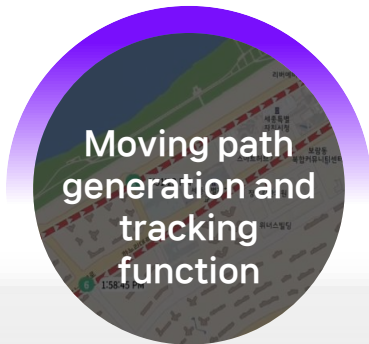
03. Overview of

VISCOPER



Overview of VISCOPER

Track the routes of cars by detecting and reidentifying people and cars seen on CCTV footage with AI-based footage analysis and GIS



- ✔ Reidentification technology that compares the **unique images** of objects for each channel with the **images of the target** to provide the results with **higher similarity first**
- ✔ Provide a **tracking function** by **generating routes** for the people and cars being searched
- ✔ Help to find people and cars earlier using the tracking function.
- ✔ Enhance **accessibility** with an intuitive UI/UX configuration
- ✔ Enable CCTV **equipment management** and **real-time image search**.
- ✔ Enhance **ease of use** by CCTV management that employs a GIS-based map
- ✔ Help find **missing persons** and increase the **preventive effects of crimes** by quickly tracking people and cars



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04. Key Technologies of

VISCOPER

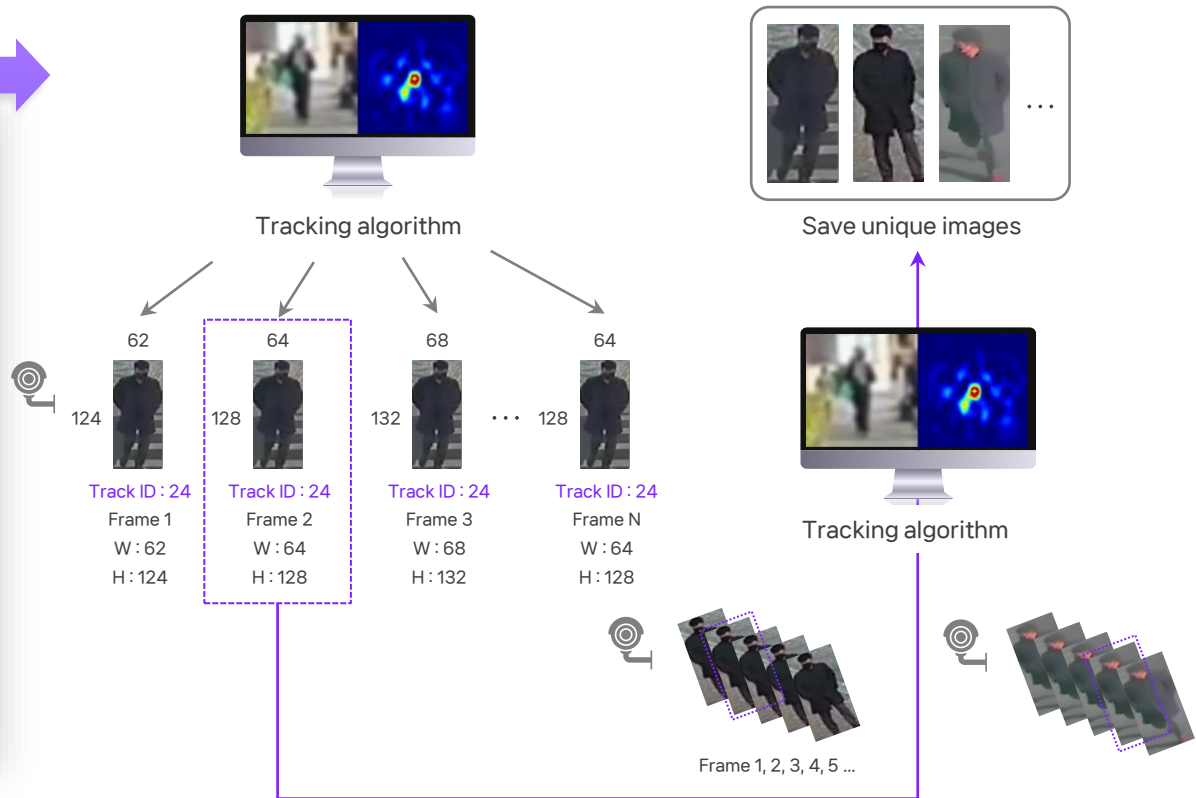
Key Technologies of VISCOPEP

01 – Unique image storage technology

Detailed Technology

✓ Saving unique images

- Select and save unique images based on the object tracking algorithm
- In tracking an object, **area information is delivered sequentially**. For an area information size of "64×128" or larger, the images and track ID are saved. The information that is delivered afterwards is ignored.



Key Technologies of VISCOPE

02 – Reidentification technology

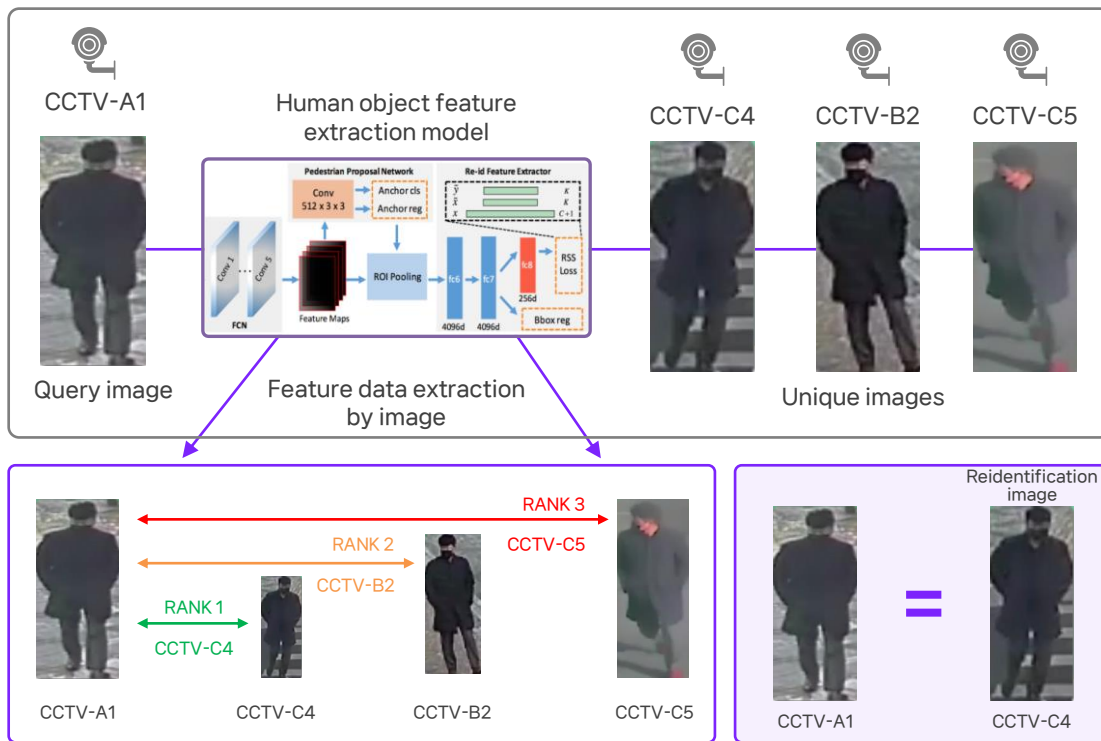
Detailed Technology

✓ Query image registration

- Register query image by selecting the target object based on real-time monitoring
- Register query image by file upload

✓ Object reidentification

- Save object images and extract features for each CCTV channel
- Save channel information, time, location and object feature information
- Compare features and determine similarity between the object image and the query image
- Reidentify the objects of the relevant channel in determining the identical object and deliver image output



