



TraffiClair Monthly Updates

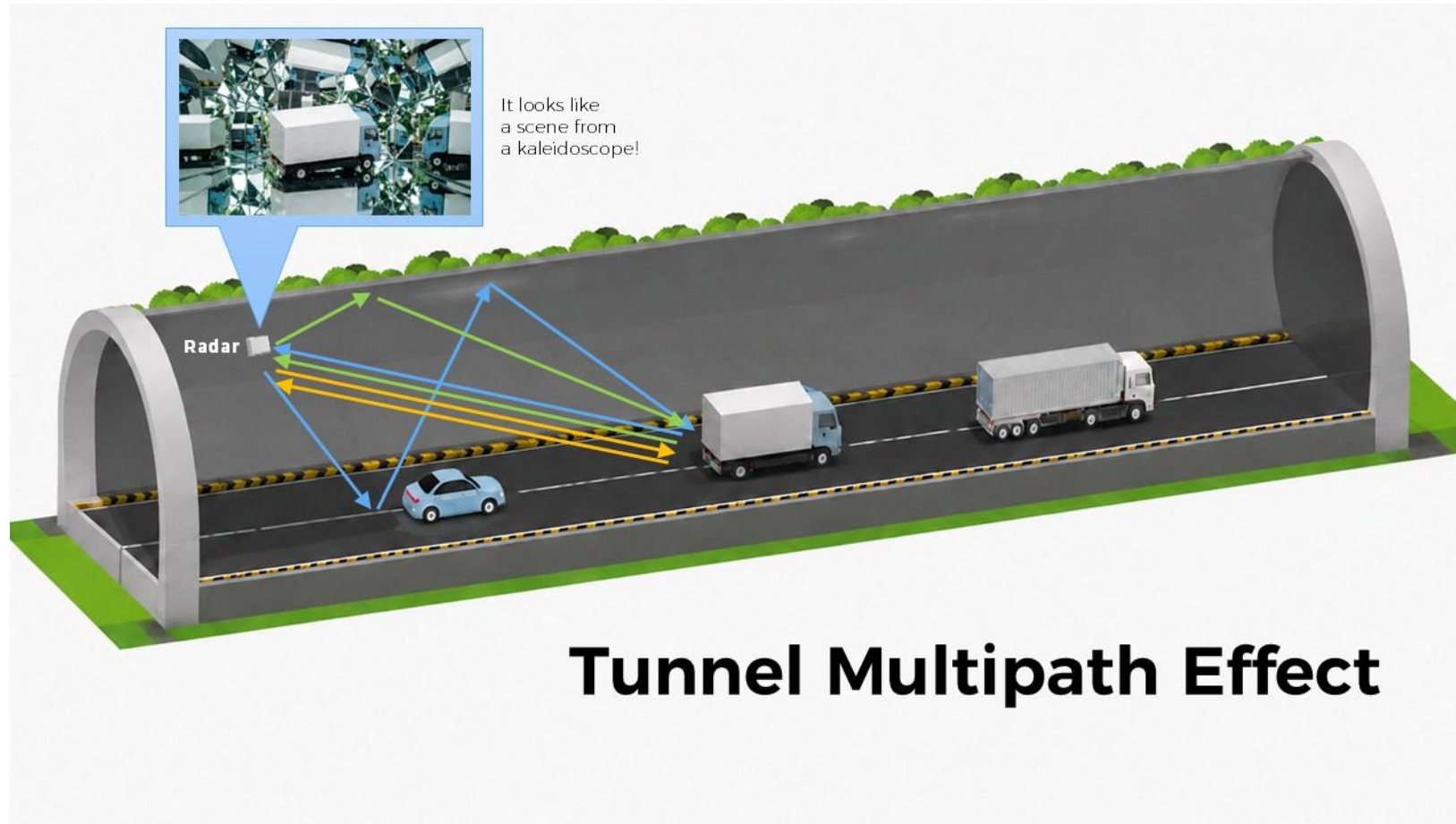
2026.08: Tunnel Radar Application

TraffiClair Team

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Tunnel Multipath Effect



In simple terms, the tunnel multipath effect occurs when radar or communication signals bounce off tunnel walls, ceilings, and floors, creating multiple reflected paths that reach the receiver at different times. These superimposed signals can cause:

- **Signal attenuation** – partial cancellation leading to weaker reception
- **Signal distortion** – inter-symbol interference from time-delayed echoes
- **Positioning errors** – inaccurate target localization in radar or tracking systems

Tunnels are particularly problematic due to their enclosed spaces and reflective materials like concrete and metal, which amplify reflection, refraction, and scattering.

