Whitepaper

How Industrial Leaders Are Automating Thermal Inspection

Identifying problems before they cause equipment failure and costly, unplanned downtime is the purpose of proactive and predictive maintenance programs. And one of the most reliable ways of catching problems before they become failures is to detect when a piece of equipment is beginning to operate outside of its normal parameters – especially if it is beginning to run too hot or too cold. Variations from normal heating are often the first signs of impending equipment failure, so frequent thermal inspections of critical equipment such as motors, belts, and drives not only helps extend the life of these assets, but keep your entire operation up and running normally.

Thermal Imaging Cameras

A thermal imaging camera lets operators “see” the invisible infrared (IR) energy given off by equipment under load, so they can visualize heat dissipation across the equipment’s surface. But IR cameras can also provide quantitative measurements of that heat energy in the form of temperature.

Collecting data on the condition and health of equipment over time can improve asset performance management (APM) systems, reduce maintenance costs, prevent unplanned outages, and improve the bottom line. Unfortunately, traditional infrared inspections are not performed often enough to allow facilities to stay ahead of their equipment issues, or for automated AI systems to have enough data to provide valuable results regarding equipment trends and failure predictions.

The thing keeping inspections from being performed with adequate frequency is simply the availability of the trained, certified professionals necessary to do the job. That’s why predictive maintenance teams in manufacturing, power generation, oil & gas, and many other applications are now deploying automated thermal inspection solutions to perform regular, reliable inspections, and get consistent, repeatable data.

Manual Thermal Inspection Drawbacks

While manual thermal inspections provide detailed inspection reports, many critical components in industrial settings have long life cycles, and their performance degrades very slowly over time. Since it’s not economical to embed sensors in every component, this equipment needs to be periodically monitored manually by trained and certified thermal inspectors. Recent staff shortages have made frequent inspections of these components even more of a challenge; lengthening the interval between inspections results in missing the thermal anomalies that can help avoid unplanned shutdowns.

Even in a perfect scenario, with more frequent manual inspections, inspectors may not collect data from the exact same location or angle each time. This can result in data variability and historical data that does not have the consistency and frequency required to provide meaningful insights over time. By integrating more efficient, automated inspection solutions into their routine operations, facilities can significantly reduce inspection intervals, capture more meaningful data, minimize downtime, ensure their employees’ safety, and improve operational reliability.

How Automated Thermal Inspection Compares

In a manual thermal inspection, the inspector typically follows a predetermined inspection route through the facility, acquiring thermal scans of specific assets from established locations.

Professional grade thermal imaging cameras allow the technician to save infrared and RGB images and video, and even voice notes to the camera's memory using a removable SD card or a USB flash drive. Hundreds of images might be stored during a given thermographic inspection. This data is then uploaded to a computer and analyzed either manually or with the aid of a third-party enterprise asset management (EAM) system.

In contrast, automated thermal inspections use autonomous drones or ground-based mobile robots to perform thermal inspections in a facility. These inspections can take place as often as needed, moving through inspection points and collecting data from each location repeatedly. Collected images and data can be processed at the edge, or automatically uploaded to a cloud management platform, sorted by relevance, and analyzed with advanced AI algorithms. Finally, predefined stakeholders receive personalized reports with needed insights.

