► Automatic Monitoring of Food Quality

An automatic test device has been developed for random sample testing of chocolate bars. A particular challenge in this task is, on the one side, the hygiene demands within the sector and, on the other, the irregular forms of the objects.

In the food industry, image processing has for some time now been part of the established techniques for product control and quality assurance. The particular challenges in this sector arise not only from the hygienic conditions, but also from the irregular shapes of the objects being examined.

The image-processing specialist Kdorf Automation, based in Kempen, includes in its skills focus the testing of objects in the food industry. In a current application, Kdorf CEO Detlef Klüssendorf, in collaboration with the Lower Rhine University, had the task of surveying chocolate bars.

The concern of the sweet manufacturer is primarily to carry out checks on the geometry of the bars, thus ensuring that his bars conform to the specifications. With the machine, already in service, this is straightforward, Klüssendorf tells us. He describes the test procedure as follows: "For measuring the chocolate bars are laid on the device's plastic-coated stainless-steel carriage, which provides the adhesive friction necessary for transporting the bars and is very easy to clean. The operator can then choose the type of bar in a drop-down menu, which automatically sets all specific parameters for the bar, e.g. dimensions, tolerances and greyscale transitions. After closing the security flap, the measuring program in the application software is then started via a button and the bar is automatically pulled into the test device."

For measuring, the chocolate bars are laid on the device's plastic-coated stainless-steel carriage, which provides the adhesive friction necessary for transporting the bars and is very easy to clean.

► Line scan cameras with telecentric lenses record the images

In the process, an integrated linear system accelerates the bar within a few centimetres, after which it is then moved with constant speed between two line scan cameras. "After the images are recorded by the two line scan cameras with telecentric lenses, the system then determines the measured values of length, breadth and height of the chocolate bar as quality assurance," as the Kdorf CEO describes the continuance of the process. Because of the irregular contours of the bars, the test task represents, in Klüssendorf's words, a particular challenge for the hardware and software of the measuring system.

At the end of the test process, the carriage returns to the security flap and the bar can again be removed. While the bar is returning to the starting position, the screen already shows the plan and side views along with all measurements of the bar.

Besides giving the measurement results with an accuracy of 100 µm, the maximum values recorded for length, breadth and height respectively of the bar show clearly, by red or green markings, whether the test results lie within the required tolerances or not. "Because of the irregular surface structures, several hundred points on the bar are measured, depending on the size of the bar, and the maximum measurements derived from these." as Klüssendorf explains one of the special features of the development.

Inexact insertion of the test objects is compensated for by the software: "If a bar is laid askew on the tray, the software used provides an exact electronic orientation of the recorded image in plan view before carrying out the measurements," Klüssendorf adds. "If the test object is in a skewed position, a signal warns the operator that he must re-insert the bar in the correct position."

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The camera system and the linear drive are located in an enclosed housing. Opening the safety flap during measuring leads automatically, for safety reasons, to an immediate emergency stop of the transport carriage. The measurement must then be repeated.

For statistical evaluation, the text results are passed on to a further program for quality assurance. The complete test protocol with all measured values and the recorded images of plan and side view are saved by the system for documentation purposes.

The image-processing components employed in the system were obtained by Klüssendorf entirely from STEMMER IMAGING in Puchheim. "We had already realised several projects with this partner in the past and were therefore sure of optimum service there," says Klüssendorf. He particularly emphasises the good cooperation with his image-processing supplier during the development phase: "Due to the irregular contours of the chocolate bars, some trials were necessary before we found the optimum combination of image-processing components for these demanding tasks. During the trials, the know-how of the experts at STEMMER IMAGING helped enormously in assembling the right hardware and software elements quickly, thus realising the system in a short time."

In the meantime, the system has successfully entered service with customers, as Klüssendorf reports. In addition, further systems have arisen out of the successful project and are in use in measuring the volume of other sweets and even of meat. In the latter case, this method also enables the indirect determination of the weight of the meat, which opens up interesting possibilities for large butcheries, for example.
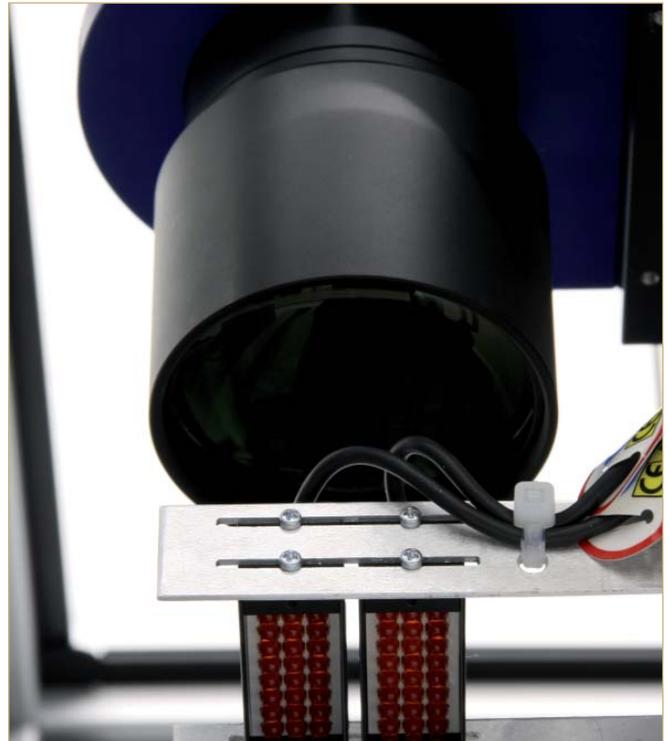
The recorded image of the chocolate bar is made via two high-quality line scan cameras by Teledyne DALSA, telecentric precision lenses by Sill Optics and LED lighting fields by CCS.

An integrated linear system accelerates the bar to be tested within a few cm and then moves it with constant speed below two line scan cameras.

► FACTS

Industrial sector:	**Food industry**
Task:	**Checks on the geometry of chocolate bars**
System integrator:	**Kdorf Automation, Kempen**

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