How does tunnel radar overcome the “tunnel multipath effects”?

To combat these challenges, the ClairWav-U24 employs a combination of advanced technologies:

1. **MIMO Antenna Arrays:** The radar utilizes Multiple Input Multiple Output (MIMO) antenna arrays, which allow for the transmission and reception of multiple signals simultaneously. This technology enhances spatial resolution and improves the radar's ability to distinguish between direct and reflected signals, thereby reducing the impact of multipath interference.
2. **Super-Resolution Angle Estimation Algorithms:** These algorithms enable the radar to achieve highly accurate angle estimation, even in environments with significant signal reflections. By precisely determining the angle of arrival of signals, the radar can better differentiate between true target positions and ghost images created by multipath reflections.
3. **AI Machine Learning Algorithms:** The integration of AI and machine learning algorithms allows the radar to continuously learn and adapt to the specific characteristics of the tunnel environment. These algorithms can identify patterns in the radar data that are indicative of multipath effects and dynamically adjust the radar's processing to mitigate their impact. Over time, the system becomes more adept at filtering out false signals and enhancing the accuracy of target detection.



[Full Story](#)
[Product Webpage](#)

Application: How Tunnel Radar Saves Lives



1. Continuous Vehicle Monitoring

The radar tracks every vehicle in real time, providing coordinates, classification (car, truck, bus), lane, speed, and trajectory. This creates a complete, live picture of tunnel traffic.

2. Incident Detection & Coordinated Response

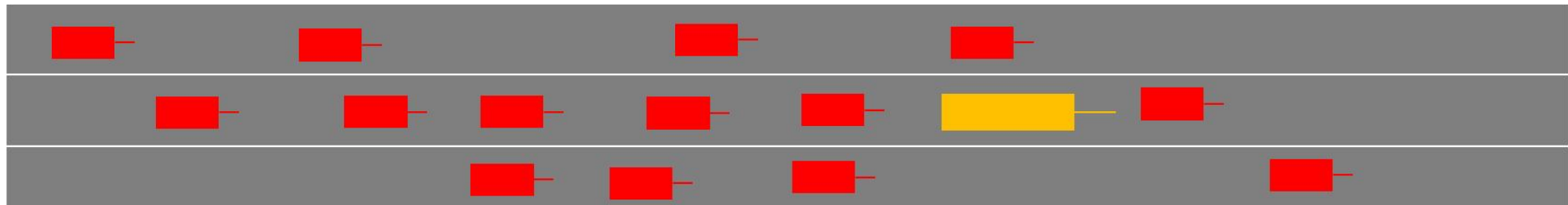
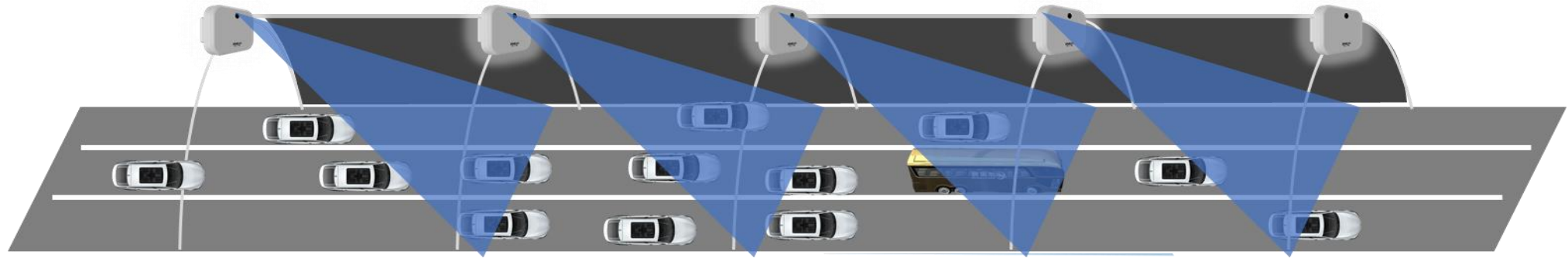
The system automatically detects hazards: congestion, sudden lane changes, speeding, tailgating, abnormal stopping, and emergency lane violations. Detection triggers a multi-system response within seconds, including variable message signs, video surveillance, tunnel broadcasting, traffic controls, and emergency dispatch.

