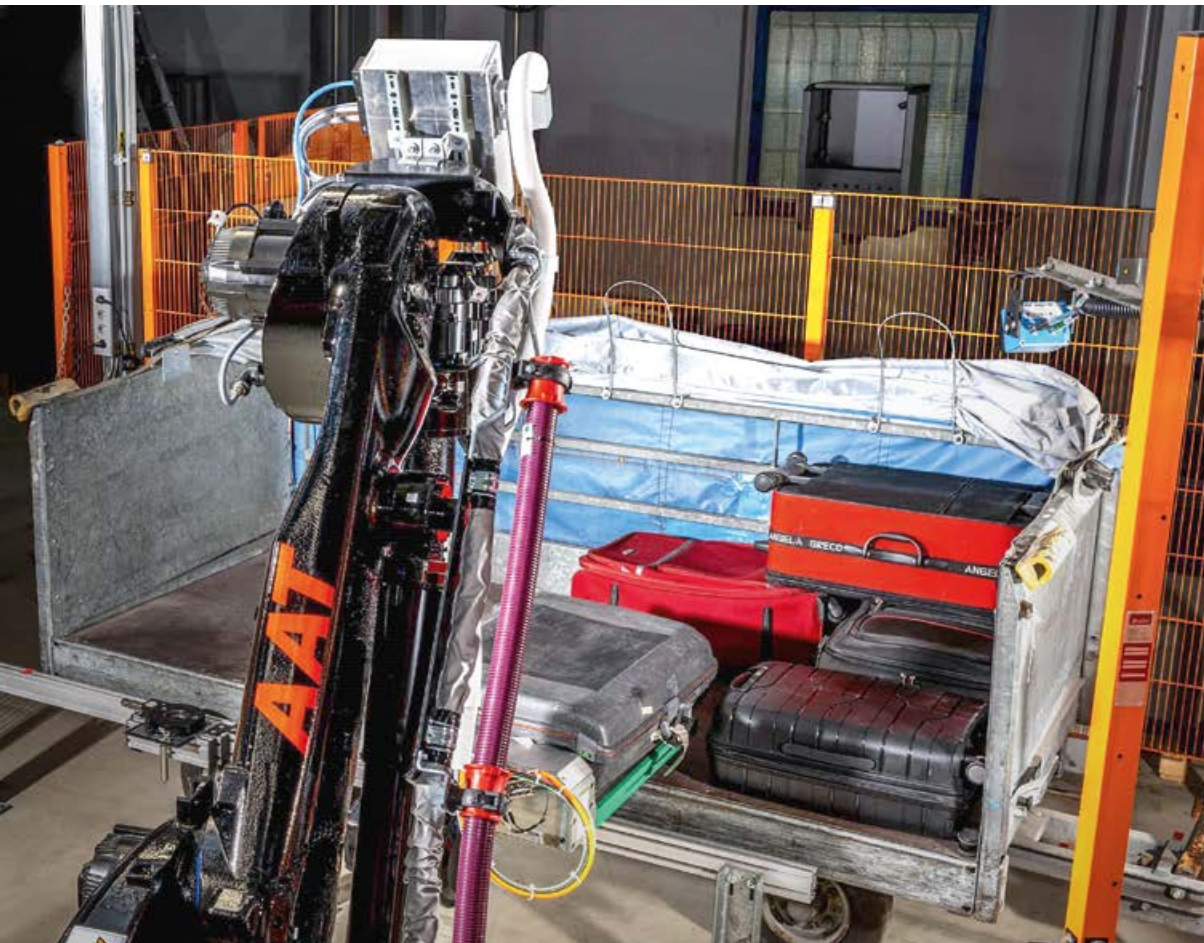


Complete Automation in Baggage Handling

Robotics and conveyor technology specialist AAT develops fully automated processes for baggage loading at the airport. The interaction of the robotic solution ABLE MK2 with innovative, AI-based solutions for automatic baggage sortation of PSI airport/BHS focuses on high handling throughputs without personnel deployment.



PHOTOS: PSI LOGISTICS, AAT AUTOMATION

Airports are highly complex multifunctional service centers. Controlled by modern software systems, operational processes are seamlessly integrated, employees and passengers are informed and automated systems such as baggage handling are used efficiently. To avoid unnecessary waiting times, passengers can check in online and even check in their baggage themselves at all modern airports. However, the underlying processes in the baggage centers have so far only been automated up to the loading end points. There, the baggage is manually removed from the conveyor system and loaded into the transport containers or onto the trailers of the baggage route trains.

