

A yellow and black quadruped robot, a Spot, is standing on the floor of a bus. The robot is holding a flashlight in its right front paw, which is illuminated. The bus interior is visible, including a window, a sign that says "JUST WALK IN", and a vertical pole. The lighting is dim, with a blueish tint.

Robotics' Role in Public Safety

How robots like Boston Dynamics' Spot are keeping people safe.

BostonDynamics



Keep people out of harm's way and safely assess hazardous situations.

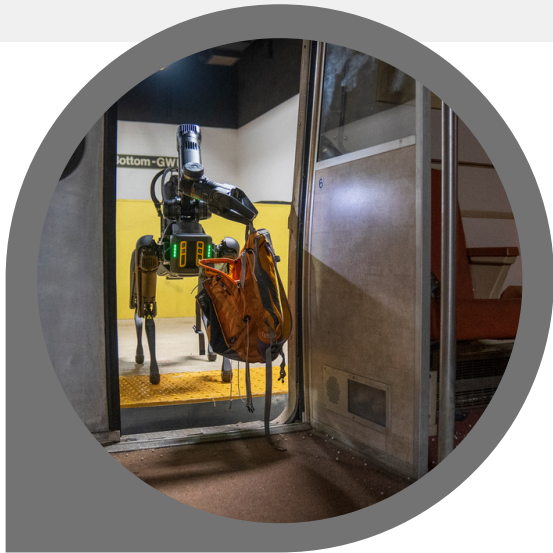
Robots have been used in public safety applications for decades, going into situations that are unsafe for people, providing a mechanism for observations from a safe distance, and investigating and disposing of potentially harmful devices.

As technology continues to evolve and robots gain more features and capabilities, they have become easier to operate and more widely applicable. We'll take a look at the current state of robotics technology and how Spot surpasses all conventional robots in the public safety setting.



Common Scenarios for Robot Response

Robots are often sent into situations where it isn't possible or desirable to send a person. There might be a dangerous situation, an unknown chemical, biological, or radiological threat, or an explosive and toxic gas or low-oxygen levels. In these cases, the robot provides eyes on the ground for incident responders who can assess situations to make well-informed decisions on how to proceed.



Suspicious Package or EOD Investigation

In the case of a suspicious package, responders can maintain a safe standoff distance by using a robot to investigate whether it is dangerous and if it contains an explosive device. Responders may be able to use a robot to move the device to a safe location for disposal.



CBRNE Detection and HAZMAT Response

Robots have also been useful in situations involving potentially harmful chemical, biological, radiological, nuclear, and explosive (CBRNE) materials. Robots can be equipped with sensors that relay valuable environmental information, keeping responders out of harm's way.



Barricaded Subject Response

When there is a barricaded subject—a person who has isolated themselves and perhaps a hostage—who refuses to engage with responders, a robot may be able to gain entry and provide critical awareness so responders can evaluate the situation.

Where Traditional Robots Fail

Early robotics offerings for the public safety sector worked well and were innovative at the time they were introduced. However, many of these solutions haven't been developed further, even with technological advances in the robotics industry, and have features that greatly limit their effectiveness in the field.

Tracks and Wheels



Front-Facing Cameras



Basic Grippers



Tracks and Wheels

The first robots on the public safety scene used tracks or wheels to move across terrain. These robots, still commonly used today, quickly come across many limitations.

Tracked robots aren't very maneuverable; their wide turning radius can be a disadvantage when they encounter corners or when immediate action is required. Tracks tend to break easily and fail often, so robots with tracks may require more frequent maintenance.

While wheeled robots can be more nimble, they're not stable on rough, uneven terrain. They can get caught on rocks or other obstacles and cause the robot to stop or fall over. They can also tumble down areas with sharp declines. On smooth surfaces that provide little friction, wheeled robots slip and aren't able to move.

Front-Facing Camera

Traditional robots have a forward-facing camera that allows the operator to see in one direction at a time, either ahead or backward, depending on which way the robot is pointing. While still useful in providing insight to the situation, it's limited in the contextual information it provides to the team for evaluating the scenario.

