

Unified AI platform

Connecting intelligence across
agencies for a safer Singapore

August, 2025

This proposal is not intended to be binding on any of the parties. It is strictly for planning and discussion purposes only. Any binding agreement between the parties will be negotiated and agreed upon in a definitive agreement, signed by all parties. Nothing in this proposal represents a binding legal obligation on any party, including without limitation any binding obligation to reach and execute the final version of a definitive agreement between the parties, and no such binding obligation shall arise until such a definitive agreement is executed by the parties.



Executive summary

HTX's AI Ambition

HTX is advancing the HTxAI movement to realize Singapore's National AI Strategy 2.0 and position the Home Team as a global leader in applied AI by 2030.

- **AI for Mission Impact:** The new AI Products unit is focused on enhancing citizen experience, boosting frontline productivity, and solving complex problems with an "AI-first" mindset.
- **Unified Platform Approach:** HTX aims to replace fragmented, outsourced systems with a cohesive, AI-native platform that can scale across agencies and use cases.
- **Strategic Engagement with Thoughtworks:** HTX is seeking a partner to co-deliver priority use cases—including video analytics, NLQ, and person ReID—and to uplift its internal squads to independently build and operate advanced AI solutions.

Why Thoughtworks

Thoughtworks brings the technical depth, delivery experience, and collaborative approach needed to accelerate HTX's AI ambitions:

- **Global Expertise, Local Commitment:** A decade of trusted work with Singapore's public sector, backed by global AI research, including collaborations with NVIDIA and AI Singapore.
- **End-to-End AI Expertise:** From model training and simulation to inference optimization and AI product delivery, supporting HTX across the entire lifecycle.
- **Proven at Scale:** Delivered over 200 production-grade AI projects in 2024 across complex domains.
- **Embedded Co-Delivery:** Work side-by-side with HTX teams to uplift skills, transfer knowledge, and enable independent AI delivery.

We are confident that our combined capability and capacity, coupled with our deep understanding of the Singapore Public Sector, and our flexible outcome-oriented commercial approach, make us the ideal strategic partner to accelerate HTX's AI journey. We look forward to the opportunity to discuss our proposal in greater detail.



What we heard (your ask)

Our understanding

HTxAI movement (June 2024)

The HTxAI movement is aligned with Singapore's National AI Strategy (NAIS 2.0) to position Singapore as a global leader in AI by 2030. As part of its AI strategy, the HTxAI movement will leverage partnerships and collaborations with industry and academia to strengthen HTX's internal AI capabilities and advance its AI research and development (R&D).

AI Central

Manages, tracks, and supports overall AI functions across HTX

AI Enablers

Enablers to support AI Infra, AI Platform, AI Data, AI Network and Security

AI R&D

HTX R&D squads covering areas such as multimodal models, post training, Emerging AI, Safety & Security

AI Products

Building impact solutions across

Improving citizen experience: across home team interfaces

Improving employee experience and productivity: Help officers work smarter by automating boring, repetitive stuff.

Improving mission outcomes: tackle problems with an "AI-first" mindset to get better result



Partners

/thoughtworks

NVIDIA

firmus

Microsoft

G

MISTRAL
AI_

HTX priority use cases

To support the evolving needs of the Home Team, HTX is shifting away from siloed, single-purpose AI systems toward a unified platform approach. This platform must scale across agencies and environments, while enabling shared infrastructure, reusable models, and enhanced capabilities.

To lay the groundwork for a scalable AI platform, HTX is prioritizing use cases that depend on core capabilities such as real-time alerting, accelerated re-identification, and video search. These initiatives are expected to deliver early value while shaping the architecture, data pipelines, and model capabilities required for broader AI adoption across the Home Team.

➤ **Fight, Fire & Crowd Detection:** Trigger real-time alerts for events like large gatherings, fights or fires, which currently lack automation.

➤ **Manhunt/re-identification:** Accelerate visual identification of persons of interest from days to near real-time. Currently a manual, time-consuming process. Currently outsourced to a third party

➤ **Searchability:** Enable natural language queries on video streams (e.g., "man in blue shirt").



- Leverages existing old 90K cameras island-wide. They will be progressively replaced.
- The existing video analytics system is over six years old and outsourced. It does not have key capabilities like alerting, person re-identification (ReID), multi-camera tracking, and natural language query (NLQ). As a result, manhunts remain manual and investigations can take days.
- 200k new cameras will be rolled out. Due to differing suppliers and space constraints, not all cameras will support edge computing. It's fair to assume that edge compute will be limited.



- SPS currently has 22,000 cameras with some alerting via legacy systems (Video Hub), high false positives remain a challenge.
- The cameras are deployed at significant heights and some locations produce usable audio data
- Long-term goal: replace existing VMS/VMS-like systems with AI-native solutions supporting masking (e.g., for privacy in prisons) and chunked video analysis.



