REMARK **ⓐ**

White Paper

Real-Time Video Analytics
Alert and Search

Content

Background

Today surveillance cameras are widely used and deployed in thousands of locations worldwide for monitoring and investigation to prevent security breaches and criminal activities while improving public safety. However, monitoring thousands of camera streams is limited by human endurance and fallibility. The repetitive work is time intensive, inefficient, and often misses what the human eye cannot see, preventing the timely alerts for the necessary security professionals to address.

Safety Space Platform (SSP)

Safety Space Platform (SSP) by Remark AI is the premier leader in applying computer vision for ID verification, behavioral, and object detection, having won numerous industry and government benchmark tasks for accuracy and speed. SSP transforms the given video stream into a series of metadata comprised of objects and activities. Its advanced data science platform mines the meta information to recognize discernable patterns that lead to a higher level of activities and events recognition, generating high-level actionable insights to improve public security, workplace safety, and operation management. SSP generates real-time alerts allowing the operation staff to respond rapidly to prevent any events or activities that can endanger public security or workplace safety. Alerts are sent directly to the control center or the onsite operation staff for further verification and reaction in real-time. Moreover, attributes of events are stored in an informative way for search and real-time remote commanding and post-event investigation.
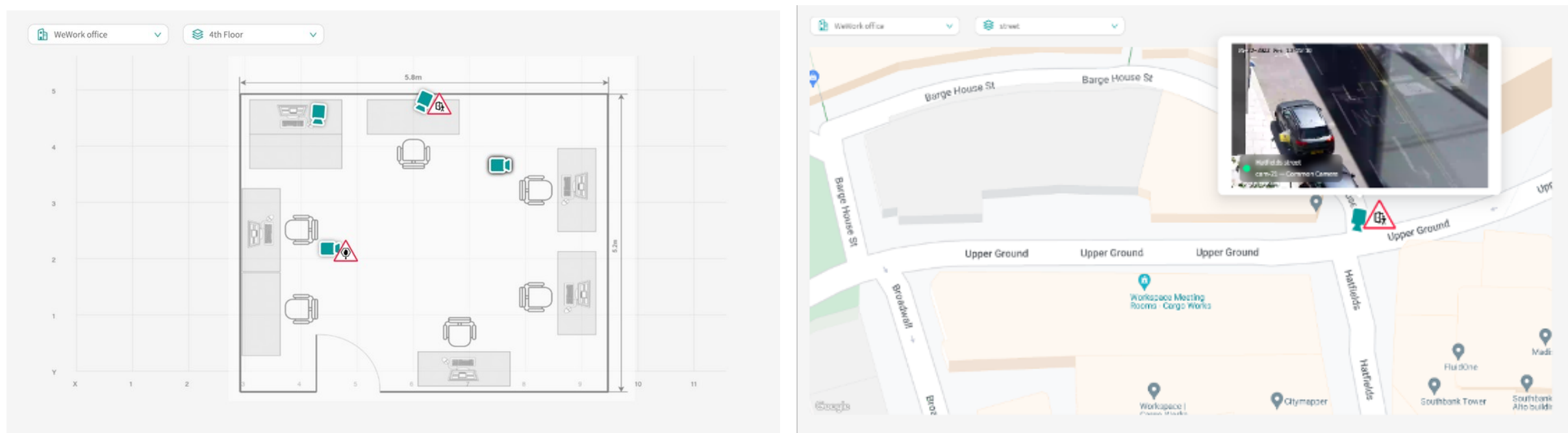
SSP combines all these events by organizing the geographic map information and dashboard in a user-friendly way so that the management team can understand the whole operation and provide actionable insights to the staff for making decisions and deploying the resources for rapid actions on stopping crimes and preventing loss.

SSP is developed on the latest modern architecture concepts, including edge AIoT and micro-service architecture. This allows expensive cost computing on edge without large video data transmission over the internet. It dramatically reduces costs while integrating various sensors on the edge, thermal imaging, radar, voice, etc., making itself a powerful and intelligent platform.

