Machine Vision Monitors for Quality

Manufacturing today churns out more products with fewer people, thanks to automated production processes. Upholding quality requires watching products closely, with intelligent video analytics — or machine vision — helping human operators do their job better.

BY LING-MEI WONG

Modern factories no longer require armies of workers. The development of Henry Ford's assembly line, which shifted cars down a moving line to individual workers, has given way to machines replacing the workers. This improves worker safety, productivity and reduces employee boredom from repeating the same motions multiple times a day. Employees are free to do more challenging tasks, such as overseeing operations or managing customers. The rise of automation has allowed people to work smarter.

Automation can only go so far though, as machines cannot think for themselves. When a machine malfunctions, human operators need to intervene for the shortest amount of downtime as improperly made products waste company resources. As human operators have limited attention spans, video analytics not only secure locations but ensure production lines run smoothly.

Improvements in networking, resolution and processing resulted in better analytics. Intelligent surveillance can watch production lines in real-time, saving time and money. With more automation and superior video analytics are deployed for manufacturing.

PRODUCTION PRIORITIES

Machine vision sets out to overcome human failings during manufacturing. "Inspection tasks are extremely tedious to perform manually because defects occur rarely and it is the natural tendency for a person to 'relax' after inspecting hundreds of good parts and not finding any defect," said Soliton, a machine vision product manufacturer and automation solutions provider serving companies such as Boeing, GE and IBM. "On the other hand, a machine vision system never 'relaxes' and ... can be operated 24-7 with repeatability and reliability which cannot be matched by a manual inspection process."

Intelligent video reduces the number of manual inspections. "Testing and inspection are critical tasks in manufacturing processes to capture defects in input

materials before it enters a machine for processing or to identify defects after the processing is completed," Soliton said. "Machine vision enables the automation of a wide variety of such inspection tasks."

An effective intelligent video solution must watch for specific events, including tracking where items are. "Part location software tools find the part within the camera's field of view," said Cognex, a machine vision specialist. "This is typically the first step in any vision application, from the simplest robot pick-and-place operation to the most complex assembly verification task."

This is easier said than done, as the most carefully controlled environments can look different on camera. "The vision system's part location tools must be intelligent enough to quickly compare model images to the actual objects moving down a production line, regardless of which side of the part faces the camera, its distance from the camera, shadows, reflections, line speed and normal variations in appearance," Cognex said.

Analytics like object detection can be used to locate parts. "Non-motion detection (NMD) technology can detect objects that are left stationary or objects that are removed from a busy scene, despite constant movement in from of and around the object, even though they may be fully obscured for periods of time," said Rustom Kanga, CEO of iOmniscient. "iOmniscient systems utilizes NMD to detect changes in the static environment. The system is able to detect when an object has been removed from the warehouse, stock room or even specific areas within the stock room."

The machine vision solution must be able to track parts in a constantly moving scene, such as warehouses packed with people and forklifts. "The iOmniscient system with its patented NMD technology will be able to register every item that is collected or moved, while make a note of who did it," Kanga said. "The system can differentiate between people, forklifts and different types of stock, allowing people only moving about in the scene to be ignored."

Manufacturing video intelligence can also require optical character recognition to "read" parts. Software scans images for text, converts the characters to a digital format and filters out unrelated content, Cognex said.

AUTOMOTIVE PLANT GAUGES FOR ERROR

Pricol is an India-based global manufacturer of automotive instrument clusters, seen at the dashboards of cars. It approached Soliton to automate the calibration and inspection process for the instrument clusters.

Soliton designed an integrated PC-based solution using four of its FireWire cameras and GaugeVIEW software that is designed to read any needle-based gauge, the company said. The software communicates with the signal generators that excite the gauges, the inspection cameras and the cluster controller.

The GaugeVIEW software performs image processing to identify the needle in the individual images and calculates its position to about 0.5 degrees, Soliton said. If there are any offsets from the expected value, the system sends this information to the cluster controller. After calibration, the cluster is inspected by giving the required input signals to the gauges and checking the needle readings to ensure that they indicate the correct values within the required accuracy tolerance.

The Soliton machine vision solution achieved reliability and cost effectiveness, the company said. Designed with no moving parts, high throughput was achieved through parallel calibration and inspection of all gauges. The entire calibration process, including the loading and unloading of the cluster, takes less than 55 seconds.

The smart cameras integrate the functionality of a machine vision system into a compact embedded unit and replaces a computer for image processing and control, Soliton said. For each application, a one-time configuration is done and saved to the smart camera.

▲ Machine vision benefits the production of glass curtain walls, the large sheets of glass used for skyscrapers.

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POLISHING GLASS PRODUCTION

Beijing Qinrun Glass produces glass curtain walls, the sheets of floor-to-ceiling glass used in high-rise buildings. Built to withstand strong winds while providing illumination, the glass must free of defects. Poorly made glass can cause light pollution, which distorts images. It is also a safety hazard, as asymmetrical glass breaks more easily and could injure passersby.

To ensure quality, Qinrun Glass brought in Beijing ConsData Computer Engineering for a machine vision solution. Qinrun Glass previously had performed quality control manually, by positioning the glass on bracket, taking a picture and then having a computer check the glass for anomalies. Each bracket would hold one to 20 sheets of glass, with quality checks for each sheet of glass. Mounting the glass and processing the images took 20 minutes for each bracket, which was inefficient. Inspection required 20 computers, 20 glass brackets, 20 cameras, 400 square meters of space and 100 quality inspectors for each production line.

ConsData employed an intelligent camera, embedded with analytics to check the surface of the glass. It looks for concave or convex anomalies by how light is refracted, speeding up the quality control process. The solution identifies types of defects and gives each sheet of glass an identification code. The code includes a picture from inspection, a time stamp, the size of the glass, the production line number and the level of the glass.

Machine vision provides timely data for a clearer picture of production. It effectively aids human operators to complete monotonous or dangerous tasks, scoring points for safety and security. The automation of production ensures machine vision will be an ongoing trend. VSD