Kellett's Corner
Machine Vision Market Analysis
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Future Manufacturing Trends Increase the Demand for Machine Vision

By Winn Hardin, Contributing Editor
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In the 1990s, productivity drove the global manufacturing engine. Today, concepts such as lean manufacturing and overall equipment effectiveness (OEE) continue to further refine the concept of productivity.

Lean operations depend on real time awareness of raw materials and production within the overall manufacturing process. Armed with real-time information, manufacturers can optimize power and materials consumption, labor, scheduling, maintenance and other critical operational factors to produce the right amount of quality product while minimizing overhead. Material handling systems are often a key link in the chain, providing moving product from place to place while providing a platform for automated data collection. In some cases, such as robotic assembly, machine vision actually enables the material handling system, often while delivering extra functionality such as quality inspection and product tracking. Today, all of these manufacturing trends are creating demand for machine vision systems to help a growing variety of industries to manufacture, track, and ship goods while keeping costs down.

Handling vs. Inspection

Machine vision systems continue to shrink in size and cost, while growing in power, functionality, and ease of use. These trends mean that machine vision is being considered more often to replace traditional, discrete sensor tracking and sensing systems because unlike the photoeye, machine vision can do more than simply turn an electrical current on and off.

For example, QUANTRONIX INC. (Farmington, Utah) makes CUBISCAN dimensioning systems for manufacturing, warehousing, and distribution centers. These systems use a combination of infrared 3D scanners and 2D machine vision cameras to capture the size of boxes, irregular shaped containers, pallets, and even full truckloads. When combined with images of the container for verification purposes, the 3D dimensional data can then be used to audit shipping costs, optimize trucking shipments, or insure that customers pay their fair share of shipping costs. “Primary applications are for determining shipping rates, storage of items, making sure warehouse has sufficient space, etc,” explains QUANTRONIX’s Joseph Cal.

Shipping costs are determined by both the weight of an object and its volume. “Generally, we’re concerned with finding the smallest rectangular package that will fit around a product,” adds Cal. “One of

the important differences between a machine vision system for product inspection, and another for package dimensioning, is spatial resolution. While we need to determine the smallest box to hold the toothbrush, the vision system that inspects the toothbrush and bristles typically requires higher resolution than the dimensional vision system."

Size Matters

It makes sense that a vision system designed to measure palletized product for shipping would not require the same spatial resolution as a vision system inspecting the product inside the pallet boxes. However, not all products are large enough to go on pallets. The shrinking world of electronics is a good example of how high-resolution machine vision systems can enable material handling operations while conducting important quality checks at the same time.

Matrox Imaging (Quebec, Canada) recently helped Netherlands-based IMS to build a micro-assembly station for feeding and inspecting micro-parts prior to final assembly. When sorting miniature electronic parts, an operator traditionally places the parts into a vibratory bowl feeder, a bowl with ridged sides. When the bowl is switched on, the parts jiggle and separate themselves on the ridges, but micro-assembly components tend to stick together or have too little mass to be transported by vibration. Other alternatives, like robotics systems or manual supply, often lack either speed or accuracy. In micro-assembly there is a need for a system that combines the functions of feeding, orienting, and inspecting parts.

According to Jasper Kerkwijk, IMS Marketing Manager, IMS and its partners developed the Vision Inspection Feeding System (VIFS) as a multi-purpose, modular system for the supply and recognition, inspection, handling, and placing of parts. VIFS is based on IMS' standard frame and equipment control system called ProMicro. To use the system, a technician calibrates the VIFS with a part that is within tolerance to create the Golden Template. Then the camera takes pictures of the parts on the inspection stage. Finally, specific processing modules in the Matrox Imaging Library analyze the parts. First the Geometric Model Finder (GMF) module locates the parts in the image, so the Metrology module can measure the features of each part. The results, both good and bad parts, are displayed on the monitor. Parts that pass inspection can be used for assembly; parts that cannot be recognized are most likely lying on their sides or too close to another part, so they are re-fed into the system by the vibratory tray. If the inspection shows a part to be out of tolerance, the system tags it; if the system is feeding parts for assembly, the non-conforming parts will be kept out of the assembly step. The system can also be programmed to find surface defects.

"Most feeder systems can't offer the combination of accuracy, speed, and flexibility that the VIFS has," he explains. "Substitutes like bowl feeders are not flexible and reliable enough to meet the challenges of micro assembly."

Small Packagers: Next Big Thing

Size also matters when it comes to vision-guided robotics, but not always in the sense of robot payloads. At the Robotic Industries Association's Robotics Industry Forum held in Orlando last fall, small companies with palletizing and similar operations were one of the few bright spots for industry growth in 2009's down economy. A small contract packaging operation in central New Jersey is a perfect example of how vision and robot companies are expanding their markets to include new, smaller corporate customers that may be fielding their first vision system.

Faber Industrial Technologies Inc. (Clifton, New Jersey) distributes Denso robotics and DALSA IPD Vision Appliance products. A small contract packaging operation came to Faber's Greg Raciti to help automate placing sample packets of shampoo, lotion, etc., on cardboard holders for insertion in magazines, newspapers, and direct mail pieces. Previously, several laborers would stand between two conveyors, pulling packets off one conveyor, and sticking them to a glue bead on the cardboard backer before final shrink-wrap. The process was labor-intensive and prone to inconsistent placement.

The operation and set-up of the small manufacturer poses unique challenges to automation providers. Unlike large companies where product changeover is limited, products change by the day or week for small contract packaging operations. The solution needed to be simple enough for packaging technicians to reconfigure a new product, and portable enough to move from one set of conveyors to another.

The solution was to build a mobile metal frame with a Denso 6-axis robot suspended upside down from the top of the frame. A pair of DALSA IPD cameras attached to a single vision-appliance image-processing unit collects images of the packets and boards coming down each conveyor and determines their X, Y, and rotation. The information is combined with encoder location for each conveyor by the robot controller, and when the packets come within reach of the robot arm, they are picked up and placed on the glue bead/mailer card on the second conveyor.

"DALSA's Sherlock software with its 4 point calibration algorithm for each camera and Smart Search algorithm made it easy for the packager to move the frame to new conveyors and adapt to constantly changing product dimension and handling needs," explains Faber's Raciti. "They don't need a PhD to set up this system. Today, it takes them about a day to move the system, place the cameras, and adapt the system to the new conveyors, which are all of different heights and sizes. As the client becomes more familiar with the operation, they expect to cut that set up time to a few hours."

A decade ago, simply bumping a machine vision camera would necessitate flying an engineer from the

system integrator to the customer site to get the vision system back on track. Today, as machine vision software takes advantage of computational advances, complex features are masked behind increasingly simple user interfaces. When combined with the improved affordability of vision systems, the result is a growing, more stable market that is supported by a wider segment of the manufacturing industry.

AIA Automated Imaging Association

900 Victors Way, Suite 140, P.O. Box 3724, Ann Arbor, MI 48106 | P: 734.994.6088 | F: 734.994.3338