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Dear readers,

In this newsletter, we present the projects MARIA, CRISTAL and QSH. MARIA is all about the future-oriented maintenance of ships. Real-time data transmission and new algorithms are used to optimize maintenance and servicing tasks. CRISTAL helps to identify and prioritize the need for action in the maintenance and repair of infrastructure such as locks and bridges. And QSH stands for quantum computing for shipping and maritime logistics in Hamburg. It shows ways in which practical problems can be solved more quickly and efficiently. In this newsletter, you can find out what role a demonstrator developed by the CML plays in this.

I wish you an inspiring read, a pleasant festive season and a good start to a healthy and peaceful 2024!

Yours sincerely,
Prof. Carlos Jahn
Head of Fraunhofer CML

State of the art in the predictive maintenance of ships

Digital apps already support personnel with many tasks on land and at sea - but what about integration into the higher-level systems on board and on land? Do sensors communicate via the right interfaces and are service providers already connected to the system to enable fast, reliable service? The MARIA project brings together these and other decisive factors for product-related aftersales services in a modular platform solution.

The targeted use of sensor technology for monitoring and diagnosing the condition of components on board plays an important role here, as does augmented reality to support the performance of maintenance and service tasks. In addition, the collected data, including sensor data, maintenance instructions and logs, can be exchanged with selected partners on a modular platform and thus used for a wide range of applications.

In the MARIA project, the CML has developed more than 40 algorithms with which the system status of several components of the engine and the shaft bearing can be monitored and diagnosed in real time. The aim of the diagnostic modules is to detect, localize and identify faulty conditions in the systems based on the measured operating data.

The solutions from the project on board the Wärtsilä research vessel AHTI passed the practical test with flying colors. Simulated maintenance requirements under real conditions in the North Sea were demonstrated just as successfully as the accompanying reporting and the reordering of used spare parts. The MARIA solutions are of particular interest to suppliers, shipping companies and ship managers, who can further optimize the maintenance and repair of their fleets with the help of the solutions developed.

Partners in the MARIA project, which has now been completed, included Wärtsilä Deutschland, Zeppelin Power Systems, drynet and Fraunhofer IGD. MARIA was funded by the Federal Ministry of Education and Research over a period of two and a half years.

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Oceanology International

From March 12 to 14, 2024, the CML exhibits at OI 2024 in London. The exhibits focus on demonstrating autonomous systems, such as the combination of several surface vehicles, and their integration via user-friendly surfaces and interfaces.

Maritime Innovation Insights MII

Our annual lecture event MII will take place on May 2, 2024 with many lectures and demonstrations in our new building.

Save the date now and register for the latest information on the main topics of the event on our website!

New demonstrator: Comparison of classical and quantum solutions with just a few clicks

Quantum computing can significantly reduce processing times. With the project Quantum Computing for Shipping and Maritime Logistics, funded by the City of Hamburg, the Fraunhofer CML is also investigating the potential of this future technology. The CML is formalizing relevant problems from operational practice in order to assess whether quantum computers can offer an advantage in solving them.

To this end, the CML has developed a demonstrator that presents practical use cases in the maritime sector and enables the comparison of classical and quantum solutions by one mouse click. Realistic problems are modelled as mathematical optimization problems and adapted to specific computers and algorithms. The application is user-friendly and the solutions are clearly visualized.

Benchmarking, in which the solution performance of a quantum computer is compared with that of a classical computer, is informative in this respect. The CML is carrying out such benchmarking for an important optimization problem from maritime logistics, the so-called Maritime Inventory Routing Problem (MIRP), on a quantum annealer. This intermediate technology is currently more technologically mature than universal quantum computers. It involves efficient route planning for bulk carriers to supply different locations with limited storage capacities. The solution of a MIRP is a plan of which ship is at which port and when, whether loading slots are available and how much cargo it loads or unloads at a port in any given unit of time - all of these parameters can be optimized.

The MIRP demonstrator is a starting point for the development of customer-specific solutions for any routing and network optimization. The Fraunhofer CML thus offers low-threshold access to quantum computers and facilitates the assessment of the potential of this technology for the maritime industry. You can find a talk (in German only, we apologize!) on this topic on our homepage.

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Monitoring port and waterway infrastructures digitally

Waterborne transportation in Germany suffers from dilapidated infrastructure due to a lack of investment. Port operators are confronted with outdated quay facilities and inland shipping companies with damaged lock and bridge structures.

The Horizon 2020 project CRISTAL supports the maintenance and availability of infrastructure for inland waterway vessels on rivers and canals. This benefits infrastructure operators, for whom various technologies are being tested in order to obtain better and faster data on the condition of the infrastructure.

The development of powerful yet cost-effective sensors, cameras and transmission electronics is making it possible to record data to a new extent: Acoustic emission analyses evaluate old lock gates and radar inspection systems measure the substance of concrete structures. They can be used to map the condition of lock structures, bridges and quay walls, with image recognition software analyzing the current situation and providing valuable information.

The identification of current maintenance requirements thus enables the focused use of scarce resources for the upgrading of infrastructure. Against the backdrop of the European Green Deal and efforts to shift goods from road to inland waterway vessels, these measures can also be transferred to less-used waterways. If these can continue to be used, even less frequented waterways can experience a renaissance.

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The condition of infrastructures can now be easily monitored digitally.

Carlos Jahn on the scientific advisory board

Dr. Volker Wissing, Federal Minister for Digital and Transport Affairs, has appointed Professor Carlos Jahn to his ministry's Scientific Advisory Board.
The independent body was established in 1949 to incorporate scientific findings into both transport policy and technical work. The topic of digitalization has been part of the ministry's portfolio since 2013 and is becoming increasingly important.

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