Our point of view

Holistic situational intelligence to ensure public safety and security

/thoughtworks

Holistic perspective to ensure public safety and security



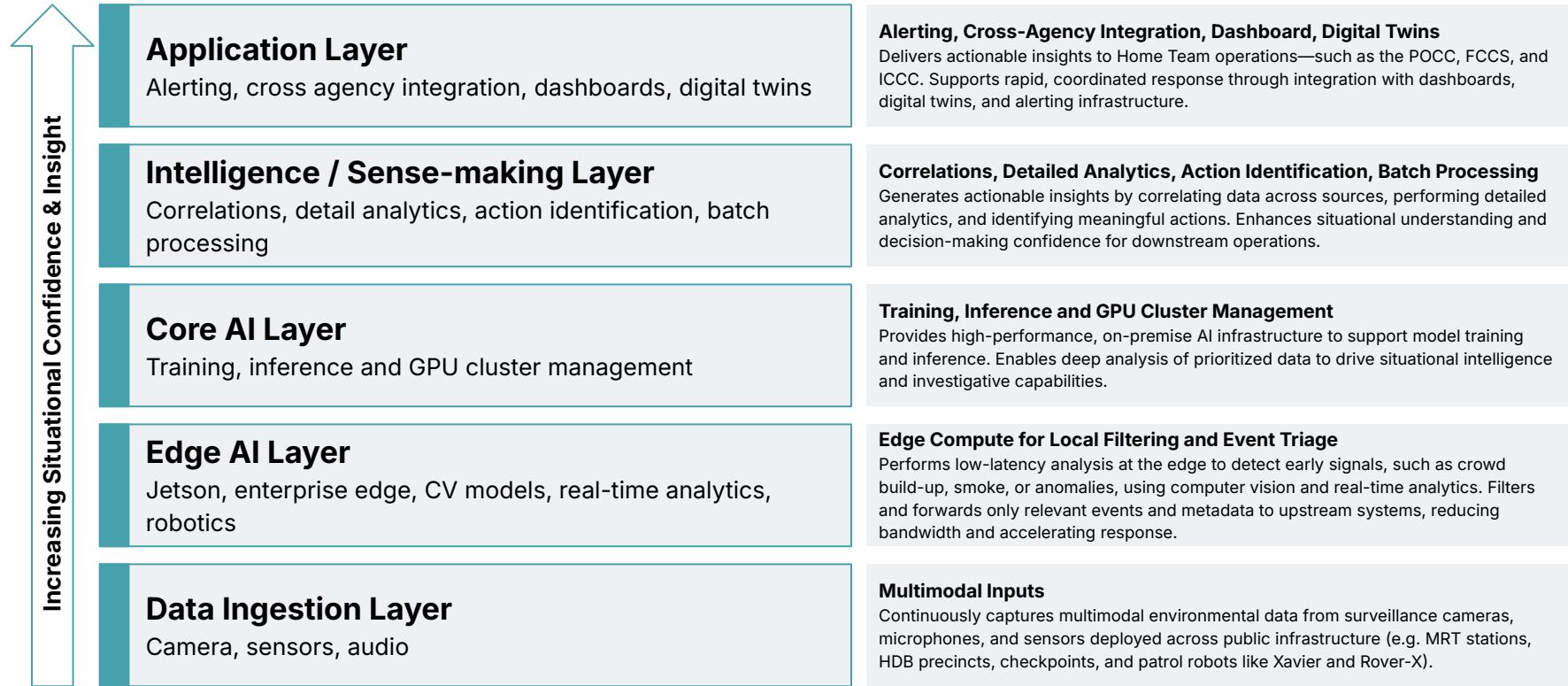
With the launch of the [HTxAI movement](#) on 1 June 2024, HTX has committed to leveraging cutting-edge AI, including generative models and multi-modal vision-language systems, to boost homeland security and public service effectiveness across Singapore. A **holistic perspective** is essential: integrating AI-driven surveillance, robotics, data engineering, sense-making, and governance across the Home Team ensures that situational awareness is comprehensive, trustworthy, and responsive in real-world environments.

The need for holistic situational intelligence to enable **timely detection** and **response** to events across the homeland

 Police Force	 Prison Service	 Civil Defence	 Immigration & Checkpoints	 Internal Security Department	 Central Narcotics Bureau
Crime prevention, public order, traffic enforcement	Inmate rehabilitation, prison safety	Emergency response, fire and rescue	Border security and customs control	Counter-terrorism, national security	Drug enforcement and surveillance
Crowd detection	Behavior monitoring (self harm, fights, exchanges)	Accidents (vehicle, people)	Behavioral anomaly	Threat recognition (unidentified objects)	Facial recognition for known drug offenders
Face find or recognition	Perimeter surveillance	Smoke and Fire	Licence plate + face recognition	Cross camera tracking (person of interest)	congestion on drugs hotspot
License plate recognition	Inmate reactions (gang related)		Crowd detection	Vehicle tracking across city	Behavior tracking (cross camera reid)
Behavioral patterns	Visitors (objects, behavior analysis etc...)			Crowd dynamics (protest/riot risk)	Hidden object detection

Unified AI platform

Conceptual framework for an AI Platform enabling holistic situational intelligence for timely detection and response



Big Rocks for HTX's Unified AI Platform

To realise the HTX Unified AI Platform vision, we must address a set of foundational “big rocks”, high-impact challenges critical to success.

This list is not exhaustive, but highlights the areas most likely to determine the success of a large-scale, vision-based AI system serving multiple Home Team agencies.

Each “big rock” outlines challenges, strategic trade-offs, and potential solutions, with deeper analysis provided in our accompanying ‘HTX Unified AI Platform - Thoughtworks POV’ and ‘HTX Person Re-Identification - Thoughtworks POV’ report.

➤ Multi-Tier Edge–Cloud Inference

Challenge: Latency, bandwidth, and compute costs in large-scale deployments.

