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INSPECTION SYSTEMS

Looking Closer at Inspection

The multiple advantages of automated inspection solutions are weighed against false reject performance.

By David Vaczek
Senior Editor

Inspection solutions are deployed for incoming components, at various stages of packaging production, and for ensuring the quality of finished goods.

Systems for high-speed production line inspection enable insights into processes that are running too fast for the human eye to follow.

Yet in some applications, the advantages that automated inspection offers in higher accuracy and labor cost savings must be balanced with the potential for lost productivity deriving from high false reject rates.

"An enemy of acceptance of machine vision technology is the impact on productivity, from rejected product that should have passed as good product," says Michael Soborski, director of inspection solutions, central engineering group, Systech International (Cranbury, NJ).

Systech has released next-generation software for optical character recognition (OCV) that the company says is more responsive to normal acceptable manufacturing variances, such as those arising from part presentation, rotation, and material finish. Systech's OCV2 verifies the content and quality of human-readable alphanumeric data, such as date and lot code.

"You can have variations that are fine from a human-readable standpoint, but if you have a font recognition engine that is not tolerant of those variations, you will get false rejects," says Soborski.

"We have built mechanisms into our OCV product that allow us to tolerate benign print quality variations, but still pick up changes that affect legibility and the integrity of the text," he adds. "[So,] the system performs with low false rejects, and no-fault accepts."

To accommodate normal print variations and avoid false rejects, the company streamlined the font-training process, which develops character libraries used to score inspected images. "We know what print variations are typically printed, and we were able to model that in our software," he says. "The system predictively puts those variations into the font library, which makes the font training faster and more user-friendly, without the exhaustive manual font training [typically] required."

The OCV2 can be configured for variable-data inspection by interfacing with an external data source for receiving the changeable data for verification. "We can exploit the advantage of OCV from a print quality enforcement standpoint, [and inspect variable data] that would otherwise require optical character recognition [OCR]," Soborski says.

SELF-MONITORING

Inspection solutions are addressing easy operator use and faster validation. Technology enhancements include cameras that capture higher-resolution images, as well as self-monitoring machine features. Symetix (Walla Walla, WA) has added self-monitoring capacity in its OptyxSG/P system for 100% inspection of softgel capsules.

An upgrade for pharma product inspection from its OptyxSG/N, which is designed for nutraceutical inspection, the OptyxSG/P features an added parallel processor that supports self-monitoring functions.

Images shown here obtained from four primary cameras are compared with previously defined accept and rejects standards. Capsules are inspected for color, size, and shape defects. When a rogue capsule or defective product is identified, the system automatically removes the problem capsule from the product stream. Pictures of all rogue-classified product are presented to the operator and stored in a batch file.

The added processing muscle helps make the system fail-safe, by supporting real-time reporting and confirmation that defective product has been ejected. Though operators can access a secure encrypted batch log for the production records, a Freeze on Reject feature allows instant feedback. The operator instructs the system to save an image of a failed product, and flag and post images of subsequent similar failures, for continuous identifying of what has failed and why.

An Eject Function Confirmation feature employs an independent system using two additional cameras for monitoring ejected product.

"One self-monitoring feature is a vision system monitoring the vision system, providing added confirmation that items tagged by the system for ejection are ejected," says Jon Donovan, product manager.

Firmware modules in the OptyxSG/P promote speed and throughput by handling image analysis, before passing a reduced data set to the inspection computer.

"When the data rate is small enough, vision systems in many applications pass the camera data directly to the computer for processing," Donovan says. "Because we are supporting multiple views, and a very high throughput, with detailed analysis at a higher degree of precision, we are preprocessing some of the data."

The OptyxSG/P can be integrated with other Symetix units to make a continuous softgel finishing line. The business unit of Key Technology last year debuted the PulseScrubber polishing system for softgel caps, and the Impulse/P grader, configurable for softgel, coated, and solid-dose product.

OFFERING OPTIONS

Omron Electronics (Schaumburg, IL) offers controller-based, as opposed to PC-based, inspection systems. Controllers are programmed via touch screen HMI, or with a handheld programming console. In the case of the company's entry-level ZFV model, operators set up inspection parameters using a keypad below the display.