SSP has developed advanced AI models that cover a wide range of security or safety functions, object (appearance and attributes) detection and recognition, protective equipment, vehicle plate number, unattended object, abnormal behavior – falling/running, fire, and smoke, etc.

Identity Verification Alert & Search

Identity Verification

In general, identity verification's accuracy relies on many factors, including camera location (placement), the distance of cameras, resolution (pixels), video quality, lighting, quality of the image, and angle/type of camera. When the environmental factors are not ideal under CCTV surveillance, Remark AI's award-winning identity verification technology can still produce high performance results.

Identity verification helps identify the suspicious target saved in the watch list and produces real-time alerts when the target appears in front of a CCTV camera. It can help search forcriminals or suspicious persons and find the missing elderly or children, improving public security andsafety. It can also help the police force to perform investigations to search the targets across cameras installed at different locations/areas.
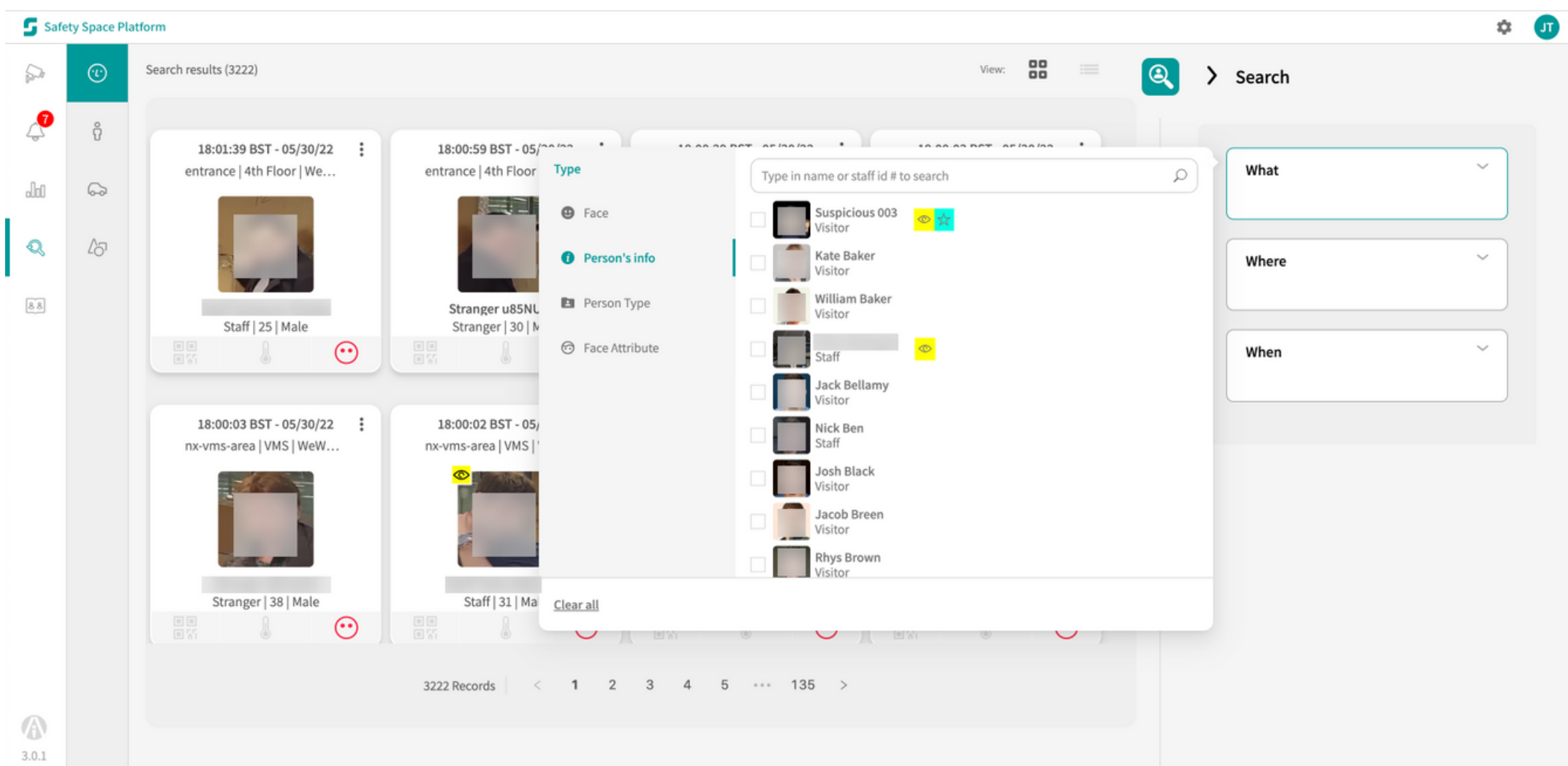
Watch List Alert

