

Autonomous Inspection

Boston Dynamics Spot levels up into condition monitoring and maintenance fieldwork

Matthew Jaster, Senior Editor

For a few years now, Spot—the agile, mobile robot—has been surveying show floors at Automate, CES and Promat. Last year, Boston Dynamics presented a slew of additional technologies at IMTS 2024, showcasing robotic innovations key to scaling autonomous industrial inspection for components such as bearings, motors, pumps, gearboxes and conveyor systems.

Industrial inspection

Many *PTE* readers have discussed employing AI technologies to tackle shop floor challenges in the coming years. An AI-enabled facility allows management to make better, faster decisions, improve safety and efficiency, and most importantly, reduce overall costs. Boston Dynamics believes the key to this evolution is capturing consistent and reliable data. These robots can now work with minimal variations to deliver frequent and accurate inspection results. Here are a few of the latest technologies, giving companies an opportunity to reduce unplanned downtime and prevent critical failures in the future:

Thermal inspection

Spot can collect thermal images of pumps, motors, and electrical equipment with pixel-level temperature data. Users can set up alerts when equipment exceeds a set range or when temperature differences between assets surpass thresholds.

Acoustic inspection

Noise anomalies can be an early indicator of impending equipment failure, but leaks, vibrations, and electrical discharge are typically undetectable by people. Acoustic inspections with Spot enable users to autonomously monitor sound signature changes to prevent unscheduled maintenance. Utilizing the Fluke Sv600—a fixed acoustic imager translating sounds into a visual representation to locate problem areas in factory systems—Spot can locate costly leaks in compressed air and gas lines, record acoustic images and videos for post-inspection analysis and alert MRO teams to maintenance issues.

Gauge reading

Spot uses machine vision models to read and analyze analog gauges that measure pressure, flow, and more. It can trigger alerts for abnormal readings and track asset trends over time.

Application examples

Nestlé Purina deployed Spot to automate thermal and acoustic inspections in their packaging lines. Autono-



Nestlé Purina incorporated Spot into its maintenance routine to automate thermal and acoustic inspections on the factory floor.

mous inspections allowed Nestlé Purina to give time back to the maintenance technicians, better predict and plan repairs, and ensure reliable operations.

“In the case of Spot and the case of freeing up that manpower to be able to work, if Spot can find these issues for us in between our changeovers in between different production runs, we’re able to catch those issues ahead of time that allows us to be more predictive, more preventative rather than reactive,” said Scott Smith, Nestlé Purina.

“We don’t see Spot as just thermal and acoustic inspection. We see Spot as something more of a tool that we can use for other applications. And we’re just starting to explore that and see what we can do in collaboration with Boston Dynamics to make Spot even more useful for our factories,” added Alyssa Carter, senior specialist, robotics engineering at Nestlé Purina.

The company has spent some time on digital transformation and saw added value in the use of acoustic compressed air leak detection moving beyond regular predictive maintenance.

The Anheuser-Busch InBev (AB InBev) brewery in Leuven, Belgium took Boston Dynamics’ Spot robot on a test run in 2022 to see how many mechanical issues or air leaks it could find in the sprawling facility. Less than two hours later, they were ready to offer the robot a full-time job.

Since this test run Spot has become a key part of AB InBev’s “Brewery of the Future” program, which invests in emerging technology to support the company’s ambition of achieving net-zero operations at the Leuven facility by 2028.

Spot conducts 1,800 individual inspections each week across ten packaging lines that churn out over 50,000 containers of Stella Artois, Budweiser, and Corona beer

every hour. In its first six months of deployment, Spot discovered nearly 150 anomalies and slashed average repair times from a few months to a mere 13 days.

“Our machinery experiences a lot of wear over time, so predictive maintenance is a top priority,” said David Gregory, scale and innovation manager at AB InBev. “Spot is seeing more than double the anomalies we were expecting, but we’re also now able to make repairs and see performance increases and energy reduction within the brewery.”

With local roots dating back to 1366, the Leuven facility is world famous for its age, as well as being one of the largest breweries in Europe. Established in 1992, the facility covers the equivalent of 30 soccer fields, with four brewing houses and over 800 employees.

The packaging floor is a labyrinth of stainless-steel piping and conveyor belts that move bottles and cans through the filling and packaging process. Intricate machinery—including pumps, compressors, gearboxes, and conveyor motors—are critical for production.

At this scale, any mechanical issue that threatens to slow or halt production is a major concern, especially since the packaging lines operate around the clock when not under repair. Preventing unscheduled downtime means identifying mechanical problems before they reach critical failure.

“It is very important for us to make sure a line does not shut down at unexpected times due to crashes or errors on our machines,” said Yentl Degeyter, FP&A manager at AB Inbev. “We can only achieve zero downtime by ensuring we can predict when a particular machine will exhibit faults so we can perform our maintenance in advance.”

Spot initially caused quite a stir during its first weeks of deployment in early 2023. Employees responded with a mixture of amazement and curiosity, treating Spot like a celebrity. However, over time, employees came to consider the robot more of a colleague than a machine.

Spot focuses on two types of inspections: thermal and acoustic. When mechanical parts begin to wear out, they tend to generate heat. Spot uses a thermal camera to provide visual evidence of excess heat emanating from problem areas. Spot simply points the camera up at a specific piece of equipment and captures an image.

In one case, Spot identified a faulty transport motor that would have shut down a packaging line for at least six hours. Spot has also discovered gearboxes low on oil and faulty motor fans. By performing these tedious, repetitive inspections, Spot frees up staff to focus on repairs.

As for air leaks, Spot uses a Fluke SV600 acoustic sensor that identifies the characteristic sound frequencies produced when compressed air escapes under pressure. Prior to Spot, the maintenance team had to shut down entire packaging lines to listen for leaks. Spot can identify leaks amidst the hum and clatter of normal operations.

“We’re identifying things that even when you’re standing right next to it, you can’t hear it because the background noise is just covering up that decibel,” said Gregory.

Many anomalies Spot finds are leaks of compressed air and other gases, the cost of which adds up quickly the longer they remain undetected. For example, Gregory estimates the average cost of an air leak as \$550 in wasted product. Leaks of ammonia and other expensive gases can create losses of up to \$15,000. Even when staff can smell a gas leak, Spot can find the exact location within seconds.

“One day the safety department called asking if Spot could help them pinpoint a very small ammonia leak,” said Gregory. “Spot found it and we repaired it instantly. Ammonia is something like ten times more expensive than CO₂.”

Two small teams have received training to operate Spot. The brewery has several zones, each with a designated “robot wrangler” who identifies inspection points and programs the robot’s missions. Gregory says anyone who can play a video game can learn how to operate Spot in less than 15 minutes. Creating a mission is as easy as maneuvering Spot to a given point along a production line and using a multitouch tablet to set and name an action.

“You can create a simple mission in five minutes or a complex mission with 50 or 40 inspection points in under one hour,” said Gregory. “The advantage with using Spot is that we’re able to continuously and accurately reproduce the same measurements—and keep reproducing those results—day in, day out.”

The Value of Autonomy

According to Boston Dynamics, thousands of Spots have been deployed around the world inspecting a million industrial assets. They can traverse hard to reach or inaccessible spaces on the factory floor or inspect hazardous machinery so vital workers can stay out of harm’s way. This is the future of condition monitoring and predictive maintenance where machines take on dirty, dull and dangerous jobs so MRO teams can focus on plant efficiency and service support.

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