AAT and PSI Logistics are teaming up to handle high throughputs without personnel deployment

This segment of physically demanding activities is characterized by high failure rates and the highest staff turnover in airports. Against this background, efforts to further automated baggage handling at airports have been growing in recent years. For example, AAT Automation GmbH, which is based in Karlsruhe, Germany, and founded in 1995, has successfully implemented a robot-assisted automated loading solution at the conveyor system/baggage loading interface at Amsterdam Schiphol Airport. "AAT has been developing and implementing innovative solutions for automation requirements with conveyor technology, robotic systems and mobile transport systems for more than 25 years," explains Roman Kaiser, managing director of the young GATE member AAT. "With the Automated Baggage Loading Equipment (ABLE), we have a solution for automated loading of baggage onto cargo trailers and containers in our portfolio, which will shape the future of airport operations with the newly developed ABLE MK2 robot."

Robotics, sensors, imaging technology and software that use special algorithms and artificial intelligence (AI) to process the recorded information in fractions of a second and allow the jointed arm robot to act with optimal options for access and storage form the basis of the solution. "Eighty years of software development went into the solution," says Kaiser, illustrating the enormous programming effort required for the targeted movements of the hardware components.

AI-based innovations

Articulated robot solutions have been reliably supporting manufacturing and picking processes in industrial production and retail logistics centers for decades. Mature technology and state-of-the-art sensor technology support safe

cooperation between machines and humans. “In industry and retail, robots usually process pre-defined, uniform formats and thus achieve high throughputs,” Kaiser explains. “However, shapes, colors, substance and surfaces are largely individual in the baggage sector. Therefore, each access and deposit position must be calculated individually. So far, this has somewhat limited the performance of the robots. We are currently working on a sustainable optimization.”

AAT has gained an important partner for this in the Airport Division of the software company PSI Logistics. With the PSIAirport Solutions for automated baggage handling (PSIAirport/BHS) and baggage reconciliation (PSIAirport/BRS), the software developers have set standards. “With the integration of methods and processes of artificial intelligence (AI), fuzzy logic, neural networks and deep learning, innovative further developments are continuously being made,” emphasizes Lars Wolff, Product Manager PSI Logistics. For example, PSI Logistics has launched Closed Circuit Television (CCTV), an AI-supported system for AutoID, documentation and tracking in automated baggage handling, which complements PSIAirport/BHS and is already proving successful at Hamburg and Cologne/Bonn airports.

With the video monitoring module PSIAirport/CCTV, 200 high-resolution cameras are installed at the airport’s conveyor and sorting line in Hamburg. They continuously record the baggage items linked to the flight and passenger data as well as their barcodes. “Using neural networks, the software can individually identify the pieces of luggage without additional scanners just by capturing images and documenting their path on the conveyors,” says Wolff. “It automatically recognizes and processes the size and color of the luggage, distinguishes between hard suitcases and soft travel bags, and records equipment features such as handle design and number of wheels.” In addition, the software detects any damage to the luggage, automatically reports



“With the integration of methods and processes of artificial intelligence (AI) further developments are continuously being made.”

Lars Wolff, Product Manager PSI Logistics

any changes and supports the determination of the cause. Investments in additional scanner technology are no longer necessary, the error rate is reduced, resources for rework are eliminated, which in conventional processes at airports can account for up to 10 % of the baggage volume, and the service level is increased.

Dynamic scheduling for uniform resource utilization

Behind this is sophisticated programming for what is known as Deep Learning. For example, the neural network for Deep Learning was “fed” with more than 2,000 images of baggage in different positions and from different perspectives.

On this basis, the software “recognizes” all further variants of luggage items fully automatically - including their individual characteristics. Further deep learning and analyses are performed in real time during operation thanks to resource-saving algorithms.

Additionally, an AI-based assistance system, the “Dynamic Disposition” of PSIAirport Solutions, ensures an equalization of traffic peaks and an even utilization of work areas and resources. Based on the available data and analysis of the holistic data stock, the system determines the optimum of a resource-optimized system and process control in real time and initiates it, or suggests appropriate options to the dispatchers. “In a joint solution, the data of the CCTV solution as well as the real-time analyses of the Dynamic Scheduling assistance system can flow into the control software of the robots in interaction with PSIAirport/BHS, generate improved baggage sequencing and significantly increase

- 1 André Beck PSI Logistics, Daniel Kaiser and Roman Kaiser, AAT, work on new solutions for automated baggage handling at airports
- 2 High resolution video tracking based on neural Networks



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the performance of ABLE,” explains AAT Managing Director Kaiser. “The integration of Dynamic Scheduling ensures continuous optimal loading of the loading robots, and the data feed from PSIAirport/BHS and CCTV acquisition reduces the identification effort for robot handling. The end-to-end automated loading solution would offer safety, efficiency and optimal throughput - and it could also work in reverse, unloading onto arrival terminal baggage belts.” Kaiser sees the next development steps in driverless transport of baggage onto the apron and a future mobile automated loading solution at the aircraft.

“The further automation of functional processes on the basis of self-learning and self-deciding intelligence, opens up significant optimization potentials,” summarizes PSI product manager Wolff. “PSI Logistics is already working on various optional applications of the AI/CCTV solution, which will result in further interesting solution approaches for the airport environment.”

PHOTOS: PSI LOGISTICS, AAT AUTOMATION