Identity verification results are compared to the current wanted Watch List. Wherever a wanted target shows up, an alert is sent at once with the map location for the supervisor to verify or the security staff near the site to respond quickly.

Access Control

Identity verification results can be checked with access rules based on time, area, and profile. E.g., students canaccess a classroom during office time but not at midnight. The security officer can access the room all the time.

Identity Search by Similarity

Identity records can be searched based on similarity by providing another image. The sources can be SSP internal captured or uploaded photos from witnesses, police ID photos, newspapers, or 3rd partysources.
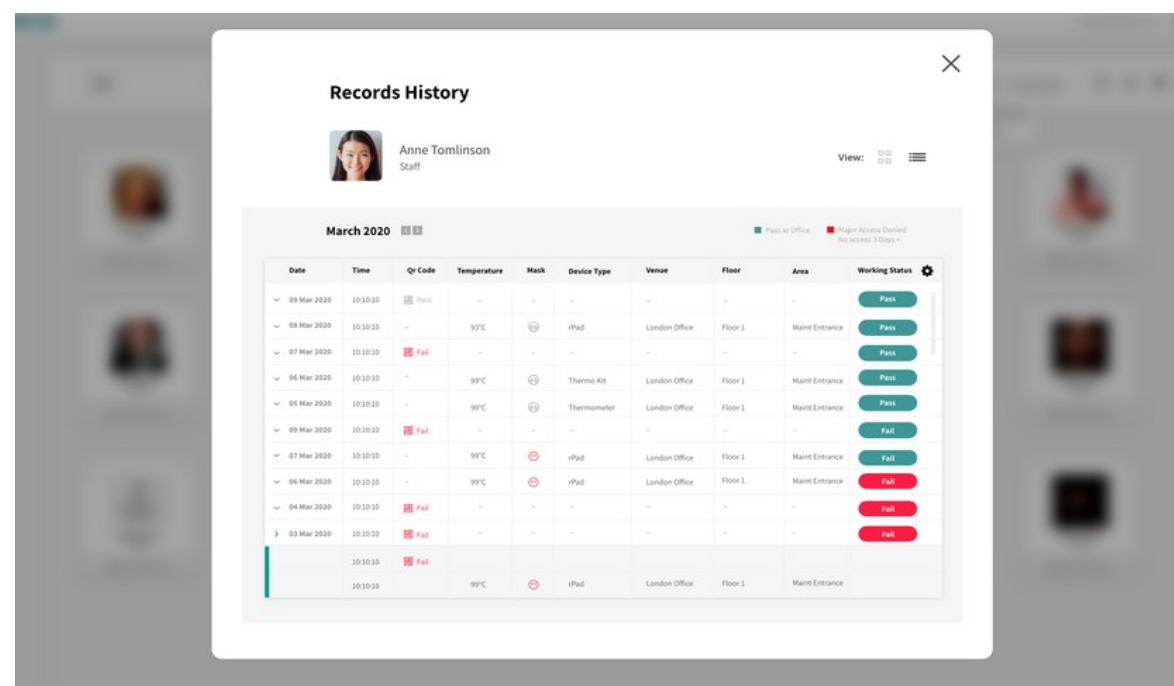
Identity Search by Attribute and Name

Identity records can also be searched based on witness verbal descriptions, e.g., a man between 25 to 38.Besides, name records in the system can also be used to search for known persons.

