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How Agentic AI and Field Robotics Are Rewiring Utility Operations

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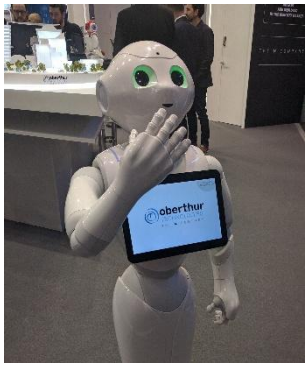

The systems electric utilities rely on provide fertile ground for agentic AI. In ADMS systems alone, they promise to enable intelligent outage restoration, coordinate distributed energy resources, speed up storm response, optimize volt-var control, improve load forecasting, and more.

But while AI agents operate in the digital world, utilities and their customers depend on prodigious amounts of hardware across vast expanses of land – and, given offshore wind, sea. Wherever hardware may be, it wears out and/or breaks. Intelligent, autonomous field robots are understandably attracting serious attention and investment in this industry.

Autonomous robots promise to reduce operation and maintenance costs and extend equipment life amid mounting pressures from aging infrastructure, workforce gaps, grid-modernization needs, and massive demand from data centers. These robots, which span from the four-legged to the winged, can inspect hardware, detect anomalies, and trigger responses without human involvement. Utilities now recognize that, while autonomous robots can add value in isolation, they work best when they interface with AI agents that are integrated into operating and business systems.

Utilities are adopting physical AI in a variety of contexts, with asset health and management emerging as potentially high-ROI application areas. That adoption has come with a recognition that smart field robots must act upon intelligence from enterprise workflows and then feed new information from their tasks back into those workflows. That way, staff and agentic AI working in operations, human resources,

finance, and procurement can act and react to asset-related developments quickly and efficiently. Here are four key steps to achieving the integration essential to exploiting the true potential of physical AI.

1) Let the utility's specific needs drive physical AI implementation strategy

Use cases should dictate a utility's autonomous robot implementation path. Many are already working with autonomous drones in areas such as automating vegetation management and maintaining utility-scale solar arrays.

Texas-based Percepto's autonomous patrolling drones present an example of unmanned aerial systems going beyond protecting power lines from branches. The company's distribution-grid inspection systems can identify broken components, rust, rot, and corrosion, as well as spot overheating components with AI-driven temperature assessments.

Israel-based Ecoppia has deployed water-free autonomous systems to clean solar panels across dozens of utility-scale projects across the Middle East and India. (In dusty regions, keeping solar modules clean can boost efficiency by 20% to 35%, thereby starkly improving the levelized cost of ownership.)

Consider also an offshore wind producer that's deploying a four-legged robot to keep tabs on an offshore wind platform. The inspection robot, made by Swiss-based ANYbotics, eliminated the need to send techs to a remote platform for months. When human intervention was eventually required, the maintenance team already knew what was wrong, which expert to send, and what equipment and spare parts to bring, avoiding costly and risky trial-and-error platform visits.

These sorts of asset health and management applications beg for agentic AI combined with autonomous robots. Such integration enables robots to inspect assets continuously with sensors that can spot anomalies based on visual, chemical, acoustic, and thermal signals; send data directly to field service management systems; have those systems assign work orders (or suggest teeing up work orders for human decision-makers); and propagate the impacts of the work to business systems (operations, procurement, finance, and so on). That gives the organization an immediate understanding of operational status and the business impacts related to that status.

If autonomous robot integration can boost the uptime of an asset portfolio by a percentage point or two, investments in physical AI will have paid for themselves many times over. But utilities are recognizing that, to properly harness such capabilities, it also often takes substantial work on the data side.

2) Get the utility's data cleaned up and harmonized

A utility's goal should be to incorporate a portfolio of autonomous-robot inspection into a maximally closed-loop system in which inspections trigger automated work orders for repairs and that automatically cascade through field service management, warehousing, procurement, finance, and beyond. Such data flows aren't possible if a utility has inconsistent, duplicative, stale, or siloed master data. That means bringing together SCADA and other operational data with a field service and asset management system's planning and scheduling solution, as well as with core business systems. The result is harmonized data across the utility's diverse IT landscape.

Harmonized data is the key enabler of the real-time integration of autonomous robotics into a utility's overall systems architecture. But autonomous robots are far from the only justifications for data harmonization: It's also vital in getting the most out of all kinds of AI. Historically, harmonizing data would have meant unifying physical databases (not possible) or data warehouses (the typical approach). Today, enterprise data analytics platforms, also called data fabric platforms, enable a virtual unified data model on top of existing systems. AI is driving its rapid uptake across many industries, with utilities among them.

3) Tighten the utility's insights-to-action loop

A typical asset health and management approach involves feeding operational and asset-status data – some IoT/machine delivered, some human-collected – into an ERP data analytics platform. The platform then does the analytics and sends results back to operational systems. But often, getting those analytics back to operational systems quickly and in actionable ways has proven to be a challenge.

Given the data volumes involved, combinations of AI agents and autonomous robots are putting even more pressure on this feedback loop. Part of the answer is to delegate to AI agents what previously required analytics. But given the diversity of assets a given utility manages and the number of AI agents that soon will be working in concert to assess those assets, utilities are finding a need to reassess their asset-related analytics strategies.

4) Build trust with the utility's human intelligence

The value of any tool, be it a wrench or an autonomous drone, depends on the trust it engenders among those who use it. O&M staff – and, more broadly, staff across the organization – must learn to trust AI. Utilities are helping them build that trust in a few ways:

· Starting AI with recommendations and suggestions (of a maintenance work order or a vegetation-management prioritization) rather than having agents actually

execute actions. Percepto, for example, uses autonomous drones but leaves the actual maintenance decisions to humans.

· Benchmarking against the performance of a utility's experts. AI agents make decisions and simulate actions, but leave the actionable decisions to human talent. Evidence of AI's performance on a par with, or better than, experts builds trust.

· Having the AI explain its recommendations. If an autonomous robot is inspecting a transformer, rather than simply reporting a high risk of failure, the system could describe rising oil temperature, elevated dissolved hydrogen levels in that oil, and a history of previous failures as justifications.

· Making the AI report not only confidence levels (i.e., vegetation encroachment risk of 80%), but also supporting evidence and alternatives, such as suggesting additional drone inspection.

· Building in audit trails and traceability with respect to the data and models used, the reasoning paths, and what system(s) made the final decision.

These investments in the workforce's confidence in AI are as important as the investments in agentic AI and autonomous robotics. Because without trust, staff will work around or override decisions that otherwise would yield greater organizational benefit.

Integrated autonomous robots are the future of utility asset management.

Empowering agentic AI with the real-world capabilities of autonomous robots has enormous potential to improve the performance of a utility's assets and, by extension, the utility's overall reliability and cost structure. Customers, shareholders, and utilities themselves stand to benefit. Physical AI pilots abound, and, in vegetation management and beyond, operations are already reaping gains.

Utilities have recognized that closed-loop operational systems feeding off harmonized data are indispensable in exploiting physical AI's potential. Given agentic AI's decision-making capabilities, analytics strategies also merit reassessment. And a utility's people must trust the system. Getting all this right will take effort, but it's worth doing considering the payoffs across efficiency, uptime, and the ability to meet growing electricity demand. The cause is noble indeed.