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*The annual listing of 10 companies that are at the forefront of providing
Manufacturing Packaging solutions and impacting the industry*

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3D Smart Sensors for Greater Automation in Packaging & Logistics Applications

Packaging and logistics involve a complex supply chain to connect sellers and customers for the transfer of retail goods. Different stages of the chain require package measurement, quality inspection, and material handling optimization—which many companies currently carry out manually.

With the magnitude increase in retail purchases made online, the need for manufacturers to automate their warehouse processes has become a top priority. Smart 3D sensors are one

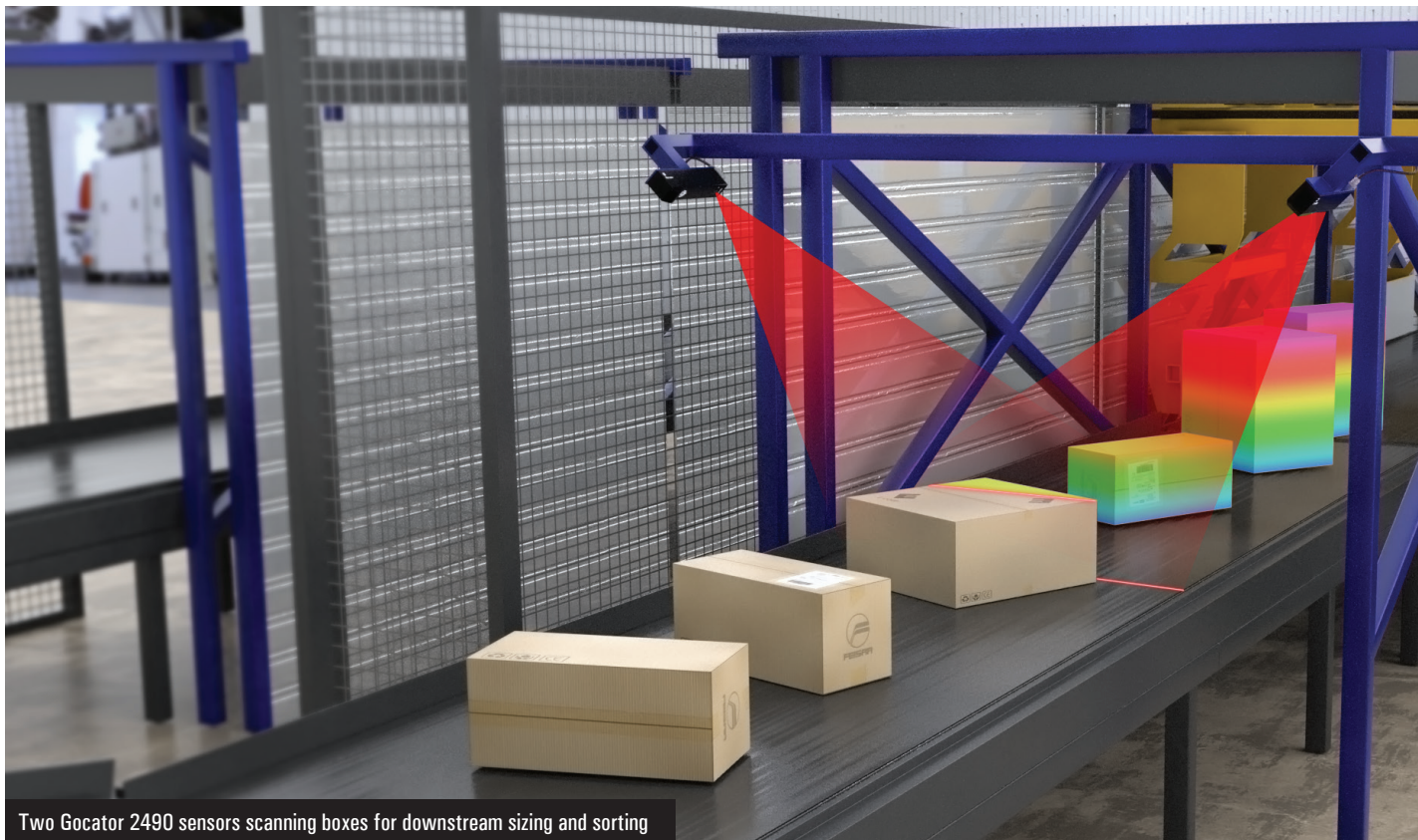
of the key drivers of greater factory automation for these processes. Leveraging automation, businesses can ensure improved manufacturing and fulfillment, higher production and order processing rates, higher throughput, increased product quality, and increased cost-efficiency.

This is where LMI Technologies, a 3D smart sensor technology provider, plays a vital role. The company has designed Gocator 2490—an ultra-wide field of view 3D laser profiler—to solve a variety of packaging and logistic applications.

Package Dimensioning

Dimensional measurements are essential to many processes in packaging and logistics, including sizing, sorting, and palletization/depalletization. In addition, the industry has undergone a shift from assessing shipping fees strictly by weight—to charging by dimensional weight—making accurate dimensional measurement more critical than ever.