Solution: Distribute inference (edge and centralized), video stream filtering, selective inference.

➤ Singapore-Optimized Models

Challenge: Off-the-shelf models will struggle with local conditions and environments.

Solution: Fine-tune and adapt models using Singapore-specific data and scenarios (real and synthetic).

➤ Embedding Architecture to Support NLQ

Challenge: Slow, inefficient retrieval from massive video archives.

Solution: Use embeddings to enable fast, intuitive search via natural language queries.

➤ Synthetic Data for Training and Validation at Scale

Challenge: Limited access to diverse, labeled real-world video.

Solution: Generate photorealistic synthetic footage to expand and balance training datasets.

➤ Autonomous Event-Driven AI Agents

Challenge: Manual monitoring limits responsiveness to real-time events.

Solution: Deploy AI agents that detect, reason, and trigger actions autonomously.

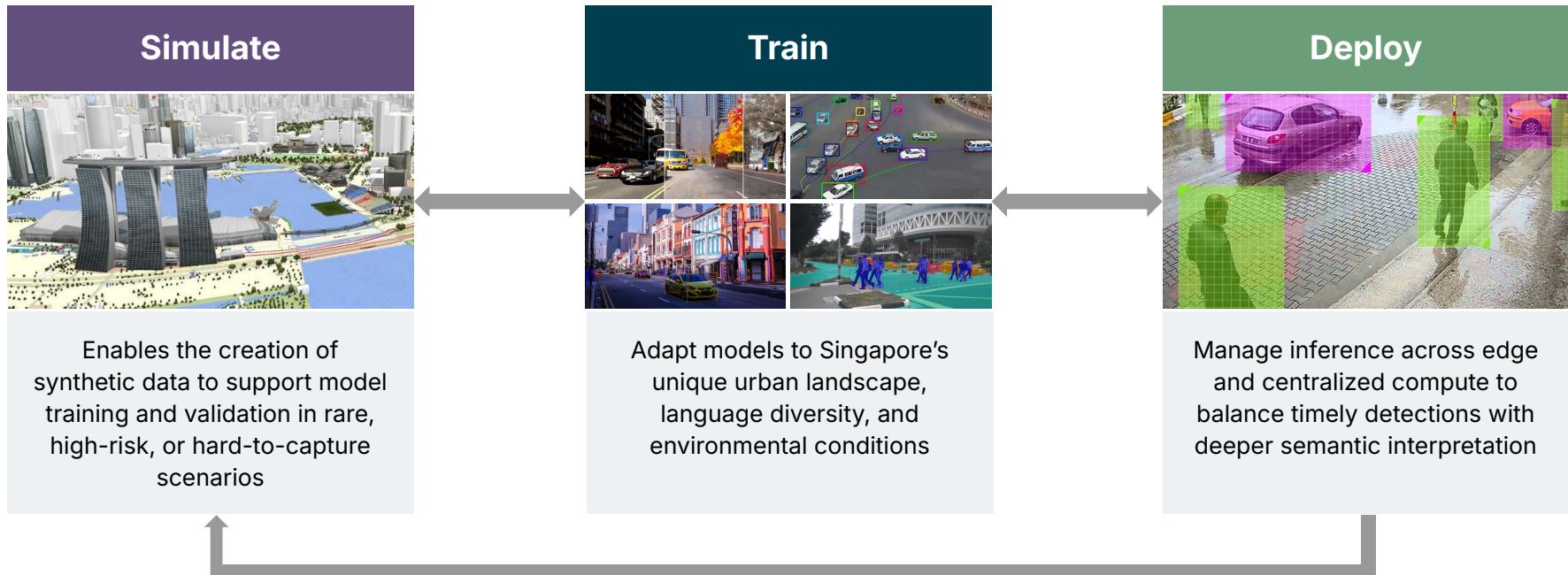
➤ Multimodal Data Fusion

Challenge: Video analysis often misses context and increases false positives and false negatives.