Similarity (feature vector distance) comparison



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05. Key Features of

VISCOPER

Key Features of VISCOPE



CCTV RTSP URL	CCTV #	주소	층	화면
rtsp://192.168.10.21:8050/text	서해CCTV_1	서구공영차	128.594	35.8
rtsp://192.168.10.21:8051/text	서해CCTV_2	서구공영차	128.6818	35.83462
rtsp://192.168.10.21:8052/text	서해CCTV_3	서구공영차	128.682871	35.83462
rtsp://192.168.10.21:8053/text	서해CCTV_4	서구공영차	128.620871	35.83462



CCTV
management
function



Real-time
CCTV footage
inquiry
function



Saved CCTV
footage
inquiry
function



Search range
selection
function

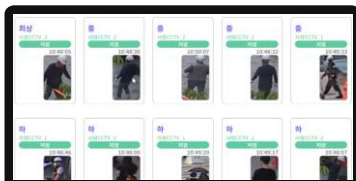


Image output
function
based on the
order of
similarity



Moving path
generation
function



Detailed Functions

01 – CCTV management function

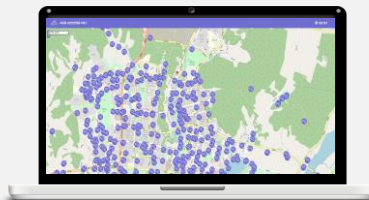
Detailed Functions

- ✓ Search a CCTV
- ✓ Check the registered CCTV list
- ✓ Check the detailed CCTV information
- ✓ Add a new CCTV
- ✓ Chang the existing CCTVs' location



Expected Effects

- ▶ Create environment for reidentifying objects through systematic CCTV management



Main screen



Searching a CCTV



Checking detailed information of CCTV



Adding a CCTV

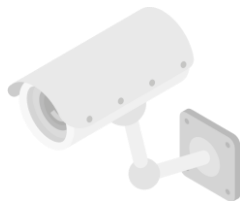


Detailed Functions

02 – Real-time and saved CCTV footage inquiry function

Detailed Functions

- ✔ Retrieve real-time CCTV footage
- ✔ Retrieve saved CCTV footage
- ✔ Select a CCTV
- ✔ Select a specific time in the past

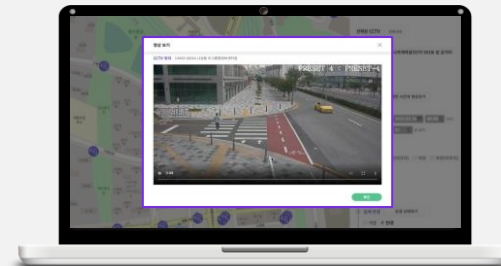


Expected Effects

- ▶ Improve footage analysis efficiency with real-time/
non-real-time **CCTV footage management and inquiry**



Real-time CCTV
footage inquiry



Saved CCTV
footage inquiry

Detailed Functions

03 - Search range selection function

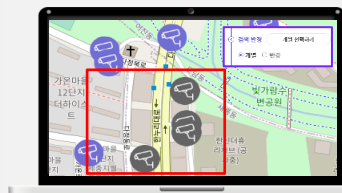
Detailed Functions

- ✔ Select a CCTV to search a target image
- ✔ Select an individual CCTV
(When selected, the color of CCTV changes from blue to gray)
- ✔ Select CCTV range setting
- ✔ Display the selected CCTV



Expected Effects

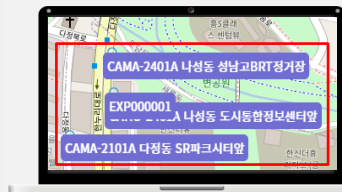
- ▶ Set an effective reidentification range with the selection of a CCTV search range by situation