"Programming and direct viewability occurs on the controller, without the need for added hardware and software," says Tom Kahn, product marketing manager, vision systems. "The validation process is thus streamlined, which is an attractive feature for our customers globally."



Omron Electronics provides color-sensing ability in the new entry-level ZFV-C Smart Sensor. Besides

comparing packaging and capsule hues, the unit handles functions such as counting, pattern recognition, and size and text verification.

for the single-camera-based model line. The unit provides basic color-match and pattern-match inspection of packaging and capsules, with the capacity to store eight programs, enabling fast changeover between product runs.

The ZFV and ZFV-C units monitor for a single task per field of view. Eight sensor functions accomplish inspection of features such as date and lot code verification, counting, size and text verification, or width and position. The ZFV-C adds color-support functionality to all these inspection tasks.

Kahn says customer demand for hue-matching inspection is being driven by the need for quality and consistency of product packaging.

Omron's higher-end inspection systems, the ZFX and FZ2, deploy multiple cameras and more controller intelligence. Algorithms support shortening and streamlining the programming of inspection thresholds and unit calibration and commissioning.

Image files can be stored and recalled.

"With the ZFX and FZ2, you can perform threshold trending, such as to detect if a label is gradually creeping out of place," says Kahn. "It may be in an acceptable range, but the operator will be alerted to the event."

Video recording is used for insight into high-speed packaging processes. Recordings can be played back in slow motion to show what caused a pill to miss a pouch or what might be causing a station to blow mold bottles. A major pharma company recently decreased false rejects in vial inspection using the 20/20 Hindsight high-speed videomonitoring system from Monitoring Technology Corp. (Fairfax, VA), says Ray Babbitt, regional sales manager.

VIDEO CONFIRMATION

In off-line testing with MTC's 20/20 Hindsight gigE solution, the firm found it was setting tolerances too tight in its automated inspection for nondissolved particulates. "The camera demonstrated what the suspension really looked like with the vial spinning at a specific rate. In readjusting the parameters, engineers were able to decrease false rejects by nearly 6% from 8%, saving about half a million dollars," Babbitt says.

Video monitoring can be deployed for many processes for showing where defects arise and how they occur, replacing labor-intensive visual troubleshooting. Technicians may or may not see occurrences because of the high production speeds, and infrequency of problems. "We can monitor continuously for hours at a time," says Babbitt. "The information is saved for repeated viewing, where users can compare complex machine functions that are working well with those that are failing."

A scan-back feature provides instant access to prerecorded video while the system is still recording. Recordings can be reviewed by scrolling back into the buffer. Recordings can be stopped, reversed, slow played, or advanced by single and multiple frames. Images can be exported, such as for problem solving and training.

The system can be deployed at a moment's notice on packaging floors as a mobile troubleshooting station. Babbitt notes the 20/20 Hindsight requires one-tenth the light of traditional systems to produce clear images, owing to camera technology that supports up to several thousand frames per second and high shutter speeds.

Complete Inspection Systems Inc. (Indialantic, FL) has launched the AutoProofPro MultiCheck image comparison and optical reading system that performs multiple inspections on a label, insert, or carton. Regions of the document are defined for different inspection types, or regions can be masked for the system to ignore.

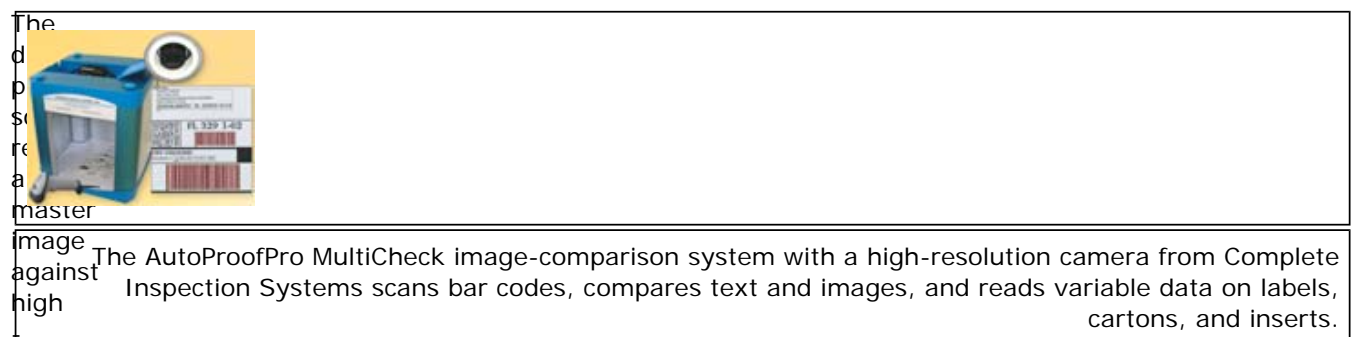
The user scans the component's bar code, which is matched with a master document in the database along with the predefined inspection regions. MultiCheck confirms the bar code and performs comparisons of text and images. Regions with variable data can be set for inspection by optical character recognition (OCR).