3. Accident Handling & Rescue Support

In a collision or fire, the radar enables second-level discovery and pinpoint localization. It operates flawlessly in darkness, smoke, and poor visibility—where cameras fail—ensuring faster rescue, quicker rerouting, and fewer secondary incidents.

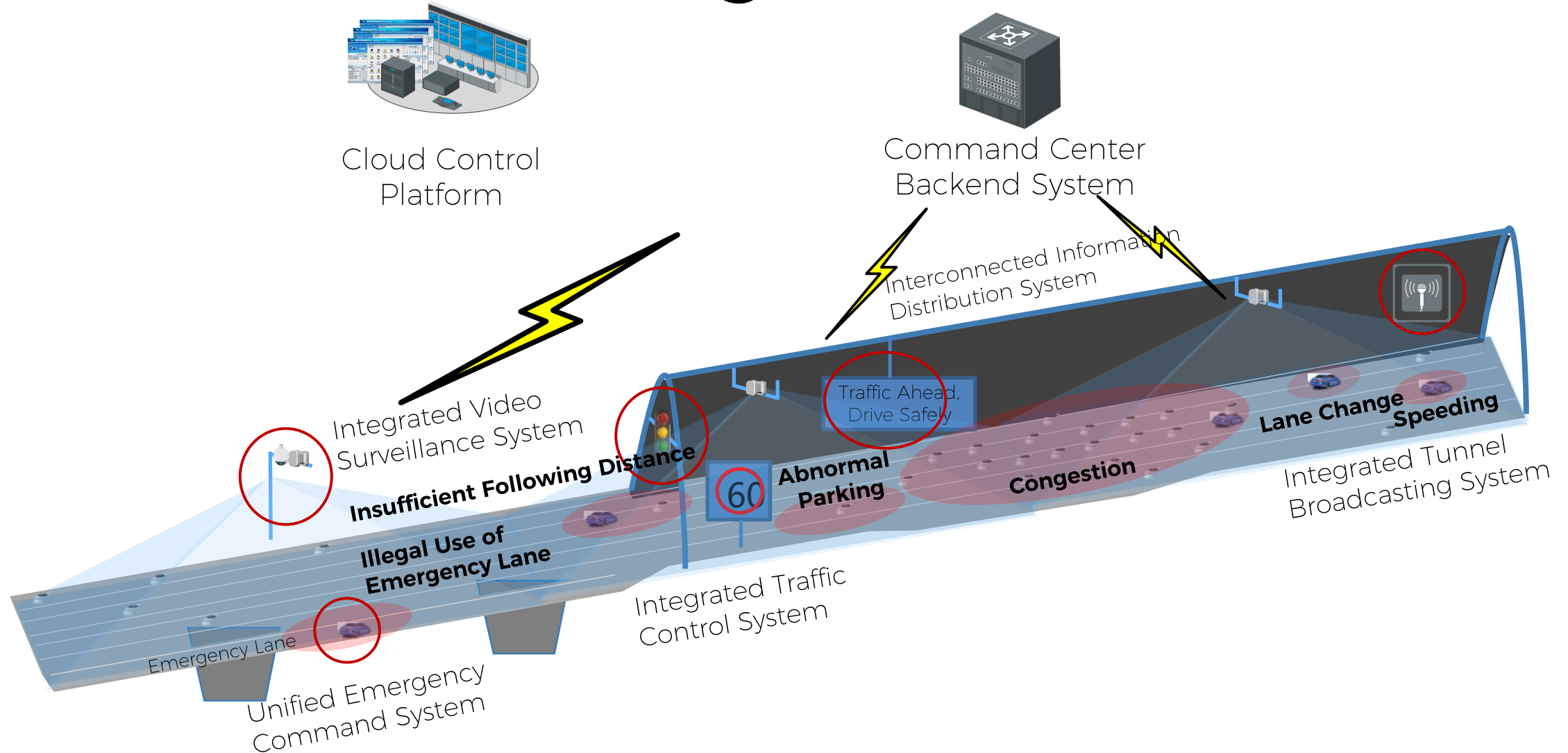
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Tunnel Vehicle Monitoring

