Plastic Part Inspection – Identifying Process Defects to Reduce Manufacturing Costs

Today's competitive manufacturing market has little tolerance for defective parts. Nowhere is this truer than in the automotive sector, where small defects can result in expensive downstream consequences. For the automotive component supplier, it is a continuing challenge not only to control process defects, but also to make sure that those non-conforming parts that somehow get made don't get passed along to the customer.

Some automotive dashboards make use of plastic pushbutton switches that are usually black or gray in color with white backlighted icons for the switch function (fan, radio, etc.). To make the button first the white backing is molded, than the remaining portion of the button is over molded. A portion of the white backing is left exposed, but is followed by application of a layer of black or gray paint. This paint is later etched away with a laser to create the icon. Because of process variability and the customer quality requirements, these part types require intensive inspection to ensure that defective parts do not pass along to the next manufacturing step.

At a major manufacturer of automotive components, the Engineering Manager noted that the laser-etched icons being produced were inconsistent. The shear number of process variables (the molding processes themselves, paint thickness and consistency, power output of the laser, etc.) was not cost-effective to control. "We needed a way to know that the icon appearance was consistent within a certain band. Those not meeting the required area and 'crispness' would be discarded. It was not possible for the operators to do this in a reasonable amount of time. The Avalon QSInspector™ System has provided us the ability to check switch for icon consistency and to correct the laser power accordingly."

Application

Performing a robust inspection required a powerful machine vision system. Inspection tolerances also necessitated the tight control of part, camera and lighting positions, as well as elimination of ambient light. To satisfy these requirements the customer selected the QSInspector™ from Avalon Vision Solutions.

Avalon has over 2,000 of its MoldWatcher™ systems installed on injection molding machines. These systems are very effective at preventing mold damage and are typically comprised of an Advantech touch panel PC with a Windows XP operation system with Avalon's MoldWatcher™

machine vision software application. QualityStation™ is a general-purpose sister product to MoldWatcher™. The two products deploy similarly powerful machine vision algorithms, but the operator interface differs somewhat between the application-specific MoldWatcher™ and the general-purpose QualityStation™.

QSInspector™ is a manually loaded, semi-automatic inspection station that employs QualityStation™ as the inspection "engine". In this application, an Advantech PPC-154T supports four high-resolution (1280 x 1024 pixels) USB 2.0 cameras with 6-15mm lenses that are used to acquire images of four quadrants of a switch assembly.

In this application, reference images of the switch assemblies are "taught" to the system and are stored in the computer's memory. These reference images will later be compared to those of parts undergoing inspection. The operator places a switch assembly to be inspected onto the "poka-yoke" fixture, which allows only one correct part position. He or she then pushes two "Start" buttons, which index the switch assembly beneath the cameras and lighting for inspection. When the part is in position, the inspections are triggered. A

QSInspector

series of images is acquired and powerful machine vision algorithms analyze the images and compare the results to those obtained during the "teach" process. If they compare favorably within a tolerance range a green light is illuminated; if they compare unfavorably a red light is illuminated. The part fixture is indexed to the operator, who either forwards it to the next process or places it into a reject bin.

QSInspector™ has many features that allow adaptability to the ever-changing automotive part population. The fixture is affixed to the indexer with location pins. When a new part is introduced to be inspected, it is a simple matter of fabricating only a new fixture. The QualityStation™ cameras are already optimized for the fixture Field Of View. And,

QualityStation™ can save thousands of inspection configurations.

Process Rx™ is a documentation database application that captures images and stores them for later retrieval, animation of stored process images for debugging, and has statistical reporting of the performance of each inspected part. This is a powerful tool for detecting process trends and for diagnosing inspection methodologies.

Conclusion

The result of QSInspector™, which combines computer hardware, software, optical technologies and mechanical fabrication into one product offering, is a robust, turn-key solution that is reliable, affordable and simple to use even by non-technical operators. This customer has saved thousands of dollars in preventing the costly consequences of downstream defects. Recognizing this, they have implemented a total of three systems over the course of a year.

Ed Kachnic, President of Avalon, says they have used over 250 PPC computers in MoldWatcher™ and QualityStation™ applications. Recently, Avalon has introduced its Validator™ product, based upon the Advantech UNO-2170 PC. Validator™ is a low-cost, simple-to-use compact vision system designed for verification applications. The reliability of the Advantech product line encourages Avalon to use these computers in their worldwide deployment of quality control, visual inspection systems.

Advantech Corporation, eAutomation Group – Founded in 1983, Advantech is a global leading ePlatform service provider integrating web-based technology, computing platforms and customization services that empower the connected eWorld. Advantech cooperates closely with system integrators to enable them in providing complete solutions for a wide array of applications in various industries. Advantech delivers more than a thousand products and solutions under 3 main categories: Embedded & Applied Computing, Industrial and Network Computing, and eAutomation. With the combined talent of more than 2,000 people, Advantech operates an extensive support, sales and marketing network in 16 countries and 28 major cities to deliver fast time-to-market services to our worldwide customers.   US operations for the Industrial Automation Group, 1320 Kemper Meadow Drive, Suite 500, Cincinnati, OH 45240.   Website for Advantech customers in North America: www.eautomationpro.com/us   Emal: info@advantech.com

Avalon Vision Solutions, LLC www.avalonvision.com helps manufacturers reduce costs by identifying process defects in real time. The company is the leading supplier of machine vision systems designed to protect plastic injection molds. Avalon has installed over 2,000 of its MoldWatcher™ mold protection machine vision systems into more than 450 plastic injection-molding plants in North America.

Recently, Avalon has been leveraging that experience into other manufacturing applications such as part verification and part quality. Its extended product line is a series of PC-based machine vision systems with hardened cameras and lighting designed for rugged manufacturing environments. Exceptionally easy and intuitive interfaces enable shop floor personnel to operate the systems with minimal training.

The headquarters is located in Lithia Springs, Georgia a suburb of Atlanta, Georgia USA. Avalon has sales offices in Michigan, Colorado, and Monterrey, Mexico. Field service support is located in Pennsylvania, Michigan, California, and the company headquarters in Atlanta, Georgia.

Recognizing that industry leaders act locally, but think globally, Avalon is aggressively expanding into the South American and Asian markets. We firmly believe that our future lies in our ability to provide quality products and services into low cost manufacturing countries.