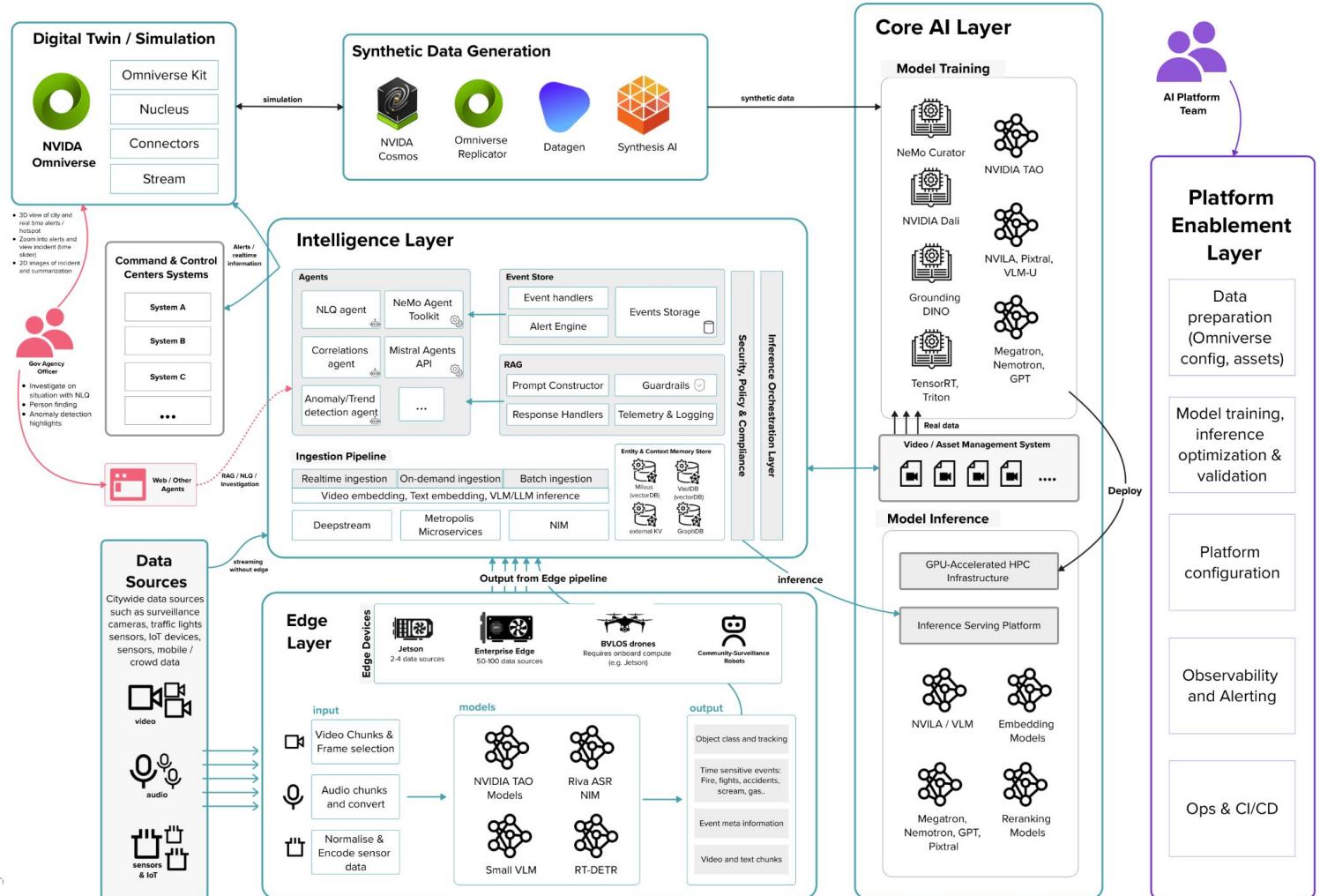
Solution: Fuse video, sensor, and audio data to improve accuracy and situational awareness.

Three computer solution

The “**Three-Computer**” solution provides a good mental model for understanding the three distinct but interconnected stages of AI system development: simulation, training, and deployment. Together, these stages form a reinforcing flywheel that improves model quality, scalability, and real-world performance. We’ll use this framing to identify the key focus areas, the “**big rocks**”, that will shape HTX’s vision.



Platform Architecture



Your immediate ask

HTX is establishing a new AI Products unit to develop innovative AI solutions across the Home Team

At HTX's request, Thoughtworks has:

- Delivered a **Point of View** on building a large-scale, vision-based AI solution to serve multiple Home Team agencies use-cases, highlighting key technical challenges, strategic trade-offs, and enabling technologies.
- Proposed an **approach for large-scale Person Re-Identification (ReID)** across Singapore's 50,000-camera Home Team network, including the processing pipeline, optimisation techniques, and GPU infrastructure estimations.

To accelerate HTX's AI ambitions, Thoughtworks will focus on:

- **Advisory** – Applying our end-to-end AI expertise, from research, model training, and data management to deployment, optimisation, and AI product delivery to help HTX achieve its mission.
- **Enablement** – Uplifting the capabilities of HTX's AI Product squads to independently design, build, and operate increasingly complex AI solutions.
- **Delivery** – Working with HTX's in-house teams and strategic partners to deliver initial priority use cases, including video analytics, natural language querying (NLQ), and person re-identification (ReID).



HTX Unified AI Platform

Connecting intelligence across agencies for a safer Singapore

August 2025

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HTX - Person Re-Identification

Linking perspectives for a smarter, safer Singapore

August 2025

/thoughtworks



**Bring the right partners together to
make HTX's vision a reality**

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Better together

Bringing the right partners together to make your vision a reality



Advisory & Implementation

Trusted partner to HTX and the Singapore Government. Thoughtworks leads delivery and integration—ensuring all partners align to HTX's goals with a tailored, end-to-end AI solution.



Linker Vision

AI Smart Cities Platform

Powered by NVIDIA Omniverse, Cosmos, and Metropolis for end-to-end smart city intelligence

Built for smart cities and national security, Linker Vision's platform enables large-scale deployments. As a close NVIDIA partner, they've been featured in Jensen Huang's keynotes and collaborate on Omniverse and VSS.



AI infrastructure, foundational technologies & accelerators (blueprints)

The foundation of modern AI infrastructure, NVIDIA delivers industry-leading GPUs and a mature software ecosystem like CUDA, powering high-performance AI at scale.



Unified Storage Platform

Designed for AI-scale data, VAST delivers ultra-fast, infinitely scalable object storage. Already integrated with NVIDIA VSS and Linker Vision's platform.



5 Reasons why this collective can deliver HTX's vision

① Global Expertise, Local Commitment

Thoughtworks has a decade of trusted work with Singapore's public sector, backed by global AI research. We're all NVIDIA partners, bringing proven innovation and execution to national-scale AI projects.

