

AI-assisted status monitoring of port vehicles optimizes logistics processes

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The first environmentally friendly, hybrid straddle carriers in the Port of Hamburg operate at HHLA's Tollerort Terminal (CTT) and are manufactured by Konecranes Noel. Credit: Dr. Thomas Koch, HHLA/Dr. Thomas Koch

Together with industry partners, the University of Bremen has developed an innovative, AI-supported status monitoring system for port vehicles in the "KISS" research project. It uses state-of-the-art technologies to monitor the technical condition of vehicles in real time

In the joint research project "AI-Based Damage and Wear Detection System for Cloud-Based Condition Monitoring of Hybrid Container Vehicles" ("KI-Basiertes Schadens- und Verschleißerkennungssystem zur cloudbasierten Zustandsüberwachung von Hybrid-Container-Fahrzeugen")—KISS for short—the condition monitoring system was developed jointly by the industrial partners ANEDO GmbH, Kessler & CO GmbH & Co. KG, SEGNO Industrie Automation GmbH, HHLA Container Terminal Tollerort GmbH, and the ITEM research institute (Institute for Theoretical Electrical Engineering and Microelectronics—Applied Electronics and Software Systems department) at the University of Bremen.

The system uses state-of-the-art technologies such as [edge computing](#), IoT (Internet of Things), data analysis, and machine learning to monitor the technical condition of straddle carriers in real time and take preventive maintenance measures.

Straddle carriers are crucial for the smooth running of container transportation. These special vehicles are used to transport containers at the terminals, between the storage areas and the various modes of transport—ship, truck, and train. They therefore play a key role in minimizing bottlenecks and maximizing efficiency. Monitoring the condition of these vehicles is therefore crucial to their readiness for use.

Straddle carriers are monitored in real time

"Thousands of containers are moved between the various transport modes in the Port of Hamburg every day. The efficiency of these

handling processes is a top priority for HHLA. This is why we use the most advanced technology for the maintenance and servicing of our equipment to ensure smooth and efficient operations," explains Thomas Sauck, Head of the Ground Handling Equipment department at Hamburger Hafen und Logistik AG's (HHLA) Tollerort Terminal.

"The introduction of advanced condition monitoring technologies for our wheel drives in the straddle carrier is an important step towards optimizing the use of our products and increasing [customer satisfaction](#)," says Daniel Oltmanns, Software Manager at Kessler & Co.

"Our edge electronics enable our customers to make their mobile machinery more intelligent," explains Fredo Harms, Managing Director of ANEDO GmbH.

The vehicle integration of the edge electronics also enables local data processing and, in combination with cloud-based data analysis, which allows for comprehensive data interpretation and use, creates new possibilities for precise monitoring of the straddle carriers in real time.

"Our solution offers seamless integration of cloud technology and edge electronics to ensure complete condition monitoring of the carriers. Service and workshop staff get a quick overview of upcoming maintenance work, which prevents breakdowns and increases efficiency," explains Vasco de Freitas, Head of Sales at SEGNO GmbH and IT security consultant.

Condition monitoring has many benefits

This sophisticated solution for condition monitoring in mobile machinery offers a number of benefits:

1. Early fault detection: Continuous monitoring allows potential

problems to be detected at an early stage, before they lead to major failures. This reduces unplanned downtime and increases [vehicle](#) availability.

2. Predictive maintenance: Based on the data collected, predictive maintenance models can be created to determine the optimum time for maintenance work. This minimizes downtimes and extends the service life of the vehicles in the long term.
3. More efficient use of resources: Precise monitoring enables optimized planning of maintenance work and better utilization of maintenance resources, especially personnel and spare parts.
4. Improved safety: Continuous monitoring helps to identify potential safety risks at an early stage and prevent breakdowns.
5. Reduced costs: Significant cost savings can be made by reducing downtime, extending the service life of vehicles, and optimizing the use of resources.

"Our research findings enable precise detection and classification of wear and damage conditions in the wheel drives of the straddle carriers," explains Julia Scholtyssek, research assistant at the ITEM research institute at the University of Bremen.

Professor Karl-Ludwig Krieger adds, "By using AI, we can not only detect impending failures at an early stage, but also predict the expected remaining service life of the components. We are convinced that this technology can make an important contribution to the further development of the transport and logistics industry."

This innovative development in the [monitoring](#) of the condition of port vehicles is intended to help to further improve port logistics and strengthen Germany as a leading trading nation.

Provided by University of Bremen

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