Application Example 1 - Box Volume Dimensioning: Here, the engineer needs to measure a large rectangular cardboard box and provide an accurate volumetric measurement for



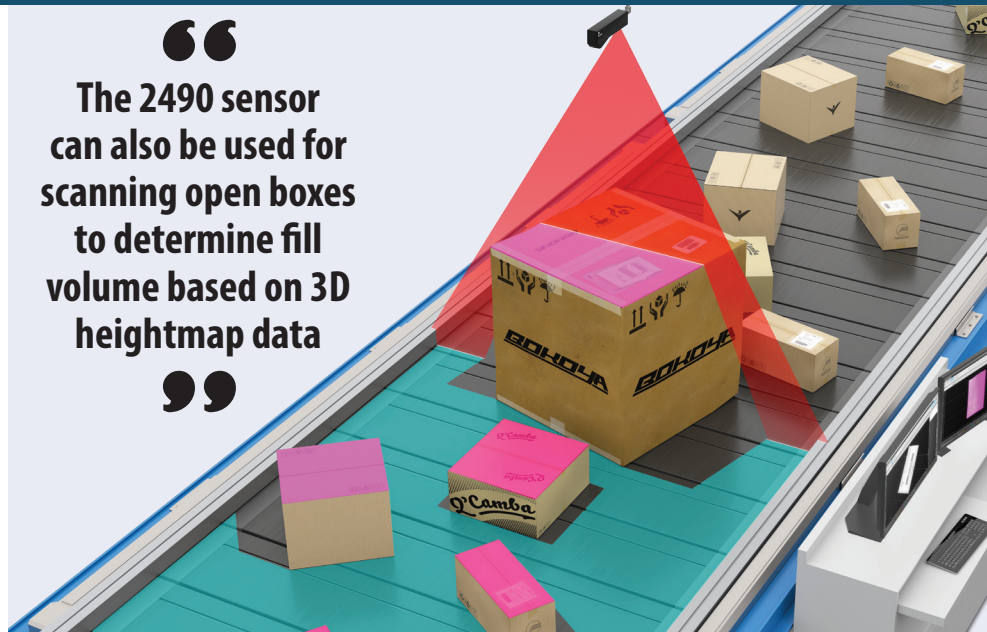
Two Gocator 2490 sensors scanning boxes for downstream sizing and sorting

determining dim-weight. These boxes are typically travelling on a conveyor at speeds of 2 m/s. For this application, a single wide field of view Gocator 2490 smart sensor is able to scan and measure complete box dimensions (WxHxD) with a 1 m X 1 m scan area, at a rate of 800 Hz and providing resolutions of 2.5 mm in all three dimensions (X, Y, Z)—even at conveyor speeds of 2 m/s. Competing camera-based systems typically offer just 3-5 mm resolution in the X, Y, and Z axes.

Application Example 2 - Filling

Inspection: The 2490 sensor can also be used for scanning open boxes to determine fill volume based on 3D heightmap data. By subtracting the fill volume from the total available box volume, the sensor generates a measurement of the “void volume”, which can be communicated downstream and used to guide the

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repacking of contents to achieve optimal fill level. It is worth noting that 2D vision solutions cannot generate heightmap data, and therefore cannot be used to make critical volumetric measurements.

Application 3 - Package Sizing and Sorting: Once the label is applied and scanned, the package is transported to a collection station or a warehouse for receiving, sizing, and sorting. Gocator 3D smart sensors are used to automate this process. Finished boxes are scanned and measured for correct sizing, then automatically sorted into the appropriate locations. Built-in timer or encoder tag and track logic ensure each box is correctly identified when it arrives at the sorting station.

Application Example 4. - Robotic Palletization/Depalletization: Dimensional measurements are required for both robotic palletization and depalletization in fulfilment applications. In this example, the Gocator 2490 sensor is mounted to a robotic arm to scan a loaded pallet and provide precise positional coordinates to accurately lift the boxes and place them on the outbound conveyor. Note that the sensor’s two-meter field of view is able to cover the entire pallet and its contents in a single scan. The sensor offers

built-in robot calibration algorithms and communicates data in real-time directly to the robot.

Package Quality Inspection

In addition to dimensional gauging, packages need to be inspected for surface defects. Receiving and sorting centers usually conduct this type of quality inspection, checking for defects such as dents, tears, punctures, and folds.

Application Example - Surface Defect Detection: Two Gocator 2490 sensors can be used to scan the exposed sides of each box travelling on a conveyor, providing real-time defect detection to flag damaged packages. Pass/fail control decisions are stamped with time and position information for every box. Each “decision tag” represents an outcome to be communicated to downstream sorting equipment.

In a nutshell, Gocator 3D smart sensor enables clients to accurately measure package dimensions for sizing and sorting, determine void space, seamlessly integrate with industrial robots to stack/unstack pallets, decode 1D and 2D barcodes for track and trace, and detect package defects such as dents, tears, punctures, and folds. 