② End-to-End AI & Smart City Expertise

From model training and GPU optimization to AI platform deployment and city-wide video analytics, our capabilities span the full lifecycle

③ Proven Track Record in AI Productization

Across the collective, we've delivered hundreds of production-grade AI solutions across diverse and complex domains, including Linker Vision's AI Smart Cities deployment in Taoyuan, Taiwan

④ Strong Product Thinking & Innovation

Experience in building products that are user-centric, value-driven, and continuously evolving

⑤ Agile and Collaborative Delivery Culture

Thoughtworks are pioneers in Agile delivery and a founding signatory of the Agile Manifesto

Example use cases





Smart City Applications

Traffic Optimization



Disaster Response



Use Case	Value
Detect traffic accident	Reduce response time (10 min → 1 min)
Mitigate congestion	Reduce mitigation time (15 min → 5 min)
Assess construction impact	Reduce bottlenecks in ~70% of work zones

Use Case	Value
Detect flooding or fire (fallen tree, rocks, landslide...)	Incident-to-notification latency (180s → 30s)
Identify emergency vehicle and personnel	Enable faster dispatch & coordination
Assess disaster severity	Prioritize rescue with contextual AI analysis



Smart City Applications



Use Case	Value
Detect unsafe behaviors and unattended objects	Reduce accidents through automatic alerts
Monitor platform crowding	Prevent incidents by early warning
Ensure boarding area compliance	Lower platform-related incidents by 30%

Use Case	Value
Detect abnormal crowd behavior	Reduce accidents through automatic alerts
Monitor restricted zones	Reduce unauthorized access by >80%
Track occupancy in real time	Optimize staffing and evacuation readiness



Smart City Applications

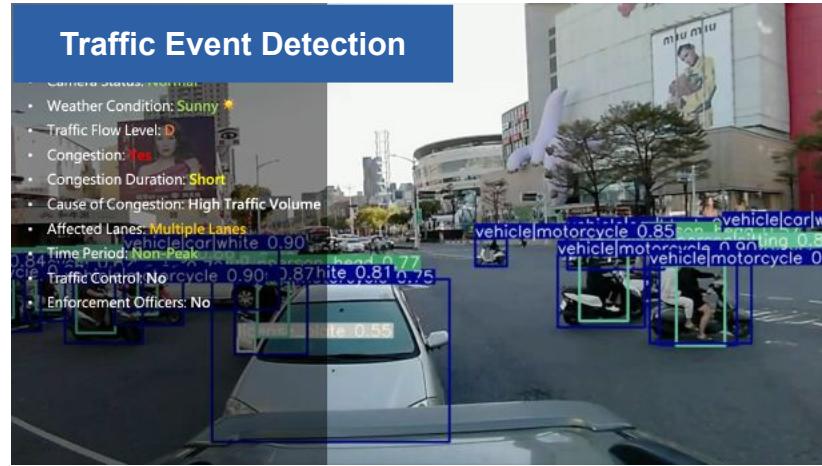


Use Case	Value
Assess disaster-related damage	Reduce inspection time by >60%
Detect equipment overheating or smoke	Enable early fire prevention and shutdown
Identify intrusion near restricted zones	Prevent human and animal contact incidents

Use Case	Value
Detect signs of pollution or early on-site hazards	Reduce manual inspection time by 60%
Detect PPE violations	Improve safety compliance rate (70% → 95%)
Track worker in restricted or hazardous zones	Reduce safety breaches by 70%



Traffic Optimization



Use Case	Value
Detect traffic accident	Reduce response time (10 min → 1 min)
Mitigate congestion	Reduce mitigation time (15 min → 5 min)
Assess construction impact	Reduce bottlenecks in ~70% of work zones

Use Case	Value
Identify potholes, cracks, or surface erosion	Prevents accidents and vehicle damage
Alert maintenance crews with GPS tagging	Enables proactive road repairs
Monitor road conditions over time	Optimizes infrastructure upkeep



Traffic Optimization



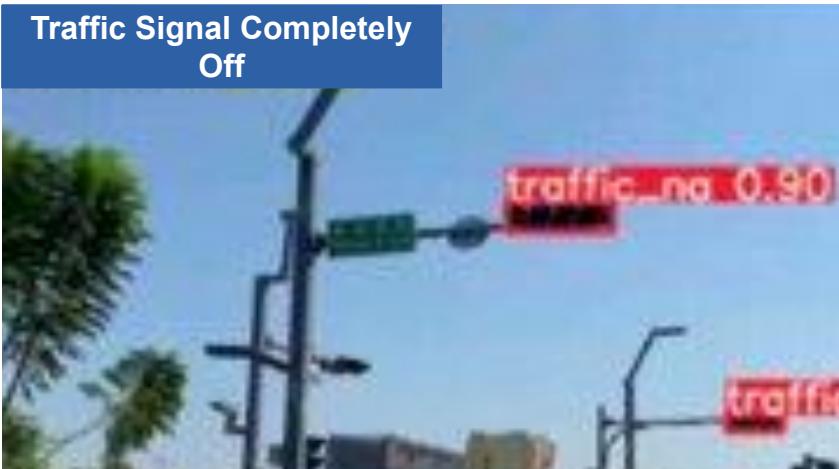
Use Case	Value
Detect faded/missing lane markings	Safer driving & AV navigation
Schedule repainting based on severity	Lower maintenance costs
Plan preventive maintenance	Better visibility in low-light

