LiDAR improve supply chains in an e-commerce world

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What is LiDAR, and how can it offer the expanding e-commerce market the flexibility it needs?

The Covid-19 pandemic led to a rapid increase in e-commerce sales as consumers turned to online shopping instead of bricks-and-mortar stores amid public health concerns. While online shopping was already growing quickly, the pandemic accelerated e-commerce by up to two years, according to estimates by Digital Commerce 360. In 2020, online retail sales increased 32.4% year on year, and in Q1 2021, online sales were up an additional 39%.

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Behind the scenes, this sustained increase in online sales has posed significant challenges for logistics and transport operations. Shipping has never been busier, with staggering volumes of product moving through the supply chain. In addition, consumer demand for next-day or even same-day order fulfilment means ports, warehouses, and distribution centres must move product as quickly as possible, avoiding downtime and lost revenue. Furthermore, logistics operations must be able to scale and adapt quickly to handle peak shipping times, all while managing costs.

Historically, many logistics tasks have been handled manually or using traditional automation methods that depend on a massive, rigid infrastructure. However, the explosive growth of e-commerce means that more versatile technologies and truly autonomous robots are now a necessity to ensure safety, efficiency and flexibility throughout the entire supply chain.

Power behind the automation

What is powering this automation? The answer is LiDAR, which stands for light, detection and ranging. LiDAR is a time-of-flight technology that provides advanced detection and measurement capabilities to automate mobile equipment, from heavy cranes to fully autonomous mobile robots (AMRs). According to ABI Research, by 2025 over four million robots will be installed in over 50,000 warehouses, and each one of these robots needs at least one LiDAR sensor for situational awareness, obstacle avoidance and navigation.

LiDAR works by pulsing low-power, eye-safe lasers and measuring the time it takes for the laser to complete a round trip between the sensor and a target. The resulting aggregate data is used to generate a 3D point cloud image, providing spatial location and depth information about the surrounding area. Mounted to the robot or crane, LiDAR sensors continuously scan the area around the equipment to detect and avoid obstacles, enable autonomous navigation, precisely position equipment for loading/unloading, and much more.

LiDAR offers many advantages over alternative technologies because it offers environmental immunity, maintaining high performance in any lighting or weather condition, indoors or outdoors. Its sensors also provide a 360-degree field of view, enabling advanced situational awareness with just a few devices per robot or crane.

Benefits of LiDAR

For logistics automation, the benefits of LiDAR are:

1. Increased efficiency

AMR robots equipped with LiDAR sensors are able to map out the entire warehouse to choose dynamically the most efficient routes and identify where to place pallets, examining any obstacles that need to be avoided. With a long range and high-density 3D point cloud, the sensors provide accurate positioning and localisation to ensure materials are picked up and delivered efficiently to the correct location.

In port applications, it makes it possible to position heavy cranes more quickly and accurately without compromising safety. Depending on the application, using LiDAR-based automation for these applications results in a 30–40% increase in efficiency compared to manual operation.

2. Improved safety awareness

Mobile equipment needs to move quickly to keep up with demands, and naturally this can pose safety risks to personnel working in the same area. LiDAR delivers not only the efficiency gains supply chains need, but also the safety awareness to keep operations running smoothly and avoid accidents and injuries – for example, LiDAR sensors enable safer navigation for automated guided vehicles and AMRs, avoiding collisions that could result in injury or equipment damage.

In ports, LiDAR sensors provide the 3D perception needed to guide cranes accurately in low-visibility areas, which allows operators to stay at a safer distance from crane movement and other potential hazards. In a recent port application, implementing LiDAR reduced the number of accidents by up to 90%.

3. Adaptability and scalability

In the past, mobile robots would navigate a facility with the help of a guide tape or wire on the floor. In order to change routes, it would be necessary to change the guide tape manually, limiting the ability to adapt quickly to new and changing requirements. With LiDAR technology, AMR robots operate using SLAM (for simultaneous localisation and mapping) navigation that allows each robot to take the whole building map into consideration and visualise its location within the warehouse.

Because AMRs do not require any infrastructure modifications to operate effectively, these smart robots are quick to start up, and they automatically adapt to changing requirements. This enables flexibility and scalability like never before – for example, AMRs can be easily redeployed in a new location or to handle a new task with minimal effort. Furthermore, with a fleet of AMRs, an empty warehouse can be up and running in just a week's time.

4. Increased uptime and cost savings

Ultimately, LiDAR is a powerful tool to protect your bottom line by accelerating workflows and reducing costly downtime – for example, mounted on the front and back of an industrial tote, LiDAR sensors can reliably detect any storage boxes or pallets that are not aligned within the shelf and any obstacles on the floor to provide an efficient storage and retrieval solution, while avoiding collisions that can damage equipment.

A 3D LiDAR sensor with a fine angular resolution, high point cloud density and wide field of view can capture details within the surrounding area in real time for safe, accident-free operation – for example, the sensor can scan shelves for anomalies such as broken or protruding pallets that could damage the tote machine. By accurately detecting and avoiding these situations, LiDAR sensors can help prevent costly equipment damage and lost production time.

Future of LiDAR

While LiDAR sensors have been available for decades, its adoption has been limited by the high cost of the technology. However, it is now reaching a point of democratisation, providing immense return on investment for enterprises while rapidly becoming more affordable for all market segments, thanks to new low-cost, high-volume production methods.

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