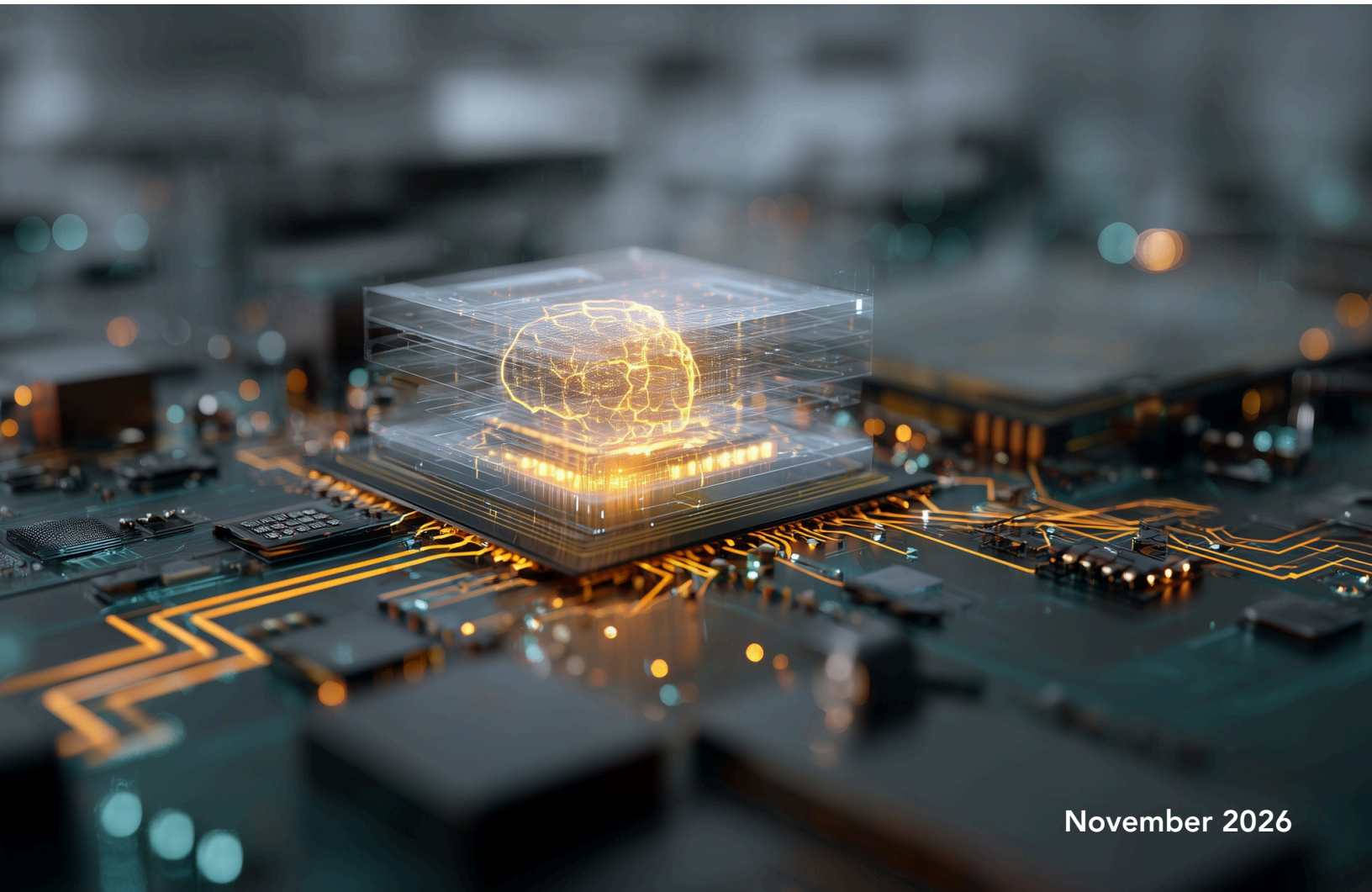
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The Orchestration Layer for Physical AI

From Sense and Detect to Coordinated, Autonomous Action



November 2026

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Executive Summary

Physical AI is already at work across industries. Robots, drones and smart cameras sense their own slice of the world and act on it. This isn't a future technology. Companies in mining, logistics, and manufacturing use these devices today, with real results: higher productivity, fewer safety incidents, lower costs.