Basic Grippers

Rudimentary robot grippers allow the operator to pick up and move an object, such as a backpack or a box, or perform light operations, such as opening a package. Gripper models come in various designs that can provide different amounts of pressure on an object or use magnetic properties or a vacuum to pick up an object. These operations are operator intensive and require a lot of training and a lot of time to execute, potentially compromising the success of the operation.





Meet Spot, The New Industry Standard

Spot, the agile mobile robot, offers distinct advantages over conventional robots and is quickly becoming the new industry standard, particularly in public safety applications.

Unprecedented mobility

Spot can go anywhere humans can go; it easily cruises through places where traditional tracked or wheeled robots struggle to move. Spot's legs allow it to navigate unstructured and antagonistic terrain, whether it is uneven ground littered with rocks, slippery surfaces such as tiled or concrete floors, or flights of stairs. It can turn tight corners, allowing it to move through narrow spaces and traverse landings. Simply direct Spot where you want the robot to go and it can get there without further operator assistance.

- Obstacles: Spot's built-in obstacle avoidance and foot planning features allow the robot to move around obstacles or step over them.
- Slippery surfaces: Spot's gait can be adjusted to walk on a variety of surfaces, including ice and wet floors.
- Stairs: Spot can walk up most types of stairs including open riser, metal, grated, rubber, and carpeted, and turn on landings quickly and easily.

Continued on next page >

Meet Spot, The New Industry Standard

Detailed thermal and visual investigations

One of Spot's most critical payloads for the field is the Spot CAM+IR. This payload improves situational awareness with a real-time 360-degree view of Spot's environment displayed on the tablet. You can pan and zoom the RGB camera up to 30X to get a better look at specific areas or objects, and you can use the built-in LEDs to illuminate operations in the dark. In darker situations, you can switch to the thermal camera payload, allowing you to see people or objects radiating heat and see through smoke or other obscurants. Finally, the payload includes a speaker and microphones for establishing two-way communication.

Modular sensing capabilities

In addition to the Spot CAM+IR, Spot can carry many different types of sensing payloads. The robot's open platform allows you to customize it with a variety of Boston Dynamics payloads and off-the-shelf sensors that can further enhance Spot's capabilities. Payloads can use Spot as a power source and relay live data back to you through the tablet interface. Spot can carry up to 30 lbs of payloads and has multiple ports for a multitude of sensing equipment. Payloads can be quickly swapped in the field, allowing for fast turnaround as situations develop and needs change.



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Meet Spot, The New Industry Standard

Manipulation abilities

Spot's integrated arm and gripper is so easy to use that you can get started with only a few minutes of training. The gripper allows you to grasp, lift, carry, place, and drag objects. It has a 4K camera that makes it ideal for further investigating hard to reach areas, and an LED light allows you to see in dark spaces. You can also use the arm to turn valves, flip levers, and open doors by issuing high level commands from a tablet. Spot takes it from there, moving all the arm joints and even the body automatically as needed.

Picking up objects is also easy with Spot. Operators can simply tap the target on the tablet screen and Spot does the rest. The robot has sensors built into the arm to determine the best way to approach and pick up the object. This far surpasses traditional robots, which require an operator to manipulate each individual joint to inspect or pick up an object.

Spot's arm can lift 15 lbs and carry about 10 lbs. It can drag up to 50 lbs over flat ground, such as a cinder block on a driveway or a car door across gravel. You can also position the gripper to use the camera to look up and over an object such as a box or a desk, or around a corner.

Fall recovery

In the event that Spot falls down, it's easy to get the robot back up. All you have to do is tap the self-right button on the operator tablet screen and Spot will stand up without any further intervention. Spot will try different movements and strategies until it gets up. We've put Spot through rigorous testing to ensure that it can get up, even when the surrounding terrain is uneven or unstable.

Operating Distance

Spot can be equipped with standard radios, such as Persistent Systems MPU5, so you can control it from 1 km line of sight. Radios can be meshed together to extend that range; some applications have extended it to 10 km. In a scenario where a large area is involved, or in a situation where the response team is further away from the incident or target, you can extend the operating distance by using a ground robot to move a radio that acts as a repeater. That radio could support other drone technology, or other parts of the responding team.