Selecting an individual CCTV



Selecting CCTV range



Checking the selected CCTV



Displaying the selected CCTV

Detailed Functions

04 - Similarity-based image output and travel route generation function

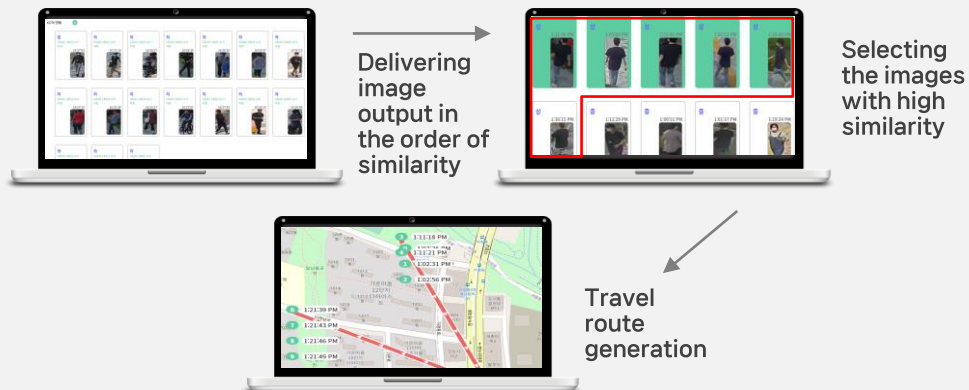
Detailed Functions

- ✓ Deliver image outputs in the order of similarity based on reidentification technology
- ✓ Generate travel route by selecting images with high similarity
- ✓ Track the location of people and vehicles based on travel route generation
- ✓ Assign numbers in the order of appearance on the CCTV by time



Expected Effects

- ▶ Enable early detection of people (missing children, elderly with dementia, criminals) and vehicles (stolen cars, criminal cars) based on object travel route generation
- ▶ Contribute to the establishment of a social safety net by preventing long-term disappearance and crimes





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06. Operational Specification & System Overview