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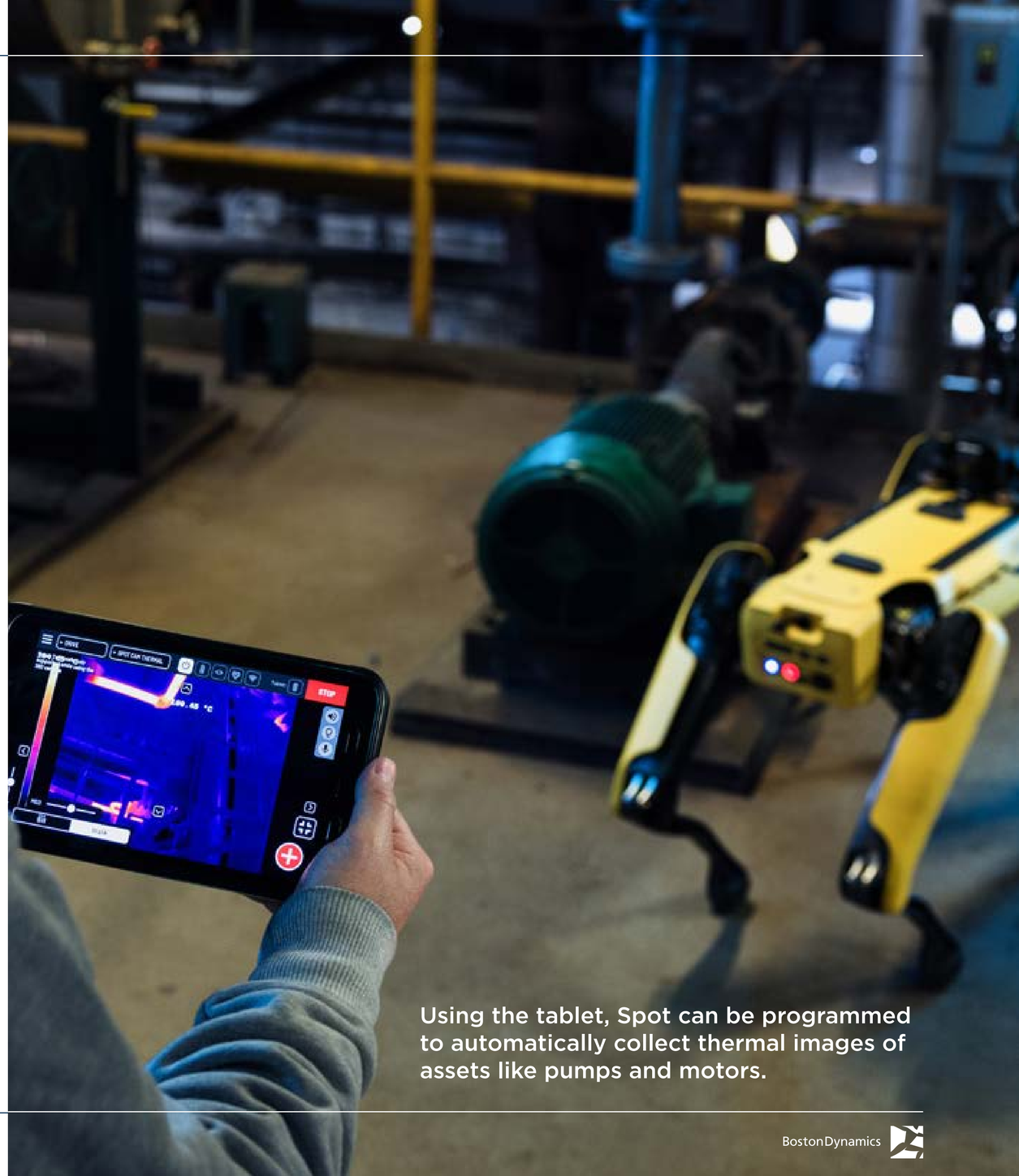
Automated Thermal Inspection Benefits

An average utility company with $1 billion in physical assets spends approximately 3% to 4% of its earnings on asset management and maintenance each year, with a significant portion of that money going toward premature preventive maintenance on an arbitrary, fixed schedule.

