LabVIEW and IMAQ Control Flexible, Vision-Guided Plastic Sheet Shearing

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The Challenge: Automating and improving the precision of a manual plastic sheet shearing manufacturing operation.

The Solution: Using National Instruments software and hardware to design and build a network-enabled, automated machine with vision capabilities, precise servo motion control, serial communications, digital I/O, a graphical user interface (GUI), and utilities for machine calibration, parameter editing, and teaching.

Automating the Shearing Process
A large manufacturer of credit cards needed to automate a process in which a shear on two perpendicular edges trims the jagged edges of 12" x 25" x 0.030" thick laminated sheets of credit cards, prior to the creation of individual cards. They wanted to automate their process to decrease scrap caused by inefficient trimming and increase process throughput by two times to 1,000 sheets per hour.

At AutomationWorks, we developed a system to precisely shear these card sheets relative to printed graphical fiducials, or reference points, by using National Instruments LabVIEW with IMAQ advanced vision software to coordinate machine vision with four-axis robotic servo motion control. IMAQ pattern matching technology was the perfect solution to the challenge of quickly and uniquely identifying the wide variety of fiducial types and colors required.

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The wide variety of card types and graphics required a machine capable of recognizing fiducials of varying type, color, and location and of shearing sheet edges in different locations relative to the graphics. This variety of graphical fiducials meant that traditional machine vision tools would have required a great deal of programming and processing time and were not flexible enough to support changing customer needs. With IMAQ vision pattern matching, we can quickly search grayscale images for patterns, and all pattern matching programs (VIs) and examples necessary for training machines to recognize new patterns, are included. To control our alignment, we wrote an interactive calibration routine in LabVIEW, so process engineers could teach the location, orientation, and pixel scale of each camera relative to robot motion. During application runtime, the robot handles the sequence of registering a sheet and transporting it to the correct location for accurate shearing.

System Adapts to Changing Needs
With LabVIEW and IMAQ vision hardware, we can easily adapt our process parameters to adjust to changing product needs. A recipe, selected by the operator at batch initialization, identifies the process operation sequence, camera, robot locations, and fiducial types required to trim a specific product type. The LabVIEW SQL Toolkit VI, a part of the Enterprise Connectivity Toolset, integrated a Microsoft Access 2000 database into the application to provide access and storage of camera calibration data and image processing settings, robot location and motion profile data, and more.

A Faster, Flexible Process
Installation of this machine doubled process throughput and increased trimming precision to reduce scrap. These process improvements were made possible, at reasonable machine cost, by the use of LabVIEW and IMAQ. Using LabVIEW, software engineers implemented the multitasking machine control, matrix math calculations, database access and maintenance, and GUI operator panels in less time than with any other development environment. IMAQ advanced vision tools integrated seamlessly with LabVIEW and IMAQ vision PC boards and provided the critical performance and speed necessary to make this project successful.

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