Operational Specification and System Overview

Operational Specification

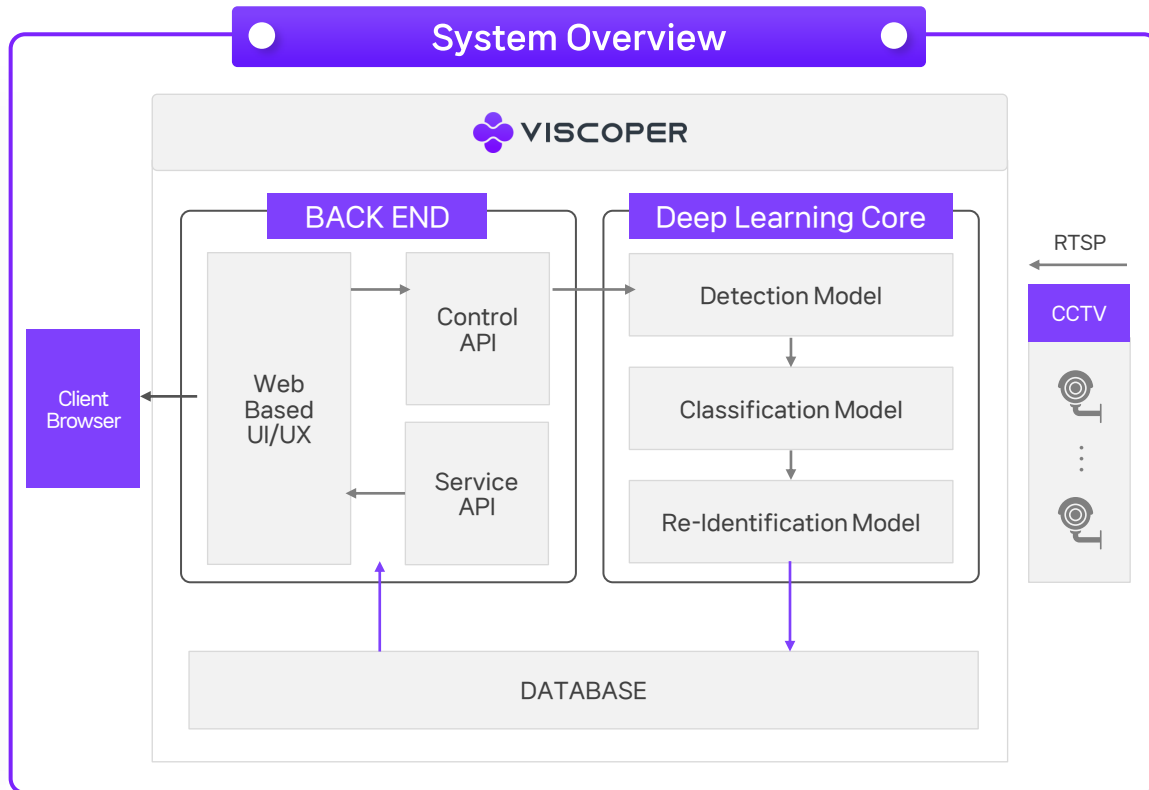
✓ Server environment


- OS: Ubuntu 18.04.6 LTS
- CPU: CPU Intel(R) Xeon(R) Silver 4216 (16C, 2.1 Ghz) or higher
- RAM: 2 x 32GB DDR4 2933 Mhz or higher
- SSD: 2 x 1.92TB SATA SSD(TBW1752)
- Installation capacity: at least 20 GB required
- DB: MongoDB v3.6.3

✓ Client environment

- OS: Windows 10 Pro 64 bit
- CPU: Intel(R) Core(TM) i7-4702MQ
CPU: 2.20 GHz or higher
- RAM: 8 GB or higher
- HDD: 1 TB or higher
- Browser: Chrome 102.0

System Overview





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07. Expected Effects



Expected Effects