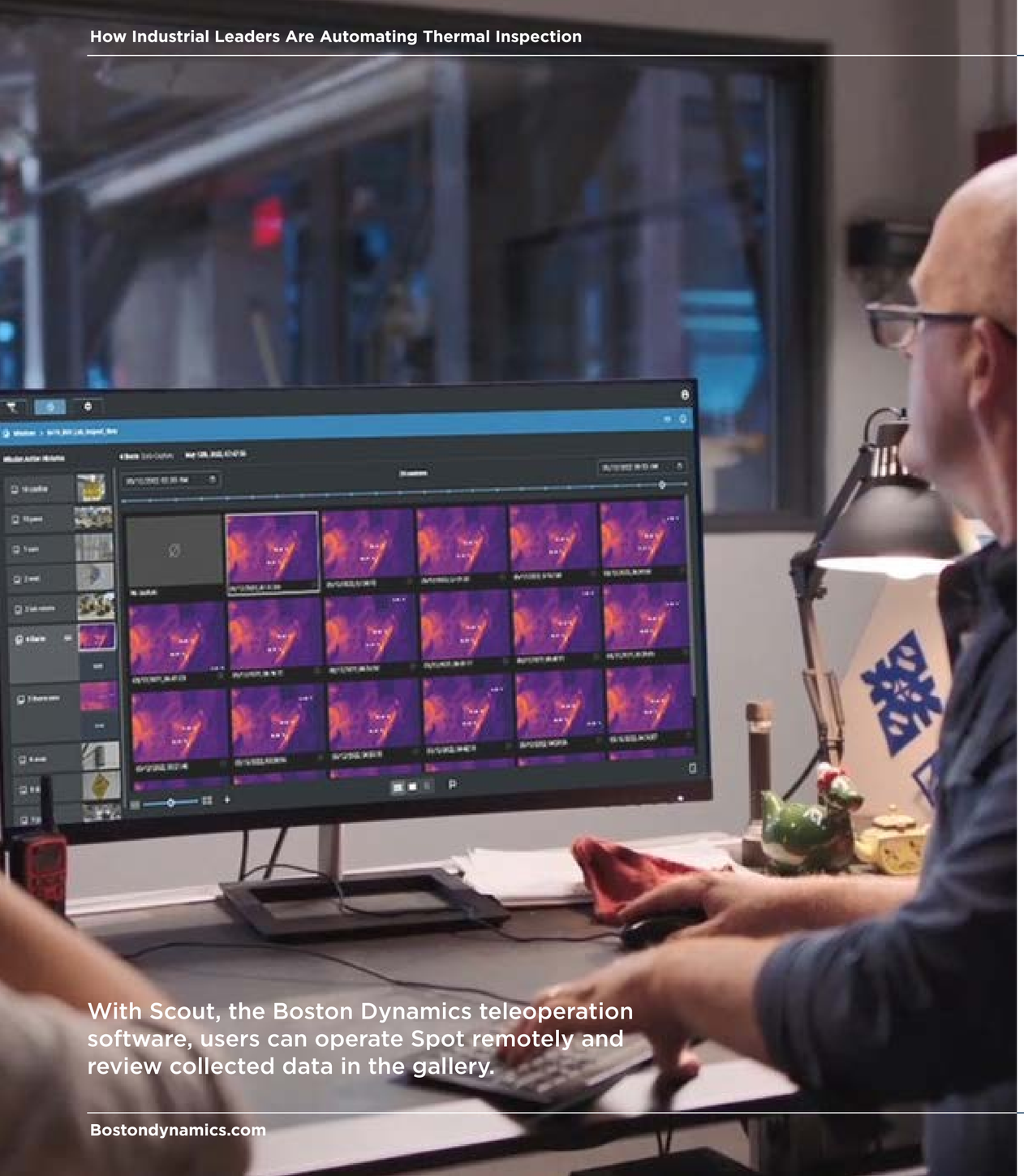
A regularly scheduled preventive maintenance scenario might involve lubricating a piece of equipment every three months to prevent failure. However, resources — including the cost of parts and technician's time — might be wasted here if the equipment isn't actually in need of fresh lubricant. Even worse, reactive maintenance costs more, as this means something has already failed.

Businesses need to shift from preventive maintenance to predictive maintenance By performing regular, consistent routes with autonomous drones and mobile robots equipped with various sensors, including thermal cameras to automatically capture data, companies are increasing inspection frequency for improved site awareness. Drones and wheeled and legged robots can go to any location a human can, and with the right sensor array and thermal cameras, they can sense what people see and much more.

More frequent thermal inspections by autonomous drones and mobile robots are the enabling factor that allows industrial leaders to unlock the full potential of thermal inspections, including reduced operation and maintenance costs, reduced risk of shutdown, improved service and reliability, streamlined regulatory compliance, and less overall downtime overall.