Additional filter for When and Where

According to other hints of the event, results can be filtered based on time and area location to narrow down the search field and get a better result.

Records History Tracklet

Every profile show-up history is organized as a tracklet (a fragment of the track followed by a moving object). It is easy to investigate or call up the recent location. It is also helpful for staff check-in and management.

Person Alert & Search

Intrusion/Loitering/Leaving Area

People are detected and tracked to trigger events based on rules. The rules can be customized toprevent undesired behaviors from breaking the working safety compliance or security requirements:
- Intrusion: Person entering the restricted area in critical infrastructure or safety control zone etc.;
- Loitering: Person loitering in a secure or restricted area for more than a specific time length;
- Leaving the area: Children leaving the playground of kindergarten themselves.

Person Re-Identification: Search by Attribute or PPE Wearing

Records can also be searched based on witness verbal descriptions by words, e.g., a male adult dressing in a white short-sleeve shirt, and long blue trousers while carrying a bag. In some circumstances, the operation may require the staff on duty to wear PPE (personal protection equipment) such as helmets and safety jackets at specific sites. The system can be customized to detect and recognize PPE to ensure the compliance rules have been followed and generate real-time notifications for non-compliance.

Records History Tracklet

Person search records are organized as a historical tracklet across cameras and areas.
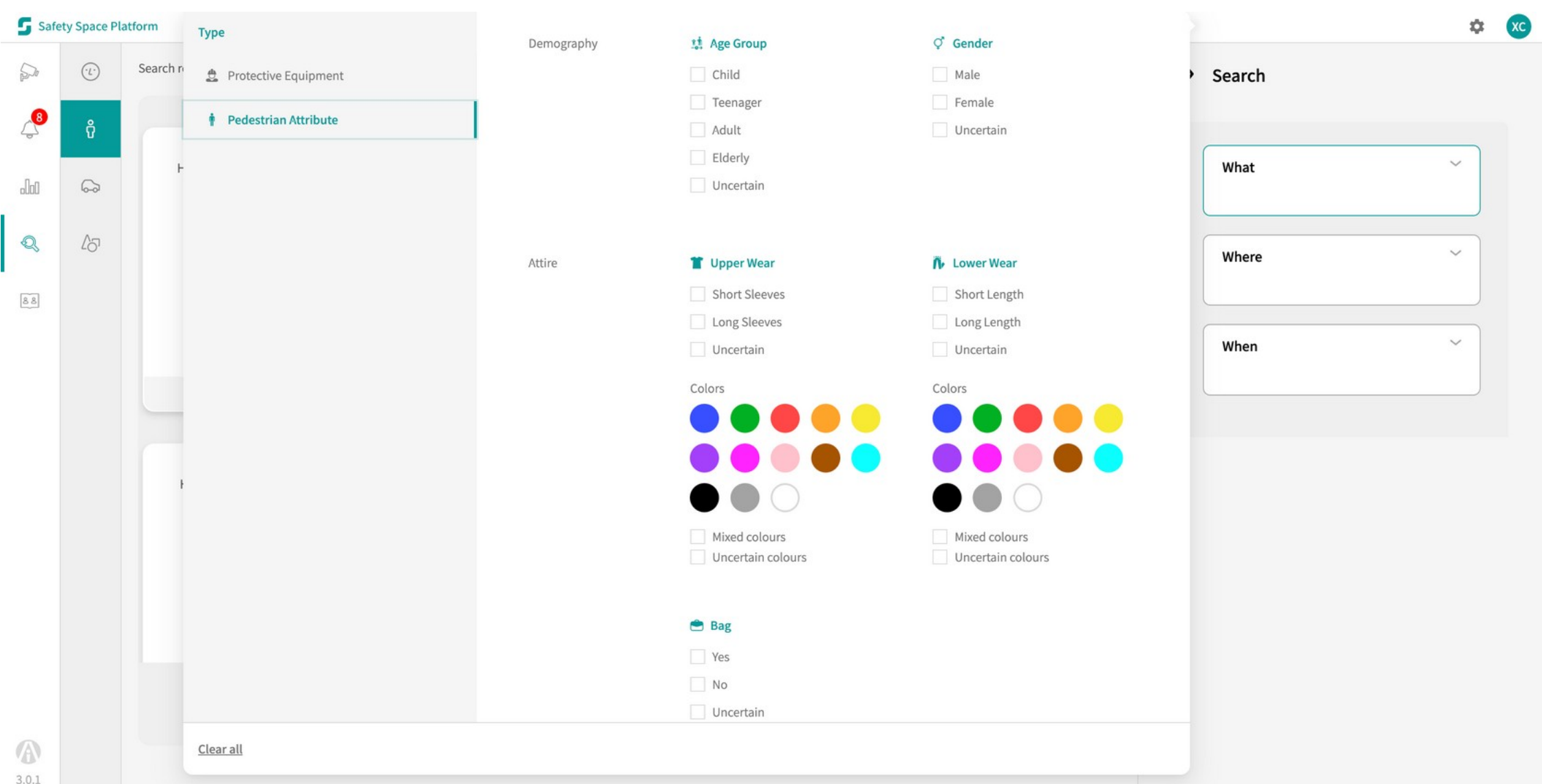
Vehicle Alert & Search

