A view on machine vision

The usefulness of a vision system in a packaging line depends as much on how well it is integrated as it does on the performance of the system itself.

> Users of modern packaging lines expect a lot from their installations. Typically, products of varying size and shape are presented for packaging at random intervals and in random orientations. In principle, robot technology offers the flexibility needed to cope with these variations, but it can't do so unless it has some way of accurately determining product size, position and orientation.

The central ingredient of the most versatile solutions is a machine vision system but, in itself, such a system is not a complete solution. Almost any modern machine vision system from a reputable manufacturer will be capable of producing good quality data, but the real issues are how that data is used, and how easy the system is to work with.

It's important to bear in mind that machine vision system manufacturers produce equipment that can be used in a wide range of applications; it is not specifically optimized for use with robots. This means that although the equipment offers all of the facilities – such as geometric pattern matching and blob analysis – needed for robot control, it will often be unnecessarily difficult for the end user of the packaging machine to access and use these facilities.

The first problem that needs to be addressed is communication between the vision system and the robot controller. This is, of course, an issue for the supplier of packaging machine, but it's important to users in that fast and dependable communication is essential for achieving high levels of productivity.

Users expect today's packaging lines to be very productive, with average throughput rates of several hundred packs per minute being quite typical.

This high speed of operation places considerable demands on the robot controller – powerful processors are needed, coupled with software which implements

>FACTS

Software to save the day

PickMaster is the ABB Packaging software that simplifies robot integration in picking, packing, palletizing and material handling. The software saves time in the engineering phase by reducing the need of robot programming to a minimum. The software is loaded with application tools that make it easy to meet a range of requirements. The graphical design concept and software structure are easy for operators to understand and use.

The software employs an advanced vision technique and tightly integrated conveyor tracking capability. The integrated vision system is advanced, but is open to communicate with any external sensor - line scanners, color vision, 3D or others – and is ideal for high speed picking applications. The software works well regardless of whether products come in at random, on guided conveyors or are placed on indexed carriers for highest precision.

PickMaster can be used as a standard tool for vision guidance of ABB robots. Tightly integrated with the IRC5 control system, it is an ideal tool for guiding robots in the packaging process. point random objects, the PC-based software uses a high performance robust vision system. It identifies and transfers 360-degree random objects in 50 to 200 milliseconds. Powerful quality inspection tools can categorize products and make sure defective ones are sorted out.

PickMaster can control up to eight robots and eight cameras, working together in one application or in multiple independent processes. The work load can be distributed evenly between all robots and it is even possible for the fellow robots to take over the work of others which they may have missed. A complete line can be operated from a remote panel, PLC or PC, through field buses or any other communication link.

For palletizing, the software can handle multiple in-feeders and multiple out-feeders in simultaneous production. Mixing different products from many stations to one pallet is as easy as distributing loads to several palletizing stations. A powerful pallet-pattern generator is included involving multi-drop movements with multi-zone vacuum tools or mechanical grippers.

Cognex vision system is used by Unilever in Germany, below. A PickMaster multi-feed simulation view, at left.

fast but stable control loops for the robot motion. All of this is, however, of little value if the communication link with the vision system is slow or unreliable.

Even the best software and best communications links are, however, of little value unless end users can take full advantage of their potential. Until recently, this was more difficult than it sounds – both vision systems and robots had a deserved reputation for being hard to set up.

Fortunately, developments in user interface technology mean that this is no longer the case. The best robotic systems have graphical programming systems which are based on familiar Windows technology and which are very intuitive in use. The days of developing manually coded programs for each application and even each product are over.

In addition, leading suppliers of robotic packaging machines provide their own interface for the vision system. Instead of the user having to grapple with the full range of functions offered by the vision system manufacturer, many of which are irrelevant in robot applications, they are presented with selected functions which have been optimised for use with robots.

Essential operations, such as system calibration and object identification, which have, in the past been tedious and time consuming, can be automated. Users can also be provided with a library of functions – such as checking that every position in a tray of products is properly filled – instead of having to program these functions from scratch. The result is big savings in machine set-up time.

Tight integration between the robot controller and the vision system can also provide the basis for other benefits, such as the automatic sharing and balancing of the workload between multiple robots used in a packaging machine. This enables throughput and operating efficiency to be maximized.

Machine vision systems provide not only motion control, however. They can also provide other functions, such as automatic inspection. For instance, a vision system can inspect the product itself, detecting all kinds of visual defects such as incorrect shape and poor color. The system can also inspect the packaging, revealing problems like missing or illegible date stamps, missing labels and incorrectly filled packs.

Best of all, in most cases, inspection can be accomplished with the same vision system that is being used for control purposes. The incremental cost of this additional functionality is, therefore, minimal but the savings it delivers by doing away with manual inspection can be very substantial.

In packaging applications, vision systems should be considered as an integral part of every robot-based installation. As we've seen, however, the performance of the vision system itself is a relatively minor concern when evaluating the installation's overall capabilities. ⊙

Reading the unreadable

A partner of ABB, Boston, U.S.-based Cognex specializes in vision systems, among other things, used in manufacturing automation. Cognex is also a leader in industrial ID readers.

Cognex specializes in vision systems that can easily handle flexible, non-planar packages, non-linear scaling, perspective views and shrink wrapping. For example, the system can find accurate locations of packages where the package and the information on it appears to be stretched out due to moving pallets with changing orientations, or tolerate misalignment of packages or products.

While finding the packaging position, the system can find missing parts, verify printed information and find print defects, as well as identify cosmetic defects or wrong parts. The system can verify that package labels match their 2D or barcode product code, and can make 360 degree package inspection without requiring rotation of products. There is no need to have the label facing the camera, no need to slow the line to rotate the package, and the label information can be only partially visible in one or more views.

Read more at www.cognex.com