The problem is coordination. Most operations run Physical AI devices from different vendors, each doing their own job, with no way to act as a unified system. A device flags a problem, and someone gets an alert, but nothing automatically updates the schedule, the work order, or the next system downstream. Human operators often must connect those dots and act. This gap is costly, and it's why Physical AI often stalls before it delivers its full value.

Vantiq closes that gap. It's a real-time orchestration platform that connects every Physical AI device, AI model, system, and person into one shared environment, so an operation can sense what's happening, decide what to do, and act, without replacing what's already in place. Vantiq is already orchestrating Physical AI across industries such as manufacturing, healthcare, defense, and smart cities, helping organizations move from a defined use case to a working system in weeks, not years.

Physical AI works in isolation. What's missing is the layer that makes various Physical AI devices, existing systems, and humans act together as one.

1. AI Is Moving into the Physical World

Physical AI is artificial intelligence built into machines and devices such as robots, drones, self-driving vehicles, cobots (robots that collaboratively work alongside people), autonomous mobile robots (AMRs), smart cameras, and wearables.

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Isolated automation is not a stepping-stone to autonomous operations. Without orchestration, Physical AI stalls.

Inside these devices, AI turns raw signals – a shifting load, a blocked path, a change in temperature – into a decision about what that device should do next, without waiting for a person to approve each step. That is what separates Physical AI from ordinary automation, which only follows rules someone wrote in advance.

Physical AI is already producing real results, not just pilots. An Australian mining company now runs hundreds of self-driving trucks; one person supervises 25 trucks at once. Productivity is up 15%, with zero accidents caused by human error. A Japanese logistics company used robots to sort and pack mixed-size boxes, cutting the workers needed from four to one and automating 90% of the packing. These companies are already running Physical AI, not testing it.

2. However, Physical AI Creates a Coordination Problem

The previous two examples prove that Physical AI works. But look closely at both: each is one vendor's software coordinating that same vendor's own fleet, one system, one type of machine, one use case. Most real operations aren't that clean or simple. They involve many different vendors, many types of machines, and many separate systems that were never built to talk to each other. That is where Physical AI runs into a harder problem: orchestration.

An inspection robot flags a cracking part, but no work order gets cut, so the part keeps running until it fails. A safety cobot pauses because a worker just stepped into its zone, but the floor supervisor is never alerted, so the near-miss goes unlogged.

An autonomous forklift reroutes around a blocked aisle, but the scheduling system still expects the delayed pallet on time, so the line downstream runs short. Each machine handles its own moment correctly. None of them tells the rest of the operation what's happening in real time.