Use Case	Value
Detect damaged/missing signs in real time	Prevent accidents
Auto-report to city systems	Faster city response
Update digital twin/map layers	Improved road safety compliance



Traffic Optimization

Traffic Signal Completely Off



Rider Not Wearing Helmet



Use Case	Value
Detect non-functioning traffic lights via video analytics	Prevents traffic confusion and accidents
Auto-alert traffic management center	Enables faster repairs
Cross-check with scheduled maintenance or power issues	Ensures continuous traffic flow and safety

Use Case	Value
Detect unhelmeted riders via camera AI	Promotes helmet use, reducing injuries
Trigger real-time alerts or enforcement notifications	Supports traffic law enforcement
Collect statistics for safety campaigns	Enhances public safety awareness



Traffic Optimization

Running a Red Light



Failing to Yield to Pedestrians



Use Case	Value
Detect red-light violations via AI camera	Reduces intersection accidents
Auto-log incidents with time/location	Supports automated traffic enforcement
Send data to enforcement or warning systems	Improves driver compliance

Use Case	Value
Detect vehicles not stopping for crossing pedestrians	Enhances pedestrian safety
Trigger alerts or warning signs	Reduces injury risk at crosswalks
Collect data to optimize crosswalk design	Informs better urban planning



Disaster Response

Real-Time Flood Monitoring

- Camera Status: Normal
- Weather Condition: Rainy ☔
- Flooded: Yes
- Flood Depth: Shallow
- Affected Lanes: All Lanes
- Vehicle Flooding: Yes
- Pedestrian Flooding: No
- Traffic Affected: Yes
- Closure Required: No
- Emergency Vehicles: Yes
- Traffic Control: Yes
- Enforcement Officers



Use Case	Value
Urban flood alert	Enable early road closure or rerouting
Vehicle and lane-level flood detection	Protect drivers and reduce vehicle damage
Emergency access monitoring	Ensure clear paths for ambulances and responders

Use Case	Value
Early wildfire outbreak alert	Speed up emergency response, minimize damage
Smoke and flame detection	Detect fires before human reports
Perimeter breach or fire spread monitoring	Help responders prioritize containment zones



Manufacturing Management

Overheating & Smoke Detection

Camera Status: Normal

- Weather Condition: Partly Cloudy
- Emission: Yes
- Emission Source: Leaking Pipes
- Visible Flame: No
- Visible Smoke: Yes
- Smoke Concentration: Medium
- Smoke Volume: Medium
- Smoke Color: White
- Crowd Gathering: No

Access & Activity Anomaly Detection

Camera Status: Normal

- Corrosion Detected: Yes
- Corrosion Area: Piping
- Corrosion Size: Small
- Corrosion Depth: Surface

Use Case	Value
Prevent transformer failure or fire	Reduce outage risk
Enable early shutdown or alert	Prevent costly downtime or accidents

Use Case	Value
Alert security or maintenance teams in real time	Reduce safety and outage risks
Trigger automated logs for audit and risk review	Minimize surveillance burden
Support intervention for wildlife or trespassers	Enable proactive, data-informed asset protection



Public Safety

Public & Crowd Behavior Detection

Camera Status: **Normal**

- Crowd Density: **High**
- Estimated Headcount: **78**
- Crowd Flow Direction: **Single Direction**
- Crowd Dwell Duration: **Long**
- Gathering Area: **Entrance**
- Exit Blockage: **No**



Onboard & Station Behavior Safety Monitoring

Camera Status: **Normal**

- People Fallen: **No**
- People Fighting: **No**
- People Running: **No**
- People Climbing: **No**
- Items Left Behind: **Yes**
- Unauthorized Entry: **No**
- Equipment Damage: **No**



Use Case	Value
Event crowd control	Prevent crowd-induced traffic disruptions
Unauthorized gathering alerts	Improve event traffic flow and real-time signal adjustment

Use Case	Value
Safety incident detection	Improve emergency response accuracy and speed
Automated reporting	Reduce manual monitoring workload
Incident review	Improve overall response processes and accountability



Industrial Facility Management

Pollution or Hazard Detection

- Camera Status: **Normal**
- On Fire: **Yes**
- Visible Flame: **Yes**
- Visible Smoke: **Yes**
- Smoke Concentration: **Medium**
- People Present: **No**
- Fire Truck Present: **No**
- Ambulance Present: **No**
- Fire Location: **Port Area**
- Exit Affected: **No**
- Crowd Gathering: **No**



Waste Disposal Area Monitoring

- Camera Status: **Normal**
- Weather Condition: **Partly Cloudy** ☁
- On Fire: **Yes**
- Visible Flame: **Yes**
- Visible Smoke: **Yes**
- Smoke Concentration: **Medium**
- Burning Area Size: **Large**
- Fire Truck Present: **Yes** fire 89.9%
- Ambulance Present: **No**
- Crowd Gathering: **No**



Use Case	Value
Alert HSE team for rapid response	Prevent environmental damage
Create reports for audits	Reduce emergency costs

Use Case	Value
Notify cleaning contractors or ESG team	Improve waste handling
Support regulatory reporting	Prevent fines or contamination



