

CROWD FLOW INTELLIGENCE WHITE PAPER

Crowd Flow Intelligence for Safer Public Spaces

Real-Time 3D Spatial Sensing for Crowd Flow Monitoring, Early Warning and Operational Response



Executive Summary

Large public spaces often experience rapidly changing crowd conditions. The operational challenge is not only knowing how many people are present, but understanding how people are moving, where local accumulation is developing, and whether a bottleneck may become critical. HYD Technology provides a privacy-friendly 3D spatial sensing layer that can complement existing crowd-management, event-operation and smart-city platforms.

- **From counting to flow intelligence:** volume, direction, speed, zone occupancy and congestion trends.
- **Privacy-friendly sensing:** image-free 3D ToF sensing focused on flow rather than personal identity.
- **Open integration:** structured data can be supplied to partner platforms for visualization, rules and workflows.
- **Channel-ready positioning:** HYD provides the sensing and data layer; partners build the operational application.

1. From People Counting to Crowd Flow Intelligence

Why real-time crowd-flow awareness matters

Traditional people counting answers a basic question: **How many people are there?** In large public spaces, operators also need to know where people are moving, how quickly flow conditions are changing, where accumulation is forming and which zones may approach capacity. These signals can support earlier operational attention before congestion becomes difficult to manage.

Common operational challenges

- Rapid crowd growth during peak periods
- Uneven crowd distribution across zones
- Bottlenecks at entrances, exits and connecting routes
- Limited real-time visibility of changing flow conditions
- Delayed response when congestion is detected manually

What data matters

- People volume
- Entry / exit flow
- Movement direction
- Flow speed
- Zone occupancy
- Boundary crossing
- Accumulation / congestion trend



The objective is not to identify individuals. It is to turn movement patterns into structured operational data.

2. HYD Sensing Layer and Open Integration

Understand the flow, not the identity

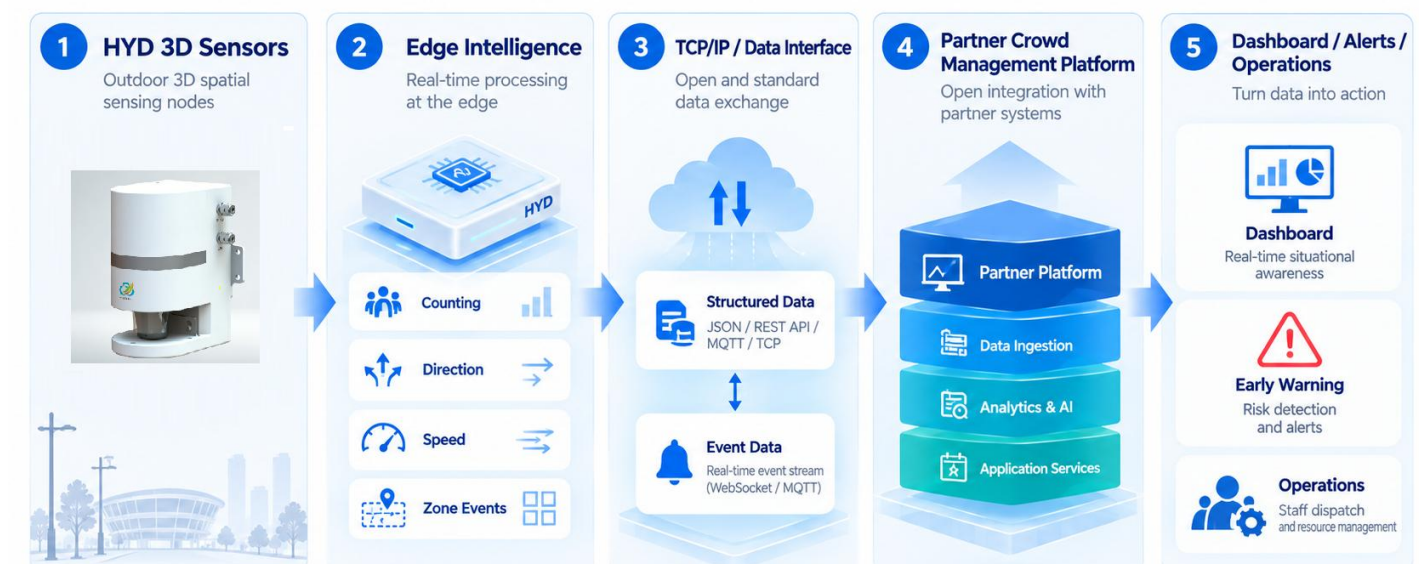
HYD focuses on structured crowd-flow data rather than identity-based monitoring. HSS-BI-T is positioned as an outdoor 3D spatial sensing node for selected wide-area and high-flow public environments. The sensor uses laser ToF technology, performs edge processing and outputs structured spatial data without relying on image acquisition.

Laser ToF	Image-Free	Edge Processing	Structured Output
3D spatial sensing	No RGB image acquisition	Real-time local analytics	Data for partner platforms

Open integration architecture

HYD role: sensing devices, edge intelligence, structured data output, integration guidance and site-specific product selection. **Partner role:** platform, dashboard, rules, operational workflow, deployment service and customer-specific applications.

Open Integration Architecture



From Sensing to Actions — Open Integration for Smarter, Safer Cities

HYD provides the sensing and data layer. Our partners turn the data into operational value.

3. Early Warning, Applications and Channel Cooperation

From alert to intervention

Early warning should not depend only on a single over-capacity threshold. A more useful approach is to identify a developing trend: inflow rises, outflow slows, zone occupancy increases, flow speed falls, and people begin accumulating near a bottleneck. These signals can support earlier operational decisions and targeted crowd guidance.

1 Sense	2 Analyse	3 Alert	4 Decide	5 Guide	6 Verify
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Where this model fits

- Public events, festivals, city celebrations and exhibitions
- Parks, scenic areas, national parks and tourist attractions
- Pedestrian streets, plazas and other high-footfall public spaces
- Entrances, exits, connecting routes, waiting areas and bottlenecks

Channel cooperation model

- **HYD:** 3D sensing, edge intelligence, structured data, integration support
- **Partner:** customer access, platform, dashboard, event logic, deployment and service
- **Joint value:** turn physical-world flow data into customer-specific operational applications



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