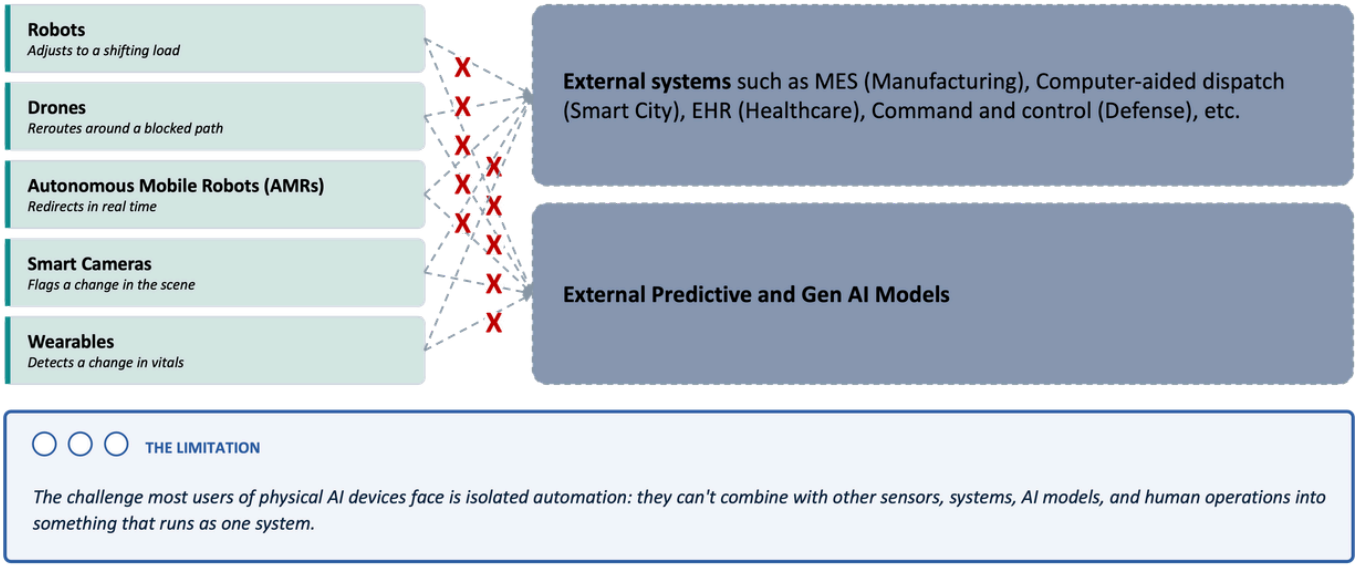


Figure 1: Physical AI provides siloed automation

That gap is expensive. The average manufacturing operation loses roughly $260,000 for every hour a line sits idle, a figure that rises past $2.3 million per hour in automotive plants. Shift supervisors still coordinate MES, scheduling, and robotics decisions by talking to each other. Quality defects get caught only after dozens of units are built with the same flaw, because the fix goes through a person, not a system.

The result is isolated automation: a smart camera here or a smart robot there, each able to sense and even act, but none combined into an operation that runs as one system. Isolated automation is not a stepping-stone to autonomous operations.

Without orchestration, Physical AI stalls. (Figure 1)

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The winners won't have the smartest robots. They'll be the ones who coordinate them all.

3. Vantiq Is the Orchestration Layer

Vantiq closes this gap. It is a real-time operational AI platform that orchestrates sensors, Physical AI devices, AI models, agents, applications, existing systems, and people to provide a single, 360-degree, real-time view of what's happening. Your robots, sensors, and systems stop acting as separate parts. Together, they become one coordinated operational system. (Figure 2)

Vantiq doesn't replace what you already run. Your ERP, MES, PLM, EHR, dispatch, and asset-management systems stay in place. So do your robots, cobots, smart cameras, and drones. Vantiq's command and control layer non-intrusively slides in across all of them. It pulls their events together in real time, uses AI to analyze and decide, then routes each decision back to whichever system, device, or person needs to act on it.

This maps to the three-layer model Gartner recommends for Physical AI. Device intelligence handles split-second calls, like collision avoidance and navigation, right on the device, where it belongs. Central intelligence handles model training, simulation, and governance, where there's enough data and computing power to do it well.

And Vantiq sits in between the two, as the local intelligence layer. It has enough site context to coordinate machines, workflows, and systems, and enough reach to turn goals and events into coordinated action across different vendors and device types. It is not a new database or a new system of record. It is the connective tissue among everything else.