Secure golden time and safety


- ✓ Allow missing people tracking and early detection
- ✓ Useful in taking initial measures for tracking criminals
- ✓ Track criminal vehicles (stolen cars)
- ✓ Decrease crime rates
- ✓ Shorten search time
- ✓ Ensure citizens' safety by optimizing golden time



Increase work efficiency

- ✓ Increase the footage analysis-based work efficiency
- ✓ Reduce labor cost by improving work environment
- ✓ Establish a fast and efficient work system
- ✓ Strengthen the safety net for citizens





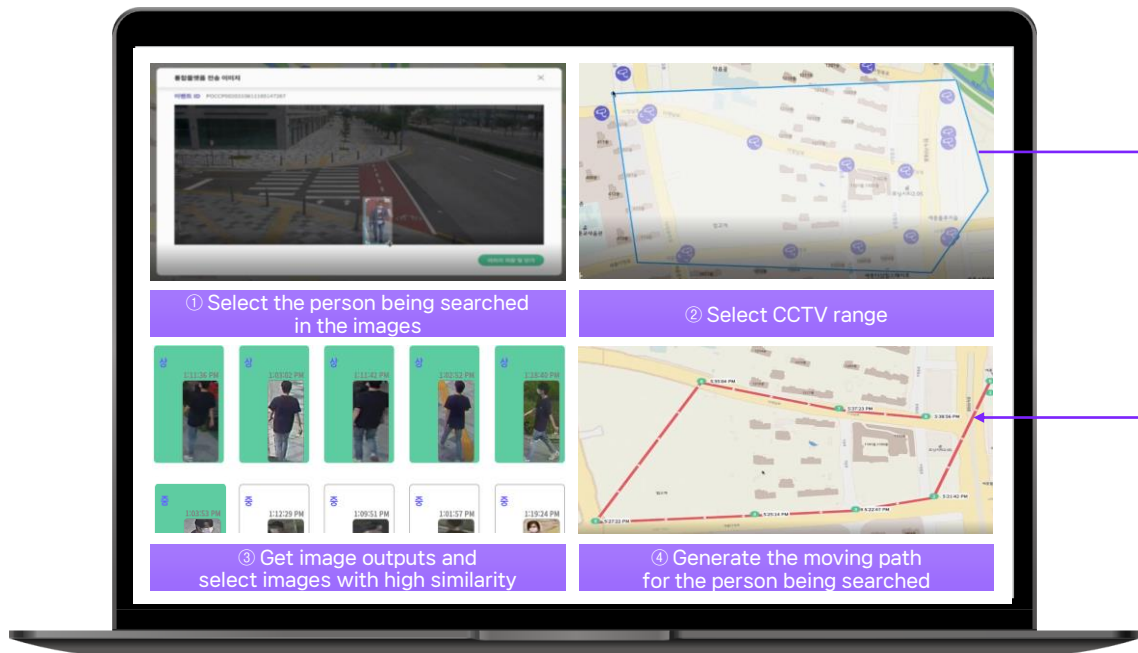
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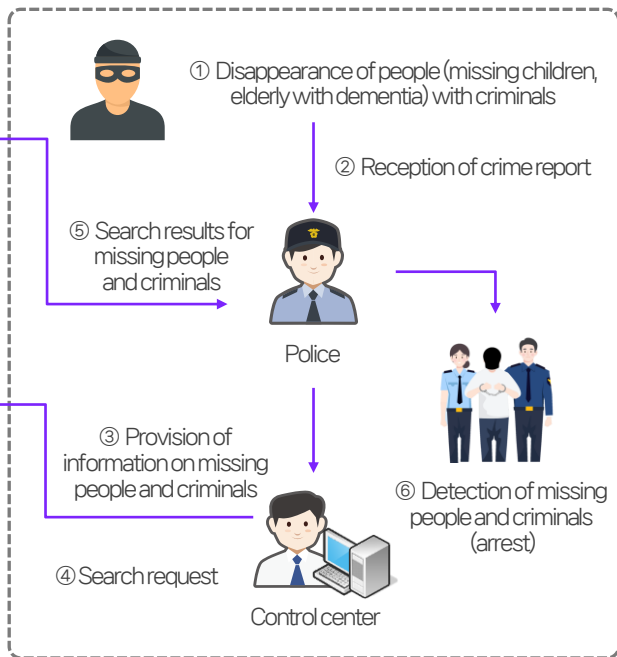
08. Service Scenarios