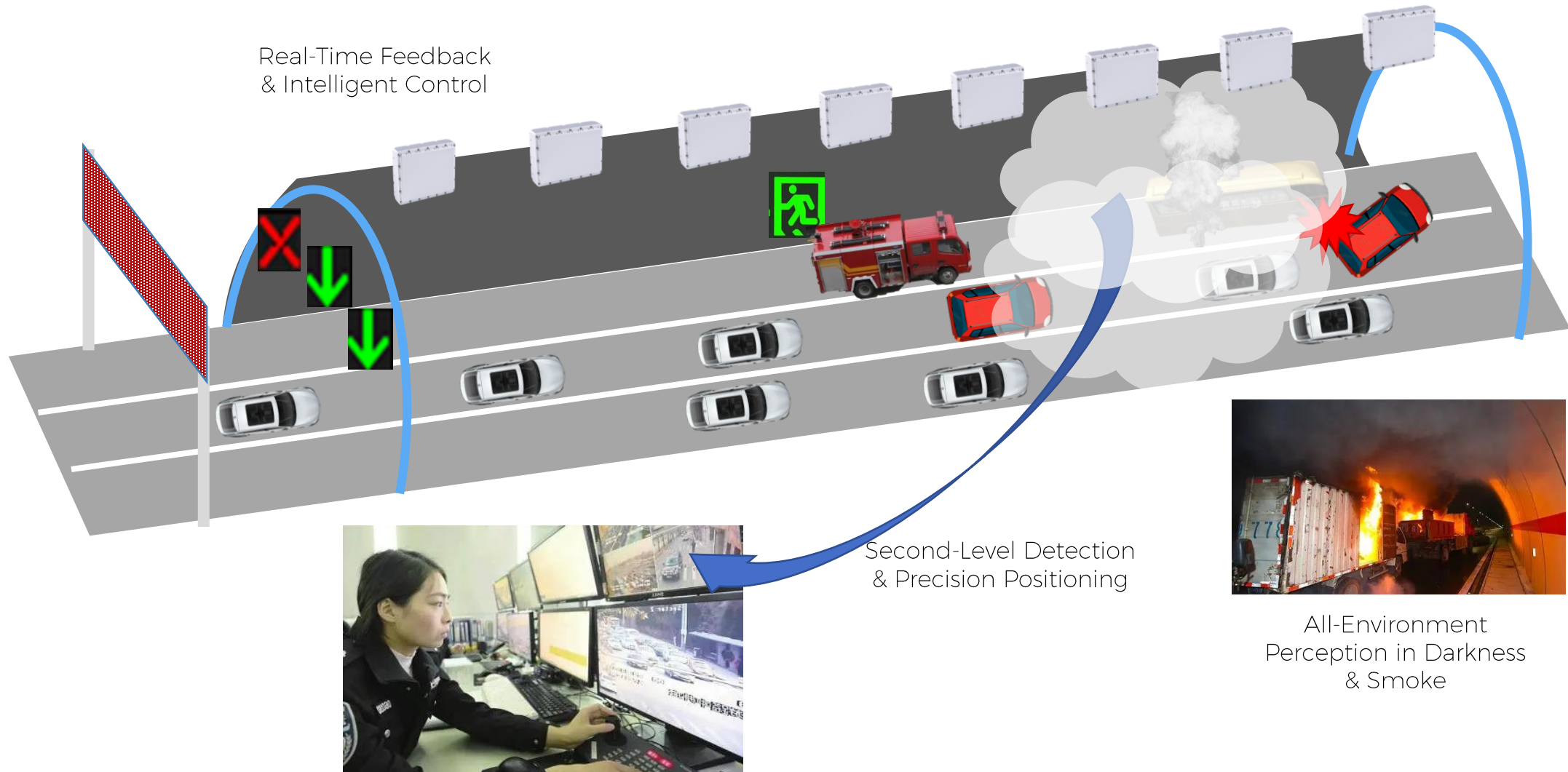


Vehicle Coordinates | Vehicle Classification | Lane Status | Target Velocity | Trajectory Tracking