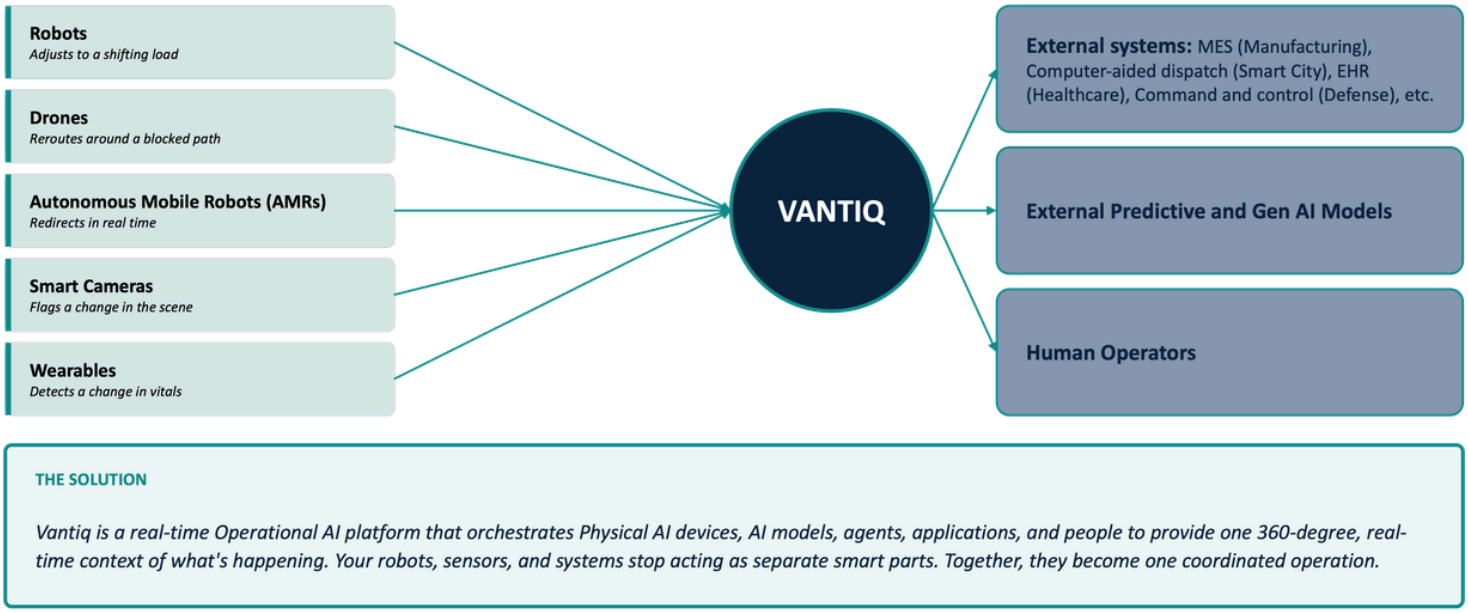


Figure 2: Vantiq provides the orchestration layer

Four architectural principles

An orchestration layer for Physical AI-based devices, sensors, systems, AI models, and people must follow these four principles:

- Event-driven by design. Vantiq processes events as they happen, asynchronously and in parallel, rather than waiting for data to land in a data warehouse before anyone can act.
- Edge-first execution. Application logic, event handling, decisions, and closed-loop actions run at the edge, so the response keeps working when the WAN drops or the site is intentionally air-gapped.
- True multi-agent (A2A) orchestration. Specialized AI agents built on different models by different teams coordinate alongside Physical AI, equipment, and people, rather than sitting trapped inside a single vendor's assistant.

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- Designed to extend and augment. It builds on the systems and Physical AI you've already invested in, instead of rip and replace.

The Response Loop: Sense, Analyze, Decide, Execute

In operational terms, every response Vantiq orchestrates follows the same four-step loop, regardless of industry. (Figure 3)

The Sense → Analyze → Decide → Execute loop. Every Vantiq-orchestrated response follows this pattern.