After the inspection is executed as a batch process, the results of each inspection category are displayed and hyperlinked for easy viewing. The unit works with a 10.3- or 13-megapixel high-resolution digital camera and uniformly lit imaging station, says Gary Parish, president.

"MultiCheck can be deployed as a stand-alone station or utilized as a real-time system interfaced to a printer for performing in-line inspection," says Parish. "The camera choice will depend on how much information the user wants, the resolution required, and the speed of the process."

The company has also introduced the Q-Spec system for inspecting, tracking, and tracing incoming package components and outgoing finished goods.

COMPONENT TRACKING



The AutoProofPro MultiCheck image-comparison system with a high-resolution camera from Complete Inspection Systems scans bar codes, compares text and images, and reads variable data on labels, cartons, and inserts. Images captured in the light box to detect and read bar codes, confirm package size, spot errors in copy or image composition, and compare colors.

Inspection results of incoming components such as caps, bottles, and labels from multiple vendors may be compared with captured images of the invoices such as to confirm component source, serial numbers, and order amounts, says Parish.

Focusing on supply-chain track and trace and authentication, Complete Inspection Systems has partnered with Digimarc Corp. to develop a unique range of digital watermarking solutions for packaging.

"The addition of digital watermarks into packaging offers numerous advantages over other technologies for identification and product track and trace. Most importantly, the digital watermark preserves the integrity of the printed material, and offers a high read redundancy for the user. The covert code is easily embedded into the label, carton, or package by the graphic artist without taking up additional copy or having to add a separate printing process," says Parish.

Parish says that watermarks can be located in easy-to-detect locations, without distracting from the graphics. Multiple watermarks can be added. Users can capture images at known package locations. "For exact authentication, a second covert watermark with the location known only to the manufacturer can be created with materials that cannot be copied."

Codes can be captured with a cell phone with embedded software for relay via the wireless provider to a registry router for lookup. Information is sent back over the Internet to the user's cell phone.

Automated tablet inspection systems promise two major advantages when compared with manual inspection: accuracy and speed. When quality control personnel are visually inspecting tablets on a conveyor, the repetition tends to "put the human eye to sleep," leading to inspection lapses. Nor does the human eye easily recognize tablet thicknesses and small defects, says Frederic Le Pape, director of sales and marketing

North America, Proditec Inc. (Narbeth, PA).

Le Pape notes that other advantages of automating tab inspection are that results are consistent and repeatable. Software statistically analyzes results, such as categorizing defects by type.

"Manufacturers will manually inspect 1000 tabs out of 2 million," Le Pape says. "If the failure rate reaches a certain percentage, they will scrap the lot, or inspect the entire lot individually. The process is slow and labor intensive." He adds that automatic inspection is 10 times faster than manual inspection.

For off-line automated inspection and sorting of hard pills and capsules, Proditec offers the Visitab 2 vision inspection system. Supporting high-volume, 360-degree visual inspection, the unit features six CCD linescan cameras, a PC-based display monitor, and database software. Proditec's Inspectab 100 is a lower throughput entry-level model for small to medium-sized batches. LB Bohle LLC markets the units in the United States and Canada.

"The Inspectab 100 is the perfect tool for use as needed for batch saving," Le Pape says. "The Proditec line uses universal tooling supporting fast changeovers when handling multiple products with different shapes. 21 CFR Part 11-compliant inspection and data management software also features autolearning capacity for configuring automatically good products," he adds.

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