

Application Report

Pocket bottles in the spotlight

Küppersbusch solves bottle inspection challenge with Leuze electronic smart camera



Before beverages are ready for shipping, numerous inspections need to be performed – after all, quality needs to be ensured in every respect. This includes, for example, inspections of the labels, of the fill level and of the caps. More-or-less transparent bottles and liquids, high throughput speeds and a harsh – as well as usually humid – industrial environment create challenging conditions for the sensors used in so-called bottle inspection systems, such as those in the Wilhelm Büchter distillery. With their BLOB analysis functionality, LSIS 412i smart cameras from Leuze electronic are predestined for inspecting multiple features in a fraction of a second.

Küppersbusch GmbH in Velbert is a company that has been developing and constructing filling machines for liquid to viscous products, capping and labeling machines as well as final inspection systems since 1972. "Automated measurement and inspection systems, such as bottle inspectors for quality

assurance, complete our line of machines and systems," explains general manager Jochen Küppersbusch. Like most of the systems he has designed, these are also adapted to the respective customer requirements. The system elements used here are, however, tried-and-tested modules. *"Nevertheless, we are constantly developing new ideas to improve the quality and performance of our systems,"* adds Küppersbusch. It was with this goal in mind that an inspector for the final inspection of 0.2 liter pocket-size bottles filled with spirits, so-called hip flasks, was developed (figure 1 and box text). The core component here is a camera inspection system created on the basis of the LSIS 412i smart camera from Leuze electronic, which simultaneously inspects several features (figures 2 and 3).

"Clear" liquids in transparent bottles

The new bottle inspector is designed for a capacity of 10,000 bottles per hour, or just under three bottles per second. In this short time, the bottles must be inspected for the presence of a label, proper fill level, and proper closure. *"First, special challenges are, above all, the clear liquids in transparent bottles,"* explains Klaus Voigt, who is responsible at Küppersbusch for development, construction and start-up. The range of products to be inspected spans from spirits that are perfectly clear and transparent to those that are diffuse and brown-colored to those that are nearly opaque. The LSIS 412i smart camera is the ideal solution to these challenges. Speaking largely in regard to the integrated BLOB analysis with pixel-perfect evaluation, Voigt says: *"I can't think of a better solution."*

Everything in a compact housing

With innovative and high-performance camera technology, LSIS 412i smart cameras make possible fast, simple quality assurance and identification. They offer all necessary components, from illumination to image processing, image and program memory, display, result display and interfaces, in a compact housing. This makes them lightweight and easy to integrate in machine designs, even in tight installation spaces. Thanks to its industrial-grade, robust design, the LSIS series is also ideally suited for the harsh – as well as usually humid – environment encountered in beverage production.

The most striking features include the motor-driven focus adjustment – which facilitates flexible use – and the homogeneous illumination developed by Leuze electronic. Thanks to the motor-driven focus adjustment, solutions can be found

even for applications with varying camera distances, such as with different-size bottles. The respective focus adjustment takes place automatically via the program selection and does not need to be performed manually following a product change. Moreover, this ensures that the optimum adjustment is reproducible.

Also relevant to quality is the integrated illumination. Instead of using just LEDs as usual, Leuze electronic developed special optics for this purpose. They create a rectangular, intense and uniformly illuminated field of view that is particularly homogeneous at a distance of 50 to 250 mm to the test object. For inspection tasks using a backlight illumination, which is necessary in the case of flask inspection, the integrated illumination can be switched off and replaced by an external light source (figures 4a and 4b). *"This allows us to detect the fill level even with clear liquids in transparent bottles,"* explains Voigt. The refraction of light is caused by the change of the refractive index, if a light wave propagates at an angle from medium 1 to medium 2. This will result in change of the propagation direction of the light wave; i. e. the boundary is seen by the camera as a dark layer. Thus, the fill level is visible as a dark line, which can be reliably detected by the evaluation criteria of the intelligent BLOB analysis from Leuze electronic.

Leuze electronic BLOB – simple and reliable

The "binary large object" analysis of the LSIS 412*i* device variant used at Küppersbusch is a decisive factor for the reliable realization of the specified inspection tasks. A so-called BLOB refers to a contiguous area of pixels whose light intensity lies between defined limit values. By setting BLOB features, individual objects or object groups can be reliably detected and differentiated on the basis of their geometric features – also when other processes already supply incorrect results. The tasks to be performed at Küppersbusch, e.g., the detection of labels, caps and the dark fill level line, are typical tasks for BLOB analysis. A wide range of criteria, such as area, perimeter, shape factor as well as height/width, length, angle and center of gravity, are available for evaluating objects. An area, for example, is the sum of pixels enclosed in a BLOB, even including free spaces within the BLOB if required. The perimeter is the length in pixels of the outer contour of a BLOB. The powerful BLOB analysis offers the possibility of grouping together various detection characteristics for the purpose of covering all liquid and bottle variants with one setting. *"The detection system*

functions so well that the fill level is reliably detected during processes even with swashing liquids," adds Voigt.

Fast implementation

In addition to the functional reliability of the LSIS 412*i*, Voigt is also pleased with the simple configuration, which he performed directly via a web browser. Thanks to the unique webConfig configuration interface, no special software needs to be installed on a separate computer. Access to the device is fast and easy via Ethernet.

----- ((In the box:)) -----

Büchter grain schnapps – a tradition since 1880

The practical pocket bottles have been a success since the early years of the Wilhelm Büchter grain distillery, located in the town of Castrop-Rauxel. What began with farmer August Büchter's first distillery license in the year 1880, the "throat cleanser" quickly found friends among underground miners. Before their shifts, they filled their metal coffee pots with "Old Büchter" and hoped it would provide effective protection against the dangerous coal dust. As in the past, true Westphalian grain schnapps is a tradition brand among Büchter's line of fine spirits. Since 1964 the spirits have been flowing from fully automatic filling systems under constant quality control. The grain schnapps from Büchter are honored by the German Agricultural Society every year. The range of products marketed by the company across Europe now also includes alcohol-free beverages as well as the familiar Büchter Alt and Büchter Pils beers. The tradition of the company is currently being continued in the fourth and fifth generations.

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Press inquiries

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Figures and captions



Figure 1. The clear liquids in pocket bottles pose a big challenge during bottle inspection. Labels, fill levels and caps are inspected with LSIS 412*i* smart cameras from Leuze electronic.



Figure 2. All necessary components are integrated in the compact housing of the LSIS 400*i* smart camera – from the illumination to image processing, the image and program memory, the display and result display and even the interfaces.



Figure 3. The LSIS 412*i* smart camera from Leuze electronic is predestined for inspection tasks in the bottle inspector from Küppersbusch.



Figures 4a and 4b. With the rear-illumination method, the fill level is visible as a dark line – emphasized by the refraction at the liquid surface.

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