Baumer
Passion for Sensors

Application report

A seamless overview

Easy visualization of rotationally symmetrical objects

In the pharmaceutical, food, and beverage industries, products must be precisely controlled to fully comply with the high standards. Industrielle Sensorsysteme Wichmann GmbH (ISW) developed a new solution for the testing of rotationally symmetrical objects. On board: four industrial cameras of the CX series from Baumer whose simultaneously captured images comprehensively depict a product.

Rotationally symmetrical objects – this admittedly slightly unwieldy term denotes many everyday products. For example spray cans, pharmaceutical vials, or cans – in other words, objects that can be comprehensively depicted by rotating them around their own axis. Such cylinder-shaped objects are often found in the pharmaceutical sector as well as the food and beverage packaging industry. These are sensitive industries, where it is essential to precisely monitor quality and safety-relevant issues, that sometimes have to meet a legal requirement in order to reliably detect potentially damaged screw connections, deformed packaging, missing spray nozzles or labels, or even incorrect contents.

New solution to an old problem

Current methods for monitoring rotationally symmetrical products focus on turning them a complete rotation around their axis for a defined distance at a constant speed and with a precise exposure time in front of a camera. The image is then processed and inspected via image processing. "However, the seam areas between the individual images are often unclean,
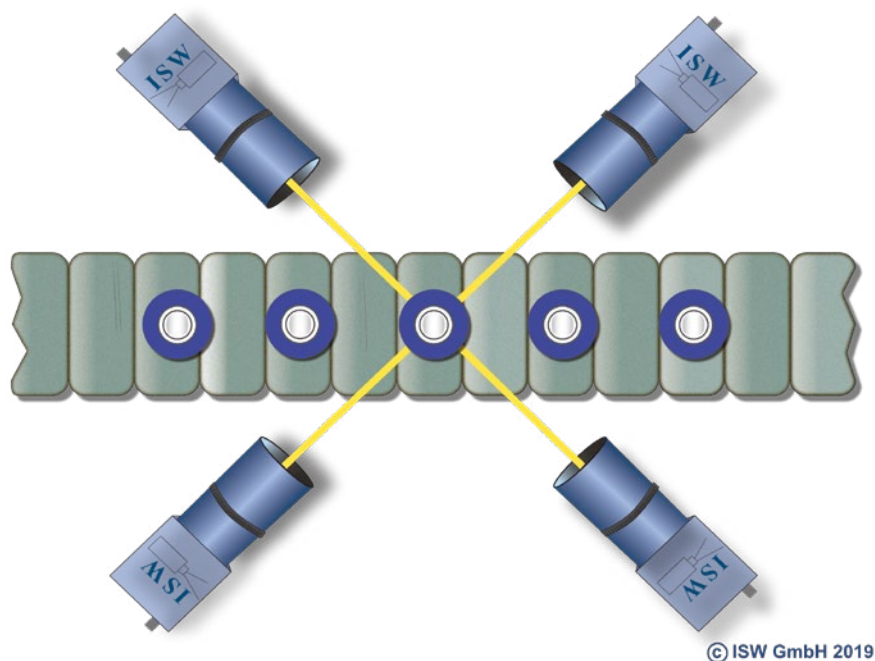

Figure 1: Four 5 megapixel cameras of the Baumer CX series each capture a 90° segment of the tested product. The images are then combined into a single shot by the involved software. (Photo: ISW GmbH)
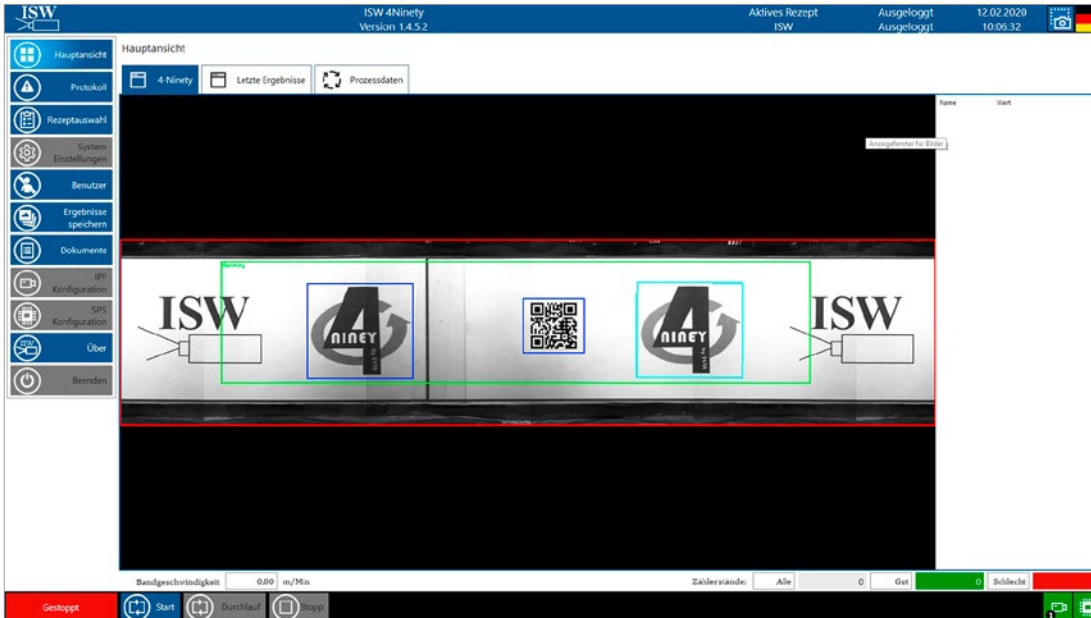
Figure 1