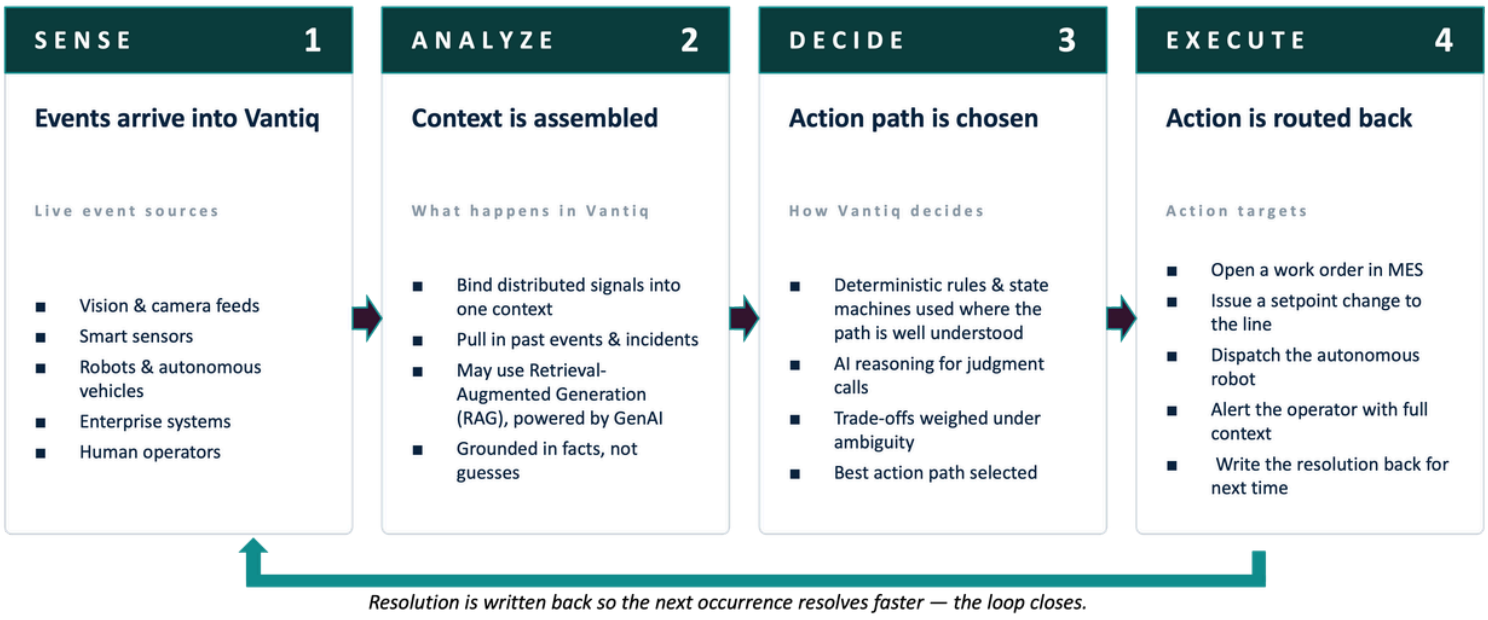


Figure 3: The Sense → Analyze → Decide → Execute loop

- Sense. Events arrive in real time from every source, including Physical AI devices (such as vision and camera feeds, IoT sensors, robots, and autonomous vehicles), as well as systems and people. Vantiq filters, prioritizes, and enriches each signal with context as it arrives.

- Analyze. Distributed signals rarely tell the whole story. Vantiq binds them into a single live operating context, using Retrieval-Augmented Generation (RAG) powered by GenAI, past events and incidents, and other relevant records, so the picture is grounded in facts.

- Decide. Vantiq applies deterministic rules and state machines where the path is well understood and invokes AI reasoning where the situation calls for judgment, trade-offs, or planning under ambiguity.

- Execute. Specialized AI agents issue commands back into whichever system owns the response: a work order into the MES, a route change for a robot fleet, an escalation to a clinician, a dispatch to a first responder, a plain-language explanation to the person on the floor.

4. Physical AI Orchestration in Action

The sense, analyze, decide, and execute patterns do not change from industry to industry. Only the Physical AI devices, sensors, the systems, and the people involved change.

Manufacturing: from Anomaly to Autonomous Action

Most plants already run Physical AI: cameras, sensors, robots, and cobots, alongside systems like MES to track production. What's missing is a way to connect them.

In operational terms, every response Vantiq orchestrates follows the same four-step loop – Sense, Analyze, Decide, and Execute.

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Application	Trigger Signals	Orchestration Role	Outcome
Quality Control	A smart condition-monitoring sensor on the production line detects an abnormal reading in temperature, sound, or vibration.	Vantiq detects the problem, finds the cause, and sends a work order to the maintenance system or an alert to the operator.	Defects caught earlier. Less scrap and rework. Fewer stoppages.
Predictive & condition-based maintenance	A smart sensor on a machine detects early signs of component wear.	Vantiq schedules a repair in the maintenance system, adjusts the production plan in the MES to route work around the affected machine, and redirects autonomous mobile robots (AMRs) to carry parts and materials to the machines picking up that work.	Equipment lasts longer. Less downtime. Delayed capital spend.
Safety	A smart camera reads unsafe posture or movement on the floor.	Vantiq flags the behavior or fall and sends the plant manager an alert with the camera view and location.	Faster response. Fewer incidents. Clear record for audits.