Worker Safety Compliance

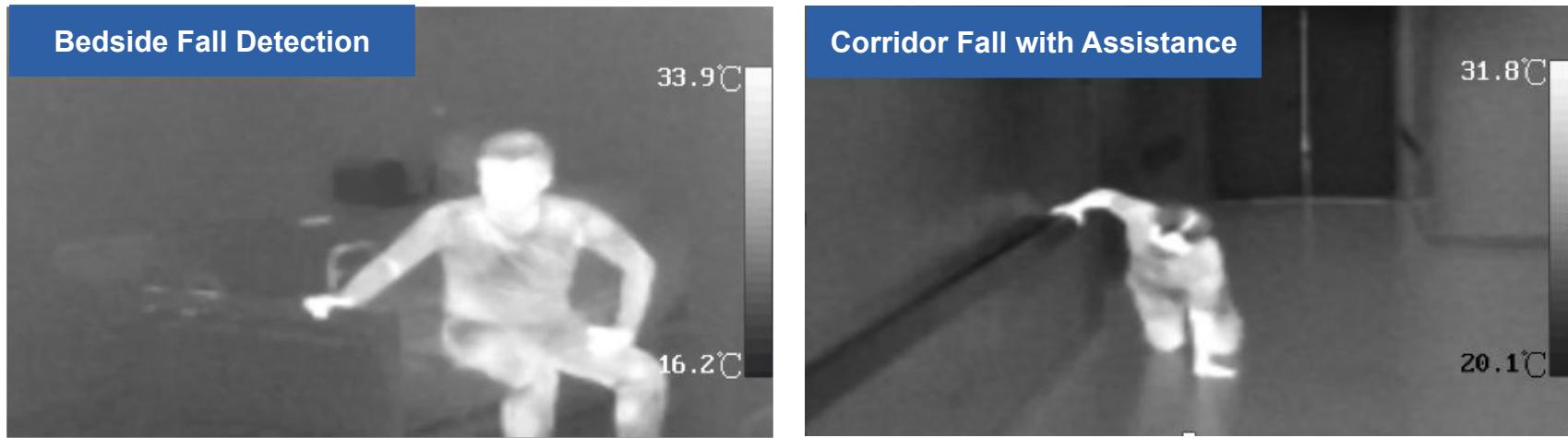


Use Case	Value
Alert supervisors when thresholds are crossed	Lower risk of injury or sabotage
Use logs for safety review	Enforce work discipline

Use Case	Value
Alert safety officers instantly	Reduce injury risks
Log events for compliance checks	Ensure compliance



Hospital Management

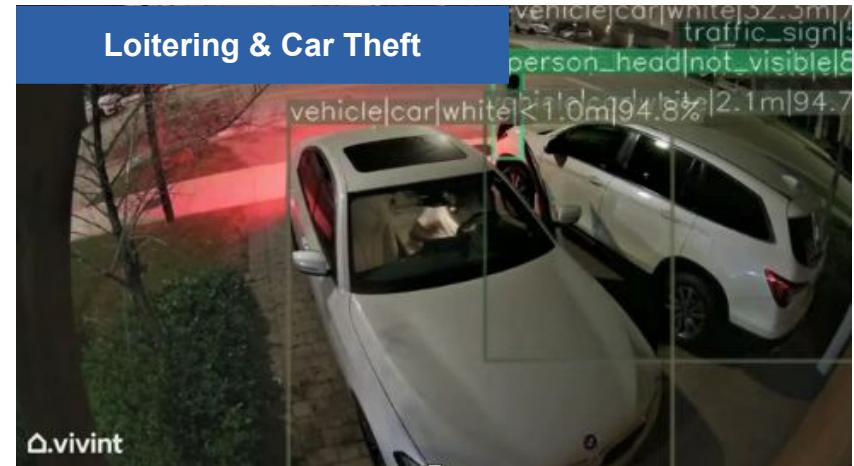


Use Case	Value
Detect falls during bed exit	Enable rapid response to reduce injury severity
Monitor high-risk patient movements	Prevent unattended exits and unauthorized mobility
Record and log incidents for review	Support staff training and incident root-cause analysis

Use Case	Value
Detect falls in hallway or shared spaces	Improve safety and reduce unnoticed incidents
Trigger immediate alert for assistance	Minimize injury impact with faster caregiver mobilization
Log and analyze assisted falls	Enhance protocols for mobility support and risk management



Suspicious Activity Detection



Use Case	Value
Suspicious behavior alert	Enable early threat detection
Armed intruder detection	Protect entry points from violent crime
Smart weapon recognition	Reduce false alarms, focus real threats

Use Case	Value
Loitering detection	Deter potential crimes before they occur
Car theft attempt alert	Enable real-time response and evidence capture
Suspicious vehicle activity	Support proactive patrol and risk prevention



Smart Venue Monitoring

Crowd Flow & Safety Monitoring

- Current Occupancy: 150/1000
- Crowd Density: Medium
- Estimated Headcount: 43
- Crowd Flow Direction: Single Direction
- Crowd Overall Duration: Short
- Gathering Area: Entrance
- Exit Blockage: No

Occupancy & Zone Access Tracking

Use Case	Value
Monitor crowd flow and density	Prevent overcrowding and ensure safe circulation
Detect abnormal or risky behavior	Reduce accidents and enable faster incident response
Track real-time headcount in zones	Optimize evacuation plans and emergency response