Intrusion/Loitering/Exit Area

Vehicles are detected and tracked to trigger events based on rules. The rules can be customized to prevent people and vehicles from breaking the public transport rules or working safety compliance:

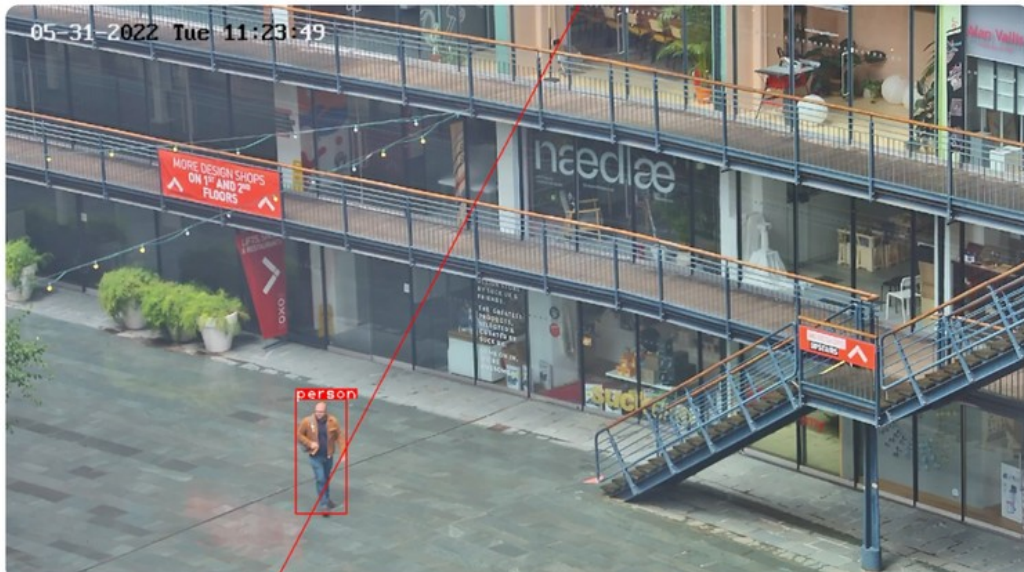- Intrusion: Vehicle violates transport rules, crossing double solid lines, or entering a one-way road but driving in the wrong direction, etc.;
- Loitering: Person/Vehicle staying or idling in a securityor safety restriction area for more than a specific time length etc.;
- Exit area: Construction vehicles leaving the restricted area etc.
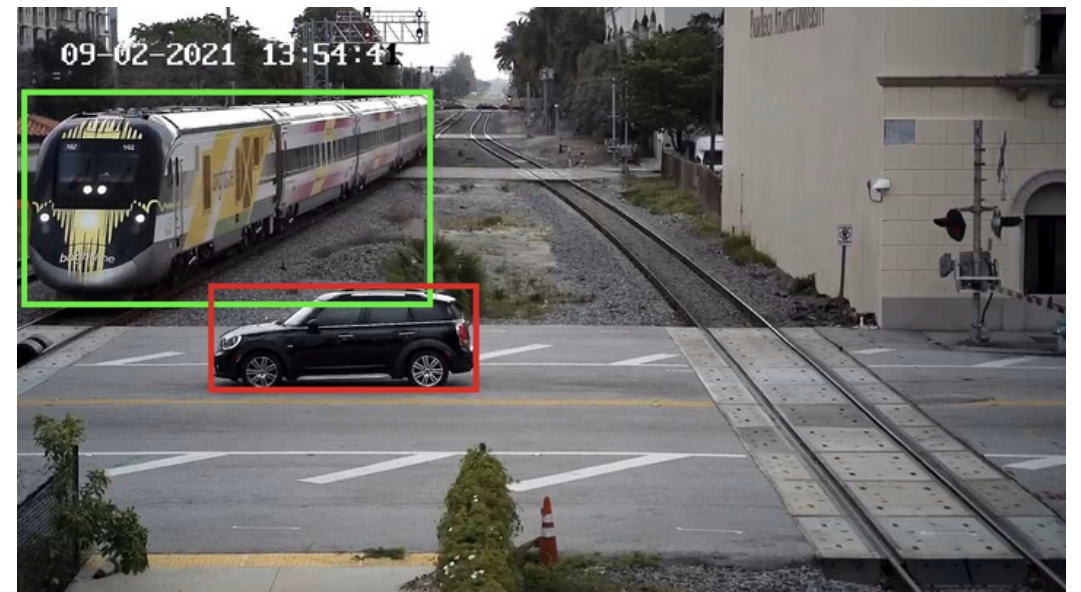
Vehicle Search by Plate Number and Attribute

Remark AI vehicle/plate detection and character recognition technology can detect and recognize the vehicle plate number from any standard CCTV video stream accurately in real-time. With regular expression, vehicles can be searched based on plate numbers from witnesses' fuzzy descriptions of memory, e.g., a car beginning with A and ending with a number without the middle characters missing.

We can also detect and recognize vehicle types and colors that can be searched together, e.g., a blue SUVbeginning with A and ending with a number.