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Figure 2: Combined processed 360° image for code control of a rotationally symmetrical product.
(Photo: ISW GmbH)

Figure 2

and thus only serial errors, i.e., errors across several products, can be recognized in a stream," explains Stefan Tukac, authorized signatory at ISW, the drawbacks of previous testing systems. The engineers of ISW decided to improve this process by developing a 100 % control system that reliably detects even one-time production errors while maintaining the production flow. Six months later, the new testing system called "4ninety" was ready. The name says it all — the system features four Baumer cameras that each cover 90° of the volume of a round object. "Which is precisely the total of 360°," explains Tukac. The software combines the four individual images into an overall picture without overlapping and evaluates them.

Extensive test range

The approach of ISW is easy and can be integrated into existing production processes with little effort. The test cell can be placed above any conveyor belt desired. With the help of different shafts, the cameras and illumination can be adjusted to different conveyor belts and products within a very short period of time. Once it is put in place, correctly aligned, and the software properly edited, the system handles a great variety of inspection tasks. The shapes of products can be controlled, e.g., for intactness, compliance with dimensions, or placement of the lids. Similarly, checks for the presence and location of characteristics such as the correct placement of labels up

to the verification of attached 1D and 2D codes or texts (OCR/OCV) are possible. "Our standard library consists of several thousand fonts. This allows us to allocate plain text of our customers to standard fonts such as "Document", "Universal", or "Pharma" for reliable readability," explains Tukac about the OCR process.

Figure 3

Figure 3: The products to be inspected are brought into the test box via a conveyor belt. An integrated belt receives the products and transports them through the test process. The system is set to the desired parameters.
(Photo: ISW GmbH)

The location and position of characteristics are measured in global coordinates, so that the easy definition of fixed threshold values can allow the sorting out of faulty products based on the measured millimeter or degree deviations. For the recognition of labels, ISW relies on a grayscale and contour algorithm that compares captured labels with a master. If there are discrepancies, the product is discarded.

The centerpiece: Image processing

The test system's centerpiece is the software-based specially developed image processing. The prerequisite for this is the capturing of images with excellent image quality. "For this purpose, we rely on Baumer cameras of the CX series, which really impressed us with their high reliability and good compatibility with our software routines," explains Tukac. The system employs four 5 megapixel CX.I cameras with Sony® Pregius™ IMX264 sensors. Polarization filters suppress the reflection of the illumination on the products. With the modular tube system patented by Baumer, the camera and lens are additionally protected, e.g., against dust, by a variable number of extension rings. At the same time, this achieves protection class IP 65 / IP 67. In combination with the hard-anodized surfaces, the cameras are then perfectly protected against the cleaning processes that are often necessary in food processing settings. "In addition to the standard-compliant GigE Vision® interface, the cameras also have fast lenses, deliver low-noise images and impressed us with their fast and reliable image transfer", adds Tukac. With their high image quality, the cameras ideally support in the detection of minor deviations and the correct seam formation between the individual images. There is also much expertise inherent in the computing power, which is always hard to come by, as Tukac knows. "The back calculation of the four individual images with 5 megapixel resolution each at a single level and the calculation of the seam areas considerably strains the processor." ISW solved this challenge with a powerful computer, multi-threading, an excellent graphics card for outsourcing computationally intense operations, and clever programming. If products with several labels that have strong dark and light contrasts are to be tested, the system can also be operated with four LXG models with a resolution of 4 megapixels and HDR function.

Figure 4

Figure 4: The GigE cameras of the CX and LX series convinced with high image quality, fast image transfer, low-noise images, and high reliability.

Future-ready system

"We introduced our system to the market in 2019. So far, our customers from the pharmaceutical sector as well as the packaging industry for food, such as sweets, are all fully satisfied," says Tukac. However, the system has much more potential for more extensive applications. This is because 4ninety can be used to test not only cylindrical objects but also many other geometric shapes such as hexagonal packaging. "A simple software adjustment is sufficient here to allow us to compensate for potential presentation errors based on the object geometry," explains Tukac.

More information:
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