Maintenance

Spot requires limited maintenance, much of which can be done in the field, eliminating the requirement to send it to a repair center.



How Spot Handles Common Scenarios

No matter what type of emergency response you're dealing with, cautious standard operating procedures (SOPs) save lives. Spot can get on scene quickly and keep officers safe.

Suspicious Package or EOD Investigation

Spot is extremely useful when responding to a suspicious package or possible explosive ordnance disposal situations. Spot's ease of use makes it ideal for quick response times. The gripper camera can get critical information to the team for evaluation and decision making. Then, the gripper can make first contact with the device.

CBRNE Detection and HAZMAT Response

In the case of a chemical or radiological hazard, Spot can enter a hot zone with integrated sensors selected based on your unique operating environment. With CBRNE sensors for chemical, biological, or radiological and explosive detection, you can use Spot to map a radiological environment, collect or swab chemical samples, or pick up and carry objects and samples from a safe distance. Having Spot inside facilitating the investigation first means you can minimize the time people need to be in a contaminated area, or possibly eliminate the need for people to go in at all.

Barricaded Subject Response

When dealing with a barricaded subject, you can send Spot in first to check out the state of the person and hostages (if any), whether the suspect is armed, and determine the layout of the building, all while keeping the responding team safe. The team can then make better informed decisions on the appropriate course of action. With Spot on-site, you can establish communications with the suspect. Just sending Spot in and providing a communication mechanism can help de-escalate the situation.

CASE STUDY

Spot Aids In Hostage Rescue

Courtesy of Flymotion

On October 25th, 2022, the St. Petersburg Police Department responded to a desperate situation: an armed man had taken a three-year-old hostage in the cab of his pickup truck. Despite the volatile nature of the call and the complex operating environment, the officers successfully rescued the child with Spot's help.

At the scene, operators responded quickly, deploying Spot and maneuvering the robot to the driver's window. From there, they used the camera in Spot's arm to get a real-time view inside the cab, where the robot arm was able to see angles inside the vehicle that were unreachable by drone. As a result, the operators were able to see the suspect's position inside the vehicle.

From screenshots taken by the robot, the SWAT team could tell how the man's body was oriented and that he was carrying a pair of scissors. Once the suspect dropped the scissors, the team was able to roll in, apprehend the suspect, and rescue the child without further incident, safely deescalating the situation.



Public Safety Package

The basic public safety package includes the Spot robot and the following add-ons:

- Spot CAM+IR: 30x PTZ and thermal camera for situational awareness
- Spot Arm: Integrated arm with a camera for manipulation and investigation
- Communications: Persistent Systems MPU5 radio package

Basic Specifications

BASE ROBOT DIMENSIONS

Length = 1100 mm (43.3 in)
Width = 500 mm (19.7 in)
Default Walking Height = 610 mm (24.0 in)
Max Walking Height = 700 mm (27.6 in)
Min Walking Height = 520 mm (20.5 in)
Net Mass/Weight = 32.7 kg (72.1 lbs)

LOCOMOTION

Max Speed = 1.6 m/s
Max Slope = $\pm 30^\circ$
Max Step Height = 300 mm (11.8 in)

TERRAIN SENSING

Horizontal Field of View = 360°
Range = 4 m (13 ft)
Lighting = > 2 Lux
Collision avoidance = maintains set distance from stationary obstacles

CONNECTIVITY

WiFi = 2.4GHz / 5GHz b/g/n
Ethernet

ENVIRONMENT

Ingress Protection = IP54
Operating Temperature = -20°C to 45°C





Overall, Spot's ease of operation and state-of-the-art mobility allow you to send it into situations quickly so you can see what's going on, determine what's needed, and take action.

Traditional robots can be a good solution for situations where the terrain is even and predictable. However, they have difficulty maneuvering in most realistic public safety scenarios and their operation requires a lot of training and time.

With major advantages over these conventional robots, Spot reduces risk in dangerous scenarios. Keep your people safe, with Spot.





Get started with Spot today.

Contact our sales team to learn more about how you can implement the robot on your team:

www.bostondynamics.com/spot-sales

Visit our website at

www.bostondynamics.com

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