VISCOPE Service Scenarios (Application plan 1)

"Generation of moving path and early detection (arrest) of missing people (missing children, elderly with dementia) and criminals"

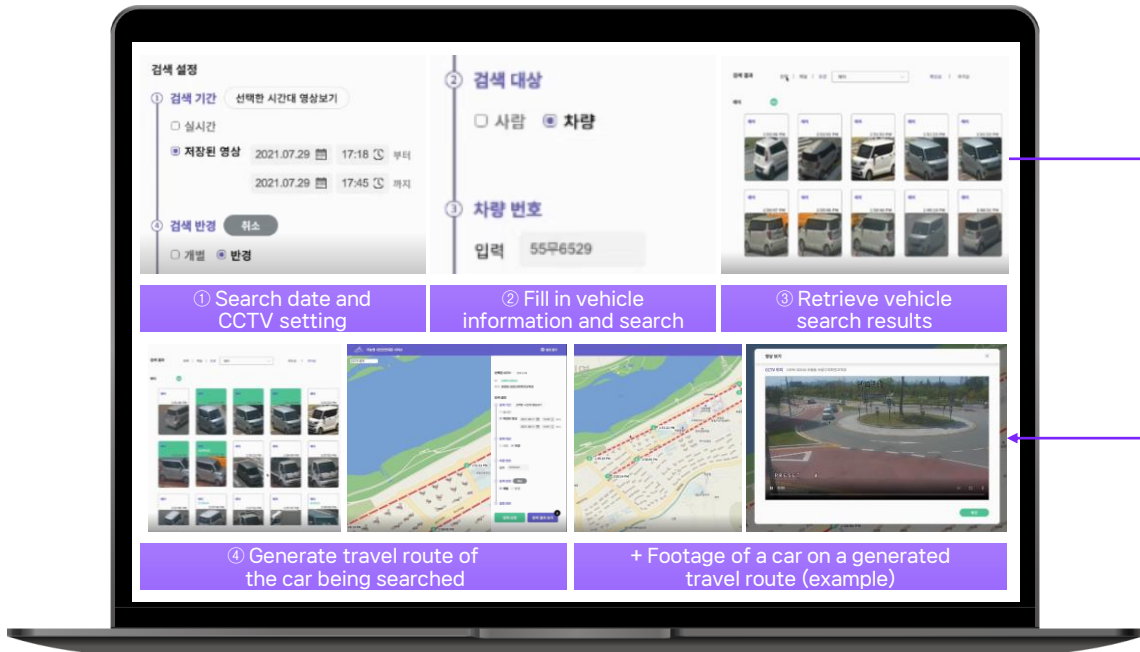


VISCOPE (Tracking people)