Records History Tracklet

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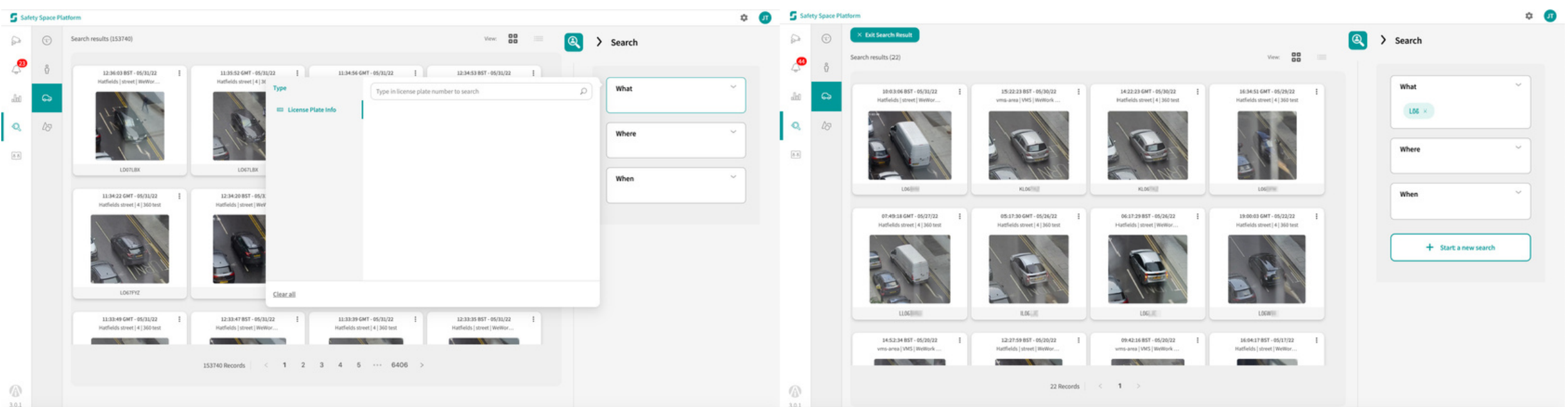
Unattended Object Alert & Search

Abnormal Object Detection

Abnormal or unattended objects from background can be detected and alerted with real-time notification. A pre-specified known object such as a person or vehicle can be excluded. This can help transport security or police nearby alerted in real-time to any unattended baggage left in the station or train and locate/remove them immediately to prevent any event endangering public security or safety. It can also help alert and locate any behavior of fly-tipping/illegal dumping of wastes in public places that can damage the public environment and waste public resources to remove them.

Handler Search of Person & Vehicle

The handler of the triggered unattended object can also be captured, including people or their vehicles. Attributes or number plate recognition similar to the above sections are also performed on the handlers. The management team can quickly identify them and search the target handler as a history tracklet.

Rules of Attendance

Our rule engine provides a flexible functionality to allow the front security staff to define various bespoke rules easily in their operations, such as:

- Passengers leaving the luggage for 3 mins to buy a ticket in the train station and return to collect the luggage;
- Passengers leaving the luggage for X meters as attendance for different camera views；
- Combing spatial and temporal information avoids false negatives of others passing by.

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Safety Event Monitoring

Abnormal Behavior Recognition – Falling, Fighting, and Vandalism

Remark AI's Pose recognition detects abnormal behavior, falling, fighting, and vandalism.
Real-time alerts to operation staff on duty enable immediate onsite assistance, prevent injuries from worsening, and protect lives.

Smoke & Fire Alert

Monitor the concentration of smoke or flames to assist in preventing accidents. Alerts will be triggered if any smoke or fire incidents are visually detected. Surveillance of the alert video can help the operation team verify false positives and evaluate the severity of an accident, e.g., an operator can upgrade to Level 3 fire remotely and mobilize more firefighters after evaluation from the video before the first fireman arrives onsite.

