CASE STUDY

Using machine vision to transform under-performing quality inspection processes

Automakers and other manufacturers are under intense pressure to accelerate production and improve quality. This relentless balancing act requires smart decision-making and capital investment. Many companies rely on vision-based quality control systems to help lines run faster while mitigating the flow of defective components into the assembly process. But the challenging conditions inside most facilities can mean these systems are not sufficiently accurate to meet modern manufacturing requirements.

Low correlation values make automated checks unreliable

A vision system for quality control operates by comparing a target object with an ideal model. Variables such as position, orientation, shape, material and color are typically part of the ideal model. If the variables correlate sufficiently, the target object is accepted and passes the quality check.

Automotive strategic account managers, Brian Carder and Terry Miller for Omron Automation Americas were recently asked to assess a customer's existing vision system, which was doing a poor job of detecting problem components.

"One of our automaker customers was using a competitor's vision system to check component quality," Carder says. "Ambient lighting in the plant was poor, and the customer had to keep lowering the system's correlation values to keep production on-track."

But lowering the correlation coefficient was causing the system to adversely categorize many good parts as defective and in turn allow some out-of-specification parts to be passed as acceptable. Neither of these outcomes was acceptable, and the customer wanted a reliable, cost-effective solution.

Shape Search III is up to nine times faster than previous algorithms

Carder and Miller were confident the customer could improve its quality control process by adopting the Omron FH Series vision system. The system includes sophisticated measurement software and an assortment of high-speed cameras using powerful controllers suitable for most industry applications.

"The system uses our Shape Search III object detection algorithm," Miller says. "Omron's advantage is our breadth of experience."

Through Omron's unique combination of perspectives from various industries that the company services, Omron is able to combine that experience and evolve to provide "functional building blocks." Omron's pattern matching algorithm evolved out of its Think & See™ technology core.

FH Series runs at high speed with nearly 100 percent accuracy

A correlation coefficient of 0.65 to 0.7 is necessary to ensure that a target object is at least moderately related to its ideal model. The customer's old vision system struggled to deliver this level of repeatability and yielded significant numbers of false-positive readings that had to be reviewed using a time-consuming manual process.

"The FH Series transformed the quality inspection process," Miller says. "The lighting conditions were still poor, but with the FH Series the customer is operating at a correlation coefficient of 0.9 or better. In

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Business Need

Defects and non-conforming parts generate substantial warranty, recall and legal expenses for automakers and suppliers, further reducing already limited profit margins. Manufacturers often rely on vision-based non-contact inspection techniques to ensure compliance, quality and efficiency. Affordable, accurate, seamless and reliable technology is critical for success.

Flexible Solution

The standalone FH Series vision system with the Shape Search III algorithm provides an accurate, affordable and easy-to-set-up solution for even challenging environments. It supports a variety of cameras and includes powerful controllers that can be remotely accessed and updated without taking the system offline in a scalable package.

Customer Benefits

The high fidelity, real-time visibility offered by the FH quality inspection solution helps drive down manufacturing costs, support continuous improvement, and ensure compliance while avoiding expensive recall and litigation efforts. The portable nature of the FH solution allows for standalone and networked implementations, allowing the manufacturer to scale as processes become more complex or rigorous.

practical terms, this level of accuracy means no defects are getting through the system."

Updated inspection stations are being equipped with four FH-SC/SM 0.3 megapixel, cameras. The resolution is sufficient for this application and allows large numbers of images to be stored without incurring significant costs. The FH Series offers additional cameras, including models with up to 12 megapixel resolution, fixed and adjustable lenses, lighting and ultra-compact housings for areas with limited space.

Powerful controllers include real-time image transfer and EtherCAT support

Controllers with two to four cores provide processing power for the FH Series. The controllers support two to eight cameras, which are more peripheral devices than controllers offered by competitors. They also feature a high-performance networking bus for transferring image data to backend system over Ethernet and data.

"We specified the FH Series with a two-core FH-1050 controller and four FH-SC/SM cameras for this application," Carder says. "The customer initially purchased two of these systems for testing and evaluation. They have since installed a total of 35 systems in this first plant and plan to roll out additional systems to other facilities in the near future."

An Omron Remote Operation Tool allows the customer to remotely access FH Series controllers over an existing Ethernet network. Remote access makes it easy to update, change or monitor model parameters and performance. Non-stop adjustment capability also means these changes can be applied to the process while quality inspections continue to run.

FH Series easily supports multiple roles in modern manufacturing environments

The FH Series' powerful processing with precise optics and sophisticated pattern-matching algorithm makes it an ideal solution for a range of automation-related tasks, including product inspection (head and tail detection or parts checks), position compensation, and target position and part detection. The system's ability to accommodate inconsistent illumination, shading and halation due to specular reflection while reacting to target overlap allows for easy installation into existing environments.

"Traceability with the FH Series provides automobile manufacturers with a strategy for implementing inspections using barcodes, OCR and 2D codes which than can be further tied to individual vehicle identification numbers," Carder says. "Eventually, this technology can provide a fully traceable record of part origin, placement and compliance for every component in every vehicle. In the nearer term, our customer is able to operate with improved efficiency and quality assurance while improving their bottom line."

"In an industry where one minute of downtime can cost upward of $250,000 and defective parts can put a manufacturer out of business, that is a valuable accomplishment."

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Omron Automation is a global automation partner that creates, manufactures and services fully integrated automation solutions. We provide controls, vision, safety, motion and robotics for the automotive, semiconductor, food/beverage, packaging, pharmaceutical and infrastructure industries.

For over 80 years, Omron has helped industrial businesses maximize potential by solving problems creatively. Currently headed by President Yoshihito Yamada, our company is 36,000 employees strong—providing products and services in more than 110 countries worldwide.

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