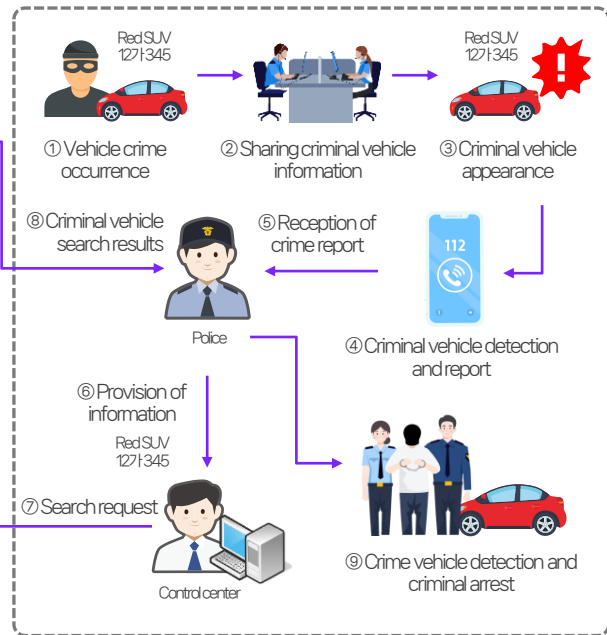


VISCOPE Service Scenarios (Application plan 2)

"Generation of moving path and early detection (arrest) of criminal vehicles (stolen cars)"



VISCOPE (Tracking cars)





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09. Case Studies

VISCOPER Case Studies



2022. 03. 13

Sejong city uses intelligent footage control for swift response

Sejong-si is building a smart, safe city by establishing an intelligent (AI) footage control system.

Sejong-si said on the 13th, that it conducted a technology demonstration in the Urban Integration Information Center on the 11th. The demonstration showcased an "AI footage analysis system," which is being developed to prevent crimes and enhance citizens' safety.

The intelligent footage analysis system utilizes AI to analyze shapes captured by CCTVs, identifying people and cars. It provides information on travel routes and locations of targets by comparing footage from multiple CCTVs.

In addition, AI recognizes and notifies certain circumstances, such as people who have fallen and illegal parking.

This demonstration was held to showcase the advanced citizen safety services that combine the technologies of CCTV, big data and AI, and to foster cooperation between relevant institutions.



The technology demonstration of the AI footage analysis system was held in Urban Integration Information Center in Sejong-si on the 11th. Photo source: Sejong city

Sejong-si crime prevention and emergency response service



Institution: Sejong-si

- Special self-governing municipality
- Population: 385,609 persons



Operational environment

- Number of CCTV channels: around 2,700
- CCTV operation: VMS integration control and integration platform
- GIS: Vworld (Ministry of Land, Infrastructure, and Transport)

Introduction of high-speed CCTV footage search system



Institution: Yeongdeok-gun, Gyeongsangbuk-do

- Population: 34,515 persons



Operational environment

- Number of CCTV channels: around 700
- CCTV operation: VMS integration control and integration platform
- GIS: Vworld (Ministry of Land, Infrastructure, and Transport)

Procurement of high-speed footage search and moving path tracking system



Institution: Tongyeong-si, Gyeongsangnam-do

- Population: 121,903 persons



Operational environment

- Number of CCTV channels: around 2400
- CCTV operation: VMS integration control and integration platform
- GIS: Vworld (Ministry of Land, Infrastructure, and Transport)

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