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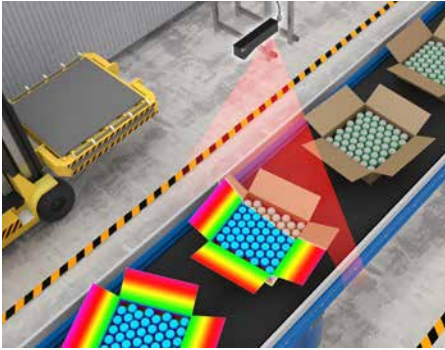# 3D SMART SENSORS FOR GREATER AUTOMATION IN PACKAGING AND LOGISTICS APPLICATIONS

Packaging & logistics involves 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.
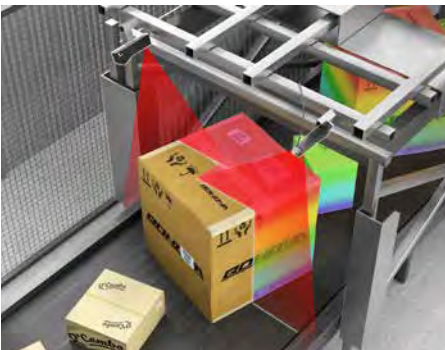
The benefits of greater automation?

• Improved manufacturing and fulfillment

• Higher production and order processing rates

• Higher throughput

• Increased product quality

• Increased cost-efficiency

In this article, we will explore some example applications that can benefit from the implementation of 3D smart sensor technology. Specifically, we will discuss the Gocator 2490, an ultra-wide field of view 3D laser profiler designed to solve a variety of packaging & logistic applications.
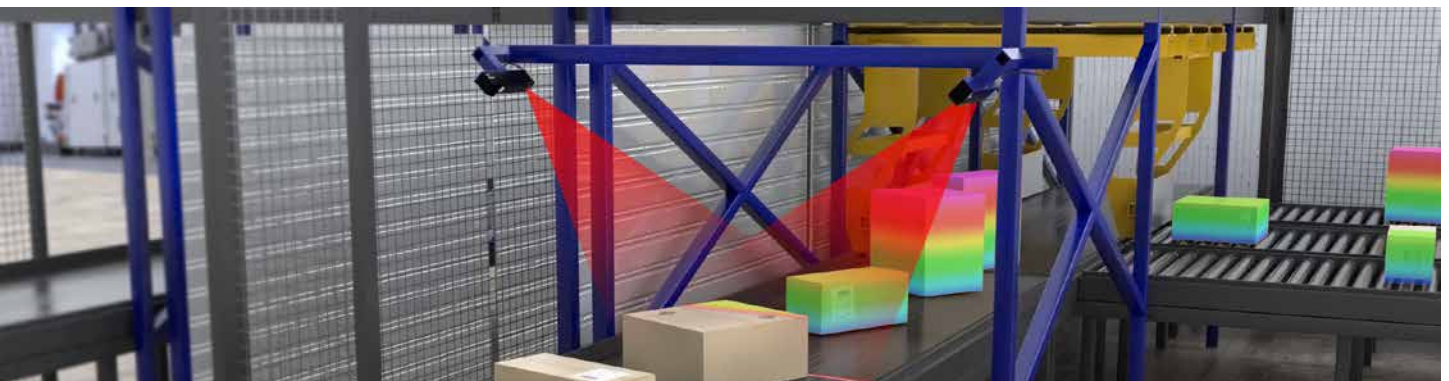
Gocator 2490 scanning packages for correct fill level

Two Gocator 2490 sensors scanning boxes for surface defect inspection

Robot-mounted Gocator 2490 used for depalletization

Package Dimensioning

Dimensional measurements are essential to many processes in packaging and logistics, including sizing, sorting, and palletization/depallitization. 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.

1. Box Volume Dimensioning

Here the engineer needs to measure a large rectangular cardboard box and provide an accurate volumetric measurement for 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.