LS Thira-UTech, which builds smart-factory software for semiconductors and battery manufacturers, embedded Vantiq at the core of its Intelligent Factory Control platform, bringing together MES, telemetry, logs, CCTV, vision, operator records, and AMR data into one real-time fabric. The result: a working prototype in six weeks, tens of thousands of events processed at the edge, and a targeted two-times reduction in anomaly recognition and analysis time against a one-to-two-hour manual baseline.

> *"Only Vantiq could orchestrate this level of manufacturing integration."*
>
> *Executive, LS Thira-UTech*

Healthcare: Coordinating Care as Conditions Change

Most hospitals and care programs already run Physical AI: bedside monitors, wearables, and home sensors, alongside systems like the EHR and care scheduling. What's missing is a way to connect them.

Use Case	Trigger Signals	Orchestration Role	Outcome
Aging in place	A smart home sensor, camera, or robot detects a fall, a missed medication, or an unusual change in routine.	Vantiq combines these signals with remote patient monitoring, telehealth, and virtual care management, and alerts the right care team immediately.	Seniors live independently, longer. Care teams step in proactively, not after a crisis.
Critical care patient monitoring	A bedside monitor or wearable detects a dangerous change in a patient's vitals, such as heart rate or oxygen level.	Vantiq flags the reading immediately, pulls in the patient's care-team assignments and current medications, and alerts the right nurse or physician with the full picture.	Faster response to deterioration. Fewer missed warning signs. Clearer record for care review.

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Defense: Keeping the OODA Loop Intact Under Pressure

Most defense operations already run Physical AI: drones, field sensors, and autonomous vehicles, alongside command-and-control systems. What's missing is a way to connect them, including when the connectivity is degraded.

Use Case	Trigger Signals	Orchestration Role	Outcome
Observe, Orient, Decide, Act (OODA) loop under degraded connectivity	Drones and field sensors across land, air, or sea detect a threat or obstacle	Vantiq processes the signal at the edge, keeping the OODA cycle running locally, and makes sure detection, risk-assessment, and response teams are all working from the same up-to-date picture	Faster decisions. Operations continue even when connectivity is degraded

Smart Cities: Coordinating a City as Conditions Change

Physical AI is used extensively throughout major cities: traffic cameras, road sensors, and connected infrastructure sitting alongside dispatch and emergency-response systems. The challenge is that these components aren't talking to each other to create true situational awareness.

Use Case	Trigger Signals	Orchestration Role	Outcome
Traffic incident response	A smart traffic camera and smart road sensor detect a crash and the resulting congestion.	Vantiq combines these feeds into a live shared context the moment the incident happens, then adjusts traffic signals, dispatches responders, and issues public alerts	Faster response. Conditions addressed as they unfold, not later

5. From Automation to Autonomy

Physical AI devices such as robots, drones, cobots, cameras, and smart sensors already work on their own. What's usually missing is something to connect them to systems, models, agents, and humans, so they act as one system. The organizations that are maturing fastest from scattered automation to real autonomy tend to make the same three choices.

- Treat orchestration as a layer, not a feature. It connects the systems and Physical AI that the organization already has; it isn't bolted onto just one application, device, or system.
- Choose an orchestration layer that works across vendors. A new robot vendor, a model change, or a system upgrade shouldn't force you to start over.
- Prove it on one use case first. Anomaly response, maintenance, or a discharge or dispatch workflow (depending on your industry) are all good starting points. Then extend the same setup to more lines, sites, or departments.

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Organizations don't need months to see this work. Some organizations have gone from picking a use case to a working, agent-driven response in as little as six weeks, then added new use cases without needing to deploy an entirely new platform.

AI is moving into the physical world. The winners won't be the ones with the smartest robot, sensor, or model. They'll be the ones who coordinate all of them, and the applications and people working alongside them, into one system that senses, reasons, decides, and acts together. That's the layer Vantiq provides.

Next step: map your highest-value Physical AI use case to a working orchestration pattern.
Contact your Vantiq representative to schedule an architecture workshop.