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Smart approach to 3D imaging

The emergence of high-speed 3D image processing technologies is a major milestone for the vision industry. With improving processing power and laser and camera systems becoming less costly and more accurate, 3D imaging is now becoming increasingly important for defect detection, measuring volumes, or measuring elevation dimensions. Mark Williamson of Stemmer Imaging looks at how the emergence of 3D smart cameras is now set to revolutionise industrial 3D measurements even further.

Traditional 3D measurement systems comprise a structured laser source, camera and optics to accommodate the laser triangulation measurement technique. By moving the product through the laser line, the camera can record profile images of the object, with image data being transferred to a host PC for 3D analysis by sophisticated 3D processing software. The emergence of a new generation of 3D 'smart cameras', analogous to the smart cameras well-established in traditional vision applications, is expected to revolutionise industrial 3D measurements.

3D smart cameras such as LMI Technologies' Gocator series not only feature an integrated laser source and optics but provide on-board processing of 3D data without the need for an external PC, allowing the direct output of the measured results. These cameras are pre-calibrated and designed to simplify setup and measurement, while providing a simple 'plug'n play' ability to link multiple cameras together for extraordinarily versatile measurement configurations.

Simplified set-up

A built-in web server makes set-up easy since no separate software is needed and the camera can be accessed using any popular web browser (Figure 1). This means real-time profile data can be viewed on any computer using any operating system.

The camera can be accessed via industry standard Ethernet and simple cabling is provided for inputs, outputs, and power. Being a 'smart' system, a powerful suite of built-in measurement tools turns live 3D profiles into real-time measurements with pass/fail decisions. A simple point and click GUI allows single or multiple measurement tools to be selected according to the application requirements. For added flexibility, scripting in 'C' is possible to allow tailored calculations. Versatile I/O capabilities allow the camera trigger to be chosen from time, encoder, external input, or software, while data and decisions can be transmitted a via RS-485 serial output channel or measurement decisions can be output digitally to external devices or measurement values and decisions can be converted to analog output signals. With no additional controllers required, it is a true stand-alone system.

Pre-calibration

Accurate calibration is an essential requirement for any industrial vision system. Calibration routines for traditional 3D measurement systems using separate camera and laser units involve moving a known object accurately through the field of view using a positioning stage. From this, the system can build a lookup table for converting XYZ pixel values to real-world co-ordinates. This type of equipment is both expensive and must be used to recalibrate cameras on production lines. In the smart camera configuration, the integral laser and camera are precision factory aligned to provide consistent, reliable measurements in real-world coordinates, even in applications where temperature variation normally would introduce measurement errors.

Figure 2 shows there is a fixed active measurement area for the camera. The field of view size (and the active measurement area) is a function of the camera model selected, but can range from 14mm to 1,260mm. A simple one-button calibration can be performed to fine-tune calibration according to the position of the product in the active measurement area.

Dual and multi-sensor

An advantage of the smart camera approach is the ability to seamlessly link a camera with a second or even multiple sensors. Seen some single and dual sensor options in Figure 3.

Single camera configurations include positioning above a conveyor belt or on a robot arm. Dual cameras possibilities include mounting side by side to measure objects that are wider than a single sensor's field of view, or tilted for improved corner measurement. Alternatively, they could be located at different positions on the production line so that the same part can be measured before and after processing. In another configuration, two cameras can be used to perform top and bottom differential measurements.

Profile data from both cameras are seamlessly combined using a single GUI to measure, make decisions, and show results. For applications that require more than two sensors, up to 24 sensors can be networked using an optional master controller using standard cabling.

Versatile and affordable

The 3D smart camera approach is opening new possibilities for 3D measurement. Most significantly it is continuing the trend of making 3D measurements more affordable and accessible to further applications.

Source: Automation

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Figure 1

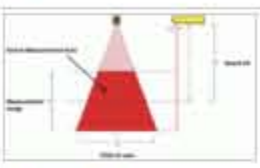

Figure 2

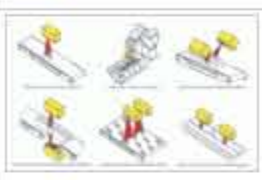

Figure 3

External weblinks

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