Event Monitoring



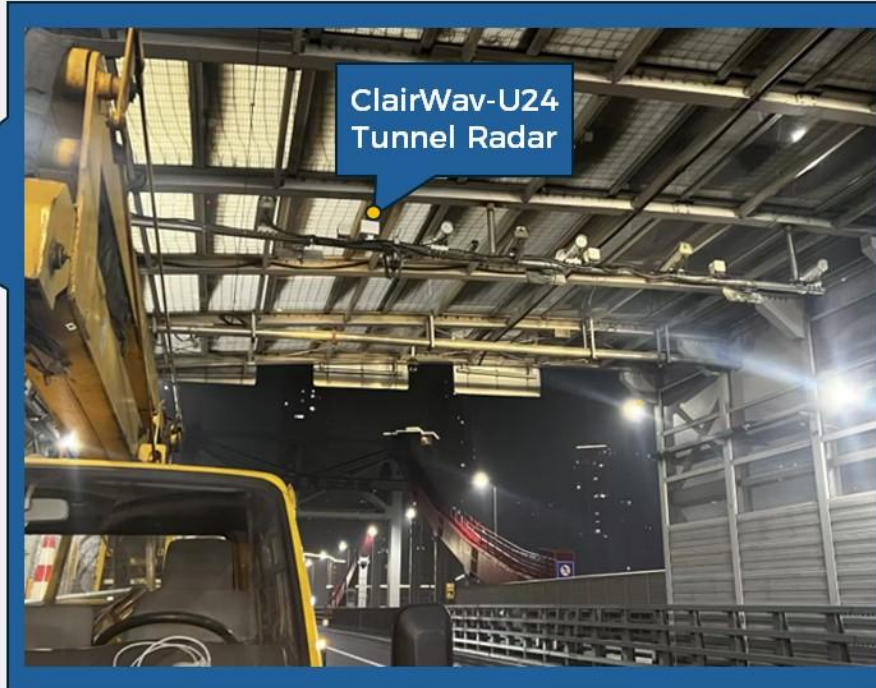
Traffic Accident Management & Rescue



Use Case: ClairWav Tunnel Radar at Chongqing's Zengjiayan Tunnel



Zengjiayan Jialing River Bridge, Chongqing



Zengjiayan Tunnel

The ClairWav-U24 has significantly enhanced safety and traffic management at the Zengjiayan Tunnel. By delivering precise, real-time data and instant incident alerts, it ensures the stable and secure operation of this critical urban route—demonstrating how advanced radar technology can effectively solve the unique challenges of tunnel monitoring in smart city infrastructure.

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Use Case: Xuefengshan Tunnel Radar Deployment



The ClairWav-U24 radar system has transformed the Xuefengshan Tunnel into a smart, self-aware corridor. By overcoming environmental limitations and providing millisecond-latency, all-weather detection—with a special focus on dangerous-goods vehicle tracking and instant event alerts—it has significantly enhanced both safety and operational efficiency on one of Hunan's most critical expressway sections.

[Full Story](#)
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Use Case: Full-Tracking & Auto-Warning for Hazardous Vehicles – Shanxi, China



A tri-sensor fusion architecture—"HD camera + intelligent video + millimeter-wave radar"—working in real-time. The radar component plays a pivotal role:

- **Continuous trajectory tracking** under all lighting and weather conditions
- **Vehicle position, speed, and density monitoring** with high precision
- **Millisecond-level event detection** (sudden stops, lane changes, tailgating, etc.)
- Seamless handover between sensor modalities to maintain track continuity even in poor visibility or tunnel interference

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[**202607:** ClairWav Radar Use Cases](#)

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[**Catalogue V1.10**](#)



Thanks

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