

High-speed image processing ensures satisfied passengers and reduces airline costs

Automated scanning system for ultra efficient baggage sorting

Lost or damaged luggage items are not only annoying for the affected passengers, they also represent a significant expense for airlines. A solution to this chronic problem is offered by the innovative BAGCHECK baggage handling system, which scans the outlines of luggage in a matter of seconds, enabling reliable separation of items that require special attention. In this way undesirable baggage jams and blockages on the conveyor belts can be reduced by 40 %. The fast screening technology is controlled using PC Control from Beckhoff.



The Control Panel indicates which luggage items can pass through the normal transport route without problem and which items can lead to problems and have to be separated out due to their shapes or special characteristics.

The BAGCHECK solution was jointly developed by the Dutch company Quintech Engineering Innovations, who are based in Delft, Netherlands and are experts in innovative automation solutions for airport logistics, and Vanderlande Industries, a global market leader for complete baggage and package handling systems. The BAGCHECK prototype is installed as a pilot system at London Heathrow Airport.

In modern airports, the baggage handling system play an essential role in dealing with huge quantities of luggage quickly and correctly. Scans and manual sorting of luggage represent a significant source of error. Staff have to judge at a glance whether a piece of luggage can pass along the conveyor belt without problem or has to be separated out as a special item. This applies to all bulky objects that may jam, round luggage items that may roll off the conveyor belt, as well as bags and rucksacks with loose handles or straps that may become trapped in the conveyor belt and lead to blockages. Although the majority of non-standard luggage items are separated out during passenger check-in, they frequently end up back in the general baggage stream in cases where passengers change planes.

High-resolution images ensure reliable baggage sorting

This is where the BAGCHECK solution developed by Quintech and Vanderlande Industries comes in. After the luggage has been weighed and fitted with a bar code label, a conveyor belt takes it to the BAGCHECK station for scanning. Unlike in a security check, the system scans the baggage outlines, not the content. Jorick Naber, co-founder and technical director of Quintech, describes the procedure: "Based on a contour scan camera



Jorick Naber, co-founder and technical director of Quintech Engineering Innovations

and a light curtain, BAGCHECK generates a high-resolution 3-D image of the outlines of the luggage item from above. The light curtain generates the side views, so that we know how tall the luggage item is and whether it has a round shape, for example. In contrast to a volume scanner, which only calculates the volume and the rough dimensions of a luggage item, this provides exact information about the outlines to be derived. Based on this information we can filter out luggage items that are not suitable for the standard conveyor within one or two seconds." The camera scans 4,000 contours per second when a luggage item passes it (1 contour corresponds to 1 mm).



BAGCHECK in action: The camera scans 4,000 contours per second when a luggage item passes it (1 contour corresponds to 1 mm). The high exposure and resolution generates a very exact image, based on which problematic luggage items are automatically separated.



Quintech company profile

The Delft, Netherlands-based Quintech Engineering Innovations provides expertise in innovative automation solutions for airport logistics to airports of any size. Quintech is a spin-off company of the Delft University of Technology.

Data transmission in real-time

A Beckhoff CP6502 Panel PC with 19-inch TFT display and Intel® Core™ Duo processor is used for synchronization of the camera, the lighting and the conveyor belts (via encoders). Alternatively Quintech may use a C66xx control cabinet Industrial PC with the CP690x "Economy" Control Panel as control platform. "The camera is linked with the PC via a 1-Gigabit Ethernet connection. "Key elements in our

decision to use EtherCAT were the speed and accuracy of the data communication," said Jorick Naber. "To achieve accurate results, the images that are acquired need to be high resolution. For this we use line scan cameras and powerful LED line lights that need to be synchronized very accurately with the conveyor velocity and position through high resolution encoders. To achieve line rates of up to 4000 Hz, the control cycle has to be as short as 125 microseconds (μ s). We found that other PLC and soft PLC systems failed to deliver the short cycle times that were needed, but Beckhoff's EtherCAT fieldbus components combined with TwinCAT NC PTP software did the job. Another advantage of TwinCAT was the straightforward integration with our image analysis and classification software by utilizing the ADS layer to link variables. And during development the Scope View feature proved invaluable for tracing areas in the software that needed to be adjusted." For the analysis and image processing software Quintech uses a C# application that is coupled with the TwinCAT control software via ADS. "With our software it is possible to analyze two

luggage items that are on top of each other or side by side, by separating them 'virtually,' so to speak," Jorick Naber added. "Existing systems are unable to do this and a situation like this would cause the conveyor to stop or direct both luggage items to the same aircraft."

Vastly improved tracking of lost luggage items

Quintech's decision to use a Beckhoff Panel PC was not only based on speed, but also on data capacity. "The PC platform integrates the controller and the database. All image data for the scanned luggage items are stored in an SQL database," said Jorick Naber. In this way even items without a label can easily be identified: BAGCHECK matches the photographs of the scanned luggage items with the item without a label and is able to trace back to which passenger it belongs.

Jorick Naber is satisfied with the development of the prototype and the performance of the Beckhoff automation components: "Through simple programming we can easily control all I/O interfaces. Due to its flexibility the open control system also lends itself to extensions and the development of new solutions." Naber is optimistic for the future: "We are currently building four more BAGCHECK systems that will be integrated in Vanderlande's baggage handling system at London Heathrow."

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 Vanderlande Industries www.vanderlande.com
 Industrial Automation Link www.ial.nl