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TIME-OF-FLIGHT CAMERA FOR AUTOMATION TECHNOLOGY
3D VIEW OF INTRALOGISTICS PROCESSES

A 3D camera expands the options offered by sensor systems in intralogistics by another dimension. This allows the camera to offer precise real-time cap-ture of fill levels or a comprehensive view of the process. In addition, it can also be used as the 'eye' of IIoT applications, allowing it to determine KPIs such as 'Overall Equipment Efficiency' (OEE).

The automation of intralogistics processes requires that the current status, e.g. the location of containers or their fill level, be recorded as precisely and as promptly as possible. This is where high-performance sensor systems come in, and as automation tasks become ever more demanding, corresponding requirements are also on the increase. Ultimately, a precise image of the current status is essential so that subsequent steps in the processing, assembly and handling of products, containers and packaging units can be initiated.

Trend: the replacement of traditional sensors with cameras

Traditional industrial sensors (magnetic, inductive, laser-based, etc.) are gradually being replaced by cameras in a very wide range of applications. Development is now going a step farther. While cameras and image-processing systems generate two-dimensional images, the first industry-standard cameras now offer 3D depth images with millimeter accuracy. These include the AM-T100 from Schmersal, a 3D camera for automation technology.

The collaboration project with a long-standing partner gave Schmersal the opportunity to integrate customer requirements directly into the development, and at the same time benefit from the partner's vast experience in the camera technology.

The camera is equipped with a Sony DepthSense™ sensor and makes use of Time-of-Flight technology (ToF) to measure emitted infrared light pulses (850 Nm) as they are reflected by objects. This allows it to quickly generate a 3D image of the scene with millimeter accuracy as a point cloud.

Fig. 1: The ToF camera offers a three-dimensional image of the automation process, with just a single sensor.

Usage examples: contour control and fill level monitoring

Thanks to a high frame rate of up to 60 fps, this type of 3D ToF camera can determine the positions and dimensions of objects in real time, e.g. the position and stacking height of boxes being palletized by a robot or the contours of a container or box. This requires no more than a single recording.

The camera can also 'look' into containers or heavy load carriers to determine their fill levels. They can also be used to determine the volume of piece goods and to monitor staging areas in production, assembly, storage and order-picking from a 'bird's eye view'. Other areas in which they can be used include for the capture of dimensions and surface quality in a 67° x 51° field of vision at a range of 6 meters.

Fig. 2: The camera can be integrated into a wide range of conveyor systems for applications such as contour control.

Fig. 3: A 3D look into the container to determine its fill level.

Real-time data evaluation, simple configuration

The added performance of the 3D camera is thanks to the pre-installed CONSAM-T software. This allows the AM-T100 to be configured so that it monitors complex and individually defined 3D zones, both in real time and as moving images. If it detects an object within these zones, it sends a signal to switch digital outputs. In addition, you can also switch back and forth between different 3D zones via digital inputs. An integrated SDK (Software Development Kit) supports software developers and system integrators with camera configuration and software application creation. This opens up countless usage opportunities in automated intralogistics.

With these data, further processing software can be used to determine the ratio of good to bad parts or deviations from visually detectable default values and to incorporate these values into production-related KPIs (Key Performance Indicators). This approach also makes it easy to determine 'Overall Equipment Effectiveness' (OEE).

From the controller to Edge Gateway with OPC UA and to the cloud

Schmersal's IIoT demonstrator allows the data determined by the cameras and evaluated in the on-site controller to be forwarded to an Edge Gateway via OPC UA and then on to a cloud infrastructure. There is then an integrated chain of information, giving users a number of options in use, as well as transparency.

New components for the safety of machinery
As one would expect from Schmersal, safety functions are also integrated into the demonstrator, including via a new version of the Safety Fieldbox, which allows up to eight safety switchgear devices to be integrated into the safety circuit at field level. The Safety Fieldbox variant getting its première at SPS can not only communicate via the PROFINET/PROFIsafe protocol as before, but also via EtherNet/IP with CIP Safety and EtherCAT with FSoE. This means that the designer can configure the machine's safety functions independently of the fieldbus system, as the three variants cover the widest possible range of control systems used internationally.

Fig. 5: The high-performance software allows the 3D camera to be adapted to a wide range of different tasks and integrated into IIoT environments.

Fig. 6: Range expansion for SPS: a new Safety Fieldbox communicates over bus systems EtherNet/IP with CIP Safety and EtherCAT with FSoE.

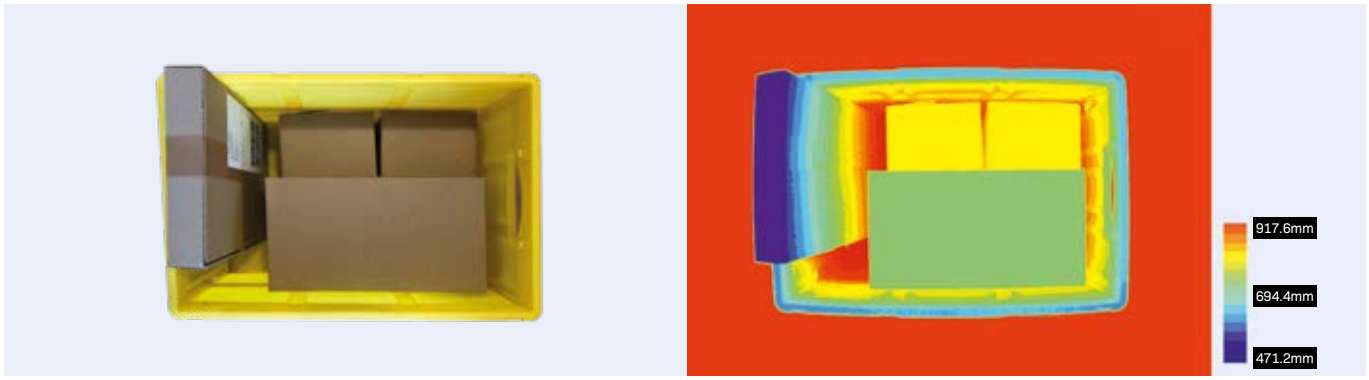

Fig. 4: Photograph with normal camera (left) and with 3D camera (right).

High-performance algorithms enable data pre-filtering so that the camera can be optimally adapted to different environmental conditions. The captured image data are transmitted via the standard GenICam data interface and can thus be evaluated by common image processing software. An Ethernet interface enables fast and rich data transfer and, if necessary, a 24 V energy supply via Power over Ethernet.

Demonstrator for IIoT application at SPS

Schmersal will be demonstrating use of the new 3D camera at SPS in Nuremberg in an intralogistics IIoT application demonstrator. Two cameras will capture the contours and fill level of each container and transfer the data to a safety controller where they will be saved and analyzed with image-processing software. A dashboard will display the results and in the event that limit values are exceeded, there will be an alert.

The safety-oriented data are not sent to the cloud, of course, but are evaluated by the safety controller. At safety of machinery level, integration at data level is also progressing, offering an advantage for intralogistics systems in view of the often extensive nature of systems, the need to protect a wide range of hazardous areas and the variety of different types of safety switchgear device used (electromechanical, sensors, optoelectronics). Safety Fieldboxes and safety-oriented bus systems, in conjunction with modern safety controllers, allow these tasks to be designed more efficiently and be better adapted to the individual application.

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