Using the tablet, Spot can be programmed to automatically collect thermal images of assets like pumps and motors.



With Scout, the Boston Dynamics teleoperation software, users can operate Spot remotely and review collected data in the gallery.

Autonomous Inspection Routes

To train a drone or mobile robot to make autonomous inspection routes, workers remotely control the drone or robot as it explores a facility and captures data. The robot simultaneously stores the path to any asset as well as the logistics of each inspection task. With the ability to record and repeat tasks, autonomous drones and robots can perform hundreds of individual maintenance missions, forming the foundation of an automated inspection route process.

By performing regular, consistent routes, autonomous drones and mobile robots equipped with thermal cameras can detect hot spots indicative of potential failure, as well as collect the rich datasets required to train AI models. With a library of data, which can be used at face value or fed into preventative maintenance programs, users can glean important equipment health insights for asset performance management (APM) systems — including predictive and condition-based maintenance systems. In addition to saving on costs, APM systems minimize downtime and maximize the efficiency of a site and team.

Automated Thermal Inspection Improves Data Consistency

Thermal imaging data tends to vary, depending on how it is collected. A trained thermal imaging inspector, a drone pilot, and remote-controlled robot operator will likely all provide different data. Whether inspecting a motor, steam system, electrical panel, or conveyor system, it's best to acquire thermal images from the same location, with the same viewing angle, and at the same time of day.

Automate Dull, Repetitive Tasks

In addition to using autonomous drones and mobile robots to up the frequency of thermal inspections, many industrial leaders are equipping these systems with payloads and computer vision models for gauge reading to provide regular, reliable data collection. Some facilities have thousands of analog gauges monitoring important assets and processes. Manual gauge reading typically involves fixed cameras that allow operators to see gauges or having a technician walk a route each shift — or multiple times per shift — to read gauges.

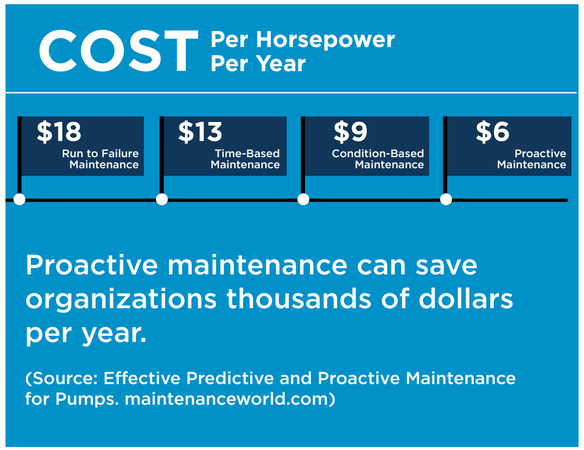
In either scenario, an autonomous drone or mobile robot with the right sensor payloads can automate the gauge-reading process. For instance, a mobile robot can navigate to each gauge, capture images, and send them back for human review, or can use software to make a digital reading using machine vision models. Human operators on gauge-reading rounds may not notice that an electric motor's noise output has increased by 5 dB during the previous week because the increase each day was so small. Equipping a robot with high sensitivity microphones solves this problem, allowing the robot to sense such an alarming trend and bring it to the attention of the right person.

Ultimately, robots act as a mobile IoT sensor platform — equipped with the tools to dynamically sense changes and track trends, notifying operators when thresholds are crossed.

Valuable Data Beyond the Visible

Collection of extremely consistent thermal inspection data using autonomous drones and mobile robots helps industry leaders, plants, and other facilities optimize data analysis. Whether for the applications discussed above or others — such as tank fill level evaluation or applications for police or fire department, defense, or search and rescue operations — a mobile robot equipped with a dynamic sensing payload delivers the ability to automate routine inspections and to capture data safely, accurately, and frequently.

Robots equipped with thermal imaging capabilities can safely operate in dull, dirty, and dangerous environments, and collect valuable data that is invisible to the naked eye. This increases efficiency, provides more regular and reliable data collection, and keeps human employees out of harm's way.



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