

Message in a Bottle

Smart Camera Ensures Traceability in Bottle Manufacturing

Glass is elegant, and glass packaged products stand out. With many unique shapes, glass containers give the product identity and character. And glass is fully recyclable: an old and used glass bottle can be remade into a new, clean glass bottle. When glass is made it is heated to around 1,600°C, thus killing off any bacteria. Glass is a truly environmentally friendly material and this is why its triumph as packaging material, especially for food and beverages, is continuing as strong as ever.



In a manufacturing line for glass bottles for beverages several pressing molds work side by side. To track defective bottles, every bottle is marked with a unique number on the bottom. This number identifies the tool that produced the bottle. So in case of a problem the causing tool can be identified and repaired.

A vision system had to be designed to read the bottle's number. Due to the optical nature of glass and the bended surface of the bottle it is not possible to achieve a constant and clear image. The press tool number varies greatly in brightness, contrast and aspect ratio from image to image. Additionally the system had to meet a performance of checking 30 bottles per second. This is a definitely big challenge for a vision system.

Character Features

Despite the varying quality of the image taken by the camera this task can be solved

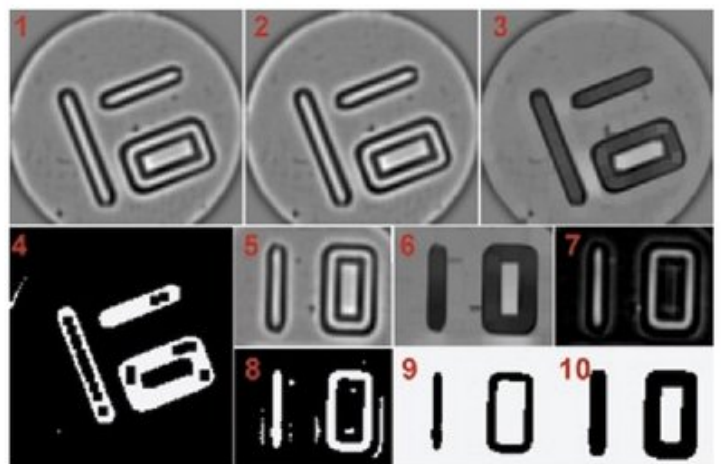
very stable and efficiently by the advanced algorithms of the Matrox Imaging Library (MIL). The core module of MIL used for this task is the String Reader, a very robust tool for locating and reading characters under harsh conditions. Contrary to standard OCR algorithms, which are based on a template matching technique, String Reader uses an approach based on geometric features of the single characters. This is why String Reader is able to accommodate changes in aspect ratio, size, contrast, brightness and to read heavily degraded fonts. All images are pre-processed by blob analysis and different morphological, arithmetic and geometric operations and then are fed into String Reader to decode the number.

Compact Platform

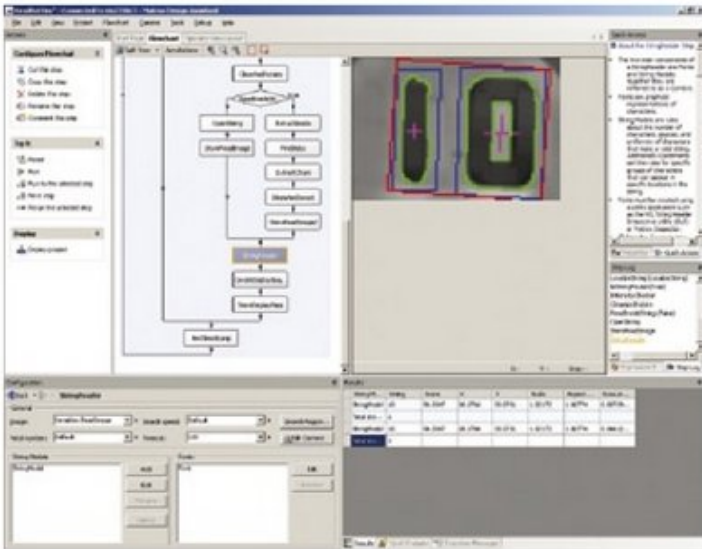
Besides developing a suitable algorithm for decoding the strings it was part of the project goal to propose a highly

integrated hardware platform. Smart cameras usually are a good choice for straightforward applications like 2D code reading, pattern matching or metrology. Nevertheless the new Matrox Iris GT smart camera was proposed. Iris GT is fast enough to process an image below 30 ms, features a sturdy, dust-proof and washable IP67-rated

housing with industrial grade M12 connectors and can be operated from 0°C to 50°C. The vision application itself can be easily configured and deployed with the Matrox Design Assistant, an intuitive, versatile and extendable integrated development environment which eliminates the need for conventional programming.



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Development and deployment is done through the integrated development environment Matrox Design Assistant (Photo: Matrox Imaging)

Speed Increase by 300%

The heart of the robust camera's hardware is the brand new Intel Atom CPU clocked at 1.6 GHz (mainly used in Netbooks so far), which features unmatched performance for embedded systems like a smart camera. Thanks to latest technology like this CPU, an internal Matrox FPGA, fast PCI-Express lanes and the real time operating system Windows CE 6.0 the camera runs up to 300% faster than its predecessor. Available CCD sensors include the latest generation of Kodak's 640 x 480 at 100 fps (KAI-0340S) and Sony's 1,280 x 960 at 22.5 fps (ICX445AL) and cover a great range of different applications. Communication with external devices is done through Ethernet (10/100/100 Mbps), VGA, USB (for keyboard, mouse and touchpads), RS-232, opto-coupled trigger- and strobe-outputs and a current controlled output for interfacing to LED lighting directly.

Design-Assistant – the Flow Chart Approach

Development and deployment is done through the integrated development environment Matrox Design Assistant. The application is interactively configured on the camera and thus foregoing the need of

conventional programming. There are two main tools within Design Assistant: the flow chart designer and the editor for the operator view.

The flow chart represents the vision application's sequence of processing steps and how the results of different operations are combined, evaluated and processed. Parallel to interactively designing the flow chart step by step, each of its steps is configured through a configuration mask. All processing and analysis modules of the field-proven MIL are available within the flow chart. The Design Assistant displays all relevant information (flow chart, configuration masks, online-help, debug information) in a very user-friendly way, so the design process is well structured and clearly represented at any time.

Web Based User-interface

The flow chart represents the sequence of the image processing during the design time, the operator view is the user interface presented to the end-user during run time. The operator view is a web based user-interface, which can be designed within the Design Assistant. All graphical elements (image display with overlays, buttons, radio buttons, text areas, graphics,

...) for input and output are arranged on the website and get linked to the results of the flow chart. The user interface can be displayed by any PC with a web browser like Microsoft Internet Explorer.

Problem Solved within Two Days

Solving of this challenging OCR application is done through combining two things: a robust imaging algorithm based on the field proven Matrox Imaging Library and a high-performance, highly integrated hardware platform for harsh environments. Time-to-Market is very short because the development of application and user interface is easy, fast and convenient. In summary this application is a characteristic example for Matrox Iris GT, which offers the best of both

worlds: a full industrial smart camera together with a new flexible concept for developing and deploying vision software.

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