Additional thermal cameras can detect more accurate abnormal smoke and fire signals.
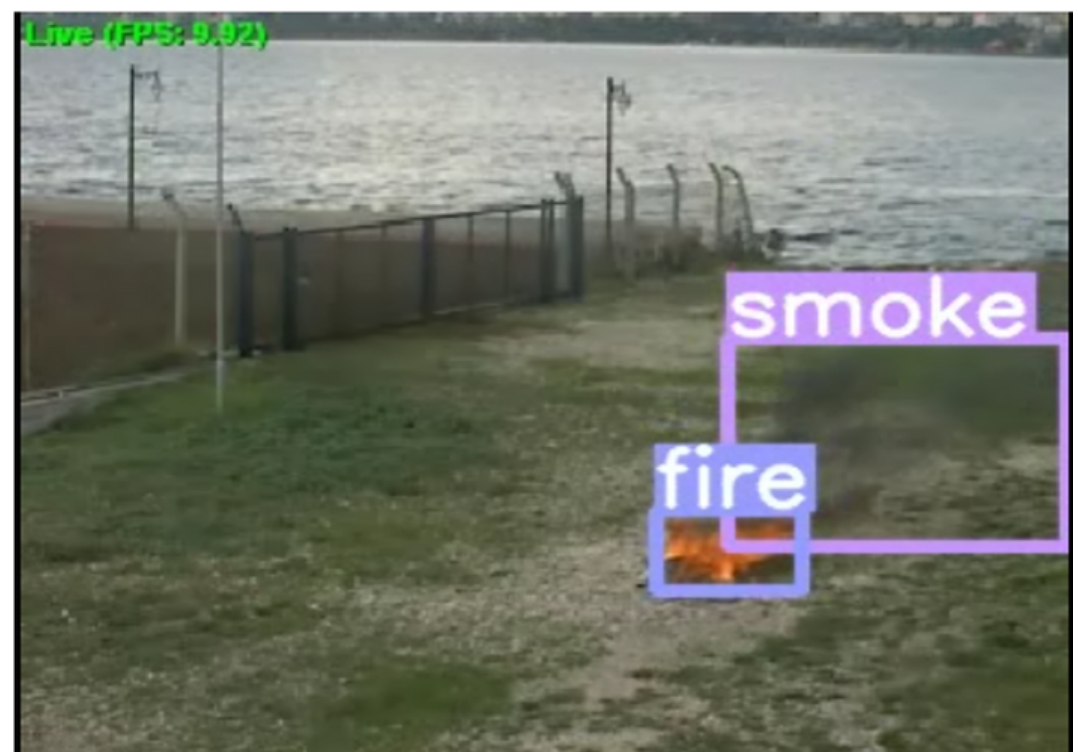
Operation Monitoring

People Flow & Crowd Alert

People flow and speed are detected and counted to summarize detailed reports as different time slots and areas. It helps the operation team maintain order and facilitate the crowd flows, e.g., opening a new entrance/exit for a platform, a one-way system for flow control, a new waiting room for the station, etc.

Abnormal sudden crowds clustering usually indicates abnormal accidents identified by passengers. Such crowd alerts can help the operation team discover accidents not covered by our current event analytics, e.g., platform ceiling damage.

Vehicle Flow Counting

Traffic flow and speed are tracked based on time and location. It helps the traffic operators locate traffic jams and accident spots to allow safe and smooth operations by designing traffic light schedules, setup road-about, junctions, one-way lanes, highway constructions, bus stops, etc.

On-Duty Check-In

The staff of different functions wearing specific uniforms is detected and tracked to verify their duty attendance through either identity verification or uniform recognition.Their activities are compared against their scheduled ones, e.g., police patrolling every 60 minutes in certain areas or places.

Key Awards

Top 5   2021 NIST's Face Recognition Vendor Test (FRVT) - Face Mask

Top 15   2021 NIST's Face Recognition Vendor Test (FRVT) - Wild Face

Top 20   2019 NIST's Face Recognition Vendor Test (FRVT)

VOT visual object tracking challenge

1st Place   2021 Visual Object Tracking (VOT-RT2021)
Short-term real-time tracking challenge, ICCV, 2021

1st Place   2021 Visual Object Tracking (VOT-RT2021)
RGBD challenge, ICCV, 2021

1st Place   2020 Visual Object Tracking (VOT-LT2020)
Long-term tracking challenge, ECCV, 2020

1st Place   2020 Visual Object Tracking (VOT-RT2020)
Short-term real-time tracking challenge, ECCV, 2020

2nd Place   2020 Visual Object Tracking (VOT-RGBD2020)
Color and depth long-term tracking challenge, ECCV, 2020

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