2. Filling Inspection

The 2490 sensor can also be used for scanning open boxes to determine fill volume based on 3D height map 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 repacking of contents to achieve optimal fill level.

It is worth noting that 2D vision solutions cannot generate height map data, and therefore cannot be used to make critical volumetric measurements.
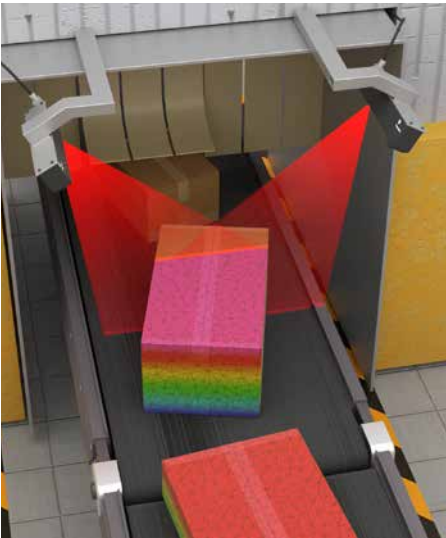
3. Package Sizing and Sorting

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.

4. Robotic Palletization/Depalletization

Dimensional measurements are required for both robotic palletization and depalletization in fulfillment 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 2 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.

Two Gocator 2490 sensors scanning boxes for downstream sizing and sorting

Package Traceability

When a package is picked up, a barcode label is applied and scanned for traceability (i.e., for determining the package's location at any given waypoint in the logistics chain). 3D smart sensors can be used to automate the scanning, reading, and tracing of these barcodes.

Application Example - Barcode/Label Reading

1D barcodes are the most prevalent format for labelling and tracking the location and movement of packages in today's logistics warehouses. To address this application, built-in software running in Gocator® allows the engineer to scan and read data encoded in 1D (linear) barcodes or OCR data from a 3D scan, without the need for 2D vision cameras or specialized barcode readers.
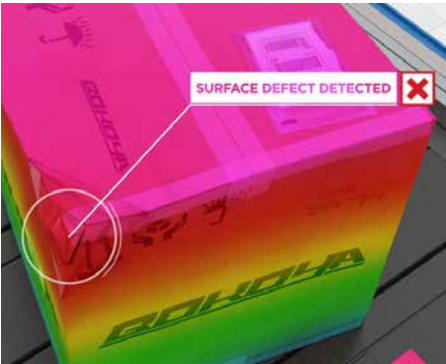
Package Quality Inspection

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 damage 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.

Smart 3D Sensors vs. Time of Flight (ToF) and LIDAR

LIDAR and Time-of-Flight are two commonly used 3D vision solutions in packaging & logistics applications based on distance measurements determined from pulsed transmit and reflection timing of a moving laser point source. The Gocator 2490 3D smart sensor offers key advantages over both of these competing technologies.

Higher accuracy. The point-to-point Z resolution (height) of 3D smart sensors is at least 10 times more accurate than time-of-flight (ToF) technologies. 3D smart sensors also provide a higher density of data laterally (i.e., across the profile) for more accurate measurement.

Higher speed. LIDAR involves rotating a mirror to move a light spot across the target surface, which places significant limitations on its scan rate. In comparison, a smart 3D laser line profiler has built in light projection and optimized design delivering 4X faster speeds than ToF vision solutions, with the possibility for even greater speed enhancements through PC- or hardware-based acceleration. This allows for greater product throughput when installed in a high speed automatic packaging line.

Easier to Integrate. More Cost Efficient. Once mounted, aligned and fed with a conveyor encoder, a 3D smart sensor does all the processing, measurement, and control decision-making onboard the sensor, with no industrial PCs or external controllers required. Unlike LIDAR and ToF, these sensors do not require a high level of integration or the need to combine data from multiple devices, making them simpler and more cost-effective for field service than component-based vision systems.

With a Gocator 3D smart sensor you can:

- 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
- Detect package defects such as dents, tears, punctures, and folds