Use Case	Value
Monitor foot traffic and heatmaps	Improve staffing and layout for shopper flow
Detect entry into restricted zones	Prevent loss and improve asset protection
Track occupancy in real time	Enhance customer experience and safety readiness



Smart City Application: Accident



VLM output

17:3
5

Traffic Accident Event

- Accident Occurred: Yes
- Weather Condition: Sunny ☀
- Vehicle Types: Motorcycle vs. Car
- Accident Type: Collision
- Affected Lanes: All Lanes
- Lane Direction Affected: One-way
- Ambulance Present: Yes
- Fire Truck Present: No
- Police on Scene: Yes
- Fire on Scene: Yes
- Alertness Level: 5



Smart City Application: Post-Disaster Inspection



VLM output

17:3
5

Abnormal Poles Event

- Camera Status: **Normal**
- Utility Pole Present: Yes
- Utility Pole Leaning: **Yes**
- Utility Pole Damaged: **No**
- Utility Pole Broken : **No**
- Utility Pole Collapsed: **No**
- Trees Nearby: Yes
- Police on Scene: **Yes**
- Power Line on Tree: **No**
- Traffic Affected: **No**

Actions

1. Classifying Event... ✓
2. Retrieving Stakeholder Mapping... ✓
3. Notifying Police Department... ✓
4. Notifying TaiPower Company... ✓
5. Action Complete... ✓

✓ Action Complete

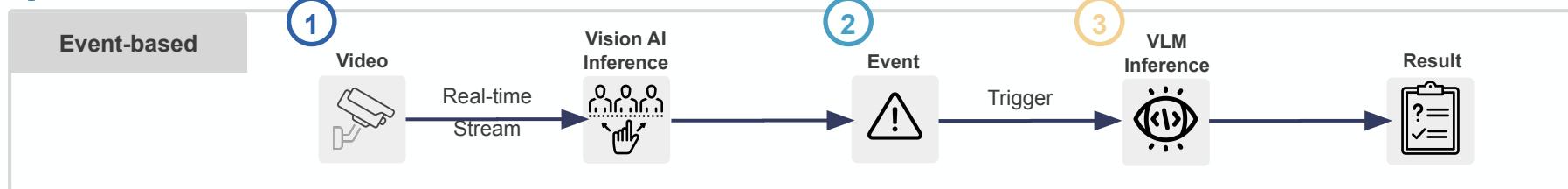
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Requirements





Reference Deployment (event-based)



1.	Live Stream	\div	Live Stream Capacity: L40S – 45	=	GPU Needed
	200	\div	45	=	4.4 → 5 L40S
	10,000	\div	45	=	222.2 → 223 L40S

2.	Live Stream	\times	Event Rate (%)	=	VLM Req/sec
	200	\times	0.5%	=	1
	10,000	\times	2.5%	=	250

3.	VLM Req/sec	\div	VLM Analysis Capacity: B200 – 10	=	GPU Needed
	1	\div	10	=	0.1 → 1 B200
	250	\div	10	=	25 B200

Live Stream Capacity: L40S – 45 | L4 – 25

Conditions: 1280×720 @ 10FPS input | 640×640 TensorRT model

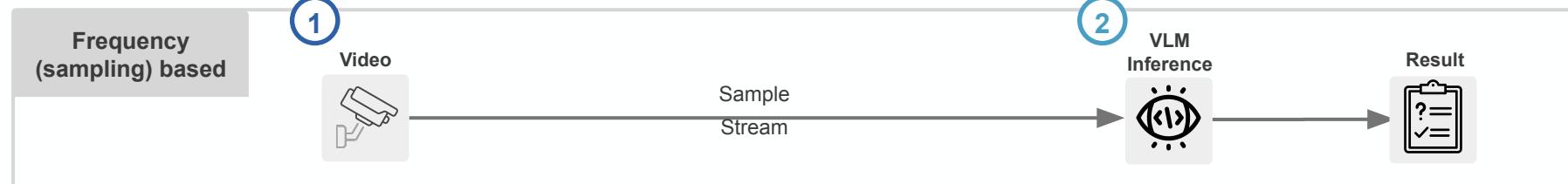
VLM Image Analysis Capacity: B200 – 10 | H100 – 4

Conditions: 250 input tokens per image + prompt

- **Event Rate (%)** refers to the percentage of all streams that generate VLM inference events per second.
- For example, if 200 cameras together produce 1 event every second, the Event Rate is 0.5%.



Reference Deployment (sampling)



	Live Stream	÷	Live Stream Capacity: L40S – 45	=	GPU Needed
1.	200	÷	45	=	4.4 → 5 L40S
	10,000	÷	45	=	222.2 → 223 L40S

- With 200 cameras and a B200 handling 10 frames per second: $200/10=20$
 - Each camera is sampled once every 20 seconds.

2.	Live Stream	÷	VLM Analysis Capacity: B200 – 10	=	Sampling Interval (sec)
	200	÷	10 (use 1 B200)	=	20
	10,000	÷	80 (use 8 B200)	=	125

- With 10,000 cameras and 8 B200 handling 80 frames per second: $10,000/80=125$
 - Each camera is sampled once every 125 seconds.

Live Stream Capacity: 140S - 45 || 4 - 25

Live Stream Capacity: E400 - 40 | E4 - 25
Conditions: 1280x720 @ 10FPS input | 640x640 TensorRT model

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Thank you

